Measuring Visual Attributes for Assessing Visual Conflicts in Urban Environments

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Abstract

The visual relationships between a proposed development and the existing urban setting have become increasingly controversial in the past two decades. Protecting and enhancing visual attributes of the current urban environment is regulated by a range of performance-based policies and regulations. However, every year many development conflicts occur between developers, local councils and residents resulting in costly delays in the development process. Visual amenity and character are two of the most contentious issues in these conflicts.

Currently, conflict resolution based on these policies relies on experts' interpretation of what appears to be visually significant. Although visual amenity experts aim to provide an impartial and objective assessment of visual effects of proposed developments, their evaluations are sometimes mixed with personal judgments and lack enough centrality and reliability. The problem is compounded by the fact that there are no consistent approaches within and between localities and experts as to what is considered visually significant. The uncertainties and inefficiencies created by performance-based planning policies, to regulate the protection of urban visual quality, highlights the importance of developing reliable, measurable and repeatable approaches to analyse visual environments and to describe the urban character.

Based on a postpositivist approach, a range of research methods using exploratory and descriptive approaches was used to answer the stated research questions. Therefore, the research design is split into three stages. The first stage involved reviewing the planning court cases in Brisbane from 2000 to 2012 to identify the overall different types of conflicts within the city. These conflicts were analysed spatially to determine their distribution and to look for any significant spatial patterns. Based on this review, four case studies were selected, and three measurable methods were developed to provide a higher level of quantitative assessment of visual properties of the urban character. In the last stage, the technical methods were evaluated by a panel of three visual amenity expert witnesses to investigate the effectiveness, usefulness and potential of these methods to be applied in expert assessments and court case resolutions.

This research focuses on urban visual amenity conflicts in the city of Brisbane, Queensland, Australia and identifies the gaps and recurring issues inherent in expert assessments and judgments. Based on this knowledge, quantitative methods to assess visual amenity and character, with greater objectivity and reliability than existing methods, have been developed. The outcome of this research contributes to the field of visual assessment and character studies in landscape planning and assists decision makers and Environmental and Planning Courts to determine development conflicts with more objectivity and reliability.

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[2] All tables have been made by the author unless stated otherwise.

Acronyms & Definitions

AILA: Australian Institute of Landscape Architects

BCC: Brisbane City Council

DCPA: Demolition Control Precinct Area

DERM: Department of Environment and Resource Management

P & E Court: Planning & Environment and Court

GIS: Geographic information system

SCQL: Supreme Court of Queensland Library

SEQ: South East Queensland

SIS: Spatial Information System

CAD: Computer Aided Design

CBD: Commercial Business District

DCP: Demolition Control Precinct

FD: Fractal Dimension

US: United States of America

UK: United Kingdom

UNESCO: United Nations Educational, Scientific and Cultural Organization.

GIS: Geographic Information System

LiDAR: light detection and ranging

Attribute: A quality or characteristic or property inherent in something (Stevenson, 2010).

Amenity: The pleasantness or desirable feature of a place, as carried by desirable attributes (Stevenson, 2010).

Character: A distinctive, recognisable pattern of elements in one area that makes one area different from another area (Lynch, 1960).

Visual Attribute: The values of observable elements that contribute to its visual attributes and characteristics.

Visual Property: an attribute of a vision shared by all members of a class.

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

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Date: 25/02/2017 ……..

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Chapter 1: Introduction

Rapid urbanisation brings great changes to the form of existing urban areas. It also challenges the highly valued natural and built environments and visual resources which support sustainable urban development (He et al., 2005). The "Urban Landscape" is the environment that we perceive and analyse. It is considered the most complex of all landscapes due to the multiple interactions between its built components, the surrounding environment and the dynamic, social, economic and cultural standards of the society (Tsouchlaraki & Achilleos, 2004b). Visual amenity, as one the aspects of amenity, is defined as the pleasantness or attractiveness of a place. A high degree of visual amenity is a very desirable quality in cities, as it makes a significant contribution to people's ability to understand and appreciate their city as a whole and to feel a strong sense of place. Therefore, improving the visual amenity of the urban environment has the potential to improve the liveability of human settlements (He et al., 2005).

The effectiveness of policies and guidelines to manage and evaluate the visual qualities that make up visual amenity is limited. This limitation is demonstrated by the fact that each year many development conflicts occur that end up in court due to visual amenity issues. This situation results in costly delays and uncertainties in the development assessment process. Currently, the visual evaluation and judgement of these conflicts are based on the personal views of experts outside a quantifiable framework of evaluation; hence judgments differ from one expert to another. Due to differing balances between the objective and subjective understandings, these assessments are unable to evaluate visual amenity and character consistently in the complex context of a city. In addition, the need for a credible process to identify, manage and preserve visual amenity is vital, particularly in historic cities, where rapid and unplanned urbanisation is changing the face of ancient urban environments. One such city is Esfahan, which was the point of departure for this study. It is of critical importance to develop quantifiable methods that can be used to evaluate urban visual qualities. Methods are needed that can be applied in the conflict analysis of 12 years of visual assessment within developing urban environments.

There are two contrasting paradigms that affect and change the balance of expert evaluations (Steg, van den Berg et al. 2012). The objectivist model that believes quality is inherent in the physical properties of an environment, and the subjectivist paradigm, that considers quality as a creation of the 'minds-eye' of the beholder. The conceptual framework underlying this research acknowledges that personal judgments lie between the two sides of subjectivity and objectivity. Hence, the framework recognises the importance of both the physical environmental features and their visual attributes and their individual perception and meanings. However, it aims to rebalance objectivity and subjectivity in the judgment of visual amenity court cases.

Focused on urban visual conflicts that have resulted in court cases in Brisbane, this research identifies the main issues and gaps in the expert assessments aimed at resolving these conflicts. The knowledge gained from this detailed understanding has enabled the development of quantifiable and reliable methods for visual quality assessment. These methods have been applied to selected court cases to compare these new quantitative evaluation methods of visual analysis against the current appraisal process used in the Environment and Planning Courts.

This chapter begins with an explanation of the research focus and problem. Firstly, conflicts in development assessments are discussed. Section 1.2 explains the development conflicts in urban environments and section 1.3 outlines the visual conflict in the urban landscape as the research problem. The research aim and research questions are defined in Section 1.5. Section 1.6 outlines the research contributions to date. Section 1.7 provides an overview of the remaining chapters of the thesis.

1.1 DEVELOPMENT CONFLICTS IN URBAN ENVIRONMENTS

Urban areas are filled with the potential for conflicts over resources, memories and meanings between people who share a place (Healey, 2015, 297). These conflicts are often not evident in the movement of society life, but they emerge when something arrives to disturb the regular flow, which can be through public or private organisations such as the redevelopment of a park or a new infrastructure in an urban landscape or a high rise development in an existing low-rise urban context.

The regulations and planning policies prepared by the government are the first areas where a solution is required for resolving conflicts and directing them into established procedures (Healey, 2015, 298). These procedures, over time, may become disconnected from the forces of political movements and momentum and lose their lawfulness in the eyes of the parties involved in conflicts. In this situation, urban conflicts scale up from a minor issue to a controversial case, pointing to planning system deficiencies.

Various development conflicts in developing countries are examples of how conflicts can become controversial cases at a national level. Developing countries, with a higher rate of growth and development, face many threats to their urban landscapes. Conflicting expectations between developers, planning authorities and the public often result in highly contested challenges nationwide and internationally.

An example of development conflict in urban settings is a controversial project in Esfahan, one of the main historical cities of Iran that is subject to modern development pressures. The trigger for the conflict was a new high-rise commercial development within the city. This development had been objected to by local community members and UNESCO to protect the visual qualities and character of the existing urban environment.

Visual conflicts are more evident in developing countries where the historical context of ancient cities is under the immense pressure of new developments. These forces result in the historical parts of such cities suffering from the impact of these new developments. Therefore, the detrimental visual effects of many new projects need to be controlled to preserve the perceived high-value visual quality of these historic cities. The high-rise commercial development in Esfahan is one of the examples of these intrusions.

Located on the Silk Road about 340 kilometres south of Tehran, on the main Iranian north–south and east–west crossing routes, Esfahan has a population of 1.6 million and is Iran's third largest city. It has been one of the greatest cities in the world and flourished in the 16th century under the Safavid Dynasty (Abouei, 2005). Esfahan has a wide variety of historical monuments and is well-known for its Islamic architecture, mosques and minarets, covered bridges, palaces and boulevards (Abouei 2005). The Naghsh-e Jahan Square (Image of the World) in Esfahan is one of the largest city plazas in the world which is a remarkable example of Iranian and Islamic architecture (*Figure 1-1*). It was registered by UNESCO in 1979 as a World Heritage Site (UNESCO, 2016).

Figure 1-1. Naghsh-e Jahan Square (Masoud Alinaghi- Flickr Account User, 2003).

In 2005 Jahan-Nama Tower, a newly built commercial development 48 meters tall was constructed west of Naqsh-e Jahan Square. This building significantly altered the horizontal skyline, which is in opposition to one of the design principles of Islamic architecture. The visual intrusion of a commercial tower into the panoramic views from inside the square significantly impacted the visual amenity of this historic site (Figure *1-2* to Figure 1-4).

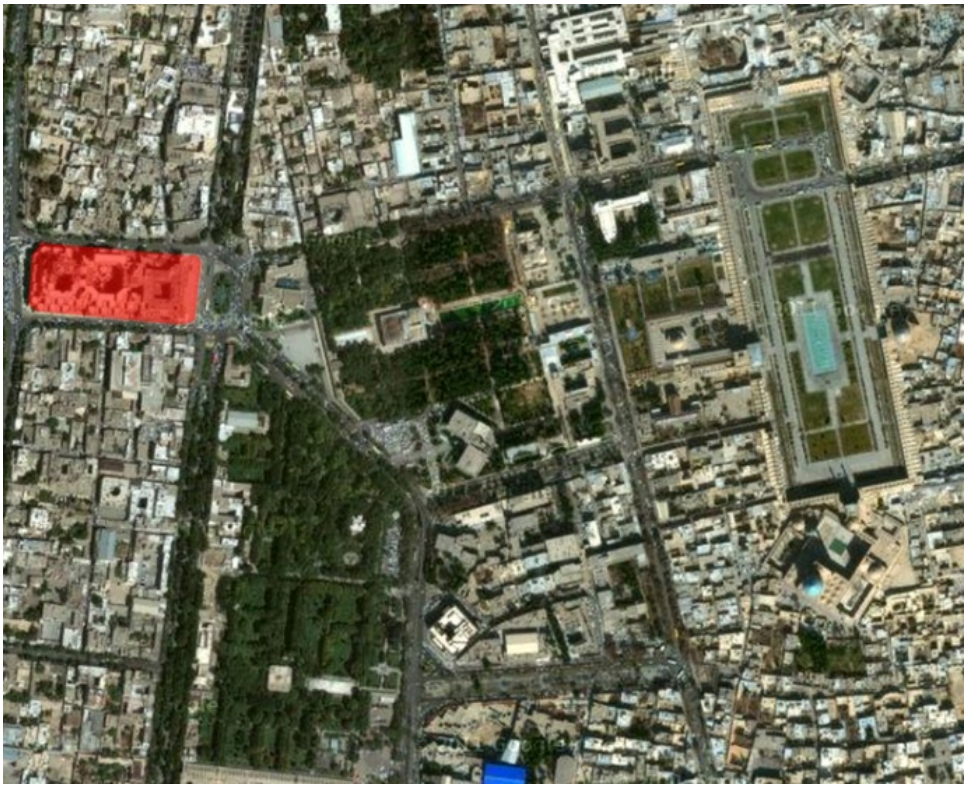


Figure 1-2. Jahan-Nama Tower located on the western side of Naghsh-e Jahan Square (Google Earth, 2012).

Figure 1-3. Naghsh-e Jahan Square Western Panorama (Masoud Alinaghi- Flickr Account User, 2003).

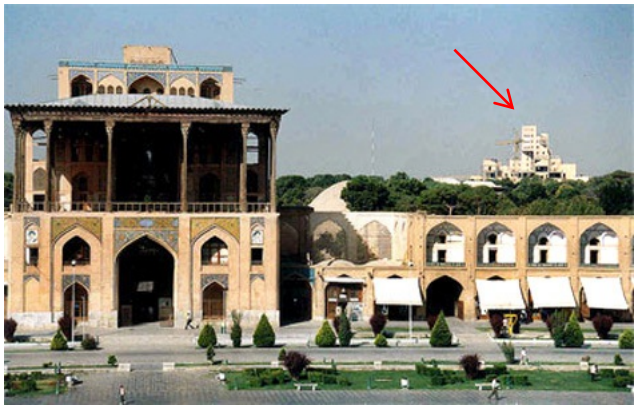


Figure 1-4. Jahan-Nama Tower intrusion viewed from Naghsh-e Jahan Square (Masoud Alinaghi- Flickr Account User, 2003).

In 2005, the UNESCO World Heritage Committee requested Iranian officials to consider UNESCO regulations for the alteration of the new tower, in consultation with local officials. In order to protect the horizontal skyline of the square, the expert panel determined that the height of the tower should be reduced significantly by 12 meters on its eastern side and 24.48 meters on its western side (Mehr News Agency, 2006). UNESCO requested the modification to be completed by 2007. Otherwise, Naqsh-e Jahan Square would be added to the UNESCO's list of world heritage sites that are in danger (Mehr News Agency, 2006).

This conflict became a national concern, and after two years of conflict and debates between Esfahan City Council and the Iran Cultural Heritage, Handcrafts and Tourism Organization, the tower height was reduced, as requested by UNESCO. The visual interventions of new developments in Esfahan are not limited to this intanse and similar issues can be seen in other parts of the city and other historical cities in Iran. Consequently, in 2010, based on a UNESCO resolution, Iran's Cultural Heritage, Handcrafts, and Tourism Organization has been requested to provide a strict urban planning scheme to determine the suitable height for construction projects.

The case of Esfahan emphasises the importance of identifying and protecting visual qualities and managing strategic views in historic cities. This case also highlights the necessity for a comprehensive process to identify and control urban character and preserve its 'sense of place' while at the same time not creating 'urban museums'. It is critical that such a process is embedded within urban planning policies, and must address a broad range of parameters, including building heights, architectural styles, materials, urban design and landscape form.

1.2 VISUAL CONFLICTS IN URBAN LANDSCAPES

Urban development pressures have brought significant challenges to the shape and visual character of cities all around the world. Developments that threaten the visual character of world heritage listed sites and towns have been the main concern of UNESCO, municipalities and the general public. Several controversial high-rise developments during the last decade, such as Jahan Nama Tower in Esfahan (Iran), OnaltiDokuz residential towers (three towers) in Istanbul (Turkey) and Makkah Royal Clock Tower Hotel in Mecca (KSA), exemplify these challenges in developing countries. Lack of planning regulations and legislation to protect visual qualities in these cities increases the unpredicted impacts of new developments on the existing urban environment.

There is now a growing concern for managing visual qualities of urban areas in developing and developed countries (Stamps 2002). It has been shown that the appearance or visual quality of urban areas affects our daily activities and can evoke such feelings and emotions as pleasure, relaxation, excitement or fear (Gao and Asami 2007). Preserving and improving the visual qualities

of urban landscapes is recognised as an efficient way to enhance the social and economic development of cities and is a way to revitalise older and underused areas (He et al. 2005).

Visual character challenges are not only limited to historical cities in developing countries; similar development conflicts can be seen in Western countries. Contemporary growing cities in Australia, such as Brisbane, are facing similar challenges, where greater use of planning regulations attempts to control and regulate visual qualities in fast-growing urban settlements. However, with more major urban development the number of development conflicts occurring each year increases proportionally.

Australian cities are growing cities and follow comprehensive sustainable planning schemes to achieve social, economic and environmental growth. However, these schemes bring significant challenges to protect and enhance environmental resources. Visual qualities are an important component of the urban environment and play a major role in community expectation and satisfaction. The visual quality of the urban context is highly sensitive to any development and can be manipulated adversely with poorly designed developments.

The city skyline is a manifestation of aesthetic values, diversity, integrity and history (Guney et al. 2012). It reflects the forces and interaction between historical, social, cultural and economic characteristics of society, and is an abstract of all (Gassner 2009). Brisbane City has an unlimited number of skylines depending on the viewpoint location and view. Today, the city skyline is under dynamic change and any development, especially high rise, can have a significant impact. Therefore it is an important concern of visual amenity planning to manage skyline form. London View Management Framework (2012) is an example of a municipality's attention to skylines.

Multiple policies and planning codes affect building design and control the visual appearance of urban landscapes. Planning codes, such as the Residential Design and Character Code, the House Code, the Demolition Code and Residential Design Code, are used to control new developments in different parts of Brisbane. A review of these codes shows that many parameters regulate the character of urban areas to create consistency within existing settings and complement the surrounding environment.

These type of policies provide the legal foundation for the protection of visual qualities of urban landscapes. However, the effectiveness of these strategies relies on an individual expert's evaluation of what appears to be visually significant. As there is no consistent approach within and between localities, this presents major problems (Alexander, 2002). Also, little attention is given to the visual character of a streetscape as a whole. Depending on a development's location, the regulations about streetscape character vary. Managing the visual qualities of a city is a major step to creating, protecting and enhancing the sense of place. Thus, codes and regulations, in regards to preserving urban character, have an important role in protecting the sense of place that is valued by the community.

Fear of losing visual amenity has become a huge concern for local councils and communities. This matter makes communities highly sensitive to any development, or even anti-development. Therefore, it is important to assess visual qualities with high accuracy to minimise conflicts and to prevent any adverse impact. Existing building height controls do not fill the gaps in development assessment. The lack of measurable, repetitive and objective methods to analyse the city skyline and visual amenity makes it difficult for developers, the community and the Council to regulate the decision-making process.

1.3 CONFLICTS IN DEVELOPMENT ASSESSMENTS

Development conflicts are an inevitable part of development assessment processes in any country. Developers, governments and communities have different expectations for future environments, which results in particular challenges between all of these parties. Economic and population growth puts high pressure on environmental conditions and resources to accept the change. Therefore, justifying the development applications is one the main challenges of municipalities for fair decision-making processes while also following their goals and visions for future generations.

Assessment of development applications follows different procedures in every country and every city council, depending on their governmental structure. In general, these processes include various individual stages from initial reviews to the final decision. Receiving feedback from other organisations, public notification and advertising are some other steps taken during the assessment process before the final determination.

After council has made a final decision on a request, applicants or the community, or other third parties affected by the development, may disagree with the final decision, which becomes the starting point for conflict between parties. Resolving development conflicts is not considered obligatory in all planning systems in the various countries. However, it is regarded as an important step in any sustainable planning system to resolve development conflicts in response to the goals of the sustainable design.

Reassessment of development applications in court systems after a conflict occurs could guarantee that the best possible decision will be achieved by a thorough assessment of development application. Using expert witness evaluations with the highest level of certainty and repeatability can result in the best possible outcome of any development application, whether the application is approved or refused. This process can lead to a more sustainable approach and resolution between conflicting parties.

While resolving development conflicts is a lengthy, time-consuming and expensive process for both sides, it is an effective way of preventing future threats and pressures which might arise in future. Several controversial conflicts have occurred around the world, which highlights the fact that conflict resolution is an important part of global development assessments in response

to the sustainable development of societies. Lack of adequate assessment of development application in appeal systems can result in a significant negative impact on society. Some of these cases are explained briefly in the following section.

1.4 EVALUATION OF VISUAL ATTRIBUTES

The visual relationship of any proposed development within an existing urban setting has become an increasingly controversial issue in urban planning. Creative solutions to understanding visual impacts of new developments on existing urban environments are only possible through describing the urban character and visual properties in greater depth (RAIA, 2004). Therefore, developing repeatable and quantitative approaches to analyse the visual properties of both the urban setting and any proposed development will assist with minimising conflicts between a new development and its setting. This achievement would be a significant step forward in built environment evaluations (Groat, 1988).

In Australia, visual qualities are regulated by a range of state and local planning policies and associated neighbourhood plans and codes. Development applications are required to comply with these planning policies to be approved by relevant authorities. If they fail to meet the requirements, a time-consuming modification process may be needed to attain council approval. Otherwise, the applicant may appeal to the Environment and Planning Court. In these disputes, the visual character of the subject area becomes a critical factor. Such visual amenity conflicts and inefficiencies embedded within planning policies to regulate this process signal the importance of a reliable, measurable, quantifiable and repeatable approach to analysing visual properties and describing the urban character.

Words like “sympathetic”, “compatible”, “sense of place”, “sensitive development”, “identity”,” character”, “consistency” are used in planning policies when defining development requirements and outcomes. However, such descriptions are primarily qualitative, which can lead to further disputes and conflicts in assessment processes and court cases. The conventional method for assessing the qualitative aspects of a development proposal is based on an expert, or experienced individual, in the relevant authority (Council or Court) to determine the visual qualities and character of the subject area and then estimating the visual impacts of the proposed development on the existing setting. Although this approach can identify many important factors and elements of the existing character, it is still problematic, as it is impossible to achieve a high degree of consistency between all assessments, as all developments within Queensland will not be assessed by the same expert (Tucker and Ostwald, 2007). Moreover, these evaluations lack enough objectivity and repeatability to derive reliable and accurate information from the visual properties in urban environments.

Therefore, there is an urgent need for planning authorities to have clear, transparent, repetitive and consistent methods to enable them to assess the visual qualities of urban landscapes and to define the character of a neighbourhood. This will allow them to evaluate development applications or undertake studies of urban environments with greater confidence (Ellefsen 1991). Through this process, the visual impact of new developments will be controlled, and the existing character will be preserved and enhanced.

A greater level of objectivity through quantification would facilitate a more rigorous evaluation of urban environments, ensuring the preservation and enhancement of the primary visual attributes that contribute to the overall urban character. They would also influence the potential visual impacts of future developments. Such approaches could also be of great value for processing development applications, assessing their visual impacts and proposing mitigation measures within state and local authorities. Similarly, they could be adopted and replicated by practitioners in the urban development industry.

It is widely agreed that the visual quality of urban areas can directly affect the social life of that place and is a major factor to be considered in revitalising urban spaces (Ernest & Bob, 2004; Kivanc Ak, 2013). However, developing explicit methods to evaluate the visual properties that contribute to this quality is a complicated process. Several researchers have developed different inventories and toolkits to attempt this (Tsouchlaraki and Achilleos 2004). Although these methods record and describe some of the important factors of visual urban environments, they still have high levels of subjectivity, and the complex visual context of urban environments cannot be evaluated by these simple forms and toolkits (DIPNR 2004).

This research is focused on visual amenity conflicts within the urban environment. It evaluates the ability of Geographic Information Systems (GIS) and novel image processing techniques to determine their effectiveness to measure visual properties of urban environments. It is proposed that advanced computational-based approaches, which can analyse visual characteristics consistently, will assist in achieving a more reliable and objective assessment of visual amenity for use in court cases and development applications, ensuring greater credibility and reliability for future judgments. Consequently, this will reduce costly delays and conflicts and results in more sustainable outcomes.

1.5 RESEARCH QUESTIONS

Given the research problem described above, a central question guiding the overall research is:

How can visual amenity be assessed in development conflicts with more certainty?

Three sub-questions were developed to investigate the central question:

1. What development conflicts occur in development applications?
2. How can visual attributes be quantified using computational methods?
3. How can computational methods be used to resolve development conflicts?

Through the research process, these questions are investigated by a combination of several methodologies and methods throughout the thesis.

1.6 RESEARCH AIM AND OBJECTIVES

The overall research aim is to develop new quantitative methods to evaluate visual properties of urban streetscapes that are important in development conflicts. In order to accomplish this, four research objectives are followed, which shape different aspects of this investigation:

1. To identify different types of developments and conflict issues occurring in a city environment;
2. To investigate spatial patterns of conflicts and to understand where they occur;
3. To determine major types of visual amenity issues associated with different types of development conflicts;
4. To develop quantifiable methods to analyse visual amenity.

1.7 STRUCTURE OF THESIS

This thesis comprises eight chapters and three appendices. The following chapter, Chapter 2, is the literature review, which focuses on four major areas. Through this review, primary literature relevant to the field of research is examined. Several gaps in the current literature are identified, which this study aims to contribute. The literature review includes the following main sections:

- Planning conflicts in Australia and other Western countries;
- Review of planning conflicts;
- Concepts of amenity and visual amenity in planning;
- Visual quality evaluations in urban environments.

Chapter 3 explains the research methodology, which is based on four underlying philosophical paradigms. Various research methodologies and strategies are employed to address the research questions. Also, a multi-stage research design is proposed to conduct the research to achieve its aim.

Chapters 4, 5 and 6 include the three major stages of the research in response to the three research questions. A similar structure is followed in each chapter to explain research methods, results, discussion and evaluations in each stage separately. This structure was considered as a more legible and clear structure to explain each section separately and to improve the clarity of the research.

Chapter 4 presents a review of planning conflicts in a city environment. A detailed examination of court cases provided a database of conflict, which is further analysed by spatial analysis. As the outcome of this review, multiple concepts and case studies were selected for further investigation in the following chapters.

Chapters 5 and 6 provide three technical methods developed to analyse visual amenity concepts with more objectivity and reliability. These methods are evaluated by a group of visual amenity expert witnesses to investigate their effectiveness and usefulness in expert evaluations and court resolutions. Also, research findings are further compared and discussed in relation to the existing body of literature reviewed in Chapter 2 to discuss research findings and contributions.

The last chapter (Chapter 7) explains the context of findings and their limitations. Implications of research results in the field of study are explained. Also, future directions and opportunities for continued improvement of this research are stated.

Chapter 2: Literature Review

In response to the research aim and questions, a review of relevant literature was conducted to provide a philosophical and knowledge basis for the study. This chapter begins with a review of planning conflicts systems in Australia and other Western countries and explains different types of planning disputes and appeals around the world, and specifically in Australia and England, based on British law. It also discusses the concept of amenity and character in planning law, which is essential for grounding the study in current concerns.

This chapter also reviews the relevant literature concerning visual attributes and their evaluations in urban environments. This section of the literature review covers a broad consideration of visual assessments of urban environments and visual properties of urban streetscapes. In the final section, conventional methods and approaches used by visual amenity experts to assess visual amenity conflicts are introduced.

2.1 PLANNING CONFLICTS IN WESTERN COUNTRIES

Planning disputes or court cases are in fact appeals against government planning decisions and these conflicts are referred to as *planning appeals* in the relevant literature. The Oxford English Dictionary defines an appeal as "a formal request to a court or to somebody in authority for a judgement or a decision to be changed". Depending on the nature of the appeal, some planning appeals can be contentious and controversial. Some appeals are resolved between parties in the early stages of a conflict. However, some last for an extended period until the final decision is made by the Court or planning authority.

Depending on the structure of the government and planning system, Western countries have evolved different systems for planning and appeal procedures. Booth (1999) divided planning schemes into two broad systems, the United States system and the British system. The policy of the United States of America (USA), is a strict zoning system that ties decision making to a series of proposed regulations. The British system leaves development decisions partly unconstrained by prior regulations (Gurran, Gilbert, & Phibbs, 2014). As a result of the British system, which covers England and Wales, *appeal rights* against an authority's planning decisions in Australia, New Zealand and Hong Kong are a standard feature of the planning process within these countries (Faghih and Sadeghy 2012). However, the concept of planning appeals is underdeveloped (Willey 2007). Currently, planning appeals are a review process to ensure planning powers are used appropriately and legitimately (Faghih and Sadeghy 2012). However, appeal rights have major differences in various Western countries, depending on their planning systems and government structures.

There is no agreement between Western democracies about the necessity of appeal rights in land use planning systems. Contrary to the countries mentioned above, most European countries and North America do not employ planning review authorities to review government decisions (Faghih and Sadeghy 2012). The planning system in Canada is mainly a local government responsibility (Newell 1986). Canada, similar to the USA, does not have an appeals process. Development is achieved by developers working closely with their local government to ensure that their development applications comply with all planning policies. Although there are many satisfactory and leading examples of urban planning and urban regeneration across Canada and North America, there is a lack of integrity and transparency within the local decision-making processes. It is compounded by the lack of an appeal process in their planning system (Willey 2007).

Willey (2005) conducted broad research on planning systems in two Western countries and developed a survey to compare legal systems in the four planning systems where appeal rights exist. These were the States of New South Wales, Victoria and Western Australia within Australia, and England. He undertook interviews with a broad range of professionals, such as Government planners and lawyers, consultant planners and architects, land developers, barristers and solicitors, academics, environmental and resident actions groups and local government councillors. His research centred on the appropriateness of *appeal rights* against the decisions of government planning agencies. However, he considered appeal reviews as critical components of the decision-making process:

> *Planning decisions lie at the intersection of a myriad of different considerations, which are not always complementary. In fact, these considerations are often conflicting. Planning then is about achieving balance and appropriately weighing the range of factors that arise in the context of any one application. It is a truism that it is an extremely difficult task to 'get the balance right' for each proposal. On this view, the concept of having a review mechanism seems reasonable as it allows the range of relevant considerations to be raised, tested and weighed again (Willey, 2005, 282).*

There are different views toward consideration of appeal rights in planning decision-making processes. Appreciating appeal rights relies on the government structure and beliefs of a country, which shapes their constitutions and legal systems. Therefore, to understand the differences in planning systems between these countries it is important to know their government systems at a higher level of decision making. Given the geographic limitations of this research, this review focuses on the Australian systems of government.

Knowledge of various planning systems and their differences are essential for providing a sound basis for this study. As this research aims to review previous records of development conflicts, this review clarifies the logics and hierarchies of the planning process to understand the complexities of planning appeals better. Relationships between different planning systems and planning appeal reviews are topics that have not been reviewed together in previous studies.

2.1.1 Planning Conflicts in Australia and Queensland

Similarly to the USA and Canada, Australia's system of government is a federated system where power is divided between the central and state-based governments. Australia is also a liberal democracy, where power ultimately rests with the people (Johnson-Laird 1999). Australia has three levels of representative government: national, state and local. Based on the national Commonwealth Constitution, urban planning is a state-level activity undertaken by local governments. Each State has its planning system where individual local governments prepare town planning schemes that fall outside the federal sphere (Sairinen, Barrow et al. 2010). These planning schemes are similar to those found in North America and the United Kingdom (UK). Recently, the planning system in Australia has shifted from a rigid plan-based system towards a more flexible and performance-based system (Johnson-Laird, 1999). The Victorian planning system is the most rigid and policy-based system, with greater emphasis on planning strategy and policy plans (Faghih & Sadeghy, 2012).

In Australia, all States and Territories planning conflicts are assessed by a statutory body, and planning decisions can be reviewed on appeal (Faghih & Sadeghy, 2012). In appeal situations, the court or tribunal stands in the shoes of the original decision-maker and reviews the appeal grounds. However, the scope of rights for appeal varies. For example, in New South Wales, Queensland, South Australia, Tasmania and Victoria a third party has the right of appeal (Johnson-Laird, 1999). In the Northern Territory and Western Australia, there is no appeal right for third parties (Ferri & Maturo, 2012). In New South Wales, Queensland and South Australia, specialist planning and environmental courts assess the appeals, while in other states and territories appeals are evaluated by specialist tribunals with a strong legal presence (Faghih & Sadeghy, 2012).

The third-party right of appeal in planning is problematic, but it is a manifestation of increased involvement in planning processes (Williams, 2012). Based on the third party appeal right, the authority must give notice to owners or occupiers of adjacent land and other residents in the locality that are directly affected to a substantial degree by the proposed development (Williams, 2012, 117). This announcement must be published in a local newspaper. Third parties within a specified limited time may lodge a written notification to the planning authority for consideration in the development approval process. If third parties are still against any development approval given by local Council, they can appeal to the court for further resolution.

Another difference in planning systems in Australia is the type of appeal review. Currently, there are two types of appeal review; one is merit-based the other judicial-based. *Merit-based reviews* include a full hearing of the case, where the court acts as the original decision maker and planning body with the same legal power (Zheng et al. , 2014). It enables the tribunal to endorse or reject planning decisions prepared by local governments. Appeals in New South Wales, Victoria and Western Australia are assessed as merit-based. Willey describes *Judicial-based appeals* (2005, 270):

> *Unlike merit appeals, which are a creature of statute, judicial review exists at common law and is available even where a formal appeal right is not. The principles of administrative law enable parties to seek judicial review of planning decisions in the common law courts on the basis that the decision was erroneous or unreasonable.*

There are different views regarding merit-based versus judicial-based reviews. Willey (2005), through his survey, found that local government decisions are often parochial and political rather than planning-based and, in limited cases, they act corruptly. Willey (2005, 271) concludes that:

> *The response also implies that because planning decisions have significant effects on the interests of the development industry and community, the exercise of such powers should include a review mechanism. Again, this exhibits institutional distrust in the ability of local councils to make decisions on behalf of their constituents. This reflects a position that appeal bodies enjoy a God's-eye view of planning.*

The responses from the most of the local councillors were against merit-based review. They believed that the planning system has a political function and that decisions made by local councils represent the values of the local community. Ignoring this fact and placing power in the hands of an independent appeal body shifts control and power away from local councils and enables the appeal body to differ from the views of the local council and community (Faghih & Sadeghy, 2012). Willey also argues that merit-based appeals are against local democracy because they result in the planning system losing its liability.

In contrast to merit-based appeals, judicial-based appeals give more weight to the local planning policies of the jurisdiction to assess planning appeals. A judicial review is a type of assessment where courts review official acts of government to determine its accordance with the constitution, rationality and compatibility within the essential principles of the justice system (Lorr, 2012). Judicial reviews have been developing in Australia since the early 1970s (Sairinen et al. 2010). Billings and Cassimatis (2014, 185) define the concept of a judicial review as:

> *Judicial review is a traditional and an essential feature of a parliamentary democracy. The jurisdiction of courts of law with supervisory jurisdiction may be invoked by aggrieved individuals in order to promote fidelity to the law by the executive branch of the state. Judicial review facilitates the practical application of the doctrine of the rule of law (that all persons be subject to and equal before the law) by providing a means of redress for individuals whose rights and interests have been adversely affected by government action.*

However, to increase the right of individuals in accordance with the environmental justice and Government accountability in Queensland, judicial review changed to *statutory reviews* in 1991 (Durning, 1999). This helped to simplify the judicial review process. A statutory judicial appeal review in Queensland is a branch of judicial review (Durning, 1999). This type of appeal review is also applied in New Zealand (Peltonen & Sairinen, 2010).

Based on Willey's (2005) conclusion, derived from his survey, merit-based appeals should be changed to judicial reviews of planning policies to retain the role of local government in planning systems. A judicial review does not make law or impose law but, rather, interprets the law and applies it to the facts of each case. It is in contrast to a merit-based appeals process. In a judicial-based process, a tribunal assesses the appeal within defined regulations and the policies of a planning scheme.

The differences of planning systems in various states of Australia highlight the different processes in appeal reviews. As this study is focused on court cases in Queensland, it is useful to know its differences to other legal systems. The British system is also reviewed as the origin of Australian planning and legal systems.

2.1.2 Planning Conflicts in England

In contrast to Australia and North America, which have federalist government systems, England has a unitary form of government (Faghih & Sadeghy, 2012). It grants more power to the central government to play a fundamental role in urban planning and development issues. As a result, local councils have limited authority to oversee urban planning issues. The planning system in England is a plan-led system, and it is based on preparation of development plans by local governments, which are equivalent to planning schemes in Australia. Comprehensive plans are the most important reference in assessing the development application proposals (Wyly, 2009). Plans are to be updated and adopted by the local government as a base for a planning system that includes structure and local plan requirements.

A *plan-led system*, promoted in the UK since the late 1980s, has a discretionary character different to regulatory regimes (Bingham, 2001). A plan-led system includes comprehensive and up-to-date plans that combine regulatory and discretionary controls to increase certainty about planning outputs (Bingham, 2001, 323). However, according to Bingham, these plans have not resulted in less planning conflicts compared to regulatory systems, which are more flexible in their operation.

Almost all planning appeals in England are determined by the Secretary of State for Local Government and Regional Planning (Ministry of Housing and Local Government) and their representatives as Planning Inspectorates (Willey, 2005, 280). Similar to merit-based appeals in Australia, the jurisdiction bodies in England are the same as that of the original decision maker. Appeal rights are limited to development applicants, and there are no third party appeal rights. It does not accord to the modern notion of environmental justice (Faghih & Sadeghy, 2012).

According to Booth (1995), England's development control system is more discretionary compared to the Australian system as English courts have more power to interpret development plans (Willey, 2007). The Australian system is more prescriptive, as more weight is attached to approved plans and less power is available to courts when determining a case (Gurran et al., 2014).

Based on Willey's surveys, English respondents' views completely mirrored those in Australia, where they supported a full merit-based system. However, they criticised the English system as it may not always have a balanced and consistent view due to the subjective nature of the appeals process. Responses from his participants highlight the need to review local government decisions with consideration of the rights of citizens under the law. Furthermore, local councillors who participated in his survey had concerns regarding a lack of local democracy in the planning system. Another main difference between the Australian and England appeals process is that the Australia's system has eight district planning jurisdictions while the UK has only one authority that hears all appeals across the entire country. He also concluded that assessing appeals by Inspectors reduced the objectivity of a review due to lack of enough knowledge of local issues. Therefore,

there should be a more regionalised focus on Planning Inspectorates in order to develop a more detailed knowledge of local sensitivities and problems.

The review of planning systems in Australia, England and other Western countries, provided an overview of development approval processes and how development conflicts are being managed in different regions. The review of planning appeals and conflicts in each country clearly highlights these differences. However, the review of planning conflicts has been given scant attention in the relevant literature. While there is a lack of review of planning conflicts in Australia and Queensland, some similar studies of planning appeals have been done in England, and which are reviewed in more details in this study. There is an opportunity for this study to review planning conflicts in Australia to understand the complexities and patterns similar to previous studies undertaken in the UK.

2.2 REVIEW OF PLANNING CONFLICTS

A review of planning conflicts and appeals is one of the ways to study underlying tendencies of urban planning processes and development pressures in cities. The findings of these studies can be valuable for governments to review their legislation, its impacts on the development process and to upgrade their planning regulations. These results can also be useful for appellants to understand the logic behind appeal assessments and to understand how their case is likely to be reviewed.

Several researchers have reviewed planning appeals in the UK to identify trends in urban planning conflicts (McNamara et al., 1986, Brotherton, 1993, Punter and Bell 2000, Guthey et al., 2014). Brotherton (1993) reviewed planning appeals in the UK and found that planning appeals vary between types of development, regions and over time. He investigated the relationship between *refusal rate* and *appeal rate* and *appeal success rate* and tried to develop a theory to explain his findings. Brotherton (1993) found that the appeal rate varies with the support of planning inspectors given to local planning authorities (LAP), appeal cost and appellants' and respondents' willingness to negotiate. He also concluded that appeal success rate in England and Wales had increased since 1974.

McNamara et al. (1986) analysed success rates of appellants and their perception of the planning appeal system in the UK. They reviewed planning appeals to develop a representative model to predict appeal success rates. Rydin et al. (1990) identified broad trends over ten years (1979 to 1989) for the Association of District Councils in England (Guthey, Whiteman et al. 2014). They identified key issues which were relevant to the design of developments and referred to these conflicts as *design appeals*. They explored design appeals in minor developments and conducted a survey of Chief Planning Offices to record local authority concerns about design appeals. They also determined the extent that new government advice had created a more positive approach for design control in England.

Punter and Bell (2000) reviewed appeals over 15 years in the English planning system. They examined the *appeal success rate* and *dismissal rate* during this period and found that design issues were the dominant concern at appeal. During the 15 years, the number of appeals and refusal rate rose considerably and were narrowly related to the pattern of development of industry activity. They identified design appeals as a very contentious area of planning control, which was regularly contested at appeal. It resulted in more enforcement and design interventions by local authorities through the plan-led system. Design appeals are defined by Punter and Bell (2000, 12) as:

> *… visual aesthetic issues including the impact upon landscape, the impact upon the streetscape/townscape, the effect on neighbours/surroundings, overdevelopment, intrinsic design, trees and woodland and 'other'. These were considered to constitute the broad range of design factors that have been identified in recent central government advice under such headings as "bulk, height, density, massing, layout landscape and access.*

They also considered the 'bad neighbour' issues, such as day or sun lighting and overlooking property, or privacy, as additional design issues in their analysis. Based on their study, 12 percent of planning application are refused in the UK annually, but only 3 percent of them end up in court; only 0.75 percent of a total number of planning permissions granted in any one year (Ebrahimi & Aliabadi, 2015).

Punter and Bell (2000) used two sources of available data to study appeals in England. The Annual Reports of Planning Inspectorate and the Relevant Case Records database were used to identify trends in the pattern of both success and dismissal rates. Design appeals were analysed in more detail, and dismissal rates and occurrences were calculated. They also disaggregated design appeals based on development type to identify different design issues. These findings were used to gauge the effectiveness of design control in town and country planning in England. Punter and Bell (2000, 236) found a strong correlation between development applications and appeals:

> *The pattern of appeals the broad trends in the number follows the broad trends in the number of planning applications and rates of refusal of planning permission, which in turn are closely related to the cyclical pattern of development industry activity, So the greater the number of applications and the higher the number and proportion of refusals the greater increase in the number of appeals.*

Punter and Bell (2000) presented several variables in a graph, including the number of appeals, the number of determined appeals, ongoing appeals at the end of the year, appeals allowed and appeals withdrawn, and the number of decided applications (see *Figure 2-1*). The graph shows consistent fluctuations over time. They also investigated and explained the underlying reason behind uptrend or downtrend periods. They explained that appeals fell in 1982 and 1983 in

response to economic recession, and increased for seven years until 1989 (p 281). Brothernton (1993) identified four reasons for the results in this uptrend: lack of central government support for LPA policy, high success rate of appeals, increasing public awareness of planning policies, and the appeal system.

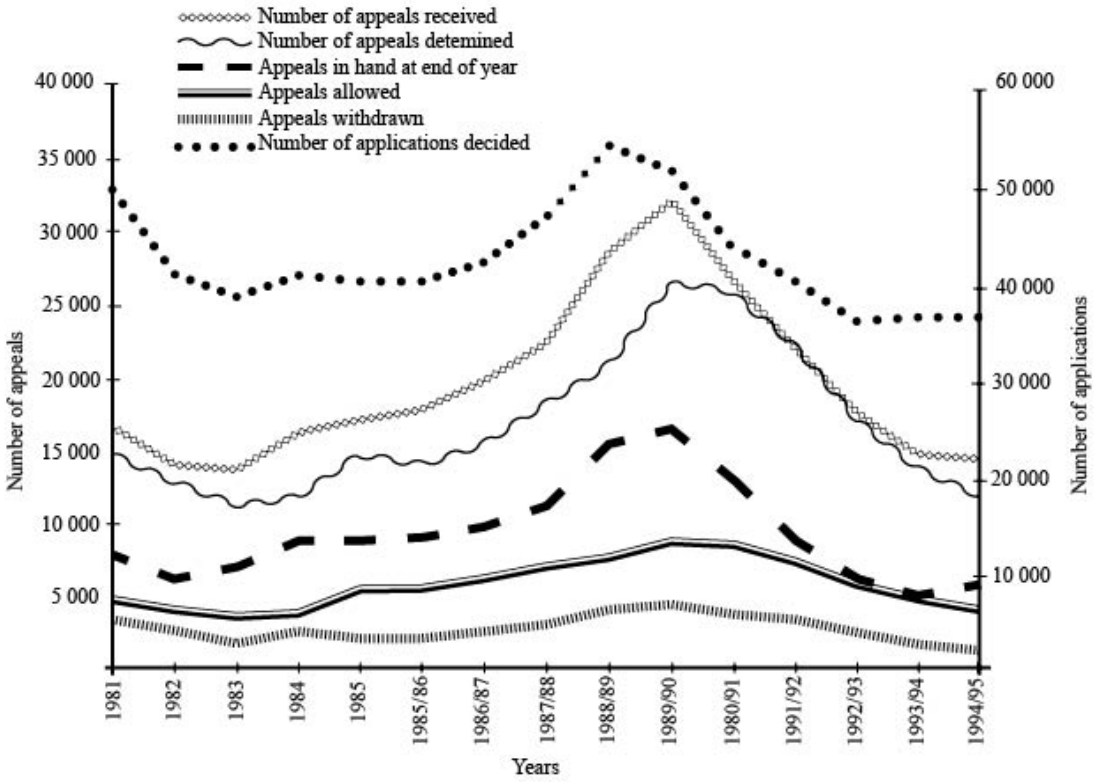


Figure 2-1. Planning appeals received, withdrawn, determined and allowed and the number of planning application decided (Adapted from Punter and Bell 2000).

Punter and Bell (2000) also considered that it was important to disaggregate the data on appeals by development type. They identified that up to 90 percent of all appeals involved minor dwellings, householder development and material change of use. They concluded that ordinary householders were more reluctant to go to appeal compared to more profit-oriented land-owners and developers (Punter and Bell, 2000, 283). They also identified several visual amenity issues (Punter and Bell, 2000, 285):

"…

- the effect on the landscape;
- the effect on neighbouring building(s)/surrounding areas (because of scale, character, materials, etc.);
- the effect on the street scene/townscape;
- tree(s)/woodland(s);

- the intrinsic design of the proposed building/development;
- overdevelopment;
- Other visual and/or aesthetic issues (Planning Inspectorate, 1987)."

Design appeals were considered as those appeals where one or more of these issues are relevant. Each design issue, including their associated issues, was investigated in their study to measure dismissal rates. The key finding of their analysis of 1991–95 data was that design issues represented two-thirds of all appeals. They also concluded that appeals related to design issues had a slightly higher than average rate of dismissal. The effect on streetscapes and townscapes were considered to constitute half of the design appeals, and the existing context and character were the critical factors in the most of design appeals.

According to Punter and Bell (2000, 291), the effect on neighbouring buildings and surrounding areas, which is a complex of visual and functional effects, were the most commonly occurring design issues (10 percent of all design-related appeals and 46 percent of appeals in combination with other design issues). The dismissal rate for this type of appeal was low compared to other forms. Bad neighbour (overlooking and overshadowing) and infrastructure issues (noise, traffic, and parking) were at average dismissal rate.

The second-most-common design issues were the effect on streetscape and townscape. It had an average 50 percent dismissal rate, but this significantly increased when it was associated with tree removals and overdevelopment. Overdevelopment was a general design issue, featuring in 11 percent of all design related appeals and strongly related to other design factors. It had high dismissal rates due to the importance of appropriate scale of development.

In summary, Punter and Bell (2000) and Rydin et al. (1990) considered that it is important to analyse the pattern of design conflicts by type of developments to understand dismissal rates. It is also mentioned that appeal reviews are useful for knowing what kind of developments raise what kinds of issues at appeal and how this may affect the dismissal rate. These findings are important for writing design policies. Design appeals with visual aesthetic issues were considered to be an important type of planning conflict. However, the number of design conflicts was reduced over time in England due to a more constructive government decision on design and the emergence of more comprehensive policy frameworks.

The review of planning appeals in England provided an overview of issues, parameters and explanations that are critical for investigating which review of planning appeals to investigate. Appeal and appellant success and refusal rates are relevant parameters which can be a measured in any appeal reviews in any planning system. Thus, they were considered as relevant factors to be analysed and measured in this study as well.

This study is also focused on design appeals covered under a broader concept – visual amenity. Visual amenity conflicts are a major group of conflicts in Australia, which has similar issues in design appeals as England. Visual amenity is a broad concept in planning and is related to visual attributes and the aesthetics of urban environments. Therefore, it is considered necessary to review the origins of this concept in the relevant literature.

2.3 CONCEPT OF AMENITY IN URBAN PLANNING

Amenity is a broad concept and not formally defined in planning legislation. Amenity is defined in the Oxford English Dictionary as "desirable or useful feature or facility of a building or place" or "the pleasantness or attractiveness of a place". Amenity has a broad usage and meaning in planning. Chambers defined amenity as "anything that makes life more comfortable and pleasant" and "a public facility" (Tsouchlaraki & Achilleos, 2004a). All definitions agree on the quality of 'pleasantness' as a basic meaning (Selman, 2008). Argent et al. (2007, 218) considered amenity as a quality related to two aspects of a locale: the attractiveness of the general environment and the qualities or facilities of a locale itself. They also considered amenity as a cumulative concept that depends on time:

> *As the time-scale at which it is applied is lengthened, more elements come into play and relative importance of the different element changes. Notably at short time-scales immediate site factors tend to determine amenity while the broader locational factors increasingly come into play as the time-scale is extended.*

Argent et al. (2007, 218) also noted amenity is a complex, overdetermined and "anthropocentric concept":

> *… relating to the subjective interpretation of aspects of the physical and cultural environment in terms of their creation of a 'pleasant' setting. It is thus dependant on a wide variety of human factors and preferences, including age, fitness, social economic status, making the choice of suitable indicators doubly difficult.*

The concept of amenity in urban planning was examined by Smith (1974) in his book, *Amenity and Urban Planning*. The origin of the concept of amenity goes back to the nineteenth century, with the establishment of the modern British planning system (Glass, 1965). Smith examined the emergence of the notion of amenity from the nineteenth century to the 1960s and identified the roots of amenity and the emergence of tendencies to improve environmental qualities in urban development. He considered that social, economic and physical changes and the government reforms of the 1870s and 1880s formed the basis for modern era planning in the next century. He also explained four factors for understanding the origins of the amenity concept:

> *… the physical state of Victorian cities; certain economic, administrative and attitudinal changes in government and urban society in the latter half of the nineteenth century; new ideas and initiatives in art; architecture and social reform, and the example of model towns. (Smith, 1974, 12)*

The growth in the migration to cities and suburbs between 1881 to 1901 was the main factor driving the remarkable expansion of Victorian cities. This increase had a deleterious effect on the appearance of these towns. Lack of open space and greenery and dullness of domestic architecture were major concerns at this time. However, some towns were developed for a wealthier class of resident and had more recreational facilities and open and entertainment areas. These became heritage listed areas 40 years later (Glass, 1965). Also, overcrowding and health issues, including unventilated and unheated rooms, waste and sewerage disposal, smoke derived from coal and steam power, were other problems in Victorian cities.

On the other hand, industrialisation produced a wealthier urban population. The growth of skilled labour, professional institutions and newspapers provided opportunities for people to take part in the public action. An electoral system permitted the development of specific urban policies and professions. Health and surveying institutions were formed, and government action was centred particularly on the Health Acts. In the last half of the nineteenth century, there were links between art, architecture, social reform and political movements to promote the concept of amenity among modern town planners:

> *The new planning legislation was itself a partial outcome of the interrelated responses to Victorian urban developments that have been described. It was one product of a complex concept of amenity whose threefold concerns for environmental health, pleasantness and civic beauty, and preservation contained the substance of a wider interest and have had a more lasting influence on environmental policy-making (Smith, 1974, 26).*

Smith considered the concept of amenity to be derived from three important aspects. The first was shaped as a solution to overcome such urban problems as a lack of cheerfulness, hopefulness causing physical and mental health (environmental health) in Victorian cities. The second aspect was specifically focused on the visual attributes of cities (pleasantness and civic beauty). The third aspect derived from the developing values of art and design at the beginning of the preservation movement to protect historical areas. These three aspects resulted in the formulation of the new planning legislation of the late 1960s.

Smith analysed 11 pieces of environmental law and classified amenity inspired actions classified into five subclasses: general policy, specific policy (e.g. smoke control); control (i.e. tree preservation); abatement (e.g. noise abatement); and improvements. He also went further by classification of underlying expectations and views of amenity in policy making. The first view he

defined as a 'reformist view' in which enhancements were regarded as essential and crucial for the benefit of the society as a whole. The second view was defined as the 'functional view', which justifies amenity regarding its social and economic impacts. He defined the third view as the 'social preference' view. He referred to the most contemporary moves toward public participation in the planning processes, where amenity measures specifically reflected public attitudes and opinions.

Roberts (1975) in his book review of Amenity and Urban Planning, considered the most multipart relationship between reformist and functional views in town planning practice and philosophy. The other relevant and important view is the 'political view', as amenity issues are highly visible (Willey, 2007).

Coppack (1988) considered the concept of amenity to sit at the higher level of psychological satisfaction rather than just a basic need. He defined amenity as the attraction of a place, which can be perceived by its pleasant characteristics and which also satisfies psychological needs, rather than just physical needs. He believed that amenity must go beyond life's necessities and be treated as a resource term separate from the function of the environment (He et al., 2005). Coppack (1988) recognises that the role of the environment may change over time, whereas the nature of the environment may not. He concluded that amenity played a key role in the evolution of urban environments.

The concept of amenity has been well-defined in the academic literature, and aspects of it are considered in planning documents and court reports. The notion of amenity is considered as a quality inherent in the presence and layout of towns that contributes to a comfortable and pleasant life, rather than being a simple phenomenon. Judge Griffin defined amenity in McDonalds Australia Limited v Logan City Council & Ors (2012, 12) QPEC 11 as:

> *Amenity may properly be described as the quality which it has of being pleasant or agreeable and that element in the appearance and layout of town and country which makes for a comfortable and pleasant life rather than a mere existence, and although the test is an objective one the considerations suggested above in various decisions involve wide-ranging and subtle criteria that may affect different individuals in different ways. Some aspects of amenity are practical and tangible such as traffic generation, noise nuisance, appearance and even the way of life of the neighbourhood. Other concepts are more elusive such as the standard or class of the neighbourhood and the reasonable expectations of a neighbourhood.*

Therefore, practice-based interpretation of amenity is considered as a quality that includes tangible and intangible aspects and is like an umbrella that covers a broad range of planning considerations. Tangible aspects are access (pedestrian and traffic), noise, appearance (visual) and way of life. Visual amenity, as one of the areas of amenity, is in the eye and mind of the beholder, which is not easy to quantify (Godschalk, 2004).

Visual amenity is one of the critical branches of amenity in planning law. The term was used for the first time as an aspect of the aesthetic qualities of the physical appearance of a place in 1966 (Stein, 2008), where visual amenity was included in planning legislation during the consideration of the impact of high-rise towers in residential suburbs in Sydney. Therefore, aesthetic values are a commonly accepted factor of amenity and are a fundamental consideration in planning legislation, because any negative visual intrusion can have a significant impact on a person's right to enjoy the pleasantness of their surrounds. The perception of visual amenity has deep psychological roots and depends on memory and background, a person's ability to absorb intangible attributes, which are connected to psychological patterns. As this study is focused on visual amenity conflicts separate from other branches of amenity, the concept of visual amenity has been investigated in more detail.

2.4 CONCEPT OF VISUAL AMENITY

Visual amenity is one of the most complicated issues in planning policy and is the principal consideration in the assessment of development applications (Stein, 2008). It refers to the visual pleasantness of a place and is closely tied to several urban design terms and concepts, including character, sense of place, place identity, place-making, genius loci, atmosphere, and imageability. While each concept has different meanings and functions and refers to the different aspect of the place, they are interconnected terms in the field of urban design and planning that connect the way that places work, as well as how they look (Sepe and Pitt, 2014).

> *It (urban design) concerns the connections between people and places, movement and urban form, nature and the built fabric, and the processes for ensuring successful villages, towns and cities'. The city thus becomes the outcome of complex intersections created by a number of operators who modify the system for different reasons. It becomes necessary to identify a microsystem within the macrosystem of the city able to make the urban variants intelligible: place is at once porous and resistant, a receptor for complex interactions. The concept of place, in the sense of a space endowed with unique features that is fundamental for establishing the identity of the contemporary city, is meant as a key concept of urban design (Sepe and Pitt, 2014, 217).*

The concept of genius loci or sense of place refers to perception and quality of places and has been well described as:

> *'Sense of place' is a much used expression, chiefly by architects but taken over by urban planners and interior decorators and the promoters of condominiums, so that now it means very little. It is an awkward and ambiguous translation of the Latin term genius loci. In classical times it means not so much the place itself as the guardian divinity of that place.… in the eighteenth century, the Latin phrase was usually*

> *translated as 'the genius of a place', meaning its influence.… We now use the current version to describe the atmosphere to a place, the quality of its environment. Nevertheless, we recognise that certain localities have an attraction which gives us a certain indefinable sense of well-being and which we want to return to, time and again (Jackson, 1994, pp. 157–158).*

Several writers in urban design considered character as the "spirit of place" or genius loci (Cullen 1960, Lynch 1961, England 1983). Norberg-Schulz (1980) described it as representing the sense people have of a place, the considered character as the sum of all physical and symbolic values in nature and the human environment. However, Jive´n and Larkham (2003, 78) defines character as:

> *It is the people—individuals and society—that integrate these features, through their value systems, to form a sense of place.*

Place character, or sense of place, has a broad meaning similar to the concept of amenity. Researchers (Ode et al., 2008) in landscape character assessment propose a more comprehensive meaning for it, as it includes all distinct, recognisable and consistent patterns of elements and attributes that make one place different to another, rather than better or worse (Ode et al. 2008). Based on this definition, it can be seen that place character includes broader elements and attributes compared to amenity, which is only limited to the perceived pleasant aspects of a place. Although place character is not only restricted to the pleasant aspects of a place, the pleasant aspects are important as they help to differentiate one area from another.

As previously discussed, protection of historical values of towns was considered as one of the origins of amenity, to conserve the sense of place. Authenticity is a relevant concept developed with respect to the protection of original and valuable visual qualities of space. It is not acceptable that an urban form deceives its users by losing its character and authenticity (Punter & Bell, 1999). Relph (1976) investigated the importance of place as the integral role in human experience and examined the authentic and inauthentic in his book, *Place, and Placeless*. He defines an authentic sense of place on page 64 as:

> *A direct and genuine experience of the entire complex of the identity of places—not mediated and distorted through a series of quite arbitrary social and intellectual fashions about how that experience should be, nor following stereotyped conventions" (Laverick, 1980).*

Relph argues that in our modern period, an authentic sense of places can be overshadowed by less authentic views to create placelessness. Jive´n and Larkham (2003) questioned the importance of authenticity of the original fabric and considered that overall character and appearance is more important to people than authenticity. However, public reaction to a new structure is often negative. They concluded that local residents' perceptions are important in

defining a sense of place, which is important as baseline criteria for gauging authenticity. It is also connected to the principles of placemaking in urban design, including activity, form and image (Skeu-Petersen & Snizek, 2008). Placemaking principles seek to promote conditions where experience is improved and a sense of place is created (Punter & Bell, 1999):

> *we propose that designers need to develop more theoretically informed conceptions of sense of place, authenticity and character, which—furthermore—should be informed to a much greater extent by the views of the people directly involved (Punter & Bell, 1999, 255).*

Another contribution by Relph's was the clarification of 'insideness' in the understanding of place. When a person feels inside a place, his or her identity is strongly associated with the place. On the other hand, when a person is separated from a place, this mode is called 'outsideness'. Outsideness and insideness establish a fundamental dialectic in human life (Shatu, Kamruzzaman, & Deilami, 2014). Seamon and Sowers (2008) in their publication, "Place and Placeless, Edward Relph" investigated the Relph's concepts in more details:

> *… through varying combinations and intensities of outsideness and insideness, different places take on different identities for different individuals and groups, and human experience takes on different qualities of feeling, meaning, ambience, and action.*
>
> ....
>
> *The strongest sense of place experience is what Relph calls existential insideness—a situation of deep, unself-conscious immersion in place and the experience most people know when they are at home in their own community and region. The opposite of existential insideness is what he labels existential outsideness—a sense of strangeness and alienation, such as that often felt by newcomers to a place or by people who, having been away from their birth place, return to feel strangers because the place is no longer what it was when they knew it earlier (Seamon and Sowers, 2008, 45).*

Relph also explains seven modes of insideness and outsideness. Therefore, the level that people share a socially constructed place experience depends on the degree of familiarity and knowledge of the place. Conflicts occur between different groups who share different experiences, expectations and perceptions of a place in response to a proposed change in its character. In these situations "insiders" may feel the proposed project will be incompatible with the existing conception of the character, while "outsiders" may not believe this incompatibility due to their lack of in-depth and meaningful connections with the place (Green, 2010).

As a summary of this section, the origin of the concept of amenity was investigated to identify its roots, meanings, and aspects. Visual amenity as one of the aspects of amenity is closely tied to several concepts developed in urban design and planning throughout the literature, such as

character, sense of place, genius loci and authenticity. Identification of relationships between these concepts was found to be one of the gaps in the available literature. Thus, these interrelated concepts were explored concisely to clarify their relationships with visual amenity in urban design literature that provided the theoretical knowledge for this study.

Understanding the different aspects of visual amenity and character is helpful to investigate and review different evaluations of visual environments that are discussed in the next section of the literature review. As this study aims to develop more quantifiable methods to evaluate urban environments, this review provides an overview of current methods, being the expert assessment. These methods have limitations, which has resulted in a high number of conflicts and inconsistencies in expert assessment.

2.5 EVALUATIONS OF VISUAL ATTRIBUTES OF URBAN LANDSCAPES

Most of the human beings are strongly visual creatures, and the goal of human vision is the recognition (Russ, 2002). Understanding and analysing visual attributes of visual environments have been an ongoing concern of a wide range of practitioners in architecture, landscape architecture, urban design and planning, psychology and geography (Llobera, 2003). Researchers in each discipline have viewed and analysed the visual environment, including natural, rural and urban, through their expertise and beliefs. In this section, different visual attributes of urban landscapes are discussed.

Urban landscapes are considered as the most complex type of landscapes due to the multifaceted interaction of their tangible and intangible elements (Smith, 1979). The urban landscape is composed of built, natural and cultural elements and refers to the total physical environment of an area within an observable frame (Ak, 2013). Ak (2013) also defined landscape visual quality as the aesthetical excellence of landscape derived from the product of the observer's psychological process.

Landscape perception can be defined as sensory awareness of the surrounding space, filtered through cognitive images through an unconscious process of comparison and contrast (Rescher, 1997). Visual attributes are perceived by a cognitive awareness of what is observed. Landscape visual quality is also considered as a joint product of the observer's perceptual, cognitive and emotional (psychological) processes that shape in interaction with the landscape elements and characteristics (Daniel, 2001). Ak (2013) defines visual quality as a concept that expresses the degree of people's opinions and aesthetic admiration of the surrounding environment. Assessment of visual attributes and defining visual objectives for urban environments are one of the major weaknesses of the planning process (Lozano, 1974). Lozano (1974) proposed the hypothesis that the major conflict between lay people and a new development is due to visual dissatisfaction. He considered that environmental studies were more versatile to

analyse and assess environmental effects, including visual qualities. He criticised aesthetic evaluations of spaces:

> *One burden of the aesthetic criticism is the architectural tradition of criticism, which has been notoriously unable to generate common criteria and acceptable methodologies of analysis to evaluate built forms and spaces. In this respect, the lay public and the 'educated' critics show little difference in their reliance on highly subjective concepts to illustrate an aesthetic reaction. Most of the assessment tends to remain at a gross level, failing to recognise the components of the problem, which is considered in its superficial totality, and often ending up in a simple polarity of positive or negative feelings - perhaps with some historical comparison to add perspective. Words such as monotonous, regimented, chaotic or confused are used to synthesise a negative assessment; words such as balanced, clear, interesting, or dramatic are used in the case of a positive assessment seldom without a definition and justification for the use of a particular adjective* (Lozano, 1974, 352).

Visual landscape assessments were developed in the second half of the 20th century by landscape planning, urban design and management objectives (Ak, 2013). Ak (2013) also considered that the visual quality assessment of an environment includes multiple visual parameters (neutrality, diversity, consistency, openness, mystery, perspective, confidence, order, the beauty of view) and is one of the hardest types of assessments to undertake. During the last half of the 20th-century, landscape quality assessment has been a contest between the expert approach and the public perceptual approach. Both approaches consider the fundamental idea that biophysical characteristics are in interaction with the human perception and experience and other components of the environment (Thompson, & Maginn., 2012):

> *Visual (quality) assessment studies focus on evaluating the visual characteristics, locational installation, and social life of a place or a route on a perceptual basis (including all sense organs, especially the eyes) within a functional relationship. These assessments become operative in urban settlements such as a broad place which includes a whole city or a division of a settlement or a route (boulevard, main road, street* (Ak, 2013, 281).

While the expert approach is more powerful in environmental management applications, user perception is more frequent in academic research projects (Ak, 2013). However, both methods accept that landscape quality initiates from interactions between the physical landscape aspects and observer perception.

Ak (2013) noted that expert approach to visual assessment studies originated from Kevin Lynch. Lynch (1960) in his work entitled *The Image of the City*, a work that has influenced architects and landscape experts worldwide. It identifies the base structural elements of city form as districts, edges, paths, nodes and landmarks. His work addresses how people orientated

themselves within the city. He introduces the importance of mental representation of the environment through human experience. By using questionnaires, he examines and analyses how people perceive, utilise and recall their surrounding area. His research incorporates two main practices: the in-place registration of the urban environment by skilled and experienced observers and interviews with permanent residents of the city and of people working in the area who are asked to describe, draw and submit their personal views on the problems of the area. Comparing and contrasting the two sets of results allowed him to formulate findings on the sensitivities and critical points within the area.

Nasar (1998), in his paper "The evaluative image of the city", emphasised the importance of the environment and users' reactions and preferences to different characteristics within it. To improve community role in shaping cities, he considered that planners need to know how people perceive the 'cityscape.' He conducted a survey to identify areas which interviewees either liked or disliked and their criteria for their evaluation.

> *Typically, visual inventories centre on visual features, such as enclosure, vistas, or visual sequences. To ensure that the public notices and appreciates visual improvements, however, it is necessary to find out how the ordinary person reacts to the visual form* (Nasar, 1992, 41).

He produced several composite maps to map interviewee's desirable features, including naturalness, upkeep, openness, order and historical significance. The maps presented the identity, location and likeability of visual features and provided a basis for a visual plan. The concept of these evaluative maps followed Lynch's (1960) approach using cognitive mapping (Nasar, 1992, 42). However, Nasar believed that imageability (paths, edges, districts, nodes, landmarks) was not enough and negative and positive feelings (evaluation) was central to human perception. Therefore, visual amenity experts considered users as the core part of the assessment in both approaches mentioned above. They conduct a comprehensive assessment of public opinion to obtain a complete assessment of visual quality.

Further to classification mentioned above, the visual quality evaluations of urban environments can be divided into two broad categories, the *subjective* and the *objective*. The subjective methods are related to the perceptual and representational qualities of aesthetics. These approaches include questionnaires and interviews to analyse public preferences about the urban environment (Madanipour, 1996; Nasar, 1992; Roberts & Greed, 2001). Subjective approaches have two underlying paradigms – the psychosocial paradigm and the psychophysical paradigm.

The psychosocial model, based largely on the work of Appleton (1975), Kaplan and Kaplan (1989), develops the foundation that landscapes can be assessed and valued according to the meanings attributed to them by viewers. The meaning may be based on cultural conditioning, past experiences and learning, and the relation to perception, cognition, affect and emotion at the time of the experience. Different responses occur in various groups of people. This model gives

more weight to user preferences and provides a theoretical base for the psychophysical approach, but, on its own, this model does not yield clear and applicable practical outcomes.

The psychophysical paradigm (Lamb & Purcell 1982) is based on the premise that certain landscapes create specific responses from viewers, some of which appear to be almost universally representative of human preferences. This idea forms the basis of actions widely used in the US and Australia, particularly among forest management agencies (Williamson & Chambers 1982) that integrate and interpret aesthetic criteria regarding public preferences for particular combinations.

In opposition to the subjective approaches, objective approaches are more focused on physical attributes and qualities of physical and visual environments rather than symbolic meanings. The conceptual framework underlying these approaches considers physical features and visual attributes rather than individual perception and meanings. While meanings and perceptions are the more intangible aspects of visual space, physical features and visual attributes are tangible. These studies are more reliable than expert opinions through objective assessment of visual attributes and environments. Notwithstanding that, expert-based approaches can identify many important factors and elements of the visual quality and character. However, this method is still problematic as it is impossible to achieve a high degree of consistency between all assessments as all cases will not be assessed by only one expert (Ostwald & Tucker, 2007).

Many methodological approaches aim to identify and analyse the visual elements and attributes of the urban landscape. Classical approaches (Cullen, 1961; Jakle, 1987; Lynch, 1960; Osborn & Whittick, 1969; Rasmussen, 1964), which show a high degree of agreement regarding (1) the basic structural elements of the urban landscape they analyse and (2) the fundamental visual attributes of the urban landscape. These studies analyse a wide variety of characteristics and qualities of urban environments, and these objective methods have been improved over the years by advances in technology and computer modelling. Ewing and Handy (2009) provided a list of 51 perceptual attributes in architecture, landscape architecture, park planning, environmental psychology, visual preference and assessment literature. Some of these attributes are analysed objectively in urban design literature while others have been considered as essential attributes (Ewing & Handy, 2009).

Table 2-1 Urban design attributes (Adapted From Ewing and Handy, 2009: 66)

Adaptability	Distinctiveness	Intricacy	Richness
Ambiguity	Diversity	Legibility	Sensuousness
Centrality	Dominance	Linkage	Singularity
Clarity	Enclosure	Meaning	Spaciousness
Coherence	Expectancy	Mystery	Territoriality
Compatibility	Focality	Naturalness	Texture
Comfort	Formality	Novelty	Transparency
Complementarity	Human Scale	Openness	Unity
Complexity	Identifiability	Ornateness	Upkeep
Continuity	Imageability	Prospect	Variety
Contrast	Intelligibility	Refuge	Visibility
Deflection	Interest	Regularity	Vividness
Depth	Intimacy	Rhythm	

More tangible and quantitative attributes

Similarly, Ewing and Hardy defined two other groups of attributes which are important in perception and analysis of urban landscapes; these are individual reactions and physical features. Individual reactions include attributes such as a sense of safety, sense of comfort and level of interest. These reflect how individuals react to the environment and perceive a sense of place. Physical features are factors such as building height, sidewalk width, traffic volumes, the number of people, etc. These three groups of factors are described in

Table 2-2.

Table 2-2 Urban Landscape Factors (Adapted From Ewing and Handy, 2009: 80)

Physical Features	Urban Design Attributes	Individual Reactions
Building Bulk And Height	Diversity	Sense Of Safety
Tree Canopy	Complexity	Sense Of Comfort
Access	Human Scale	Level Of Interest
Traffic Volumes	Openness	Like/Dislike
Weather	Enclosure	
People	Coherence	

The urban design attributes are in fact the visual properties of urban environments that can be analysed and evaluated by experts. While some of these properties are more qualitative and intangible, some others are more tangible and quantitative, and are outlined in Table 2-1. Visual properties such as diversity, dominance and complexity are some of the important attributes which

are quantified by several researchers in this field. However, there is a lack of empirical work in relation to assessing these methods to be used by experts in court case evaluations. Visual complexity, diversity and dominance are considered as quantifiable properties of urban environments. These properties are further reviewed in this study.

2.5.1 Complexity and Diversity

Visual complexity is related to the number of differences visible to a viewer per unit time whether it is pedestrian (3 mph) or motorist (60 mph) (Ewing and Handy, 2009, 79). Too much information in a short space of time can create sensory overload and too little information produces a sensory deficiency (Ewing & Handy, 2009). Many urban designers indicate that visual complexity as an essential determining factor in perceptual satisfaction of urban landscapes (Laverick, 1980). Lynch (1960) referred to visual complexity by defining 'richness' in the visual urban landscape. Cullen (1961) focused on visual complexity in his work.

However, notions of visual complexity and contrast were explicitly described by Rapoport and Kantor (1967). They defined physical complexity as the sense of intricacy in design and defined the concept of 'optimal perceptual rate' as a measure of psychological need for complexity and ambiguity. Complexity is defined as the perceptual property of a group of elements, including the relationships between them (Rapoport & Hawkes, 1970).

Visual complexity has a long history, going back to 17th century in both English and Chinese literature and was central to picturesque theorists (Laverick, 1980). Repton (1803) recommends visual complexity in landscape design to create a balance between uniformity and chaos. According to Laverick (1980), picturesque theorists expressed their desires for more visually complex landscapes. He believed that similar to the picturesque era; now we need more complex landscapes. He argues that 20th-century urban design is criticised as being unable to provide visual stimulation. Rapoport and Kantor (1967, 215) criticised simplicity of modern architecture and urban design:

> *Simplicity has been the aim of contemporary architecture and, implicitly, that of much urban design. The call has been for clarity, lucidity, simplicity. While the striving for simplicity has always tended to distinguish the designed environment from the vernacular which has been more complex, it has been more typical of recent work than of the past. It is our contention that contemporary urban complexes have failed to answer important needs. By reducing sensory input to low levels, they have led to a lack of interest in our environment.*

Lozano (1974) considered diversity and related quality to variety. He considered variety as a higher, and multiple, an order of diverse elements that belong to a recognisable pattern. He has also examined diversity as a higher level of differentiation than variety.

> *A row of residential brownstone buildings exhibiting minor architectural differences f detail is a case of variety within a common typology and homogenous use; but diversity should be applied to qualify the whole set of different building types devoted to housing in a given area. It must be clear that the difference between variety and diversity is a matter of agreement, since both qualities are actually points along a continuum (Lozano, 1974, p357).*

According to Ewing and Handy (2009), complexity is the result of several factors, such as building shape, size, material, colour, architecture and ornamentation, and variance in these adds to the complexity. Other elements of urban landscapes, such as trees and vegetation, which are rich in visual detail, contribute strongly to complexity. Jacobs valued the constant movement of branches and leaves (Jacobs, 1992). Street furniture, signage and paving are considered as other elements that add to the complexity. Cullen (1961, 151) considered signage as a unique and effective contribution to twentieth-century urban scenery, in both its negative and positive aspects. However, people's activity is also considered as another contributor to urban landscape complexity.

Alexander (2002) argues that good urban design must express a coherent scale and consist of a range of definable properties, including levels of scale, boundaries, positive space and voids, to contrast with the surrounding environment. However, the perception of urban spaces is not limited to buildings as we perceive them to be part of "an extended and undivided continuum." Therefore, other visual elements, built and natural, within urban environments, like gardens, vegetation, street furniture, electricity cables, should be considered as visual elements affecting complexity.

The terms diversity and variety are also used with regard to complexity in the literature. When diversity is greater, complexity will be higher. Several researchers from different fields have investigated the relationships between pleasure and diversity or complexity (Eisenman and Rappaport 1967; Vitz and Todd, 1969; Nasar, 1981, Nasar 1983; Nasar, 1984; Stamps, 1994; Tucker, 2004; Stamps, 2002). Almost all of these researchers identified some relationships between interest, pleasure and complexity. Visual complexity and diversity are calculated by researchers through different methods, from simple calculations to more mathematical and computational approaches. The use of mathematical approaches for quantifying and measuring visual attributes has been more evident since the 1990s. Both fractal dimension and entropy are quantifiable methods for measuring visual complexity and diversity. These methods are described below.

2.5.2 Visual Complexity and Fractal Geometry

Euclidean geometry developed around 300BC is unable to determine the size and complexity of any natural feature in the landscape (Vaughan and Ostwald, 2010). In response to this deficiency, fractal dimension was developed for the determination of complexity of natural systems (Vaughan and Ostwald, 2010). Fractal geometry has a geometric order that is created from self-similarity and can describe and measure the self-similarity of natural forms (Perry, 2012).

Mandelbrot (1982), proposed a new geometry to describe the complexity of natural systems over multiple scales of observation. He called this new geometry "Fractal Geometry". Architects adopted fractal geometry in their work after Mandelbrot's formulation, and after a decade it was being used to analyse visual properties of natural and built environments (Tucker, 2004). Mandelbrot explained several methods to measure the dimensions of natural forms by fractal geometry (Vaughan and Ostwald, 2010). Mandelbrot (1982) considered particular natural forms which can be measured by the fractal dimension such as irregular natural shapes of rivers, lakes, trees, sky or galaxies. He acknowledged the usefulness of fractal dimension for measuring and comparing various coastlines. Further works in other disciplines including geography, landscape and urban planning and architecture investigated links between fractal geometry and built environment in macro and micro scales (Liang et al., 2013). Fractal analysis of built environment is one of the most widely used methods for quantification of visual properties (Vaughan and Ostwald, 2013).

The fractal dimension is a measure of the degree of self-similarity within a pattern or structure, and it refers to how a pattern changes with a change in scale (Perry, 2012). Therefore, fractal dimension refers to a particular type of complexity. It also describes irregularity in an object or pattern and can be calculated and presented as a number between 1 to 3 (Cooper & Oskrochi, 2008). For example, the fractal dimension of a simple straight line is 1, while the fractal dimension of an irregular line (such as a coastline) would lie between 1 and 2. The fractal dimension is a measure of how a particular object fills a space.

Fractal dimension has been used in landscape planning and preference studies to analyse preferences for the visual complexity of natural landscapes (Keller et al. 1987; Stamps 2002; Hagerhall et al., 2004). Keller et al. (1987) distinguished different natural elements such as mountains and trees by measuring their fractal dimensions. Stamps (2002), investigated visual aesthetic of three principles for designing skylines by measuring the fractal dimension. However, he found that fractal structure cannot be an effective design principle for cityscapes. Torres Sibille et al., (2009) used fractal dimension as an indicator of the aesthetic impact of wind farms. They compared the fractal dimension of the wind farm versus the main topographic line of the background (skyline).

Further to natural elements, it was found that the fractal geometry can also be useful for quantifying the properties of human creations such as art, architecture and the built environment (Mandelbrot, 1982). Several researchers have used fractal geometry to analyse different aspects of urban environments (Batty & Longley, 1994; Cooper & Oskrochi, 2008; Vaughan and Ostwald, 2010; Perry, 2012). However, Voss (1987) argued that fractal dimension is only appropriate for natural forms with large scales and natural boundaries. Chalup and Ostwald (2010) used fractal dimension as an anthropocentric biocybernetic approach to analyse built environment. They used fractal dimension for city skylines and identified different types of cityscapes using this method. Bovill (1996) refers to the perception of different scales of architecture.

> *[w]e experience architecture by observing the overall profile of a building from a distance; as we approach closer, the patterns of window and siding come into attention; as we approach even closer, the details of doors and window frames come into attention, down to what the door knob is like. The process then continues inside the building. The fractal characteristic of an architectural composition presents itself I this progression of interesting detail as one approaches, enters and uses a building (Bovill, 1996, p. 117).*

In macro scale analysis, various researchers used the fractal dimension to analyse urban environments (Cartwright, 1991, Batty and Longley, 1994, Batty, 2005, Cardillo et al., 2006). Cartwright (1991) explained the importance of the fractal dimension in town planning. Batty and Longley (1994) developed a method for adapting fractal dimension to analyse the visual growth patterns of large-scale urban settlements. Batty (2005) explored the topological properties of multiple complex networks of urban cities. Cardillo (2006) analyse the fractal dimension of 20 different cities.

At smaller scales, Bovill (1996) in *Fractal Geometry in Architecture and Design* shows how the box-counting approach can be used to determine the approximate fractal dimension of buildings. The box-counting method works by superimposing a series of grid squares, at different sizes, to count the number of boxes which are filled by the object. After counting the number of filled boxes for each grid size, the comparison can be plotted on a log-log diagram to estimate the fractal dimension. The box-counting method was applied in numerous studies to measure the fractal dimension of architecture (Sala, 2002, Cooper and Oskorochi, 2008, Tucker, 2004, Ostwald and Tucker, 2007, Vaughan and Ostwald, 2010). Sala (2002) applied Bovill's method on Frank Lloyd Wright's Robie house. Architectural works of multiple well-known architects such as Le Corbusier, Frank Lloyd Wright, Eileen Gray, Peter Eisenman, Glenn Murcutt and Kazuyo Sejima were are analysed using fractal dimension (Ostwald et al. 2008, Ostwald and Vaughan, 2008, 2009, 2016, Ostwald et al. 2009,). Ostwald and Vaughan (2010) also compared the nature and architecture using the fractal dimension to analyse relationships between architecture and its setting.

Ostwald and Ediz (2014) used fractal dimensions to analyse visual properties considering form, ornamentation and materiality of Kılıc¸ Ali Pas Mosque compared to Su¨leymaniye Mosque in Istanbul. They analysed three variations of the façade including form only, form with ornaments and form with ornaments and materiality. Fractal dimensions calculated for each variation and mosque showed that Suleymaniye Mosque is 10% more visually complex than the other mosque. Cooper and Oskrochi (2008) applied the box counting method to calculate the fractal dimension of 26 streetscapes to identify any relationship between visual variety in urban design with fractal dimension. They converted digital photos using an edge detection function and applied the box counting method. Calculation of fractal dimensions for all streets resulted in the categorisation of streetscapes into seven different categories. They identified that variations in the average fractal dimensions for streetscapes were due to the amount of vegetation, visible building, sky and open space. They also conducted a subjective survey to identify any relationships that may exist between people's perceptions and fractal dimension. The concluded that fractal dimension provided a high potential indicator of visual complexity in urban streetscapes.

Vaughan and Ostwald (2016) in "The Fractal Dimension of Architecture" calculated visual properties of eighty-five design and investigated how they relate to each other. However, they acknowledged that it is not productive to describe architecture only using numbers. They also considered social and historical context (architectural movements) as a shift between qualitative and quantitative approaches to study architecture. Architectural plans and elevations and other representation of designs were used to calculate the fractal dimension. The measure visual property was referred as *characteristic complexity or statistical roughness.*Their investigation started with defining three primary hypotheses were defined to be investigated throughout the book. The found that the fractal dimension is unable to distinguish architectural styles. They also defined three ranges of fractal dimension for plans and elevations with low, average and high visual complexity.

Fractal dimension has been calculated using box-counting method since the 1990s by architectural researchers (Ostwald, 2012). Ostwald (2012) considered five independent factors which are critical in accuracy of the results. They include field properties, image properties, grid disposition, scaling coefficient and statistical divergence. He considered fractal dimension estimation rather than calculation as the correct term to be used. He provided the best practice and standard method to estimate fractal dimension using the box-counting method.

Despite the potential and wide usage of the fractal dimension to quantify complexity within urban environments, there is no correlation between what may be considered as 'good design' and the fractal dimension (Tucker, 2004). The fractal dimension using box-counting can be used as a comparative measure of visual complexity to see if a proposed development is sympathetic to the existing neighbourhood character or not (Ostwald & Tucker, 2007).

The fractal dimension allows a comparison of visual complexity of a streetscape to the visual complexity of a proposed building. Therefore, fractal geometry can be considered as a quantitative method for quantifying visual complexity. However, previous studies have not applied these methods in the assessment of court cases. Visual Diversity and Entropy

Entropy, in this context, is a measure of diversity or physical disorder within a system (Andrew, 1984). According to Andrew (1984), all systems tend to evolve in the direction of increasing disorder and hence lower entropy. When everything is similar, entropy equals zero and is maximised when each thing is different.

Stamps (2003) used multiple images of streetscapes to calculate visual diversity by finding a correlation between human responses and the arrangement of the physical elements within the environment. He also developed another method to calculate the number of elements within a building's facade that occur at multiple different scales of magnitude. This approach was based on the assumption that it is easier to comprehend groups of similarly sized elements compared with groups of shapes with no similarity.

Visual diversity, as an attribute to visual complexity, has been analysed and quantified by Stamps (2003). He proposed a hypothesis that similarity and pleasure have an Inverted-U function, which means when similarity level increases, pleasures increase to a point, and beyond a certain degree of similarity, pleasure declines. He attempted to calculate visual diversity through mathematical formulation and proposed the concept of *entropy*. He also investigated the relationship between visual entropy and people's preferences.

The basic mathematical calculation of entropy is a list of *m* items (factors), where each can have *n* types. Stamps (2003) explained the calculation of entropy for photos using a grid. He calculated entropy for a series of similar images in different grid sizes.

Stamps (2003) found a strong correlation between the rated diversity by respondents for a series of photographs and the measured entropy. He considered five stimulus factors: variations in shapes, material, articulation, and opening sizes and colours. He considered entropy as a good physical predictor of visual diversity and that they could be used in design to avoid monotony and chaos while promoting diversity.

Entropy and fractal dimension are both quantifiable measures to analyse and evaluate visual properties of urban environments. They offer the potential for the statistical characterisation of places by providing a measurement of visual attributes (Cooper & Oskrochi, 2008). Therefore, fractal dimension and entropy were considered as potential tools to analyse the visual appearance of urban environments and to calculate the level of contrast and harmony in different scenes. In this research, these methods are applied to actual visual amenity court cases to develop and explore methods of analysis.

2.5.3 **Visual Dominance**

The English Oxford Dictionary defines dominance as “power and influence over others”. Visual dominance analysis is considered as part of a broader visual impact and visibility assessment. Rod and van der Meer (2009) mentioned that common visibility analysis methods do not provide information on how dominant a structure will be. They defined *visual dominance* as the relative proportion an object would occupy in a photomontage. A GIS-aided visibility and dominance analysis technique were developed to determine how much of a feature is visible in each location (Rod & van der Meer, 2009). They considered two factors: the distance from the observer and the proportion of visible object from any viewpoint.

They also felt that there were limitations in the common binary view analysis (visible or not visible) in GIS. Fisher (1994) developed the concept of a 'fuzzy viewshed'. This refers to the degree to which an object can be seen from a certain location. They argue:

> *The primary property of the fuzzy viewshed is the clarity of which there is a continuum of conditions between `being distinguishable' and `being indistinguishable (Fisher, 1994, 162).*

A fuzzy viewshed is measured by calculating the *visibility decay* factor. The simplest decay factor was defined as the distance decay function which distance is the main parameter to calculate the decay factor. A more complex decay factor includes methods to consider the effect of fog, solar glare, atmosphere haze, and vegetation (Rod & van der Meer, 2009). Fisher (1994) only considered distance as an essential element, while Rod and van der Meer (2009) considered distance and area as measures of decay factor. Rod and van der Meer calculated visual decay based on cumulative viewshed analyses by using three viewpoints at different heights (58m-8m) to calculate visibility of a high-rise building. They also considered orientation and the planar dimension of the planned high-rise building. They expressed visual dominance measurements as a percentage of view, and came up with a classification of impacts:

> *low impact for values up to 5%, moderate impact from 5% to 20%, and high impact for values above 20% (Rod and van der Meer, 2009, 707).*

Visual dominance and decay factor have been quantified in rural and natural landscapes in more complex approaches. Preston (2002), in his work conducted for Ipswich City Council in Queensland, Australia, considered a decay factor based on the transparency of different land cover types. He calculated decay factor for various land covers (Table 2-3). His parameters were not tested empirically and were more intuitive (Skeu-Petersen & Snizek, 2008).

Table 2-3 Selected distance decay factor in different land cover types (Adapted from Preston 2002, 5)

		Distance from viewer (m)					
Land cover type	Decay Factor, per 25m	0	25	50	75	100	500
1: Open	0.975	100%	98%	95%	93%	90%	60%
3: Pasture	0.975	100%	98%	95%	93%	90%	60%
6: Low Density Trees	0.900	100%	90%	81%	73%	66%	12%
7: Dense Trees	0.750	100%	75%	56%	42%	32%	0%
8: Very dense trees	0.500	100%	50%	25%	13%	6%	0%

Skov-Peterson and Snizek (2008) provide a more complex type of visual dominance and visibility decay analysis. They considered three factors in analysing visibility decay: increasing distance, transparency and viewing angle. They considered near objects to be more relevant to a viewer than distant objects. Therefore they surmised distance is a major factor. Weather and light conditions and vegetation are essential transparent factors affecting visibility. The viewing angle is also a major factor affecting human visibility (Campbell, 1996).

Skov-Peterson and Snizek (2008) took a psychological and physical approach to model probabilistic visibility and conducted a field study to check visibility of a target person at different distances in a forest environment to empirically test Preston's findings. They considered objects movement and colour as critical parameters in increasing or decreasing visibility. They also calculated and mapped probability visibility in GIS based on calculated decay factor.

While these methods calculated distance decay based on complex factors, including weather conditions and land cover, they were considered as less practical methods to be used in urban environments. Visual dominance in urban environments is less complex, and it more relies on the distance to built forms. This study investigates the visual dominance in urban environments with a more useful and relevant method.

2.5.4 Expert Methods in Assessment of Visual Amenity

Visual landscape assessment theory and techniques have developed over the last thirty years to assess the visual values and attributes of landscapes and are a major component of landscape assessment and planning (He et al., 2005). Visual quality assessment contributes to the overall management of urban and natural environments by assisting the decision-making process in determining development proposals. For instance, which geographic areas are suitable for urbanisation or what built infrastructure should be protected based on its inherent or associated visual quality.

Visual impact assessment in planning is divided into two areas – the urban and non-urban. The non-urban realm is the focus of geographers, foresters, landscape architects, environmentalists and resource managers concerned with rural and regional landscapes. In contrast, the urban scene,

or townscape, attracts architects, landscape architects, urban designers and planners and geographers who take a more qualitative stance (Porteous, 1996).

Visual impact assessment in urban planning adopts various methods and approaches compared to visual impact assessments in rural and natural areas. Visual landscape planning studies in non-urban areas are more focused on hiding and reducing the visual impacts of development to protect the existing setting (Danese et al., 2009). In urban planning, saving the view of monuments, landmarks, natural features, overshadowing, protecting and enhancing and consistency with visual amenity and character of existing environments are common objectives.

There is a range of approaches and techniques for visual analysis that are mainly based on expert assessment and interpretation of visual environments (Gao and Asami, 2005). These approaches are either based on personal experiences or the presumption of likely visual impacts (He et al. 2005). However, although these approaches provide evaluations for qualitative aspects of the visual environment, they are not repeatable methods to use to evaluate urban landscapes comprehensively. The assessment is subjective, uses technical language and is sometimes not easy for people and decision makers to understand (Tucker, 2010).

Systematic expert assessment of landscapes was initially developed to meet the demands of environmental and planning legislation and public concern over forest harvesting. In the US, procedures for expert assessment of forest areas have included formal aesthetic criteria, rated and categorised to indicate relative aesthetic values (Chenoweth et al. 1997). These have been a model for evaluation techniques in Australia. In the UK, procedures developed by the Countryside Commission for expert assessments also include a formal aesthetic criterion, but their evaluation is more descriptive and less reliant on standardised categories and relative values. This approach has wider application to rural, natural and urban landscapes than the US Forest Service systems due to less complexity in non-urban areas, but it is more dependent on the expertise of the assessors and is less likely to yield consistent results (Chenoweth et al. 1997).

Visual assessment in urban areas and landscape planning in the countryside are both conducted by experts and practitioners with different levels of quantifiable measures, depending on planning policies and regulations. Three-dimensional (3D) computer photomontages, walk through animations, and Geographic Information Systems (GIS) are now widely being used by experts to assess likely visual impacts of development on existing conditions to improve the objectivity of expert assessments. Similarly, in recent years, planning authorities have adopted more measurement tools to analyse and assess visual attributes in both landscape and urban areas. Hence, there is a move to more transparent and quantifiable approaches to planning policy, to increase consistency and reliability of expert assessments.

Both visual experts and the general public are concerned about the quality of the landscape and the built environment, hence the need to assess the visual attributes of new development applications (Williams, 2012). It has led to the development of powerful techniques to evaluate

visual impacts of proposed developments. Computer graphics in the visual quality assessment were initiated in the 1970s (Ghadirian & Bishop, 2008). One of the most common techniques used is computer aided photomontage to superimpose a 3D model of a new scheme onto a photograph of the existing condition (Williams, 2012). Photomontage modelling, as a representation of landscape changes, was the first computer-based technique and could achieve a high level of accuracy (Lange, 1990). Lever (1993) argues:

> *The value of the photomontage system lies in its ability to produce a faithful pictorial representation of the changes brought about by new schemes for buildings, roads and urban renewal, or indeed any disturbance of the environment. This enables more rational discussions to be conducted, for example, at planning enquiries, since local residents and others affected by the environmental changes can be more readily assured that an accurate impression of the scheme is being presented through the impartiality of the computer system. The consequences of design decisions can be more readily visualised at an early stage in planning (Lever, 1993: 387).*

According to research undertaken by Bates-Brkljac (2009), the proposed superiority of this technology has been questionable. Based on her research, photomontages that have a maximum likeness to the existing environment are likely to be perceived as more credible compared to other architectural representations, such as artistic impressions or abstracted renders. However, the credibility of photomontages has been a significant concern for experts and locals (Bates-Brkljac, 2009). Showing the proposed development at the right scale and perspective is the primary concern in these representations, which results in further arguments between the local community, Council, and developers.

Generally, in the development assessment process, the attributes and character of a locality will be more analysed than at the time of creation of the overall planning scheme. As discussed, the initial analysis of visual amenity and character are perhaps the least quantifiable or most open-ended of investigations in planning policy. It requires the planning authority or court or tribunal to take the concerns of residents and external and internal experts into account to create a clear view (Stein, 2009). Photomontages have been considered as the most efficient way to visualise likely changes in the existing environment (before and after conditions) as well as providing a shared language of communication between planning authorities, experts and local residents.

Lever (1993) defined nine parameters for an accurate photomontage: the camera position (X, Y, Z); the camera orientation (A), the camera elevation (B), the camera tilt (G), the scale factor (S) and focal centre (X, Y). The camera position also will be surveyed. The scale factor is defined by the camera focal length multiplied by the crop factor. However, an accurate photomontage as a tool in visual assessment has limitations in that it is a single static view with a limited field of view (FOV) (Rod & van der Meer, 2009). Although Rod and van der Meer (2009) considered the

advantage of photomontages to give a high degree of realism, they considered photomontages to be unable to provide a comprehensive tool for assessing visual impacts. They found GIS to be another complementary tool to be used in the assessment of visibility and visual impacts.

According to Ghadirian and Bishop (2008), visualisation techniques and methods have progressed considerably since the 1970s. GIS provides sophisticated spatial analytical techniques that can be widely used in environmental sciences and urban planning (Jiang, Claramunt, & Klarqvist, 2000). Appleton et al. (2002) discussed the three-dimensional (3D) visualisation of GIS and considered it as a valuable tool for assessment and decision-making processes to present a large complex amount of information to a broad audience. GIS is also considered as a transparent tool through which large models can be generated and manipulated in far less time compared to photomontages (Appleton et al., 2002). They discussed three broad categories: image draping, photorealistic renders, and visual worlds.

> *The more detail with which objects are modelled, the more real they appear. This detailed modelling is supported by rendering algorithms which are precise and realistic rather than being optimised for rapid performance. A high degree of realism is, therefore, the main benefit of this approach, while the output is not interactive and would be still images or animation of a series of images (Ghadirian and Bishop, 2008: 227).*

Ghadirian and Bishop (2008) proposed a virtual environment that is fully interactive and enables users to explore the model or environment. He et al. (2005) applied GIS for assessing visual quality through combining visual resource and perception. Xia and Qing (2009) developed a 3D virtual model for qualitative and quantitative assessment of urban environments. They argue that:

> *3D GIS supports the real multidimensional environment imitation and the deepen space analysis. It has incomparable superiority in many important application area compared to 2D GIS. 3D space analysis function can obtain the needed visual information of the visual scape plane, and it can be described to 'the seen means the gain'. Some design regulations with strong maneuverabilities could be discovered through the analysis to the visual information. 3D space analysis and the application of decision supports are the basic motive of the development and existence of 3D GIS. Visual analysis based on the 3D GIS can expand the application field of the 3D GIS, and it has important meaning to the development of the 3D GIS (Xia and Qing, 2009, 152).*

Space syntax theory provides a language to enable the description of an urban structure and aims to explain human behaviours in relation to their spatial configurations (Jiang et al., 2000). GIS support this by providing a comprehensive set of tools, data integrations techniques, analysis, and visualisation capabilities to support these urban and regional studies (Jiang et al., 2000). According to Jian et al. (2000), GIS can be used as a quantitative tool to measure visual distinction

between different places. Isovist or viewshed and visibility analysis are common tools developed in GIS that can measure visibility with high accuracy.

The purpose of GIS-base landscape analysis is to investigate to what extents an element is visible in the landscape by mapping a viewshed (Sang et al., 2016). Viewshed mapping in GIS is based on ray tracing on a raster digital elevation model (DEM). It has a wide usage in visual impact and landscape studies. Viewshed analysis in GIS superseded the old-fashioned method such using large red balloons to check the intervisibility (Ervin and Steinitz, 2003).

Oh (1998) analysed the visibility of mountain peak in Seol using viewshed analysis to identify public spaces and areas in the city which require management to protect the visual connections to surrounding landscape features. Bishop et al. (2004) analysed the visibility of natural landscape features such as vegetation and water from high-density urban areas. However, reliability and credibility of these modelling have been questionable (Ervin and Steinitz, 2003). Fisher (2004) pointed out that viewshed realistically should be referred to as a 'fuzzy' or 'probable' viewshed. Accuracy of the digital terrain model, earth curvature, atmospheric conditions are important factors to be considered in viewshed analysis (Ervin and Steinitz, 2003),

Appleton et al. (2002) argued that there is no universal approach in visualisation modelling techniques. Ghadirian and Bishop (2008) concluded that the approach taken must depend on the type of change and the purpose of the study. A combination of different methods was considered to be the best approach to improve the visual assessments. Answering questions of "what are scenic resources?" and "how they can be protected?" resulted in the development of a wide range of theoretical assumptions and practical method including modelling techniques (Ervin and Steinitz, 2003).

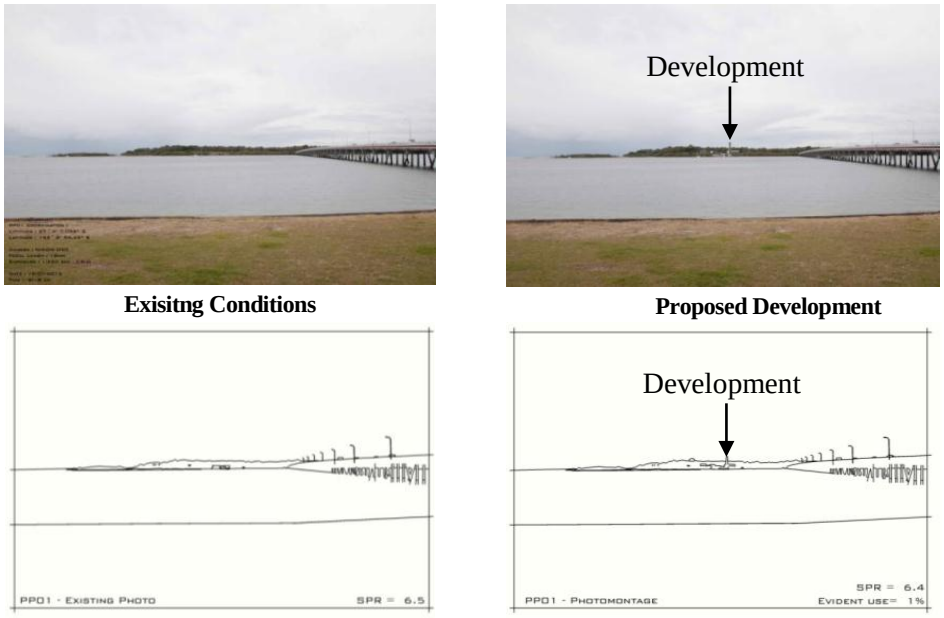
Further to the techniques mentioned above, planning authorities tend to encourage more concerted approaches in the evaluation of visual attributes of environments. For instance, in recent years planning authorities in Queensland, Australia, have developed policies and methods to evaluate and assess the landscape and scenic amenity values to regulate landscape assessments. In 2007, a regional scale guideline for evaluating scenic amenity within South East Queensland (SEQ), known as Implementation Guideline No. 8: Identifying and Protecting Scenic Values (Queensland Goverment, 2007), was developed. This approach is based on the assumption that the aesthetic quality of the landscape is inherent in the physical features and can be generalised by measuring preferences of a survey group. Scenic preference is based on the interrelationships of complex formal characteristics, which are "objective" and insensitive to political and social externalities (Chenoweth 1997). This approach yields more repeatable and consistent results and can provide clear maps of relative scenic value within an area; however, it still lacks credibility (AILA, 2009).

Implementation Guideline 8 is based on two dependent factors – visual exposure and scenic preference. Visual Exposure is purely an objective process. It is a visibility analysis based on a Digital Terrain Model (DTM) within GIS viewshed modelling plus Annual Average Daily Traffic (AADT) data to rate visual exposure of different landscapes. Scenic Preference is based on a broad public preference survey implemented in SEQ (2004). In the preference survey, 1000 people rated 500 photos of various types of landscape throughout the SEQ region. The combination of the Visual Exposure Mapping and the Scenic Preference Mapping can produce something called a scenic amenity map, which can be used in planning to control future developments in rural and natural landscapes.

The scenic preference survey discussed above resulted in the development of a tool (SPRAT2) to measure the visual impacts of proposed developments in rural and regional landscapes. As a requirement of Queensland Coastal Protection Plan (2011) State Planning Policy 3/11, any proposed development within 500m buffer of the coastal zone should be assessed using this tool to calculate their potential visual impacts (See Figure 2-2).

SPRAT2 measures the change in scenic preference rating pre- and post-development to check whether the proposed change is within the acceptable threshold or not. To calculate scenic preference change in a view, the percentage of different visual elements in the view can be measured and entered in SPRAT 2. Figure 2-2 shows an example of using this tool to measure visual impacts of a proposed motel and hotel complex within the 500m buffer of Brisbane's coastline.

Although this method was developed in an attempt to measure the visual impact of developments more objectively, the method has some limitations. As stated, this tool is based on a public preference survey, which is the amalgamation of many individual responses to different types of landscapes. Based on this survey, overhead power lines or wind farms considerably detract from the scenic beauty. However, cables or poles only cover a low proportion of scenery, which results in a minor change in scenic preference rating, calculated by SPRAT2. As this tool was developed for regional open space analysis, it is evident that it is not capable of estimating scenic preferences for complex urban environments that contain many dominant visual elements. Thus, the aim of this study is to develop comprehensive methods to be applied in urban settings.



Exisitng Conditions **Proposed Development**

SEQ SPRAT-2 SEQ Scenic Preferece Rating Assessment Tool for Two views

Visual Domains	View 1	View 2
BUSH	2%	2%
COAST	35%	35%

	View 1	View 2
RURAL	0%	0%
URBAN	63%	63%
TOTAL (Domains)	100%	100%

Inputs

Visual Elements - Built	View 1	View 2
Buildings low non-residential	1%	1%
Buildings low residential	0%	0%
Building low solitary	0%	0%
Buildings medum - high	0%	1%
Building trees grass	0%	0%
Built elements water	2%	2%
Farm elements	0%	0%
Fence	0%	0%
Mines, Quarries, Dumps	0%	0%
Park cultural buildings	0%	0%
Park elements	0%	0%
Path	0%	0%
People	0%	0%
Retaining wall	0%	0%
Road freeways	0%	0%
Roads	0%	0%
Signs	0%	0%
Towers cables poles	0%	0%
Vehicles	0%	0%
Built misc	0%	0%

Visual Elements - Natural	View 1	View 2
Coastal vegetation	1%	1%
Crops pasture animals	0%	0%
Euc forest etc	0%	0%
Garden	0%	0%
Grass mown	30%	30%
Grass natural	0%	0%
Grass unmanaged	1%	0%
Modified vegetation	0%	0%
Mud	0%	0%
Native pine	0%	0%
Pine forest	0%	0%
Rainforest	0%	0%
Rock	0%	0%
Sand	0%	0%
Trees planted	0%	0%
Water bay	19%	19%
Water constructed	0%	0%
Water inland	0%	0%
Water ocean estuary	0%	0%
Natural misc	0%	0%
TOTAL (built + natural)	54%	54%

Output

SCENIC PREFERENCE RATING (1-10)	View 1	View 2	Difference	Direction	Statistically significant?
	6.5	6.4	-0.1	decrease	N

Figure 2-2 SPRAT 2 to calculate visual impacts of proposed developments within 500 buffer Coastal Zone

2.6 SUMMARY AND IMPLICATIONS

In the first part of this chapter, planning appeals in Australia and other Western countries was reviewed. In this section, planning court systems in Australia's states and territories were compared to British, American and Canadian systems were reviewed, and differences in assessment of appeals were discussed with regard to the existing literature. Moreover, several appeal reviews in England were identified and explained. However, no similar studies in the review of planning appeals in Australia and Queensland were identified in the existing literature.

The second part of the literature review was devoted to considering and defining the concept of amenity in academic and planning literature. The origin of amenity was investigated, from the industrial movement to the contemporary period, and several interpretations and meanings were presented. Visual amenity, as one aspect of amenity, was introduced and explained in relation to other interconnected concepts in urban design, including character, sense of place or genius loci, authenticity, conservation and concept of place. This review provided a broad overview of the concept of amenity and visual amenity as umbrella terms linked to a wide range of concepts and theories in urban design and planning.

The last part of the literature review focused on the identification of visual attributes, and attributes of urban landscapes, and a review of evaluation methods of visual quality. After the review of different paradigms and approaches in the assessment of visual attributes, a broad list of visual attributes was presented. Previous methods used to analyse visual complexity and diversity using image processing and visual dominance was briefly discussed. In addition, current visual expert methods for assessing visual attributes were introduced. The limitations and opportunities to improve expert assessments were also discussed. A limited body of research have been done to evaluate visual attributes of the existing condition and to measure visual impacts of new developments on the current character to inform planning regulation and environmental planning in court cases. These shortcomings were considered as opportunities for this study to investigate and develop further.

The three parts of the literature review in this research that has identified gaps in the literature for further work are summarised in Table 2-4. The rest of the chapters in the thesis are focused on the identified gaps in the literature in response to the thesis research questions and objectives. The research methodology and methods are discussed in coming chapters to explain the research approach used to address these gaps.

Table 2-4 Literature review topics and identified gaps

Literature Review Topics	Gaps for further work
Studies of visual amenity in urban development in the UK and other countries Booth (1999); McNamara et al. (1986); Brotherton(1993); Bingham (2001); Willey (2005), Sairinen et al. (2010); Faghih and Sadeghi (2012); Gurranet et al. (2014); Williams (2012); Zheng et al. (2014)	Lack of understanding of patterns in visual amenity conflicts in post-colonial planning and development context
Theoretical understanding of amenity in urban environments Glass (1972) ; Relph (1976) ; Smith (1974); Godschalk (2004); He et al. (2005); Willey (2007) ; Stein (2009)	Lack of knowledge related to relationships between amenity and interrelated concepts
Studies of using methods for evaluating visual quality in urban environments Lozano (1974); Rescher (1997); Ak (2013); Bishop et al. (2004), Ewing and Handy (2009); Thompson et al. (2012)	Lack of empirical work measuring tangible visual amenity concepts

Chapter 3: Methodology

The previous chapter reviewed the relevant literature to this research, including a review of planning systems in Australia and other Western countries, the concept of amenity and the evaluation methods for assessing visual properties of urban environments. This chapter aims to provide a philosophical framework for investigating visual amenity conflicts and measuring visual properties of urban areas. The research framework is established based on the author's background and beliefs founded in Persian architecture and its mathematical and geometrical relationships, and a discussion of the subjective nature of visual attributes of urban environments and the inevitable change in urban environments. This section demonstrates the relevant philosophies to the research.

This chapter also explains how the evaluation of visual amenity links to a postpositivist approach. It provides a theoretical framework for the study using abduction and induction strategies for investigating visual amenity issues and for assessing the visual properties of urban environments. A research framework is proposed in order to address and answer the research questions by integrating a mix of strategies and methodologies, including exploratory and descriptive. The research methods are also established in Chapter 4,5 and 6, which focus on the process of data collection and analysis.

3.1 PHILOSOPHICAL FOUNDATIONS OF THE STUDY

The philosophical foundation used in shaping the study underpins the values for what reality should be investigated and how findings should be interpreted and analysed. These philosophical ideas indicate the relationships between ontology (the nature of reality), epistemology (what can be known) and methodology (how reality can be studied based on the researcher's beliefs).

The philosophical ideas are related to interconnected theories and concepts. Firstly, the concept of sustainable development and conflicts is discussed. Harmony with existing values is also discussed as another underlying assumption of sustainable development influencing this research. The concept of objectivity as the fundamental assumption of this study is explained.

3.1.1 Sustainable Development and Conflicts

The 20th century brought concepts of sustainable development and livable communities. These have created both opportunities and threats for urban landscapes (Godschalk, 2004). Cities throughout the world are in dynamic spatial transformation (Leichenko & Solecki, 2008). The big challenge for urban planning is how to cope with these challenges and expand settlements to be sustainable and liveable. Sustainable development, as defined by the United Nations World Commission on Environment and Development (1987), aims to ensure that developments meet the needs of the present generation without disregarding the necessities of future generations. Explaining the underlying theoretical paradigms of sustainable development is outside the scope of this study; however, it is briefly reviewed to define the research belief. Also, rising awareness of global climatic change, carbon performance and resilience of urban areas has further influenced the sustainability discourse (Gurran et al., 2014).

Sustainable development is a complex concept that dates back to the 1970s and has been applied since the 1990s in the context urban renewal (Zheng et al., 2014). Lorr (2012) reviewed three of the most common theoretical approaches in the context of North American cities to sustainability. They are the inter- and intra-generational equity and justice perspective, the comprehensive environmental, economical, equitable change perspective, and the free-market greening outlook.

The second viewpoint (comprehensive environmental, economical, fair change) emphasises the interconnections between environment, economy and equity in the United Nations definition. This perspective considers a positive relationship and environmental conversation between environment and economy (Lorr, 2012). This goal can be reached by economic and governmental progress, re-regulating and monitoring urban human behaviour to improve the environment while also improving the economy and social justice (Lorr, 2012). This resulted in the development of sustainable planning schemes in Australia and Queensland.

Lorr (2012) identified slightly different approaches and focused in the various countries in the North American context. The dominant approach in the United States toward urban sustainability is toward ecological modernisation. Canadian cities are focused on comprehensive environmental, economical, equitable change with ecological socialism. Mexican cities are focused on intra-generational equity and justice in their urban sustainability to fight environmental impacts of tourism. Lorr (2012) considered democracy to be a failure, regarding controlling redevelopment of cities and proposed an ecological democracy through a greater participatory planning system. The Sustainable Planning Act 2009 in Australia provides a framework for integrating planning and development assessment to manage effects of development and to control it in an ecologically sustainable way.

The Ecologically Sustainable Development (ESD) Act initiated in Australia 1989 by Prime Minister Hawke issued a statement on the environment: ‘Our Country, Our Future’ (Lorr, 1992). Local governments implement sustainability through land use plans. Australia’s planning instruments

provide a comprehensive body of policy intent and controls for implementation by integrating ecological democracy through the decision-making process (Gurran et al., 2014). Including all of the aspects of sustainability in a holistic approach will assist in resolving challenges and conflicts to achieve more sustainable outcomes.

Campbell (1996) considered that the conflicts arising from promoting economically growing cities are simply because of the different personal preferences and contradictions between primary goals of sustainable development. He illustrated these conflicts as a triangle with a goal at each point and conflict occurring along each axis. The property conflicts occur between economic growth and equity on the use of goods as a private resource and the use of private property for the public good (Campbell, 1996). Development conflicts occur between social equity and ecology when the need is to grow cities and provide housing for the poor while at the same time trying to protect the environment. Resource conflicts happen when economic and ecological challenges arise over the consumption of natural resources (See *Figure 3-1*).

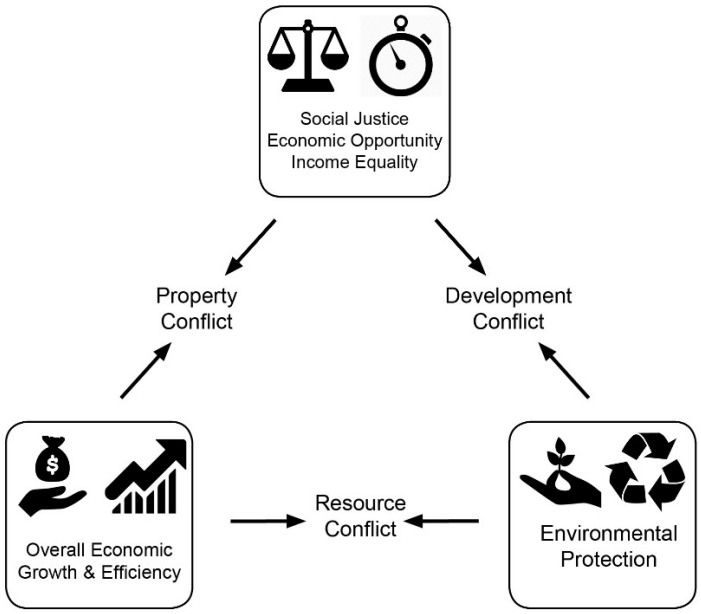


Figure 3-1. Triangle of planning sustainable goal (Adapted from Campbell (1996, 298)).

According to Campbell, conflicts are an inevitable component of sustainable growth. He considered sustainability as a powerful and useful organising principle for urban growth to focus on conflicting economic, environmental and social interests. He concluded that planners should act as mediators between community groups, labour, environmentalists, and businesses, and should play a central role in the battle over growth, the environment, and social justice (Campbell, 1996). He considered that these conflicts would be valuable to achieve better sustainable outcomes.

Politics and conflict lie at the heart of planning, and planning is a process to resolve disputes (Peltonen & Sairinen, 2010). According to Peltonen and Sairinen (2010), these conflicts are due to competition for demands on a limited resource, unequal distribution of costs and benefits or because of the environmental impacts of land use change and developments. Decision-making on

environmental conflicts result in the main changes to governance and practices in planning and assessing the environmental impacts are a key tool in policy-making (Sairinen, Barrow et al. 2010). Planning policies and regulations play a significant role in managing decision-making situations and conflict resolution.

These conflicts can be resolved by administrative procedure, courts, mediations and negotiations (Sairinen et al., 2010). Mediation is a participatory conflict resolution process which can be defined as alternative dispute resolution (Sairinen et al., 2010). A conventional fact-finding process has been developed to produce trusted information that all parties can rely on, and through this process, both sides build common knowledge to justify their case (Sairinen et al., 2010, 331).

According to the above arguments, planning conflicts are an integral part of any sustainable development approach in any city context. Therefore, resolving planning conflicts can be an envisaged component of the comprehensive and objective approach toward sustainable development. As previously argued, environmental values include the concept of visual amenity. Therefore, visual amenity should be considered in any sustainable development framework.

Another related concept to sustainability is the notion of harmony with nature and existing values. Equality as one of the principles of sustainable development is a return to the original state of harmony as laid out in nature (Campbell, 1996). In fact, sustainability is being in harmony with the existing system by taking a holistic approach rather than an individualistic approach (Campbell, 1996). Therefore, harmony with the existing condition and values was considered as another ontological paradigm in this study.

3.1.2 Harmony with Existing Values

Harmony with the existing environment has been one of the dominant paradigms in urban development and landscape planning. Britain has always had some degree of anti-urbanism in town planning (Glass, 1972). Even though urban planning systems aim to achieve healthy, beautiful and pleasant cities, the long-term paradigm has been to refuse, limit or restrict development (Selman, 2010). According to Selman (2010), this paradigm was shaped to limit the effect of development on the green and pleasant qualities of natural landscapes.

As discussed in Chapter Two, visual amenity and qualities, place, sense of place and character are inter-connected concepts in the analysis of visual environments. These concepts are considered as valuable components of sustainable development as they can have an effect on the other elements of sustainability (Guthey, Whiteman et al. 2014). Evaluation of these qualities comes under the field of landscape planning. It has become a leading branch of planning to assess the relationship between new developments and the existing environment. Landscape planning is considered as a key driver toward sustainable development (Selman, 2010). Therefore it is necessary

to understand the contemporary intention of this field as applied in this study, in order to assess visual amenity conflicts with more objectivity and reliability.

Contemporary landscape planning has moved away from the old British preservationist paradigm to a more engaging and integrative paradigm that considers the sustainability of environments. This new model creates a balance between protection of the existing environment and planning regulations and incorporates an understanding of the properties of landscape character and distinctiveness. It involves less prevention and engages in the potential of landscapes to enhance place character and to accommodate sustainable change. (Selman, 2010).

Assessment of visual amenity and character is combined with objective and subjective methods. Delineating boundaries and understanding differences between objective and subjective epistemologies is vital to develop new quantitative methods. Different variations of objectivity in relation to subjective nature of visual qualities are discussed in more details.

3.1.3 Objectivity and Subjectivity

According to Bourgeois (1999) in his dissertation on the meaning of objectivity, he considered objectivity as a confusing and complex term in philosophy. Objectivity is a relevant and shared term used in the discussions between scientific, art and moral theorists who question whether the theory can be called objective (Bourgeois, 1999). Bourgeois considers that the territory of objectivity is too large and includes 'countless arbitrary' instances of how philosophers use the word.

Megill (1994) in his multidisciplinary collection of papers on objectivity, provides a comprehensive categorising framework. He distinguished four senses of objectivity: *absolute, procedural*, *disciplinary* and *dialectal*. Even though these senses are intertwined, they can be distinguished from each other (Megill 1994). According to Megill (1994), the traditional or *absolute* sense of objectivity refers to the idea of representing things as they are. He explains this as aspiring to acknowledge reality without any distortion to present truth. This objectivity excludes subjectivity, and it is not dependent on any individual's perception or taste.

Bourgeois (1999) suggests that *absolute objectivity* is the central and purest form of the sense of objectivity and presents the greatest challenge for any of the other-other senses. Rescher (1997) considers objectivity as a sort of 'universal rationality' and person neutral. He notes that the concept of objectivity has been under attack due to misunderstanding and misinterpretation (Rescher 1997). Universality is the founding principle for Rescher, and he describes it as an accurate photograph that represents reality as any observer recognises it from their point of view.

However, this straightforward and familiar sense of objectivity conveys ambiguity that results in a large variety of definitions (Bourgeois, 1999, 6). The absolute sense of objectivity is an ambitious and arduous idea that becomes problematic as it advances (Bourgeois, 1999). The remaining senses of objectivity are defined without absolutes, replaced with more achievable foundations.

Disciplinary objectivity is considered as the consensus view of something among the members of a particular research community. Bourgeois (1999) applies this sense of objectivity to disciplines such as academic departments or scientific fields with established institutions. However, it can also apply to any community or identifiable group of 'knowers', whether officially designated or self-recognised. Megill (1994) notes that while absolute and procedural objectivity completely excludes subjectivity, disciplinary objectivity attempts to subordinate subjectivity to the judgment of a group.

Dialectical objectivity takes a constructive and integral approach compared to the other senses of objectivity. According to Megill (1994), dialectical objectivity considers subjectivity to be an integral part of knowing. It is constructed on two aspects: one believes that knowledge is 'out there to be passively gained,' the other that knowledge should also be actively engaged and constructed. A dialectic between subject and object. It is seen in Nietzsche's philosophy and postmodern conception as well (Bourgeois, 1999). In this approach, both subjectivity and objectivity are seen as positive quantities and attached to physical objects, propositions and ideas.

Mechanical objectivity is another type of objectivity, a favourite approach of positivist philosophers, which has wider appeal to the wider public (Porter, 1996). It follows the rule that makes personal biases or preferences impossible to affect outcomes. However, it is challenged by disciplinary peers (Porter, 1996). Mechanical objectivity cannot be purely mechanical and is criticised for mathematical and quantitative methods which conceal profound and important issues (Porter, 1996).

Procedural objectivity considers the idea of methods as a set of rules for narrowing the effects of subjectivity. Rules provide an alternative to personal judgments regardless of community standards (disciplinary objectivity) or supreme value (absolute objectivity). According to Bourgeois, this sense of objectivity is seen in the two realms of science and bureaucracy. Bureaucrats use scientific procedures in an impersonal bias to ensure a repeatable and fair approach. Procedural objectivity attaches both the procedures and their results to people who follow them.

It can be seen that based on these categories, objectivity varies in type and applies to various things such as beliefs, knowledge, procedures, objects or people (Bourgeois, 1999). The different senses of objectivity make it impossible to understand objectivity as a property of a particular kind of thing. Nevertheless, objectivity is epistemological property, and it is a reflection of our knowledge (Newell, 1986). While objectivity may attach to something other than judgments, judgments are always the basis of those attachments.

Bourgeois (1999) proposes a new sense of *synthetic objectivity,* which falls between absolute and disciplinary objectivity and depends on community standards. This sense is not limited to a single or small group of communities and promotes a court of appeals that is more democratic. He considers that larger populations are necessary for defining the standards applied to knowledge. His conception is more procedural and is concerned with repeatability of scientific experiments. He considers a higher level of objectivity that goes beyond a single community and which is repeatable and endorsing of the

fact in other communities. Hence, he believes that objectivity must be repeatable from one level, or community, to the next to broaden itself (Bourgeois, 1999). He also considers his new meaning, about dialectical objectivity, to be a more comprehensive approach. He concludes that the synthetic definition as the best definition, one which meshes with the other four senses of objectivity defined by Megill (1994).

Subjectivity, in opposite to objectivity, is an individual's judgement based on personal opinions. While the objective paradigm looks for universal rules in the phenomenon, the subjective paradigm believes in the intangibility of qualities. Subjectivity refers to ideas and opinions that stay in mind, but objectivity is the ability to know things as they exist (Porter, 1996). Visual amenity and qualities are considered as confusing terms in philosophy to be defined as subjective or objective entities. Visual amenity as the pleasantness or attractiveness of a place has a close relationship with the concept of aesthetic and beauty in philosophy, which is briefly reviewed in this section.

Visual quality assessments are based on the two separate paradigms of subjectivity and objectivity discussed above. The objectivist paradigm considers that quality is inherent in the physical environment and can be evaluated similarly to physical features. This paradigm ignores the subjectivity in the perception of visual environments and accepts that quality is an inherent and intrinsic attribute of physical landscape (Lothian, 1999). The subjectivist paradigm regards quality as being inherent in the in eye, or mind, of the beholder.

Beauty, as one of the aspects of visual amenity, has a long history of philosophy and is seen by some as one of the three ultimate values (methodology, metaphysics, and theory of value) (Lothian, 1999, 181). According to Lothian's review of classical philosophy (Plato 427-347 B.C. and Aristotle 384-322 B.C.), beauty is considered as a physical attribute and is contained in certain properties of an object. Similarly, during the Christian era, philosophers considered beauty as an expression of God, an inherent value in objects (Augustine-354-430 A.D., Aquinas 1224-1274, Bonaventure 1217-1274). During the 18th century, this paradigm was attacked by Kant (1724 -1804) and Hume (1711-1776), and modern philosophy of aesthetics shaped the subjective view of aesthetic quality, which considers distinction of mind and nature. This was further developed by British and German aestheticians (Lothian 1999).

Philosophers John Locke (1632-1704), David Hume (1711-1776), Edmund Burke (1729-1797) and Kant (1724-1804) considered that beauty is in the eye of the beholder and distinguished its three components as object, recipient and experience (Lothian, 1999). In *Critique of the Power of Judgment,* Kant (1790) claims that the judgement of taste is based on a subjective principle. However, it has a universal validity (Kant, Guyer, & Matthews, 2000). According to Kant, it is a common occurrence that some elements in nature produce pleasure in us and some do not, and he claims that this pleasure is part of aesthetic judgment. Kant considered that the harmony between an object's imaginative representation and our understanding creates aesthetic pleasure (Lothian, 1999). He claimed that universality and necessity are two factors that are based on our previous experience, or

'a priori' knowledge. He considered a subjective principle that determines what pleases or displeases with a universal validity.

Kant also developed the notion of *Sensus Communis* as the common root of our external senses and a capacity for judgment that unites sense regarding an object. He considers that subjective desires and tendencies are based on our objective mental patterns. When we accept that knowledge is universally communicable, we also can accept that cognitive perceptions based on established mental patterns are universal, which has same subjective principles. He also considered that individuals try to communicate their innermost feelings in a universal way and human terms. However, taste is entirely an inner sense and does not need any conceptual criteria, proof or logic, and it contains freedom. Kant's philosophy has been further developed in contemporary theories. Kant's philosophy is relevant to the visual quality of environments, and visual quality, similar to beauty, has no ideal or limit, and pleasure is a common response and universal phenomenon (Lothian, 1999).

Kant's philosophy and its followers resulted in a subjectivist paradigm of visual quality assessments that are based on psychophysical methods to examine public preferences for identifying universality. In this paradigm, visual environments provide the basis for cognition, perception and preferences of human beings (Lothian, 1999, 178). Lothian (1999) provided a broad list of approaches in both paradigms and mentioned that the objective approach covers ecological, formal aesthetic and expert sets while the subjective approach includes psychophysical, cognitive/psychological and experiential/phenomenological sets.

He considered that the objectivist paradigm, the prevailing paradigm in recent centuries, suffers from an inherent nature of assumptions, while the subjectivist paradigm is limited to its resource demands and the proficiency required to implement it. He notes that objectivists criticise subjective approaches for errors in estimating quality measurements based on individual responses. Objectivist approaches lack replicability and do not reflect general community preferences. Lothian proposed a mixed method of both objective and subjective paradigms to assess the visual quality of landscapes.

Therefore, in both philosophical paradigms (objectivity and visual qualities) it is considered that a mix of objectivity and subjectivity is the most comprehensive approach. However, boundaries between objectivity and subjectivity are blurred, and not easy to define. Subjectivity and personal views become more problematic in social interaction, which result in conflicts between points of view. This study considers this and believes that objectivity supports and complements the subjectivity of personal judgements to achieve more sustainable decision making and outcomes.

The philosophical ideas discussed above provide ontological and epistemological assumptions to define other research components such as methodology and strategies. These assumptions represent the research paradigm used to employ relevant research methodologies to design and conduct the research. Planning conflicts, as part of sustainable development, require an objective assessment to achieve sustainable outcomes. A procedural stance of objectivity was

considered as a suitable approach to assessing the concept of visual amenity. Based on the Persian worldview, visual properties of urban environments can be measured by mathematical relationships to analyse relationships between existing setting and proposed development in a more objective assessment. This evaluation can present the levels of harmony and contrast between an existing context and the proposed development. As yet, few studies have investigated this, and this research aims to investigate this gap.

Not enough work has been found in relation to the concept of visual amenity. This research is focused on this concept and investigates it with regards to development conflicts. It is proposed that greater scientific contribution to this field will facilitate the objective decision-making process to help achieve more sustainable outcomes. Visual amenity has its complexities and variations, which are discussed further in the following section.

3.2 VISUAL ATTRIBUTES RESEARCH

Research on the visual attributes and properties of urban environments needs a selection of suitable strategies and methods in response to the research questions. It is an essential to distinguish research paradigms shaped around positivist versus post-positivist views. Research strategies and methodologies are chosen in relation to the research paradigm and aim to implement research methods.

3.2.1 Post-positivism in measuring visual conflicts and properties

Positivism and post-positivism are both major research philosophies that have been developed in Western thought. Positivist, empiricist or traditional theory assumes 'discrete events' create ordered and reality, which is the common approach in reductionist science (Blaikie, 2009). According to Blaikie (2009), this paradigm contends that by using human sense and experimental and comparative analysis, researchers can create new knowledge. It posits that reality exists externally and objectively and can be understood by analysing data or through observations. Positivists use empirical tools such as quantitative methods, surveys and statistical analysis to extract the rules that define reality for as broad a population as possible.

Scientific or positivist research considers research to be based on facts and is free of any ideology, values and beliefs of the researcher (Ryan, 2006). In empiricist-positivist studies, concepts and knowledge are gained through a rational deduction of that which causes particular phenomenon (Ryan, 2006). This model asserts that social research can follow the same scientific research process.

However, since the 1970s, the positivist approach has been criticised by postpositivist theorists due to its objectivist foundation (Durning, 1999). Postpositivist thinkers believe that objectivity is not absolute and the conception of objectivity is mixed with some levels of subjectivity (Mohanty, 2001). However, objectivity is still a goal for postpositivists and is an epistemic goal, but they accept the likelihood of error in an objective approach (Mohanty, 2001).

Postpositivism accepts that the theories, background, knowledge and values of the researcher can influence what is observed and can be known with some degree of probability (Robson, 2002). In the postpositivist approach, the positivist focus on experimental and quantitative methods have been superseded and combined with qualitative methods to gather a broader range of information outside the framework of measured quantities. Postpositivism accepts that the complexity, insubstantiality of research practices and unseen historical events can change the research conclusions (Mohanty, 2001).

This study takes a postpositivist approach, as the researcher's belief in mathematical patterns in the urban context was considered as an underlying philosophical assumption for this study. In addition, while objectivity has a central role in this study, it is not considered absolute and is mixed with a level of probability and subjectivity. However, empirical works and investigations are used in this study to extract rules to analyse the phenomenon.

3.2.2 Abductive And Inductive Strategies To Investigate Visual Conflicts

Based on the theoretical and philosophical assumptions outlined in section 3.1 and 3.2.1, the research process embarks on data collection and empirical work that initiates, contradicts or organises research to enable the researcher to understand or explain observations (May, 2011). This research follows the operationalising tradition concerned with turning concepts into variables by finding the key concepts to be used in a particular study in order to define and measure them (Blaikie, 2009).

This research is designed in three stages: a review of Planning and Environment Court Cases, spatial analysis of conflict patterns and developing objective methods to analysis visual properties. In each stage of a research project, different strategies and reasoning are employed to enable conclusions to be drawn, predictions to be made or explanations constructed. It is commonly agreed that the combining of different research tactics and strategies results in a more accurate representation of the phenomena under exploration and allows investigation of complex research questions and permits verification of findings within a single study (Hartig, 2011).

Research strategies such as deductive, abductive and inductive are embedded in positivism and postpositivism paradigms. The *deductive strategy* is a logical top-down approach, and a conclusion is reached through narrowing down the data range under consideration (Blaikie, 2009). It starts with a regularity that needs to be explained; then an uncertain theory is constructed; then a hypothesis is shaped. Through deductive reasoning, a logically certain conclusion will be reached.

The inductive strategy is the most common type of social scientific research, where a researcher employs objective observation, measurements and accurate analysis of data to produce key findings (Blaikie, 2009). It accords with positivistivism, where research contends that order can be observed using objective methods to get to generalisations about relationships between concepts.This strategy is used as the appropriate strategy for this research (*Figure 3-2*)

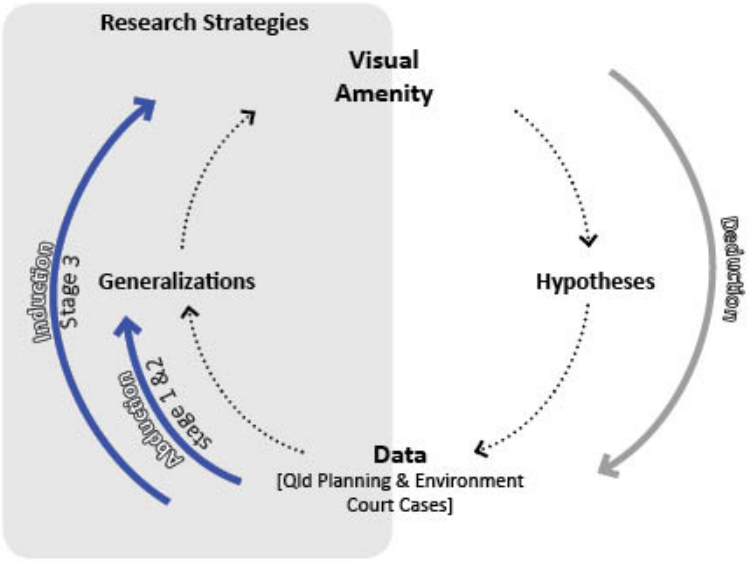


Figure 3-2. Research Strategies

Inductive research strategies can be applied to generalised descriptive patterns. However, induction creates generalities based on objective observations of a phenomenon, while abductive thinking normally begins with a partial set of observations and interpretations and proceeds to a likely description for the set (Thagard & Shelley, 1997). The first point of consideration is the relationship between theory and data, where the facts speak for themselves and are distinct from the understanding of the researcher (May, 2011).

Abductive research strategy aims to find generalities to formulate concepts of a particular aspect of phenomena to guide the research to the next stage (Blaikie, 2009). Abductive reasoning is similar to daily decision-making, which works with the information at hand (Thagard & Shelley, 1997). Blaikie (2000) mentioned that abductive strategies explore the everyday language or knowledge that social actors use in interpretation and production of the phenomenon and is followed by an explanation of that phenomenon.

A pragmatic research approach is adopted in this study, which allows the combination of different strategies that are best suited to investigate the research questions. The research will look for generalities in conflicts and develop key concepts in relation to theory. The first stage is the review of the documented Environmental and Planning Court cases in Brisbane based on abductive reasoning. These reviews will be used to identify or develop the initial concepts for evaluation of the visual properties of urban environments. These tasks are best addressed by utilising both abductive and inductive strategies to identify generalities.

The second stage of this research, based on inductive reasoning will be applied to developing scientific measurements of identified concepts and the theoretical principles generated by the first stage. Mathematical calculations within a GIS and the development of innovative image processing techniques will be tested on selected court cases to measure objectively the visual properties of urban environments for the further development of concepts contributing to theory.

Inductive research strategy will be applied in the third stage of the study to evaluate the research findings. Several interviews with selected expert witnesses will be conducted to identify general opinions about the research results and their effectiveness for use in expert assessments. The research strategies are displayed in *Figure 3-2*.

Abductive and inductive strategies used in this study led to an interest in selecting several research methodologies for the research. Exploratory, descriptive and case study methodologies are chosen to investigate and interpret the data. They are explained below.

3.2.3 Finding Patterns of Conflicts

This study employs the case study methodology to some extent in response to the research questions to collect the study's data, in analysing the data and reporting and presenting the data, which are the key features of this methodology (Yin, 2011). This methodology can address the descriptive research question "What conflicts occur in development applications?". Thus, it is necessary to study the phenomenon (conflicts) within this real-world context that needs the collection of data in its natural setting, which is one the main characteristics of case study methodology.

According to Yin (2011), case study methodology is a method for understanding in-depth relationships of a single or a small number of cases in the real work context. It is also an empirical study of a contemporary phenomenon (planning conflict court cases) set within its real context (development assessment process). The aim of this study is to produce an invaluable and thorough understanding of the cases, which results in new knowledge about real-world behaviour and its meaning.

Despite the apparent applicability of case study research in studying many relevant real-world situations, there are some widespread concerns associated with such methodologies (Yin, 2011, 5). The exploratory phase of this methodology at the beginning of research is that it cannot be a rigorous and reliable inquiry. However, this conception is based on a traditional and outdated view toward case study methodology, which can act beyond the exploratory function (Yin, 2011). The second concern comes from a lack of trust in the reliability of a case study researcher procedure and the inability to generalise the findings to any broader level.

According to Yin (2011), careful design of case study methodology is required to construct validity, internal validity, external validity and reliability in doing case study research to overcome these concerns. As a general rule, the more cases or experiments, the greater the confidence and certainty in a study's findings can be achieved. Using a theory is also another useful method to complete methodological steps. It can help to organise the initial data analysis strategies and generalise the findings from case studies. A case study research with a theoretical proposition will be easier to implement (Yin, 2011, 9).

In order to avoid the concerns associated with the case study methodology, this research combines post-positivist methodology and strategies with case study methodology to explore phenomenon to respond to the research questions. To investigate the research questions stated in Chapter 1, different research methodologies are employed. The first research question, which is a 'what' question, is concerned with identifying the various types of conflicts that occur in the city of Brisbane. Therefore, an exploration of planning court cases and development conflicts are required to identify different type of development disputes. The exploratory research methodology is applied to this stage of the study to review and analyse case studies for this study, which are Planning and

Environment court cases. This data is available through the Supreme Court Library database. These cases include a wide variety of court cases to increase the credibility of generalisations.

Exploratory research is research conducted to address a problem that is not clearly defined (Shields & Rangarajan, 2013). This approach aims to locate a problem to be explored by data and helps to clearly develop concepts and concerns (Welman, Kruger, & Kruger, 2001). The exploratory research relies on reviewing the literature and data or is based on qualitative approaches such as informal interaction with research groups or formal interviews. The aim of the exploratory research is to learn all that is important about a subject group, activity, process or situation and produce a hypothesis or tentative generalisation (Stebbins, 2001). However, exploratory research in this study will not develop a hypothesis to be tested for its validity.

The exploratory research can be classified as exploratory data analysis and exploratory factor analysis. Exploratory data analysis, which is focused on the review of data, can be elaborated and further developed by discovering new patterns and relationships within the presented data (Stebbins, 2001). With suitable data, the spatial investigation can facilitate the understanding of new patterns and relationships that exist in the data. Exploratory factor analysis aims to discover latent and hidden variables and rules.

Exploratory research is employed to understand the phenomenon and its complexities and variations through review of court reports and judgments. This review provides a detailed understanding of the research problem, which helps to investigate other research questions. Both exploratory data analysis and exploratory factor analysis are applied to review court cases in this research. A descriptive research approach is also applied to investigate where the conflicts occur, and to describe patterns and predict their likely occurrence.

Through this review, several concepts are important in the objective assessment of visual amenity disputes. These methodologies are also applicable to the second research question, which is a mix of ‘what’ and ‘how’ questions: “How can visual conflicts be assessed with more objectivity?” Exploratory and descriptive research methodologies are used to investigate the second research question to develop techniques to analyse concepts.

Descriptive research is used to identify and gather information on the characteristics of a particular problem or issue in order to discover new meaning. It is also used to describe what exists and determines the frequency with which something occurs (Dulock, 1993). In addition, this type of research intends to discover relationships between, or among, selected variables. Determining the cause and effect is not the goal.

According to Dulock (1993), descriptive research has four subtypes: descriptive survey, longitudinal descriptive study, correlation study and case study. The survey study is used to collect information from a targeted group of expert witnesses to evaluate the research findings and provide feedback by using questionnaires or interviews. The longitudinal study uses repeated data gathering measures to describe stability and change or trend over time. The correctional study describes how a

variable is related to other variables, and the case study is a useful approach to study a phenomena or life of events over time.

A descriptive research based on survey and interview output is employed in the last stage of the study. This is considered in response to the third research question: "how objective methods can be evaluated?" A series of interviews are conducted to assess the research findings.

These research methodologies are based on the post-positivist research paradigm as scientific research strategies. In descriptive research, there is no manipulation or control of variables and the purpose is to determine if the there is an association between two or more variables (Dulock, 1993). The results of the descriptive research will be used as a basis for further study.

The research methodologies are conducted by applying various research strategies. In addition, the range of research methods and techniques in each research methodology are employed to analyse and investigate the phenomena. The research methods are explained in the next chapter of the thesis.

3.3 A NEW APPROACH TO STUDY VISUAL CONFLICTS AND PROPERTIES

The research plan was designed in three stages to address three research questions. The first phase of research was an exploratory and descriptive phase to analyse and generalise the findings and results. In this phase, Environment and Planning Court case reports during a 13-year period were reviewed and analysed (Stage 1). In this process, all court cases were registered in their spatial location, which provided a basis for case study selection. Through these stages of the research, data was generalised into broad categories to identify major patterns in both content and spatial data. Through a review of the visual amenity conflicts and generalisation of data, several concepts in relation to the theory were identified and measured in the next stage.

In the second stage, three measurable methods in GIS and Image processing were developed to assess the visual properties of urban environments. These methods were developed to increase the objectivity of expert evaluations in the assessment of visual amenity court cases. An evaluation stage was considered as the last stage of the study to investigate the usefulness and applicability of these methods to be used by expert witnesses in actual conflicts. Table 3-1 outlines the selected research strategies and methodologies used to investigate the research questions. Data sources, types and analysis methods were also identified to implement each stage of the study.

Table 3-1 Research Framework

Research Questions	Research Strategy	Methodological Approach	Data Source/Types	Data Collection	Data Analysis
1. What conflicts occur in development applications?	Abductive	Case Study/ Exploratory & Descriptive	Court Case Reports Planning scheme and Local Plans & Maps	Supreme Court of Queensland Library / Brisbane City Council/DNRM	Content & Spatial Analysis
2. How can visual attributes be quantified using computational methods?	Inductive	Descriptive	Photos & Photomontages/ GIS information/ LiDAR	DCP and Character Areas Multiple visits	Image Processing and GIS
3. How can computational methods be used to resolve development conflicts ?	Inductive	Descriptive	Interviews & Literature Review	Interview with expert witnesses	Content Analysis

3.4 METHODOLOGIES AND METHODS

This research is designed in three stages in response to the research questions. Research methods in relation to the selected methodologies were identified in each stage. Three stages of study are described in *Figure 3-3*.

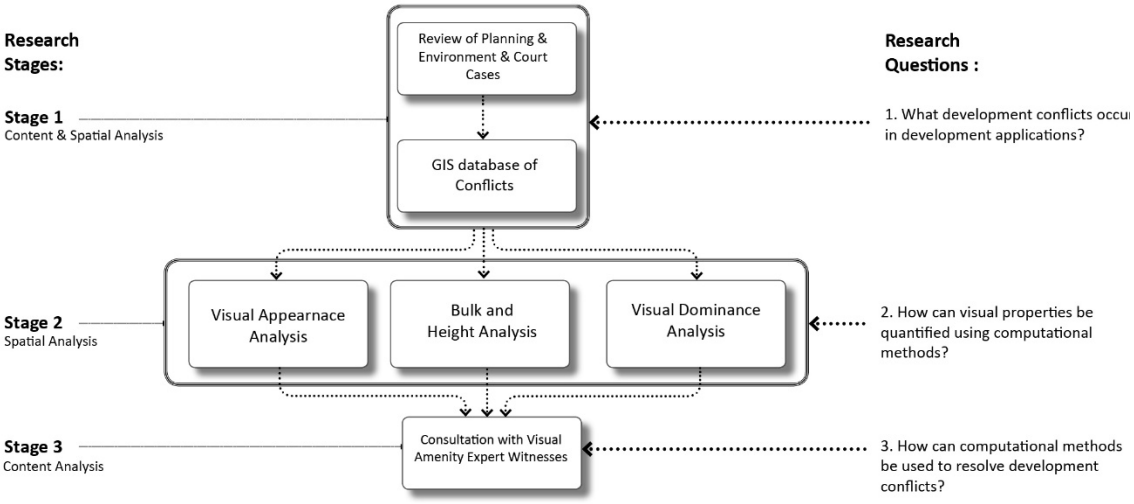


Figure 3-3. Research Stages

Stage 1: In response to the first research question to identify different types of conflict in Brisbane, court case reports occurring in Brisbane were selected and reviewed using content analysis. In this review, several attributes for each court case were identified and recorded. These attributes included issues of conflicts, development types, conflict parties and final court orders for each court case.

After classification of all court cases, a GIS database was developed to geo-reference[3] each court case, with associated attributes based on its spatial location in Brisbane city. A data coding process was developed to classify each court case into limited classes based on the main issues of conflict, development types, conflict parties and final court orders. This database provided a base for data modelling for each court case to be described and analysed spatially. Multiple thematic maps[4] helped to identify patterns and areas with a high occurrence of conflict in the city. This analysis provided a solid rationale to identify suitable case studies for further analysis in the next stage of research.

By detailed review of visual amenity conflicts, several concepts were identified in expert assessments that lacked the appropriate level of objectivity. Three concepts were selected for further investigation in the second stage of the study to develop more quantitative methods and techniques to

[3] Geo-reference means to define data existence in physical space.
[4] Thematic map is a type of map which represents particular features and classes for a specific geographic location.

improve these assessments. Several case studies relevant to these concepts were selected to develop these techniques. This stage of the study is explained in the next chapter.

Stage 2: in response to the second research question, this stage includes three parallel investigations that contributed to more quantitative and measurable assessment of visual amenity court cases. Several concepts, techniques and methods were developed in GIS and image processing to improve the objectivity of court judgments.

This stage of the study is the most technical part of the research where several methods and concepts were developed to analyse selected case studies. Selection of these techniques was mainly based on the review of court cases in the previous stage of research. These methods were developed in image processing and spatial analysis and were modelling techniques to analyse visual properties of urban environments through quantification. This stage of research is detailed in Chapters 5 and 6.

Stage 3: the last stage of the study is considered to evaluate the research findings in the previous stage and investigate how technical methods can be used to resolve development conflicts. These technical methods are more quantitative methods that can assist expert witnesses in visual amenity court case evaluations. Therefore, a group of visual amenity experts were selected and interviewed to evaluate and provide feedback on the research findings. Through these interviews, usefulness and effectiveness of these techniques to be used in real court cases were investigated. These feedbacks and evaluations are explained separately in Chapters 5 and 6 in relation to the research findings.

Consultation with experienced expert witnesses to evaluate the study results can also assist the researcher to improve and calibrate developed techniques. The consultation is comprised of separate interviews with three expert witnesses using questionnaire forms to collect data and investigate their views and feedback regarding developed methods. Due to the nature of the enquiry (visual amenity) to be undertaken and the nature of the participants, a low-risk human ethics clearance was submitted to and approved by QUT's Research Committee. An ethics approval was provided by the University Ethics Committee.

3.5 SUMMARY

This chapter described the research methodology for studying visual conflicts and analysing visual properties of urban environments. Based on Persian architectural principles, there are underlying mathematical relationships, between visual properties and aesthetic experiences (an ontological assumption). From this position, the physical reality we experience can be assessed and measured with some level of uncertainty and error (an epistemological assumption). Therefore, this study is investigating and analysing quantifiable visual relationships in the urban environment. Further to this belief that there are mathematical relationships in visual properties of constructed environments, it is assumed that the tangible aspects of visual qualities can be quantified.

This research applies a combination of procedural and disciplinary objectivity to evaluate visual qualities. Based on the subjectivist and objectivist paradigms about visual qualities of environments, this study takes a procedural objectivist approach to assessing visual properties of urban environments. Visual qualities of landscapes do not equal beauty, which is only assessable through a subjective approach. The author believes that using scientific logic and new technology makes it possible to quantify the tangible aspects of visual qualities which are important in the perception of environments. In addition to defining the research approach to deal with visual qualities, it is necessary to understand the visual context of urban environments. The finding of these objective methods will be evaluated by a group of experts in this field to achieve a disciplinary objectivity.

From a landscape planning perspective, the author believes in the acceptance of a definable level of harmony and change in an existing urban condition. While the existing values of a visual environment should be conserved, the proposed change should reinforce, restore or create a stronger and consistent sense of place.

Based on philosophical ideas that have shaped the ontological and epistemological assumptions of the author, this research will be built based on the post-positivist paradigm to develop and employ mathematical methods relating to natural phenomena. This research is intended to develop and employ methods to analyse visual properties with some level of probability. The process of measurement is central to this research because it provides the fundamental connection between empirical observation and the mathematical expression of visual relationships.

To implement a post-positivist approach, abductive and inductive research strategies were selected to investigate research questions. In addition, three research methodologies – exploratory, descriptive and case study – were discussed to investigate research questions. Through this process, the Planning & Environment conflicts will be explored to generalise the data. Descriptive research explains the patterns and trends in the existing data. Through this abductive process, several concepts are identified in relation to the concept of visual amenity. These concepts are described by reviewing development conflicts, measurements and analysis of data to develop scientific and quantitative methods.

The designed three stages of study will implement this study. The first stage includes a review of Planning and Environment Court Cases in Queensland and a spatial analysis of these conflicts in the city environment. This stage is explained the next chapter.

Chapter 4: Development Conflicts in City Environments

Urban development growth has brought significant challenges to our urban landscapes. It has resulted in a growing number of conflicts between developers, local councils and the community. Resolving these planning and development conflicts is an essential component of the decision-making process in developed countries. Planning decisions can lie between a wide range of different considerations, which are not always complementary and are often conflicting (Willey, 2005, 282). Therefore, the aim of resolving development conflicts is to achieve a balance by appropriately considering all factors relevant to the conflicting application.

A review process in a court system provides an opportunity to raise, test and weigh a range of relevant considerations for conflict applications. Different countries have developed different review systems to resolve planning disputes. The aim of all of these systems is to provide an objective legal system to reassess conflicts in a higher level of development assessment process to ensure planning powers are not exercised inappropriately.

Urban landscapes are the realm of these challenges in cities, and every year numerous conflicts occur. While these conflicts are unpredictable, they occur due to similar forces and reasons between developers, local councils and the public. A review of these conflicts can provide insight into underlying causes and challenges in the planning system, which are hidden behind the physical structure of our cities. This review could also be a valuable source for identifying sustainable development challenges in our city environments.

With greater urban development, the number of conflicts grows proportionally. Moreover, the ineffectiveness of planning policies to protect and enhance visual amenity and reliance on expert witnesses can result in numerous development conflicts between all parties. The aim of this research is to develop quantitative methods to evaluate visual attributes and to measure visual impacts of new developments. More quantification would increase the objectivity of expert assessments and facilitate more rigorous assessments of urban landscapes and development conflicts. Three research questions were formalised to investigate the research aim. A review of the conflicted landscape cases could provide a broad database for this investigation.

The first research question is to investigate what types of development conflicts occur in our city environment. In response to this question, this chapter discusses the review of Planning and Environment Court Cases in the selected city. This chapter begins with a review of the methods applied in Section 4.2 to investigate and analysis the data. Subsequently, the final results of this chapter are presented and discussed. This structure has been applied to provide a more logical structure to explain research approaches and results. This chapter will address:

- selections of study area and conflicts;
- review of identified conflicts in the selected study area;
- classification of court cases to determine different types of conflicts;
- measuring appeal and appellant success rates;
- development of a GIS database of court cases
- spatial analysis of GIS database to identify conflict patterns.

After reviewing and classifying all types of Planning and Environment Court conflicts in response to the research questions, visual amenity conflicts are given more focus in order to identify different types of issues in these conflicts. Contents of visual amenity conflicts were reviewed in more detail to determine gaps in expert assessments and judgements. These shortcomings were identified as opportunities for this research to investigate and develop more objective and repeatable approaches, which are discussed in the next chapters. These are further discussed in the following sections. A review of planning and environment court cases in Queensland was conducted to choose a focused study area and to select case studies.

4.1 PLANNING COURT CASES IN QUEENSLAND

There are different legal procedures in every country to resolve development conflicts that occur between developers, local councils or residents. As explained in the review of the planning system in Western countries in Chapter 2, Australia has a comprehensive planning system to review planning appeals and to govern development conflicts, including third party rights. All states and territories in Australia have a statutory body to review planning decisions on appeals. However, there are two types of appeal reviews: merit-based and judicial-based. Queensland planning appeals are reviewed in a judicial, or statutory-based, system.

In Queensland, any legal conflicts are assessed and heard by Queensland courts, which consist of multiple courts designated for specific types of conflicts. The Queensland Court system also has three levels of assessment: Magistrate, District and Supreme Courts (Queensland Government, 2016). These courts hear both criminal and civil cases. Civil cases are disputes between two or more parties, where one party takes legal action to acquire compensation from some harm or loss by an opposite party. There are also specialised courts in Queensland, such as the Children's Court, Industrial Court, Land Court, Mental Health Court, Planning and Environment Court and Queensland Industrial Relations Commission (Queensland Government, 2016).

The Planning and Environment Court (P and E) in Queensland is established by judges and hears cases relating to:

- planning and development;
- environmental protection;
- coastal protection and management;
- fisheries;
- marine parks;
- nature conservation;
- heritage;
- transport infrastructure;
- vegetation management.

The Planning and Environment Court assesses development disputes in Queensland and operates in major regional cities and towns. Disputes can be assessed and determined at a place close to these centres. Planning and Environment Court judges are based in Brisbane, Cairns, Townsville, Rockhampton, Maroochydore and Southport (Queensland Courts, 2016).

The Planning and Environment Court performs effective administration of all cases and manages each case separately. Cases are prepared for hearing by instructions made by a judge. The progress of each conflict is repeatedly monitored and reviewed. The vast majority of disputes in the P & E Court are resolved or come to an agreement before the final hearing (Queensland Courts, 2016).

Alternative Dispute Resolution (ADR) through mediation is highly encouraged and is free in the P & E Court to minimise the costly and lengthy process (Queensland Courts, 2016).

Those cases that are not mediated in early stages of appeal resolution in the Planning and Environment Court will be heard in court by judges. Each party engages their legal team and associated expert witnesses to provide evidence in support of their case and claims to assist the Court to make a decision on matters of conflict. These processes can be costly and time-consuming and could take a year or more to be resolved, with a decision being made by the judge whether the case is allowed or dismissed. After completion of a case, a judgment proceeding will be published as a court judgement report, which is a summary of matters discussed in each case and which explains all issues considered by the tribunal and parties in the conflict in reaching the final conclusions.

In order to review the Planning and Environment Court cases in Queensland, court judgment reports were accessed through the Queensland Courts website. Court judgement reports are legal text reports prepared by court judges and are accessible through the Supreme Court Library (SCQL) website for public use. These reports are sorted yearly and are available for the years 2000 to the present. This database only includes those appeals taken to court for judgment and does not include appeals mediated in the earlier stages of court case determination. Depending on total conflicts in each year, the number of court case judgments varies.

The Supreme Court Library database includes all registered trials up to the current date. However, the final decision making for these court cases has a delay, and the most recent cases are still not finalised. To review this database, it was necessary to focus on those years that include finalised court cases. Therefore, court cases from 2000 to 2012, available on the SCQL website, were selected to be reviewed in this study. *Figure 4-1* shows the number court report judgements available in this period in all districts in Queensland.

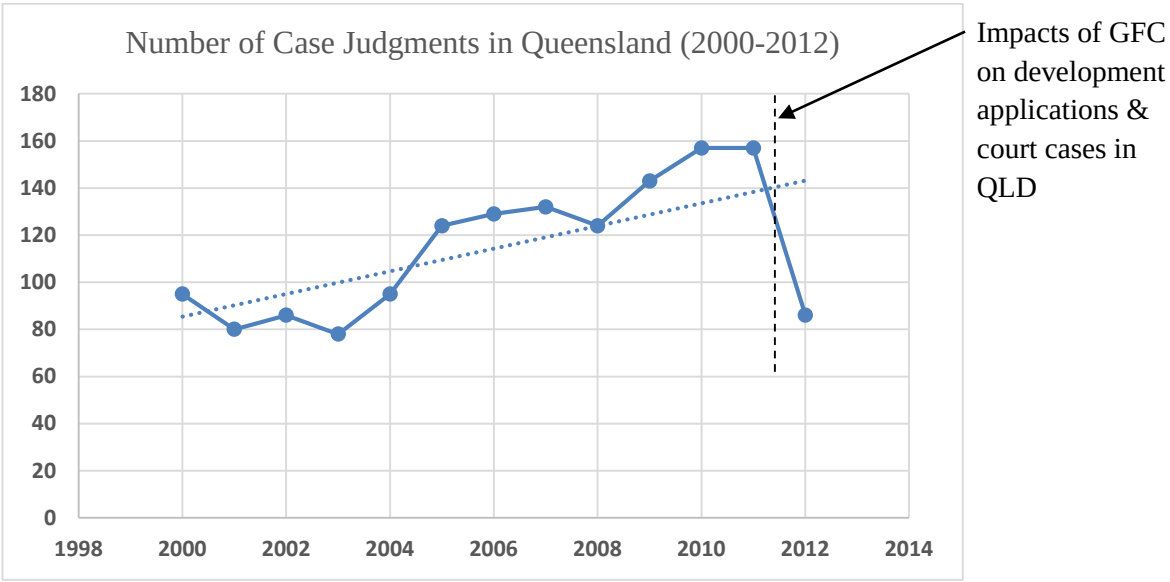


Figure 4-1. Number of Court Cases in Queensland (2000-2012)

Figure 4-1 shows that the number of court cases has increased in this period in Queensland. Consistent with development rate, the number of court cases increased from 2000 to 2011 and sharply decreased in 2012. The sharp decline in the number of court cases is due to a sharp decline in the number of development applications, which might be due to recession and impacts of the Global Financial Crisis (GFC) on the rate of development in the Queensland market. These court cases occurred in different cities in Queensland. Relevant planning policies and codes are also explained in each court report and are used as a basis to justify court judgments.

4.1.1 Planning and Environment Court Cases in Queensland

Due to high demand for higher density developments within the cities footprint, conflicts between development applications and local plans are continually arising (Godschalk, 2004). Every year there are a considerable number of Environmental and Planning Court cases in Brisbane, which highlights the ineffectiveness of the existing planning policies and development assessment process. The visual amenity issues that occur in many of these cases are based on issues such as fragmentation in urban form and skyline, inappropriate scale, bulk and size of development, significant degree of visual modification and impacts (due to inappropriate height, colour, materials etc.), demolition of pre-1946 houses in DCP areas, adverse impact on character and sense of place, adverse impact on the amenity of adjacent dwellings and interrupting existing views and vistas.

These conflicts are examined by experts, through analysing the development applications, local authority plans, and policies, as well as using public consultation to recommend final decisions. This typical analysis of an urban landscape is primarily an individual's interpretation of what appears to be visually significant, without a consistent approach within and between localities. To date, information derived from the character of streets and neighbourhoods lacks a quantifiable and repeatable basis for meaningful discussion of a development's appropriateness and fails to support expert judgments in these assessments.

There are numerous conflicts occurring each year in Australian cities. Visual conflict concept has many complexities that are difficult to understand in the first view. Development of rigorous and reliable methods to increase the objectivity of expert assessments was considered necessary to identify *what types of development conflicts occur in the city?* It was also important to find out *where do these conflicts arise in* the *city?* In response to these research questions, all Court judgments available in the Queensland Supreme Court Library were reviewed. Brisbane was selected as the area of study due to a higher number of conflicts compared to other cities in Queensland.

This study has combined a set of methods and procedures to develop a simple structure to reviewing and classifying of all court cases. A structure to review these trials was provided and consequently, 251 court cases were reviewed. This review provided a broad overview of all types of conflicts in Brisbane city. A wide range of issues was classified and coded into limited groups of conflict issues and development types. This classification provided a broad understanding of high occurrence conflicts for particular types of conflict in Brisbane.

4.2 METHODS

Two major research methods were employed in this stage of the research to review the Planning and Environment court cases in Queensland. The previous record of Planning and Environment Court in Queensland reports was considered as the main source of data for this investigation. These reports are mainly text data that includes all details of a court case. Thus, a detailed content analysis and categorisation of the text data was the primary method to initiate. The findings of this review were further analysed by spatial analysis to understand distribution patterns of these conflicts. These methods and steps are explained in detail below.

4.2.1 Content Analysis of Judgment Records

Previous judgement records have a similar structure that covers all issues relevant to the case. These reports are mainly text data and are a summary of arguments and evidence provided at the court. On the front page of each report, a summary of the case, including parties, final order and catchwords, are provided. This gives an overview of the case (See *Figure 4-2*). Depending on the issues discussed in each court case, these reports can be up to 100 pages and includes all the arguments between parties. It is written by the judge.

PLANNING & ENVIRONMENT COURT OF QUEENSLAND

CITATION:	*Sia & Anor v Brisbane City Council & Ors* [2009] QPEC 8
PARTIES:	**HEATHER SIA, IAN HARRISON SMITH, ANNETTE DEBORAH (TAN) SMITH, NORMAN LOVE, DARREN JOHN BUCHANAN, ALEX CALLEGARI, RICHARD ANNING, PAUL LAMB, MERCER PHELPS, PATRICIA EADE, GERALD McCONNELL, JANINE McCONNELL** Appellants v **BRISBANE CITY COUNCIL** Respondent and **CBD LAND PTY LTD** Co-Respondent and **CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENTAL PROTECTION AGENCY** Co-Respondent by Election
FILE NO/S:	2269/2008
DIVISION:	Planning and Environment
PROCEEDING:	Submitter Appeal
ORIGINATING COURT:	Brisbane
DELIVERED ON:	20 March 2009
DELIVERED AT:	Brisbane
HEARING DATE:	11 February 2009
JUDGE:	Searles DCJ
ORDER:	**1. Appeal dismissed** **2. Application approved.** **3. Appeal adjourned to permit the Council and the co-respondent to finalize appropriate conditions of approval.**
CATCHWORDS:	PLANNING AND ENVIRONMENT – Application for

Figure 4-2. Sample Court Report Coverage - Court Case Number 8/2009 (Source: Queensland Supreme Court Library)

The analysis of content is a central technique in the first stage of this study. Content analysis is commonly defined as a procedure for making interpretations to identify characteristics of written, spoken or graphical materials systematically and analytically (Holsti, 1969). It is a research technique to make repeatable and valid implications from texts and their contexts (Krippendorff, 2004). Krippendorff (2004) considers the reading of the text, the use of text in its social content and analysis of text to be key components of content analysis.

Content analysis can have both quantitative and qualitative forms (Sommer and Sommer, 2002, Holsti, 1969, Krippendorff, 2004). Quantitative content analysis seeks to identify a pattern or structure through repetition and frequency of occurrence of certain words or constructs in the text to show the characteristics of the content (Holsti, 1969). The quantitative content analysis is also referred to as a dictionary-based approach. Qualitative content analysis is accomplished through understanding and interpretation of themes included in the text and is implemented by the researchers, who start by selecting what they consider relevant to the research (Berg, 2001). Defining clear rules is necessary for a quantitative content analysis, where a text is being scanned and content categories are identified and coded. The selection criteria of codes must be comprehensive and include all variations of text content, and it must also be equally exclusive so that other people looking at the same data get the same, or equivalent, results (Berg, 2001). This research started with a dictionary-based content analysis (quantitative) to identify different classes and codes. In the second step, qualitative content analysis was employed to focus on intentionality and the implications of codes and concepts.

Court judgment reports include a wide range of data, tangible and intangible. These reports are mainly of a legal and planning nature and include an overview of the case. It covers all reasons and grounds for why the development has been appealed. It also covers all relevant planning policies and regulations relevant to the case. These policies define a basis for justifying the development by interpretation of theses policies. Consequently, it covers each ground separately and explains the expert witness evidence and judgement of the evidence. In the end, the judge explains final reasons and decisions, and the court's order and conclusion as the result of this process.

In order to review these court cases, a detailed categorisation of qualitative and quantitative data was required. This was a multi-step process in increase the depth of review and to understand each court case individually and to identify connections to other similar court cases. Categorisation and coding of qualitative data were used to develop the database.

4.2.2 Categorisation of Planning and Environment Court Judgments

A combination of quantitative and qualitative content analysis techniques was applied to review Planning and Environment Court Cases in stage 1 of this study. Data reduction and analysis were combined in a three-step process to reduce, categorise and code all court cases (See *Figure 4-3*). An abductive research strategy was followed to find generalities in the reviewed court cases and to identify concepts and ideas to guide the research to the next stage.

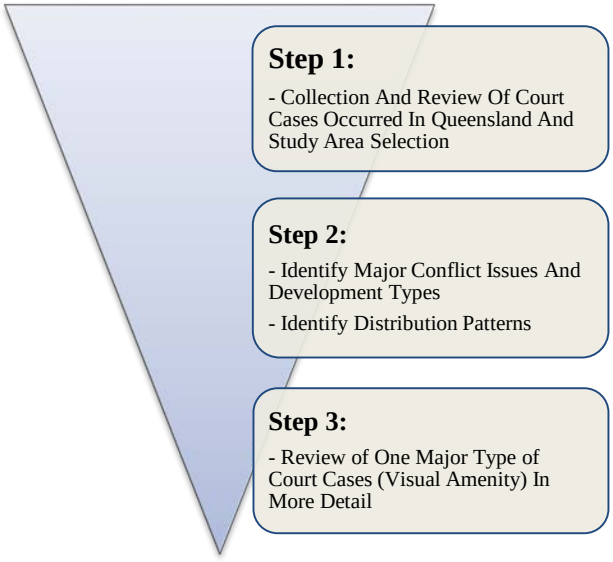


Figure 4-3. Stage 1 data collection/analysis and reduction flowchart

In the first step of review and data reduction, all planning and environment court cases available in the Supreme Court Library database between 2000-2012 were examined to identify in which city or region they occurred. This preliminary analysis showed that judgements took place in more than 65 different towns and cities in Queensland. *Figure 4-4* shows a limited number of cities with more than ten court cases in this database.

Figure 4-4 also confirms that Brisbane had the highest number of court judgements (364 cases) within this period. It is evident from this analysis that population density is a major factor driving the number of Planning and Environment Court cases. Within any particular area, Brisbane has the highest number of court cases compared to other cities in Queensland. Therefore, Brisbane was selected as the study area as it provided the greatest diversity of cases. This diversity is essential to understanding the different types of conflicts and their distribution patterns throughout the city.

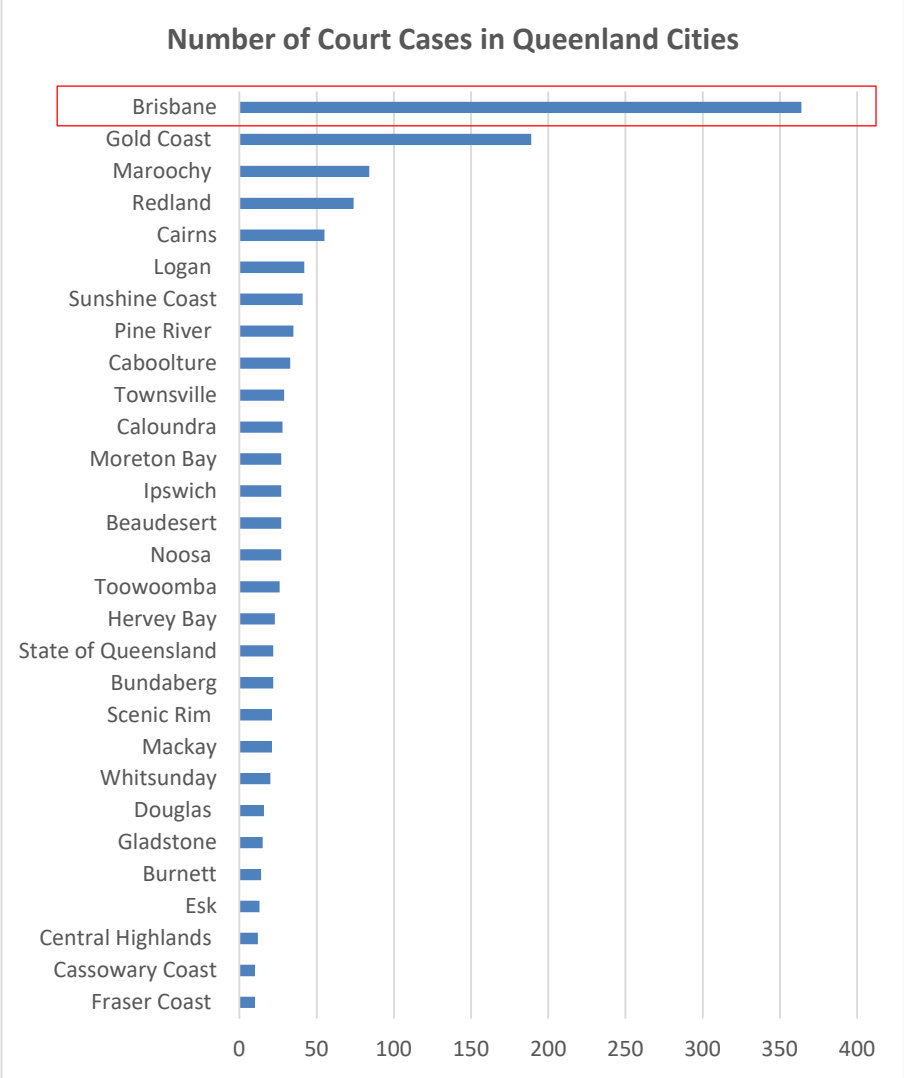


Figure 4-4. Number Court Cases occurred in Cities in Queensland

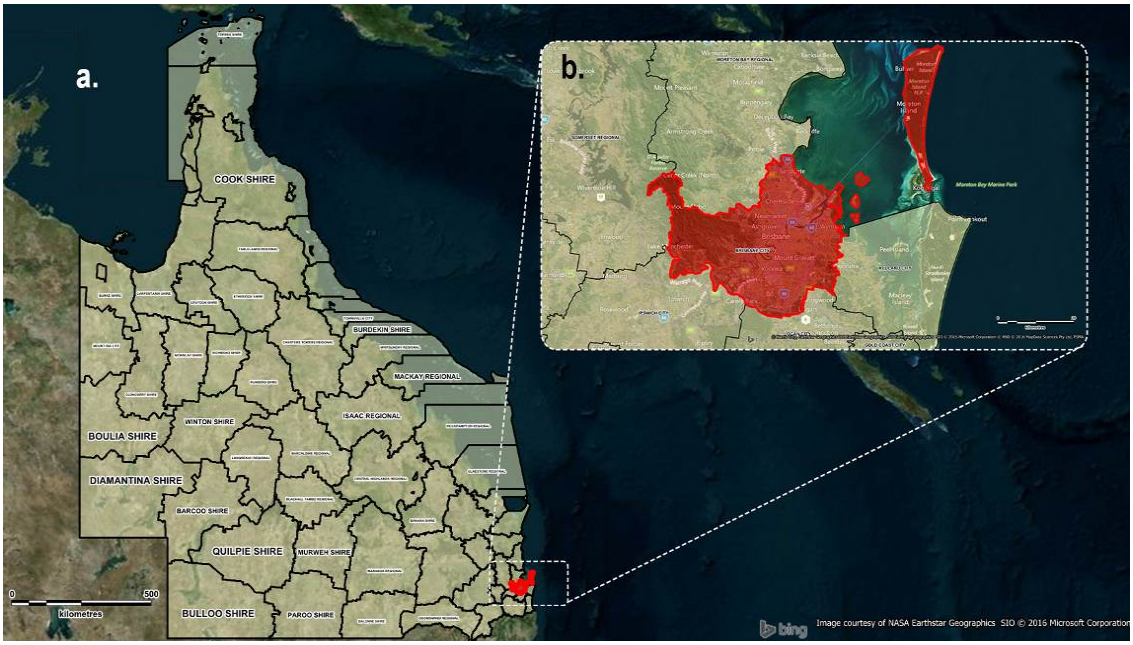


Figure 4-5. Queensland (**a**. Local Government Boundaries - **b**. Brisbane City Boundary)

Brisbane is the capital and the largest city in Queensland. It is the third most populous town in Australia, with a population of over two million (Regional Population Growth, 2015). It is located along the Brisbane River and sprawls along the Moreton Bay floodplain. There is little doubt that Brisbane is facing a future of higher density urban development. According to the state government regional plan, in the next 20 years, Brisbane City Council must supply 145,000 new residences within its urban footprint to accommodate the growth (Queensland Government, 2009).

Of the 364 court cases that occurred during this period. It was found that near one-third of them were adjourned and not finalised. Therefore, the number of finalised court judgements to be reviewed in this study was reduced to near 251 court cases. These cases were reviewed in more detail to identify classification categories and to identify major themes or categories. The categories were then listed and, whenever they begin to repeat or overlap, they were combined into one category. The resulting categories were then tested on the new textual material (other court reports) to see how well they fit the content categories.

All of the Court reports follow a similar structure which includes: court case number; court case parties (appellant, respondent and solicitors); location or address; order (court decision); conflict issues and development types. This categorisation helped to develop a summary form in Microsoft Excel to summarise each court case into limited categories (Table 4-1). All 251 cases were summarised yearly in the same template (See *Figure 4-2*, Refer Appendix A for all 13 years).

Table 4-1 Court cases summary form (Refer Appendix A)

Court Case Number	Conflict Issue	Type of Development	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC05-003	Character Conflict with pre-1946 residential/size and style of the proposed development/out of character with the existing older homes/Amenity/inappropriate development – conflict with Planning Scheme/inapproporate use-commercial	MULTI-UNIT DEVELOPMENT (additions to an existing building) eight residential units	corner of Annerley Road and Grantham Street/1,801m2	rejected by Council and is opposed by a number of local residents	dismissed	Developer VS BCC	City Plan 2000,

Table 4-2. Summarised Court Cases (2003) (Refer Appendix A)

Court Case Number	Conflict Issue	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC03-001	Minor Change/enclose their balcony with glass, to reduce the traffic noise from the Captain Cook Bridge/increasing the gross floor area of their lot.	Glass on Balcony to reduce noise	Lot 28 in Riviera II at Kangaroo Point.	BCC	allowed. Application is properly made	Owner VS BCC	2003 - 12cases
QPEC03-006	appeal against an approval subject to conditions/height over 8.5 limit/	a house	58 Watson Street, Newmarket	BCC, 17 objectors	dismissed to another application (changes were not minor)	Developer VS BCC	
QPEC03-007	Application to demolish pre 1946 dwelling house	a house	40-42 Boyd Street, Bowen Hills/Lots 12 and 13 on SL 5982		appeal is dismissed	Developer VS BCC	
QPEC03-010	Westfield objection against BCC approvel: conflict with the Toombul-Nundah Major Centre Local Plan Code	hopping centre,offices and multi-unit dwellings		Westfield	appeal is allowed/application is returned to court to reassess	Objector VS BCC+Developer	
QPEC03-025	preservation of character house/traffic; amenity	Multi-unit development over two existing allotments/LMDRA/three storeys in height.	corner of Rode Road and Windsor Street/Nundah	local resident	appeal is dismissed	Objector VS BCC+Developer	
QPEC03-031 Constums house case	relationship to other buildings,views .... to the heritage place	refurbishment of the Colonial building and the provision of four additional floor levels to accommodate a total of thirtyfive residential units and ancillary recreational and business facilities	443 Queen Street, Brisbane	Developer	appeal is allowed	Developer VS BCC	View:the sight or vision of something Vista:"A view or prospect, especially one seen through an avenue of trees or other long and narrow opening." in a modern living city, buildings of different eras can co-exist comfortably and can even complement each other
QPEC03-035	appeal against council's approval for a material change of use – compliance with **relevant code/s - traffic - over-development - character** If the development was reduced to three units and suitably conditioned, their opposition would be withdrawn	multi-unit dwelling comprising four units	end of Colton Avenue/Lutwyche **The land's rear boundary adjoins the Kedron Brook reserve.**	Local people	the appeal must be dismissed.	Objector VS BCC+Developer	the Integrated Planning Act suggest that compromise should be read to mean "threaten"
QPEC03-043	rezoning from Rural Res to Residential	27 Dwelling added to exisitng 4 on 5.9 ha bushland site	37, 39, 69 and 71 Brookfield Road, Kenmore, also parts of 41 and 55 Brookfield Road and the Oakmont Street Road Reserve, Kenmore./8-10 on registered plan 81879 and lot 36 on registered plan 895537	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	
QPEC03-055	"Vehicle Movement. Parking. Noise/Inadequate Private Open Space/Imposition on Boundaries/Poor Environmental Design/Garbage Bins/Garage- Abutting Eastern Boundary/Stormwater Drainage/Bulk and Size of the Proposed Development	multi-unit dwellings (2 "townhouses") behind pre-1946 cottage on Low-Medium Density Residential	11 Brook Street, South Brisbane described as Lot 56 on RP 11691,	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	
QPEC03-057	conflicts with the intent of the Strategic Plan, the Residential A zone, and Planning Policy/The proposal constitutes a freestanding, out of centre commercial development/inconsistent with the residential character of the area/undesirable and unnecessary pedestrian and vehicular crossings	Application for a Material Change of Use to develop a land for a a local store and local surgery/previously been operated as a service station. additions have been made on the southern side of the building to convert it to a residential use/application for local store of 139 square metres and a local surgery of 60 square metres	corner of Sussex Street and Osborne Road Mitchelton, being Lot 1 RP 123766, Parish of Enoggera, The premises are opposite the main entrance to Brookside Shopping Centre in Osborne Rd.	BBC refusal	Appeal Refused	Developer VS BCC	1987 Town Plan
QPEC03-067	conflict with planning instruments – amenity – noise – traffic – heritage conflict with the relevant planning provisions and general planning issues/amenity issues/traffic issues/heritage issues	re-development of the rowing shed used by the Anglican Church (demolition of a structure which has outlived its usefulness and a replacement of it by a new, more attractive, effective and safe rowing shed complex) material change in the intensity or scale of the existing use of the premises	Grammar School at Mowbray Park	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	1988 Town Plan/visual impact (Messrs Chenoweth and Kay tighter controls in respect of areas of heritage importance in City Plan
QPEC03-077	two appeals are heard together first, brought by the co-respondents, seeks an order that the appeal be struck out with costs. The second, brought by the appellants, seeks an order that the time allowed for the appellants to give written notice of the appeal to other parties be extended until 27 November 2003	a material change of use to facilitate the development of a multi-unit dwelling	as Lots 14, 41-42 on RP 19619, Parish of Enoggera, situated at 29 Mort Street, Paddington	resident objector	co-respondents to strike out the notice of appeal is allowed/appellants have failed to demonstrate that sufficient grounds exist to warrant an extension of time The application to enlarge time is therefore dismissed/will hear any submissions in relation to costs in due course.	Objector VS BCC+Developer	

The review of 13 years of court cases in Brisbane in stage 1 of the study provided a comprehensive database to answer the first research question. A wide variety of court cases during this period were considered in developing a generic structure to classify and code all court cases. Based on a general overview of all conflicts, these court cases can be classified into four broad categories: *Conflict Issues*, *Development Types*, *Appellant* and *Order*. Each of these categories was analysed and then further divided into sub-classes.

Conflict issues included five subclasses: traffic, environment, visual amenity, amenity and planning. Each subclass covers a wider variety of relevant items within each subclass. For instance, visual amenity issues include heritage, character, height, bulk and size, views, overdevelopment, sense of place, compatibility, sunlight and daylight issues.

Development application types included six subclasses: infrastructure, residential 1 (multi-unit), residential 2 (reconfiguration of a lot), residential 3(demolition), commercial and industry and community facility. The appellant category had two separate classes: adverse submitter (third party) and developer. The order category of final court decision had two subclasses: dismissed or allowed. For example, infrastructure subclass in development types included paths, bikeways, roads, easements, telecommunications and other Council works. Full details of subclasses are presented in Appendix B.

Appellant and order categories only include two subclasses. Appellant could be adverse submitter, including third parties and local community or developer. Court decisions comprised two subclasses: whether litigation was dismissed or allowed with conditions. The classification template was used to classify each court case based on their summarised characteristics is shown in Table 4-3.

Table 4-3 Court case classification template (Refer Appendix A)

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues.., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed

A coding criterion was defined in order to identify attributes of each court case based on relevance to each subclass and to extract some statistics from the developed database. Based on this criteria, if a sub-class was relevant to a court case, it scored one. Otherwise, that subclass was left blank, which means a nil value (0). This coding process was applied to all of the court cases to assign their attributes.

Table 4-4 displays sample coding completed for a series of court cases. Classification and coding of all court cases are available in Appendix A. Results of this process were further used in the spatial analysis to develop a spatial database. Converting qualitative attributes to numeric values was used to count frequencies and to analyse court cases spatially to identify distribution patterns.

Table 4-4. Coded Court cases based on relevant fields (refer Appendix A)

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2000_QPEC003	1	1		1	1		1					1	1	1	
2000_QPEC004				1	1					1		1			1
2000_QPEC007			1		1		1		1			1			1
2000_QPEC009			1		1		1					1		1	
2000_QPEC010	1			1						1		1		1	
2000_QPEC014	1		1	1							1	1		1	
2000_QPEC023					1				1				1		1
2000_QPEC032	1			1	1		1			1		1		1	
2000_QPEC046			1					1					1		1
2000_QPEC048			1						1				1		1
2000_QPEC049			1						1				1		1
2000_QPEC051				1						1		1		1	
2000_QPEC055				1		1						1		1	
2000_QPEC057				1							1	1		1	
2000_QPEC078					1					1			1		1
2000_QPEC083		1					1					1		1	
2000_QPEC089					1	1						1			1
2000_QPEC091			1	1	1					1		1		1	
2000_QPEC094					1	1						1		1	
2001_QPEC005		1	1		1			1				1			1
2001_QPEC006	1		1	1			1					1		1	
2001_QPEC008					1				1				1	1	
2001_QPEC009			1		1					1		1		1	
2001_QPEC015				1							1	1		1	
2001_QPEC022					1		1					1		1	
2001_QPEC024			1						1				1		1
2001_QPEC041		1	1							1			1		1
2001_QPEC043			1				1						1		1
2001_QPEC045			1		1		1					1			1
2001_QPEC049					1						1	1			1
2001_QPEC050			1						1				1	1	
2001_QPEC051			1				1		1			1		1	
2001_QPEC054					1					1			1	1	
2001_QPEC058			1		1					1		1			1
2001_QPEC061	1		1	1			1					1			1
2001_QPEC062				1				1					1	1	
2001_QPEC065					1	1							1		1
2001_QPEC075			1	1			1					1		1	

All court cases were scored based on the scoring criteria mentioned above. After the scoring of all court cases, the sum of each column shows a frequency of that subclass within all trials in Brisbane. Total values of each subclass are provided in Table 4-5. It is important to consider that each court case might include several conflict issues and was scored accordingly in the relevant subtype.

Table 4-5. Court Case classification scoresheet and total frequencies (Refer Appendix A)

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2009_QPEC 97					1					1			1	1	
2009_QPEC53	1						1						1	1	
2010_QPEC 130			1						1				1	1	
2010_QPEC 137			1						1				1	1	
2010_QPEC 143		1	1	1	1			1					1	1	
2010_QPEC 70			1	1	1		1						1		1
2010_QPEC 72		1	1			1						1		1	
2011_QPEC 101		1								1			1	1	
2011_QPEC 55			1		1				1				1		1
2011_QPEC 87	1		1	1			1					1		1	
2011_QPEC54					1						1		1	1	
2012_QPEC022	1	1		1						1		1		1	
2012_QPEC032			1	1			1					1			1
2012_QPEC042					1					1			1	1	
2012_QPEC047			1						1				1		1
2012_QPEC071			1	1			1					1		1	
2012_QPEC080			1		1		1		1			1		1	
2012_QPEC081			1		1				1			1		1	
Lambert St	1						1						1		1
Totals	30	26	79	36	90	10	52	20	39	36	10	94	63	114	43

4.2.3 Spatial Analysis of Court cases

In order to analyse court cases in more depth and to understand their spatial pattern and distribution with the city, Geographic Information Systems (GIS) was used to structure the database spatially. GIS provided a powerful tool to identify distribution patterns of conflicts inside the study boundary by creating several maps to simplify the complexity of 251 court cases.

More organisations are using GIS for more complex decision making (Nyerges, 2009, 5). While GIS software and hardware technology have developed considerably over the past three decades to address spatial problems, there is still great opportunity to improve problem-solving and decision making by enhancing people's analysis for gaining insight into the relationships among urban, social and ecological concerns (Nyerges, 2009). Recent progress in personal computer capability has meant the representational methods of GIS to visualise relationships between elements may be represented spatially (Old, 2001).

GIS can be used to manage tremendous volumes of spatial and attribute data from a variety of databases and offers tools and modules for spatial analysis and modelling of the data. Efforts to integrate qualitative and quantitative data and techniques with GIS have been building in recent years. A growing number of research studies use GIS-based spatial analysis, in concert with methodologies more familiar to qualitative researchers, to strengthen the research findings by bringing together different ways of knowing (Elwood and Cope, 2009).

In GIS, several thematic maps can be produced by defining a geospatial location of a phenomenon and adding associated attributes to it. A thematic map is a type of map produced to show a particular theme to a particular geospatial location. Thematic maps can portray specific attributes associated with a group or a feature and can graphically represent qualitative or quantitative data in an area or location (Hinterberger, 2009). According to Hinterberger's (2009) classification, there are five types of thematic maps: choropleth (shaded or different patterns), dot, proportional symbol, isorhythmic and dasymetric maps. Dot maps use similar size dots to show the presence of a feature in order to display spatial distribution. Dot map representation was used here to analyse court case distribution patterns based on their attributes.

For the spatial analysis of the court case database, multiple GIS datasets were collected to prepare a base for the GIS mapping. These datasets include cadastre, roads, aerial imagery and contour information which sourced from Department of Natural Resources and Mines. This data is available online for free through Queensland Spatial Catalogue5. This base was used to register each court cases based on street address and location. It resulted in the development of a GIS database with a series of points, in which each point represents a specific court case number. Figure 4-6 shows 170 registered court cases within the Brisbane city boundary[6].

[5] http://qldspatial.information.qld.gov.au/catalogue/

[6] Even though 251 court case were reviewed in Stage 1, 81 of these court cases did not have any specific address to be located in GIS database.

Cadastral boundaries were the most important layer to locate each court case based on address or lot and plan number. Google Maps was also used to ascertain each location. After identification of the respected lot boundary for each court case, a point was located on the centroid [7]of each lot boundary which represented a single court case.

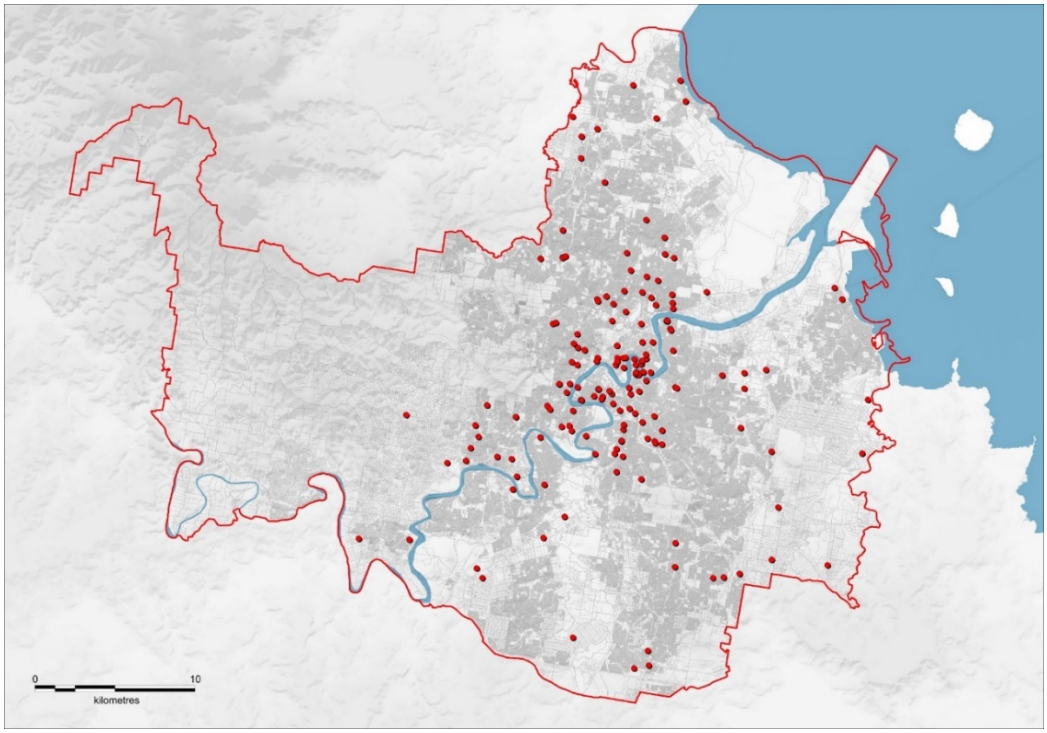


Figure 4-6. Registered Court Cases in GIS

In order to add case attributes, such as conflict and development type, which was tabulated in the previous review, court case numbers were used to reference field to join court case database to court case locations (dots). This process was done using Arc GIS Desktop version 10.2 and Microsoft Excel to apply the joint process. The Latest version of Arc GIS provided improved functionality to analyse and visualise spatial data.

After the joint process in GIS, a new spatial layer was developed based on court case addresses, which included court case attributes and characteristics for each case. As shown in Figure 4-6, 170 court cases were registered in the Brisbane boundary. In overall, court cases were more concentrated around the Brisbane CBD and scattered toward boundaries and showed strong spatial correlation with city density. As the density increases, there are more conflicts in these areas and vice versa.

These cases are further analysed in this chapter using GIS and thematic maps. Based on four broad categories of court cases (conflict issues, development types, appellant and order), all registered court cases were presented in 4 separate maps for each category. These maps are presented and interpreted in more detail.

[7] Centroid is the geometrical centre of a two dimensional region.

4.3 RESULTS

According to the top-down reviewing process of court cases, they are classified into separate modes, categories and sub-classes. The hierarchical assessment helped to understand and analyse the complexities of court cases as they occur in different situations. The results of this analysis are further discussed in the following sections and include court cases modes and classifications. These findings are mainly based on the content analysis of all of the court cases available in the database.

4.3.1 Modes of Conflict In Planning And Environment Court Cases

In a preliminary review of Court cases, three broad modes of conflict have been identified. These modes are mainly based on different types of conflict parties from appellant and respondent. However, the court process to review each mode is similar, and tribunals aim to assess each case impartially based on facts and merits in accordance with the relevant planning policies.

Developer vs. Council is the most frequent form of conflict in Brisbane. It represents the dispute between the developer as appellant and Brisbane City Council (BCC) as the respondent and planning authority (See *Figure 4-7*). *Third party vs. Council and developer* mode includes Court cases in which a third party, including local community or businesses (appellant) who have opposed an approved development application, and BCC is the respondent in this type of conflict (See *Figure 4-8*). *Council vs. developer* mode, which is a rare mode of conflict, relates to specific cases where Council opposes a previously approved court case. In all court cases, appellants and respondents employ trusted experts in various fields, through their solicitors, in order to defend their case (*Figure 4-9*).

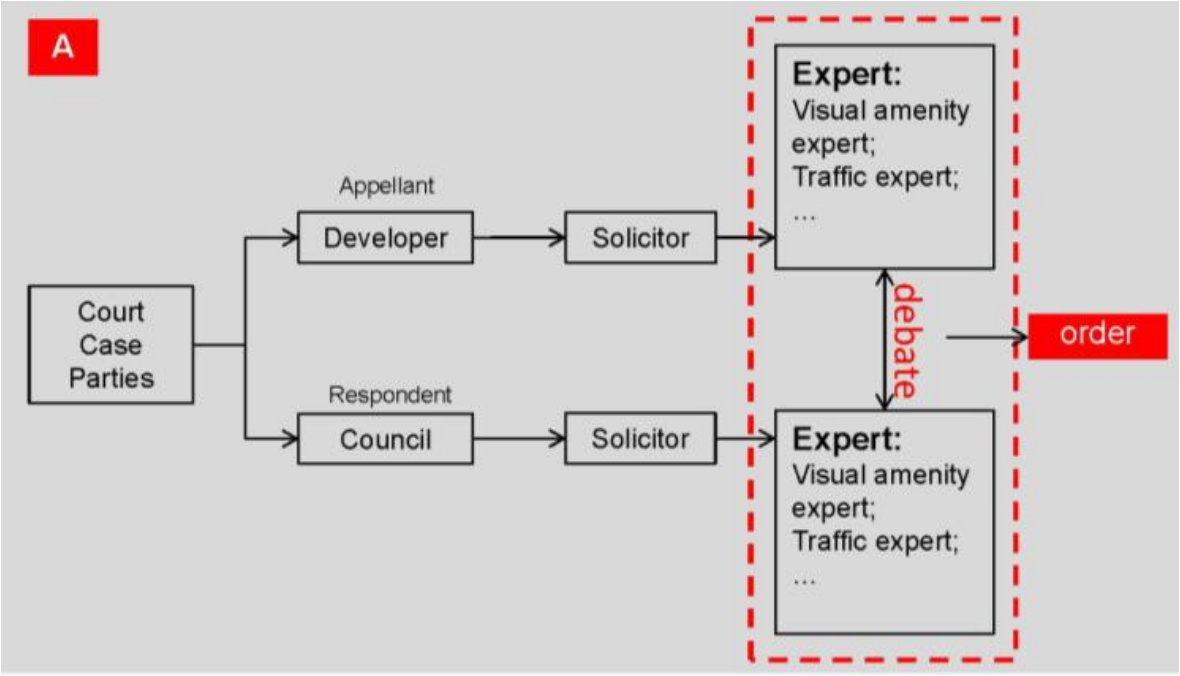


Figure 4-7. Developer vs. Council Mode of Conflict

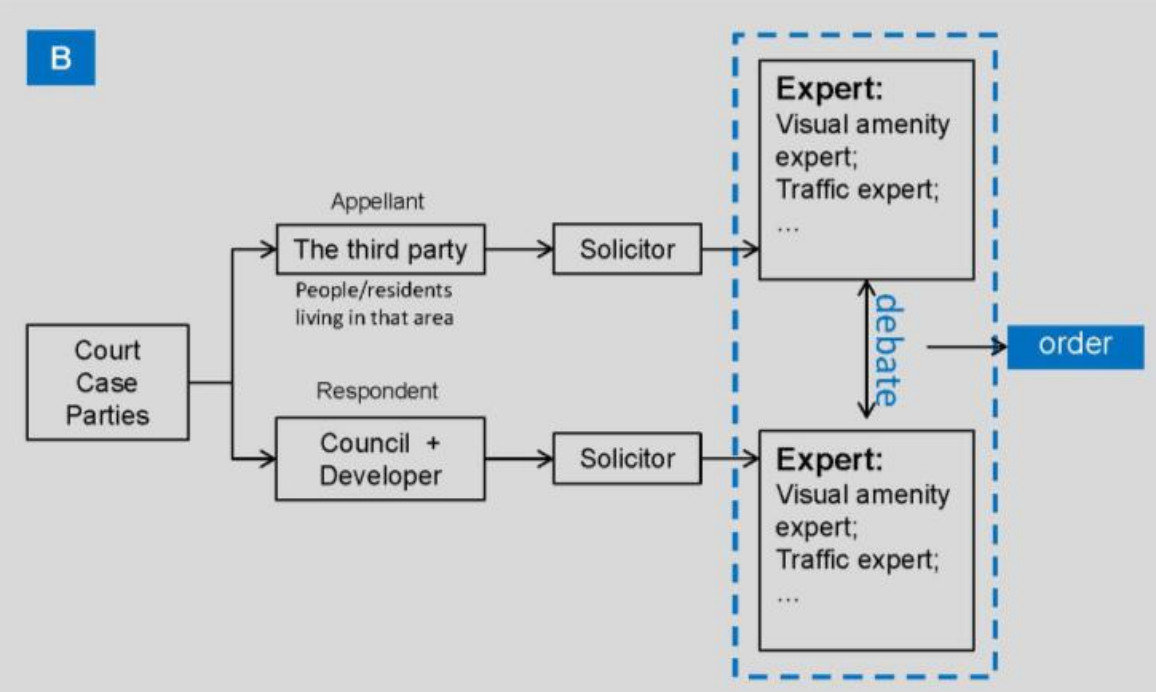


Figure 4-8. Third party vs. Council and developer Mode of Conflict

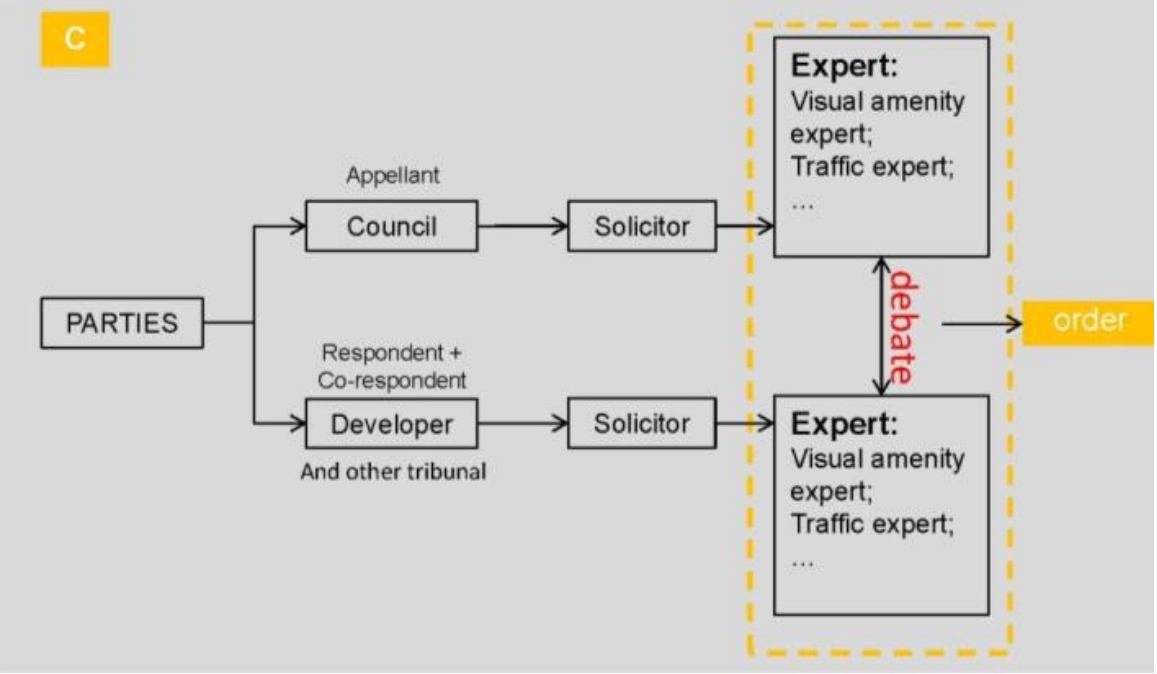


Figure 4-9. Council vs. Developer Mode of Conflict

The identified conflict modes provide a broad picture of each conflict. However, court cases with similar conflict modes have many differences in detail, which are further analysed in the detailed classification of each court case. This classification identified the major type of development types and conflict issues in these conflicts regardless of their conflict modes.

4.3.2 Types of Developments

Based on the overall review of all court cases in Brisbane, six broad categories were defined to classify all court cases. These categories include a wide range of development applications that are appealed to the court. These categories are:

- **Infrastructure:** paths, bikeways, roads, easements, telecommunications, Council works;
- **Residential 1:** new multi-unit residential building;
- **Residential 2:** new reconfiguration of lots, subdivision;
- **Residential 3:** change to an existing development, such as demolition, extension, modifications;
- **Commercial & Industry:** shopping centre, nightclub, restaurant, office, service and transfer station, bus depot, motel, backpacker;
- **Community Facility:** golf course, tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, recreational purposes, student accommodation;

Due to the frequency of residential developments compared to other identified categories, they are classified into three separate categories for clarity (Residential 1-3). While the types of developments that occur in a city environment are not limited to the above developments, these were the most highly contested types of developments in the reviewed court cases in Brisbane.

Development frequencies derived from the databases revealed some major trends. Overall, *Residential 1* (multi-unit residential) and *Residential 3* (demolition cases) were the most contested types of development. Residential 1, with 52 cases, and Residential 3, with 39 cases, were the most frequent type of conflict compared to other categories. *Figure 4-10* shows the number of cases for each development type.

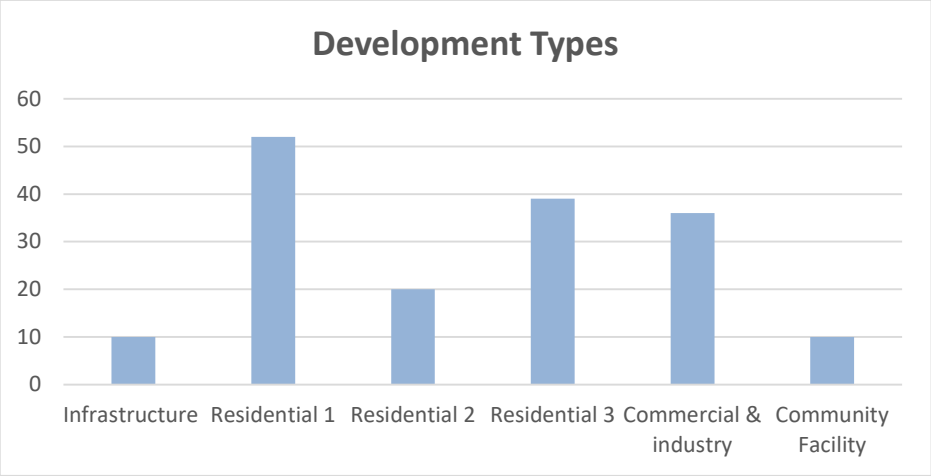


Figure 4-10. Frequency of Development Types in Brisbane Court Judgments (2000-2012)

Development types were further analysed spatially to identify their distribution patterns. *Figure 4-11* displays the distribution of court cases based on six classes of development types. Based on this, multi-unit (*Residential 1*) was the most common type of developments, which were located around high-density CBD and inner city suburbs. In contrast, subdivision residential (*Residential 2*) developments were scattered in the suburbs with an outer urban footprint north and south.

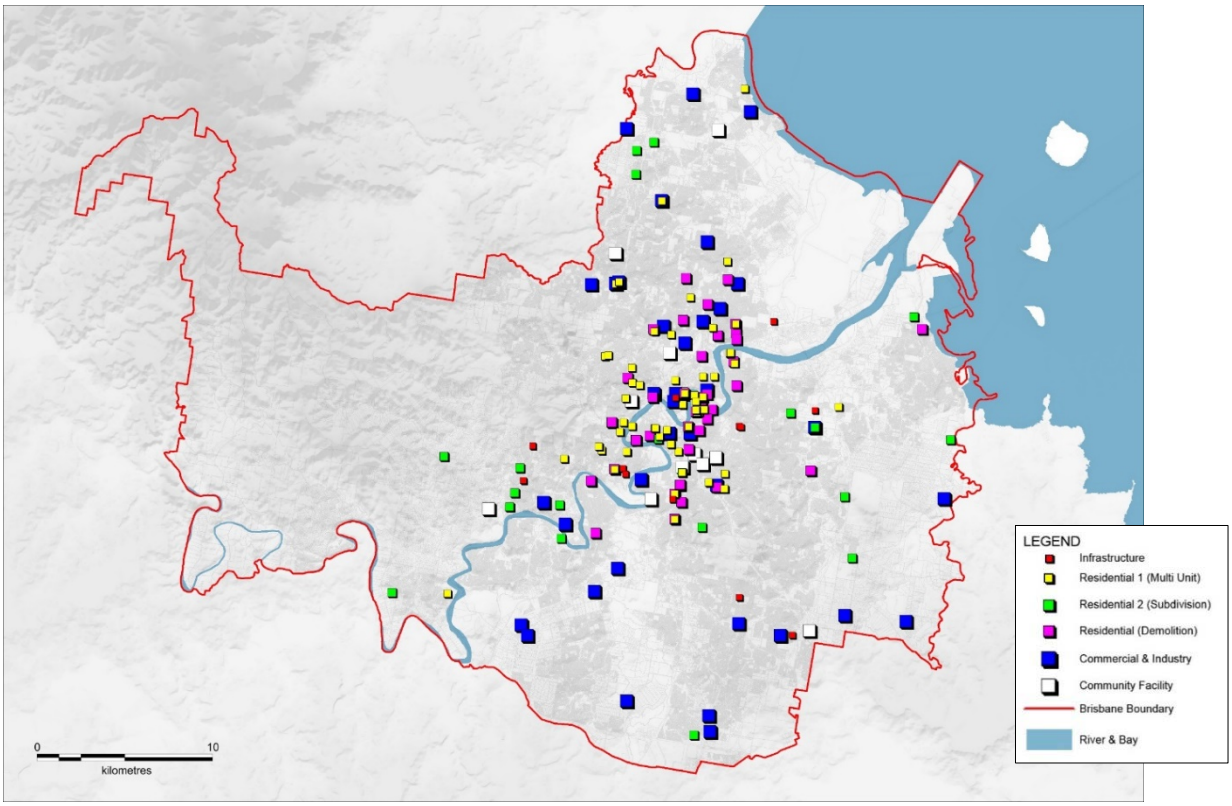


Figure 4-11. Classified Court Cases based on Development Types

Infrastructure, *Commercial & Industry* and *Community* facilities were the least represented type of conflict and include a wide variety of development types which might occur in any part of the town. As confirmed by *Figure 4-11*, they are scattered within and outskirts of the urban footprint, near to city boundaries. The demolition cases (*Residential 3*) occurred around the CBD in inner city suburbs, within a 7km radius from the CBD.

4.3.3 Issues of Conflicts

According to the reviewed court cases, five major issues of conflicts were identified, which cover a wider range of issues. This classification is based on the identification of a field of issues and expert disciplines. They include:

- **Traffic:** accessibility, easement, road, parking
- **Environment:** ecology, soil contamination, waterways, flood, sewer, storm water;
- **Visual Amenity:** heritage, character, height, bulk & size, views, overdevelopment, sense of place, compatibility, sunlight, daylight;
- **Amenity:** land use, dust, noise, pollution, security, privacy, behaviour, sensitivity, social impact;
- **Planning:** zoning, compliance with policy requirements, public notification & application process, court process issues…, interpretation of planning policies and Desired Environmental Outcomes (DEOs), Gross Floor Area (GFA);

Based on conducted analysis, visual amenity and planning issues were the most frequent issues of conflict. *Visual amenity* and *Planning Court* cases, with total scores of 79 and 90 respectively, were the most common type of conflict, far outweighing *Traffic*, *Environment* and *Amenity* categories. *Figure 4-12* shows the number of conflicts in each category.

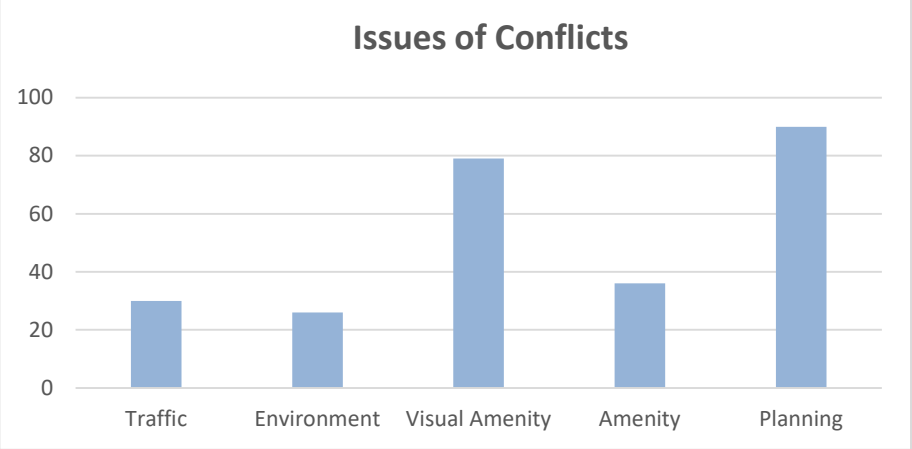


Figure 4-12. Frequency of Issues of Conflict in Brisbane Court Judgments (2000-2012)

Issues of conflicts were also analysed spatially to identify their distribution patterns. *Figure 4-13* demonstrates the distribution of court cases based on five classes of conflict types: *Traffic*, *Environmental*, *Visual Amenity*, *Amenity* and *Planning* issues. Town planning issues were the most common type of conflict compared to other classes and were scattered all around the urban footprint. These issues are very common issues, which can be seen to be occurring in any part of the city.

Visual amenity issues (green dots) are the second most common type of conflict, with a concentration in the CBD and inner city suburbs. This confirmed that visual amenity conflicts were more associated with medium and high-density suburbs in Brisbane city, where more height limits for multi-unit residential buildings are allowed than in these areas.

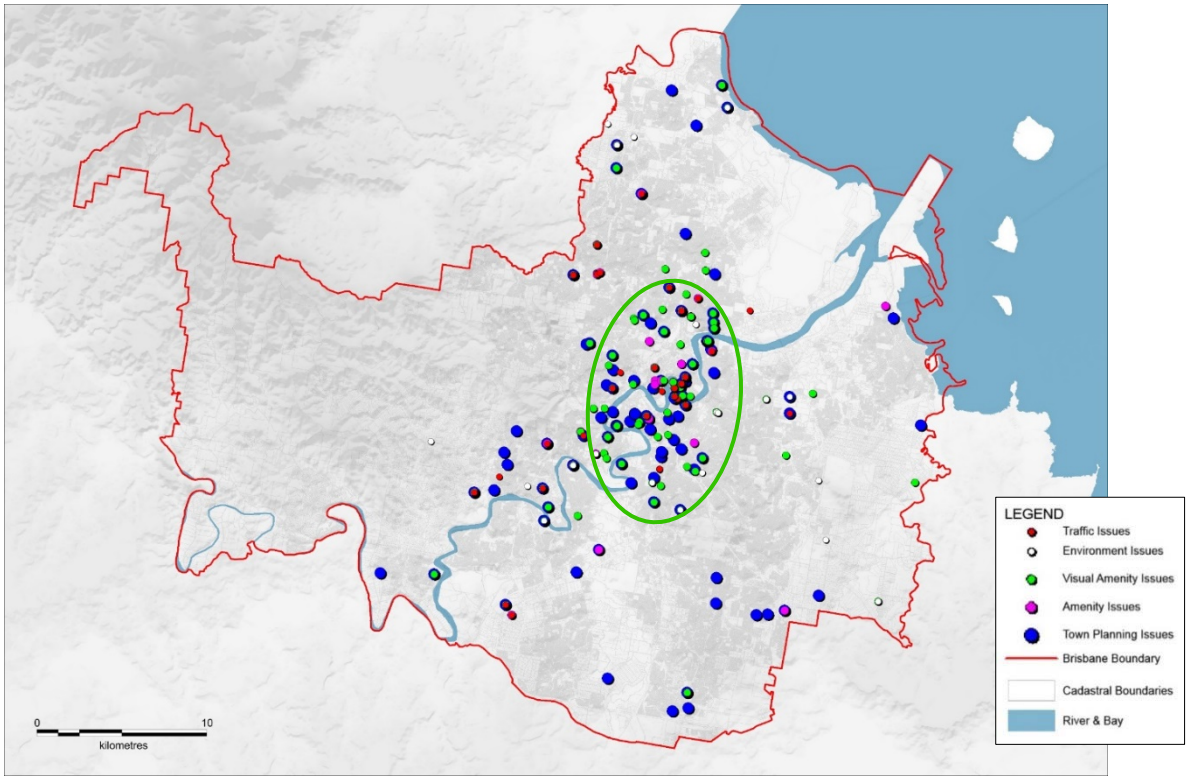


Figure 4-13. Classified Court Cases based on Issues of Conflicts

The *Amenity* category includes the other aspect of amenity including dust and air pollution, noise, social impacts. These categories, similar to *Traffic* and *Environment* issues, are considered a particular type of conflict. They might occur in any part of town, around the CBD or on the outskirts of the urban footprint, in rural areas. Types of developments are another aspect of these conflicts, which have been discussed in relation to issues of conflicts.

4.3.4 Types of Developments Vs. Issues of Conflicts

Relationships between types of development and issues of conflict as the major categories of classification were analysed by developing a matrix. This matrix demonstrates the underlying trends in conflicts by referring to types of development and conflict issues. The numbers of conflicts were counted in each class, which provided 30 typologies of conflict. This matrix is presented in Table 4-6**.** This highlights that with respect to visual amenity disputes, demolition cases, with 28 cases, or 72%, and Multi-Unit Residential, with 30 cases, or 58%, were the highest type of court case (Table 4-6). The most common types of case are highlighted in the second table.

Table 4-6. Number of Court Cases based on Conflict Issues and Types of Developments

Issues / Development Types	Infrastructure (Total 10)	Residential (Multi Unit) (Total 52)	Residential (Subdivision) (Total 20)	Residential (Demolition) (Total 39)	Commercial & industry (Total 36)	Community Facility (Total 10)
Traffic	1	14	3	3	9	3
Environment	3	4	10	3	7	1
Visual Amenity	3	30	7	28	12	3
Amenity	1	15	2	3	12	6
Planning	5	29	12	16	27	7

Percentage of Court Cases in each category

Issues / Development Types	Infrastructure	Residential (Multi Unit)	Residential (Subdivision)	Residential (Demolition)	Commercial & industry	Community Facility
Traffic	10%	27%	15%	8%	25%	30%
Environment	30%	8%	50%	8%	19%	10%
Visual Amenity	30%	58%	35%	72%	33%	30%
Amenity	10%	29%	10%	8%	33%	60%
Planning	50%	56%	60%	41%	75%	70%

*Pink cells are the highest numbers in each category

This analysis confirmed that visual amenity issues were the most common conflict issue in Residential multi-unit and Residential (demolition cases) developments. Planning issues were also common issue of conflict in all types of development applications.

Figure 4-14 demonstrates these relationships more graphically.

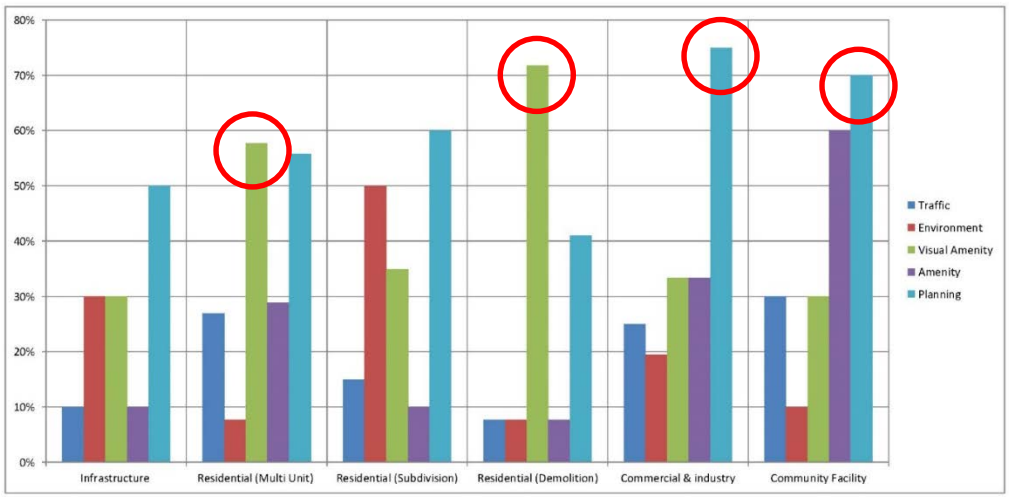


Figure 4-14. Court Case Frequencies (Conflict issues versus development types)

Some other trends can be identified from the database. Infrastructure court cases are more associated with visual amenity, planning and environmental issues. *Residential 2* (subdivisions) category is more associated with environmental and planning issues. Also, community facilities developments have more planning and amenity issues.

Visual amenity conflicts were compared to other types of conflict based on the different development types. Based on this comparison and the statistics, visual amenity conflicts were the second most common in Brisbane. These court cases were further analysed spatially using GIS to examine and identify distribution patterns of conflict. Spatial analysis of distribution patterns provides essential information about the court cases to understand where they occurred and where the hot spots are for development conflicts in the city environment.

Further to relationships and distributions of development conflicts and conflict issues, appellants and the final court order are another categories which were reviewed in these court cases. Two other variables are calculated based on the statistics derived from the database. This helped to understand underlying trends in these conflicts.

4.3.5 Appellants and Success Rates

Two major appellant subclasses were identified in these conflicts: *Adverse Submitter* and *Developer*. Adverse submitters are in fact third parties who have an objection to the development and submit an appeal to the P&E Court to challenge a development approval given by the local Council. According to the research database, 60 percent of conflicts were objected to by adverse submitters. Remaining conflicts were appealed by developers in response to a refusal of their development application.

Spatial analyse of appellants shows that adverse submitters are scattered through the middle of the city and to the north, while developers were everywhere. There were more tensions between developers and adverse submitters in the CBD and inner city suburbs in relation to multi-unit residential developments. *Figure 4-15* shows the distribution of appellants across the study area.

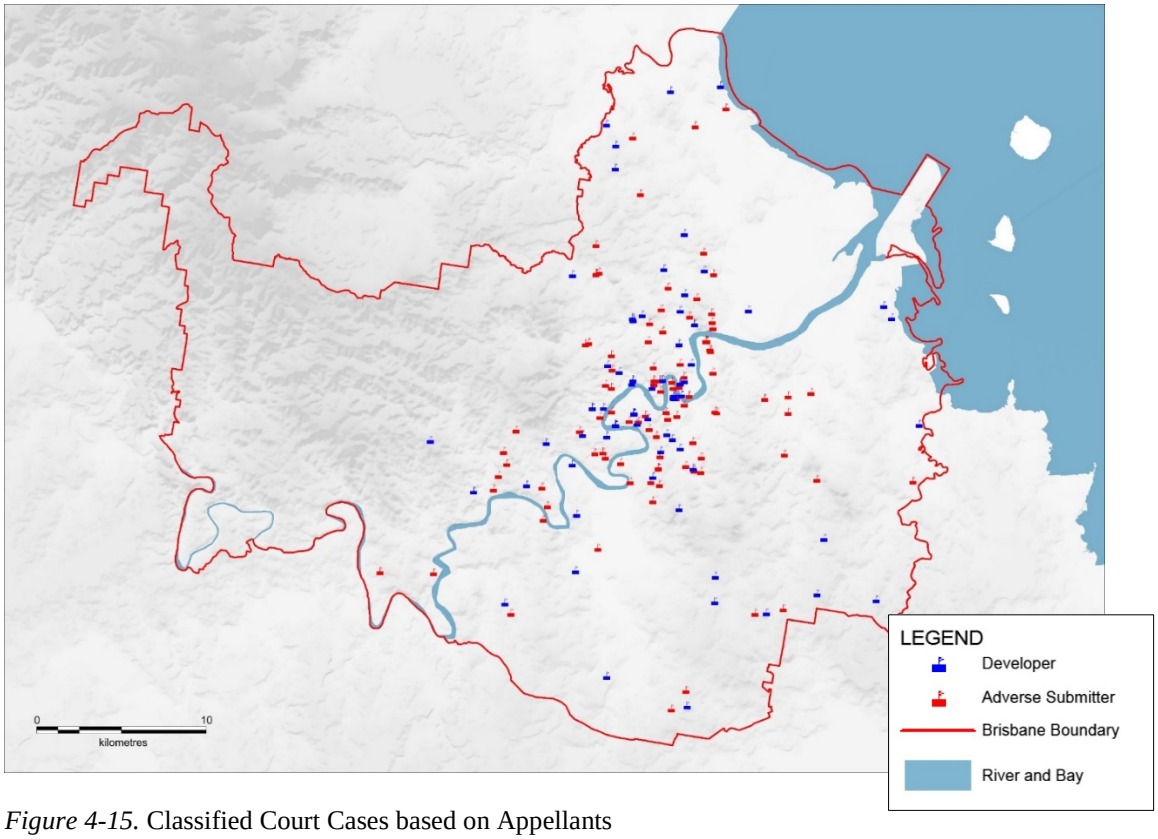


Figure 4-15. Classified Court Cases based on Appellants

Understanding the relationship between appellants and development types became possible by developing a new variable as the appellant success rate for each development type. This could provide more underlying pattern and prediction of case occurrence in the database. Appellant success rate refers the whether an appeal was won either by a developer or an adverse submitter (third party). This was calculated for each type of development defined in the database. *Figure 4-16* displays the estimated appellant success rate, which is visually described in *Figure 4-15*.

According to this statistic, developers had a higher success rate compared to adverse submitters in *Infrastructure*, *Residential 1 and 3*, *Commercial* and *Industry* categories. The third party had more

success in *Residential 2 and Community Facility* categories. In Residential 2 (*Demolition and Extension*) category, developers had a considerably higher winning rate compared to adverse submitters (*Figure 4-16*). Appellant success rate interpreted the underlying pattern of court orders in the database. However, this calculation is based on a limited number of court cases in this study.

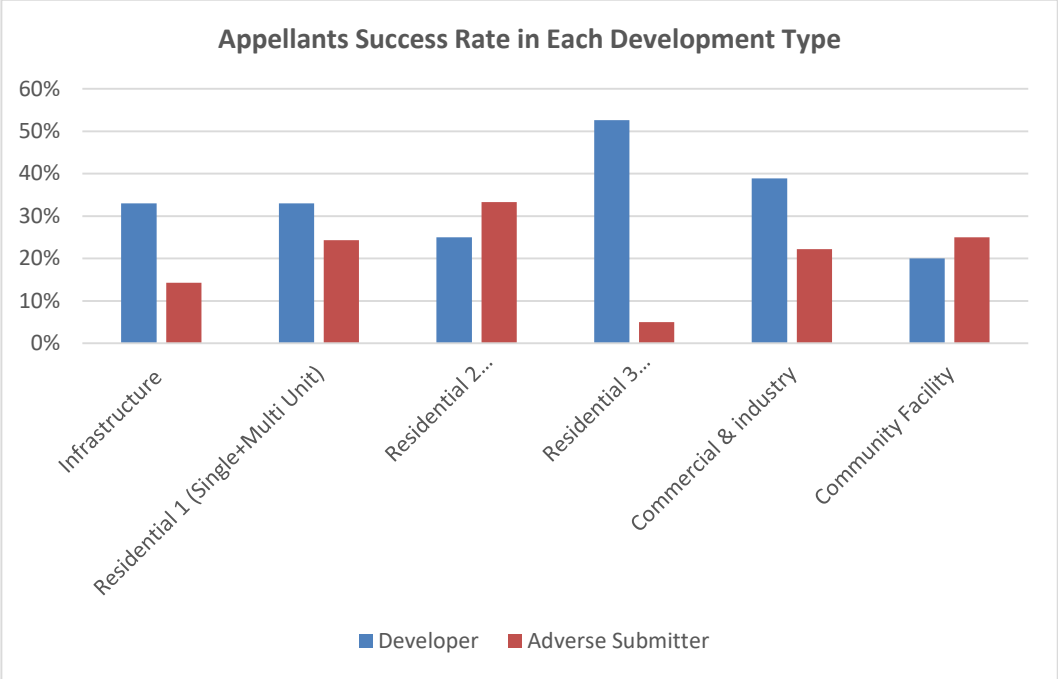


Figure 4-16. Appellant success rate comparison

4.3.6 Final Orders and Conflict Success Rates

The final court decisions, or final orders, were also classified in the database and were described as *Dismissed* and *Allowed* subclasses. Overall, 72 percent of reviewed court cases were dismissed. The remaining court cases were allowed, with some conditions applying for their approval. Based on the spatial pattern of these conflicts shown in *Figure 4-17*, *Allowed* appeals were more scattered in the middle and south of the city. The court dismissed most of the conflicts in the CBD and inner city suburbs.

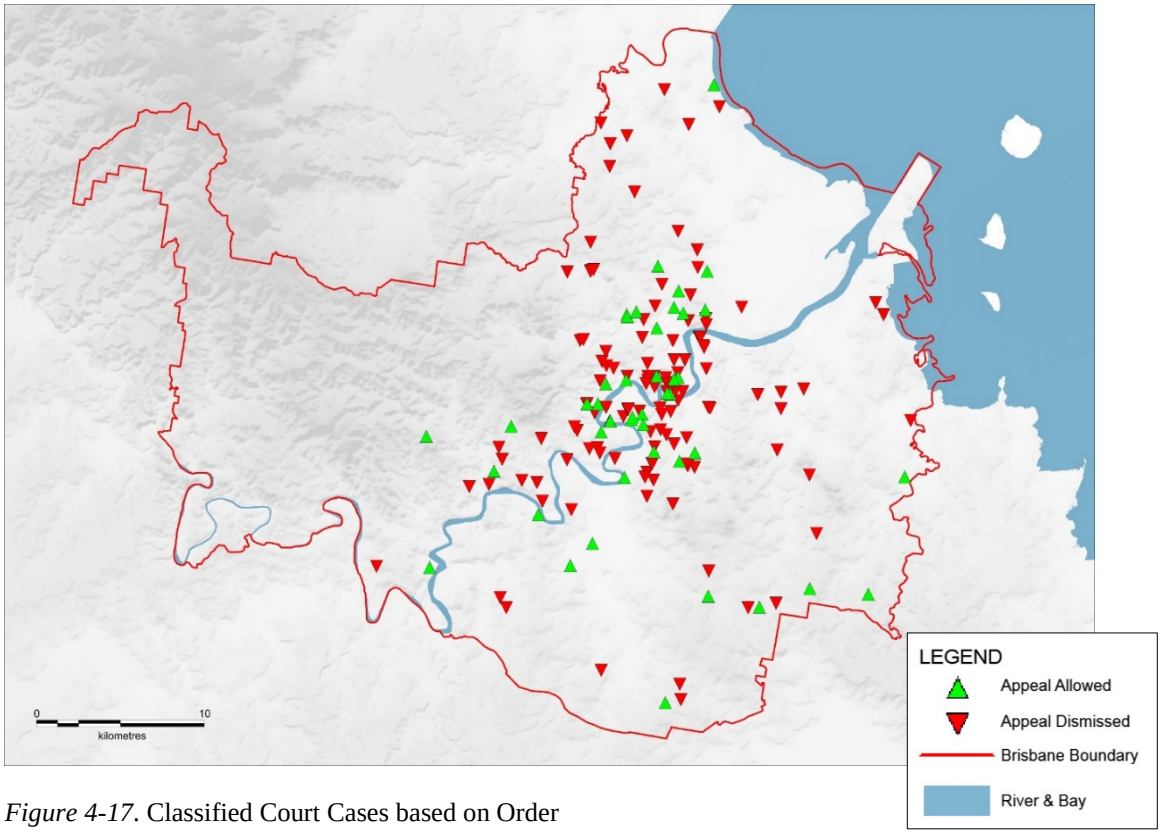


Figure 4-17. Classified Court Cases based on Order

Further to the spatial distribution of court cases in terms of judgment order, an appeal success rate was calculated for different development types in Brisbane. This calculation is based on a total number of court decisions in the database (Table 4-7). Infrastructure and community facility developments had the lowest success rate (20%) compared to *Residential 2* and *Commercial* and *Industry* developments (30% and 31%). However, the appeal success rate calculation is limited to reviewed court judgments in the developed database.

Table 4-7 Appeal Success Rate Based on Development Type

Development Type	Appeal Success Rate
Infrastructure	20%
Residential 1 (Single, Multi-Unit)	27%
Residential 2 (Subdivision)	30%
Residential 3 (Demolition, Extension)	28%
Commercial & industry	31%
Community Facility	20%

The spatial analysis of court cases provided a broad overview of all court cases in Brisbane. Visual amenity conflicts were identified as a critical and common type of conflicts associated with high-rise residential buildings and demolition court cases in DCP areas. Considering the research aim and the importance of visual amenity disputes, this study is focused on these court cases for more investigation and analysis. More in-depth analysis of these conflicts provided a basis for identifying gaps in the court's judgment and expert witness evidence in the assessment of these types of conflict.

4.4 VISUAL AMENITY AS CRITICAL TYPE OF CONFLICT

After review and classification of all kinds of conflicts in Brisbane and understanding a broad range of conflict issues in different development types, visual amenity conflicts were reviewed and classified in more detail. Visual amenity conflicts were considered as one of the most contentious issues in Planning and Environment conflicts, specifically related to multi-unit and demolition developments. Visual amenity and character issues can be summarised in the following categories:

- fragmentation in urban form and skyline;
- inappropriate scale, bulk and size of development;
- a significant degree of visual modification and impacts/inconsistent visual appearance (due to inappropriate height, colour, materials, etc.);
- demolition of pre-1946 houses in Demolition Control Precinct (DCP) areas;
- adverse impact on character and sense of place;
- adverse impact on the amenity of adjacent dwellings, and
- interrupting current views and vistas.

In the review of visual amenity conflicts, it was considered that some of these aspects were more tangible, while some other aspects were more qualitative and intangible. Issues such as adverse impacts on character and sense of place, the amenity of an adjacent dwelling or visual appearance are more qualitative. Other visual amenity issues, including fragmentation of urban form and skyline or inappropriate scale and bulk and size of the development, are attributes related to physical built-form of the urban environment and could be measured.

With further detailed analysis of visual amenity court cases, major classes of visual amenity conflicts were identified where expert judgments lacked enough certainty and reliability for the court. This classification helped to understand major types of visual amenity issues and identified areas where this study could contribute to the next stage by developing more measurable and reliable methods to determine them with more certainty and objectivity. These broad visual amenity conflicts, and the gaps therein are briefly discussed below, as notions of similar issues in other court cases as each of these trials are lengthy and complex to explain in full and individually. A summary of court cases in Appendix B provides links to the relevant court cases with similar issues to further review through the Supreme Court Library's online database.

4.4.1 Inappropriate Bulk, Height and Dominance

The major identified class of visual amenity conflicts was the height and bulk of the proposed developments in the existing setting. Almost 58 percent of multi-unit developments and high-rise developments had this issue. The height or bulk of the proposal, or blocking sightlines have been objected to by the Council or third parties, which resulted in more assessments by experts to identify the visual impact of a proposed development in the existing context. Even though experts use similar

methods to be objective in their assessment of height and bulk (i.e. accurate photomontages), their judgment lacked the required objectivity and differed between experts.

In one of the reviewed court cases[8], a mixed-use multi-storey development in Woolloongabba was objected to by a third party due to several issues, including excessive height, bulk, and scale. Visual amenity experts engaged by both sides provided different assessments and evidence to the court. The appellant's expert witness believed that the maximum possible height was 6-8 storeys, while the proposed development had 12-15 storeys. Several photomontages were prepared to show the proposed development from various viewpoints. While photomontages were a useful tool for visualising the future development within the proposed site, experts provided conflicting evidence in relation to the appropriate height of development.

> *Mr Elliott's photo montages do not suggest that the buildings will be of a bulk and scale that will lead to conflict, particularly in light of the conclusions earlier about the relevance of the PDA. I accept Mr. … evidence that the proposed development will have —little additional impact on people in Woolloongabba —where it is accepted that even in the Precinct (on the interpretation I have favoured), buildings of up to 15 storeys may be developed. This is more obvious when one takes into account 20 storeys on much smaller sites in the Core, and up to 30 storeys in the adjacent PDA. Mr …, the visual amenity expert for the appellant, was at a disadvantage (some may say it was an advantage), as he was giving evidence by telephone from an exotic overseas location, and he had not assessed impacts appropriately in light of Mr. … photo montages. Nothing in his evidence causes me to doubt Mr … conclusions which are borne out by my interpretation of the relevant provisions of the Neighbourhood Plan (QPEC 13-77, page 15).*

Photomontages are a requisite tool for showing how a development looks in its context. A valid and reliable 2D representation of visual characteristics of the proposed development is highly useful in the decision-making process in the P&E Court. However, due to the limitation of this method, as discussed in Chapter Two (limitation of FoV compared to the human eye, 2D representation, lack of quantification), the assessment of building height and bulk differs between experts. The judge's statement above confirms the limitations of photomontages as a tool for a proper and comprehensive assessment of bulk and height issues. This court case is chosen as one of case studies in this research and is further discussed in Chapter 6.

Another reviewed court case[9] is an appeal against the Council's approval for a residential development in New Farm. Two adverse submitters objected to the development due to excessive height (10 storeys) that resulted in obstruction of their view to the Brisbane River. While there are other high rise buildings around the subject development, the height limit is up to 5 storeys in this area. These

[8] Court case number: QPEC13-077
[9] Court case number: QPEC08-045

developments were identified and listed. However, there was an argument between appellants and respondents regarding counting the development storeys and height of development:

> *There may be room for argument whether storeys have been counted correctly for the listed projects. In some instances, Mr … count and Mr … count may be different; it can depend on which elevation one looks at. There is no component of Ciel which is 8 storeys – there may be none exceeding 5: the appearance of 8 is given when viewing the whole development from the River (QPEC08-045, p 15).*

Counting of storeys and their visible heights were considered as a different issue in P&E Court cases. A building might look shorter from one direction while from another location it might appear bulkier and higher in its locality. Using conventional methods (counting of storeys, using elevations and sections) are inefficient in the assessment of building heights in the local area, which has resulted in repetitive arguments in similar court cases (see court case numbers: QPEC00-094, QPEC01-006, QPEC01-009, QPEC01-45, QPEC01-58).

Another related issue to bulk and height of developments was when experts assess the visual dominance of a proposed development, or elements visible in the view. Due to the lack of any measurement of the visual dominance in planning policies to regulate this aspect of developments, experts and appellants have different opinions and interpretations regarding this factor. This issue is evident in court cases associated with a loss of view to a landmark or a feature element, whether it is dominant in the view or not (river).

In the same court case discussed above, the appellants were concerned about the loss of their view to the Story Bridge and Brisbane River and the visual relationship with other building in the vicinity. Relocation of proposed built form was a suggestion, to reduce visual dominance:

> *…The suggestion to relocate further back from the River emerged very late, too late for montages to be prepared like that as in exhibit 5B illustrating the effect on views from Bellerive, which would obviously suffer more from relocation, as a tower 6 m closer would appear more dominating, and obscure a greater portion of the views available (including views of sky) (QPEC08-45, p 30).*

The distance from the proposed tower to the receptor and the height and bulk of the proposed tower were considered as critical parameters in considering the visual dominance and the impacts on view obstruction from nearby buildings. However, all arguments on these matters stayed at this level, without any quantification and measurements to support the judgments. A similar discussion on the proportion of a view without any quantification can be seen in this court case. While the current definitions of what constitutes a "view" and a "sightline" confirms a distinction based on their

proportion of field of view and view angle, there is no indication of view angle or proportion of view occupied by a certain element.

> *In common parlance, a "view" need not be expansive - a sliver is enough to support assertions that a property has a view of ocean, harbour, lake or river – literally there is a view "to" the river, however narrow it be, provided a sight line to the water is available (QPEC08-45, p30).*

A similar discussion on the visual dominance of the CBD skyline and Story Bridge as visible landmarks in the local areas can be seen in a court case in Kangaroo Point (QPEC14-64). According to the local plan requirements, views to these landmarks are protected in the locality. Moreover, any development in this area is to have a sensitive scale and height to maintain the visual dominance of the city centre skyline and the Storey Bridge superstructure. However, they lack a measurable and accurate method to determine the visual dominance and significance of CBD buildings, and the confusion of experts regarding this matter and its interpretation in planning policies resulted in excessive arguments in this case. This court case is selected as a case study for further assessment and is discussed in more detail in Chapter 6.

> *The use of "dominance" concerning the city centre skyline and the use of "significance" (referable only to the Story Bridge) concerning the inner-city skyline appear to show that different considerations (but concerning the same skyline) are undertaken. The dominance referred to is that of the skyline of the buildings in the city centre (at times, designated as the CBD) as compared with buildings in the "locality" (constrained by scale and height in that usage). On the other hand, the significance, in terms of the scale and height of buildings in the locality, is of the Story Bridge in its visual association with the inner-city skyline. The use in Performance Criteria P2 and P3 of the slightly different term, the "city skyline", appears to be nothing other than a reference to the skyline of the same "city centre" buildings. The reasons for this are not only the reference in Development Principle 2.4 to the dominance of the "city centre" buildings – reflecting the "purpose" of the KPLPC to ensure that development is "consistent with" such development principles – but also that the reference to "city skyline" buildings in both Performance Criteria P2 and P3 are preceded by almost identical wording, suggesting that at least between P2 and P3 there is a necessity for consistency. And that consistency extends to being consistent with Development Principle 2.4 because the relationship, which can only be visual, must be one of domination by the city centre buildings (QPEC14-64, p20).*

Another related issue to height is the visual relationship of the proposed development in relation to nearby existing buildings. It is encouraged by planning codes that the proposed development maintains a visual relationship with other buildings in the vicinity. The visual relationship includes any

visual characteristics, including height, setback, visual appearance, etc. However, height is usually the most important consideration in the assessment of visual relationships. It is also discussed in this case:

> *A new building will necessarily destroy the pre-existing visual relationship and replace it with a new one. If buildings can be looked at together, they necessarily have a visual relationship. P1 must be intended to require more than the creation of some visual relationship. The focus, for the moment, is on height. I take what is required to be maintained is a visual relationship that is pleasing, sympathetic, supportive, harmonious or complementary. There must be room for notions of reasonableness which, among other things, would indicate to my mind that a range of outcomes is usually likely to be acceptable, because reasonable minds may differ; however, a bare rule of reasonableness not qualified any further is not likely to be helpful (QPEC08-45, p33).*
>
> ….
>
> *the proposed 10-storey tower would fit neatly in a straight line from the high point of Peregrine House to that of "Cosmopolitan", a new 6-storey building downstream of Aville Court. Aville Court at its present height would be dominated by Cosmopolitan and (even) a 5 storey building upstream. While respectful of Mr … opinion, I am persuaded by the evidence of his counterparts that the proposal, in its height, will result in a visual relationship with its upstream and downstream neighbours being achieved which can be adjudged pleasing and complementary, etc. (QPEC08-45, p34).*

While this statement precisely describes the visual relationship of the proposed development to nearby buildings, it is more a qualitative assessment. This highlights quantifiable opportunities associated with high-rise developments. These shortcomings are considered as potential areas for this study to develop and investigate. More quantitative measurement of building height, bulk and scale and dominance of building can assist expert witnesses and the courts to argue facts rather that personal interpretations. Another dominant type of visual amenity conflict is the demolition of pre-1946 houses in DCP areas, which is explained below.

4.4.2 Visual Appearance of Demolition of Pre-1946 Houses

Another identified major group of visual amenity conflicts was the demolition of protected houses in DCP areas (10% of conflicts). Any changes to these houses, including demolition, extension or modification, is an impact-assessable application under the city planning scheme due to high sensitivity in Brisbane. 72 percent of these demolition cases were associated with visual amenity issues. *Figure 4-18* shows the distribution DCP areas within the study area, showing that they are scattered around the CBD area in a 7km radius. It also shows the court cases in relation to the DCP area footprint.

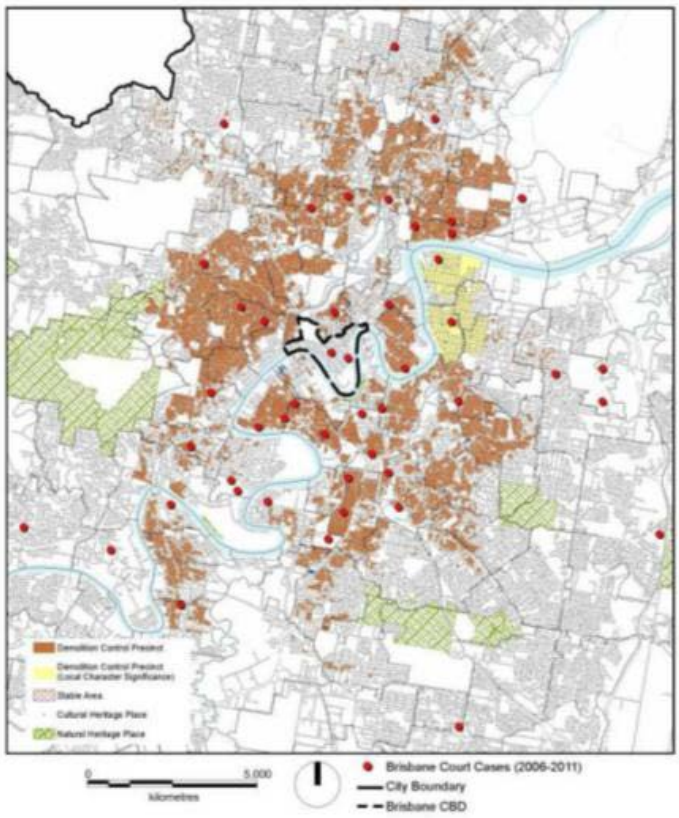


Figure 4-18. Visual amenity conflicts within DCP areas in Brisbane

To assess this type of development application, a Demolition Code has been developed by Brisbane City Council (2007). This code provides purpose, performance criteria and acceptable solutions for assessing works dealing with demolition, partial demolition, removal or repositioning of a building located in DCP and any pre-1946 built houses. This Code is also applicable to development conflicts related to these types of development applications. Its purpose is to:

- *protect the residential buildings that give the Residential Areas in the Demolition Control Precinct their traditional character and amenity;*
- *protect the non–residential character buildings in the Demolition Control Precinct that contribute to the general character of the locality and provide or have provided a variety of services to the community;*

- *ensure the preservation of buildings where they form an important part of a streetscape where the buildings and streetscape were constructed and/or established in or prior to the end of 1946;*

- *ensure the contribution of houses constructed prior to the end of 1946 that reflect design styles and materials other than 'timber and tin' architecture is recognised and retained in the Low-Density Residential Area and Character Residential Area (BCC, 2007, 69).*

As part of Demolition Code, an assessment guidance and explanation of traditional building character is provided. It explains the street patterns and context, building form and scale, material and details, setting and landscape. These descriptions provide a basis for assessing an area for its traditional character.

Regarding street pattern, DCPs are the first established subdivision patterns in Brisbane, with 16, 24 or 32 lots with 10m, 15m or 20m frontages. They are also mainly single storey houses with uniform scales and spacing between them. Traditional houses have a solid core with attached or integrated verandas that creates a lightweight appearance. They also include other architectural styles, including Art Deco, Spanish Mission, Californian Bungalow and Georgian. They are characterised by lattice screens and batten panels with a unifying theme of painted timber walls and corrugated steel roofing to create the 'timber and tin' character (BCC, 2007, 70). Streetscapes are shaped by similar building lines with separate front gardens connected by a pedestrian path and single driveway.

Assessment of visual character and amenity of the streetscape, or a component of the streetscape, is a key step in the evaluation of this kind of visual amenity conflict. A definition of the streetscape is provided in City Plan 2000, which is considered in the evaluation of these conflicts. Accordingly, the streetscape comprises all of the visible components within a street:

- topography, landforms and vegetation;
- street arrangements and patterns;
- widths (including arrangements of carriageways, paths, verges, etc.);
- property shapes and sizes;
- street trees and planting;
- various other items in the street (stoplights and street furniture);
- housing types and size.

While planning policies provide a clear criteria and description for assessment of streetscape character, assessment of existing and future streetscape characters is a conflicting issue (Refer Appendix A court case numbers: QPEC00-48, QPEC00-049, QPEC01-008, QPEC01-024, QPEC01-051, QPEC02-072, QPEC02-073, QPEC03-067, QPEC04-059, QPEC04-063, QPEC06-044, QPEC06-124 QPEC07-009 QPEC07-093, QPEC08-033, QPEC08-049, QPEC08-049, QPEC09-135, QPEC10-047, QPEC10-0130, QPEC10-0137, QPEC11-055, QPEC12-047 and QPEC 12-080). In almost all of these conflicts, opposite parties and expert witnesses assessed the streetscape character differently, which makes the situation more complicated for the court to determine the case.

Usually in these cases, developers, as appellants, claimed that the demolition work would not result in the loss of traditional building character or that the area has no traditional building character or the subject house did not contribute to the traditional character. In opposition, respondents believed that the subject house represented traditional building character and demolition would result in the loss of that character. While in some of other cases, the appellant proved that the house did not contribute positively to the traditional character of the streetscape.

In the detailed review of these cases, it is understood that at some stage, experts came up with a different and subjective description for streetscape character. As these demolition cases were accompanied by the introduction of another new development in that context, assessment of future environment with consideration of a new building is also a conflict. The streetscape character and analysis of the visual appearance of the existing house is the central concern in these arguments.

A demolition case in Greenslopes (QPEC 04-059) for a pre-1946 house is an example of this type of conflict and argument. The developer's (appellant) expert witness and the Council's expert witness (respondent) presented opposite opinions regarding the visual appearance of the subject house in the streetscape and its contribution to the streetscape character. These judgments were based on observations and assessments of the modifications to the original house and current materials and finishes:

> *Mr …, who was involved in the formulation of the Council's character preservation controls, was of the opinion that the house possesses a range of features (including its timber construction; medium pitch, hipped roof sheeted with corrugated iron, single level, elevated above the ground, timber weatherboard and evident front veranda with its decorative features attached to the solid core of the dwelling) which give it the appearance of being constructed prior to 1946, and consequently has a traditional building character. Rather than detracting from its pre-1946 appearance, Mr … considered that the less common features of the house represent innovative detailing and that although such features are found on both pre-war and post-war houses, they do not deprive the house of a pre-1946 appearance (QPEC04-059, 8).*

However, the opposite appellant expert witness conceded that the house lacks a pre-1946 appearance:

> *I obtained a great deal of assistance from the evidence of both architects. They gave their opinions lucidly and fairly, making appropriate concessions to meritorious opposing suggestions. Their differing opinions on the character of the house reflected shades of emphasis rather than diametrically conflicting beliefs (QPEC04-059, 9).*

Conflicting evidence by different expert witnesses highlights the complexities of visual appearance analysis of streetscape and existing houses. Also, similar arguments of the visual appearance of proposed buildings are found where experts assess the level of detail, elements, articulations in building facades and their contribution to the streetscape character. These assessments differed completely between various experts, which again highlights a gap in more consistent and measurable approaches to assessing visual character. Further explanation of these concepts and views are discussed in following chapters, where each conflict is explained in more detail.

4.4.3 Quantification of Visual Amenity Concepts

The identified concepts (bulk & height, dominance and appearance) and technical gaps in expert testimonies were considered as the new direction for this study. This has been in accordance with abductive research strategy to formulate concepts of a particular aspect of the phenomenon (visual amenity) to guide research to the next stage.

As per the reviewed visual amenity conflict, each conflict has very specific issues that require specific methods and argument to be taken by an expert witness to address these concerns specifically. Therefore, to select case studies in the next stage of research, it is necessary to define a set of criteria to identify these cases. Each case is suitable for investigation of a specific type of issues. The case study selection criteria and selected case studies for each concept are explained in Chapters 5 and 6 respectively.

Bulk and height and visual dominance were identified as issues highly associated with high-rise developments. These concepts were considered as more interrelated concepts. Another visual amenity concept was visual appearance, which was more related to demolition cases in DCP areas. Visual appearance concept is further discussed in relation to the visual representation of urban environments.

To quantify these concepts, the next chapter, Chapter 5, is dedicated to visual appearance, and Chapter 6 is focused on bulk and height and visual dominance, as they are related concepts. *Figure 4-19* shows the following chapter structure. Several court cases are selected as case studies to investigate these concepts. Selected court cases based on the defined criteria are explained further in each chapter

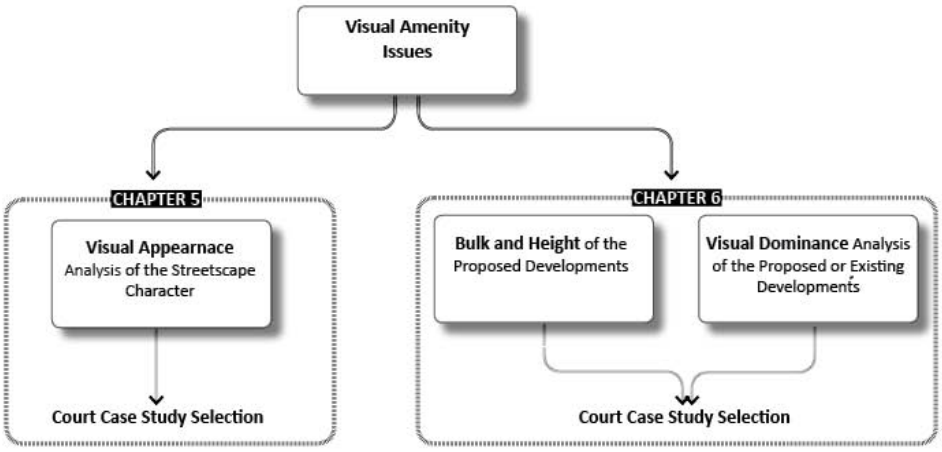


Figure 4-19. Major Visual Amenity Issues for Quantification

4.5 DISCUSSION

This section provides an overall assessment of the findings of this chapter. Firstly, the concept of visual conflict, which is developed in this study, is discussed in relation to previous studies. Analysis of conflict typologies, another result of this study, is compared with previous researchers. Identification of distribution patterns of conflicts as a new method to analyse development conflicts is explained. Calculation of conflict and appellant success rates are reviewed. Finally, validity, reliability and significance of findings are discussed.

4.5.1 Visual conflict as a concept

Visual representation of our urban environments is the most changeable and unpredictable aspect of our cities, due to changes emerged by proposed developments. Population growth and development pressures have brought challenges to sustainable development of city environments. These challenges and conflicts are an integral part of a comprehensive development approach that needs be resolved in the planning system. Resolving development conflicts brings more sustainable and suitable outcomes for the community and for future generations.

The review of Planning and Environment Court Cases in Queensland show that there is a growing number of court cases each year in Queensland. Court cases in Queensland differ from one region to another, depending on of the population and their need for housing, infrastructure, community facilities and businesses. It has been found that Brisbane, as the largest city in the state, had the highest number of development conflicts than other major regions in Queensland, such as Gold Coast, Maroochy, Redland, Cairns and Logan, and has been chosen as the study area for further investigation.

Review of Planning and Environment Court cases in Queensland is a new investigation; other researchers in Australia have not investigated this. Willey (2005) provided a broad assessment of the court systems in Australia, in different states, in comparison with other countries. However, he did not

review previous records of court cases in each state. More analysis of planning appeals has been done in the UK by MacNamara et al. (1986), Rydin et al. (1990), Brotherton (1993) and Punter and Bell (2000) to review of planning appeals.

In Brotherton's (1993) review of planning appeals in the UK, he found that the number of planning appeals varied between types of development, regions and over time. He found the reasons behind these appeal rates were appeal cost, support of planning inspectors given to local planning authorities (LAP) and appellants' and respondents' willingness to negotiate. He found an increase in appeal rates in the UK since 1974. MacNamara et al. (1986) analysed success rates of appellants and their perception of the planning appeal system in the UK. They reviewed planning appeals to identify appeal success rates. Rydin et al. (1990) identified broad trends over ten years (1979 to 1989) and identified key issues which were relevant to the design of developments. They referred to the conflict as 'design appeals'. Punter and Bell (2000) provided a more detailed analysis of appeals during 15 years in the English planning system. They examined the appeal success rate and dismissal rate during this period. Similar to Rydin et al. (1990), Punter and Bell (2000) considered design issues to be the dominant concern at appeal.

While these studies present different findings and results, they are all focused on the previous record of planning appeals. This research has a similar nature as these studies conducted in the UK, but as a new study in Australia, it was focused on Planning and Environment court cases in Queensland. While this research has some similarities to previous studies in the UK, it follows a different approach and is more focused on identifying development conflict typologies. Rather than being more focused on the reasons behind court cases and appeal and refusal rates, this research has been dedicated to identifying different types of conflict issues, development types, appellants and final orders. It also analyses various relationships between these four categories. Therefore, it presents a new and different kind of analysis of development conflicts.

This research also identifies visual amenity conflicts as one of the most problematic issues occurring in Brisbane city courts. Therefore, visual amenity cases are given more focus for analysis in its more technical aspects. As the primary aim of the study is to assist courts by increasing the certainty of court judgements in assessing development applications and their impacts, several gaps have been identified in a detailed review of these conflicts. These arguments highlight several measurable concepts and variables that could reduce disagreement among experts by developing more objective and reliable methods to assess the existing visual character and impacts of the proposed change.

In studies conducted by MacNamara et al. (1986) and Rydin et al. (1990), visual amenity issues are referred to as "design" issues. They identified the key design issues in appeals and conducted a survey of Chief Planning Offices to determine their concerns in relation to identifying design issues. The current research is specifically focused on past available records of Planning and Environment Court cases. The main difference in this study compared to other studies is that the review of court cases was used to identify gaps in the assessment of visual amenity and to improve the certainty of the

decision-making process by providing quantitative methods. Thus, it was necessary to determine the conflict typologies and understand the major problems and types of developments that frequently occur. This is a new approach compared to previous studies by Brotherton (1993) and Punter and Bell (2000) conducted in the UK, and it provides a new opportunity to look at development conflicts to find new directions to improve decision making.

4.5.2 Typologies of Development Conflicts

A matrix of conflicts was developed which showed the number of conflicts based on development types and conflict issues. The highest number of visual amenity conflicts in multi-unit developments and demolition cases signalled the importance of these two categories for further detailed analysis and investigation. These cases were reviewed in more detail to identify potential areas to improve expert assessments to resolve the conflicts with more objectivity and reliability. Through a detailed examination of these cases, three concepts were defined and selected for further development and investigation.

Punter and Bell (2000) also considered conflict issues and development types as important categories to disaggregate the planning appeals in the UK. However, they identified minor dwellings, householder development and material change of use as the major group of developments. Also, they found that householders were more reluctant to appeal compared to developers.

Review of Planning and Environment Court cases in Brisbane followed a similar approach compared to previous studies by Punter and Bell (2000) and Brothernton (1993). They reviewed appeals in England to identify trends and different important factors in appeal rate, and relationships between appeal success and refusal rates. The present research considered court judgements to determine major types of conflict and development types in Brisbane. In comparison, the database for this investigation was more limited compared to previous studies in this field, as it was only focused on court judgments rather than all appeals submitted to the court.

Although, the generalities concluded in this research cannot describe a definite trend in planning appeals, it confirmed the major design issues identified by Punter and Bell (2000). Bulk and height issues, density, massing, layout, sunlight/overshadowing, overlooking/privacy and access were also identified as main conflict issues in the review of cases in Brisbane. Visual amenity issues similar to design issues were identified as important issues in conflicts. Also, multi-unit developments in high-density areas confirmed the findings of Buys and Miller (2012) that Australian residents were highly concerned about high-rise developments and that there was a negative view of the impacts of this type of development.

Punter and Bell (2000) used different terminology and classifications compared to the present research. They referred to visual amenity issues as visual aesthetic matters that included development effects on the streetscape or townscape, neighbours/surrounding and overdevelopment. Overdevelopment was considered as bulk, height, density, massing, landscape layout and access and other aesthetic issues. In this review of court cases, these items were all classified under visual amenity.

Punter and Bell (2000) also studied the relationship between a number of appeals with determined appeals, allowed and withdrawn appeals and decided development applications. This is another potential area for further work, as the details about appeals were not available for this study; the available data through the Supreme Court Library was only court judgements.

Through a detailed review of visual amenity conflicts, three concepts were found that lacked objectivity and reliability in expert assessments. Visual appearance, bulk and height and visual dominance were found to be three significant visual amenity issues. Such important issues as the lack of objectivity and measurable methods resulted in contradictory expert evidence and excessive argument between the judge and different expert witnesses. These conflicts were chosen in relation to the spatial pattern of conflicts as case studies.

4.5.3 Spatial Patterns of Conflicts

The review of planning court cases was further investigated spatially to determine the hot spots for where conflicts occur in the city, and the review of cases was further expanded into GIS and spatial analysis. After registration of all cases in their spatial locations, a spatial database was developed to identify significant patterns and development conflicts to find hot spots. This research contributed more to this field through a spatial assessment of court cases in GIS than those studies conducted by Punter and Bell (2000) and Brothernton (1993). The GIS database developed in this research made it possible to map the distribution of conflicts in the city and to analyse conflict patterns spatially.

Several thematic maps were produced to show the distribution of court cases based on development types, conflict issues, appellant and orders. These maps presented each category separately, which was useful to understand development patterns within the study area. Understanding of development patterns was valuable information for case study selection as well. According to this, the Brisbane CBD and inner city suburbs were identified as conflict hot spots.

According to spatial analysis results, Brisbane CBD and inner city suburbs in higher density areas were the most controversial areas compared to other parts of the city. Visual amenity issues, as the second most common type of conflict, had more concentration around the CBD and inner city suburbs. These cases are mostly multi-unit developments in high-density areas, which are allowed around CBD and inner city suburbs. Therefore, multi-unit court cases in these areas were selected for further investigation of bulk and height and visual dominance issues.

Another map was produced to see the relationship of visual amenity conflicts with Demolition Control Precincts (DCP). Most demolition or extension cases with visual appearance issues were located in DCP areas. This guided the research in case study selection.

Therefore, spatial analysis of court cases resulted in a selection of four case studies for the next stage of research. This analysis provided a spatial link between all complexities of court cases to understand where they occur. This knowledge is valuable to identify areas where similar court cases can happen with the same issues and concerns. Therefore, any contribution to a more objective assessment of these court cases can guide any future development in the vicinity.

Based on findings presented in this chapter, three concepts were identified in visual amenity court cases that lacked an adequate level of objectivity in expert judgements. This resulted in unjustified arguments in these court cases. These areas were considered as potential areas for this study to contribute further. These concepts are related to visual appearance, bulk and height of developments and visual dominance analysis. In addition, four court cases where selected in specific locations for further study in this research. The following three chapters are focused on each identified concept to develop measurable methods for analysing each concept with more objectivity.

4.5.4 Conflict parties and success rates

Another valuable piece of information is knowing the winning rate and refusal rates of conflict cases, similar to previous studies in the UK. Two variables – appellant success rate and appeal success rate – were calculated based on the database and describes the percentage of appellants and appeal types in winning court cases.

According to the findings in this section, calculated appeal success rate for different development types ranged from 20% to 31%. Infrastructure appeals had the lowest rate while commercial and industry appeal had the highest rate. Multi-unit residential appeals had 27% percent success rate, and demolition cases had 28%. These statistics show that the nearly two-thirds of court cases in all types of development were refused in the court.

Based on another variable calculated from the database, appellants, whether they were a developer or adverse submitter (local community), had different winning rates in the Planning and Environment court. In most appeals based on development types, developers had a higher winning rate compared to adverse submitters. In demolition cases, developers had a 53% winning rate compared to a 5% winning rate of adverse submitters. In multi-unit developments, developers and adverse submitters had closer winning rates of 33% to 24% respectively.

Appellant and appeal success show the overall trends of court orders. However, this statistic is based on a limited number of court cases in the database and does not include all submitted appeals in the city. Also, these findings show that adverse submitters had fewer grounds and a winning rate averaging 20% compared to professional developers' average of 33%. This could be due to several

reasons, including lower awareness about planning policies for challenging local Council decisions and developers.

While success rates provide an overall view of success, it does not indicate a success rate for future appeals. Each appeal in Planning and Environment Court will be heard based on its merits and in detail by expert witnesses, which is a very unpredictable process. However, considering common law as a basis of these judgements, these trends and statistics can be informed with some levels of probability.

Other research by Brotherton (1993) and MacNamara et al. (1986) identified relationships between appeal rates and refusal rates to propose a theory to explain a relationship between them. However, their findings were more focused on understanding the relationships between local planning authorities (LAP), appeal costs and appellants' and respondents' willingness to negotiate than in understanding the primary roots of these conflicts. MacNamara et al. (1986) also analysed successful appellants' perception of the planning appeal system in the UK. In contrast, the current study did not identify relationships between calculated success rates and relevant local planning policies and planning schemes during history as this was considered beyond the research aim and focus. However, there is an opportunity to investigate these relationships in future studies.

Understanding the relationships between development types and conflict issues were the main finding of this study. Visual amenity issues associated with high-rise residential developments and demolition of pre-1946 houses were identified as major types of the reviewed court cases. These findings directed the research for further investigation of visual amenity conflict focused on these two types of development.

The following chapters are dedicated to the development of quantitative methods for objective assessment of Planning and Environment court cases. These methods are developed based on identified gaps in the current expert evaluation of these conflicts. Visual appearance, dominance and bulk and height of developments were concepts which were identified in the review of court cases in Brisbane. Visual appearance issues are investigated in Chapter 5, and visual dominance, bulk and height issues are discussed in Chapter 6.

4.5.5 Validity, Reliability and Significance of Findings

Review of problems, issues and challenges in development conflicts in Brisbane results in a time-consuming and costly process. While this process is an essential part of the current sustainable planning system, many of these issues and conflicts can be avoided or facilitated by improving the assessment methods in earlier stages. Therefore, in order to identify the gaps in expert assessments, it was necessary to review these conflicts. This is considered to be a significant contribution to knowledge as it extends beyond amenity conflicts to encompass such other disciplines as planning, engineering and environment studies.

This chapter has presented findings of a review of Planning and Environment court cases in Brisbane over 13 years (2000-2012). A method was presented to review court cases using content analysis and spatial analysis. Based on descriptive and case study methodologies, an abductive research strategy was adopted to review these cases. However, due to traditional concerns related to case study methodology, including a lack of trust and reliability of rigorous and reliable enquiries (Yin, 2011), this process was carefully designed to be a valid and transparent approach to overcome these concerns.

Content analysis of judgment report was applied in a multi-step process to categorise the data and to identify major parameters and classes of data. Once these were tested for several court cases, it was used as a structure to summarise all court cases occurred in the study area. This structure, based on four classes of conflict characteristic (conflict issue, development type, conflict parties and final order), is a clear and general structure that can be used as a template to summarise court cases in development conflict around the world. The database records are easily accessible and can be reviewed. This provides a valid and reliable database to analyse court cases. All derived statistics, including a number of cases in each category conflict and appellant success rate, are descriptors of the provided database and shows the back record of conflict within the reviewed timeframe. These statistics are subject to change by increasing the number of court cases, but the proposed structure is general and adaptive to expansion.

Identifying the most common type of developments leading to conflicts in the courtroom opens up key opportunities for developing and improving measurable and quantifiable modellings to reduce controversy and time in resolving conflicts. Quantifiable and measurable methods were considered as significant ways to increase the certainty of expert judgements and to facilitate the decision-making process. The knowledge of complexities of development conflicts also provides insight into development pressures and threats and helps to identify new ways of avoiding or reducing development conflict.

Chapter 5: Conflict in Streetscapes

This chapter and the next chapter cover the development of three technical methods to analyse and quantify visual environments with more objectivity. Development of measurable methods in response to the second research question "*How can visual properties be quantified using computational methods?*" In response to this question, visual appearance analysis is applied to the conflicts. The visual appearance of built forms and streetscapes was identified as one of the most common types of conflict in the review of planning and environment court cases.

The visual appearance of buildings is considered to be a complicated aspect of visual attributes of urban environments. This concept includes a broad range of issues, which were identified in the literature review of urban design qualities, such as diversity, complexity, human scale, etc. Visual appearance is a broader classification that covers those conditions in relation to visual representation within urban environments. The term 'presence' implies a combination of built and natural landscapes mixed in an urban setting.

Lozano (1974) considered the assessment of visual appearance as one of the weaknesses of the planning process. Visual appearance was also considered as an aspect of urban environment linked strongly to subjective human perception rather than as a quality that can be assessed objectively. Due to connections with aesthetics, visual appearance is judged mainly on the observer's perceptual, cognitive and emotional processes. Different perceptions of the visual environment are the primary reason for conflicts.

Perception of visual environments in court cases is usually contested through two major approaches: expert approach and public perceptual approach. The court system mainly relies on expert interpretations of policies and assessments of expert witnesses. In this process, visual amenity experts endeavour to justify their assessment of visual appearance in more systematic and procedural ways based on evidence to assist planning court in determining conflicts. However, with the movement towards more sustainable development, public perceptions and preferences are being considered in new planning policies in the assessment of development applications. While these planning policies and codes are the basis of development applications in Planning and Environment courts, expert assessments provide more input into the determination of visual amenity conflicts.

Based on the identified visual amenity issues in expert witness assessments, this chapter provides a new method for assessing and quantifying visual appearance as one of the major identified visual amenity issues(*Figure 5-1*). One of the aims of this research is to develop a tool for expert witnesses to determine visual properties, visual complexity and level of detail and

articulation of built forms in a more measurable approach than common subjective expert assessment. This chapter includes following sections:

- Case study selection;
- Conflicts associated with visual appearance issues;
- Image processing techniques in assessment of visual appearance;
- Pilot study of application of image processing technologies;
- Pre-1946 house in Nundah-case study one;
- McDonald's Restaurant-case study two;
- Discussion.

Image processing was considered as a high potential tool to assess the visual appearance of urban streetscapes. Several image processing techniques have been applied to urban streetscapes to analyse visual urban landscapes in a mathematical and quantitative approach. These methods were firstly tested in a pilot study to understand and interpret the image processing numerical outputs by applying these techniques to different types of landscapes and scenes. After understanding the relationship between calculated values and landscapes, these methods were applied to two selected court cases to analyse visual appearance issues and concerns associated with each case. These cases were selected based on a number of defined criteria.

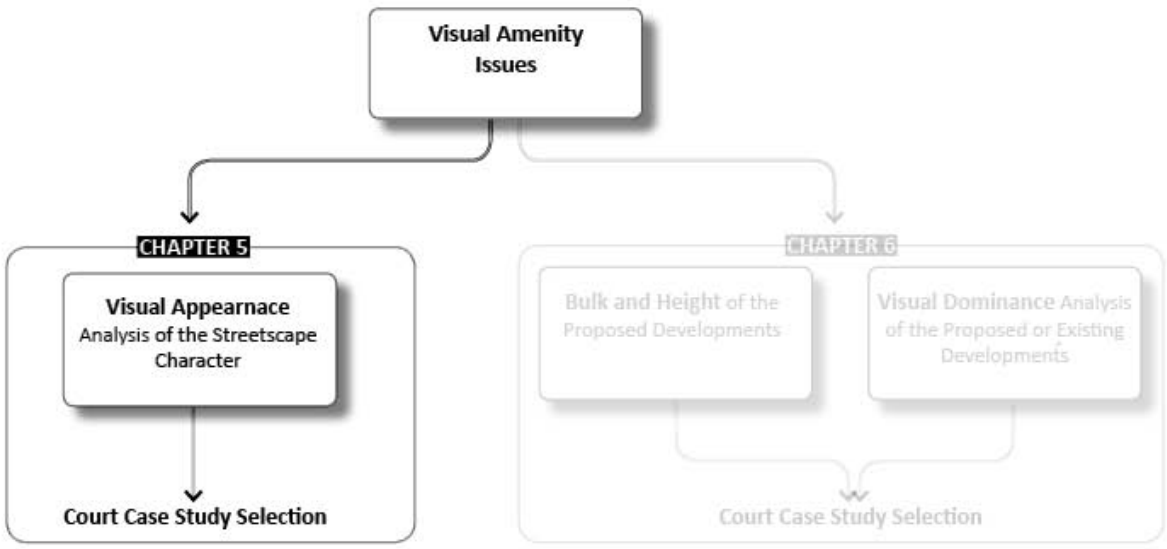


Figure 5-1. Visual Appearance Analysis and Selected Case Studies

5.1 VISUAL APPEARANCE IN VISUAL AMENITY CONFLICTS

Streetscape character is considered a complex combination of natural and built elements. Expert-based approaches in visual amenity assessments are focused on the understanding of physical attributes and tangible aspects of urban landscapes. The expert methods have a high degree of agreement in terms of identification of structural elements and fundamental visual qualities of urban streetscapes.

There are near 51 perceptual visual attributes of urban streetscape identified in the literature review (Chapter 2). Attributes such as ambiguity, unity, complexity, continuity, diversity, variety, order, contrast, depth, rhythm and interest are some of the visual attributes relevant to the visual appearance of urban streetscapes. Due to the complexity of these attributes and multiple aspects of urban streetscapes, judgment of streetscape character based on an expert witness is contradictory from one expert to another, especially in court case decisions where they are from opposing parties.

In the review of Planning and Environment Court cases in Brisbane presented in the previous chapter, visual appearance was found to be one type of visual amenity conflict. Further to the review of visual amenity conflicts, it was found that visual appearance analysis is highly associated with certain types of development types. Discussion on the visual appearance of the existing streetscape or a proposed development occurs in nearly 50% of visual amenity conflicts, which shows the importance of this issue.

One of the frequent development types with appearance issues was the demolition court cases classified under Residential 3. In this type of conflict, assessment of streetscape character was very contentious between experts and court case parties, mixed with subjective judgments. These conflicts usually occur where developers propose a change to a protected pre-1946 house in a DCP area, including demolition, extension or other modifications that result in a change of streetscape character.

Appearance is defined as an impression of something and as a process of coming into existence of use (Stevenson, 2010). Thus, visual appearance issues also related to new proposed developments that are inconsistent with the designated land use. Usually, in these types of court cases, visual amenity conflicts compare the visual appearance of subject development with the existing context, in a subjective approach. The expert evidence mixed with subjective judgments result in unjustified arguments which highlight the lack of quantitative approaches.

Experts gave evidence in these conflicts that questioned whether the subject house contributed positively to the streetscape character, which was mostly personal and differed from one expert to another. There is also a lack of objective methods in the assessment of visual appearance of urban streetscapes. Therefore it was considered that a quantitative method to assess

visual properties of streetscape characters could contribute to the assessment of these types of conflict to increase the reliability of judgments.

According to the literature review in Chapter 2, different aspects of visual appearance have been analysed by several other researchers using various methods (Bovill, 1996, Stamps, 2003, Cooper, 2008). Image processing was considered as a new tool by these researchers to analyse visual qualities of urban streetscapes. Several mathematical methods, including fractal dimension and entropy, were developed to examine different aspects of the visual appearance of urban streetscapes, such as visual complexity. Findings of these researchers showed the high potential of image processing techniques to be applied in streetscapes character assessment and court case resolutions. Selection of specific case studies was necessary to develop and investigate the application of image processing techniques.

5.2 CASE STUDY SELECTION

In order to identify suitable case studies for visual appearance analysis in this chapter, major visual amenity issues, including bulk and height and visual appearance, were mapped within the study area (*Figure 5-2*). Visual appearance issues were considered as conflict issues more relevant to the demolition of a per-1946 house in CDP areas. In these cases, the existing appearance of a subject house in its setting is the main concern of visual amenity experts. The demolition court cases shown on *Figure 4-18* in relation to the DCP overlay in the Brisbane's City Plan are scattered over a 7km radius from the CBD, within inner-city suburbs such as Nundah, West End, East Brisbane, Brisbane City and Hamilton.

Furthermore, visual appearance is also relevant to any visual impact assessment where a new development is planned to be added to a setting. It becomes more critical when the proposed development has a conflict with the intended development as envisaged by the planning scheme. Therefore, the future look and appearance of the proposed development are major concerns in these cases.

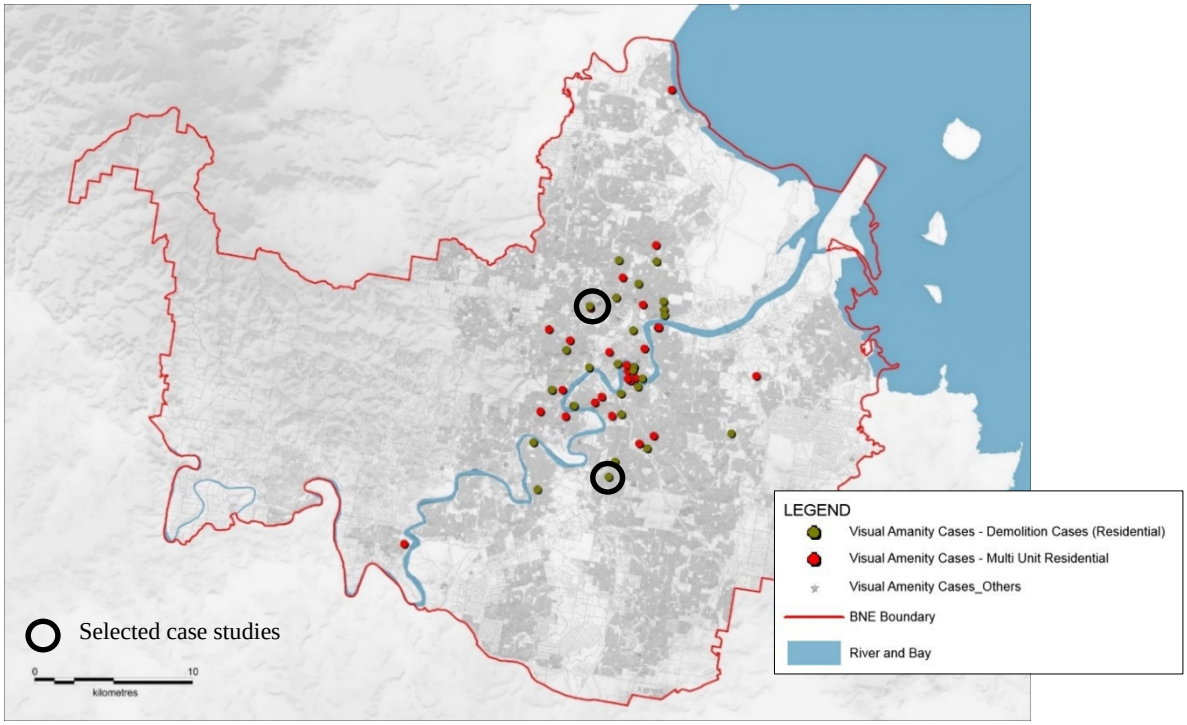


Figure 5-2. Major Visual Amenity Conflicts

Two court cases were selected as case studies for visual appearance analysis, according to the following criteria:

- One case had to be a demolition of an existing house in DCP area, and another case had to be a new future development in an existing setting;
- The demolition case had to be in an established street with similarly protected houses and more contemporary houses with different type of built forms;
- The new development case study had to have conflict with intended development for the site with visual appearance issues;
- The cases had to have adequate background information including photomontages to be investigated further;

In response to the above criteria, the first selected court cases are in relation to the demolition of a pre-1946 house within the DCP, classified as *Residential 3* in Chapter 4. The second is a Material Change of Use conflict, a development application for a McDonald's restaurant in a residential zone. Visual appearance analysis is firstly applied to the demolition case and then implemented in the second case, which is a proposal considered inconsistent with the designated land use by the planning scheme.

The first case occurred in the DCP area at 50-52 Collins Street. It was an appeal against Council's refusal of a development application to demolish a pre-1946 house in the DCP due to incompliance with the DCP code. The Court judgment concluded that the subject house was an important part of the streetscape character and demolition would result in the loss of the traditional character of the streetscape (P&E Court, 2010). As a result, the appeal was dismissed.

The second case is related to a refusal by Council of an application for a McDonald's food outlet and advertising devices in the suburb of Underwood, south of Brisbane. Council decision notice included issues of character and visual amenity in relation to the visual appearance of the proposed development in the existing setting. This type of development was classified under *Commercial and Industry* category. This category is highly associated with planning and visual amenity issues (75% and 33% respectively). This court cases case was also dismissed after the hearing.

These court cases were considered suitable for investigating the effectiveness of image processing techniques to analyse visual properties and to reassess visual conflicts through a mathematical and measurable method. Image processing techniques were applied to these cases to analyse and compare the visual appearance of subject developments with surrounding settings. These applications and results are explained separately.

Two different approaches were used to analyse visual properties. In the demolition case, a series of photos were taken from the streetscape in order to investigate visual properties that describe the streetscape's character. In the second case, existing photos and photomontages from two viewing locations were used to analyse and measure the visual impact of the proposed restaurant on the existing visual setting.

5.3 METHODS: IMAGE PROCESSING TECHNIQUES IN VISUAL ASSESSMENT

The application of image processing tools, using algorithms developed for refining computer visualisation, is one possible way of describing the visual attributes and elements of urban landscapes. The intention of implementing such assessments is to provide a visual measure to compare various urban conditions and their visual attributes. These calculations provide a measure of form, complexity and other attributes of urban streetscapes and architectural forms that represent different aspects of the overall visual appearance.

A number of image processing techniques were considered:

- quadtree decomposition;
- fractal dimension;
- entropy.

These techniques were implemented to analyse the visual appearance of urban streetscapes. They were developed and implemented in MATLAB software. Fractal dimension, as one the properties of visual environments, is explained in detail in the literature review (Chapter 2) and is not repeated here. Some of the concepts used in this evaluation are introduced below.

5.3.1 Homogeneity: Quadtree Decomposition of Images

Image segmentation is the process of dividing the image into multiple sets of pixels to simplify and convert the image to gain more meaningful results. There are several segmentation methods, which can be divided into the two broad categories: region-base and edge detection techniques. It is considered here that region based methods are more accurate than edge detection methods as they include more image detail (Russ, 2002). In this study, the region-based method known as quadtree decomposition was applied to analyse digital images of the urban streetscape.

Homogeneity, as a measure of uniformity in a system, can be applied to digital photos in image processing. This concept can analyse the materials or surface structures based on a region segmentation process. Quadtree decomposition is a technique in image processing that transforms digital images into quadrants, or regions, based on their pixel values and criterion of homogeneity (Chinga, 2006).

In MATLAB, the quadtree function can be applied only to an intensity image (8-bit photo, 256 grey levels) and squared size image 2n x 2n (power of 2). This process starts by dividing a square image into four equal square blocks and checks each block to confirm if it meets the homogeneity criterion. If a block meets the criterion, it will not be subdivided further. If a block does not meet the criterion, it will be subdivided into four blocks, and the test criterion will be

applied to the new blocks. This process continues until all pixels in a block meet the homogeneity criterion (Mathworks, 2016).

The criterion can be defined as a threshold between maximum and minimum of grayscale values (8-bit photo, 256 grey levels) in each block, divided by 255, which will be a value between 0 and 1. When the threshold is closer to 1, there is a wider range of values located in each block. When the threshold is closer to 0, the image will be divided into finer block sizes. This threshold is generic and is applied to all blocks in the image. Function syntax in MATLAB is defined as:

```
S = qtdecomp (I, threshold)
I= intensity image; threshold = a value between 0 and 1
```

This function was applied to a series of urban photos presented in a pilot study. In order to view the block representation of quadtree decomposition, the following algorithm was applied to a sample 8-bit photo to produce final quadtree decomposed photo.

```
I = imread('sample photo.jpg');            (loading sample image)
S = qtdecomp (I,0.3);
blocks = repmat(uint8(0), size(S));
for dim = [512 256 128 64 32 16 8 4 2 1];      (block sizes)
numblocks = length(find(S==dim) ;(Counting block numbers in different sizes)
if (numblocks > 0)
values = repmat(uint8(1), [dim dim numblocks]);
values (2: dim,2: dim, :) = 0;
blocks = qtsetblk(blocks,S,dim,values);
end
blocks (end,1: end) = 1;
blocks (1: end, end) = 1;
e=blocks*255;
imwrite(e, 'sample quadtree sample.jpg');
```

Block sizes defined in this code have different dimensions (512x512, 256x256, 128x128, 64x64, 32x32, 16x16, 8x8, 4x4, 2x2, 1x1). The output of this process is a 2-bit photo showing the transformed image. This image shows how the original photo is decomposed into homogeneous blocks. The number of blocks in each different size can describe the overall level of detail in an image. Figure 5.3 shows a sample photo segmented using this method.

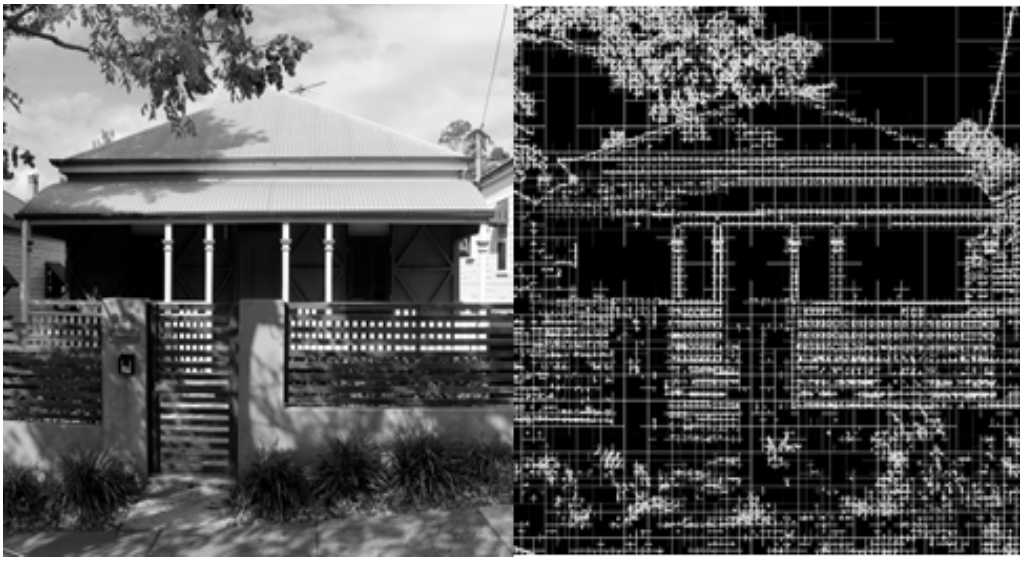


Figure 5-3. Sample segmented photo using quadtree decomposition

5.3.2 Disorder and Diversity: Entropy of Images

The concept of entropy has attracted the attention of many in various fields (Stamps, 2002). Entropy is a quantitative measure of the degree of disorder and diversity in a system (Bostanci et al., 2011). The concept of entropy was proposed by Rudolf Clausius (1822–1888) in thermodynamic within the field of physics (Bostanci et al., 2011). Entropy is a probabilistic measure related to the distribution of events in an uncertain condition (Bostanci et al., 2011). Entropy is zero if everything is similar and entropy is maximised if everything is different (Stamps, 2002). According to Stamps (2002), entropy is a strong variable as a physical measure of diversity.

Entropy is considered as a relevant variable in environmental aesthetics to measure visual diversity. Many researchers have investigated the relationships of rated preference, interest, pleasure, uncertainty, colour and complexity with entropy. Some have a high linear fit, while others show an inverted U function (Stamps, 2002). However, there are contradictory findings regarding possible relationships between pleasure and entropy (Stamps, 2002). Typical principles in urban design – promoting visual diversity, avoiding monotony, avoiding chaos – can be measured by entropy (Stamps, 2002).

A collection of components that are all the same have no diversity, thus in a state of total homogeneity (Stamps, 2003, 450). Diversity is maximised if all the components are different. Entropy can describe this mathematically as a measure of physical disorder. Entropy is zero if everything looks similar, which is the maximum uniformity, and increase as the things become different. Therefore, entropy can be a measure of subjective impression of diversity (Stamps, 2003). The basic equation of entropy is:

$$H_{\text{factor}} = -\sum_{i=1}^{n} p_i \log_2 p_i$$

The basic mathematical structure for calculating entropy is simply a list of m items (the factors), each of which can be one of n types (the levels within each factor). For convenience, I will use letters for the types. A basic structure for m = 10 units, each of which could have n = 4 types, can be generated with 10 random numbers from 1 to 4. Suppose the output were ABBCCCDDDD. Then there would be 1A, 2Bs, 3Cs, and 4Ds; the frequencies would be 1/10, 2/10, 3/10, and 4/10, and application of equation (1) would generate a value of entropy H= 1.84 bits (Stamps III, 2003, 451).

Calculation of entropy for 2D images is based on segmentation of a picture into limited occurrences, grids or a list of materials. Krampen (1979) used a grid method to calculate entropies for facades of buildings. An alternative parsing method was developed by Stamps (2003) to create visual images with known components (windows, doors), count the frequencies of each component and calculate the entropy. A similar equation is applied in Matlab to calculate entropy for a grayscale image by calculating the histogram counts of an image. Entropy can be calculated in Matlab using the Entropy syntax below:

```
E = entropy(I)
I= image; E= Entropy of I = -sum (p.*log2(p))
```

E is a value representing the entropy of grayscale image I, which is a statistical measure of randomness that can be considered as a characteristic of the texture of the input image. P contains the histogram count of the image. For instance, calculated entropy for *Figure 5.3* equals 0.746. This variable described the overall randomness of an image texture and was incorporated in this analysis.

This calculation is applied in this study to calculate the overall entropy in this study. Based on Quadtree decomposition results, the number of blocks in each is calculated for each block size (10 different sizes). Therefore, the probability of each block size is calculated and the overall entropy for an image is measured for grayscale images.

5.3.3 Complexity: Fractal Dimension of Images

Fractal dimension describes the complexity of natural systems and is used by researchers to analyse visual properties of natural and built environments (Batty and Longley, 1994, Tucker, 2004, Ostwald, 2008, Cooper and Oskorochi, 2008, Perry, 2012). Fractal geometry is a geometry created by natural forms, and Fractal Dimension is a measure of the degree of self-similarity in an

object or pattern and can be calculated as a number. Complexity, which is the state of being complicated, can be described by Fractal Dimension as a visual property of urban scenes.

Depending on dimensional properties of an object, fractal dimension varies from 1 to 4, depending on the dimensions of that object. For a one-dimensional (1D) line, fractal dimension could be a value between 1 to 2; for a two-dimensional (2D) image or shape, fractal dimension could be between 2 to 3. Similarly, for a three-dimensional volume, the fractal dimension can be 3 to 4.

Fractal dimension can be calculated by different methods in urban environments. Bovill (1996) used the box-counting method to determine the approximate fractal dimension of buildings. Box-counting is a method to analyse complex patterns by breaking them into smaller box shape pieces. It is similar to zooming in and out of an object to analyse how the details change. However, it is more than a zoom in and out process; box sizes change to calculate some boxes that cover the whole shape. Therefore, fractal dimension (FD) is based on some boxes (N) and size of boxes(R) to cover a fractal set which follows a power law.

$$N = A * R^{(-FD)}$$

N= Number of Boxes; R= (size of box = X^2; X=side length of box); A= multiplier; FD=Fractal Dimension

Box counting algorithms are developed in image processing to calculate the fractal dimension of 1, 2 and 3-dimensional patterns. An algorithm developed by Moisy (2009) in MATLAB was used in this study to calculate the fractal dimension of digital photos of urban streetscapes. This algorithm is described as:

```
[N,R] = box count(e,'slope');
df = -diff(log(n))./diff(log(r));
disp(['Fractal dimension, Df = ' num2str(mean(df(4:8))) ' +/-
' num2str(std(df(4:8)))]);
```

In this study, the box count method was applied to segment by quadtree decomposition. Quadtree Transform converts a 2D image into a 1D segmented image. The fractal dimension of a converted image by Quadtree transform will be between 1 to 2. To apply and test the above-mentioned techniques and variables in image processing, and to understand the potential of the methods to be implemented in the evaluation of urban streetscapes, a pilot study was conducted to test the feasibility of the algorithms and to calculate these variables (number of blocks, fractal dimension and entropy).

5.3.4 Feasibility of Three Image Processing Techniques

Urban environment visual perception is complicated and depends on many parameters of physical space. Edges and faces, colours and materials, distance and perspectives all are important in the perception of the physical environment. Quadtree transformation provided a new approach to segmenting digital photos of urban environments into homogenous blocks to quantify the level of detail. According to preliminary tests in this study, this transformation is highly sensitive to any changes and variations in colour, materials and edges, and describes all of these parameters with different sizes of blocks and numbers.

The quadtree transformation is limited to squared grayscale images (8-bit). The conversion of a coloured image to a grayscale image significantly reduces the level of detail in a coloured image as a representation of the real world. By converting an RGB image to grayscale, the final grey scale pixel value is based on a combination of many factors, such as materials, light and shade, colour, image resolution, distance, as well as the transformation algorithm (Photoshop). Therefore, the homogeneity value is an overall level that includes all these factors.

In preliminary tests utilising quadtree decomposition, it is noted that this function provided the opportunity to analyse the visual surface of the urban environment and to measure the amount of detail in urban visual settings. Multiple descriptors, including the number of blocks (nQT), mean block size (mQT), the standard deviation of the block sizes (sQT), fractal dimension(FD) and entropy (E), seemed to be suitable surface descriptors to quantify structural changes in urban environments. Graphical illustration of the quadtree decomposition was also considered explanatory and interpretive and provides exceptional opportunity to observe and track variations in visual properties (Chinga, 2006).

For application of the function of quadtree decomposition on different urban landscape settings, four 8-bit (256 grey levels) photos were selected for transformation. These photos were considerably different in terms of visual context, elements, details and distance range of visual objects. But all photos had the same size and original image resolution, 2048 by 2048 pixels.

Based on some preliminary tests, quadtree decomposition threshold was set to 0.27, a dividing criterion that is a default setting in MATLAB. This threshold presented the best transformation results in preliminary tests. This threshold is the difference between the maximum to minimum grayscale values (0 to 256) in a block. If the difference is more than 68 points, the area will be divided into four regions. Once the criterion is met, the function stops splitting the areas into smaller blocks. This process continues until the value is less than 68 point. Ten different block sizes between 512 x 512pixels to 1x1 pixel were defined to divide each photo. These photos and quadtree decomposition results are shown in *Figure **5-4*** to *Figure **5-7*** which includes original and transformed results as implemented in the MATLAB.

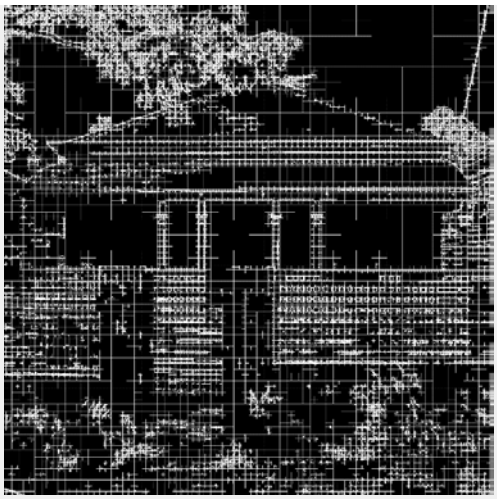


Figure 5-4 Queenslander–tin & timber structure

Quadtree Decomposition result

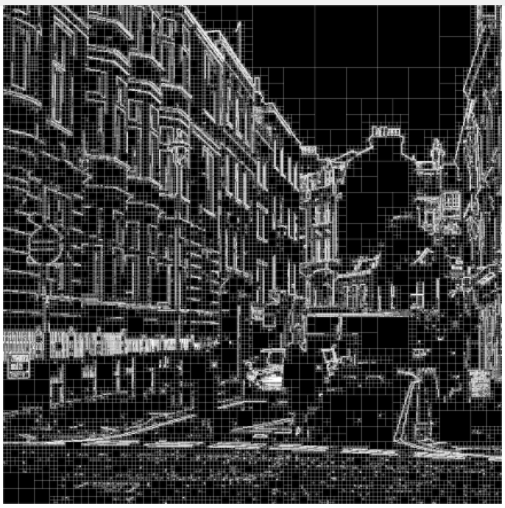
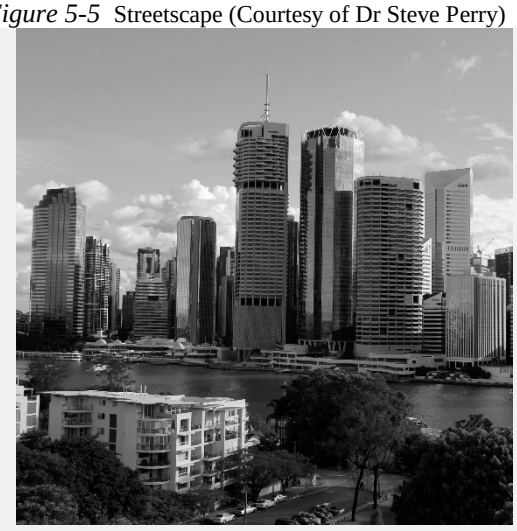


Figure 5-5 Streetscape (Courtesy of Dr Steve Perry)

Quadtree Decomposition result



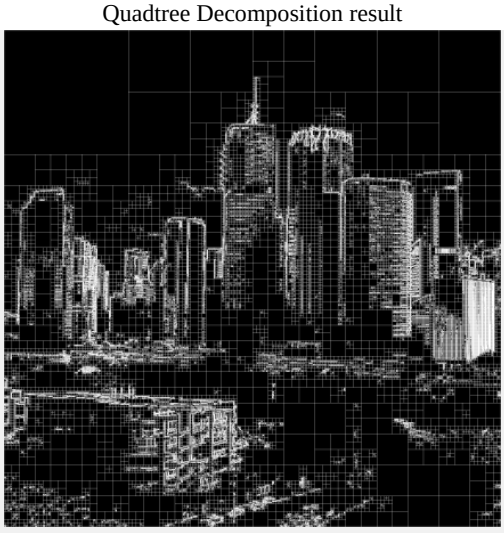


Figure 5-6 Brisbane CBD

Quadtree Decomposition result

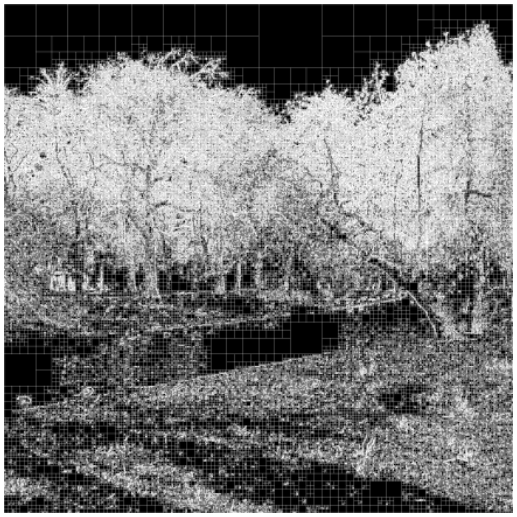


Figure 5-7 Urban Park (Courtesy of Dr Steve Perry)

Quadtree Decomposition result

Transformation results were used to count the number of blocks in different sizes and the overall number of blocks (nQT). Numbers of blocks in all photos are compared in Table 5-1. Generally, the number of blocks increases exponentially as the block size reduces, as described in Figure 5-8.

Table 5-1. Number of blocks in different sizes

Figure No.	Context	512*512	256*256	128*128	64*64	32*32	16*16	8*8	4*4	2*2	1*1	nQT	Entropy	FD
1	Queenslander House	0	1	20	112	726	3,722	12,235	29,682	73,111	95,684	215,293	0.746	1.8883
2	Streetscape	0	3	13	68	673	4,340	13,010	32,276	73,770	61,848	186,001	0.7493	1.899
3	Brisbane CBD	1	7	22	159	738	2,360	8,169	20,806	47,163	57,460	136,885	0.6049	1.8099
4	Urban Park	0	1	16	41	202	1,432	10,502	59,615	268,302	426,072	766,183	0.992	1.9538

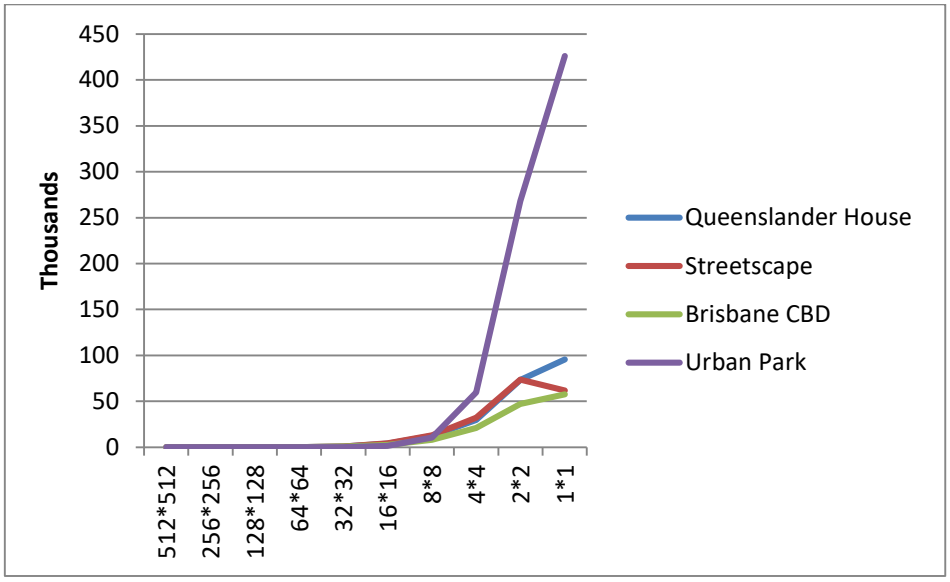


Figure 5-8. Quadtree decomposition –Number of Blocks

Quadtree decomposition showed that different environments and visual settings comprise a different level of detail, which results in various block sizes, fractal dimension and entropy values. Natural environments have a higher value of fractal and randomness compared with urban scenes. In general, in all photo edges resulted in a high degree of detail that reduced the block size to 1x1. However, the level of edge detection and block breakdown is highly dependent on distance to objects, which confirms the fact that the level of detail increases in lower distance ranges. A higher number of blocks for *Figure **5-7*** compared to other photos supported this claim. In addition, the number of blocks depends on materials, light conditions (i.e. the level of shadow), the angle of the photo and distance to the subject.

The low number of blocks in an image indicates that the image is more homogenous. *Figure **5-6***, which has the lowest number of blocks, is the most homogenous photo due to a higher distance range between viewer and object, and other factors such as colour, materials and elements. *Figure **5-7*** has the highest block numbers, fractal dimension and entropy value, which confirms that natural environments show greater complexity and randomness at closer ranges. However, it should be considered that converting an RGB image to Grayscale, significantly reduces the level of detail in a view and combines multiple factors – colours, materials, shadow and highlights – into a single grayscale value.

Camera model, settings and quality of digital photos are highly important factors in image processing, which affects the quadtree decomposition results, entropy and fractal dimension. Therefore, it was found that a particular criterion is required to capture similar digital photos. In addition, in order to use quadtree decomposition in analysing Court cases and comparing visual properties of different photos, photos should be taken at the same distance range and with the same resolution quality.

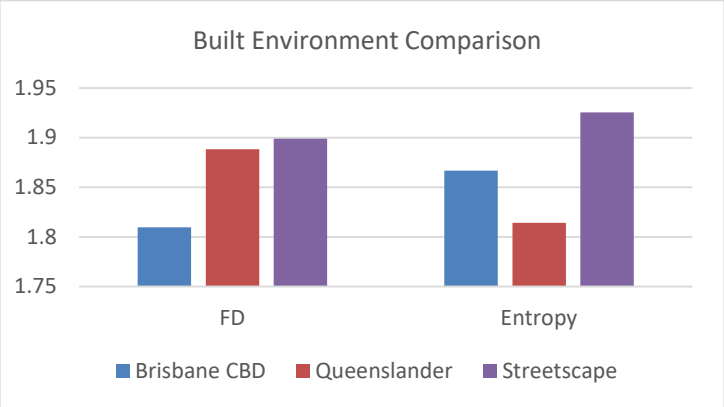


Figure 5-9. FD and E values for photos with built forms

For further assessment of these measurements and their performance on photos with built forms (excluding the urban park photo), the entropy and fractal dimension photos were compared for all three photos (See *Figure 5-9*). This chart shows that the streetscape photo (*Figure **5-5***) has the highest FD and E values compared to the other scenes. Brisbane CBD and London's photos have greater visual diversity (entropy) compared to the house photo. The house photo also has higher FD compared to the Brisbane CBD photo, which confirms that closer view distance results in a higher fractal dimension. The distance was considered again as a major factor to compare image processing results.

Preliminary image processing results to calculate quadtree decomposition as a measure of visual detail, entropy as a measure of diversity and fractal dimension as a measure of complexity, presented the potential for these techniques to analyse digital photos. However, in order to achieve meaningful results, setting a defined criterion to take similar photos is highly important. These quantitative techniques were considered capable of quantifying visual properties of digital photos with similar settings (camera, distance and lighting). Therefore, they can be used as comparative descriptors of digital photos to analyse visual properties more quantitatively. This is further applied to the investigated selected cases studies.

5.3.5 Expert Witness Evaluations of Techniques

In order to understand the potential of the developed method and its findings to be used in actual visual amenity conflicts, a consultation with visual amenity expert witnesses was considered as part of this research. This consultation was included to investigate the third research question: *"How can computational methods be used to resolve development conflicts?"*. A series of interviews were conducted with practitioners in the field of landscape and visual amenity assessments to receive their feedback on the research findings. This assisted the researcher to understand the weaknesses and potential of the research findings to be used in court case assessments to resolve conflicts. An ethics application was submitted and approved by QUT Human Research Ethics Committee (Approval number 1500000947) to conduct these interviews.

Three experienced expert witnesses in Queensland were selected for an interview. The interviewees were selected based on their experience as court expert witnesses and their familiarity with technical methods. The selected three experts have different levels of experience – 25, 15 and 10 years. According to the ethics approval, participant's identities are not disclosed, and they are only referred to by number. The interview records and identification details are saved in the author's research records to access in future if required.

The first participant was a landscape architect and visual amenity expert with 15 years' experience in this field. She has extensive experience in assessing visual amenity conflicts and court cases. She also has a particular interest in new techniques in visual impact assessments. The second participant was another visual amenity expert with less industry experience (10 years). She is also highly skilled in new methods and techniques in the field of visual assessment. She also had experience in Australia and overseas as a visual amenity expert witness. The third interviewee was a renowned expert witness in the field of visual amenity assessment with more than 25 years of experience in this area. He has been engaged in more than 100 court cases in Queensland. He is also highly experienced in developing and using new methods in this field.

All selected visual amenity experts are mainly professional landscape planners and urban designers who give technical evidence in Planning and Environment Court in support of, or against, a development application with visual amenity issues. These experts were introduced to the methods developed in this research and were asked for their evaluation of usability and reliability in expert assessments. They were also requested to evaluate the potential of these methods and if they are 'code-ready' methods for urban planning policy making and urban visual assessments.

The participants were informed of the aims and benefits of the study, their rights as participants and their permissions were requested for the use of opinions in regards to the developed methods. In order to receive expert feedback, a questionnaire was designed to collect quantitative and qualitative data types. Firstly, they were asked to answer the following three questions by rating on a scale 1 to 5. Score 1 was the lowest, and 5 is the highest rating for each question. The questions are shown in *Figure 5-10*. They were also asked to provide their comments and feedback on visual appearance analysis methods, namely, the calculation of quadtree decomposition, fractal dimension and entropy.

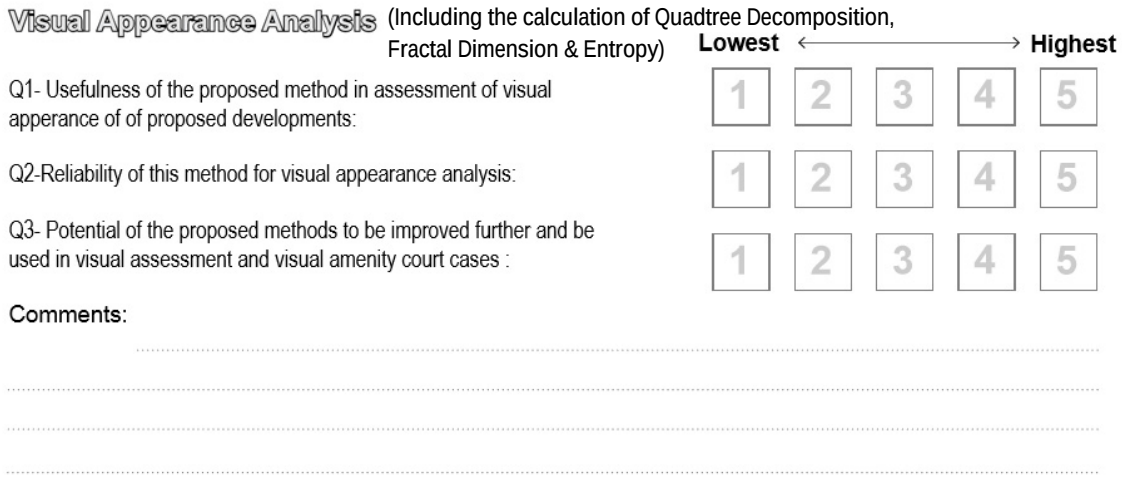


Figure 5-10. Questionnaire to receive interviewee's response regarding visual appearance analysis method including calculation of quadtree decomposition, fractal dimension and entropy

The interviews with each expert witness were conducted over one hour. Half of the time was dedicated to the explanation of the methods, and another half hour was spent in discussion and receiving their feedback. The whole interview was voice recorded.

Three questions were asked of each interviewee. The first question was to know the level of usefulness of the developed method to analyse visual appearance of a proposed development. The second interview question was about the reliability of the proposed method, and the last question was the potential of this approach for further development.

5.4 RESULTS

Research results include the application of image processing techniques to the selected case studies. The first case study was a demolition of a pre-1946 house in DCP area. The second court case was a new McDonald's restaurant in Underwood. In addition, evaluation of selected visual amenity expert witnesses is also explained.

5.4.1 Demolition of a Pre-1946 House at Nundah

In the first case study, the character of Collins Street in Nundah, architectural style and level of detail of the subject house was compared with other dwellings in the street and the area, and its contribution to the streetscape and DCP were the issues of conflict. Demolition of pre-1946 houses was classified as *Residential 3* category in the review of court cases (Chapter 4). This type of conflict was considered as the second major type of development associated with visual amenity (visual appearance) issues.

Based on the image processing techniques introduced in the previous section by using quadtree decomposition, these methods are used to quantify visual properties along Collins Street. These techniques were applied to quantify and measure the visual character of the streetscape, as well as comparing visual characteristics of the subject house with other pre-1946 houses in the vicinity. A field study session was conducted to assess the locality and take streetscape photos with the same criteria.

Collins Street extends from Hamson Terrace in the west to Bradbury Street (Toombul Railway Station) in the east and is intersected by Bage Street and Toombul Terrace, running north–south. Based on the field assessment and what was agreed by the visual expert, the relevant part of the street is between Bage Street in the east and Toombul Terrace in the west. The DCP is confined to the western part of Collins Street. The eight lots in the DCP (lots 70, 66, 62, 58-60, 54-56, 50-52, 46-48, and 42) all contain detached houses on wider blocks, all of which were constructed before 1946, except for lot 66 which, although "timber and tin", was constructed in the 1950s and is afforded no protection from the Demolition Code.

Although the house is not protected from potential demolition in that way, its replacement, were it, demolished, would have to comply with the Residential Design Code. The Character Code encourages development in DCP to reflect and strengthen pre-1946 housing character through harmonious form, scale, material and detailing for new developments. On the northern side of Collins Street, five pre-1946 detached residences were demolished as per previous Council's approval. As a result, several double storey buildings are constructed, reflecting similar developments along the street in accordance with the Residential Design-Character Code (*Figure 5-11*).

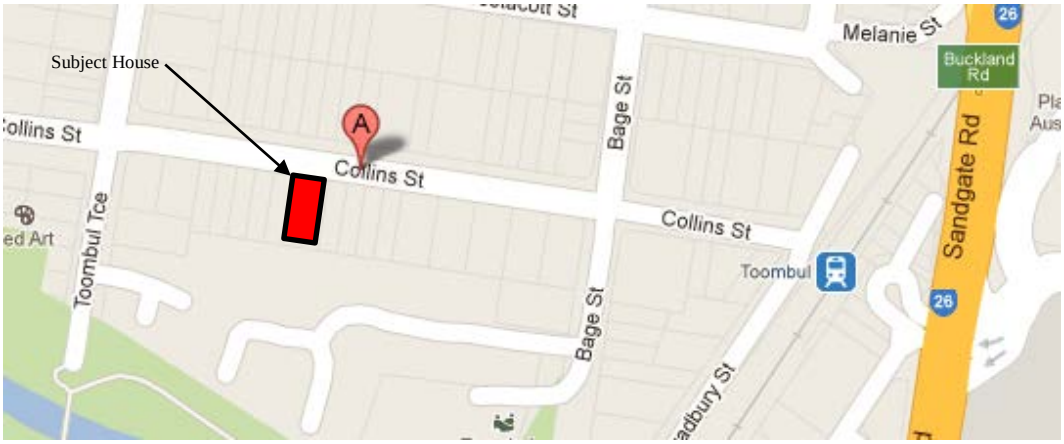


Figure 5-11. Subject house location (Source: Google Maps)

5.4.1.1 Quadtree Decomposition of Collins Street Images

In order to investigate these issues using image processing as an objective tool to assess visual properties, several photos were taken from footpaths along Collins Street looking at the opposite side of the street using the same camera setting[10]. Therefore, all photos were taken in similar distance range (within a few meters), which resulted in a consistent evaluation of digital photos (*Figure 5-12*). Multiple photos were taken along Collins Street from neighbouring properties. A total of eight houses were selected for image processing analysis. These houses are the closest houses to the subject house shown in *Figure 5-12*. These photos were cropped into square proportion (2048x2048) and changed to grayscale images (256 grey levels).

Figure 5-12. Photo points and view direction along Collins Street to Selected Houses

[10] Photos are taken with a DSLR camera, Cannon 60D-18mm-135mm lens with 50mm focal length (33mm on digital lens) and 1/160 speed based on light conditions on photography day (21 October 2012-11am) and 18mega pixel resolution.

As the photos are taken from another side of the street, they include all visual elements of the streetscape, including street trees and backyard vegetation, road, footpath, fencing, etc. However, in this court case, conflict issues were more related to built forms and their architectural features. Therefore, to analyse visual properties of built forms per se, as a second option other elements were excluded from the photos using Photoshop. *Figure 5-13* shows the captured and modified photos from Collins Street. Houses, including CC1 (subject house), N2, N1, N13, N3, are pre-1946 houses, and N12, N11 and N10 are contemporary, double-storey houses.

While every effort was made to capture photos using the same criteria, there are slight differences in terms of the direction of visible built-form due to backyard vegetation screening parts of buildings. Therefore, photos were taken at various angles to capture the most visible parts of the built forms of the streetscape. However, consistency in the proportion of built forms was sought in all photos.

The difference in photos, including slightly different view angles of houses, is a factor which can result in inconsistent image processing results. Also, various ragged edges produced by the vegetation removal in Photoshop in each photo are another important factor that can lead to inconsistent image processing results. However, based on final results, these variations and divergences would not result in significant different to completely affect the conclusion. In addition, the process of removal of vegetation was applied similarly to all photos, which made for a consistent change to all evaluated photos. Therefore, the final results are comparable as they have been modified similarly and consistently.

Figure 5-13. Collins Street Photos (with and without vegetation options)

Selected photos (CC1, N1-4 & N10-13) and their masked options were transformed by quadtree decomposition in order to measure several variables. *Figure 5-14* shows the result of the transformation of twin photos.

Figure 5-14. Transformed Collins Street Photos by Quadtree Decomposition (with and without vegetation options)

Multiple variables, such as the number of blocks (nQT), mean block size (mQT), median quadtree (meQT), standard deviation (sQT), entropy(E) and fractal dimension (FD), were calculated for each quadtree transformation (Table 5-2).

Table 5-2 Quadtree transformation results

Subject House →

Photo no.	Context	512*512	256*256	128*128	64*64	32*32	16*16	8*8	4*4	2*2	1*1	nQT	mQT	meQT	sQT	E	FD
CC1-Q	2010-QPEC55	0	3	8	116	649	3531	12494	36550	87035	90420	230806	23080.6	2090	36406.0921	0.779	1.8978
CC1-wotree-Q	2010-QPEC137	8	5	20	88	261	864	3945	12945	26428	27584	72148	7214.8	562.5	11169.1129	0.3983	1.6321
N1-Q		0	0	4	104	753	3690	14078	39163	96068	75200	229060	22906	2221.5	35564.303	0.8264	1.925
N1-wotree-Q		3	13	21	95	504	1847	6107	39163	37865	33068	118686	11868.6	1175.5	17299.0856	0.5071	1.7356
N2-Q		1	5	41	123	417	2127	10189	31099	67390	38168	149560	14956	1272	23183.0094	0.7458	1.863
N2-wotree-Q		8	2	27	60	249	807	4305	18926	49505	40028	113917	11391.7	528	18656.9072	0.4947	1.6756
N3-Q		0	5	35	142	490	2198	10269	34217	90117	81948	219421	21942.1	1344	35439.0542	0.7402	1.8546
N3-wotree-Q		6	8	36	99	313	1081	3586	10076	23421	20172	58798	5879.8	697	8977.72084	0.3751	1.6357
N10-N		0	4	40	191	777	3266	8180	14088	24339	16436	67321	6732.1	2021.5	8730.59778	0.5279	1.8046
N10-wotree-N		6	8	50	139	324	735	1693	3556	4996	3440	14947	1494.7	529.5	1844.83791	0.2299	1.5335
N11-N		0	5	37	195	854	2107	6777	22366	52725	45324	130390	13039	1480.5	20235.8572	0.6052	1.8052
N11-wotree-N		9	0	30	90	290	802	3327	9785	21339	17732	53404	5340.4	546	8111.23749	0.3497	1.6023
N12-N		0	5	29	207	767	2480	8060	21886	55140	36752	125326	12532.6	1623.5	19354.0449	0.6172	1.8189
N12-wotree-N		6	8	25	111	372	1337	3923	9671	21212	19040	55705	5570.5	854.5	8253.1005	0.3794	1.6439
N13-Q		1	4	20	88	532	2882	11075	34155	94438	66296	209491	20949.1	1707	33702.7271	0.7504	1.8722
N13-wotree-Q		8	5	14	58	197	996	4706	17814	54978	39704	118480	11848	596.5	19820.7427	0.5054	1.6769

As the first identified finding, it was seen that vegetation increases the values considerably in all photos. Results show that the pre-1946 houses exhibited higher values in terms of FD, Entropy and, the number of blocks compared with double-storey dwellings along Collins Street. This is due to their architectural styles and level of detail in their facades, and although their bulk is smaller than double-storey buildings, they have more FD and E levels. *Figure 5-15*, *Figure 5-16* and *Figure 5-17* shows the comparison between pre-1946 houses along the southern side of Collins Street and double storey buildings on the northern side with and without vegetation.

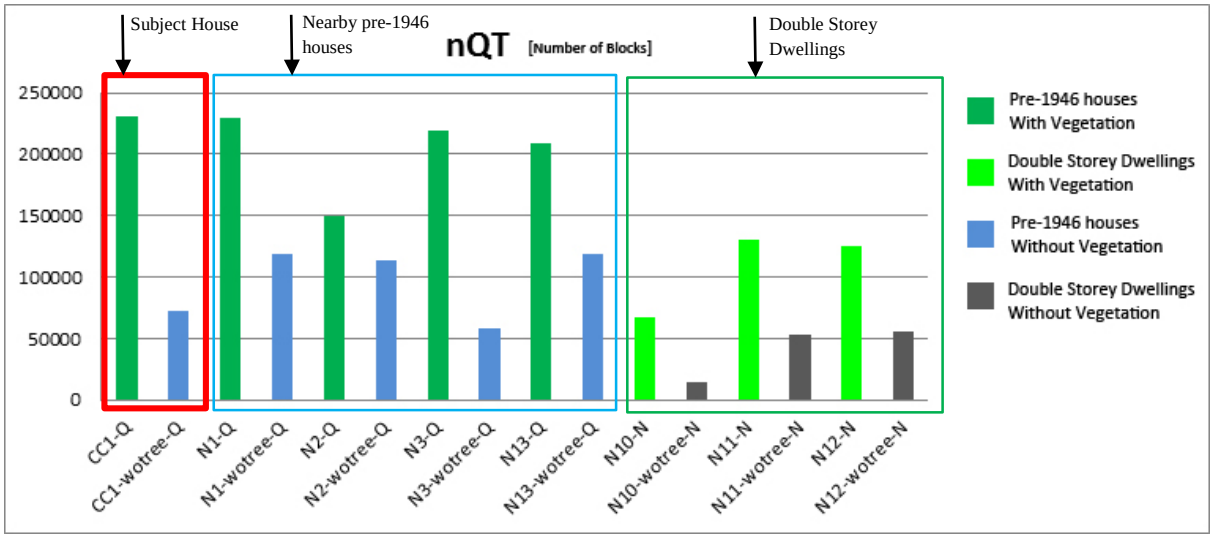


Figure 5-15. Quadtree decomposition results (number of blocks)

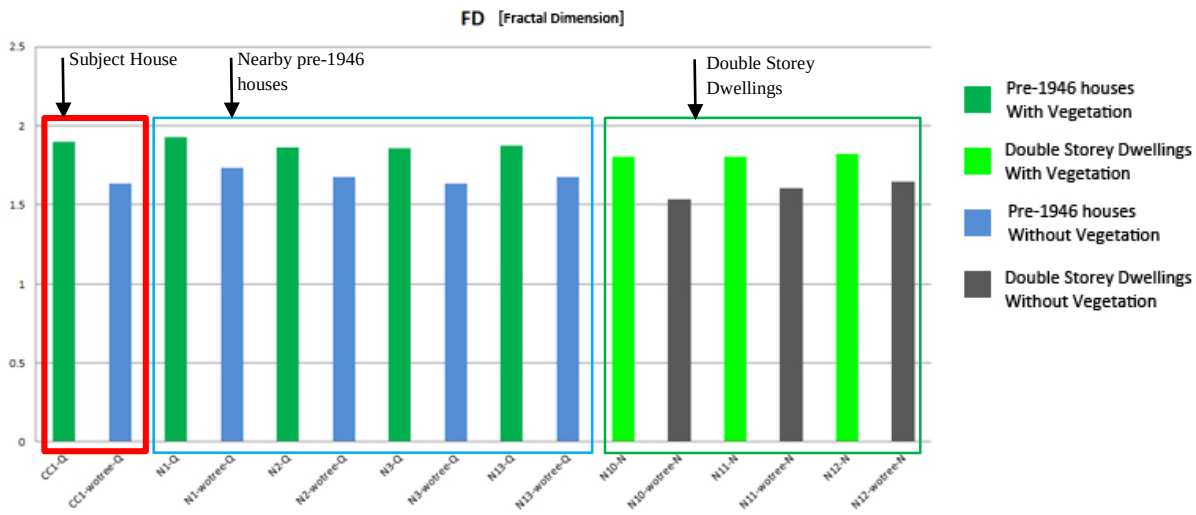


Figure 5-16. Quadtree decomposition results (Fractal Dimension)

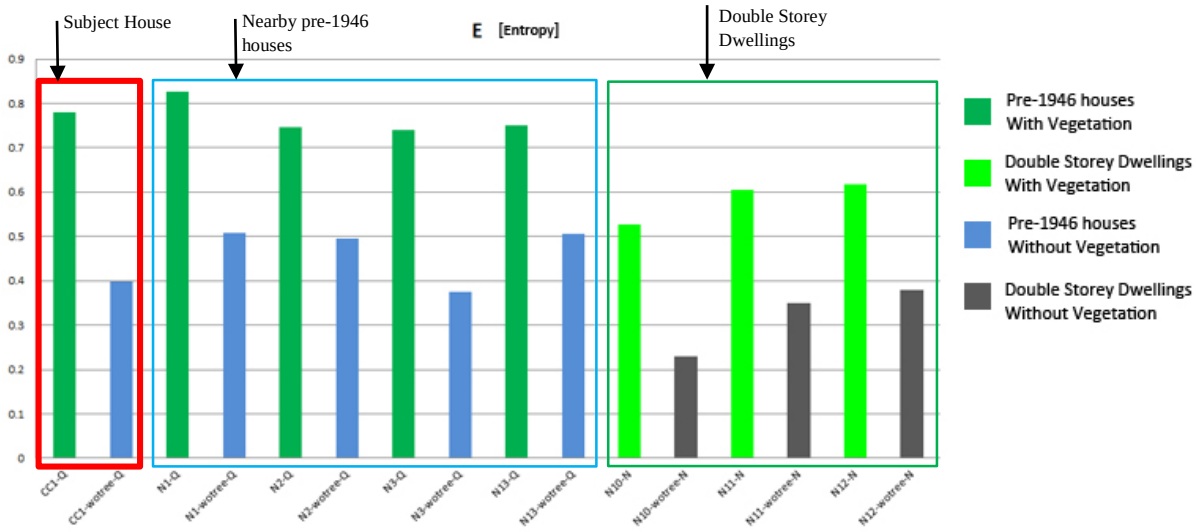


Figure 5-17. Quadtree decomposition results (Entropy)

Results show the potential of quadtree decomposition to measure different variables along the streetscape in order to analyse its visual properties and character. It can be expanded to include all buildings along Collins Street based on their spatial location on the street, and measuring these values in more detail in order to find a mean value for FD, E and, nQT for all streets as a descriptor of streetscape character. Therefore, the subject house can be compared with the mean value to see its relationship with other houses. Based on preliminary results, the subject house had close values (FD, nQT and E) compared with the nearby pre-1946 houses. This confirmed the expert witness evidence that the subject house contributes to the streetscape character.

Based on the Code's definition, the streetscape character is the result of all streetscape elements –- street trees, footpaths, fences, signs and built forms – which together create the overall character and sense of place. The calculation of fractal dimensions, number of blocks and Entropy described the overall level of visual details, complexity and diversity of elements considered in the

original definition. Therefore, the proposed method finds that all visual elements are important in creating an overall character.

Image processing techniques – quadtree decomposition, fractal dimension and entropy – provided a quantifiable method to measure various visual properties of a streetscape. This method was applied to an existing house, and other properties were used as comparative measures to analyse the relationships between various built forms to understand their contribution to the overall streetscape.

As per reviewed court cases in Chapter 4, visual appearance issues are not only limited to demolition court cases but it is also relevant to new developments in an existing setting. The appearance of the new development in its context was one the key concerns of development assessors and experts. Photomontage modellings are widely used to show how the proposed development looks in its setting. Thus, image processing was considered as a high potential method to be applied before and after photomontages to measure visual properties. This is investigated further in the second case study in this chapter.

5.4.2 McDonald's Restaurant On a Vacate Land at Underwood

This case relates to a refusal by Council of a combined application by the appellant for a food outlet and advertising devices to facilitate a McDonald's drive-through and dine-in family restaurant in the suburb of Underwood, south of Brisbane's CBD. This development was classified, and Council's reasons for refusal included issues of character and amenity, which are addressed in this report. Due to the relation of this case to the visual appearance concept and discussion on the visual appearance of new development in the existing urban setting, it was selected as another type of conflict for further assessment.

The subject land is Lot 605 on RP826149 at 1-13 Brookvale Drive, Underwood (on the corner of Brookvale Drive and Kingston Road), and is currently vacant (*Figure 5-18*). While Lot 605 is 11,400 m^2, the proposed development would occupy only the eastern part of the subject land, an area of approximately 3462 m^2 (the development site). The eastern site boundary is defined by Kingston Road and the southern border aligns with Brookvale Drive. Land to the west of Lot 605 is developed for detached residences, but approved residential townhouses will occupy the western part of the subject land, between the existing houses and the development site (*Figure 5-18*).

Figure 5-18. McDonalds Restaurant Location Map

The proposed development, which is the subject of this appeal, is a single storey restaurant plus car park and advertising signage. A multi-unit residential is approved for development on the western part of the vacant land (Lot 605 on RP826149). The proposed restaurant is a flat-roofed building with a simple low profile modern design and horizontal battens (the "MOD series" of McDonald's restaurant designs), with a McCafé coffee shop and a drive-through fast food service, similar to the restaurant at Richlands (Chenoweth, 2012). Based on the Court's visual amenity expert assessment, the proposed restaurant development will have no adverse visual amenity impacts on the Brookvale Drive and Springvale Crescent residential locality. In general, the visual amenity expert believed that the proposed development did not compromise the achievement of the relevant Desired Environmental Outcomes and should have been approved by Council (Chenoweth, 2012).

5.4.2.1 Quadtree Decomposition of Photomontage Images of Underwood Case

In order to assess the visual impacts of proposed developments in an existing setting in the Planning and Environment Court, two locations have been selected to prepare a photomontage. Photomontages are important documents in Court and expert judgments, and final decisions rely heavily on them. However, the accuracy and validity of photomontages are the main concern of all parties.

Several factors, including photo locations and camera focal length, are essential for producing a reliable photomontage that truly represents the future environment. It is critical to creating a highly accurate 3D model of the existing environment and the proposed development based on surveyed data. In this case, Mark Elliott Illustrations Pty Ltd produced two photomontages from two locations in support of the appeal to be presented at court.

High-quality digital photos and photomontages are analysed by image processing as a measurable technique to quantify visual impacts of the proposed development on the existing setting. This analysis is limited to only two views due to the limitation of producing photomontages for this case. *Figure 5-19* shows the location of selected photo points around the subject land for photomontage. Similar to the previous case analysis, these digital photos were cropped and reduced to 2048 x 2048 pixels and transformed to intensity images (256 grey levels) in Photoshop to be analysed by quadtree transformation. *Figure 5-20* shows original photomontages, and *Figure 5-21* shows modified images to be transformed by quadtree decomposition.

Figure 5-19. Photo point locations

Figure 5-20. Original photos and photomontages presented at P&E Court (Source: Mark Elliott Illustrations)

Figure 5-21. Modified photos and photomontages for Quadtree transformation

Grayscale photos (shown in *Figure 5-21. Modified* photos and photomontages for Quadtree transformation) were transformed by quadtree transformation as presented in **Error! Reference source not found.**. The number of blocks (nQT), fractal dimension (FD) and entropy (E) are measured accurately for each image (existing and photomontage). The calculated properties are described in Table 5-3.

Quadtree transformation values showed that the level of detail increases by proposed development in PP02 and reduces in PP03. From photo point 2 (PP02), nQT increases slightly, fractal dimension and entropy decrease as the existing trees at subject land will be removed and substituted with the proposed restaurant. Conversely, from photo point 3 (PP03) the proposed landscaping plus built forms add to the fractal dimension and entropy values compared with existing conditions. The quadtree decomposition provided a quantitative method to calculate the level of detail, diversity and complexity (FD and E) and measure visual changes before and post-development conditions.

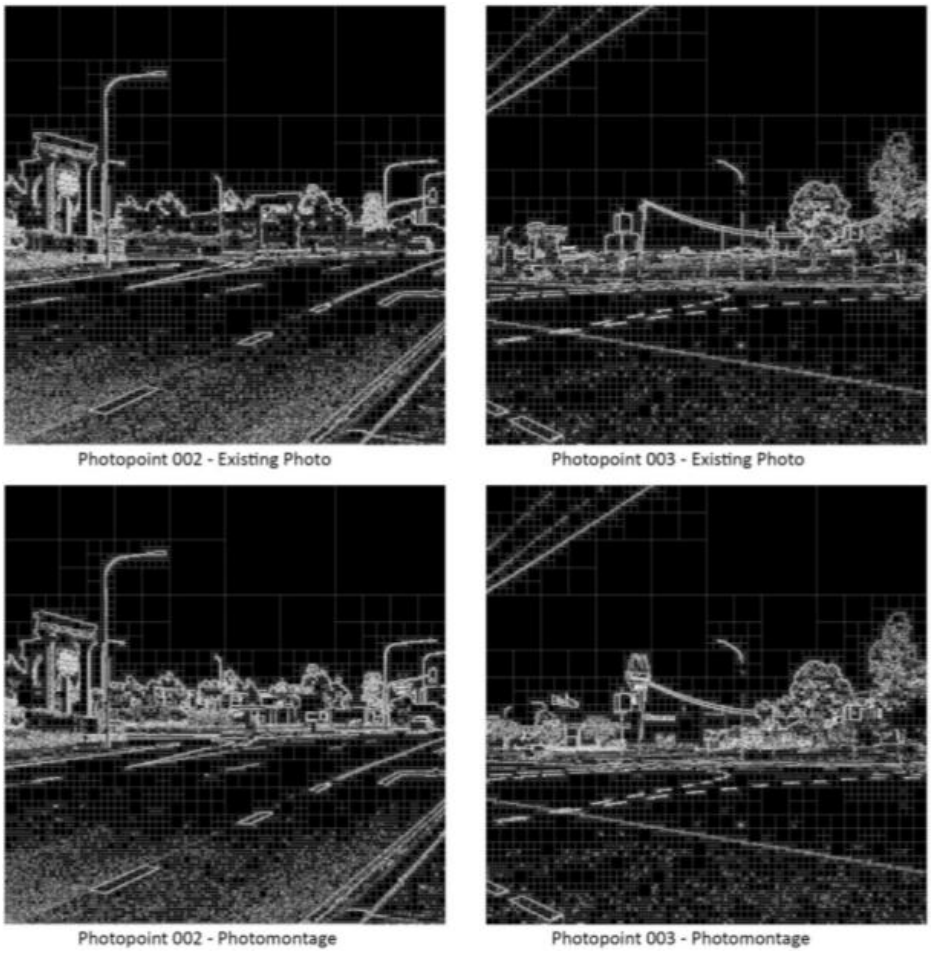


Figure 5-22. Quadtree transformation of *Figure 5-21*

Table 5-3 Quadtree Transformation Calculations

Photo no.	512*512	256*256	128*128	64*64	32*32	16*16	8*8	4*4	2*2	1*1	nQT	E	FD
PP02-Exisitng	2	9	17	90	537	2550	10028	23267	45402	34664	116566	0.6058	1.8108
PP02-Photomontage	2	9	16	109	549	2495	9120	22304	48568	35872	119044	0.6007	1.8043
PP03-Exisitng	2	7	27	143	744	2478	6133	15931	29956	19712	75133	0.507	1.7683
PP03-Photomontage	2	7	25	147	731	2428	6140	17244	33404	26960	87088	0.5242	1.7725

In this case, the image processing was limited to only two photos, before and after development, as the 3D model was not available to produce more photomontages. These photos were nominated by visual amenity experts engaged for this court case and were taken at 50m and 75m distance from the proposed development. According to preliminary pilot studies and previous court case analysis, distance is a major factor measuring visual complexity and level of detail. It was found that close range would increase the level of detail, complexity and diversity while having more distance would reduce all of the calculated variables (nQT, FD and E).

In support of this appeal, the visual amenity expert claimed that the proposed single-storey McDonald's restaurant and its signage would be consistent with the existing commercial character of the immediate area and the Kingston Road frontage. He also considered that the development to be an improvement on its streetscape character, which is dominated by a Bunnings Warehouse

and incongruent Greek column structure at the Brookvale Drive corner (Chenoweth, 2012). It was accepted by visual amenity experts and the court that the proposed development improved the overall visual appearance of the streetscape. This was confirmed by the results of image processing analysis by adding more visual detail resulting from the proposed built form and landscape. However, this appeal was rejected by the Planning and Environment Court due to noncompliance with other aspects of amenity – the noise and character of a McDonald's restaurant and amenity impacts on nearby residences.

Results of the case study were consulted with three expert witnesses. This was done to investigate the usefulness and applicability of the proposed method to analyse the visual appearance of urban streetscapes. This evaluation is followed by the overall assessment of findings in relation to the availability of similar research in this field.

5.4.3 Feasibility of Use

Based on conducted interviews, all expert witnesses agreed that the developed method for analysing visual appearance has a low potential for use in urban character assessments. They also considered the image processing method – quadtree decomposition, fractal dimension and entropy – were too complex and difficult to be applied in actual visual amenity court cases. Although they appreciated the concepts of complexity and order and fractal dimension, they considered that the quantification of visual properties of urban environments is not a very useful tool for visual amenity experts and the conflict resolution process.

Furthermore, the interviewees acknowledged that the proposed methods in image processing were more applicable and suitable for scientific and academic researchers than court case resolution. Interviews with expert witnesses were useful for identifying potential areas to develop the methods further. Considering subjective preferences beside quantitative data can add more meaning to the quantitative results as mentioned by the interviewees. Expert's assessments and feedback are summarised separately below.

Participant Number 1

The first interviewee considered that the proposed visual appearance analysis suggested in this chapter is not a usable tool for landscape character assessment. Regarding usefulness, she rated it a 3 on the scale and believed that the proposed method was not a very practical tool for expert witnesses to assess visual appearance. However, she considered the proposed visual appearance method as a reliable method to be replicated and repeated consistently to quantify visual properties. She believed that computation methods in image processing could produce consistent results using the same algorithm. But, these quantifications are not meaningful enough to be used and interpreted by visual amenity experts.

Although the first interviewee believed that the visual appearance analysis using image processing was not a useful tool for expert witnesses, she thought it has a great potential for character assessments with further development. She also found that the method was more useful in architectural research to analyse facades and other purposes. Overall she rated three questions by an average score of 4 for all three questions.

Participant Number 2

The second interviewee similarly considered that the proposed method using image processing was not a useful tool for court cases analysis. She explained that visual appearance is a more subjective and intangible aspect of the visual environment, and quantification methods are not able to provide meaningful results for expert witnesses. She considered the proposed methods for calculation of fractal dimension and entropy to be only mathematical concepts with no use in visual amenity assessments. Therefore, she considered that this approach was not a reliable method to analyse visual appearance of urban streetscapes, and rated it 2.

However, she acknowledged a high potential for these techniques to be improved by considering community values, meanings and other subjective responses beside numeric results to understand the correlation between them. She mentioned that understanding the qualitative and quantitative data could bring more meaning into results to help expert witnesses understand the potential of these methods to be integrated into visual amenity conflict assessments. Considering preferences and correlation with numeric calculations will provide more insight into these practices.

Participant Number 3

The third interviewee similarly considered the method to be of low-level use in actual court cases and visual character assessments. He also found this method unreliable for court case assessments as the numeric results were not meaningful enough to be presented in the courtroom. He also considered that the image processing was not a useful tool and not user-friendly for visual amenity expert witnesses, and was "*too technical*" an approach to visual appearance.

However, he considered a medium rate for the potential of this method to develop more in 3D and to calculate the complexity of built form volumes, which is a new direction of research. He thought calculating the complexity of building envelopes, the level of articulation in 3D, considering setback and size of developments were necessary and useful information for assessing development applications. He found this to be a useful area for more research.

The proposed methods are further compared to previous studies in this field. Also, an overall assessment of techniques in terms of validity, reliability and significance of the finding is provided.

5.5 DISCUSSION

This section provides an overall evaluation of findings of this chapter. Firstly, the concept of visual appearance developed in this study is discussed in relation to previous studies. Analysis of visual appearance by image processing techniques using quadtree decomposition, fractal dimension and entropy are compared with previous research. Finally, generalisability, reliability and validity of findings are discussed.

5.5.1 Visual Appearance As A Concept

Visual appearance is the most sensual aspect of any development. Appearance depends on many visual properties, including colours, materials, physical features and elements, size and dimension, which affect the perception of that object in the urban environment. These factors shape an overall perception and feeling of the visual appearance of a particular structure in the eye of the beholder. Image processing provided an opportunity to quantify and measure these properties to some extent.

Visual appearance is referred to differently in Planning and Environment Court cases compared to urban design literature. While visual presentation covers a broad range of attributes in urban design, in court cases it is more related to visual characteristics of a building considering its architectural styles, shapes, forms and details in relation to its setting. Assessment of visual appearance by expert witnesses is focused on answering how a development looks in its visual setting. These evaluations are a mix of objective and subjective judgements that sometimes result in opposite opinions from conflicted parties.

Visual appearance concept was considered as both a subjective and objective concept as defined by different researchers in this field. Subjective-based approaches (Appleton, 1975, Kaplan and Kaplan, 1989, Mandaniour, 1996, Nasar, 1992, Roberts and Greed, 2001) considered visual perception to be affected by values, meaning, past experiences and learning. Objective-based approaches followed physical features and attributes and qualities of physical urban environments (Lynch, 1960, Jakle 1987, Ewing and Handy 2009). This research followed the objective-based paradigm and quantified visual properties of urban images, including levels of homogeneity and level of details, complexity and diversity.

While overall judgement of expert witnesses will remain a mix of subjectivities, improvement in quantifying objectivity will provide more assistance for expert assessments to come to more consistent and reliable judgments. Attention to the existing visual setting and investigating how the development looks in a setting were the central part of this study to provide a measurable method for a comparable quantitative assessment of visual properties.

Image processing was identified as an objective tool to analyse some attributes of the visual appearance of urban streetscapes. It provides a computational resource to analyse visual environments, natural or constructed. As a repeatable method, it is capable of quantifying visual

properties of the urban environment. Quantification of visual properties of digital photos makes it possible to compare development applications. Image processing has been widely used by researchers in this field to quantify different aspects of the visual appearance, such as visual complexity, order and diversity (Mandelbrot, 1982, Tucker, 2004, Batty and Longly, 1994, Cooper and Oskrochi, 2008, Perry, 2012). Therefore, it was considered to be a high potential tool to assess the visual appearance of urban streetscapes.

The method presented in this chapter provided a quantitative method to analyse visual properties of urban environments. It provided a more quantitative method to compare and monitor visual changes in urban scenes compared to conventional subjective expert evaluations. However, this approach does not give a basis to a more qualitative justification of visual appearance, whether it is desirable or not, and requires more research to understand this.

5.5.2 Assessment of Techniques

Quadtree decomposition was used for the first time in this study as an image segmentation technique to analyse several visual properties of urban streetscapes. It was applied to digital photos to calculate the level of visual detail visible in photos. Fractal dimension, as a measure of visual complexity, and entropy, as a measure of visual diversity, were other variables calculated for quadtree decomposition results for each digital photo for comparative analysis.

The other visual appearance techniques which were developed in this research can be compared with previous research done by Bovill (1996), Cooper et al. (2008), Stamps (2003) and Tucker (2004). Similar to these scholars, this study followed similar box-counting methods to calculate visual properties of urban streetscapes using fractal dimension. However, quadtree decomposition is a new technique in image processing and was used for the first time in assessing the visual properties of urban environments. Quadtree decomposition provided a new method for reconstructing streetscape to calculate *Fractal Dimension* (FD), *Entropy* (E) and *level of detail* in an image.

Notwithstanding the findings mentioned above, the research confirmed that the calculation of different aspects of visual properties of urban streetscapes and built forms does not imply a good design or outcome. This finding was consistent with Ostwald and Tucker (2007) research and conclusions. This calculation and analysis could be used only as a comparative tool to measure visual properties of urban streetscapes and to check relationships between different structures or streetscapes.

The visual appearance analysis method can describe the visual properties of an image, including visual complexity and diversity, and compare it with another image. With further research, it might be possible to identify some thresholds for a desirable level of articulation in built forms for different types of development. This requires the collection of qualitative data to identify public perceptions and comparing it with quantitative measurements to find any correlations.

Findings also supported the theory of contextual fractal fit, where development is more desirable when it is consistent with a fractal dimension of the surrounding environment.

The calculation of entropy as a measure of visual diversity was based on its original equation. Quadtree decomposition provided a new segmentation technique to transform each photo by breaking it into homogeneous blocks. This method is very similar to Krampen's grid method to calculate entropies for facades of apartment buildings. Krampen (1979) applied different grid sizes (1, 2, 4, 8, 16, 32, 64 and 128) on 512 x 512 pixels to calculate entropy. However, quadtree decomposition provided a new and accurate method for segmenting the stimuli into different sizes of blocks by identifying homogenous blocks. This approach is also different to Stamps' (2003) method as he produced visual images with known components, counted the frequency of each component and calculated the entropy accordingly. The current method is a comprehensive method which can be applied to any 2D image and estimate the level of diversity (E) using quadtree decomposition. These techniques and quantifications were applied to two cases to identify how they responded in different settings and for various purposes.

In the first case study, visual properties of an existing and protected house in a DCP area was analysed compared to nearby houses in the street to examine visual relationships between a subject house with other buildings. Based on this calculation, the subject house had a very close relationship with nearby DCB-protected (pre-1946) houses and had more visual detail compared to contemporary double-storey buildings on the other side of the street.

In the second court study, before and after photomontages were used to analyse visual details of the proposed restaurant in the existing setting. The proposed McDonalds restaurant increased the level of visual details in the existing environment. It was also understood that the proposed landscaping increased the visual details and complexity of digital photos. However, the proposed method is limited to the measurement of these variables and is unable to answer the main issue in the case of whether the proposed use was appropriate or not.

The visual appearance analysis provided a new method to calculate and measure overall visual details of an image, including all elements such as lines, colours, surfaces, built forms and vegetation. This method could be investigated further to be used as a computer-based method to analyse architectural styles and design options. However, in order to achieve a better understanding of the method developed in this chapter to explain visual appearance, a consultation with a group of expert witnesses was considered as part of the investigation.

5.5.3 Validity, Applicability and Significance of Findings

Validity is defined as a quality of being logically sound and based on facts (Stevenson, 2010). The proposed method of visual appearance analysis based on the calculation of three visual properties – quadtree decomposition (a measure of homogeneity and visual details), fractal dimension (a measure for visual complexity) and entropy (a measure of visual diversity) – was considered a valid, logical and scientific method by previous researchers and the interviewed expert witnesses. These properties were measured by image processing techniques using defined algorithms to quantify them for 2D digital photos of urban streetscapes. This method provided numeric values to compare visual properties for different photos and settings.

The visual appearance of a proposed or existing development is one the key concerns in visual assessment studies. A detailed description of visual appearance considering its attributes, including materials, colours, visual details, articulation, is a part of expert evaluations. However, justification of these attributes and overall visual appearance of the subject development is a conflicting part of these assessments. Quantification of this aspect of development was considered as a way to increase the certainty of expert judgements. Previous methods developed by the Queensland Government (SPRAT 2 tool – Figure 2-2) shows a tendency to more quantification of visual change as the results of a new development. Therefore, quantification of visual changes and modification by a new development is considered a significant contribution to this field.

The proposed method identified different types of environments – natural or built elements – by calculating three variables. This method also distinguished different types of built forms and architectural styles, including single- or double-storey houses. This finding showed the potential and applicability of this method to be applied in visual assessment to analyse visual properties of urban streetscapes. This method was also useful for quantifying visual change and modification as results of a new development. Before and after photomontages can be used to analyse the visual change modification and contribute to viewpoint-based visual impact assessments.

According to consultation with visual amenity experts, the proposed method to quantify visual properties of urban streetscapes has a low potential for use in expert assessments. The proposed image processing method was considered too complicated to be interpreted by visual amenity experts, lawyers and judges in development conflicts. In addition, application of these methods in image processing was considered difficult for expert witnesses. Therefore, applicability or usability and functionality of this method were considered limited.

However, the proposed visual appearance method was considered to be a new method for analysing and quantifying visual change as a result of development. Quadtree decomposition, fractal dimension and entropy were considered useful visual properties to analyse for urban streetscapes. They are also applicable to the calculation of visual change and for measuring visual modifications by new developments. However, these measures do not provide any justification for

whether they are acceptable or not. But, there is a potential in this method, which will be needed to develop further to achieve this.

Developing a technical method to analyse court cases in response to the research aim and questions is not limited to visual appearance and image processing, as presented in this chapter. Two other relevant concepts were identified in court case reviews that lacked certainty in expert assessments: bulk and height analysis and visual dominance. These concepts are discussed in the next chapter, and more quantifiable methods are developed to increase the certainty of urban character assessments.

Chapter 6: Conflicts with High Rise Developments

The previous chapter presented a new method to analyse certain attributes of the underlying visual appearance of urban streetscapes. However, visual amenity issues, as identified in Chapter 4 (Section 4.4), were seen to be not only limited to visual appearance issues but to other issues such as bulk, height and dominance issues associated with high-rise development. This type of conflicts was the most contentious kind of visual amenity conflict. Bulk and height issues are highly critical issues controlled by the planning scheme. However, non-compliance with the height and plot ratio limits results in numerous conflicts in different parts of cities. Based on the review of court case cases, discussed in Chapter 4, these issues were highly associated with medium to high-density development applications within the Brisbane CBD and inner city suburbs.

Developers, councillors and local residents have different expectations and interpretations of *building heights,* which results in numerous court cases with bulk and height issues. Similar to demolition court cases, assessment of bulk and height was highly challenging for. Justifying the visual impact of high-rise developments and whether the height of the proposed development was consistent with the local character results in contradicting evaluations in visual amenity court cases. Assessments of visual impact on the locality, in some court cases, are vague and differs from one expert to another. Therefore, an urgent need for a repetitive method was found after reviewing these types of visual amenity conflicts.

Visual amenity experts usually investigate *bulk and height* conflict by using such standard methods such as photos, photomontages, cross sections and elevations. However, in some situations, as explained in Section 4.4.2, expert judgements lack adequate tools resulting in contentious arguments between different parties. In order to improve expert assessments in relation to bulk and height analysis, GIS was considered as a tool to be applied to help resolve this type of issue.

Another visual attribute that was discussed by experts was the *visual dominance* of subject structures or developments. Visual dominance refers to size or presence of a structure from a certain viewpoint and depends on several factors including distance, size, colour and object's movement. In some of the court cases, experts assessed visual dominance of an object based on approximate proportions in the view of the human eye. However, almost all these estimations were not accurate or certain and differed from one expert to another, resulting in different opinions in the P&E Court. Bulk, height and visual dominance concepts are addressed in this chapter, and these methods are applied to selected court cases, as displayed in *Figure 6-1*.

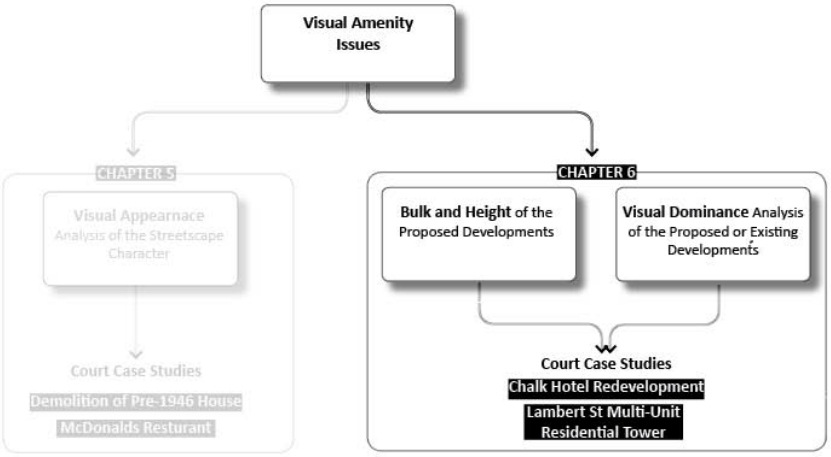


Figure 6-1. Bulk and Height and Visual dominance Analysis Applied to Selected Case Studies

Due to the importance of visual dominance, this issue was identified as another variable to quantify and increase the certainty of expert judgments. Visual dominance has high usage in expert witness assessments to assess the visual impact of proposed developments. Any contribution to this issue will be useful to visual amenity specialists and landscape architects in more accurate and reliable assessments of visual impacts. In these cases, lack of accurate and reliable methods resulted in unjustified arguments regarding the visual dominance of a proposed structure.

Visual dominance of development or an object is about the size of development in an observer's field of view. Therefore, the perception of visual dominance largely depends on the size of the object and its distance to the observer. Calculation of visual dominance should consider these two factors. The perception of visual dominance is, basically, that objects closer to the viewer are bigger than objects in the distance. However, the decay factor based on distance is not quantified in previous studies. Therefore this chapter is focused on the calculation of the decay factor and applies it to visual assessment and court case resolution. An experimental test was conducted to calculate the visual decay factor and is discussed below.

While the perception of bulk and height and visual dominance are different concepts, they have some connections as well. Both concepts are related to physical attributes and the proportion of the physical urban environment, which are quantifiable and measurable characteristics. Using recent technologies in GIS provides an opportunity to measure and quantify these qualities with more certainty and accuracy. Therefore, this chapter will address the following topics related to bulk and height concepts:

- GIS techniques for modelling visible space;
- vewshed and skyline analysis in GIS;
- visual openness and visibility ratio;
- visual bowl concept and skyline diagram;

And the following topic is discussed in relation to the concept of visual dominance:

- calculation of decay factor;

These methods are applied to two selected court cases in high-density areas. An introduction to LiDAR and city models and visual analysis techniques available in GIS are explained. Also, key concepts and variables related to bulk and height analysis are discussed. These sections provide a background and foundation for investigating the bulk and height of proposed developments in their existing contexts with more objectivity.

6.1 CASE STUDY SELECTION

Spatial analysis court cases conducted in Chapter 4, identified high-density areas in Brisbane, including the CBD and inner city suburbs, as hot spots for visual amenity conflicts with height and bulk issues. This area has the highest development density in Brisbane, and similar court cases with similar issues are likely to occur in this area in future.

As displayed in *Figure 6-2*, multi-unit residential towers with bulk and height issues are concentrated in the CBD. These areas were selected for a more detailed review of court cases. In order to select suitable court cases with these issues, criteria were defined.

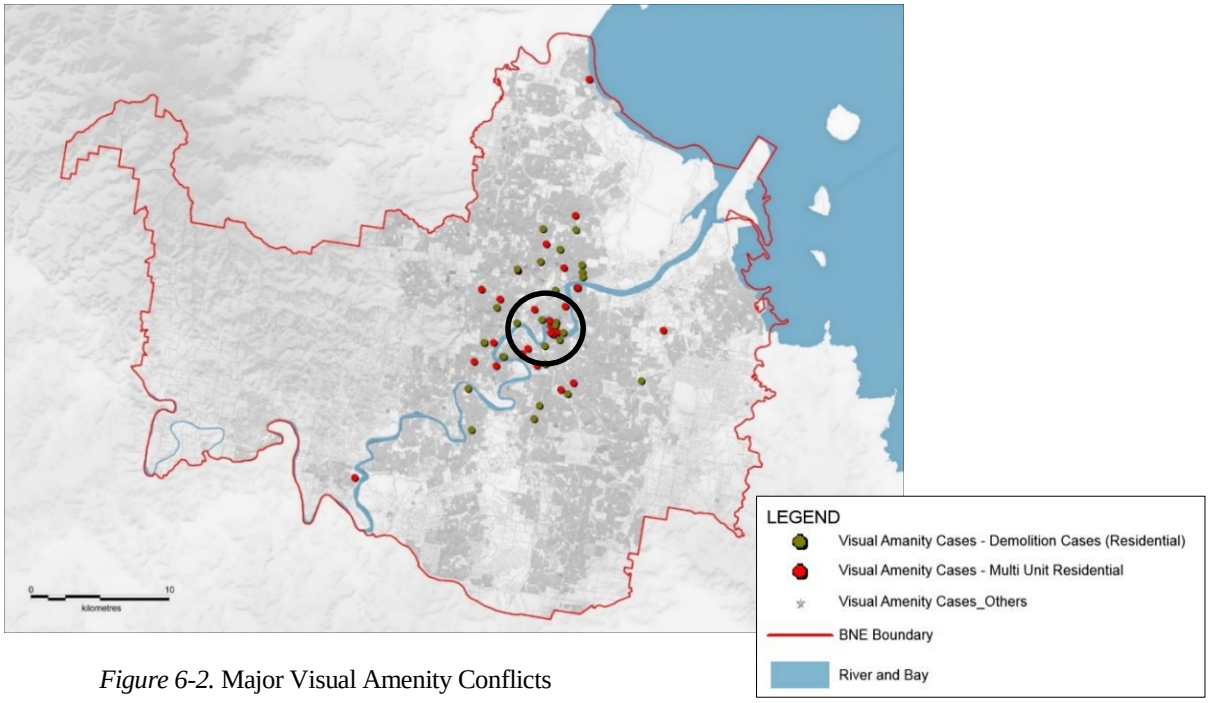


Figure 6-2. Major Visual Amenity Conflicts

These areas were identified as prone areas for similar conflicts in Brisbane due to a large number of court cases with similar height and bulk issues. Two court cases were selected as case studies according to the following criteria:

- Selected cases had to have bulk and height issues;
- Case studies had to be high-rise developments;

- The new development case study had to have conflict with height limits identified by the planning scheme;
- The cases had to have adequate background information, including photomontages, to be investigated further in this study.

As the result of this assessment, two high-rise developments were chosen as case studies in this chapter for investigation. The first case study is a mixed-use multi-storey development in Woolloongabba, Brisbane that has three towers with multi-unit dwellings and short term accommodation, hotel, shop, office and restaurants. The second study is a multi-unit high-rise development proposed at Kangaroo Point, close to the Brisbane CBD. Both selected cases were appealed by third parties due to bulk, height and visual dominance issues. Several concepts and methods related to bulk and height issues were developed in this chapter to analyse visual amenity with more quantification and certainty.

6.2 METHODS:

The research methods applied in this chapter are mainly developed based on the spatial analysis. These methods were developed to calculate different aspects physical urban environments related to bulk, height and visual dominance. In order to quantify bulk, height and visual dominance of built forms, several inter-related concepts were developed, and methods to model, measure and quantify these attributes are explained. Application of these methods in GIS is also explained in detail.

6.2.1 Bulk And Height Of Proposed Developments

Bulk and height of future developments in urban environments are one of the most important considerations in planning policies and schemes prepared by local councils in Australia. Several design guidelines and requirements are given in these policies to define the shape and size of different types of developments in various parts of the city. Their overall aim is to minimise the impact on the surrounding areas and to integrate the proposed development into the existing setting.

Several objectives area defined in these policies depending on the existing character and context of the urban setting. In these policies, attention is given to mass, bulk and form, scale, setbacks and height limits to minimise the visual impact of proposed developments while enhancing the existing visual amenity. Design objectives vary depending on the urban area.

As identified, bulk and height developments are highly associated with medium to high-density areas in Brisbane. These areas are in the suburbs in proximity (less than seven kilometres) to the CBD. Kangaroo Point, as one the suburbs close to CBD, is a high-density area subject to

many court cases each year. Some of the performance criteria defined in the Kangaroo Point Neighbourhood Plan (Brisbane City Council City Plan 2000) are set out below:

> ***" P1*** *Development is of a height, bulk and scale that:*
>
> *• supports the creation of clearly defined, high intensity mixed use growth corridors;*
>
> *• is consistent with the intended height, bulk and character of the relevant precinct as indicated in Table 1—Maximum Building Heights;*
>
> *• does not result in a density that would place disproportionate pressure on transport infrastructure, public space or community facilities;*
>
> *• is consistent with the intended scale and character of the precinct and streetscape*
>
> *• is commensurate with the size of the lot;*
>
> *• enables existing and future buildings to be well separated from each other to allow light penetration, air circulation and privacy;*
>
> *• does not create overbearing development by restricting access to daylight, breezes and privacy for neighbouring dwellings and their open space.*
>
> ***P2*** *Development provides a transition in building height to surrounding residential areas and Heritage Places and does not create an overbearing appearance or significantly impact on their privacy and amenity.*
>
> ***P3*** *Tall buildings comprise a modulated podium and clearly defined slender tower to create a fine–grain, human–scale street environment and enable solar access, cross ventilation and privacy."*

In order to achieve these objectives several acceptable solutions are considered in these planning policies: defining limits on site and footprint areas, building height, site coverage by the proposed developments, setbacks from site boundaries in different levels and consideration of podiums. The Kangaroo Point Neighbourhood Plan (Brisbane City Council City Plan 2000) defines the following acceptable solutions to achieve the abovementioned objectives:

> *"A1.1 Minimum site area is 800m2*
>
> *A1.2 Building height complies with Table 1— Maximum Building Heights*
>
> *A1.3 Maximum site cover is:*
>
> *• 80% where including a residential use in a Multi–purpose Centre Area*
>
> *• 70% wherein the Medium Density Residential Area*
>
> *• 50% where in any Area for a tower component (any part of the building above the maximum podium height)*
>
> *A1.4 Building setbacks are in accordance with Table 2—Minimum Building Setbacks.*
>
> ….

A3.1 Buildings greater than eight storeys have a podium that is at least two storeys and no greater than four storeys."

While these policies provide detailed requirements for the height and bulk of developments in the neighbourhood, they are still ineffective in stopping development pressures in high-density areas. In the review cases in these areas, bulk and height issues were the main issues of conflicts between residents, Council and developers. An increasing number of bulk and height issues with increasing number of high-rise developments in high-density areas emphasises the insufficiencies of current measures to control and prevent development conflicts.

Overall, the perceivable bulk and height of a proposed development are shaped by physical and tangible aspects of a development proposal. All footprint and height dimensions result in the final perceivable bulk of development in that neighbourhood, and these quantities transform into qualities and attributes of the urban space. Thus, it can become a complex concern for the assessment of proposed developments. Similar to visual appearance quality, which was discussed earlier, the assessment of bulk and height is mixed with subjective interpretations by expert witnesses and results in unjustified arguments between appellant and respondent parties.

Recent developments in GIS were considered crucial tools to contribute to a more quantitative assessment of bulk and height of proposed developments in high-density areas. GIS was considered to be a crucial tool for developing methods to analyse bulk, height and scale of developments.

6.2.2 GIS as a Tool

GIS for visual resources analysis can be used as the visual Environmental Geographical Information System. A system like this can have the role of advisor and presenter for many applications. This specific GIS may also include non-visual resource content in its spatial database. GIS is well suited to particular forms of qualitative data. For example, it allows for a rich visualisation of information in the form of maps and other types of graphic data (Pavlovskaya, 2009).

GIS offers sophisticated tools to generate complex models of urban contexts, including built form and vegetation to implement spatial analysis in two and three-dimensional spaces. Its extensive capability for city modelling, using LiDAR and many analytical functions, provides a unique opportunity to develop reliable and accurate techniques in the field of visual assessment of urban spaces. Application of GIS in the assessment of bulk and height of developments is explained through several steps including creating city models using LiDAR and bulk and height evaluation and surface modelling.

Advanced 3D spatial models are necessary for decision making and visualising the planned developments in urban planning to handle a broad amount of spatial data (Guney, 2012). Modern cities are very complex in term of spatial context, building forms and heights, and not only does a city extend upwards but it also extends downwards in tunnels and underground infrastructure (Guney, 2012). This resulted in the development of 3D visualisation and analysis techniques to help represent modern cities. Therefore, 3D city models have become a very popular tool for urban planning and design.

GIS has had wide usage in mapping and analysing proposed developments in the past three decades (Qiming and Wenjiang, 2004). According to Qiming and Wenjiang (2004), city modelling is a multi-disciplinary study area of urban GIS, Computer Aided Design (CAD) and presentation and spatial modelling. While urban GIS systems are mostly based on 2D spatial data, the field of CAD is highly developed in 3D data models. Integration of the GIS and CAD systems have progressed extensively in the past five years and has been expanded dramatically by using 3D scanners and improved survey systems.

Advances in survey technologies have provided extensive opportunities to investigate and measure visual properties in a complex system. Light Detection and Ranging (LiDAR) technology offer high-resolution capture of surface elevations (Lloyd & Atkinson, 2002; Priestnall et al., 2000). Airborne and terrestrial LiDAR sensors are used for scanning the earth's surface. The captured data is stored in point cloud files, which are a collection of points with elevations which include landform, vegetation, building and other natural and man-made objects. Point clouds are used to create digital surface models (DSMs) by interpolation techniques. DSMs and their derivatives have been used in many earth science fields, including environment and engineering studies (Stal et. al. 2012).

Our perceptions of visual space are defined and limited by both natural and built elements. Therefore, a DSM that includes landform built forms and vegetation with a high degree of realism can be useful for analysing and quantifying levels of visibility in urban environments. Multiple relevant urban design attributes, including openness and closure, can be quantified and measured with a high degree of precision. Measuring and quantifying visual properties and visibility with respect to natural landscapes is essential for informing policy makers and planners to protect the existing visual environment and to enhance the landscape character in local or broad scale urban areas. GIS enables the assessment and analysis of landscapes with greater accuracy and objectivity (Weitkamp, 2011).

The current GIS tools available achieve a level of sophistication in modelling and measurement techniques not evident in previous studies in this field. The recent functionality of GIS platforms such as ESRI ARC GIS provides further opportunities to analyse visual properties and relationships of built and natural city environments. Extraction of the urban skyline is a

function in GIS which provides valuable information on urban skylines and city forms and aesthetic factors of a city (Guney, 2012).

Opposite to qualitative methodologies based on a survey, experimental, psychological or behavioural studies, positivist and scientific methodologies are focused on numerical attributes of the urban form using computational techniques and modelling to analyse visual attributes. Computer-based models provide an opportunity for measuring and evaluating visual qualities in more detail. These virtual models help to increase objectivity and accuracy of development assessments, which can be useful for court case resolutions. Calculation of the visible area from a viewpoint has been one of the fundamental calculations nested in the space syntax theory. This theory and related concepts were identified as relevant issues to quantify bulk, height and dominance of developments in urban areas.

6.2.3 Viewshed and Skyline Analysis in GIS

There are several concepts and attributes have been analysed by researchers for quantitative analysis of urban form. These concepts include fractal geometry, space syntax, entropy, fuzzy logic techniques and methods (Chalup et al. 2009; Cooper & Oskrochi, 2008; Crompton and Brown 2008; Heath et al., 2000; Ostwald et al. 2008; Guney, 2012). These concepts describe and represent different attributes of urban environments. These studies resulted in more quantitative and scientific analysis of urban form to help urban planners and designers in the decision-making process. Fractal geometry, as a measure of visual complexity, and entropy, as a measure of diversity, were used in the previous chapter to analyse streetscapes. However, opportunities to develop measurable methods to assess visual amenity conflicts are not limited to these concepts.

Space syntax includes a collection of theories and methods for the analysis of spatial configuration of urban forms (Park, 2008). The concept is to break spaces into components and describe and analyse networks and relationships of the viewer and visual setting in graphs and diagram to describe the relationships and integration of spaces (Hillier and Hanson, 1989). Space syntax theory has been developed in architecture, urban design, planning, transport and interior design and is concentrated on the free spaces between buildings, structures or spatial obstacles. It also attempts to explain human behaviour and activity as they occur in the space configuration, which has a major effect on the perception and use of that space (Tucker, 2010).

Theorists in this field considered that urban environments could be understood in two ways. In one way, we comprehend the building relationships and forms all at once when we are in a position to see it as a whole to understand the structure and order with the rational, formal and logical constructive activity of the human mind, which is similar to an oblique aerial view (Rashid, 2012). In another way, perception is similar to what is comprehended on the ground through movement. This mode of perception has been critical to space syntax theorists to perceive and

experience urban environments. This can change the experience of highly structured urban form to a highly unstructured experience when viewed at street level (Hillier and Hanson, 1989).

Initially, spatial configuration studies founded on space syntax theory were focused on pedestrian movement patterns in cities (Hillier 1993; Turner 2001). However, these studies were based on information derived from planar views and building heights and level of the enclosure and visual details. Texture and quality of streets were not covered in these studies (Tucker, 2010). Further research in this field considered the building features in facades (Hillier, 1996, Tucker, 2004). Some other studies examine the spatial form of city skylines perceptions and their perceptions (Turner, 2003; Guney, 2012). However, these studies differ from each other based on the methods they have employed. Some of these studies (Turner, 2001, Tucker, 2004) used empirical methods to analyse streetscape while other researcher's methods are based on speculative theory building (Appleton, 1996).

With the emergence of technical innovations in GIS, CAD and other virtual environments, new concepts in space syntax related to spatial form can be developed, which adds more depth to this theory. Several relevant concepts, such as visual openness and visibility ratio, were developed in this research. These concepts were developed based on the initial key concepts in syntax theory, such as isovist or viewshed.

One of the fundamental conceptions in space syntax theory is an isovist. An isovist is a viewshed, or visibility polygon, that encloses the field of view from any particular viewpoint. The visible space from a single viewpoint is a three-dimensional space defined and limited by visual obstacles such as built-forms or natural elements. This space can be drawn by connecting the end of all visibility sightlines radiating through 360 degrees which can be described by a 2D map as a viewshed map. A viewshed map identifies an area, or cell, in a terrain model that can be seen from one or more observation points. The green area shown in *Figure 6-3*, shows the visible area from viewpoint A as defined by the surrounding built and natural elements.

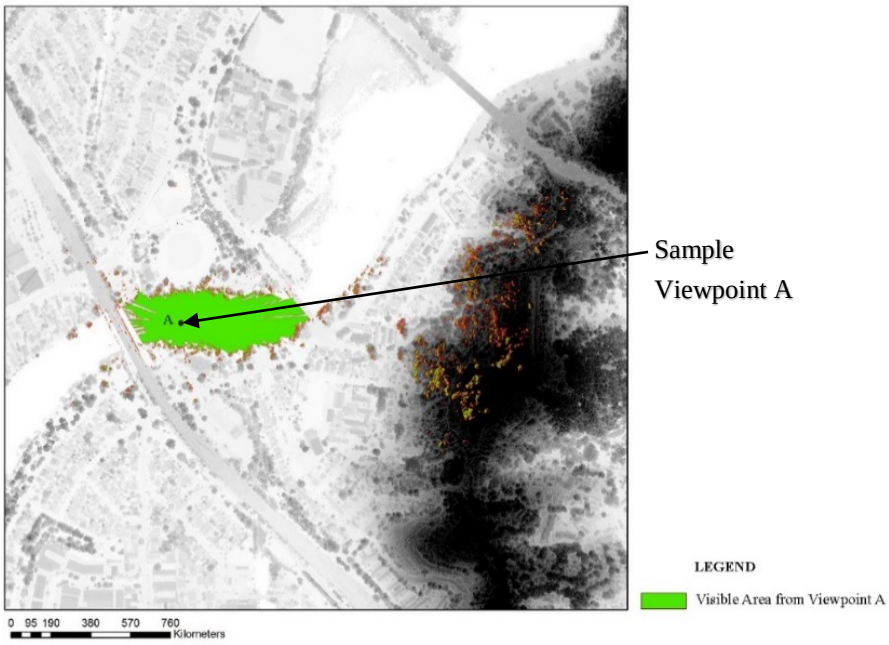


Figure 6-3. Sample calculated viewshed for viewpoint A

Further functionality developed in GIS software (ESRI Arc GIS Desktop 10.2) makes it possible to model the viewshed in three dimensions (3D). This space includes the space between built forms and natural elements and landforms defined by the height of surrounding buildings. This modelling provides more information regarding the visible surfaces of building facades within the viewshed. *Figure 6-4* shows a sample 3D viewshed modelled in GIS within an urban context with natural and built structures. The visible 3D space is defined by the skyline. *Figure 6-4* simply describes the modelled skyline in GIS and shows the visible skyline defined by the top of the surrounding built-forms.

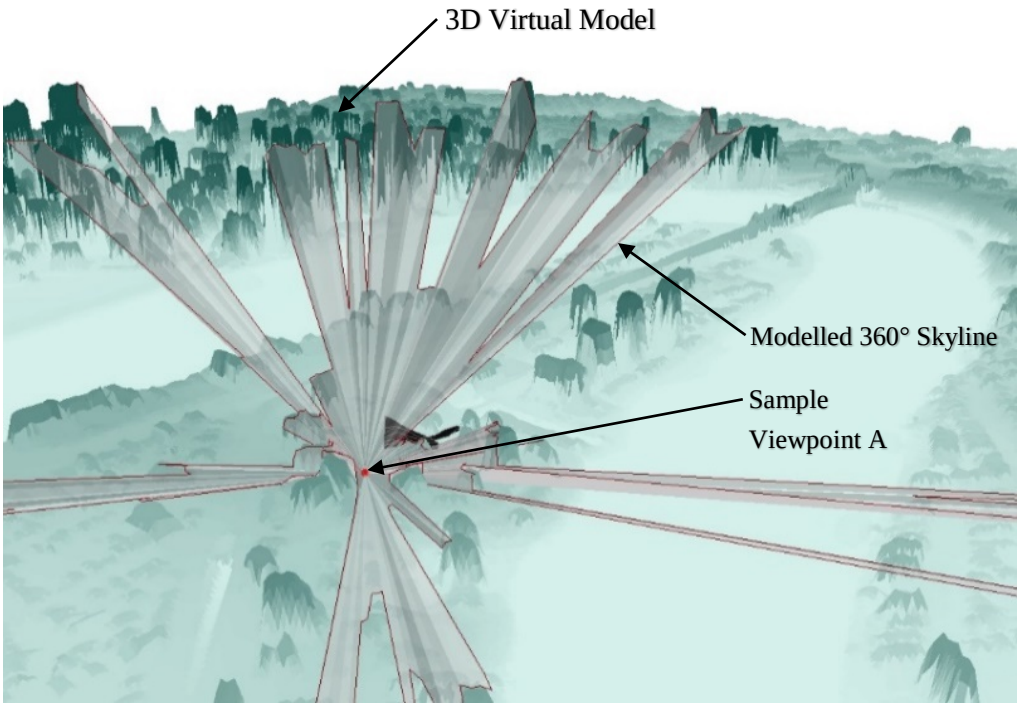


Figure 6-4. Sample Skyline Modelled in GIS

While viewshed and isovist have the same meaning, they have different usages in various fields. According to Weitkamp (2011), isovist is a more common term between architects as visible space defined by only building. Viewshed has larger scale usage and refers to the visibility of features, including terrain height, which is more common among landscape architects and planners. The area from which a structure can be seen is known as the zone of visual influence, which can be referred to as viewshed as well (Weitkamp, 2011).

Quantification of visible space using CAD and GIS can provide valuable input into analysing different aspects of environments to study human perception patterns in more detail (Weitkamp, 2011). Further investigation and quantification of visual space provide an opportunity for this research to assess proposed developments and conflicts with more quantification and certainty. Some of the relevant and new concepts to determine bulk and height of developments have been investigated and reviewed in this study.

Visual openness, visibility ratio and visual dominance are qualities that can be changed by the proposed development in urban environments. These concepts are in fact new concepts related to space syntax theory, which can be quantified by advancements in GIS. Development of these concepts was considered as preliminary steps to quantification of bulk and height of built forms.

The relationships between these concepts and their relationship to syntax theory and bulk and height analysis are described in *Figure 6-5*. The newly developed concepts expand the boundary of syntax theory and contribute to the quantitative analysis of bulk and height issues associated with high-rise development conflicts.

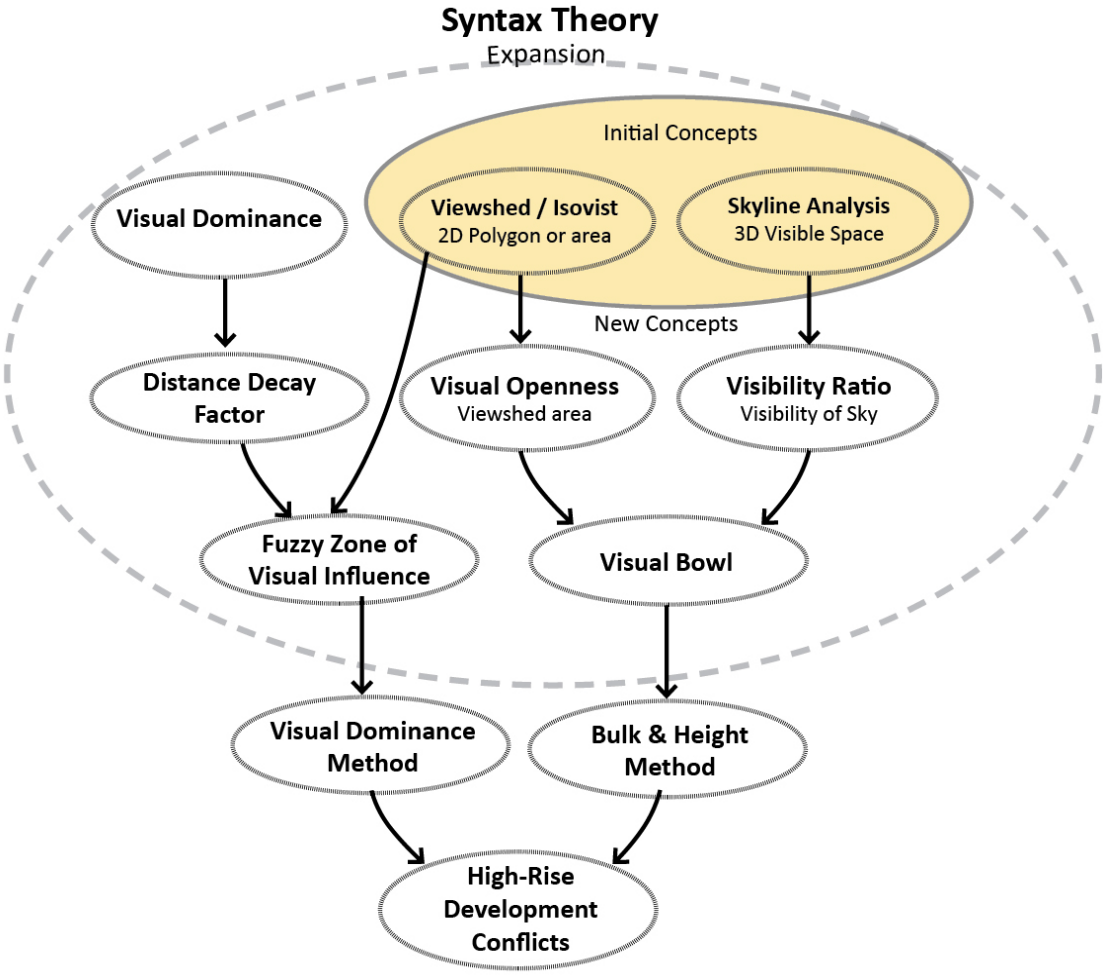


Figure 6-5. New Concepts in Syntax Theory

6.2.4 Visual Openness and Visibility Ratio

Visual openness is an aspect of visible space that is strongly emphasised in visual quality and landscape preference studies (Weitkamp, 2011). Kaplan and Kaplan (1989) identified four predictors of landscape preferences and found openness to be the most powerful predictors of landscape preference. They found that the spatial configuration that generates the most favourable responses involves areas that are open, yet defined. A negative factor was identified for both extreme openness and extreme closure.

Other studies found a positive relationship between openness and preferences (Weitkamp, 2011). Appleton (1975) considered biological, cultural and personal factors as important factors in responding to visual openness. Therefore, visual openness can be considered as a core urban design visual attribute which can be changed by future proposed development.

There is a link between the landscape type, function and activities relevant to perception. In each landscape domain – urban, natural or rural – we have different expectations of openness and closure that makes them distinct from each other. Also, in each domain, observers move through a combination of openness and closures created by visual elements. The various levels of visibility can be analysed and quantified.

There are two types of viewshed modelling in 2D and 3D using skylines, which can describe and quantify two attributes of the visual environment. The first attribute is *visual openness (VO)*. Another variable which can be quantified in 3D is *visibility ratio (VR)*. The visibility ratio is the proportion of sky visible from a location. These two variables can be modelled and calculated for different places within urban environments using GIS.

Varying levels of visual openness and visibility ratio can be described for urban environments (*see Figure 6-6*). A flat landscape has the maximum level of visual openness and visibility ratio (100% visible sky) (Figure *6-6*- Situation A). However, different urban environments might have similar levels of visibility ratio (i.e. 40%) but with various levels of visual openness (*Figure 6-6*-Situations B and C). The ability to accurately determine the visibility ratios and visual openness for any location within 3D space may assist in understanding the human perception of the space.

Therefore, in urban environments, built forms and structures reduce our visibility ratio and visual openness. This effect can be measured and quantified accurately in GIS, which can provide more detailed analysis of the potential visual effects of proposed developments in the existing urban contexts. 3D viewshed defined by skyline could provide a comprehensive analysis of bulk and height of developments. Quantification of these concepts in GIS can provide a more logical and reliable approach to assessing bulk and height of developments.

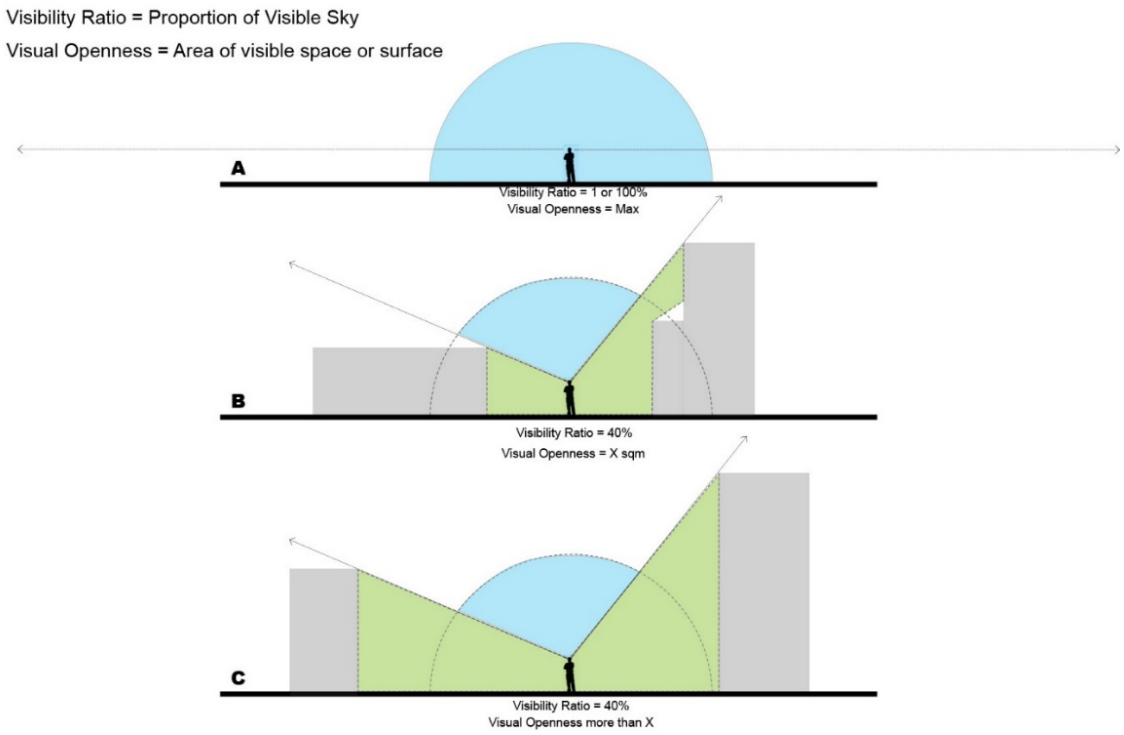


Figure 6-6. Variations of Visual Openness and Visibility Ratio in Urban Environment

6.2.5 **Visual Bowl Concept and Skyline Diagram**

To analyse the bulk and height of proposed developments using these techniques in GIS, the concept of 'visual bowl' was established. The visual bowl was defined as a visible 3D dimensional space around a given viewpoint (360°). In this space, viewers perceive and compare the height a proposed development with the height of the existing developments within this visual bowl (*Figure 6-7*). Therefore, detailed calculations of viewer sightlines to the highest edges of the visual bowl (Skyline) was applied to analyse bulk and height of developments accurately in GIS.

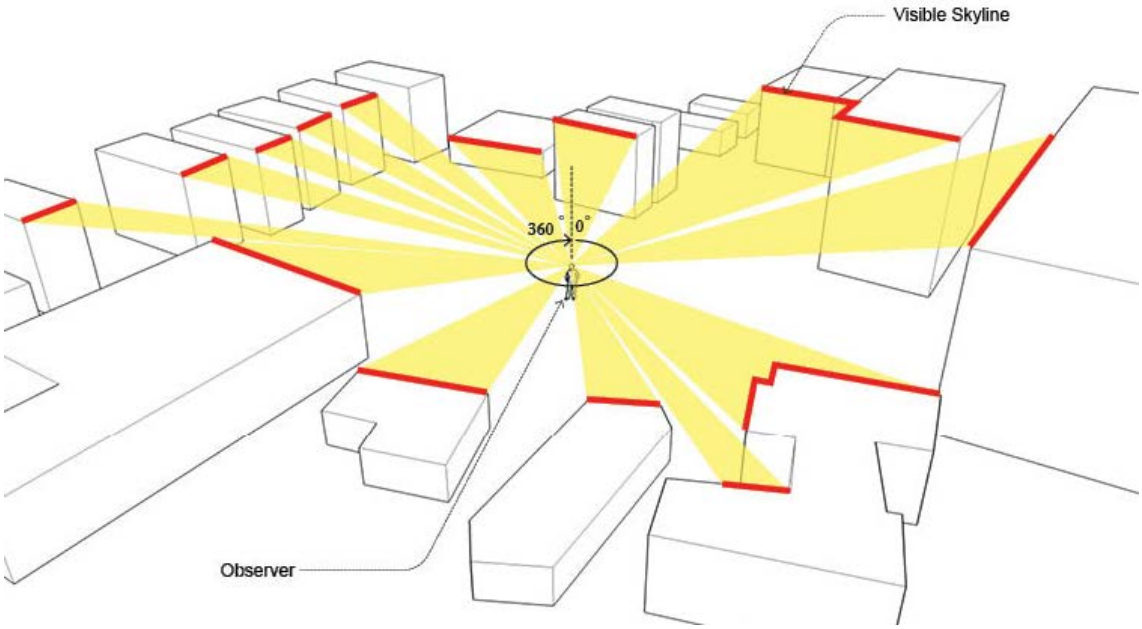


Figure 6-7. Visual Bowl Defined by Skylines Around an Observer

To analysis bulk and height of built forms from a selected viewpoint, after modelling skyline in ArcGIS, zenith, azimuth and elevation angle values were calculated using Skyline Graph function. Azimuth (A) is an angular measurement (degrees) in a sphere-shaped coordinate system. Zenith (z) is the angle between sightline to the skyline and vertical axis from observer point. Elevation angle (h) is the angle between the horizontal line and the viewer sightline to the skyline. These variables are shown in *Figure 6-8*.

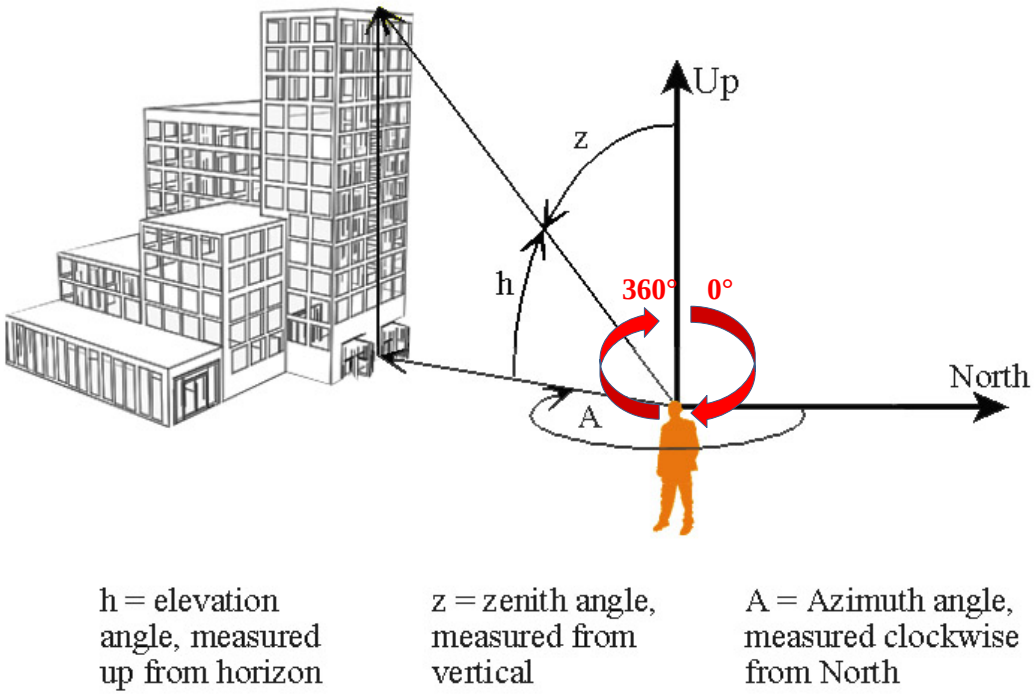


Figure 6-8. Quantifiable Variables in Visual Bowl

After calculation of these variables for selected viewpoints, it became possible to describe values in a 2D silhouette diagram, which is an unwrapped presentation of the visual bowl concept as shown in *Figure 6-9*. This diagram accurately described the projection of horizontal angle or silhouette of the visual bowl as visible from a selected viewpoint. The horizontal bar is 0 to 360 degrees and the vertical dimension the zenith angle. The human eye field of view (FOV), which is 124 degrees (a third of view), is shown in relation to the 360 degrees' diagram.

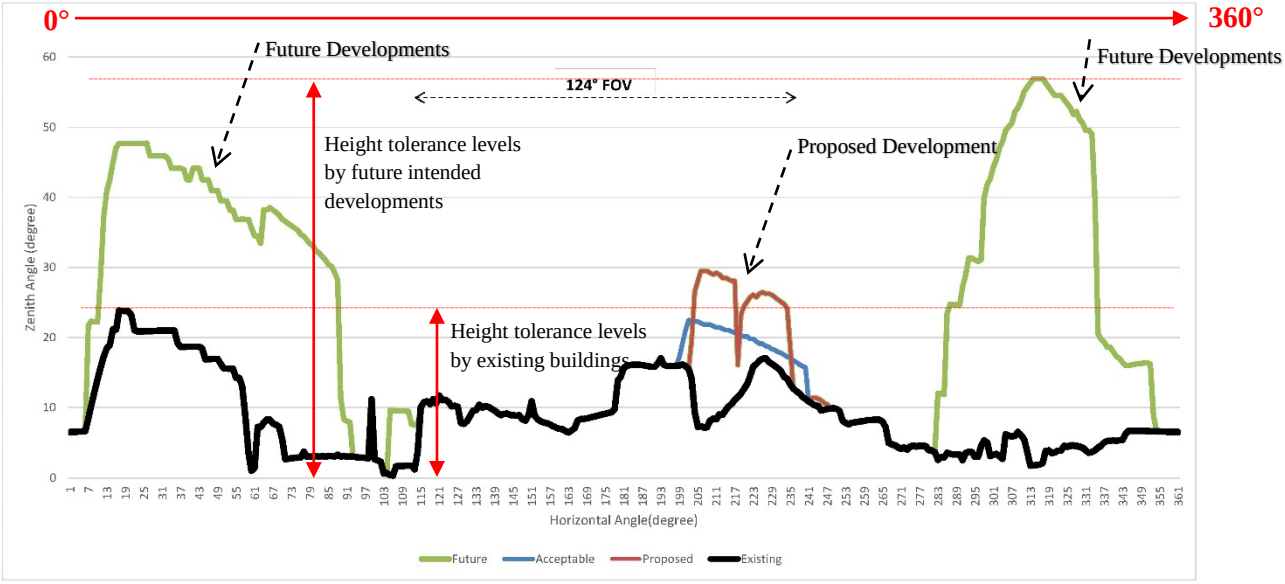


Figure 6-9. Sample 360° Plot of skyline a viewpoint (Unwrapped Skyline)

The concept of the visual bowl was developed to describe the visual environment more accurately. The visual bowl was defined as a 360° visible 3D environment from a viewpoint. The visual bowl is a 3D environment modelled based sightlines from viewpoint to the visible skyline. Skyline is defined as the outline of a building or structure seen against the sky (Chalup, Henderson, Ostwald, & Wiklendt, 2009). *Figure 6-4* shows a sample visual bowl modelling from a sample viewpoint based on Digital Surface Model and skyline. Based on the unwrapped skyline diagram (*Figure 6-9*), a height threshold can be defined based on the highest height of buildings visible in the visual bowl.

The concept of visual bowl improves the assessment of visible bulk and height of a proposed development in the existing environment. While the human eye is limited to a field of view (124 degrees horizontal), we have the ability to look around and scan the whole environment. The human eye compares the height of a proposed development to other visible buildings or structures in its visual bowl. This perception is a dynamic 360° perception of visual space.

Photomontages are widely used in development assessment to show the appearance and true scale of a proposed development in the existing condition. However, it only covers a limited section of human eye field of view and could not be a comprehensive tool to broadly compare and

visualise the height of a proposed development within its context with surrounding built forms. Photomontage cannot represent the perceptual 360 degrees of 3D space.

The perception of visible height and bulk of a proposed development is highly dependent on the viewing distance and the height of the observer. Visual dominance as a concept to describe the overall size of built forms and structures was identified as a relevant factor but is a separate issue in planning and environment court cases, which is discussed in more detail below. While bulk and height analysis, explained above, can describe the visual dominance of built forms' bulk to some extent, visual dominance should be considered as a separate concept in relation to bulk and height analysis.

6.2.6 Concept of Visual Dominance

The visual dominance of high rise buildings and structures is another concern considered in planning schemes. It was also identified as one the conflicting issues in visual amenity court cases in Brisbane. It is another visual quality attribute that may suffer from high-rise and large scale developments in Brisbane.

Dominance is defined as the 'power and influence over others' (Stevenson, 2010). It is also defined as the level of visibility of an element (Rød, 2009). Therefore, visual dominance can be defined as the dominance or power of an object compared to other visual elements visible in that view and could be a comparative analysis. Visual dominance analysis is highly associated with high-rise or medium rise buildings, depending on their context and their bulk and size compared to other visual elements in that locality.

Although high-rise developments or structures are highly visible, the main planning issues are whether they are more or less appealing, more or less dominant or more or less clear (Rød, 2009, p704). While attractiveness is more a qualitative factor than a quantitative factor, this study aims to quantify visual dominance. Clarity assessment has been previously analysed by Fisher (1994), where he developed the term of Fuzzy Viewshed as a degree to which an object can be seen from specific locations, whether it is distinguishable or not.

Perception of visual dominance depends on different factors that result in various methods to quantify it. The simplest fuzzy viewshed is based on distance decay factor while more complex models consider various other factors, including the presence of fog, solar glare, and atmospheric haze (Fisher, 1994). Distance and size of the object are considered as measures of visual dominance as the location of observer changes (Rød, 2009, p704).

Reviewing these factors and their effect on visibility resulted in the development of various methods for the different propuses in visual assessment. More complex models are more suitable for analysing the dominance of an object in its context due to weather conditions, which are further discussed in landscape and forestry fields. As explained in Section 4.4.1, the simple visual dominance quantification based on distance and size of objects is more applicable in planning and

court case resolutions. This issue resulted in excessive arguments related to the bulk and size of proposed developments or loss of view to a particular landmark.

Visual amenity expert witnesses in the assessment of visual bulk and size of developments, consider the viewer distance to the development. They also analyse the size and bulk of development in relation to nearby buildings visible in the locality. Photomontages, cross sections, and elevations are current tools used for assessing visual dominance. However, these methods do not specifically measure the visual dominance from different locations and require the expert witness to make personal interpretations, which may differ from one expert to another.

In planning scheme documents in Brisbane, the notion of visual dominance is considered as an important visual quality factor to the assessment of development applications. Controlling the development bulk, height and location with regards to important landscape elements or landmark structure are measures to consider in proposing and assessing development applications. Kangaroo Point South Neighbourhood Plan (BCC, 2000), discusses visual dominance of the Kangaroo Point cliffs when viewed from Brisbane CBD and limits the development heights to 5 storeys to protect the visual dominance of natural cliffs as visible from the CBD.

Another issue related to the visual dominance in planning policy documents is the consideration of protecting views and sightlines to specific landmarks or natural elements such as river and natural hills. Kangaroo Point Peninsula Neighbourhood Plan code (BCC, 2015), in performance outcome, requires:

> **"***Development close to the river is designed and located to provide view corridors for existing and prospective development further from the river, and vistas for people moving about the local area."*

Protecting views and sightlines were identified as a contentious visual amenity issue associated with high-rise developments. Due to their excessive height and bulk, medium-rise or high-rise developments have the potential to block views to significant elements identified in the relevant planning codes. This could result in planning and environment court cases due to conflict with planning codes appealed by residents against development approval or by developers against refusal of a development application.

According to the review of planning and environment court cases presented in Chapter 4, visual dominance was identified as an issue that lacked a precise measure to describe it in expert assessments. Further quantification of this concept could contribute to the expert evaluation of visual impacts of high-rise developments or other types of developments. As discussed, the simple model of visual dominance is based on distance and decay factors is considered more useful for the purpose of the study, to be developed and applied further later in this paper.

It is necessary to understand and calculate the visual decay factor based on distance and size of an object to accuratly calculate the visual dominance. Distance decay factor means a gradual decrease of the scale of an object through increased distance. An empirical experiment is explained below to calculate the distance decay factor of an object to apply it to an actual court case conflict.

6.2.6.1 Decay Factor

To quantify visual dominance in reality, an empirical work was conducted to calculate the visual dominance decay factor based on two parameters: size of object and distance to the viewer. In this study, a series of photos were captured with 5-meter interval (5m to 65m) from a white canvas in a park. Photos were taken with a 50mm lens, which has a 47-degree horizontal field of view and is similar to the human eye in term of perspective without distortion. However, the human field of view(124° FOV) is much wider than a 50mm lens (See *Figure 6-10*). Also, the human eye captures much higher resolution than does a camera lens. However, for the purpose of the analysis, size reduction was considered more important than image quality decline over distance, and image resolution decay was ignored in visual dominance analysis.

White Canvas (60cm x 45cm) at 5m
50mm Lense

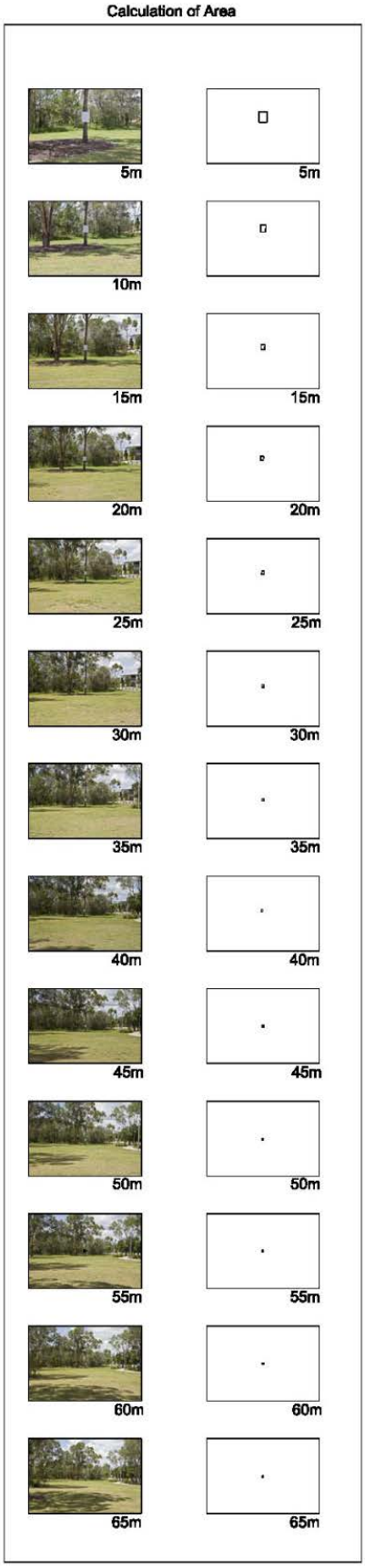


Figure 6-10. Experimental calculation of Visual decay based on distance

The proportion of visible white canvas in each frame was calculated in AutoCAD and included in a spreadsheet developed in Microsoft Excel (Table 6-1). The projected graph showed an exponential relationship decay over distance (*Figure 6-11*). The size of object and viewer distance are, then, important factors to describe and calculation decay factor.

Table 6-1 Calculated Area of Visible Canvas In Various Distances

	Photo	Distance	Area of Canvas	Area of Canvasx2	Area of Canvas x3	Percentage
1	IMG_1946	5	6463.5564	12927.1128	19390.6692	0.9695335%
2	IMG_1947	10	2827.8423	5655.6846	8483.5269	0.4241763%
3	IMG_1948	15	1564.3886	3128.7772	4693.1658	0.2346583%
4	IMG_1949	20	1005.3636	2010.7272	3016.0908	0.1508045%
5	IMG_1950	25	701.246	1402.492	2103.738	0.1051869%
6	IMG_1951	30	513.8964	1027.7928	1541.6892	0.0770845%
7	IMG_1952	35	391.613	783.226	1174.839	0.0587419%
8	IMG_1953	40	308.7324	617.4648	926.1972	0.0463099%
9	IMG_1954	45	252.3568	504.7136	757.0704	0.0378535%
10	IMG_1955	50	207.4466	414.8932	622.3398	0.0311170%
11	IMG_1956	55	172.8813	345.7626	518.6439	0.0259322%
12	IMG_1957	60	147.4263	294.8526	442.2789	0.0221139%
13	IMG_1958	65	126.702	253.404	380.106	0.0190053%

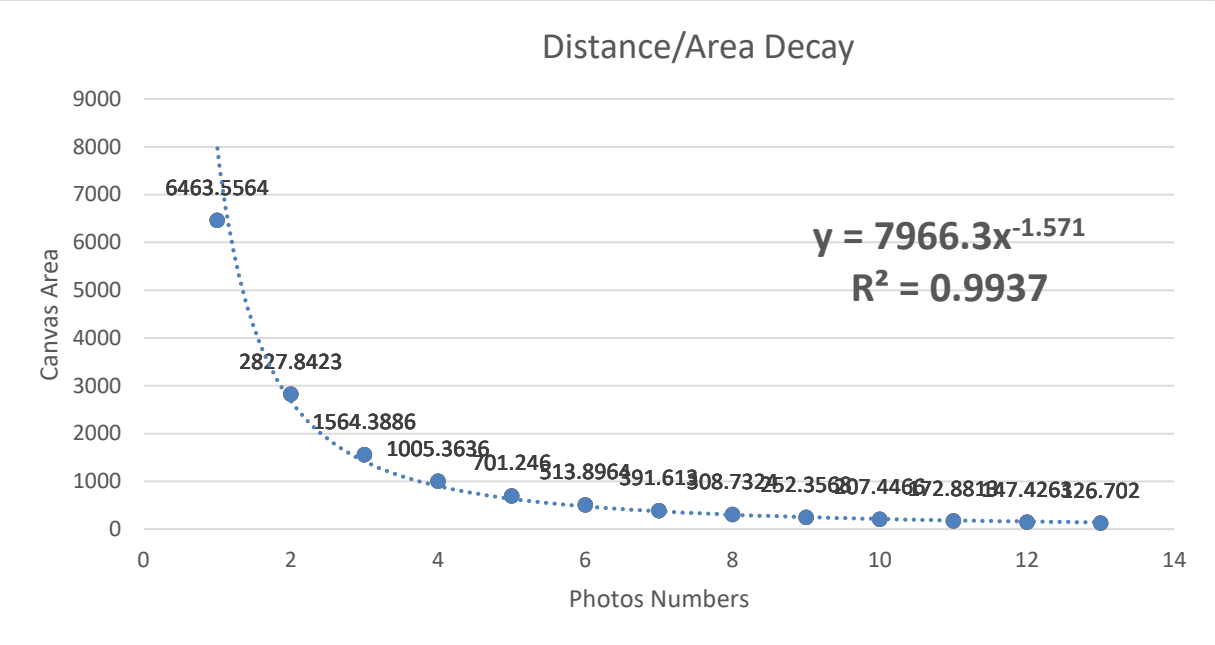


Figure 6-11. Decay factor analysis based on distance and size of object

The proposed method applies to any structure or development, and the same process can be replicated to calculate visual decay factor based on distance and size of the structure. However, this process can be done in a virtual environment and modelling. Similar measurements can calculate the visible structure in each view distance, create the graph and calculate the visual decay factor. This analysis is applied to selected court cases in the next section.

In order to apply the proposed research methods in GIS and key concepts in the assessment of bulk and height, including skyline analysis and visual dominance concept, a surface model was required. This model is a 3D surface model which includes the landform, buildings and other structures.

6.2.7 3D surface modelling for Selected Case Studies

Multi-unit developments were identified as the primary type of development associated with visual amenity issues. According to the spatial analysis conducted in Chapter 4, these developments are focused in the CBD and inner city suburbs. As explained in Section 6.1, two court cases were selected to apply bulk and height and visual dominance analysis. The first case study is a mixed-use development in Woolloongabba (Chalk Hotel redevelopment) and the second case study is a residential tower in Lambert Street, Kangaroo Point, Brisbane. Both cases studies are located in proximity to the Brisbane CBD.

A virtual model of the whole study area (including terrain model and built forms) was created to analyse bulk and height of built forms in GIS. The virtual model was created in GIS from LiDAR data purchased from Department of Natural Resources and Mines (DNRM). The model covers 4 x 4 kilometres including Brisbane CBD and surrounding inner city suburbs.

3D modelling of urban areas is an approximation process due to structural complexity, diversity, and a fine degree of detail (Stal et al., 2012). Development of techniques and tools to create a 3D model of a city started in the 1990s (Haala & Kada, 2010). The most important step in this process, as compared to previous methods, was to develop an even more accurate model of the city that included landform, built forms and vegetation heights. Advancements in remote sensing technology make it possible to produce very precise models of urban environments, including vegetation, built structures, terrain and other elements that limit visibility.

This virtual model created in ArcGIS provided an accurate base (+/- 150mm accuracy for X, Y and Z of points) for bulk and height analysis in the next step. This model was created from LiDAR point cloud data with a point density of average 2.5 points per square meter. The source files were in LAS format, where all points are classified into three separate classes including ground, built form and vegetation.

As shown in *Figure 6-12*, a 3D model (3km x 2km) were developed which covered Brisbane CBD and selected court cases for bulk and height analysis. Bulk and height analysis procedure is explained separately for each court case in more detail in the following sections. For

this investigation, Digital Surface Model (DSM) was modelled based on terrain and built form point classes. Vegetation was excluded from the modelling. This allowed for a more discrete analysis of bulk and height of developments for the case studies.

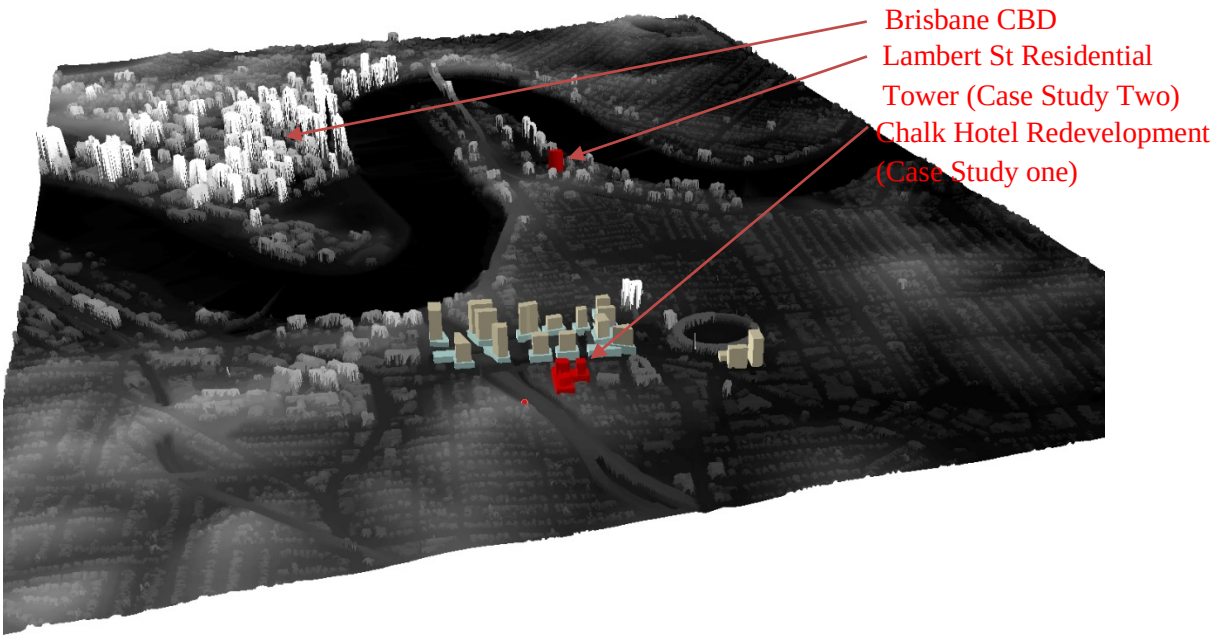


Figure 6-12. Modelled Digital Surface Model (DSM) of Study Area and Selected Case Studies

6.3 EXPERT WITNESS EVALUATIONS OF TECHNIQUES

Similar to the previous chapter, three expert witnesses were interviewed and asked to provide feedback on the two presented methods (bulk and height, visual dominance). The interviewees were three experienced expert witnesses in Queensland who were selected to be interviewed individually. These visual amenity experts were landscape planners and urban designers with different levels of experience – 25, 15 and ten years respectively. They provide technical evidence in Planning and Environment Court on a monthly basis. They were introduced to technical methods developed in this chapter and were asked to evaluate these techniques.

Two separate sections of the interview with the selected expert witnesses were dedicated to receiving the expert's feedback on two developed methods for bulk and height and visual dominance analysis (*Figure 6-13*). Similar interview questions to visual appearance method were asked for interviewees to answer. The first question was to find the level of usefulness of the developed method to analyse visual appearance of a proposed development. The second interview question was to find out how reliable the proposed method was. The last research question was to find the potential of these methods for further improvement and development to become a useable

tool for conflict assessments. They also discussed their broad comments and feedback in more details, and which is set out below.

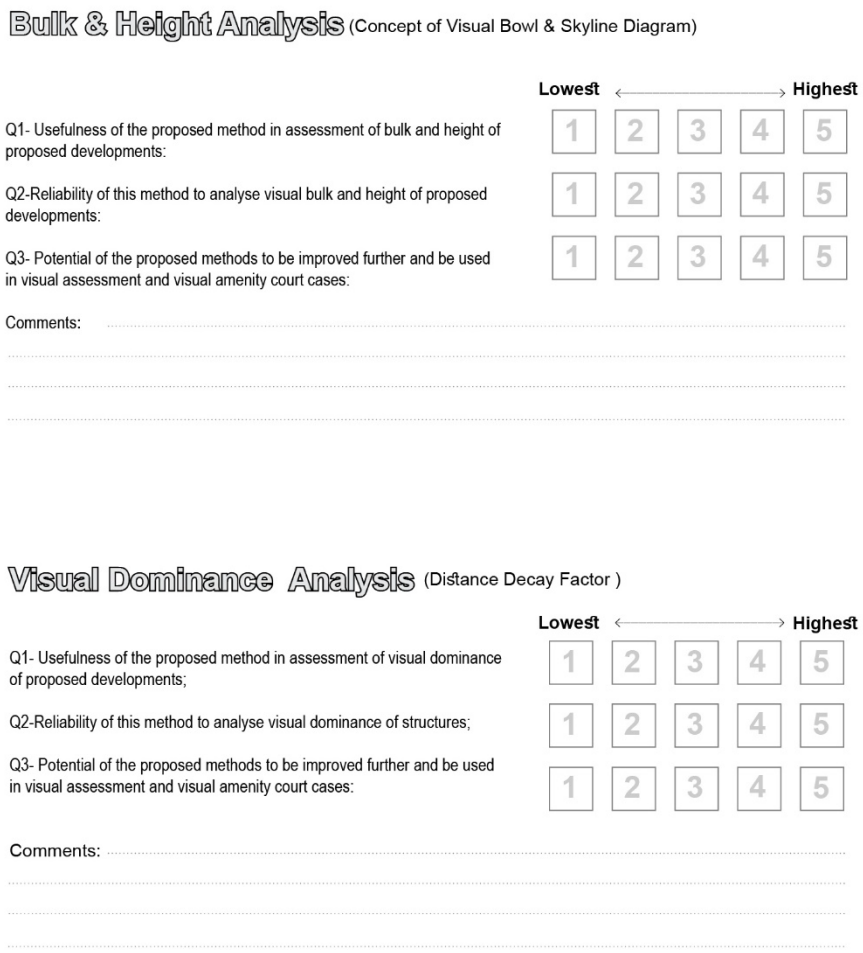


Figure 6-13. Questionnaire to receive interviewee's response regarding visual appearance analysis method developed in this chapter (Refer Appendix C)

After selection of the case studies (Chalk Hotel Redevelopment and Lambert Street Residential Tower), developed methods for bulk and height analysis and visual dominance analysis were applied to each case separately. In advance, bulk and height method was applied to the selected multi-storey development application conflicts. The visual dominance method is explained after the bulk and height analysis, and it only applies to the second case study (Lambert Street Residential Tower) as it was one of the issues of conflict.

6.4 RESULTS

Explained methods and relevant concepts were applied to the selected case studies. This section explains the background information related to each case to clarify issues and concerns related to each court case. Skyline modelling and bulk and height analysis were applied for each case separately. In addition, visual dominance concept and distance decay analysis was applied to only one of these cases. Expert witness consultation feedback is included as part of the results.

6.4.1 Mixed-Use Redevelopment at Woolloongabba

The first selected case study in this chapter is an appeal by a third party against the Council approval for a mixed-use multi-storey development in Woolloongabba, Brisbane. The development application was for a multi-unit Dwelling and Centre Activities (Short Term Accommodation, Hotel, Shop, Office and Restaurant). This development type was categorised as *Residential 1 (multi-unit)* in Chapter 4, identified as the type of development most associated with bulk and height issues.

The development site comprises 17 lots with a combined area of 8,635 m2 between Stanley, Hubert and Reid Streets Woolloongabba (2-20 Reid Street, 735 – 747 Stanley Street and 9 Hubert Street-*Figure 6-14*). It is a long north–south rectangular area of land fronting Reid Street, plus an eastwards extension with a frontage to Hubert Street. The corner of Stanley and Reid Streets is currently occupied by the Chalk Hotel, part of which is a two-storey 19th-century building (formerly the Railway Hotel), listed as a heritage place.

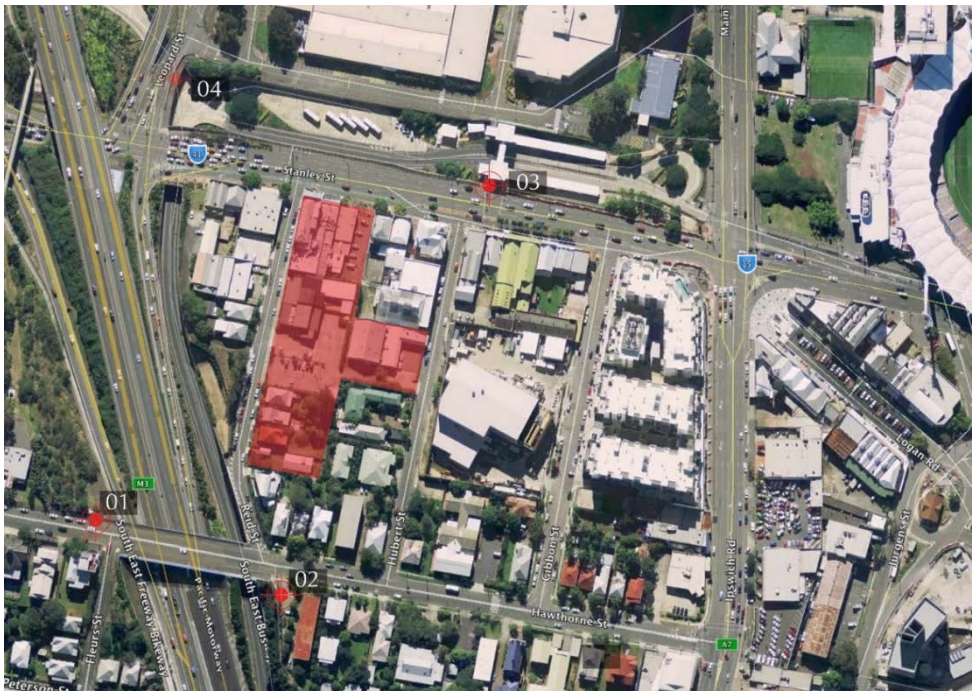


Figure 6-14. Site Location

The proposed development, as shown in Kowalski Architects drawings, retains the existing Chalk Hotel but redevelops the remainder of the site with three multi-level towers: Tower 1 of 20 storeys behind the Chalk Hotel, Tower 2 of 18 storeys fronting Hubert Street and Tower 3 of 12 storeys in the southern corner. The subject land is also within the area of the Woolloongabba Centre Neighbourhood Plan (WCNP), wherein it is shown as part of the 'Ipswich Road and Stanley Street Corridor'. In the Ipswich Road and Stanley Street Corridor, building heights up to 12 and 15 storeys (depending on parcel size) are envisaged by the WCNP, but that other provisions of the WCNP indicate that 6–8 storeys are the maximum acceptable building heights.

As part of the Joint Expert process, several photomontages were prepared by a trusted visualisation company[11] to model the proposed development from agreed selected viewpoints, shown in *Figure 6-14*. All selected viewpoints were selected from vantage viewpoints where the development is highly visible to the public. As one of the main concerns in dispute, and in experts' arguments, was the impact of other approved developments surrounding subject land, another series of photomontages were produced to show the future intended and approved developments surrounding the subject land, as described in *Figure 6-15*. The future development's surrounds, which were included in photomontages to demonstrate how the proposed development would look in the environment. Another option was also prepared to show WCNP height limits for the subject land. These photomontage's variations are shown in Table 6-2.

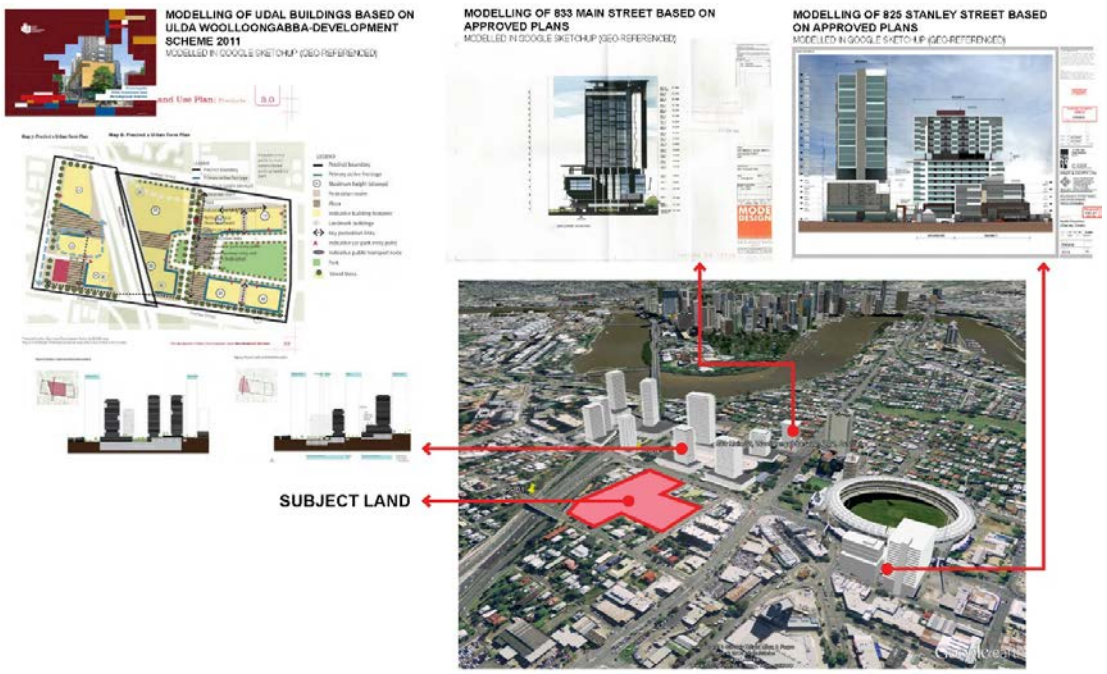


Figure 6-15. Future intended developments surrounding subject land (Source: Cardno, 2012)

[11] Mark Elliott Illustrations.

Table 6-2 Photomontage Modelling (Source: Mark Elliott Illustrations)

Existing Photo	Photomontage showing the proposed development	Photomontage showing WCNP acceptable heights limits (Blue and Red planes)	Photomontage showing the proposed development and other future developments
			
PPO1			
			
PPO2			
			
PPO3			
			
PPO4			

In general, the primary concern of appellants was that the proposed development (with three towers to 12, 18 and 20 storeys) exceeded the building heights and other requirements of the WCNP. It also detracted from the character and amenity of the area, contrary to the reasonable expectations of residents and the intentions of the WCNP. In summary, the visual amenity issues in dispute in this appeal were:

- visual impacts associated with height, bulk and scale; over and above the built form intended for this area and an amalgamated site of this size;
- adequacy of screening and landscape treatment to reduce visual amenity impacts;
- impacts of the proposed development on streetscape/character of the area and nearby heritage buildings and settings;
- impacts on the amenity of adjoining residential properties including adequacy of setbacks, shadow effects and visual impacts;
- the proposed development is contrary to the intention of a higher density “core” plan, with decreasing densities and building heights and bulk stepping away and around the core.Expert witness opinions regarding dispute issues are summarised in Table 6-3.

Table 6-3 Summary of Conflict Issues

Conflict Issues	Appellant's Expert	Correspondent's Expert
Issue A: Visual impacts associated with height, bulk and scale; over and above the built form intended for this area and for an amalgamated site of this size	considers that the WCNP envisages building heights of 8 – 12 storeys/such that 12 storey buildings would be the upper limit of expectations	a parcel of 10,000 m2 or greater could be achieved through site amalgamation in the MP2 zone, within the area bounded by Stanley, Reid, Hubert and Hawthorne Streets, hence building heights to 15 storeys form part of reasonable community expectations/consideration of future approved developments surrounding subject land
Issue B: Adequacy of screening and landscape treatment to reduce visual amenity impacts	**Agreement:** The experts agree that the proposed development does not meet one of the Acceptable solutions regarding deep planting	
	Disagreement: the importance of deep planting and boundary vegetation	
Issue C: Impacts of the proposed development on streetscape / character of the area and nearby heritage buildings and settings.	**Agreement:** character of Woolloongabba is currently very mixed, divided by transport infrastructure, and will undergo significant changes as intended by CityPlan 2000 and State Government initiatives; that the proposed development will be significantly different in height, bulk and scale to the existing built form in this part of Woolloongabba	
	the proposed development will be significantly different in height, bulk and scale to the existing built form in this part of Woolloongabba	the proposed development will not cause changes to the streetscape character of Stanley Street, Hubert Street, Reid Street
Issue D: Impacts on amenity of adjoining residential properties including adequacy of setbacks, shadow effects and visual impacts.	**Agreement:** the setbacks do not meet WCNP Acceptable Solutions	
		The setbacks avoid or adequately minimise visual impacts on neighbouring residential properties
Issue E: The proposed development is contrary to the plan's intention of a higher density "core" with decreasing densities and building heights and bulk stepping away and around the core.		Various buildings of 20 storeys or taller surrounding the 'core' will in effect remove this distinction
Generally	The proposed development (with three towers to 12, 18 and 20 storeys) exceeds the building heights and other requirements of the WCNP, and thereby detracts from the character and amenity of the area, contrary to the reasonable expectations of residents and the intentions of the WCNP	

These issues and arguments were not resolved during the Joint Expert Report (JER) process, and the case was progressed through the hearing process in Court. Similar to the Lambert Street case, the primary concern was the impact of bulk and height of the proposed development on local character and whether it was appropriate or not. After a hearing in P&E Court, the case was dismissed, and the developer was given leave by the council to build the approved application.

As in the previous court cases, photomontages were used in the same way by experts in support of their judgements. Although accurate photomontages are relevant and useful evidence to see visual appearance of the proposed development in its existing context, they are only a visual document that lacks any analytical assessment of the proposed change. Photomontages are similar to still photos in that only a limited proportion of the view is visible, and expert opinions are subjective and differ from one expert to another.

6.4.1.1 Skyline Diagram and Bulk and Height Analysis

In order to reassess bulk and height of the proposed development, the four photo points were selected for photomontage were used for the visual bowl and skyline analysis in GIS. The model presented in *Figure 6-12* was used as the basis for bulk and height analysis for this case study. This model is based on LiDAR data of the existing built urban environment. The proposed development and future buildings were manually added to this base for further assessment. This 3D model included terrain and built forms. Vegetation heights were excluded from LiDAR point cloud data. Skyline modelling was conducted from the same photo points, as nominated in this court case, to compare photomontages with the outputs of this method.

Four variations of the virtual model were considered to model and analyse change in a visual bowl. Skyline analysis was calculated for all four variations separately from selected viewpoints (*Figure 6-17*). These variations included:

- the existing conditions (Figure *6-16*);
- the existing condition and acceptable solution (10 storey building);
- the existing condition and the proposed development (20 storeys) and
- the existing condition of the proposed development and other approved development applications in the vicinity of subject land as the future environment.

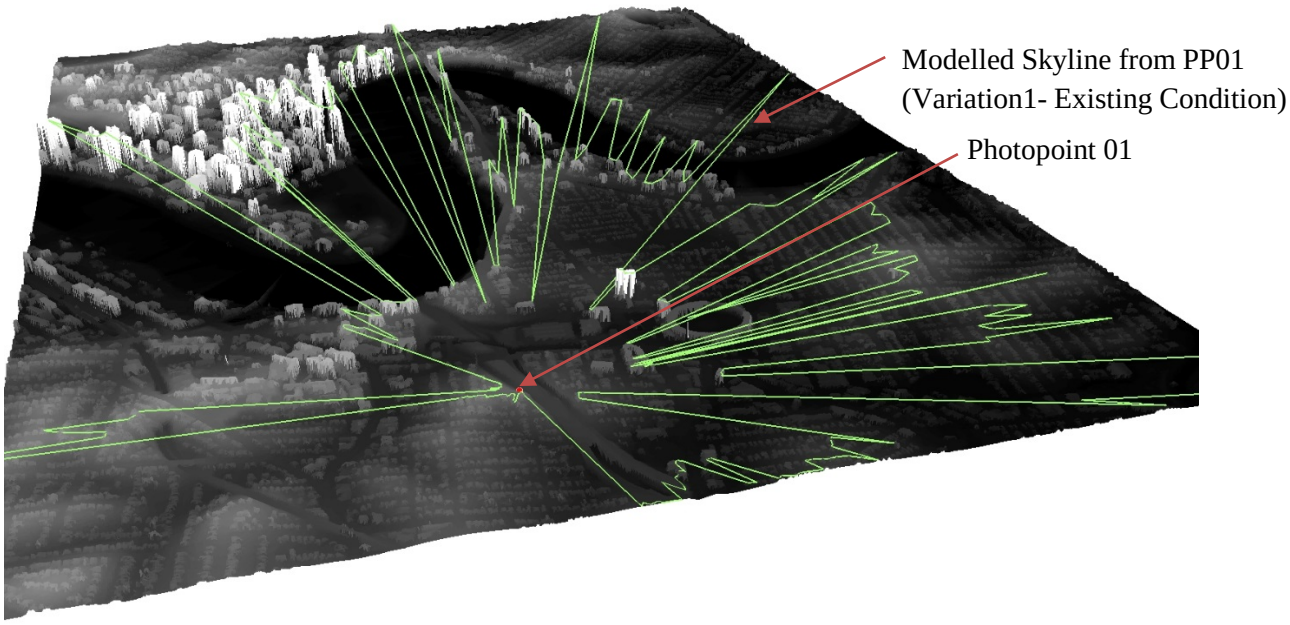


Figure 6-16. Existing Condition with modelled skyline from PP01 (Variation 1)

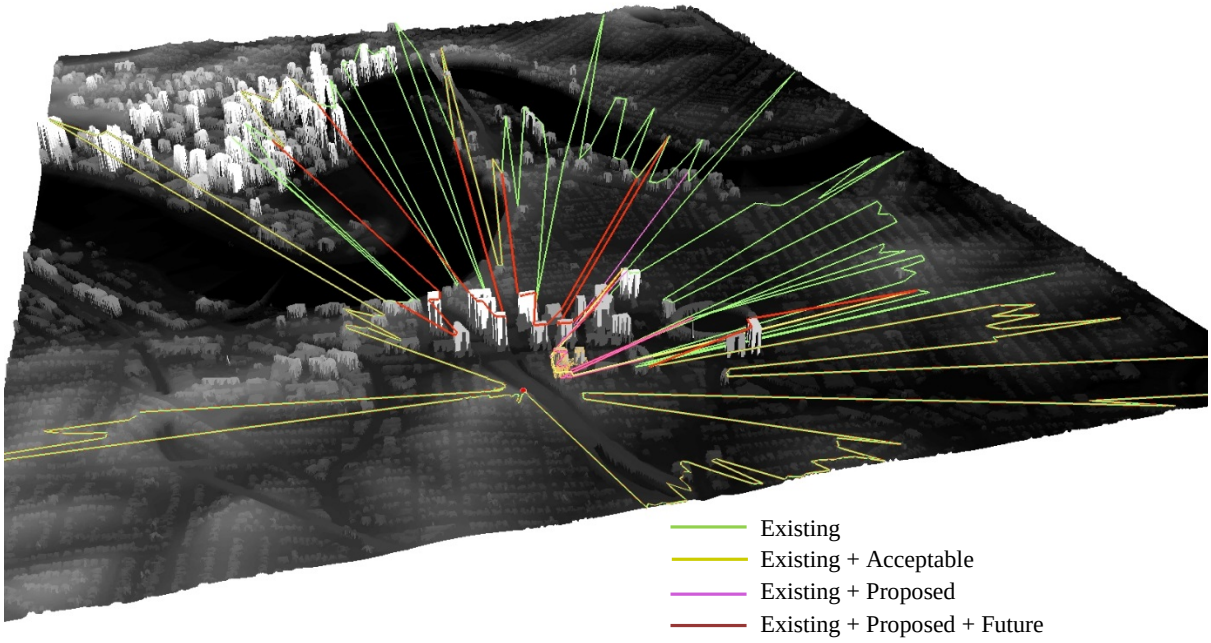
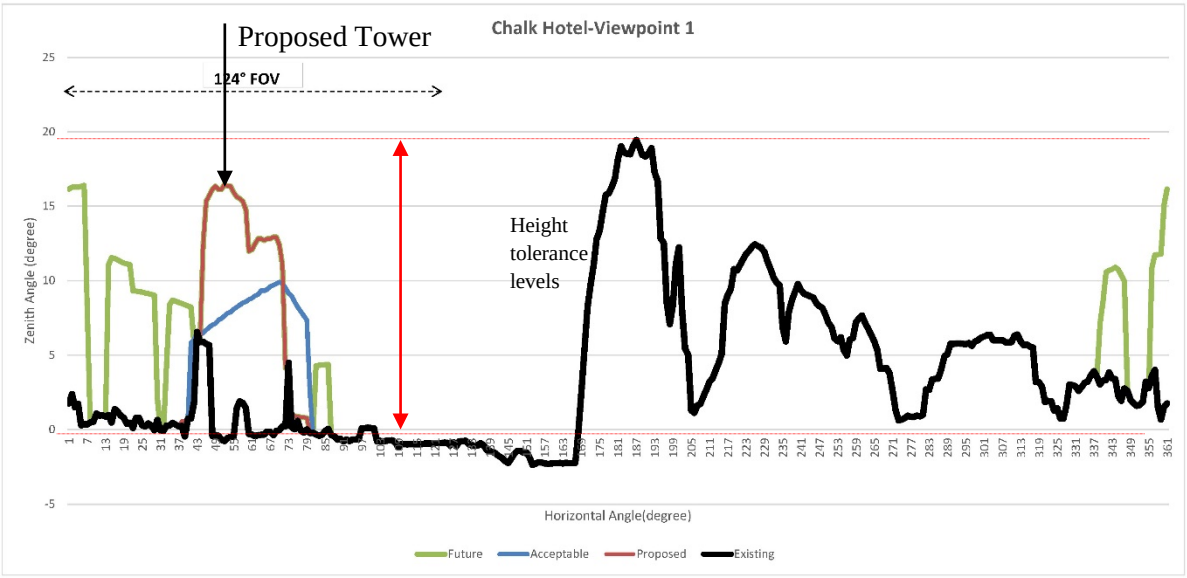


Figure 6-17. Combined Modelled Skylines for Four Variations of Virtual Model

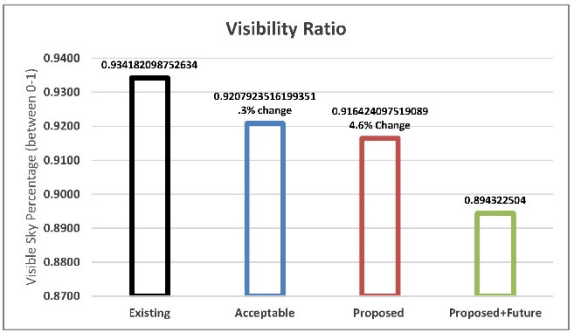
Modelled skylines were described in a 2D graph for all viewpoints. *Figure 6-18* displays the plotted graph based on the modelled skyline from photo point 01 (PP01). Also, a 360° existing photo and photomontage was provided using Google Street View to compare the skyline graph with the real condition. A height tolerance level was defined based on maximum and minimum existing heights (black line) visible from this viewpoint. Visibility ratio levels (level of the visible sky) were also calculated for four variations. The polar array of zenith angle diagram shows the changes in the skyline in 360° around the central viewpoint. Skyline graphs for other viewpoints are presented in Appendix C.

The comparison between skyline graph and photo made it easier to distinguish built forms visible in this visual bowl. However, the skyline graph did not include existing trees, as compared to the photo. In this way, it became possible to describe real perceivable height and bulk of existing built forms with the proposed change, from this viewpoint.



Existing 360° Photo

Proposed and future development 360° Photomontage



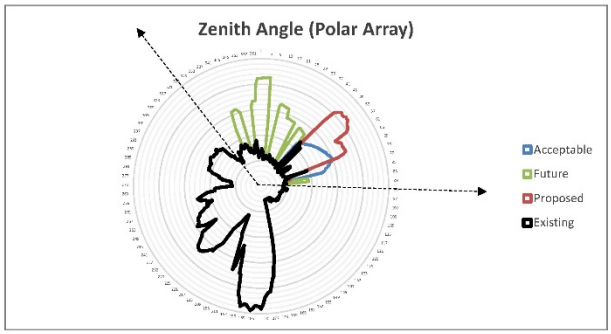


Figure 6-18. Skyline Graph and 360° Photos for PP01

The unwrapped Skyline graph showed that, from this viewpoint, the proposed development was within height tolerance level defined by the existing development in this visual bowl due to considering distance factor to the subject land. In addition to this, other skyline options for an acceptable solution and future options were under this height. As discussed by visual amenity experts, future approved developments will change the visual bowl considerably, and the proposed development will be consistent with the height of future developments within that height limit.

Calculation visibility ratio confirms that the level of the visible sky declines from an average of 93% to 89% in each variation as the height of built forms increase. This is a measure of density as visible from a viewpoint to the surrounding skyline. The zenith angle polar array diagram is also another representation of skyline change from this viewpoint.

The unwrapped 2D diagram of the skyline also describes the visual dominance of visible built forms based on their distance to the observer. As the observer distance increases to a structure, the zenith angle reduces. Based on this diagram, the double-storey houses have a larger bulk and size compared to the proposed 12–15 storey developments at 1km distance.

This modelling was also conducted for three other viewpoints, and resulting diagrams confirmed that the proposed development was within height tolerance levels as extracted from modelled skylines (refer Appendix B). This confirmed and supported respondent evidence with measured evidence that the proposed building height was consistent with the existing character and visual environment. This bulk and height analysis was replicated for another high-rise building to analyse similar visual amenity concerns using skyline analysis.

6.4.2 Multi-Unit Residential Tower at Kangaroo Point

The second court study is a multi-unit high-rise development proposed in Kangaroo Point close to Brisbane CBD. Similar to the previous court cases, this case was classified in Residential 1(multi-unit) in the review of court cases in Chapter 4. The development application was approved by Council, but a community group (Kangaroo Point Residents Association (KPRA)) appealed Council's decision to the Planning and Environment Court.

The subject land is located at 36-48 Lambert Street and 67 Cairns Street, Kangaroo Point, described as Lots 7–9 on RP10940, Lots 108-109 on RP10926 and Lot 1 on RP10931, totalling 3291m2 (See *Figure 6-19*). These five allotments together are currently vacant, with an 83 m western frontage to Lambert Street and a narrow 10m strip (approximately 39 m long) linking to Cairns Street to the north. The landform slopes approximately 10 m from south-east to the north (*Figure 6-20*).

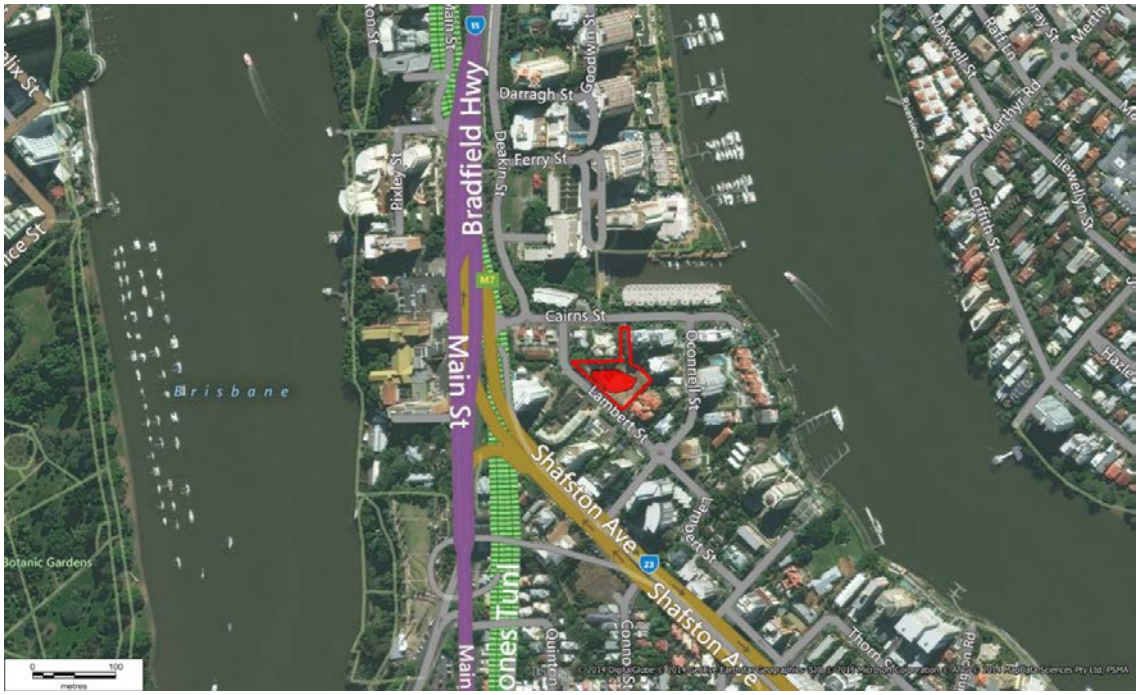


Figure 6-19. Location map showing subject land and the proposed tower footprint

Figure 6-20. Subject land as viewed from Lambert Street, sloping from south to north

The proposed development of "Riverview Towers" comprises 207 units in a 20-storey residential tower and seven residential townhouses (double-storey) fronting Lambert Street, and a rooftop landscaped sky garden. The complex also has 3.5 levels of basement car park, accessed from Cairns Street via a 38m long driveway between existing unit buildings on Cairns Street.

The relevant parts of the City Plan for assessing matters of bulk and scale, streetscape and local character and amenity were the Kangaroo Point Local Plan Code (KPLP Code), the Kangaroo Point Peninsula Local Plan, Residential Design - High-Density Code, City Plan 2000 Strategic

Plan, and Draft New City Plan. The application was impact-assessable because it was categorised as a "generally inappropriate" development in a High-Density Residential area (Chapter 3 of City Plan 2000 s.5.5.3).

The visual amenity issues in dispute in this appeal can be grouped in 7 issues as:

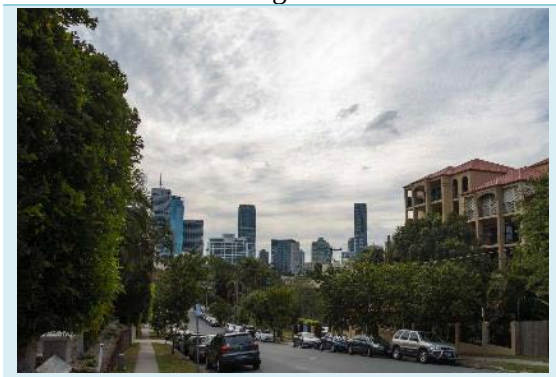
- building height, scale, bulk and form;
- views to and from Story Bridge;
- relationship to the built form skyline;
- integration with existing Residential and Streetscape Character;
- impacts on the amenity of neighbours;
- consistency with community expectations; and
- amenity 'benefits' (grounds for approval) of the development.

During the appeal process, visual amenity experts from two opposite parties prepared their Joint Expert Reports (JER) to justify their arguments and opinions regarding these issues. Before preparation of JER, a court-trusted visualisation company was engaged to prepare accurate photomontages to be used by both parties to support their arguments. These photomontages were used as highly important documents in JER process to show visual appearance of proposed development in the existing context. 9 Photo points were selected with consent of both expert parties (

Figure 6-21). A selection of these photomontages is shown in Table 6-4. All viewpoints were selected from vantage points which are accessible by the public. Only one viewpoint (PP08) was taken from appellant's balcony to show the obstruction of view to Story Bridge superstructure.

Figure 6-21. Photo point locations for photomontage

Table 6-4 Lambert Street Photomontages (Source: Mark Elliott Illustrations)

Existing Photo	Photomontage
	
PP01	
	
PP03	
	
PP07	
	
PP08	

During the JER process, the appellant's expert witness had conflicting opinions in relation to these issues compared to the respondent's and developer's expert witnesses. Almost in all issues, they expressed opposite verdicts in evidence to the P&E Court. Their opposite views and opinions are summarised in Table 6-5.

These issues and arguments were not resolved during JER process, and the case was progressed through to a hearing. Even though there were several issues in this conflict, the primary concern was the impact of bulk and height of the proposed development on local character and whether it was appropriate or not. After hearing this case in P&E Court, the case was dismissed and the developer given leave to start construction.

Similar documents and tools (photomontages and GIS virtual modellings) were used by experts in support of their judgments, but they resulted in different opinions. Although an accurate photomontage is an important and efficient tool to see the appearance of the proposed development in its existing context, they are only visual documents and lack quantitative measurement. The subjectivity involved in the evaluation resulted in conflicting opinions between experts.

Table 6-5 Visual Amenity Issues and Expert Arguments

Issue	Appellant's Expert Evidence	Respondent's Expert Evidence
ISSUE A: Building height, scale, bulk and form	Kangaroo Point Peninsula comprises precincts and areas with different character	there is little difference in streetscape character between an area dominated by buildings of 7 – 12 storeys and one dominated by buildings of 15 – 23 storeys
	proposed development creates excessive differences in size and bulk, that the height difference relative to other buildings in Lambert Street is excessive, and that it will have an overbearing presence due to excessive width and height.	Contrasts of scale and age between adjacent properties are in fact part of the character of Kangaroo Point generally, and are common in the O'Connell Street – Lambert Street – Cairns Street area
	lack of street setback and its streetfront 'town homes' , which he regards as " …ineffectual in reducing its overwhelming effect on the streetscape"	the town homes with minimal street setback 'humanise' the development's interface with the public street. Development will have only minor and acceptable impacts on streetscape and 'ground level' perceptions of character
		the proposed development will have a similar scale and bulk to the approved 'Dockside Gardens Towers' development at Ferry Street,
ISSUE B: Views to and from Story Bridge	the impact of the proposed development on views to and from the Story Bridge for residents in the north-facing residential units of the 9-storey 'Riviera Gardens' and the 10 storey 'Story Apartments'	view to the Story Bridge from this part of the Kangaroo Point Peninsula is a minor view.Views to the Story Bridge from these residential units are at distance of approximately 1.1 km and the bridge forms only a minor proportion of these views
ISSUE C: Relationship to the built form skyline	concerns about the proposed tower complying with the skyline envelope	the proposed development will suitably relate to the skyline of existing high density built form within Kangaroo Point and also the approved 20 storey 'Dockside Gardens Towers' development.
ISSUE D: Integration with existing Residential and Streetscape Character	whether the proposal addresses the street and satisfies the Intent for High Density Residential Areas	podium and tower development will provide a similar building typology to the nearby 'Dockside Gardens Towers' development which will comprise two towers located on a mixed use podium, but with a better relationship to the streetscape
ISSUE E: Impacts on amenity of neighbours;	Adverse amenity impacts	Do not consider that the development will be overbearing on the amenity of either the existing street nor the few residential buildings nearby
ISSUE F: Consistency with Community Expectations	the proposal is not consistent with community expectations	reasonable expectations are for high density urban form in Kangaroo Point, consistent with its proximity to the city and the number of existing tall buildings exceeding 10 storeys

These opposing arguments highlight the inefficiencies of the existing approach and lack of agreement on methods and procedures to assess bulk and height with more objectivity and reliability between visual amenity experts. Therefore, there is a need to determine bulk and height measurement of proposed developments in relation to the existing environment. The measurable method of analysing bulk and height of a proposed development in the existing context is applied to this case to investigate these issues with a more objective approach.

6.4.2.1 Skyline Diagram and Bulk and Height Analysis

In order to reassess bulk and height of the proposed development, nine photo points selected for photomontage were used for the visual bowl and skyline analysis in GIS. *Figure 6-22* shows the 3D GIS model based on LiDAR. This 3D model only included terrain, with built forms and vegetation excluded. This provides a more focused base to analyse building heights. Skyline modelling was conducted from same photo points to compare photomontages with outputs from this method.

In expert witness assessments, experts compared and assessed different options for the proposed development. Similar to the previous case study (Chalk Hotel redevelopment), four variations were considered to model and analyse change in the visual bowl. These variations included:

- Variation 1: The existing conditions;
- Variation 2: The existing condition and acceptable solution (10-storey building);
- Variation 3: The existing condition and the proposed development (20-storeys) and
- Variation 4: The existing condition with proposed development and other developments approved in the vicinity of the subject land as the future environment.

Skyline was calculated for all four variations for each viewpoint (*Figure 6-23*).

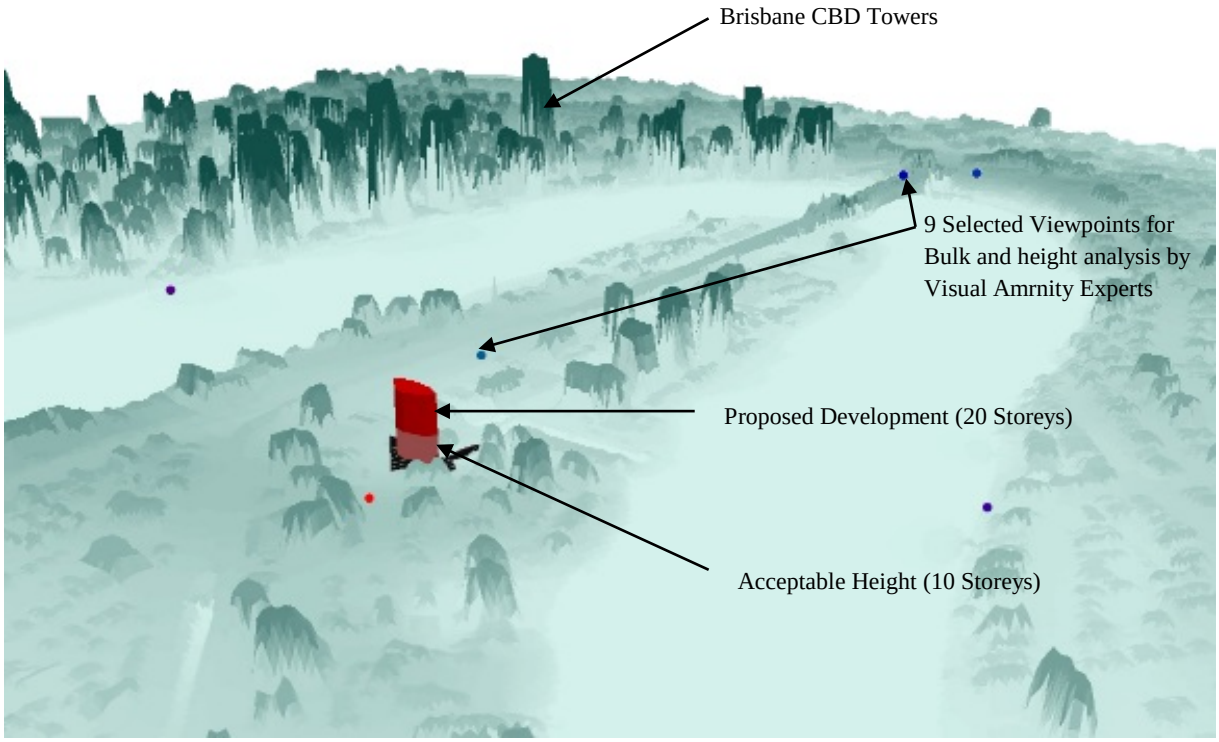


Figure 6-22. 3D GIS Model for Skyline modelling from 9 photo points surrounding subject development (terrain and built forms excluding vegetation heights)

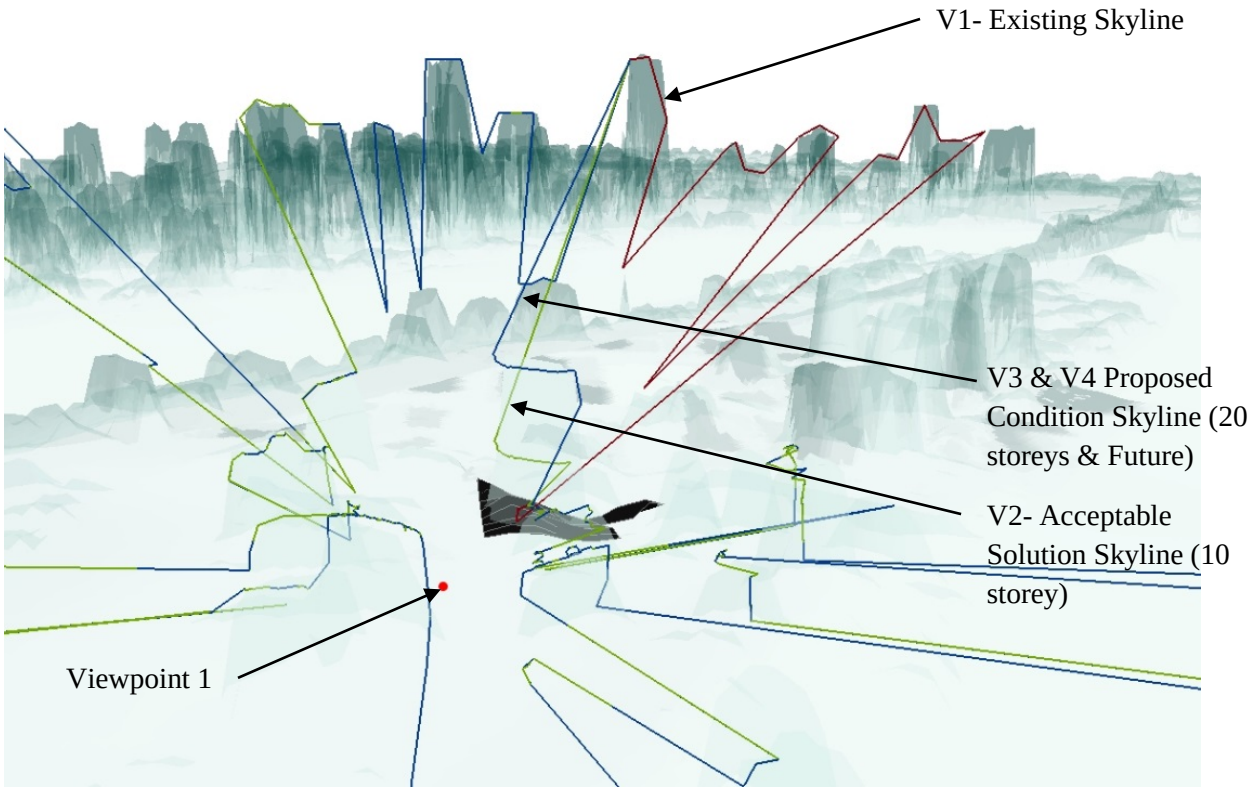


Figure 6-23. Combined 3d Skylines for Four Variations (Variation 3 and 4 are similar in this view)

After modelling the visual bowl and skyline for all viewpoints, the skyline was described in a 2D graph. This diagram accurately described the projection of horizontal angle or silhouette of the visual bowl as visible from a selected viewpoint. *Figure 6-24* shows viewpoint location and modelled skylines in a plan view. *Figure 6-25* shows the modelled skyline from viewpoint 01.

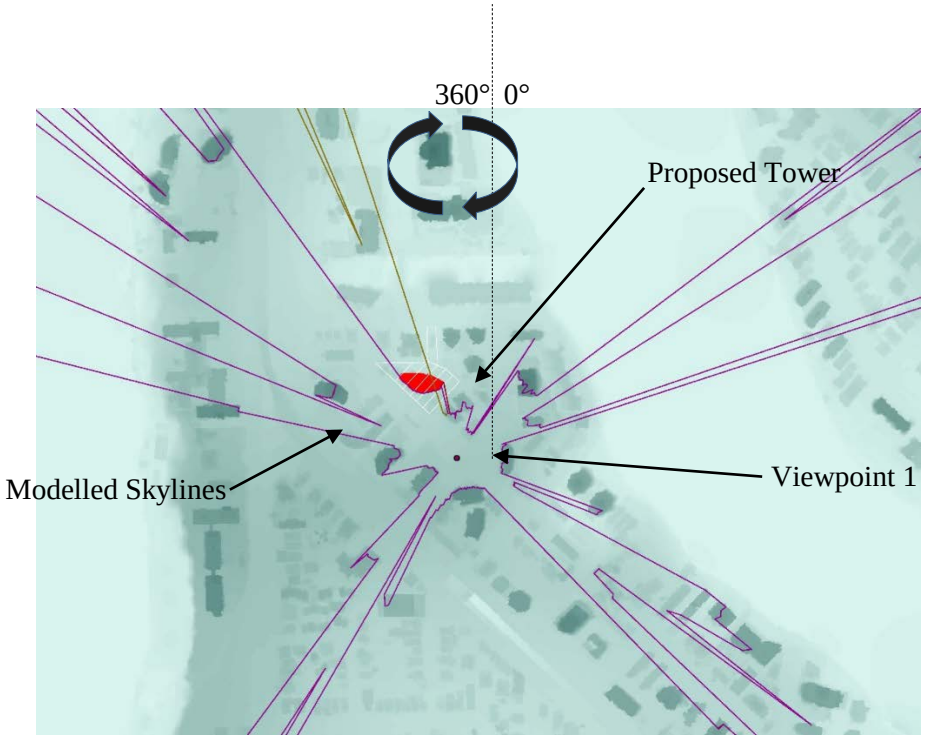


Figure 6-24. Modelled 360° skyline for Photo point 01

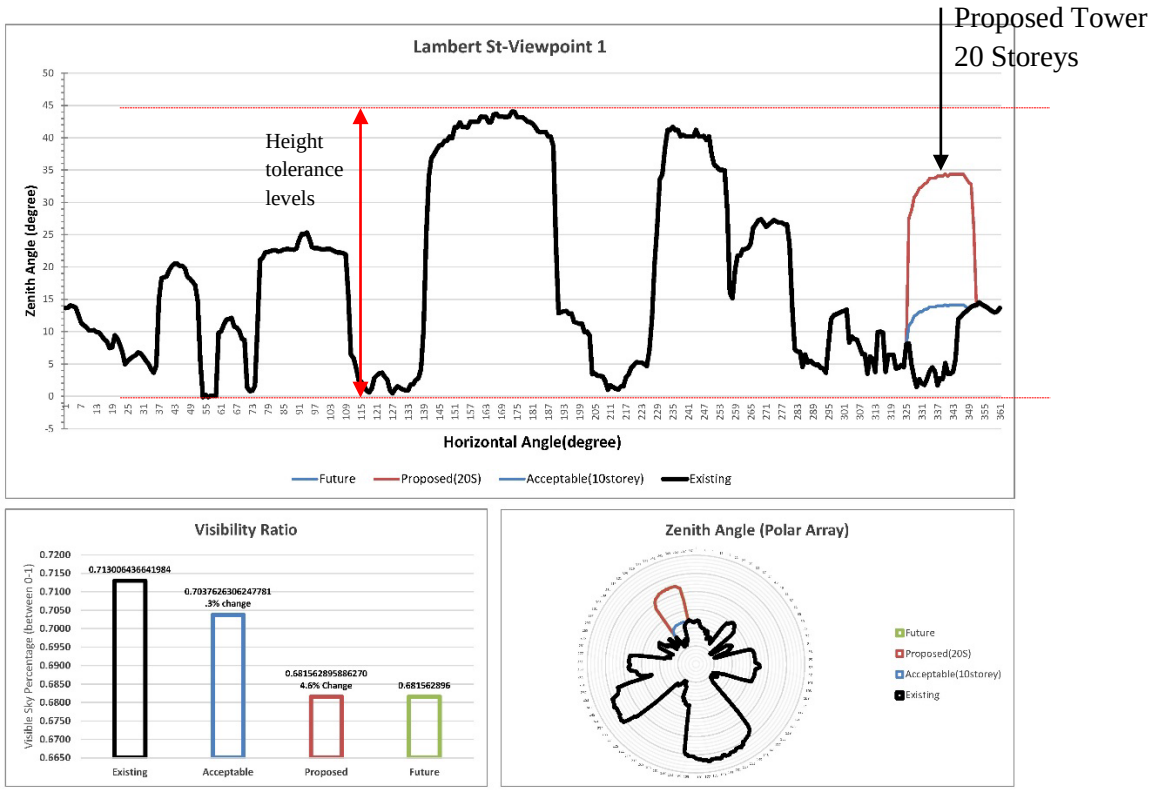


Figure 6-25. Skyline Graph for Photo point 1

The skyline graph showed that from this viewpoint, the proposed development (20-storeys) was within height tolerance level defined by the existing development in this visual bowl. However, the skyline diagram confirmed that visual ratio would decrease due to the addition of this tower. From this viewpoint, it could be concluded that the proposed 20-storey tower was consistent with surrounding high rise threshold.

This modelling was conducted for eight other viewpoints and the resultant diagrams confirmed that the proposed development (20-storeys) was within height tolerance levels extracted from modelled skylines (refer Appendix C for all viewpoints). This analysis confirmed and supported respondent evidence, with more objectivity, that the proposed building height was within the defined height threshold in the local area. Therefore, it was considered consistent with the existing character and visual environment.

The skyline diagram also described the visual dominance of the existing and the proposed built forms based on their distance to the observer. As described in *Figure 6-26*, the proposed 20-storey tower has less bulk compared to existing buildings in this visual bowl. While the skyline diagram displays the dominance of any structure from a viewpoint, it does not provide a quantitative measure, such as the proportion of built form occupying the field of view. Therefore, the empirical work presented in Section 6.2.6.1 to calculate decay factor was applied in this case to analyse visual dominance. This analysis is in response to another issue related to the dominance of the Story Bridge as visible in the locality, the sight of which would be blocked by the proposed development.

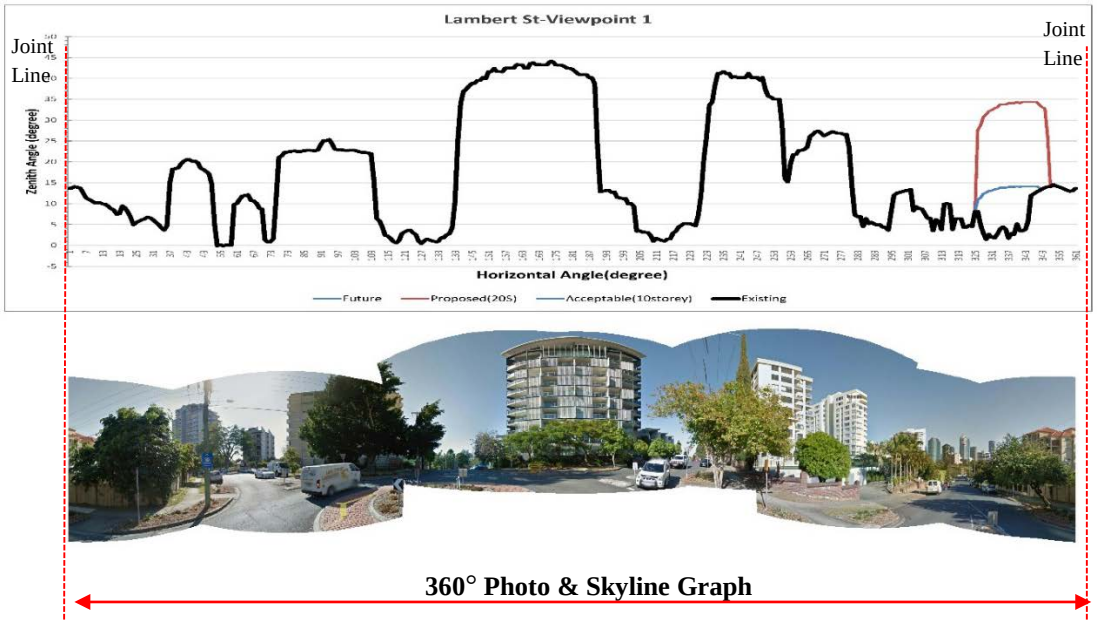


Figure 6-26. Skyline Graph versus Existing Photo

6.4.3 Visual Dominance Analysis

In order to quantify and measure visual dominance of structures and buildings, the Lambert Street Court Case, which was previously used in bulk and height analysis, was selected again for investigation. In the Lambert Street case, one of the issues of conflict was the interruption of views from nearby units to the Story Bridge by the proposed development. Performance Criteria P3 of the Kangaroo Point Local Plan Code (KPLPC) states that it is required "*new buildings must maintain views to and from the Story Bridge*".

In this case, one of the appellants was a resident of Story Apartments, from which the proposed development would obstruct the view to the Story Bridge superstructure. Based on prepared photomontage modellings, the proposed 20-storey tower does not protect views to the Story Bridge from a limited number of units.

Table 6-6 shows the photomontage modelling from selected units. The modelling confirmed that the view to the Story Bridge, which could be protected by an acceptable solution (10-storeys option), would be blocked by the proposed 20 storeys tower.

Table 6-6 Photomontage from Story Apartments Unit (Source: Mark Elliott Illustrations)

Existing Photo from Story Apartments @ Level 8 to Story Bridge	Photomontage showing Acceptable solution option (10 storeys)	Photomontage showing the proposed development (20 storeys)
		

After preparation of photomontages and confirmation of view interruption to the Story Bridge, experts argued about the visual dominance of the Story Bridge from these limited units. Due to the considerable distance from this receptor to the Story Bridge (approximate 2km) and the limited view of the superstructure of the bridge, the co-respondent's expert said that the visible part of Story Bridge was a negligible proportion of the field of view and was not worthy of protection under on Local Plan. This argument became controversial and was published in the local newspaper (*Figure 6-27*).

As mentioned earlier, the visual dominance of an object depends on several parameters, including weather conditions, distance, colour, form, etc. However, the major factor is the distance to the object. In response to the argument between the experts regarding the dominance of the Story Bridge and the proportion of the field of view occupied by this landmark from the receptors viewpoint, the Storey Bridge was selected for analysis to calculate visual dominance and the decay factor.

The Story Bridge is a heritage-listed steel bridge spanning the Brisbane River and carries vehicular, bicycle and pedestrian traffic between the northern and the southern suburbs of Brisbane. The bridge has a high steel superstructure that makes is highly visible even in high-density areas (Kangaroo Point, New Farm and Brisbane CBD) and across the Brisbane River (*Figure 6-28*). The Bridge superstructure has permanent night lighting that makes it highly visible at night.

Local plans for New Farm and Kangaroo Point protect views any view from the public and private locations to the Story Bridge and any development needs to comply with performance criteria. For this reason, any receptor within the zone of visibility of the Story Bridge whose view might be interrupted by a proposed development can object and appeal to the P&E Court regardless of the proportion of visible Bridge. Lack of a visibility threshold in planning regulations has costly consequences for developers and appellants in court. This issue applies to other landmarks or landscape features, like the Brisbane River. Therefore, there is a need to calculate visual

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BRIDGE TOO FAR?

SPOT THE LANDMARK

VIEW: Kangaroo Point resident Katerina Dracopoulos opposes the development. Picture: Peter Wallis

Residents' court fight to save view

MATTHEW KILLORAN

YOU might struggle to spot the Story Bridge in this picture but Kangaroo Point residents are prepared to go to court over losing the glimpse of the landmark.

The Kangaroo Point Residents Association and other residents have lodged a legal challenge against Brisbane City Council's approval of the $120 million, 20-storey Riverview Towers.

The residents argue it will block views of the Story Bridge, ignores planning protocols and sets dangerous precedent for development approvals.

The proposed building will be twice as high as the city plan's recommended 10-storey height limit for the suburb but the council said there was precedent for 20-storey buildings there.

The 221-unit development at Lambert and Cairns streets was proposed by David Devine's Metro Property Development. It received 160 objections during public consultation.

"It's Brisbane City Council blatantly refusing to stick to its own plan," Kangaroo Point resident Karen Williams said. "This could happen anywhere in the city ... we don't want to be the guinea pigs."

Kangaroo Point resident and architect Katerina Dracopoulos said the height of the building meant she would lose sight of the Story Bridge and the city skyline.

"I will be looking at a glass wall, 30m from my face," she said. "People don't buy in Kangaroo Point because they want to live across the road from 200 units in a bulky glass wall."

Metro Property Development did not return calls yesterday and a BCC spokesman said he could not comment because the matter was before the court.

Figure 6-27. Published article in local newspaper in relation to visual dominance of Story Bridge from Appellant's Balcony (Source: Couriermail.com.au)

dominance and visibility thresholds to regulate this factor in more detail to reduce the number of objections and the inefficiencies in planning policy.

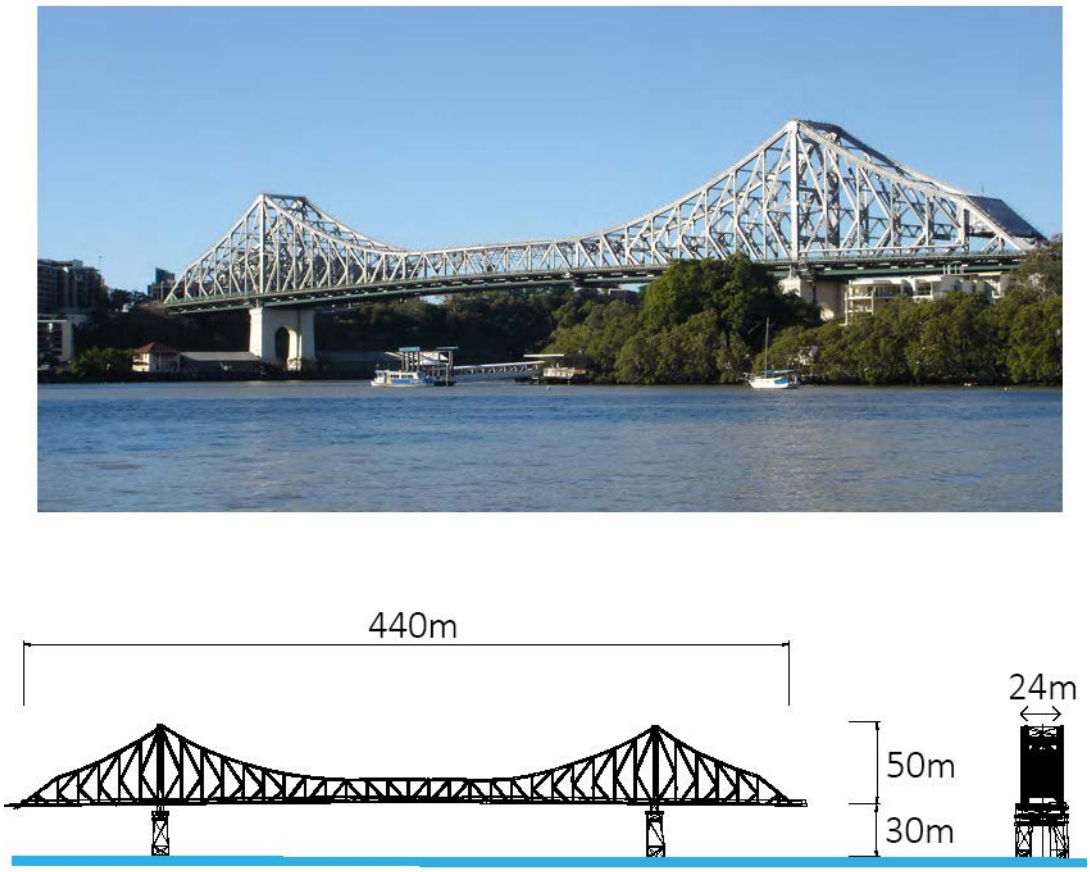
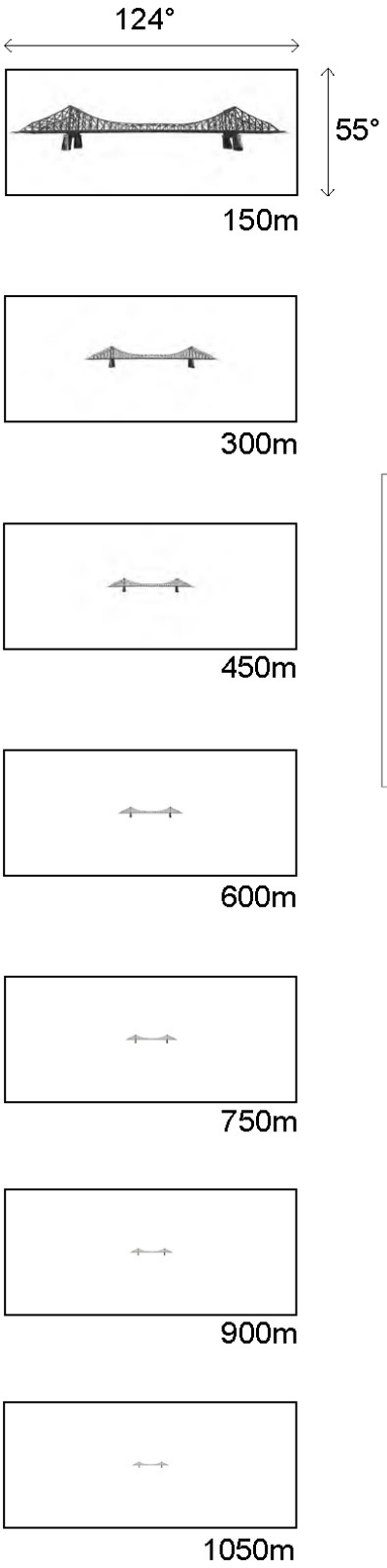


Figure 6-28. Story Bridge views and dimensions

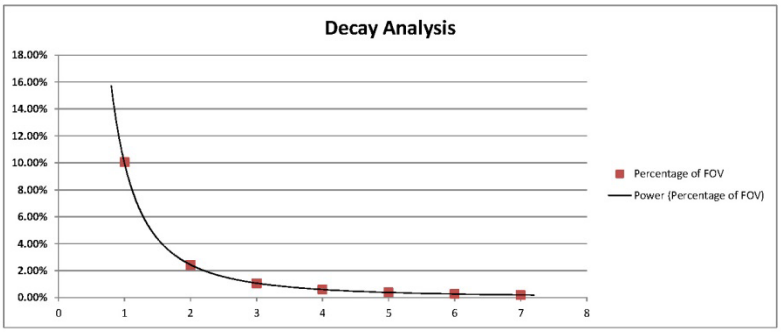
Therefore, distance decay factor was calculated for this landmark to quantify the visual dominance of the Story Bridge. This process was applied based on the empirical method explained in Section 6.2.6.1. However, this calculation was implemented based on a 3D virtual model rather than using the actual structure, due to the limitation of a clear view to the superstructure in reality.

6.4.3.1 Distance Decay Factor

In order to calculate visual dominance based on distance factor, a decay factor was calculated using a virtual model of the bridge in 3D Studio Max. Multiple views, with a wide camera lens similar to human eye FOV (124° X 55 °), were saved with 100m distance intervals from the bridge. The proportion of the Story Bridge in view was calculated in AutoCAD for each view. A graph was projected based on a percentage of FOV and distance. The graph confirmed that there was an exponential relationship between size and distance, and decay factor dramatically increases over distance. A final mathematical relationship was formulated with high accuracy, which could describe the decay factor and visual dominance for the Story Bridge (*Figure 6-29*).



Distance	Percentage of FOV
150m	10.06%
300m	2.42%
450m	1.05%
600m	0.60%
750m	0.38%
900m	0.26%
1050m	0.19%



$y = 0.0998x^{-2.035}$

Decay Factor Equation calculated for Story Bridge (x=distance)

Figure 6-29. Calculation of Distance Decay Factor

6.4.3.2 Zone of Visual Influence (ZVI)

After calculation of distance decay factor for the Story Bridge, GIS viewshed analysis was conducted to map Zone of Visual Influence (ZVI) of the bridge. In order to calculate ZVI, 36 visibility points were located on tops of the superstructure, with equal intervals, to check visibility. In addition, a large DSM model (6km X 4km) was created in GIS to cover the CBD and inner city suburbs. *Figure 6-30* and *Figure 6-31* demonstrates the ZVI of the bridge (large scale and zoomed in view). Different colours describe the different number of visible points in Brisbane. Red areas have the maximum visibility to the superstructure, while blue areas have the least.

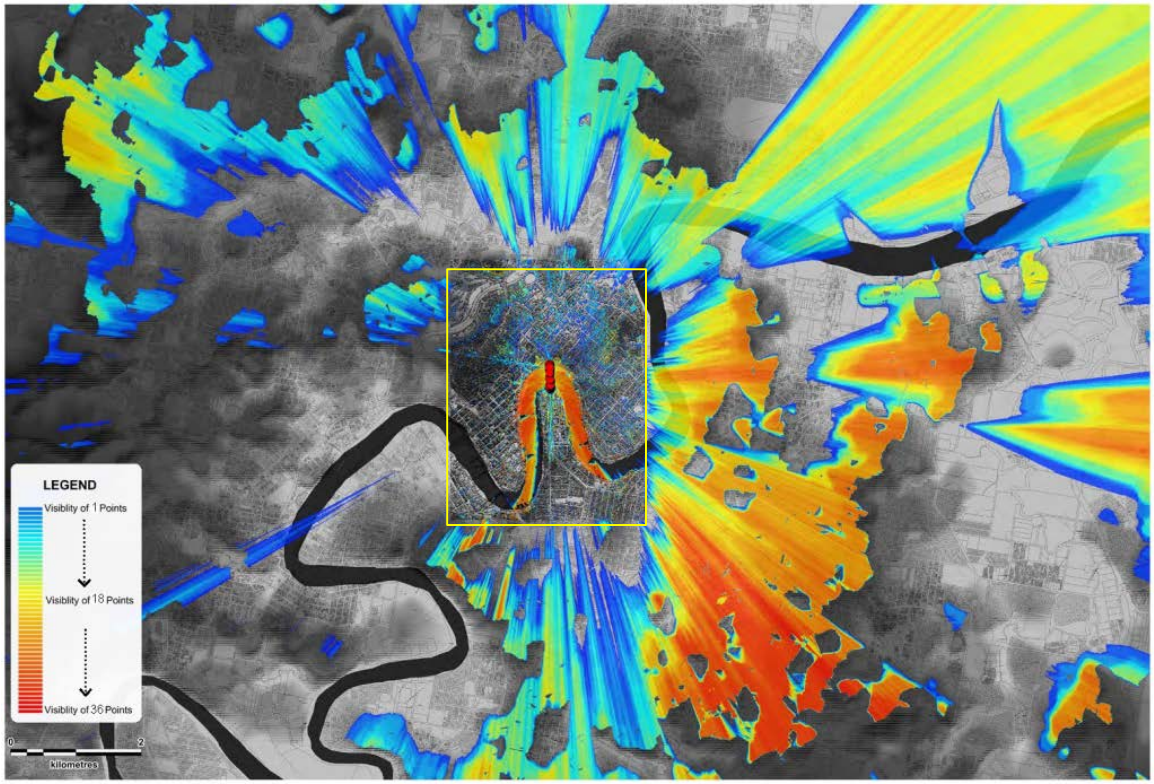


Figure 6-30. Story Bridge Zone of Visual Influence (ZVI)

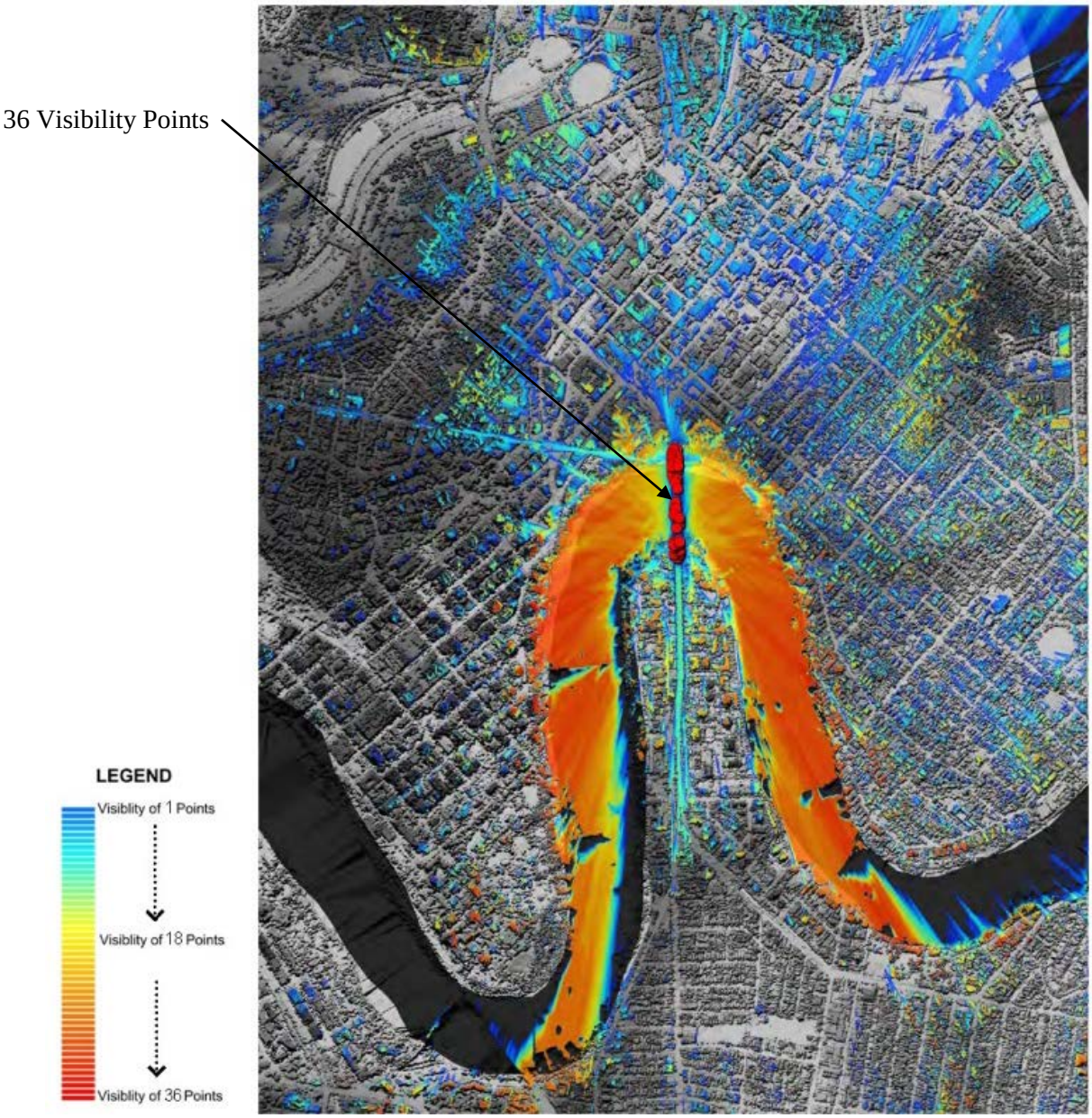


Figure 6-31. Storey Bridge ZVI-Zoomed In View

Although ZVI modelling demonstrates the visibility of the Story Bridge superstructure within the city environment, it does not describe the visual dominance of the superstructure within the visible areas. As *Figure 6-31* indicates, the superstructure is highly visible from the river and developments along the river edge. However, all of these areas are shown as one value, which means they have the same level of visibility, but this does not take into account the dominance of the superstructure. By application of the decay factor calculated in Section 6.4.3.1, a fuzzy model of ZVI was modelled that described the visual dominance in addition to the visibility of the Story Bridge by the inclusion of distance decay factor.

6.4.3.3 Fuzzy Zone of Visual Influence

Considering distance visual decay factor (calculated in *Figure 29*) in ZVI modelling results in the production of a more sophisticated ZVI or fuzzy ZVI map. This modelling includes the percentage of the visible bridge to FOV, in addition to the visibility of the superstructure. Fuzzy ZVI became possible by applying a mathematical formula developed in Section 6.5.1. *Figure 6-32* and *Figure 6-33* display fuzzy ZVIs, and different colours depict visibility and the percentage of the bridge that occupies the FOV.

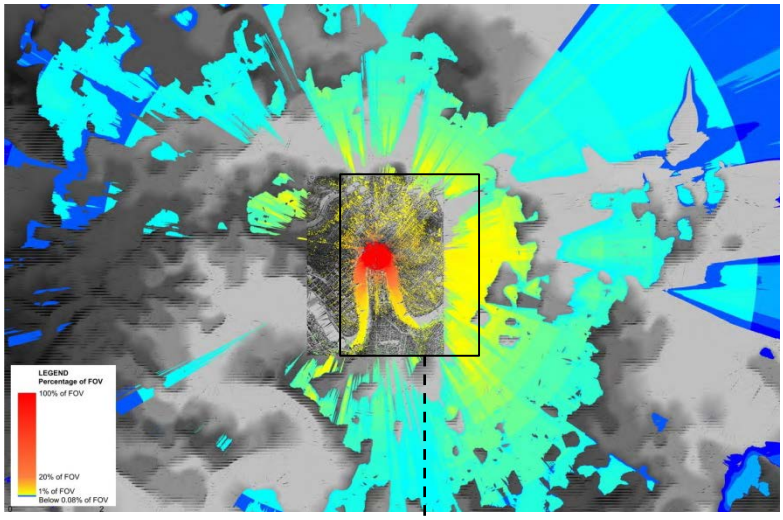


Figure 6-32. Fuzzy ZVI (including distance decay factor)

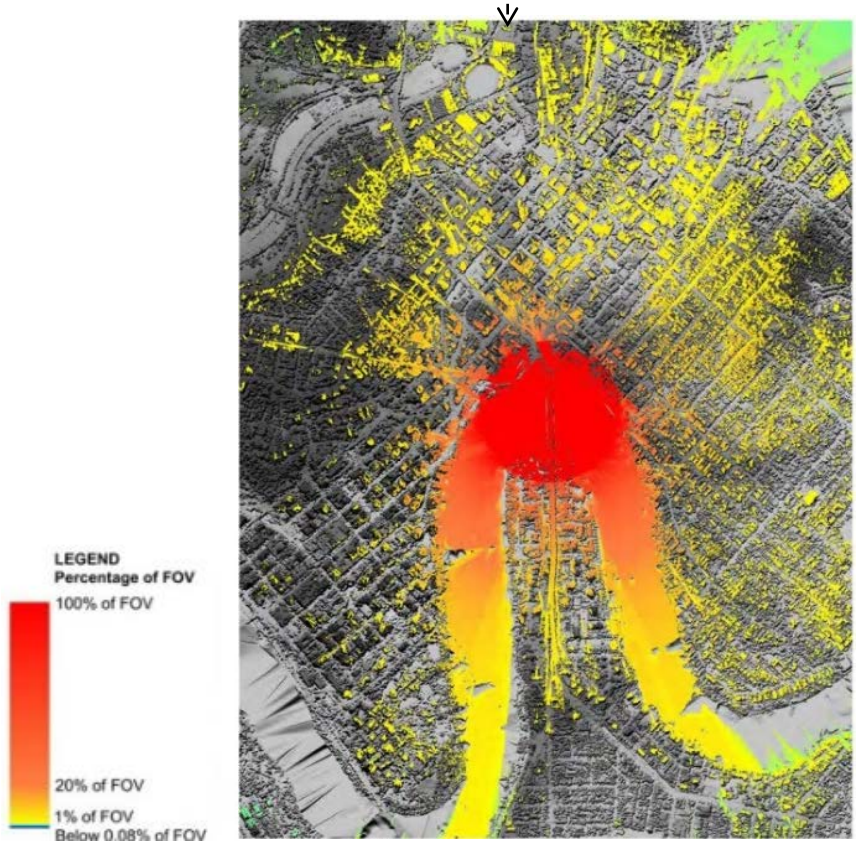


Figure 6-33. Fuzzy ZVI (including distance decay factor) Zoomed In View

6.4.3.4 Zone of View Protection

After modelling of ZVI, including distance decay factor, it became possible to identify different levels of Story Bridge visual dominance in Brisbane. Based on fuzzy ZVI mapping, visual dominance dropped considerably to less than 5% from 1.5 km distance and over. A threshold of 5% of FOV was assumed as a trigger to define a *zone of visual protection* for the Story Bridge. *Figure 6-34* displays a defined zone of protection for Story Bridge. Any private receptors outside this zone would have less than 1% of bridge view and would not be considered as visual receptors in relevant planning codes related to views to Story Bridge.

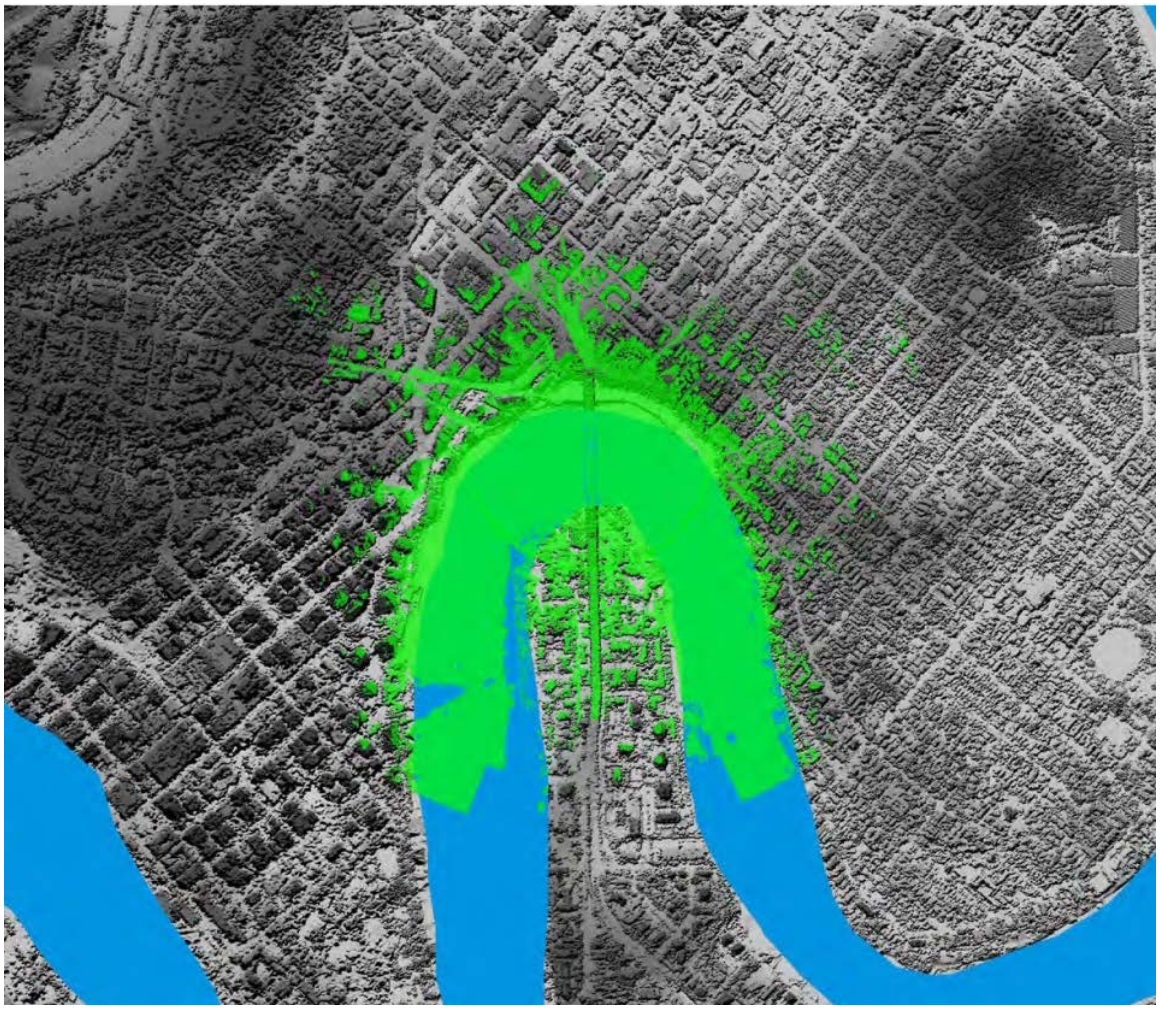


Figure 6-34. Story Bridge Zone of View Protection (Green is the areas with views to Story Bridge and superstructure occupies more than 1% of FOV)

Based on this process a zone of view protection from private residences was defined using GIS and mathematical calculation with regard to the visual dominance of Story Bridge. However, this process is a broad and general method to calculate visual dominance of any structure for any location in the landscape. The visual dominance of any built form or structure can be quantified through this process and estimated for any location within a zone of visibility.

The usefulness and effectiveness of the proposed methods are the next part of this chapter, which is the consultations with selected expert witnesses. A series of interviews was conducted with three selected court experts in Queensland to evaluate research findings in more detail. Moreover, the presented methods are further compared with the previous literature. This provides an overall assessment of the developed methods.

6.4.4 Feasibility of use

All three experts considered visual bulk and height analysis as a useful method to analyse urban environments. However, they believed that this process is too complex to be used for court cases and is more applicable to urban studies and assessments. They found the potential for further research in the approach. Two of the experts pointed out that the reliability of the method is highly reliant on the accuracy of the base GIS data. They rated this tool moderately (score 3) in terms of usefulness and reliability.

All of the interviewees considered the developed visual dominance method and concept as highly valuable and useful for actual court cases and visual impact assessments. Its scientific base to calculate distance decay factor and integration with the GIS were seen as positive points, making it a powerful tool for analysing visual dominance with more quantification and greater certainty. It has the potential to develop dominance thresholds and levels and to define significance and acceptance levels for the proposed developments. Overall, they rated this tool as highly useful and reliable.

Participant Number 1

The first interviewee (introduced in the previous chapter) considered bulk and height analysis as a useful method for assessing development applications. She also considered it as a tool to determine building height thresholds for consideration in planning schemes. Regarding the technical issue, she wondered if this method could be applied to any viewpoint. In general, she rated this method maximum in term of usefulness and reliability with the potential for further development.

In relation to visual dominance, the interviewee considered distance decay quantification as a significant step in quantifying visual dominance of elements in terms of visibility within a field of view. She also mentioned that this method had great potential in landscape and visual assessment studies. This quantification would help landscape architect practitioners for landscape and visual assessments to assess visual impacts more scientifically and with more objectivity. Similarly, she rated this method highly with the potential for improvement.

Participant Number 2

The second participant considered bulk and height analysis to be a useful tool compared to current conventional methods developed by architects and landscape architects. However, she considered that the reliability of this method depended on the quality of the base 3D model being used in 3D visualisations. She mentioned that the LiDAR models were not entirely accurate and were only moderately reliable, and they needed to be field checked and confirmed to increase quality. She also considered that this method had great potential to be used for court cases and public consultation and photomontages.

In relation to visual dominance, she rated this method as a highly useful tool in the assessment of visual dominance of high-rise developments. The scientific method to calculate distance factors was scored 5. She considered that this method had moderate potential to be improved further by developing thresholds and ratings for acceptable levels of the visual dominance of high rise developments.

Participant Number 3

Survey participant number three gave the bulk and height analysis a moderate score (3 out of 5) for usefulness for visual amenity court cases due to its complexity. Although, he considered that the method would be more useful for dense urban areas than for rural and natural landscapes. He considered it reliable and that LiDAR data quality is improving. However, the analysis undertaken in this study ignored the street tree heights in the modelling of skylines. It was explained that tree heights could be included in the model if the analysis was more focused on the tree and building heights in response to the concerns discussed in the court case. He considered that this method needed more work to become more useful for urban assessments, but there was potential to develop some openness score by measuring overall visibility ratio for each street.

In relation to the visual dominance method, the interviewee believed that the proposed method was highly useful for visual impact assessments and visual amenity court cases. He considered it to be a reliable method and could be improved by more accurate GIS data. He also considered that this method has moderate need for improvement to develop dominance thresholds to find if there is a significant level of dominance. He mentioned that the method should consider power lines and power poles as objects that can have high dominance rather than their size and area being determined in the FOV, which is negligible.

6.5 DISCUSSION

In addition to the visual appearance analysis methods presented and evaluated in the previous chapter, this chapter presented two measurable methods to analyse two visual attributes of urban environments that can be affected by high-rise developments. These concepts were identified in the detailed review of Planning and Environment Court cases. Therefore, in response to the research questions, these concepts were investigated in more detail and two measurable methods were developed to quantify the concepts.

6.5.1 Critique of Bulk and Height Analysis

Assessing the appropriate height and bulk of a proposed development is the most contentious type of conflict in the urban environment. Based on the review of court cases, bulk and height issues were seen to be the most common type of conflict issues in multi-unit residential buildings. Bulk and height analysis was applied to two selected court cases to assess the subject development compared to three other options (acceptable solution, existing and future conditions) using GIS. Recent advances in GIS and survey systems were used to assess visual height and bulk with more objectivity and reliability. The findings strongly supported expert evidence in support of the proposed height.

Visual bulk and height analysis considered viewer location in relation to the surrounding environment. In this method, visible skyline from a specific viewpoint was modelled in GIS based on digital LiDAR model. A skyline graph displayed building relationships and heights visible from that viewpoint. In this assessment, apparent bulk and height of built forms varied depending on the distance to the viewpoint. A height limit threshold was identified by plotting the skyline graph. Any proposed development within that height limit was considered consistent with that viewpoint.

Quantitative assessment of the skyline for different purposes has previously been investigated by several types of research by Stamps (2002), Chalup et al. (2009) and Guney (2012). Stamps and Chalup et al. calculated the fractal dimension of cityscape skylines to measure their complexity. Guney et al. (2012) proposed a development plan by using a geomodel created in GIS. This was the first example identified in the literature that applied skyline extraction and analysis in current GIS functionality. Similar to this research, GIS and a virtual model were used to extract skyline data from selected viewpoints to analyse building heights within each visual bowl. Creating a 360-degree skyline graph to identify height thresholds and height relationships was examined for the first time in this field of research. By developing skyline graphs, it is possible to calculate the fractal dimension of city skylines from different locations with more accuracy, similar to how models by Chalup et al. (2009) and Stamps (2002 & 2003) work but with differences. Therefore, the proposed method offered a new method to analyse building heights as compared to previous literature.

6.5.2 Critique of Visual Dominance Analysis

The third developed concept in this chapter was the visual dominance analysis. The visual dominance of an existing or proposed development or structure is usually discussed in court cases without an accurate calculation of visual dominance to visual receptors. Another contribution of this research was to calculate and quantify the decay factor based on distance from an object. An empirical method was conducted to calculate decay factor and apply it to the zone of visual influence of Story Bridge as a city landmark. The modelling in GIS calculated the zone of visual influence and visual dominance of Story Bridge within urban areas. As a final result, a zone of view protection was defined for Story Bridge from private residences. Any receptor outside this zone might have views of Story Bridge, which is less than of 1% of their view, which is considered minimal by the researcher. However, identifying an accurate threshold for visual dominance requires more experimental research, which was not undertaken in this research.

The decay factor in relation to distance has been previously calculated by other researchers in this field. The concept of "*probabilistic visibility*" was developed by Skov-Petersen and Snizek (2008) in opposition to contemporary GIS and CAD visibility calculations, which were a binary or boolean[12] result (visible or not visible). They considered the effect of landform, distance, viewing angle and vegetation types, and calculated decay factor based on these elements. Preston (2003) estimated that decay factor was related exponentially to distance. Similar to these researchers, physical relationships between visibility and distance was calculated accurately in this research. An exponential relationship was found to exist between the size of an object and its distance. However, decay calculation was integrated into visual dominance and zone of visual influence, and modelled in GIS.

Incorporation of decay factor into visibility analysis provided a useful tool for measuring these values. The proposed method is similar to the Rød (2009) method as a GIS integrated method. However, his calculation of distance decay factor was based on photomontages from a different location, which is different to the proposed method. The proposed method used a 3D virtual model of the subject building to calculate the area of the visible object in the field of view at several distances to calculate the exponential equation for the decay factor and to generalise it for any other location in the landscape.

Measurable methods to calculate visual attributes in the urban environment contributed new approaches to the existing literature and field of knowledge. By confirming previous findings of researchers for each visual attribute, the results of this research propose additional and new methods for calculating and measuring these characteristics.

[12] Having two values

6.5.3 Overall Applicability, Feasibility and Significance of Findings

The developed methods for bulk and height and visual dominance were considered usable because of the transparency of its modelling and the analytical steps taken. They were also considered adaptable to any location and can be replicated depending on the availability of source data. These methods were relevant to physical and tangible aspects of urban environments that can be quantified by advances in GIS. Compared to the visual appearance method presented in the previous chapter, using image processing, the bulk and height analysis and visual dominance have been identified as more useable methods in the assessment of visual amenity court cases. However, the interviewed experts considered bulk and height analysis to be less feasible than that of visual dominance analysis due to its complexity of procedure and vagueness of results for judges in court.

The proposed methods were developed in GIS using functions and techniques to model skylines and view sheds. Interviewed experts appreciated these techniques. Any GIS expert with sufficient knowledge in spatial analysis can perform the same process by following the same steps for each method, depending on the availability of GIS data.

The LiDAR data used in this modelling is available for purchase through the Department of Environment and Resource Management and can be modelled in GIS. The Queensland Government's database covers all of Brisbane city as part of the 2009 South East Queensland LiDAR capture project. It is available in a classified point cloud data and includes ground, non-ground and buildings. This data provided accurate elevation data for use in land planning and developing strategies.

Application of these methods by expert witnesses in their assessment is dependent on time and budget. It requires the employment of a qualified GIS analyst to replicate these methods. The application of new methods in GIS would not be a problem for expert witnesses as they widely use GIS in their current visual assessments. These procedures were considered credible due to their transparency. The developed methods are relevant and acceptable representations of bulk and height and visual dominance in urban environments. As two interviewees mentioned, the input GIS data to create a 3D model, including LiDAR data, is highly relevant to determining the creditability of outputs. Therefore, to achieve the most reliable and accurate result for decision-making purposes, 3D models should be accurate and up to date and reflect a true representation of the GIS data.

According to expert witnesses and the previous literature, validity of bulk and height analysis is highly reliant on the accuracy of GIS data and visual models created in GIS. Assuming that the 3D model is accurate and trustworthy, it can increase the creditability of outputs and results. Rød (2009) also considered the accuracy of GIS data as an important factor in determining creditability.

The identified concepts and developed methods directly address visual amenity conflicts. The proposed bulk and height analysis and visual dominance method were identified as useful tools for providing a more quantitative basis for expert assessments. All interviewed experts agreed that measurable and scientific approaches are very valuable for visual impact assessments, with potential for them to be developed further.

Although the research findings do not provide any threshold or acceptable level for bulk and height or visual dominance, the findings have the potential to improve these levels. These standards have not been developed in previous research in this field. Therefore, further studies could provide more useful information to be integrated into development assessments. Furthermore, the new concepts, such as visual openness, visibility ratio and visual bowl, are related to urban environments and are useful for further analysis of urban character.

Quantification and measurement of bulk, height and visual dominance were considered significant findings for improving evaluations in visual assessments. These concepts are commonly assessed by visual amenity expert using photomontages, which is not a quantifiable method for analysing such issues. Therefore, justification of bulk, height and dominance of development in its setting is mixed with uncertainty and subjectivity. The skyline method and the decay factor analysis provide measurable methods for evaluating these concerns with more certainty. The next chapter provides the conclusion to the presented research and findings.

Chapter 7: Conclusion

This research was based on the review of Planning and Environment Court cases in Brisbane. These conflicts are related to development conflicts between developers, the local council and residents, which results in a costly decision-making process. Complying with current planning regulations, impartial and objective assessment of the impact of developments are the primary objectives of the jurisdiction process in P & E Court. To achieve this, relevant expert witnesses are engaged to provide objective evidence in support or against the proposed development to assist the judgment. Therefore, providing reliable, transparent, repeatable assessments is valuable for appellants and respondents alike to reduce costly delays and worries. In the review of visual amenity conflicts, quantification was considered as a way to increase the certainty of expert evidence and to assist the decision-making process in reducing costly delays and uncertainties.

The aim of this research was to identify measurable concepts for expert witness testimony in visual amenity conflict cases. The Planning and Environment Court cases in Brisbane provided a broad database of development conflicts in Brisbane. The reviewed conflicts presented a broad range of issues and problems that have not previously been given enough attention. Focused on visual amenity disputes, this study identified specific concepts and issues that lacked the required certainty in expert assessments. These inefficiencies highlighted the necessity to develop more objective and repetitive methods to analyse them.

This study employed an abductive research strategy as a way to understand the complexity of P&E Court cases in Brisbane, in Chapter 3. This review developed an extensive database of court cases and classified them into limited groups. Several concepts were identified for further investigation based on the derived statistics and generalisations. This research quantified visual properties of the physical environment by developing technical methods using recent trends in technology in GIS and image processing. This contributed to the measurable analysis of visual amenity. A postpositive paradigm achieved useful findings to assist and facilitate the decision-making process.

7.1 NEW KNOWLEDGE IN DEVELOPMENT CONFLICTS

In Chapter 4, this study reviewed the Planning and Environment Court cases in Brisbane to identify the reasons, diversification, development types, locations and results of these conflicts. The study also sought to find the major visual amenity conflicts and issues and to improve the objectivity of expert assessments in their testimony. Research objectives and questions were investigated in three stages. In the first stage of the study, all Planning and Environments Court judgments during the last 13 years (2000-2012) were reviewed.

A GIS database was developed to analyse the distribution of court cases in Brisbane. Several patterns of conflicts were identified. A classification system was applied to summarise all reviewed court judgments, using a template, and to identify major types of conflicts and issues. Spatial patterns of conflicts identified hotspots for certain types of conflict. Visual amenity conflicts were shown to be focused in high-density, inner-city suburbs and Demolition Control Precinct areas. Four case studies were selected as the result of this analysis, which was located in different parts of the city.

The first part of the research contributed to the identification of visual amenity conflicts and the most contentious issues. As the aim of the study was to increase the certainty of expert assessments in court judgments through quantification, these problems were investigated to identify gaps in the assessments and to develop new repeatable and measurable methods to address them. Three major issues were identified: visual bulk and height, visual appearance and dominance. These visual attributes were highly contested in the reviewed cases and expert assessments were seen to lack certainty and quantification. These concepts were investigated in GIS and image processing to develop methods and to analyse these attributes with more quantification.

Similar studies were done by Rydin et al. (1990), Brothernton (1993), Punter and Bell (2000) in the UK to review planning appeals. However, the review of court cases in Brisbane conducted in this research has not been investigated by other researchers in Australia and is a new study in Queensland. The review of previous development conflicts provided a broad knowledge of the complexities of the conflicts. It also provided a basis for identifying many deficiencies and uncertainties in expert assessments specifically related to visual amenity disputes. These were considered to be new opportunities for investigation by this research to develop quantitative methods to analyse visual properties. Findings of this review guided the research in the next stages.

This research presented a new approach to improving and calibrating visual assessment. Development conflicts provided a source of problems that are frequently repeated in similar cases due to deficiencies and uncertainties of expert evaluations. However, quantification is considered to be supplementary to expert evaluations to increase objectivity and certainty, which is not

currently absolute and 100 per cent accurate and reliable. New knowledge in Quantification of Visual Properties

In Chapter 5, to examine the visual appearance of urban streetscapes, a new technique in image processing was used to analyse digital photos. Quadtree decomposition was used to divide photos, based on their grayscale values, into various block sizes based on a homogeneity threshold. The number of blocks in different sizes was considered as a measure of visual detail of an image. Two other visual properties, fractal dimension as a measure complexity and entropy as a measure of visual diversity, were calculated based on the segmented photos.

Similar to Bovill (1996), Cooper et al. (2008), Stamps (2003) and Tucker (2004), fractal dimension calculated by a box counting method. However, this research applied quadtree decomposition to transform photos. Quadtree decomposition results were used to calculate entropy, which is a new approach compared to Stamps (2003).

The visual appearance method was applied to two selected court cases associated with visual appearance concerns. The first case study was a demolition application for a pre-1946 house in a DCP area. The visual appearance method was used to calculate visual properties of the subject house compared to nearby houses in the street. Results confirmed that the subject house contributed similarly to nearby protected houses in term of visual appearance.

The second case study for visual appearance analysis was a new McDonald's restaurant proposed on vacant land with a different land use. Visual appearance method was applied to quantify the visual change as a result of the development. Before and after conditions were utilised for the analysis, which was limited to viewpoints only. The proposed development increased the level of detail and complexity in the photos. Also, the proposed landscaping raised the level of detail from selected viewpoints.

Further to previous studies conducted by Mandelbrot (1982), Tucker (2004), Batty and Longly (1994), Cooper and Oskrochi, (2008), Perry (2012), this research introduced a new method to analyse visual properties of urban streetscapes. Quadtree decomposition provided a new and useful tool to segment and analysed photos and to measure levels of articulation, diversity and complexity. While this quantification did not confirm whether the development was appropriate or not, it provided a measurable tool to compare the visual appearance of various built forms based on their visual properties. This provided a supplementary analysis of visual properties, including visual details, complexity and diversity of urban streetscapes.

7.2 NEW KNOWLEDGE IN VISUAL IMPACTS OF HIGH RISE DEVELOPMENTS

In Chapter 6, other visual amenity issues were investigated, namely, bulk, height and dominance analysis as applied in GIS. These items were highly associated with proposed residential towers near the CBD. Visual changes resulting from high-rise developments were discussed by the introduction of two new concepts related to space syntax theory: visual ratio and visual openness. In addition, the concept of the visual bowl was developed based on skyline analysis in GIS. A 2D diagram was extracted from skyline analysis to accurately describe the skyline change and the dominance of visible built forms from any viewpoint. This analysis showed the skyline change in the local area from different viewpoints as the result of the proposed development and for future intended developments in the vicinity.

Quantitative analysis of the skyline was focused on the analysis of bulk and height of developments. Previous studies by Stamps (2002), Chalup et al. (2009) and Guney (2012) quantified another aspect of the skyline, including complexity, which was not useful for resolving development conflicts. Skyline graph and visibility ratios were new concepts and methods used to analyse urban skylines. The new concepts represented substantive contributions to syntax theory and visual amenity concepts.

Bulk and height and visual dominance were identified as two concepts highly associated with high-rise developments. Assessment of these developments resulted in contrasting opinions regarding the visible bulk and height of proposed built forms and their visual impact on local scale character. Two selected court cases were used to apply and develop these methods.

The bulk and height analysis applied to two high-rise developments in Brisbane, in high-density areas. Considering deficiencies of current photomontage method, as discussed in Chapter 2 (Section 2.5.5), the visual bulk and height method provided an unwrapped diagram of the 360-degree visible skyline to comprehensively analyse built form heights and bulk visible from a single viewpoint within its visual bowl. This modelling is based on a developed concept of the visual bowl, which is a three-dimensional representation of a view shed in the real world.

A skyline analysis was conducted from several viewpoints for each case and showed exact changes to the skyline from each viewpoint to analyse the bulk and height of proposed development. This modelling was conducted for existing, proposed and planning scheme options to show a comparative analysis of the skyline. This technique considers distance and scale of objects to the viewer and displays the built form height and scale more accurately compared to conventional sectional or elevational views. Therefore, a 20-storey tower in viewpoint background will have less impact as a 10-storey tower in viewpoint foreground. This will assist expert witnesses in assessing visual bulk and scale of buildings in the local scale.

The second concept related to high-rise development conflicts was visual dominance. It was also related to the visibility of landmarks and sightline obstruction due to high-rise

developments. The visual dominance concept is related to the level of visibility of an object and its dominance in relation to other visible elements in a field of view. Distance decay factor based on the size of objects was considered as a useful factor to quantify visual dominance applied in planning and visual impact assessments.

Based on the method presented in Chapter 6, visual dominance was quantified by an experimental study. Based on this experimentation, size decay factor was calculated for an object. More detailed visual dominance analysis was developed to calculate the dominance of the Story Bridge superstructure. This was investigated because of the claimed obstruction of views from residents' balconies to this landmark and arguments related to the visual dominance of the superstructure in the available views. Story Bridge is considered as a significant landmark, and the views to this landmark are protected under the Neighborhood Plan. It was considered that quantification of visual dominance would increase the objectivity of arguments regarding the dominance of a structure.

The proportion of the visible superstructure in the FOV was calculated by estimating visual decay to quantify the visual dominance. By calculating the decay factor using a virtual model and adding it to the ZVI mapping in GIS, it became possible to quantify and predict visual dominance and to determine the level of dominance at any location within the modelled visibility area. A more accurate zone of view protection was suggested to identify areas with high visual dominance to the Story Bridge in the local area. It was shown that any receptor outside this zone had a negligible level of dominance and could not object that views to the landmark were being obstructed.

The calculation of visual dominance based on decay factor was similar to Kov-Petersen and Snizek (2008) and Preston (2002) in relation to the concept of *probabilistic visibility*. However, they calculated a complex type of decay based on weather and landscape conditions. The decay factor in this study was mainly calculated on distance, which presented an exponential relationship with the size of objects. The calculated decay factor was applied in GIS to produce a fuzzy zone of visual influence. Rød (2009) developed the same method, calculating distance decay based on modelled photomontages.

The results of this research provided several methods to quantify concepts. These quantifications potentially increased the objectivity of expert assessments by providing a higher level of precision and detail. These methods were evaluated by actual expert witnesses to identify the usefulness and potential of the techniques to be applied in real visual amenity conflicts. According to the conducted interviews and collected responses, developed methods to investigate visual appearance, bulk and height and visual dominance presented different potentials for assessment of visual amenity purposes.

The visual dominance quantification was evaluated as a useful method to be used in expert assessments. The visual appearance method, using image processing, was considered as a too

complicated procedure to quantify visual properties. The concepts of entropy and fractal dimension were considered as complex concepts for application in expert assessments. However, it was considered that the methods could contribute to other urban assessments if developed further to enhance calibration and to simplify the procedure. The bulk and height analysis using skyline analysis was also identified to possess useful attributes that required further development.

The central concept of the methods was for them to be repeatable and quantifiable approaches that could be applied to any environment to analyse visual attributes (heights, bulk, dominance and appearance) of the urban environment. As introduced in the research background, the developed methods can be used in other cities, such as Esfahan, to analyse visual impacts of the proposed developments in a more quantitative way. More rigorous assessment of urban character and amenity would assist in the evaluation of urban areas and improve the decision-making process.

7.3 NEXUS BETWEEN RESEARCH AND PRACTICE

This research has a dual function. In the first view, the developed database of court cases for the last 13 years in Brisbane can be used by all parties involved in the development assessment process, including developers, councils, local communities and residents, planning lawyers and expert witnesses. A developed database in GIS that included all conflict issues and development types attached to the spatial location of each case would provide a concise and informative platform for all parties. This searchable database could be used to identify different types of development applications inside the City boundary.

The Court Case database could be a very valuable source of information to be used by developers and residents in support of their appeal. This database could be expanded to include all court cases for all other states in Australia. Such a database could inform, support or prevent many similar future court cases and reduce costly delays and uncertainties. This database could be shared publicly in an interactive web-based GIS platform and include cadastral information and conflict history. It can also be updated regularly to include recent and upcoming conflicts.

Another implication of research in the field of visual character assessments could be the usage of developed methods in the assessment of visual amenity disputes. Developed measurable techniques to quantify and analyse visual bulk and height, visual appearance and dominance can be improved and applied to expert assessment to achieve a more objective, accurate and reliable assessment of visual amenity. These methods are based on modelling techniques in GIS and image processing that can be replicated for any types of development. Based on interviews conducted with selected expert witnesses, the visual dominance method was regarded as having a high potential for use in expert assessments. Other methods have similar possibilities for improvement by further calibrating their methods.

These technical methods can also be used in the design and decision-making process to include a more quantitative assessment of development applications. More certainty and applicability of analytical methods will result in a quicker and more rigorous and certain decision-making process. This improvement could prevent costly delays and conflicts in the court process and development applications.

Regarding particular field contributions, this study contributed in two main ways. Firstly, the review of past Planning and Environment Court Cases contributed to the understanding of development conflict occurring in Brisbane. This review identified many conflicts related to various fields, including environment, design, engineering and planning. Other researchers in other fields of knowledge (planning, environment, engineering) can investigate these conflicts to develop new methods or to improve existing methods to resolve conflicts.

Identification of different types of conflicts and their patterns provided new knowledge for development conflicts in Brisbane. The detailed review of visual amenity court cases shaped a basis for understanding development conflicts and visual amenity issues associated with different types of development. This database was hidden in the written records of the Supreme Court Library. It was uncovered by this researcher, and its resurrection gives opportunities for further research and expansion.

This study, in the second instance, contributed focus to the field of urban landscape character and visual amenity studies. It has provided quantitative methods to analyse visual properties of urban streetscapes and character. These methods contribute to a more quantitative and comprehensive analysis of the visual environment in relation to identified gaps in expert evaluations.

Quantification of visual bulk and height, visual appearance and dominance, were new methods in the field of visual assessment. These techniques, with a combination of experimental tests and technical tools, contributed to the improvement of expert evaluations. These methods are also useful in the planning and decision-making process to assess visual impacts of proposed developments with more reliability and accuracy. They are universal and repetitive in any urban context, depending on the availability of source GIS data. The technical methods were presented in a multi-step process to be transparent, and any expert in the field would be able to recreate the modellings.

7.3.1 Theoretical contributions

Theoretical contributions of this study are twofold: an alternative framework to identify gaps and problems in the assessment process of development impacts, and an exploratory model to increase the certainty of expert assessments.

Firstly, this research, through its review of P & E Court cases identified a broad range of development conflicts and issues in various fields of the building and construction industry. These issues and conflicts were considered as a source of problems to be examined by different experts in each field. Methodological improvements to minimise conflict in the category contributes to the design stage and overall assessment of development. In the area of visual amenity, it is found that quantification and precision increase the certainty and confidence of expert evidence in court. This finding stands in contrast to the more descriptive, subjective and unreliable approaches by different experts. Appropriate use of quantification in the assessment of visual impacts would provide more straight-forward and reliable outputs to assist courts in making decisions. Also, these quantifiable measurements derived from models are considered to be more acceptable findings between opposing experts engaged in these conflicts. These measures would be useful for experts in other fields, such as planning and law.

Secondly, through exploration of GIS and image processing techniques, it was found that technological advances provide ongoing opportunities to employ the tools to increase the accuracy of expert assessments. This needs constant calibration and improvement to progress evaluation methods. Further testing of the proposed methods, calibration of techniques and using new functions in GIS and image processing may allow for improved validity and generalisability of findings. In addition, it is necessary to create and identify the relationships between quantifiable methods and previous expert methods to align them in a constructive way.

This research produced new concepts relevant to visual amenity and space syntax theories. Concepts such as visual openness, visibility ratio and visual bowl were new concepts for analysing different aspects of visual environments. These concepts expanded the extent of space syntax theory and added new concepts to the theory through advancements in GIS and modelling techniques.

7.4 RESEARCH OUTPUTS

This research has resulted in several outputs to date. A conference paper on visual openness in an urban environment was presented at the Fifth International Constructed Environment Conference held in Philadelphia, USA, October 2014. This article was also published in *The International Journal of the Constructed Environment*. Another journal paper on measuring the visual appearance of urban streetscapes using 'Quadtree Decomposition' has been submitted to the *Journal of Landscape and Urban Planning*. Also, this research has been nominated by QUT for the ESRI Young Scholars Award, 2015, due to its contribution to the field of knowledge by developing new methods in Geographic Information Systems (GIS). Several ideas have also been shaped for contribution to more publications to continue to expand on the research herein.

7.5 LIMITATIONS OF STUDY

The study has proposed an evaluative process to review Court cases in Brisbane occurred in Brisbane during the last 13 years to identify major patterns of conflict. As a consequence, the current review of Court cases is limited to this period. Also, due to open access limitations to the planning appeals, the study is limited to Court judgments and does not include all appeals submitted to the P & E Court. The number of appeals submitted to the Court is much higher than Court judgments because many of appeals are mediated at an early stage. It is essential to examine all planning appeals to increase the reliability of research findings and generalisations. By including more appeals and court cases in the database, calculated variables for appellant and appeal success rates would become more valid and trustworthy measures. Also, major types of conflicts and developments would be identified with more confidence.

In the second part of the study, measurable methods are limited to only three methods. However, there are more opportunities available to develop more measurable methods to assess the urban character. The developed methods to analyse and quantify visual appearance, bulk and height and visual dominance, are limited to recent GIS and image processing capabilities. The sophistication and advances of technical methods are confined to time and are still gradually progressing. Therefore, the proposed methods are not absolute and can be improved on by future technological advances in GIS and modelling. Quantification of visual attributes requires constant improvement to increase the reliability of findings. These opportunities are mentioned as potential future directions for this research.

The accuracy and reliability of the proposed technical methods were some of the main concerns of this research and interviewed expert panel. As mentioned by the experts, the accuracy of LiDAR models used in this study is limited to the accuracy of point cloud data which is limited to 2.5 points per square meter. Although the proposed bulk and height method is rigorous and

defensible, quality of source data is not very high and limited to current surveying technologies which need to be improved.

7.6 FUTURE DIRECTIONS OF RESEARCH

This research could be expanded and improved in two separate ways. As mentioned previously, GIS database of all court cases can be broadened to include all cases in Queensland cities. This will considerably increase the number of cases for each year. Furthermore, the review of cases can be expanded to incorporate both appeals and finalised court judgements. Only concluded judgments during the last 13 years have been reviewed and used in this research. By adding appeals to this consideration and expanding to include all cities in Queensland, this database would grow considerably. This will increase the rationality of generalisations and findings of this research to attract developers, residents or local councils to use the database to support or resolve their development issues and concerns.

Another direction for the research to expand into is to calibrate and fine-tune the developed technical methods to assess visual bulk and height, visual appearance and visual dominance. While these properties were quantified and measured accurately in this research, there is room to calibrate and adjust these methods to increase objectivity and accuracy of the techniques.

Visual bulk and height analysis can be investigated and improved by modelling skyline function in GIS based on more detailed virtual models. In this research, the virtual model was shaped on LiDAR points, which is not a very accurate basis when compared to the real world. The accuracy of the virtual model would increase the reliability and accuracy of the skyline graph for bulk and height analysis. Higher resolution point cloud data using photogrammetry techniques provide future opportunities to achieve higher quality survey data to be used in developed methods.

Visual appearance analysis method can be calibrated and improved by applying quadtree decomposition to a wider range of built forms, from single storey to multi-storey, to check the relationship of values for different built forms. This method can be elaborated further in assessing architectural design options and different architectural styles. The box-counting method can be expanded to the cube counting method (Voxel[13]) to calculate the fractal dimension of 3D objects and structures. Also, quadtree decomposition can be expanded in 3D as 'octree' to partition a 3D object by subdividing it into eight octants and calculating the number of blocks and diversity of a 3D model.

Visual dominance analysis also can be improved by further comparing results to the real world to identify visibility thresholds. Based on modelling explained in Chapter 5 to calculate visual dominance of the Story Bridge, any receptor with less than 1% of Story Bridge view was

[13] A voxel is a value on a grid in three-dimensional space similar to pixel in a 2D image. It is a concept created by a combination of volume and pixel.

excluded from the zone of view protection. However, 1% view threshold needs to be verified by site visits to make sure it is indeed a negligible dominance value. Hence, more field work is required to identify levels of visual dominance for different structures. Preference studies can gauge These measurements.

In general, four directions were identified for future investigation. Expansion of research in each direction could increase the reliability and usage of these findings to be used in court case resolution. In addition, further work could see visual properties expanded to other visual attributes to add more objectivity and reliability to expert assessments. Expansion and technical improvement of these methods will contribute effectively to more objective and comprehensive assessment of urban character and visual amenity. Simplification of these methods will increase the applicability of quantitative methods to be applied in expert evaluations and conflict resolutions.

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Appendix A

Planning & Environment Court Cases
(2000-2012)

Review, Classification and Coding

Court Case Number	Issues and Arguments	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC01-005	issues of **town planning**, the **treatment of the environment**, and of **visual amenity**.	71 lots to be developed for residential purposes	QCL established a cement making operation on large areas of land at Seventeen Mile Rocks.divided into 4 preceincts,riverside preceinct is the subject of this appeal 7.355 hectares, sloping up from Fremont Street.	Adverse submitters	appeal must be allowed – the development approval is not acceptable	Objectors VS BCC and Co-respondents	TOWN PLAN
QPEC01-006	interruption of river views/ntensity of development/ invasion of privacy/ traffic generation/proximity of buildings of considerable bulk and building form and invasion of his privacy	An apartment building comple	riverfront at Kangaroo Point /condominium block	Adverse submitters	Appeal refused	Objectors VS BCC and Co-respondents	
QPEC01-008	applicant prefers "alteration, addition, extension, modification or renovation".respodent describes as demolition	demolition	47 Prospect Street, Wynnum	BCC	Appeal refused	Developer VS BCC	
QPEC01-009	contrary to relevant planning provisions/Carparking access will lead to overdevelopment of the site/Traffic problems and safety considerations will arise particularly in Mactier Street/adverse impact upon existing development character and scale of the proposals / **visual impact was the major concern for the appellants**	the erection of a new administration building,an erection of a car park	60 Mactier Street, Fig Tree Pocket Lot 114 on RP818257	Adverse submitters	Appeal refused	Objectors VS BCC and Co-respondents	1987 Town Plan
QPEC01-015	concerns of amenity/there has been fundametal change in a use without consultation/number of incidents/disturbing anti-social behaviour/loud and vulgar language emanating from the premises/ in respect of public notification of the application.“If the land has more than one road frontage, a notice must be placed on each road frontage for the land”.	subject land were used for Nursing Home purposes providing care and accommodation for elderly residents/vacated and abandoned around April 2000/land was sold in vacate position/It's being used for metally handicapped persion & short term accomodation for immigrants/ change use constitute material change of use/no permit obtained which constitute offence	129 Butterfield Street, Herston Lot 128 on RP102307	Adverse submitters/HERSTON KELVIN GROVE RESIDENTS ACTION GROUP INC	here has been no material change of use/proper management procedures would be capable of controlling such occurrences The application is, therefore, dismissed.	Objectors VS BCC and Co-respondents	
QPEC01-022	Emphasis should be placed on the words “any road”	Public Notification issue	Lot 1 on RP 78773 (1181 m2) and Lot 3 on RP 86631 (1201 m2).	Adverse submitters	That requirements relating to posting of notice on subject land have been sufficiently complied with.	Objectors VS BCC and Co-respondents	
QPEC01-024	“visual character and amenity of the streetscape or a component of the streetscape” and the effect that the removal of the existing dwelling would have in that respect	demolition or removal of an exisitng house and replacements with modern dwellings	corner of Watson and Crane Streets Newmarket	BCC refusal	The design of the proposed new building would complement and enhance the character of the area+The removal or demolition of the existing dwelling would be unlikely to adversely affect the visual character and amenity of the streetscape or a component of the streetscape **the appeal will be allowed**	Developer VS BCC & respondents	“Streetscape for the purposes of this policy comprises:- all of the visible components within a street including:- · topography, land forms and vegetation;· street arrangements and patterns;· widths (including arrangement of carriageways, paths, verges etc); · property shapes and sizes; · street trees and planting; · various other items in the street (are stoplights and street furniture); · housing types and size.”
QPEC01-041	very unusual case/Rural non urban designation/impact that the proposal would have on the amenity,environment and water quality of the area/Only about 30% of the site has been affected by development	regularise a use of land which has been going on for about twenty-seven years/a business which involved the transporting of children to and from school by bus under a contract with the Department of Education/**transport facility servicing-a bus depot**	4ha western side of Kloske Road,Burbank	appeal against the BCC refusal	considerable community benefits which out-weighed any inconsistencies with the planning documents/ **Appeal allowed**	Developer VS BCC	Mr Delaney found that the proposal would not adversely impact upon the areas water quality to an extent which would call for its rejection.
QPEC01-043	compensation dispute with a previous owner of the site consequent upon a resumption whether “desirable views” would be offered to justify high density high rise residential accommodation impacts on amenity of surrounding parklands and private land/the land is designated High Density under City Plan. **Appearance of the Proposed Development/Land Street Impact**	Material Change of Use and preliminary approval to construct 2-10 storey apartment buildings on land adjacent to railway line/ 104 dwelling units	The site is at 8-32 Land Street, Toowong, described as Lot 2 on RP 123839 and Lots 1-7 on SP 115659 Parish of Enoggera	refusal of application by BCC	Appeal allowed subject to appropriate conditions	Developer VS BCC	‘Residential B’ The Council did not reject the application which it now says the Court should reject.
QPEC01-045	Size/bulk /height/planning scheme inconsistency/character and style are unlike anthing else in the area	application for material change of use “character” house; large apartment building/retain the house and to build an apartment building behind it/ten units	30m frontage to the southern side of Dornoch Terrace,1701m²	Council	the building is too wide, too long and, especially, too high/Appeal dismissed	Developer VS BCC	1987 Town Plan/R4 designation
QPEC01-049	to have the Court rule on certain arguments of the appellants (objector/submitters) about three alleged defects in the public notification of a development application/the information request had been sent in error/complaint is that McIlwain carried out the public notification too early	swimming pool on land	at 35 Stevens Street, Yeronga	Objectors	Application allowed; appeal to proceed.	Objectors VS BCC and Co-respondents	Public notification error and issues

2001 - 22cases

Court Case Number	Issues and Arguments	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC01-050	Streetscape; character houses; non-compliance with performance standards for height, boundary clearances. Design issues:fails to comply with codes character issues: whether complements or enhances the character/maximum height greater than 8.5m./	move the existing cottage wholly onto lot 96 and to build a new house on lot 95 and to live in that house	lot 95 & 96 Dibley Street and Eighth Avenue	BCC	Appeal dismissed	Developer VS BCC and local objectors as respondets	The site is in the Residential A zone and within the designated Heritage and Character Building Area. Wilston is an old suburb which contains a large number of attractive, traditional Brisbane "tin and timber" houses as well as many modern houses "Noosa style" of architecture **'The character of areas, which contributes to their livability, embraces a number of elements which may be subject to change. These elements include people, housing, vegetation, streetscapearchitectural styles, community services and facilities and open space, places to meet and socialise, safe bikeways and pedestrian facilities, security and local identity features. In some areas, there is greater diversity of these elements while in other areas more uniformity of these elements is evident.**
QPEC01-051	**demolition of heritage building**, **proposed use** and **intensity of development**	partial demolition of a building and refurbishment of the remaining part of the building and the extension of it for the purposes of an apartment building- 15 units	corner of Leopard and Lockerbie Streets, Kangaroo Point Lots 3, 4 and 5 on RP 1160	five submissions made in respect of the application	proposal is meritorious and Appeal dismissed	Objectors VS BCC and Co-respondents	Residential B zone under the 1987 Town Plan
QPEC01-052	a money contribution for parkland purposes as condition of approval by BCC which appealed to court by developer	reconfiguring a lot;building work;material change of use.		BCC	developer start the development subject to the appeal	Developer VS BCC	application by Mingara for an order permitting part of a development to commence before the appeal is decided.
QPEC01-054	application for a declaration that application is code assessable, not impact assessable!	Erect high-rise office tower/Erect low-rise office tower/Use existing and new buildings as: business permisses,shops,resturants and place of assembly(nigh club)	25-61 Petrie Terrace lots 2 and 3 on registered plan 809878	Conditioned by BCC	In the result the declaration sought is refused.	Developer VS BCC	
QPEC01-058	**Planning NEED**:A motel is consistent with the intent of the Inner Residential Zone and with the Industrial Precinct of the Grange District Local Plan **Streetscape and Amenity:** proposed development is compatible with the character of the neighbourhood in which it is located **Over-development:** although this makes no positive contribution to the amenity of the area, it does not significantly detract from it. **Parking:** inadequate provision for parking combined with the failure to show a need for the re-zoning	application for a material change of use for a motel development, three-storey component, 68 rooming units	153-159 Lutwyche Road Windsor, the property being Lots 12, 13 and 18 on RP 46442	submitter appeal	the appeal is allowed and the development application for a material change of use is refused	Objectors VS BCC and Developer	A motel is thus generally consistent with the intent of the Inner Residential Zone subject to compliance with the standards indicated
QPEC01-061	is an overdevelopment of the site with **unacceptable impacts on visual amenity**, **acoustic and visual privacy**, **traffic safety**, **the easements on the land**, and the criteria for development set out in the planning documents.	a material change of use of land at Kangaroo Point, amalgamation of five parcels of land. three residential towers and a fourth low building containing a gymnasium and visitors car park, with a tennis court on the flat roof. 70 units	Downstream, it is next to three recently constructed houses – the Mowbray houses;Behind it, on the slope of the hill, are two older apartment buildings, 24 and 40 Castlebar Street. **Refer report**	submitters appeal	Matters of considerable concern: intensity of development & boundary clearance, seperation and privacy, extensive use of shutters looks bulkier buildings are hardly "transparent" between the balconies, especially when one looks above or below a direct line of sight **The appeals are allowed. The development approval of the Brisbane City Council is set aside.**	Objectors VS BCC and Developer	"The court's duty is a traditional one, to give an impartial and reasoned decision on the evidence" The court is not a town planning authority, such as the Council. Its task is to interpret and accept the town planning documents and principles that have been adopted, and apply them to this land.
QPEC01-062	The standard of amenity that would be enjoyed by the new residents, particularly with regard to noise, odour, and air quality/The expectations of those new residents/planning need/impact of complaints from new residents on nearby industrial uses. **Claims for compensation.** appeal to	a development permit for a material change of use to establish a residential estate, and a development permit for the reconfiguration of the two allotments into 56 allotments, and a hectare of parkland.	Wynnum North Tingal Road and Wynnum North Road /two blocks of land /area of a little over 5 hectares	BCC refusal	the decision of the Council, to reject this application, was correct/the level of complaints, and the provisions of the draft Local Plan are enough to reject the application/ too close to industries The appeal is dismissed.	Developer VS BCC + Elected	even if an application is in conflict with provisions of a Strategic Plan, it might still be approved if it has sufficient planning merit, despite that conflict decription of industries in detail
QPEC01-065	Planning and Environment Court against local government's refusal to pay compensation for injurious affection allegedly caused by rezoning of appellants' land Non_urban land to open Space	change of Land Use	208 Gaskell Street, Eight Mile Plains. 3.769 hectares	BCC	Compensation should be paid	Land Owener VS BCC	
QPEC01-075	traffic, streetscape, visibility of parking, setback, noise, views and private outdoor living and recreation space / main issues concerned amenity of future residents within Lot 7	Material Change of Use and Preliminary Approval for proposed Apartment Building and Attached Houses orty residential tower units and eleven villa style units nearer the river are proposed	10 Holman Street and 15 Anderson Street Kangaroo Pt Lot 9 on Crown Plan No 885002 & Lot 7 on registered plan No 885001	submitter appeal	some development conditions should be changed, but appeal refused	Objectors VS BCC and developer as respondent	
QPEC01-077	form of the public notice; whether all of the landwas identified in the application.	application was for approval of a multi-unit development	north western corner of Kurilpa and Duncan Streets at West End	submitter appeal	in favour of the corespondent appeal is dismissed	Objectors VS BCC and developer as respondent	person interested might attend at the offices of the co-respondent (located nearby) to inspect material relating to the application
QPEC01-079	people are againts Council to close the pool	decomission Pool to build six storey office complex	Toowong Municipal Swimming Pool and is on the western side of Coronation Drive immediately to the east of the Toowong Village Centre	submitter appeal as a group	Appeal dismissed	Objectors VS BCC and developer as respondent	

Court Case Number	Issues and Arguments	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
						2002 - 21cases	
QPEC02-003	an application by sumbitter objectors for leave to amend a development application which has been approved by the respondent: - changes involve altering the buildings facing Boundary Street - increasing the height of the building fronting Manning Street -increasing the number of residential units from 53 to 56 - gross floor area of the building from 4,770 to 5,973 square metres **City views are cut off by a three storey building so the increase in height of parts of this building will have no effect on skyline views**	53 dwelling units, and a commercial unit with a gross floor area of 120 square metres, with on-site carparking for 79 vehicles/ Existing development is generally commercial or light industrial save one house property on the south eastern side of the subject site	46-48 Boundary Street and 5 Manning Streets, South Brisbane, containing 2,628 square meters	Residents at Nos. 2, 6, 8 and 12 Brereton Street	the changed application would not be likely to attract an adverse submission that was not provoked by the proposal, in its original form	Objector VS BCC+Developer	Town Plan for the City of Brisbane 1987 (1987 Town Plan). That Plan included the South Brisbane Area Development Control Plan (DCP). The Brisbane City Plan 2000 (City Plan 2000) came into effect on 20 October 2000. **The essential question is, then, whether this court can be satisfied that the changed application would not be likely to attract an adverse submission that was not provoked by the proposal, in its original form.**
QPEC02-004	Arguments about front face of building and Ground Level	A multi-storey apartment building	Kangaroo Point on a site which is bounded on its northern side by Cairns Street, on its eastern side by O'Connell Street, and on its southern and western sides by privately owned land.	BCC	Declare "front wall of building" is the northern wall	Developer VS BCC	definition of Ground Level/Storey and Arch, front wall and face **front wall" in relation to a building is that wall in which the principal entrance is located**
QPEC02-005	Minor change issue -measures to avoid expressed concerns about the possibility of golf balls crossing the property boundary - add parking + relocation of entrance and storage shed	A golf driving range.		an adverse submitter against the respondent's planning approval of a proposal by the co-respondent	Co-respondent should proceed to the hearing of the appeal on the basis of the amended application	Objector VS BCC+Developer	
QPEC02-009	Appeal against refusal arguments about access and park	reconfiguration and Material change of use for proposal including 2.887 for Park/5844sqm for industry/118 dwelling	land at Hendra **(refer court case for address)**	BCC	The appeal will accordingly be allowed	Developer VS BCC	to be checked against Town Plan 1987 **Mr Chenoweth**
QPEC02-013	traffic, increased crime and graffiti, overcrowding and loss of property value, inadequacy of infrastructure in the area, critical changes to surrounding wildlife dependent areas (and) loss … . of a vital "living lungs greenbelt"/Issues reduce to 2 by Judge : whether to require referral co-ordination and a longer period of advertising/whether council had giver proper consideration to flora and fauna?	to Reconfigure a Lot to provide, inter alia, 39 residential lots and Preliminary Approval for Material Change of Use for sports centre	Lot 1 on RP 163346, Parish of Nundah, a parcel of some 19.3 hectares / 202A Lacey Road, Bald Hills as balance lot	Resident	Appeal dismissed	Objector VS BCC+Developer	Department of Main Roads was the only advice agency **An appellate can never initiate a re-zoning** **Mr Chenoweth here!**
QPEC02-014	Key issue was the ecological value attributed to Mt Elphinstone	reconfiguration of land at Pullenvale subdivided into 2 allotments/the eastern side of Mt Elphinstone.(lot 2) was one of 11 allotments created in 1999 when a parcel comprising 53.77 hectares was subdivided	Pullenvale /the eastern side of Mt Elphinstone	BCC	Appeal allowed formulation of approporiate conditions of approval(suggested by Mr Chenoweth)	Developer VS BCC	the application must be decided under the now superseded Town Plan with appropriate and considerable weight being given to the relevant provisions of City Plan. **Mr Chenoweth here**
QPEC02-020	Conflict with City Plan/Light Industry Area designation in City Plan and is impact assecible	apartment building and townhouse complex at West End	northwestern corner of Duncan and Kurilpa Streets.West End	an adverse submitter	Appeal Dismissed	Objector VS BCC+Developer	West End Local Plan is not yet approved
QPEC02-023	Land in Rural areas, fall within difinition of outdoor sport and recreation, generally appropriate Concern of appeallant that golf balls enter its property and pose a safety risk	Application for material change of use for development of church in semi-rural area	Land at Eight Mile Plains 3.77 hectares and having frontage to Levington Road	an adverse submitter	Appeal Dismissed	Objector VS BCC+Developer	24m buffer of vegetation to north, adequeate buffer 15 to 23 meters fence
QPEC02-029	Whether or not an amendment to application is more than a minor change.	Application for material change of use for development of church in semi-rural area	2427-2475 Moggill Road, Pinjarra Hills	BCC	appeal can proceed (not finalised)	Developer VS BCC+Rural Envo Planning Asso	school acess is through church land
QPEC02-041	availability of alternative site – location – traffic – impact of the development – environmental impact – local residents Council refused due to : Contrary to Town Plan/impact on visual amenity / Heavy excavations/extensive clearing/lighting	Application for material change of use for development of church in semi-rural area	2427-2475 Moggill Road, Pinjarra Hills	BCC	Appeal Dismissed	Developer VS BCC+Rural Envo Planning Asso	350 submissions to Council supporting application **Chenoweth here on developer side**
QPEC02-042	to enclose the balcony of their home with glass window due to traffice noise/architectural standpoint visual obtrusive	Enclose balcony by window	West End, Riviera II,unit 28	BCC	Appeal Dismissed works should be applied by body corporate	Developer VS BCC	
QPEC02-044	Council mistakenly thought the application was for something different – a multi-unit dwelling/public notices were inappropriate and confusing	new houses retain existing (house) – subdivide 1 lot into 3/multi-unit dwelling Material Change of Use & Reconfiguring a Lot	Denham Street and Ensign Avenue, Annerley, Brisbane/It is Lot 4 on RP 43685	Objector	Appeal allowed	Objector VS BCC+Developer	

Court Case Number	Issues and Arguments	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC02-045	Appeallant believed that application is code assessable rather than impact assessable/the western facade, which will form the backdrop against which the heritage listed Police Barracks building will be seen, was very plain.	commercial building	Lot 3 on RP 8-9878 and Lot 6 on RP 826295 is code assessable	BCC	Application dismissed	Developer VS BCC	Appication is Facing Petrie Terrace are well-recognized buildings of heritage significance, namely the former Police Barracks generally in accordance with definition
QPEC02-046	amenity – privacy, increased traffic, increased sewage, increase in flood levels due to filling/privacy of his swimming/	material change of use for multi-unit dwelling, demolition and filling, and for preliminary approval of operational work on seven suburban lots. 14 houses on the 7,764 m2 combined area of the subject land	270, 272, and 276-284 Indooroopilly Road.	several adverse submitters	Appeal is dismissed conditions added	Objector VS BCC+Developer	
QPEC02-049	appeallant: development is impact assessable land designated 5 areas: Parkland, General Industry, Future Industry, Light Industry and Rural	subdivide 43.6ha land to develop 39 separate lots, for industrial purposes material change of use+reconfiguration	Tingalpa Lot 4 on RP 118579	several adverse submitters	Appeal is allowed Development is impact assessable+stage 1 is invalid	Objector VS BCC+Developer	
QPEC02-069	inconsistent with Strategic Plan objectives/fails to retain or restore the habitat and riparian amenity of the waterway corridor and natural drainage/diminish the special landscape qualities of the site/detract from the residential amenity of the surrounding area	33 dwelling units in all, comprising 6 detached houses, 3 attached houses and 12 duplexes	194 Mayfield Road, Tarragindi	refused by BCC	Appeal dismissed	Developer VS BCC	
QPEC02-070	land is unsuitable for development as it contains areas of significant historic arc bushland and ecological values(scenic or environmental constraints) its koala habitat	Material Change of Use and Reconfiguring a Lotproposed residential subdivision of 114 lots	Lots 2, 4 and 5 on RP 84957, Lot 32 on RP / 858163 and Lot 661 on S 312946, Parish of Tingalpa.	BCC	Appeal dismissed BCC to incure costs in consequesnce of late introduction of landfill development plan	Developer VS BCC	
QPEC02-071	visual amenity locally, threatened impact on distant views, alleged incompatibility of low density residential use and the co-respondent's small goat stud next door	material change of use of land and the reconfiguration of a lot residential development in accordance with the provisions of the Residential A zone.	Lot 175 Graham Road, Bridgman Downs	BCC	Appeal dismissed	Developer VS BCC + adverse submitters	Mr Van Pelt
QPEC02-072	GFA and whether bulk on development constitute over development; heritage values, traffic and parking	Demolition of pre-1946 + material change of use for the purposes of a multi-unit dwelling(8 units)	86/88 Moray Street, New Farm/Lot 1 on RP 54179 ("Lot 1")	BCC refusal	The appeal is allowed the limited extent of giving permission to the appellant to demolish the non-original additions to Moana	Developer VS BCC + adverse submitters	a multi-unit dwelling is subject to impact assessment and the Development Code under the Local Plan is applicable
QPEC02-073	pre 1946 house, The structure is in a relatively sound state of repair refused because house contributes positively to Albert Street	building work which involved the demolition of a dwelling house at Annerley	northern side of Albert Street near its western end Annerley	BCC refusal	Appeal dismissed	Developer VS BCC	
QPEC02-077	Adverse visual impacts/riparian 20m setback	a material change of use extensions to an existing dwelling on riverfront land at Yeronga		Adverse submitters	Appeal dismissed	Objector VS BCC+Developer	Mr Chenoweth here!

Court Case Number	Conflict Issue	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC03-001	Minor Change/enclose their balcony with glass, to reduce the traffic noise from the Captain Cook Bridge/increasing the gross floor area of their lot.	Glass on Balcony to reduce noise	Lot 28 in Riviera II at Kangaroo Point.	BCC	allowed. Application is properly made	Owner VS BCC	**2003 - 12cases**
QPEC03-006	appeal against an approval subject to conditions/height over 8.5 limit/	a house	58 Watson Street, Newmarket	BCC, 17 objectors	dismissed to another application (changes were not minor)	Developer VS BCC	
QPEC03-007	Application to demolish pre 1946 dwelling house	a house	40-42 Boyd Street, Bowen Hills/Lots 12 and 13 on SL 5982		appeal is dismissed	Developer VS BCC	
QPEC03-010	Westfield objection against BCC approvel: conflict with the Toombul-Nundah Major Centre Local Plan Code	hopping centre,offices and multi-unit dwellings		Westfield	appeal is allowed/application is returned to court to reassess	Objector VS BCC+Developer	
QPEC03-025	preservation of character house/traffic; amenity	Multi-unit development over two existing allotments/LMDRA/three storeys in height.	corner of Rode Road and Windsor Street/Nundah	local resident	appeal is dismissed	Objector VS BCC+Developer	
QPEC03-031 **Constums house case**	relationship to other buildings,views …. to the heritage place	refurbishment of the Colonial building and the provision of four additional floor levels to accommodate a total of thirtyfive residential units and ancillary recreational and business facilities	443 Queen Street, Brisbane	Developer	appeal is allowed	Developer VS BCC	View:the sight or vision of something Vista:"A view or prospect, especially one seen through an avenue of trees or other long and narrow opening." in a modern living city, buildings of different eras can co-exist comfortably and can even complement each other
QPEC03-035	appeal against council's approval for a material change of use – compliance with **relevant code/s - traffic - over-development - character** If the development was reduced to three units and suitably conditioned, their opposition would be withdrawn	multi-unit dwelling comprising four units	end of Colton Avenue/Lutwyche **The land's rear boundary adjoins the Kedron Brook reserve.**	Local people	the appeal must be dismissed.	Objector VS BCC+Developer	the Integrated Planning Act suggest that compromise should be read to mean "threaten"
QPEC03-043	rezoning from Rural Res to Residential	27 Dwelling added to exisitng 4 on 5.9 ha bushland site	37. 39, 69 and 71 Brookfield Road, Kenmore, also parts of 41 and 55 Brookfield Road and the Oakmont Street Road Reserve, Kenmore./8-10 on registered plan 81879 and lot 36 on registered plan 895537	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	
QPEC03-055	"Vehicle Movement. Parking. Noise/Inadequate Private Open Space/Imposition on Boundaries/Poor Environmental Design/Garbage Bins/Garage- Abutting Eastern Boundary/Stormwater Drainage/Bulk and Size of the Proposed Development	multi-unit dwellings (2 "townhouses") behind pre-1946 cottage on Low-Medium Density Residential	11 Brook Street, South Brisbane described as Lot 56 on RP 11691,	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	
QPEC03-057	conflicts with the intent of the Strategic Plan, the Residential A zone, and Planning Policy/The proposal constitutes a freestanding, out of centre commercial development/inconsistent with the residential character of the area/undesirable and unnecessary pedestrian and vehicular crossings	Application for a Material Change of Use to develop a land for a a local store and local surgery/previously been operated as a service station.additions have been made on the southern side of the building to convert it to a residential use/application for local store of 139 square metres and a local surgery of 60 square metres	corner of Sussex Street and Osborne Road Mitchelton, being Lot 1 RP 123766, Parish of Enoggera,The premises are opposite the main entrance to Brookside Shopping Centre in Osborne Rd.	BBC refusal	Appeal Refused	Developer VS BCC	1987 Town Plan

QPEC03-067	conflict with planning instruments – amenity – noise – traffic – heritage conflict with the relevant planning provisions and general planning issues/amenity issues/traffic issues/heritage issues	re-development of the rowing shed used by the Anglican Church (demolition of a structure which has outlived its usefulness and a replacement of it by a new, more attractive, effective and safe rowing shed complex) material change in the intensity or scale of the existing use of the premises	Grammar School at Mowbray Park	adverse submitter group(hundreds of local people)	Appeal dismissed, conditions varied	Objector VS BCC+Developer	1988 Town Plan/visual impact (Messrs Chenoweth and Kay tighter controls in respect of areas of heritage importance in City Plan
QPEC03-077	two appeals are heard together first, brought by the co-respondents, seeks an order that the appeal be struck out with costs. The second, brought by the appellants, seeks an order that the time allowed for the appellants to give written notice of the appeal to other parties be extended until 27 November 2003	a material change of use to facilitate the development of a multi-unit dwelling	as Lots 14, 41-42 on RP 19619, Parish of Enoggera, situated at 29 Mort Street, Paddington	resident objector	co-respondents to strike out the notice of appeal is allowed/appellants have failed to demonstrate that sufficient grounds exist to warrant an extension of time The application to enlarge time is therefore dismissed/will hear any submissions in relation to costs in due course.	Objector VS BCC+Developer	

Court Case Number	Conflict Issue	Type of Development	Address	Opposed by	Order	Parties	Personal/Important notes
							2004 - 17cases
QPEC04-005	reconfiguration of the land into two lots/no local opposition/no conflict with Local Plan	Officworks	Oxley at the intersection of the Ipswich Motorway and Oxley Road	rejected by Council and is opposed by a number of local residents	The appeal will be allowed but for now I adjourn it to a date to be fixed to allow the parties to attempt to agree proper conditions of the development.	Developer VS BCC+co-respondent	
QPEC04-017	Appeal against preliminary approval/impact on views, the height of the building, its gross floor area, and the provision of open space for its residents, the set backs from side boundaries, and the reasonable expectations of nearby residents / There is overdevelopment and domination of the neighbouring buildings	multi-unit development in the low-medium density behind exisitng detached houses	In Chatsworth Road, near the corner of Henzell Terrace, two old Queensland houses sit side by side	opposition from four neighbours	The appeal will be allowed	Local objectors VS BCC & developer	1987 Town Plan/good visual case/Proposals that create unreasonable loss of views, privacy, air circulation, and sunlight for existing residents will be discouraged
QPEC04-030	co-respondent beileves that objection is note a properly made submission	multi-unit retirement village comprising 80 units and parkland	at Weekes Road, Moggill		appellants to pay the co-respondent's costs of and incidental to the appeal, including this application	Submitter VS BCC & developer	
QPEC04-036	height, bulk and scale of the medium rise buildings/amenity issues including visual effects, noise, light and air quality/traffic & stormwater	100 detached and semi-detached two and three level townhouses	Lot 11 on RP 185897 and Lots 4, 5 and 12 on SP 113532, and contains 4.12 hectares	Local residents	Appeal is dimissed	Local objectors VS BCC & developer	carindale is Medium Density Residential Area/maximum building height must not exceed "34 m AHD or 10 storeys, whichever is the lesser".
QPEC04-037	Located near a pre 1946 house/its appearance and bulk was incompatible with the pre-1946 character of the area/character, gross floor area, privacy, landscaping, building set-backs, visitor carparking, building orientation and pedestrian and vehicular entry point.	material change of use to construct a two unit dwelling on the land.	Ryans Road, St Lucia (lot 69),	BCC and residents	The appeal will be **allowed** but for now is adjourned to permit the parties to seek to agree appropriate conditions.	Developer VS BCC+co-respondents	
QPEC04-039	loss of land for sport and recreation purposes/height and character of the proposed development; its effects on visual amenity/traffic **Mr Chenoweth** concerns: the loss of sports and recreation land, and the height of the buildings	redevelop the former Milton Tennis Courts site for residential purposes/174 multi-unit dwellings	It is presently comprised of 22 allotments containing a total area of 29,250m2 and has frontages of approximately 176 metres along Milton Road, 20 metres to Lucy Street, and 17 to Frew Street.	local residents	appeal is dismissed	Local objector VS BCC & developer	Argument on zone of visual influence of the proposed development on surrounding streets (Chenoweth VS Lamb)
QPEC04-046	Crespondent application for costs to be paid by appellant, because they believe the appeal is vaxatious	demolish two houses and build multiple dwellings on the site	46-48 Wambool Street, Bulimba		application is dismissed	Local objector VS BCC & developer	
QPEC04-047	reconfiguration of the land by subdivision into three lots		267 Rickertt Road, Ransome, described as Lot 8 on RP 122198 and containing 3.4575 ha				
QPEC04-051	number of climbers is likely to be far greater than expected (max 15KpY) issues: residential amenity(Noise) ,Cultural Heritage,Planning	Story Bridge Adventure Walk	Storey Bridge, parking at 10 Wharf Street, Kangaroo Point	local resident	The appeal is dismissed.	Objector VS BCC and **STORY BRIDGE ADVENTURES PTY LTD**	vandalism to the arm of the Mona Lisa would be less culturally damaging than vandalism to her face/most people would regard the cross river spans as of greater townscape value than the approach ramp
QPEC04-059	**Demolition** of a pre-1947 dwelling house / character	**Demolition**	27-29 Headfort Street, Greenslopes.		The appeal is dismissed.	Developer VS BCC	
QPEC04-063	a material change of Use/ Inadequate car parking/bulk and style/GFA last submission/time for appellant to prepare his case	material change of use for multi-unit dwellings (5 units)+demolition of an existing pre 1946 dwelling	102 Waverley Street, Annerley and described as Lot 80 on RP37801		Appeal is adjourned	Developer VS BCC+co-respondent	
QPEC04-064	Not finalised						
QPEC04-065	charging the developer appellant for contributions towards sewerage headworks and water supply	shops and stores on lot 2	Lot 2 on RP 132999.		The appeal is dismissed.	Developer VS BCC	appeallant belief: "double dipping" or "taking two bites at the cherry".
QPEC04-068	too big and out of character	1860 Mt Gravatt-Capalaba Road,	1860 Mt Gravatt-Capalaba Road,Lot 26 on SL 11034	local residents and BCC	the appeal should be allowed	Developer VS BCC+Local residents as co-respondents	Intresting case
QPEC04-069							
QPEC04-075	Respondenet and Co-respondent have carried out an unlawful use of land (designated Parkland Area)		42 Depot Road, Deagon		Appeal is adjourned	BCC is Applicant BCC vs owner	
QPEC04-076							

Court Case Number	Conflict Issue	Type of Development	Address	Opposed by	Order	Parties	Personal/Important notes
					2005 - 28 cases		
QPEC05-003	Character Conflict with pre-1946 residential/size and style of the proposed development/out of character with the existing older homes/Amenity/inappropriate development – conflict with Planning Scheme/inappropriate use-commercial	MULTI-UNIT DEVELOPMENT (additions to an existing building) eight residential units	corner of Annerley Road and Grantham Street/1,801m2	rejected by Council and is opposed by a number of local residents	dismissed	Developer VS BCC	City Plan 2000,
QPEC05-004	Character/Minor change to original approved application to install a driveway leading to the property from Abercrombie Street/against the House Code and the Residential Design – Character Code	A new house	construct a new house on vacant land at 58 Teneriffe Drive, Newstead	proposed driveway as an addition to approved application is not minor change	dismissed	Developer VS BCC	City Plan 2000,
QPEC05-009	material change of use a shed in a farm/characterised as warehouse /industry usage under city plan /designated as Rural Area	shed in a farm/	shed is on land at 45 Van Dieren Road, Pallara, a semi-rural area south of Oxley	BCC	dismissed	Developer VS BCC	
QPEC05-017	Minor change to approved application/The determinative question is whether the change to the proposal would be likely to attract an adverse submission that was not provoked by the proposal in its original form	Backpacker	backpacker's hostel at 55 Annie Street, New Farm	objected by local residents	dismissed/ changes are minor	third part VS BCC	
QPEC05-019	appellant decided to strat construction before the appeal is decided	multi-unit dwelling	a multi-unit dwelling (78 units) on land at 28 Shafston Avenue, Kangaroo Point, Brisbane.			Developer VS BCC	
QPEC05-024	changes to development approval/ planning+amenity+traffic/Local people against approved multiunit dwelling	multi-unit dwelling	Lot 84 on RP 12589 and Lot 1 on RP 12617, Bulimba, Wambool ST	objected by local residents	dismissed	Local residents VS BCC&developer	
QPEC05-026	appeal against BCC aproval for a multi-unit dwelling/planning issues/conflict with City Plan /front & back B20boundarty+retaining walls+landscaping+open space	multi-unit dwelling	(lots 1 and 3) at 165 Eildon Road and 41 Silvester Street	objected by local resident	dismissed	Local resident VS BCC&developer	
QPEC05-035	Development application to Council completed wrongly/Applicant's having to repeat the public notification stage.	100 Lot Residential Subdivision/Emerging Community and the change of use from "Broadacre Residential to Low Density Residential".	Lots 1 and 2 on RP 67732 and Lots 2 and 3 on RP 90457/120-200 Church Road and 165-169 Witty Road, Bellbowrie.		dismissed	Local resident VS BCC&developer	
QPEC05-038	conflict is about conditions imposed by the Council on a Code Assessable approval/minor change failed due to changes to proposal	a dwelling house.	The site contains approximately 450 m². The south-western boundary has frontage to Teneriffe Drive. The south-eastern boundary adjoins a steep section of an unconstructed road reserve which extends from the constructed section of Abercrombie Street to the north-east. This unconstructed steep road reserve has been attractively landscaped. The reserve is traversed by a footpath which links Abercrombie Street with Teneriffe Drive via the footpath and a flight of stairs.		dismissed	Developer VS BCC	
QPEC05-043	traffic (access),setbacks and proper calculation of gross floor area (GFA) adverse impact on the heritage place and neighbouring development,setback.traffic	MULTI-UNIT DWELLING FROM LOW-MEDIUM DENSITY on Land Adjoining a Heritage Place and Building Work on the site of a Heritage Place	86-88 Moray Street, New Farm and is made up of Lot 1 on RP 54179 (1108m2) and Lot 2 on RP 54179 (1120m2).	objected by local residents	Appeal allowed, conditions to be reviewed	Local residents VS BCC&developer	
QPEC05-047	Appeals by developer against refusal of development applications for material change of use/proposed development constitutes a "warehouse" under City Plan/inconsistent with DEOs	constructed **backyard shed** for storing a collection of classic English motor vehicles	Lots 101 and 102 on RP 12905, Hunter St at Greenslopes		dismissed	Developer VS BCC	
QPEC05-050	Change to Approved Building Permit/incrase in height,addition of sixth storey and GFA/generally inappropriate	home units building	33-35 Griffith Street, New Farm	council	dismissed	Developer VS BCC	
QPEC05-058	proposed development" conflicts with the Body Corporate and Community Management Act	subdivision(2 houses)	lot 1 on SP145009/11C Scenic Rd, Kenmore	submitter objectors	dismissed	Local residentVS BCC&developer	
QPEC05-060		a new house on land	369 Waterworks Road Ashgrove / lot 282 on RP18732.	submitter objectors	N/A	Local residentVS BCC&developer	
QPEC05-061	Change of approved condition/seeks to constrain the range of business premises which were permitted to be established in an existing building pursuant to the approval				N/A	Developer VS BCC	
QPEC05-065							
QPEC05-066							
QPEC05-072							
QPEC05-073							
QPEC05-074							
QPEC05-078	Material change of use/the proposal to erect a new dwelling on the site brought the development, as a whole, within the definition of a multi-unit dwelling/commercial character building activities/A use of	extension to commercial character building (caretaker's residence) as a House	49 Laura Street, Highgate Hill		N/A	Developer VS BCC	
QPEC05-083							
QPEC05-086							
QPEC05-093							
QPEC05-100							
QPEC05-102	Appeal against against deemed refusal of request to change a development approval(addition of a 6th storey and 20% increase in GFA/plot ratio)/minor change conflict	Multi unite dwelling	33-35 Griffith Street New Farm/18 & 19 on RP8732,		dismissed/ some conditions are added	Developer VS BCC	JVP is visual expert/proposed change is fine in terms of visibility to landmarks/good case for further assessment
QPEC05-104	noise, amenity,traffic	Backpacker	backpacker's hostel at 55 Annie Street, New Farm	objected by local residents		third part VS BCC	
QPEC05-108	height exceeds 8.5m limit / invalid approval due to conflicts with boundary clearance / public notification insufficiently	extensions to a substantial house	66 Markwell Street,Hamilton.	objected by local residents	proceed	local residents VS BCC & developer	

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC06-006	change of applicant	to demolish a building on land	90 Coonan St, Indooroopilly.	Adverse submitters	Appeal dismissed	Objector VS BCC+Developer	complicated case
QPEC06-007	whether a development permit for a material change of use is required pursuant to City Plan	to revelope previously operated as a service station	243 Hamilton Road, Wavell Heights	BCC	Appeal dismissed	developer VS BCC	
QPEC06-011							
QPEC06-019	Character building to be demolished to build 3 unit multi-unit dwelling.design/character issues/Particular attention was focussed on the roof form of the proposed new building.roof form is new building is the main issue/exisitng house to be rotated	demolish Queenslander	20 Rupert Street, Windsor	Adverse submitters	Appeal dismissed/conditions ought to include adoption of the alternative proposal with a skillion roof.	Objector VS BCC+Developer	Judge is satisfied that the proposed new building complies with the performance criteria in the code difference between “complement” and “reflect”.
QPEC06-028							
QPEC06-035	Neighbour house enjoys extensive views.Submitter believes that application in not code assessable and should not be approved by Council	add one floor to queenslander	76 Windermere Road, Hamilton.	Adverse submitters	Appeal dismissed	Objector VS BCC+Developer	Gateway Bridge view would be obscured by the proposed development(addition 1 storey)
QPEC06-040	a loss of amenity/adverse environmental problems/conflicts with City Plan/out of character	Former bowl club sold to a private property developer, permission to fill it to a higher level and reconfigure the existing seven allotments into eight, which could then be developed for residential use.	Wharf Street and Oxley Road at the corner of Rosebery Terrace and Luxford Street	BCC+nearby resident as co-respondent	Appeal allowed, conditions to minimise impacts of filling land	developer VS BCC + co-respondent by election	
QPEC06-044	Whether subject house is a character house	demolition of a dwelling	34 Warmington Street, Paddington	BCC	Appeal dismissed	developer VS BCC	
QPEC06-054							
QPEC06-061	Incosistent with Advertisements Policy 1999	exhibition of an illuminated advertising device on a building at 130 Queen Street, Brisbane	130 Queen Street, Brisbane	BCC	Appeal dismissed	developer VS BCC	
QPEC06-067	property damage and traffic disruptions/the question of footpath closure	Four-storey property	45-47 Edward Street, Brisbane	Adverse submitter(adjoining building)	Appeal dismissed	Objector VS BCC+Developer	
QPEC06-070	Ancillary description is put forward in application and notification rather than dwelling	a new detached dwelling at the rear of an existing building(a caretaker’s residence)/exisitng commercial use	47 Wahcumba Street, Dutton Park	Adverse submitter(adjoining building)	hear parties for appropriate orders	Objector VS BCC+Developer	
QPEC06-072							
QPEC06-073							
QPEC06-077							
QPEC06-086	Faild notification process	demolish a building containing three dwelling units (in a community title scheme)+19 Park St Hawthorne, subdivide the land into three parcels, and construct three new single-unit dwellings.	19 Park St Hawthorne	Adverse submitter(adjoining building)	Appeal dismissed	Objector VS BCC+Developer	
QPEC06-090	discussion on heritage register	extensions to her residence as a heritage Place(impact assessable)	66 Markwell Street, Hamilton	Adverse submitter(adjoining building)	Preliminary point determined against Co-respondent	Objector VS BCC+Developer	
QPEC06-092	GFA more than 0.75/over development , bulk and size	(centre activity – multi-unit dwelling for four units)	331 Waterworks Road Ashgrove	Adverse submitter(adjoining building)	Appeal is adjourned	Objector VS BCC+Developer	
QPEC06-103							
QPEC06-124	Heritage Lisitng changes	Development Application for its demolition	81 Dornoch Terrace, Highgate Hill,	Adverse submitter(adjoining building)	Declare listing in Heritage Register Planning Scheme Policy to be invalid	Objector VS BCC+Developer	The house is in the Medium Density Residential Area.

2006 - 20 cases

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
							2007 - 22 cases
QPEC07-003	Proposal compromises the achievement of the Desired Environment Outcomes+conflict with the planning scheme Noise and traffic Conditions	new retail and residential development at Everton Park.	Brookside Shopping Centre, and Stafford Plaza Shopping Centre/Lots 1-4 on RP 108888, Lot 1-2 on RP 80720, Lot 3 on RP 80099, and Lot 13 on RP87716. The address is 752 Stafford Road, Everton Park	Adverse submitter(adjoining building) BCC+Co-respondents	Appeal Dismissed Adjourned to refine noise and traffic conditions	Objector VS BCC+Developer Developer VS BCC +Co-respondents(objectors)	former Woolworths distribution centre at Everton Park Under Brisbane's City Plan 2000 for Light Industry
QPEC07-009	conflict with the Demolition Code of the Brisbane City Plan 2000.	4 new dwelling units on a property at 97 Sylvan Road, Toowong. a material change of use to establish the new residential units.	97 Sylvan Road, Toowong.	Adverse submitter(adjoining building) BCC+Co-respondents	Appeal Dismissed Application is approved with conditions	Objector VS BCC+Developer Developer VS BCC +Co-respondents(objectors)	
QPEC07-021 **QPEC07-027**							
QPEC07-034	Public notification failure integrate with the potential development in adjoining sites is Council's main concern CHANGES: provision of a public road, increase dwelling from 16 to 18 and GFA from 39% to 44%	Community Facilities including aged care accommodation (multi-unit dwellings), a medical centre and child care facility on land material change of use for a multi-unit dwelling containing 16 units. 12 two storey, 3 bedroom detached dwellings, and a block of 4 attached dwellings containing 2 and 3 bedroom units. GFA 39%	413-455 Richmond Road, Carina 46 Bleasby Road, Eight Mile Plains	BCC+Adverse submitter BCC+Co-respondents	Adverse submitter is allowed to become co-respondent Changes to development application is minor/appeal to be proceed based on revised proposal application is allowed	Developer VS BCC Developer VS BCC +Co-respondents(objectors)	Church's appeal against Council's refusal of its development application Orginal application didn't opposed by any submitter, however objector drew attention to changes
QPEC07-040 **QPEC07-053**							
QPEC07-063	to close exisitng access	Access road proposed by another developer near subject land	110 Lamington Avenue, Brisville's	BCC	Dismissed	Developer VS BCC	an auction depot, storage yard, general industry and restaurant (canteen ancillary to auction depot).The land has been developed and may generally be described as a large vehicle
QPEC07-067	was not a properly made application; and application was not properly notified	a material change of use for a nightclub and for a preliminary approval for building work	Stanley Street, Woolloongabba.Lot 1 on SP102439, being Lot 1 in the South Bank Chambers Community	Adverse submitter(adjoining building)	Dismissed	Objector VS BCC+Developer	
QPEC07-073	visual amenity, and impacts; impacts on the heritage values of the site; issues arising from the fact the proposal is said to be part of a larger bikeway system	Bikeway and fenceing proposed by BCC boundary of St Lucia Golf Course1	St Lucia Golf Course1	Adverse sumbitter	actual visual impact will be minimal. Appeal is dimissed	Adverse sumbitter VS BCC	Toowong-Indooroopilly District Local Plan photomontages prepared by Mr Elliot
QPEC07-092	Whether or not the tower and an associated electric hut were safe and suitable in a flood-prone area/Visual impacts of the structure,	Telstra's application for a development permit to construct a telecommunications tower	77 Adina Street, Norman Park.	Adverse submitter(adjoining resident)	Dismissed	Objector VS BCC+Developer	
QPEC07-093	Whether house contributes positively to the visual character of the street/whether or not it is capable of structural repair	**Demolish** an old Queensland house	97 Sylvan Road Toowong	BCC+Co-respondents	**Allowed**	Developer VS BCC + Co-respondents(local residents)	dint of its location and immediate surrounds the demolition of this building will not result in the loss of traditional character in the street
QPEC07-094							
QPEC07-092	whether its consistent with planning intentions	upgrade an existing sporting field in a memorial park	Yeronga Park	Adverse submitter (locals)	the planning controls are against the proposal Appeal Allowed	Objector VS BCC+Developer	
QPEC07-121 **QPEC07-122** **QPEC07-123** **QPEC07-124** **QPEC07-126** **QPEC07-130**							
QPEC07-132	One condition required the stump to be replaced with an advanced fig tree of the same type. It was to be planted in the northeast corner of the site.	move slightly and then renovate the existing house, and to build a tennis court at the rear of the property	28 Queens Road, Hamilton	BCC	Plants and trees are an everyday aspect of that residential use. Dismissed	Developer VS BCC (appeal against a condition)	received approval for house , but run into trouble for tennis court location

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC08-007	Whether complies with City Plan	new supermarket and retail complex	Eight Mile Plains.261 Warrigal Road, Lot 6 on RP 37245	Adverse submitter(AMP and Westfield)	Dismissed	Objector VS BCC+Developer	**2008 - 17 cases**
QPEC08-022	Appeal to struck out second co-respondent				second respondent stuck out	Developer VS BCC and Co-Respondent by election	
QPEC08-030	imcompliance with DEOs/incremental extension of a non-residential use within close proximity of an established local neighbourhood centre. Proposal does not detract from res amenity!	development permit for a material change of use as a branch legal office of Delaney & Delaney, solicitors	131 Kedron Brook Road and Main Avenue, Wilston being lot 88 on RP 60064	BCC	I consider the proposed development will satisfy a need in the area Appeal is Allowed	Developer VS BCC	Grange District Local Plan Subject land is being 110 metres1 from Wilston Village Convenience Centre (Wilston Village) an MP4 Centre2 **Council's opposition as really a strategic one based on wider considerations than the amenity of the area**
QPEC08-031	Proposal is not code assessable/wrong zoning	reconfiguration of Lot into 170 lots, park and new road	Lot 101 on SP143458/2865 Beaudesert Road, Parkinson	Adverse submitter(Locals)	Development is impact assessable/proposal remains at application/Not approved/Allowed	Objector VS BCC+Developer	
QPEC08-033	**Vehicular access** and, in particular, that the majority of the units would gain access via Norman Street, rather than Vallely Street	demolition of a house in a Demolition Control Precinct and for the making of a material change of use, to facilitate the development of five townhouses	53 Vallely Street, Annerley.	Adverse submitter(Locals)	Dismissed/to revise conditions	Objector VS BCC+Developer	
QPEC08-034	proposed extension will have an adverse impact/be oppressive and overbearing/be incompatible and inconsistent/adversely impact on privacy/inconsistent with realistic expectations as a future amenity/breezes	permit extensions to an existing house (which is a heritage place) on that site.	66 Markwell Street, Hamilton.	Adverse submitter (residents)	Dismissed/to consider condtions of approval	Objector VS BCC+Developer	It should be noted that there are two categories of impact assessable development under City Plan, namely "generally appropriate" and "generally inappropriate".Being "generally appropriate" impact assessable development, the proposal is of a kind for which adverse impacts are usually able to be mitigated.
QPEC08-035	relaxation/period of currency					Developer VS BCC +Concurrence Agnecy	
QPEC08-040	the scale, character and lack of integration of the proposed development with consequential unacceptable visual impacts; ecological impacts upon a 'habitat node' and corridor for wildlife movement; unacceptable loss of vegetation; traffic; and, stormwater quality and quantity.	proposed accommodation for aged persons, and associated facilities/128 beds.	413-455 Richmond Road, Carina and contains just over 4 hectares.	Adverse submitter(Locals)	dismissed	Objector VS BCC+Developer	
QPEC08-045	character and sense of place/heritage/visual relationship/road amalgamation/reconfiguration/demolition	10-storey one, said to present to the street as 8-storeys	79 Moray Street New Farm	3 Adverse submitter(Locals)	dismissed	Objector VS BCC+Developer	Right to view? "Prospect … is a matter only of delight, and not of necessity, no action lies for stopping thereof, and yet it is a great commendation of a house if it retains a long and large prospect but the Law don't give an action for such things of delight."
QPEC08-048	squirrel glider habitat development zone/adverse impacts on waterways and wetlands; impacts on flora and fauna, particularly squirrel gliders/flooding and water quality; concerns about acid sulphate soils; traffic; an alleged lack of need for a public golf course; and, what was said to be an inaccuracy in surveying highest astronomical tide for the CMD	BMD's proposal to develop a large parcel of vacant land at Cannon Hill, slightly to the south of his residence, for a golf course, a residential subdivision, and associated commercial purposes.	125 hectares and is owned by Brisbane City Council. It lies to the west of Bulimba Creek, and is east of Creek Road and north of Fursden Road	Adverse submitter(Locals)	proposed development is one showing significant planning merit/dismissed	Objector VS BCC+Developer	
QPEC08-049	Preivous addition changes the character of house/	Demolition of a house in a Demolition Control Precinct to build a multi unit however the development will ultimately present as two single detached character buildings to Linton Street	97 Linton Street, Kangaroo Point located in the Demolition Control Precinct	BCC	Allowed	Developer VS BCC	O'Brien
QPEC08-075	properly made submission issue (outside 10 days period)	development application was for extension of an existing (pre-1946) dwelling	57 Fisher Street, East Brisbane and new dwelling in the rear portion of the narrow site,	Submitter	dismissd	Submitter VS BCC & Developer	
QPEC08-080	whether any material change of use was exempt development – whether development involved assessable vegetation clearing or other assessable operational works/works occurred within the watercourse constituted by Bulimba Creek/impacts on biodiversity/vegetation clearance/	Bikeway	Minnippi Parklands at Tingalpa.lot 50 on RP160209 (lot 50) and starts at Wynnum Road to the north and connects to a narrow strip of dedicated road connecting lot 50 to Proprietary Street	Adverse Submitter	dismissd	Submitter VS BCC	
QPEC08-084	Extension of time/20 days period	a multi-unit dwelling (three units) and a preliminary aproval for building work for the partial demolition of an existing pre-1946 dwelling		Adverse Submitter	dismissd	Submitter VS BCC+developer	
QPEC08-115	extend the life of its development approval/new City Plan-changed requirements/change of ownership in the area which may object the development/inconsistency with current planning policy	19 years, Ardmore has had plans to build an apartment building with three home units,That was for a three storey apartment building, to contain eight units	39/41 Brighton Road, Highgate Hill, Brisbane	BCC	dismissd	Developer VS BCC	
QPEC08-116	To stike out one of co-respondents	new drive-way crossovers onto surrounding streets for Gravatt Plaza Shopping Centre.	MT Gravatt Plaza Shopping Centre	BCC	Allowed	Developer VS BCC +co-respondents	
QPEC08-119	involved operational work on a heritage place/was a material change of use/New Lagoon Street/impact assessable rather than code assessable/conflict with codes/The Flood Immunity Works/GFA issue	a new shopping centre, full-line Woolworths Supermarket and will also provide for six speciality shops	Sandgate town centre, on the western side of Bowser Parade	Adverse Submitter	dismissd	Submitter VS BCC+developer	

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC09-008	Minor Changes/conflict with the Council's Planning Scheme & DEOs/unacceptable impact on the amenity/Over-development/unacceptable impact on character/sense of place	a material change of use for 35 multi-unit dwellings/11 two-storey townhouses and 24 apartments	125 Bulimba Street, Bulimba Lots 15, 23, 25, 26, 81 and 84 on RP 87060	Adverse submitter	Dismissed	Objector VS BCC+Developer	Mr Perkins Principles: human scale, character buildings, enhancing character, consistency(incompatible uses), sense of place **over-development parameteres**: population density, height,GFA, **bulk** in relation to character of area indicators of negative impacts by over-development: **insufficient setback, insufficient landscaping/open space, insufficient on-site parking, overshadowing, loss of privacy, building articulation**
QPEC09-010 QPEC09-013 QPEC09-019 QPEC09-021					Struck out		
QPEC09-034						developer VS BCC+co-res.	if the court concludes that the proceeding was frivolous or vexatious, appeallant should pay costs to respondent/co-respondent/having no reasonable grounds';
QPEC09-040	if appeal was frivolous and vexatious/amenity issues).	easement issue	Oxford Street, Bulimba	developer Objector	appeallant pays costs part of the proceeding was frivolous and vexatious	Objector VS BCC+Developer	
QPEC09-041	transport/access/poor design/of-centre extension of the existing centre/proposal is not sensitive to surrounding development/conflicts with the Strategic Plan/visual impact	permit for material change of use for office and a preliminary approval for building work for office	85 Hudson Road, Albion.Lot 1 on RP19174	BCC	Application to change conditions	developer VS BCC	
QPEC09-042 QPEC09-048							
QPEC09-053	Easement The bulk of the building development work/has there been any required	retain the existing building and construct a three storey extension at the rear to incorporate offices. Development Permit for a Material	237 Given Terrace, Paddington (Lot 10).	BCC	application is not properly made/application is dismissed,	developer VS BCC	
QPEC09-056	statutory notification to residents of the surrounding area/extension outside commercial character legislation/impact of car park	Change of Use for a Restaurant (Café) not in a Commercial Character Building within the Low Density Residential Area	19 Orontes Road, Yeronga.	Objector	Does not compromise the achievement of the DEOs Appeals dismissed.	Objector VS BCC+Developer	
QPEC09-058	overdevelopment – conformity with planning strategy – hydraulic impact – traffic – privacy – loss of vegetation and bushland character – ecological impact – ecological sustainability – compliance with codes	12 lot subdivision	Lots 7 and 8 on RP73434./350-354 Fig Tree Pocket Road	Adverse submitter	Does not compromise the achievement of the DEOs Appeals dismissed.	Objector VS BCC+Developer	
QPEC09-056	300mm height increase/failure to minimise amenity impacts/loss of enjoyment of these decks	House up to 9.5m above GL	127 Denman Street, Greenslopes	Previous Court case	Previous court conditions changed	developer VS BCC	
QPEC09-072							
QPEC09-078	Notification stage/extension to office space(25sqm)	material change of use for 175m2 of "office" in a proposed extension to an existing building required impact assessment	664 Miles Platting Road Rochedale;includes land described as Lot 4 RP885558	BCC	Allowed	developer VS BCC	
QPEC09-097	non-compliance with public notification process/notice of appeal to submitters	develop a shopping centre	Bracken Ridge Road, Bracken Ridge. Frontages to both Bracken Ridge Road and the Gateway Arterial.	BCC+co-respondents	Non-compliance with requirements	WAW Developments Pty Ltd VS Council+Co-respondents(Wool worth etc)	
QPEC09-102	access road issue	Subdivide large parcel to five allotments	31 Gem Road, Kenmore	Adverse submitter	application changes/allowed	Objector VS BCC+Developer	
QPEC09-109	Conflict with Planning scheme/environmental impact – fauna – flora – scar trees – visual amenity – hydrology – whether proposed new code ought be amended-traffic	proposed Industry and Business development including up to 98,000 m2 GFA of non-ancillary office space	Wacol Army Barracks, located near the Ipswich Motorway–Centenary Highway interchange	BCC+co-respondents	unacceptable on planning grounds The appeal is dismissed	developer VS BCC+co-res.	
QPEC09-111							
QPEC09-113	amenity impacts on neighbouring dwelling (sunlight, daylight and privacy)	single unit dwelling,involves two "single unit dwellings" one of which is an existing pre-1946 residence	176 Arthur Street, Fortitude Valley	Adverse submitter	Appeal dismissed	Objector VS BCC+Developer	
QPEC09-122 QPEC09-123 QPEC09-124							
QPEC09-135	impact assessable in DCP area/ access and traffic issues	Reconfiguration of two lots into three and material change of use for three single unit dwellings (two new units) 3 x single unit dwellings/post war house demolition	Lot 3 on Registered Plan 62186 (611m2)	BCC	dismissed	developer VS BCC	
QPEC09-138	whether subdivision ought provide for a centrally located linear corridor through the site for recreation or environmental purposes/whether proposal retaining vegetation at eastern end of the site would provide a suitable corridor if one were required	reconfiguration for residential subdivision	56 and 61 Greendale Way and 58 Ridgeview Street, Carindale	Adverse submitter	Appeal dismissed	Objector VS BCC+Developer	

2009 - 23 cases

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC10-011							
QPEC10-012							
QPEC10-014	not a properly made application/inconsistent with the terms of the easement	a multi-unit development at Coronation Drive/replace an existing two-storey multi-unit dwelling (of four dwellings) with a new nine-storey building containing nine three-bedroom dwellings	lot 24 on SP 114135 (lot 24)+lot 40 on SP 139833 (lot 40)	Adverse submitter	Dismissed	Objector VS BCC+Developer	
QPEC09-016	property were such as to render it no longer representative of a traditional character house (19 reasons)	Material Change of Use, namely to demolish a pre-1946 house/17 Bodalla Street, Norman Park	Lot 653 on Crown Plan SL 6059 County of Stanley	BCC	Allowed	developer VS BCC+co-res.	Mr Elliot
QPEC10-018	to adjourn the hearing of two matters which are set down to commence			BCC	Dismissed	developer VS BCC+co-res.	
QPEC10-028		to relocate the upstairs part of the office component of the mixed development to ground floor level at the expense of parking provisions in a space which was always to be enclosed.					
QPEC10-032							
QPEC10-033	related to 2009 Cout case/feature a path of approximately 3 metres in width extending for approximately 1,554 metres in length;	Stage 2 of a path(a path of approximately 3 metres in width extending for approximately 1,554 metres in length)	Lot 3 on RP141525 (Lot 3) (ii) Lot 2 on SP224771 (Lot 2) (iii) Lots 166 and 167 on RP207897 (Lots 166 and 167) (iv) Lot 50 on RP160209 (Lot 50) (v) Lot 6 on RP806629 (Lot 6)	Adverse submitter(He has a sincere and deeply held concern for local wildlife and, in particular, the local squirrel glider population)	adjourned/council to investigate issues related to nature conservation regulation 2006	Objector VS BCC+Developer	
QPEC10-039							
QPEC10-040							
QPEC10-043					Mcdonald Vs BCC		
QPEC10-044					does not contribute positively to the visual character of the street		
QPEC10-047	Character	Demolition Case in DCP built prior to 1900	44 Palmer Street, Windsor	BCC	Allowed	developer VS BCC+co-res.	
QPEC10-048							
QPEC10-055	related to 2009 Cout case/feature a path of approximately 3 metres in width extending for approximately 1,554 metres in length;	Stage 2 of a path(a path of approximately 3 metres in width extending for approximately 1,554 metres in length)	Lot 3 on RP141525 (Lot 3) (ii) Lot 2 on SP224771 (Lot 2) (iii) Lots 166 and 167 on RP207897 (Lots 166 and 167) (iv) Lot 50 on RP160209 (Lot 50) (v) Lot 6 on RP806629 (Lot 6)	Adverse submitter(He has a sincere and deeply held concern for local wildlife and, in particular, the local squirrel glider population)	Dismissed	Objector VS BCC+Developer	
QPEC10-058							
QPEC10-062							
QPEC10-064							
QPEC10-067							
QPEC10-069	was not a properly made application error or mistake of law on the part of the Tribunal/Overshadow adjoining houses; and Obstruct the outlook from adjoining lots."	development application seeks to regularise a structure in the order of 18 metres long, 2.3 m wide and up to 2.8 m high at the level of the balustrade, which has been constructed over the footpath adjacent to the appellant's restaurant premises situated	Wyandra Street, Newstead	BCC	That the appeal be struck out	developer VS BCC+co-res.	
QPEC10-070		construction of a new two storey home	30 Clayton Street Sandgate, being Lot 8 on RP74840	BCC	Allowed	BCC VS developer and tribunal	
QPEC10-072	Removal and replacement of Ficus benjamina trees; additional planting of one Ficus; removal of trees of no heritage significance; temporary removal of wooden marker post; remedial pruning.	BCC works	Yeronga Memorial Park	Adverse submitter	Dismissed	Objector VS BCC	
QPEC10-079							
QPEC10-080							
QPEC10-081							
QPEC10-099							
QPEC10-106							
QPEC10-107							
QPEC10-0116	Heritage - Town Planning - Heritage Values - amenity issues -Arboreal issues	Development application to build café, kiosk, restaurant and function room facility on lease area within park boundary	New Farm Park	BCC	Dismissed	developer VS BCC+co-res.	
QPEC10-119	Minipippi Wetlands.			Adverse submitter	Dismissed	Objector VS BCC	
QPEC10-120							
QPEC10-123		factory warehouse				developer VS BCC+co-res.	
QPEC10-0128	related to case QPEC10-055				To pay respondent cost	Submitter VS BCC	
QPEC10-0130	whether demolition will result in the loss of traditional building character.	demolition pre 1946 house	Lots 3 and 4 on RP 29573/32 Harrowby Street, Corinda	BCC	Dismissed	developer VS BCC	
QPEC10-0134	to meet a somewhat lower price point in the market/reduction in the overall height of the building in absolute terms although, by adopting lower floor to ceiling heights/**definition of a permissible change.**	proposed change to multi-unit development to decrease building envelope but increase density	Lambert and Cairns Streets, Kangaroo Point	BCC refusal of change to application	Dismissed	developer VS BCC	
QPEC10-0135	experts			Adverse submitter	Appellant should pay cost to co-res	Objector VS BCC+Co-Res	
QPEC10-0137	whether demolition will result in the loss of traditional building character.	demolition pre 1946 house	50-52 Collins Street, Nundah.	BCC	Dismissed	developer VS BCC	
QPEC10-0143	Ecological and Landscape Value – Permeability, Connectivity - Integration – Character – Realistic Expectations – where proposal conflicts with part of Neighbourhood Plan adopted post application	Application for reconfiguration from 2 lots and 32 lots in the Emerging Community Area	Lot 12 on RP 77971 (Lot 12) and Lot 2 on RP 131791 (Lot 2)	Adverse submitter	Dismissed/approval subject to conditions	Objector VS BCC+Co-Res	
QPEC10-0151	Appeal against refusal to change approval/whether permissible change – where gross floor area decreased and reduced building height / **same Case 134**	multi-unit dwelling	Lambert and Cairns Street, Kangaroo Point	BCC	Allowed (change is approved)	developer VS BCC	
QPEC10-0154	minor change						
QPEC10-0155							

2010 - 41 cases

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC11-003							**2011 - 37 cases**
QPEC11-004							
QPEC11-009							
QPEC11-010							
QPEC11-011							
QPEC11-019							
QPEC11-022							
QPEC11-026							
QPEC11-028							
QPEC11-030							
QPEC11-031							
QPEC11-036							
QPEC11-038							
QPEC11-039							
QPEC11-040							
QPEC11-042							
QPEC11-043							
QPEC11-047		carrying out of building work for partial demolition and relocation of a pre 1946 building in the demolition control precinct (DCP)					
QPEC11-054	whether student accommodation falls within the definition of house or multi-unit development under the Brisbane City Plan 2000/not properly made application	student accommodation involving multiple bedrooms and common facilities	17 Wilkins Street, Annerley, 32 O'Keefe Street, Woolloongabba, and at 178 Cornwall Street, Greenslopes	BCC	Dismissed	developer VS BCC	
QPEC11-055	Contrary to DCP code	demolition of two pre-1946 houses	5-11 Orleigh Street, West End being lots 113, 114, 115 and 240 on RP10977.	BCC+25 adverse submission	Allowed	developer VS BCC	
QPEC11-064		community facilities church	880 New Cleveland Road at Gumdale	BCC+25 adverse submission		developer VS BCC	
QPEC11-068							
QPEC11-070							
QPEC11-074	rare case, whether or not the building was constructed in accordance with the approved plans/fire issue	owner of a number of units in an apartment building in a resort at Tangalooma, seeks a declaration that the approval under which the building was constructed which the respondent Mr Nunn issued some years ago is null and void	Moreton Island Tangalooma	Owner	adjourned	Objector VS developer + BCC	
QPEC11-078							
QPEC11-079							
QPEC11-082							
QPEC11-087	intended character for Precinct was residential, featuring "traditional built form character" in "unified streetscapes, noise, headlight glare, traffic, blocking of breezes and sunlight, relationship/compatibility with other/nearby buildings and positive contribution to amenity and character of the local area	Large building Water Street, Spring Hill for the Royal Australasian College of Surgeon	Union Street, Spring Hill (lot 1 on RP 1269361)-(Victoria Street and Water Street)	Adverse submitters (appellants made common cause.)	Dismissed subject to minor changes to proposal	Objector VS BCC+Developer	**Mr Chenoweth**
QPEC11-089							
QPEC11-091					appeal allowed by consent		
QPEC11-101	Water issues	for extractive industry – application unsupported by evidence regarding allocation of or entitlement to any "State resource"	Lot 11 on SP 122601 to Lot 108 on SP 122599	BCC	Dismissed	developer VS BCC	
QPEC11-108	Costs awarded to a developer against applicant for declaration its development approval was invalid on withdrawal of that application						
QPEC11-111	Adverse submitter appeal in respect of approval for multi-unit dwelling in a low-medium residential density area allowed by consent - "minor changes" ameliorated impacts near the boundary - additional time allowed for service of notice of the appeal on the concurrence agency						
QPEC11-113	Developer relieved from statutory lapsing of a development approval for reconfiguration						
QPEC11-115	submitter appellant who has a heritage property next to co-respondent developer's site						
QPEC11-117	Minor change to development application						
QPEC11-122	Definition of "business day"						

Court Case Number	Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties	Personal/Important notes
QPEC12-015	(delivered ex tempore)						
QPEC12-018				Adverse submitters	Dismissed subject to minor changes to proposal	Objector VS BCC+Developer	
QPEC12-019							
QPEC12-022	traffic, ecological, noise, odour, dust, lighting and social impacts of proposal considered - concern about run-off and waterway corridor (Bullockhead Creek) nearby -	waste transfer station on a site separated by a 50 metre wide mutual neighbour	Site comprises no. 24 (lot 171) and no. 32 (lot 170 on RP86573)	Adverse submitter(Church)	Dismissed	Objector VS BCC+Developer	
QPEC12-026	Conditions appeal - relief granted - changes to the proposal adjudged minor change						
QPEC12-027	Submitter appeal by neighbours against council approval - development application related to work already done without any approval, and was to "regularise" development already carried out - court order gave effect to						
QPEC12-030							
QPEC12-032	Amenity, Height	material change of use (multi-dwelling unit)	35 Burdett Street, Albion, Brisbane, Qld, 4010/ lot 2 on RP801651, parish of Toombul, County of Stanley	Adverse submitter(Church)	allowed (Council deceision is invalid)	Objector VS BCC+Developer	
QPEC12-034							
QPEC12-042	Minor change issue/planning designation	Change approved low-key shopping centre to hotel+night club	south-eastern corner of the intersection of Illaweena Street and Beaudesert Road, Drewvale	BCC	Dismissed	developer VS BCC	
QPEC12-047	visual character of the street/a loss of traditional building character	demolition of a pre-1946 house situated within a Demolition control Precinct under the respondent's City Plan 2000	western side of Quay Street	BCC	Allowed	developer VS BCC	
QPEC12-049	BCC to pay costs to respondents			appealed by BCC	dismissed	BCC VS repondent+certifier	
QPEC12-059							
QPEC12-061	"permissible change" to an approval for a 34 lot townhouse development						
QPEC12-065	about the proper construction of infrastructure contribution			appealed by BCC	allowed	BCC VS developer	
QPEC12-071	Application was not properly made/height/amenity	a new Multi-Unit Dwelling and Shop/Office/Restaurant over land located	28-32 Morrow Street and 2 Harrys Road, Taringa described as lots 1 and 2 on RP54864 and lot 36 on SP159242	Adverse submitter(Church)	Dismissed	Objector VS BCC+Developer	
QPEC12-078							
QPEC12-080	whether proposal compliant with performance criterion that "development size and bulk must be consistent with the low to medium density of the locality" – site the only vacant parcel in a street overwhelmingly characterised by smaller pre-1946 character	a multi-unit dwelling in a Demolition Control Precinct	22 Goodwin Terrace	Adverse submitter(Church)	Dismissed	Objector VS BCC+Developer	
QPEC12-081	Demolition of building on Brisbane Heritage Register - Appeal against refusal – Compliance with Heritage Place Code – Can Cultural Heritage of a listed property be questioned	Demolition of building on Brisbane Heritage Register	42 Maxell Street, at the intersection with Dodwell Lane, New Farm	Adverse submitter(Church)	Dismissed	Objector VS BCC+Developer	

2012 - 19 cases

Court Case Classification Categories

Issues and Arguments/Grounds	Application & Development Type	Address	Opposed by	Order	Parties
Traffic Access **Hydraulic** Waterways , Flood **Environment** Ecology (flora and fauna) Soil contamination Sustainability **Amenity** Heritage/cultural heritage Dust Pollution Noise Social Impacts Visual Character(visual, views, visual relationship, privacy, overdevelopment, bulk/size, frontage, intesity, Design, Greenery and green space) Bulk/scale **Town Planning** Use/zoning compliance/conflict with planning scheme and DEO GFA/height Code assessment VS impact assessment Properly made application Public notification process minor change to application Need	**Material Change of USE** **Reconfiguration of Lot** **Building Works (OPW)** Waste Transfer station Multi-unit residential/accommodation Detached housing (town houses) Commercial (Shopping centre, night club, resturant, service station, office) Demolition pre-1946 houses reconfiguration of lot /subdivide Infrastructure (paths, Bikeways, access roads, access driveways, services, easments, telecommunication towers) Community Facility (golf course, tennis courts, swimming pools, Aquatic centre, school, Church, Mosque, aged care(nursing), surgery, back packer, medical centre) Vegetation clearance Industrial Extentions / Upgrade / Rennovation/Refurbishment (enclose balcony, shutter, blinds, awnings, advertising signage, backyard shed)		Adverse Submitter(s) Brisbane City Council BCC+Co-respondents(ad. Submitters) Court	Dismissed Allowed Adjourned Allowed with conditions Dismissed with conditions	Objector VS BCC+Co-Respondents Developer VS BCC+(objectors) BCC VS developer Developer VS BCC + Co-Res+Concurrence Agency

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2000_QPEC003	1	1		1	1		1						1	1	
2000_QPEC004				1	1					1		1			1
2000_QPEC007			1		1		1		1			1			1
2000_QPEC009			1		1		1					1		1	
2000_QPEC010	1			1						1		1		1	
2000_QPEC014	1		1	1							1	1		1	
2000_QPEC023					1				1				1		1
2000_QPEC032	1			1	1		1			1		1		1	
2000_QPEC046			1					1					1		1
2000_QPEC048			1						1				1		1
2000_QPEC049			1						1				1		1
2000_QPEC051				1						1		1		1	
2000_QPEC055				1		1						1		1	
2000_QPEC057				1							1	1		1	
2000_QPEC078					1					1			1		1
2000_QPEC083		1					1					1		1	
2000_QPEC089					1	1						1			1
2000_QPEC091			1	1	1					1		1		1	
2000_QPEC094					1	1						1		1	
2001_QPEC005		1	1		1			1				1			1
2001_QPEC006	1		1	1			1					1		1	
2001_QPEC008					1				1				1	1	
2001_QPEC009			1		1					1		1		1	
2001_QPEC015				1							1	1		1	
2001_QPEC022					1		1					1		1	
2001_QPEC024			1						1				1		1
2001_QPEC041		1	1							1			1		1
2001_QPEC043			1				1						1		1
2001_QPEC045			1		1		1					1			1
2001_QPEC049					1						1	1			1
2001_QPEC050			1						1				1	1	
2001_QPEC051			1				1		1			1		1	
2001_QPEC054					1					1			1	1	
2001_QPEC058			1		1					1		1			1
2001_QPEC061	1		1	1			1					1			1
2001_QPEC062				1				1					1	1	
2001_QPEC065					1	1							1		1
2001_QPEC075			1	1			1					1		1	
2001_QPEC077					1		1					1		1	
2002_QPEC003			1				1					1		1	
2002_QPEC004					1		1						1	1	
2002_QPEC013		1						1				1		1	
2002_QPEC014		1						1					1		1
2002_QPEC020					1		1					1		1	
2002_QPEC023				1	1						1	1		1	
2002_QPEC029&41	1	1	1	1	1						1		1	1	

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2002_QPEC044					1		1	1				1			1
2002_QPEC046		1		1			1		1			1		1	
2002_QPEC069		1	1		1			1					1	1	
2002_QPEC070		1						1					1	1	
2002_QPEC071			1		1			1					1	1	
2002_QPEC072	1		1						1				1		1
2002_QPEC073			1						1			1		1	
2003_QPEC001					1				1				1		1
2003_QPEC006			1				1						1		1
2003_QPEC007			1						1				1	1	
2003_QPEC010					1					1		1			1
2003_QPEC025			1				1					1		1	
2003_QPEC031			1				1		1				1		1
2003_QPEC035	1		1		1		1					1		1	
2003_QPEC043					1			1				1		1	
2003_QPEC055	1	1	1		1		1					1		1	
2003_QPEC057	1		1	1	1					1			1	1	
2003_QPEC067	1		1		1				1			1		1	
2003_QPEC077					1		1					1		1	
2004_QPEC005					1					1			1		1
2004_QPEC017			1		1		1					1			1
2004_QPEC036			1						1			1		1	
2004_QPEC037			1	1	1		1						1		1
2004_QPEC039	1		1		1						1	1			1
2004_QPEC046					1				1			1		1	
2004_QPEC047					1			1					1	1	
2004_QPEC051				1	1						1	1		1	
2004_QPEC059			1						1			1		1	
2004_QPEC063					1		1		1				1	1	
2004_QPEC065		1								1			1	1	
2004_QPEC068			1							1		1			1
2004_QPEC075					1						1	1		1	
2005_QPEC003			1				1					1		1	
2005_QPEC004			1		1		1						1	1	
2005_QPEC009					1					1			1	1	
2005_QPEC017				1	1					1		1		1	
2005_QPEC019					1		1						1	1	
2005_QPEC024	1			1			1					1		1	
2005_QPEC026					1		1					1		1	
2005_QPEC035					1			1				1		1	
2005_QPEC043	1		1		1		1					1			1
2005_QPEC047					1					1			1	1	
2005_QPEC050			1				1						1	1	
2005_QPEC058					1			1				1		1	
2005_QPEC060					1		1					1		1	
2005_QPEC078				1	1					1			1		1

Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2005_QPEC102			1		1		1						1	1	
2005_QPEC104	1		1	1						1		1		1	
2005_QPEC108			1		1				1			1		1	
2006_QPEC 124					1				1			1		1	
2006_QPEC 19			1						1			1		1	
2006_QPEC 35			1		1				1			1		1	
2006_QPEC 40		1	1	1	1				1				1	1	
2006_QPEC 44			1						1				1	1	
2006_QPEC 61					1					1			1	1	
2006_QPEC 67	1						1					1		1	
2006_QPEC 7					1					1			1	1	
2006_QPEC 70					1		1					1			1
2006_QPEC 86					1				1			1		1	
2006_QPEC 92			1		1		1					1		1	
2007_QPEC 132		1							1				1	1	
2007_QPEC 9			1						1			1		1	
2007_QPEC 93			1						1				1		1
2007_QPEC 3	1			1			1			1		1		1	
2007_QPEC 63	1					1							1	1	
2007_QPEC 67					1					1		1		1	
2007_QPEC 73			1			1						1		1	
2007_QPEC 92		1	1			1						1		1	
2008_QPEC 115					1		1						1	1	
2008_QPEC 116					1	1							1	1	
2008_QPEC 119		1	1		1					1		1		1	
2008_QPEC 30			1		1					1			1		1
2008_QPEC 31					1			1				1			1
2008_QPEC 33	1								1			1		1	
2008_QPEC 34			1	1					1			1		1	
2008_QPEC 40		1	1					1				1		1	
2008_QPEC 45			1						1			1		1	
2008_QPEC 48	1	1			1			1		1		1		1	
2008_QPEC 7					1					1		1		1	
2008_QPEC 75					1				1			1		1	
2008_QPEC 80		1			1	1						1		1	
2009_QPEC 102	1							1				1			1
2009_QPEC 109	1	1	1		1					1			1	1	
2009_QPEC 113				1			1					1		1	
2009_QPEC 135	1				1		1						1	1	
2009_QPEC 138		1						1				1		1	
2009_QPEC 41	1		1	1	1					1			1		1
2009_QPEC 56			1		1					1		1		1	
2009_QPEC 58	1	1	1		1			1				1		1	
2009_QPEC 62			1				1					1			1
2009_QPEC 78					1					1			1		1
2009_QPEC 8			1	1	1		1					1		1	

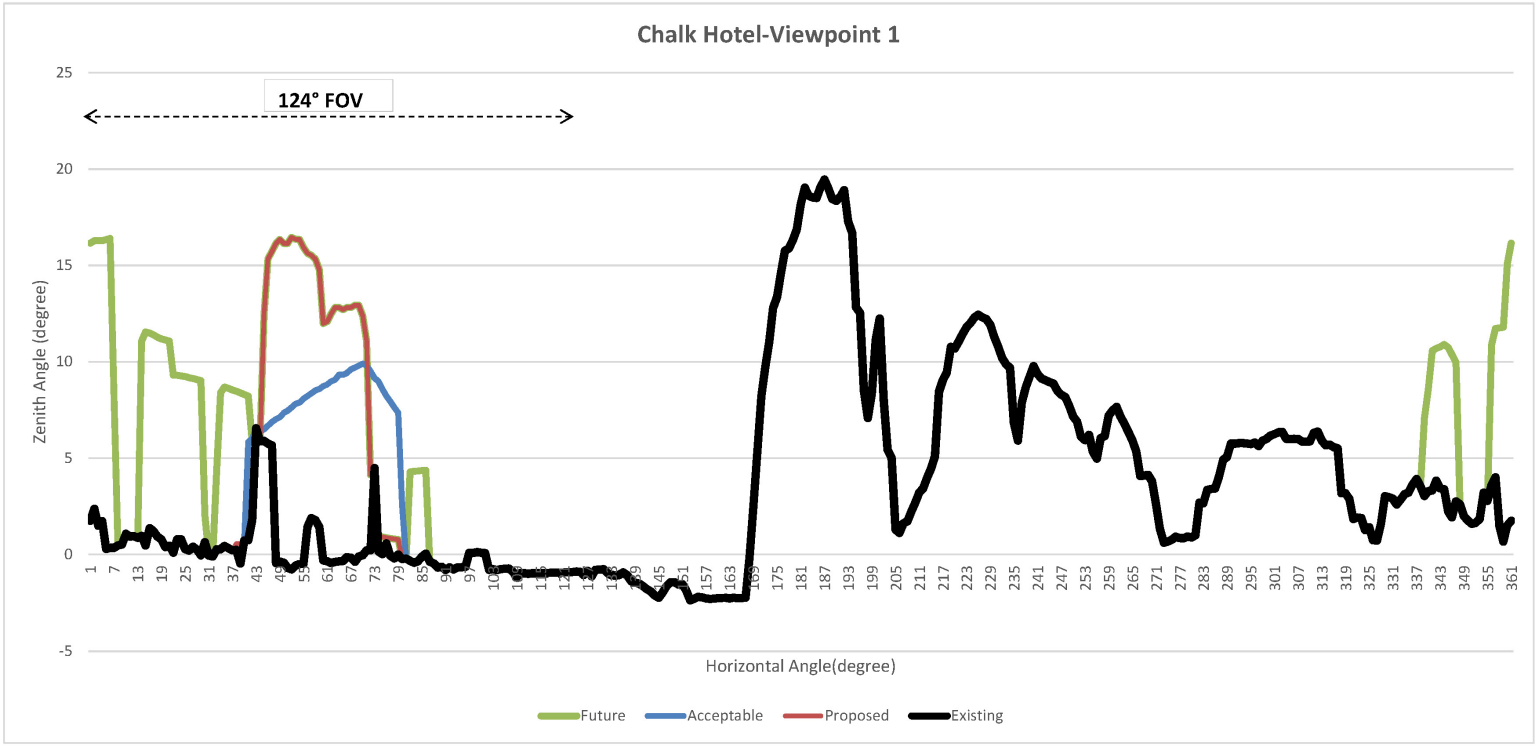
Judgments	Issues/Conflics					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination ,waterways,flood,sewer,storm water)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(land use, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements,public notification & application process, court process issues..., DEOs)	(paths,bikeways,rd,easment,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfiguration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, extension, enclose balcony,nonres)	(shopping centre,night club, resturant, office, service/transfer station, bus depot,motel,back packer, shed,advertisement, industry)	golf course,tennis court, swimming, pools, aquatic centre, school, church, mosque, aged care, hospital, Story B climb, student accomodation)	Adverse submitter	Developer	Dismissed	Allowed
2009_QPEC 97					1					1			1	1	
2009_QPEC53	1						1						1	1	
2010_QPEC 130			1						1				1	1	
2010_QPEC 137			1						1				1	1	
2010_QPEC 143		1	1	1	1			1					1	1	
2010_QPEC 70			1	1	1		1						1		1
2010_QPEC 72		1	1			1						1		1	
2011_QPEC 101		1								1			1	1	
2011_QPEC 55			1		1				1				1		1
2011_QPEC 87	1		1	1			1					1		1	
2011_QPEC54					1						1		1	1	
2012_QPEC022	1	1		1						1		1		1	
2012_QPEC032			1	1			1					1			1
2012_QPEC042					1					1			1	1	
2012_QPEC047			1						1				1		1
2012_QPEC071			1	1			1					1		1	
2012_QPEC080			1		1		1		1			1		1	
2012_QPEC081			1		1				1			1		1	
Lambert St	1		1				1					1		1	
Totals	30	26	79	36	90	10	52	20	39	36	10	94	63	114	43

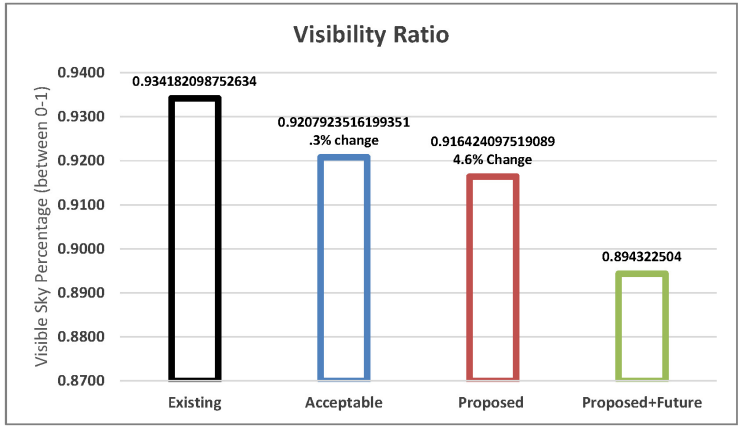
Appendix B

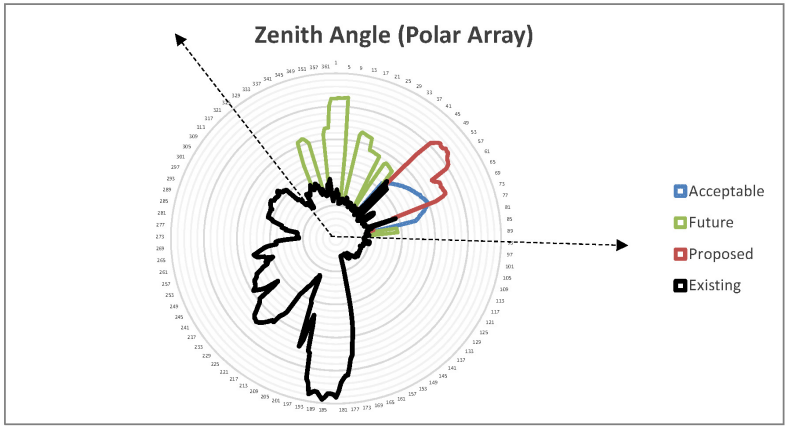
Additional Skyline Graphs Modelled For Selected Cases Studies

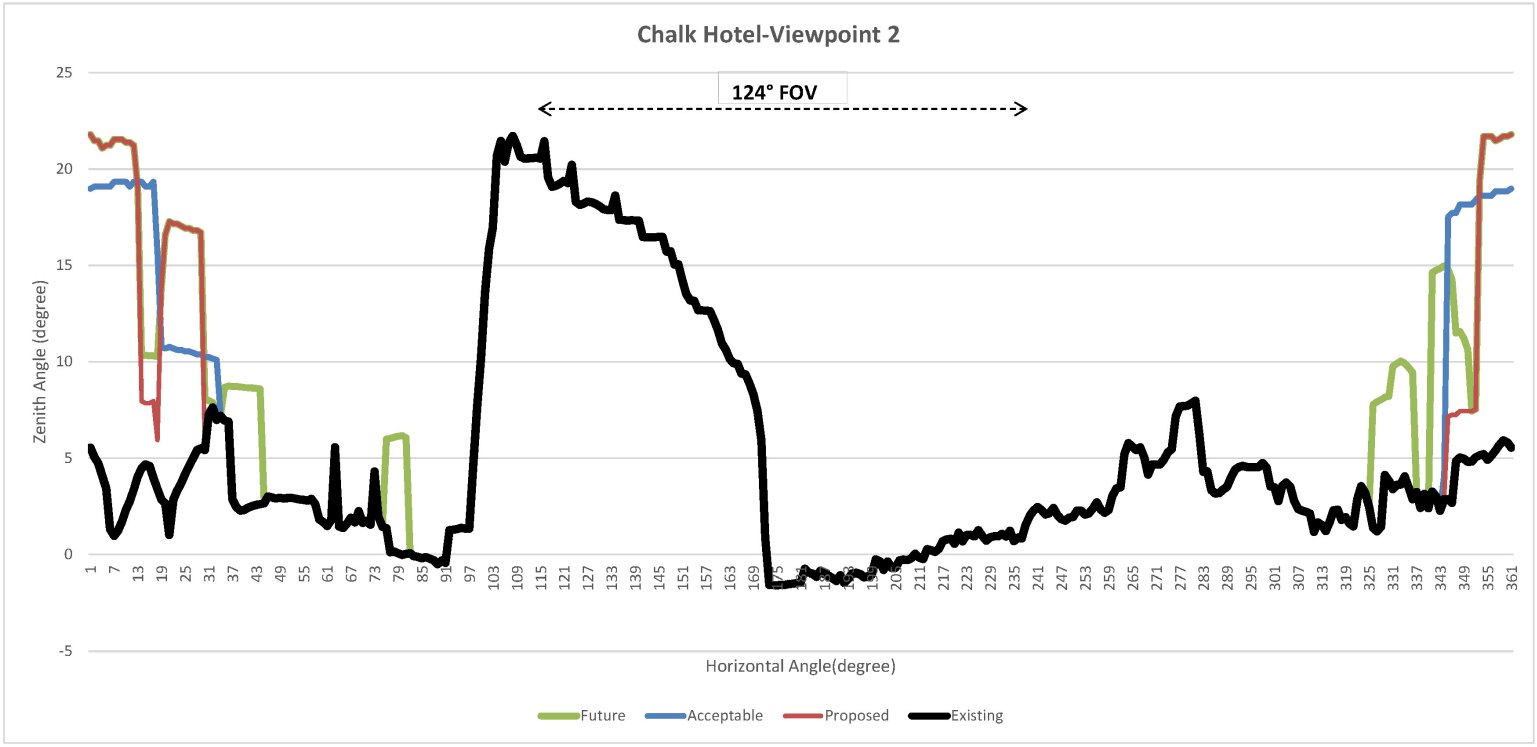
1.Chalk Hotel Mixed-Use Redevelopment

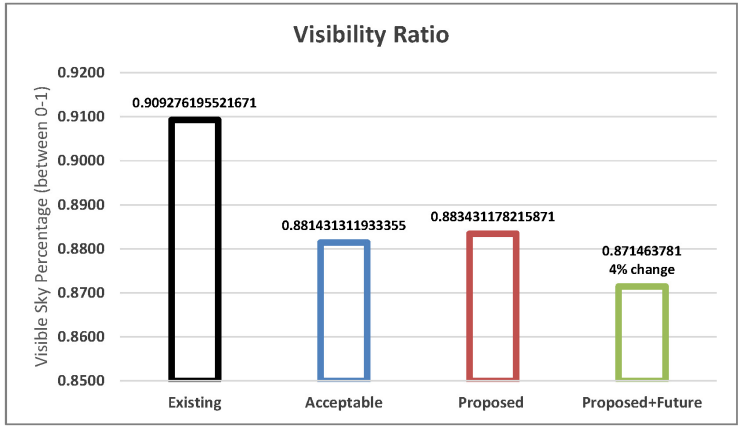
2. Lambert Street Multi Unit Residential Tower

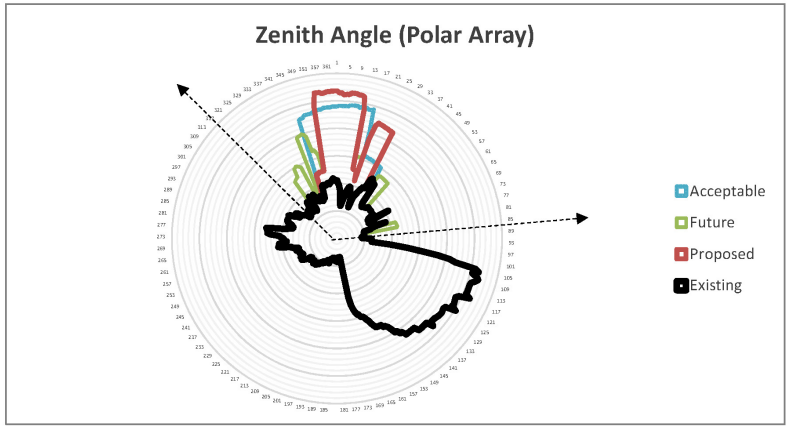

Chalk Hotel-Viewpoint 1
124° FOV
Zenith Angle (degree)
Horizontal Angle(degree)
Future
Acceptable
Proposed
Existing

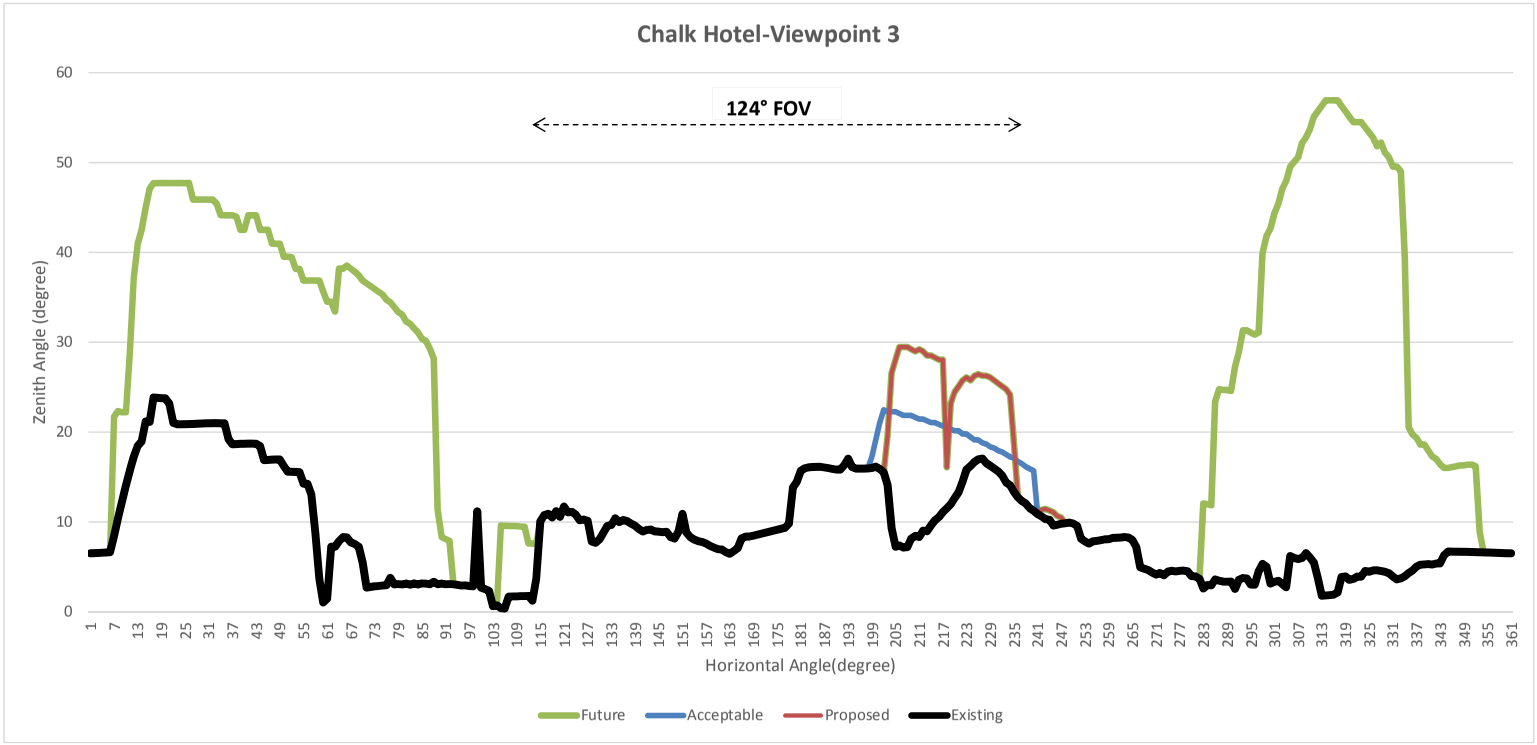

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.934182098752634
0.9207923516199351
.3% change
0.916424097519089
4.6% Change
0.894322504
Existing
Acceptable
Proposed
Proposed+Future

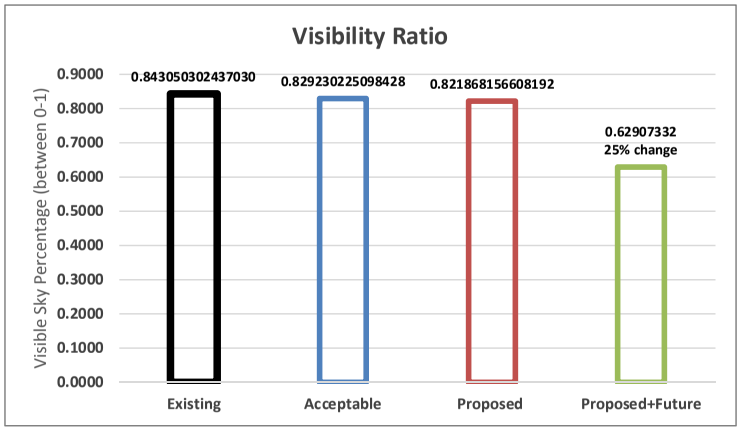

Zenith Angle (Polar Array)
Acceptable
Future
Proposed
Existing

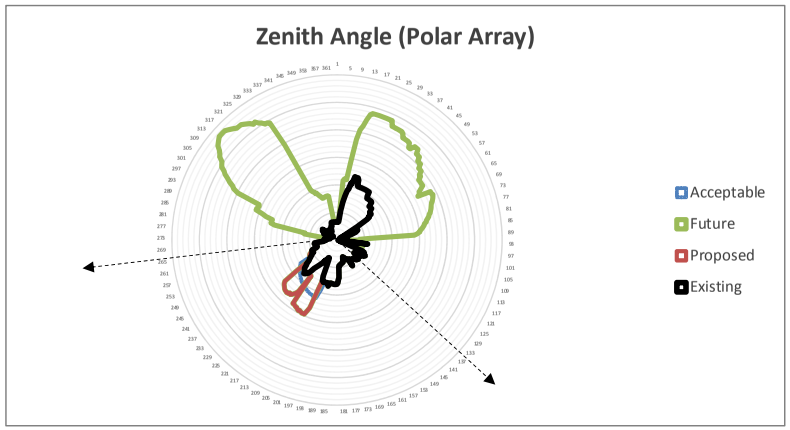

Chalk Hotel-Viewpoint 2
124° FOV
Zenith Angle (degree)
Horizontal Angle(degree)
Future
Acceptable
Proposed
Existing

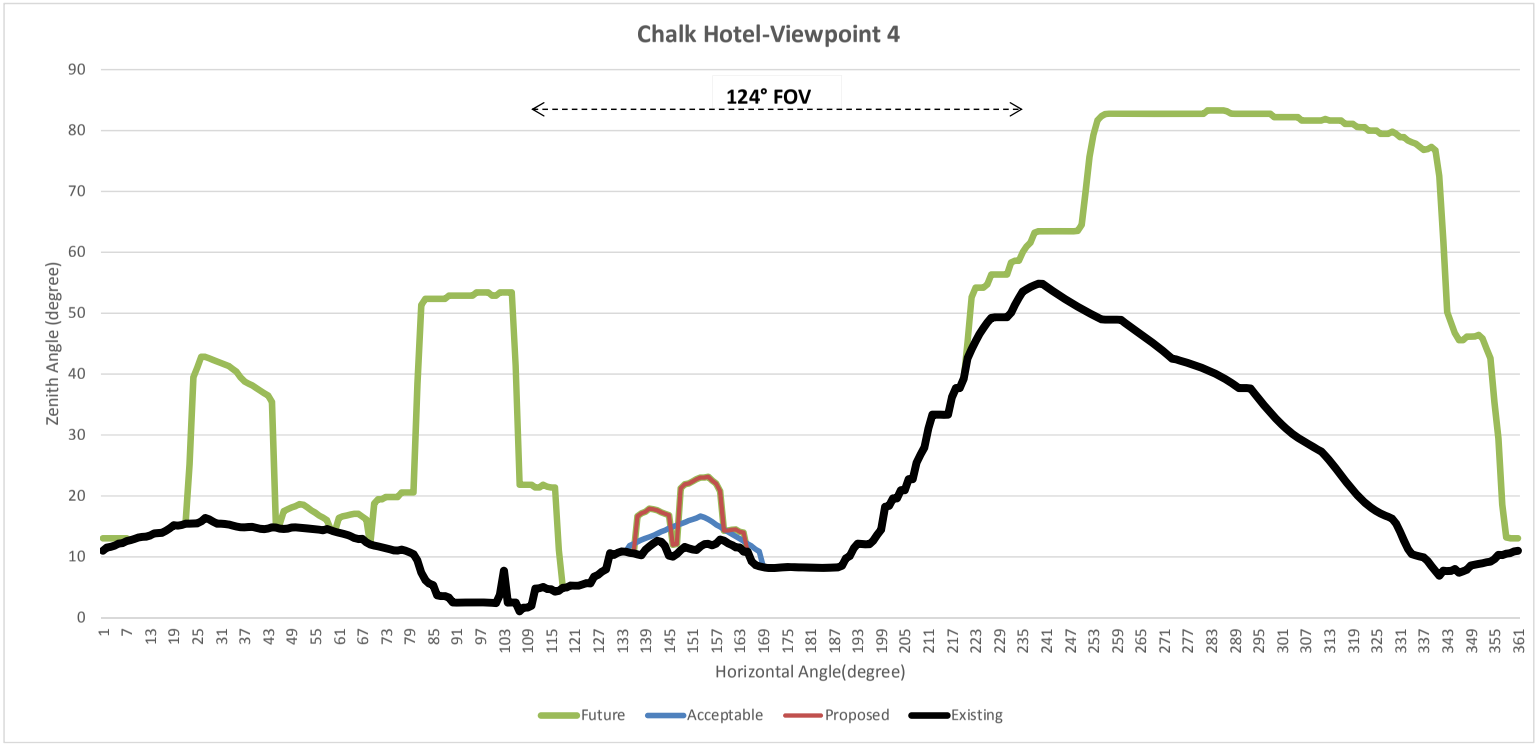

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.909276195521671
0.881431311933355
0.883431178215871
0.871463781
4% change
Existing
Acceptable
Proposed
Proposed+Future

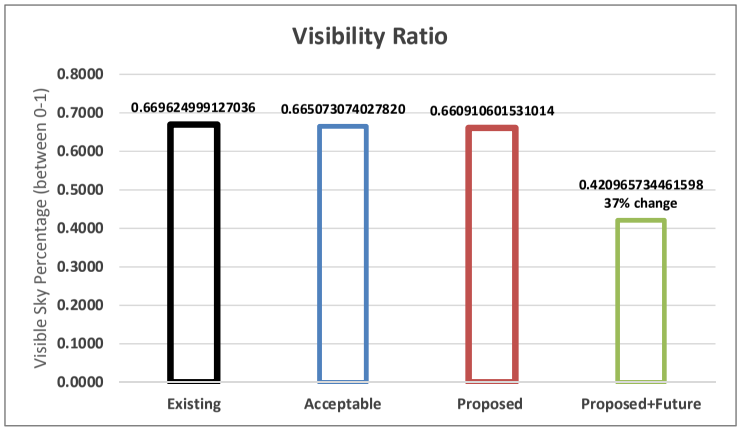

Zenith Angle (Polar Array)
Acceptable
Future
Proposed
Existing

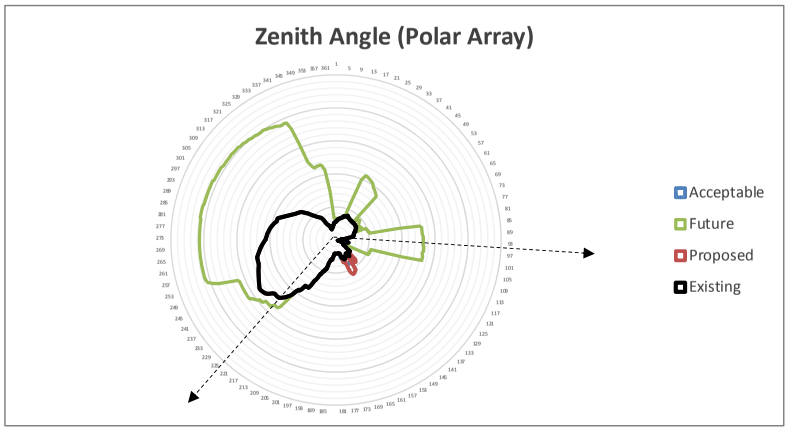

Chalk Hotel-Viewpoint 3
124° FOV
Zenith Angle (degree)
Horizontal Angle(degree)
Future
Acceptable
Proposed
Existing

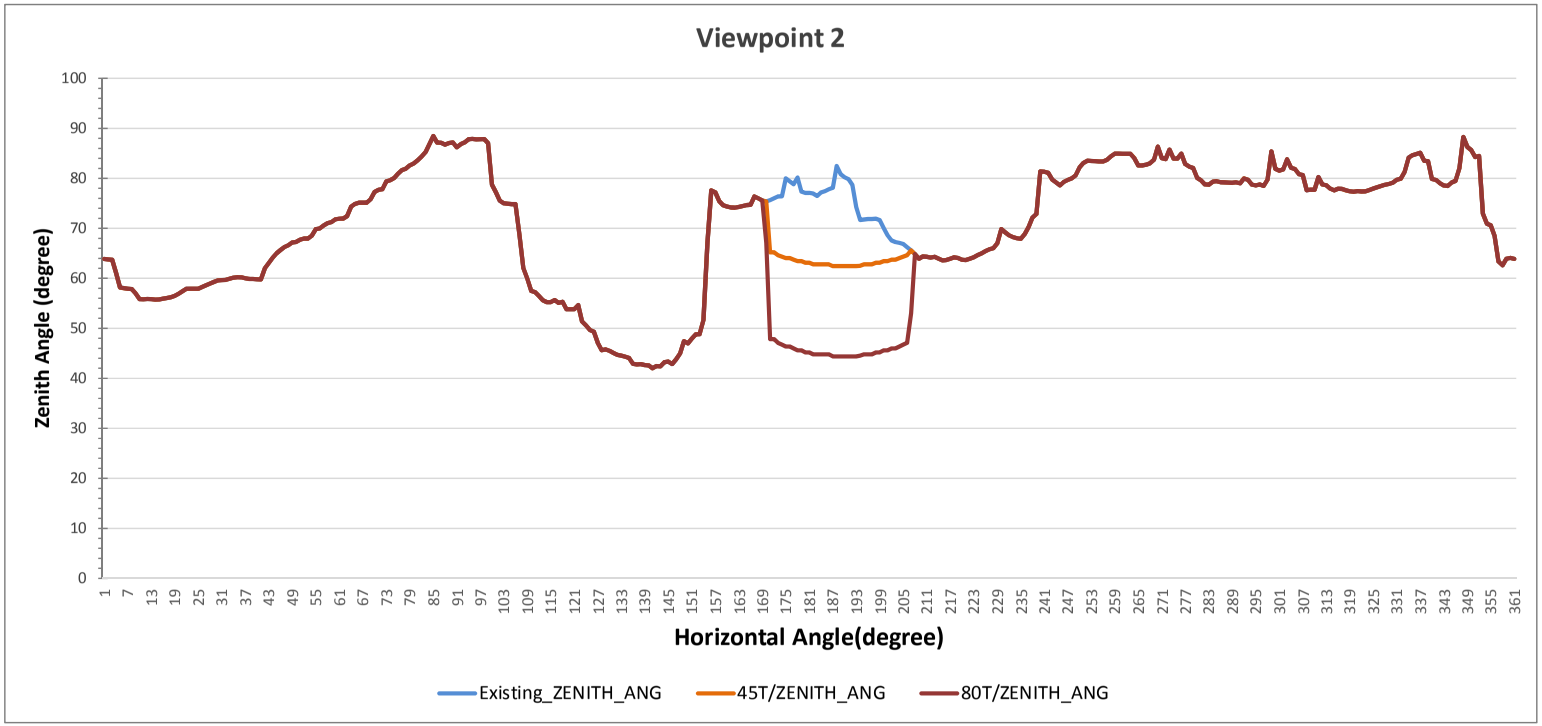

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.843050302437030
0.829230225098428
0.821868156608192
0.62907332
25% change
Existing
Acceptable
Proposed
Proposed+Future

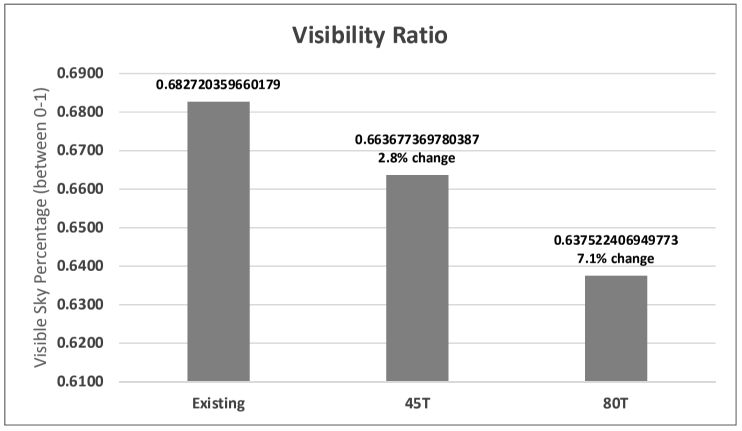

Zenith Angle (Polar Array)
Acceptable
Future
Proposed
Existing

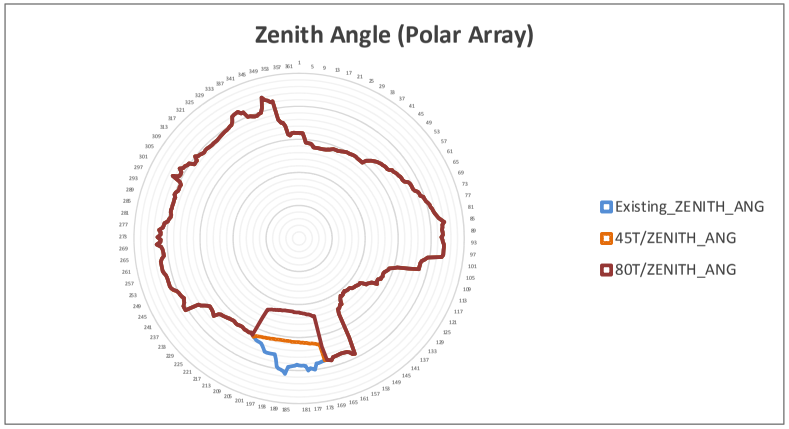

Chalk Hotel-Viewpoint 4
124° FOV
Zenith Angle (degree)
Horizontal Angle(degree)
Future
Acceptable
Proposed
Existing

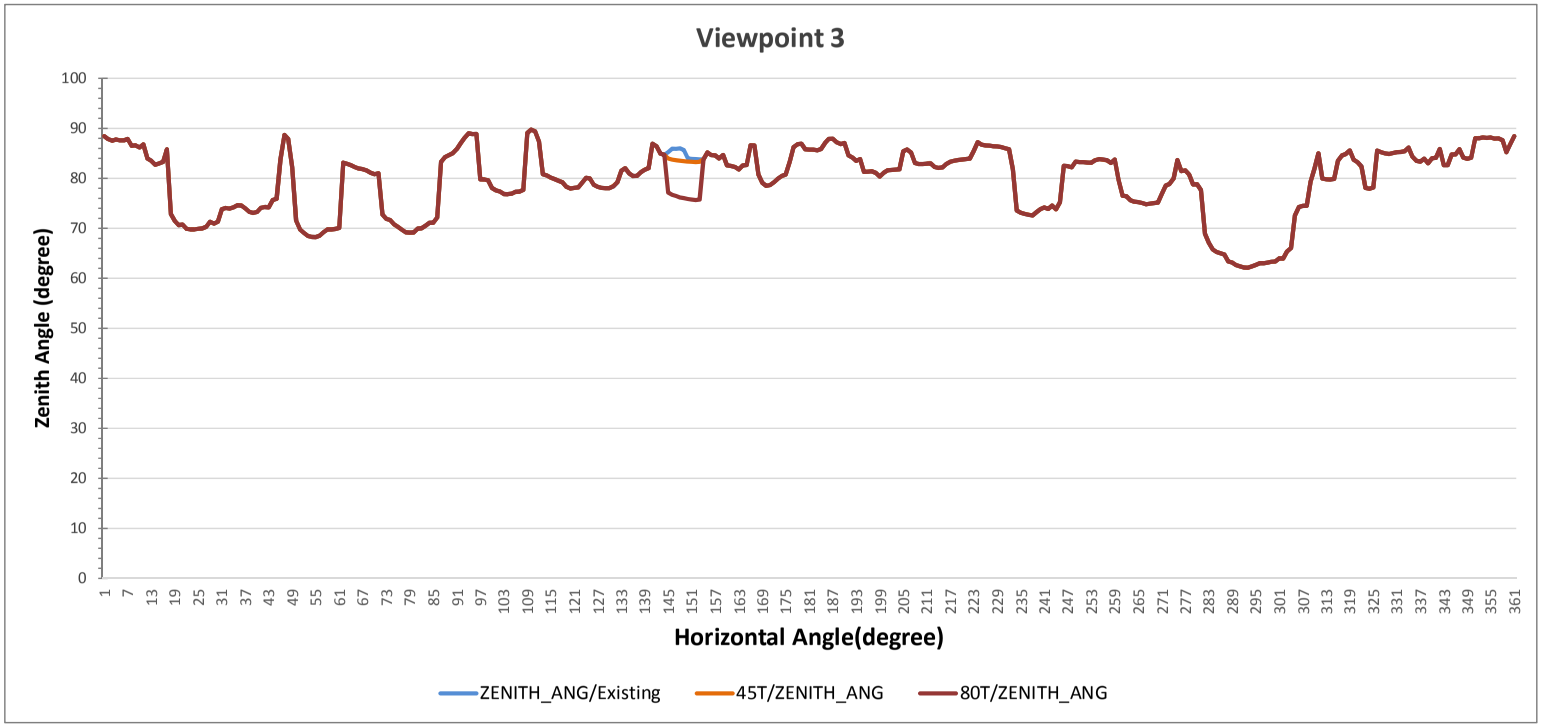

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.669624999127036
0.665073074027820
0.660910601531014
0.420965734461598
37% change
Existing
Acceptable
Proposed
Proposed+Future

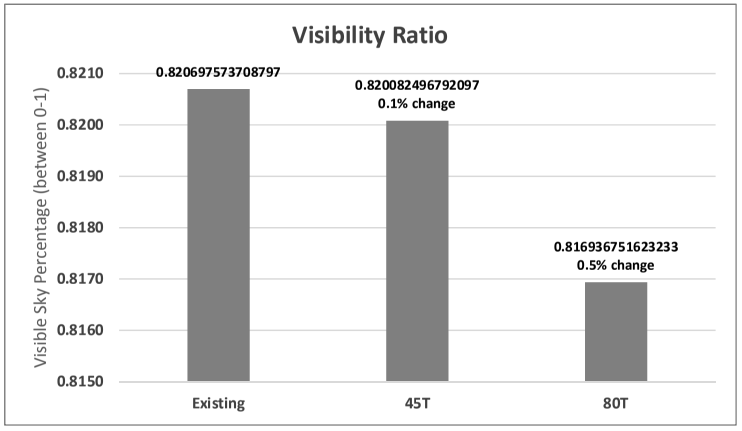

Zenith Angle (Polar Array)
Acceptable
Future
Proposed
Existing

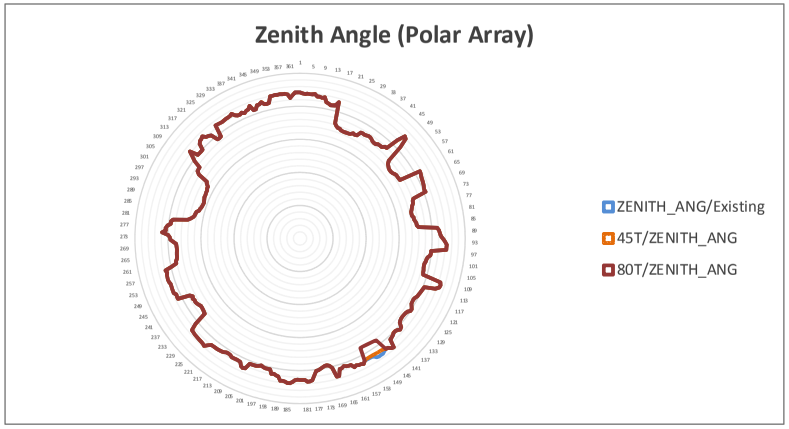

Viewpoint 2
Zenith Angle (degree)
Horizontal Angle(degree)
Existing_ZENITH_ANG
45T/ZENITH_ANG
80T/ZENITH_ANG

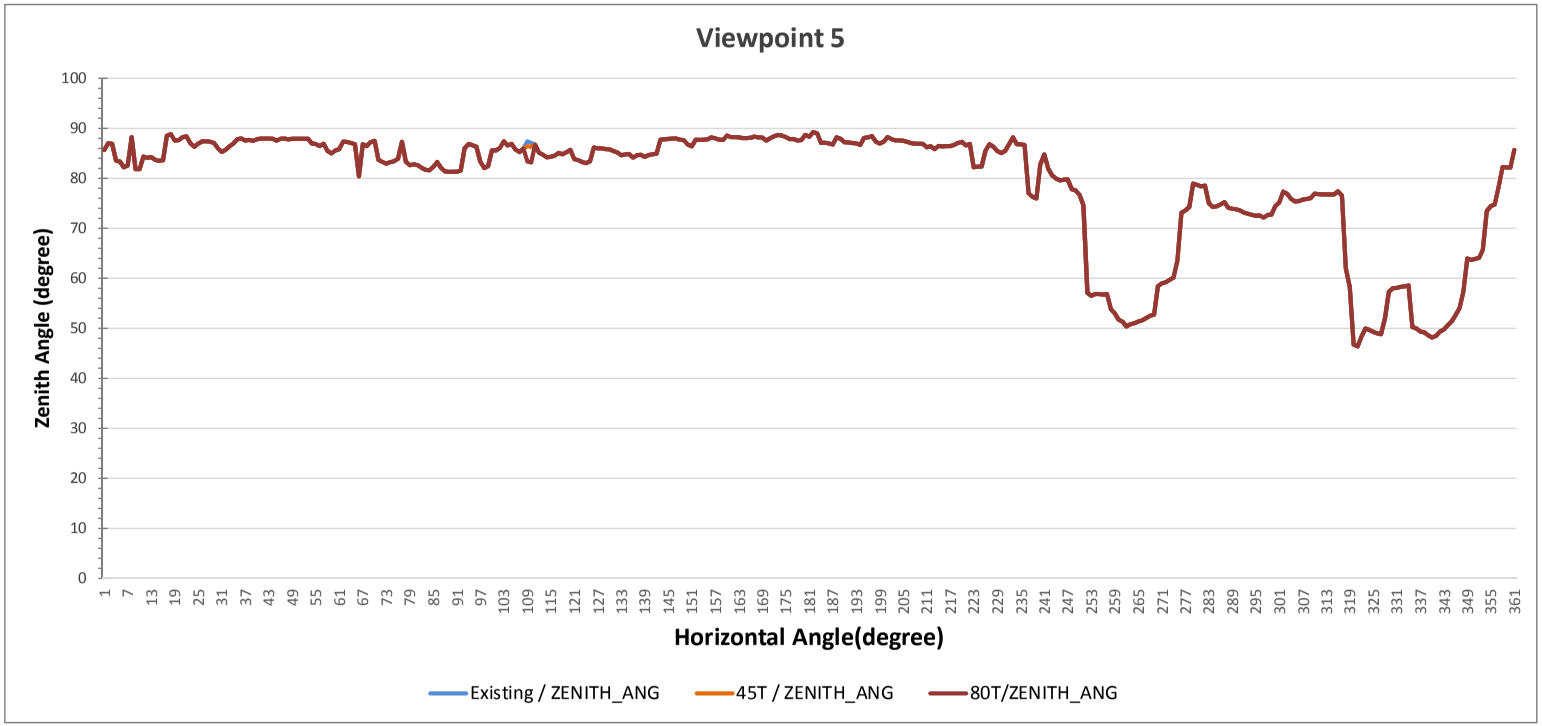

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.682720359660179
0.663677369780387
2.8% change
0.637522406949773
7.1% change
Existing
45T
80T

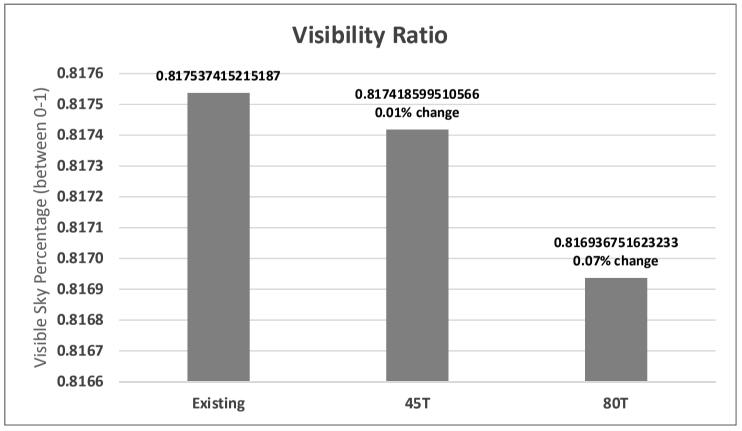

Zenith Angle (Polar Array)
Existing_ZENITH_ANG
45T/ZENITH_ANG
80T/ZENITH_ANG

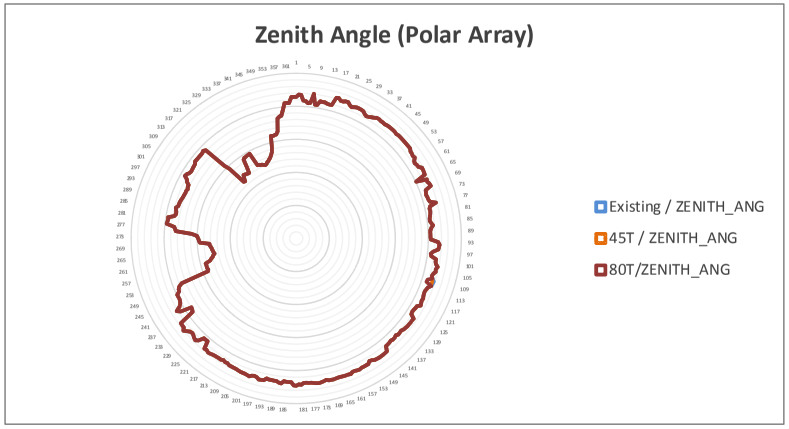

Viewpoint 3
Zenith Angle (degree)
Horizontal Angle(degree)
ZENITH_ANG/Existing
45T/ZENITH_ANG
80T/ZENITH_ANG

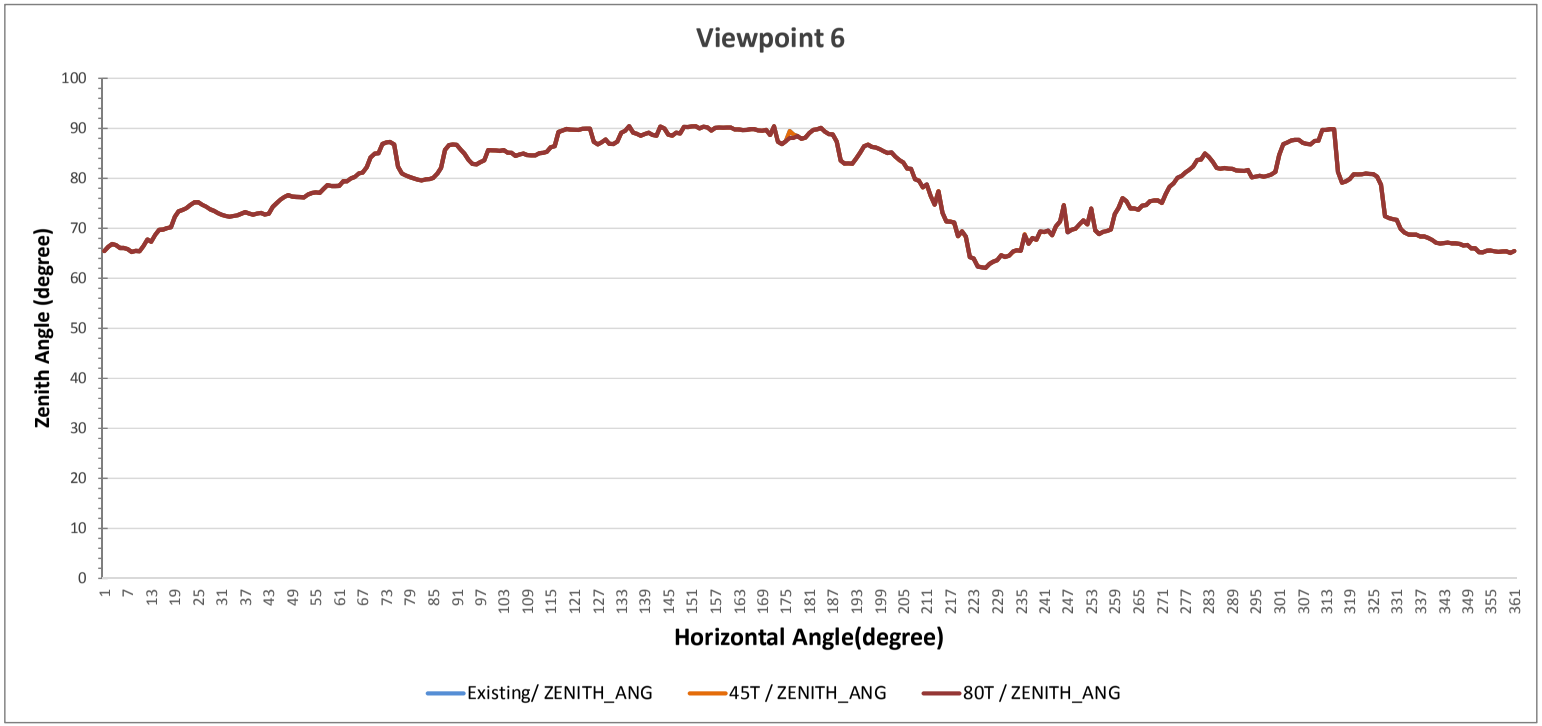

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.820697573708797
0.820082496792097
0.1% change
0.816936751623233
0.5% change
Existing
45T
80T

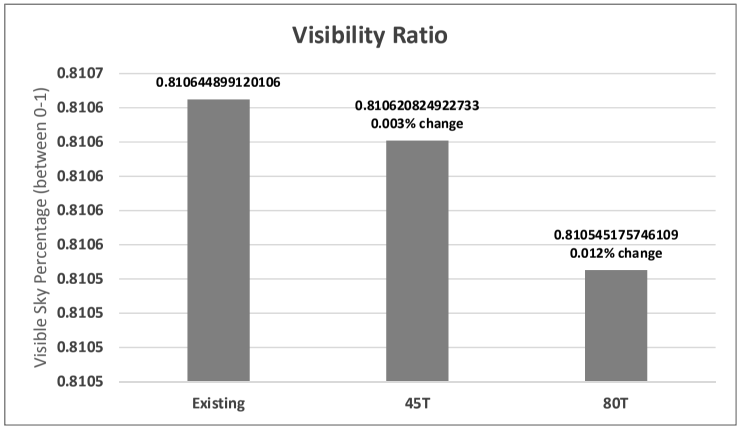

Zenith Angle (Polar Array)
ZENITH_ANG/Existing
45T/ZENITH_ANG
80T/ZENITH_ANG

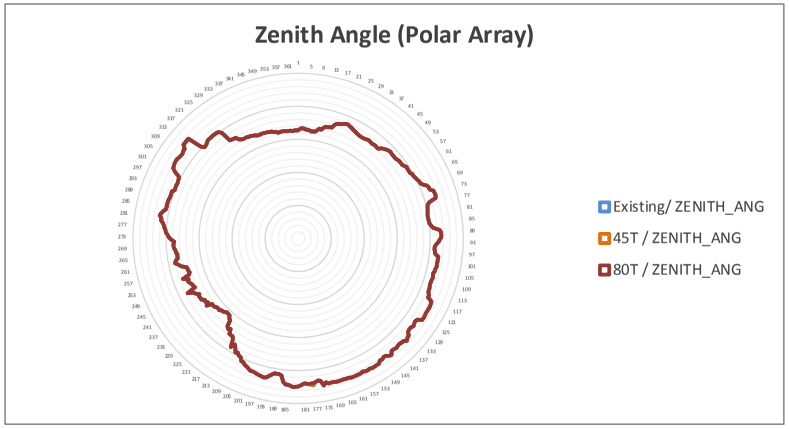

Viewpoint 5
Zenith Angle (degree)
Horizontal Angle(degree)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T/ZENITH_ANG

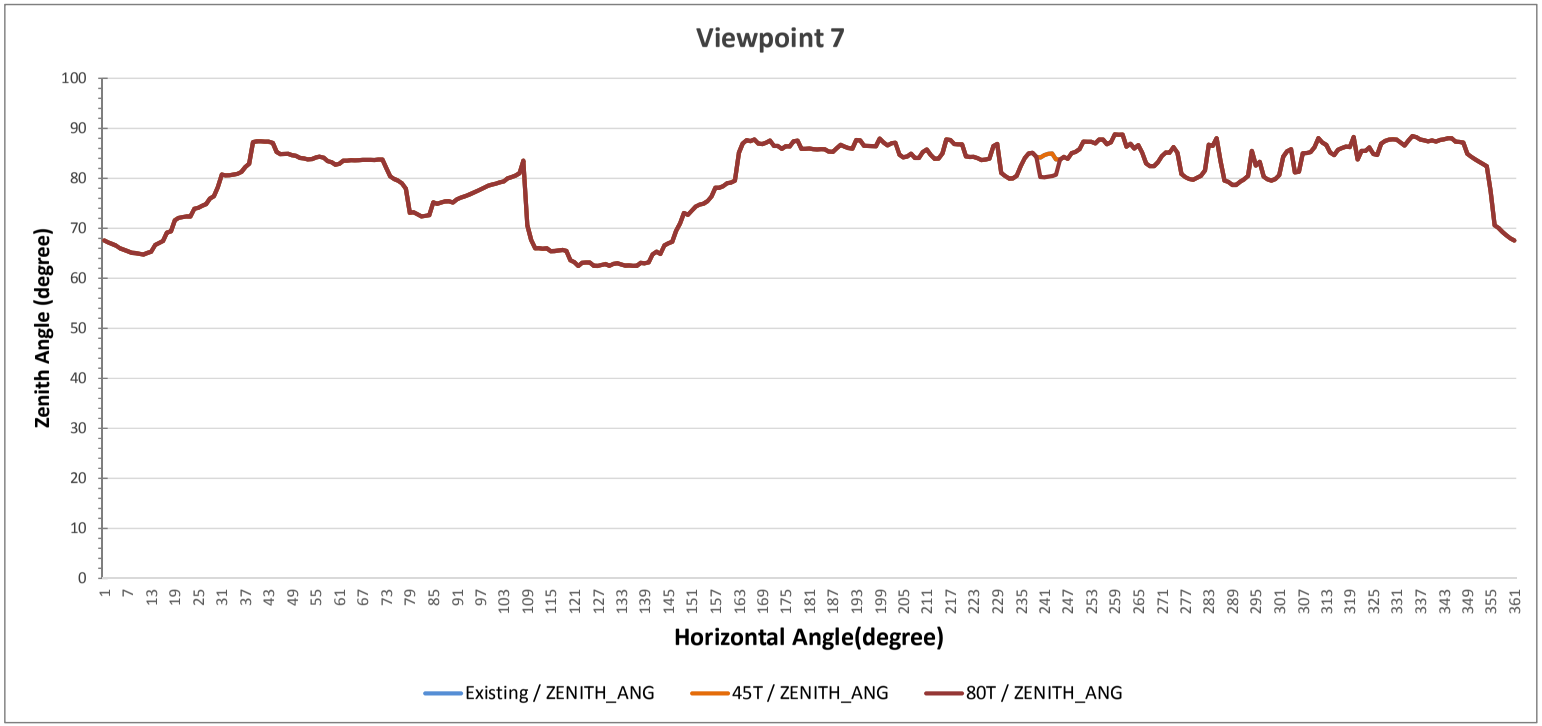

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.817537415215187
0.817418599510566
0.01% change
0.816936751623233
0.07% change
Existing
45T
80T

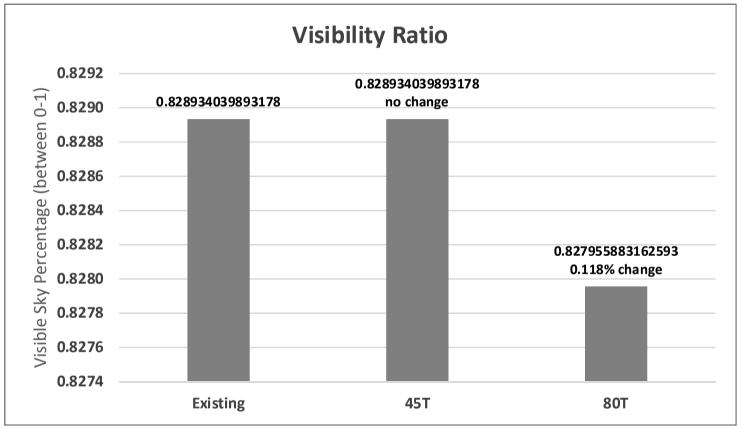

Zenith Angle (Polar Array)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T/ZENITH_ANG

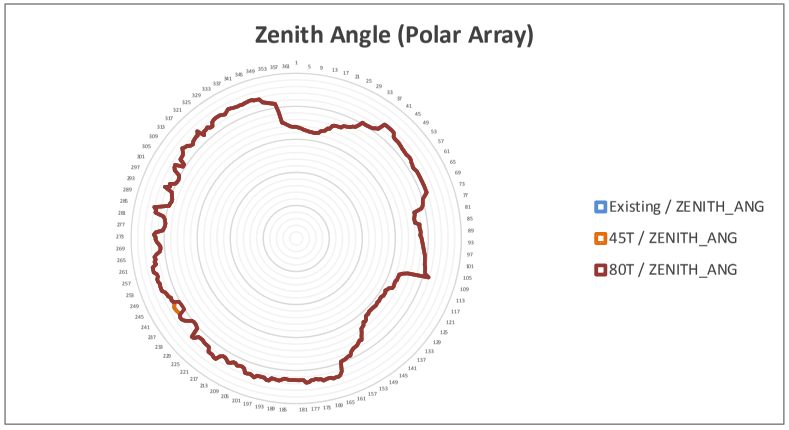

Viewpoint 6
Zenith Angle (degree)
Horizontal Angle(degree)
Existing/ ZENITH_ANG
45T / ZENITH_ANG
80T / ZENITH_ANG

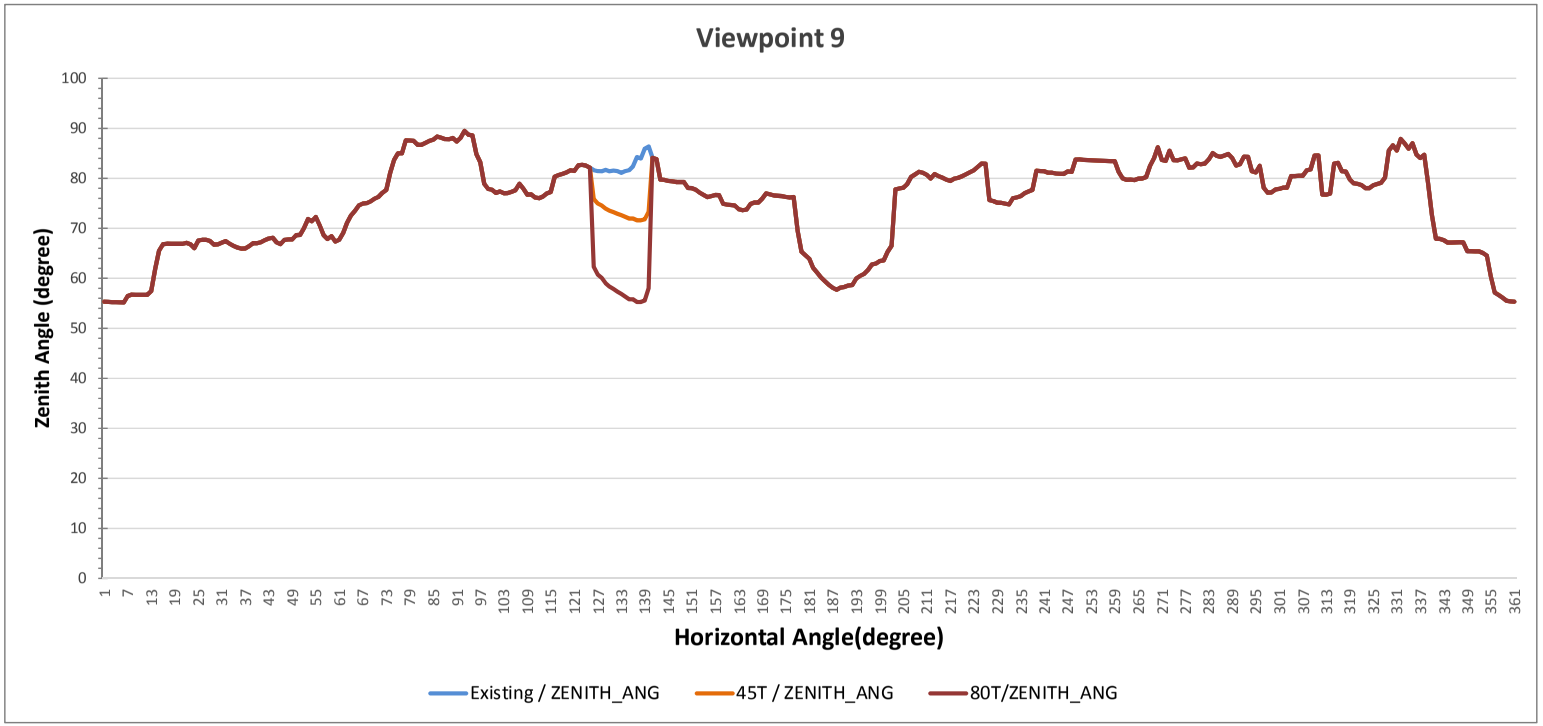

Visibility Ratio
Visible Sky Percentage (between 0-1)
0.810644899120106
0.810620824922733
0.003% change
0.810545175746109
0.012% change
Existing
45T
80T

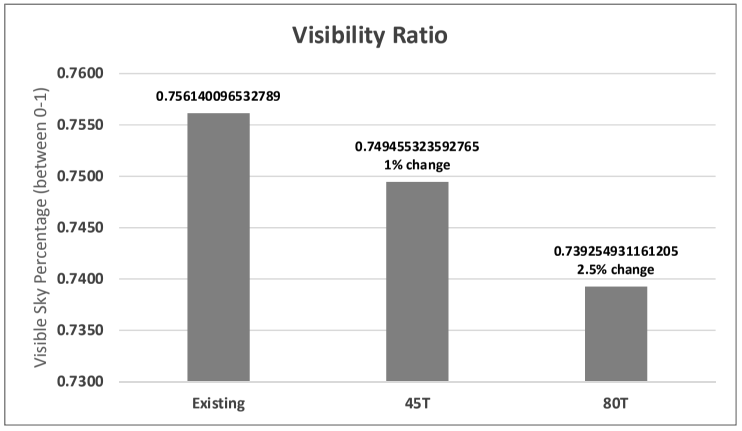

Zenith Angle (Polar Array)
Existing/ ZENITH_ANG
45T / ZENITH_ANG
80T / ZENITH_ANG

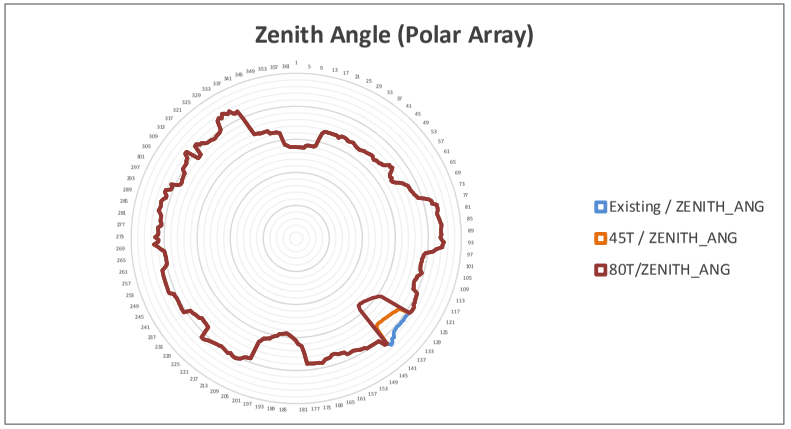

Viewpoint 7
Zenith Angle (degree)
Horizontal Angle(degree)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T / ZENITH_ANG


Visibility Ratio
Visible Sky Percentage (between 0-1)
0.828934039893178
0.828934039893178
no change
0.827955883162593
0.118% change
Existing
45T
80T


Zenith Angle (Polar Array)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T / ZENITH_ANG


Viewpoint 9
Zenith Angle (degree)
Horizontal Angle(degree)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T/ZENITH_ANG


Visibility Ratio
Visible Sky Percentage (between 0-1)
0.756140096532789
0.749455323592765
1% change
0.739254931161205
2.5% change
Existing
45T
80T


Zenith Angle (Polar Array)
Existing / ZENITH_ANG
45T / ZENITH_ANG
80T/ZENITH_ANG

Appendix C

Interview Documents and Completed Questionnaires

Research Topic:

Visual Conflicts in Urban Environments

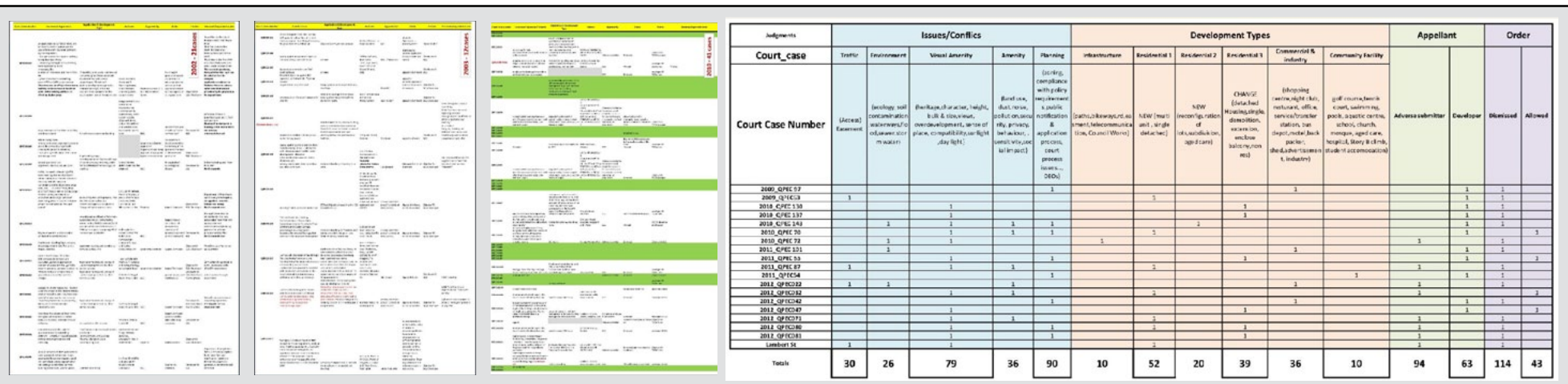
An Exploration of Image Processing and GIS Techniques in Assessment of Environmental and Planning Court Cases

Research Aim:

To increase objectivity of visual amenity and character assessments

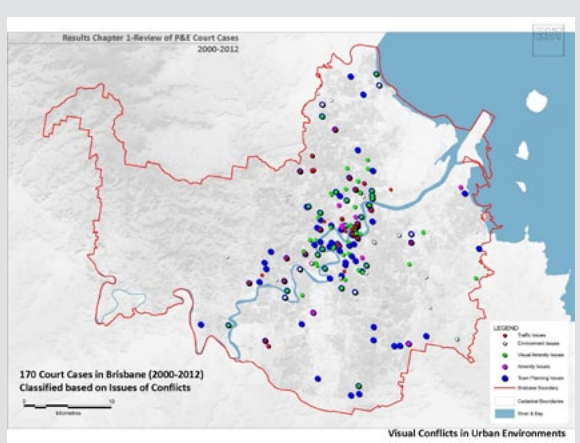
Research Methods & Results

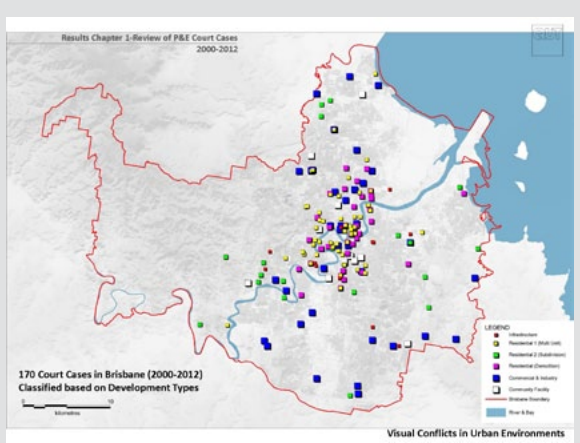
Review of Planning & Environment Court Judgments in Brisbane (2000-2012)

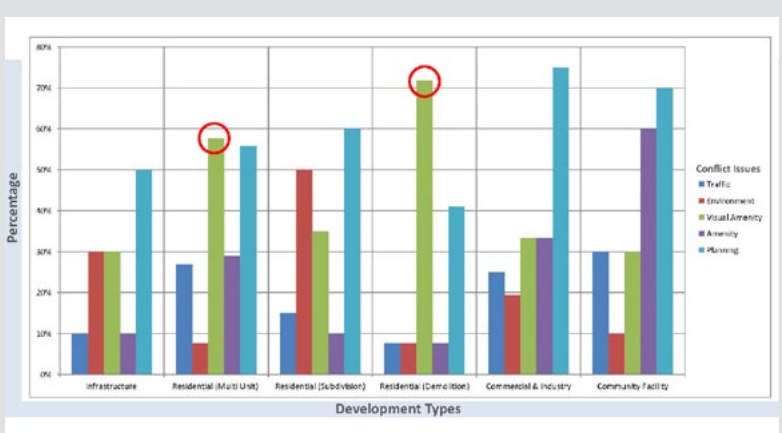


Judgments	Issues/Conflicts					Development Types						Appellant		Order	
Court_case	Traffic	Environment	Visual Amenity	Amenity	Planning	Infrastructure	Residential 1	Residential 2	Residential 3	Commercial & Industry	Community Facility				
Court Case Number	(Access) Easement	(ecology, soil contamination, waterways/flood,sewerage, stormwater)	(heritage,character, height, bulk & size,views, overdevelopment, sense of place, compatibility,sunlight ,day light)	(landuse, dust,noise, pollution,security, privacy, behaviour, , sensitivity,social impact)	(zoning, compliance with policy requirements, public notification & application process, court process issues.., DAOs)	(cable,pipeways,road, easement,telecommunication, Council Works)	NEW (multi unit , single detached)	NEW (reconfig.ration of lots,subdivision, aged care)	CHANGE (detached Housing,single, demolition, vacancies, enclose balcony,nonres)	(shopping centre,night club, restaurant, office, service/transfer station, bus depot,motel,backpacker, shed,advertisement, industry)	golf course,tennis court, swimming pool, aquatic centre, school, church, mosque, aged care, hospital, library &climb, student accomodation)	Advers submitter	Developer	Dismissed	Allowed
2000_QPEC 57					1					1			1	1	
2009_QPEC3	1						1						1	1	
2010_QPEC 130			1						1				1	1	
2010_QPEC 137			1						1				1	1	
2010_QPEC 143		1	1	1	1			1					1	1	
2010_QPEC 70			1	1	1		1						1		1
2010_QPEC 72		1	1			1						1		1	
2011_QPEC 101		1								1			1	1	
2011_QPEC 53			1		1				1				1		1
2011_QPEC 87	1		1	1			1					1		1	
2011_QPEC54					1						1		1	1	
2012_QPEC022	1	1		1						1		1		1	
2012_QPEC032			1	1			1					1			1
2012_QPEC042					1					1			1	1	
2012_QPEC047			1						1				1		1
2012_QPEC071			1	1			1					1		1	
2012_QPEC080			1		1		1		1			1		1	
2012_QPEC081			1		1				1			1		1	
Lambert St	1		1				1							1	
Totals	30	26	79	36	90	10	52	20	39	36	10	94	63	114	43

Spatial Analysis of Court Cases

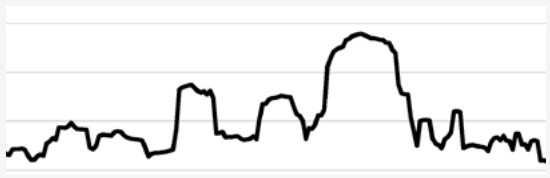






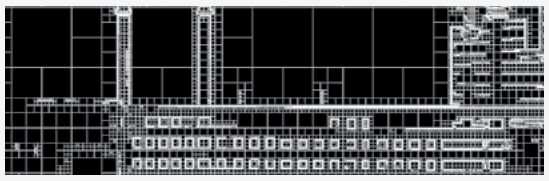
New Concepts and technical methods

1



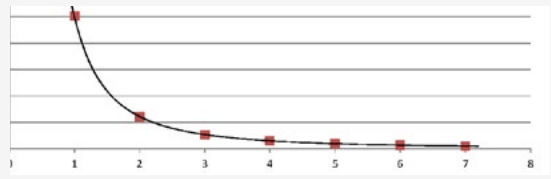
Bulk and Height Analysis

2



Visual Appearnace Analysis

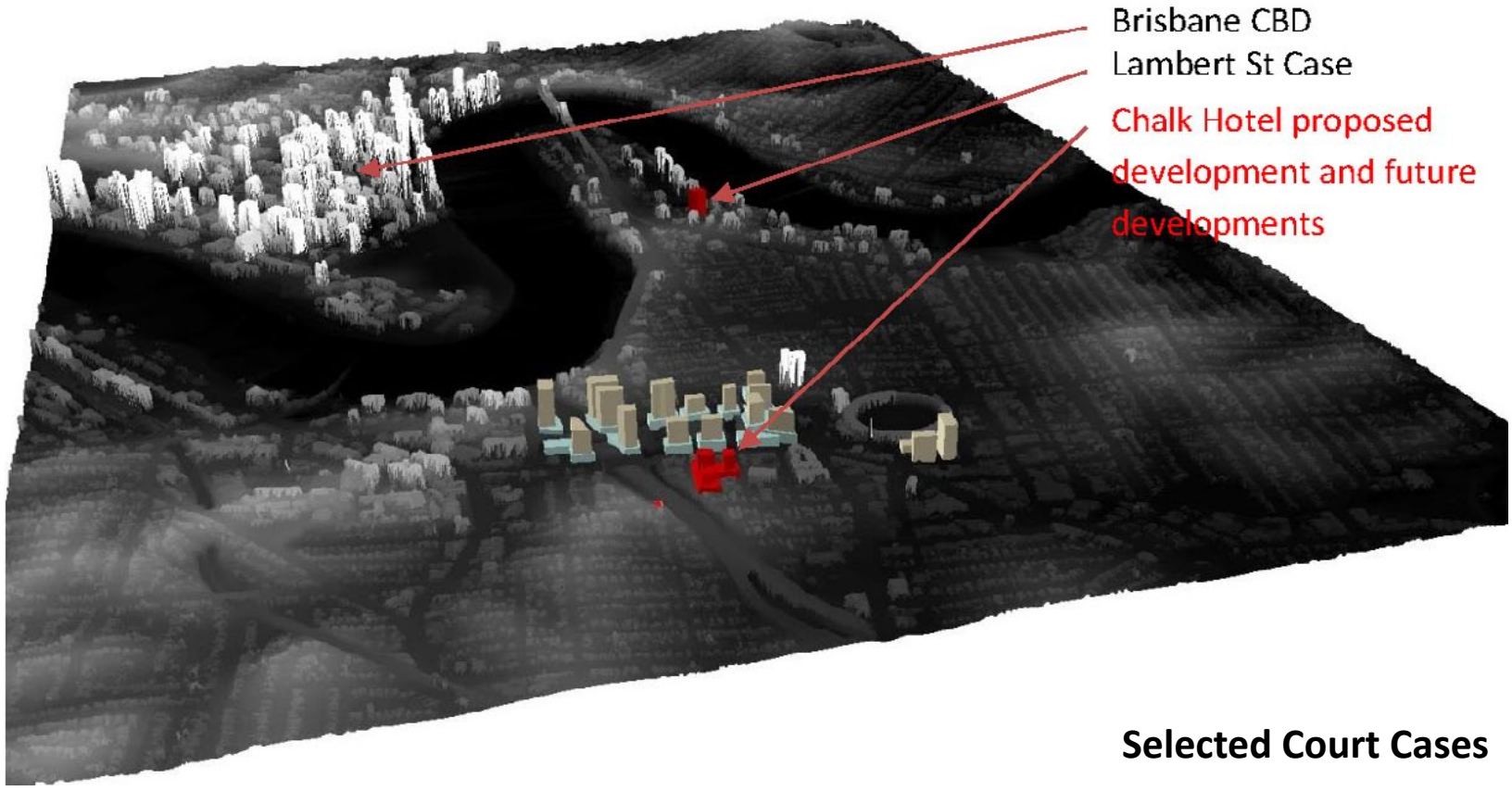
3



Visual Dominance Analysis

Cosultation with Visual Amenity Experts

1 Bulk & Height Analysis



Selected Court Cases

Lambert Street Court Case- Kangaroo Point

Chalk Hotel Court Case- Woolloongabba

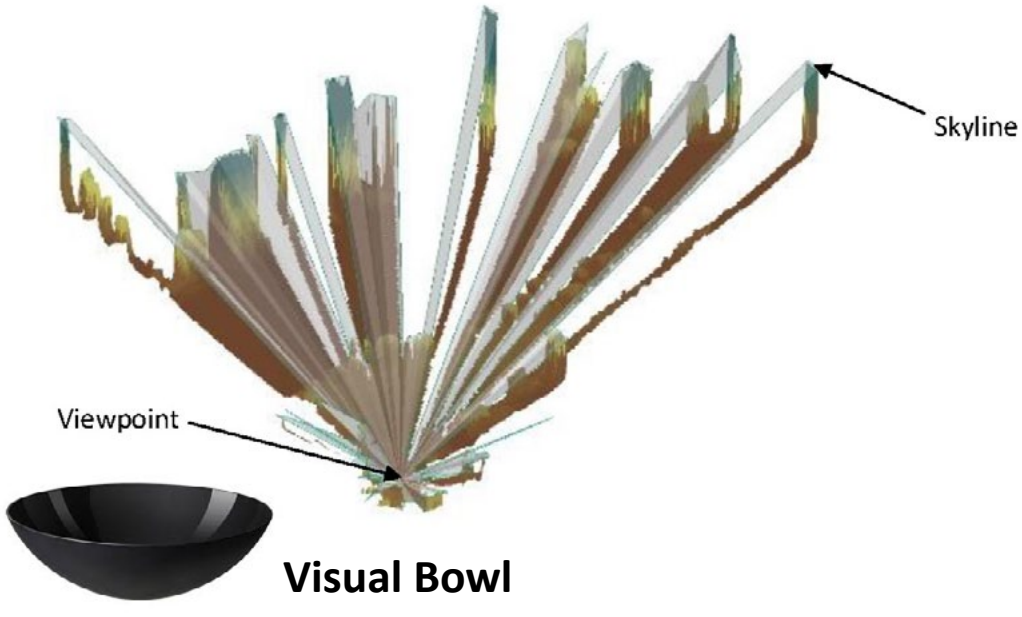
Issues:

- **Building height, scale, bulk and form;**
- **Interruption of views to Landmarks;**
- **Integration with existing Residential and Streetscape Character.**

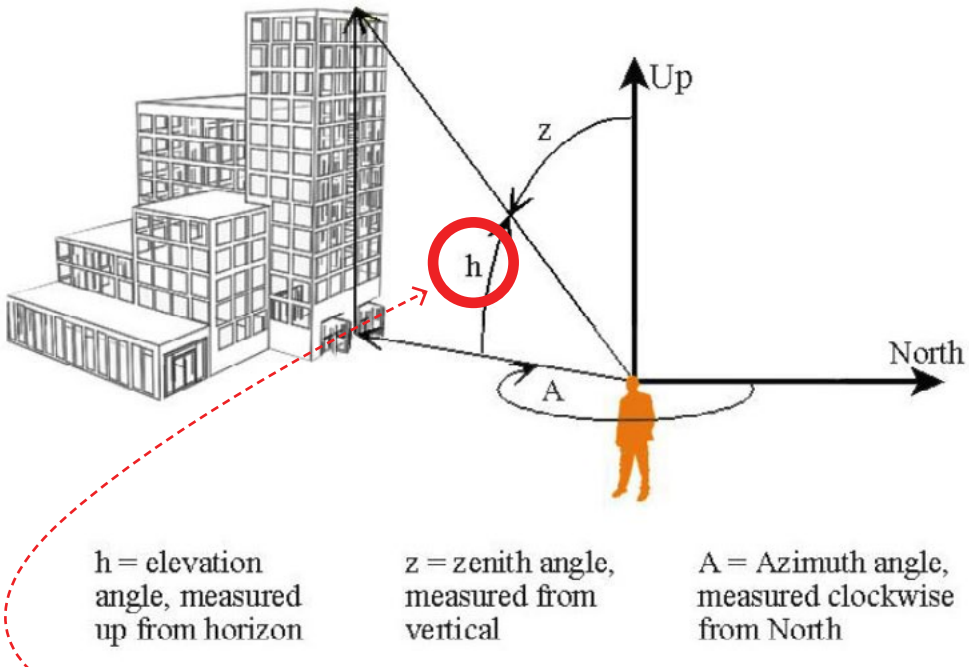
1 Lambert Street
Bulk & Height Analysis

Visual Conflicts In Urban Environments
Consultation with Visual Amenity Expert Panel
Ata Tara -PhD Student- 2015

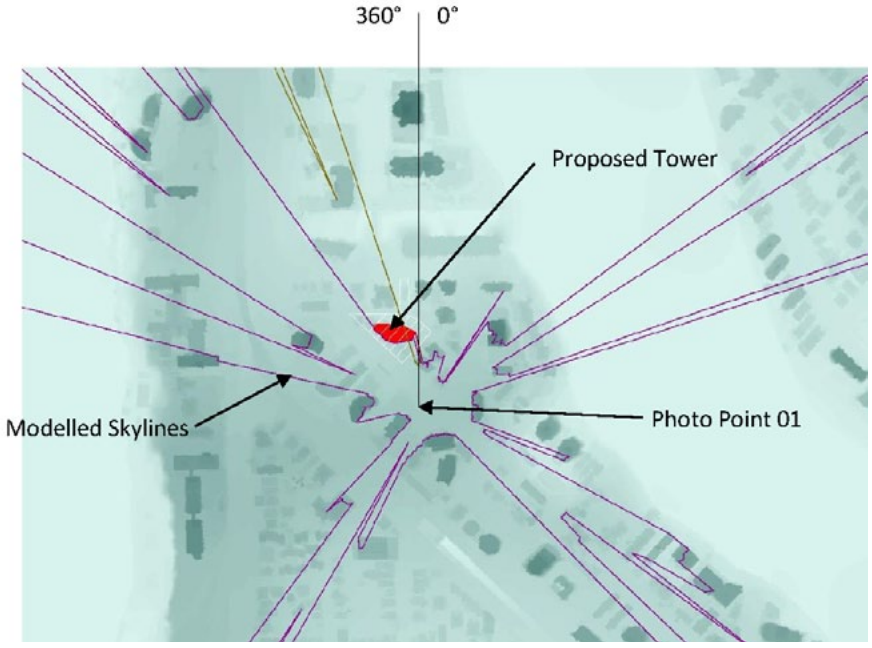
QUT

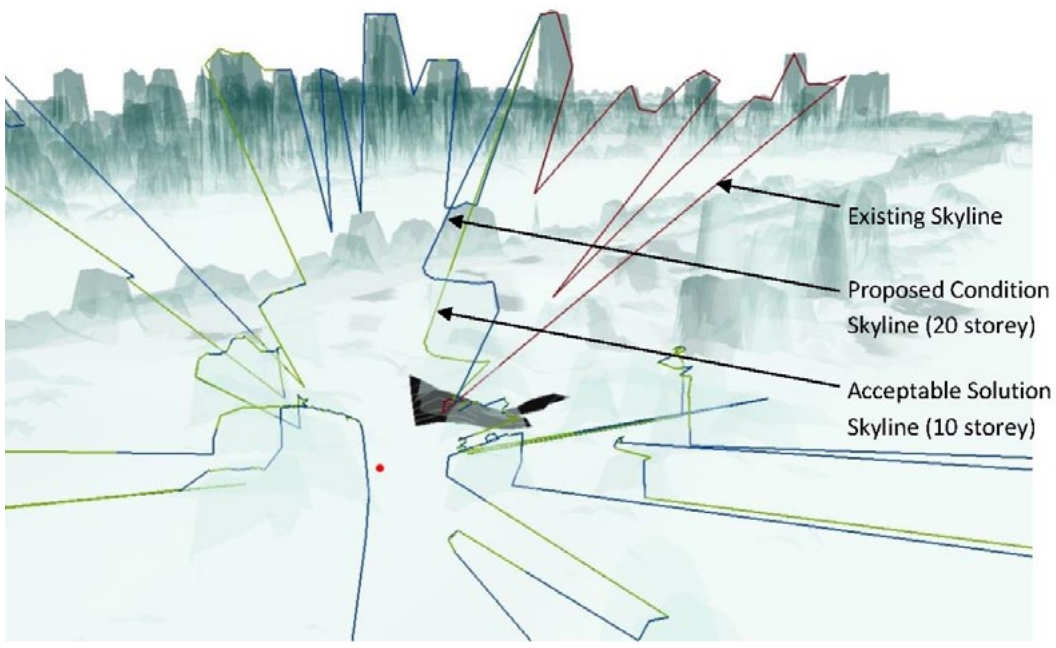


Visual Bowl

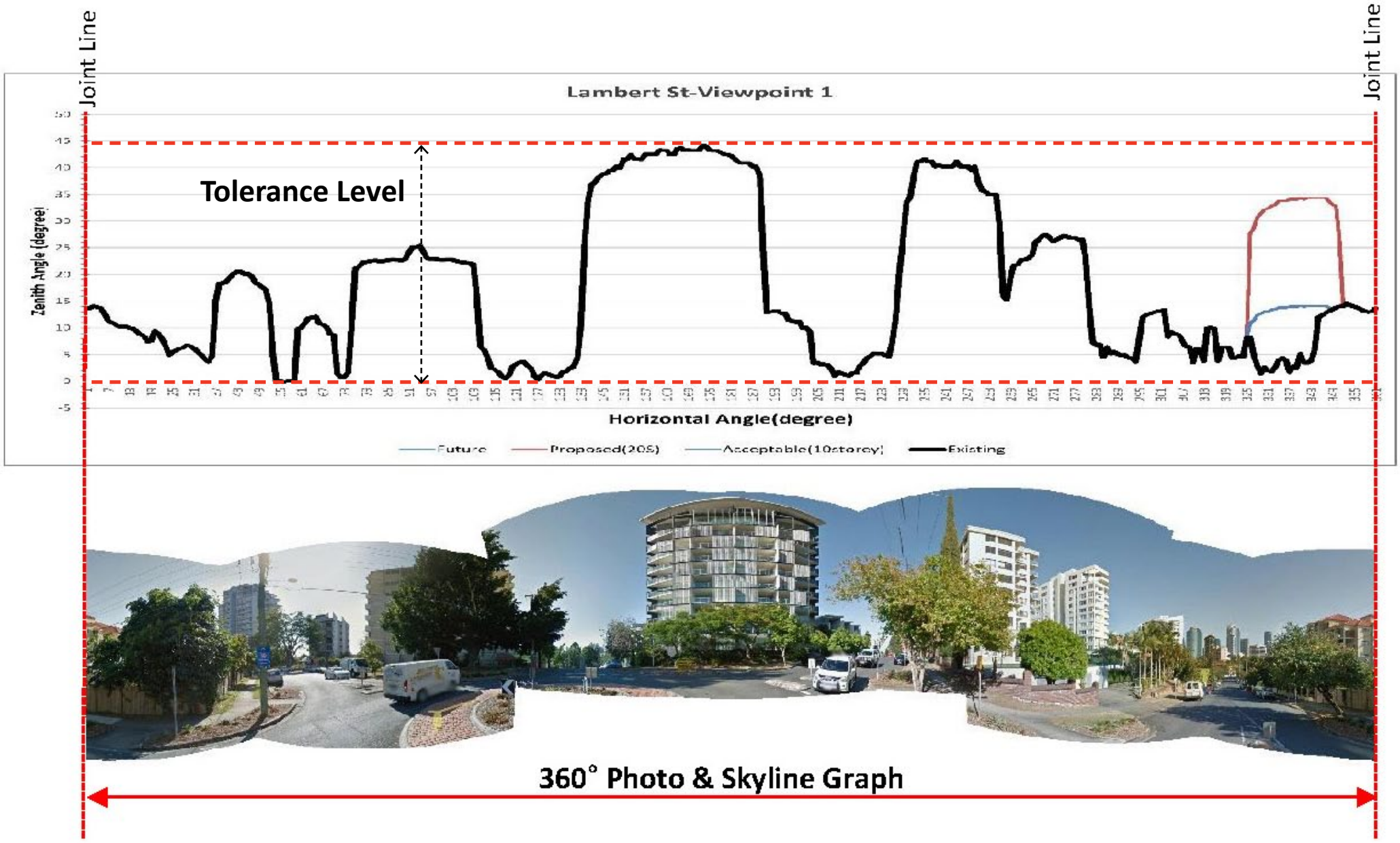


Calculation of sightline degree





Skyline Modelling for 4 development Options



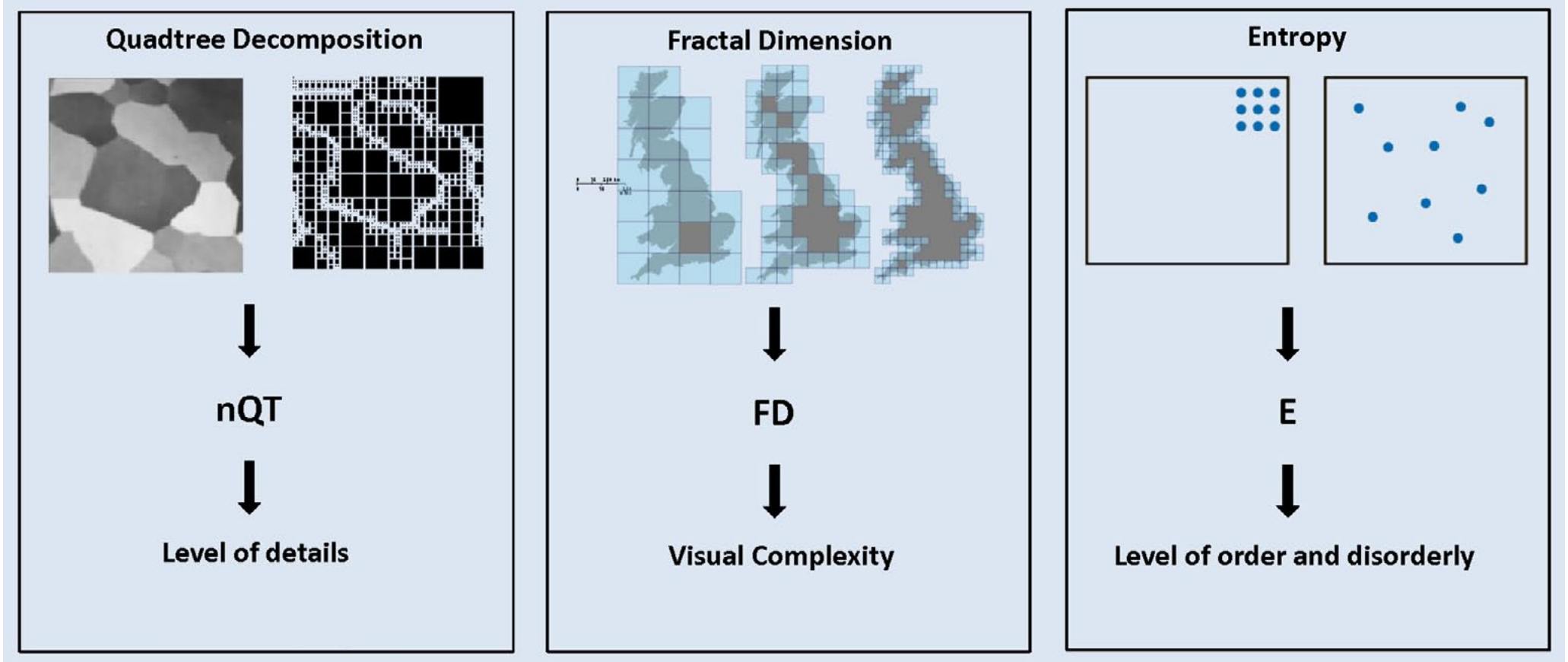
360° Photo & Skyline Graph

2 2010-QPEC137 Nundah
Visual Appearance Analysis

Demolition of Pre-1946 House

Streetscape for the purposes of DCP policy comprises:
all of the visible components within a street including: **topography**, **land forms** and **vegetation**, **street arrangements** and **patterns**; **widths** (including arrangement of carriageways, paths, verges etc); **property shapes and sizes**; **street trees and planting**; various other items in the street (are s**toplights and street furniture**); **housing types and size**.

Image Processing (segmentation)



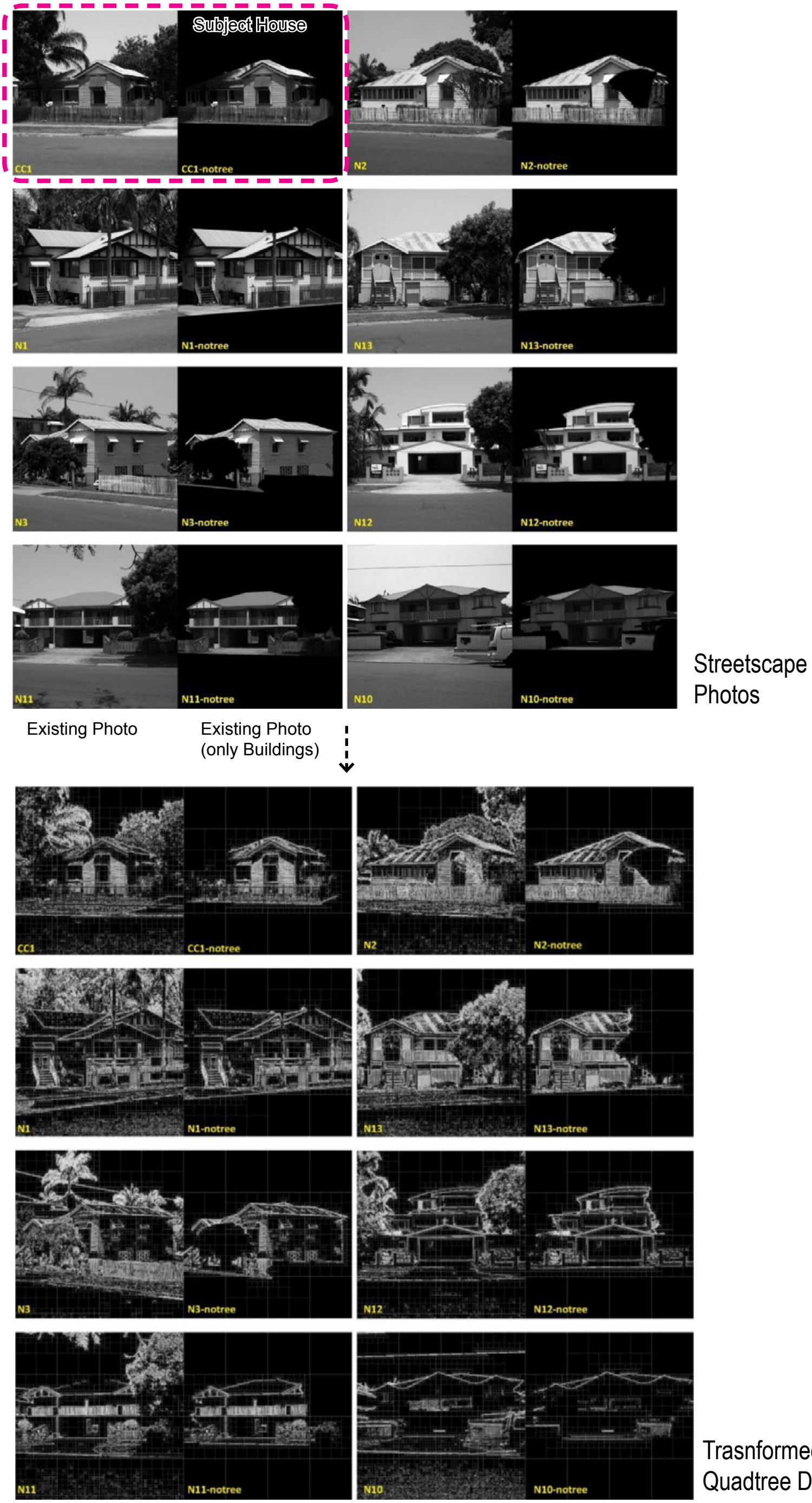
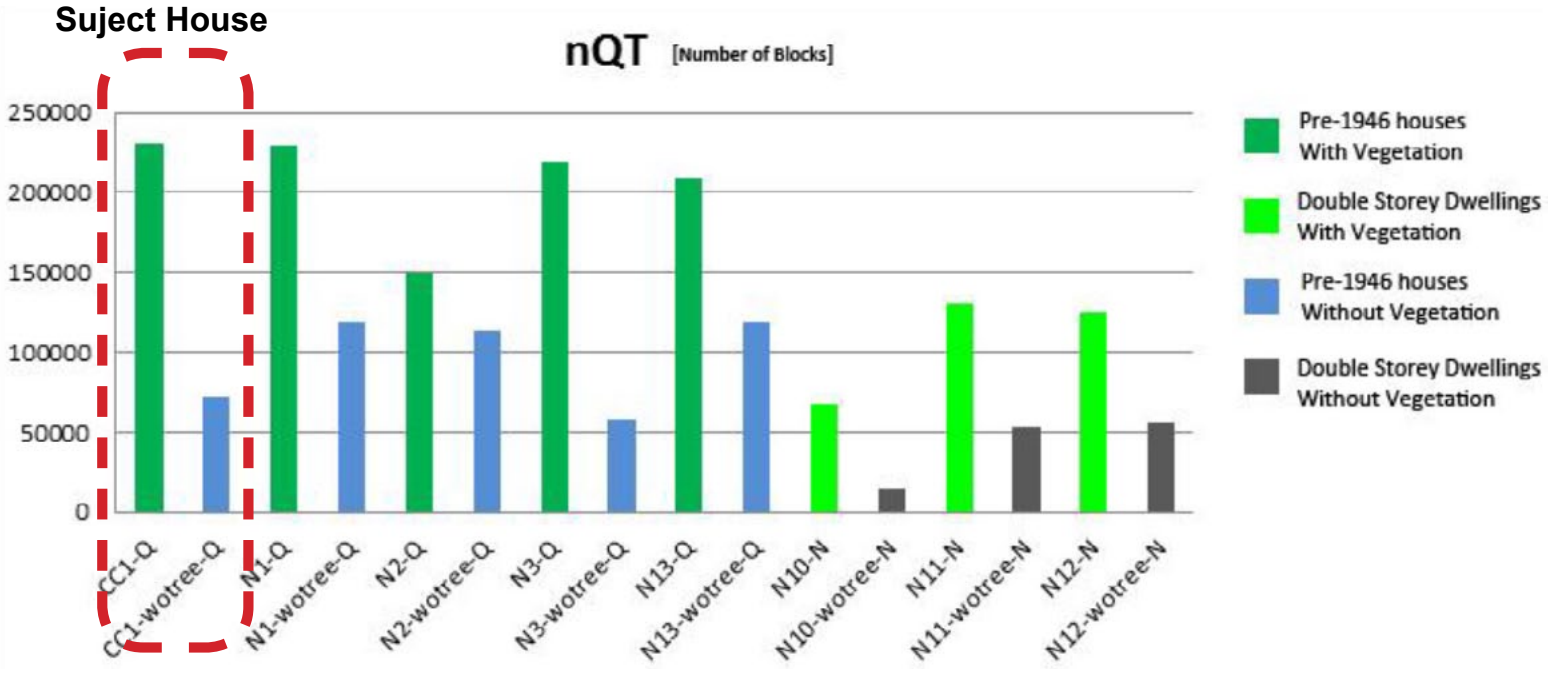
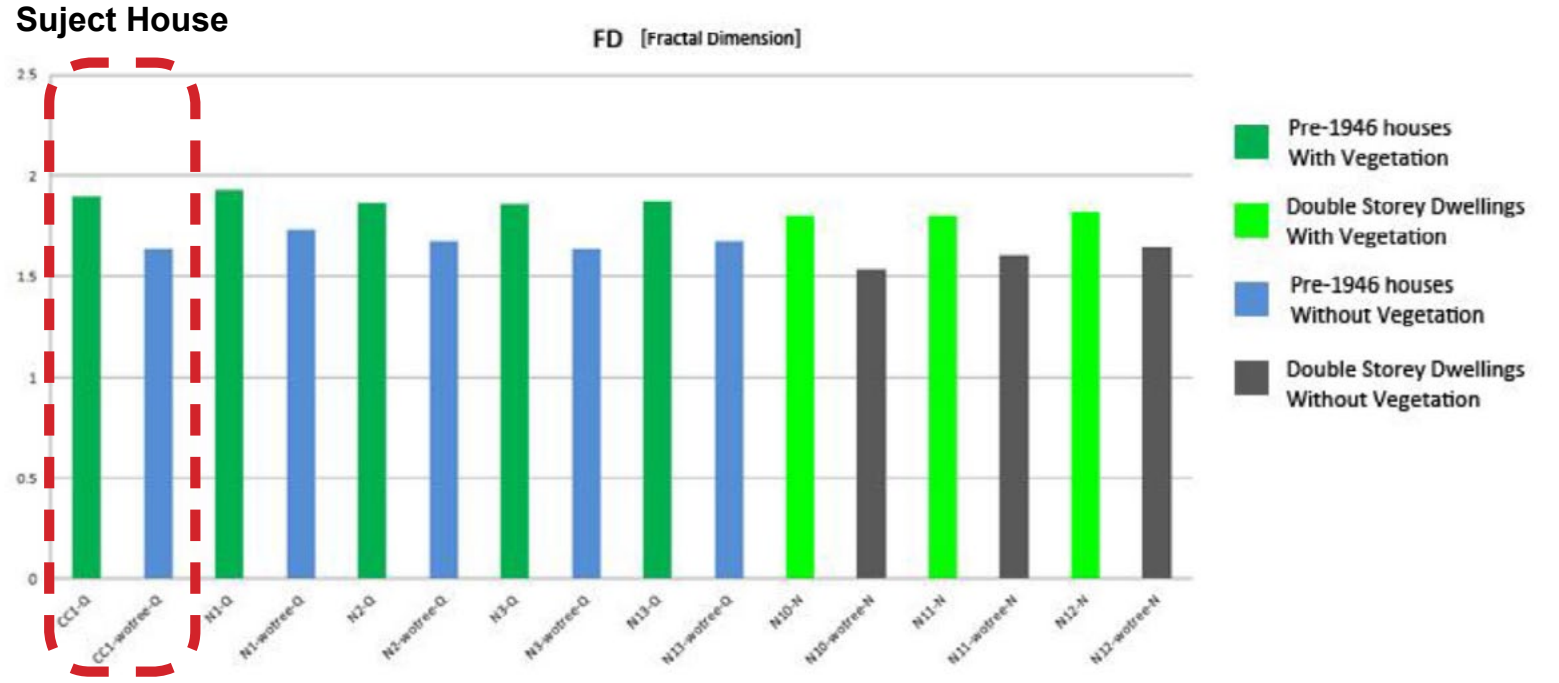

Subject House
CC1
CC1-notree
N2
N2-notree
N1
N1-notree
N13
N13-notree
N3
N3-notree
N12
N12-notree
N11
N11-notree
N10
N10-notree
Streetscape Photos
Existing Photo
Existing Photo (only Buildings)
CC1
CC1-notree
N2
N2-notree
N1
N1-notree
N13
N13-notree
N3
N3-notree
N12
N12-notree
N11
N11-notree
N10
N10-notree
Trasnformed Photos by Quadtree Decomposition

Photo no.	Context	512*512	256*256	128*128	64*64	32*32	16*16	8*8	4*4	2*2	1*1	nQT	mQT	meQT	sQT	E	FD
CC1-Q	2010-QPEC55	0	3	8	116	649	3531	12494	36550	87035	90420	230806	23080.6	2090	36406.0921	0.779	1.8978
CC1 wotree Q	2010-QPEC137	8	5	20	88	261	864	3945	12945	26428	27584	72148	7214.8	562.5	11169.1129	0.3983	1.6321
N1-U		0	0	4	104	753	3690	14078	39163	96068	75200	229060	22906	2221.5	35564.303	0.8264	1.925
N1 wotree Q		3	13	21	95	504	1847	6107	39163	37865	33068	118686	11868.6	1175.5	17299.0856	0.5071	1.7356
N2-U		1	5	41	123	417	2127	10189	31099	67390	38168	149560	14956	1272	23183.0094	0.7458	1.863
N2-wotree-Q		8	2	27	60	249	807	4305	18926	49505	40028	113917	11391.7	528	18656.9072	0.4917	1.6756
N3-Q		0	5	35	142	490	2198	10269	34217	90117	81948	219421	21942.1	1344	35439.0542	0.7402	1.8546
N3-wotree-Q		6	8	36	99	313	1081	3586	10076	23421	20172	58798	5879.8	697	8977.72084	0.3751	1.6357
N10-N		0	4	40	191	777	3266	8180	14088	24339	16436	67321	6732.1	2021.5	8730.59778	0.5279	1.8046
N10-wotree-N		6	8	50	139	324	735	1693	3556	4996	3440	14947	1494.7	529.5	1844.83791	0.2299	1.5335
N11-N		0	5	37	195	854	2107	6777	22366	52725	45324	130390	13039	1480.5	20235.6572	0.6052	1.8052
N11-wotree-N		9	0	30	90	290	802	3327	9785	21339	17732	53404	5340.4	546	8111.23749	0.3497	1.6023
N12-N		0	5	29	207	767	2400	0060	21006	55140	36752	125326	12532.6	1623.5	19354.0449	0.6172	1.8109
N12-wotree-N		6	8	25	111	372	1337	3923	9671	21212	19040	55705	5570.5	854.5	8253.1005	0.3794	1.6439
N13 Q		1	4	20	88	532	2882	11075	34155	94438	66296	209491	20949.1	1707	33702.7271	0.7504	1.8722
N13-wotree-U		8	5	14	58	197	996	4706	17814	54978	39704	118480	11848	596.5	19820.7427	0.5054	1.6769

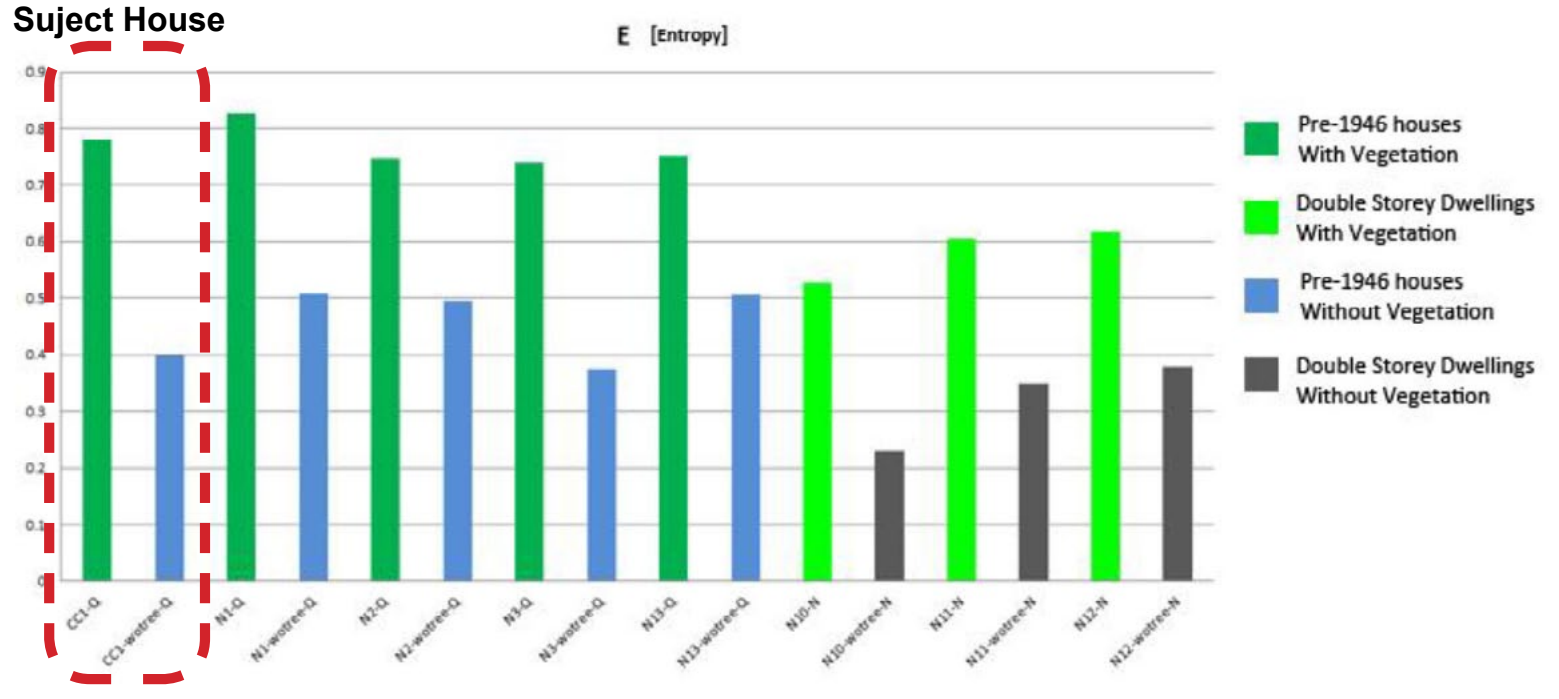
Suject House



Suject House



Suject House



TUESDAY JANUARY 28 2014 COURIERMAIL.COM.AU

BRIDGE TOO FAR?

SPOT THE LANDMARK

VIEW: Kangaroo Point resident Katerina Dracopoulos opposes the development. Picture: Peter Wallis

Residents' court fight to save view

MATTHEW KILLORAN

YOU might struggle to spot the Story Bridge in this picture but Kangaroo Point residents are prepared to go to court over losing the glimpse of the landmark.

The Kangaroo Point Residents Association and other residents have lodged a legal challenge against Brisbane City Council's approval of the $120 million, 20-storey Riverview Towers.

The residents argue it will block views of the Story Bridge, ignores planning protocols and sets dangerous precedent for development approvals.

The proposed building will be twice as high as the city plan's recommended 10-storey height limit for the suburb but the council said there was precedent for 20-storey buildings there.

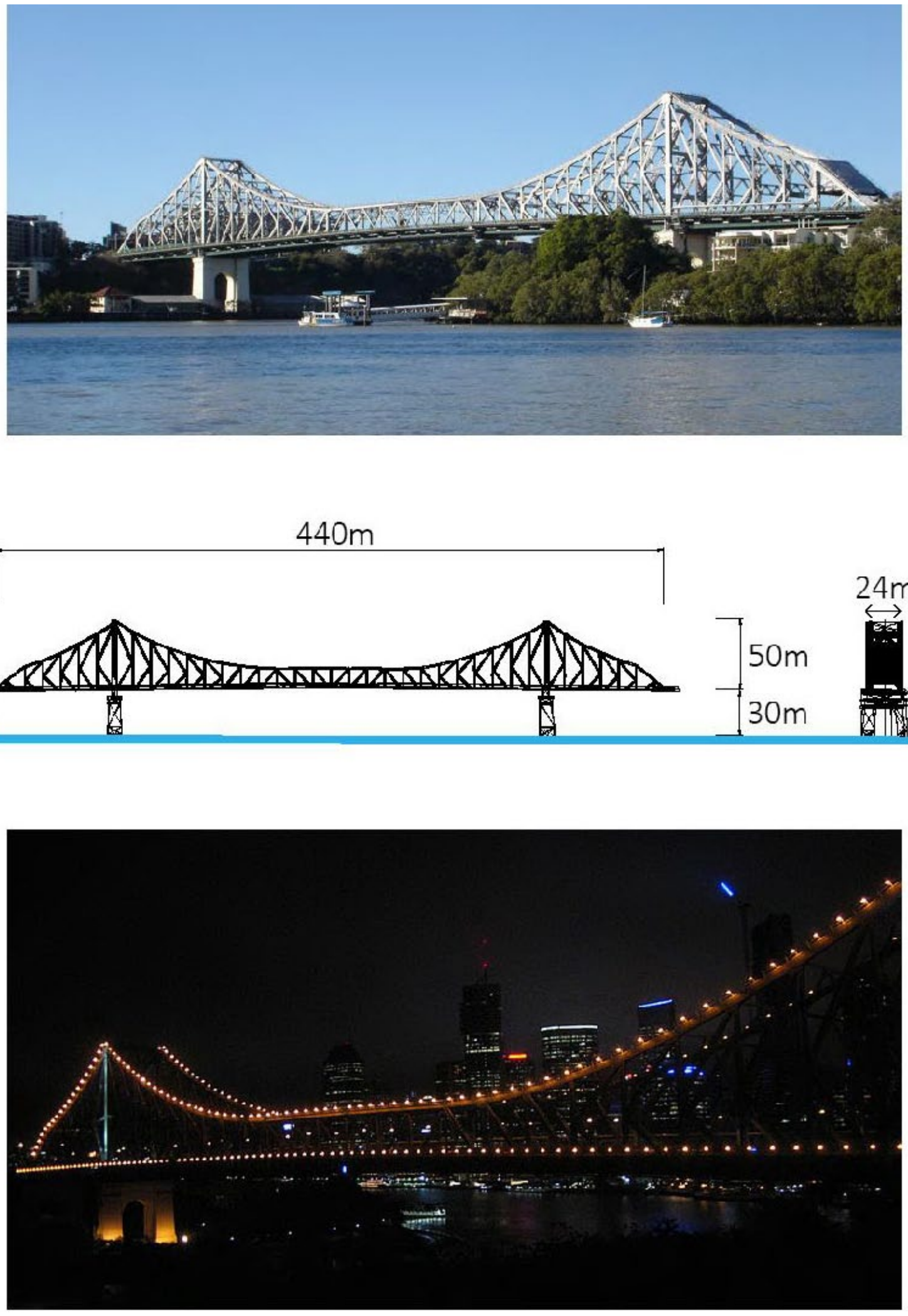
The 221-unit development at Lambert and Cairns streets was proposed by David Devine's Metro Property Development. It received 160 objections during public consultation.

"It's Brisbane City Council blatantly refusing to stick to its own plan," Kangaroo Point resident Karen Williams said. "This could happen anywhere in the city ... we don't want to be the guinea pigs."

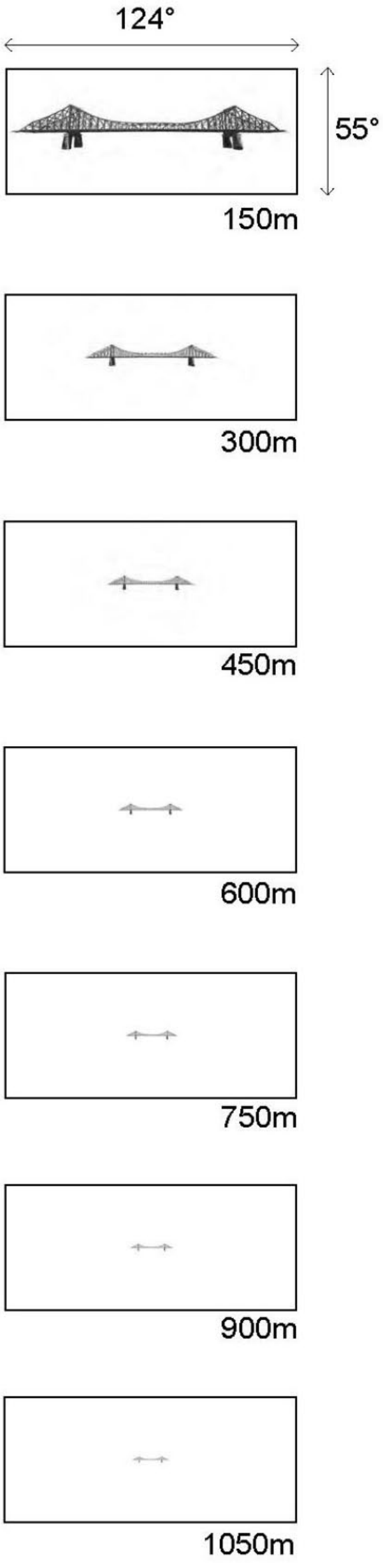
Kangaroo Point resident and architect Katerina Dracopoulos said the height of the building meant she would lose sight of the Story Bridge and the city skyline.

"I will be looking at a glass wall, 30m from my face," she said. "People don't buy in Kangaroo Point because they want to live across the road from 200 units in a bulky glass wall."

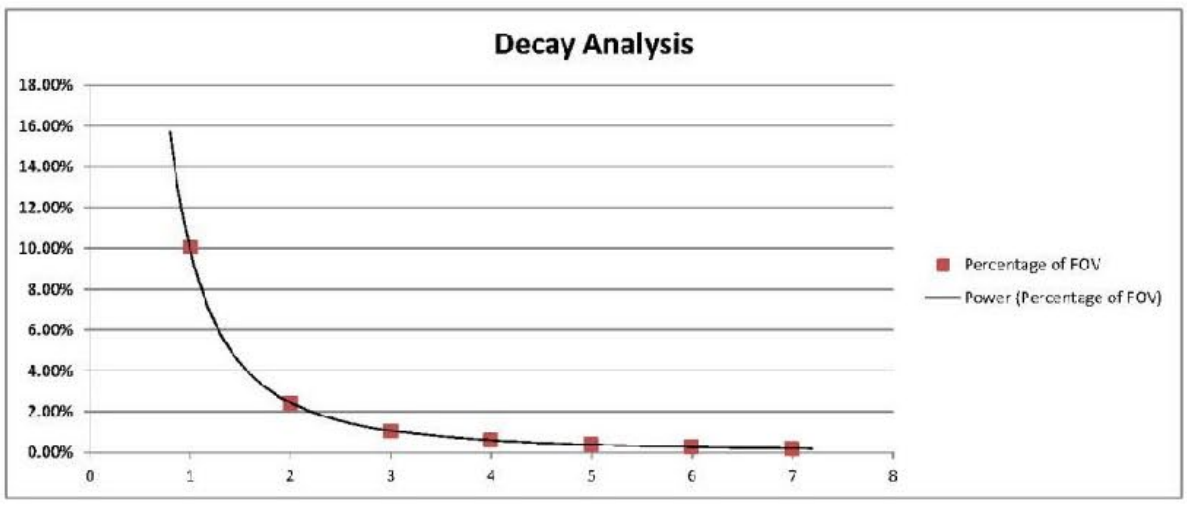
Metro Property Development did not return calls yesterday and a BCC spokesman said he could not comment because the matter was before the court.



Views to Landmarks

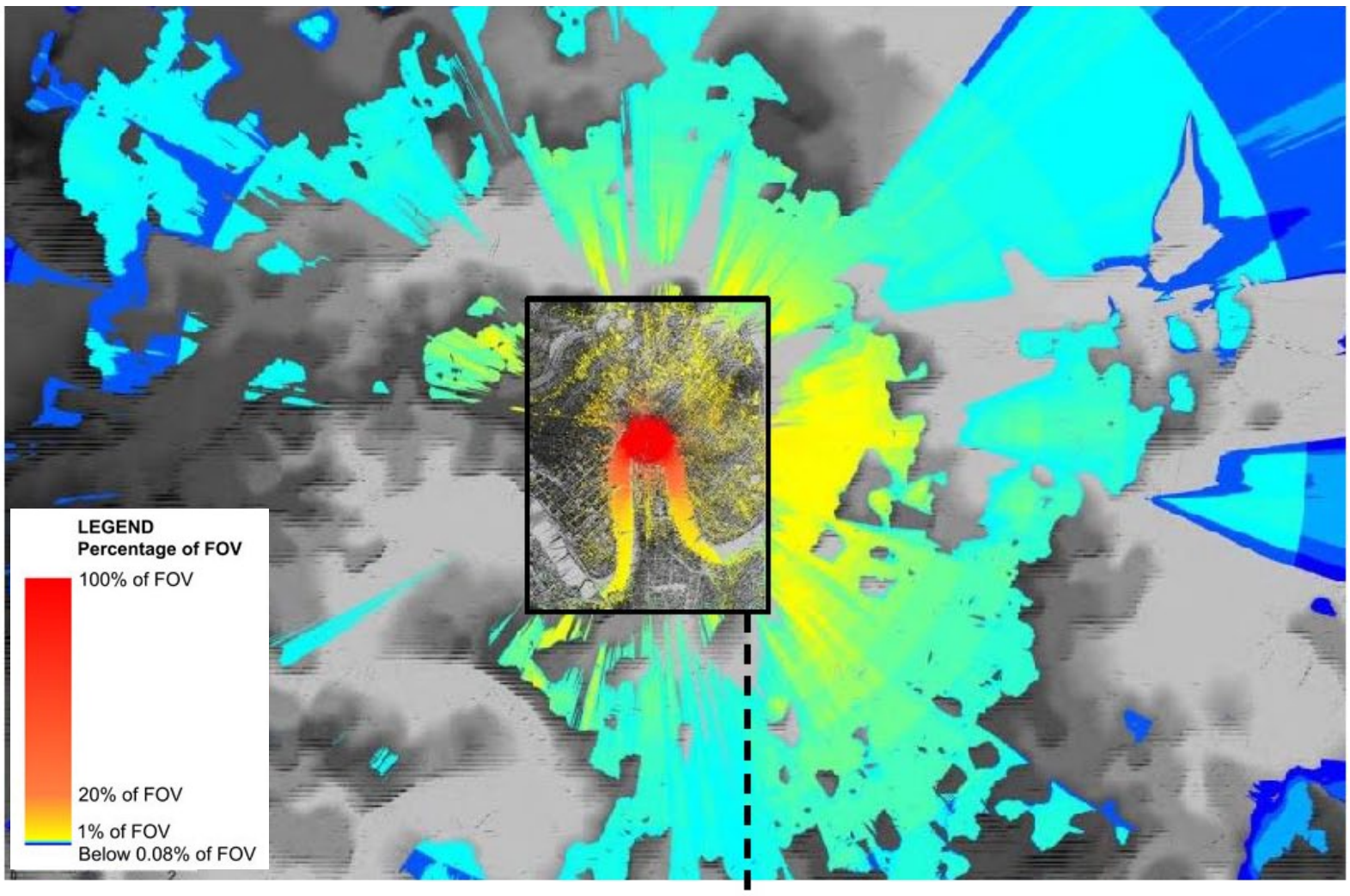


Distance	Percentage of FOV
150m	10.06%
300m	2.42%
450m	1.05%
600m	0.60%
750m	0.38%
900m	0.26%
1050m	0.19%

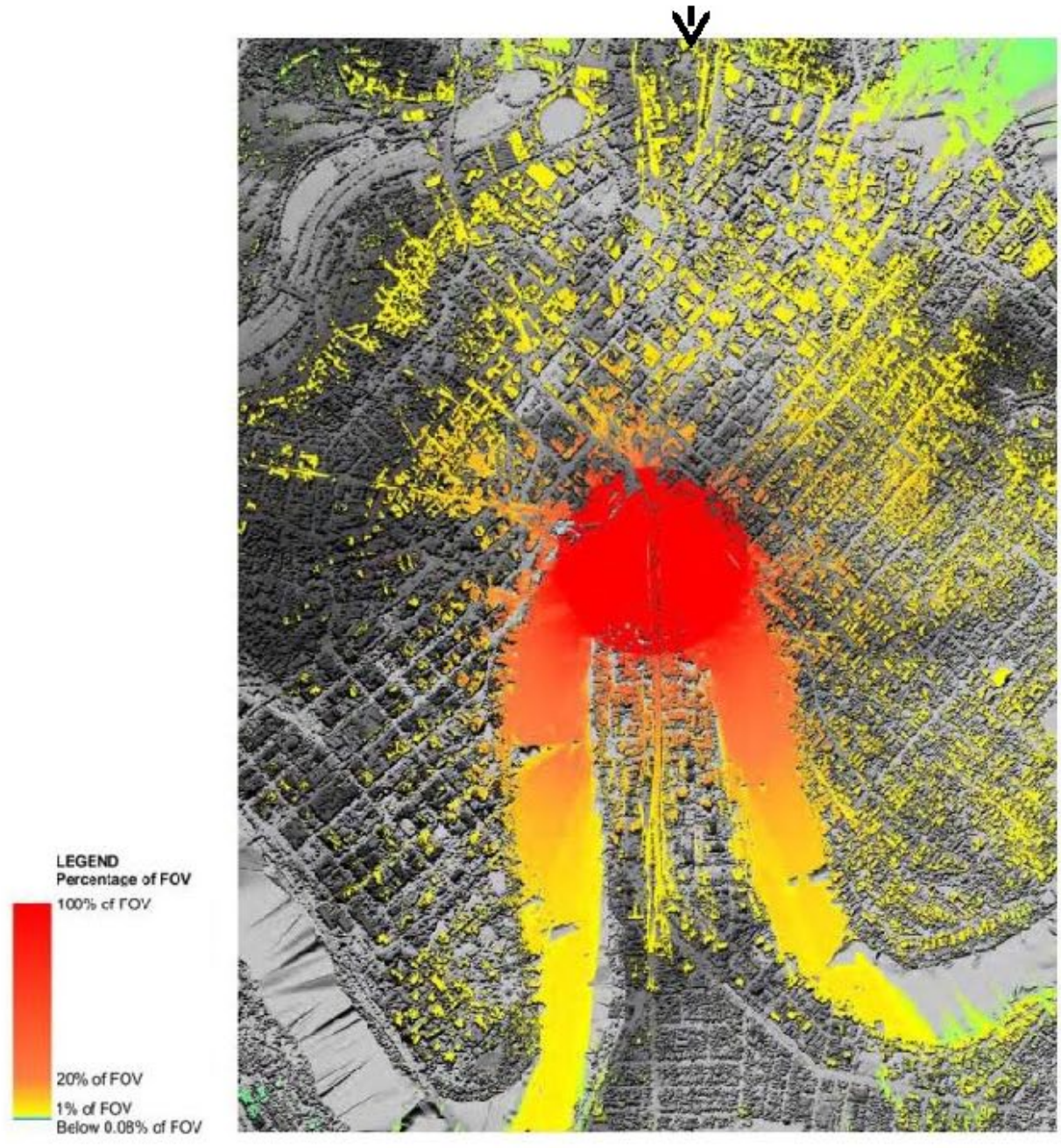


$y = 0.0998x^{-2.035}$

Calculation of visual decay based on distance



Fuzzy ZVI (including distance decay factor)



Fuzzy ZVI (including distance decay factor) Zoomed In

Survey Form

Participant No : .....1.....

Visual Conflicts In Urban Environments
Consultation with Visual Amenity Expert Panel
Ata Tara -PhD Student-2016

QUT

Please score each statement in a scale of 1 to 5:

1 Bulk & Height Analysis

Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of bulk and height of proposed developments: 1 2 3 ~~4~~ 5

Q2-Reliability of this method to analyse visual bulk and height of proposed developments: 1 2 3 4 5

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases: 1 2 3 4 5

Comments: This method is useful for DA's but also to determine 'building height thresholds' for consideration in Planning Schemes. Can this 'visual bank' also be undertaken from other VP's, such as balconies?

2 Visual Appearance Analysis

Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of visual apperance of of proposed developments: 1 2 3 4 5

Q2-Reliability of this method for visual appearance analysis: 1 2 3 4 5

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases : 1 2 3 4 5

Comments: Great analysis but not sure it as significant a tool for assessment as (1) Bulk + Height analysis and (3) Visual Dominance Analysis

3 Visual Dominance Analysis

Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of visual dominance of proposed developments; 1 2 3 4 5

Q2-Reliability of this method to analyse visual dominance of structures; 1 2 3 4 5

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases: 1 2 3 4 5

Comments: 'Visual decay' is a significant step in quantifying visual impacts in terms of visibility within a FOV. This has great potential for LVIA generally!

Survey Form

Participant No : 2

Visual Conflicts In Urban Environments
Consultation with Visual Amenity Expert Panel
Ata Tara -PhD Student-2016

QUT

Please score each statement in a scale of 1 to 5:

1 Bulk & Height Analysis

Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of bulk and height of proposed developments: 4

Q2-Reliability of this method to analyse visual bulk and height of proposed developments: 3 Quality of data

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases: 4 5

Comments: For Court ✓ For Public - PM. Both ideal

2 Visual Appearance Analysis : Complementary Qualitative

Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of visual apperance of of proposed developments: 3

Q2-Reliability of this method for visual appearance analysis: 2 Subjective 4 Accurate.

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases : 5 +

Comments:

+ subjectivewitness Community values

3 Visual Dominance Analysis

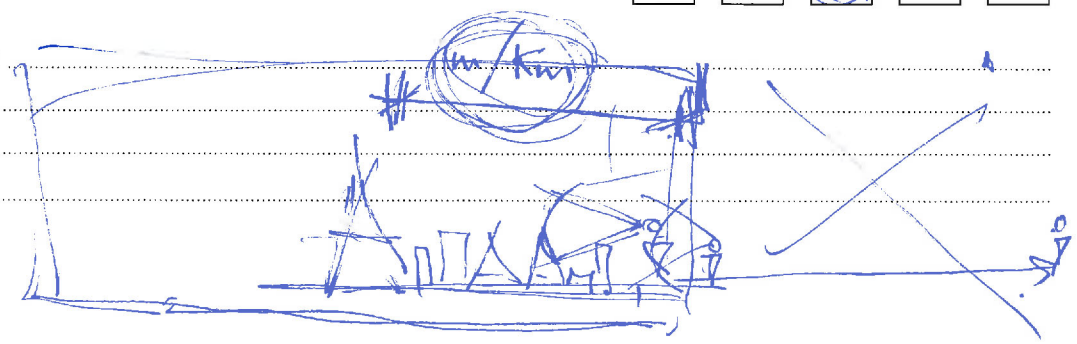
Lowest ⟷ Highest

Q1- Usefulness of the proposed method in assessment of visual dominance of proposed developments; 5

Q2-Reliability of this method to analyse visual dominance of structures; 5

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases: 3

Comments:



Survey Form

Participant No : 3

Visual Conflicts In Urban Environments
Consultation with Visual Amenity Expert Panel
Ata Tara -PhD Student-2016

QUT

Please score each statement in a scale of 1 to 5:

1 Bulk & Height Analysis

Q1- Usefulness of the proposed method in assessment of bulk and height of proposed developments:

Q2-Reliability of this method to analyse visual bulk and height of proposed developments:

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases:

Lowest ⟷ Highest

	1	2	3	4	5
Q1			✓		
Q2				✓	
Q3				✓	

360° 5km line diagram. Quantify for skyline only but ignores street trees

Comments:

eg. as a comparative "open-ness" score for each street

2 Visual Appearance Analysis

Q1- Usefulness of the proposed method in assessment of visual apperance of of proposed developments:

Q2-Reliability of this method for visual appearance analysis:

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases :

Lowest ⟷ Highest

	1	2	3	4	5
Q1		✓			
Q2		✓			
Q3			✓		

— open to being "fridual"

eg. 3D "voxels"

Comments:

3 Visual Dominance Analysis

Q1- Usefulness of the proposed method in assessment of visual dominance of proposed developments;

Q2-Reliability of this method to analyse visual dominance of structures;

Q3- Potential of the proposed methods to be improved further and be used in visual assessment and visual amenity court cases:

Lowest ⟷ Highest

	1	2	3	4	5
Q1					✓
Q2				✓	
Q3				✓	

doesn't need much improvement but consider power line anomalies

Comments: