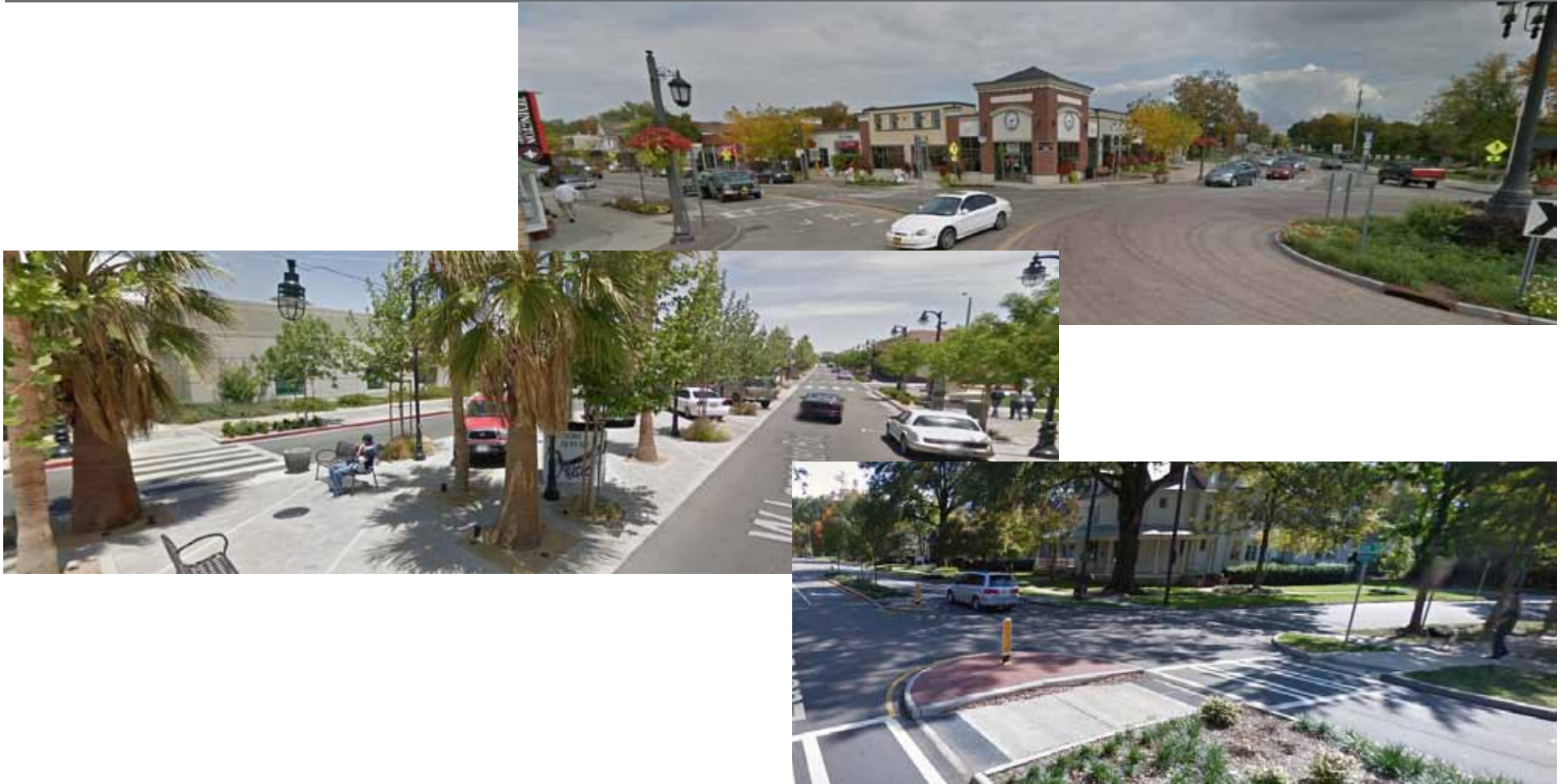




RECLAIMING URBAN SPACE:

A Study of Arterial Street Redesigns

Daniel Reid

MCRP Terminal Project

March 2015

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TABLE OF CONTENTS

<u>ACKNOWLEDGEMENTS</u>	<u>5</u>
<u>EXECUTIVE SUMMARY</u>	<u>6</u>
<u>CHAPTER 1: INTRODUCTION</u>	<u>8</u>
PROJECT ORGANIZATION	8
<u>CHAPTER 2: LITERATURE REVIEW</u>	<u>9</u>
POLICY AND CONFLICT IN STREET DESIGN	9
INTEGRATIVE DESIGN RESPONSES	14
METHODS FOR SURVEYING AND MEASURING URBAN STREET QUALITIES	17
CONTRIBUTIONS OF THE PRESENT STUDY	21
<u>CHAPTER 3: METHODOLOGY</u>	<u>22</u>
COST-BENEFIT ANALYSIS	22
CASE STUDY STREETS	24
<u>CHAPTER 4: RESULTS</u>	<u>35</u>
25 TH AVENUE, SAN FRANCISCO, CA	36
EAST BOULEVARD, CHARLOTTE, NC	38
HIGGINS AVENUE, MISSOULA, MT	42
MAIN AND BUFFALO STREETS (U.S. HIGHWAY 62), HAMBURG, NY	44
WEST LANCASTER BOULEVARD, LANCASTER, CA	46
<u>CHAPTER 5: DISCUSSION</u>	<u>49</u>
SYNTHESIS	49
DESIGN RECOMMENDATIONS	50
POLICY IMPLICATIONS	50
LIMITATIONS	51
RECOMMENDATIONS FOR FURTHER STUDY	52
CONCLUSION	53
<u>BIBLIOGRAPHY</u>	<u>54</u>
<u>APPENDIX</u>	<u>57</u>



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EXECUTIVE SUMMARY

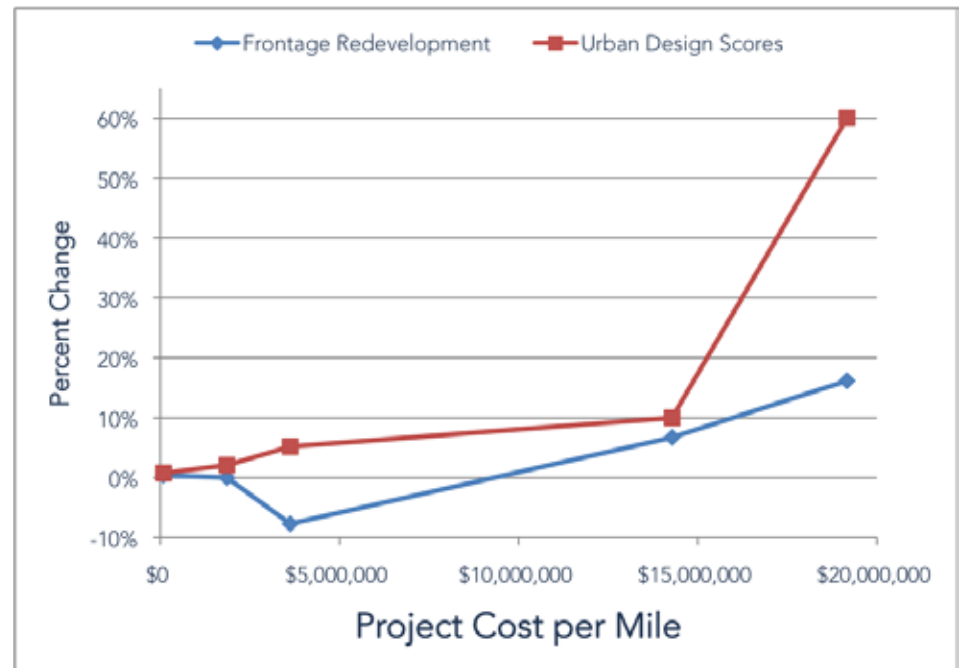
Arterial streets, because of their commonly accepted function of optimizing safe and efficient traffic flow, tend to be automobile-dominated by definition. However, their role as primary linkages among neighborhoods and regions suggests that they can serve a broader function in the internal cohesion of cities. Indeed, many communities are now searching for ways in which arterial streets can provide walkable, inviting, human-scale urban space while also supporting appropriate traffic movement.

Because municipal capital-project budgets tend to be severely constrained, redesign measures must also be cost-effective and produce clear results in the public perception of the affected streets. The purpose of this project is to study how the design of the street cross-section can advance these goals. Specifically, what cross-sectional design strategies most effectively create good urban space in arterial corridors?

The effort to answer this question focuses on five arterial streets that underwent recent cross-sectional design changes aimed at improving conditions for all users, including pedestrians, cyclists, transit riders, drivers, business owners, and residents. The costs and benefits of each redesign are analyzed in terms of both economics and urban design, using before-and-after Google Street View images and GIS data.

Synthesis of Results

Street Name	Total Cost	Cost/Mile	Percent Change	
			Frontage Redevelopment	Urban Design Scores
25th Avenue	\$80,000	\$88,889	0.42%	0.8%
East Boulevard (Phase 2)	\$1,300,000	\$1,857,143	0.00%	2.1%
N Higgins Avenue	\$1,450,000	\$3,625,000	-7.71%	5.2%
Main & Buffalo Streets	\$20,000,000	\$14,285,714	6.72%	10.0%
W Lancaster Boulevard	\$11,500,000	\$19,166,667	16.15%	60.0%



Design Recommendations

Every city will of course have to determine what type and level of intervention is feasible and appropriate for a given street based on its political and budgetary climate. However, the following recommendations, based on the literature and the findings of this study, may serve as useful starting points for many arterial streets.

- Go On a Road Diet

Many arterial streets, with two, three, or more lanes in each direction as well as center turn lanes, give far more real estate to vehicular traffic than is necessary for smooth traffic flow.

- Improve the Pedestrian Realm

Reductions in travel lanes can give street designers plenty of room for pedestrian amenities such as sidewalks wide enough for strolling families, planting strips, human-scale lighting, and corner or mid-block bulb-outs.

- Make Space for Other Modes

Travel lanes can also be converted for use by bicyclists, buses, and streetcars, depending on the local transportation mix.

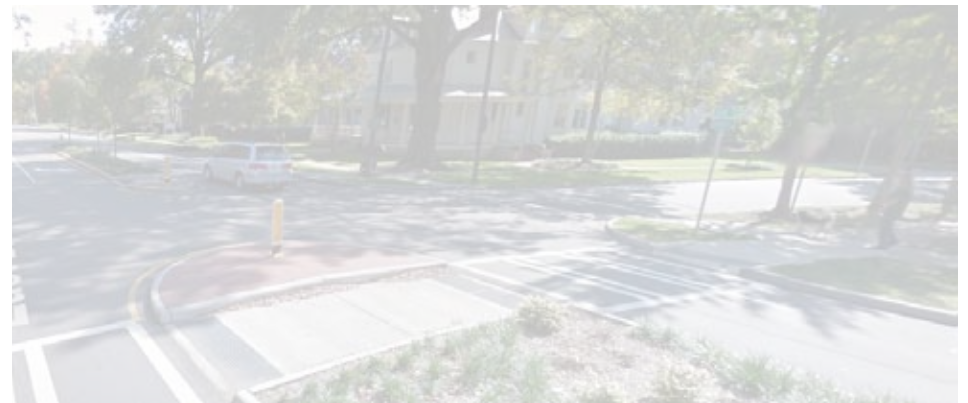
- Plant Trees, Shrubs, Flowers, Grasses

Planting vegetation in tree wells, buffer strips, medians, and roundabouts is a relatively low-cost, high-impact intervention in most cases.

Recommendations for Further Study

An exciting and needed outcome for future research could be a Post-Occupancy Evaluation (POE) protocol for street redesigns. The architecture profession and building trades have begun to recognize the value of these evaluations in recent years, in which building designers and managers study how effectively and efficiently a completed building serves the needs of its users, and how closely it performs to its design goals.

The planning and urban design professions, however, have adopted no such formal evaluation practices for completed street designs. If a future researcher developed a standardized POE methodology for streets based on the present study, that tool could help to objectively identify best practices for street design and construction, and could inform the creation of better urban spaces.





Many of us in the planning profession tend to imagine cities as compositions of buildings of various forms and uses, but the urban space of a community is actually defined by the spaces between the buildings. Our city streets form the majority of the public space that we share in the urban condition, so their composition and spatial qualities play a critical role in the function and experience of the city, from the desolate suburban boulevards of my hometown to the confined neon confusion of San Francisco's Chinatown.

Arterial streets in particular, by virtue of their commonly accepted function of optimizing safe and efficient traffic flow, tend to be automobile-dominated by definition. However, their role as primary linkages between neighborhoods and regions suggests that they could serve a broader function in the internal cohesion of cities beyond traffic circulation. Indeed, many communities are now searching for ways in which arterial streets can provide walkable, inviting, human-scale urban space while also supporting appropriate traffic movement.

Because municipal capital-project budgets tend to be severely constrained, redesign measures must also be cost-effective and produce clear results in the public perception of the affected streets. The intention of this project is to study how the design of the street cross-section can advance these goals. Specifically, what cross-sectional design strategies most effectively create good urban space in arterial corridors?

The sectional qualities of a street are particularly interesting because they encompass both the public spaces of the street itself and the space-making qualities of the buildings on either side. For example, the ratio of the buildings' height to the street width determines the degree to which people experience a sense of enclosure in the street, which can affect pedestrian activity, traffic speed, and other qualities. The buildings' materiality, articulation, overhangs, and setbacks at the street edge can affect the degree of interaction between interior and exterior space. The presence of on-street parking can contribute to pedestrian safety through traffic calming and physical buffering, as well as the perception of commercial activity on the street frontage. Other elements, such as furniture, trees, and lighting, provide focal and resting points, shade and soften hardscapes, and modulate pedestrians' perceptions of walking distances.

Project Organization

Following this introduction, Chapter 2 will present a review of the scholarly literature dealing with historical trends and current attitudes toward the design of urban arterials; best practices for designing these streets to meet the needs of pedestrians, cyclists, residents, and shopkeepers as well as drivers; and survey instruments and methods for empirically assessing the walkability and urban design aspects of street environments. Chapter 3 will then briefly describe the five urban case study streets, together with the methodology used to assess the economic and urban design effects of their recent cross-sectional redesigns. Chapter 4 will present the results of those assessments, and Chapter 5 will include a synthesis of the results, discussion of design recommendations and policy implications for other cities, limitations of the study, possibilities for future research, and concluding thoughts.



CHAPTER 2: LITERATURE REVIEW

The design parameters of city streets have been described previously by authors such as Christopher Alexander, Allan Jacobs, and Kevin Lynch, all of whom drew upon the lessons of urban space in cities that predate the automobile, and discussion of those works lies outside the scope of this project. More recent work has explored the roots of perceived conflicts between the demands of motorized traffic and the needs of pedestrians, cyclists, mass transit users, business owners, and residents. Other research has provided tools to objectively measure and validate the urban qualities of streets with the goal of reconciling these conflicts. However, this survey of the literature suggests that a gap exists in providing recommendations for cost-effective redesign strategies to help cities under budget constraints improve the urban space of their arterial streets. This project will attempt to fill that gap.

Policy and Conflict in Street Design

Human spatial perceptions and desires are linked to the scale of the human body and the speed of a person walking. This explains our persistent cultural nostalgia for pre-modern city and village spaces; they developed as direct consequences of those human spatial dimensions. The modern hegemony of motorized transport, on the other hand, dictates street geometries and scales linked to the external dimensions, turning radius, mass, and velocity of a car or truck. Optimization of vehicle movement based on those criteria has informed the bulk of the

twentieth century's urban development in the United States. Toward the end of that century and into the twenty-first, however, urban residents, businesspeople, and policymakers have become increasingly dissatisfied with urban streetscapes that seem to include no place for human form and experience.

Michael Hebbert's 2005 paper "Engineering, Urbanism and the Struggle for Street Design" explores the roots of the perceived opposition between the practical requirements of modern road engineering and the human needs of good urban design. It then examines how this conflict can be resolved, because "without excellent engineering there cannot be good urbanism."¹

Hebbert begins by recounting the development of the engineering profession's responses to the rise of motor travel in the 20th Century, including road design, traffic management, and the resultant effects on land-use planning. The paradigm of segregation of property access and traffic movement is likened to cells and arteries in living tissue:

Cellular layout requires origins, destinations and non-movement to be grouped within bounded areas, so motorized traffic can by-pass around the edges. The arterial principle requires road systems to be organized in a hierarchy of volume and purpose with each level linked dendritically to the next, from the parking lot through local streets, collector/feeder roads and primary highways to dedicated expressways.²

This conceptual separation and hierarchy, backed by exhortations for public health and safety, extended to a "division of labour amongst built environment professions:" traffic engineers act as the "prime movers" who dictate large-scale urban form, and the chain of authority

1 Michael Hebbert, "Engineering, Urbanism and the Struggle for Street Design," *Journal of Urban Design* 10, no. 1 (February 2005): 39.

2 *Ibid*, 40

extends downward through planners, developers, architects, builders, and landscapers.³ Modernist architects, such as Le Corbusier and other proponents of the International Style, seized upon the highway engineers' sinuous curves and functional segregation in their new city design concepts.

In conventional urbanism a street's importance had been measured by the height and architectural adornment of its building frontages. Hierarchical road design turned that upside down, putting traffic capacity in an inverse relation to building capacity, so the most important arteries would carry no building at all.⁴

These philosophies continued to develop and gain traction, along with suburbanization, "urban renewal," and major transportation projects such as the U.S. Interstate Highway system, through the 1960s. Outside forces such as economic downturns, the OPEC oil crisis, recognition of the value of historic street forms, and emerging environmental and social justice movements then applied the brakes, but the conceptual framework remained. Meanwhile, city form and public space were greatly eroded:

The highways compromise has not been good for urban design. The engineer's assumption of velocity requires a paradoxically slow geometry of sluggish curves and visibility angles unresponsive to building enclosure and grain. Its spatial organization favours separation of activities and discontinuity of the public realm.

...

The environmental outcome is also clearly inequitable: for Manhattan's Lexington Avenue, between 57th and 61st Streets, W. H. Whyte calculated that the widened 50 foot wide carriageway carried 25,000 people per day in vehicles, while the narrowed and cluttered sidewalks used by 41,000 pedestrians per day, narrowed to a nominal width of under 13 feet, were actually pinched to

less than 6 feet by the assortment of clutter.⁵

More recently, however, members of the engineering profession have found themselves aligning more closely with the urban designers. Hebbert states that "Street-friendly engineering has evolved piecemeal and often as a by-product of other policy objectives," and that some engineers "have challenged the conventional behavioural assumption that safe driving requires a standardized and predictable environment."⁶ The author then explores some of the urban responses to this philosophical shift, such as reconnecting public housing projects to their street networks in response to conditions of social exclusion, reintegration of traffic-calmed residential streets such as the *woonerven* of Germany and the Netherlands, New Urbanism and other neo-traditional design movements, and revitalization of depressed and depopulated city centers that had been strangled by ring roads and expressways.

On this last point, Hebbert elaborates that "The turn of the 21st century has proved a new golden age of the boulevard. Cities across the world have been rediscovering the art of celebrating major roads and transforming them from single-purpose traffic conduits into complex urban spaces."⁷ Resurgent design ideas such as the "Complete Streets" movement have helped bring pedestrian, bicycle, transit, commercial, and social uses back to urban arterials, and cities have begun to rediscover the values of mixed use, interconnectivity, and human-scale placemaking in their streets.

To those who would resist the reintegration of traffic and development

3 *Ibid*, 41

4 *Ibid*, 42

5 *Ibid*, 46

6 *Ibid*, 46 – 47

7 *Ibid*, 49

on the grounds of safety, Hebbert points to studies that find that “Non-compliant streets do not appear to have a poorer safety record than those engineered to modern specifications ... Nor do multiway boulevards which mix access and through traffic perform more dangerously than conventional segregated highways.”⁸ In fact, standard safety measures such as wide rights-of-way, one-way traffic patterns, large-radius curves, and continuous guardrails tend to make drivers less cautious and more prone to speeding and aggressive maneuvers. On the other hand, integrated urban streets – with narrower lanes, on-street parking, street trees, cross traffic, cyclists, and pedestrians – restrict drivers’ vision and introduce elements of uncertainty, which tends to cause drivers to slow down and be more alert.⁹

Hebbert concludes by reiterating the need for traffic engineers to put down their design-standard rulebooks, actively participate in good urban design, and fit their roads to the urban form rather than the other way around. However, he states that “a dangerous gap is now opening between the street paradigm and the inertia still embodied in official highways standards. Institutionally, most new thinking has been sponsored by non-transportation branches of government.”¹⁰ This bureaucratic disconnect tends to hinder progress toward desirable redevelopment and street improvement:

Irrespective of the quality of the design solutions, long-term success is undermined by the prevailing institutional bias in favour of motorists’ interests and the consequent exclusion of the other street users’ interests in the way streets are managed.¹¹

Hebbert does not ultimately offer a solution to this deep-rooted

8 *Ibid*, 53

9 *Ibid*, 55

10 *Ibid*.

11 *Ibid*, 57

contradiction, but a solution needs to be found if we are to unify engineering with urbanism.

Paul M. Hess addresses similar conflicts between urban and technical design in the 2009 article “Avenues or Arterials: The Struggle to Change Street Building Practices in Toronto, Canada.” The purpose of this article is to examine why Toronto’s pedestrian-oriented urban policies are not better reflected in the actual design and construction of its arterial streets. The author states that Toronto, like many cities, has recently pushed its policies toward redesigning large urban streets to promote walkability for public health, economic vibrancy, and place-making.¹² However, most new and rebuilt streets still follow established practices that have been institutionalized by engineering standards and administrative policies.

The author examined the case study of Toronto through a “detailed policy review and semi-structured, confidential interviews with 17 participants ... Most interviews were with departmental managers, but issues were also discussed with lower-level staff, involved citizens and a city councillor.”¹³ The participants were asked with what aspect of street building they were involved, both individually and within their departments, and how they cooperated with other departments. They were also asked what role public participation played in their street design work and how pedestrians’ needs were taken into account in street-making.

The author’s policy review covered a wide array of legislative and administrative documents, but this paper only discusses three of these in depth. The Toronto Pedestrian Charter was passed in 2002 and lays

12 Paul M. Hess, “Avenues or Arterials: The Struggle to Change Street Building Practices in Toronto, Canada,” *Journal of Urban Design* 14, no. 1 (February 2009): 2.

13 *Ibid*, 8 – 9

out a broad vision of “accessibility, equity, health, sustainability, safety and community vitality ‘to ensure walking is a safe, comfortable and convenient mode of urban travel;”¹⁴ however, the Charter is an advisory document and is not legally binding.

In contrast, the Toronto Official Plan (OP) is a governing document that mandates “policies and practices that ensure safe, direct, comfortable, attractive and convenient pedestrian conditions.”¹⁵ The OP designates many of Toronto’s high-volume arterial roads as growth areas, to be reshaped into “main streets that are focal points for the community with attractive, bustling sidewalks . . . [with] a quality pedestrian environment” through mid-rise urban redevelopment.¹⁶ However, the OP is a 30-year comprehensive plan, so the changes it prescribes for these arterials are likely to happen incrementally over many years. It also does not address these streets’ roles in the larger transportation network, such as how they can be reconnected to adjacent residential neighborhoods.

The third document Hess discusses is Toronto’s Road Classification System (RCS), which the city’s transportation officials use to sort streets into five categories based on their degrees of traffic flow and local property access, and which specifies geometric design standards for each category. The RCS also assigns the design and maintenance of expressways and arterials to the citywide Public Works Committee, while collector and local streets are the responsibility of district-level Community Councils. Furthermore, unlike the OP, the RCS explicitly defines major and minor arterials as “intended to serve primarily a traffic movement function,” while pedestrians must be satisfied with concessions

such as that “arterials should have sidewalks.”¹⁷

This kind of inconsistency among Toronto’s planning documents is not officially addressed in city policy, so it is left to planning and transportation staff to negotiate potentially conflicting priorities across departments on a day-to-day basis. For example, one opportunity for physical redesign of a street comes when it is due for resurfacing or rebuilding by the transportation department, but these operations are part of a decades-long life cycle. The transportation department, meanwhile, tends to be reluctant to stray from existing street designs due to liability concerns and a constrained maintenance budget. The existing curb lines are also used to define the transportation department’s area of responsibility within a right-of-way, while the area from the curb to the property line falls under the planning department’s purview; as a result, curb lines are rarely changed.

On the other hand, the planning department has the opportunity to effect street design changes through the development review process, which often requires developers to provide improvements to the streets adjacent to their building sites to accommodate traffic increases. However, according to one staff member,

Traffic issues are institutionalized in the process—not peds—there is no formalized way to incorporate, nobody at the table for peds— applications may be assessed from an urban design view, but they [urban design] are not at the table [in the transportation department] when infrastructure gets looked at—no pedestrian side is represented there—they are not high on anyone’s agenda.¹⁸

Hess concludes by stating that “Changing policy is not enough. The ways that routine street-making processes are institutionalized also needs to be

14 *Ibid.*, 9

15 *Ibid.*

16 *Ibid.*

17 *Ibid.*, 12

18 *Ibid.*, 21

examined much more closely.”¹⁹ He finds that inconsistencies in planning documents and among city bureaucracy practices lead to reliance on traditional standard practices in street-building, and “the inability to effectively tackle fundamental issues of street design is critical because once a street is built according to old models the next opportunity for change may be decades away.”²⁰ Other cities in North America will obviously face their own sets of challenges in making good street design, but there will likely be many parallels as well, and Toronto’s example will offer important lessons.

Reid Ewing’s 2002 paper “Impediments to Context-Sensitive Main Street Design” covers similar ground to Hebbert and Hess, but goes farther in discussing solutions to conflicts in street design. This paper, prepared for the New Jersey Department of Transportation (NJDOT), explores the constraining factors that tend to prevent state traffic engineers from pursuing highway and arterial street designs that are sensitive to urban contexts where the roads serve as “main streets.” The author examines case studies in Albuquerque, NM; Anchorage, AK; Brooklyn, CT; Saratoga Springs, NY; South Miami, FL; and Westminster, MD to show what factors constrained the design of roads that pass through the cities, and how they overcame those factors to achieve safe, walkable, urban “main streets.”

Ewing dispels the conventionally held notion that the primary constraints on main street design are the geometric standards in the AASHTO “Green Book” – which do, in fact, permit many common street improvements – and concerns of tort liability, from which most Departments of Transportation (DOTs) are legally immune. The author

finds that the real issues are:

- State DOT standards that are more stringent than AASHTO’s guidelines;
- Misclassification of streets’ functions and urban or rural contexts;
- Level-of-service standards for vehicular traffic flow;
- Over-use of typical street sections without sufficient regard for context;
- Application of new-construction standards to resurfacing, restoration, and rehabilitation projects;
- Reluctance to pursue design exceptions for contextual reasons;
- Reluctance to maintain street trees, special paving, and other improvements.

Ewing makes several recommendations to NJDOT, including:

- Allow main-street projects to be considered for de-designation and transfer of ownership or maintenance to local governments;
- Consider social, environmental, and community impacts in design exception reports;
- Provide for lower design speeds and traffic calming on main streets;
- Consider pedestrian and bicycle-friendly features as controlling design elements;
- Exempt reconstruction projects from current standards as long as they have acceptable safety histories;
- Accept AASHTO minimum geometric standards for main streets;
- Designate “main streets” based on a prescribed formula.

Although the author examines engineering policies and practices at the state level in this paper, he finds several similarities to those discussed in the Toronto case study, such as budgetary limitations and the excessive

19 *Ibid*, 22

20 *Ibid*, 23

reliance on established typical street designs. However, Ewing also downplays the liability concerns that several of the Toronto city staff members mentioned, which may be due to differences between U.S. and Canadian legal frameworks.

Integrative Design Responses

Recent urban design work has attempted to reconcile the spatial and policy conflicts between human-based and vehicle-based street layouts. These designers recognize the need for streets that both enable safe and efficient vehicle movement and create comfortable urban space for human movement, habitation, commerce, and recreation.

Ewing's "Impediments" paper continues a deep catalog of his scholarship related to urban street design. In the 1996 manual "Pedestrian- and Transit-Friendly Design," prepared for the Public Transit Office of the Florida Department of Transportation, Ewing presents a checklist of urban design elements for pedestrian- and transit-friendly streetscapes. He draws from classic urban design literature, other transit-oriented development (TOD) manuals, and original research to compile the recommended elements, which are broken down into "Essential," "Highly Desirable," and "Nice Addition" categories. The original studies, which Ewing conducted in various locations around Florida, included a visual-preference study related to bus stop design, a mode-share analysis of land use influences, and an analysis of urban design factors on transit ridership.

Many of the elements Ewing discusses relate directly to sectional street design. "Essentials" include streets with two or four travel lanes, raised medians or refuge islands, continuous networks of sidewalks wide enough for strolling couples, safe and frequent pedestrian crossings with clear markings and good lighting, sufficient planting strips or barriers to buffer

pedestrians from traffic, and buildings oriented to provide walkable destinations and visual enclosure to the street. His "Highly Desirables" category includes traffic calming measures to reduce vehicle speed, shade trees spaced no more than 30 feet on center and planted between curb and sidewalk, and minimal dead space (including blank walls, reflective glazing, and visible off-street parking).

This manual serves as a useful breakdown of positive street features for good urban design, and can help designers and policymakers prioritize elements for the greatest impact within a given budget. However, it is not focused specifically on arterial streets, but rather any urban street that is served by mass transit. Furthermore, Ewing concedes at the beginning of the second chapter that "some features deemed essential for general walkability may not be all that important to the subset of pedestrians accessing transit systems," possibly because many transit users are walking "for utilitarian purposes"²¹ of transportation rather than for exercise, leisure, shopping, or socializing.

Designers and users of urban streets elsewhere in the world face similar issues as shown in "Arterial Streets for People," produced by the "Arterial Streets Towards Sustainability" (ARTISTS) Project at Sweden's Lund University in 2005. The purpose of this report is to outline a system for designing and managing "more amenable, sustainable, and people-friendly arterial streets."²² It proposes that arterial street design should start with people, who may or may not use vehicles, rather than vehicles themselves; it should encourage walking, bicycling, public transportation, and non-transport uses; and it should solicit public participation to create unique, locally-tailored design solutions.

21 *Ibid*, 5

22 ARTISTS Project: Arterial Streets Towards Sustainability, "Arterial Streets for People," ed. Åse Svensson, 2005, www.tft.lth.se/artists (accessed January 25, 2014), 6.

The authors propose an interesting method of operationalizing the “streets for people” concept: rather than the traditional engineer’s unit of vehicle throughput,

“it should be the individual person that should be the most basic unit, whether that person is in a vehicle or not. This approach gives the pedestrian equal weight with the cyclist and the car driver or bus passenger. It also gives higher occupancy vehicles a ‘weighting’ proportional to the number of people carried.”²³

They also advocate balancing the needs of both “through users,” such as vehicle drivers at speed, and “locale users,” such as residents and business patrons along a given street. Similarly, they propose to classify a street section according to both its “link status,” or its function in the transportation network, and its “place status,” or its function in the urban fabric, in order to appropriately allocate street space to travel lanes, sidewalks, and so on.²⁴ The authors also emphasize the importance of extensive public stakeholder participation in any street design process so that the “streets for people” balance the needs of all users.

This report focuses primarily on large-scale theoretical visions of arterial street design and on methods of facilitating public participation, but does not detail the empirical basis for the presented concepts. Instead, it claims to “draw from the experience of the ARTISTS project” and from research, analysis, and evaluation of best practices. It uses illustrative examples and case studies from various European cities to support its recommendations, but it does not offer specific street design guidelines or insight into the cost-effectiveness of various design options.

23 *Ibid*, 12

24 *Ibid*, 26

Returning to the United States, the 2005 paper “Turning Highways into Main Streets: Two Innovations in Planning Methodology” by Reid Ewing and colleagues offers more empirical scholarship on street design. The purposes of this paper are to outline the authors’ methods of applying statistical analysis to visual preference surveys, to arrive at an operational definition of “main streets” for the New Jersey Department of Transportation, and to direct efforts “to qualify certain highways for special treatment as main streets or to redesign certain highways to be more main street-like.”²⁵

The authors administered a visual assessment survey to a “convenience sample” of attendees to a meeting of the Main Street New Jersey/ Downtown Revitalization Institute. The survey presented participants with photos and video clips of state highways in urban contexts and asked them to rate each scene on a seven-point Likert scale. The authors then “estimated a cross-classified random effects model using main street scores as the dependent variable, and characteristics of scenes and viewers as independent variables.”²⁶ The authors found several variables to be statistically significant, including:

- Proportion of street frontage with parked cars at curbside;
- Proportion of street frontage covered by tree canopy;
- Curb extensions visible;
- Proportion of buildings that house commercial uses;
- Average sidewalk width;
- Number of travel lanes;
- Proportion of street frontage made up of dead spaces.

25 Reid Ewing, Michael R. King, Stephen Raudenbush and Otto Jose Clemente, “Turning Highways into Main Streets: Two Innovations in Planning Methodology,” *Journal of the American Planning Association* 71, no. 3 (2005): 269-282.

26 *Ibid*, 269

These significant variables aligned with the authors' expectations based on the urban design literature. However, "... average building setback and ratio of building height to street width plus building setbacks proved insignificant and actually had the 'wrong' signs in various model runs, positive and negative signs, respectively,"²⁷ which contradicts established urban design wisdom. Further studies using larger or more representative survey samples would likely be needed to validate or reject this finding.

Finally, the authors present their derived "Main Street Score" formula, which applies positive and negative multipliers to each significant variable, and recommend that NJDOT use it to designate main streets with a qualifying threshold score of zero. They also suggest that the formula could be applied to proposed street redesigns to quantify their expected effects and determine whether specific interventions will result in a desired "Main Street" status.

Ewing and his colleagues continued this work in 2006 with "Identifying and Measuring Urban Design Qualities Related to Walkability." This study uses a visual assessment survey similar to that used in New Jersey, but broadens its scope "to develop operational definitions and measurement protocols for key urban design qualities of streetscapes"²⁸ so that such design qualities can be quantified objectively and consistently by any investigator. The authors assembled a panel of 10 urban design experts, administered the survey using video clips of a variety of street scenes, measured the physical characteristics of each scene, and analyzed

the statistical relationships between the experts' ratings and the physical features. Finally, they selected the urban design qualities with the strongest empirical support, developed objective measurement protocols, and assembled a field manual that anyone can use to quantify an urban street's walkability.

The researchers used cross-classified random effects models similar to those used in the NJDOT study to statistically link physical features to urban design qualities.

"Six features were significant in two models: long sight lines, number of buildings with identifiers, proportion first floor façade with windows, proportion active uses, proportion street wall—same side, and number of pieces of public art. Two features were significant in three models: number of pedestrians and presence of outdoor dining."²⁹

The authors also found that

"overall walkability (as rated by the expert panel) was directly and significantly related to each urban design quality individually ... [and] human scale had the strongest relationship to overall walkability almost regardless of what combination of variables was tested."³⁰

Six of the nine urban design qualities this study examined met the authors' threshold criterion of 0.4 for inter-rater reliability across the expert panel: imageability, enclosure, human scale, transparency, complexity, and tidiness. The remaining three were legibility, linkage, and coherence; these qualities were not included in the field manual, and tidiness was later dropped as well due to major inconsistencies between field and lab measurements.

27 *Ibid*, 277

28 Reid Ewing, Susan Handy, Ross C. Brownson, Otto Clemente and Emily Winston, "Identifying and Measuring Urban Design Qualities Related to Walkability," *Journal of Physical Activity and Health* 3, no. Suppl. 1 (2006): S224.

29 *Ibid*, S234

30 *Ibid*, S235

This study met its stated goal to develop quantitative measures for urban design qualities related to walkability, and the resulting field instrument can be used both by professional urban designers and by the lay public. Similar methods could be used “to develop measures for perceptual qualities of other physical settings, such as residential streets, plazas, parks, and trails.”³¹

Ewing and colleagues’ work continues further with “Identifying and Measuring Urban Design Qualities Related to Walkability: Final Report.” This report provides a complete account of the research and process that the investigators undertook, building upon their other “Walkability” papers and culminating in the “Field Manual” document. It repeats much of the conceptual and background material the authors covered elsewhere, both in the Introduction and Appendices. It then breaks down the researchers’ 16-point work plan, including assembling the expert panel, shooting and analyzing video clips of street scenes, collecting and analyzing visual survey data, developing operational definitions for urban design qualities and associated physical features, and developing the survey instrument presented in the “Field Manual.”

Ewing and Susan Handy approach their work from a different angle with “Measuring the Unmeasurable: Urban Design Qualities Related to Walkability” in 2009. This article is a more design-oriented treatment of the authors’ efforts to derive objective, measurable operational definitions for urban design qualities of city streets, and to determine the significance of these qualities as related to walking behavior. As mentioned in the 2006 “Walkability” paper, the researchers assembled an panel of 10 urban design experts for this study, showed them a series of 48 video clips designed to mimic the pedestrian experience of a variety of streetscapes,

and asked them to rate each scene on 8 distinct urban design qualities. The researchers also measured physical features in each video clip, such as street width, building heights, number of pedestrians, and so on.

The authors were able to operationalize five of the eight urban design qualities: imageability, enclosure, human scale, transparency and complexity. The paper presents the definitions and history in the literature of each quality, as well as physical features that significantly contribute to each quality. These five qualities were also employed in the “Field Manual” document.

Methods for Surveying and Measuring Urban Street Qualities

Many other researchers have also attempted to measure and operationalize the spatial qualities of urban streets, such as Terri Pikora and colleagues in their 2002 article “Developing a Reliable Audit Instrument to Measure the Physical Environment for Physical Activity.” This paper presents the development process and reliability test results for the Systematic Pedestrian and Cycling Environmental Scan (SPACES) audit instrument, which the authors claim is the first to “measure the physical environment in a systematic and empiric manner”³² for the purpose of identifying environmental features that may encourage or discourage walking and cycling.

This instrument builds upon an earlier study of walking and cycling behavior among 1,803 participants. That study found that access to public open space and attractive, inviting environments encouraged walking,

31 *Ibid*, S237

32 Terri J Pikora, Fiona C.L. Bull, Konrad Jamrozik, Matthew Knuiman, Billie Giles-Corti and Rob J Donovan, “Developing a reliable audit instrument to measure the physical environment for physical activity,” *American Journal of Preventive Medicine* 23, no. 3 (October 2002): 188.

“with the odds of walking as recommended decreasing by half in those with limited access to attractive public open space.”³³ The SPACES study attempts to compile specific physical features related to walking into a simple audit tool that can be used by lay observers.

The researchers chose a total of 1,987 kilometers of street segments that lay within 400 meters of the previous study participants’ residences in Perth, Western Australia. They then produced maps covering about 1.5 square kilometers each for their 16 trained observers to use while walking the segments. The auditors returned sets of maps and audit forms each week from February to April 2000, for a total of 12,925 audited segments. Finally, the researchers performed inter- and intra-rater reliability tests by selecting random segments and observers for re-auditing, and they calculated statistical measures of agreement for each item in the instrument.

The SPACES audit includes functional factors of the walking/cycling surface, street and traffic characteristics, and street network permeability; personal and traffic safety; streetscape and view aesthetics; destination facilities; and subjective assessments of attractiveness and difficulty for both walking and cycling. Most of the items within each factor show high levels of agreement, but the subjective ratings and the item for number and height of street trees proved difficult for the auditors to score consistently and reliably.

The observers suggested that tree canopy coverage may be a more useful and simpler audit item for future versions of the instrument, and that the subjective assessments should be rated on a five-point rather than three-point scale. The authors also note a lack of variation in the types of street

segments that they chose for the study, as they appear to have focused primarily on residential neighborhoods. They state that the SPACES audit is a “reliable and practical instrument for collecting data and that trained observers found it easy to use”³⁴ for the purpose of studying walking and cycling from a public-health perspective. However, the audit items primarily ask whether physical features are present or absent, and do not address subtler questions of urban design that relate to walkability.

Similar to the SPACES instrument and Ewing’s “Field Manual,” the “Irvine–Minnesota Inventory to Measure Built Environments” by Kristen Day and colleagues is an in-person audit instrument designed to allow investigators to systematically and objectively measure physical characteristics of the built environment as they relate to walking. Development of the instrument, completed in 2003–2004, included a literature review to identify built features that could affect walking behavior, interviews with focus groups intended to solicit the perspectives of underrepresented populations, field tests across 27 locations in California, and an expert panel that was asked to review a draft of the instrument.³⁵

The final version of the Irvine–Minnesota Inventory includes 162 items, categorized into four domains: “accessibility (62 items), pleasurability (56 items), perceived safety from traffic (31 items), and perceived safety from crime (15 items).”³⁶ These items are all physical features of the built environment, as in Ewing’s “Walkability” work, but they are focused only on walking behavior and are not linked to larger concepts of good urban design.

33 *Ibid.*

34 *Ibid.*, 194

35 *Ibid.*, 147

36 *Ibid.*, 149

The authors note that the focus-group interviews were not as useful as expected in identifying relevant built-environment features for the instrument. They also note that, at 162 items, it may be too time-consuming to use in its entirety for a large number of street segments. However, it may be modified or adapted to focus on specific elements relevant to a particular study.³⁷

The Pedestrian Environmental Data Scan (PEDS) is another street audit instrument that was developed by Kelly J. Clifton et al. and presented in “The Development and Testing of an Audit for the Pedestrian Environment” in 2007. This paper opens with a discussion of research on walkability as it relates to both transportation and public health policy, and outlines the need for “generally accepted standards for what constitutes a walkable environment and unearthing the nature of the relationship between this environment and walking behavior.” The authors then describe the development and testing of their audit instrument, which they describe as a “consistent, reliable, and efficient method to collect information about the walking environment.”³⁸

Along with a brief review of previous walkability literature and other measurement instruments, the authors present the one-page PEDS audit and state that it “builds upon existing work in this area with particular emphasis on the audit from Systematic Pedestrian and Cycling Environmental Scan (SPACES).”³⁹ The instrument contains a series of yes/no and Likert-scale rating questions in categories related to the built environment, facilities in the pedestrian realm, physical attributes of

the road or street, the “Walking/Cycling Environment,” and subjective assessments of safety and attractiveness.

The authors then describe the “extensive use of detailed and intensive training to ensure reliability of the audit,” which includes two days of classroom and field exercises, photographic examples of audit items, practice audits using video clips, and auditor reliability tests.⁴⁰ Next, they outline their methods of mapping and defining pedestrian pathway segments and how auditors administer the instrument in the field using either pencil and paper or a personal digital assistant (PDA), then report on their process for reliability tests that they administered in College Park, MD in the summer of 2004.

According to the authors, “A total of 71.5 miles of street and pedestrian pathways, equal to 995 segments, were surveyed on foot” by 12 undergraduate auditors, and the authors performed statistical data analysis to determine “(1) the overall rater reliability (intra- and inter-) of the audit; (2) variation in the reliability by urban context; and (3) influence of various modes of implementation of the audit (pairs, individuals, wave) on reliability of the data collected.”⁴¹ The authors determine that “Overall, the instrument proved to be reliable,” though several of the more subjective or abstract items, such as attractiveness, road condition, and spatial enclosure, individually yielded low reliability scores.⁴² They also state that “Even with the training and other administrative costs included, PEDS is an efficient methodology for collecting microscale pedestrian data,” as a two-rater team can audit a typical 400-foot segment in about 3 – 5 minutes.⁴³

37 *Ibid*, 150

38 Kelly J Clifton, Andréa D. Livi Smith and Daniel Rodriguez, “The development and testing of an audit for the pedestrian environment,” *Landscape and Urban Planning* 80, no. 1-2 (March 2007): 95.

39 *Ibid*, 98

40 *Ibid*, 99

41 *Ibid*, 102

42 *Ibid*, 104

43 *Ibid*, 106

The authors claim that the reliability results for the PEDS audit are comparable to those of the SPACES and Irvine-Minnesota instruments. They also note that the reliability testing was administered mainly in a suburban setting, “but, in general, PEDS was designed to be versatile with respect to the administration settings (urban, suburban and rural), capturing the features that are most commonly thought to be associated with walking behavior.”⁴⁴ However, its substantial reliance on subjective rating items, its extensive training requirements, and its minimal inclusion of urban design elements make it difficult to apply to an independent assessment of urban streetscapes.

The 2005 document “Measuring Urban Design Qualities: An Illustrated Field Manual”⁴⁵ is the end product of Reid Ewing and his colleagues’ “Walkability” studies. As noted previously, its purpose is to define and operationalize the urban design qualities of imageability, enclosure, human scale, transparency, and complexity, and to provide methods for objective measurement of these qualities.

The manual asks the researcher to choose a city block or a 300-foot portion of a long block to use as a study area. It then presents definitions of each quality based on urban design literature and expert opinions, along with photographic examples of urban scenes rated high or low for each quality, and several metrics by which the study area is to be rated on that quality. Finally, it provides a scoring sheet for recording and totaling the scores for each quality.

44 *Ibid*, 109

45 Otto Clemente, Reid Ewing, Susan Handy and Ross Brownson, “Measuring Urban Design Qualities—An Illustrated Field Manual,” *Active Living Research Program*, Robert Wood Johnson Foundation, July 2005, http://activelivingresearch.org/sites/default/files/FieldManual_071605.pdf (accessed August 12, 2014).

This manual is an appropriate and useful instrument for conducting independent urban street audits for several reasons. First, it requires no auditor training beyond the explanations and photographic examples of rating elements that are contained in the manual itself. Second, it enables in-depth measurement and comparison of urban design qualities beyond simple assessments of “attractiveness.” Finally, it uses objective measurements of physical street features to derive urban design scores, which will facilitate consistent and reliable audits across multiple locations by minimizing confounding factors such as image quality and rater fatigue. Consequently, it was chosen for use in the present study of street redesigns.

Finally, the question may arise of how to perform street audits in multiple cities within the time and budget constraints of an unfunded graduate student. This question is answered in the 2011 paper “Using Google Street View to Audit Neighborhood Environments” by Andrew G. Rundle et al.⁴⁶ The aims of this study were to determine the validity and feasibility of using Google Street View to perform remote neighborhood audits, to determine which neighborhood features could be reliably measured by this method, identify any potential problems, and develop consistent protocols for Street View audits.

The researchers performed parallel audits of 37 high-walkability block faces in New York City, using both Google Street View and in-person field auditors, and measured concordance between the data using percentage agreement and Spearman rank-order correlations. The audits included data related to “seven neighborhood environment constructions:

46 Andrew G. Rundle, Michael D.M. Bader, Catherine A. Richards, Kathryn M. Neckerman and Julien O. Teitler, “Using Google Street View to Audit Neighborhood Environments,” *American Journal of Preventive Medicine* 40, no. 1 (2011): 94-100.

aesthetics, physical disorder, pedestrian safety, motorized traffic and parking, infrastructure for active travel, sidewalk amenities, and social and commercial activity.”

The study found high concordance rates for 54.3% of the audit items, particularly for measures of pedestrian safety, motorized traffic and parking, and infrastructure for active travel. Constructions that rely on small or temporally variable neighborhood features, such as physical disorder, showed lower concordance levels. The authors found that limitations inherent to using still images prevented remote measurement of field audit items such as “noises, odors, and traffic speeds ... a 10-minute pedestrian count, and sidewalk width.”⁴⁷ Another limitation is that Google Street View images are captured by a camera car driving in a traffic lane, so their point of view is necessarily different from that of a pedestrian, and some sidewalk features are often obscured by parked cars.

Overall, however, the authors found that Google Street View can be an efficient and valid tool for neighborhood audits, allowing data to be collected across large or dispersed geographic areas without the need for physical travel.

Contributions of the Present Study

This review of scholarly literature has shown significant bodies of work related to conflicts in public policy and street design practices. It has also outlined attempts to operationalize and reliably measure urban street qualities in order to find the best paths toward reconciling these conflicts. However, no study has addressed the balance of the costs of redesigning arterial streets with the potential benefits that cities may derive from

these projects.

The present study is an attempt to fill this gap in the literature in order to help cities both create better urban street spaces and accommodate the needs of all street users while under constrained budgets.

47 *Ibid*, 96

CHAPTER 3: METHODOLOGY

As this project is an extension and elaboration of the *Rethinking Streets* book,¹ five of the case study streets presented in the book were selected for further study. This effort focused on arterial streets that underwent cross-sectional design changes aimed at improving conditions for all users, including pedestrians, cyclists, transit riders, drivers, business owners, and residents, and for which Google Street View images are available from before and after completion of the redesign work. The selected streets, in order of project cost per mile, are presented at the end of this chapter.

Cost-Benefit Analysis

Once the case study streets were selected and a standardized cost figure determined for each, the benefits derived from each project were then analyzed on both economic and urban design fronts. The first step in this cost-benefit analysis was to measure the change in economic activity along each project corridor. A full economic analysis of five separate urban areas lies outside the scope of this project, so the focus was narrowed to surveys of storefront occupancy and infill development as indicators of economic development on the case study streets.

¹ Marc Schlossberg, John Rowell, Dave Amos, and Kelly Sanford, *Rethinking Streets: An Evidence-Based Guide to 25 Complete Street Transformations*, (Eugene: University of Oregon, 2013).

The “time travel” slider in Google Street View allowed access to streetscape images taken just before and three years after completion of each project. The Google Earth “Ruler” tool was used to record the street frontage length, in linear feet, of empty storefronts and vacant or dilapidated properties on both sides of the street for each time frame, excluding active construction sites. The total cost of the redesign project was then divided by the difference in developed street frontage:

$$\text{Development Cost/Foot} = (\text{Project Cost}) / (\text{Developed Frontage}_{\text{After}} - \text{Developed Frontage}_{\text{Before}})$$

Next, because the benefits of these redesign projects are not only economic, the level of improvement to the urban design of each project corridor must also be quantified. Google Street View images from just before and three years after each project allowed a survey of the streets according to the “Measuring Urban Design Qualities” field manual. This document presents consistent and quantitative metrics for rating the urban design of any given study area and allows the researcher to compile scores for the urban qualities of imageability, enclosure, human scale, transparency, and complexity.²

The study instrument is designed for a one-block survey, so a representative block was chosen for each project street. A few metrics in the manual – namely pedestrian counts and noise levels – are not suited to a remote survey, so those measures were removed from the scores for each street. The five sub-scores and a total score were compiled for the before-and-after urban condition of each case study street. The total cost

² Otto Clemente, Reid Ewing, Susan Handy and Ross Brownson, *Measuring Urban Design Qualities: An Illustrated Field Manual*, Active Living Research Program (San Diego: Robert Wood Johnson Foundation, 2005).

of the redesign project was then divided by the difference in the total urban design scores:

$$\text{Urban Design Cost/Point} = (\text{Project Cost}) / (\text{Design Score}_{\text{After}} - \text{Design Score}_{\text{Before}})$$

In this and other cases, it was unnecessary to use Cost/Mile and Score/Mile figures because the “Mile” terms algebraically cancel each other out, so they were omitted from the calculation.

Finally, the frontage development and urban design figures for each case study street were compiled into a single table to enable comparison of cost-effectiveness across projects.



BEFORE

25th Avenue, San Francisco, CA:

\$80,000 /0.9 mile = \$88,889 per mile

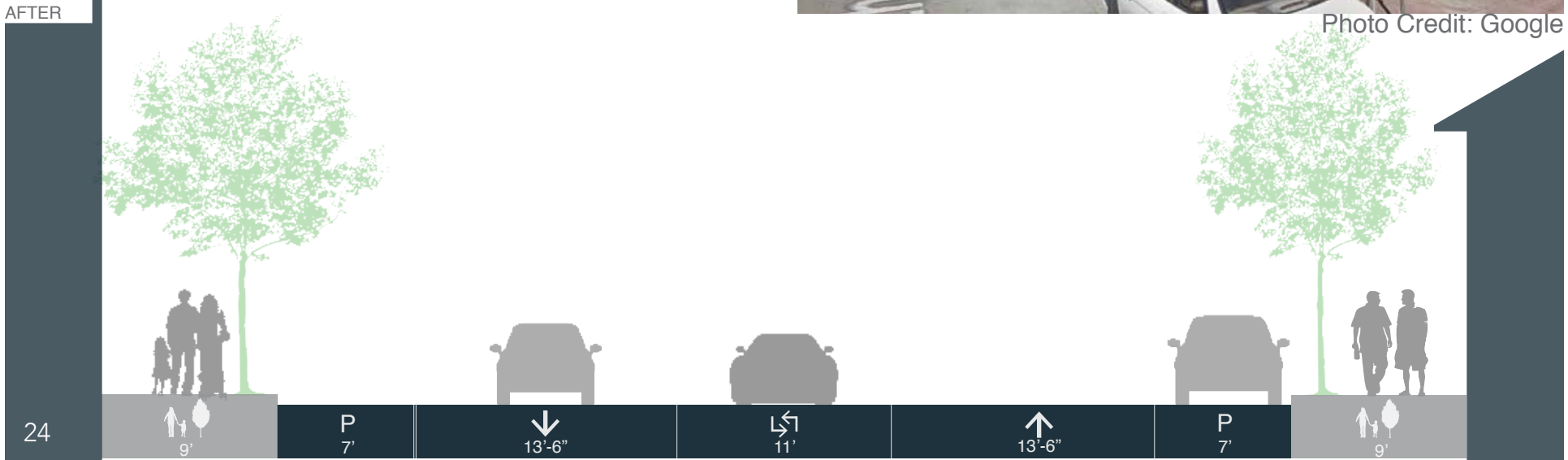
3 4

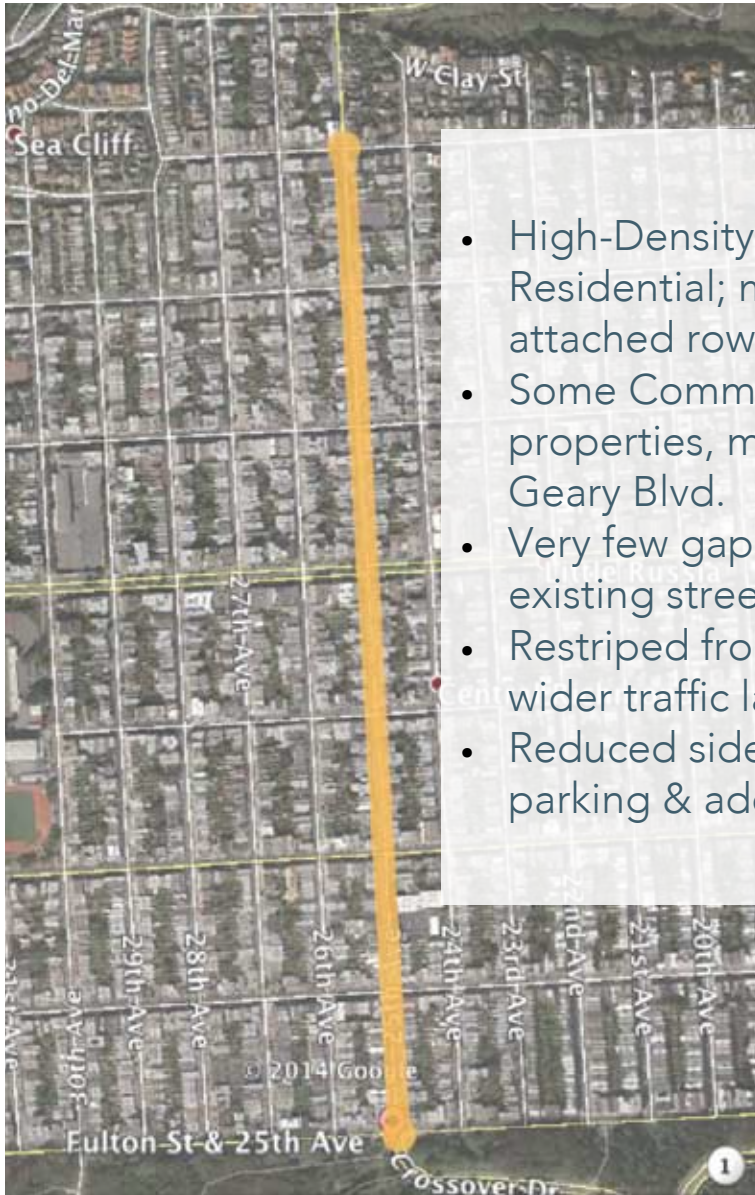
This was by far the lightest intervention among the case study streets. The City and County of San Francisco simply restriped the roadway in April 2008, converting it from four to two travel lanes with a center turn lane. The three resulting lanes are wider than before, preventing traffic from encroaching on the curbside parking zone, which had often led drivers to park on the sidewalk. As a result, the sidewalk is more useable by pedestrians, and the CCSF was able to plant street trees. Bus loading zones were also added or extended as part of this project.

- 3 Schlossberg et al., *Rethinking Streets*, 17.
- 4 Jack P. Broadbent, "Transportation Fund for Clean Air (TFCA) Regional Fund Grant Awards for FY 2005/06," (office memorandum prepared by J. Ortellado, Bay Area Air Quality Management District, San Francisco, October 17, 2005), 18.



Photo Credit: Google





- High-Density Residential; mostly attached row houses
- Some Commercial properties, mainly at Geary Blvd.
- Very few gaps in existing street wall
- Restriped from 4 to 3 wider traffic lanes
- Reduced sidewalk parking & added trees



BEFORE



AFTER

Image Credits: Google



East Boulevard, Charlotte, NC:

$\$1,300,000 / 0.7 \text{ mile} = \$1,857,142.86 \text{ per mile}$
(Phase 2 only).

5 6

The City of Charlotte converted East Boulevard, like 25th Avenue, from four to two lanes of vehicular traffic with a center left-turn lane. However, this “road diet” was combined with people-friendly improvements such as curb extensions, landscaped medians with pedestrian refuge crossings, bicycle lanes, and wheelchair ramps in order to mitigate excessive speeding and improve pedestrian safety and connectivity across the street. These changes were specified in the *East Boulevard Pedscape Plan*, which was adopted by the Charlotte City Council in 2002, and were implemented in three phases from 2006 to 2011; Phase 2 was completed in August 2010.⁷

In addition to the urban design and frontage development analyses, the availability of geocoded parcel data, including assessed value, enabled an analysis of the change in property tax revenue following the East Boulevard redesign. Guidance to the regional GIS data site was kindly

Photo Credit: Google



provided by Evan Lowry with the City of Charlotte.⁸

First, the total assessed property values were assembled for the project corridor in the three years before and after project completion.⁹ Property tax revenues were then calculated using published combined tax rates for the City of Charlotte and Mecklenburg County.¹⁰ The monetary return on investment (ROI) that the municipality accrued after completion of the project was calculated by dividing the difference in property tax

AFTER

5 Schlossberg et al., *Rethinking Streets*, 33.
6 City of Charlotte Engineering & Property Management, *Frequently Asked Questions - East Boulevard – Phase 2 (South Boulevard to Dilworth Road West)*, City of Charlotte, North Carolina, <http://charmeck.org/city/charlotte/epm/Projects/Transportation/Roads/Documents/East%20Bldv%20Phase%202%20FAQ%20-%202009.pdf> (accessed May 3, 2014).

7 *Ibid.*

8 Electronic mail from Evan Lowry, City of Charlotte, NC. December 16, 2014.

9 Mecklenburg County, North Carolina, Mecklenburg County GIS, <http://maps.co.mecklenburg.nc.us/openmapping/data.html#> (accessed December 16, 2014).

10 Office of the Tax Collector, Mecklenburg County, NC, “Property Taxes,” City of Charlotte and Mecklenburg County Official Government Website, <http://charmeck.org/Pages/default.aspx> (accessed February 20, 2015).





- Low-Density Residential, Light Commercial & Churches
- Reduced from 5 to 2 traffic lanes
- Curb extensions, landscaped medians, refuge crossings, bike lanes, etc.

revenues along the project corridor by the project cost:

$$ROI = ((\text{Revenue}_{\text{After}} - \text{Revenue}_{\text{Before}}), \text{Cost}) \times 100\%$$

In order to account for economic growth at the municipal or regional levels, the percentage change in revenue on the project corridor was also compared to the percentage change in median household tax payments across the city as a whole. This calculation gave the marginal share of growth that can be attributed to the redesign project:

$$\text{Share} = ((\text{Corridor Revenue}_{\text{After}} - \text{Corridor Revenue}_{\text{Before}}), (\text{Corridor Revenue}_{\text{Before}}) \times 100\%) - ((\text{Median HH Tax}_{\text{After}} - \text{Median HH Tax}_{\text{Before}}), (\text{Median HH Tax}_{\text{Before}}) \times 100\%)$$

Image Credits: Google



BEFORE

Higgins Avenue, Missoula, MT:

\$1,450,000 / 0.4 mile = \$3,625,000 per mile

11 12

In addition to a reduction in vehicular travel lanes like 25th Avenue and East Boulevard, the redesign of Higgins Avenue included two bicycle lanes at curb height between the sidewalk and on-street parallel parking. Cyclists are buffered from parked cars by a “door zone” with special paving, and the bike lanes are marked with green paint at intersections to improve visibility. The project also included sidewalk bulb-outs, or “corner plazas,” and improved landscaping. The project was completed in September 2010. The majority of the project funding (\$1.2 million) came from the federal American Recovery and Reinvestment Act, and the remainder came from the Montana Legislature and the state Department of Transportation.¹³



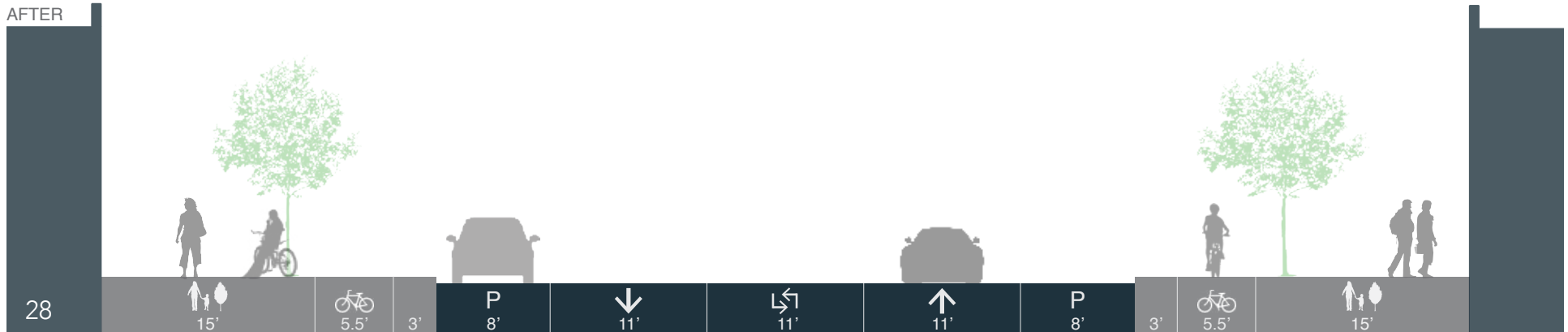
Photo Credit: Google

11 Schlossberg et al., Rethinking Streets, 105.

12 Keila Szpaller, “Missoula’s downtown streetscape changes celebrated,” Missoulian, October 15, 2010, http://missoulian.com/news/local/article_c88e0bce-d8dd-11df-ac88-001cc4c002e0.html (accessed June 14, 2014).

13 *Ibid.*

AFTER





- Downtown Commercial corridor, mix of historic & recent buildings
- Significant amounts of vacant frontage
- Restriped 4 to 3 narrower traffic lanes
- Added 2 curb-height bike lanes between sidewalk & street parking
- "Door Zone" between bikes & parked cars
- Curb extensions, bike parking, improved landscaping



BEFORE



AFTER

Image Credits: Google



BEFORE

Photo Credit: Google

Main & Buffalo Streets, Hamburg, NY:

\$20,000,000 / 1.4 mile = \$14,285,714 per mile

14 15

These streets, also designated as part of U.S. Route 62 and a major truck route, were redeveloped in partnership with the New York State Department of Transportation. NYSDOT initially proposed adding a travel lane, eliminating parallel parking, and narrowing sidewalks in order to improve the road's level of service for vehicular traffic, but members of the Hamburg community organized a committee to oppose the plan out of concern for the vitality of their main streets.¹⁶ The final redesign, executed from 2005 to 2009, employed several traffic-calming and people-friendly strategies, including narrower lanes, four roundabouts, mid-block crossings, curb extensions, refuge islands, bike/safety lanes, and improved landscaping.¹⁷

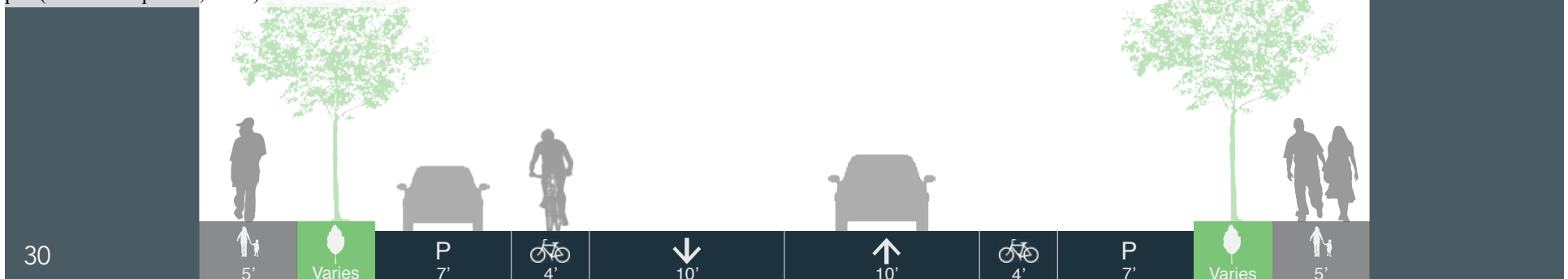


14 Schlossberg et al., Rethinking Streets, 83.

15 Federal Highway Administration, U.S. Route 62 Village of Hamburg, U.S. Department of Transportation, 2005, http://contextsensitivesolutions.org/content/case_studies/u_s_route_62_village_of_hambur/ (accessed April 24, 2014).

16 *Ibid.*

17 Jeff Belt and Chuck Banas, "Walkable Olean: A Vision for Union Street," September 2011, http://www.walkableolean.com/docs/Walkable_Olean_Vision_online.pdf (accessed April 24, 2014).



BEFORE

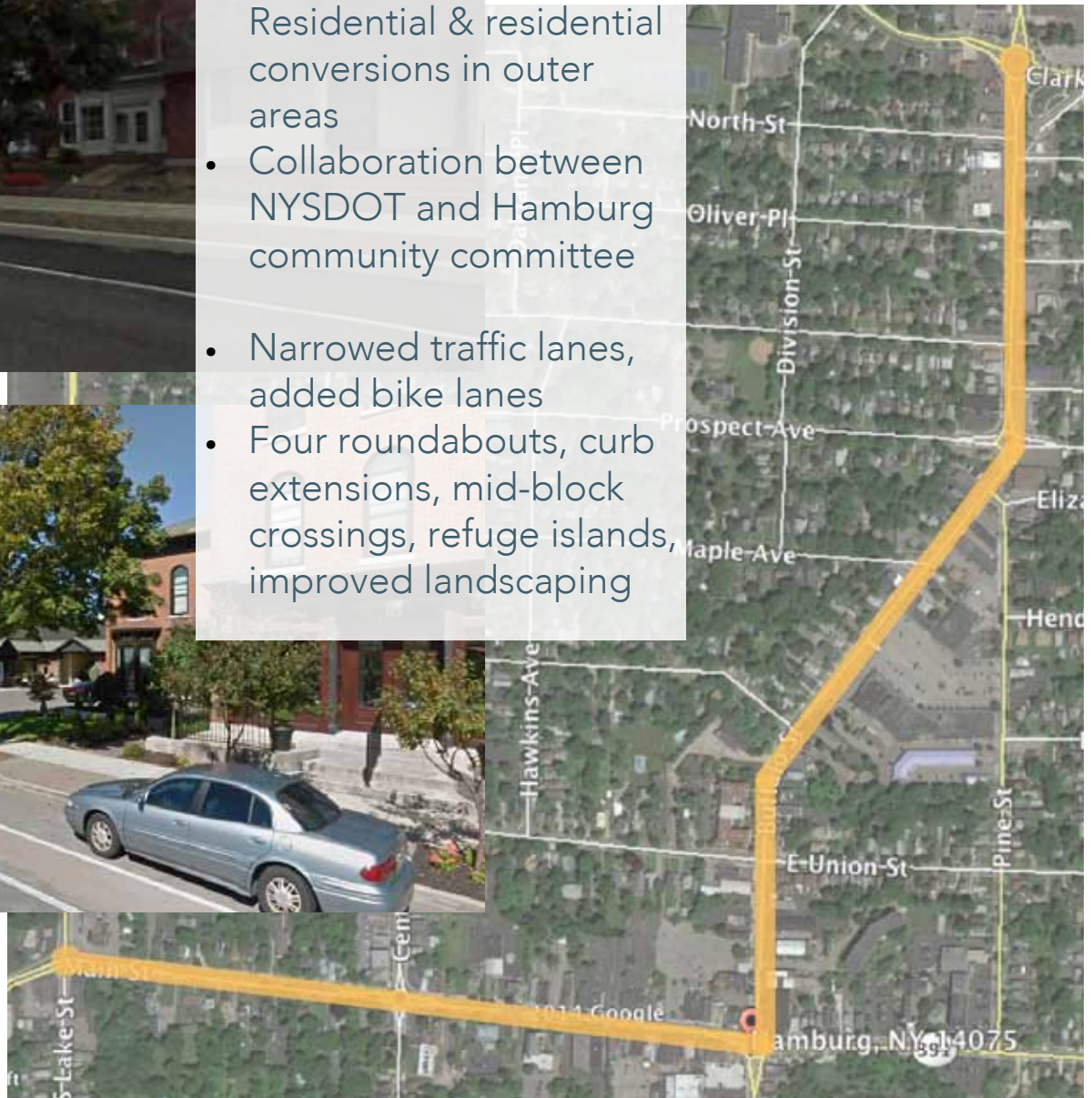


AFTER



- Downtown Commercial; Residential & residential conversions in outer areas
- Collaboration between NYSDOT and Hamburg community committee
- Narrowed traffic lanes, added bike lanes
- Four roundabouts, curb extensions, mid-block crossings, refuge islands, improved landscaping

Image Credits: Google





BEFORE

Photo Credit: Google

W Lancaster Blvd, Lancaster, CA:

\$11,500,000 / 0.6 mile = \$19,166,667 per mile

^{18 19}

Downtown Lancaster needed a dramatic change to reverse a long trend of economic decay and to improve pedestrian conditions, and it found one with this bold redesign in 2010. Three of the five travel lanes on West Lancaster Boulevard were replaced with a hardscaped plaza, or “ramblas,” featuring two rows of trees, planters, seating, and overhead lighting; the sidewalks also received similar upgrades. The two outer lanes were retained for vehicular traffic, and the central plaza provides diagonal parking when the street is not being used for public festivals, markets, or other events.²⁰ The added trees provide shade and moderate the strong westerly winds that prevail in Lancaster’s desert environment, and the lane reduction has reduced traffic speeds and collisions.

¹⁸ Schlossberg et al., *Rethinking Streets*, 75.

¹⁹ Congress for the New Urbanism, *Moule & Polyzoides Receive Smart Growth EPA Award*, November 30, 2012, <http://www.cnu.org/cnu-news/2012/11/moule-polyzoides-receive-smart-growth-epa-award> (accessed April 24, 2014).

²⁰ Sargent Town Planning, *Lancaster Boulevard Transformation*, <http://www.sargenttownplanning.com/projects/lancaster-boulevard-transformation> (accessed May 24, 2014).

AFTER





BEFORE



AFTER

- Downtown Commercial corridor; nearly 1/4 vacant before redesign project
- Very broad right-of-way (102 ft)
- Total road-bed reconstruction
- Reduced from 5 to 2 traffic lanes
- Created hardscaped "Ramblas" within right-of-way with diagonal parking, trees, furniture, & overhead lighting

Image Credits: Google





CHAPTER 4: RESULTS

The following chapter presents the interpreted results of the research methods described in Chapter 3. The original urban design score sheets and calculation spreadsheets may be reviewed in the Appendix.



25th Avenue, San Francisco, CA:

\$80,000 /0.9 mile = \$88,889 per mile

Frontage Redevelopment

This section of 25th Avenue is dominated by high-density residential development, primarily in the form of attached row-houses. A few commercial properties exist on the corridor, mainly at the intersection with Geary Boulevard, and a few educational and religious buildings are sprinkled along the avenue as well. Very few gaps exist in the street wall, so there is little space for redevelopment.

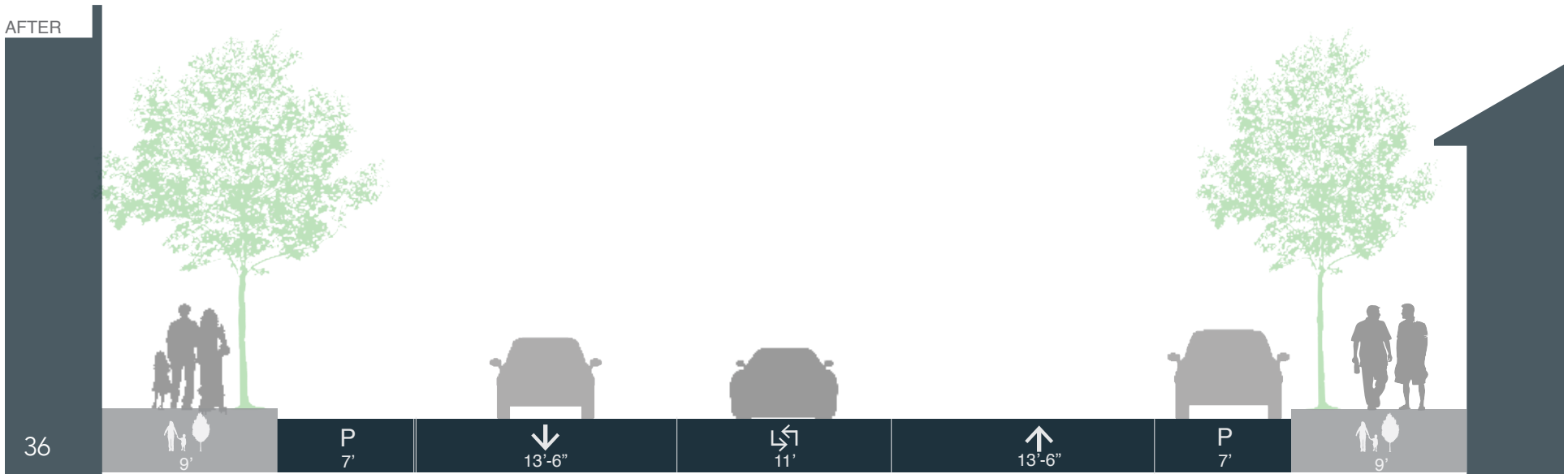
At the time of the 2007 Google Street View image, only one house had a dilapidated facade that was boarded up with plywood at the street level, and its owner may have been preparing to renovate it; by the April 2011 image, this house and its immediate neighbor had each received a new

facade and a third story. Changes in development at the scale of a single house are likely not attributable to a street-level redesign, especially one as low-key as 25th Avenue's, so the calculated redevelopment cost of \$4,000 per foot does not accurately reflect this project's benefit to the city.

Urban Design Scores

The block of 25th Avenue from Geary to Clement was chosen for this assessment in order to include a mix of commercial and residential frontage. As in the redevelopment assessment, this modest restriping project likely had a correspondingly modest effect on the block's already strong urban environment.

The small increase in the block's urban design score was driven by its Complexity sub-score, which reflected an increase in the number of building colors on the block. This change is probably not attributable to the street redesign, so the Cost/Point figure is misleading in this case. However, Schlossberg et al. reported an increase in pedestrian activity



following the project,¹ which would have increased both the Imageability and the Complexity sub-scores but was not captured in this remote survey. The street trees that were added in the project may also increase the Enclosure sub-score as they mature.

¹ Marc Schlossberg, John Rowell, Dave Amos and Kelly Sanford, *Rethinking Streets: An Evidence-Based Guide to 25 Complete Street Transformations* (Eugene, Oregon: University of Oregon, 2013).

- Frontage change due to a single renovated house; probably not related to street work
- Urban Design score increase driven by Complexity sub-score due to more building colors
- Rethinking Streets reported an increase in pedestrian activity

Frontage Redevelopment

Gaps _{Before} - Gaps _{After}	20 lf
% Redevelopment	0.42%
Redev. Cost/Foot	\$4,000

Urban Design Scores

Total _{After} - Total _{Before}	0.14
% Change	0.8%
Cost/Point	\$571,429



BEFORE



Image Credits: Google
AFTER



BEFORE

East Boulevard, Charlotte, NC:

$\$1,300,000 / 0.7 \text{ mile} = \$1,857,142.86 \text{ per mile}$
(Phase 2 only).

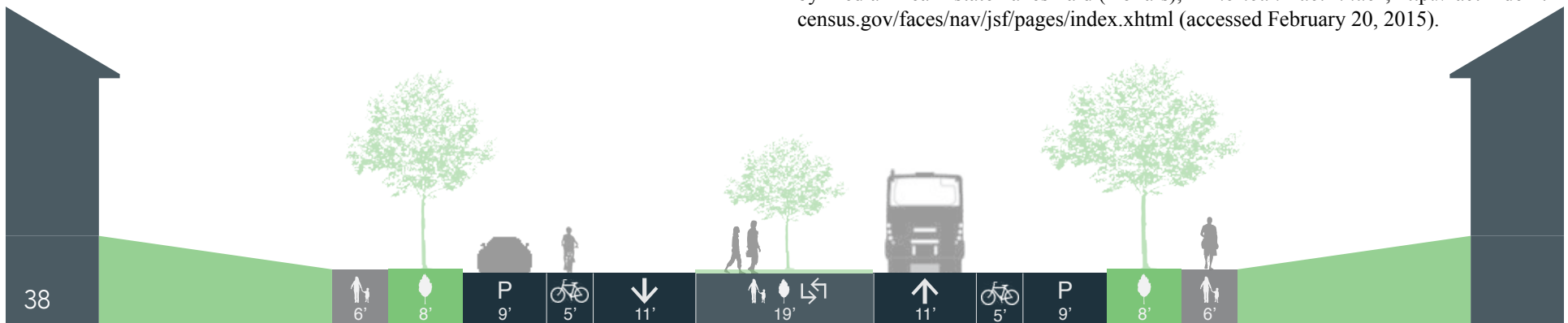
Tax Revenues

Property values along the East Boulevard project corridor, and the associated tax revenues, declined following the 2007-2008 housing market crash, then increased sharply after completion of the Phase 2 redesign in 2010.^{2,3}

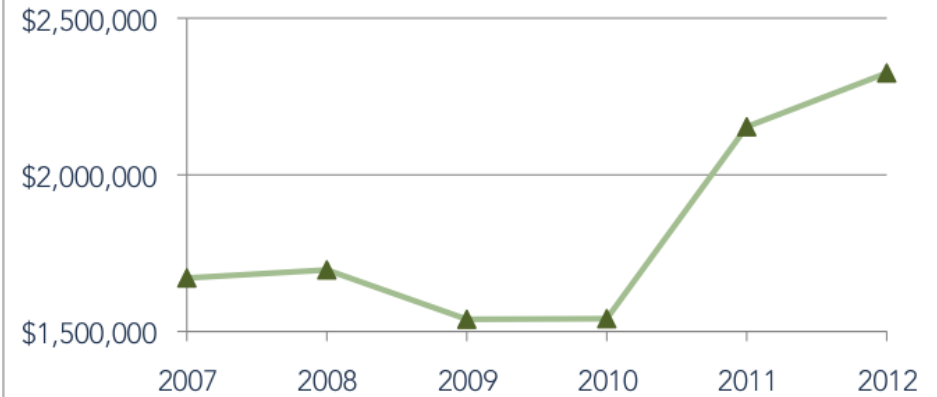
The Return on Investment (ROI) formula from Chapter 3 shows that the

- 2 Mecklenburg County, North Carolina, Mecklenburg County GIS, <http://maps.co.mecklenburg.nc.us/openmapping/data.html#> (accessed December 16, 2014).
- 3 Office of the Tax Collector, Mecklenburg County, NC, "Property Taxes," City of Charlotte and Mecklenburg County Official Government Website, <http://charmeck.org/Pages/default.aspx> (accessed February 20, 2015).

AFTER



Corridor Tax Revenue



increase in property tax revenue repaid over 85% of the Phase 2 project cost within the first three years after completion.

The Marginal Growth Share analysis shows that Charlotte's citywide property tax revenues increased by just over 5%,⁴ leaving over 17% of the calculated growth to originate in the project corridor.

- 4 U.S. Census Bureau, "ACS 3-Year Estimate Table B25103: Mortgage Status by Median Real Estate Taxes Paid (Dollars)," *American FactFinder*, <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml> (accessed February 20, 2015).

Return on Investment

3-Year Total Revenue	After (2010-2012)	\$6,019,187.52
	Before (2007-2009)	\$4,906,205.86
Difference		\$1,112,981.65
÷ Project Cost		\$1,300,000.00
ROI		85.6%

Marginal Growth Share

3-Year Total Revenue (Corridor)	After (2010-2012)	\$6,019,187.52
	Before (2007-2009)	\$4,906,205.86
Growth		22.7%
3-Year Total: Median Taxes Paid (Citywide)	After (2010-2012)	\$5,924
	Before (2007-2009)	\$5,625
Growth		5.3%
Growth Share		17.4%



Image Credits: Google



BEFORE

East Boulevard, Charlotte, NC:

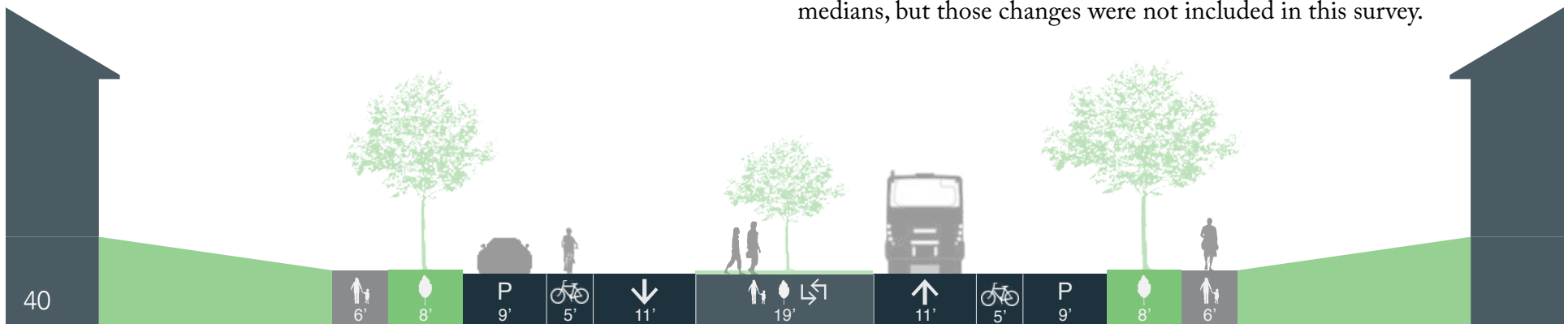
\$1,300,000 / 0.7 mile = \$1,857,142.86 per mile
(Phase 2 only).

Frontage Redevelopment

Like 25th Avenue, East Boulevard's development is primarily residential in character, though some of the houses have been converted to light commercial uses; the corridor also includes other commercial buildings and several churches. East Boulevard exhibited a much lower-density development pattern than 25th Avenue, both before and after the redesign, with a broad right-of-way, deep setbacks, and large grassy side-yard areas.

One large corner lot was vacant on the corridor prior to the redesign project, and it remained vacant as of the October 2011 Google image. Because none of the corridor frontage was redeveloped, the Cost/Foot calculation does not apply.

AFTER



Urban Design Scores

As in the San Francisco assessment, the block of East Boulevard between Springdale Avenue and Lennox Avenue was selected for urban design scoring in order to capture a mix of commercial and residential uses.

The increase in the total urban design score came from increases in the Imageability, Human Scale, and Transparency sub-scores. The Imageability increase was due to two additional buildings with external identifiers, which may or may not be linked to the redesign project. On the other hand, the Human Scale and Transparency increases were caused by the project's addition of a pull-out bus stop with associated street furniture and the clearing of adjacent overgrown vegetation.

Similar to the 25th Avenue case, additional increases in Imageability, Enclosure, and Complexity might be expected due to the improved pedestrian environment and future maturing of trees in the landscaped medians, but those changes were not included in this survey.

- Property tax increase paid back 85% of project cost in 3 years
- Urban Design score increase driven by Imageability, Human Scale, and Transparency sub-scores due to more building identifiers, added bus stop, & vegetation clearance

Frontage Redevelopment

Gaps _{Before} - Gaps _{After}	0 lf
% Redevelopment	0.00%
Redev. Cost/Foot	N/A

Urban Design Scores

Total _{After} - Total _{Before}	0.31
% Change	2.1%
Cost/Point	\$4,193,548



Image Credits: Google



Higgins Avenue, Missoula, MT:

\$1,450,000 / 0.4 mile = \$3,625,000 per mile

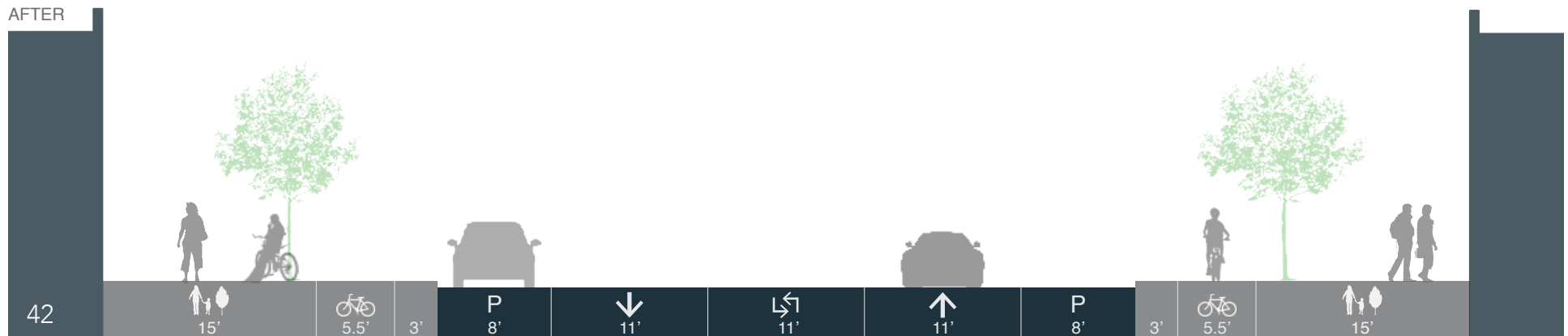
Frontage Redevelopment

The project corridor on North Higgins Avenue is primarily devoted to commercial uses, with a mix of historic and more recent buildings. It also includes significant amounts of vacant frontage, including unbuilt lots, vacant storefronts, and off-street parking.

The large increase in vacant frontage that occurred between the Google Street View surveys was primarily due to the closure of a Macy's department store at the south end of the corridor. This closure was probably unrelated to the redesign, but it left a 156-foot vacancy that remained unfilled as of the April 2012 image. Otherwise, the vacancy rate on the corridor was nearly unchanged, which likely points to larger economic issues beyond the scope of the project.

Urban Design Scores

This block of North Higgins enjoyed a fairly good urban environment before the redesign despite a low Enclosure sub-score, which did not change following the project. An increase in the Human Scale sub-score came from the bicycle-oriented redesign's addition of a bike corral, street lighting, and other street furniture. A further increase in Complexity came from an increase in the number of building colors, which may be peripherally related but not directly caused by the street redesign project.



- Negative frontage change due to Macy's closure at south end of corridor
- Vacancy rate elsewhere on corridor was nearly constant
- Urban Design score increase driven by Human Scale & Complexity sub-scores

Frontage Redevelopment

Gaps _{Before} - Gaps _{After}	-158 lf
% Redevelopment	-7.71%
Redev. Cost/Foot	-\$9,177

Urban Design Scores

Total _{After} - Total _{Before}	0.92
% Change	5.2%
Cost/Point	\$1,576,087



Image Credits: Google



BEFORE

Main & Buffalo Streets, Hamburg, NY:

\$20,000,000 / 1.4 mile = \$14,285,714 per mile

Frontage Redevelopment

The portion of Route 62 that coincides with Hamburg's Main and Buffalo Streets hosts predominantly commercial development, but many of the buildings outside the downtown core are houses that were converted to commercial uses such as dentists' and attorneys' offices. Sections of the street redesign within the downtown were under construction during the earliest available Google Street View images.

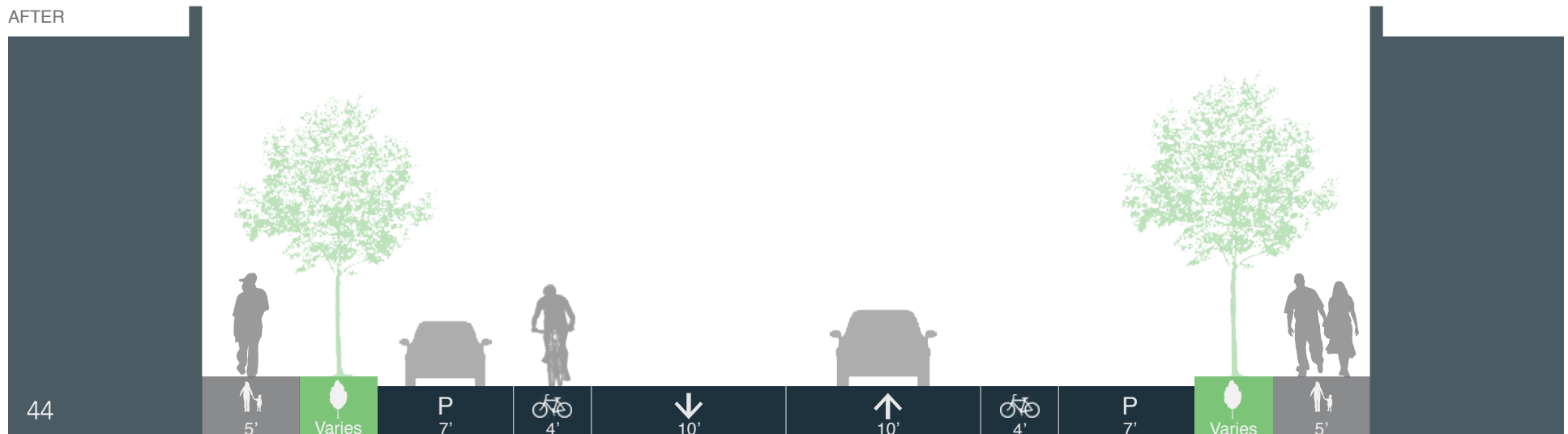
A large portion of the properties along the project corridor were either vacant or dilapidated in October 2007. Some of the vacant frontage coincided with the street construction in progress at the time, but the majority lay well away from construction activity, so the vacancies were not caused by the disruption of the street. According to Town of Hamburg Assessor Bob Hutchison, the Town coordinated several

redevelopment incentives with the street project, including grants for facade renovations and property-tax abatements for redevelopment through Industrial Development Area special zoning.¹ As a result, more than half of the gaps in street frontage were filled by September 2013.

Urban Design Scores

The combination of the street redesign, facade improvements, and infill development contributed to increases in all five urban design sub-scores for this block, which is just north of the intersection where Route 62 turns northward on Buffalo Street. Redevelopment of a large commercial property on the intersection, including a taller facade profile and new signage and finishes, drove significant increases in Imageability, Enclosure, and Transparency. Streetscape improvements, including a small plaza, planters, and other street furniture, added to the Human Scale and Complexity sub-scores.

¹ Telephone conversation with Bob Hutchison, Assessor, Town of Hamburg, NY. December 17, 2014.



AFTER

- More than half of the existing frontage gaps were filled within 4 years
- Urban Design score increase driven by increases in all 5 sub-scores
- Local government offered property tax incentives for redevelopment

Frontage Redevelopment

Gaps _{Before} - Gaps _{After}	446lf
% Redevelopment	6.72%
Redev. Cost/Foot	\$44,843

Urban Design Scores

Total _{After} - Total _{Before}	2.04
% Change	10.0%
Cost/Point	\$9,803,922



Image Credits: Google



W Lancaster Blvd, Lancaster, CA:

\$11,500,000 / 0.6 mile = \$19,166,667 per mile

Frontage Redevelopment

Prior to the redesign of West Lancaster Boulevard, the project corridor suffered from vacant storefronts, buildings, and lots that added up to nearly a quarter of the corridor's total length. These frontage vacancies, combined with a very wide right-of-way, created an extremely unwelcoming urban environment.

Following the street's redesign and reconstruction, over two thirds of the net frontage gap was filled in by May 2012, primarily with active commercial uses. In addition, of the total frontage gap after the project was completed, only one lot and two storefronts (totaling 136 feet) recorded before the project remained vacant. The balance of the May 2012 vacancies were individual storefronts within the new development.

Urban Design Scores

West Lancaster Boulevard's dramatic redesign led to a correspondingly dramatic increase in the urban design scores for this block, which I selected as representative of the project corridor as a whole. Before-and-after comparison of the block's urban conditions shows major increases in all five sub-scores. For example, the addition of a plaza, outdoor dining, and signage increased Imageability; new plantings and amenities on both the "Ramblas" and the sidewalks increased Enclosure and Human Scale; and new and infill frontage development increased Enclosure, Transparency, and Complexity.



- Over 2/3 of net frontage gap filled within 2 years
- Only 1 lot and 2 storefronts recorded before the project remained vacant
- Dramatic increases in all 5 Urban Design sub-scores

Frontage Redevelopment

Gaps _{Before} - Gaps _{After}	545 lf
% Redevelopment	16.15%
Redev. Cost/Foot	\$21,101

Urban Design Scores

Total _{After} - Total _{Before}	7.23
% Change	60.0%
Cost/Point	\$1,590,595



Image Credits: Google



CHAPTER 5: DISCUSSION

Synthesis

When the results for all five case study streets are synthesized by plotting project costs per mile against the percent changes in both frontage redevelopment and urban design scores, the beginning of a pattern appeared to suggest itself. If the anomaly of the Macy's closure is removed from North Higgins Avenue, then both plots follow relatively smooth upward curves, and the urban design curve rises sharply with the larger-scale interventions of Main & Buffalo Streets and West Lancaster Boulevard. This pattern seems to make intuitive sense: greater investment tends to yield greater improvement, especially in streetscapes that need the most help.

Street Name	Total Cost	Cost/Mile	Percent Change	
			Frontage Redevelopment	Urban Design Scores
25th Avenue	\$80,000	\$88,889	0.42%	0.8%
East Boulevard (Phase 2)	\$1,300,000	\$1,857,143	0.00%	2.1%
N Higgins Avenue	\$1,450,000	\$3,625,000	-7.71%	5.2%
Main & Buffalo Streets	\$20,000,000	\$14,285,714	6.72%	10.0%
W Lancaster Boulevard	\$11,500,000	\$19,166,667	16.15%	60.0%

Inclusion of the property tax data for the East Boulevard project corridor adds an interesting new dimension. As Chapter 4 showed, the increase in property tax revenues following completion of Phase 2 appeared to be on track to repay the project cost in just over three years. In addition, the majority of the calculated revenue growth appears to be indigenous to East Boulevard itself rather than driven by growth at the city or regional level. These findings may improve the feasibility outlook for other cities considering similar redesign projects. Future research with more complete data sets, including data from other cities, will be helpful to verify the validity of these results.

More generally, this study's sample size of five case study streets is too small to establish statistical correlations among the variables, so further research encompassing more streets in other cities would be needed to confirm these apparent associations. Nevertheless, the appearance of these patterns does suggest several recommendations for other cities considering redesigns of their own arterial streets.



Design Recommendations

Every city will of course have to determine what type and level of intervention is feasible and appropriate for a given street based on its political and budgetary climate. However, the following recommendations, based on the literature and the findings of this study, may serve as useful starting points for many arterial streets.

▪ Go On a Road Diet

Many arterial streets, with two, three, or more lanes in each direction as well as center turn lanes, give far more real estate to vehicular traffic than is necessary for smooth traffic flow. Nearly all of the case study redesigns reduced the number of traffic lanes to one each way, plus center turn lanes or pockets where appropriate, and none have resulted in dramatically increased congestion or traffic diversion to secondary streets.

These lane reductions can be accomplished by a range of methods depending on budget, from simple restriping to added curbs and medians to total reconstruction. The resulting leftover space in the right-of-way can then be repurposed for some of the following improvements.

▪ Improve the Pedestrian Realm

A common characteristic of many arterials is an inadequate pedestrian realm: narrow or nonexistent sidewalks, no buffer between sidewalk and traffic, inadequate lighting, and infrequent or unsafe crossings. Reductions in travel lanes can give street designers plenty of room for pedestrian amenities such as sidewalks wide enough for strolling families, planting strips, human-scale lighting, and corner or mid-block bulb-outs. These improvements will go a long way toward creating a safe, inviting, pleasant pedestrian environment.

▪ Make Space for Other Modes

Travel lanes can also be converted for use by bicyclists, buses, and streetcars, depending on the local transportation mix. Even if few cyclists currently use a particular arterial road, a lack of safe bike lanes may be suppressing a latent demand for bicycle transportation.

▪ Plant Trees, Shrubs, Flowers, Grasses

Planting vegetation in tree wells, buffer strips, medians, and roundabouts is a relatively low-cost, high-impact intervention in most cases. Mature street trees provide shade, enclosure, rhythm, complexity, and scale to a streetscape. Vegetation also improves soil retention and stormwater infiltration, provides color and variety, softens the perception of hard surfaces, improves urban air quality, and can provide connections to local indigenous ecosystems.

Policy Implications

First it is important to recognize – as any city official knows – that the variables affecting urban development and vitality are far too numerous, complex, and interrelated to hope to establish causality in this type of study. As in Missoula, arterial street redesigns alone will not necessarily induce private investment and development. Further, even the most beautiful and welcoming streets will see few pedestrians or cyclists if they do not connect to desirable destinations.

However, even modest improvements such as striping, street furniture, trees, and lighting can have noticeable effects on the urban environment, especially when targeted at a specific problem like San Francisco's narrow travel lanes that led to illegal sidewalk parking. These small changes can also have larger intangible effects on the quality of life of the people who

use and inhabit the streets, such as their collective sense of belonging to, and ownership of, their urban environment.

Furthermore, the importance of improving the qualities of public street spaces should not be underestimated, especially in the neighborhoods that need the most help. As in Hamburg and Lancaster, streets with the most room for improvement can benefit the most from municipal interventions. If cities are willing and able to attack the problem on multiple fronts – including physical redesign and reconstruction, partnerships with other government agencies, and incentives for private redevelopment – then they can create the conditions for dramatic gains in economic activity, community vitality, and urban livability.

If cities are able to achieve the kind of total transformation in their streets that we saw in Lancaster Boulevard, then their attentions may need to shift toward managing the consequences of that success. That kind of rapid change and growth carries the risk of homogenizing city centers like Lancaster's with national chains and trendy design until they resemble high-end malls anywhere in the country and much of their unique local character is lost. It also opens the door to gentrification of economically depressed areas, which can drive rents upward and beyond the reach of lower-income residents and struggling small businesses. City officials need to be aware of these potential consequences of redevelopment, but given the choice, most would likely prefer to deal with these issues than with disinvestment and decay in their city centers.

Limitations

First, a case study format is not conducive to the large sample sizes required for statistical analysis, so any associations found in this study are correlative rather than causative. Conclusions of causation between

the street redesigns and changes in economic activity are precluded by a host of confounding factors. For example, this study's scope did not include a full policy analysis for each city and region, so the observed changes in the case study streets may have been influenced by external factors such as development incentives, demographic shifts, changes to the industrial or employment mix, zone changes, locational advantages or disadvantages, and so on. Each of the redesign projects was also completed during the major recession that began in 2008, so their economic effects are intertwined with those of the nationwide downturn.

Next, this study's reliance on the urban design work of Reid Ewing and his colleagues imparts a relatively limited perspective on the qualities of good urban space. Ewing et al.'s research and survey instrument was chosen for this study because it focuses specifically on the street environment, is relatively simple to administer, and uses objective item counts and measurements to yield reliable results. However, it does not capture locational advantages or connectivity of a streetscape to its larger context, and it does not address the effects of building uses on the street at varying times of day or night.

The economic data used in the cost-benefit analyses are also highly simplified. The "Project Cost" figures are gross totals based on limited available data. They do not capture differences in funding sources such as city or county capital funds, state allocations for transportation projects, or federal redevelopment grants. They do not separate the costs of underground infrastructure improvements, which may not directly affect the urban design of the streetscape, from those of surface-level work. They do not control for the number of rebuilt intersections in a given project, which take up a much larger share of the project cost than mid-block improvements. They do not quantify costs or other harm to existing businesses or residents that may be caused by construction work in their

streets.

The “Benefit” side of the equation is similarly simplified; for example, it does not capture changes in sales or payroll tax revenue, employment levels, or spending power that may be driven by increased economic activity. The use of linear feet of street frontage as an indicator of economic development also does not capture differences in business type, intensity of use, or turnover of individual businesses.

In addition, this project was intended to include tax revenue analyses for all of the case study streets in order to enable a financial cost-benefit comparison of redesigns across cities. However, the necessary data were only available from the City of Charlotte at the time of writing. The scope of the data set was also narrowed to include only properties with direct frontage on the redesigned portion of East Boulevard. This helped keep the analysis manageable, but did not capture any peripheral effects of the redesign on property values in the larger neighborhood.

Several of this study’s limitations also stem from the use of Google Street View and Google Earth for remote street surveys. While these were efficient and cost-effective tools for conducting before-and-after surveys over a span of years in multiple cities, they could not capture the full pedestrian experience on the survey streets. The Google Street View camera cars record images while driving on travel lanes in the streets, so the viewing angles and lines of sight are different from those of a pedestrian on the sidewalk, and image quality depends on lighting conditions, photographic resolution, and other variables. The use of remote surveys also required the street noise and pedestrian activity metrics to be excluded from the urban design scoring, so some of the effects of the street redesigns were not recorded.

Recommendations for Further Study

The ideal future study along the lines of this project would use a longitudinal design, with field research teams conducting in-person surveys for several years before and after major street redesigns in at least 40 cities. This fieldwork would be coupled with economic and policy analyses of each city in order to isolate the effects of the redesigns. This type of study would address the remote-survey limitations and other confounding factors, and statistical analysis of the resulting data set may be able to establish causal relationships between street redesigns and economic and urban design benefits. This is, of course, a highly idealized research concept.

A more realistic avenue for further research might be to pursue a similar methodology, but to focus only on a single redesigned street. This narrowed scope may enable the researcher to dig more deeply into detailed urban design studies, in-person field surveys, and economic and policy analyses. The area of inquiry could also be broadened to include surrounding neighborhoods, and a control neighborhood could be identified that did not undergo a redesign project. This approach could help to tease out many of the confounding factors that the present study encountered, yielding more robust and reliable results.

An exciting and needed outcome for such a future study could be a Post-Occupancy Evaluation (POE) protocol for street redesigns. The architecture profession and building trades have begun to recognize the value of these evaluations in recent years, in which building designers and managers study how effectively and efficiently a completed building serves the needs of its users, and how closely it performs to its design goals.



The planning and urban design professions, however, have adopted no such formal evaluation practices for completed street designs. If a future researcher developed a standardized POE methodology for streets based on the present study, that tool could help to objectively identify best practices for street design and construction, and could inform the creation of better urban spaces.

Conclusion

The intention of this project is to show city planning officials across the country that the urban and spatial qualities of our arterial streets can be improved at a broad range of municipal investment levels. Even with tightly managed capital-improvement budgets, a well-considered and targeted redesign can raise the quality of a city's public spaces and send ripple effects of private-sector improvement through the surrounding urban fabric. The author hopes that planners and researchers will find this study's methods and conclusions to be helpful, and that it will serve as a platform for further research to continue to develop these ideas.



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APPENDIX

Urban Design Score Sheets	58
Calculation Spreadsheets	68

measuring urban design qualities scoring sheet

street 25th Ave

date & time

Feb. 2007 (B)

step	recorded value	multiplier	(multiplier) x (recorded value)
imageability			
1. number of courtyards, plazas, and parks (both sides, within study area)	-	0.41	-
2. number of major landscape features (both sides, beyond study area)	-	0.72	-
3. proportion historic building frontage (both sides, within study area)	40	0.97	0.39
4. number of buildings with identifiers (both sides, within study area)	4	0.11	0.44
5. number of buildings with non-rectangular shapes (both sides, within study area)	6	0.08	0.48
6. presence of outdoor dining (your side, within study area)	-	0.64	-
7. number of people (your side, within study area)	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4	0.02	-
8. noise level (both sides, within study area)	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4	-0.18	-
add constant +2.44			
	imageability score		3.75
enclosure			
1. number of long sight lines (both sides, beyond study area)	1	-0.31	-0.31
2a. proportion street wall (your side, within study area)	19	0.72	0.65
2b. proportion street wall (opposite side, within study area)	19	0.94	0.85
3a. proportion sky (ahead, beyond study area)	20	-1.42	-0.28
3b. proportion sky (across, beyond study area)	15	-2.19	-0.33
	add constant +2.57		
	enclosure score		3.15
human scale			
1. number of long sight lines (both sides, beyond study area) *from above	1	-0.74	-0.74
2. proportion windows at street level (your side, within study area)	1	1.10	0.11
3. average building height (your side, within study area)	35	-0.003	-0.11
4. number of small planters (your side, within study area)	-	0.05	-
5. number of pieces of street furniture and other street items (your side, within study area)	7	0.04	0.28
	add constant +2.61		
	human scale score		2.15
transparency			
1. proportion windows at street level (your side, within study area)	1	1.22	0.12
2. proportion street wall (your side, beyond study area) *from above	19	0.67	0.60
3. proportion active uses (your side, within study area)	19	0.53	0.48
	add constant +1.71		
	transparency score		2.91
complexity			
1. number of buildings (both sides, beyond study area) see below	38	0.05	1.90
2a. number of basic building colors (both sides, beyond study area) 10 colors	6	0.23	1.38
2b. number of basic accent colors (both sides, beyond study area) 10 colors	5	0.12	0.60
3. presence of outdoor dining (your side, within study area) *from above	-	0.42	-
4. number of pieces of public art (both sides, within study area)	-	0.29	-
5. number of walking pedestrians (your side, within study area)	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4	0.03	-
add constant +2.61			
	complexity score		6.49

measuring urban design qualities scoring sheet			auditor
street	from	date & time	
25th Ave	Geary Blvd - Clearest St	Apr 2011 (A)	
step	recorded value	multiplier	(multiplier) x (recorded value)
imageability			
1. number of courtyards, plazas, and parks (both sides, within study area)	-	0.41	-
2. number of major landscape features (both sides, beyond study area)	-	0.72	-
3. proportion historic building frontage (both sides, within study area)	.40	0.97	0.39
4. number of buildings with identifiers (both sides, within study area)	3	0.11	0.33
5. number of buildings with non-rectangular shapes (both sides, within study area)	6	0.08	0.48
6. presence of outdoor dining (your side, within study area)	-	0.64	-
7. number of people (your side, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.02	
8. noise level (both sides, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		-0.18	-
			add constant +2.44
		imageability score	3.64
enclosure			
1. number of long sight lines (both sides, beyond study area)	1	-0.31	-0.31
2a. proportion street wall (your side, within study area)	.90	0.72	0.65
2b. proportion street wall (opposite side, within study area)	.90	0.94	0.85
3a. proportion sky (ahead, beyond study area)	.20	-1.42	-0.28
3b. proportion sky (across, beyond study area)	.15	-2.19	-0.33
			add constant +2.57
		enclosure score	3.15
human scale			
1. number of long sight lines (both sides, beyond study area) *from above	1	-0.74	-0.74
2. proportion windows at street level (your side, within study area)	.10	1.10	0.11
3. average building height (your side, within study area)	.35	-0.003	-0.11
4. number of small planters (your side, within study area)	-	0.05	-
5. number of pieces of street furniture and other street items (your side, within study area)	7	0.04	0.28
			add constant +2.61
		human scale score	2.15
transparency			
1. proportion windows at street level (your side, within study area)	.10	1.22	0.12
2. proportion street wall (your side, beyond study area) *from above	.90	0.67	0.60
3. proportion active uses (your side, within study area)	.90	0.53	0.48
			add constant +1.71
		transparency score	2.91
complexity			
1. number of buildings (both sides, beyond study area)	36	0.05	1.80
2a. number of basic building colors (both sides, beyond study area)	7	0.23	1.61
2b. number of basic accent colors (both sides, beyond study area)	6	0.12	0.72
3. presence of outdoor dining (your side, within study area) *from above	-	0.42	-
4. number of pieces of public art (both sides, within study area)	-	0.29	-
5. number of walking pedestrians (your side, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.03	-
			add constant +2.61
		complexity score	6.74

measuring urban design qualities scoring sheet		auditor
street <i>East Blvd</i> from <i>Springdale - Lenox</i> date & time <i>Aug. 2007 (B)</i>		
step	recorded value	multiplier (multiplier) x (recorded value)
imageability		
1. number of courtyards, plazas, and parks (both sides, within study area)	-	0.41
2. number of major landscape features (both sides, beyond study area)	-	0.72
3. proportion historic building frontage (both sides, within study area)	<i>.70</i>	<i>0.68</i>
4. number of buildings with identifiers (both sides, within study area) <i> </i>	<i>3</i>	<i>0.33</i>
5. number of buildings with non-rectangular shapes (both sides, within study area) <i> </i>	<i>12</i>	<i>0.96</i>
6. presence of outdoor dining (your side, within study area)	-	0.08
7. number of people (your side, within study area)	-	0.64
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.02
enclosure		
1. number of long sight lines (both sides, beyond study area) <i>/</i>	<i>1</i>	<i>-0.31</i>
2a. proportion street wall (your side, within study area)	-	0.72
2b. proportion street wall (opposite side, within study area)	<i>.40</i>	<i>0.94</i>
3a. proportion sky (ahead, beyond study area)	<i>.15</i>	<i>-1.42</i>
3b. proportion sky (across, beyond study area)	<i>.20</i>	<i>-0.44</i>
Total		<i>-2.19</i>
Total divided by 4		<i>-0.18</i>
human scale		
1. number of long sight lines (both sides, beyond study area) *from above	<i>1</i>	<i>-0.74</i>
2. proportion windows at street level (your side, within study area)	-	1.10
3. average building height (your side, within study area)	<i>2.5'</i>	<i>-0.003</i>
4. number of small planters (your side, within study area)	-	0.05
5. number of pieces of street furniture and other street items (your side, within study area)	-	0.04
Total		<i>+2.57</i>
Total divided by 4		<i>1.99</i>
transparency		
1. proportion windows at street level (your side, within study area)	-	1.22
2. proportion street wall (your side, beyond study area) *from above	-	0.67
3. proportion active uses (your side, within study area)	<i>0.50</i>	<i>0.53</i>
Total		<i>+1.71</i>
Total divided by 4		<i>1.79</i>
complexity		
1. number of buildings (both sides, beyond study area) <i> </i>	<i>12</i>	<i>0.05</i>
2a. number of basic building colors (both sides, beyond study area) <i>wh, rd, bl, br, gr</i>	<i>5</i>	<i>0.23</i>
2b. number of basic accent colors (both sides, beyond study area) <i>gr, br, wh, rd</i>	<i>4</i>	<i>0.12</i>
3. presence of outdoor dining (your side, within study area) *from above	-	0.42
4. number of pieces of public art (both sides, within study area)	-	0.29
5. number of walking pedestrians (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.03
complexity score		
		<i>4.84</i>

measuring urban design qualities scoring sheet			auditor
street	from	date & time	
East Blvd	Springdale - Lennox	Oct 2011	(A)
step	recorded value	multiplier	(multiplier) x (recorded value)
imageability			
1. number of courtyards, plazas, and parks (both sides, within study area)	-	0.41	-
2. number of major landscape features (both sides, beyond study area)	-	0.72	-
3. proportion historic building frontage (both sides, within study area)	70	0.97	0.68
4. number of buildings with identifiers (both sides, within study area)	5	0.11	0.55
5. number of buildings with non-rectangular shapes (both sides, within study area)	12	0.08	0.96
6. presence of outdoor dining (your side, within study area)	-	0.64	-
7. number of people (your side, within study area)	-	-	-
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.02	
8. noise level (both sides, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		-0.18	-
enclosure			
1. number of long sight lines (both sides, beyond study area)	1	-0.31	-0.31
2a. proportion street wall (your side, within study area)	-	0.72	-
2b. proportion street wall (opposite side, within study area)	40	0.94	0.38
3a. proportion sky (ahead, beyond study area)	15	-1.42	-0.21
3b. proportion sky (across, beyond study area)	20	-2.19	-0.44
add constant +2.57			
enlosure score			
1. number of long sight lines (both sides, beyond study area) *from above	1	-0.74	-0.74
2. proportion windows at street level (your side, within study area)	-	1.10	-
3. average building height (your side, within study area)	25'	-0.003	-0.08
4. number of small planters (your side, within study area)	-	0.05	-
5. number of pieces of street furniture and other street items (your side, within study area)	1	0.04	0.04
add constant +2.61			
human scale score			
transparency			
1. proportion windows at street level (your side, within study area)	-	1.22	-
2. proportion street wall (your side, beyond study area) *from above	-	0.67	-
3. proportion active uses (your side, within study area)	0.60	0.53	0.32
add constant +1.71			
transparency score			
complexity			
1. number of buildings (both sides, beyond study area)	12	0.05	0.60
2a. number of basic building colors (both sides, beyond study area)	5	0.23	1.15
2b. number of basic accent colors (both sides, beyond study area)	4	0.12	0.48
3. presence of outdoor dining (your side, within study area) *from above	-	0.42	-
4. number of pieces of public art (both sides, within study area)	-	0.29	-
5. number of walking pedestrians (your side, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.03	-
complexity score			
add constant +2.61			
complexity score			
4.84			

measuring urban design qualities scoring sheet		auditor	
street <u>N. Higgins Ave.</u> from <u>E Pine St - E Spruce St</u>		date & time <u>May 2008</u> (13)	
step	recorded value	multiplier	(multiplier) x (recorded value)
imageability			
1. number of courtyards, plazas, and parks (both sides, within study area)	1	0.41	0.41
2. number of major landscape features (both sides, beyond study area)	1	0.72	0.72
3. proportion historic building frontage (both sides, within study area)	1.40	0.97	0.39
4. number of buildings with identifiers (both sides, within study area)	7	0.11	0.77
5. number of buildings with non-rectangular shapes (both sides, within study area)	1	0.08	0.08
6. presence of outdoor dining (your side, within study area)	1	0.64	0.64
7. number of people (your side, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.02	
enclosure			
1. number of long sight lines (both sides, beyond study area)	3	-0.31	-0.93
2a. proportion street wall (your side, within study area)	1.70	0.72	0.50
2b. proportion street wall (opposite side, within study area)	1.50	0.94	0.47
3a. proportion sky (ahead, beyond study area)	1.35	-1.42	-0.50
3b. proportion sky (across, beyond study area)	1.20	-2.19	-0.44
		add constant +2.57	
enlosure score			
1.67			
human scale			
1. number of long sight lines (both sides, beyond study area) *from above	3	-0.74	-2.22
2. proportion windows at street level (your side, within study area)	0.80	1.10	0.88
3. average building height (your side, within study area)	2.5'	-0.003	-0.08
4. number of small planters (your side, within study area)	4	0.05	0.20
5. number of pieces of street furniture and other street items (your side, within study area)	22	0.04	0.84
		add constant +2.61	
human scale score			
2.23			
transparency			
1. proportion windows at street level (your side, within study area)	0.80	1.22	0.98
2. proportion street wall (your side, beyond study area) *from above	0.70	0.67	0.47
3. proportion active uses (your side, within study area)	0.80	0.53	0.42
		add constant +1.71	
transparency score			
3.58			
complexity			
1. number of buildings (both sides, beyond study area)	7	0.05	0.35
2a. number of basic building colors (both sides, beyond study area)	3	0.23	0.69
2b. number of basic accent colors (both sides, beyond study area)	6	0.12	0.72
3. presence of outdoor dining (your side, within study area) *from above	1	0.42	0.42
4. number of pieces of public art (both sides, within study area)	1	0.29	0.29
5. number of walking pedestrians (your side, within study area)			
Walk through 1			
Walk through 2			
Walk through 3			
Walk through 4			
Total			
Total divided by 4		0.03	
complexity score			
5.08			

measuring urban design qualities scoring sheet		auditor
street	from	date & time
N. Higgins Ave	E Ave St - E Spruce St	Apr. 2012 (A)
step	recorded value	multiplier
imageability		(multiplier) x (recorded value)
1. number of courtyards, plazas, and parks (both sides, within study area)	1	0.41
2. number of major landscape features (both sides, beyond study area)	1	0.72
3. proportion historic building frontage (both sides, within study area)	40	0.97
4. number of buildings with identifiers (both sides, within study area)	7	0.11
5. number of buildings with non-rectangular shapes (both sides, within study area)	1	0.08
6. presence of outdoor dining (your side, within study area)	1	0.64
7. number of people (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4	0.02	
8. noise level (both sides, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4	-0.18	
		add constant +2.44
		imageability score 5.45
enclosure		
1. number of long sight lines (both sides, beyond study area)	3	-0.31
2a. proportion street wall (your side, within study area)	70	0.72
2b. proportion street wall (opposite side, within study area)	50	0.94
3a. proportion sky (ahead, beyond study area)	35	-1.42
3b. proportion sky (across, beyond study area)	20	-2.19
		add constant +2.57
		enclosure score 1.67
human scale		
1. number of long sight lines (both sides, beyond study area) *from above	3	-0.74
2. proportion windows at street level (your side, within study area)	80	1.10
3. average building height (your side, within study area)	25	-0.003
4. number of small planters (your side, within study area)	4	0.05
5. number of pieces of street furniture and other street items (your side, within study area)	28	0.04
		add constant +2.61
		human scale score 2.51
transparency		
1. proportion windows at street level (your side, within study area)	80	1.22
2. proportion street wall (your side, beyond study area) *from above	70	0.67
3. proportion active uses (your side, within study area)	80	0.53
		add constant +1.71
		transparency score 3.58
complexity		
1. number of buildings (both sides, beyond study area)	7	0.05
2a. number of basic building colors (both sides, beyond study area)	4	0.23
2b. number of basic accent colors (both sides, beyond study area)	7	0.12
3. presence of outdoor dining (your side, within study area) *from above	1	0.42
4. number of pieces of public art (both sides, within study area)	1	0.29
5. number of walking pedestrians (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4	0.03	
		add constant +2.61
		complexity score 5.43

measuring urban design qualities scoring sheet		auditor
street	date & time	
Maize & Buffalo - 1562	Oct 2007 (B)	
from Maize St - Union St		
step	recorded value	multiplier (multiplier) x (recorded value)
imageability		
1. number of courtyards, plazas, and parks (both sides, within study area)	2	0.41
2. number of major landscape features (both sides, beyond study area)	0.1	0.72
3. proportion historic building frontage (both sides, within study area)	15	0.97
4. number of buildings with identifiers (both sides, within study area)	1	0.11
5. number of buildings with non-rectangular shapes (both sides, within study area)	1	0.08
6. presence of outdoor dining (your side, within study area)	1	0.64
7. number of people (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.02
8. noise level (both sides, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		-0.18
		add constant +2.44
		imageability score
enclosure		
1. number of long sight lines (both sides, beyond study area)	2	-0.31
2a. proportion street wall (your side, within study area)	0.9	0.72
2b. proportion street wall (opposite side, within study area)	0.5	0.94
3a. proportion sky (ahead, beyond study area)	0.30	-1.42
3b. proportion sky (across, beyond study area)	0.25	-2.19
		add constant +2.57
		enclosure score
human scale		
1. number of long sight lines (both sides, beyond study area) *from above	2	-0.74
2. proportion windows at street level (your side, within study area)	0.8	1.10
3. average building height (your side, within study area)	15	-0.003
4. number of small planters (your side, within study area)	1	0.05
5. number of pieces of street furniture and other street items (your side, within study area)	27	0.04
		add constant +2.61
		human scale score
transparency		
1. proportion windows at street level (your side, within study area)	0.8	1.22
2. proportion street wall (your side, beyond study area) *from above	0.9	0.67
3. proportion active uses (your side, within study area)	0.7	0.53
		add constant +1.71
		transparency score
complexity		
1. number of buildings (both sides, beyond study area)	17	0.05
2a. number of basic building colors (both sides, beyond study area)	3	0.23
2b. number of basic accent colors (both sides, beyond study area)	8	0.12
3. presence of outdoor dining (your side, within study area) *from above	1	0.42
4. number of pieces of public art (both sides, within study area)	1	0.29
5. number of walking pedestrians (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.03
		add constant +2.61
		complexity score
		5.82

measuring urban design qualities scoring sheet		auditor
street	date & time	
Main & Buffalo - 4562 from Main St - Union St	Sep. 2013 (A)	
step	recorded value	multiplier (multiplier) x (recorded value)
imageability		
1. number of courtyards, plazas, and parks (both sides, within study area)	3	0.41
2. number of major landscape features (both sides, beyond study area)	1	0.72
3. proportion historic building frontage (both sides, within study area)	0.1	0.97
4. number of buildings with identifiers (both sides, within study area)	16	0.11
5. number of buildings with non-rectangular shapes (both sides, within study area)	1	0.08
6. presence of outdoor dining (your side, within study area)	1	0.64
7. number of people (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.02
8. noise level (both sides, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		-0.18
add constant +2.44		
imageability score		6.25
enclosure		
1. number of long sight lines (both sides, beyond study area)	11	-0.31
2a. proportion street wall (your side, within study area)	0.9	0.72
2b. proportion street wall (opposite side, within study area)	0.5	0.94
3a. proportion sky (ahead, beyond study area)	0.30	-1.42
3b. proportion sky (across, beyond study area)	0.15	-2.19
add constant +2.57		
enclosure score		2.31
human scale		
1. number of long sight lines (both sides, beyond study area) *from above		-0.74
2. proportion windows at street level (your side, within study area)	0.8	1.10
3. average building height (your side, within study area)	20	-0.003
4. number of small planters (your side, within study area)	12	0.05
5. number of pieces of street furniture and other street items (your side, within study area)	29	0.04
add constant +2.61		
human scale score		3.71
transparency		
1. proportion windows at street level (your side, within study area)	0.8	1.22
2. proportion street wall (your side, beyond study area) *from above	0.9	0.67
3. proportion active uses (your side, within study area)	0.9	0.53
add constant +1.71		
transparency score		3.77
complexity		
1. number of buildings (both sides, beyond study area)	17	0.05
2a. number of basic building colors (both sides, beyond study area)	6	0.23
2b. number of basic accent colors (both sides, beyond study area)	7	0.12
3. presence of outdoor dining (your side, within study area) *from above	1	0.42
4. number of pieces of public art (both sides, within study area)	1	0.29
5. number of walking pedestrians (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.03
add constant +2.61		
complexity score		6.39

measuring urban design qualities scoring sheet

street <i>W. Lancaster Blvd</i>		auditor <i>Jan. 2008</i>	
from <i>Fig Ave - Elm Ave</i>		date & time <i>Dec. 2007 (13)</i>	
step		recorded value	(multiplier) x (recorded value)
imageability			
1. number of courtyards, plazas, and parks (both sides, within study area)		-	0.41
2. number of major landscape features (both sides, beyond study area)		-	0.72
3. proportion historic building frontage (both sides, within study area)		-	0.97
4. number of buildings with identifiers (both sides, within study area)	<i> </i>	4	0.11
5. number of buildings with non-rectangular shapes (both sides, within study area)		-	0.08
6. presence of outdoor dining (your side, within study area)		-	0.64
7. number of people (your side, within study area)			
	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4		0.02
8. noise level (both sides, within study area)			
	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4		-0.18
		add constant	+2.44
		imageability score	<i>2.88</i>
enclosure			
1. number of long sight lines (both sides, beyond study area)	<i> </i>	2	-0.31
2a. proportion street wall (your side, within study area)		1.2	0.72
2b. proportion street wall (opposite side, within study area)		1.0	0.94
3a. proportion sky (ahead, beyond study area)		1.40	-1.42
3b. proportion sky (across, beyond study area)		1.40	-2.19
		add constant	+2.57
		enclosure score	<i>1.58</i>
human scale			
1. number of long sight lines (both sides, beyond study area) *from above		2	-0.74
2. proportion windows at street level (your side, within study area)		0.1	1.10
3. average building height (your side, within study area)		20'	-0.003
4. number of small planters (your side, within study area)		15	0.05
5. number of pieces of street furniture and other street items (your side, within study area)			0.04
		add constant	+2.61
		human scale score	<i>1.78</i>
transparency			
1. proportion windows at street level (your side, within study area)		0.1	1.22
2. proportion street wall (your side, beyond study area) *from above		0.2	0.67
3. proportion active uses (your side, within study area)		0.2	0.53
		add constant	+1.71
		transparency score	<i>2.07</i>
complexity			
1. number of buildings (both sides, beyond study area)	<i> </i>	6	0.05
2a. number of basic building colors (both sides, beyond study area)	<i> </i>	2	0.23
2b. number of basic accent colors (both sides, beyond study area)	<i> </i>	3	0.12
3. presence of outdoor dining (your side, within study area)		-	0.42
4. number of pieces of public art (both sides, within study area)		-	0.29
5. number of walking pedestrians (your side, within study area)			
	Walk through 1		
	Walk through 2		
	Walk through 3		
	Walk through 4		
	Total		
	Total divided by 4		0.03
		add constant	+2.61
		complexity score	<i>3.73</i>

measuring urban design qualities scoring sheet		auditor
street	from	date & time
W. Lancaster Blvd	Elm Ave.	May 2012 (A)
step	recorded value	multiplier
imageability	(multiplier) x (recorded value)	
1. number of courtyards, plazas, and parks (both sides, within study area)	1	0.41
2. number of major landscape features (both sides, beyond study area)	-	0.72
3. proportion historic building frontage (both sides, within study area)	-	0.97
4. number of buildings with identifiers (both sides, within study area)	7	0.11
5. number of buildings with non-rectangular shapes (both sides, within study area)	1	0.08
6. presence of outdoor dining (your side, within study area)	1	0.64
7. number of people (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.02
8. noise level (both sides, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		-0.18
		add constant +2.44
		imageability score 4.45
enclosure		
1. number of long sight lines (both sides, beyond study area)	11	-0.31
2a. proportion street wall (your side, within study area)	16	0.72
2b. proportion street wall (opposite side, within study area)	16	0.94
3a. proportion sky (ahead, beyond study area)	130	-1.42
3b. proportion sky (across, beyond study area)	120	-2.19
		add constant +2.57
		enclosure score 2.45
human scale		
1. number of long sight lines (both sides, beyond study area) *from above	2	-0.74
2. proportion windows at street level (your side, within study area)	15	1.10
3. average building height (your side, within study area)	12	-0.003
4. number of small planters (your side, within study area)	7	0.05
5. number of pieces of street furniture and other street items (your side, within study area)	24	0.04
		add constant +2.61
		human scale score 2.95
transparency		
1. proportion windows at street level (your side, within study area)	15	1.22
2. proportion street wall (your side, beyond study area) *from above	16	0.67
3. proportion active uses (your side, within study area)	16	0.53
		add constant +1.71
		transparency score 3.04
complexity		
1. number of buildings (both sides, beyond study area)	10	0.05
2a. number of basic building colors (both sides, beyond study area)	8	0.23
2b. number of basic accent colors (both sides, beyond study area)	6	0.12
3. presence of outdoor dining (your side, within study area) *from above	1	0.42
4. number of pieces of public art (both sides, within study area)	1	0.29
5. number of walking pedestrians (your side, within study area)		
Walk through 1		
Walk through 2		
Walk through 3		
Walk through 4		
Total		
Total divided by 4		0.03
		add constant +2.61
		complexity score 6.38

HOUSENO,C,10	2007 TOTALVALUE,N,19,11	2008 TOTALVALUE,N,19,9	2009 TotalValue,N,19,9
201	580600	580600	580600
201	580600	580600	580600
208	2198100	2198100	2198100
211	764800	764800	764800
219	534500	534500	534500
223	468700	468700	468700
224	1100000	1100000	1100000
227	592000	592000	592000
228	572100	572100	572100
300	76900	101000	103400
300	103400	103400	77000
300	372700	103400	101000
300	101000	103400	76600
300	103400	76900	372700
300	103400	77000	103400
300	100400	76000	76900
300	76600	76900	103400
300	76900	76600	444100
300	76000	372700	532800
300	77000	444100	76000
301	444100	532800	100400
307	532800	100400	76900
311	582700	582700	582700
316	469000	469000	469000
317	241400	241400	241400
319	447500	447500	447500
321	447500	447500	447500
324	513400	513400	513400
325	279000	279000	279000
330	382300	382300	382300
331	455300	455300	455300
400	4858600	4858600	4858600
401	328300	328300	328300
407	359600	359600	359600

409	376200	376200	376200
417	84900	87000	87000
417	84900	84900	84900
417	84900	84900	84900
417	84900	84900	84900
417	87000	84900	84900
417	87000	87000	84900
417	84900	87000	84900
417	84900	84900	87000
417	84900	84900	87000
417	84900	84900	84900
417	87000	84900	84900
417	87000	87000	87000
427	210000	210000	210000
429	471600	471600	471600
500	1447700	1447700	1447700
501	345200	345200	345200
505	678000	678000	678000
508	1447700	1447700	1447700
511	522600	522600	522600
512	391000	391000	391000
517	458900	458900	458900
518	578500	578500	578500
521	516600	516600	516600
524	405000	405000	405000
525	10000	10000	10000
527	10000	10000	10000
527	10000	10000	10000
528	464100	464100	464100
529	10000	10000	10000
531	10000	10000	10000
600	4772500	4772500	4772500
600	4772500	4772500	4772500
601	11628000	11628000	168200
605	11628000	11628000	11463800
605	11628000	11628000	11463800

605	11628000	11628000	11463800
605	11628000	11628000	11463800
605	11628000	11628000	11463800
700	195900	128500	128500
700	128500	128500	128500
700	128500	128500	128500
700	128500	195900	195900
701	558900	558900	558900
704	67900	67900	67900
704	67900	67900	67900
704	67900	67900	67900
704	67900	67900	67900
708	435300	435300	435300
709	515100	515100	517100
712	593300	593300	593300
715	1279700	1279700	1279700
716	586100	586100	586100
719	1080200	1080200	1080200
720	555700	555700	555700
726	487600	487600	487600
737	594300	594300	594300
800	160600	300000	300000
800	300000	252700	160600
800	406800	160600	406800
800	252700	406800	252700
801	2044600	2044600	2044600
812	1090900	1090900	1134200
814	536700	536700	578600
820	598200	598200	598200
821	543000	543000	543000
827	536300	536300	536300
828	1090900	1090900	1134200
833	222600	222600	222600
900	921700	921700	921700
901	1073900	1073900	1073900
909	767700	767700	767700

910	542500	542500	542500
916	475900	475900	475900
922	445400	445400	445400
927	2259600	2259600	2259600
930	1264300	1264300	1264300

	2007	2008	2009
Total - All Properties	\$130,777,400.00	\$130,777,400.00	\$118,627,100.00
Tax Rate (per \$100)	\$1.2775	\$1.2973	\$1.2973
Total Revenue	\$1,670,681.29	\$1,696,575.21	\$1,538,949.37

$$\text{ROI} = ((\text{Revenue}_{\text{After}} - \text{Revenue}_{\text{Before}}) / \text{Cost}) \times 100\%$$

3-Year Total Revenue	After (2010-2012)	\$6,019,187.52
	Before (2007-2009)	\$4,906,205.86
Difference		\$1,112,981.65
Project Cost		\$1,300,000.00
ROI		85.6%

ACS 3-Year Estimate Table B25103: MORTGAGE STATUS BY MEDIAN REAL ESTATE TAXES PAID (DOLLARS)

2007	2008	2009
\$1,842	\$1,914	\$1,869

$$\text{Share} = ((\text{Corridor Revenue}_{\text{After}} - \text{Corridor Revenue}_{\text{Before}}) / (\text{Corridor Revenue}_{\text{Before}}) \times 100\%)$$

$$- ((\text{City Revenue}_{\text{After}} - \text{City Revenue}_{\text{Before}}) / (\text{City Revenue}_{\text{Before}}) \times 100\%)$$

3-Year Total Revenue	After (2010-2012)	\$6,019,187.52
(Corridor)	Before (2007-2009)	\$4,906,205.86
Growth		22.7%

3-Year Total: Median	After (2010-2012)	\$5,924
Taxes Paid (Citywide)	Before (2007-2009)	\$5,625
Growth		5.3%

Marginal Growth Share	17.4%
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City of Charlotte:

	2007	2008	2009
N	267065	269559	279750
Total - All Properties	\$187,661,698,591.00	\$195,903,141,930.00	\$212,904,460,178.00
Tax Rate (per \$100)	\$1.2973	\$1.2973	\$1.2973
Total Revenue	\$2,434,535,215.82	\$2,541,451,460.26	\$2,762,009,561.89

East Blvd: South Blvd - Dilworth Rd W		
3-Year Total Revenue	After (2010-2012)	\$6,019,187.52
	Before (2007-2009)	\$4,906,205.86
Difference		\$1,112,981.65
Project Cost		\$1,300,000.00
ROI		85.6%

East Blvd: South Blvd - Dilworth Rd W		
3-Year Total Revenue (Corridor)	After (2010-2012)	\$6,019,187.52
	Before (2007-2009)	\$4,906,205.86
Growth		22.7%
3-Year Total: Median Taxes Paid (Citywide)	After (2010-2012)	\$5,924
	Before (2007-2009)	\$5,625
Growth		5.3%
Growth Share		17.4%

	2010	2011	2012	2013
TotalValue,N,19,9	TotalValue,N,19,9	totalvalue,N,19,0	totalvalue,N,19,8	
	580600	0	1377800	0
	580600	0	1377800	0
	2198100	0	2544700	0
	764800	1585000	1573200	0
	534500	836000	836000	0
	468700	935600	1199700	0
	1100000	0	935600	0
	592000	929200	1199700	0
	572100	610100	928100	0
	77000	101200	610100	0
	101000	76800	76800	0
	76600	103500	101200	0
	103400	103500	392000	0
	372700	77200	77000	0
	103400	392000	103500	0
	103400	77000	77200	0
	76900	103500	103500	0
	444100	536400	103500	0
	532800	644400	536400	0
	76000	100600	643400	0
	100400	76200	76200	0
	76900	77000	77000	0
	613000	0	100600	0
	469000	679100	745700	0
	241400	0	679000	0
	375000	660100	321200	0
	375000	660100	469200	0
	513400	0	469200	0
	282800	382800	718300	0
	382300	0	380600	0
	455300	560000	443500	0
	4858600	6896000	559900	0
	328300	495300	6691300	0
	359600	413300	495300	0

376200	427600	413300	0
84900	0	427600	0
84900	96900	96900	0
87000	98900	96900	0
84900	96900	96900	0
84900	96900	98900	0
84900	96900	96900	0
84900	0	101200	0
87000	96900	96900	0
84900	0	98900	0
87000	98900	96900	0
84900	96900	98900	0
87000	101200	96900	0
210000	280000	96900	0
471600	513300	280000	0
1447700	1578600	512700	0
345200	478400	1577100	0
678000	760100	477600	0
1447700	1578600	760100	0
522600	741500	1577100	0
391000	443000	739000	0
458900	506900	442700	0
578500	664600	505700	0
516600	577700	664300	0
405000	466300	577000	0
10000	0	465900	40000
10000	0	40000	40000
10000	0	40000	40000
464100	640000	40000	0
10000	0	640000	40000
10000	0	40000	40000
4772500	24821600	40000	0
4772500	24821600	24799500	0
168200	175900	24799500	0
11516200	14443100	175400	0
11516200	14443100	14443100	0

11516200	14443100	14443100	0
11516200	14443100	14443100	0
11516200	14443100	14443100	0
195900	257100	14443100	0
128500	233100	232300	0
128500	233100	232300	0
128500	233100	232300	0
558900	672600	256000	0
67900	109100	671500	109100
67900	109100	109100	109100
67900	109100	109100	109100
67900	109100	109100	109100
435300	575800	109100	0
517100	628100	575800	0
593300	835500	628100	0
1279700	1471700	835100	0
586100	669200	1455500	0
1080200	1234300	669200	0
555700	0	1233800	0
487600	646800	583200	0
594300	0	573000	0
406800	273600	741600	0
300000	320600	185500	0
160600	185500	433400	0
252700	433400	273600	0
2044600	0	320600	0
1134200	1386400	2448800	0
578600	727200	1381100	0
598200	700400	727200	0
543000	646700	700400	0
536300	646100	646700	0
1134200	1386400	646100	0
222600	616400	1381100	0
921700	1181700	614500	0
1073900	0	1181700	0
767700	1009600	1381300	0

542500	696400	1009500	0
475900	627700	696400	0
445400	624400	627700	0
2259600	0	624400	0
1264300	1497600	2563500	0
		1497600	

2010	2011	2012	2013
\$118,778,200.00	\$171,770,400.00	\$189,144,500.00	\$636,400.00
\$1.2973	\$1.2536	\$1.2292	\$1.2844
\$1,540,909.59	\$2,153,313.73	\$2,324,964.19	\$8,173.92

2010	2011	2012	2013
\$1,948	\$1,962	\$2,014	\$1,990

2010	2011	2012	2013
280873	283635	284303	286167
\$216,430,874,843.00	\$180,505,969,017.00	\$251,586,720,769.00	\$38,342,601,509.00
\$1.2973	\$1.2973	\$1.2973	\$1.2973
\$2,807,757,739.34	\$2,341,703,936.06	\$3,263,834,528.54	\$497,418,569.38

Corridor Tax Revenue: East Blvd, Ph. 2



Each entry:

Frontage Gap Type Approx. Address Frontage Length (lf)

Note: Corridor lengths measured from street centerlines at indicated intersections.

25th Ave: Fulton St - Lake St			
Before - Feb 2007			After - Apr 2011
DB	353 25th Ave	20	
Total			Total
Corridor Length (lf)			Corridor Length (lf)
% Corridor Length			% Corridor Length
4807			4807
0.42%			0.00%

Total _{Before} -Total _{After}	20
% Redevelopment	0.42%

Types:

DS/DB	Dilapidated Storefront or Building
VS/VB	Vacant Storefront or Building
VL	Vacant Lot

East Blvd: South Blvd - Dilworth Rd W					
Before - Aug 2007			After - Oct 2011		
VL	589 East Blvd	105	VL	589 East Blvd	105

Total _{Before} -Total _{After}	0
% Redevelopment	0.00%

N Higgins Ave: Front St - Railroad St							
Before - May 2008				After - Apr 2012			
VL	321 N Higgins	30		VS	114 N Higgins	156	
VS	419 N Higgins	98		VS	313 N Higgins	30	
VS	625 N Higgins	27		VL	321 N Higgins	30	
				VS	625 N Higgins	65	
				VS	523 N Higgins	32	
Total			155	Total			313
Corridor Length (lf)			2049	Corridor Length (lf)			2049
% Corridor Length			7.56%	% Corridor Length			15.28%

Total _{Before} -Total _{After}	-158
% Redevelopment	-7.71%

Main St/Buffalo St: Lake St - Legion Dr							
Before - Oct 2007				After - Sep 2013			Before
VL	240 Main St	109		VL	240 Main St	109	VS
VL	220 Main St	50		VL	220 Main St	50	VS
DB	86 Main St	32		VB	202 Main St	28	VL
VS	46 Main St	30		VS	46 Main St	30	VS
VB	40 Main St	51		VB	52 Buffalo St	51	VS
VS	32 Main St	36		DB	88 Buffalo St	42	VS
VS	7 Buffalo St	105		DB	188 Buffalo St	23	VS
DB	88 Buffalo St	42					VS
DB	100 Buffalo St	15					VB
DB	134 Buffalo St	35					VB
VS	180 Buffalo St	48					VL
DB	184 Buffalo St	26					VS
DB	186 Buffalo St	25					VL
DB	188 Buffalo St	23					VS
VS	240 Buffalo St	16					VS
VL	260 Buffalo St	136					
Total		779	Total			333	Total
Corridor Length (lf)		6634	Corridor Length (lf)			6634	Corridor Length (lf)
% Corridor Length		11.74%	% Corridor Length			5.02%	% Corridor Length

Notes:

Street redesign under construction during earliest available GSV imagery.

GSV imagery incomplete north of 300 Buffalo St.

Total _{Before} -Total _{After}	446
% Redevelopment	6.72%

W Lancaster Blvd: 10th St W - Sierra Hwy				
Before - Dec 2007/Jan 2008		After - May 2012		
750 W Lancaster Blvd	23	VS	822 W Lancaster Blvd	26
769 W Lancaster Blvd	27	VS	811 W Lancaster Blvd	48
742 W Lancaster Blvd	66	VS	701 W Lancaster Blvd	18
731 W Lancaster Blvd	28	VL	651 W Lancaster Blvd	67
729 W Lancaster Blvd	25	VS	626 W Lancaster Blvd	23
725 W Lancaster Blvd	59	VS	530 W Lancaster Blvd	51
715 W Lancaster Blvd	32	VS	510 W Lancaster Blvd	16
701-705 W Lancaster Blvd	83			
700 W Lancaster Blvd	150			
685 W Lancaster Blvd	63			
675 W Lancaster Blvd	55			
653 W Lancaster Blvd	33			
651 W Lancaster Blvd	67			
650 W Lancaster Blvd	32			
530 W Lancaster Blvd	51			
	794	Total		249
	3374	Corridor Length (lf)		3374
	23.53%	% Corridor Length		7.38%

Total _{Before} -Total _{After}	545
% Redevelopment	16.15%

25th Ave: Fulton St - Lake St			
Before - Feb 2007		After - Apr 2011	
Frontage Gap Total (lf)	20	Frontage Gap Total (lf)	0
Corridor Length (lf)	4807	Corridor Length (lf)	4807
% Corridor Length	0.42%	% Corridor Length	0.00%
		Total _{Before} -Total _{After}	20
		% Redevelopment	0.42%
Project Cost	\$80,000	Redev. Cost/Foot	\$4,000

100%

East Blvd: South Blvd - Dilworth Rd W			
Before - Aug 2007		After - Oct 2011	
Frontage Gap Total (lf)	105	Frontage Gap Total (lf)	105
Corridor Length (lf)	3696	Corridor Length (lf)	3696
% Corridor Length	2.84%	% Corridor Length	2.84%
		Total _{Before} -Total _{After}	0
		% Redevelopment	0.00%
Project Cost	#####	Redev. Cost/Foot	N/A

0%

N Higgins Ave: Front St - Railroad St			
Before - May 2008		After - Apr 2012	
Frontage Gap Total (lf)	155	Frontage Gap Tota	313
Corridor Length (lf)	2049	Corridor Length (l	2049
% Corridor Length	7.56%	% Corridor Length	15.28%
		Total _{Before} -Total _{After}	-158
		% Redevelopment	-7.71%
Project Cost	\$1,450,000	Redev. Cost/Foot	-\$9,177

-102%

Main St/Buffalo St: Lake St - Legion Dr			
Before - Oct 2007		After - Sep 2013	
Frontage Gap Total (lf)	779	Frontage Gap Tota	333
Corridor Length (lf)	6634	Corridor Length (l	6634
% Corridor Length	11.74%	% Corridor Length	5.02%
		Total _{Before} -Total _{After}	446
		% Redevelopment	6.72%
Project Cost	\$20,000,000	Redev. Cost/Foot	\$44,843

57%

W Lancaster Blvd: 10th St W - Sierra Hwy			
Before - Dec 2007/Jan 2008		After - May 2012	
Frontage Gap Total	794	Frontage Gap Total	249
Corridor Length (lf)	3374	Corridor Length (lf)	3374
% Corridor Length	23.53%	% Corridor Length	7.38%
		Total _{Before} -Total _{After}	545
		% Redevelopment	16.15%
Project Cost	\$11,500,000	Redev. Cost/Foot	\$21,101

69%

25th Ave: Geary Blvd - Clement St				East Blvd:	
Before - Feb 2007		After - Apr 2011		Before - Aug 2006	
Imageability	3.75	Imageability	3.64	Imageability	
Enclosure	3.15	Enclosure	3.15	Enclosure	
Human Scale	2.15	Human Scale	2.15	Human Scale	
Transparency	2.91	Transparency	2.91	Transparency	
Complexity	6.49	Complexity	6.74	Complexity	
Total	18.45	Total	18.59	Total	
		Total _{After} -Total _{Before}		0.14	
		% Change		0.8%	

: Springdale Ave - Lennox Ave			N Higgins Ave: E Pine St - E Sp		
07	After - Oct 2011		Before - May 2008		After
4.41	Imageability	4.63	Imageability	5.45	Imageability
1.99	Enclosure	1.99	Enclosure	1.67	Enclosure
1.79	Human Scale	1.83	Human Scale	2.23	Human Scale
1.98	Transparency	2.03	Transparency	3.58	Transparency
4.84	Complexity	4.84	Complexity	4.79	Complexity
15.01	Total	15.32	Total	17.72	Total
Total _{After} -Total _{Before}		0.31	Total _{After} -Total _{Before}		
% Change		2.1%	% Change		

ruce St		Main St/Buffalo St: Main St - Union St (on Buffalo)	
- Apr 2012		Before - Oct 2007	After - Sep 2013
5.45	Imageability	5.73	Imageability 6.25
1.67	Enclosure	2.09	Enclosure 2.31
2.51	Human Scale	3.09	Human Scale 3.71
3.58	Transparency	3.66	Transparency 3.77
5.43	Complexity	5.82	Complexity 6.39
18.64	Total	20.39	Total 22.43
0.92			Total _{After} -Total _{Before} 2.04
5.2%			% Change 10.0%

W Lancaster Blvd: Fig Ave - Elm Ave			
Before - Dec 2007/Jan 2008		After - May 2012	
Imageability	2.88	Imageability	4.45
Enclosure	1.58	Enclosure	2.45
Human Scale	1.78	Human Scale	2.95
Transparency	2.07	Transparency	3.04
Complexity	3.73	Complexity	6.38
Total	12.04	Total	19.27
		Total _{After} -Total _{Before}	7.23
		% Change	60.0%

25th Ave: Geary Blvd - Clement St					
Before - Feb 2007		After - Apr 2011			
Total Score	18.45	Total Score	18.59		Total Score
		Total _{After} -Total _{Before}	0.14		
		% Change	0.8%		
Project Cost	\$80,000	Cost/Point	\$571,429		Project Cost

East Blvd: Springdale Ave - Lennox Ave			N E
Before - Aug 2007	After - Oct 2011		Before - May 2008
15.01	Total Score	15.32	Total Score
	$\text{Total}_{\text{After}} - \text{Total}_{\text{Before}}$	0.31	
	% Change	2.1%	
\$1,300,000	Cost/Point	\$4,193,548	Project Cost

Liggins Ave: E Pine St - E Spruce St			Main St/Bufalo St: Mai	
	After - Apr 2012		Before - Oct 2007	
17.72	Total Score	18.64	Total Score	20.39
	Total _{After} -Total _{Before}	0.92		
	% Change	5.2%		
\$1,450,000	Cost/Point	\$1,576,087	Project Cost	\$20,000,000

n St - Union St (on Buffalo)		W Lancaster Blvd: Fig Ave - Elm A	
After - Sep 2013		Before - Dec 2007/Jan 2008	
Total Score22.43		Total Score12.04	Total Score
Total _{After} -Total _{Before} 2.04			Total _{After} -Total _{Before}
% Change10.0%			% Change
Cost/Point\$9,803,922		Project Cost\$11,500,000	Cost/Point

Ave
After - May 2012
19.27
7.23
60.0%
\$1,590,595

Street Name	Total Cost	Cost/Mile	Percent Change	
			Frontage Redevelopment	Urban Design Scores
25th Avenue	\$80,000	\$88,889	0.42%	0.8%
East Boulevard (Ph. 2)	\$1,300,000	\$1,857,143	0.00%	2.1%
N Higgins Avenue	\$1,450,000	\$3,625,000	-7.71%	5.2%
Main & Buffalo Streets	\$20,000,000	\$14,285,714	6.72%	10.0%
W Lancaster Boulevard	\$11,500,000	\$19,166,667	16.15%	60.0%

