



Undergraduate Honors Thesis
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INTRODUCTION

According to recent press, America is in the midst of an unprecedented urban renaissance. Popular media has been reporting an increased interest in urban living for much of the last decade (Karp 2008; Leinberger 2008; Rosales 2012). Surveys find that today's twenty-and-thirty-somethings ("millennials," "generation y," "the echo-boomers") value mixed-use locations where they can get around without a car (Fry 2013; Rockefeller Foundation 2014; Urban Land Institute 2013; American Planning Association 2014). Employers are adapting to the desires of the new workforce; companies such as Yahoo, Coca-Cola, Motorola and United Airlines have made recent moves to downtown offices. The Wall Street Journal has gone so far as to pronounce an "era of corporate urbanism" (Weber 2013; Vanderkam 2011).

Yet, despite this increased interest in urbanism, little effort has been made to quantitatively measure changes occurring in the nation's most urban places: downtowns. In fact, most of the discussion on downtown trends relies on housing preference surveys rather than observed population change. Because desires do not always align with actions, the applications of these findings are limited.

Cities are investing heavily in downtown revitalization to compete in the increasingly urban job and housing markets. Accurate data demonstrating the changes occurring downtown is crucial for local governments, developers and downtown organizations to

justify their expenditures and to assess the impact of their projects.

Current approaches to downtown evaluation lack a structured methodology. Academics study downtown job densities and demographic changes, but their methods do not accommodate idiosyncratic local boundaries and typically do not provide accurate information for the downtowns of small cities. Local planning departments and downtown Business Improvement Districts (BIDs) develop their own ad hoc evaluation measures, creating reports that usually cannot be compared across cities and sometimes cannot even be compared over time for the same downtown. Because the revitalization strategies used in each downtown are often borrowed from other cities, it is important

to identify indicators that can be compared across cities as well as over time.

The goal of this thesis is to present an improved methodology for evaluating the overall quality of downtowns. The result is a set of Quality of Downtown Indicators that can be summarized by a comprehensive Quality of Downtown Index (QDI). This evaluation framework has three distinct advantages over current practice:

It is comprehensive

Real estate professionals, demographers, economists and urban planners have differing concerns regarding urban places and thus evaluate places with different criteria. The QDI includes performance indicators used in all of these fields, organized by four key elements of a quality downtown: accessibility (urban form and transportation), economy (employment and real estate), community (downtown as a residential neighborhood) and identity (distinctiveness, culture and activity).

It provides unprecedented geographic precision

A major shortcoming of existing downtown research is its dependence upon data collected at the census tract level. Census tracts are defined based on residential population, so downtowns with few residents have very large tracts. These coarse units are often a poor fit for downtown geographies. The QDI was developed for fine geographic precision; its

indicators primarily use data available at point, parcel and block levels.

It is transparent

This paper explains each step in the development of the QDI; it justifies the underlying assumptions behind each indicator of the index. It presents the sources where data for each indicator can be found, including the limitations of each data source.

The next chapter presents a review of the literature that informed the assumptions and methodology of the QDI. Chapter 3 explains the key decisions that went into its development, including the geographic definition of downtown, the reasoning behind selected performance indicators, and the process of constructing a composite index. Chapter 4 applies the methodology to two case cities in North Carolina and discusses how the results align with local perceptions of downtown change. The paper concludes by identifying areas for further research and potential improvements to the QDI and by describing potential applications for academics,

professionals, policy-makers and the public.

SEEKING COMMON GROUND IN “DOWNTOWN”

What is downtown? Although the word is ubiquitous in the American vernacular, there is little agreement on what downtown means. Cities have unique names for their most urban areas; Locals disagree on where boundaries lie. The literature reviewed in this chapter presents a variety of perceptions of what downtown is and what it should be. The methodologies, definitions and limitations found in these works informed key decisions on what indicators to use and what geographies to study in the Quality of Downtown Index. The first section of this chapter clarifies terminology used to describe downtown. The second section surveys prior approaches to downtown evaluation. The final section discusses literature on downtown’s geographic definition and associated limitations on data availability.

A. CLARIFYING THE TERMINOLOGY

There is an abundance of literature on the history, changing roles and renewed popularity of the American downtown. Since 2000, “Downtown” has appeared in the titles of over 4,000 academic publications. One of few points of consensus in the literature is that the definition of downtown lacks clarity.

While some authors directly confront this issue by establishing their own working definitions, others acknowledge it implicitly by providing an alternative terminology—a downtown alias with its own slightly nuanced definition. Authors may add to the confusion by employing several names

for downtown in a single paper. Drawing connections among works using different terms can appear fallacious, drawing false equivalencies. This literature review begins with a clarification of terminology to avoid that outcome.

“City center” is the term most frequently used synonymously with downtown (Paumier 2004; Balsas 2004; Levy & Gilchrist 2013). Despite its ubiquity, “city center” can be confusing due to its similarity to “central city,” a Census designation for the largest city in a Metropolitan Area (US Bureau of the Census 1994). At least one published work misses that distinction and uses central city as an equivalent to both

downtown and the central business district (Burayidi 2013, p.24).

The Central Business District (CBD) is another term that frequently appears in the literature. Historically, the American downtown was literally the central business district of a city and the two terms were synonymous (Fogelson 2003, p. 12). However, as businesses decentralized in the latter half of the 20th century, the concept of a central business district became less relevant. Given the wide range of functions in contemporary downtowns, many authors draw a distinction between downtown and the CBD (Ford 2003, p.6; Levy & Gilchrist 2013; p. 8; Burayidi 2013, p. 21). When the CBD is discussed in recent literature, it is often in studies of job sprawl and office performance (Cortright 2006; Glaeser & Kahn 2002; Malizia 2014; Stoll 2005).

Many terms used to describe downtown locations also have broader applications. “Urban center” and “urban core” appear in several texts discussing downtowns, though their context makes it unclear at times whether the terms are meant to be directly equivalent to downtown, or if they refer to a larger area (Levy & Gilchrist 2013, p.10; Faulk 2006; Wachs 2013). Authors also describe downtowns as urban cores, vibrant centers, mixed-use centers and employment nodes, but also apply these terms to suburban developments, institutional campuses and/or neighborhood areas. These terms will not be assumed to describe downtown

without a careful interpretation of the original context.

This paper will use the following definition for downtown: an area with current or historic significance as a center of economic activity and a comparatively urban character. It is more intensively developed than the rest of the region, but may or may not contain high densities of jobs or residents. It has sidewalks and storefronts but may or may not have active street life or high concentration of retail. This definition allows downtown to include historically active urban districts that are presently underutilized and acknowledges that downtowns are determined by local perceptions rather than standard criteria. This terminology will be used consistently except when quoting another author or discussing an idiosyncratically named downtown (e.g. Chicago’s Loop, Midtown Manhattan, Charlotte’s Uptown).

B. DEFINING AND MEASURING QUALITY DOWNTOWNS

Although downtown assessments have no standardization, they do have a good deal of precedent. This section merges a review of the literature with an overview of indicators presented in earlier evaluation frameworks. It includes the criteria found in annual reports from the downtown Business Improvement Districts of Austin, TX; Cincinnati, OH; Philadelphia, PA; Raleigh, NC; and Seattle, WA. These cities were chosen partly to cover any regional variations in approach and partly because

their reports were extremely easy to find online, suggesting wide distribution to the public.

In addition to criteria from the BID reports, this section will introduce the criteria used in two downtown scoring systems designed for public consumption: the annual ranking of “Best Downtowns” by Livability.com and the one-time ranking by Forbes. The evaluations surveyed share several general categories of criteria:

1. **Accessibility**
urban form and transportation
2. **Economy**
employment and real estate
3. **Community**
downtown as a residential neighborhood
4. **Identity**
distinctiveness, culture and activity

The remainder of this section is organized within these four categories. I introduce each category’s most common evaluation criteria and provide examples of how they have been used. When possible, I connect the criteria to broader theories of urbanism. Some criteria, such as walkability, have been the focus of a great deal of research. For those, I also discuss evaluation methods used in research outside the downtown context.

The purpose of this section is not to determine the best indicators for downtown evaluation but rather to examine which qualities have been considered worthy of evaluation in the past. For that reason, I withhold most commentary on the

usefulness of any indicator until Chapter 4 where I discuss the selection process for my own indicators.

I. ACCESSIBILITY

Today’s dominant urban planning trends promote compact, walkable, mixed-use environments. New Urbanism, Walkable Urbanism, Pedestrian Oriented Development and Transit Oriented Development take slightly varied approaches to reach the same end; they all aim to create places where a resident’s daily activities are readily accessible without the use of a car (Leccese & McCormick 2000; Leinberger 2007, p. 117; Schmitz & Scully 2006, p.16; Cervero et al 2002, p. 2). This goal heavily depends on a place’s physical design. Because many American downtowns were developed prior to automobile prevalence, they are often walkable by default, one reason for the resurgent interest in urban living.

In the late nineteen-nineties the characteristics that allow automobile-independence were categorized as the “3 Ds of the built environment”: density, diversity and design (Cervero & Kockleman 1997; Ramsey and Bell 2014). Since then researchers have added a host of other Ds to the list, the most commonly used being destination accessibility and distance to transit (Ewing & Cervero 2010). Here, I examine the most commonly cited goals for downtown accessibility: downtown should

be walkable, compact, diverse and multi-modal.

Downtown should be walkable

Of all criteria for downtown accessibility, walkability deserves the most attention. Walkability is an absolutely critical element of urbanity. As Jeff Speck notes, the pedestrian is “the canary in the coal mine of urban livability” (2012, p.10). Street activity is the most obvious sign of urban vitality and a downtown will not be seen as thriving if its sidewalks are empty.

Urban planners, environmentalists, public health experts, gerontologists and economic developers all recognize the importance of walkability. Residents of walkable places have smaller carbon footprints and lower obesity rates than residents of traditional suburbs (Alberts 2014; Frank et al. 2004). Walkable places allow aging residents to remain independent even after they are unable to drive a car. There is evidence that customers who travel by non-motorized means spend more per month at local businesses than those that drive (Kelly et al. 2013).

Many downtown BIDs reference walkability in their annual reporting, citing it as a key element of their downtown’s attractiveness. Philadelphia’s Center City Partners and the Downtown Seattle Association both report the share of downtown employees who walk to work, as well as the Walk Score of downtown neighborhoods (Walk Score will be discussed in greater detail below). Downtown Seattle Association and Downtown Raleigh Alliance also record pedestrian traffic at key intersections. Cincinnati references downtown

walkability, but does not provide metrics for assessment. Austin only provides general descriptions of mobility and infrastructure initiatives, with no measures of walkability.

Walkability has been a criterion in Livability.com’s “Best Downtown” rankings for two of the four years it has been released. In 2011, the rankings cited walkability as a criterion without giving methods for determining it. In its 2015 rankings, the website measures walkability using Walk Scores.

In broader literature, researchers have explored many methods to assess walkability, most of which evaluate proximity between trip origins and destinations or factors that affect the quality and directness of routes to destinations (Frank 2000). Proximity measures include density, diversity of land uses, and as-the-crow-flies distances to destinations. Connectivity measures include “micromeasures” like intersection density, street connectivity, and the presence of sidewalks (Frank 2000; Saelens et al. 2003). These physical measures of connectivity have indeed been found to correlate with walking behavior (Frank et al 2005). But, as Reid Ewing and Susan Handy observe, they fail to capture a pedestrian’s perception of walkability (2009).

Ewing and Handy establish consensus definitions for five perceptual qualities of walkability (imageability, human scale, enclosure, transparency and complexity) and find that these qualities correlate with thirty-eight objective physical characteristics of the built environment. The characteristics with the strongest correlations include the proportion of

historic buildings, presence of outdoor dining, proportion street wall¹ and proportion of first floor with windows.

Ewing and Handy's approach begins to account for another key factor of walkability: pedestrian motivation. Walk Score, a popular online scoring system, measures a location's walkability by its proximity to particular amenities like groceries, dining, retail, schools, parks and entertainment opportunities. In its first iteration, the system measured proximity as-the-crow-flies, but since 2013, Walk Score has been integrating street networks into its algorithm, allowing it to measure not just proximity but also connectivity (Hirsch et al. 2013; Lerner 2014). Walk Score's validity has been tested against other common indicators of walkability, proving significant correlations with variables such as destination density, pedestrian route directness, intersection density and speed limit (Duncan et al. 2011). Although Walk Score's applications may be limited by its presentation as a composite measure, that fact may actually contribute to the tool's validity; a recent study has found that composite measures better indicate

walkability than individual variables (Vargo et al. 2011).

Downtown should be compact and diverse

Compact, mixed land uses are characteristic of all the world's most urban places. A mixed-use environment brings together a diverse range of activities. Downtowns depend this diversity to keep the area active at all hours of the day. Though the two traits are very different, they are deeply related. Density allows a greater number properties, which in turn allow opportunities for a broader range of uses.

Though none of the BID reports surveyed track these characteristics, academics have developed operational measures. Researchers assess land use diversity using statistical models of entropy and dissimilarity (Cervero 1997). Entropy measures how equally land uses are distributed across some specified area, while dissimilarity measures the likelihood that any given parcel will have a different land use than its neighboring parcel (Brown 2009; Cervero 1997).

In an urban environment compactness and density refer to the intensity of development. Density is primarily measured using one of three metrics: population density, job density, or floor-area-ratio (Cervero 1997, p.206; Malizia 2013).

Population density is measured by either population or households per square mile or acre; job density is measured intuitively by the number of jobs per square mile or acre. Floor-area-ratio (FAR) is measured as a building's gross leasable area (GLA) divided by its lot size. "Urban character" has been

1. The authors use this term to describe the proportion of the street lined with buildings: "The buildings become the 'walls' of the outdoor room, the street and sidewalks become the 'floor', and if the buildings are roughly equal height, the sky projects as an invisible ceiling. Buildings lined up that way are often referred to as 'street walls'"

defined as generally having an FAR greater than 1.0 (Leinberger 2005).

Downtown should be multimodal

Despite the many benefits of walkability, few would argue it should be a singular transportation goal for urban places. Even the most prominent walkability evangelists admit, “walkable cities rely on [transit] utterly” (Speck 2012, p.71).

Seattle and Philadelphia present their multimodality through statistics on the means of transportation to work for downtown employees. The downtown BIDs of Seattle, Raleigh and Philadelphia report downtown transit ridership, though Raleigh only reports ridership for its downtown circulator route. Philadelphia also reports Transit Score and Bike Score, both from the creators of Walk Score. The Transit Score algorithm considers distance to the nearest stop, the frequency of routes serving the stop and the mode of transit (Walk Score, “Transit Score Methodology”). Bike Score essentially adds the presence of bike lanes, topology and bike commuting mode share to the Walk Score algorithm (Walk Score, “Bike Score Methodology”).

Though the costs and benefits of parking are a contentious topic, the number of parking spaces downtown does indicate accessibility by one mode of a multimodal system. Raleigh, Cincinnati and Seattle report the number of parking spaces

downtown, but only Raleigh’s BID presents abundant parking as an amenity.

II. ECONOMY

With its origins as the primary hub of local business activity, downtowns have always held major economic significance. Although major industries vary from city to city, an obvious and fundamental indicator of downtown’s economic health is its density of jobs. All of the surveyed BID reports provided downtown employment statistics as a key indicator of economic growth (or decline – Philadelphia’s Center City Partners went out of their way to illustrate how their downtown has fewer jobs than it did forty years ago). Most reports also profiled major downtown employers.

In addition to job counts, property and tax information create a more complete picture of how a downtown location is valued. Office property performance demonstrates how highly employers value a downtown location. All five BID reports include downtown office rents and occupancy rates, as well as an indicator of property investment – either as a monetary amount or as newly constructed square footage. Raleigh and Austin’s downtown BIDs also compare downtown’s taxable value per acre to the rest of the city or county.

For a downtown Business Improvement District, economic indicators have obvious significance. Downtown rankings in popular media place somewhat less emphasis on downtown’s economic standing; Forbes’ ranking considered no economic variables, while Livability.com has shifted emphasis from year to year. In 2011, no economic variables

were considered; in 2012 they vaguely assessed “economic growth” as a separate variable from vacancy and unemployment rates; in 2014 they considered income growth and vacancy rates; and in 2015 they only considered vacancy.

Literature on downtown revitalization supports the use of employment and property data to evaluate downtown’s economic health. Dagney Faulk suggests that downtown revitalization should be measured by growth in jobs, businesses and housing (2006, p.230). Michael Burayidi’s evaluation framework includes employment, business count, change in tax base, real property investment and office space occupancy (2001, p.60).

A more refined approach to urban economics has taken the spotlight in recent years. Rather than focusing on universal job growth, people-focused theories like those of Richard Florida and Ed Glaeser define a city’s success by the types of workers it attracts. According to Glaeser, a city’s strength lies in its human capital, defined as “its education and level of entrepreneurship” (Glaeser 2014, p.12).

Florida refines this human capital theory to focus on the “scientists, techies, professionals, artists and media types” whom he has dubbed the “creative class” (2014a). He argues that attracting the creative class is key to economic growth. Florida assesses cities’ attractiveness to creative people by measuring the city’s creative class share of the workforce, its Tech Pole Index (an indicator of high-tech industry developed by the Milken Institute), its patents per capita and a Gay Index to estimate openness, diversity and tolerance

(2002). Indeed, cities deemed more creative by Florida’s criteria have demonstrated more growth in total jobs and total wages than less creative cities (Florida 2014b, p.200).

III. COMMUNITY

The human capital and creative capital economic theories described above have major limitations – they tend to undervalue the working class without which a city could not operate – however they do illustrate how a place’s success can be influenced by its demographics. A successful downtown’s many retail and dining establishments require a substantial lower-wage workforce.

In an equitable downtown, these workers should be represented not only in the workforce but also in the residential community. With Americans’ growing interest in urban living, downtowns must be evaluated as not only places to work and play, but also as residential communities.

All the surveyed BID reports provided some discussion of their cities’ growing downtown residential populations. Beyond that basic statistic, the demographic reporting varied widely across the cities. Austin and Philadelphia include figures on downtown rent and/or home prices. Seattle and Philadelphia report information on where downtown workers live, including the population that lives and works downtown.

Interestingly, only three of the BIDs report any direct measures of residential diversity. Philadelphia reports income distribution, racial diversity, household type and educational attainment. Raleigh reports

population by age and income. Seattle reports household type and educational attainment.

Diversity has been a goal of urban planners for decades, but the methods by which it is measured vary widely. Diversity can be measured within many categories (race, age, income, household type, education), but there has been little if any effort to establish which type of diversity is most desirable. Common indicators of diversity include racial/ethnic diversity, employment by industry sector and income distribution (Breen & Rigby 2004; Burayidi 2001; Cortright 2006).

IV. IDENTITY

In describing vibrant, successful urban places, many authors describe some quality far less tangible and more subjective than any matter of urban form or demographics. It has been called “hipness” (Breen & Rigby 2004), “sense of place” (Ewing & Clemente 2013; American Institute of Architects 2005) and “authenticity” (Brown & Dixon 2014). These qualities, while difficult to operationalize and evaluate, demonstrate the need for indicators of downtown’s culture, history and all the activities that contribute to a unique identity.

In BID reports, these indicators include convention attendance (Philadelphia, Seattle), arts organizations (Seattle), visitor counts at downtown attractions (Philadelphia, Raleigh, Seattle) and number of outdoor festivals (Raleigh). Storefronts, historic buildings and outdoor dining all contribute to perceptions of imageability, “the quality of a place that makes it distinct, recognizable and memorable” (Ewing &

Handy 2009). Raleigh and Philadelphia report their numbers of outdoor dining options and Seattle reports the types of ground level businesses downtown.

In the literature, authors have assessed these qualities by counting convention facilities, historic districts, festival attendees, destinations and major attractions (Ford 2003; Faulk 2006; Malizia 2013). At the regional scale, researchers at the Urban Institute have developed a set of indicators for cultural vitality including “arts establishments per thousand population,” “percentage of employment in nonprofit and commercial arts establishments as a proportion of all employment,” “nonprofit arts organizations per thousand population,” and “nonprofit community celebrations, festivals, fairs and parades per thousand population” (Jackson 2006, p. 39).

Many of the above indicators, not just of identity but in all four categories, are difficult to track and have limited data availability – especially for downtown geographies. The limitations will be discussed in the following sections, but despite shortcomings, these prior evaluations revealed a framework for organizing the qualities of a successful downtown and provided a starting point

for the development of indicators presented later in this paper.

C. DEFINING DOWNTOWN GEOGRAPHIES

Geographically defining downtown is a difficult task. There are no standards for downtown boundaries and no requirements for cities to delineate them. Zoning maps, comprehensive plans and transportation documents all come straight from city hall but frequently present conflicting downtown boundaries. Downtown Business Improvement Districts (BIDs) and local visitor centers may also distribute maps that contribute to the boundary confusion. These boundaries not only vary widely but are often irregular and do not align with more ubiquitous geographic units like zip codes or census tracts (Birch 2002; Burayidi 2001; Burayidi 2013; Levy & Gilchrist 2013).

Nearly all downtown research relies on boundaries built from an aggregation of census tracts, but researchers employ a variety of methods to determine which tracts to consider. In this section, I discuss the various approaches found in the literature.

I. LOCAL BOUNDARY DEFINITIONS

Because of the variations of local boundaries described above, few researchers have attempted to use local downtown definitions. In her work on demographic trends in American downtowns, Eugenie Birch defines each downtown with a collection of census tracts

that best approximates locally accepted boundaries, as determined by conversations with local officials (2002, 2005, 2009). Birch built these boundaries from 1970 tracts so that they could be compared over time. She acknowledges that this approach is better suited for longitudinal studies than cross-sectional, as local definitions reduce comparability across cities.

Michael Burayidi does not share Birch's concerns with using local boundaries for cross-sectional research. He defines the geographies of fourteen "resilient downtowns" using local definitions but builds some of these boundaries from a collection of both census tracts and block groups and does not provide a thorough explanation of his methods or reasoning (2014).

II. RADIAL BOUNDARY DEFINITIONS

Authors frequently cite a need for nationally standardized downtown geographies (Levy & Gilchrist 2013; Ford 2003). Since the discontinuation of the Census Bureau's Central Business District program in 1982, there have been no nationally delineated geographies equivalent to downtowns (US Bureau of the Census 1994, p. G-11). As established in the terminology section above, the CBD is not an adequate representation of today's downtown, yet a number of studies have employed the Census CBD delineations twenty to thirty years since their last update. In these cases, however, the old CBD designations are generally used to define the central point of some radial area (Stoll 2005; Cortright 2009; Cortright 2014). This approach was popularized by a 2001 Brookings Institute

report that used a three-mile radius around the CBD to determine the existence of a “well-defined employment center” (Glaeser & Kahn 2001, p. 2).

Although the Census CBD boundaries are out of date, this method still has validity

FIGURE 1. ONE, TWO, AND THREE MILE RADII AROUND NEW YORK CITY HALL



in some contexts, such as measuring job sprawl by the distance to the centroid of the CBD (Stoll 2005). However, some researchers have used these antiquated CBD rings as approximations of downtown, a context in which their validity is more questionable. When only a few square miles are being studied, the misplacement of a centroid has much more significance. The former CBD centroid may have little relevance to today’s diverse downtown activities and if the centroid happens to sit near a waterfront, a large area of downtown may be underwater

(as is the case in New York City, shown in Figure 1).

Reports from CEOs for Cities frequently use three-mile radii around the 1982 CBD, most recently to define “close-in neighborhoods” or the “urban core” (Cortright 2014, p. 2).

The Census Bureau recently attempted to assess the demographic changes in downtowns, also using radial boundary definitions (Wilson 2012). A report on “Patterns of Metropolitan and Micropolitan Change” defined downtown using census tracts with centroids within two miles of city hall (p. 26). Critics of this report aptly note that “Not all city halls are at the geographic center of their downtowns nor, generally, does a circle capture the idiosyncratic shapes of urban commercial areas” (Levy & Gilchrist; 2013, p. 12). These radial downtown boundaries are attractive for large, cross-sectional studies because they are simple to compute and easy to compare. However, not addressing local idiosyncrasies results in findings with little relevance for many downtowns.

III. ALTERNATIVE BOUNDARY DEFINITIONS

A 2013 report from Philadelphia’s Central City Partners and the International Downtown Association introduced an alternative methodology for defining downtown boundaries (Levy & Gilchrist 2013). Levy and Gilchrist utilize Local Employment Dynamics (LED) data to

determine boundaries for the commercial downtowns of 150 U.S. cities and places.

LED data is one of the Census Bureau's newest and most geographically precise data products. It provides data on the employed population based on the census block where they work and the census block where they reside.

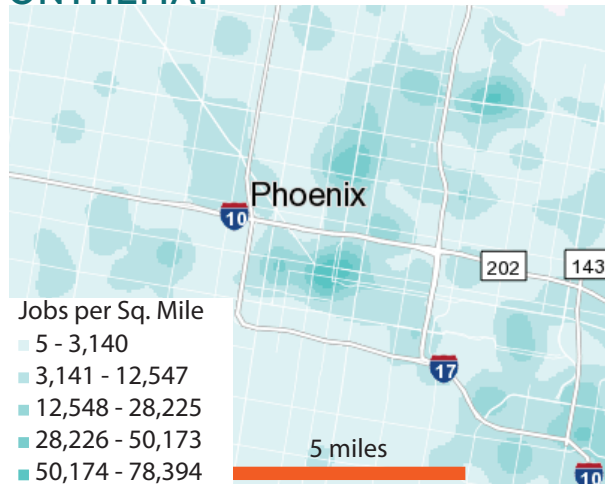
The Census's OnTheMap tool visualizes LED data with a density heatmaps; areas with the most jobs or residents per block are generalized and displayed in darker colors. Levy and Gilchrist establish boundaries of 231 job nodes based on "visual job-density levels" shown in OnTheMap (p. 13, p. 54 2013). They then define downtown using the census tracts represented in these employment nodes.

Levy and Gilchrist present this methodology as a means to "map downtown commercial areas and institutional districts, however irregular in shape," yet by simplifying the LED-defined job nodes to census tracts, they eliminate this advantage (p. 14 2013).

Their methodology is also not nearly as standardized and replicable as they imply; rather than determining employment nodes by some standard minimum job density (i.e. tracts where job densities are in the 75th percentile for the MSA), they determine the nodes visually based on the color gradations shown in the OnTheMap viewer. This makes their downtown designation difficult to replicate, especially in cities with decentralized employment patterns. A downtown where job densities are no higher than surrounding areas would be overlooked with OnTheMap's default job-density classifications. Figure 2 demonstrates the the minimal contrast

in how job densities are displayed across a large area of Phoenix, AZ.

FIGURE 2. JOB DENSITIES IN PHOENIX, AZ AS DISPLAYED IN ONTHEMAP



While defining downtowns by job density patterns could help ensure that similar areas are being compared across cities, this approach relies on an outdated assumption that downtown must be a job center. Defining boundaries by current job densities would discount the significance of primarily residential or entertainment-oriented downtowns.² This approach would also completely ignore historical downtowns that have not begun to recover from major declines.

Though several approaches have been taken in determining downtown geographies, no major studies have defined downtown without generalizing the boundaries using

² This is not to suggest that a residential or entertainment-oriented downtown would not provide jobs, merely that their job densities would likely be low in comparison with traditional office-oriented employment centers.

census tracts. The reasons for this are straightforward: local data on population and workforce is generally derived from national sources such as the Census and the American Community Survey. These sources only release limited data for geographies smaller than the tract (Levy & Gilchrist 2013, p. 11). Still, for many downtowns, tract boundaries result in overgeneralization and would benefit from performance measures derived from smaller geographies. The following chapter will illustrate the problems with tract-based boundaries in small downtowns and will introduce data sources that allow a more fine-grained analysis.

THE QUALITY OF DOWNTOWN INDEX

Some might suggest that downtown's greatness can't be measured— that it's one of those “know it when you see it” things. This paper attempts to prove otherwise, quantifying the characteristics essential to a successful downtown. After considering the approaches discussed in the previous chapter, I construct a comprehensive “Quality of Downtown Index” that includes characteristics essential to all of downtown's primary activities.

In this chapter, I describe the rationale behind the key decisions in the development of the Quality of Downtown Index (QDI). First, I critique the status quo for downtown research: the use of census tract-based downtown boundaries. The remainder of this chapter explains the process used to select indicators of downtown quality, following the categorization used in the literature review: indicators of downtown accessibility, economy, society and identity.

A. THE CASE AGAINST TRACT BOUNDARIES

Because the geographic definition of downtown would determine the data availability for all indicators, I had to determine what geographic units would be studied from the outset. After giving consideration to all of the approaches found in the literature, I chose to base the QDI

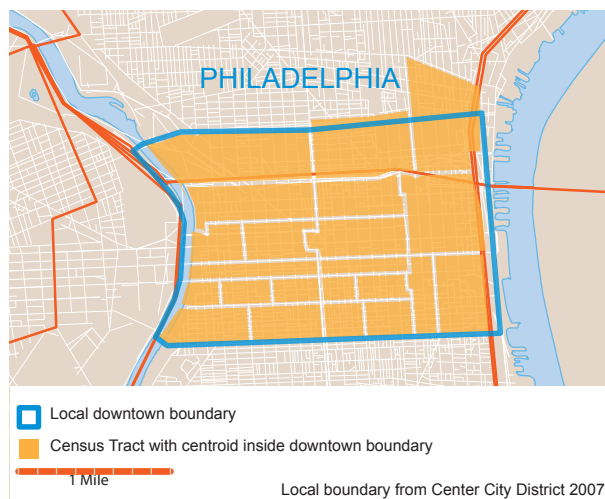
on locally-defined downtown boundaries. Radial definitions are only appropriate for measures of sprawl and centralization. Attempts to standardize downtown geographies post-facto fail to incorporate the diverse activities of the contemporary downtown. For researchers comparing a broad sample of downtowns, these generalizations may be acceptable, but for an indicator to be useful to locals, it must be tracked with local definitions.

As stated in the previous chapter, few researchers employ local boundary definitions in the study of downtowns. Those that do construct an aggregation of census tracts to approximate the local definition. These approximations work well in the downtowns of the nation's largest cities, but they have major shortcomings for downtowns with smaller populations. A census tract's physical size is determined by the size of its residential population; each is

FIGURE 3. CENSUS TRACTS AND LOCAL DOWNTOWN BOUNDARY IN CHICAGO, IL



FIGURE 4. CENSUS TRACTS AND LOCAL DOWNTOWN BOUNDARY IN PHILADELPHIA, PA



designed to hold somewhere between 1,200 and 8,000 people, with an ideal population of 4,000 (US Census Bureau 2010 Geographic Terms). This means they vary greatly in geographic size and are much smaller in dense areas.

In large, densely populated downtowns, census tracts are very small. For example, Chicago’s four square mile “Central Area” (a downtown definition extending slightly beyond the Loop’s historic business district) contains 18 tracts with an average area of 0.28 square miles (Figure 3)

Philadelphia’s downtown, a three square mile area called the Center City, contains 22 tracts with an average size of 0.13 square miles. These small geographic units allow reasonable approximations of local downtown boundaries (Figure 3, Figure 4).

Downtowns that do not have a major residential population contain fewer census tracts with each tract covering a larger geographic area. Downtown boundaries built from these coarse geographic units may have little in common with local boundaries and can result in gross misrepresentations of downtown’s contents. As Larry Ford notes in his comparative assessment of downtowns, “Boundaries and definitions are extremely important since the inclusion or exclusion of a few blocks can make for significant differences in, for example, employment or recreational opportunities or population” (Ford 2003, p. 7).

This is well illustrated by the downtowns of Durham and Raleigh, North Carolina. Both cities have small downtowns that are rapidly gaining residents, jobs and

amenities. The local definition of downtown Durham is a 0.89 square mile district.

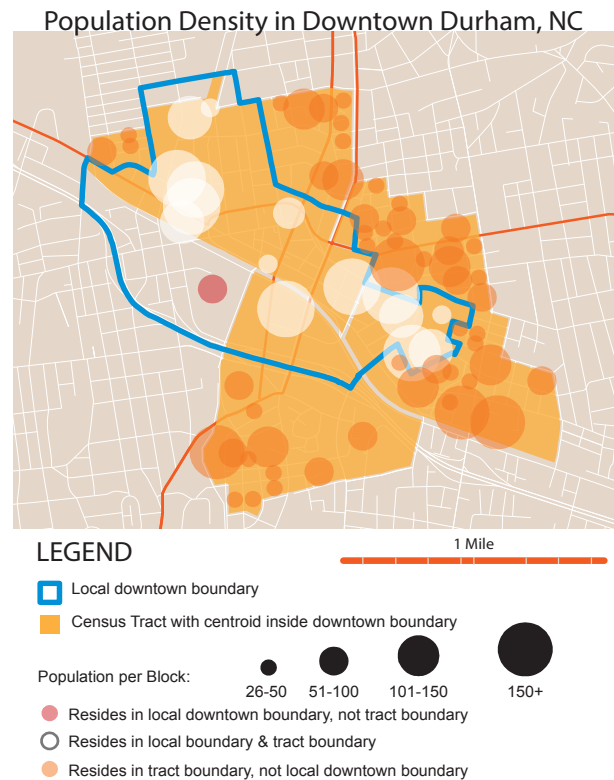
Figure 5 shows the three census tracts whose centroids are within Durham's local downtown boundary (the origins of this local boundary are discussed in Chapter 4). These tracts cover an area more than twice that of the local definition and hold a residential population more than twice as large.

On the other hand, only one census tract has its centroid in Raleigh's 1.47 square mile downtown. An approximation of downtown using this tract would result in an area roughly half the size of the local definition, missing more than half of the actual downtown residential population.

These small, rapidly changing downtowns are those most in need of clear indicators of progress and precise measures of change. Tract-based downtowns may provide information good enough for a large cross-sectional study, but the information is not precise enough for the assessment of a specific downtown. The methods presented in this paper are original in their independence from census tract geographies. The data sources used here are available at point, parcel and block level allowing the collection of objective, quantitative data for downtowns of many shapes and sizes.

Perhaps a reason previous studies have not used this level of geographic precision is lack of awareness of sources for data at this scale. Some of the sources providing this level of detail are relatively new and although others have been in existence longer, trends in "open data" have made resources increasingly accessible (www.

FIGURE 5. CENSUS TRACTS AND LOCAL DOWNTOWN BOUNDARY IN DURHAM, NC



Data.gov). Appendix A provides a detailed guide to the data sources considered when selecting this paper's indicators.

B. SELECTING THE INDICATORS

I identified preliminary indicators based on their ability to demonstrate one of the characteristics of successful urban places discussed in the literature: accessibility, economy, community, or identity. Many were pulled directly from the literature, where they may or may not have been applied in a downtown geographic context.

The potential viability of each indicator was rated on the following criteria:

1. Reliability of data and face validity of variable

Data provided by a trustworthy source and the variable measured must have a demonstrated relationship to the characteristics of a quality downtown

2. Geographic scale of data

Data availability at a fine-grained geography, such as point (address or geographic coordinates), parcel, or block

3. Geographic range:

Data available for many cities, preferably through the same database. When local data sources are used in comparative analysis, they must be sufficiently comparable across municipalities

4. Temporal scope:

Data distributed regularly, availability of historic data and potential for the variable to show change (because the QDI is intended to be useful in demonstrating revitalization and

or decline, its indicators must have the potential for change over time)

5. Ease of Access:

Cost of data, restrictions on user access and existence of national databases

A complete list of indicators that were considered can be found in Appendix B along with their data sources and ratings for the above criteria.

Two criteria were often at odds: data with a broad geographic range frequently had a limited temporal scope, while the variables with the most abundant historical data often come from unique local sources. For example, online platforms like Open Street Map (OSM), Google Maps and WalkScore provide useful information on the distribution of amenities nationwide, but many of these sources do not archive data or do not make historic data easily accessible. Meanwhile, cadastral parcel data provides a wealth of information on property values and land uses often going back over a decade, but this data is often only accessible through the departmental webpages of local governments.

These two classes of data lend themselves to different types of research. The data available for the broadest geographic scope would be crucial for cross-sectional downtown research comparing the quality of downtowns in many cities. In these projects, accessing and streamlining data from local agencies would be time-consuming and the comparability of the data may be limited. The historic data available only from local sources would be

crucial for longitudinal studies, assessing the changes in quality of individual downtowns over time.

Discovering this limitation led to the decision to base the Quality of Downtown Index on only a core set of indicators accessible through national databases. Some of the quality of downtown indicators can be tracked over time, and supplementary indicators reported by local sources could help fill in gaps in historical analyses. The composite QDI cannot demonstrate progress from a historic baseline (though it can demonstrate progress each year after initial implementation), but it is easily collected and readily comparable for the downtowns of many cities.

The Quality of Downtown Index consists of four sub-indexes: the Downtown Accessibility Index, the Downtown Economy Index, the Downtown Society Index and the Downtown Identity Index. The remainder of this chapter will present the indicators for each sub-index.

I. INDICATORS OF DOWNTOWN ACCESSIBILITY

The review of literature in the first chapter found consensus on the key characteristics of accessibility: compact/dense development, a diversity of land uses, a variety of destinations and accessibility by a variety of modes of transportation – especially by foot. Over a dozen variables were considered as potential indicators of downtown accessibility (details on all variables considered can be found in Appendix B. A guide to data sources can be

found in Appendix A). Given the quality and availability of data, the Accessibility Index is based on the following core indicators:

1. Density: Average Floor-Area-Ratio

Measured with: Square footage of commercial properties

Recommended data source: CoStar

Floor-Area-Ratio (FAR) refers to the ratio of a building's gross leasable area (GLA) to the size of the lot on which the building sits. Of the three measures of density introduced in Chapter 2, FAR requires the most difficult data inputs. Population density and job density have important implications for downtown's social and economic conditions, but because the contemporary downtown is not made up solely of office buildings or solely of homes, neither metric provides an adequate picture of the density of downtown's development.

Minimum and maximum FARs are commonly included in zoning regulations. This indicator measures the average FAR for downtown commercial properties, using data collected from the CoStar property analytics.

2. Mixed Use

Measured with: Square footage of commercial properties

Diversity of Uses by Building Area

Recommended data source: CoStar

This indicator measures the mix of uses present in downtown commercial properties. I calculate the diversity of downtown's square footage among office, retail, warehouse and multifamily residential uses using an entropy equation.³

³ From Frank et al. 2005: Land-use mix = $(\sum 1) \times [(\text{SF commercial} / \text{SF all uses}) \ln (\text{SF commercial} / \text{SF all$

The selection of property types included in CoStar data limit the usefulness of this indicator. CoStar does not include non-commercial properties such as government-services or single-family residences. When parcel data is accessible, it is recommended that it be used to better demonstrate downtown's mix of uses.

3. Transit Accessibility

Percentage of downtown workers living in walking distance of transit
Recommended data source: Google Transit Feeds and OnTheMap

A common measure of transit accessibility builds quarter-mile buffers around transit stops to determine the area is transit-served. However, this indicator says little about the usefulness of the transit: do buses arrive frequently enough? Do buses go where travelers need to go?

Data availability limits the feasibility of indicators of transit utility. Though transit riders have easy access to route information through online maps, mobile applications and agency websites, it is still fairly difficult for researchers to access this data. Most transit agencies use the standard data format required by Google maps and Google Transit Feed Specifications (GTFS), but this data format is based on many related tables and requires a long sequence of operations

to extract data on route frequencies for typical weekday routes.

It is, however, quite simple to extract the geographic locations of transit stops from GTFS data. In an effort to better represent not only the presence of transit, but its utility, I measure the percentage of downtown workers who live within walking distance of transit.⁴ This measure demonstrates the coverage of transit and how well the region is connected to downtown.

I calculated this by first mapping bus stops with GIS software. I then created simple quarter mile buffers around these stops and considered the resulting area to be within walking distance of transit.⁵ I then imported this GIS layer into the Census's OnTheMap tool, alongside the downtown boundary layer. I used OnTheMap's paired analysis tool to find the number of people who live in the transit-served area and also work within the downtown boundary.

4. Supplemental indicators of Accessibility

Of all of the QDI's core indicators, those of accessibility are the weakest. It is difficult to access comparable data on the built environment across many cities. Most of the data on the built environment is collected locally so supplemental indicators based on

4 To the best of my knowledge, this measure has not been used in any prior research. Prior to the release of LEHD data the relationship between home geographies and workplace geographies could not be evaluated on a fine geographic scale. I believe this indicator has strong potential as an easily calculated measure of transit accessibility. Future research could test the validity of this measure against other measures of transit accessibility.

5 This could be improved by making buffers that follow street networks.

uses) + (SF office / SF all uses) ln (SF office / SF all uses) + (SF residential / SF all uses) ln (SF residential / SF all uses)] / ln (n3); where n3 = 0 through 3 depending on the number of different land uses present

local data provide a better representation of downtown accessibility. The following supplemental indicators are recommended:

When local cadastral parcel datasets include building area, that data should be used to calculate FAR. It can cover a greater portion of downtown, including non-commercial properties.

Most parcel data reports some categories of land use, though the classifications and specificity vary by municipality. Calculating land use diversity with this data includes non-commercial properties.

When GTFS data is available for a transit system, additional measures of transit accessibility should be calculated, including the total number of routes servicing downtown and the frequency of stops made downtown.

II. INDICATORS OF DOWNTOWN ECONOMY

Traditional indicators of urban economics are much more easily collected than those of accessibility. Reliable data sources provide office property performance and job densities at downtown geographies.

1. Office Rents Compared to County

Recommended data source: CoStar

Office rents demonstrate how highly businesses value a downtown location. Comparing downtown rents to regional rents shows the relative advantage that businesses are willing to pay for. This indicator calculates the average downtown office rent per square foot, divided by the

average office rent per square foot for the metropolitan statistical area.

2. Office Occupancy Compared to County

Recommended data source: CoStar

While some downtowns might take pride in low office rents as a sign of affordability (Raleigh State of Downtown 2014), vacancy rates are more difficult to give a positive spin, making them a straightforward indicator of the downtown office market. This indicator calculates the average downtown occupancy rate, divided by the average vacancy rate for the metropolitan statistical area.

3. Job Density

Recommended data source: LEHD (OnTheMap)

Job growth over time is easily extracted from the Census Bureau's LEHD data. These figures are reported for most of the nation from 2002 onward,⁶ and demonstrate downtown's strength as an employment center.

4. Supplementary Indicators

Most of the indicators used in urban economics research are available without using local data sources. Property values and tax assessments are the exception; this information is available at the parcel level only through local datasets. Taxable value per acre downtown compared to the county average is recommended as a supplementary indicator to show the

⁶ According to an announcement dated February 3, 2015, the LED data used in OnTheMap is on hold. Data has only been released through 2011, but the announcement assures users that standard releases will resume as soon as a data sharing agreement is approved.

relative economic importance of downtown properties.

III. INDICATORS OF DOWNTOWN COMMUNITY

Indicators of the quality of downtown's residential community measure not only who is living downtown but also how well downtown serves their needs.

1. Population Density

Recommended data source: Census (Decennial & ACS), Esri

Because downtowns are not Census geographies, their populations are most accurately measured by summing the populations of downtown blocks. Although population is only released on the block level every ten years, downtown population can be estimated between these years using weighted block apportionment. This method uses the block populations from decennial years as weights to distribute the population of the blocks groups or tracts that intersect the downtown boundary. Esri's Business Analyst Online automatically calculates population for custom geographies using this method.

2. Diversity of Household Types

Recommended data source: Census (Decennial & ACS)

As discussed in Chapter 2, there is no consensus over what type of diversity is desirable in a downtown population. Given the concern over whether millennials will still be attracted to urban life once they start families, it is important to evaluate what types of households live downtown. This indicator measures the diversity of downtown's family, non-family and single

households with a model multigroup entropy index previous used by the Census Bureau (Iceland 2004).⁷

3. Live-Work Dynamic: Share of Nearby Residents Who Work Downtown

Recommended data source: LODS, accessed through OnTheMap

This indicator measures the share of the employed residents living within a quarter mile of downtown who also work downtown. It assumes that people who live within walking-distance of downtown are more likely to spend a significant portion of their time in downtown using its amenities, supporting its retailers and populating its sidewalks and public spaces.

Many factors of downtown's success depend on consistent daily foot traffic, including retail viability, public perception of safety (the oft-cited "eyes on the street" of Jane Jacobs) and the success of public spaces (Speck 2012). A quarter-mile buffer was chosen to define the residential area based

7 "A unit within the metropolitan area, such as a census tract, would analogously have its entropy score, or diversity, defined as:

$$E_i = \sum_{t=1}^t (\Pi_{it}) \ln[1 / \Pi_{it}]$$

where t_i refers to a particular racial/ethnic group's proportion of the population in tract i " (2004, p.8).

on the concept of a five-minute walkshed (Crankshaw, p.92).

4. Resident-Serving Businesses per Block

Recommended data source: Esri Business Analyst

Downtown must have an adequate concentration of resident-serving establishments to be a quality residential community. This indicator measures the resident-serving retail establishments per block downtown. TABLE 1 shows the NAICS codes used to classify resident-serving establishments.

5. Supplementary Indicators

There are many additional ways to measure community diversity; racial diversity, educational attainment, age distribution, and income distribution all have important implications for a residential community. Because not all of this data is available for custom geographies using Esri’s BAO, they were not included as core indicators.

IV. INDICATORS OF DOWNTOWN IDENTITY

A successful downtown must have a unique and authentic identity. Based on the prior evaluation approaches described in Chapter 2, downtown’s identity is a product of its history and culture and the activity on its streets. These qualities are difficult to measure and even more difficult to compare across cities, but I identified three

TABLE 1. RESIDENT-SERVING CLASSIFICATION

NAICS CODE	BUSINESS TYPE
445	Food and Beverage Stores
446	Health and Personal Care Stores
6211	Offices of Physicians
62411	Child and Youth Services
6244	Child Day Care Services
6111	Elementary and Secondary Schools
5221	Depository Credit Intermediation
8121	Personal Care Services
8123	Drycleaning and Laundry Services

core indicators of downtown identity that can be tracked consistently across cities.

1. Destinations per Square Mile

Recommended data source: ReferenceUSA, Esri Business Analyst

Using the same methods as the resident-serving business indicator above, I measure the density of destination businesses: bars, restaurants, theaters, nightclubs and non-

TABLE 2. DESTINATION BUSINESS CLASSIFICATION

NAICS CODE	BUSINESS TYPE
71	Arts/Entertainment/Recreation
721	Accommodation Businesses
722	Food Service & Drinking Places
451	Sport/Hobby/Book/Music Business
448	Clothing & Accessory Businesses
443	Electronics/Appliance Businesses

resident serving retail, as outlined in TABLE 2.

2. Storefront occupancy

Recommended data source: CoStar

Active uses of ground-level storefronts have a major impact on a visitor's perception of imageability (Ewing & Handy 2009). Although occupancy does not necessarily indicate an active use, the occupancy rates of storefront retail properties provide a reasonable indicator of street-level business activity.

3. Relative Concentration of Downtown Arts & Culture Jobs

Recommended data source: LEHD (OnTheMap)

The relative concentration of arts and cultural employment indicates downtown's position as a regional cultural center. This indicator evaluates the percentage of an

Urban Area's total "Arts, Entertainment and Recreation" employment (using NAICS Industry Sector classification, as provided in the Census's OnTheMap tool) that is located in the Urban Area's downtown. This indicator evaluates total jobs as opposed to primary jobs, based on the assumption that arts professionals are likely to have another career alongside their creative endeavors.

4. Supplementary Indicators

Although historic character and perception of crime are key elements of downtown identity, measures of these traits are not sufficiently comparable across downtowns.

In an attempt to include the downtown crime rate as an identity indicator, I found that although most law enforcement agencies have a public viewer for crime data, it is impossible to extract this data for analysis.

My attempts to create an indicator of historic character were also unsuccessful. Historic buildings are the second most significant feature contributing to the perception of imageability or identity (after the number of other people on the street; Ewing & Handy 2009). But the number of downtown historic buildings would be an impractical evaluation measure, since a city can do nothing to replace structures that have already been lost to time or urban renewal. I attempted to create an indicator to evaluate the cumulative investment in historic preservation by summing the total cost of downtown Historic Preservation Tax Credit projects but this measure was

difficult to normalize since the values would vary so much across cities.

Although these measures could not be compared across cities, this information is still valuable for individual downtown evaluations, so it is recommended that it be tracked as supplementary indicators.

V. CONSTRUCTING THE INDEX

To aggregate the indicators into a composite Quality of Downtown Index, I normalized each variable using fixed target ranges rather than mean-standardized values. Though z-score normalization is common practice in walkability and vibrancy indexes, it is not a suitable technique for the QDI. Data for the quality of downtown indicators have not been collected for a large enough sample to normalize them against mean values and, more importantly, one of the primary intents of the index is to track changes over time in individual downtowns - an application that z-score normalization does not allow. If the QDI were based on z-score normalization, changes in a downtown's QDI each year would demonstrate not only on changes in that downtown but also changes in the best and worst downtowns.

To evaluate changes in quality over time as well as across cities, I established static minimum and maximum values for each indicator. This technique comes from the methodology behind the United Nation's Human Development Index, which is normalized using fixed "goalposts" based on historical minimums and projected

maximums for each variable (Anand and Sen 1994, p. 11). The Transit Score released by Walk Score also normalizes scores based on static values, defining a perfect score as the averaging of five model cities: San Francisco, Chicago, Boston, Portland and Washington, D.C.

TABLE 3 shows the minimum and maximum values used to normalize each measure, as well as the conceptual reasoning behind the chosen range. The maximum values for job density and population density were based on estimated values from three model cities: Chicago, Philadelphia and Washington D.C. These locations were chosen simply because their downtowns are dense, but their density is not often met with the same level of criticism as New York or Los Angeles.

After normalization, the indicator scores are adjusted to fit within a range of 0 to 25. The scores within each sub-index are averaged (with equal weights) and the sub-

index scores are summed for a maximum score of 100.

The development of a composite indicator requires many considerations. Academics have harshly criticized hastily developed indexes (Böhringer and Jochem n.d.).

The intent of this thesis was to present improved downtown evaluation methods, but fully developing and testing a composite indicator goes beyond this project's scope.

The index methodology presented here should not be viewed as definitive but rather seen as a starting point for further research and validation. The normalization ranges are subjective and could be improved with further research and data from more downtowns.

TABLE 3. INDEX NORMALIZATION TABLES

DOWNTOWN ACCESSIBILITY SUB-INDEX			
CHARACTERISTIC	OPERATIONAL INDICATOR	NORMALIZATION RANGE	JUSTIFICATION
COMPACT DEVELOPMENT	Floor Area Ratio	0.3 to 15	Leinberger uses 0.3 as the maximum FAR for drivable suburban development (2007, p.114). A downtown with a suburban FAR is given no points. 15 was a common FAR found in NYC commercial Zoning codes
MIXED USE	Entropy of commercial land uses by lot size	0 to 1	Implicit in entropy model. Completely even distribution = 1
TRANSIT ACCESSIBILITY	Share of downtown workforce living within walking distance of transit	0 to 1	Natural range of 0 to 1 (There are likely places where transit is minimal enough to result in near 0 scores and others where nearly every worker can walk to transit)
DOWNTOWN ECONOMY SUB-INDEX			
CHARACTERISTIC	OPERATIONAL MEASURE	NORMALIZATION RANGE	JUSTIFICATION
OFFICE RENTS	Ratio of downtown office rents to county office rents	0.5 to 2	Based on max difference between CBD and suburban markets in Malizia 2014. No additional points are assigned for rents more than twice the surrounding suburbs. Zero points are assigned downtowns with rents less than half those in surrounding suburbs.
OFFICE OCCUPANCY	Average annual office occupancy rate	0.75 to 1	Assumes full occupancy is ideal. No points are assigned where fewer than 75% of downtown's storefronts are occupied.
JOB DENSITY	Primary jobs per mi ²	0 to 343,500	The maximum value was determined by averaging estimated jobs per square mile in three model downtowns

DOWNTOWN COMMUNITY SUB-INDEX			
COMMUNITY	OPERATIONAL MEASURE	NORMALIZATION RANGE	JUSTIFICATION
POPULATION DENSITY	Population per mi ²	0 to 22,500	The maximum value was determined by averaging estimated population per square mile in three model downtowns
HOUSEHOLD DIVERSITY	Entropy of household types	0 to 1	Implicit in entropy model. Completely even distribution = 1
LIVE WORK DYNAMIC	Share of employed population living within ¼ mile of downtown, who also work downtown	0 to 1	Natural range of 0 to 1. 1 meaning every employed resident within walking distance of downtown works downtown.
RESIDENTIAL SERVICES	Resident serving business per block	0 to 10	Resident serving businesses are determined using ten NAICS codes. This range assumes that no additional value would be gained by having more than one of each type of business per block.

DOWNTOWN IDENTITY SUB-INDEX			
	OPERATIONAL MEASURE	NORMALIZATION RANGE	JUSTIFICATION
DESTINATIONS	Destinations per block	0 to 21	Destinations are determined using seven NAICS codes. This range assumes that no additional value would be gained by having more than 3 of each type of destination on each block.
STREET LEVEL ACTIVITY	Storefront occupancy	0.5 to 1	Full occupancy is ideal. No points are assigned where fewer than half of downtown's storefronts are occupied.
ARTS AND CULTURE	Share of Urban Area's Arts, Culture and Entertainment jobs located downtown	0 to 1	Natural range of 0 to 1, there are likely places where this figure is minimal enough to result in near 0 scores and others where nearly all arts activity occurs downtown

APPLYING THE QDI IN TWO MID-SIZED SOUTHERN CITIES

To test whether the Quality of Downtown Indicators can truly gauge downtown's overall quality, I applied it to two of the downtowns I know best: Durham and Raleigh, North Carolina. This chapter discusses the Quality of Downtown Indicators in practice.

I chose to test my indicators on these cities because I am familiar with their downtowns and I have witnessed much of their recent revitalization. My familiarity allowed me to better compare the QDI's measures with local perception of downtown changes and to compare the accuracy of various data sources. These downtowns are also of the class that I believe most needs improved evaluation criteria; they are changing rapidly, but existing evaluation measures are a poor fit for their idiosyncratic boundaries (see Chapter 2 section C).

This chapter begins by introducing the two downtowns. I will briefly discuss their histories and the timelines of their downtown decline and revitalization. Next, I will explain how I determined the boundaries by which to define downtown geographies. I then explain challenges and idiosyncrasies uncovered while operationalizing the indicators before presenting each downtown's resulting QDI.

A. CONTEXT

Raleigh and Durham are neighboring cities in central North Carolina, known for their research and educational institutions. Though they are often discussed as a unified region, the Census has placed them in separate metropolitan areas since 2003 (US Census Bureau, Historical Delineation Files). When the cities are grouped, it is often as part of the "Research Triangle" or simply "The Triangle" (the other point on the Triangle being Chapel Hill, which is a part of Durham's urbanized area).

This lexicon comes from Research Triangle Park (RTP) – a seven-thousand acre office park that sits in a municipal no-man's land between Durham and Raleigh. The park is home to more than 200 companies with over 39,000 employees (RTP 2015). Research Triangle Park has made an undeniable impact on the region and, for

most of the last half century, Raleigh and Durham have largely built their identities around it (Rohe 2012). In more recent years, however, both cities have been cultivating more individualized, increasingly urban identities.

Between 2000 and 2010, Raleigh and Durham grew at rates well above the national average (Table 1), but RTP's workforce was declining during the same time period (Jones 2005). As IBM and Glaxo-Smith-Kline made headlines with major RTP job cuts, revitalization and redevelopment projects in Downtown Raleigh and Downtown Durham were attracting cutting edge technology firms.

A little over two decades ago, few would have imagined that the downtowns of either of these cities would be competing with RTP for the offices of major companies. In 1993, office rents in Downtown Durham were just one-third to one-half the rates of comparable suburban markets (Space 1993). The many warehouses of Downtown Durham, once a major hub of the tobacco trade, sat empty after American Tobacco and Liggett & Myers closed their doors in 1987 and 2000 respectively (Rohe 2012, p.191). As late as 2000, Main Street was described as "empty" and "deserted, even during the day" (Barrett 2000).

With a substantial governmental workforce, Downtown Raleigh never reached the same level of decline as Downtown Durham. But in the 1970s, as regional malls pulled retailers into the suburbs, the City of Raleigh responded dramatically, converting Fayetteville Street to a pedestrian mall. Closing Downtown's primary shopping street to traffic ultimately led to further

decline and by the early 1990s the street and its storefronts were mostly empty (Rohe 2012, p.201).

Today, Fayetteville Street is open to automobile traffic and Downtown Raleigh has seen tremendous investment in multifamily residential and office developments. Likewise, the streets of Downtown Durham are more active than they have been in decades. Both downtowns are hubs for early stage ventures and start up activity. American Underground, an entrepreneurial hub with backing from Google, has two locations in Downtown Durham and one in Downtown Raleigh, holding 205 startups among them (Ohnesorge 2015).

Recently, Downtown Raleigh has been the relocation destination for several high profile tech companies: Citrix renovated 130,000 SF of office space in Downtown Raleigh's Warehouse District; Red Hat moved all of its Raleigh employees to a downtown office tower; and Ipreo has plans to invest over \$3 million in a new downtown facility (Ohnesorge 2012; Hoyle and Baysden 2011; Ohnesorge 2013). In addition to the tech startups of American Underground, Downtown Durham holds offices for a diverse range of establishments, including several that previously had or still have offices in RTP, including GlaxoSmithKline, Burt's Bees and FHI 360, a nonprofit human development organization.

These companies have brought more people to the streets of both downtowns. New employers have been accompanied by new restaurants, retail establishments and housing developments. The transformations of these downtowns were not simply

TABLE 4. POPULATION CHANGES IN THE TRIANGLE REGION (US CENSUS)

	City			Urbanized Area			MSA		
	2000	2010	% Change	2000	2010	% Change	2000	2010	% Change
Durham	187,0353	228,330	22%	287,796	347,602	21%	1,187,941	504,357	18%
Raleigh	276,093	403,892	46%	541,527	884,891	63%		1,130,490	42%
National Avg.						12%			11%

organic processes; both were guided by bold visioning plans, catalyzed by major developments and funded by optimistic investors. The timeline above outlines the critical moments in the revitalization of each downtown.

B. DETERMINING BASELINES

Before applying the QDI to downtown Raleigh and Durham, I had to determine the temporal and geographic scope of the evaluation. Given the events outlined above, it seemed that an ideal baseline would be 1990, before any catalytic developments or plans had emerged in either downtown. However, the temporal availability of the necessary data proved that timeframe to be overly ambitious.

Of the indicators that can be evaluated with historical data, most are not available until after some time between 2000 and 2006. The Census has released Longitudinal Employment Dynamics (LED) data for most

of the nation beginning in 2002. CoStar provides information on Durham and Raleigh office markets dating back to 2000, but data for other commercial properties begins in 2006. The CoStar data used to find the denominator of the FAR measure is only accessible for current properties.

Esri’s Business Analyst Online only provides data for some of its Census variables for 2000 and it only provides the data based on the American Community Survey for the most recent 5-year release. Its business location data also shows only the most current information.

Historical data on crime, public transit access and business locations is difficult to access and thus is not included in the longitudinal evaluations. If a local agency with easy access to this data were conducting an evaluation, I would encourage them to include it. If these indicators were tracked regularly for a

DURHAM

RALEIGH

	1975	Fayetteville Street Converted to pedestrian Mall
American Tobacco Factory Closes	1987	
Downtown Durham Inc (DDI) established	1993	
New Durham Bulls Athletic Park opened	1995	
	1996	Downtown Raleigh Alliance (DRA) established
Liggett & Myers closes	2000	
	2003	Downtown Raleigh Liveable Streets Plan
First phase of American Tobacco Redevelopment opens	2004	
	2006	Reopening of Fayetteville Street to traffic
According to DDI, Downtown had a billion dollars of investment since 2000 (Green 2008)	2007	
Main St converted from one-way to two-way traffic		
	2008	Convention Center and Marriot City Center open
The 2,700 seat Durham Performing Arts Center opens	2009	Opening of City Plaza

downtown moving forward, this data would prove valuable in the future.

Because the historical data from different sources often does not align on release years, I decided to track indicators starting from generalized baselines. I thought it was critical to measure a pre-recession and post-recession time period, but I also wanted to evaluate a period as close to the start of the millennium as possible.

This system is admittedly not ideal. The indicators cannot be tracked back to a single pre-revitalization baseline year. But the longitudinal applications of the QDI are still significant. The earliest available year shared by all longitudinal variables is 2006, meaning the indicators can be used to demonstrate downtown changes since the Great Recession.

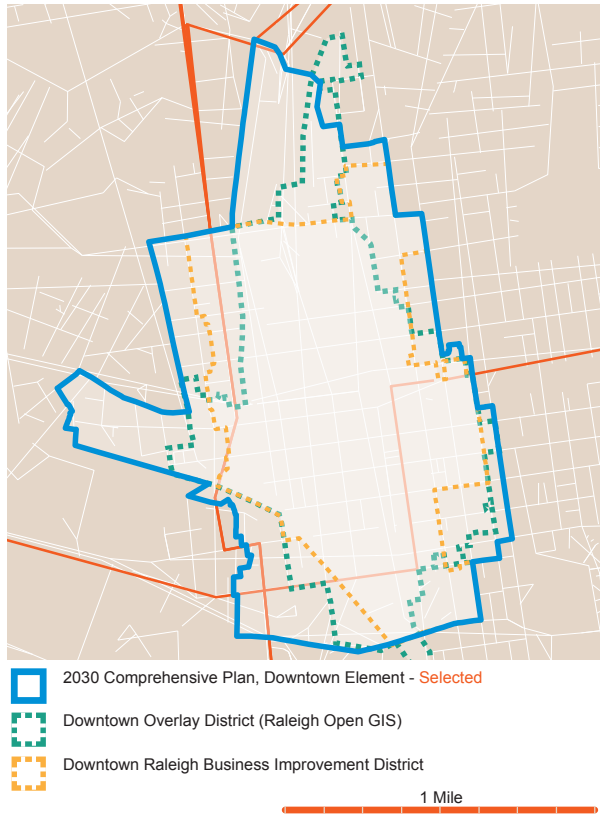
C. DETERMINING BOUNDARIES

As discussed in Chapter 2, the QDI was designed to accommodate idiosyncratic local boundaries. Using local boundaries requires research and outreach to find what local boundaries exist and which to use. For Durham and Raleigh, I found these boundaries by searching local GIS databases, reviewing downtown planning documents and corresponding with city and BID staff.

Raleigh

The City of Raleigh has joined a growing cohort of local governments in an effort to open access to city data. Through the Open Raleigh initiative the city has developed an Open Data Portal which includes a

FIGURE 6. VARYING DEFINITIONS OF DOWNTOWN RALEIGH



bevy of GIS layers. Through searching this online database, I found two geographic definitions for downtown: one from a layer showing planning overlays and one showing various “centers” including Mixed-Use and Transit Oriented Districts. After extracting the downtown definitions from this data, I compared them to boundaries shown in reports from Raleigh’s BID, Downtown Raleigh Alliance (DRA). Though the boundaries I found shared some common borders, there was not an obvious “best” definition.

Through direct email correspondence, David Diaz, the President and CEO of DRA, told me that he believed the “downtown element” outlined in the city’s 2030

comprehensive plan was a more complete representation of downtown than the BID service area. DRA staff connected me to Carter Pettibone of the Raleigh Urban Design Center, who shared a GIS layer of the 2030 Downtown Element.

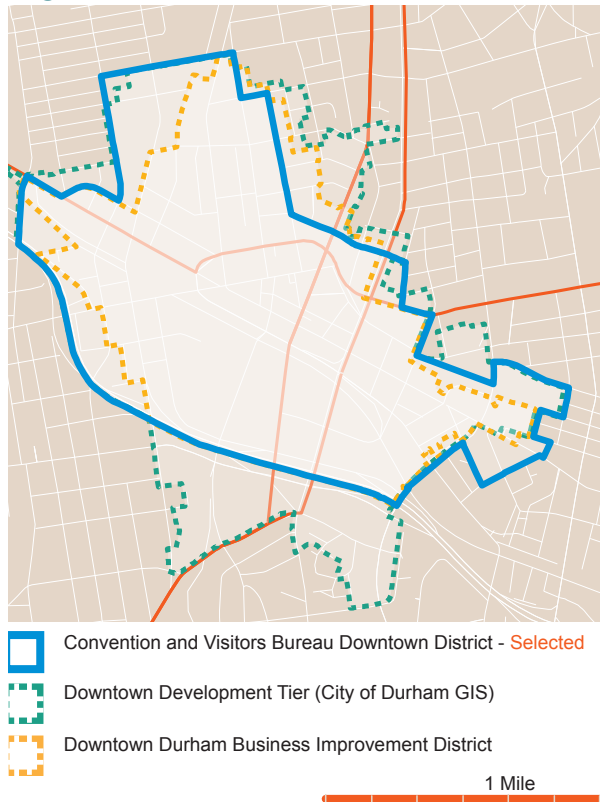
After comparing the various boundaries, I agreed that the 2030 Downtown Element was the best boundary choice for my evaluation. This area cover 1.47 square miles, and 184 blocks. The various local boundaries are displayed in Figure 6.

Durham

I took a similar approach to determining the boundaries by which to define Downtown Durham. The City of Durham has not made the same efforts toward open data as Raleigh and a good deal of the GIS data I used was only available to me because of my university affiliation.

Durham County is in the process of phasing out its old public GIS data viewer: Spatial Data Explorer/Go Maps. This viewer shows two downtown boundaries: one simply called the downtown district and another called the downtown “development tier.” This webpage does not allow GIS data downloads. A newer Go Maps portal containing much of the same data was introduced in the fall of 2014. It still does not allow GIS data downloads and although it also includes the downtown

FIGURE 7. VARYING DEFINITIONS OF DOWNTOWN DURHAM



“development tier” layer, it does not have the downtown district layer.

From communications with Matt Gladdek at Durham’s BID, Downtown Durham Inc (DDI), I acquired a map of Durham’s downtown BID boundary, which does not align with either of the other boundaries I had located.

Finally, after communications with a GIS analyst for the City of Durham, I was given access to GIS data for the three downtown boundaries I had located (Figure 7). I was also given context for the downtown districts layer: it is the Convention and Visitors’ Bureau (CVB) definition of

downtown, used in the maps they distribute and on prominent downtown signage.

I chose to use this Convention and Visitors’ Bureau definition. Like the boundary chosen for Downtown Raleigh, this definition’s boundaries are major roads that would likely be perceived as the districts edges from the street level experience. The Downtown Development Tier boundary, on the other hand, extends across the Durham Freeway, resulting in a fragmented district. Another strength of the CVB boundary is its ubiquity. Even though this definition did not come from the local government, it is the definition the public sees most often via maps and signage. Having spent much of my life in Durham, this was the boundary that looked the most familiar to me. This definition of downtown Durham covers 0.89 square miles, and 131 blocks

D. RESULTS

With boundaries decided, I began evaluating each downtown. My goal was to collect the most recent data for all core indicators and to collect historical data for the indicators with longitudinal applications. The pre-normalization Quality of Downtown Indicators for Raleigh and Durham are presented in TABLE 5. The cities’ Quality of Downtown Index scores are shown in TABLE 6.

To assess the relevance and accuracy of the Quality of Downtown Indicators, I compared the above findings to the local perceptions of downtown’s revitalization in the Triangle region. I use the indicator values rather than the index scores for this assessment. With only one year’s QDI for only two cities, the index scores have little

meaning. But with future data releases and a larger sample of downtowns, the QDI has potential as a powerful tool to compare and rank downtowns and to assess progress over time.

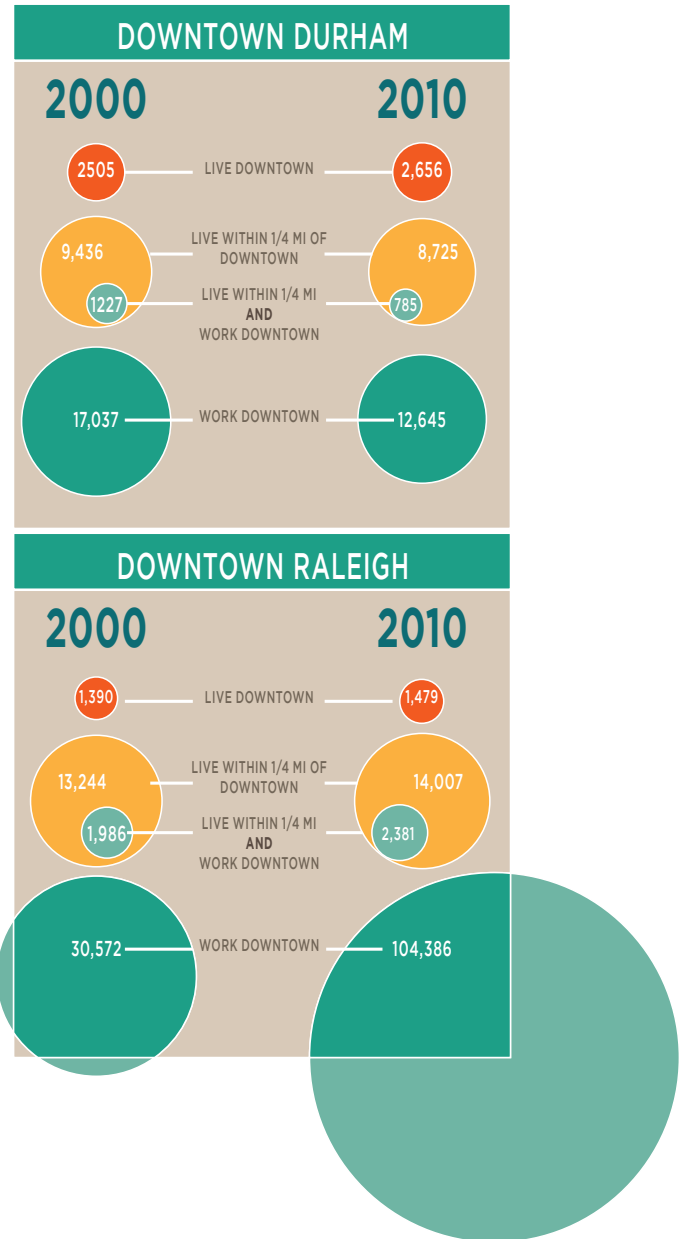
In the Triangle region the common perception is that Downtown Durham and Downtown Raleigh have been rapidly revitalizing over the past decade. The Quality of Downtown Indicators support the notion that these downtowns have undergone rapid changes, but not every indicator shows an upward trend.

The positive shift in perception is most clearly demonstrated by their office performance. Office rents in both downtowns have risen from below their county averages in 2000 to significantly above in 2014. These relative rent increases occurred while maintaining fairly stable occupancy rates.

Population gains and changes in the live-work dynamic also suggest positive changes. Since both variables have both increased consistently, it implies that many of downtown’s new residents are also downtown workers. Raleigh’s downtown BID estimates downtown population using block groups with centroids 1 mile from the Capital building. This definition results in a downtown population density estimate of 4,728/square mile in 2010, a slight overestimate in comparison with the QDI findings.

The data suggests that businesses are responding to the growth in downtown’s residential community; both downtowns have gained resident serving businesses since 2010. Although the indicator for destinations per block does not account

FIGURE 8. KEY DOWNTOWN CHANGES, 2000-2010



for business closures, it does provide valuable information regarding when current businesses opened in their downtown locations. More than a third of Downtown Raleigh’s destination businesses opened between 2010 and 2013 (33.7%) and

TABLE 5. QUALITY OF DOWNTOWN INDICATORS IN DURHAM AND RALEIGH

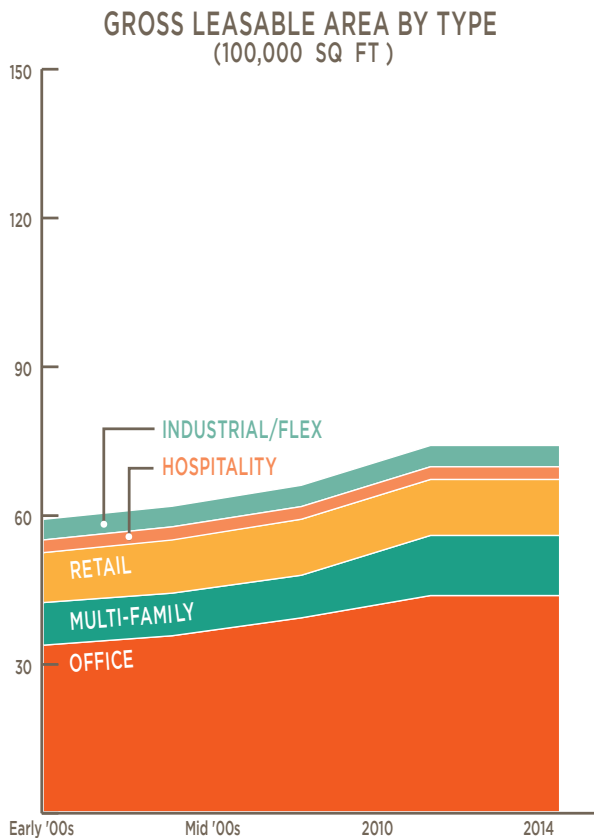
	EARLY '00S		MID '00S		2010		2014	
	D	R	D	R	D	R	D	R
ACCESSIBILITY								
COMPACT DEVELOPMENT	-	-	1.23	1.05	1.23	1.08	1.26	1.13
MIXED USE	-	-	0.73	0.76	0.76	0.80	0.77	0.79
TRANSIT ACCESSIBILITY	30%	21%	28%	19%	22%	9%	-	-
ECONOMY								
OFFICE RENTS/ COUNTY OFFICE RENTS	0.73	0.94	1.05	1.00	1.17	1.02	1.15	1.18
OFFICE OCCUPANCY	96%	94%	90%	94%	90%	94%	96%	95%
JOBS PER SQUARE MILE	19,143	20,797	15,462	19,335	14,208	71,011	-	-
COMMUNITY								
POPULATION PER SQUARE MILE	2815	946	-	-	2984	1006	3133	4527
HOUSEHOLD DIVERSITY	-	-	-	-	0.85	0.77	-	-
LIVE:WORK RATIO	13%	15%	12%	14%	9%	17%	-	-
RESIDENTIAL SERVING ESTABLISHMENTS PER BLOCK					0.81	0.96	0.96	1.07
IDENTITY								
DESTINATIONS PER BLOCK	0.19	0.55	0.27	0.70	0.66	1.14	0.86	1.48
STOREFRONT OCCUPANCY	-	-	91%	90%	91%	89%	94%	93%
SHARE OF UA'S ARTS AND CULTURE JOBS DOWNTOWN	19%	23%	10%	10%	12%	6%	-	-

more than 77% of Downtown Durham’s destination businesses opened since 2000.

Changes in the built-environment have been more subtle: FAR and diversity of land uses have increased slightly in both cities. These variables may see more dramatic changes in the next year; both downtowns have major, high-density developments in the works which will likely increase FAR.

The indicators contradict public perception on several variables: the press coverage of employers relocating downtown would suggest that the regions would be gaining jobs. The job densities found from LED show, however, that Durham has been rapidly losing jobs. Raleigh, on the other hand, saw

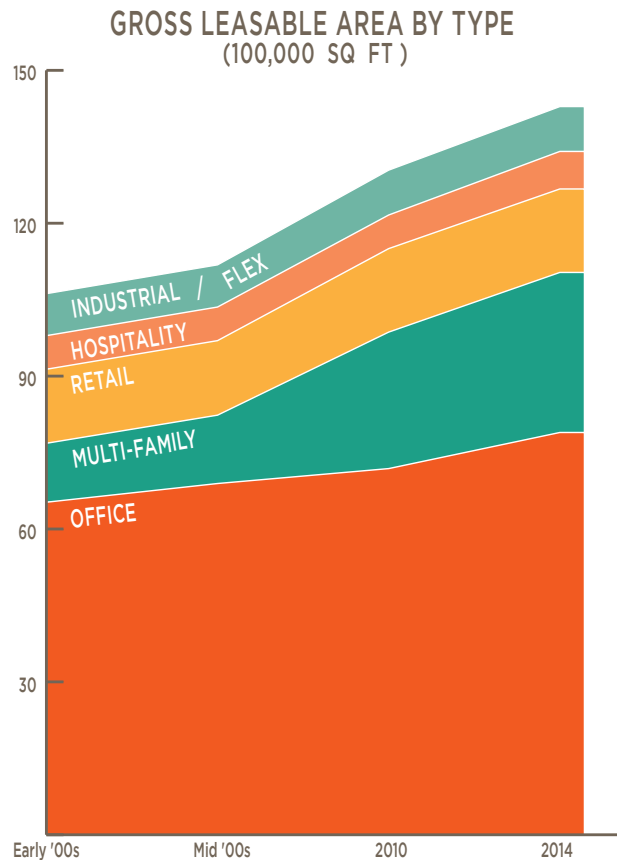
FIGURE 9. MIX OF COMMERCIAL USES IN DOWNTOWN DURHAM



very little change between 2000 and 2010 and astounding growth between 2010 and 2014. Both downtowns have become transit accessible to fewer workers since the early 2000s - a sign that the region’s growth has not been centralized or transit-oriented.

Durham and Raleigh’s BIDs track few of the same variables as the QDI, so there was little room for comparison across reporting measures. Although this meant that there was little opportunity to compare the QDI findings to current evaluations, it also suggests that the Quality of Downtown Indicators would be useful to these BIDs for their future downtown evaluations.

FIGURE 10. MIX OF COMMERCIAL USES IN DOWNTOWN RALEIGH



2010 QDI SCORES

DURHAM RALEIGH

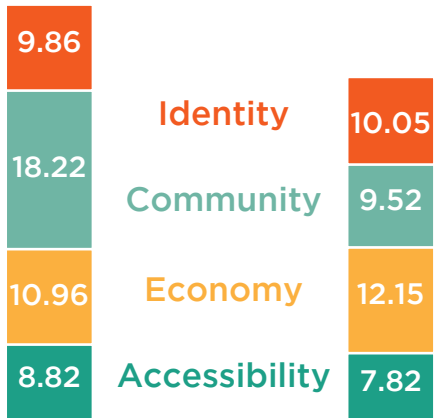


TABLE 6. 2010 QUALITY OF DOWNTOWN INDEX SCORES IN DURHAM AND RALEIGH

	DURHAM	RALEIGH
Accessibility Sub-Index	8.82	7.82
Compact Development	1.63	1.41
Mixed Use	19.33	19.80
Transit Accessibility	5.50	2.25
Economy Sub-Index	10.96	12.15
Office Rents	10.86	11.33
Office Occupancy	21.00	20.00
Job Density	1.03	5.12
Community Sub-Index	18.22	9.52
Population Density	31.17	5.06
Household Diversity	21.25	19.25
Live Work Dynamic	2.25	4.25
Residential Services	2.4	2.68
Identity Sub-Index	9.86	10.05
Destinations	3.07	5.29
Street level activity	23.5	23.26
Arts and Culture	3	1.50
OVERALL QDI SCORE	48/100	40/100

CONCLUSION

In the midst of today's urban renaissance, it is becoming ever more important to accurately evaluate the changing dynamics of the American downtown. American cities are in a period of great change. If current trends toward urban living continue, many of the nation's downtowns will see rapid growth in population, employment and real estate investment. Yet this growth cannot be assumed. While some downtowns grow, others may not.

Decision-makers need accurate indicators of changes to adequately address the needs of downtown stakeholders and make informed decisions about downtown development initiatives. Planners and Business Improvement Districts need to be able to evaluate the performance of their downtown initiatives, as well as the impact of initiatives from other cities that could be adopted. Making this information publicly accessible can help residents, workers, employers and visitors make informed decisions about where to locate or spend time and tax dollars.

This paper has identified indicators of downtown quality that can be applied in cities across the country, regardless of size. These indicators have potential for use by local governments, downtown organizations, researchers, developers, and the public.

Though it would require resources outside the scope of this project, the ideal application of the QDI would be a web platform allowing the public to access performance data for downtowns across

the nation. Americans want to compare the quality of downtowns; Google searches for Best Downtown are over four times more popular than they were a decade ago (Google Trends, n.d.). Yet this Internet search returns few relevant results – Livability.com has released a top-ten list of America's best downtowns for three of the last four years, but the evaluation criteria has changed with each release and the website does not disclose details on its methodology or release any data for individual indicators.

By standardizing the criteria for downtown evaluation, the QDI makes information on downtown performance more easily packaged for distribution to the public. Publishing the Quality of Downtown Indicators through an interactive web application would allow viewers to easily see where a downtown stands in comparison with others. Only data from the core indicators would be available for the widest range of downtowns, but local organizations tracking the supplemental indicators for internal evaluation could also choose to publish the supplemental

indicators to the web platform. This would allow the public to make informed decisions about where to live, work and visit. Businesses could use this information in deciding where to locate, potentially reducing a city's expenditures on retail recruiting.

People feel strongly about their cities and often react passionately to accolades and ratings. This passion could be used to the advantage of each downtown; updates and data releases showing improvement have the potential to go viral, bringing a city positive publicity. If locals disagree with their downtown's QDI, the web viewer's feedback page could serve as a venue for collecting valuable information on public perception. Public perception is a crucial indicator of downtown's quality and performance, but it could not be included in the core indicators since very little perception data is collected. Collecting survey responses is often difficult without major investments in incentives or staffing an outreach effort. A survey built into a public data viewer could harness local pride (or displeasure) as an incentive. This would likely not reach a representative sample of the population but, given that public perception is not tracked at all for many downtowns, the results would still have value.

By providing standardized criteria for assessing downtowns, the QDI allows performance to be more readily compared across cities. By presenting a methodology that does not depend on coarse geographies like census tracts, the QDI can be applied to downtowns of all sizes. Whether the indicators and data sources presented in this paper are adopted only for internal use

in a single BID, or whether they are used to share the status of downtowns across the nation, the methods presented in this paper are a major improvement over the current system of downtown evaluation.

APPENDIX A: DATA GUIDE

American Community Survey

Variables: Population, demographics, commute information

Release Schedule: Depends on variable and geographic area. Data is released for each variable once a large enough sample has been collected over 1, 3, or 5 years.

Geographic unit: Smallest geography covered is block group, only included in 5-year releases.

Comments: National data for variables that cannot be accessed anywhere else (commute information especially). Although block-group data is not ideal, other data providers, such as Esri, create estimates for unique geographies by weighting the data based on block population. This data is freely available and easily accessed.

CoStar

Variables: Real estate data including rents, occupancy, square footage, construction deliveries, land-use

Release schedule: Quarterly

Geographic Unit: Point data for individual properties. Compiles data for markets, submarkets, cities, counties, user-defined radii, and user-defined custom geographies

Comments: Excellent geographic and temporal coverage (dates back to 2000 for many variables). Not easily accessible – subscriptions are expensive, although educational discounts are available. Public officials would be encouraged to partner with real estate professionals for academics to access data.

Decennial Census

Variables: Demographic, housing, employment, education

Geographic Unit: Block (not for all variables)

Comments: The Decennial Census provides the best data for estimating population on unique geographies. Though it is only available every ten years, it can be used to weight variables from other sources (such as the American Community Survey) that are released more frequently. Data providers like Esri build these weighted estimates automatically for some variables.

Esri Business Analyst Online (BAO)

Release Schedule: Aggregates data from many sources, varies by source

Variables: Business locations from Bradstreet & Dunn include business sector, year business began, square footage and sales volume; demographic data from the American Community Survey and Decennial Census can be accessed for custom geographies using block-weighted aggregation; also includes data on market potential for various business types

Geographic Unit: Point business locations, custom geographies for ACS and Census data
Comments: This data is not free, but can be accessed through many educational institutions. Public officials would be encouraged to partner with academics to access data. BAO may also be cost effective to subscribe, given the wealth of data from other proprietary sources it provides, and its user-friendly format.

Google Transit (GTFS data)

Release Schedule: As agencies update their feeds.

Variables: Transit stop locations, route locations, route schedules

Geographic Unit: Point

Comments: There is a wealth of data available through Google Transit Feed data, but not all agencies release this data to the public, and the format is not easily understandable. Although extracting stop locations from this data is fairly simple, more in depth information can be more easily accessed through other providers who have pre-interpreted the route frequency information. WalkScore's Transit Score and the Smart Location Database both utilize GTFS, although the geographic units for which they release data are not ideal.

OnTheMap (releases Longitudinal Employer-Household Dynamics (LEHD) data)

Release Schedule: Generally annual, although releases are currently on hold.

Variables: Job density, worker resident location, direction/distance traveled to work, live/work

Geographic Unit: Block data, allows custom geographic inputs

Comments: OnTheMap is an incredibly powerful tool providing an unprecedented level of precision and frequency of employer data. It also may have applications for estimating population, although it can only account for the employed population.

Open Street Map

Release Schedule: Regularly updated

Variables: Amenities such as bike lanes, benches, parks, parking lots, business locations

Geographic Unit: Point, polygon, line depending on feature

Comments: Open Street Map is an open source map. It is similar to Google Maps except that everything shown on the map was input by volunteers. In some cases, this leads to better accuracy than Google's proprietary means (for example, Google's business type labels are often incorrect – a convenience store may be listed as a supermarket even though little food is available). But, the accuracy and updates of the data depend heavily on the local population's knowledge of the interface, and technical proficiency.

Parcel Data

Variables: Land use, lot size, property value

Release schedule: Annual

Geographic Unit: Parcel

Comments: Many local governments release parcel data containing a range of information for various property variables. But, this data can currently only accessed through local governments, and each location releases data for different variables, so comparability is limited. This is an excellent source of data for researching individual

cities, but it is likely infeasible for studying a wide range of areas.

Reference USA

Variables: Business locations

Release Schedule: Rolling

Geographic Unit: Point

Comments: Reference USA is a free database providing information on businesses at the point level. Data can be filtered by NAICS codes, and historical data is available. It would be an excellent free alternative to Esri BAO for business location data, but extracting data is more difficult. Because of limits on the number of entries that can be exported, making the data usable is significantly more time-intensive than accessing the same data through Esri.

Smart Location Database

Release schedule: Unknown. Depends on input data sources

Variables: Land use diversity, density, transit accessibility, demographics (and many more)

Geographic Unit: Block group

Comments: This database, released by the EPA, tracks many variables of interest for downtowns. It also contains the information from Google Transit, in a more ready-to-use format. However, because it is only released on the block group level, its applicability for downtowns is limited.

WalkScore.com

Release schedule: Rolling updates

Variables: Proximity and connectivity to amenities, Transit Score (including location of transit stops, and utility of transit)

Geographic Unit: Address

Comments: Walk Score compiles data for many variables of interest in downtowns. It is freely accessible for individual addresses. However, it is difficult to access this data for areas larger than an individual address. Researchers with the appropriate technical expertise could work with Walk Score's API to systematically extract Walk Scores for every intersection in an area of interest (Duncan et al. 2011).

APPENDIX B: INDICATOR SELECTION CRITERIA

Each variable considered as an indicator of downtown accessibility was evaluated with the criteria below. The same variable was assessed separately for each source of the data. For information on the data sources see Appendix A. The variable's potential viability was scored 0-4 for each criterion:

0 = No potential 1 = Poor 2 = Limited 3 = Acceptable 4 = Excellent

Appendix B Table 1. Accessibility Indicators

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Gross Leasable Area (GLA)	CoStar	3	4	4	3	2	Considered for the numerator of Floor Area Ratio (FAR), a measure of development density. Only available for commercial properties.
Lot Size	CoStar	3	4	4	1	2	Considered for the FAR denominator. Only available for commercial properties, difficult to access for any time period except present.
	Parcel	4	4	2	4	2	An alternative for the denominator of FAR for past years. Accurate, and provided by most municipalities, but generally only accessed through local pages.
Land Use by Parcel	Parcel	4	4	2	4	2	Considered for calculating mix of uses. Most parcel data specifies land-use, but classifications vary by city. Parcel size may not be the best unit by which to calculate uses, given variations in building size.
Vacant Lots	Parcel	4	4	2	4	2	Potential indicator of development density. Not consistently reported across different locations.

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Intersection Density	Various	4	4	4	0	4	Commonly cited as a factor of walkability. Data needed is widely available from a variety of sources, and the measure is easily calculated. However, it will only change with major street redesign, and a static indicator would not add valuable information.
Average Block Size	Various	4	4	4	0	4	See Intersection density.
Destinations	CoStar	3	4	4	2	2	Commercial properties can be filtered by type and use, but only current data is easily accessible.
	Parcel	2	4	2	4	2	Some municipalities have very detailed information on business type in parcel data, but this varies by location.
	OSM	3	4	4	2	4	OSM has tags for many destination amenities such as retail, restaurants, and parks. Only current available.
	WalkScore	4	3	4	2	4	The WalkScore algorithm is based on distance to amenities, but data is only easily accessible for individual addresses.
	Reference USA	4	4	4	4	4	Directory information for nearly all businesses, type can be filtered by industry codes.
Transit Stop Density	GTFS, Local Agency	4	4	2	2	3	Participating agencies may choose to make transit feeds public. Not available for all agencies, and not accessible without significant data and tech skills.
	EPA SLD	4	4	2	2	4	Uses GTFS data, eliminating the issue of necessary skill to access data. Still limited by few participating agencies.
Transit Service Frequency	GTFS, Local Agency	4	4	2	2	3	Better indicator of transit access, but same limits as Stop Density

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Transit Route Coverage	GTFS, Local Agency	4	4	2	2	2	A measure of how much of the region is covered by transit routes serving downtown, would be the best indicator of transit access, but this data is very difficult to access.
Transit Ridership	National Transit Database	4	0	4	4	4	Only agency-wide data available, no way to restrict for downtown service
"TransitScore"	WalkScore	4	3	4	1	4	WalkScore has done the grunt work of accessing data from local agencies, but still only accessible for individual addresses. Simplified into a score, so actual data isn't given.
Means of Transportation to Work	ACS	4	2	4	3	4	The means of transportation to work for downtown workers would be an excellent indicator of accessibility, but the smallest geography it is released on is block group. Block apportionment method may be useful here.
Structured Parking	CoStar	4	4	4	2	2	Considered for comparison with surface parking, as an indicator of prioritization of auto vs. pedestrian. Structured parking is listed with total Square footage.
Surface Parking	Parcel	4	4	2	4	3	Not listed as a property type in all municipalities. Excellent when given.
	CoStar	2	4	4	2	2	Only includes freestanding commercial parking lots, not lots associated with other businesses, or publicly owned lots.
	LiDAR	3	4	4	4	2	Can be used to find impervious surface area. Requires comparison with parcel data and/or satellite imagery to determine which are surface lots.
	Satellite Imagery	4	4	4	4	4	Cannot be used to find lots on its own, but can be used to improve the validity of data from parcels and LiDAR.

Appendix B Table 2: Economy Indicators

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Jobs by Industry Type	OnTheMap	4	4	4	4	4	Could be used as a measure of diversity, or for subscribers of Creative Class theory, to assess the creativity of the Downtown Workforce
Number of Businesses	RefUSA	4	4	4	4	4	Historical and current business directory listings. Can be filtered by NAICS codes. X,Y data for locations can be exported and mapped. However, extracting data for many entries is not time-efficient.
	EsriBAO	4	4	4	2	2	Business directory data including location, NAICS code, Square Footage, year business began, and sales volumes. Historical data not provided.
Number of Jobs	OnTheMap	4	4	4	4	4	Job counts for block geographies. Can be filtered by many variables, including all jobs vs. primary jobs. Historical data available. Data easily exported.
Office Rents	CoStar	4	4	4	4	2	Data available for commercial properties in most of the nation. Historical data available.
Office Vacancy	CoStar	4	4	4	4	2	"
Property Values	Parcel	4	4	2	4	3	Not reported in parcel data for all cities for all years.
New Construction	CoStar	4	4	4	4	2	Square footage of construction deliveries for commercial properties. Historic available. (Figures are included in FAR measures)
Storefront Vacancy	CoStar	4	4	4	4	2	Data available beginning in 2006. Cannot tell whether storefront has an active use, but still indicates a more active street experience. (used included as an Identity indicator)

Appendix B Table 3: Community Indicators

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Population per Area	Decennial Census	4	4	4	3	4	Every ten years, the Census releases population data to the block level. This is the best source for estimates of downtown population, because it requires minimal estimation.
	Esri BAO	4	4	4	2	2	Esri releases population for not only the decennial years, but also mid-decade years. They create these estimates by weighting ACS population with decennial year block populations. Although this data source is not free, it makes accessing population for unique geographies much simpler.
Households per Area	"	4	4	4	2	2	"
Diversity - Various types	Decennial Census/ American Community Survey/Esri BAO	4	2	4	3	4	Diversity can be measured for a wide range of categories including race, income, educational attainment, and age. There is little in the literature to describe which types of diversity are desirable. Not all of these indicators are released for each ACS survey.
Diversity - Type of Households	Esri BAO	4	4	4	4	2	In an effort to minimize the number of inputs, this measure was chosen based on the assumption that it would predict other types of residential diversity; that non-family households would be more likely younger and lower-income than family households.
Live-Work Dynamic	OnTheMap	4	4	4	4	4	OnTheMap's LEHD data can show the percentage of workers in one user-defined geography who live in another user-defined geography.

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Resident-Serving Businesses	Esri BAO	4	4	4	2	2	BAO provides business location data on the point level that can be filtered by NAICS code. Historical data is not available, but the year each business began is provided, so some measures of change over time area possible.
	ReferenceUSA	4	4	4	4	2	ReferenceUSA provides the same information as BAO, but is freely accessible to all. However, limitations on the number of entries that can be exported make it less user-friendly.
Share of Residents who are members of social organizations	Esri BAO	4	4	4	4	2	This information is accessible through BAO's Sports and Leisure Market Report. It was considered as an indicator of community involvement, however it was not chosen because it would require making value judgments that could not be backed by literature.

Appendix B Table 4: Selection Matrix for Identity Indicators

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
Arts Non-Profits Located Downtown	IRS	3	4	4	2	2	This indicator was inspired by indicators of cultural vitality proposed by Jackson et. al 2006. The information is easily accessible for current year, but is very expensive to access historically. Many of the addresses provided are PO boxes, so the indicator had limited utility even for current years.
Ratio of Local Restaurants to Chain Restaurants	Esri BAO	2	4	4	2	2	This indicator was more difficult to measure from EsriBAO than expected; chain restaurants are not classified separately from locally owned businesses, so the comparison could not be made without further research.
Share of Residents Who go to Live Theater/ Dined Out/ Visit Museums/ Visit Art Galleries	Esri BAO	3	3	4	2	2	This information is provided through the Retail Market Potential Report (GfK MRI). This indicator was not selected because it could only show the share of downtown residents engaging in these activities, and could not provide information for downtown as a regional entertainment destination.
	SimplyMap.com						Block Group estimates derived from National Survey of American Consumer by EASI. Same limitations as Esri BAO.
	SimplyMap.com	3	3	4	2	3	SimmonsLOCAL down to block group. Collected at Designated Market Area level. Same limitations as Esri BAO
Storefront Occupancy	CoStar	4	4	4	4	2	Although this indicator does not ensure that the storefront is occupied with an active use, it does indicate a more engaging street-level experience, contributing to the area's imageability.
Destination Businesses	Esri BAO	4	4	4	2	2	BAO provides business location data on the point level that can be filtered by NAICS code. Historical data is not available, but the year each business began is provided, so some measures of change over time area possible..

Variable	Source	Reliability & Validity	Geographic Scale	Geographic Range	Temporal Range	Accessibility	Notes
	Reference USA	4	4	4	4	3	ReferenceUSA provides the same information as BAO, but is freely accessible to all. However, limitations on the number of entries that can be exported make it less user-friendly
Downtown Arts and Cultural Employment	OnTheMap	4	4	4	4	4	LEHD data provides information about workers by industry of employment based on work and home geographies. Using the OnTheMap's area comparison tool, one can find how many of the Arts/Culture/Recreation jobs located in the Urban Area (or any other regional measure) are located in the downtown geography.
Crime Rate	SpotCrime	2	4	4	2	2	There are many online crime maps, but SpotCrime has the broadest geographic coverage. However, exporting data to map it and limit it to downtown geographies is very difficult. After attempting to export this data, concerns were also raised about the reliability, when many dates were missing from a calendar year.
Number of Historic Sites	PolicyMap	4	4	4	4	4	This data is easily accessed, but was not chosen as an indicator because it would penalize cities for something no longer in their control: historic buildings that have already been lost.
Investment in Historic Preservation	PolicyMap	4	4	4	4	4	This indicator was considered as an alternative to the above because it would measure something that still has the potential to change for the positive in the future. However, it was still determined to be too difficult to normalize across cities given the wide variations in opportunities for historic preservation.

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