

**ORTHOGRAPHIC PROJECTION  
AND THE ELABORATION OF THE IMAGINARY**

**BY**

**DUNCAN GEOFFREY ANDERSON**

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARCHITECTURE (PROFESSIONAL), VICTORIA UNIVERSITY OF WELLINGTON 2012

## **CONTENTS**

### **CHAPTER ONE: INTRODUCTION**

1.0.0 ABSTRACT	7
1.0.1 LIST OF FIGURES	9
1.0.2 DEFINITIONS	11
1.0.3 PREFACE	12
1.0.5 INTRODUCTION	15
1.0.4 MATRIX	18
1.0.6 METHODOLOGY	20

### **CHAPTER TWO: DRAWINGS**

#### **(1) REPRODUCTION DRAWINGS**

2.1.0 INTRODUCTION	31
2.1.1 SITE PLAN	36
2.1.2 NORTH/NORTH-EAST	42
2.1.3 SOUTH/SOUTH-WEST	48
2.1.4 EAST/SOUTH-EAST	54
2.1.5 WEST/NORTH-WEST	60
2.1.6 POINTS OF ORDER	66
2.1.7 LIFELESS ENTRANCES	68
2.1.8 LANDSCAPE ORDERS	70
2.1.9 CONSTRUCTION AIDS	72

#### **(2) ANALYTICAL DRAWINGS**

2.2.0 INTRODUCTION	74
2.2.1 BASE GEOMETRIES	76
2.2.2 CONSTRUCTION LINES	80
2.2.3 WINDOWS AND OPENINGS	84
2.2.4 VERTICAL AND HORIZONTAL LINES	88
2.2.5 VERTICAL AND HORIZONTAL ABSENCE	94

#### **(3) EXPERIMENTAL DRAWINGS**

2.3.0 INTROUCTION	100
2.3.1 THE DEVELOPED SURFACE	104
2.3.2 CIVIC RHYTHM	110
2.3.3 VERTICAL RE-CONSTRUCTION	116
2.3.4 PROJECTION OF FRAGMENTS	122
2.3.5 MIRRORED NETWORKS	128

### **CHAPTER THREE: CONCLUSION**

3.0.0 CONCLUSION	135
3.0.1 BIBLIOGRAPHY	139

## **CHAPTER ONE: INTRODUCTION**

### 1.0.0 ABSTRACT

With the development of digital technologies, orthographic projection has been slowly removed from the *process* of architectural design. Instead, orthographic projection drawings are increasingly utilised purely post-design in the form of technical construction documents. Yet, according to Robin Evans orthographic projection is an active agency in the formation of images, and an effective agency for the elaboration of imaginary objects. Furthermore, for Iain Fraser and Rod Henmi orthographic projection produces *conceptually sophisticated constructs* whose abstract representation of space allows certain aspects and relationship to be seen which may not otherwise be visible. This thesis argues that the reduced role of orthographic projection in the process of design has affected architects' ability to elaborate the imaginary.

To investigate the potential of orthographic projection in the elaboration of the imaginary, this thesis expands upon Marco Frascari's written theory of *technological images* as a palimpsest displaying three overlapping relationships: (1) between a real artefact and the reflected or projected image of it, (2) between a real artefact and its instrumental image, and (3) between the instrumental image and its symbolic image. To expand upon this theory graphically this thesis employs a methodology of *architectural drawing as research*. Outlined by Clemens Steenbergen, this framework proposes three distinct forms of architectural drawing that constitute research. This thesis couples these three forms with Frascari's three overlapping relationships of a *technological image*: (1) The *Reproduction Drawings* aim to register more accurately how something is made up through a process which interprets the object of observation and incorporates it into memory. These drawings embody the first overlapping relationship of Frascari's, *technological image*, between a real artefact and the projected image of it. (2) *Analytical Drawings* reveal abstract qualities and potentials by reducing the complex compositions of the first series to their elementary geometric forms, lines and grids. These drawings embody the second overlapping relationship, between a real artefact and its instrumental image. (3) *Experimental Drawings* project the *reproduction* and *analytical drawings* into an existing context to expand upon or reinforce the relationships and conceptual connections formed in relation to the site in the preceding two series. The effects of these interventions are assessed and altered, ultimately leading to new concepts and new compositions. These drawings aim to elaborate imaginative relationships between buildings and architectural ideas, through a process Frascari terms a *mutual measure* derived from a familiar *nature*. These drawings embody the third and final overlapping relationship between the instrumental and its symbolic image. By extending upon Frascari's theory graphically, this thesis argues that orthographic projection remains a valuable tool in the *process* of design.

The real artefact chosen to demonstrate the continued value of orthographic projection is Wellington's Civic Square. This site was selected as the buildings located around its formal rectilinear domain offer a heterogeneous mix of civic architecture, ranging from the strictly orthogonal Town Hall and City Gallery to the curvilinear Public Library and City Administration Building. This site offers the opportunity to test both the advantages and disadvantages of orthographic projection, for the reading of architecture and the elaboration of the imaginary, within a formally diverse existing urban environment.

### 1.0.1 LIST OF FIGURES

1.1	Athfield Architects Ltd. (1990). Existing site plan, Mercer Street, Wellington.	28
1.2	Civic Square. (2011). Wellington.	29
1.3	Town Hall, 1904. (2011). Civic Square, Wellington.	29
1.4	City Gallery, 1940. (2011). Civic Square, Wellington.	29
1.5	City Administration Building, 1991. (2011). Civic Square, Wellington.	29
1.6	Public Library, 1991. (2011). Civic Square, Wellington.	29
2.1	Le Corbusier. (1929). Aménagement de la Porte Maillot, Paris, France.	33
2.2	Louis Kahn. (1973). Master Plan, National Capitol, Dacca, Bangladesh.	35
2.3	Richard Meier and Partners. (1986-1994). Site Plan, The Hague City Hall and Central Library, The Hague.	35
2.4	Thom Mayne. (1975). <i>Sixth Street House</i> .	103
2.5	Thomas Lightoler. (1757). <i>Section for a Stair Hall</i> .	104

## 1.0.2 DEFINITIONS

*...architecture itself is a projection of architectural ideas, horizontal footprints and vertical effigies, disclosing a symbolic order in time...The architect's task, beyond the transformation of the world into a comfortable or pragmatic shelter, is the making of a physical, formal order that reflects the depth of our human condition, analogous in vision to the interiority communicated by speech and poetry, and to the immeasurable harmony conveyed in music.<sup>1</sup>*

### RESEARCH PROBLEM:

With the development of digital technologies orthographic projection has slowly been removed from the *process* of architectural design. Instead, orthographic projection drawings are increasingly utilised purely post-design in the form of technical construction documents.

### RESEARCH QUESTION:

How can Marco Frascari's theory of *technological images* be tested through Clemens Steenbergen's critical framework of *architectural drawings as research*, in order to determine the importance of orthographic projection in the elaboration of architectural theory and to architects' ability to elaborate the imaginary?

### ORTHOGRAPHIC:

*Orthographic = ortho + graphic or straight writing. Orthographic drawings use two axes of measurement, fixed at right angles to each other. In plan, the axes measure length and width, while in section and elevation the axes measure width and height. Only two dimensions are accurately measured in each drawing; there is no provision for the direct depiction of a third dimension in the construct. In orthographic drawings, projection lines are parallel and orthogonal to the picture plane. By convention, they are also parallel to the major surfaces of the depicted project. There is no diminishment in size relative to distance along any axis and every surface of the project parallel to the picture plane is represented without distortion of shape, size, or proportion.<sup>2</sup>*

<sup>1</sup> Alberto Perez-Gomez. (2007). *Questions of Representation: The Poetic Origin of Architecture*. In Marco Frascari, Jonnathan Hale & Bradley Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 11-22). London: Routledge. 12-13

<sup>2</sup> Iain Fraser & Rod Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. New York: Van Nostrand Reinhold. 42

### 1.0.3 PREFACE

*Orthographic drawings are forms of representation that confront their viewers with edited ways of seeing. It is their specific viewpoints and ways of looking that can alter the conceptions that authors have toward projects. Viewing a cut building from above offers the heightened possibility of seeing horizontal relationships... Viewing into the interior of a building cut vertically increases the chance of seeing vertical spatial relationships... Both present the increased possibility of visualizing order and continuity... In the formation of these conceptions, orthographic drawings play a central and generative role.<sup>3</sup>*

Grounded in the theory of Robin Evans - specifically his 1995 posthumously published book *The Projective Cast*, and his chapter *On Projection* from the 1989 book *Architecture and its Image* – this section begins with the observations that for centuries orthographic projection was the dominant method for devising and picturing architecture before it was built, and although orthographic projection has slowly been removed from the process of design, it nevertheless holds possibilities for the elaboration of imaginary objects and concepts. Still following Evans it is suggested that although architectural drawing must invoke projection in some form, there remains a gap between drawing and building that projection alone cannot close. Rather than a negative, this is considered a key advantage to the orthographic projection drawing's abstract representation of space. Supporting this view is Alberto Perez-Gomez, who proposes that digital technologies disregard this gap between drawing and building, leaving little room for the imaginary to emerge through the process of drawings. Iain Fraser and Rod Henmi, observe, in their 1994 book, *Envisioning Architecture: An Analysis of Drawing*, that orthographic projection suppresses one dimension to focus more intently on the other two. From this they propose that the orthographic set, of plan, section, and elevation are *conceptually sophisticated constructs*, in the sense that they allow certain aspects and relationships to be seen which may not otherwise be visible. Although two-dimensional, these relationships are nevertheless important to our understanding of architecture. The aim of this section is to define the nature of orthographic projection as it is viewed by this thesis, in order to address the research question of *how can orthographic projection elaborate the imaginary through Marco Frascari's theory of architectural drawing as a technological image displaying three overlapping relationships?*

For centuries orthographic projection was the preeminent method for devising, picturing and transmitting ideas of buildings before they are built.<sup>4</sup> However, with the development of digital technologies orthographic projection has been slowly removed from the process of architectural design. Instead, this method of projection is generally utilised post-design in the form of technical construction documents. Nevertheless, for Robin Evans orthographic projection holds possibilities outside of the purely technical, as it is an active agency in the formation of images, and an effective agency for the elaboration of imaginary objects.<sup>5</sup> Evans proposes in his 1995 book, *The Projective Cast*, that what “connects things to imagination, imagination to drawing, drawing to building, and building to our eyes is projection in one guise or another.”<sup>6</sup> Although architectural drawings must invoke projection, this is not to suggest that projection alone is capable of closing the gap between drawing and building. For Evans, the line between drawing and building is in fact

not straight, rather once an observer with the capacity to imagine is included in the relationship between drawing and building then the line between the two becomes a series of circuits, as opposed to a single straight line.<sup>7</sup> Rather than considering this distance between drawing and building a negative, for Evans it is a key advantage of orthographic projection's abstract representation of space. Through this abstract representation of space, orthographic projection triggers a *projecting forth* of architectural ideas through the *activating imagination* of an observer.<sup>8</sup> Similarly, for Alberto Perez-Gomez the distance between drawing and building is what provides the opportunity to elaborate the imaginary in architectural design, what Perez-Gomez terms *making visible the invisible*.<sup>9</sup> Perez-Gomez proposes that a growing obsession with productivity and rationalism embodied in the digital technologies of the contemporary architecture profession has the potential to transform the design process from *idea to built* into a systematic representation, leaving little room for the invisible to emerge through the process of design.<sup>10</sup> Perez-Gomez identifies this contemporary view of orthographic projection as a purely technical device capable of closing the gap between drawing and building, as holding serious implications for the manifestation of the poetic and imaginary in architectural design:

*Understanding the nature of projections as ephemeral, dynamic and endowed with shadows may generate an architecture once more experienced as a flowing musical composition, in time...<sup>11</sup>*

In a similar vein, Robin Evans proposes that if the *activating imagination* of an observer is removed from consideration then orthographic projection slips into the category of mere technical facilitator, from which two ingrained prejudices arise: firstly, that its usefulness in construction documents impedes its promotion as a form of knowledge; and secondly, that orthographic projection is either unconnected with imagination or a positive hindrance to it.<sup>12</sup> This thesis attempts to disprove the latter, by demonstrating how orthographic projection is of use outside of technical construction documents, and how it is heavily connected with architectural imagination.

For Iain Fraser and Rod Henmi in their co-written book *Envisioning Architecture: An Analysis of Drawing*, the orthographic set of plan, elevation and section are *conceptually sophisticated constructions* as each view suppresses the information of one dimension to focus on and clarify the other two. This they term orthographic projection's *synoptic view*.<sup>13</sup> For Fraser and Henmi this *synoptic view* is an aid to visualisation as, for example, a flattened vertical section through a building or site allows “certain aspects and relationships to be seen which may not otherwise be visible.”<sup>14</sup> Orthographic projection represents these visual relationships by juxtaposing different parts of a building in ways not readily perceivable during physical occupation. Presenting such elements as windows, walls and columns within an orthographic view leads to *conceptual connections* between parts, giving rise to a process of comparing and contrasting configuration, arrangements and relative sizes.<sup>15</sup> This thesis utilises orthographic projection to form these conceptual connections and relationships between the parts of the chosen site and uses

3 Fraser & Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 40

4 Robin Evans. (1989). *Architectural Projection*. In Eve Blau & Edward Kaufman (Eds.), *Architecture and its Image: Four Centuries of Architectural Representation. Works from the Collection of Canadian Centre of Architecture* (pp. 18-35). Montreal Canadian Centre for Architecture. 21

5 *ibid* 24

6 Robin Evans. (1995). *The Projective Cast: Architecture and its Three Geometries*. Cambridge: The MIT Press. xxxi

7 Evans. (1989). *Architectural Projection*. 24

8 *ibid* 20

9 Perez-Gomez. (2007). *Questions of Representation: The Poetic Origin of Architecture*. 19-20

10 *ibid*

11 *ibid* 15

12 Evans. (1989). *Architectural Projection*. 20

13 Fraser and Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 25

14 *ibid* 26

15 *ibid*

#### 1.0.4 INTRODUCTION

them as the fundamental drivers for further compositions, which elaborate imaginative concepts. Although orthographic projection's simplification of an object from three dimensions to two draws our attention to spatial relationships that cannot be seen in nature due to the foreshortening of optical vision, for Gerald Allen and Richard Oliver in their co-edited book *Architectural Drawing: The Art and the Process*, these relationships nevertheless "reveal things that are important to our understanding of a building when we are actually in it."<sup>16</sup> For this reason, this thesis argues that orthographic projection is a valuable tool for uncovering and understanding the formal composition and relationships present in our existing urban environment, not only in the technical sense of objective information, but as the driver of imaginative architectural ideas, designs and representations.

This section outlines Marco Frascari's theory of architectural drawings as *technological images*, through a number of texts written between 1990 and 2009. It begins with an account of the structure and components of Frascari's theory, before introducing how the drawings of this thesis expand upon it graphically. This section begins with a distinction between *imaginative universals* and *intelligible universal* as outlined by the philosopher Giambattista Vico, a division Frascari views as representative of the current "negative" condition of contemporary architectural practice. It then explains how architectural representations based in *imaginative universal* lead to the formation of *technological images* through three overlapping relationships. These *technological images* are based on a view of architectural drawings as *demonstrations* analogously related to construction. Frascari proposes that this idea of *demonstration* is embodied in the Vitruvian concept of arrangement; the three orthographic views of plan, section, and elevation.

Marco Frascari proposes that it is imperative to re-evaluate the graphic procedures involved in the conception of architecture for we are "in an age in which unconsidered consumerist interests have exploited architecture... and ...buildings are the targets of technologies of absurd variation..."<sup>17</sup> For Frascari the present treatment of architectural drawing is as an ancillary component to both the analysis of buildings and the elaboration of architectural theory. Yet drawings are "the most important architectural agents, since they carry embodied in them the non-verbal essence of architectural theory."<sup>18</sup> The use of Frascari's theory to investigate orthographic projection's ability to elaborate the imaginary is relevant, as Frascari proposes "a research that aims to produce imaginative, rather than normative data."<sup>19</sup> For Alberto Perez-Gomez, Frascari's theory of *technological images* is of immense value as it:

*...offers the only possible alternative for architecture in a world of simulations. Architecture is drawing (in the sense of our tradition of revealing the invisible in the visible). It is the theoretical project...If we truly wish for an architecture of presence, for more buildings to dwell poetically on this earth...we must engage, both in practice and education, the radical consequences of Frascari's realization for architectural representation.<sup>20</sup>*

Frascari himself states that the overall intent of his theory "is to suggest a possible critical approach to architectural projects [through] a method based on the use of *imaginative universal*."<sup>21</sup> As defined by the philosopher Giambattista Vico, *Imaginative Universals* are seen as "the outcome of a productive poetic mind," (the Italian: *Ingegno*), in contrast to *Intelligible Universals*, which are "the product of a rational, but soporific mind," (the French: *Espirit*).<sup>22</sup> For Frascari "the present 'official' research in architecture is a result of the search for *intelligible universal*."<sup>23</sup> This is an approach to research that forms an "understanding of architecture as a system of generalized notions; it creates catalogues, codes, guidelines, or normative prescriptions."<sup>24</sup>

17 Marco Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. Maryland: Rowman & Littlefield Publishers Inc.

18 Marco Frascari. (2007). Introduction. In Marco Frascari, Jonnathan Hale & Bradley Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 11-22). London: Routledge. 5

19 Marco Frascari. (1990). A New Angel/Angle in Architectural Research: The Idea of Demonstration. *The Journal of Architectural Education*, 44(1), 11

20 Alberto Perez-Gomez. (1992). Review of Marco Frascari's 'Monsters of Architecture'. *Journal of Architectural Education*, 46(1), 60.

21 Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. 106. My italics

22 Giambattista Vico. (1984). *The New Science of Giambattista Vico* (T. G. Bergin & M. H. Fisch, Trans.). Ithaca: Cornell University Press. 473-482

23 Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. 106. My italics

24 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 13

16 Gerald Allen & Richard Oliver. (Eds.). (1981). *Architectural Drawing: The Art and the Process*. London: The Architectural Press Ltd. 15



Frascari's theory of architectural research and representation through *imaginative universals* on the other hand, "proposes an understanding of architecture as a system of representational knowledge resulting from technological signs."<sup>25</sup> This is an approach concerned with generating an understanding of architecture through the image, not from rational categories (catalogues, codes, guidelines, or normative data). For Frascari a critical approach through *imaginative universals* is possible only through a radical change in our understanding of the role of drawings in architecture, as it seeks a presentation of the parts of architecture through a system Frascari equates to a thesaurus of *technological images*.<sup>26</sup>

As defined by Frascari, a *technological image* is the combination of a *techne* of *logos* (the symbolic representation) orientated in a *logos* of *techne* (the instrumental representation).<sup>27</sup> The word *technological* and its variants are not used by Frascari in the contemporary sense, as the "application of scientific knowledge for practical purposes." Rather, it reflects its original meaning, embodied in the Greek *techne*: the rational method involved in producing an object or accomplishing an objective, which belongs to the notion of *poiesis*, a "bringing forth" or "to make"; the basis of our modern word "poetry", which reveals or discloses *aletheia*; the truth.<sup>28</sup> Based on the productive and poetic outcomes of *imaginative universals*, Frascari proposes that *technological images* (the combination of the symbolic and instrumental image) are a palimpsest displaying three overlapping relationships: (1) between a real artefact and the reflected or projected image of it (the immediate interpretant), (2) between a real artefact and its instrumental image (the dynamic interpretant), and (3) between the instrumental image and its symbolic image (the final logical interpretant).<sup>29</sup>

*Technological images* are an appropriate method for testing orthographic projection's ability to elaborate the imaginary as they "do not search for a [visual] likeness as the basis for relating buildings and an architectural conception, but a mutual measure derived from a familiar nature..."<sup>30</sup> This *mutual measure* which connects buildings and architectural conceptions requires the *activating imagination* of the author or observer to trigger a *projecting forth* of architectural ideas. This *projecting forth* was identified as a key component of orthographic projection's abstract representation of space (as observed by Robin Evans in the preceding section (0.4.0 *Preface*)). Within this interpretation of architecture drawings - as *technological images* based in *imaginative universals* - drawings are not considered as objects themselves. Rather, they are compositions analogically related to construction through the corporeal dimension of architectural representation, as *demonstrations of architecture*.<sup>31</sup>

*Drawings must become technographies...graphic representations analogously related to the built world through a corporeal dimension.*<sup>32</sup>

Frascari proposes that in the Vitruvian concept of arrangement, of plan, elevation, and section, the origin of architectural drawings as analogically related to the physical construction, as the *demonstrations of construction*, is to be found.<sup>33</sup> This notion of *demonstration* reinforces the relevance of this model for the analysis of orthographic projection, as it proposes an imaginary connection between a drawing and a built artefact. For Vitruvius, orthographic projection's three types of arrangement refer to the three aspects of a mental image (the Greek: *Ideai*):<sup>34</sup>

25 Perez-Gomez. (1992). *Review of Marco Frascari's 'Monsters of Architecture'*. 60

26 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 13

27 Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. 107

28 Alberto Perez-Gomez & Louise Pelletier. (1992b). Representation beyond Perspectivism. *Perspecta*, 27, 22

29 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 15

30 Marco Frascari, M. (2009). Splendor and Miseries of Architectural Construction Drawings. *Interstices: Journal of Architecture and Related Arts*(11), 110

31 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 14

32 *ibid*

33 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 14

34 *ibid* 14-15

***Ichnography (Plan)***: This involves the competent use of compass and ruler to draw the plan, which is analogically the "demonstration of an edifice's plan with lines, ropes, and boards on the grounds of the selected site."<sup>35</sup> Frascari cites Cesare Cesariano's commentary on the first Italian translation of Vitruvius's treatise to suggest that the mechanical drafting of a plan is a "graphic demonstration analogous to the demonstration of the future construction given by the architect to the builder when he is pacing through the site pointing out features of the building...[and] the location of "keystones".<sup>36</sup>

***Orthography (Elevation)***: An elevation is analogically the *demonstration* of the vertical raising of a building, whose analogical demonstration is embodied in the structure of scaffolding.<sup>37</sup>

***Sciographia (Section)***: According to Frascari this is the most difficult *idea* to explain, as it has often interpreted as perspective due to a misleading notion generated by the homophonous term meaning "stage design". Frascari cites Daniele Barbaro's 1584 translation and commentary on Vitruvius's treatise, which suggests that the translation of *sciographia* as perspective resulted from its misreading as *scenographia* in the original text; a form of perspective whose application was important only in the building of stage sets.<sup>38</sup> Thus Barbaro terms this third arrangement *profico*, a vertical cut showing the building during construction:

*From this third idea...great unity is derived, because through the description in profile we understand the thickness of walls...in this the architect is like a physician who demonstrates all the interior and exterior parts of works.*<sup>39</sup>

The thesis' first series of drawings concern the accurate graphic reproduction of the chosen site through mechanically drafted orthographic projections. This series begins by drawing the site in plan, though a process treated as analogically related to the set-out and construction of the physical site, as a *demonstration of construction*. Following the site plan, four combination elevation and section drawings are constructed. As a set these drawings become the first overlapping relationship of a *technological image*, as they are concerned with demonstrating the analogical relationship between a real artefact and the projected image of it. The second series of drawings build upon the first series, and are concerned with the relationship between the projected image of the real artefact and its instrumental image. The third series of drawings embody the third and final overlapping relationship of a *technological image*. They seek to recombine and re-contextualise the first two series of drawings, orientating the symbolic image within the instrumental representation. It is proposed that the overlapping relationships of these three series of drawings are the graphic embodiment of Marco Frascari's theory of a *technological image*. These drawings demonstrate orthographic projection's value in the formation of theories of architecture and the elaboration of the imaginary in architectural design.

The following section, 0.6.0 *Methodology*, introduces the site of study and the justification for selection in relation to the theory of Frascari. Following this, it further defines the aims of each series of drawings introduced above. It outlines how this thesis builds upon Marco Frascari's theory of *technological images* graphically, following a critical framework of *architectural drawing as research*, as outlined by Clemens Steenbergen. It argues that the combination of these two theorists will lead to a successful investigation of the main research imperative concerning orthographic projection's elaboration of the imaginary. Furthermore, the following section outlines the structure of, and relationship between, the three series of drawings produced, and proposes how the results of these drawings will be presented and discussed.

35 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration* 15

36 *ibid* 15. In summation of C. Cesariano's translation (1521) of Vitruvius. *De Architectura* (On Architecture)

37 *ibid*

38 *ibid*

39 Daniele Barbor. Translation and commentary of: Vitruvius. (1584). *The Ten Books of the dell'Architetturad*. Venice: Marcolini. 30

1.0.5 MATRIX

3 EXPERIMENTAL DRAWINGS

2 ANALYTICAL DRAWINGS

1 REPRODUCTION DRAWINGS

ARCHITECTURAL DRAWING AS RESEARCH

THE THREE OVERLAPPING RELATIONSHIPS  
OF A TECHNOGRAPHICAL IMAGE:

BETWEEN A REAL ARTEFACT AND  
ITS PROJECTED IMAGE 1

BETWEEN A REAL ARTEFACT AND  
ITS INSTRUMENTAL IMAGE 2

BETWEEN THE INSTRUMENTAL IMAGES  
AND ITS SYMBOLIC IMAGE 3

### 1.0.6 METHODOLOGY

*Every drawing is in fact an answer to a question; in answering one, it raises the next. If this process of questioning and answering operates according to certain rules, imposing a certain order on the design activities, one might speak of research. Research with drawings is in that sense the process of classifying various series of drawings. In that classification, every drawing is of interest as a product of research to the extent that within it, a conscious arrangement of its constituent parts opens up the design, as a new composition, to discussion.*<sup>40</sup>

This section begins by presenting Clemens Steenbergen's critical framework for *architectural drawing as research*. It then outlines how Steenbergen's three forms of *architectural drawing as research* are coupled with Marco Frascari's three overlapping relationships of a *technological image*, introduced in the previous section. This thesis examines how these two theories can be strategically integrated as a means of testing orthographic projection ability to elaborate the imaginary. Building upon this, is an overview of the structure of each of the three series of drawings, and an outline of how and what conclusions are drawn from these drawings in the following sections. Concluding this section is the introduction of the selected site and its justification for selection in relation aims of this thesis.

Clemens Steenbergen proposes in *Architectural Design and Composition*, that research in architectural drawing is found through the process of classifying various series of drawings. Within this classification each drawing is of significance as a product of research to the extent that within it "a conscious arrangement of its constituted parts opens up the design, as a new composition, to discussion."<sup>41</sup> For Steenbergen the field of composition is a discursive and continuously open system, requiring an ambiguous interpretation, which becomes a generator of ideas by putting forth a *multi-vocal* result, which is the critical instrument of primary creative energy.<sup>42</sup> However, this view is, for Steenbergen, at odds with the current treatment of architectural drawings. He suggests rather that the drawings from which an architectural design is derived are "seldom considered from the point of view of creating an internal technique of analysis and critique."<sup>43</sup> Instead, recent drawings and documents within the working process have been endowed with a certain autonomy that focuses on the *drawing as object*. This autonomy is perhaps best defined as a view of a single drawing possessing independence or importance over all other drawing produced in a given design, or treating drawings as separate to the architecture they project or represent. This view ignores everything the drawing itself can *project forth*, and overlooks the fundamental role of *architectural* drawing as a means to progress, or at least point toward, architecture.<sup>44</sup> As Marco Frascari proposes, architectural drawings should be seen as the essential part of architectural production, rather than works of art in their own right.<sup>45</sup>

Following this interpretation by Steenbergen and Frascari, the drawings of this thesis are not considered as the culmination or final object of design. Rather, these drawings are of significance for what they can *open up* architecturally, in the form of new ideas and imaginative architectural conceptions. This *opening up* of architectural ideas was identified by Robin Evans and Alberto Perez-Gomes as a key component to orthographic projection's abstract representation of space in section 0.4.0 *Preface*. Thus, the *opening up* of a design through Steenbergen's classification of various series of drawings, coupled with the intrinsic *opening up* of architectural space through orthographic projection, allows for the elaboration of the imaginary to be approached in a two-fold manner. On the one hand, the classification of a drawing in relationship to the other drawings, and on the other hand, through the orthographic composition and elements of the individual drawings themselves. Within Steenbergen's framework for *architectural drawing as research* are three distinct forms or categories of architectural drawing. These three forms are coupled with Frascari's three overlapping relationships of a technological image.

40 Clemens Steenbergen. (2002). The Power of Drawing. In Clemens Steenbergen, Henk Muhl, Wouter Reh, Ferry Aerts (Eds.), *Architectural Design and Composition* (pp. 158-177). Bassum: THOTH Publishers. 158

41 *ibid* 158

42 *ibid* 157

43 *ibid*

44 Architectural drawings fundamental role as projecting outwards to speak of, or progress architecture, as opposed to projecting inward to form an autonomous *object* is argued by a number of theorists: Evans. (1989). Allen. (1992). Linzey. (2009)

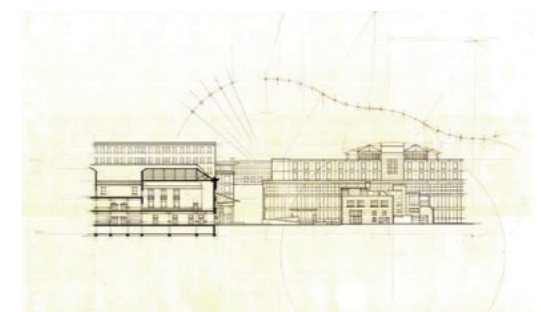
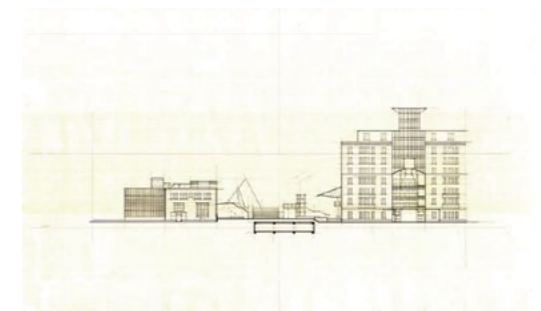
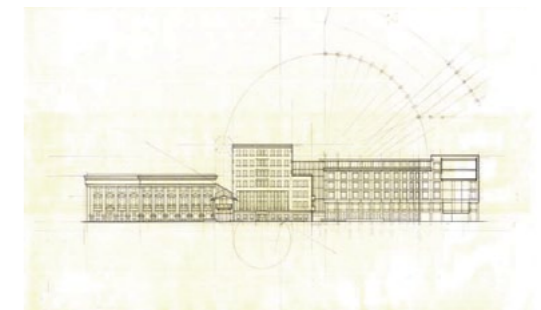
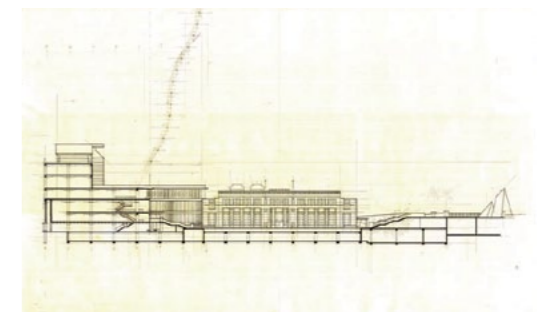
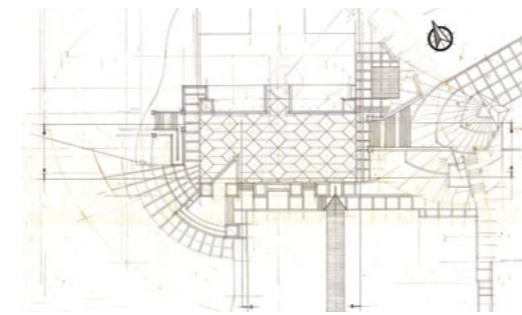
45 Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. 5

1) *Reproduction Drawings* (section 2.1.0): For Steenbergen *reproduction drawings* involve not only technical drawing skills, but are concerned with looking more consciously and registering more accurately how an artefact is composed.<sup>46</sup> Steenbergen proposes that “copying” an artefact can become the first step in research, as by perceiving something so consciously, through a process of reproduction, it is registered and stored away as a collection in ones memory.<sup>47</sup>

[Reproduction drawings] can be described as a process that interprets the object of observation and incorporates it into the memory.<sup>48</sup>

The *reproduction drawings* of the selected site embody Frascari’s first overlapping relationship of a *technological image*, between a real artefact and the reflected or projected image of it.<sup>49</sup> These drawings concern accurate *reproduction* through measured and scaled orthographic projections. The first step is the *reproduction* of the site in plan. Following this four combination elevation and section drawings are drafted, which from here are referred to simply as sections. As observed in 1.0.5 *Introduction*, for Frascari it is in the Vitruvian concept of arrangement, of plan, elevation and section, that the origin of architectural drawing as a *demonstration* analogously related to construction it to be found.<sup>50</sup> Thus it is in this first series of *reproduction drawings* that Frascari’s theory of *architectural drawings as demonstrations of construction* becomes most present. It is proposed that through the process of reconstructing the site through mechanically drafted orthographic projections an in-depth understanding of the physical relationships and formal makeup of the site is achieved.

As mentioned in 1.0.3 *Preface*, orthographic projection flattens one dimension to focus on and clarify the other two. For Fraser and Henmi, this is orthographic projection’s *synoptic view*. Through this *synoptic view* orthographic projection is an aid to visualization as it allows “certain aspects and relationships to be seen which may not otherwise be visible.”<sup>51</sup> Furthermore, they propose that presenting building elements within an orthographic view in their accurate and ‘real’ relationship – not as they would be seen in nature – gives rise to a process of comparing and contrasting arrangements and relationships, leading to the formation of *conceptual connections*.<sup>52</sup> It is the aim of this first series of *reproduction drawings* to facilitate the formation and understanding of these *conceptual connections* and physical relationships. The readings formed through this process are subsequently reinforced or denied, or in any case pushed further, by the second series of *analytical drawings*.



46 Steenbergen. (2002). *The Power of Drawing*. 158

47 *ibid*

48 *ibid* 159

49 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 15

50 *ibid* 14

51 Fraser & Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 26

52 *ibid*

**REPRODUCTION DRAWINGS  
SECTION 2.1.0**

2) *Analytical Drawings* (section 2.2.0): For Steenbergen *analytical drawings* aim to reveal abstract qualities and potentials by reducing the complex compositions of the *reproduction drawings* to their elementary abstractions: geometric forms, lines, and grids.<sup>53</sup> Steenbergen proposes that through this process of reduction it is possible to explore the reciprocal confrontations and relations between both the *reproduction drawings* and the physical site itself. Under Steenbergen's definition drawings of this nature are primarily concerned with proportion, relations, rhythm, frequency, symmetry and asymmetry, the distribution of surfaces, the degree to which something is open or closed, or the way parts meet a whole.<sup>54</sup>

*The purpose of analytical drawings is not to discover a notion of style; it seeks an imaginary repetition of the process of weighing the combinations of the aspects mentioned above to find the right ones.*<sup>55</sup>

These *analytical drawings* embody Frascari's second overlapping relationship between a real artefact and its instrumental image.<sup>56</sup> For Frascari the *main stumbling block* in the challenge to what he perceives as the present "negative condition" in the production and use of architectural drawings is that the study of drawing is often seen as subsidiary to the analysis of buildings.<sup>57</sup> Yet even when they are considered together – the analysis of buildings *through* drawing – Frascari suggests that it is only through rules of reproduction, recognition and similarity. Consequently, Frascari proposes, architectural drawings are always considered and presented as *ancillary components* to the elaboration of theories of architecture, whereas they should be treated "as the most important architectural agents, since they carry embodied in them the non-verbal essence of architectural theory."<sup>58</sup> Thus Frascari proposes that the rules of *cosmopoiesis* must sit alongside the rules of reproduction, recognition and similarity in the analysis of building through drawing. Under Frascari's definition the rules of *cosmopoiesis* search for an understanding of architecture through the means of *analogy, opposition and sympathy*.<sup>59</sup> This can be seen to align very closely with the aims of Steenbergen's *analytical drawings* as defined above.

Thus, the second series of drawings seeks to develop a deeper understanding of the site by imposing further reductions on the information contained in the complex *reproduction drawings*. By reducing the *reproduction drawings* to specific categories, focusing on specific sets of information, this second series unveils further conceptual and imaginative relationships present in the built artefact, a step toward what Alberto Perez-Gomez terms *making visible the invisible*, and a critical step toward elaborating the imaginary through orthographic projection. As Gerald Allen and Richard Oliver observe in their co-edited book *Architectural Drawing: The Art and the Process*, a drawn representation of a building is always fighting a losing battle with the limitations of the drawing itself. However, there are two possible consequences of this: either the drawing ends up as a very poor substitute for the actual object, or through the drawing's intrinsic limited vision some aspects are more vividly represented by the exclusion of many other aspects.<sup>60</sup> This series treats orthographic drawings as the latter. The *reproduction drawings* provoke a reading of the *visible* relationships of the site through orthographic projection, while the *analytical drawings* seek to provoke a reading of the *invisible* relationships within the site, which become present through orthographic projection. The combination of these two series leads to the third and final series of *experimental drawings* and the third and final overlapping relationship of Frascari's *technological image*. The *experimental drawings* treat orthographic projection - as observed by Robin Evans - an active agency in the formation of images, and an effective agency for the elaboration of imaginary objects.<sup>61</sup>

53 Steenbergen. (2002). *The Power of Drawing*. 159

54 *ibid*

55 *ibid*

56 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 15

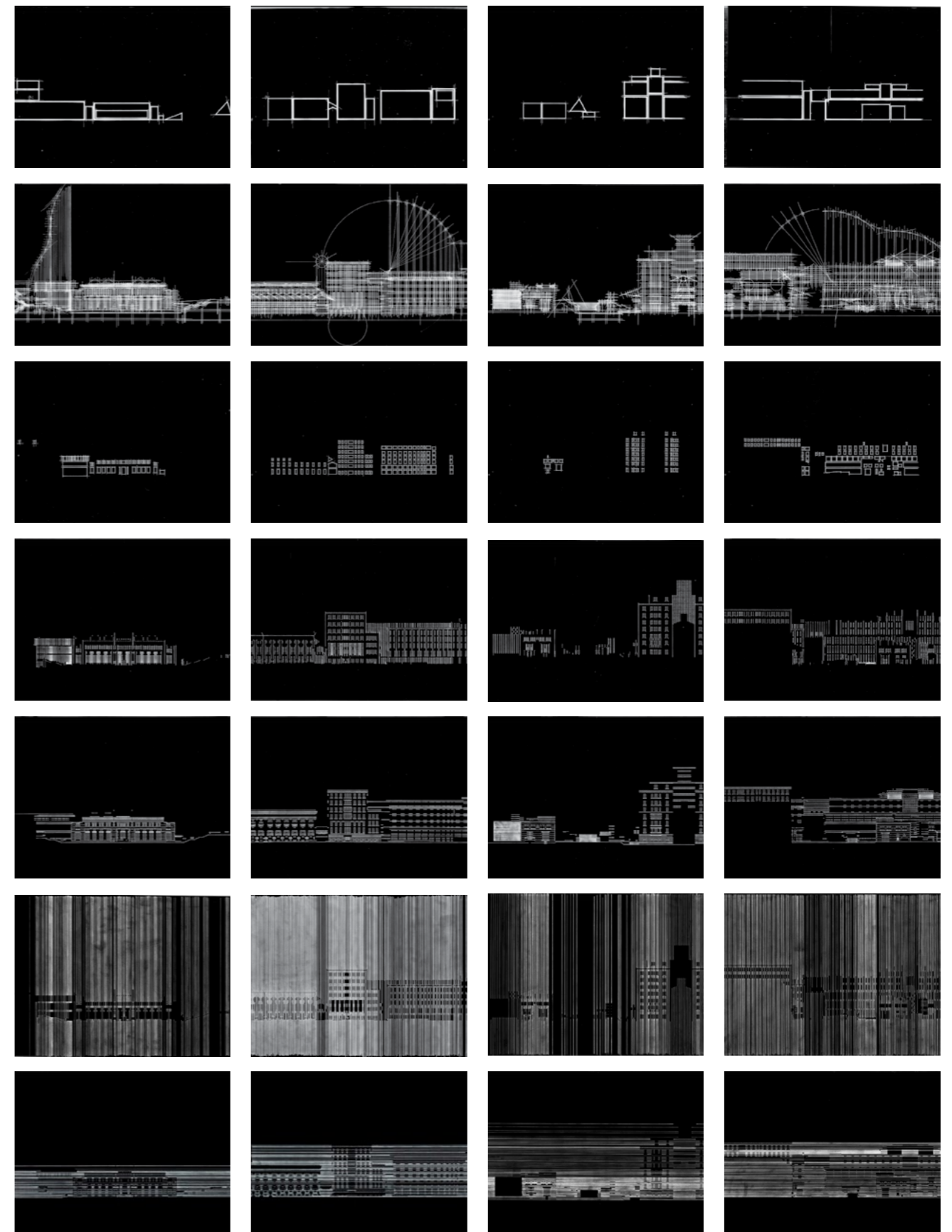
57 Frascari. (2007). *From Models to Drawings: Imagination and Representation in Architecture*. 5

58 *ibid*

59 *ibid*

60 Allen & Oliver. (1981). *Architectural Drawing: The Art and the Process*. 13

61 Evans. (1989). *Architectural Projection*. 24

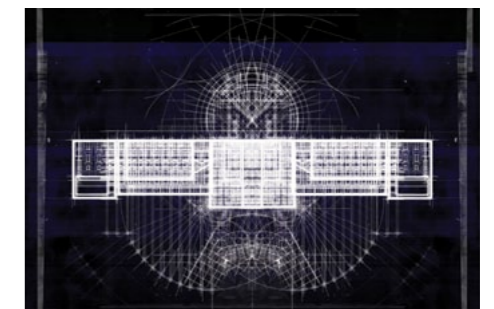
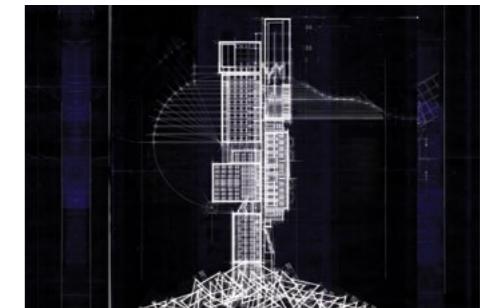
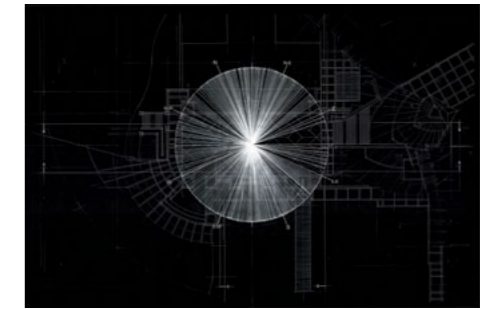
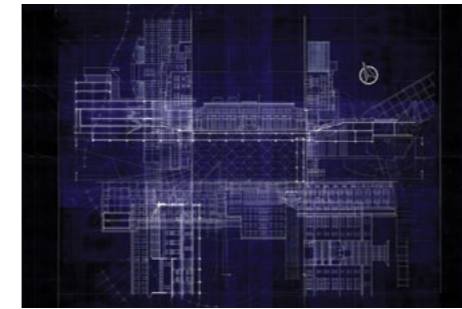


ANALYTICAL DRAWINGS  
SECTION 2.2.0

3) *Experimental Drawings* (section 2.3.0): Steenbergen proposes that *experimental drawings* play the role of the hypothesis or challenge to concepts or readings formed of a site through the preceding two series.<sup>62</sup> These drawings project the various images and layers of the *reproduction* and *analytical drawings* into an existing context to form new compositions. In a process of re-combining and re-contextualizing the first two series, the effects of interventions are assessed and adapted, ultimately leading to the conformation of existing, or the formation of new, concepts. For Steenbergen, drawings of this nature allow the designer to investigate possibilities for change in both the pre-existing readings of site and concepts expressed in the drawings themselves.<sup>63</sup>

*Every drawing serves as a hypothesis that lays bare a stream of thought and moves it further...*<sup>64</sup>

These *experimental drawings* embody the third and final overlapping relationship of Frascari's *technological image*, between the instrumental image and its symbolic image.<sup>65</sup> Following Frascari's definition the third series is the combination of a *techne* of *logos* (the instrumental image) orientated in a *logos* of *techne* (the symbolic image), based in the productive and poetic outcomes of Giambattista Vico's *imaginative universals*. The *experimental drawings* are *technological images* which re-combine and re-contextualise the *reproduction* and *analytical drawings* to form new compositions. These *experimental drawings* no longer search for a visual likeness as the basis of relating buildings and architectural conceptions, rather as Frascari proposes, through a mutual measure derived from a familiar nature.<sup>66</sup> These drawings treat orthographic projection, first and foremost, as a means for elaborating and representing imaginary architectural conceptions and relationships.



**EXPERIMENTAL DRAWINGS  
SECTION 2.3.0**

<sup>62</sup> Steenbergen. (2002). *The Power of Drawing*. 159

<sup>63</sup> *ibid*

<sup>64</sup> *ibid*

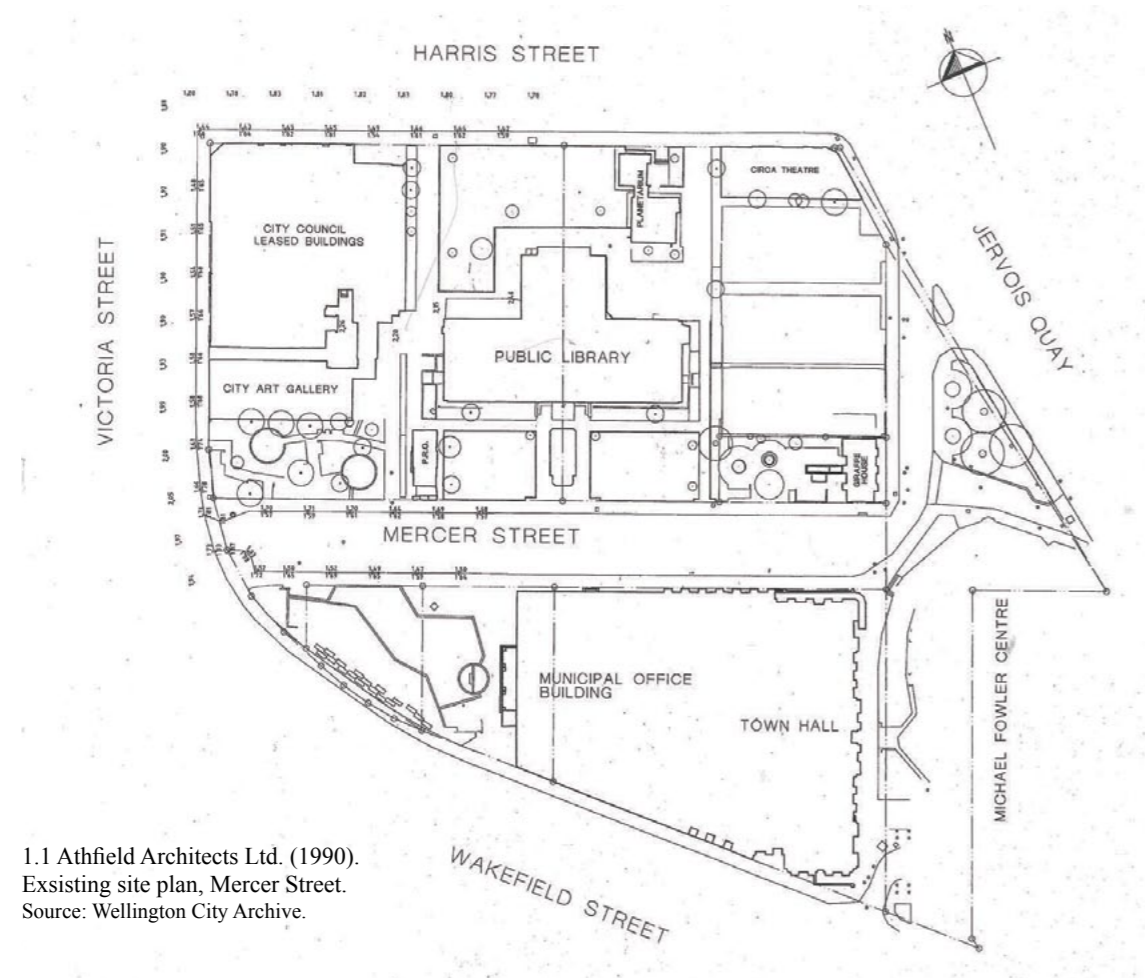
<sup>65</sup> Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 15

<sup>66</sup> Frascari. (2009). *Splendor and Miseries of Architectural Construction Drawings*. 110

Wellington's Civic Square was selected as the appropriate site to test the merged theories of Frascari and Steenbergen, and to investigate how orthographic projection is able to elaborate the imaginary within the design project. The buildings located around Civic Square's formal rectilinear domain offer a heterogeneous mix of civic architecture, ranging from the strictly orthogonal Town Hall and City Gallery (Fig 1.3-1.4), to the curvilinear City Administration Building (CAB) and Public Library (Fig 1.5-1.6). This site offers the opportunity to test both the advantages and disadvantages of orthographic projection in the reading of architecture and elaboration of the imaginary within a formally diverse existing urban environment. The development of Mercer Street in 1991 (Fig 1.1) changed dramatically the surrounding site conditions of the primarily orthogonal buildings. This took place through the construction of both a public square and further buildings of civic function, which departed formally from the existing structures. The square itself is the centre point for a number of important pedestrian arteries, and when approached is initially seen through a number of small site lines and openings (Fig 1.2). As John Gray observes "You reach the square by going through or between buildings... each gap in the wall of buildings squeezes out its own invitation view."<sup>67</sup> The diverse range of buildings present in this site present in themselves a diverse range of architectural and conceptual relationships. This diversity becomes apparent through Steenbergen's first step for *architectural drawing as research*. By "copying" the site through a process of *reproduction*, it is registered and stored away as a collection in the memory.<sup>68</sup> The conceptual relationships formed through this process, in conjunction with the second and third series, are utilized to test the imaginative possibilities of orthographic projection through the graphic embodiment of Frascari theory of *technological images*.



1.2 Civic Square. (2011). Wellington.  
Source: Google Earth



1.1 Athfield Architects Ltd. (1990).  
Existing site plan, Mercer Street.  
Source: Wellington City Archive.



1.3 Town Hall, 1904. (2011).  
Civic Square, Wellington.  
Source: Authors own photograph



1.4 City Gallery, 1940. (2011).  
Civic Square, Wellington.  
Source: Authors own photograph



1.5 City Administration Building, 1991. (2011). Civic  
Square, Wellington.  
Source: Authors own photograph



1.6 Public Library, 1991. (2011).  
Civic Square, Wellington.  
Source: Authors own photograph

67 John Gray. (1992). Worth Waiting For. *Architecture New Zealand* (March/April). 48  
68 *ibid*

## CHAPTER TWO: DRAWINGS

### (1) REPRODUCTION DRAWINGS

#### 2.1.0 INTRODUCTION

*Between the mode of depiction of painters and architects there is this difference...the painter achieves an appearance of relief...by shadow and the foreshortening of lines and angles, while the architect, avoiding shadows, gets his relief from the drawing of a plan, and indicates on other drawings the form and measurement of the façade and sides by lines of invariable length and real angles, since he does not want his work judged by illusory appearances, but precisely on the grounds of determined qualities.<sup>69</sup>*

This section uses *Reproduction Drawings* to test Marco Frascari's theory of *technological images*, as set within Clemens Steenbergen's critical framework of architectural drawing as research. The two theories are strategically integrated as a means of critically examining how orthographic projection can facilitate architects' ability to elaborate the imaginary. Following this, this section offers further analysis of Civic Square as it relates to the aims and execution of these drawings. Le Corbusier's view of a site plan is introduced for its many similarities to the goals of both Steenbergen's *reproduction drawings* and Frascari's first overlapping relationship of a *technological image*. Two site plans, by Louis Kahn and Richard Meier and Partners, are discussed to offer contrast to the methods used in these drawings.

This series of drawings orientates Marco Frascari's first overlapping relationships of a *technological image* within Clemens Steenbergen's first series of drawings from his framework of *architectural drawing as research*.<sup>70</sup> These are Steenbergen's *reproduction drawings*, which represent Frascari's first overlapping relationship of a technological image: between a real artefact and the projected image of it.<sup>71</sup> Following Steenbergen's definition, these *reproduction drawings* reproduce Civic Square through measured and mechanically drafted orthographic projection drawings. For Steenbergen, drawings of this nature involve not only technical drawing skills, but are concerned with looking more consciously and registering more accurately how an artefact is made.<sup>72</sup> Steenbergen proposes that by perceiving something so consciously through the process of *reproduction*, it is registered and stored away as a collection in one's memory.<sup>73</sup>

*[Reproduction drawings] can be described as a process that interprets the object of observation and incorporates it into the memory.<sup>74</sup>*

As observed in 1.0.5 *Introduction*, for Frascari it is in the Vitruvian concept of arrangement - of plan, elevation and section - that the origin of architectural drawing as analogously related to construction is to be found. Thus in this series of *reproduction drawings*, Frascari's notion of *architectural drawings as demonstrations of construction* becomes most present. It is proposed that through the process of reconstructing the site through mechanically drafted orthographic projections an in-depth understanding of the physical relationships and formal makeup of Civic Square is achieved.

<sup>69</sup> Alberti. *Architettura*. II. 1. 4

<sup>70</sup> Steenbergen. (2002). *The Power of Drawing*. 158

<sup>71</sup> Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 110

<sup>72</sup> Steenbergen. (2002). *The Power of Drawing*. 158

<sup>73</sup> *ibid*

<sup>74</sup> *ibid* 159

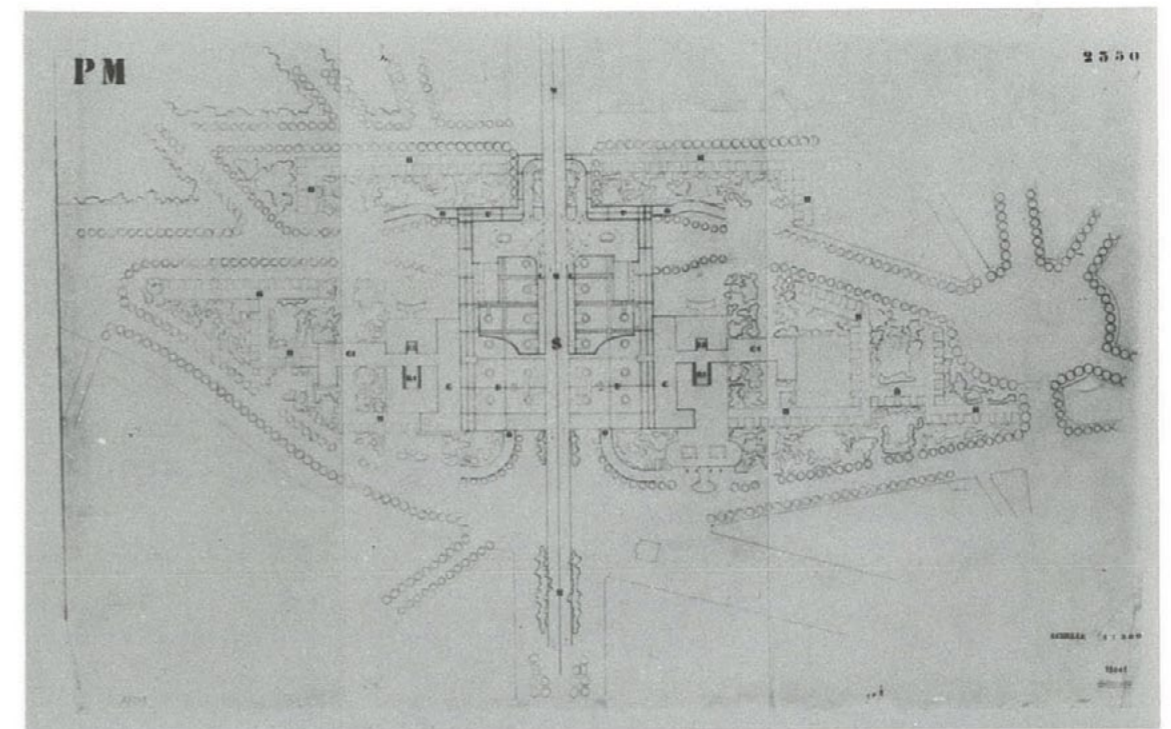
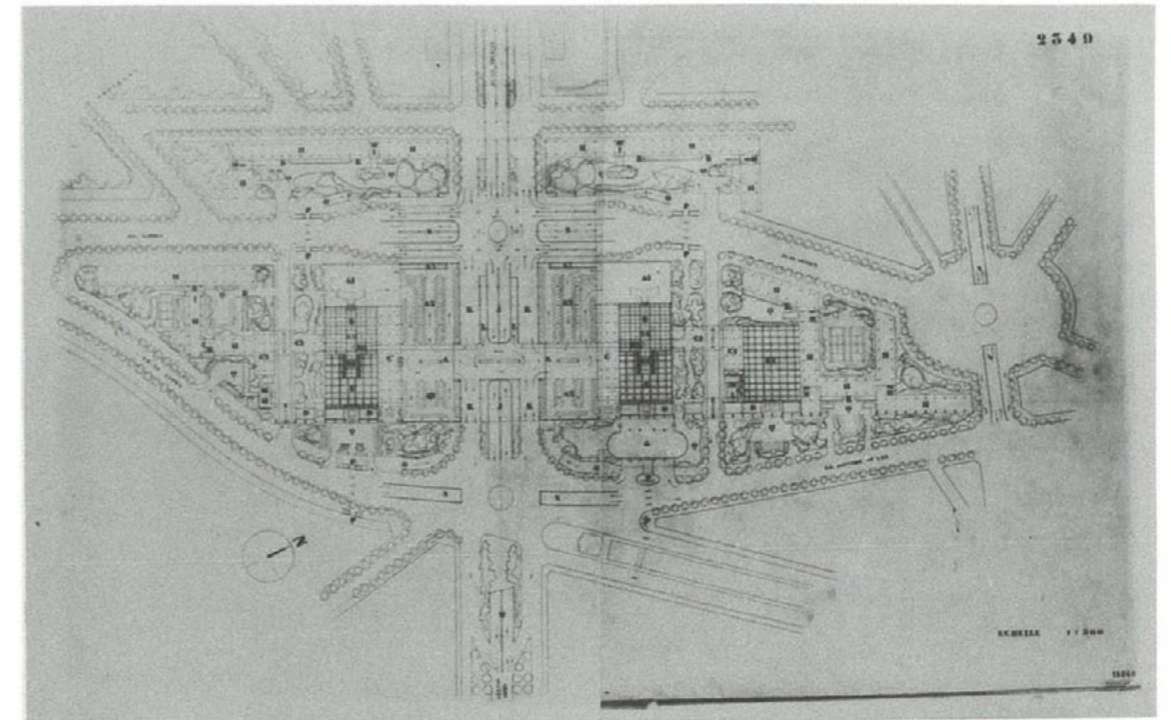


As mentioned in section 1.0.3 *Preface*, orthographic projection flattens one dimension to focus on and clarify the other two. For Fraser and Henmi this is orthographic projections *synoptic view*. Through this *synoptic view* orthographic projection is an aid to visualization as it allows “certain aspects and relationships to be seen which may not otherwise be visible.”<sup>75</sup> Fraser and Henmi propose that presenting building elements within an orthographic view in their accurate and ‘real’ relationship gives rise to a process of comparing and contrasting arrangements and relationship, leading to the formation of *conceptual connections*.<sup>76</sup> It is the aim of this first series to facilitate the formation and understanding of these *conceptual connections* and physical relationships intrinsic to orthographic projection. The readings and concepts formed through this process are tested by the second series of *analytical drawings*, which seek to look *into* the *reproduction drawings* and test readings formed through a rigorous process of reduction.

In discussing the aims of the Civic Square development of 1991 Ian Athfield suggests that “here the collective is more important than the buildings themselves, each building will have its merits for different reasons, but it is really important to see it as a collective.”<sup>77</sup> There are seven buildings surrounding Civic Square. Following Athfield’s proposal of a collective, this thesis identifies six of these buildings as *the buildings of Civic Square*: The Town Hall, Municipal Office Building (MOB), City Administration Building (CAB), Public Library, City Gallery, and the Capital E Discovery Centre. The seventh building, the Michael Fowler Centre, is located a relatively large distance from the square. A large portion of its base is hidden from view from within the square by the Town Hall, and it has little to no interaction or immediate relationship with the six aforementioned buildings. Built prior to the redevelopment, it appears that this building was excluded from Ian Athfield’s plans to make a more cohesive collective.<sup>78</sup> Thus it is excluded from this study of Civic Square.

The first step in this series is the *reproduction* of the Civic Square in plan. The information contained in this site plan facilitates the construction of four vertical section drawings through the site. With great similarity to Steenbergen’s definition of *reproduction drawings*, Fraser and Henmi propose that Le Corbusier (fig. 2.1) sees in a plan’s reduction of three-dimensions to two not only the represented building, “but ideas, intentions, and impulses that generate the shapes and underscore the project.”<sup>79</sup> For Corbusier the process of drawing a plan is to determine and fix ideas:

...one uses one’s eyes and draws, so as to fix deep down in one’s experience what is seen. Once the impression has been recorded by the pencil, it stays for good, entered, registered, inscribed.<sup>80</sup>



2.1 Le Corbusier. (1929). *Amenagement de la porte Maillot*, Paris, France. Source: H. Allen Brooks. (Ed.). (1984). *Le Corbusier: Buildings and Projects, 1928-1929*. New York: Garland Publishing, Inc. 321

75 Fraser & Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 26

76 *ibid*

77 Ian Athfield quoted in: Debra Millar. (1992). A Meeting of Minds. *Architecture New Zealand*(March/April), 44

78 *ibid* 44

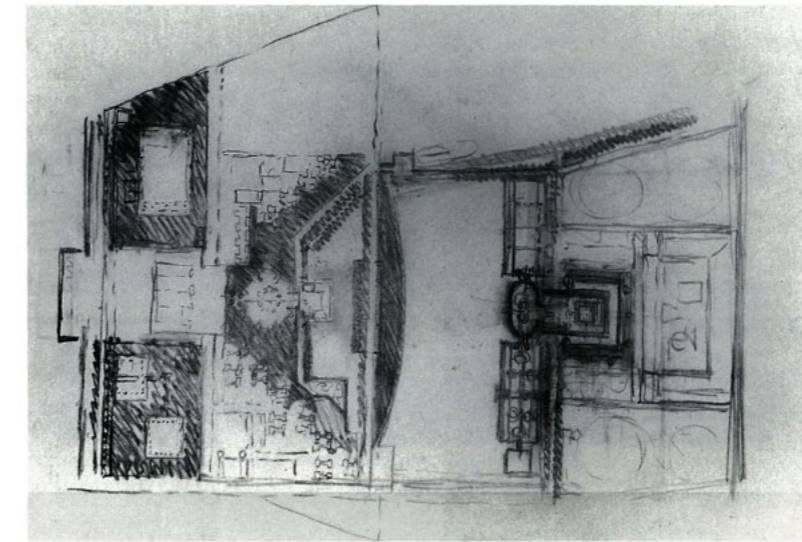
79 Fraser and Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 25

80 *ibid*

A site plan depicts a building in relationship to its setting, or a group of buildings and their relationship to one another. Louis Kahn's site plan for the National Capitol in Dacca, Bangladesh (Fig 2.2) leaves buildings untoned, while closely hatching the ground in black marks, projecting the white buildings "from the dark background in a powerful sense of three-dimensional relief."<sup>81</sup> Richard Meier and Partners, in their site plan for the City Hall and Central Library of the Hague, tie the new design to the existing urban fabric by depicting the project in relation to its surrounding urban make up (Fig 2.3). As Fraser and Henmi observe, both the new and existing buildings are given height by cast shadows to enhance three-dimensionality - "lengths of shadow correspond to measured depth according to a precise constructional process"<sup>82</sup> - allowing the indication of three-dimensional information in the two-dimensional orthographic projection. These two examples show the potential techniques employed by architects to imply depth in a strictly two dimensional representation. They are included here to offer contrast to the construction of the *reproduction site plan*, which forgoes both shadow and hatching to explore the flat, two-dimensional space intrinsic to orthographic projection. These *reproduction drawings* do not attempt to provide orthographic projection with a sense of three-dimensional relief, rather they propose that its two dimensionality is one of its key advantages for the formation and elaboration of imaginary architectural ideas.

The presentation of the following *reproduction drawings* is split into two distinct approaches. The first, section 2.2.1 – 2.1.5, presents each full *reproduction* on a double spread with six full scale (1:200) fragments independent of text. The second approach uses certain aspects of the *reproduction drawings* as diagrams to illustrate and argue a number of key readings of Civic Square. These readings concern that which becomes most apparent though Civic Square's orthographic representation, and seeks to express the *visible* characterises of Civic Square, in a critical step towards what Perez-Gomez terms *making visible the invisible*, and a critical step towards the main research imperative, of elaborating the imaginary through orthographic projection.

Section 2.1.6 *Points of Order*, illustrates the main set-out points of the site, and discusses what these reveal of the relationship between the buildings of Civic Square. Following Frascari's notion of *architectural drawing as the demonstration of construction*, this section aims to present those first lines and points that order the construction of the remainder of the site. Section 2.1.7 *Lifeless Entrances*, discusses the entrances of Civic Square's buildings, following the observations of John Gray. This section leads to a key reading of Civic Square's row of buildings as walls, and argues that orthographic projection's flattening of space reinforces this interpretation. Section 2.1.8 *Landscaping Order*, uses the *reproduction site plan* to investigate the larger-scale orders present in the landscaping of Civic Square. It is concerned with the visible relationships that become present through these *reproduction drawings*. Section 2.1.9 *Construction Aids*, analyses the role of construction lines in the accurate representation and foreshortening of the site's two curved buildings. This section discusses how the conventions of orthographic projection act to inform the reading of Civic Square's buildings, and demonstrates how orthographic projection's influence over the architecture it represents can alter the conceptions an author holds towards a site or projects.



2.2 Louis Kahn. (1973). Master Plan, National Capitol, Dacca, Bangladesh.  
Source: Iain Fraser and Rod Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. New York: Van Nostrand Reinhold. 31



2.3 Richard Meier and Partners. (1986-1994). Site Plan, The Hague City Hall and Central Library, The Hague.  
Source: Iain Fraser and Rod Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. New York: Van Nostrand Reinhold. 32

81 Fraser and Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 25  
82 *ibid* 31

**CAPITAL E DISCOVERY  
CENTRE**  
Architect: Ian Athfield  
Date: 1991

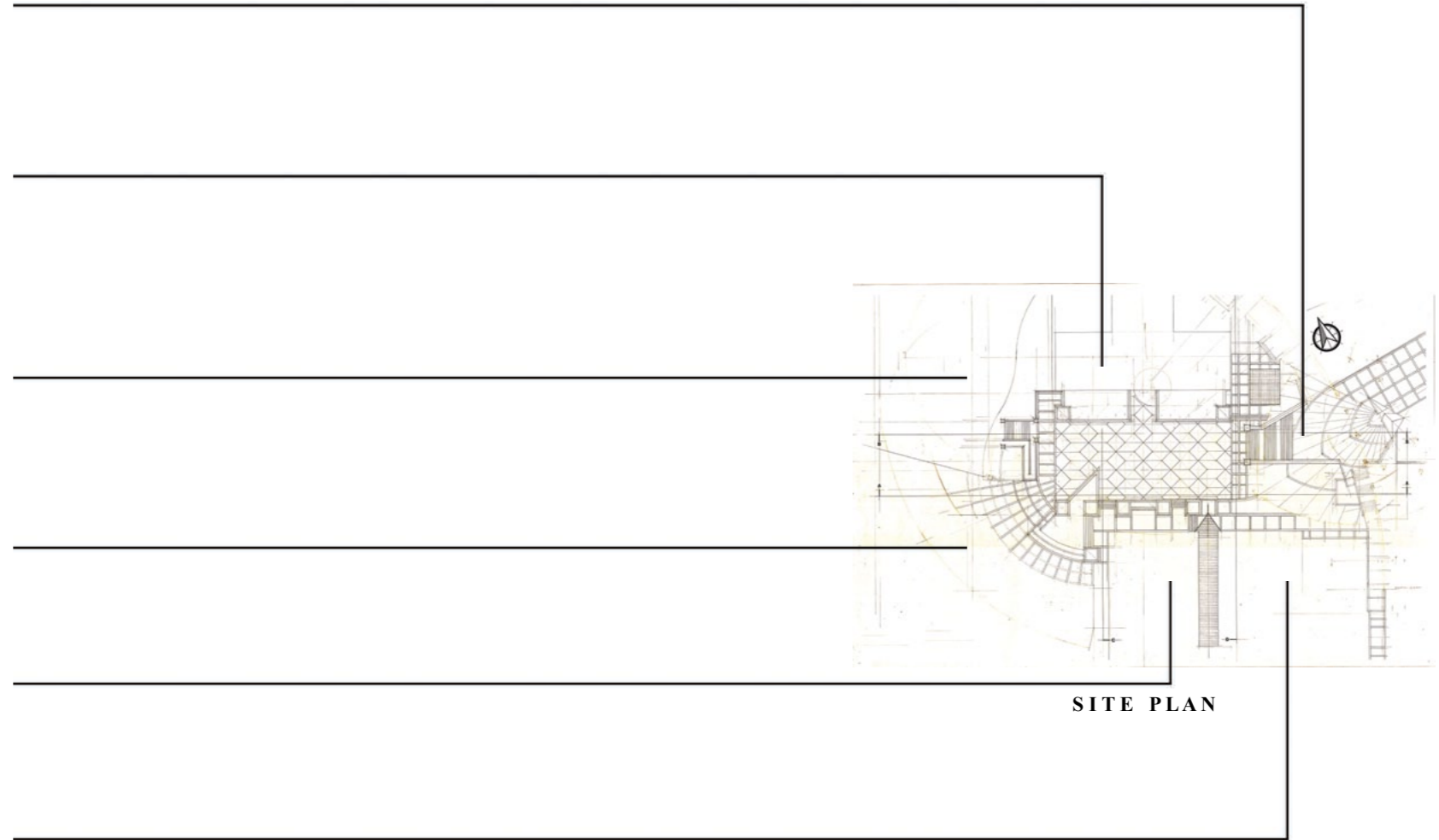
**CITY GALLERY  
(OLD PUBLIC LIBRARY)**  
Original Architect: Gummer & Ford  
Date: 1940  
Refurbishment Architect: Roger Shand  
Date: 1991

**PUBLIC LIBRARY**  
Architect: Ian Athfield  
Date: 1991

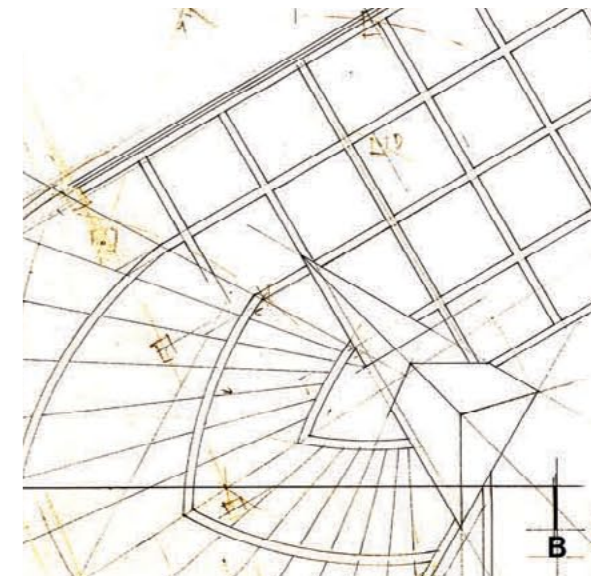
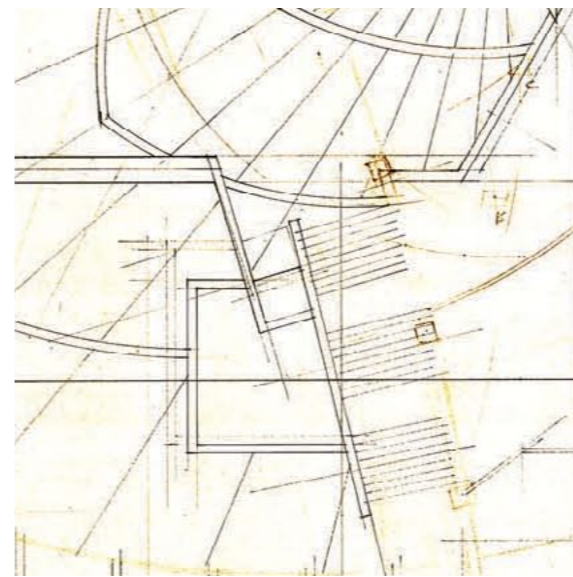
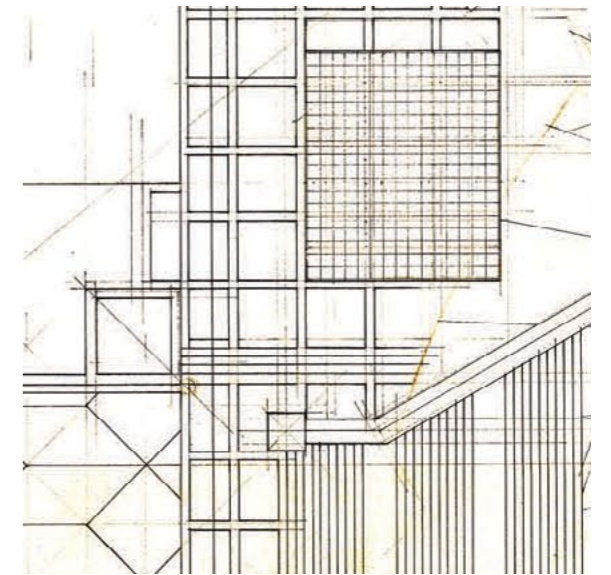
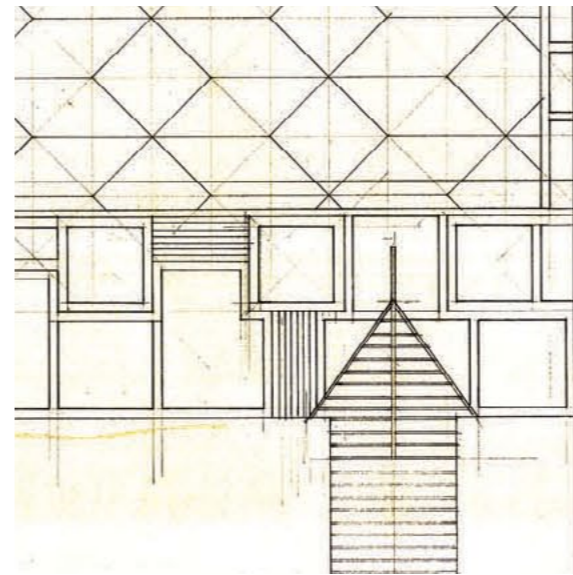
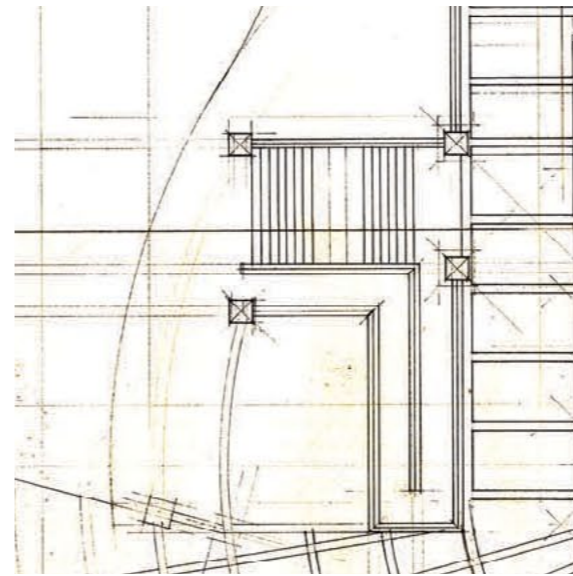
**CITY ADMINISTRATION  
BUILDING**  
Architect: Stephenson & Turner  
Date: 1991

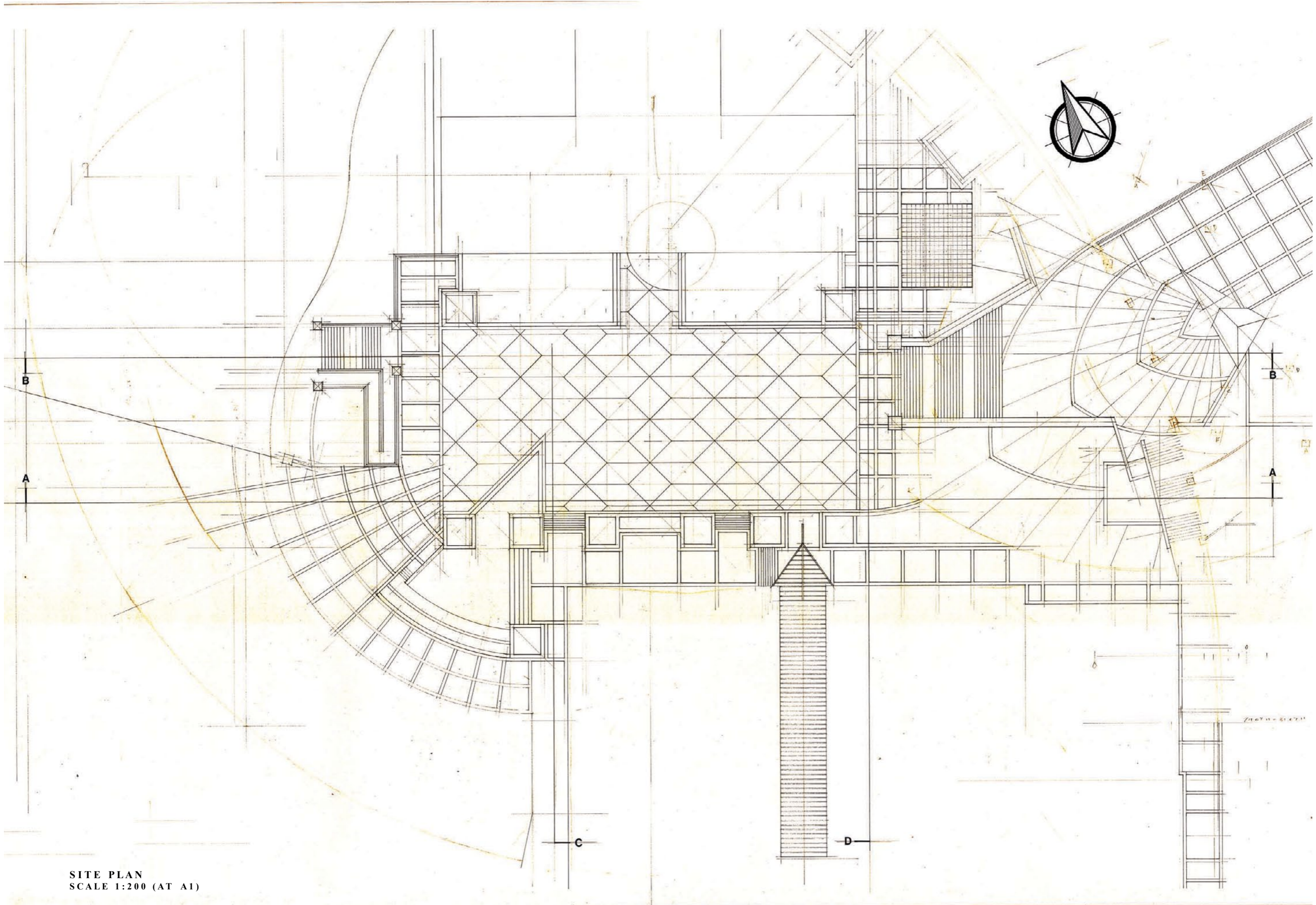
**MUNICIPAL OFFICE  
BUILDING**  
Architect: Craig Craig Moller  
Date: 1991

**TOWN HALL**  
Architect: Joshua Charlesworth  
Date: 1940  
Refurbishment Architect: Craig Craig  
Moller  
Date: 1991-1992



2.1.1 SITE PLAN  
SCALE 1:200





SITE PLAN  
SCALE 1:200 (AT A1)

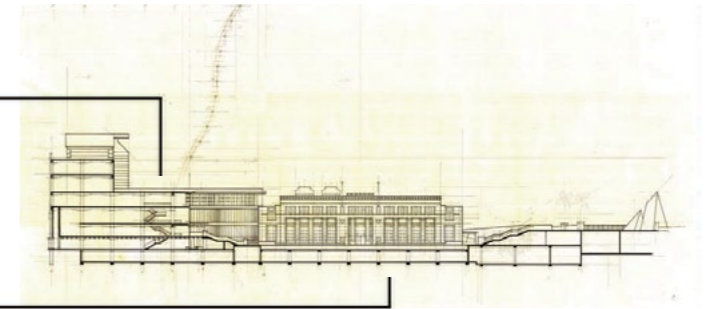
**PUBLIC LIBRARY**

**Architect: Ian Athfield  
Date: 1991**

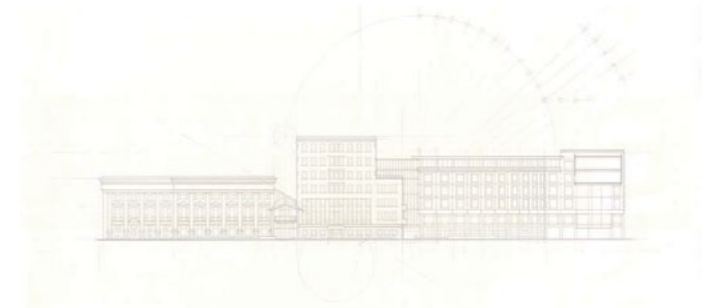
**CITY GALLERY  
(OLD PUBLIC LIBRARY)**

**Original Architect: Gummer & Ford  
Date: 1940**

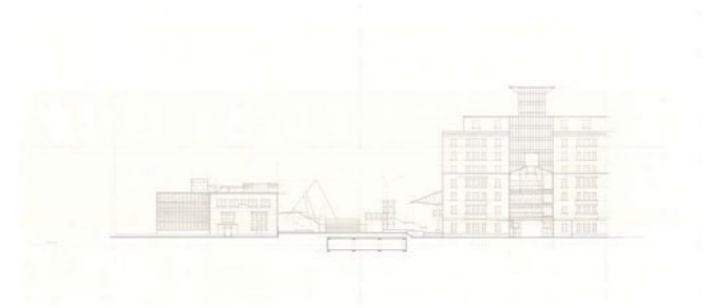
**Refurbishment Architect: Roger Shand  
Date: 1991**



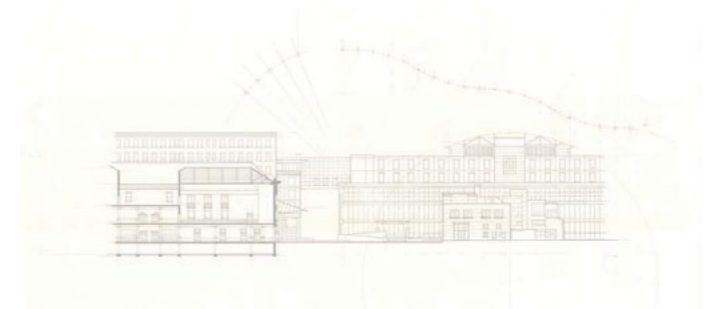
**NORTH / NORTH - EAST**



**SOUTH / SOUTH - WEST**

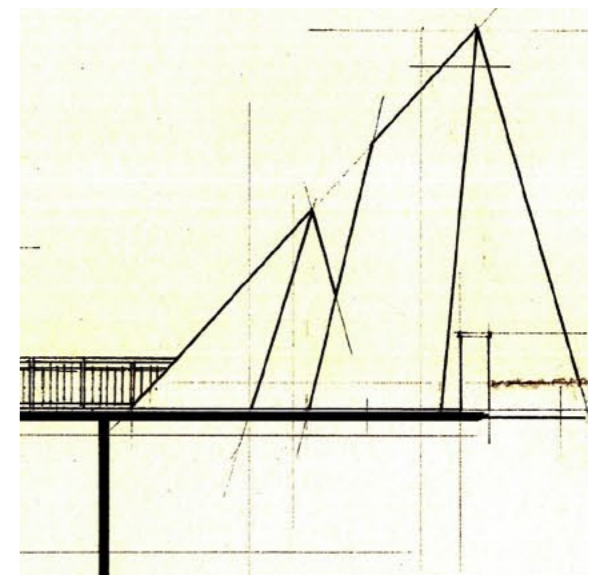
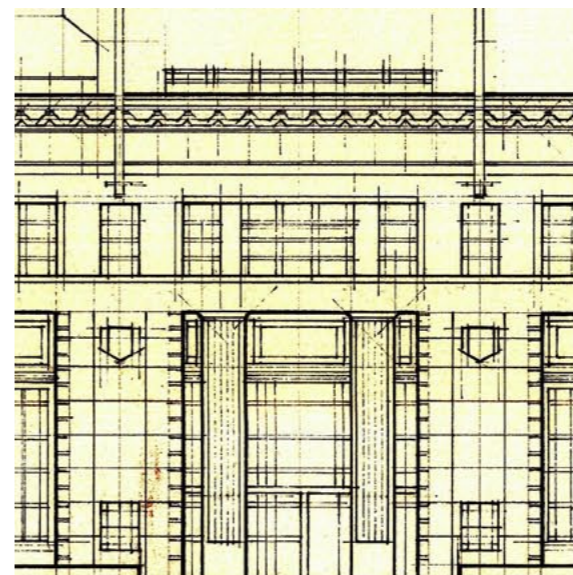
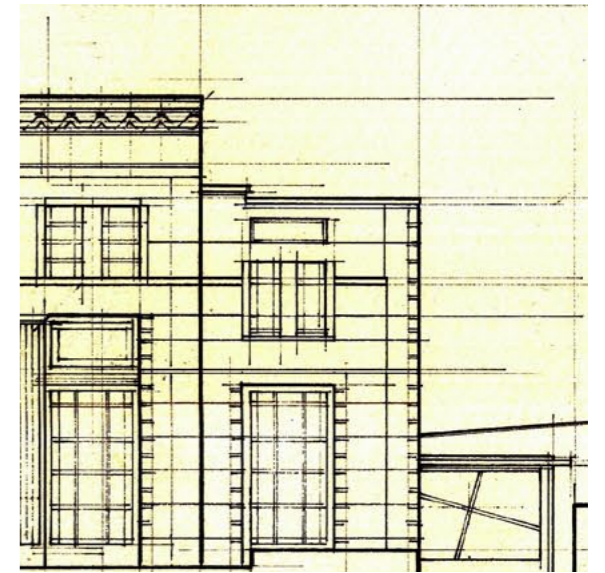
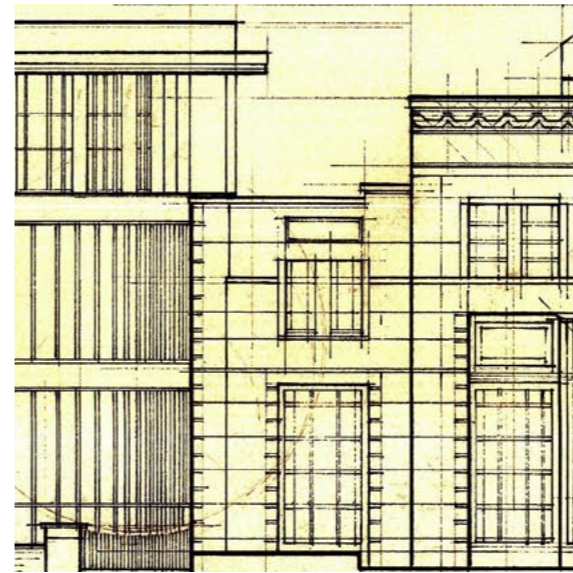
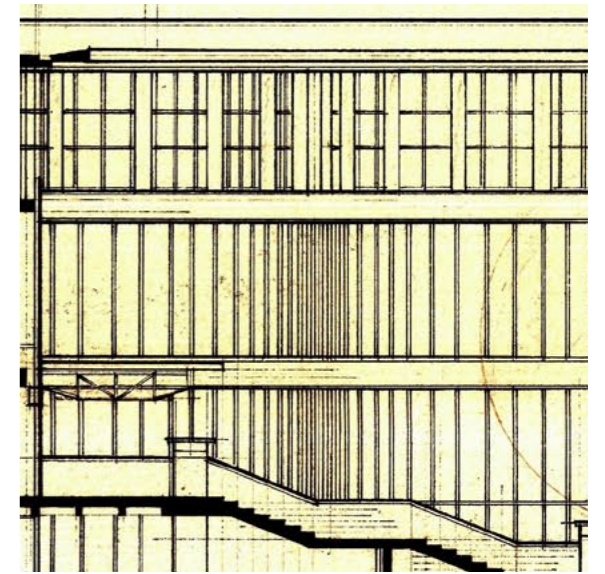
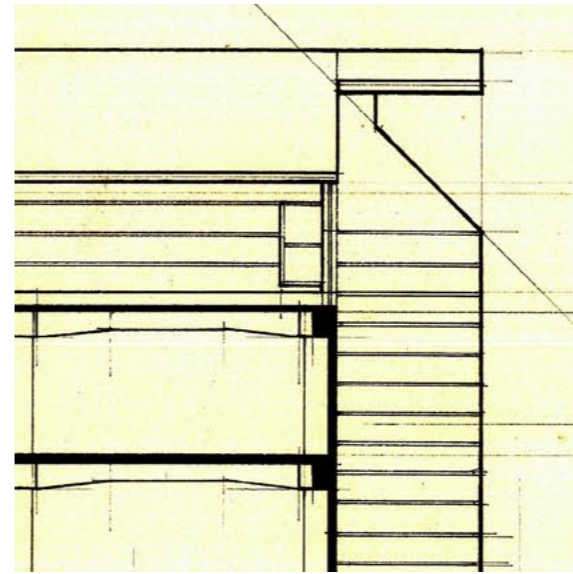


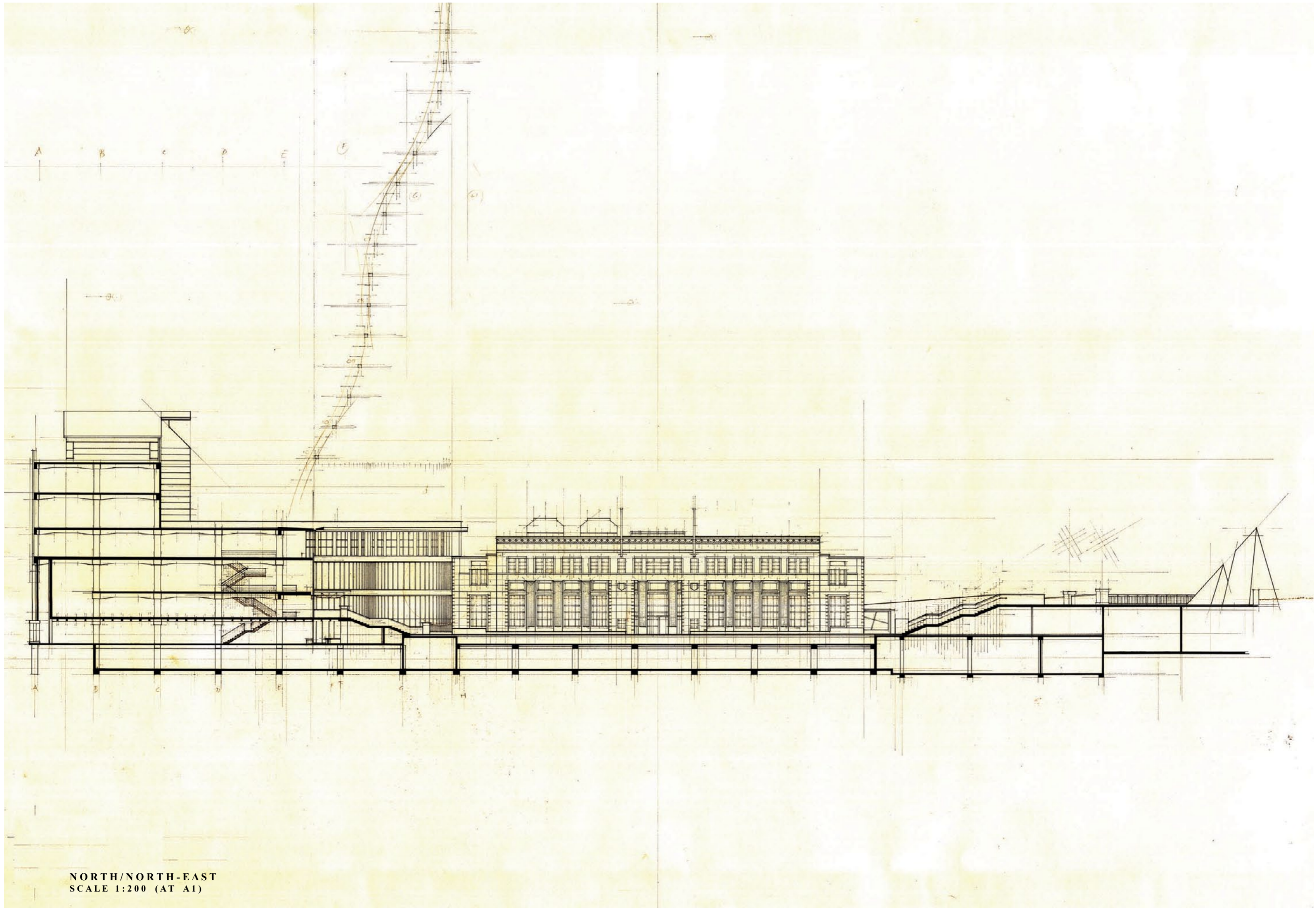
**EAST / SOUTH - EAST**



**WEST / NORTH - WEST**

2.1.2 NORTH/NORTH-EAST  
SCALE 1:200





NORTH/NORTH-EAST  
SCALE 1:200 (AT A1)



**MUNICIPAL OFFICE  
BUILDING**

**Architect: Craig Craig Moller  
Date: 1991**

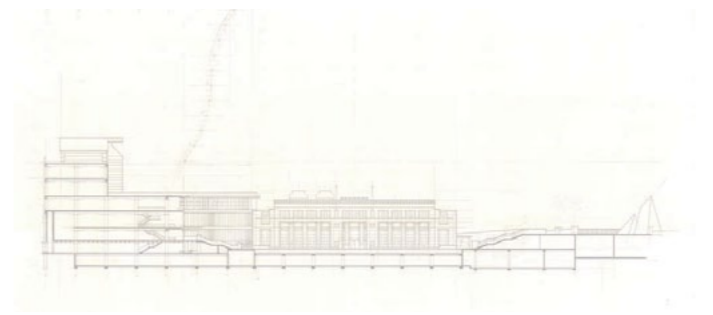
**TOWN HALL**

**Architect: Joshua Charlesworth  
Date: 1940**

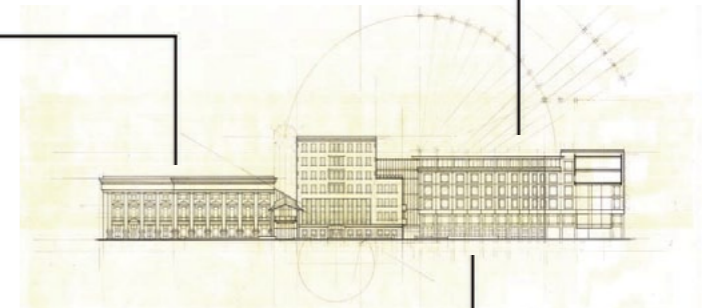
**Refurbishment Architect: Craig Craig  
Moller  
Date: 1991-1992**

**CITY ADMINISTRATION  
BUILDING**

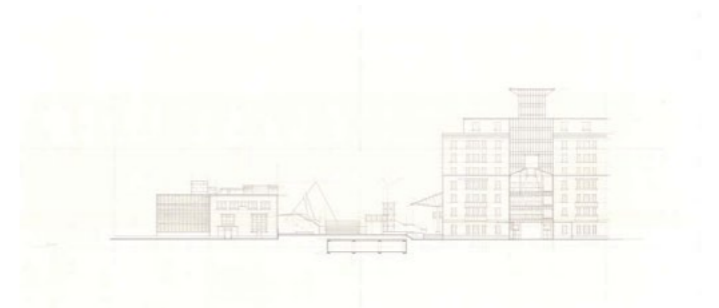
**Architect: Stephenson & Turner  
Date: 1991**



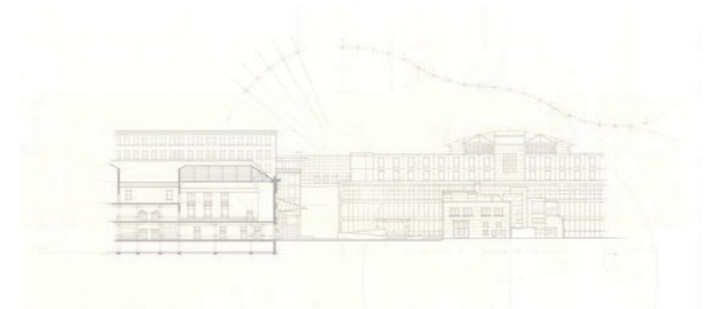
**NORTH / NORTH - EAST**



**SOUTH / SOUTH - WEST**

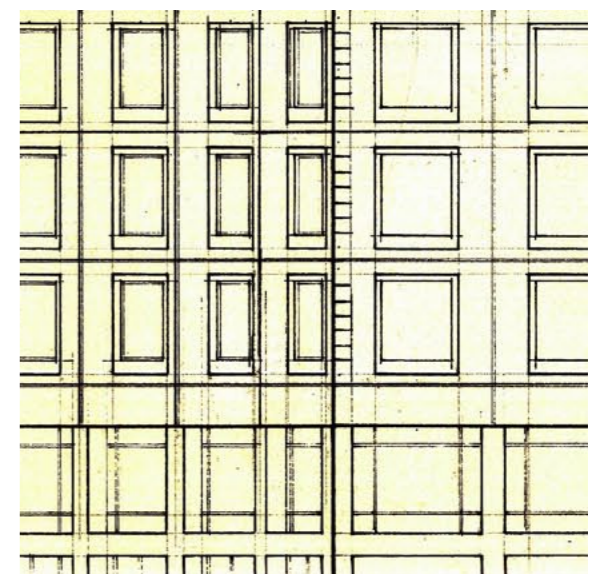
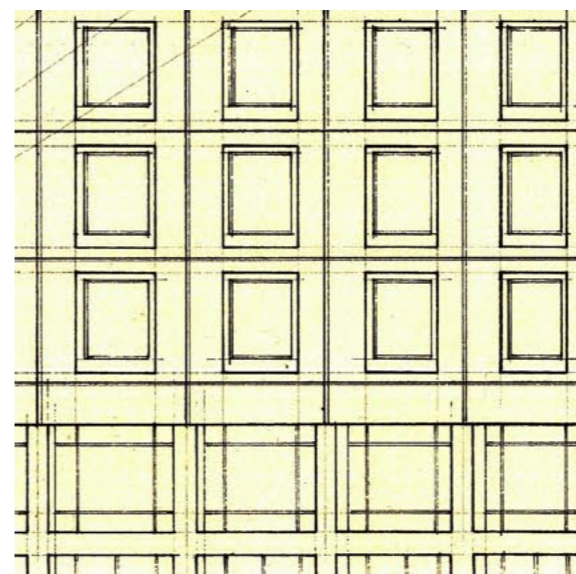
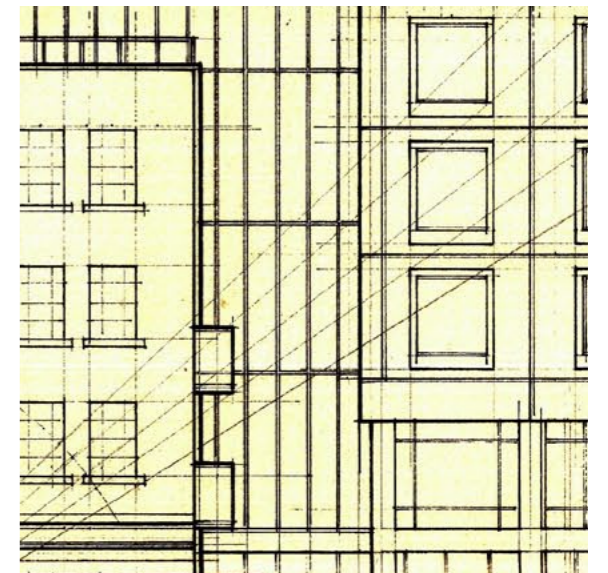
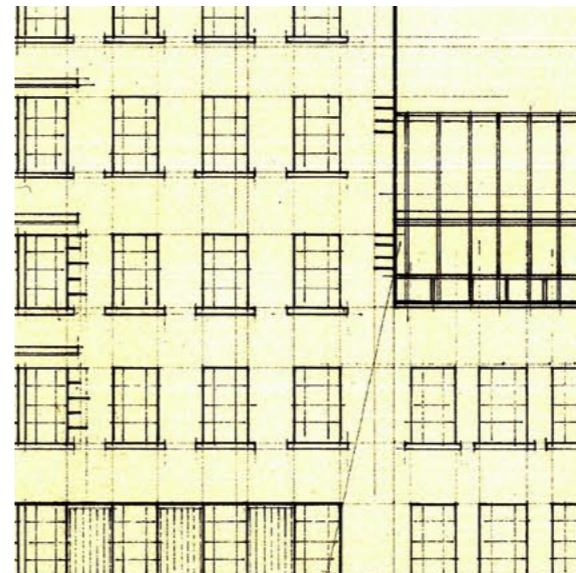
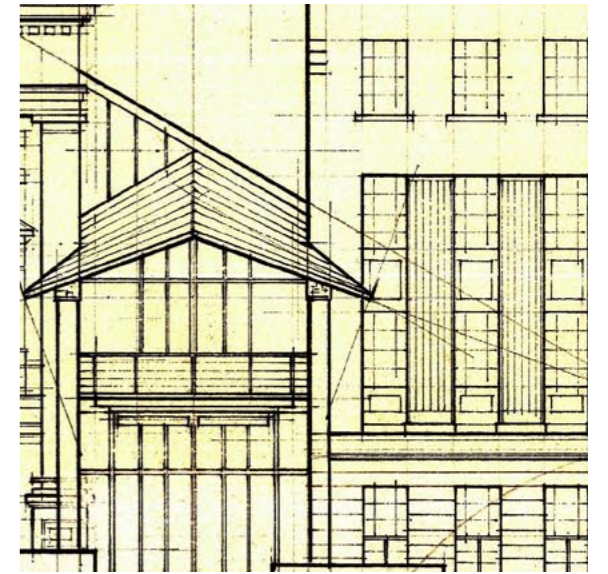


**EAST / SOUTH - EAST**



**WEST / NORTH - WEST**

2.1.3 SOUTH/SOUTH-WEST  
SCALE 1:200





SOUTH/SOUTH-WEST  
SCALE 1:200 (AT A1)

**CITY TO SEA BRIDGE**

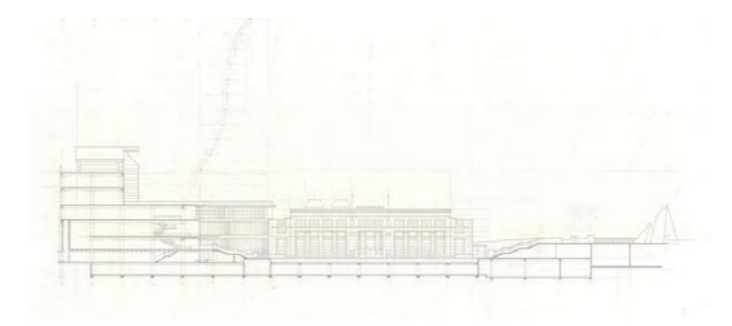
Architect: John Scott  
Date: 1993

**CITY GALLERY  
(OLD PUBLIC LIBRARY)**

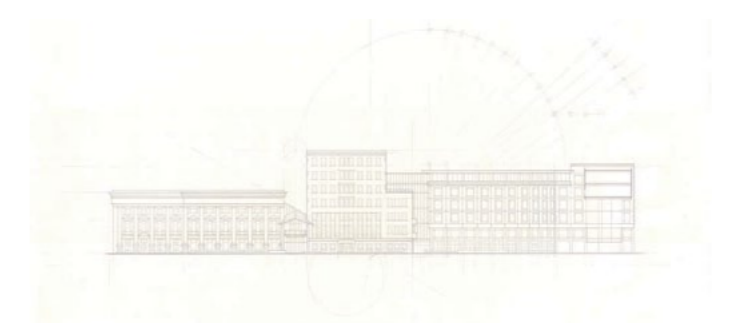
Original Architect: Gummer & Ford  
Date: 1940  
Refurbishment Architect: Roger Shand  
Date: 1991

**CITY ADMINISTRATION  
BUILDING**

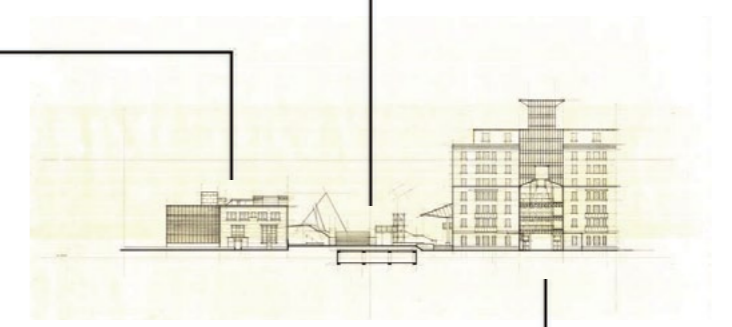
Architect: Stephenson & Turner  
Date: 1991



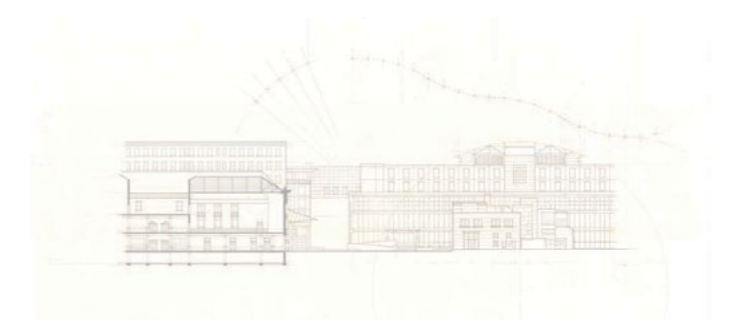
NORTH / NORTH - EAST



SOUTH / SOUTH - WEST

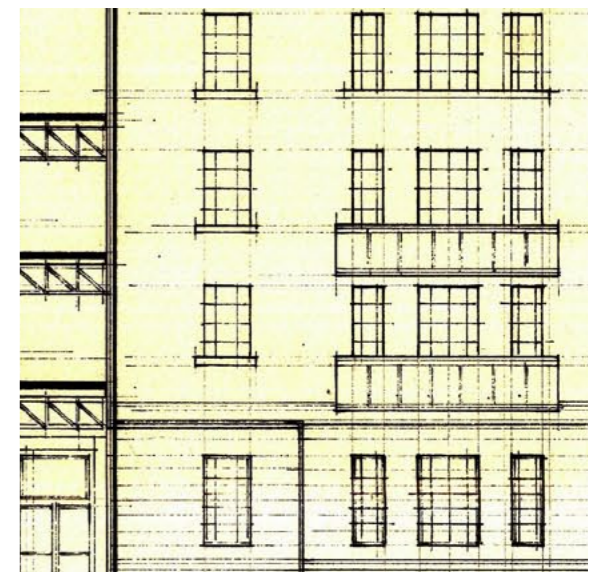
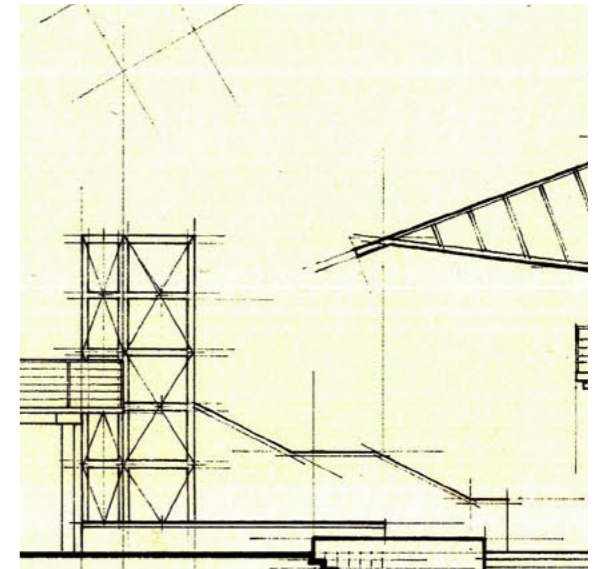
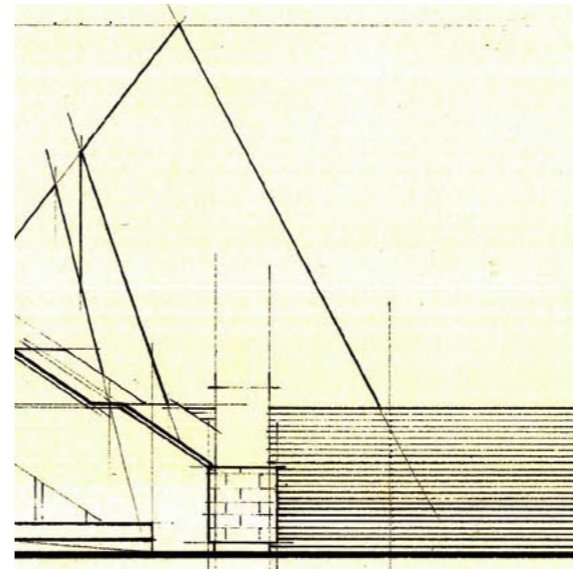
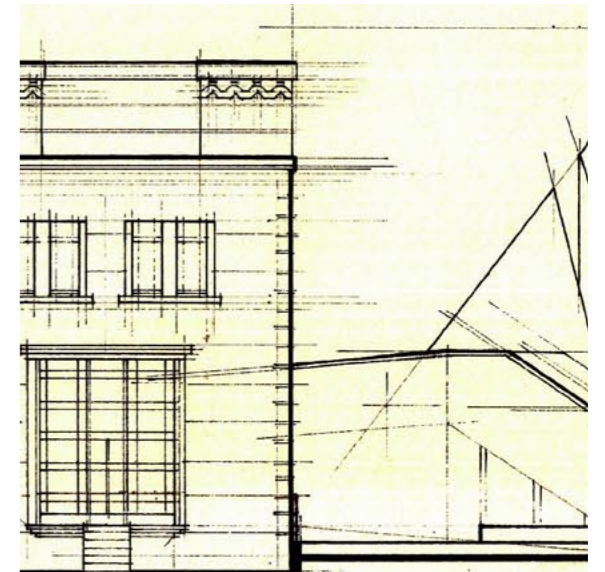
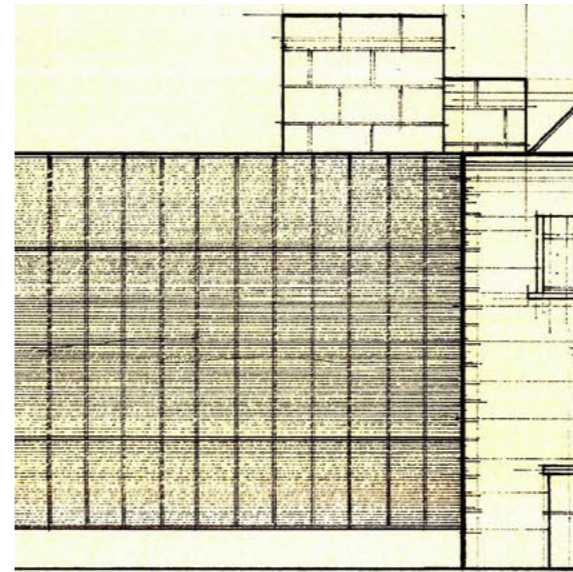


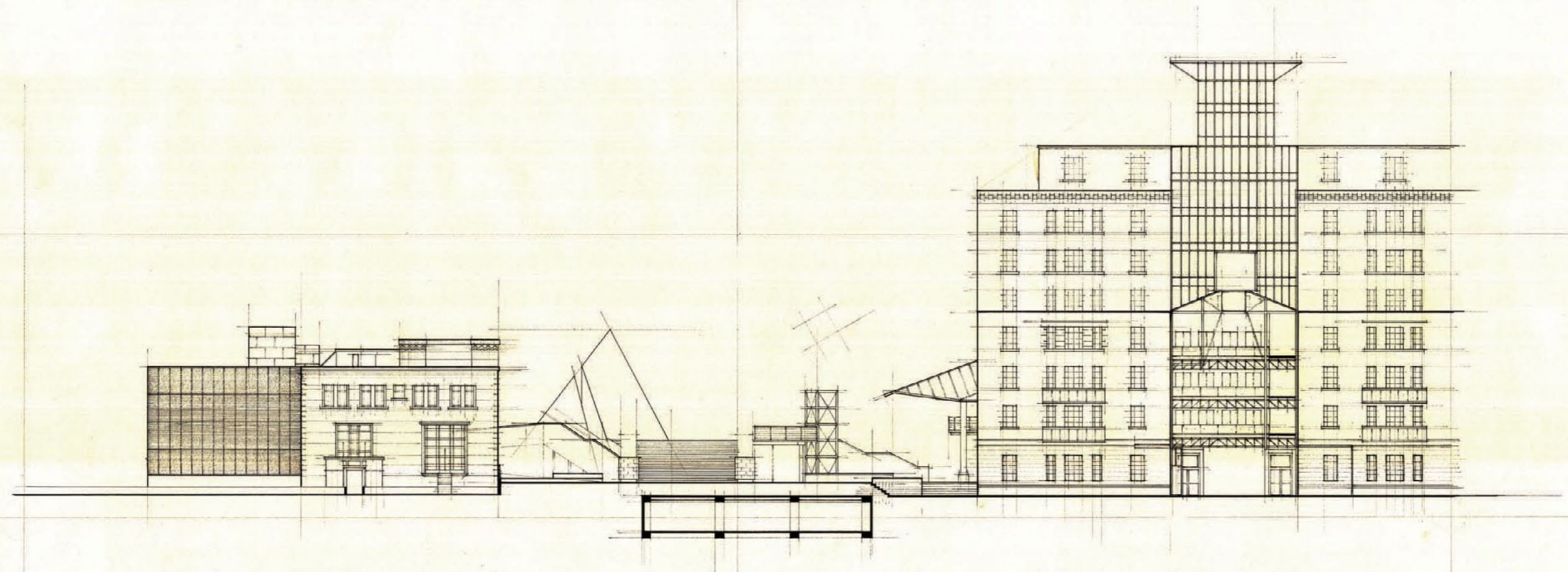
EAST / SOUTH - EAST



WEST / NORTH - WEST

2.1.4 EAST/SOUTH-EAST  
SCALE 1:200





EAST/SOUTH-EAST  
SCALE 1:200 (AT A1)

**PUBLIC LIBRARY**

**Architect: Ian Athfield  
Date: 1991**

**CITY GALLERY  
(OLD PUBLIC LIBRARY)**

**Original Architect: Gummer & Ford  
Date: 1940**

**Refurbishment Architect: Roger Shand  
Date: 1991**

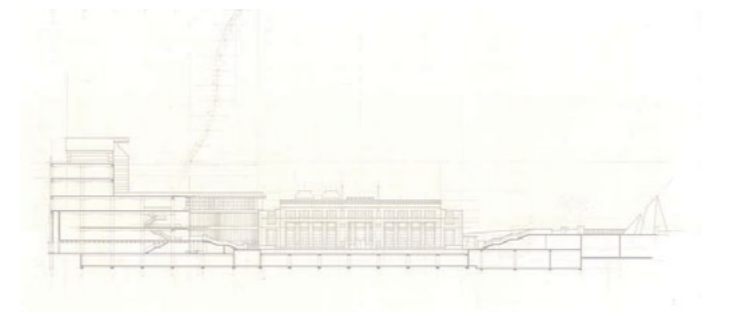
**MUNICIPAL OFFICE  
BUILDING**

**Architect: Craig Craig Moller  
Date: 1991**

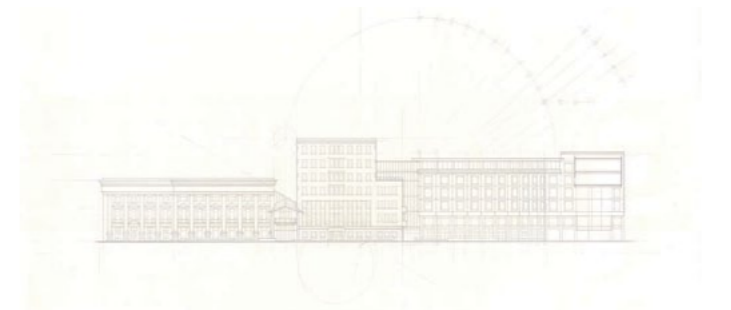
**TOWN HALL**

**Architect: Joshua Charlesworth  
Date: 1940**

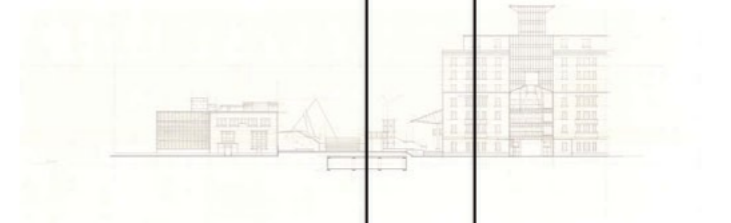
**Refurbishment Architect: Craig Craig  
Moller  
Date: 1991-1992**



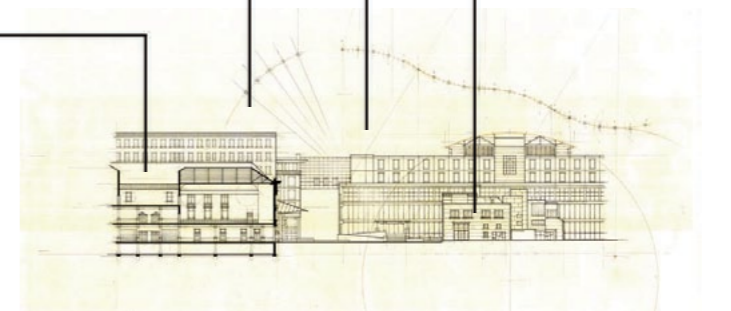
**NORTH / NORTH - EAST**



**SOUTH / SOUTH - WEST**

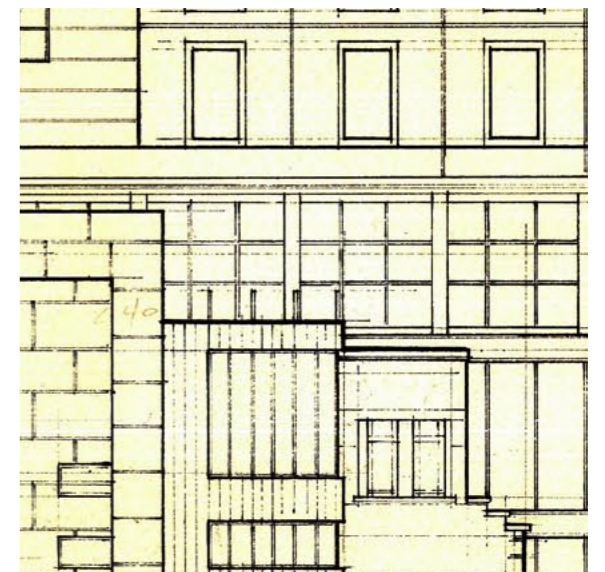
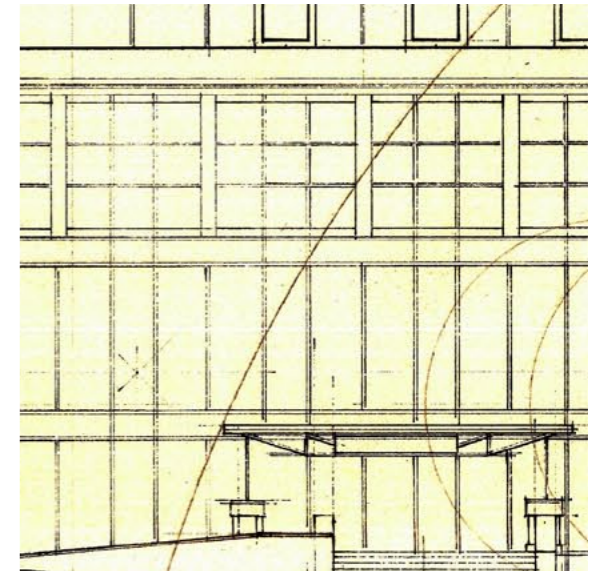
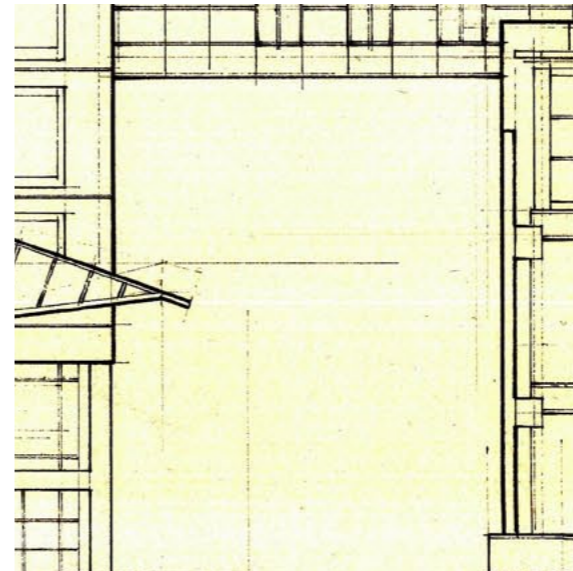
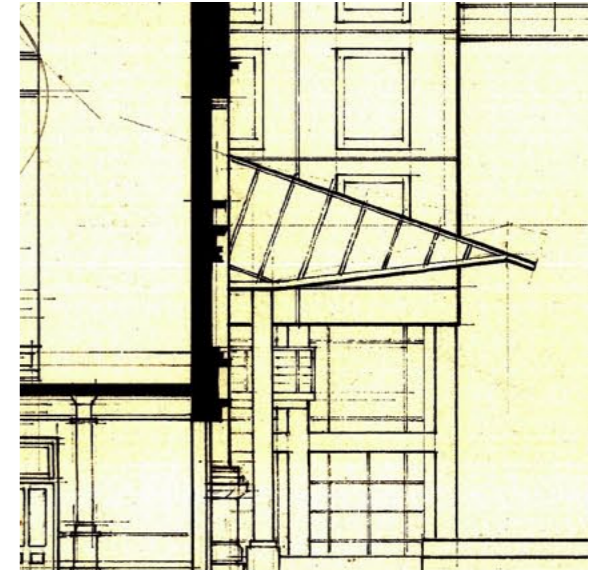
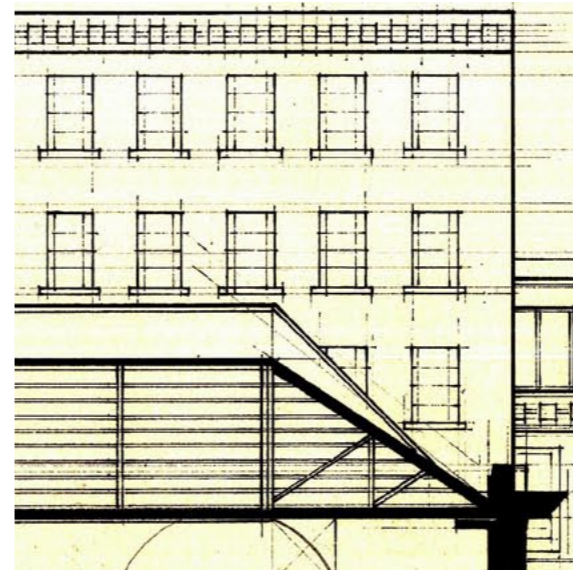


**EAST / SOUTH - EAST**

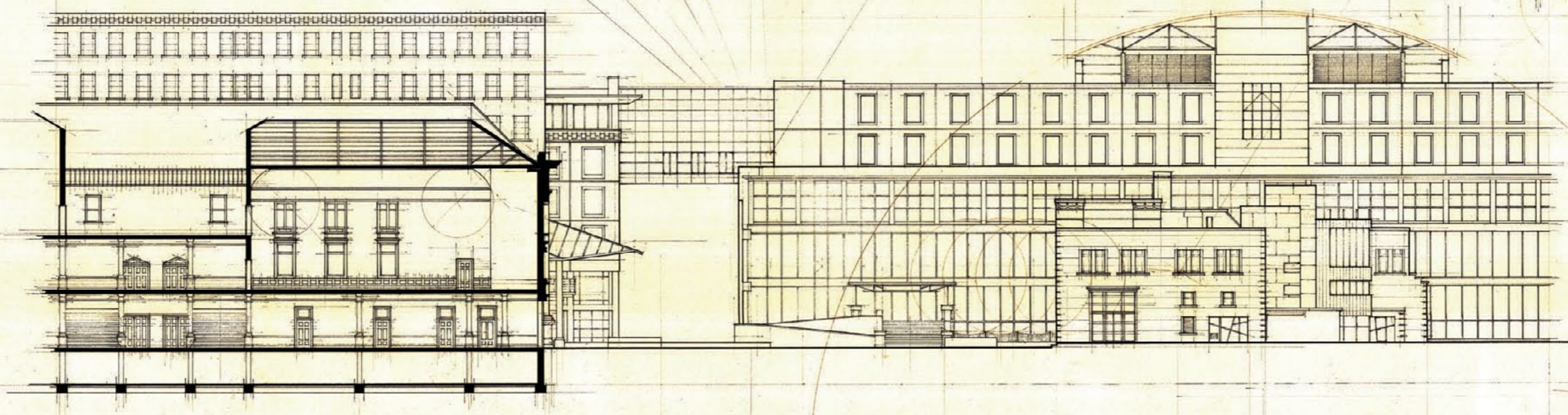


**WEST / NORTH - WEST**

2.1.5 WEST/NORTH-WEST  
SCALE 1:200







WEST/NORTH-WEST  
SCALE 1:200 (AT A1)

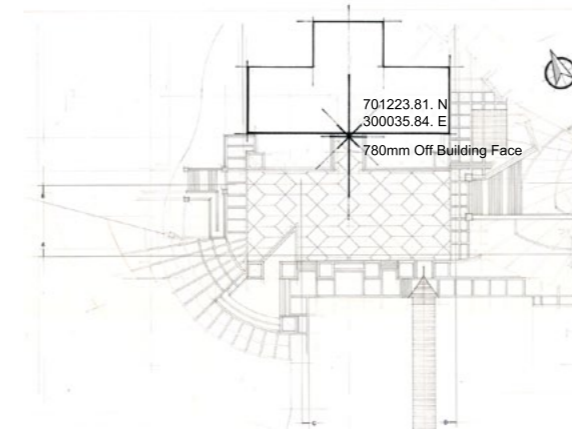
## 2.1.6 POINTS OF ORDER

This section illustrates the main set-out points of the site, and discusses what these reveal of the relationship between the buildings of Civic Square. Following Frascari's notion of *architectural drawing as the demonstration of construction*, this section aims to present through the *reproduction drawings* those first lines and points which ordered the new landscaping and buildings of the 1991 redevelopment.

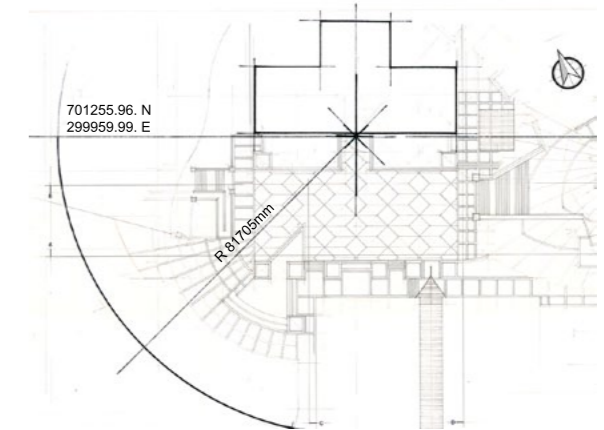
Mechanical architectural drawing is a graphic *demonstration* analogous to the process of construction. For Marco Frascari, this relationship exists between the graphic markings of the outline of a building on the surface of the page and the surveying on site to demonstrate the location of the 'corner-stones' and other important features, between the drawn construction lines as a demonstration of the vertical raising of a building and its analogical demonstration embodied in the structure of scaffolding during construction.<sup>83</sup> Thus the discovery and reproduction of set-out points become the first steps in the understanding of Civic Square.

There are a number of main set-out points dictating the layout of Civic Square. The first is located on a line extending perpendicular from the centre of City Gallery's front facade, located at the coordinates 701223.81 N, 300035.84 E, 780mm off the building face (1). From this point the curve of the back facades of both the Public Library and the CAB are drawn (2). A secondary set-out point extends 23914mm south-west and 15530mm north-west from the main set-out point, this becomes the point from which the inner facing curve of the CAB's front facade and the southernmost convex curve of the public library are drawn. This point also dictates the back curve of the southwest raised triangular grass section and the paving in the southwest corner of the site (3). Located at the back of the CAB is a further set-out point from which the curved walkway enclosing the northeast corner of Civic Square is scribed (4).

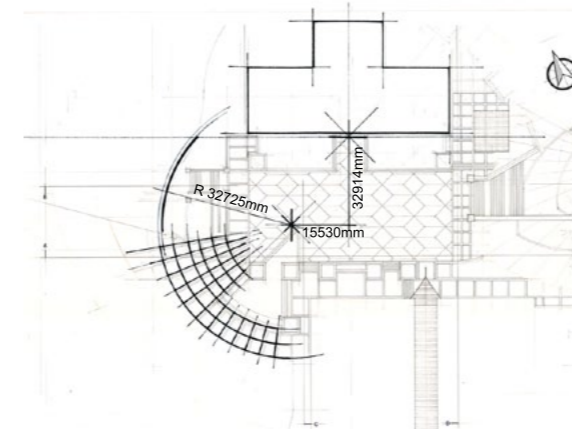
The remainder of the alternating convex and concave curves of the Public Library's front façade follows a pattern of 10600mm S-E, 35000mm N-E (5). The more this façade extends north-east, the more it is hidden from view from within the square by City Gallery, the more independent its set-out points become, suggesting that the more buildings are visually part of Civic Square the more their set-out points and locations share similar points of order. The set-out points discussed above, and the relationships between buildings that they dictate, offer an understanding of Civic Square's buildings by means of hierarchy. All the new buildings and landscaping constructed during the 1991 development have their basis in the point 780mm off the City Gallery's front façade, suggesting that this building is the most important in understand the layout and order of Civic Square. This reading of the City Gallery's dominance plays a significant role in the re-presentation of the site in the third series of *experimental drawings*. It also acts to contradict Debra Miller's summation of chief architect Ian Athfield's intentions of the development: "conceived as a collective, the development [of Civic Square] presents an integrated vision where no one building dominates."<sup>84</sup> Although various buildings and components sharing points of order helps to present these buildings as a *collection*, the dominance of City Gallery, combined with an observation discussed in the following section, that any ideas of order in Civic Square are only external, contradicts Athfield's idea of Civic Square as a hierarchy-free *collective*.



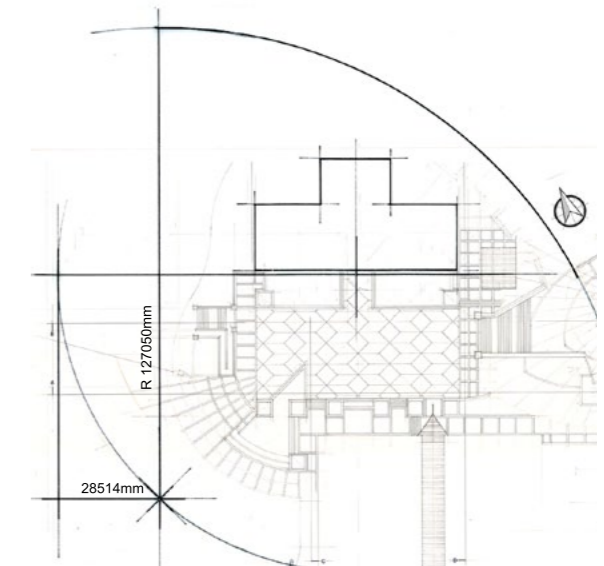
ONE



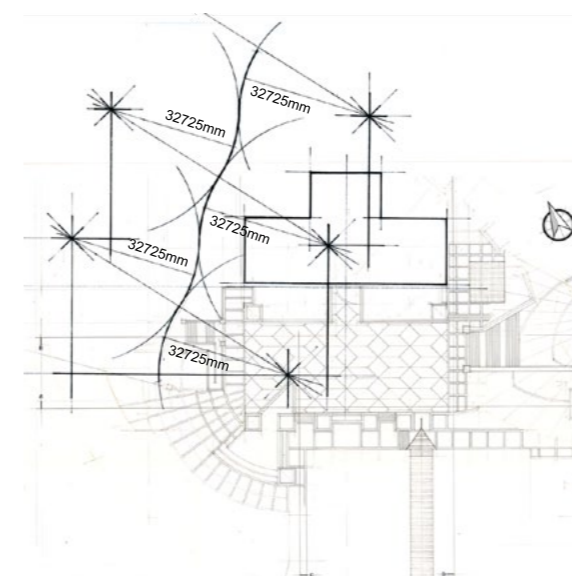
TWO



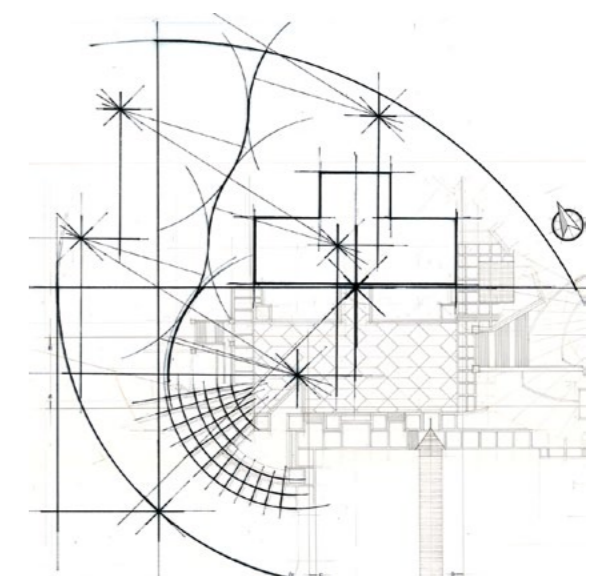
THREE



FOUR



FIVE



SIX

83 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 15

84 Millar. (1992). *A Meeting of Minds*. 44

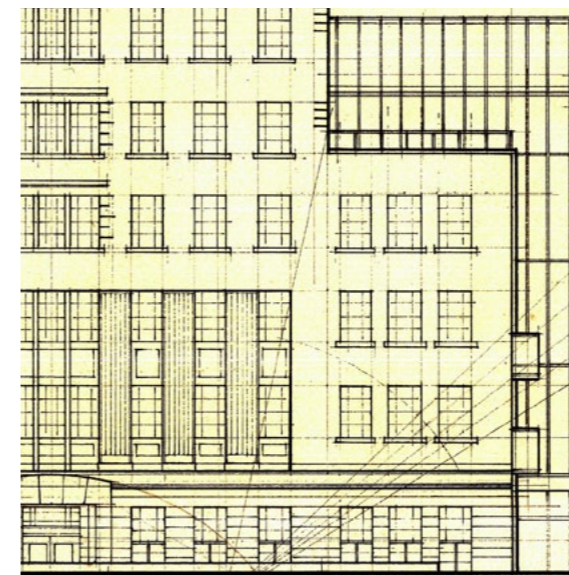
### 2.1.7 LIFELESS ENTRANCES

This section discusses the entrances of Civic Square's buildings following the observations of John Gray. This section leads to a key reading of Civic Square's rows of buildings as *walls*, and argues that orthographic projection's flattening of space reinforces this interpretation

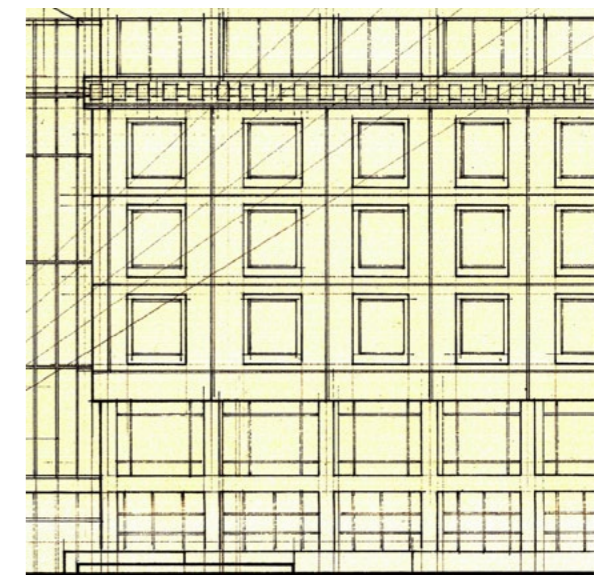
*...most activities in most buildings are not, and cannot be, linked with the square – not surprisingly, the windows and entrances are consequently lifeless.*<sup>85</sup>

Although special zoning conditions exempted the development of Civic Square from the usual planning requirements, meaning landscaping could extend right to the edge of buildings<sup>86</sup>, there remains little interaction between the interior functions of the buildings and the external landscaping. For John Gray this has resulted in the buildings becoming spectators of the Square, not participants.<sup>87</sup> Gray cites the raised grass beds along the south-side of the square as delimiting the role of space between the square and the building edges, resulting in relatively lifeless entrances (1+2). The *lifeless entrance* is a condition that can be seen to extend to all of Civic Square's buildings. The entrance to the Public Library is located up two flights of stairs in the north-west corner of the square; a large canopy ensures that this entrance is permanently in shade, and a view of the stairs from the south-west corner is severely limited due to the size of the Oamaru stone disabled access ramp (3). The entrance to the Town Hall is located around a corner to the east of the building and is also largely in the shadow of the Michael Fowler Centre. The City Gallery's entrance, although opening directly onto the Square, is positioned off centre to the east and is relatively small in comparison to what is suggested by the monumental spacing of the columns and the height of the windows (4). Although this entrance opens directly onto the square, one must first make the transition across a circular section of paving before reaching the brick of the diamond paving (5), creating a visual threshold in the one entrance that holds the most promise for a direct connection between the public square and the public building.

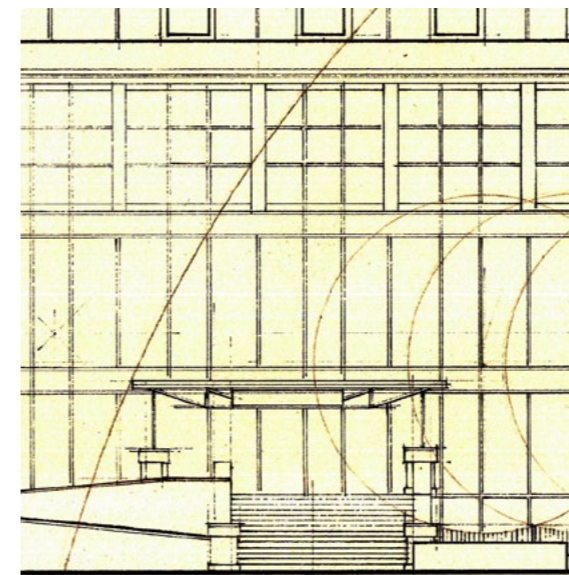
This lack of interaction between the external environment of Civic Square and the interior functions of buildings leads John Gray to propose that Civic Square's rows of buildings are *walls*, rather than individual buildings, which surround the centre rectangular area of brick paving.<sup>88</sup> This notion is reinforced by orthographic projection's flattening of space. By removing depth from consideration, the four sections through Civic Square present the individual buildings as occupying a single plane. By not representing the variations in the position and depth of facades, the individual buildings, particularly those of the N-N/E and S-S/W sections, present themselves as continuous walls which enclose the Square. The following section discusses the relationships and order of Civic Square's landscaping that is enclosed by these *walls*.



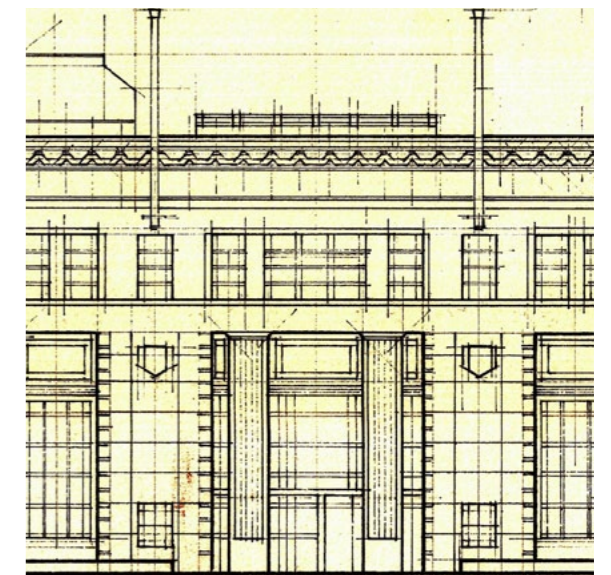
ONE



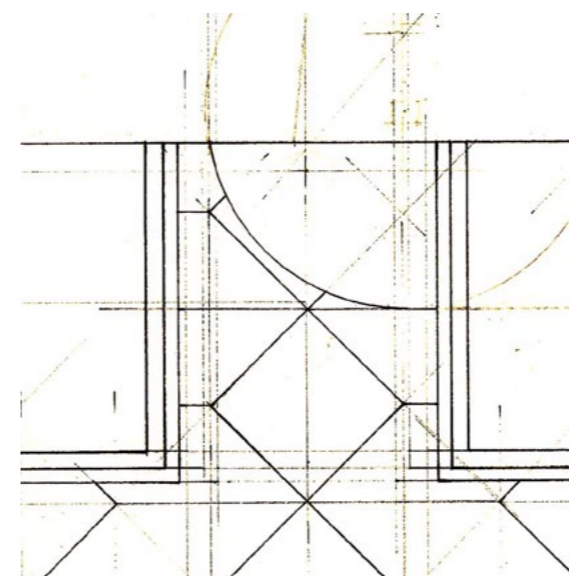
TWO



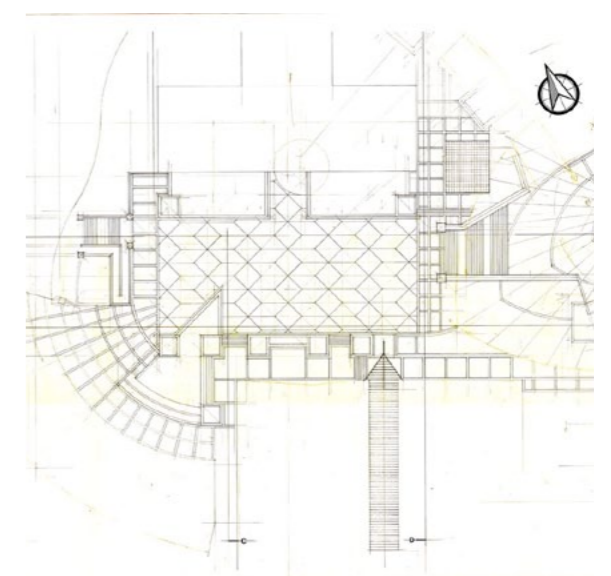
THREE



FOUR



FIVE



SIX

85 Gray. (1992). *Worth Waiting For*. 50  
 86 Millar. (1992). *A Meeting of Minds*. 47  
 87 Gray. (1992). *Worth Waiting For*. 50  
 88 *ibid*

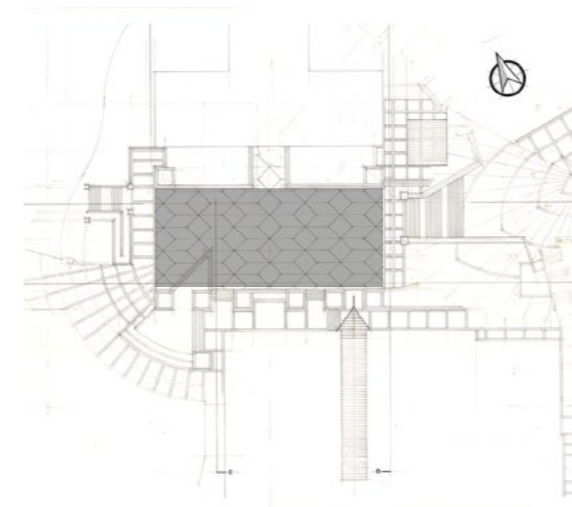
### 2.1.8 LANDSCAPE ORDERS

This section uses the *reproduction site plan* to investigate the larger-scale orders present in the landscaping of Civic Square. It presents further visible relationships of the site which have become present through its representation in orthographic projection. This section reinforces notions concerning the dominance of City Gallery over the layout of Civic Square during its development in 1991, the idea of these the rows of buildings as *walls*, and addresses the strength of a west-east path through site.

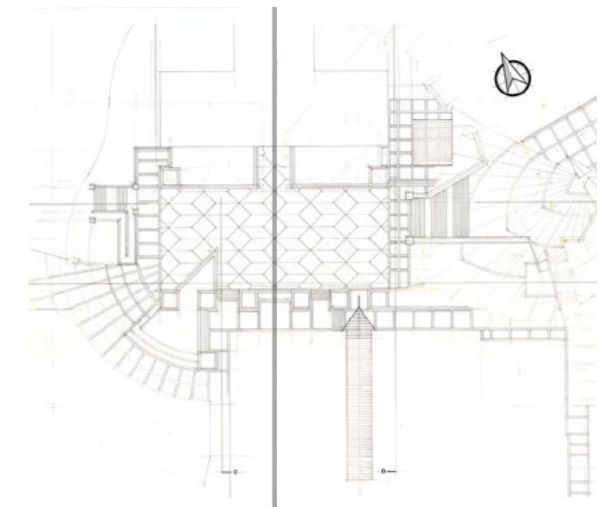
The hard landscaping of Civic Square contains some of the strongest geometric relationship and ideas of order. Yet, the distance between connected parts means that many of the strongest patterns and relationships go unnoticed during the physical occupation of site. The scaled *reproduction* of Civic Square, however, renders these relationships visible. The centre rectangle of diamond paving is an example of this: the size of the diamond pattern and the subtle difference in colour between the bricks causes it to be partially hidden when physically passing through the site (1). Furthermore, the left and right edges of this paved area align with the left and right edges of City Gallery, the centreline following the centreline of the City Gallery, which is the line upon which the main set-out point of Civic Square is located (2). The longitudinal centreline through the diamond paving orders the location of the S/S-W edge of the steps leading to the City to Sea Bridge (3). All four corners of this paved rectangle are anchored by concrete planter boxes raised 500mm from the main ground level, creating a secondary perimeter, or vertical transition between the edge of the diamond paved area and the rows of building facades (*walls*) inclosing Civic Square (4). The rectangular paving at the W/S-W and E/N-E ends of the diamond paving align along the longitudinal axis, yet a physical distance of 55 meters separates these two areas, ensuring their connection remains invisible (5).

The N/N-E and S/S-W edges also share components of aligned geometry, and the shorter distance between the two edges, combined with the fact that they are slightly raised above the main ground level, renders their relationship all the more visible and important. The two large raised grass areas in front of City Gallery are mirrored by four smaller squares on the opposite side of the centre rectangle (6). By the larger grass areas existing in front of the most monumental civic building, we witness further evidence of City Gallery dictating the overall order of Civic Square. The two large areas align with the footprint of City Gallery, but the four smaller areas on the S/S-W do not possess any relationship with the footprints of the buildings they lay in front of.

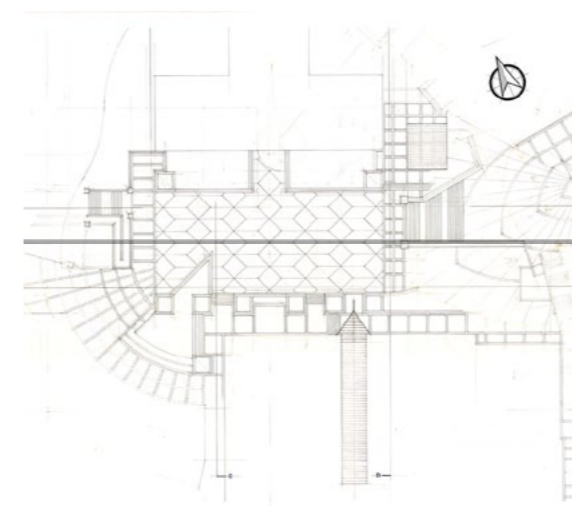
The path from west to east - from between the CAB and Library to the City to Sea Bridge - is the least resistant path through Civic Square. On this path the aligned geometries at either end of the diamond-paved area share a consistent ground level (5). This is in contrast to the top and bottom edges of the diamond paving, which also share aligned geometries, but with a vertical displacement above the main ground level (6). The shared ground level of the aligned geometries on the left and right reinforces the main path through the site, while the raised geometric components aligned at the top and bottom reinforce the notion of the N/N-E and S/S-W facades as boundary walls containing and facilitating this transition through the site. These two concepts relating to the identity of the four sections – two openings, two impenetrable walls – become two of the main driver in the *experimental drawings*. They are tested, and subsequently reinforced in the re-representation of Civic Square in the third series of drawings, particularly the compositions *The Developed Surface* (section 2.3.1) and *Civic Rhythm* (section 2.3.12).



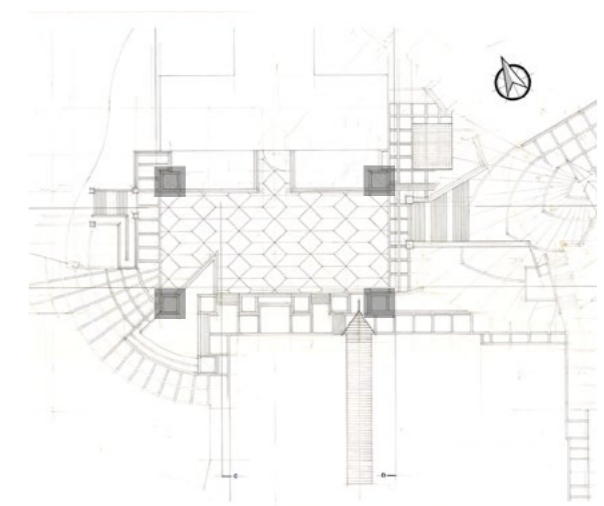
ONE



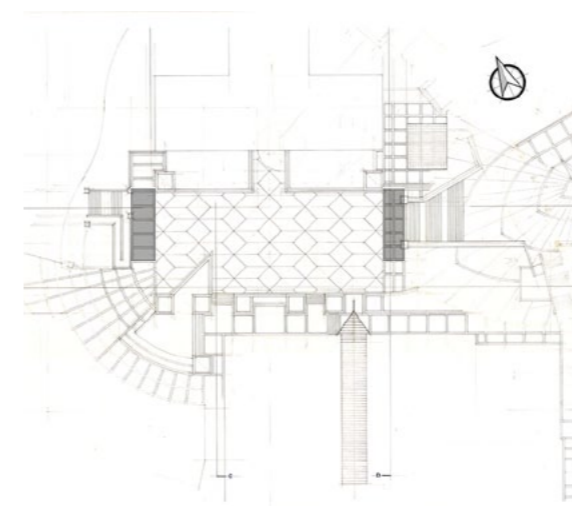
TWO



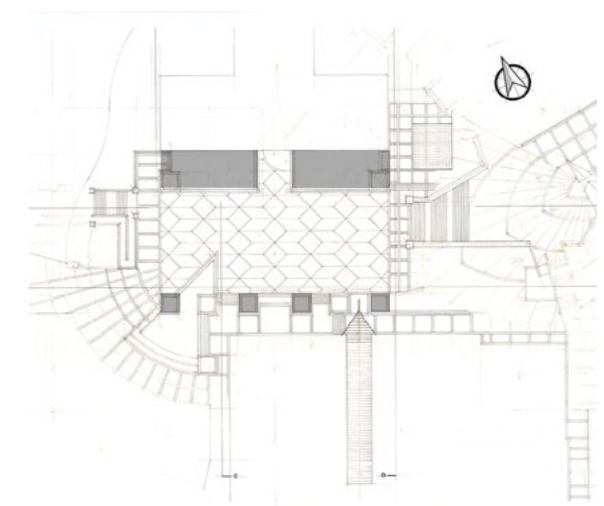
THREE



FOUR



FIVE



SIX

### 2.1.9 CONSTRUCTION AIDS

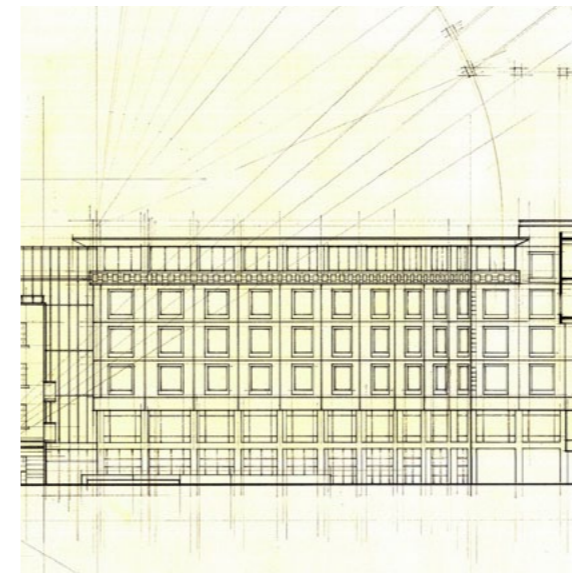
This section analyses the role of curved construction lines in the accurate representation and foreshortening of the site's two curved buildings. This section discusses how the conventions of orthographic projection act to inform the reading of Civic Square's buildings, and demonstrates that orthographic projection's influence over the architecture it represents can alter the conceptions that an author has towards a site.

There are two predominately curved buildings in Civic Square: the CAB (1) and the Public Library (2), both of which were designed as part of the Civic Square development and constructed in 1991. As demonstrated in *Points of Order* (section 2.1.6) these two buildings have their centre most curves scribed from points within the centre diamond paving in locations ordered by the City Gallery. To aid the accurate reconstruction of these two facades in the section drawings it was necessary to first draw the curves of their respective plans (3+4). These construction lines, traced at a uniform line weight in the *analytical drawing Construction Lines* (section 2.1.6), become an important feature in the *experimental drawings*, in particular *Vertical Re-Construction* (section 2.3.3). However, it is important to discuss here the extent to which orthographic projection is capable of representing curved objects, and to what extent these two buildings retained an accurate reading through their orthographic reproduction.

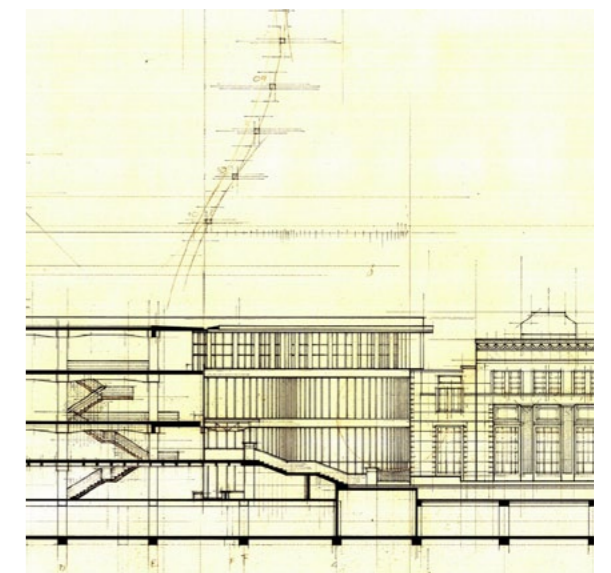
The representation of the CAB in the S/S-W section is, in comparison to the Public Library, a more accurate and successful translation of the physical object. This is largely attributable to formal differences between the two facades. The CAB's facade is split into three horizontal sections (5): the bottom consists of a series of beams and columns, forming square openings two bays high, the middle section is composed of uniform rectangular windows three rows high and ten across, while the top most section is a series of double vertical divisions, short square columns in front, setback windows behind. The consistent horizontal rhythm of the two lower sections provides the foreshortening of this facade's two-dimensional representation with enough consistency to afford the translation with a certain measure of stability.

The Public Library's Civic Square facing facade (6), on the other hand, consists of five alternating curves, three concave and two convex. Also composed of three horizontal sections, the two bottommost are formed by a large number of faint vertical divisions between separate panes of glass, the topmost section is composed of short columns and recessed glass, (similar to the topmost section of the CAB), but with the greater distance between glass and column skewing their *actual* consistent relationship into visual disorder. Furthermore, a great reduction in the length of this facade by the viewing angle of the representation causes a great deal of compression between vertical divisions. This compression holds the potential for a reasonably accurate translation of this curved surface, yet the alternating convex and concave curves and their shallow depth relative to the curves of CAB keeps a full understanding of this facade's formal structure within an orthographic projection elusive.

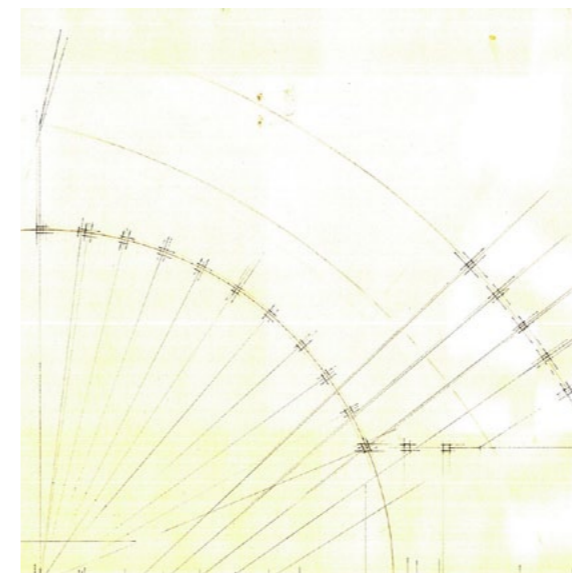
The following series of *analytical drawings* builds upon the *visible* orders and relationships observed through the *reproduction drawings*. The *analytical drawings* seek to reduce the complex compositions of this section to specific categories and sets of information, in order to test Frascari's second overlapping relationship of a *technological image*: between a real artefact and its instrumental image. While the *reproduction drawings* are concerned with understanding Civic Square through that which is *visible* in an orthographic representation, the following section seeks to uncover those readings and conceptions of Civic Square which are *invisible* or hidden, but nevertheless present in the *reproduction drawings* of this series. This second series of drawings, in combination with the *reproduction drawings*, becomes a critical step towards the elaboration of the imaginary through orthographic projection and Marco Frascari's *technological image*.



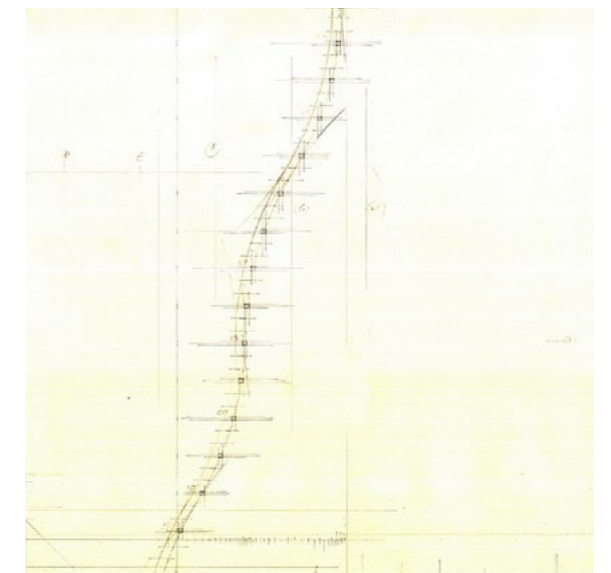
ONE



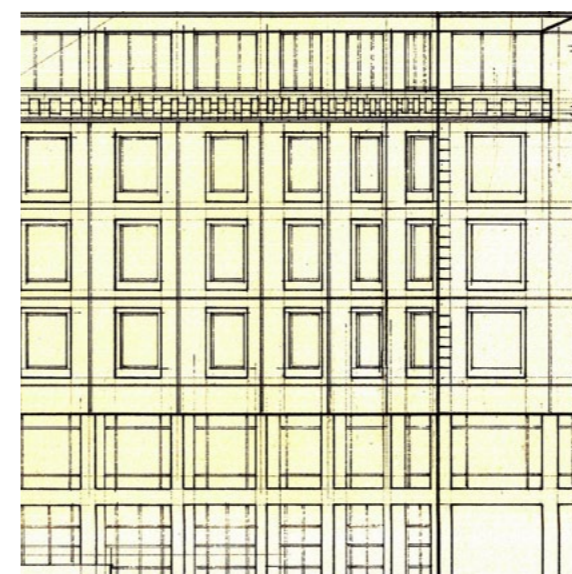
TWO



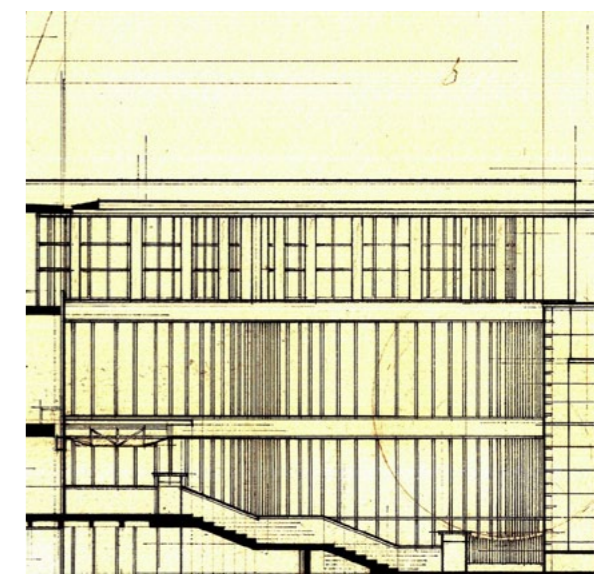
THREE



FOUR



FIVE



SIX

## (2) ANALYTICAL DRAWINGS

### 2.2.0 INTRODUCTION

[Orthographic projections'] *power is that they limit what is being portrayed and therefore dramatize certain architectural aspects while muting or even altogether silencing others.*<sup>89</sup>

This section uses *analytical drawings* to test Marco Frascari's theory of *technological images*, following Clemens Steenbergen's critical framework of *architectural drawing as research*. The two theories are strategically integrated as a means of critically examining how orthographic projection can facilitate architects' ability to elaborate the imaginary. This begins with Steenbergen's definition of *analytical drawings*, before outlining how Frascari's second overlapping relationship will manifest graphically through this second series of drawings. The role of orthographic projection in this series is then outlined following the observations of Gerald Allen and Richard Oliver. Concluding this section is a description of the structure of presentation, and form of analysis undertaken in the reading of this series of *analytical drawings*.

These drawings orientate Marco Frascari's second overlapping relationships of a *technological image* within Clemens Steenbergen's second series of drawings from his framework of *architectural drawing as research*.<sup>90</sup> These are Steenbergen's *analytical drawings*, which represent Frascari's second overlapping relationship: between a real artefact and its instrumental image.<sup>91</sup> Following Steenbergen's definition, these *analytical drawings* aim to reveal abstract qualities and potentials by reducing the complex compositions of the *reproduction drawings* to their elementary abstractions: geometric forms, lines, and grids.<sup>92</sup> Steenbergen proposes that through this process of reduction it is possible to explore the reciprocal confrontations and relations between the *reproduction drawings* and the physical artefact. For Steenbergen, drawings of this nature are primarily concerned with proportion, relations, rhythm, frequency, symmetry and asymmetry, the distribution of surfaces, the degree to which something is open or closed, or the way parts meet a whole.<sup>93</sup>

*The purpose of analytical drawings is not to discover a notion of style; it seeks an imaginary repetition of the process of weighing the combinations of the aspects mentioned above to find the right ones.*<sup>94</sup>

For Frascari the *main stumbling block* in the challenge to what he perceives as the present "negative condition" in the production and use of architectural drawings is that the study of drawing is often seen as subsidiary to the analysis of buildings.<sup>95</sup> Even when they are considered together – the analysis of buildings *through* drawing – Frascari suggests that it is only through rules of reproduction, recognition and similarity. Consequently, Frascari proposes, architectural drawings are always considered and presented as *ancillary components* to the elaboration of theories of architecture, whereas they should be treated "as the most important architectural agents, since they carry embodied in them the non-verbal essence of architectural theory."<sup>96</sup> Thus, Frascari proposes that the rules of *cosmopoiesis* must sit alongside the rules of reproduction, recognition

and similarity in the analysis of building through drawing. Under Frascari's definition the rules of *cosmopoiesis* search for an understanding of architecture through means of *analogy, opposition and sympathy*.<sup>97</sup> This can be seen as the very aim of Steenbergen's *analytical drawings* as defined above.

This second series of drawings seeks to gain a *deeper* understanding of Civic Square and its two dimensional representation by reducing the information contained in the complex *reproduction drawings*. By reducing the *reproduction drawings* to specific categories, focusing on specific sets of information, this second series provokes a deeper analysis of Civic Square, a step toward what Alberto Perez-Gomez terms *making visible the invisible*, and a critical step toward elaborating the imaginary through orthographic projection. As Gerald Allen and Richard Oliver observe in their co-edited book *Architectural Drawing: The Art and the Process*, a drawn representation of a building is always fighting a losing battle with the limitations of the drawing itself. However, there are two possible consequences of this: either the drawing ends up as a very poor substitute for the actual object, or through the drawing's intrinsic limited vision some aspects are more vividly represented by the exclusion of many other aspects.<sup>98</sup> The orthographic drawings of this series are considered as the latter. The *reproduction drawings* provoke a reading of the *visible* relationships present in Civic Square through orthographic projection, while the *analytical drawings* seek to provoke a reading of the *invisible* relationships present in Civic Square through orthographic projection. The combination of these two series leads to the third and final series of *experimental drawings* and the third and final overlapping relationship of Frascari's *technological image*.

The following *analytical drawings* are presented as thumbnail images alongside text, followed by each image at a large size to allow both their reading against their images, and to make the detail of the drawings visible. Section 2.2.1 *Base Geometries*, follows one aspect of Steenbergen's definitions of *analytical drawings*, by reducing the complex *reproduction drawings* to their elementary geometric forms. In relation to Frascari, these drawing represent the geometric instrumental image. This opens up the sections to a compositional analysis, undertaken following the compositional theory of art theorist Rudolf Arnheim. This process leads to readings of Civic Square concerning its relationship to the vertical city and the horizontal sea. Section 2.2.2 *Construction Lines*, traces all lines drawn during the construction of the four main sections at a uniform line weight. By removing the hierarchy imposed by the use of line weight these drawings test Frascari's notion of *sympathy* to the original *reproduction drawings*. This process leads to a discussion concerning the visual weight of particular aspects of Civic Square's buildings. Section 2.2.3 *Windows and Openings*, tests the extent to which the windows and openings of Civic Square's buildings, when isolated, present a representation visually linked to the original through Steenbergen's notions of distribution and weight. These drawings lead to a rereading of the observations made in section 2.1.7 *Lifeless Entrances*, concerning the interaction between the windows and opening of Civic Square and the exterior landscaping of the site. Section 2.2.4 *Vertical and Horizontal Lines*, separates all vertical and horizontal lines on separate drawings. By separating the graphic information contained in the *reproduction drawings* to these two specific categories it is possible to examine their presence and meaning, following the theorist Cecil Elliot, of a stronger vertical or horizontal allegiance within the buildings of Civic Square. Finally, section 2.2.5 *Vertical and Horizontal Absence*, takes a similar approach to the preceding drawings. It traces and extends all vertical and horizontal lines to the edge of the page, leaving a gap where they exist on the reproduction drawings. This process leads to the analysis of the four sections through Steenbergen's notions of rhythm and frequency, and Frascari rules of *cosmopoiesis*.

89 Allen & Oliver. (1981). *Architectural Drawing: The Art and the Process*. 14

90 Steenbergen. (2002). *The Power of Drawing*. 158

91 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 110

92 Steenbergen. (2002). *The Power of Drawing*. 159

93 *ibid*

94 *ibid*

95 Frascari. (2007). *From Models to Drawings: Imagination and Representation in Architecture*. 5

96 *ibid*

97 Frascari. (2007). *From Models to Drawings: Imagination and Representation in Architecture*. 5

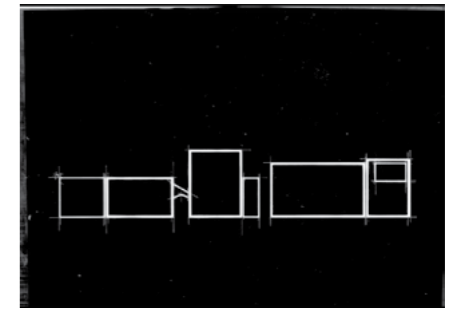
98 Allen & Oliver. (1981). *Architectural Drawing: The Art and the Process*. 13

### 2.2.1 BASE GEOMETRIES

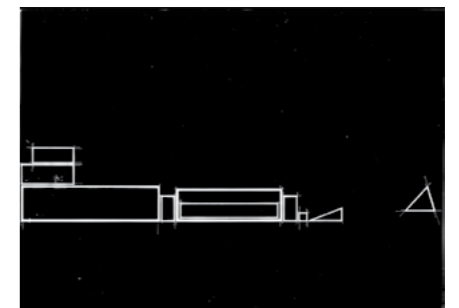
These drawings follow one aspect of Steenbergen's definition of *analytical drawings*. They reduced the complex *reproduction drawings* to their elementary geometric forms. This opens up the sections to a compositional analysis, undertaken following the compositional theory of art theorist Rudolf Arnheim. This process leads to a reading of Civic Square concerning its relationship to the vertical city and the horizontal sea.

The characteristics and details that define the individual character of the separate buildings are removed in these drawings in favour of a simple geometric language. The largest forms are drawn at the thickest line weight, while the smaller forms are drawn at a smaller line weight. This process presents a hierarchy, which follows the means of reproduction (i.e. larger forms are drawn/measured first, while smaller shapes/elements are located in relation to the larger). These drawings become a diagram of compositional distribution, and in relation to Frascari they represent the geometric instrumental image.

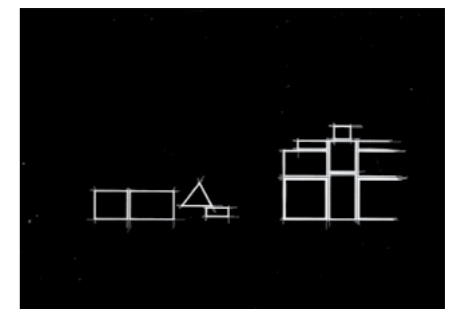
In the N/N-E section there is a decrease in building density leading from the left to the right. For Rudolf Arnheim the reading of visual information from left to right is both the instinctive procedure and met with less visual resistance.<sup>99</sup> Walking under the bridge connecting the Library and the CAB one is physically and visually directed towards the N/N-E section by the raised triangular grass section (see *site plan*, page 40-41), whose ease of reading from left to right is combined with a decrease in building size and density leading from left to right, from the city to the sea. Although a decrease in density leading towards the sea is not an uncommon urban characteristic, it is important in relation to Civic Square through manipulations in the course of pedestrian thoroughfare, leading to *visual resistance* towards the city and *visual ease* towards the sea. For example, the angle of the City to Sea Bridge angles a viewer towards the southwest section where a similar effect is present (see *site plan*, page 38-39). This idea of Civic Square as a transition point between the vertical city and the horizontal sea becomes a fundamental ordering principal in a number of the *experimental drawings*. This notion is tested in the drawing *Civic Rhythm* (section 2.3.2), and dictates the position and rotation of buildings in *Vertical Re-Construction* (section 2.3.3)



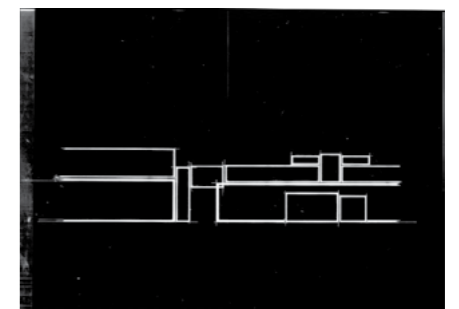
N / N - E



S / S - W

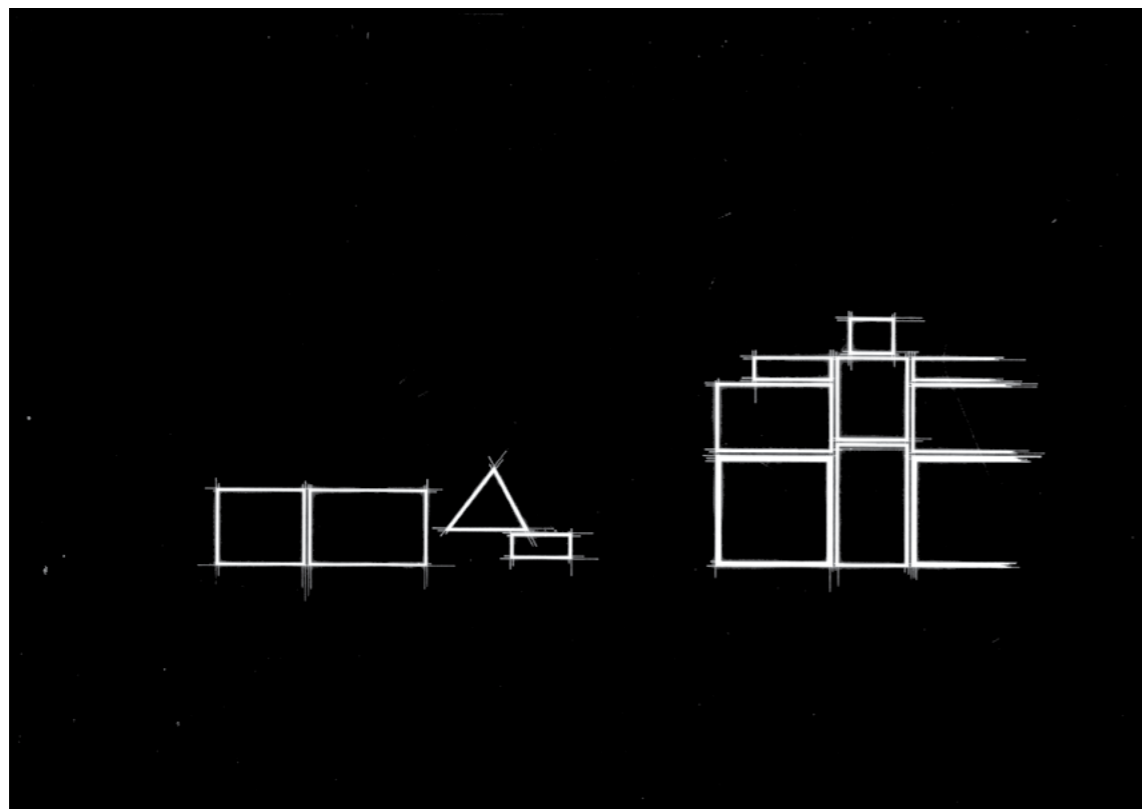


E / S - E

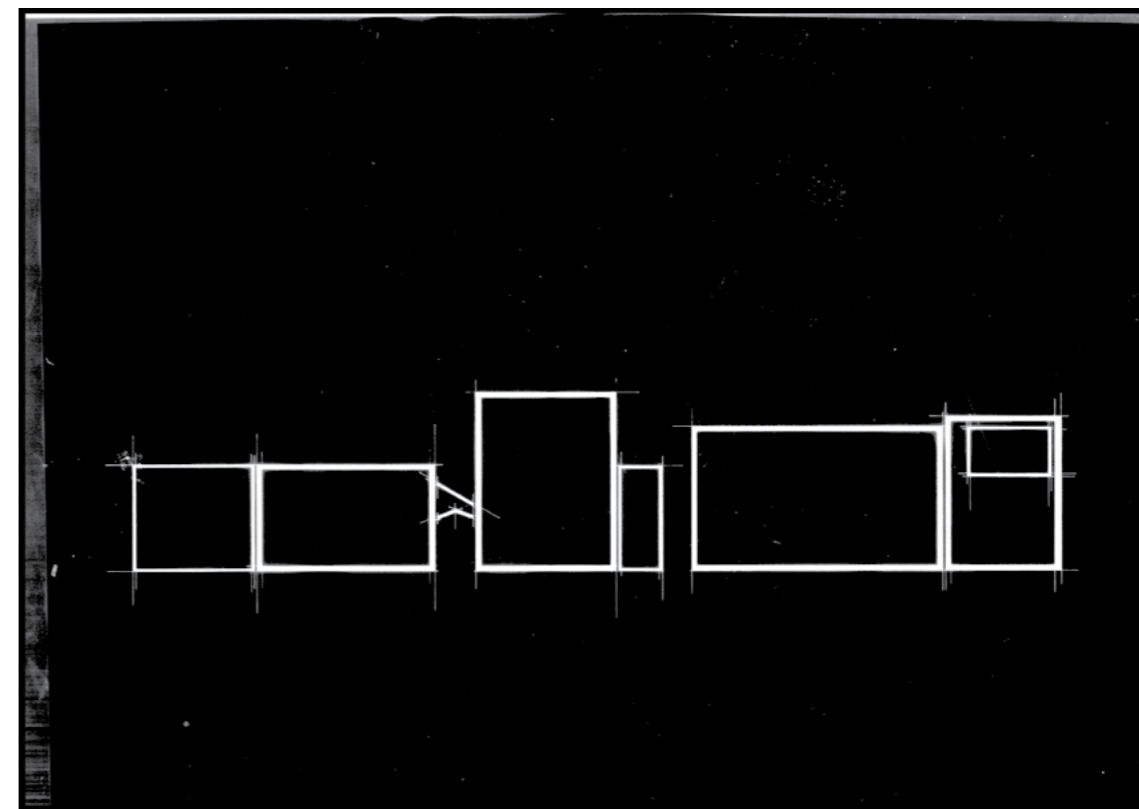


W / N - W

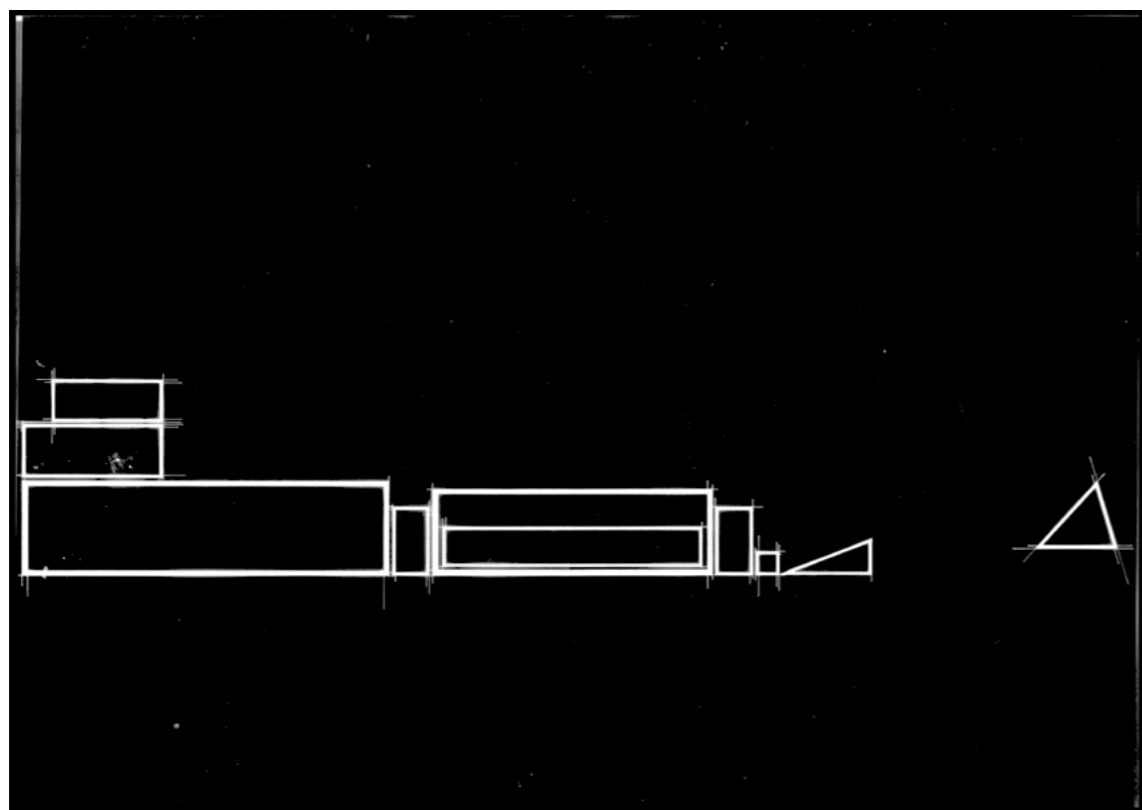
<sup>99</sup> Rudolf Arnheim. (1974). *Art and Visual Perception: A Psychology of the Creative Eye*. Los Angeles: University of California Press.



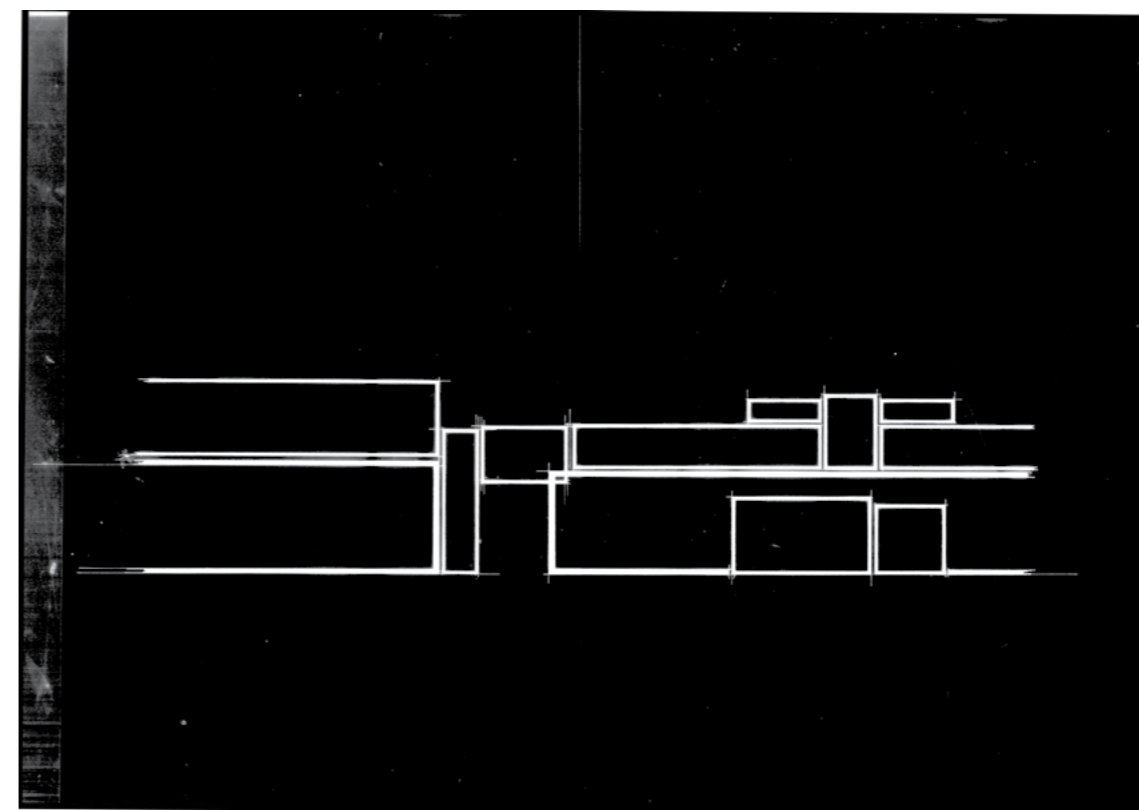
NORTH/NORTH-EAST



SOUTH/SOUTH-WEST



EAST/NORTH-EAST



WEST/SOUTH-WEST



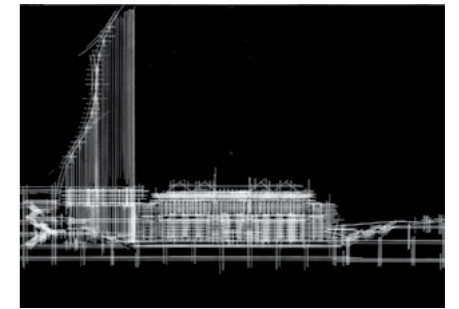
### 2.2.2 CONSTRUCTION LINES

These drawings trace all lines drawn during the construction of the four main sections at a uniform line-weight (0.2mm at A2). By removing the graphic hierarchy imposed by line-weight, these drawings test Frascari's notion of *sympathy* in relation to the original *reproduction drawings*. This process leads to a discussion concerning the *visual weight* of particular aspects of Civic Square's buildings.

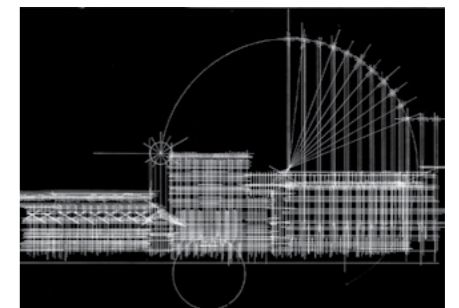
Of particular note in these drawings are the lower level columns of the City Gallery in the N/N-E section. These columns retain their original impact as both heavier and more solid than the upper level, visually securing the building firmly to the horizontal ground. In the *reproduction drawing* of this façade (page 46-47), these columns are drawn at a thicker line-weight to reinforce their increased visual weight, yet City Gallery achieves this not only through the lower windows being three times larger than the upper, but also through the multiplicity of lines composing these grounding elements: column flutings, inner-frame window divisions, and horizontal grooves. Even without the aid of a line-weight imposed hierarchy, this lower level retains its relative weight simply by representing the complexity of its lines.

A similar condition can also be witnessed in the MOB in the S/S-W sections. While all the windows on this façade retain a uniform size and adhere to a single grid, the inclusion of columns between the windows on the lower portion - and the vertical lines they carry with them - present a grounding relationship with the horizontal through their visual weight and comparative complexity. This suggests that visual solidity and density are formal characteristics which do not necessarily need representation through varying line weight, instead the increased multiplicity of lines present in the visually heavier elements of these buildings allows adequate translation to the surface of the page, even through a uniform line-weight.

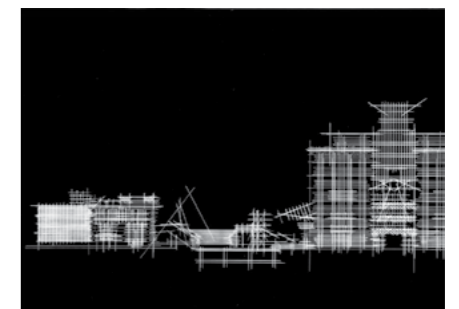
In relation to the gap between drawing and building, as outlined following Robin Evans in section 1.0.3 *Preface*, simple acts of multiplicity also risk producing false appearances of visual weight in orthographic projection drawings. This can be seen, for example, in the extension of the City Gallery in the far left of the E/S-E section. The surface of this extension consists of repeated metal grates of horizontal strips with little vertical spacing between. The material uniformity and thinness of these horizontal elements are drawn at the thinnest possible line weight in the *reproduction drawings* (0.05mm at A1) to represent their relative lightness. Yet, by tracing the lines of this façade at the increased line weight, an appearance of visual weight inconsistent with the original is represented. Within this series of drawings, this has become the most visually heavy element, while in reality - and in the *reproduction drawings* - it carries little visual impact through both the uniformity of its pattern and through the thinness of its elements. This is demonstrative of what Fraser and Henmi observe as orthographic projection ability to alter the conceptions that authors have towards projects.<sup>100</sup>



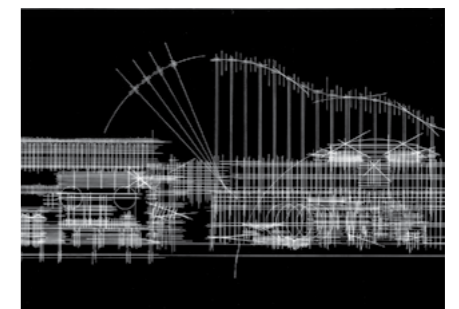
N / N - E



S / S - W

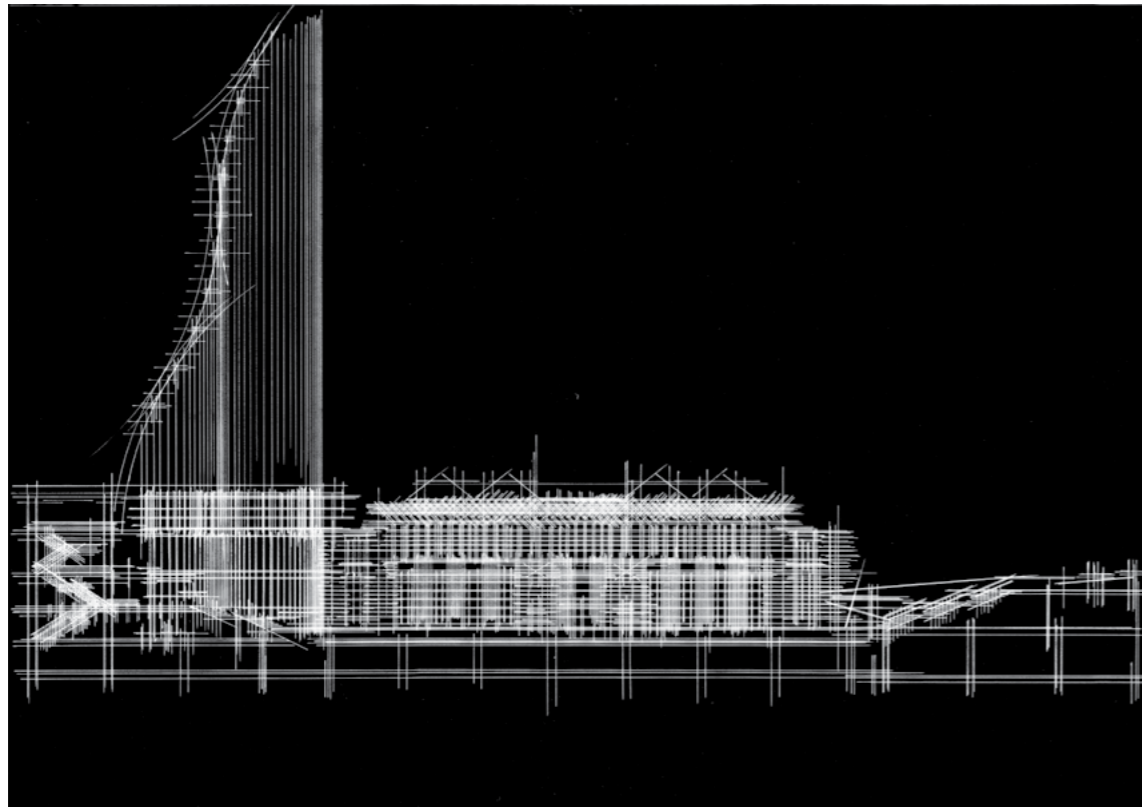


E / S - E

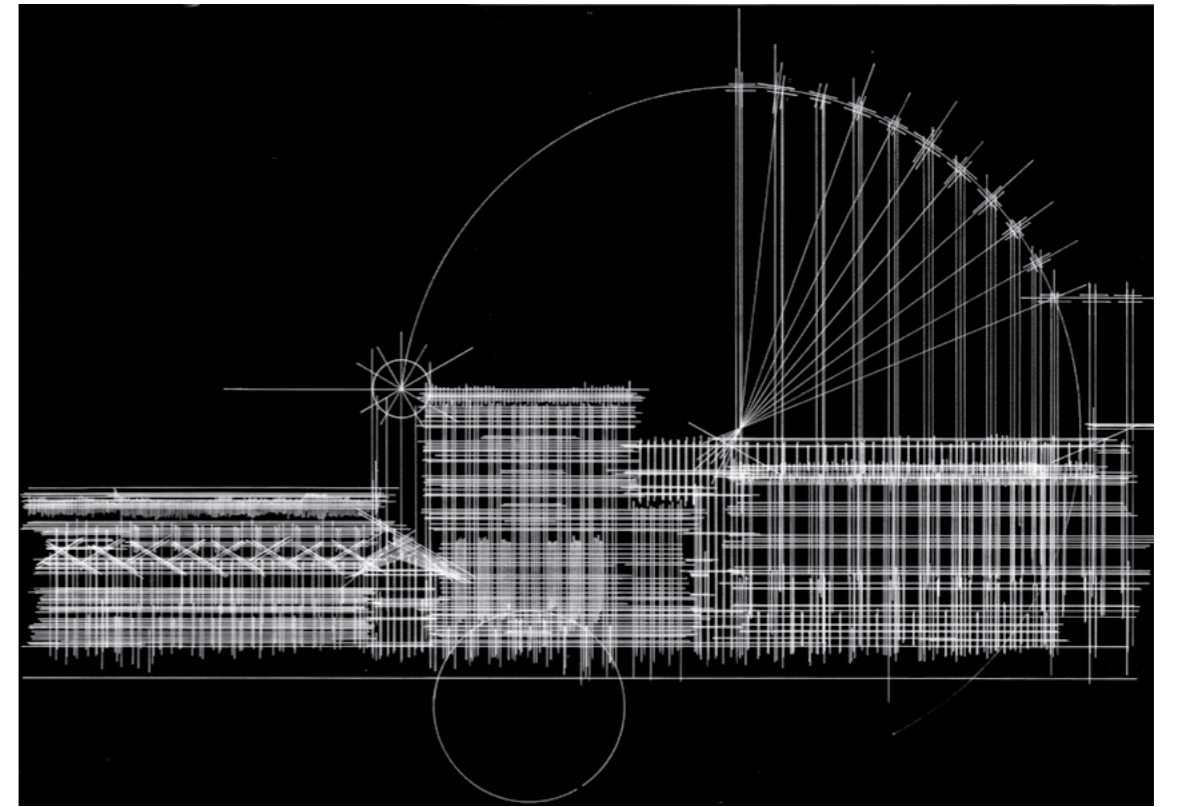


W / N - W

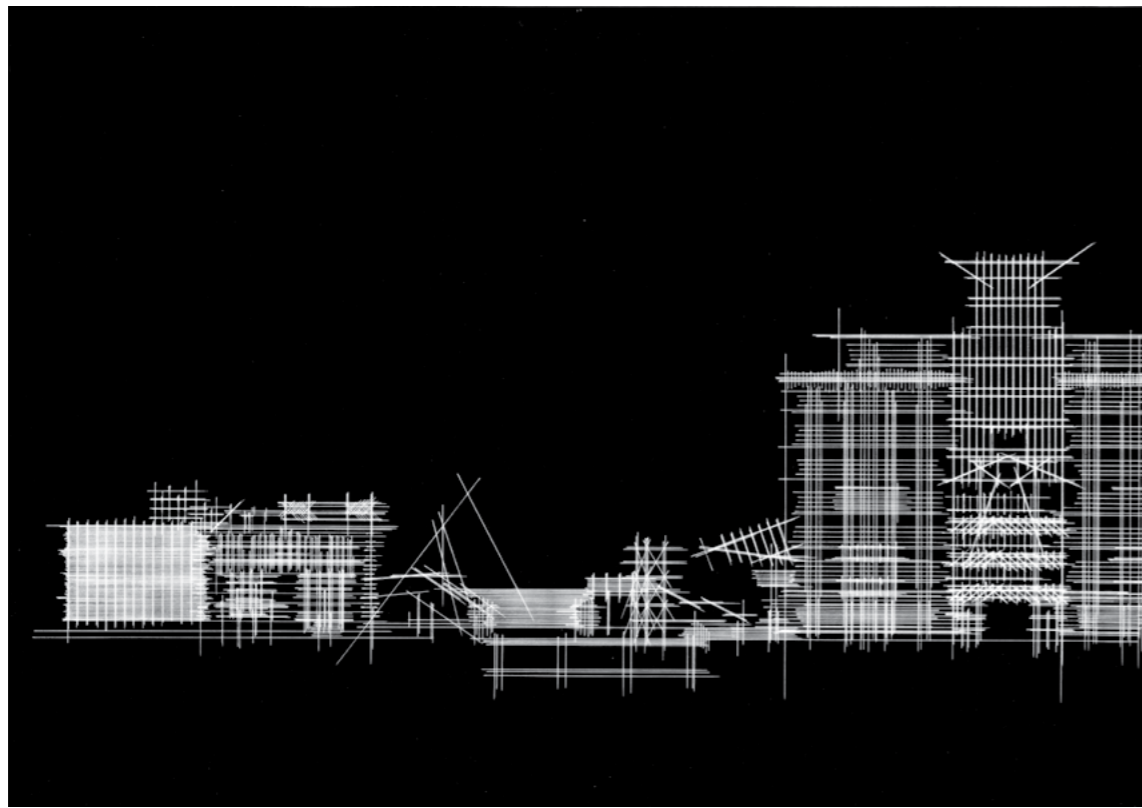
100 Fraser & Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 40



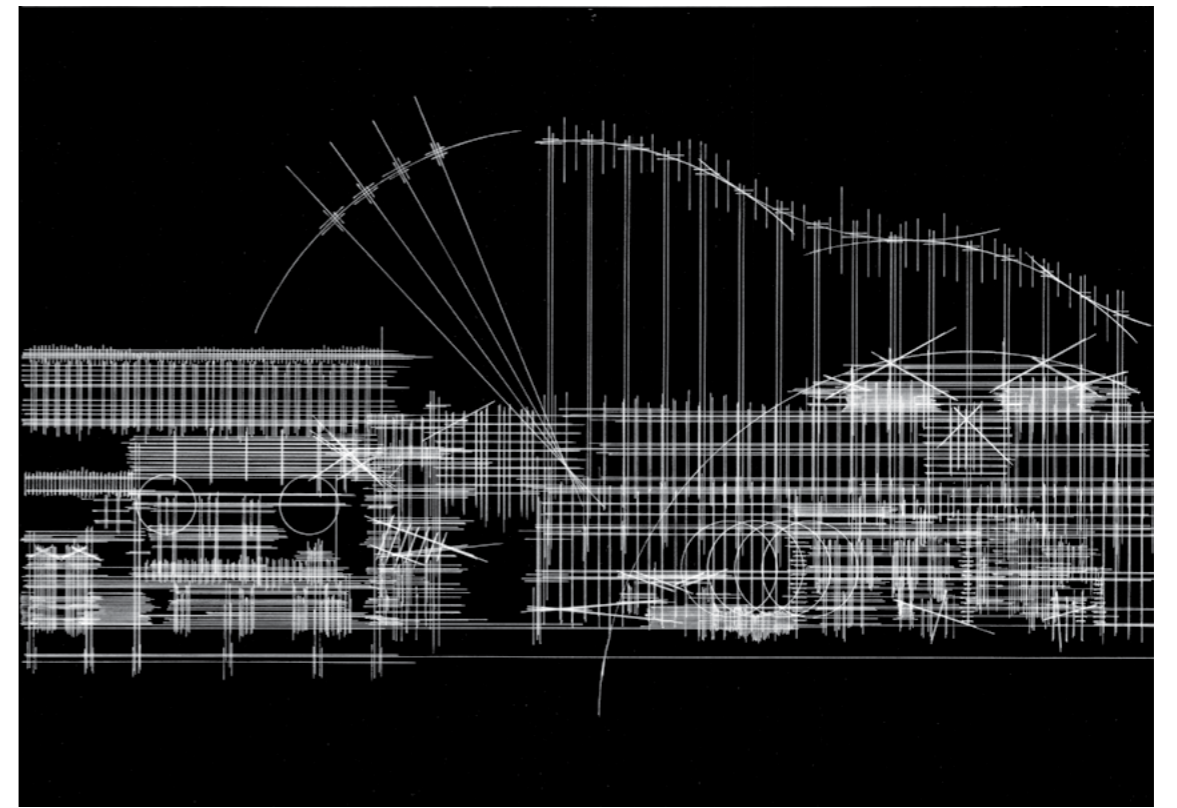
NORTH/NORTH-EAST



SOUTH/SOUTH-WEST



EAST/NORTH-EAST



WEST/SOUTH-WEST

### 2.2.3 WINDOWS AND OPENINGS

These drawings test the extent to which the windows and openings of Civic Square's buildings, when isolated, present a representation visually linked to the original through Steenbergen's notions of distribution and weight. These drawings lead to a rereading of the observations made in section 1.3.1 *Lifeless Entrances*, concerning the interaction between the windows and opening of Civic Square and the exterior landscaping of the site.

The fact that these drawings can be read as invariably linked to the *reproduction drawings*, through what Frascari terms *sympathy*, suggests that an *instrumental image* of Civic Square's buildings is contained within their openings. This becomes interesting in relation to the observations of John Gray and the reading of site put forth in section 2.1.7 *Lifeless Entrances*. Although it was proposed that the windows and opening of Civic Square's building interact little with the square, they are nevertheless able to present an *instrumental image* of Civic Square when isolated.

These drawings play a significant role in the *experimental drawing Vertical Re-Construction* (section 2.3.3). They are used in this composition to intensify the outline of the windows over top of the *reproduction drawings*. This is done in order to express that although the interior functions of the buildings interact little with the exterior environment, these windows alone carry the *essence* of Civic Square, and in isolation form an instrumental image.



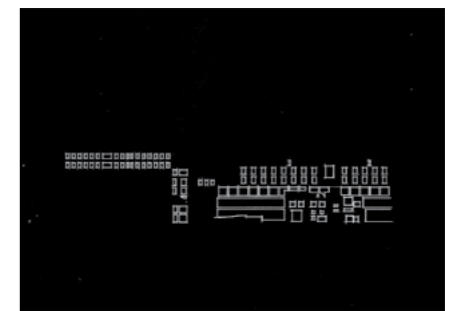
N / N - E



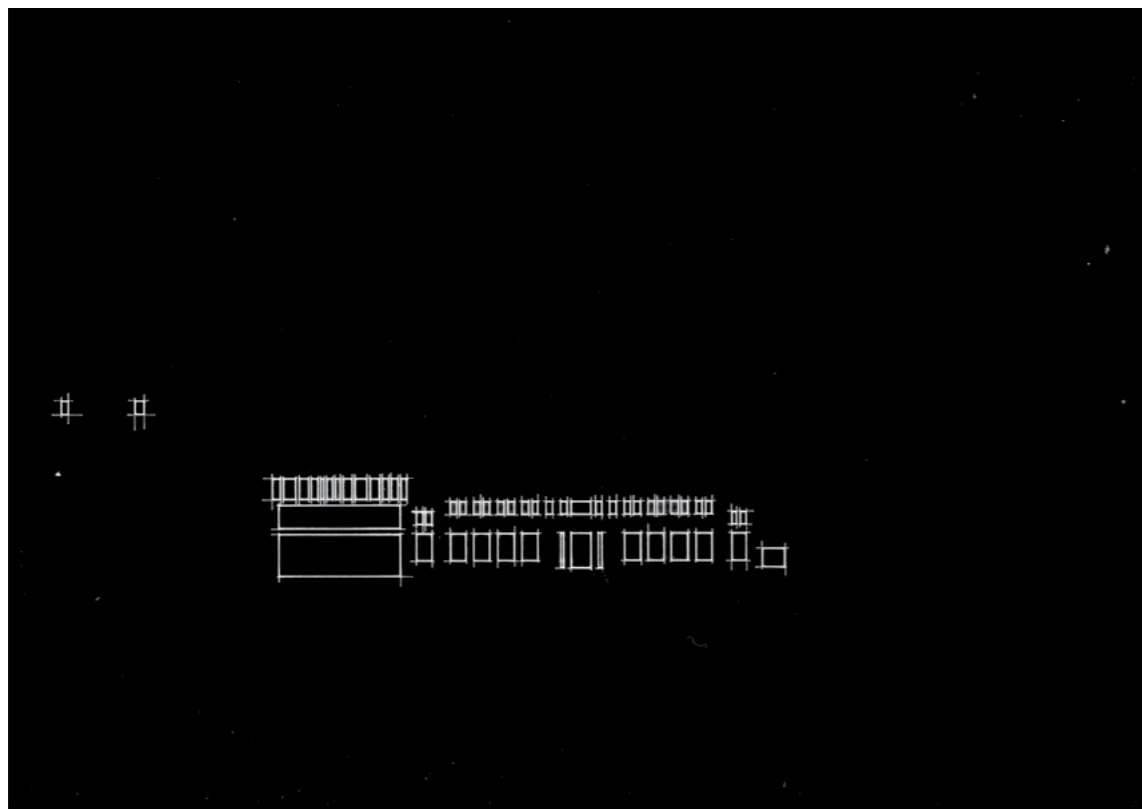
S / S - W



E / S - E



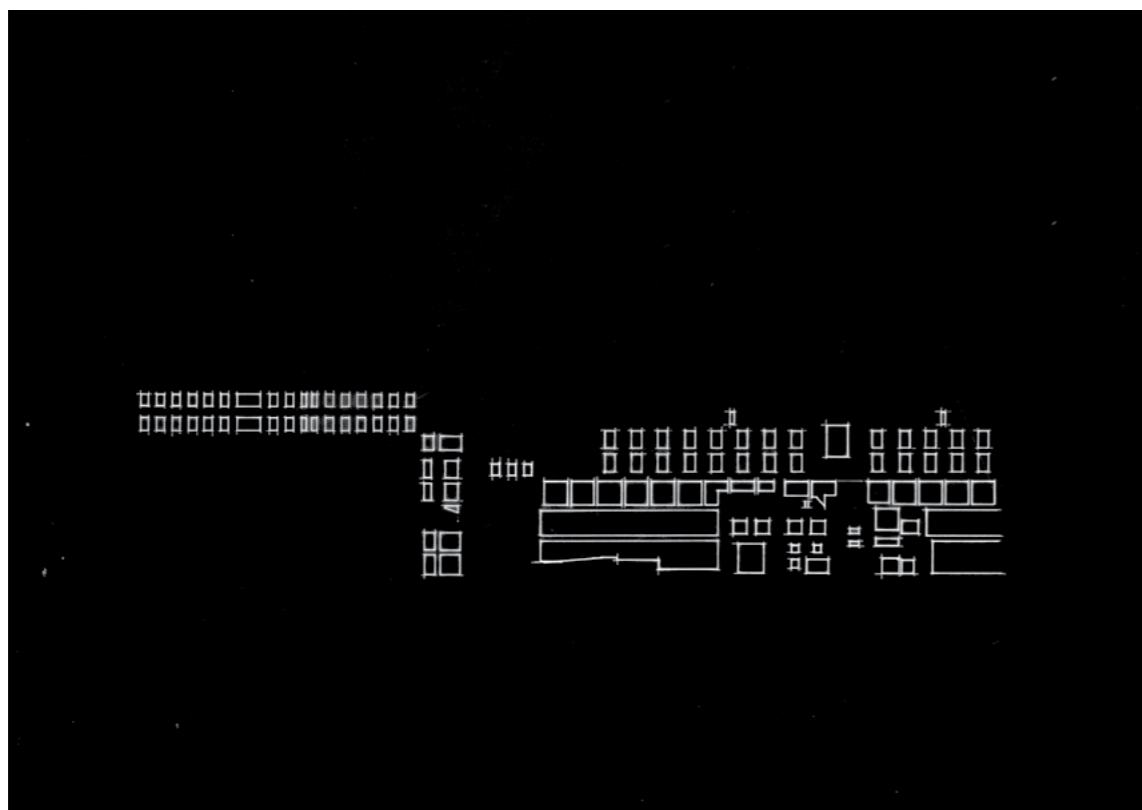
W / N - W



NORTH/NORTH-EAST



SOUTH/SOUTH-WEST



EAST/NORTH-EAST



WEST/SOUTH-WEST

## 2.2.4 VERTICAL AND HORIZONTAL LINES

These drawings isolate all vertical and horizontal lines on separate drawings. By separating the graphic information contained in the *reproduction drawings* into these two specific categories it is possible to examine the presence and meaning of a stronger vertical or horizontal allegiance within the buildings of Civic Square, following the theory of Cecil Elliot. These drawings trigger a revisiting of the discussion concerning Civic Square as a *collective* or *collection* of buildings instigated in section 2.1.6 *Points of Order*.

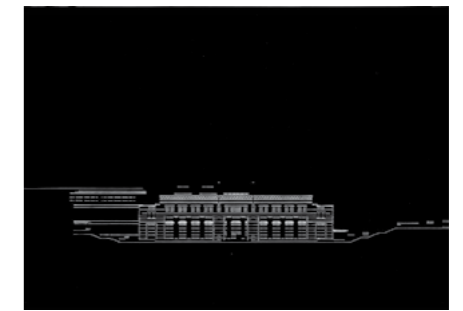
For Cecil Elliot, whether to accentuate the vertical or horizontal becomes, respectively, a question of placing greater allegiance to the magnitude of a building's function, or protecting the individuality and independence of the occupants:

*The vertical relates to the identity of a building as a total construction; the horizontals declare the building to be a layering of familiar dimensions.*<sup>101</sup>

From the numbers opposite we see that all four compositions contain a greater number of horizontal lines. Although these numbers are based on the totality of lines in the compositions, and do not differentiate between the size or visual impact of each individual line, they clearly display a stronger horizontal allegiance, as within each composition there is roughly two hundred more horizontal lines than vertical. Under Elliot's definition these drawing demonstrate the buildings "to be a layering of familiar dimensions," which places greater allegiance to the magnitude of a buildings function.<sup>102</sup> One of the main goals of Civic Square, as stated by chief architect Ian Athfield, was to create a more cohesive whole – a *collective*<sup>103</sup> - where no one building dominates. Yet, as was argued in section 2.1.6 *Points of Order*; there is a hierarchy present in the layout of Civic Square which sees the City Gallery as the dominant force in the ordering of the 1991 development. Thus this thesis sees the buildings of Civic Square as a *collection* rather than a *collective*. For John Gray, "the brick floor of the Square is the gallery floor from which we... view the building works on the walls, or rather the building works that are walls."<sup>104</sup> An interpretation of the rows of buildings as walls, as a collection of facades, is an idea which plays a significant role in the *experimental drawings* of chapter three. Particularly the composition *The Developed Surface* (section 2.3.1) which treats Civic Square as a large outdoor and presents it accordingly.



882 (4) N / N - E



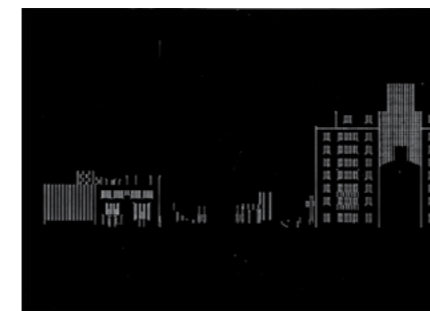
1046 (4) N / N - E



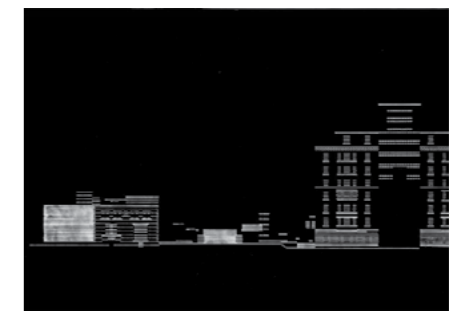
1818 (1) S / S - W



2092 (1) S / S - W



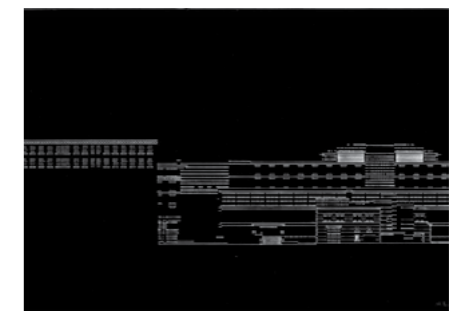
1006 (3) E / S - E



1273 (3) E / S - E



1317 (2) W / N - W



1574 (2) W / N - W

101 Cecil Elliott. (1963). The Variety of Scale. *Journal of Architectural Education*, 18(3), 37

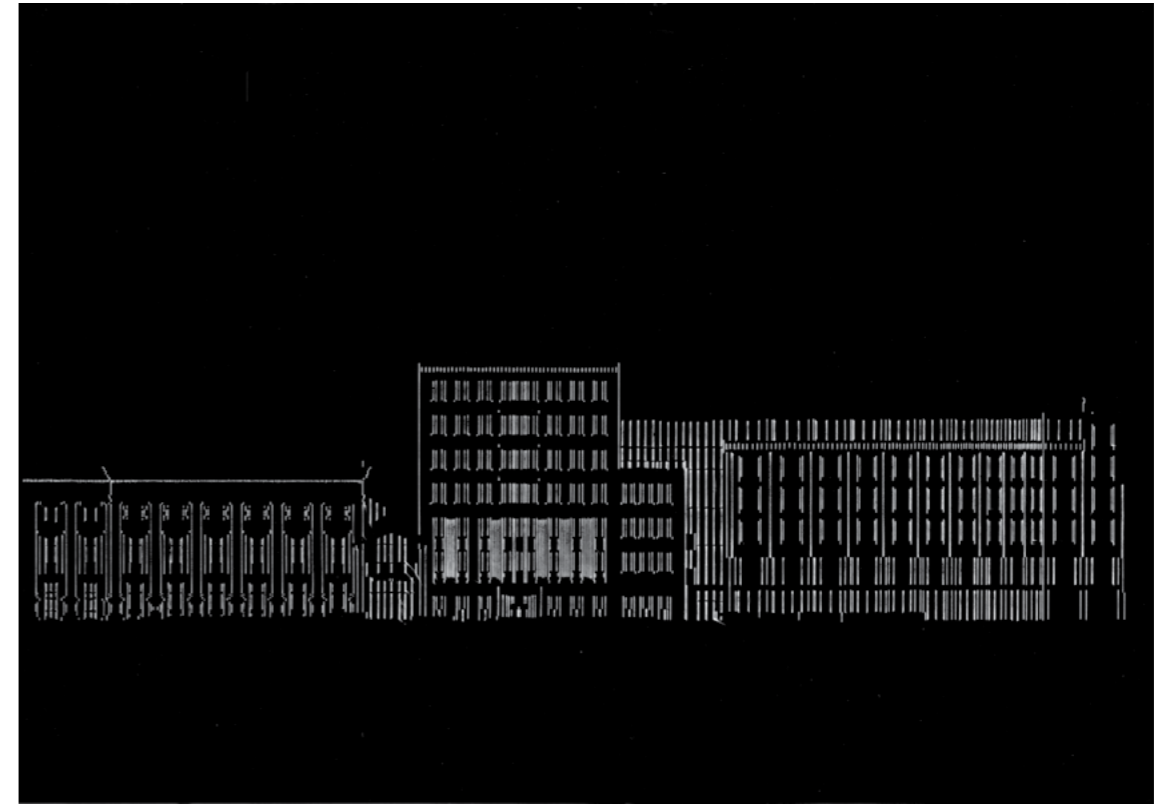
102 *ibid*

103 Ian Athfield quoted in: Millar. (1992). *A Meeting of Minds*. 44

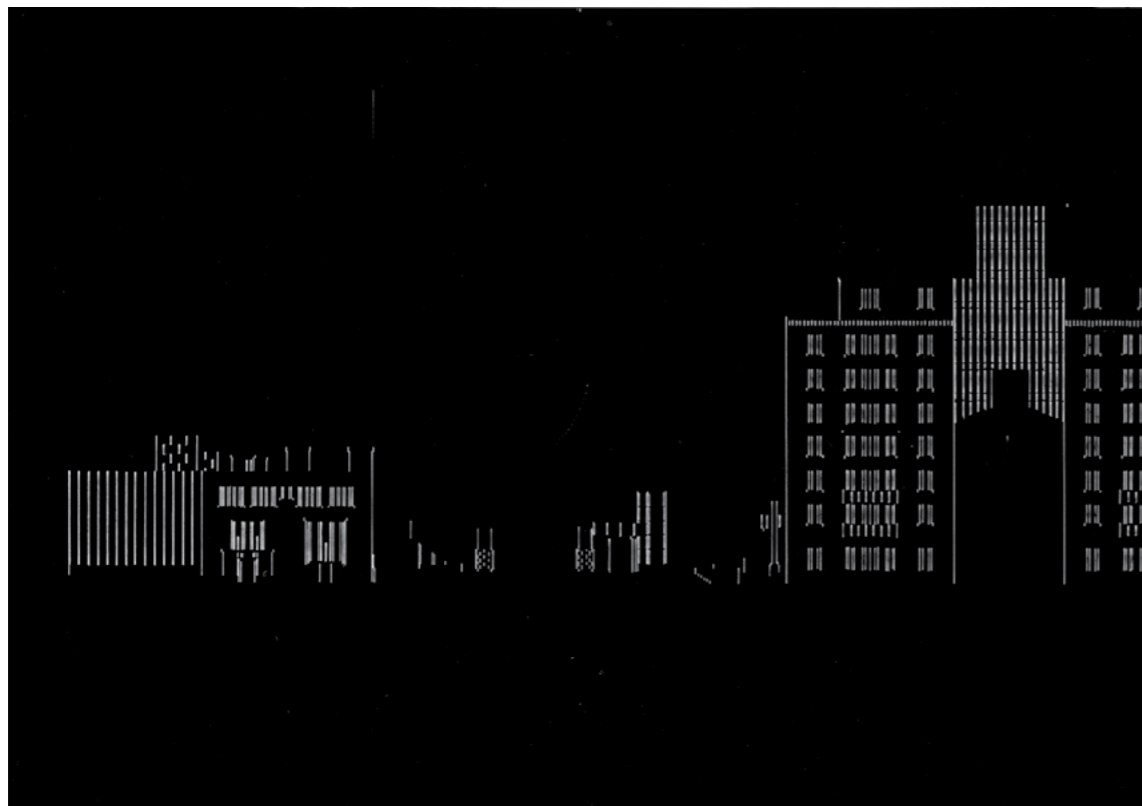
104 Gray. (1992). *Worth Waiting For*. 49



NORTH/NORTH-EAST



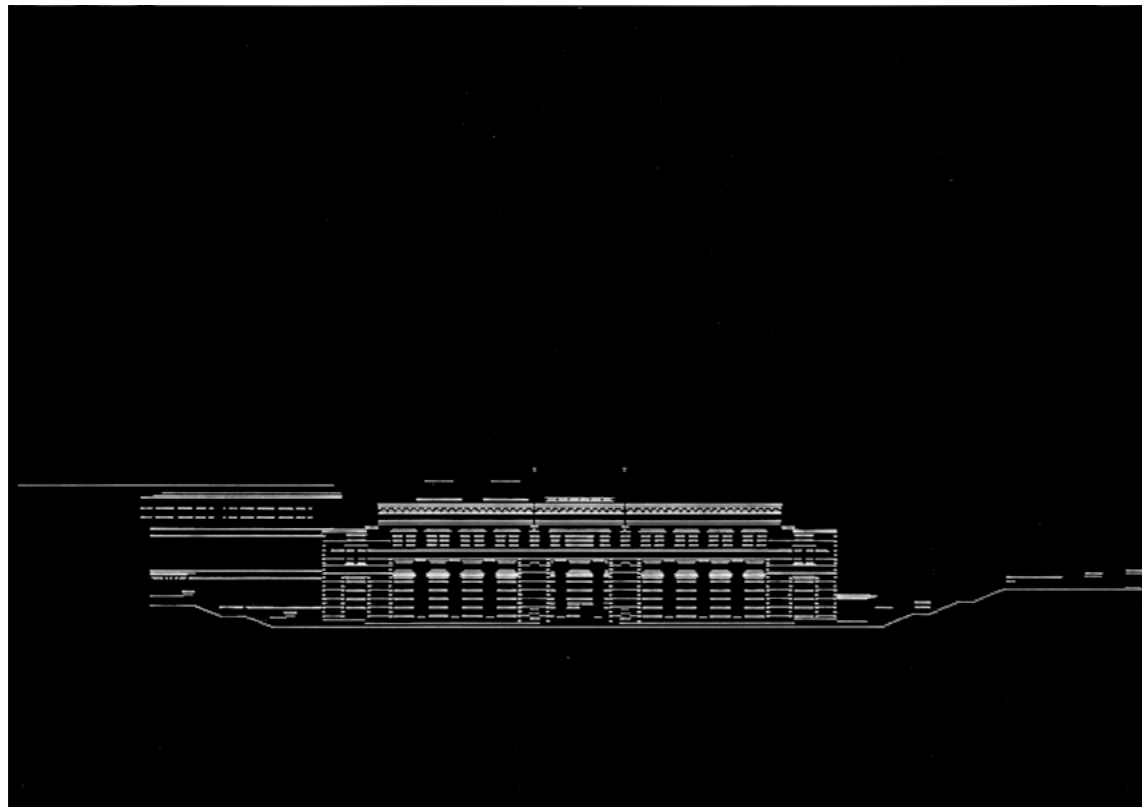
SOUTH/SOUTH-WEST



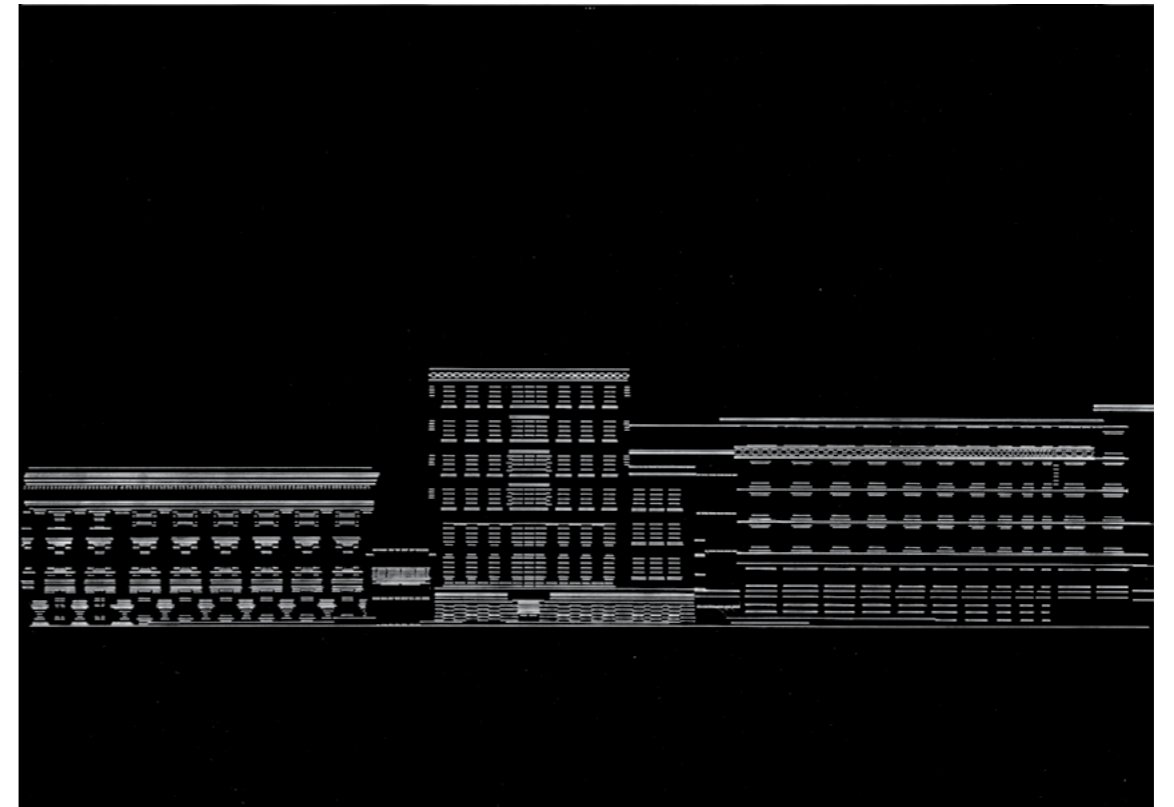
EAST/NORTH-EAST



WEST/SOUTH-WEST



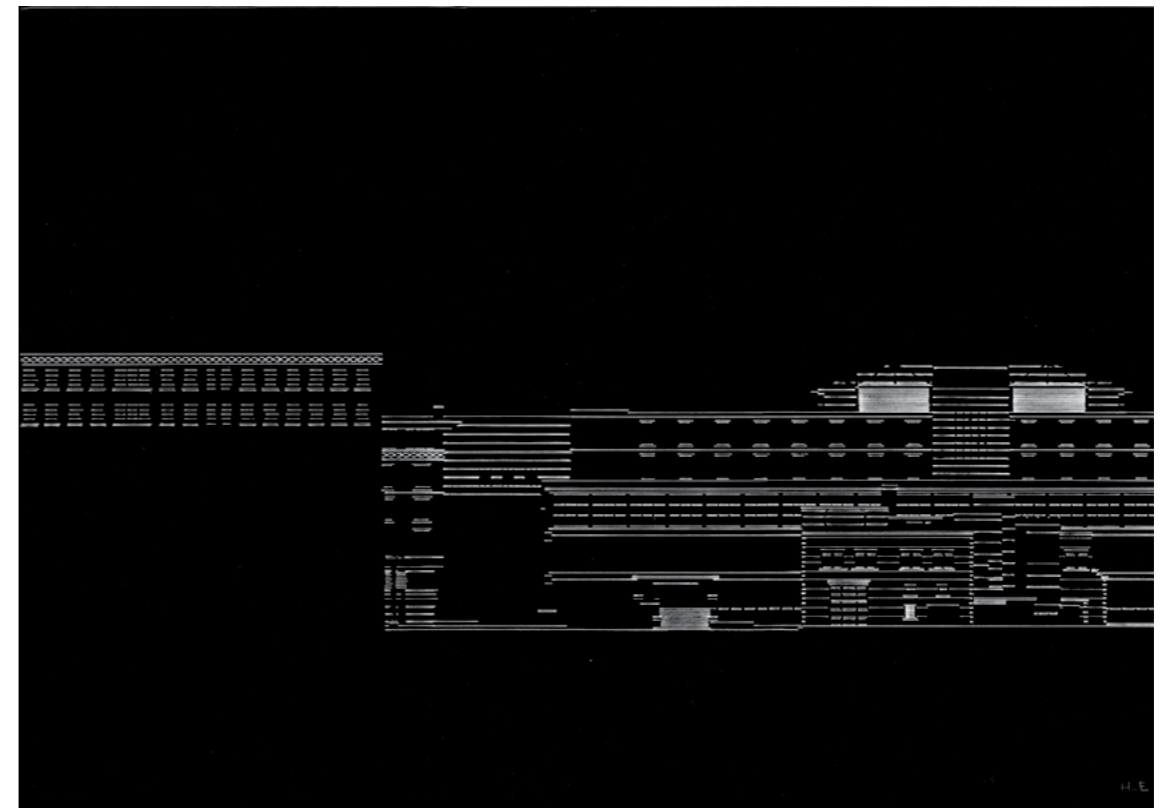
NORTH/NORTH-EAST



SOUTH/SOUTH-WEST



EAST/NORTH-EAST



WEST/SOUTH-WEST

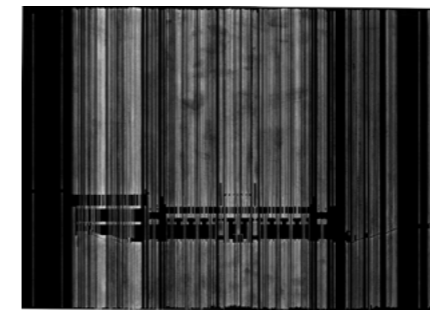
### 2.2.5 VERTICAL AND HORIZONTAL ABSENCE

These drawings concern Steenbergen's ideas of rhythm and frequency and Frascari's rules of *cosmopoiesis*: of analogy, opposition and sympathy.<sup>105</sup> Frascari sees these rules of *cosmopoiesis* as the solution to the current negative condition of architectural drawing, which treats drawing as separate to the analysis of building, and as an ancillary component to architectural theory.<sup>106</sup> These drawings are defined by absence, through a process which extends lines to the edge of the page and leaves a gap where they exist on the *reproduction drawings*. Through this process, representations concerned with rhythm and frequency are formed, while the sections themselves are visible through opposition, through the *absence* of lines.

The S/S-W section contains the greatest number of vertical lines, as expressed in the numbers opposite. This is largely attributable to all three buildings possessing small square elements along the top of their façades. Leading from left to right, these elements increase in size, conversely they decrease in size following the age of the building: City Administration Building, largest (1991), Municipal Office Building, mid (1991), and Town Hall, smallest (1904). Rudolf Arnheim's proposition relating to the natural reading of visual information from left to right being met with less resistance is again of relevance here,<sup>107</sup> as the decrease in frequency leading from left to right aids the natural reading of this section from left to right.

Furthermore, something not present in this line count, which was in the preceding series, is a consistent relationship between the number of verticals and horizontals in each respective section. W/N-W is the only composition wherein the vertical and horizontal numbers align at second place (V348\_H116), while the E/S-E composition has the least number of vertical lines, but the greatest number of horizontals. The differences between the line counts themselves, practically the horizontal column, suggests that the counts are more or less indicative of horizontal complexity, at least in their relationship to one another. The vertical drawings of this group become the main driver in the *experimental drawing Civic Rhythm* (section 2.3.2). This composition utilizes the representation of rhythm to test the notion of the four sections as two openings and two impenetrable walls by drawing all vertical lines into the centre of a circle to present the vertical rhythm and frequency of each section simultaneously.

The following series of *experimental drawings* combine the *visible* orders and relationships observed through the *reproduction drawings* with the *invisible* or hidden orders and relationship observed in this series of drawings. This series of drawings recombines and re-contextualises all the images from the first two series to form the third and final overlapping relationship of Frascari's *technological image*. The following section begins with Steenbergen's definition of *experimental drawings*. Following this it outlines how this third series will embody Frascari's third overlapping relationship, and the role and treatment of orthographic projection in this series of drawings.



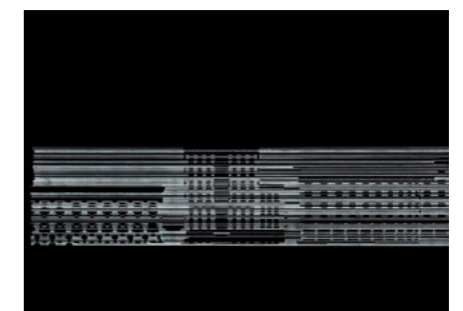
3 1 9 (3) N / N - E



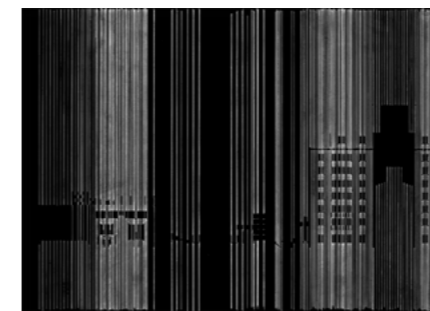
5 6 (4) N / N - E



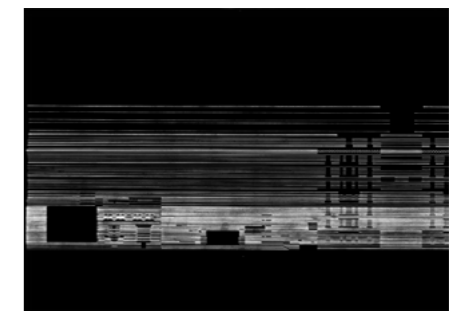
4 3 8 (1) S / S - W



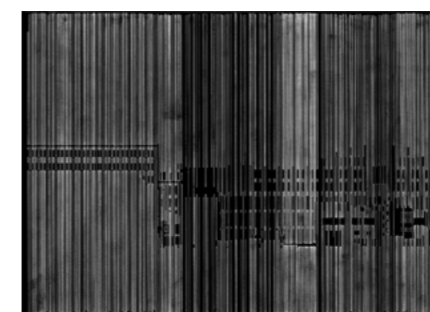
1 0 2 (3) S / S - W



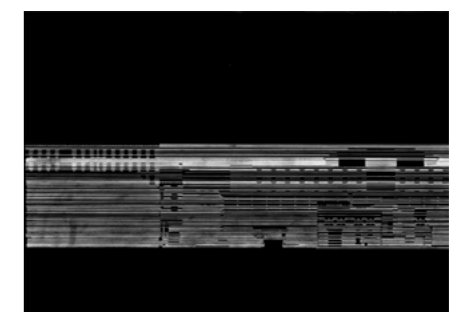
2 2 9 (4) E / S - E



1 4 3 (1) E / S - E



3 4 6 (2) W / N - W



1 1 6 (2) W / N - W

105 Frascari. (2007). *From Models to Drawings: Imagination and Representation in Architecture*. 5

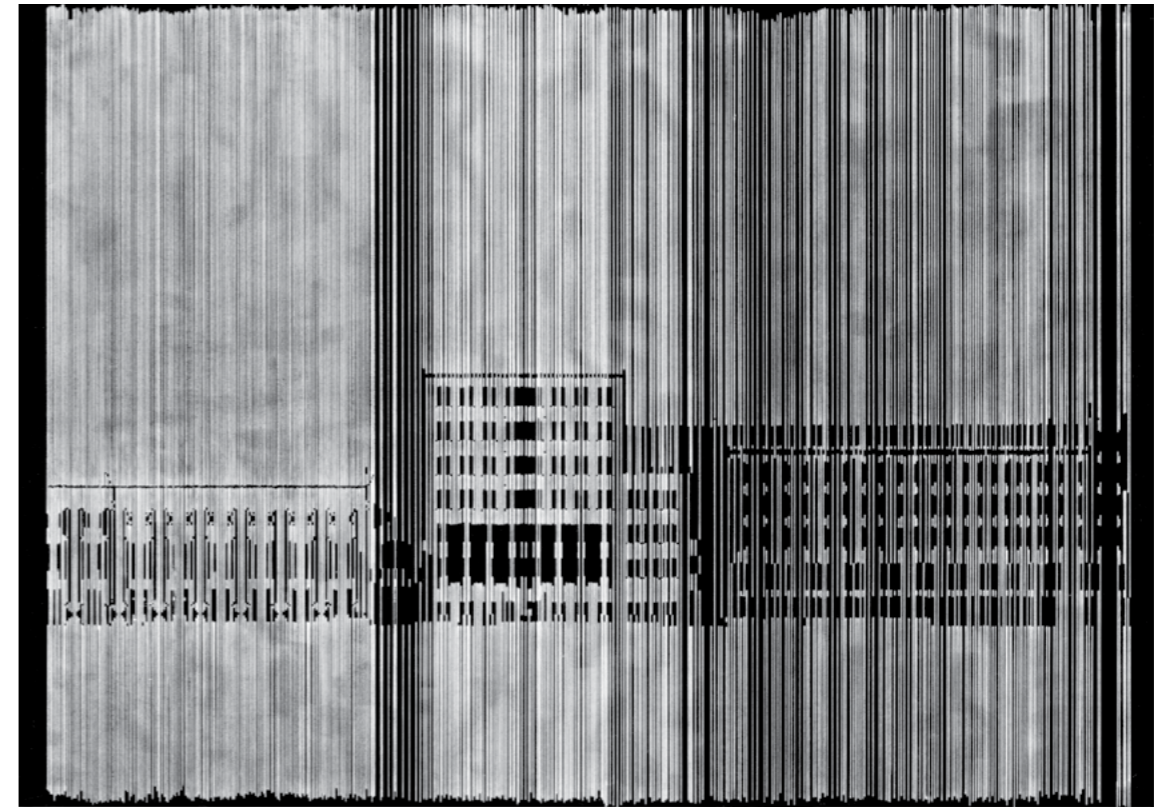
106 *ibid*

107 Arnheim. (1974). *Art and Visual Perception: A Psychology of the Creative Eye*.

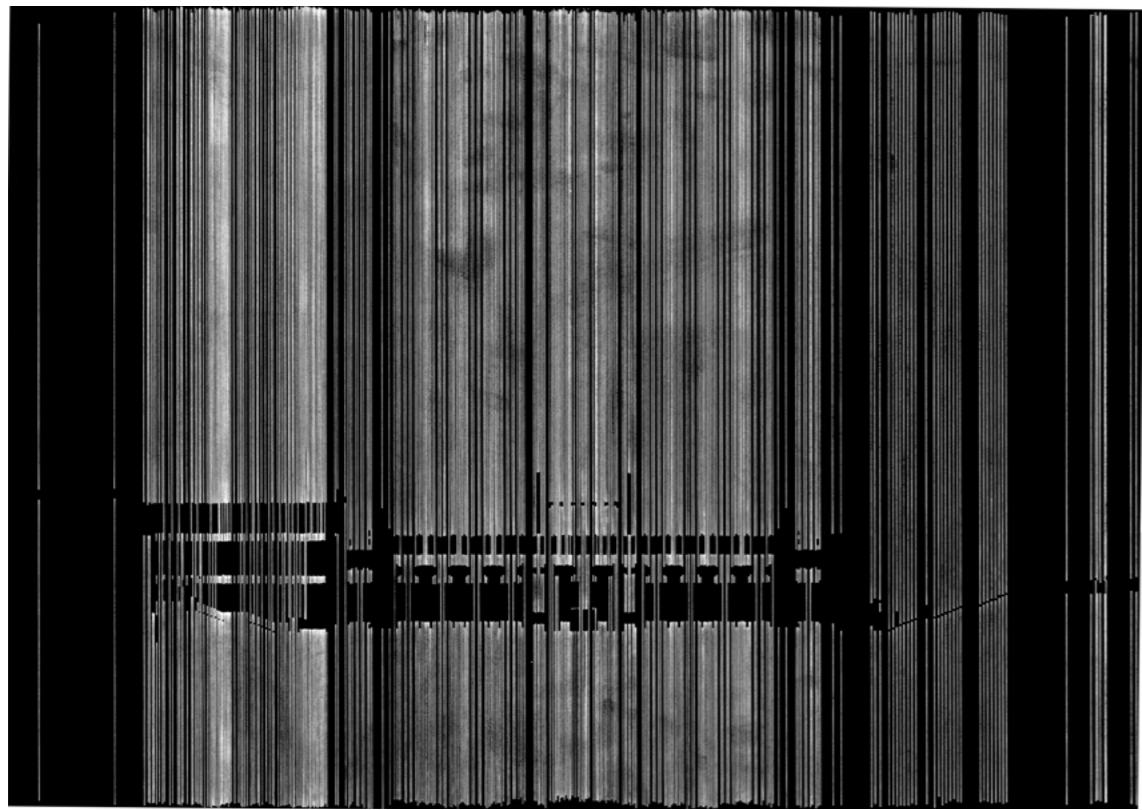




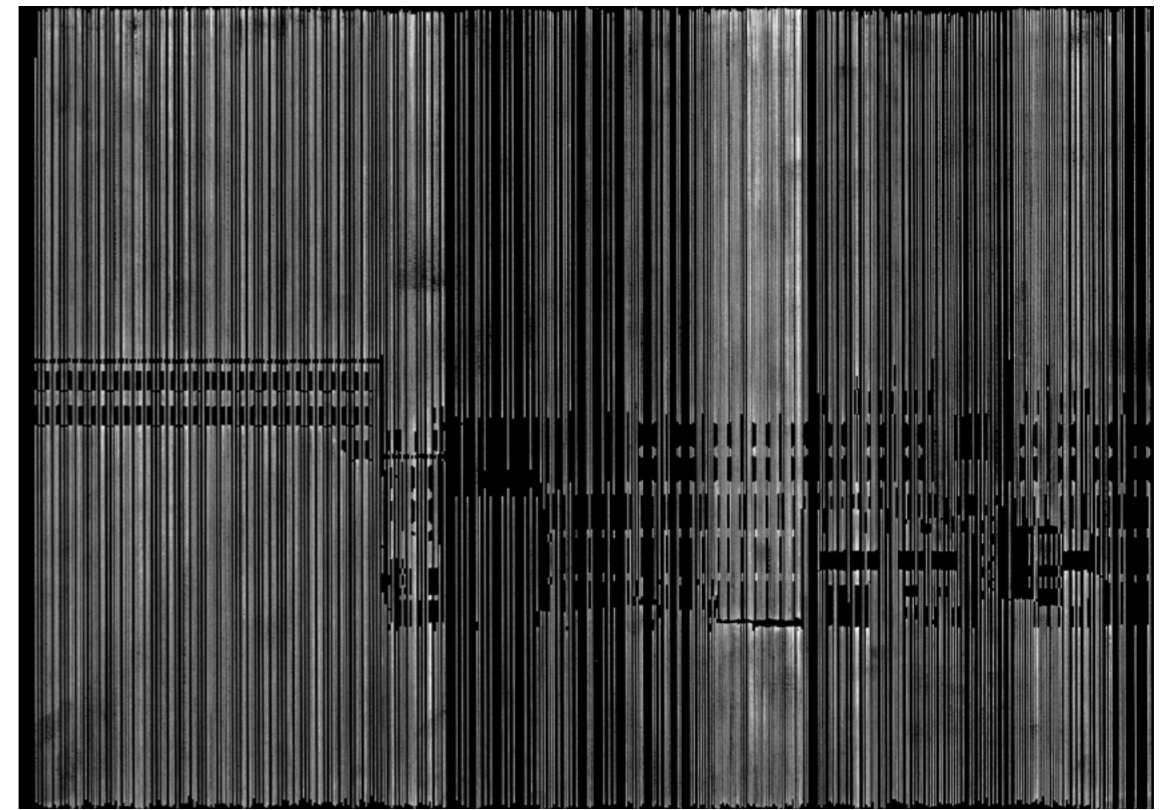
NORTH/NORTH-EAST



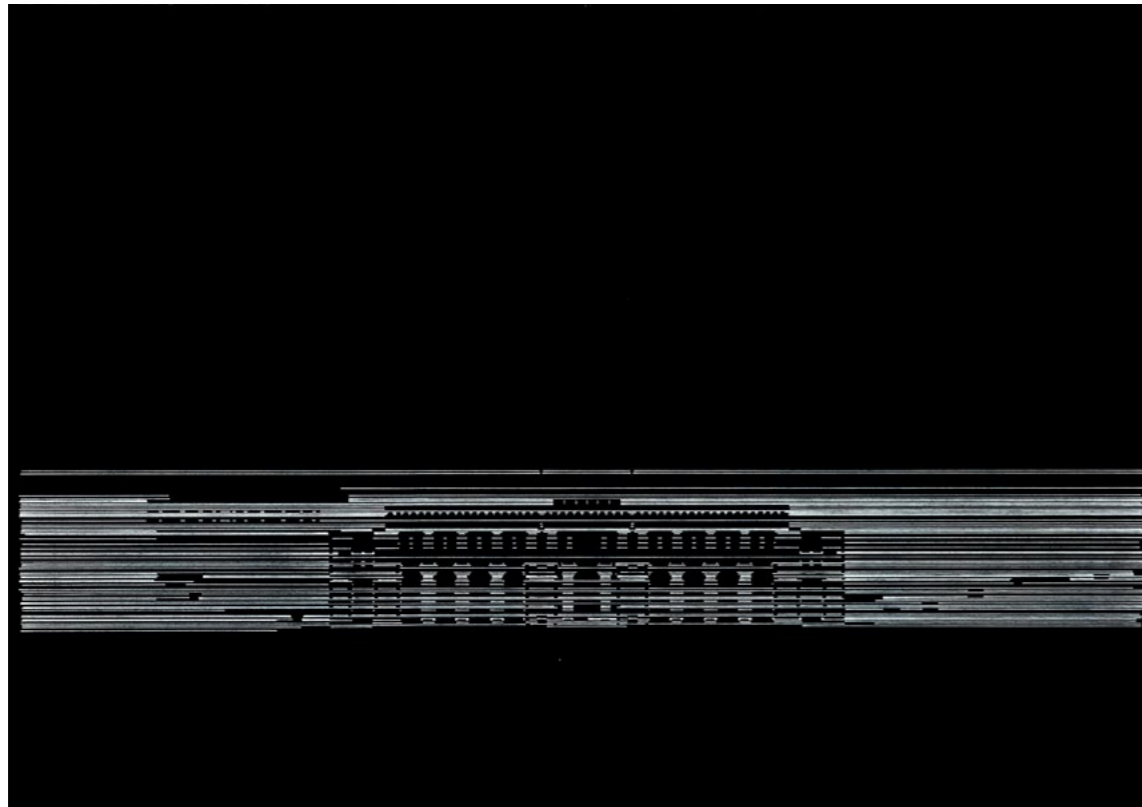
SOUTH/SOUTH-WEST



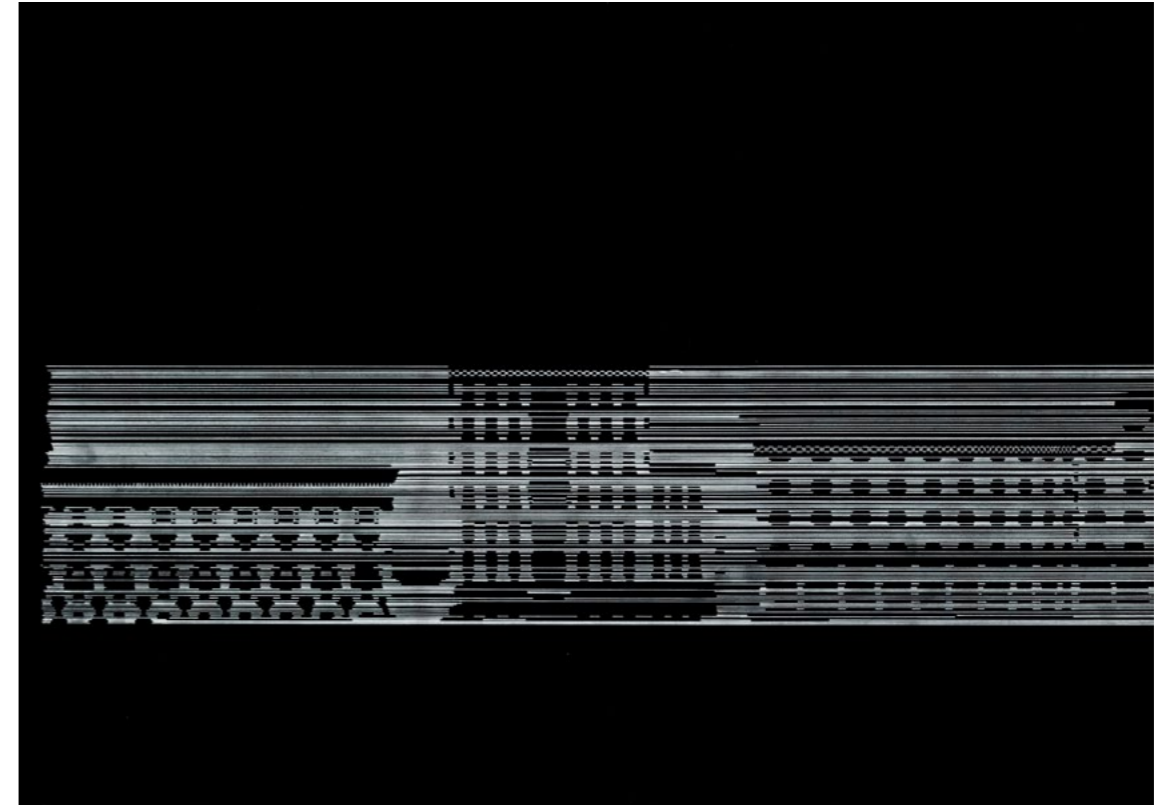
EAST/NORTH-EAST



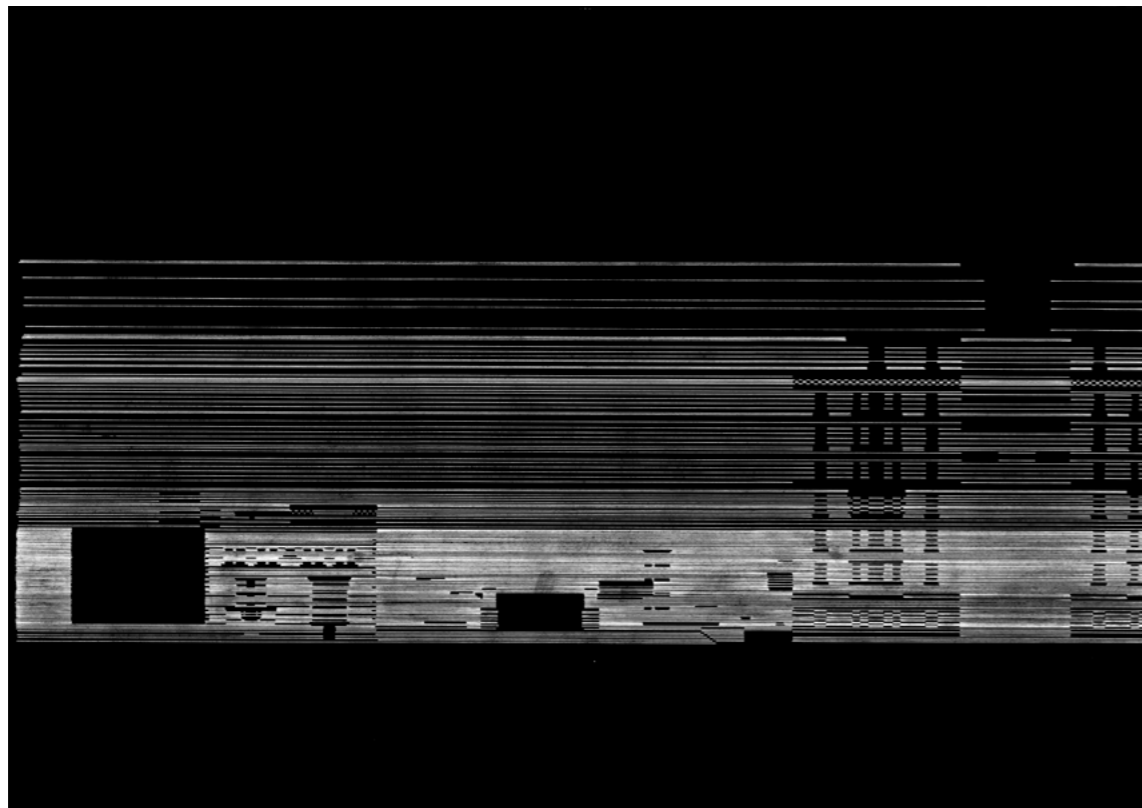
WEST/SOUTH-WEST



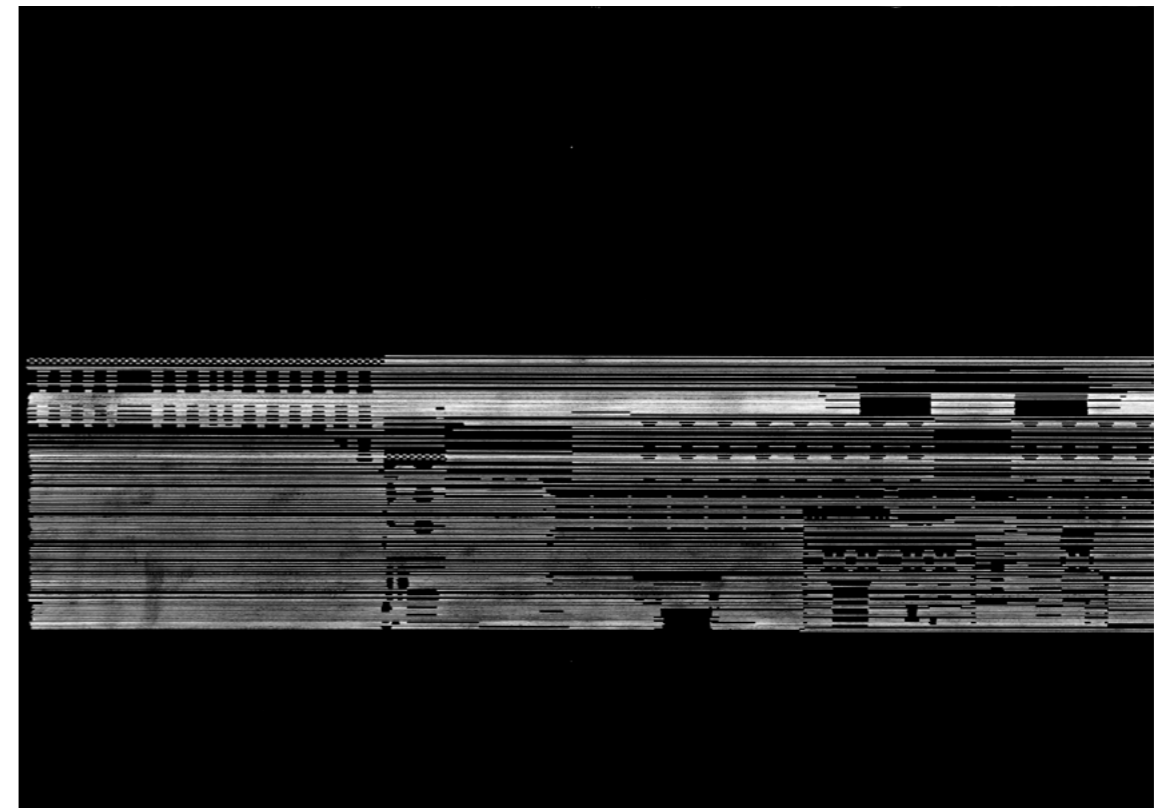
NORTH/NORTH-EAST



SOUTH/SOUTH-WEST



EAST/NORTH-EAST



WEST/SOUTH-WEST

### (3) EXPERIMENTAL DRAWINGS

#### 2.3.0 INTRODUCTION

This section uses *Reproduction Drawings* to test Marco Frascari's theory of *technological images*, as set within Clemens Steenbergen's critical framework. The two theories are strategically integrated as a means of critically examining how orthographic projection can facilitate architects' ability to elaborate the imaginary. An observation made by Frascari concerning a dualism in the process of architectural drawing is presented. It is proposed that this dualism aligns with Steenbergen's definitions of *reproduction* and *analytical drawings*. Thom Mayne's drawing for the *Sixth Street House* is discussed to further define the methods used to form this series of *experimental drawings*. Concluding this section is a description of the structure of presentation and the form of analysis undertaken in the reading of this final series of *experimental drawings*.

This series of drawings orientates Marco Frascari's third overlapping relationship of a *technological image* (between the instrumental image and its symbolic image),<sup>108</sup> within Clemens Steenbergen's third series of drawings (*experimental drawings*) from his framework of *architectural drawing as research*.<sup>109</sup> Steenbergen's *experimental drawings* are used here to embody Frascari's third overlapping relationship, which constitutes a *technological image*. Following Steenbergen's definition, these *experimental drawings* combine the first series of *reproduction drawings* and the second series of *analytical drawings*. By doing this, Steenbergen proposes that *experimental drawings* play the role of the hypothesis or challenge to concepts or reading formed through the preceding two series.<sup>110</sup> These drawings project the various images, layers, and information contained in the *reproduction* and *analytical drawings* into an existing context to form new compositions. In a process of re-combining and re-contextualizing the first two series the effects of interventions are assessed and adapted, ultimately leading to the conformation of existing, or the formation of new, concepts. For Steenbergen, drawings of this nature allow the designer to investigate possibilities for change in both the pre-existing readings of site and concepts expressed in the drawings themselves.<sup>111</sup>

*Every drawing serves as a hypothesis that lays bare a stream of thought and moves it further...*<sup>112</sup>

108 Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 100

109 Steenbergen. (2002). *The Power of Drawing*. 158

110 *ibid* 159

111 *ibid*

112 *ibid*

Following Frascari's theory of *technological images* this third series is the combination of a *techne* of *logos* (instrumental representation) orientated in a *logos of techne* (symbolic representation), based in the productive and poetic outcomes of Giambattista Vico's *imaginative universals*.<sup>113</sup> The *experimental drawings* are *technological images* which re-combine and re-contextualise the *reproduction* and *analytical drawings* to form new compositions. These drawings no longer search for a visual likeness as the basis of relating buildings and architectural conceptions, rather as Frascari proposes, represent these relationship through a *mutual measure* derived from a *familiar nature*.<sup>114</sup> These drawings demonstrate how orthographic projection is an effective means for the elaboration and representation of imaginary architectural conceptions and relationships. Frascari proposes in his 1991 book, *Monsters of Architecture* that within the theory of *technological images* an author acts out a dualism, which can be seen to align with Steenbergen's definition of *reproduction* and *analytical drawings*. Frascari terms this dualism a *Janus-like presence*.<sup>115</sup>

- 1). Observing the physical world of human construction (*reproduction drawings*)

*...takes place between the site of a construction and its visualization on the drawing board of an architectural survey.*

- 2). Observing a hypothetical and internal world of envisioning (*analytical drawings*)

*...takes place on the drawing board where the architect is expressing diagrams and graphic constructions of their own.*<sup>116</sup>

For Frascari this dualism equates to a *technological image*, which is the synthesis of theory and practice whereby choices made in the drawing, stemming from theory, can be *demonstrated*.<sup>117</sup> These following *experimental drawings* aim to demonstrate the readings made of Civic Square in the *reproduction* and *analytical drawings* through graphic compositions. The choices made in these drawings act to reinforce or expand upon the conceptual connections and symbolic relationships formed previously, in order to elaborate the imaginary through architectural drawings based in orthographic projection.

113 Vico. (1984). *The New Science of Giambattista Vico*

114 Frascari. (2009). *Splendor and Miseries of Architectural Construction Drawings*. 110

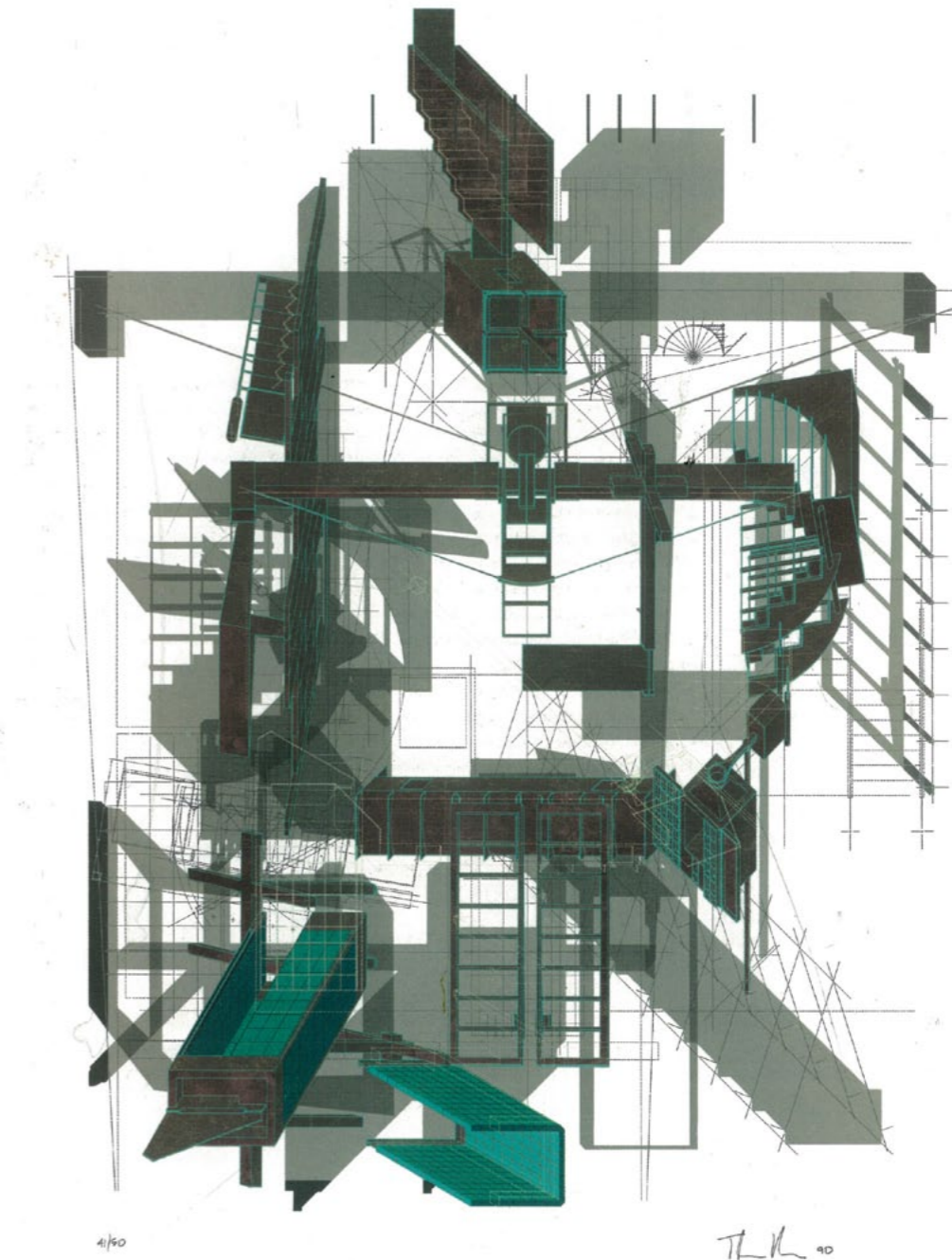
115 Frascari. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. 91

116 *ibid*

117 *ibid*

Thom Mayne's drawing for the *Sixth Street House* can be seen to follow a similar method to the *experimental drawings* of this series. Although not strictly a *technological image*, or an *experimental drawing* following Steenbergen's three-stage approach, it is nevertheless similar in both intention and execution to the following *experimental drawings*. Mayne's drawing consists of layering eleven 1:24 details of found machinery parts upon a 1:16 plan and elevation of an existing house (Fig 2.3). According to Tina de Carlo, Mayne reworks these parts into function elements in a single composition through "juxtapositions of scale, obliquity, projection, and rotation, challenging the historical view of drawing a passive medium at the service of architecture."<sup>118</sup> This drawing, Mayne claims, "would bring invention to the site" and have "the capacity to embody in built form an imagined prehistory of a place, and a contemporary archaeology of past and future, and its subsequent transmission across time"<sup>119</sup> By projecting orthographic and parallel based projection's into an existing context, as a means of progressing and discovering an architectural design, Mayne demonstrates how 'technical' projections can lead to the discovery of imaginative architectural forms and ideas.

The following *experimental drawings* are each presented in three forms. As an introduction to each composition, all *reproduction* and *analytical drawings* used to form it are displayed as a catalogue. Following this, each composition is discussed and analysed alongside fragments of the larger image, and finally each *experimental drawing* is presented in its entirety. Section 2.3.1 *The Developed Surface* tests the notion of Civic Square's rows of buildings as *walls*, following an eighteenth century drawing technique of interiors as outlined by Robin Evans. This composition forces a discussion concerning the change in meaning and reading of orthographic drawings when they are represented in an altered form. The composition of this *imaginative* representation of Civic Square is based in the ideas and readings developed in the *reproduction* and *analytical drawings*. Section 2.3.2 *Civic Rhythm* examines the idea of vertical rhythm present in Civic Square. It combines the *reproduction site plan* with the information contained in the *Vertical Absence experimental drawings* to form a composition that represents the vertical rhythm and frequency of all four sections simultaneously. This composition is used to test and reinforce the notions of the N-N/E and S-S/W sections as two solid *walls*, and the E/S-E and W-N/W sections as two *openings* facilitating the west-east path through the site. Section 2.3.3 *Vertical Reconstruction* concerns an imaginative re-representation of the N/N-E and S/S-W sections through means of rotation and accumulation. This composition is driven by notions of the vertical city and the horizontal sea, formed in *Base Geometries* (section 2.2.1) and *Vertical and Horizontal Absence* (section 2.2.5). Section 2.3.4 *Projection of Fragments* takes a series of architectural fragments from the *reproduction drawings*. These fragments are then placed upon a circular grid in order to demonstrate and represent the relationships and conceptual connections between the buildings of Civic Square formed in the *reproduction* and *analytical drawings*. The composition theory of Rudolf Arnheim is discussed here to reinforce the compositional decisions made, and their meaning. Section 2.3.5 *Mirrored Network* forms a representation of the S-S/W section to investigate what the relationship between symmetry and asymmetry present in site offers to our understanding of Civic Square and its buildings.

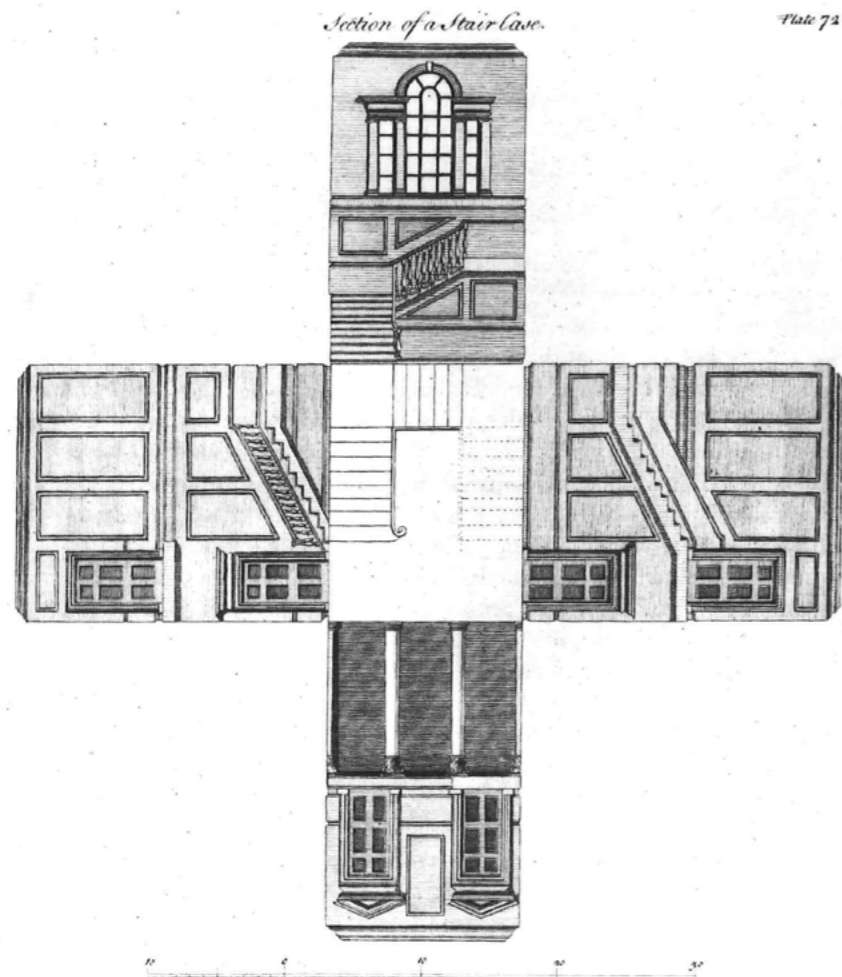


3.3 Thom Mayne. (1975). Sixth Street House.  
Source: Tina di Carlo. (2003). Thom Mayne. In M. McQuaid (Ed.), *Envisioning Architecture: Drawings from the Museum of Modern Art* (pp. 238-239). New York: Museum of Modern Art. 238

118 Tina di Carlo. (2003). Thom Mayne. In M. McQuaid (Ed.), *Envisioning Architecture: Drawings from the Museum of Modern Art* (pp. 238-239). New York: Museum of Modern Art. 238

119 Thom Mayne quoted in: *ibid* 238

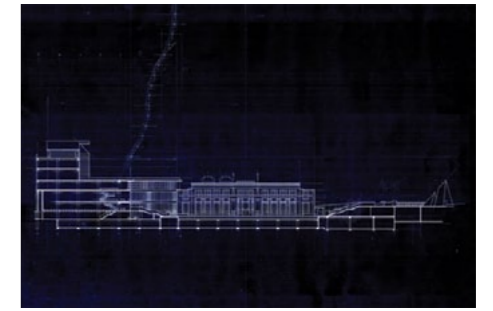
### 2.3.1 THE DEVELOPED SURFACE



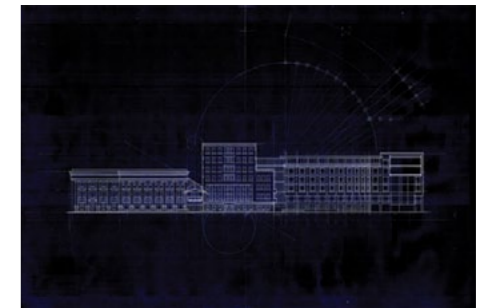
3.5 Thomas Lightoler. (1757). Section for a Stair Hall.  
Source: Robin Evans. (1989). *The Developed Surface: An Enquiry into the Brief Life of an Eighteenth Century Drawing Technique*. 9H(8), 126



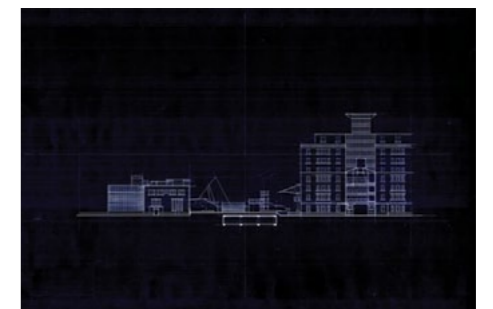
SITE PLAN



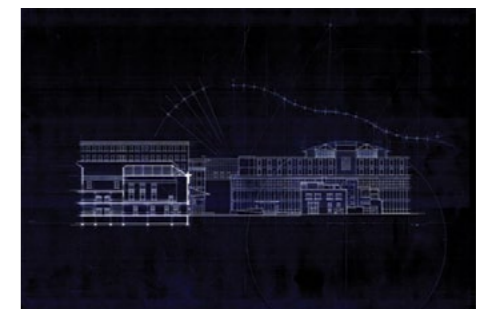
N/N-E



S/S-W



E/S-E



W/N-E

This drawing tests the notion of Civic Square's rows of buildings as *walls*, following an eighteenth century drawing technique of interiors as outlined by Robin Evans. This composition leads to a discussion of the change in understanding of orthographic drawings when represented in an altered form. The composition of this *imaginative* representation of Civic Square is based in the ideas and readings developed in the *reproduction* and *analytical drawings*. For John Gray, Civic Square is a large outdoor room, with rows of buildings that are conceptually viewable as *walls*.<sup>120</sup> This drawing takes this reading of Civic Square and re-presents it through an eighteenth century drawing technique of interiors. Beginning in the mid-eighteenth century a new way of representing interiors, *the developed surface*, was found for a brief period more frequently in design drawings and pattern books.<sup>121</sup> Thomas Lightoler's drawing (1775) (Fig 2.4) shows the plan in the centre of four elevations "folded from their upright position and flattened into the same plane as the plan."<sup>122</sup> For Evans, through this process of representing five discontinuous planes on one single plane an illustration becomes completely hermetic, "allowing nothing of the outside to be shown."<sup>123</sup> The relevance of this technique in relation to orthographic projection lies in the fact that a simple reordering of existing information nevertheless provokes an alteration in sense, which is an alternation in understanding:

*A geometric figure works differently in different situations. It is not like a gene, something that always carries the same message, always producing the same results. It does not, that is, have a meaning independent of the circumstances of its employment.*<sup>124</sup>

Through this re-representation Civic Square's four rows of buildings become four *walls* folded flat around the site plan. This opens up the site to a new analysis, through which we witness the N/N-E and S/S-W *walls* as solid barriers and the E/S-E and W/N-W as comparatively open, reinforcing the notion of an open path leading us from west to east, from city to sea. Of the two *walls* framing this path, the first, the N/N-E section, presents itself as a solid and impenetrable *wall* dividing the Square from other Civic buildings to the north: the Police Station, the Supreme Court, and Parliament, through the full symmetrical extension of the neoclassical City Gallery. The second, the S/S-W section, is composed of a series of buildings asymmetrical in their undulating heights and complexities. The centremost building in this section, the Municipal Office Building, is abutted on both sides by glass entrances, the west-most of which penetrates directly through to the street on the other side of the building. Although this *wall* is not of a single uniform extension, as is the N/N-E, it remains a solid visual barrier and physical boundary to west-east movement through its greater sizes and heights.

As the *reproduction* sections extend further than the centre paved rectangle the four sections overlap and confront their two perpendicular sections at each corner (1-4). It is at these overlapping corners that what is plan, what is one section, and what is the other becomes ambiguous. No longer easily discernable as the single representations of the *reproduction drawings*, the corners are tightly knitted and complex. At these corners the sectional views of structural systems and exterior elevations confront one another and obscure their own reading as either vertical or horizontal in relation to their respective baselines. The complexity of these corners suggests that reaching the other side of these *walls* is not a matter of circumnavigating them; rather paths must be found which penetrate through. This reinforces the strength of the path leading from west to east - from between the large arch connecting the City Administration Building and the Public Library - and up and out of the Square through the steps of the City to Sea Bridge. The following composition, *Civic Rhythm* investigates the nature of these *walls* and west-east path through the representation of vertical rhythm.

120 Gray. (1992). *Worth Waiting For*. 49

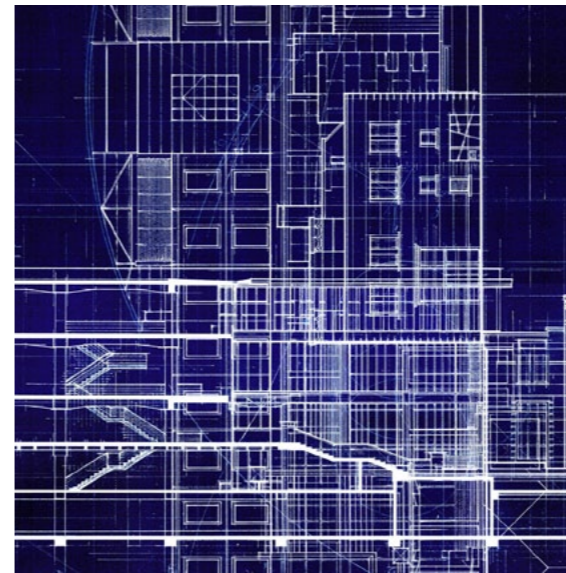
121 *In descriptive geometry folding out the adjacent surfaces of a three dimensional body so that all faces can be seen on a single sheet of paper is called a developed surface.* (Robin Evans. (1989). *The Developed Surface: An Enquiry into the Brief Life of an Eighteenth Century Drawing Technique*. 9H(8), 126)

122 Evans. (1989). *Architectural Projection*. 126

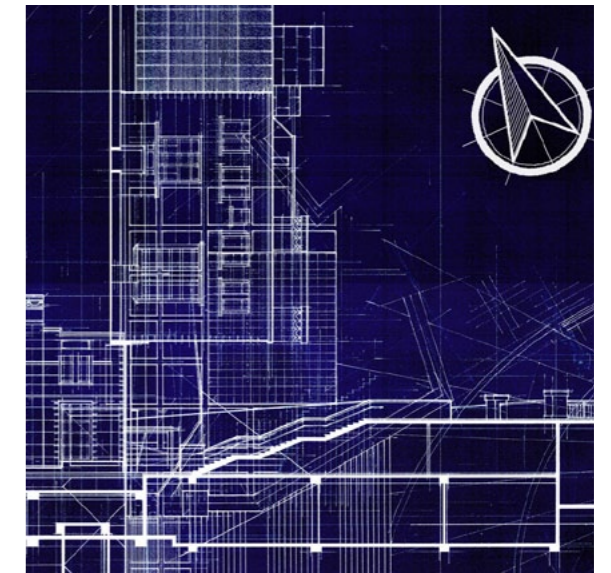
123 *ibid*

124 *ibid* 139

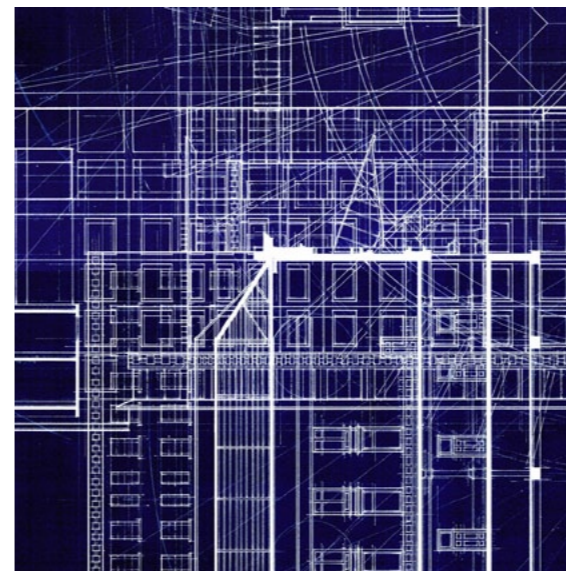
ONE



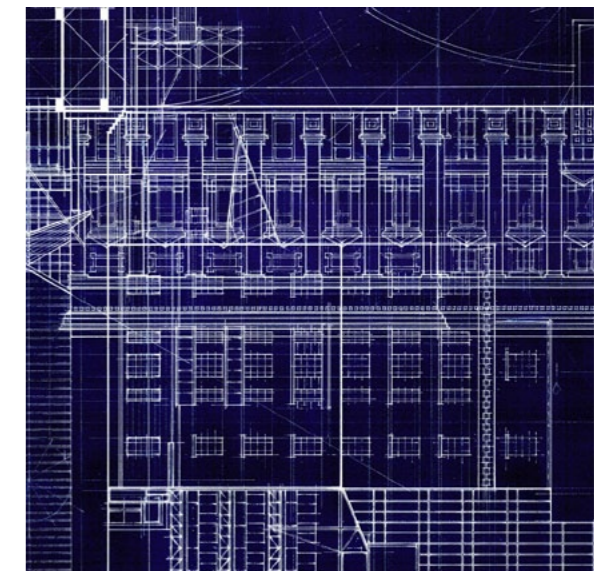
TWO



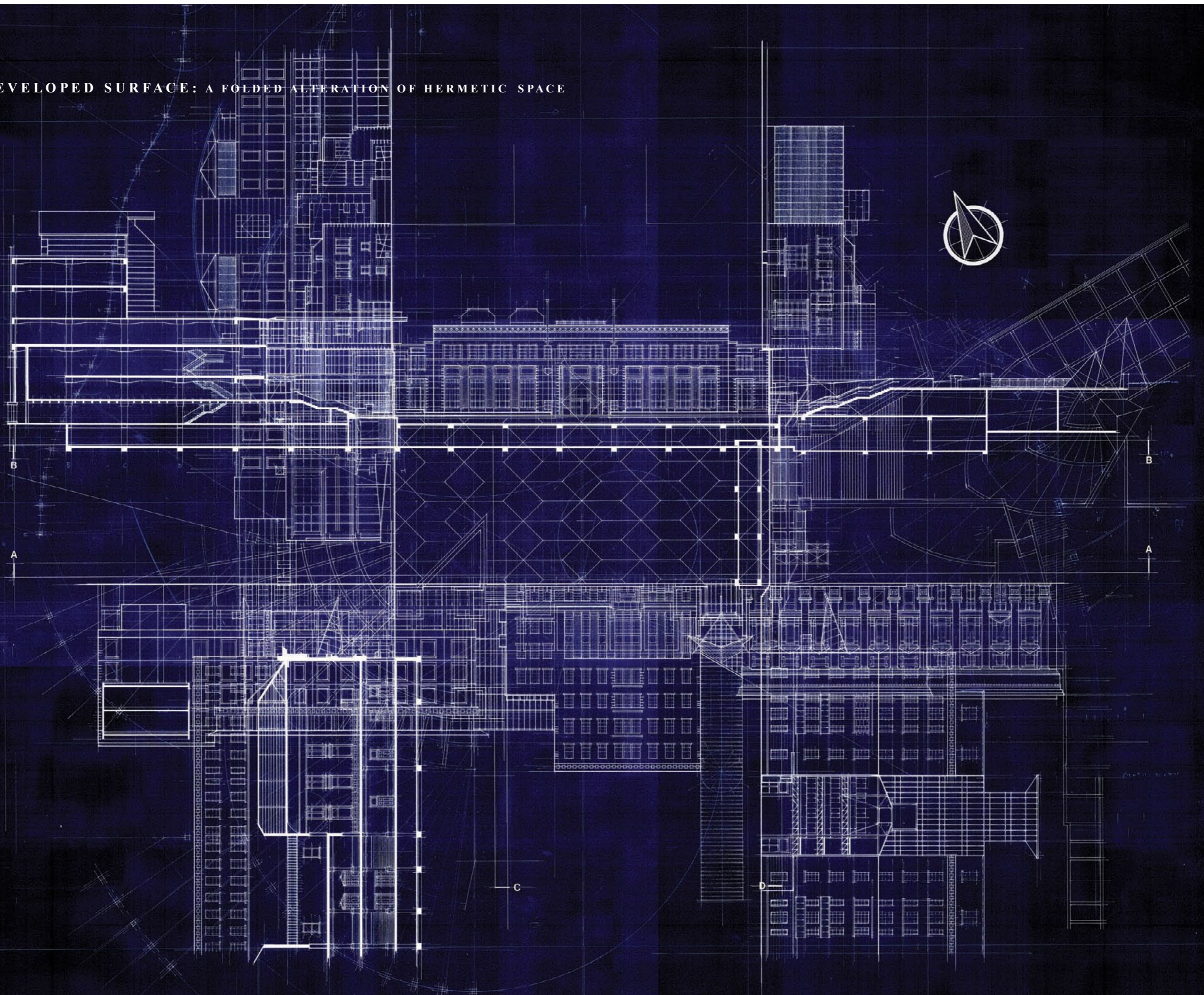
THREE



FOUR



THE DEVELOPED SURFACE: A FOLDED ALTERATION OF HERMETIC SPACE



B

A

B

A

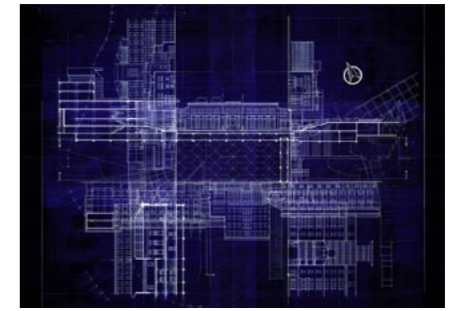
C

D

2.3.2 CIVIC RHYTHM



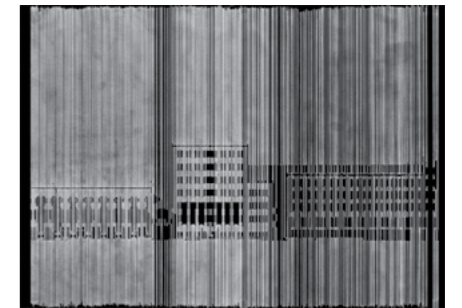
SITE PLAN



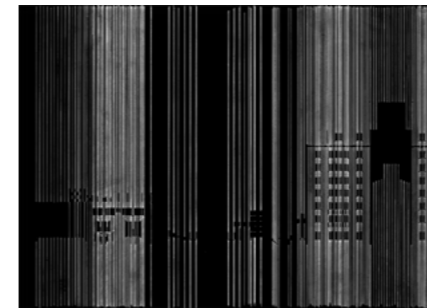
DEVELOPED SURFACE



N/N-E V\_ABSENCE



S-S/W V\_ABSENCE



E/S-E V\_ABSENCE



W/N-W V\_ABSENCE



DEVELOPED SURFACE  
V\_ABSENCE

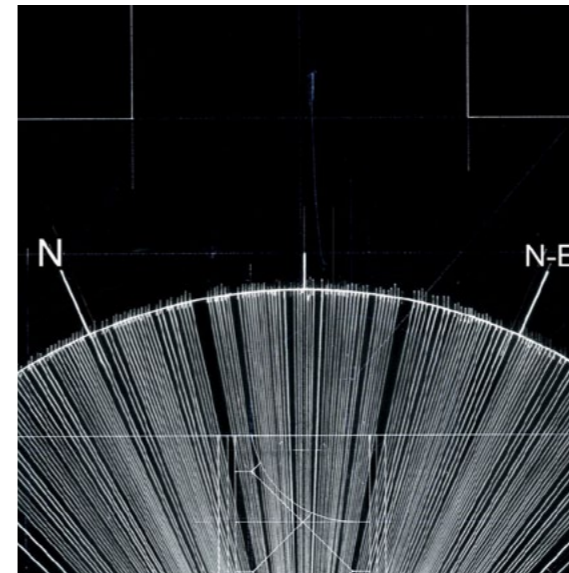


This composition concerns the vertical rhythm of Civic Square. It combines the *reproduction site plan* with the information contained in the *Vertical Absence experimental drawings* to form a composition that represents the vertical rhythm and frequency of all four sections simultaneously. This composition is used to test and reinforce the notions of the N-N/E and S-S/W sections as two solid *walls*, and the E/S-E and W-N/W sections as two *openings* facilitating the west-east path through the site. Following Steenbergen's definition of *experimental drawings*, this composition threatens the relationship between the buildings and sections of Civic Square as purely *rhythmic*. This drawing takes a slightly different approach to the preceding experimental drawings, as it uses the *information* contained in the *analytical drawings* and applies it to the *reproduction site plan* to form a new composition, rather than recombining the layers intact.

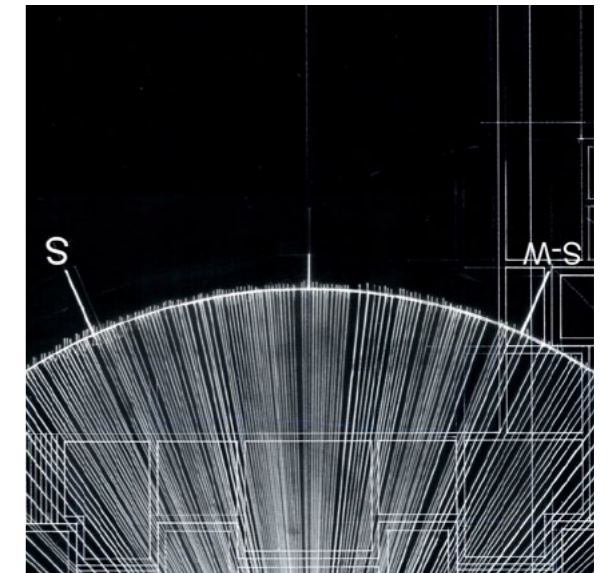
This composition begins with the *Developed Surface* arrangement of plan and sections. The *Vertical Absence analytical drawings* (section 2.1.5) are laid over their respective sections, presenting the complexity and distribution of the vertical lines of the four *reproduction drawings* in relation to their position on the plan of Civic Square. A circle is inscribed from the centre point, whose circumference touches the corners of the rectangular paved area. The vertical lines of the *analytical drawings* are marked on the circumference of this circle and drawn inward to touch the centrepoint, representing the *vertical rhythm* of all four sections simultaneously in plan, contained within a compass presenting the rhythm of Civic Square as thoroughly directional.

This process reinforces the observations made in the *Developed Surface*: the symmetry of the N/N-E (1), the equally complex but asymmetrical S/S-W (2), and the relatively simplistic W/N-W (3) and E/S-E (4), the latter of which contains the largest break in rhythm caused by the steps leading to the City to Sea Bridge. As this break is the biggest and most visually open pathway through Civic Square, it reinforces the notion of decreased density of the waterfront's urban environment in relation to the CBD. Fundamentally, these are notions of the vertical city and the horizontal sea. This acts as the main driver for the following *experimental drawing*, which re-presents the N-N/E and S-S/W section through means of rotation and accumulation dictated by this relationship between vertical and horizontal.

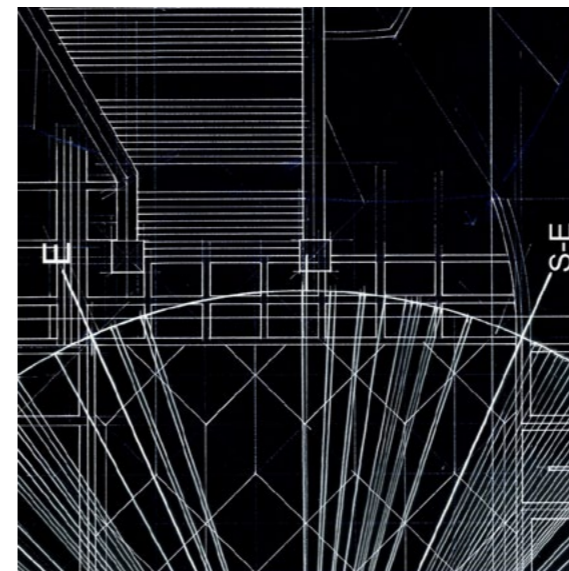
ONE



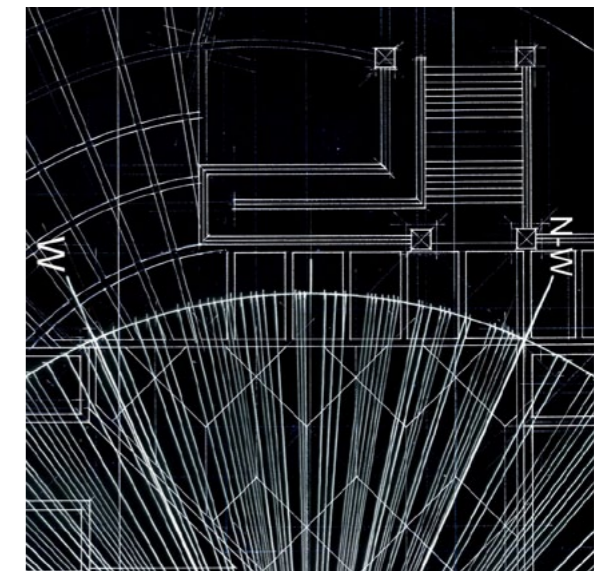
TWO



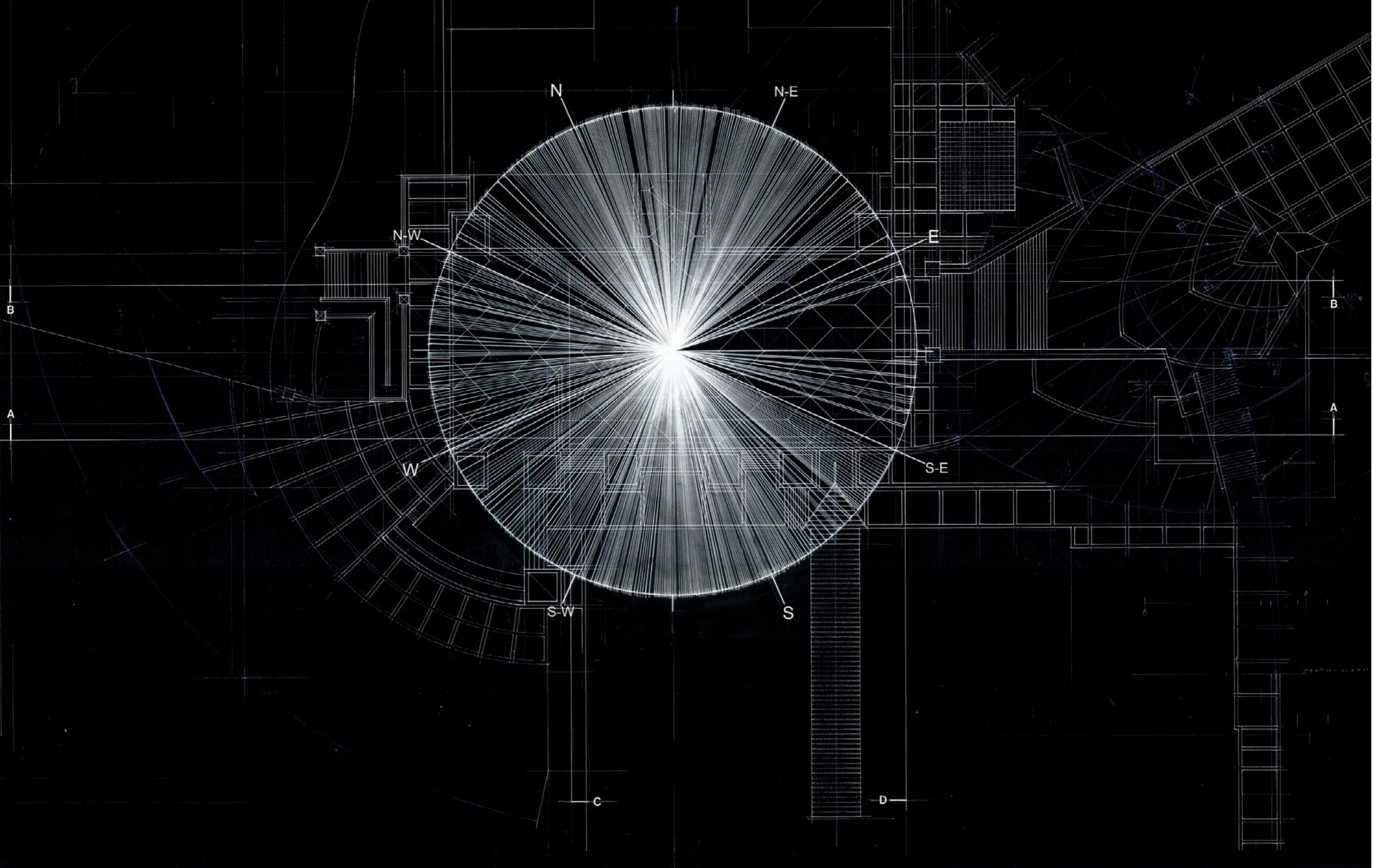
THREE



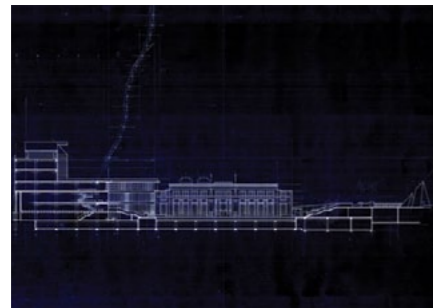
FOUR



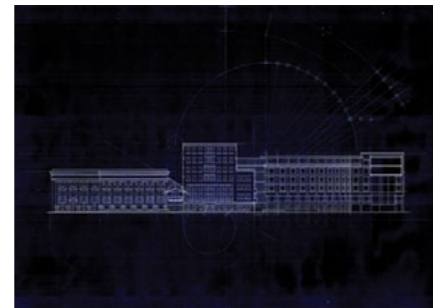
CIVIC RHYTHM: A CIRCUMFERENCE OF VERTICAL FREQUENCY



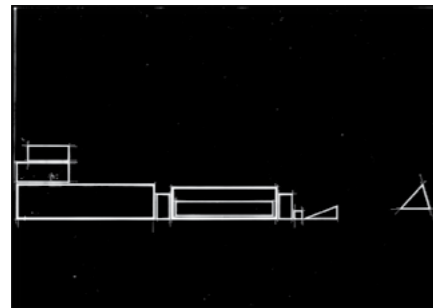
2.3.3 VERTICAL RE-CONSTRUCTION



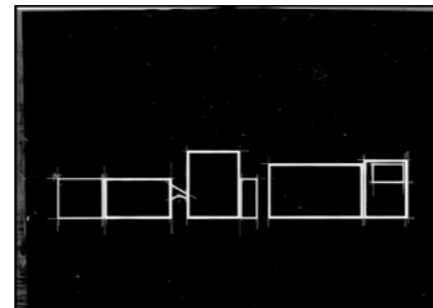
N/N-E



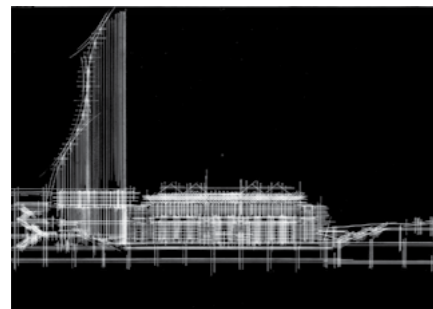
S/W-W



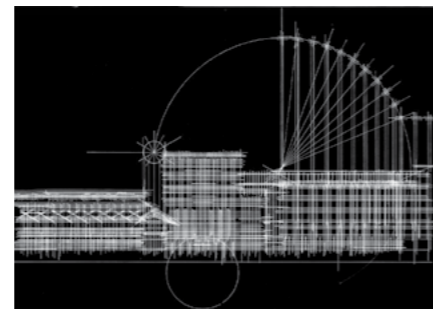
N/N-E GEOMETRY



S/S-W GEOMETRY



N/N-E CONSTRUCTION



S/S-W CONSTRUCTION



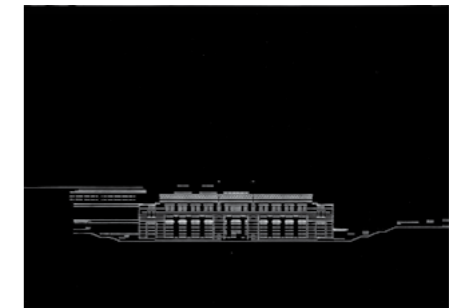
N/N-E WINDOWS



S/S-W WINDOWS



N/N-E VERTICAL



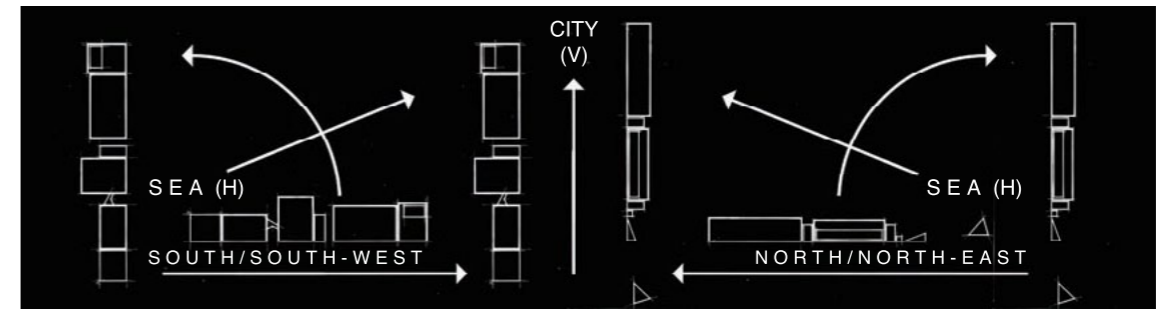
N/N-E HORIZONTAL



S/S-W VERTICAL



S/S-W HORIZONTAL



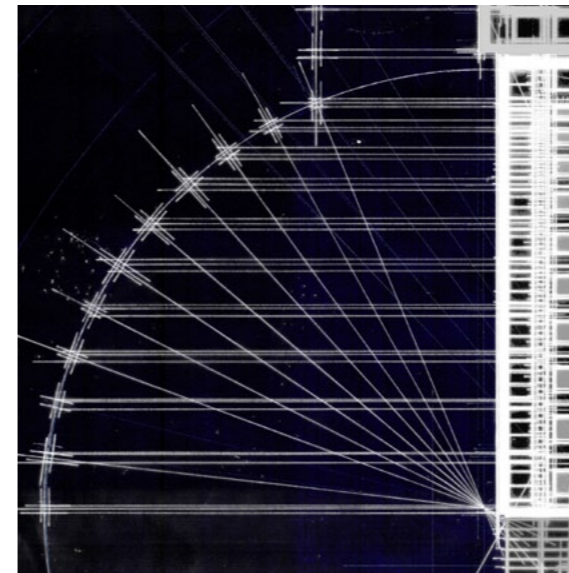
90° ROTATION

This composition concerns a re-presentation of the N/N-E and S/S-W sections through means of rotation and accumulation. The compositional structure of this drawing is driven by notions of the vertical city and the horizontal sea, formed in *Base Geometries* (section 2.2.1) and *Vertical and Horizontal Absence* (section 2.2.6), and reinforced in the previous *experimental drawing Civic Rhythm* (2.3.2)

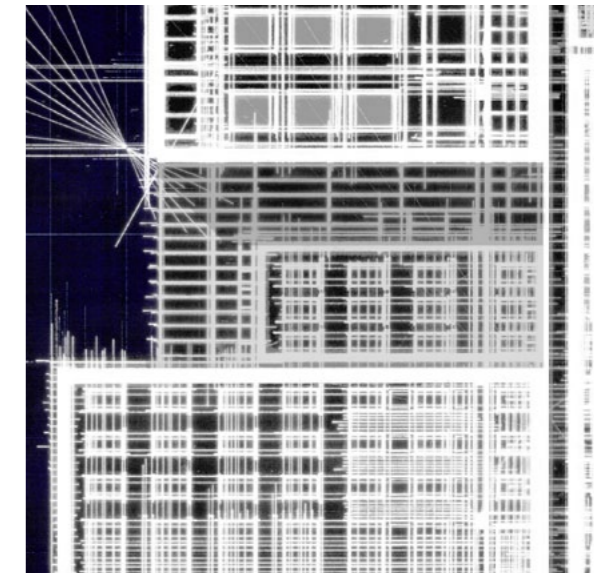
The N/N-E and S/S-W sections are rotated 90° to sit on their East (ocean facing) ends, and are oriented inward to connect vertically along their original horizontal ground lines (see diagram, page 117). The single structure formed by the combination of these two sections consists of the *reproduction drawings* plus all their related *analytical drawings*, (excluding the *Vertical and Horizontal Absence* layers to preserve the outline of the original sections). The *analytical drawings* are overlaid to blur the original clarity of the information *within* the outline of the *reproduction drawings*. The *Construction Lines analytical drawings* intensify the curved construction lines of the CAB (2) and Public Library. Through the 90° rotation these construction lines forgo their original connection to the graphic construction of their respective buildings. Instead they present themselves here as an imaginative structure of cantilevers supported by large networks of tension cables, or thin structural members extending at right angles from a vertical structure. The transformation of these technical construction lines into imaginative architectural form demonstrates the ability of orthographic projection to elaborate the imaginary.

The *reproduction* site plan has been used as the base layer to link the new structure to the existing site. This has resulted in fragments of the site plan appearing at the far edges, containing or framing the new architecture within remnants of the original, tying this representation to ideas of history in the form of the drawings themselves (3). John Scott's pyramid structure from the City to Sea Bridge, *Te Aho a Maui*, represents the story of Maui the great explorer, who is said to have fished up the North Island. It "comprises a mountain form split in two and a paved area leading through it denoting the fishing line unravelling from the mountain to the sea".<sup>125</sup> This pyramid's conceptual connection to land is adopted here, and through multiplication and rotation it forms the ground of a new architecture (4). The repetition of the small mountain forms the tip of a new and larger mountain, upon which the vertical extension of the new structure sits. From here it grows upward, not only from the relationships and orders of the buildings of Civic Square, but also from the history of the ground upon which it sits. The following *experimental drawing, Projection of Fragments* represents the various relationships between the buildings of Civic Square formed through the *reproduction* and *analytical drawings*. It uses these relationships and conceptual connection to form an *imaginative* representation of Civic Square through architectural fragments.

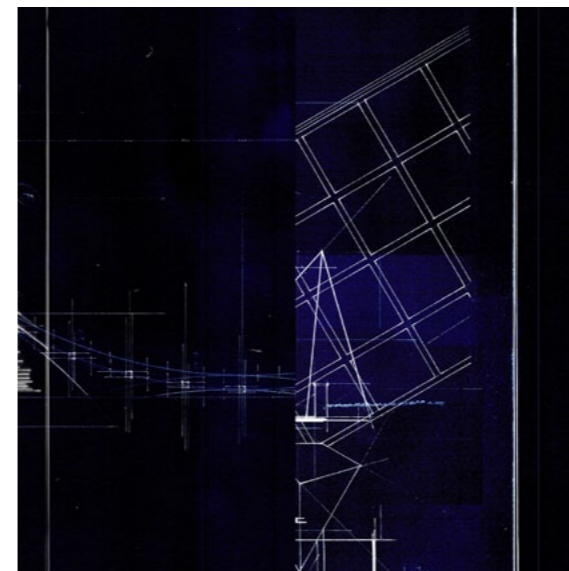
ONE



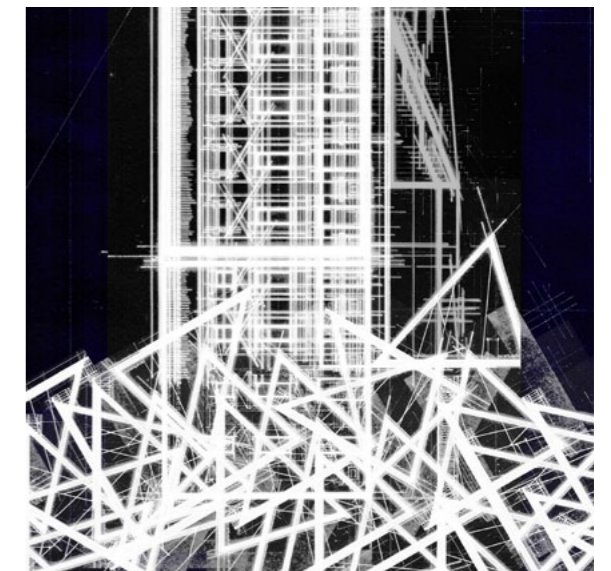
TWO



THREE

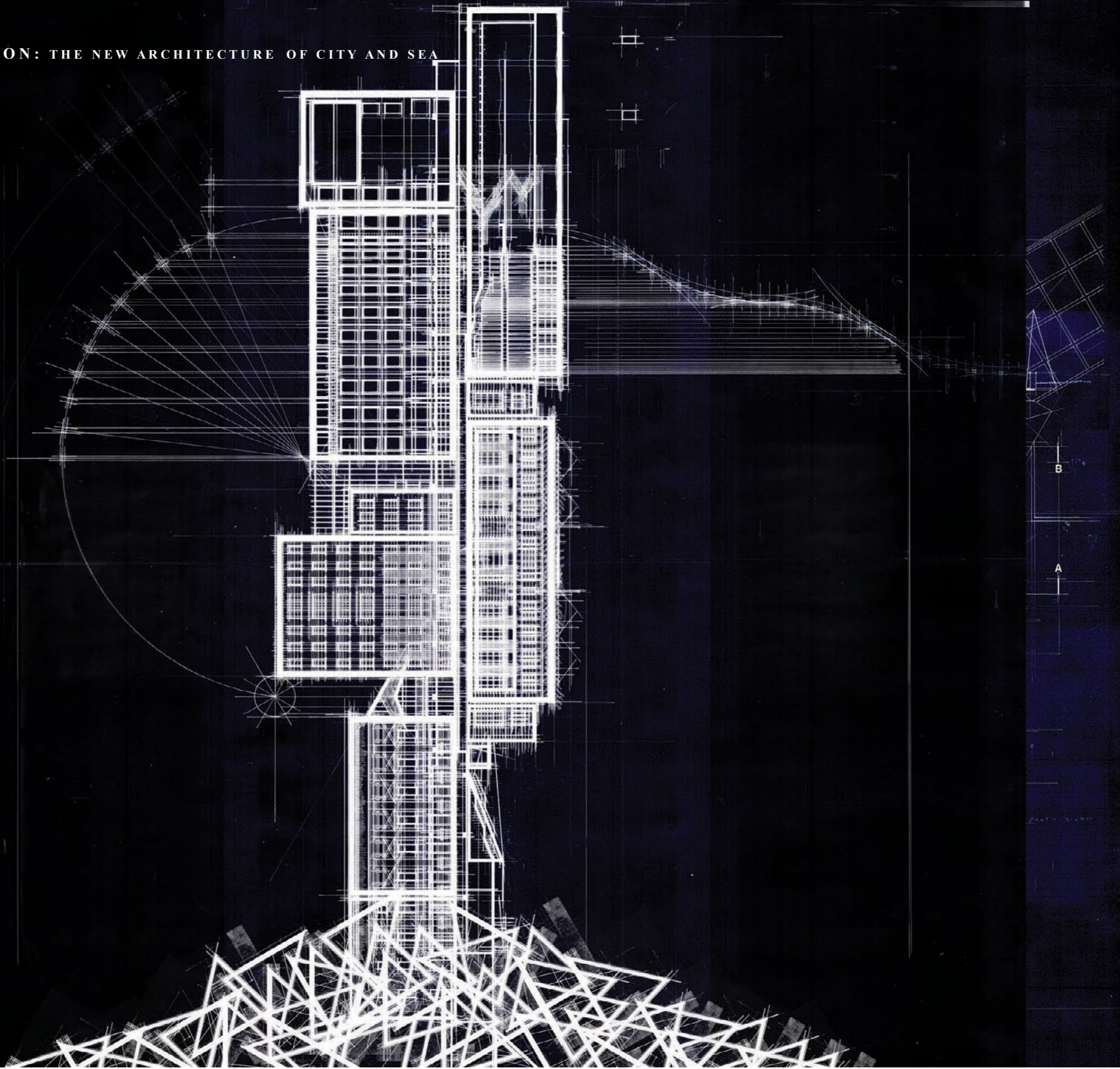


FOUR



125 Heather Galbraith. (2007). Civic Square: A Civil Centre. In J. Harper & A. Lister (Eds.), *Wellington: A City for Sculpture* (pp. 62-73). Wellington: Victoria University Press. 68

VERTICAL RE-CONSTRUCTION: THE NEW ARCHITECTURE OF CITY AND SEA



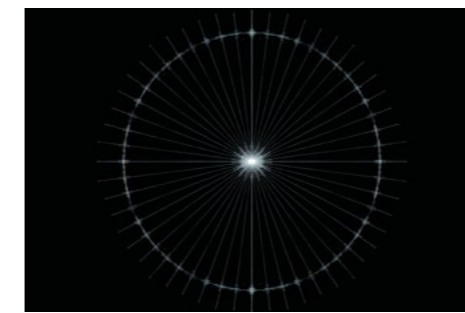
### 2.3.4 PROJECTION OF FRAGMENTS<sup>126</sup>

This *experimental drawing* takes a series of architectural fragments from the *reproduction drawings*. It places these on a circular grid in order to demonstrate and represent the relationships and conceptual connections between the buildings of Civic Square formed in the *reproduction* and *analytical drawings*. The compositional theory of Rudolf Arnheim is discussed here to reinforce the compositional decisions made and their meaning. In relation to Frascari's *technological images* this composition does not search for a visual likeness as the way of connecting the relationship of buildings and their placement on the grid, rather "through a mutual measure derived from a familiar nature."<sup>127</sup>

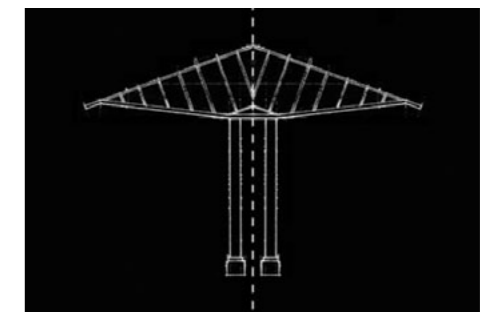
All fragments used in this composition are of elements containing visual or physical penetrations (windows and doors), or fragments on the perimeter of entrances (Town Hall Column). These openings are presented here projecting outward from a central point upon a circular grid (1). The grid, formed through the completion of a full circle of the CAB drawn in plan on the S/S-W section (page 52-53), was chosen as its curve is scribed from a set-out point within the rectangular area of diamond paving, a point from which these windows and entrances are all visible.

Excluding the entrance canopy (2) (located between the City Administration Building and Municipal Office Building on the W/N-W section), all fragments are taken from the N/N-E and S/S-W sections. This entrance canopy is mirrored through its vertical axis, presenting itself in the following representation as an arrow pointing inward toward the centre point of the circular grid network. Juxtaposing this direction is the fragment of the Public Library's glass façade (3) undulating outwards, extending from the window and column section of the City Gallery (4) and out past the circular ordering grid. This is in reference to the close physical relationship of City Gallery and Public Library and the opposing formal relationship of their Civic Square facing façades: as orthogonal versus curvilinear. In this composition this causes the City Gallery fragment to be firmly secured within the ordering grid, while the Library fragment breaks free, and out of the grid. As demonstrated in the *reproduction drawing* set-out diagrams (section 2.1.6, *Points of Order*), the City Gallery is the primary element dictating the layout and order of Civic Square, while the majority of the Public Library's Civic Square facing façade, (although its initial curve is drawn from within the square), extends north-east and out of the square with curves drawn from increasingly independent and distant points. Thus, the treatment of these two opposing elements in this representation follows the notion that the City Gallery is heavily restricted, and predetermined to exist within the bounds of the orders it dictates, while the Public Library's undulating curves extend out of Civic Square to north-east, and past the order put forth by the City Gallery's neoclassical architecture.

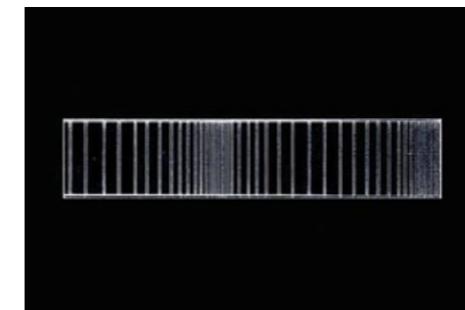
The last two fragments, the entrance between the Town Hall and MOB (5) (viewed at a 90° angle to the same entrance from the W/N-W section), and the Town Hall pediment and column (6), also extend past the circular ordering grid. Although the City Gallery (1940) shares a similar orthogonality with the Renaissance revival Town Hall (1904), built 36 years prior, the gallery is unable to impose the same ordering control upon it, as it does the newer buildings constructed during the 1991 development of Civic Square.



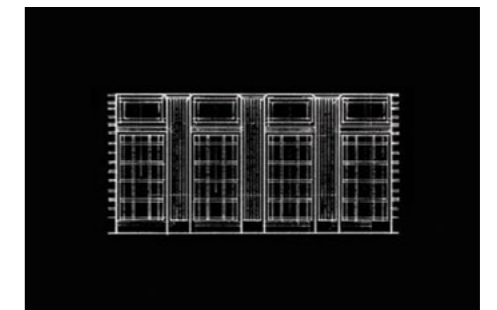
CAB  
CONSTRUCTION GRID  
[S/S-W]



MOB  
ENTRANCE CANOPY  
[W/N-W]



PUBLIC LIBRARY  
GLASS FACADE  
[N/N-E]



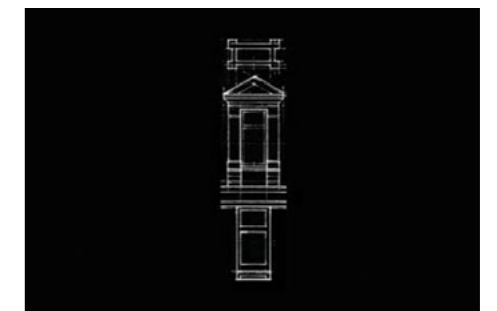
CITY GALLERY  
WINDOWS & COLUMN  
[N/N-E]



MOB  
ENTRANCE CANOPY  
[S/S-W]



TOWN HALL  
COLUMN  
[S/S-W]



TOWN HALL  
WINDOW & PEDIMENT  
[S/S-W]

<sup>126</sup> This drawing takes its title from a drawing for the project *House for Euclid* by Raimund Abraham (1983) (Fig 3.2, p105). Brigitte Groihofer. (Ed.). (2011). *Raimund Abraham [UN]BUILT*. New York: SpringerWienNewYork. 89

<sup>127</sup> Frascari. (2009). *Splendor and Miseries of Architectural Construction Drawings*. 110

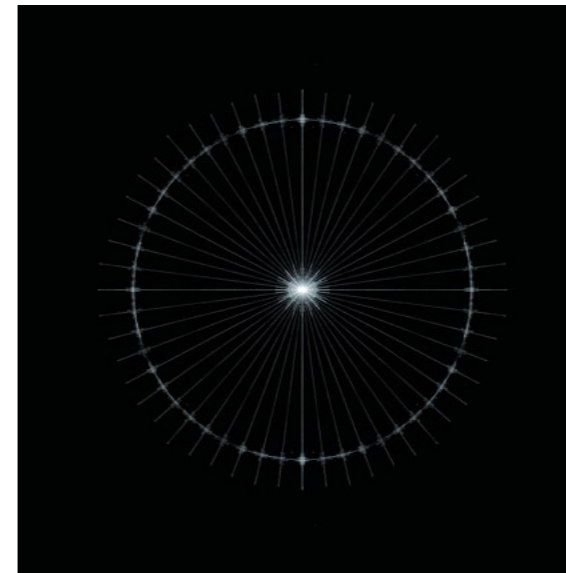
To examine Frascari's notion of a *mutual measure* it is salient to examine, through the compositional theory of Rudolf Arnheim, how the structure of this composition expresses the relationship between buildings and the placement of their fragments on a grid. Arnheim proposes that the balance or imbalance of elements within a square, or a circle in which a square is drawn, are influenced not only by their perimeter boundaries and centrepoint, but also by a series of cross-shaped frameworks through the central vertical, horizontal and diagonal axes.<sup>128</sup> For Arnheim the centre is the principal locus of attraction and repulsion, which establishes itself through the crossing of the four aforementioned main structural lines.<sup>129</sup>

Rudolf Arnheim proposes that for any object on a diagonal line, the point of balance lies closer to the corner of the square than to the centre, meaning that the centre possesses a stronger visual pull than the corner. Thus, any object set on the line between the centre and corner must be offset towards the latter to retain visual balance: "as though corner and centre were two magnets of unequal power."<sup>130</sup> Furthermore, Arnheim proposes that any object at any location which "coincides with a feature of the structural skeleton introduces an element of stability."<sup>131</sup> Therefore, the placement of the City Gallery fragment is offset towards the centre, suggestive of a pull towards the centre of the rigid ordering grid. Conversely the Town Hall fragments are offset from the centre in pursuit of balance, simultaneously reinforcing the notion that these elements are independent of the order dictated by the City Gallery, while still coming from a balanced and orthogonal renaissance revival building.

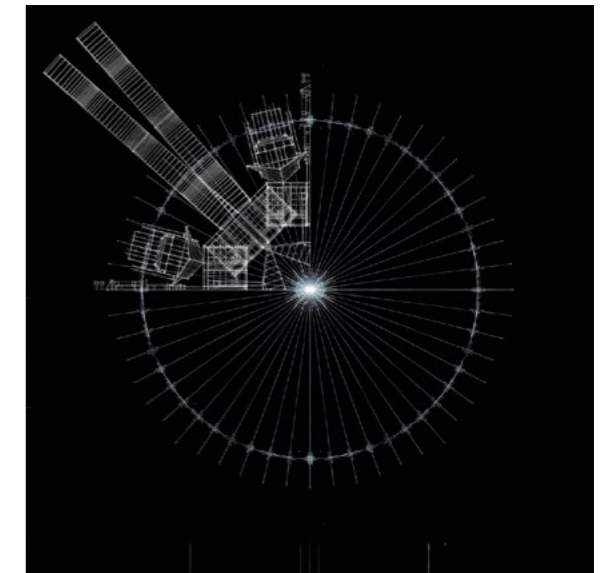
Under Frascari's definition, this *experimental drawing* is a *technography* demonstrating instrumental relationships through symbolic compositional placement. This *experimental drawing* is tied to Civic Square through a *mutual measure* derived from a *familiar nature*, as opposed to a visual likeness. Under Steenbergen's definition, this drawing acts to further elucidate ideas and readings of Civic Square formed in the *reproduction* and *analytical drawings* by re-contextualising elements in a new composition. The next *experimental drawing* concerns a re-presentation of the S/S-W section to investigate the role of symmetry and asymmetry in its reading as a *wall*.

128 Arnheim. (1974). *Art and Visual Perception: A Psychology of the Creative Eye*. 13  
 129 *ibid*  
 130 *ibid* 14  
 131 *ibid*

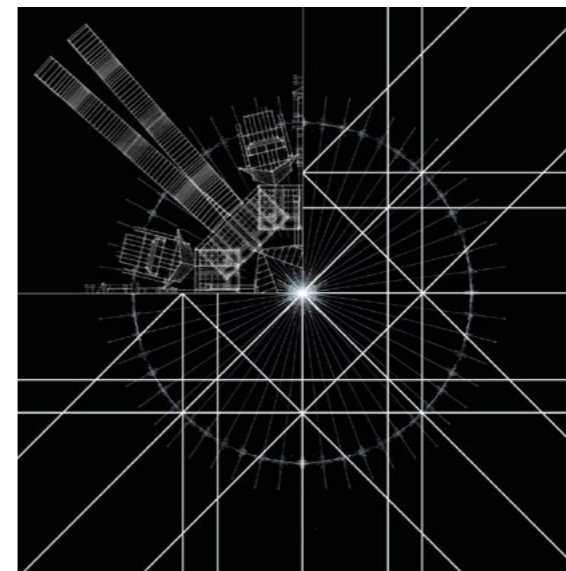
ONE



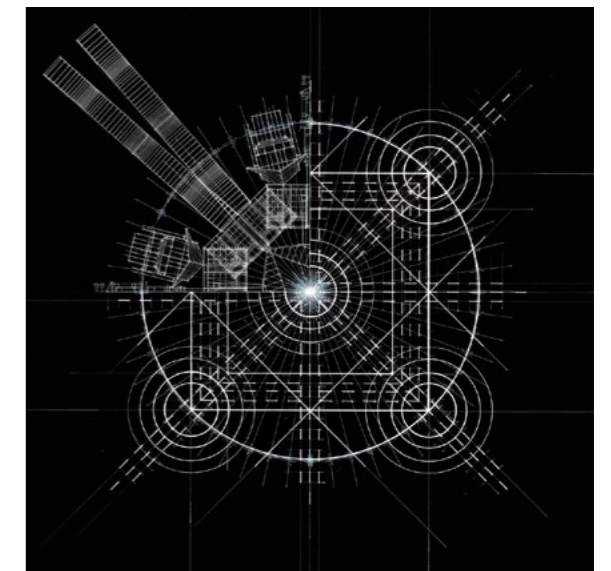
TWO



THREE

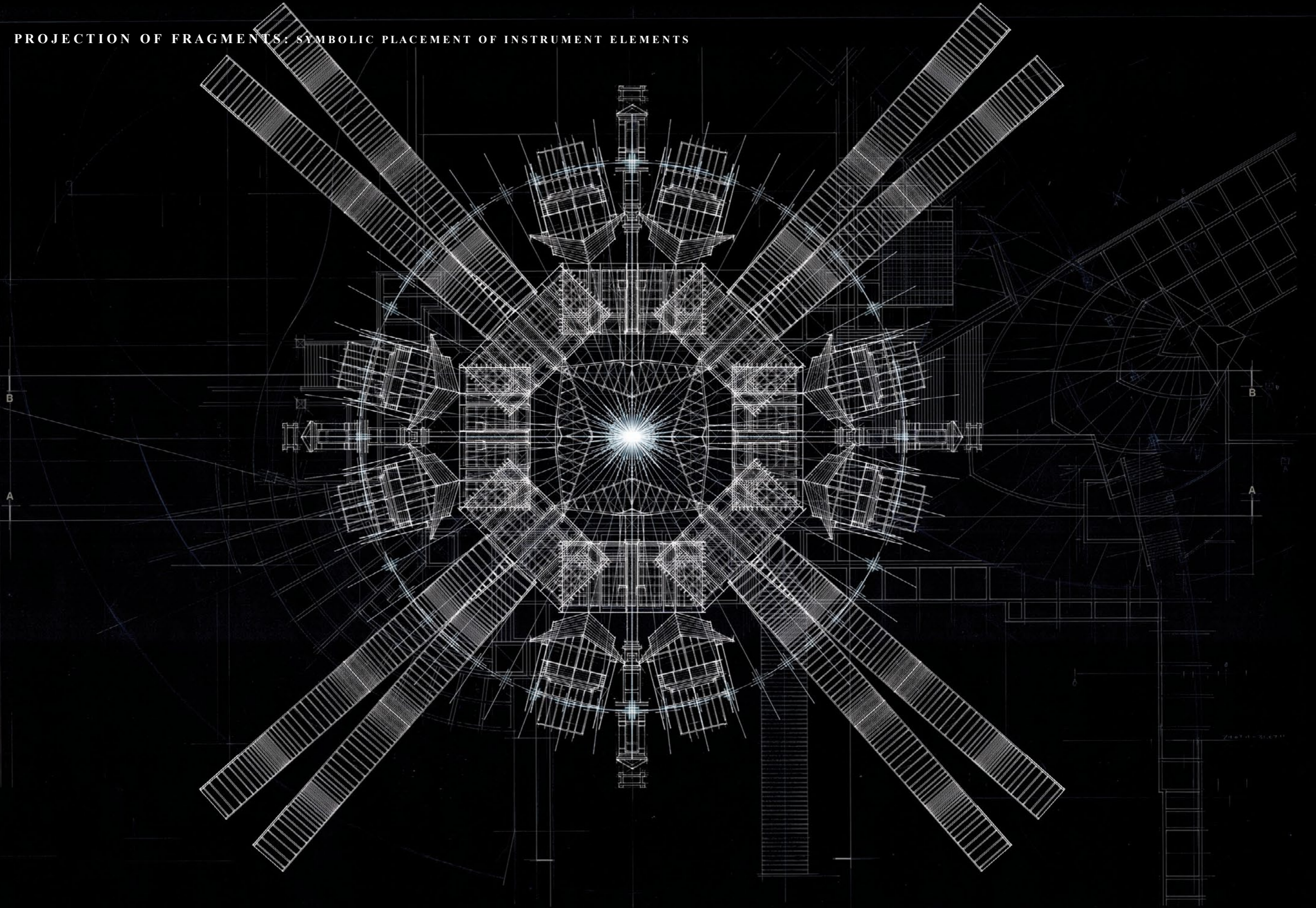


FOUR



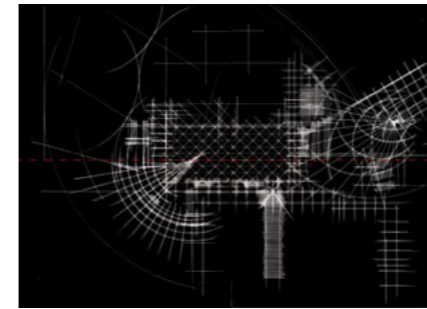
This diagram (four) is based on an image by Rudolf Arnheim. (1974). *Art and Visual Perception: A Psychology of the Creative Eye*. Los Angeles: University of California Press. 13

PROJECTION OF FRAGMENTS: SYMBOLIC PLACEMENT OF INSTRUMENT ELEMENTS

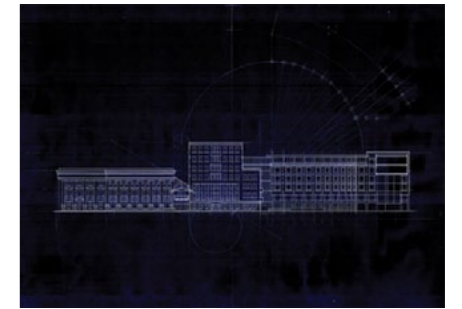




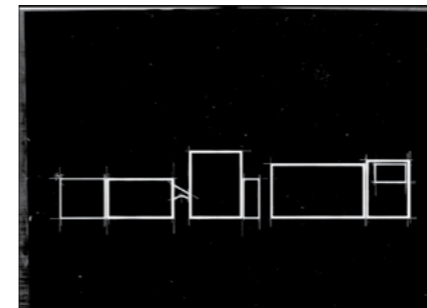
2.3.5 MIRRORED NETWORKS



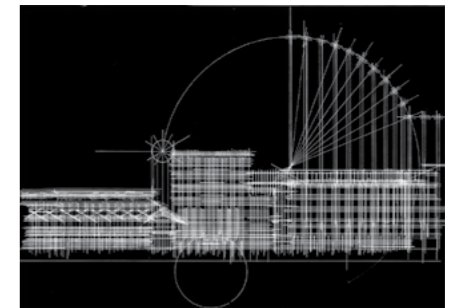
*SITE PLAN CONSTRUCTION*



*S/W-W REPRODUCTION*



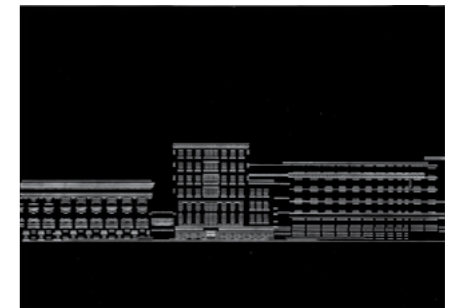
*S/S-W GEOMETRY*



*S/S-W CONSTRUCTION*



*S/S-W VERTICAL*



*S/S-W HORIZONTAL*



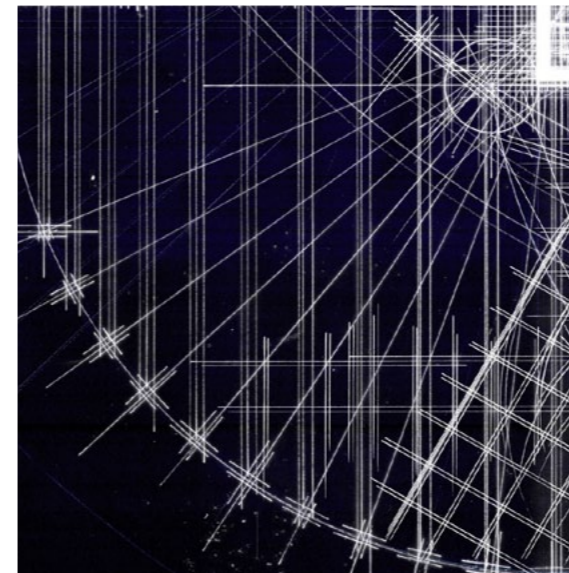
*S/S-W WINDOWS*

This *experimental drawing* concerns the re-presentation of the S-S/W section to investigate the role of symmetry and asymmetry in its reading as a wall, and to graphically investigate the relationship between the curved and straight lines and buildings of Civic Square. As observed in the *Developed Surface*, in relation to the N/N-E section the S/S-E lacks the solidifying symmetry of the City Art Gallery, relying heavily on its greater heights to form the second boundary wall to the west-east path through site. This composition mirrors the S/S-E section and the majority of its *analytical* layers down a central vertical axis (through the MOB). By doing this it provides this asymmetrical and imbalanced section with formal symmetry and stability. Although this procedure brings the S/S-W section formally closer to the City Gallery, by flipping the section vertically and placing it atop the multiple grids and line networks of the site plan's thickened construction lines (also mirrored down a central axis), the section is transformed, forcing a different reading to the original. Thus, to examine what this drawing represents in relationship the readings formed of Civic Square through the *reproduction* and *analytical drawings* it is again necessary to invoke Frascari's theory of representation through a *mutual measure* rather than a *visual likeness*.<sup>132</sup>

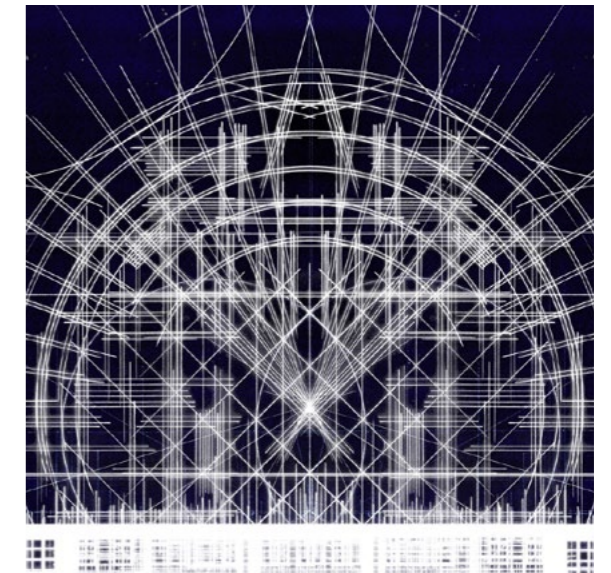
The altered relationship of this section to its original horizontal baseline, and its placement spanning the short length of the centre diamond paving greatly reduces its previously strong relationship to the west-east path. Instead, the circular construction lines of the CAB in plan interact with the lines of the site plan causing precedence to be given to the ambiguous field of grids and lines upon which it sits. By mirroring the construction lines of the site plan, the west-most area of circular paving forms a circle enclosing the diamond paving, *the circular enclosing the orthogonal*. In the lower portion of the composition the relationship between curved and straight becomes more dynamic: curves gain dominance over the orthogonal geometry of the City to Sea Bridge through multiple grids overlapping and extending from and through one another to match the complexity of the mirrored S/S-W section, transforming it into an orthographic view which more in common with a plan than a vertical section. This result is expressive of Steenbergen observation that *experimental drawings* hold the potential to transform the original reading of images,<sup>133</sup> alongside the observation of Fraser and Henmi, that the orthographic projection has the ability to alter the conceptions that authors have towards drawings and projects.<sup>134</sup>

The curved lines of the site plan and CAB in plan project and undulate inward toward this now symmetrical and solid structure, where they are absorbed and translated into strictly vertical and horizontal vectors through the rigidity of the Town Hall, MOB, and CAB. As demonstrated in section 2.1.6 *Points of Order*, the City Gallery orders the curves of the site's landscaping and newer buildings. In this composition, one of these newer curved buildings, the CAB whose inner facing curve is dictated by the City Gallery, is transformed into a visually rigid form through the accumulation of the *analytical layers*. This buildings new found orthogonal rigidity processes and contains the multiple, freeform curves. Placed firmly in the centre of this complex field of curves, the altered S/S-W section offers an architectural expression of civic stability, processing and overcoming the curved and complex exterior disorder, through its new-found symmetry. This composition and the others in this series of *experimental drawings* are the graphic manifestation of Frascari's *technological image* which demonstrates orthographic projection ability to elaborate the imaginary and value in the *process* of architectural design.

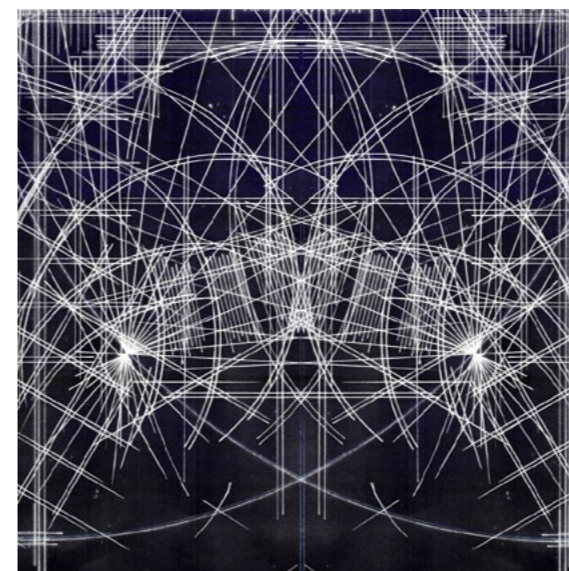
ONE



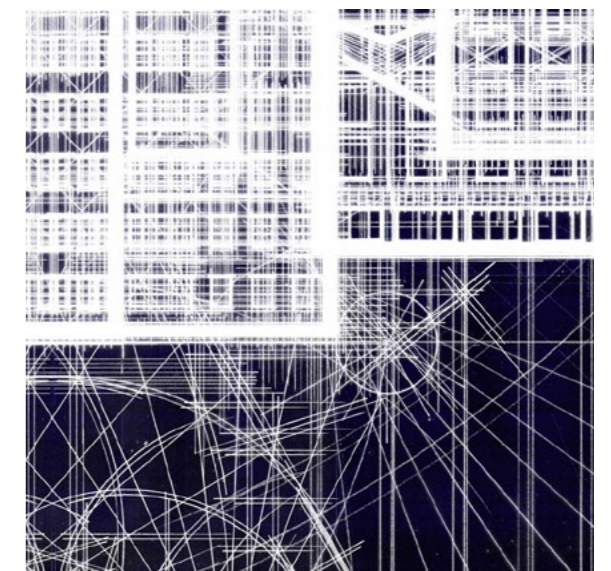
TWO



THREE



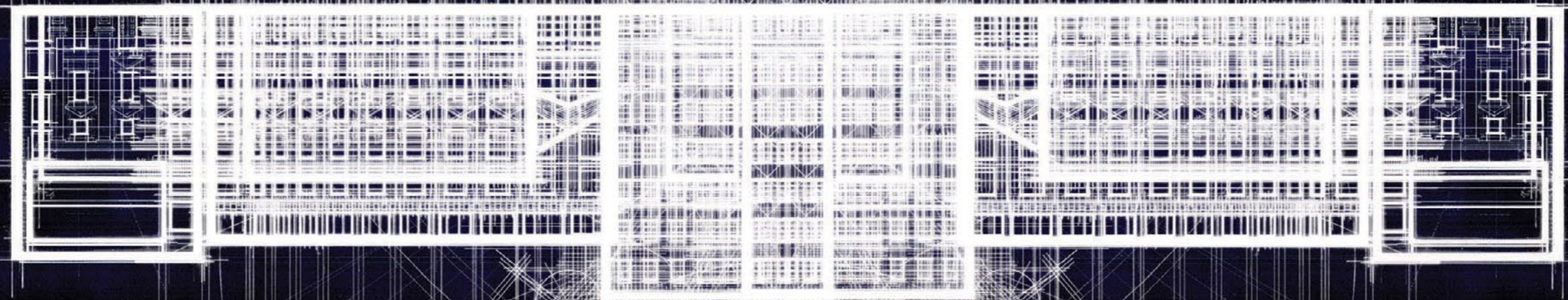
FOUR



132 Frascari. (2009). *Splendor and Miseries of Architectural Construction Drawings*. 110

133 Steenbergen. (2002). *The Power of Drawing*. 159

MIRRORED NETWORKS: FAMILY DYNAMICS OF STRAIGHT AND CURVED



## CHAPTER THREE: CONCLUSION

### 3.0.0 CONCLUSION

Orthographic projection is an active agency in the formation of images, and an effective agency for the elaboration of imaginary object.<sup>135</sup> Furthermore, it produces *conceptually sophisticated constructs*, whose abstract representation of space allows certain aspects and relationship to be discovered which may not otherwise be *visible*.<sup>136</sup> However, the development of digital technologies has damaged its use in the *process* of architecture design. The architectural profession now sees orthographic projection utilised almost exclusively in technical construction documents post-design. Thus, this thesis has argued that the reduced role of orthographic projection in the *process* of design has affected architects' ability to make *visible* the *invisible* through the graphic elaboration of the imaginary.

To address this issue this thesis graphically expanded upon the written theory of Marco Frascari through Clemens Steenbergen's critical framework for *architectural drawing as research*. The goal of this research has been to test orthographic projection's ability to elaborate the imaginary through Frascari's critical theory of architectural drawing as a *technological image* displaying three overlapping relationships: (1) between a real artefact and its projected image, (2) between a real artefact and its instrumental image, and (3) between the instrumental image and its symbolic image.<sup>137</sup> Frascari's theory proposes a form of research that aims to produce imaginative, rather than normative data.<sup>138</sup> Following Steenbergen's framework, this thesis has combined Frascari's three overlapping relationships with Steenbergen's three forms of architectural drawing, in a manner that treats the field of composition as a discursive and continuously open system, at the service of architecture, which is a generator of ideas and the critical instrument of primary creative energy.<sup>139</sup>

The site of Civic Square was chosen to undertake this research as the formal rectangular domain offered a heterogeneous mix of civic architecture, which ranged from classical and strictly orthogonal buildings (Town Hall and City Gallery) to contemporary and curvilinear buildings (CAD and Public Library). This site offered the opportunity to test orthographic projection's potential in the reading of architecture and the elaboration of the imaginary within a dynamic and formal diverse existing urban environment. The curved buildings in particular, and the construction lines necessary to construct them in orthographic projection, provided the *experimental drawings* with a dynamic character that would not have been possible in a strictly orthogonal or less formally diverse site.

The first series of *reproduction drawings* aimed to register accurately the *visible* order and relationships of Civic Square through a process that interpreted the object of observation and incorporated it into memory. Embodying Frascari's first overlapping relationship, between a real artefact and its projected image, this series reconstructed Civic Square through measured and mechanically drafted orthographic projection drawings, leading to a number of key readings concerning the *visible* order and conceptual connections between the site's buildings and element. These readings include the existence of set-out points on site and what this revealed of the relationship and hierarchy between various buildings, the relationship between the interior of buildings and the exterior landscaping, and what this disproved in relation to the intentions of chief architect, Ian Athfield.

<sup>135</sup> Evans. (1989). *Architectural Projection*. 21

<sup>136</sup> Fraser and Henmi. (1994). *Envisioning Architecture: An Analysis of Drawing*. 25

<sup>137</sup> Frascari. (1990). *A New Angel/Angle in Architectural Research: The Idea of Demonstration*. 110

<sup>138</sup> *ibid* 11

<sup>139</sup> Steenbergen. (2002). *The Power of Drawing*. 157

The second series of *analytical drawings* revealed abstract qualities and potentials hidden in the *reproduction drawings*, and thus hidden on site, by reducing the complex compositions to specific categories and sets of information. Embodying Frascari's second overlapping relationship, between a real artefact and its instrumental images, this series used a process of reduction, which was observed as a key advantage intrinsic to orthographic projection, to reveal *invisible* relationships and conceptual connections. This process tested many of the readings formed in the *reproduction drawings*, reinforcing them and pushing them further. These readings include the notion of Civic Square as a transition point between the vertical city and horizontal sea, the relationship between the visual weight of architectural elements and their drawn translation, and the idea of Civic Square's four rows of buildings existing as two impenetrable *walls* and two openings facilitating a west-east path through site. The *analytical drawings* demonstrated the declared "intentions" of Athfield to be very different that what is really happening in Civic Square, and the three-stage approach of this thesis allowed Athfield's intentions to be rigorously tested from three distinct perspectives.

The *reproduction drawings* facilitated a reading of the *visible* relationships present in Civic Square through orthographic projection, while the *analytical drawings* provoked a reading of the *invisible* relationships present in Civic Square through orthographic projection. The combination of these two series lead to the third and final series of *experimental drawings* and the third and final overlapping relationship of Frascari's *technological image*. This series re-combined and re-contextualized the images and information contained in the *reproduction* and *analytical drawings*, ultimately leading to new compositions and the elaboration of *imaginary concepts* through orthographic projection. Embodying Frascari's third and final overlapping relationship, this series of drawings are *technological images*, which do not search for a visual likeness as a means of relating buildings and architectural ideas, but a *mutual measure* derived from a familiar nature.

The art of architecture allows the incorporation of relationships that an occupant will intuitively understand even if not explicitly marked. The architect can knowingly incorporate such relationships, and theory can establish foundations upon such relationships. Yet, if the architect loses one of the key means of perceiving and elaborating these relationships then a huge loss has occurred. Beginning with the accurate and technical representation of Civic Square, the final series of *experimental drawings* merged presumptive boundaries separating architecture, architectural experience and architectural theory. By merging or displacing such presumptive boundaries, the architectural imagination is liberated.

### 3.0.1 BIBLIOGRAPHY

- Abbott, E. A. (1884). *Flatland: A Romance of Many Dimensions*. New York: Dover Publication.
- Abraham, R. (2011). In Anticipation of Architecture: Fragmentary Notes. In B. Groihofer (Ed.), *Raimund Abraham [UN]BUILT* (pp. 101-103). New York: SpringerWienNewYork.
- Abraham, R. (2011). The Enigma of the Muses. In B. Groihofer (Ed.), *Raimund Abraham [UN]BUILT* (pp. 108-109). New York: SpringerWienNewYork.
- Abraham, R., & Brillembourg, C. (2001). The Essential Condition for Architecture: An Interview. *BOMB*(77), 58-65.
- Ackerman, J. S., & Jung, W. (Eds.). (2000). *Conventions of Architectural Drawing: Representation and Misrepresentation*. Cambridge MA: Harvard University.
- Allen, G., & Oliver, R. (Eds.). (1981). *Architectural Drawing: The Art and the Process*. London: The Architectural Press Ltd.
- Allen, S. (1992). Projections Between Drawing and Building. *A+U*(259), 40-65.
- Allen, S. (1993). On Projection. *The Harvard Architecture Review*, 9, 122-137.
- Allen, S. (2000). *Practice, Architecture, Technique and Representation*. Amsterdam: G+B Arts International.
- Arnheim, R. (1974). *Art and Visual Perception: A Psychology of the Creative Eye*. Los Angeles: University of California Press.
- Association, A. (Ed.). (1988). *Nostalgia of Culture: Contemporary Soviet Visionary Architecture*. London: Architecture Association.
- Baiche, B., & Walliman, N. (Eds.). (2000). *Neufert Architects' Data* (Third ed.). Iowa: Blackwell Science Ltd.
- Benjamin, W. (1969). The Work of Art in the Age of Mechanical Reproduction (H. Zohn, Trans.). In H. Arendt (Ed.), *Illuminations* (pp. 217-251). New York: Schocken Books.
- Bois, Y.-A. (1981). Metamorphosis of Axonometry. *Daidalos*(1), 40-58.
- Brooks, H. A. (Ed.). (1984). *Le Corbusier: Buildings and Projects, 1928-1929*. New York: Garland Publishing, Inc.
- Brown, M. (2006). For\_Getting Drawing: Toward an Architectural Pedagogy for Digital Media. In J. Al-Qawasmi & G. L. d. Valasco (Eds.), *Changing Trends in Architectural Design Education* (pp. 59-79). Morocco: The Centre for the Study of Architecture in the Arab Region.

- Bruegmann, R. (1989). The Pencil and the Electronic Sketchboard: Architectural Representation and the Computer. In E. Blau & E. Kaufman (Eds.), *Architecture and its Image: Four Centuries of Architectural Representation. Works from the Collection of the Canadian Centre for Architecture*. Montreal: Canadian Centre for Architecture.
- Bunschoten, R. (1992). Cutting the Horizon: Two Theses on Architecture. *Forum*, 36(1), 40-49.
- Burgin, V. (1987). Geometry and Abjection. *AA Files*(15), 35--41.
- Butler, C. H., & Zagher, C. d. (Eds.). (2010). *On Line: Drawing Through the Twentieth Century*. New York: The Museum of Modern Art.
- Camerota, F. (2008). The Eye of the Sun: Galileo and Pietro Accolti on Orthographic Projection. In M. Carpo & F. Lemerle (Eds.), *Perspective, Projections and Design: Technologies of Architectural Representation* (pp. 115-125). New York: Routledge.
- Carlo, T. d. (2003). Thom Mayne. In M. McQuaid (Ed.), *Envisioning Architecture: Drawings from the Museum of Modern Art* (pp. 238-239). New York: Museum of Modern Art.
- Carpo, M. (2004). Pattern Recognition (G. Carino, Trans.) *Metamorph 9. International Architecture Exhibition Focus* (Vol. 3, pp. 44-57). New York: Rizzoli.
- Carpo, M. (2004). Nonstandard Technologies and its Discontents. In A. Vidler (Ed.), *Architecture: Between Spectacle and Use* (pp. 127-142). New Haven: Yale University Press.
- Carpo, M., & Lemerle, F. (Eds.). (2008). *Perspective, Projections and Design: Technologies of Architectural Representation*. New York: Routledge.
- Christ, A. (2000). Theo van Doesburg and the Undescriptive Qualities of the Axonometric. In J. S. Ackerman & W. Jung (Eds.), *Conventions of Architectural Drawing: Representation and Misrepresentation* (pp. 145-165). Cambridge MA: Harvard University.
- Clark, J. (1997). *Drawing on Architecture: Gender, Subjectivity, Surface*. Master of Architecture, Victoria University, Wellington.
- Corbusier, L. (1960). *Creation is a Patient Search*. New York: Frederick Praeger.
- Coyne, R. (2007). Forms in the Dark. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 129-135). New York: Routledge.
- Damisch, H. (1984). The Drawings of Carlo Scarpa. In F. D. Co & G. Mazzariol (Eds.), *Carlo Scarpa: The Complete Works* (pp. 209-213). New York: Rizzoli.
- Davis, M. (2010). Maintaining the Abstract Critical Facility in Post-Critical Drawing Practice. *Interstices: Journal of Architecture and Related Arts*(11), 82-92.
- Durer, A. (1977). The Painters Manual: A Manual of Measurement of Lines, Areas, and Solids by Means of Compass and Ruler Assembled by Albracht Durer for the use of all Lovers of Art with Appropriate Illustrations (W. L. Strauss, Trans.). New York: Abaris Books.
- Eisenman, P. (1987). *House of Cards*. Oxford: Oxford University Press.
- Eisenman, P. (1991). Representation of the Limit: Writing a 'Not-Architecture. In D. Libeskind (Ed.), *Daniel Libeskind: Countersign* (pp. 120-121). London: Academy Editions.
- Elliott, C. D. (1963). The Variety of Scale. *Journal of Architectural Education*, 18(3), 35-37.
- Emmons, P. (2007). Drawn to Scale: The Imaginative Inhabitation of Architectural Drawings. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings* (pp. 64-78). London: Routledge.
- Estevez, D., & Tine, G. (2008). Project and Projections: Some Advantages of the Principle of Opacity. In M. Carpo (Ed.), *Perspective, Projections and Design* (pp. 163-174). New York: Routledge.
- Evans, R. (1983). In Front of Lines that Leave Nothing Behind. *AA Files*(6), 89-96.
- Evans, R. (1986). Translations Between Drawing and Building. *AA Files*, 12, 3-18.
- Evans, R. (1989). Architectural Projection. In E. Blau & E. Kaufman (Eds.), *Architecture and its Image: Four Centuries of Architectural Representation. Works from the Collection of Canadian Centre of Architecture* (pp. 18-35). Montreal: Canadian Centre for Architecture.
- Evans, R. (1989). The Developed Surface: An Enquiry into the Brief Life of an Eighteenth Century Drawing Technique. *9H*(8), 120-147.
- Evans, R. (1995). *The Projective Cast: Architecture and its Three Geometries*. Cambridge: The MIT Press.
- Flusser, V. (1974). Walls. *Main Currents*, 30(4), 136-138.
- Flusser, V. (1999). *The Shape of Things: A Philosophy of Design*. London: Reaktion Books Ltd.
- Frascari, M. (1982). Professional Use of Signs in Architecture. *Journal of Architectural Education*, 36(2), 16-23.
- Frascari, M. (1988). Maidens "Theory" and "Practice" at the Sides of Lady Architecture. *Assemblage*(7), 14-27.
- Frascari, M. (1988). The Drafting Knife and the Pen. In R. Miller (Ed.), *Implementing Architecture*. Atlanta: Nexus Press.
- Frascari, M. (1990). A New Angel/Angle in Architectural Research: The Idea of Demonstration. *The Journal of Architectural Education*, 44(1), 11-19.
- Frascari, M. (1991). *Monster of Architecture: Anthropomorphism in Architectural Theory*. Maryland: Rowman & Littlefield Publishers Inc.
- Frascari, M. (2007). Horizons at the Drafting Table: Filarete and Steinberg. In A. Perez-Gomez & S. Parcell (Eds.), *Chora Five: Intervals in the Philosophy of Architecture* (Vol. Five, pp. 179-200). Montreal: McGill-Queens University Press.

Frascari, M. (2007). A Reflection on Paper and its Virtues within the Material and Invisible *Fac-tures* of Architecture. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 23-33). New York: Routledge.

Frascari, M. (2009). Splendor and Miseries of Architectural Construction Drawings. *Interstices: Journal of Architecture and Related Arts*(11), 107-113.

Frascari, M., Hale, J., & Starkey, B. (Eds.). (2007). *From Models to Drawings: Imagination and Representation in Architecture*. New York: Routledge.

Fraser, I., & Henmi, R. (1994). *Envisioning Architecture: An Analysis of Drawing*. New York: Van Nostrand Reinhold.

Galbraith, H. (2007). Civic Square: A Civil Centre. In J. Harper & A. Lister (Eds.), *Wellington: A City for Sculpture* (pp. 62-73). Wellington: Victoria University Press.

Gmerer, H., & Nesser, T. (2010). *The First Dimension: Drawing and Perception - A Workbook for Designers*. Basel: Birkhäuser.

Goodman, N. (1976). *Languages in Art*. New York: Hackett.

Gray, J. (1992). Worth Waiting For. *Architecture New Zealand*(March/April), 48-50.

Groihofer, B. (Ed.). (2011). *Raimund Abraham [UN]BUILT*. New York: SpringerWienNewYork.

Hamel, C. (2007). Drawing Lines of Confrontation. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 201-207). New York: Routledge.

Harper, J., & Lister, A. (Eds.). (2007). *Wellington: A City for Sculpture*. Wellington: Victoria University Press.

Hejduk, J. (1991). The Albatross Screeched. In D. Libeskind (Ed.), *Daniel Libeskind: Counter-sign* (p. 122). London: Academy Editions.

Hewitt, M. (1985). Representation Forms and Modes of Conception: An Approach to the History of Architectural Drawing. *Journal of Architectural Education*, 39(2), 2-9.

Hoffpauir, S., & Rosner, J. (1989). *Architectural Illustration in Watercolor*. New York: Whitney Library of Design.

Ingraham, C. (1991). Line and Linearity: Problems in Architectural Theory. In A. Kahn (Ed.), *Drawing/Building/Text: Essays in Architectural Theory* (pp. 63-84). New York: Princeton Architectural Press.

Kahn, A. (Ed.). (1991). *Drawing/Building/Text: Essays in Architectural Theory*. New York: Princeton Architectural Press.

Kemp, M. (1987). Perspective Rectified: Some Alternative Systems in the 19th Century. *AA Files*(15), 30-35.

Kunze, D. (2007). Concealment, Delay and Topology in the Creation of Wondrous Drawings. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 137-145). New York: Routledge.

Libeskind, D. (1981). Daniel Libeskind: Drawings. In G. Allen & R. Oliver (Eds.), *Architectural Drawing: The Art and the Process* (pp. 60-67). London: The Architectural Press Ltd.

Libeskind, D. (1981). *Micromegas, Symbol and Interpretation*. Zurich: Cranbrook Academy of Art.

Libeskind, D. (1991). *Daniel Libeskind: Countersign*. London: Academy Editions.

Libeskind, D. (2001). *Lineskind at the Soane: Drawing a New Architecture*. Great Britain: Sir John Soane's Museum.

Linzey, M. (2009). Architectural Drawings do not Represent. *Interstices: Journal of Architecture and Related Arts*(11), 31-39.

Lotz, W. (1977). *Studies in Italian Renaissance Architecture*. Cambridge: The MIT Press.

Mayne, T. (1997). *Morphosis*. Tokyo: A.D.A. Edita.

Mayne, T. (2009). *Morphosis Buildings and Projects: 1999-2008*. New York: Rizzoli.

McQuaid, M. (Ed.). (2003). *Envisioning Architecture: Drawings from the Museum of Modern Art*. New York: Museum of Modern Art.

Millar, D. (1992). A Meeting of Minds. *Architecture New Zealand*(March/April), 44-47.

Oechslin, W. (1981). Geometry and Line. *Daidalos*(1), 20-35.

Oechslin, W. (1981). From Piranesi to Libeskind: Explaining by Drawing. *Daidalos*(1), 15-19.

Packer, C. (1992). A Place for People. *Architecture New Zealand*(March/April), 43.

Panofsky, E. (1955). *Meaning in the Visual Arts: Papers in and on Art History*. New York: Double Day.

Panofsky, E. (1991). *Perspective as Symbolic Form* (C. Wood, Trans.). Cambridge: The MIT Press.

Perez-Gomez, A. (1982). Architecture as Drawing. *Journal of Architectural Education*, 36(2), 2-7.

Perez-Gomez, A. (1992). Review of Marco Frascari's 'Monsters of Architecture'. *Journal of Architectural Education*, 46(1), 58-60.

Perez-Gomez, A. (2007). Questions of Representation: The Poetic Origin of Architecture. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 11-22). London: Routledge.



Perez-Gomez, A., & Parcell, S. (Eds.). (2007). *Chora Five: Intervals in the Philosophy of Architecture* (Vol. Five). Montreal: McGill-Queens University Press.

Perez-Gomez, A., & Pelletier, L. (1992). Representation beyond Perspectivism. *Perspecta*, 27, 20-39.

Perez-Gomez, A., & Pelletier, L. (1997). *Architectural Representation and the Perspective Hinge*. Cambridge: The MIT Press.

Pickard, Q. (Ed.). (2002). *The Architects' Handbook*. UK: Blackwell Science Ltd.

Price, L. O. (2010). *Line, Shade and Shadow: The Fabrication and Preservation of Architectural Drawings*. Delaware: Oak Knoll Press.

Reiter, W. (1999). *Vessels and Fields*. New York: Princeton Architectural Press.

Schneider, B. (1981). Perspective Refers to the Viewer, Axonometry Refers to the Object. *Diadalos*(1), 81-95.

Schodek, D., Bechthold, M., Griggs, K., Kao, K. M., & Steinberg, M. (2005). *Digital Design and Manufacturing: CAD/CAM Applications in Architecture and Design*. New Jersey: John Wiley & Sons, Inc.

Schultz, A.-C. (Ed.). (2007). *Carlo Scarpa: Layers*. London: Edition Axel Menges.

Scolari, M. (2007). *Considerations and Aphorisms on Drawing* (J. S. Ackerman, Trans.). Rovereto: Ediziom Stella.

Stark, M. (Ed.). (2011). *The Magic of Computer Graphics*. New York: CRC Press.

Steenbergen, C. (2002). The Power of Drawing. In C. Steenbergen, H. Muhl, W. Reh & F. Aerts (Eds.), *Architectural Design and Composition* (pp. 158-177). Bassum: THOTH Publishers.

Steenbergen, C., Muhl, H., Reh, W., & Aerts, F. (Eds.). (2002). *Architectural Design and Composition*. Bassum: THOTH Publishers.

Twose, S., & Smitheram, J. (2009). The Paper Life of Buildings: Performative Interaction. *Interstices: Journal of Architecture and Related Arts*(11), 49-61.

Vesely, D. (1985). Architecture and the Conflict of Representation. *AA Files*(8), 21-38.

Vico, G. (1984). *The New Science of Giambattista Vico* (T. G. Bergin & M. H. Fisch, Trans.). Ithaca: Cornell University Press.

Vitruvius, M. (1584). *The Ten Books of the dell'Architetturad*, translation and commentary by Monsignor. Daniele Barbaro. Venice: Marcolini.

Wigley, M. (1989). The Translation of Architecture, the Production of Babel. *Assemblage*(8), 6-21.

Wigley, M. (2001). Paper, Scissors, Blur. In M. Wigley & C. d. Zegher (Eds.), *The Activist Drawing: Retracing Situations Architectures from Constant's New Babylon to Beyond* (pp. 27-56). Cambridge: The MIT Press.

Wigley, M. (2008). Towards a History of Quantity. In A. Vidler (Ed.), *Architecture Between Spectacle and Use* (pp. 155-163). Williamstown, Mass.: Sterling and Francine Clark Art Institute

Wigley, M., & Zegher, C. d. (Eds.). (2001). *The Activist Drawing: Retracing Situations Architectures from Constant's New Babylon to Beyond*. Cambridge: The MIT Press.

Zhu, Q. (2007). The Cultural Context of Design and the Corporeal Dynamism of Drawing as the Foundations for the imagination of Construction. In M. Frascari, J. Hale & B. Starkey (Eds.), *From Models to Drawings: Imagination and Representation in Architecture* (pp. 79-87). New York: Routledge.



