

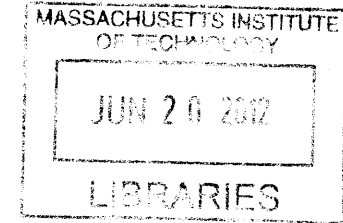
Successful Streets: Performance Measures, Community Engagement, and Urban Street Design

By

Jeremy R. Steinemann
Bachelor of Arts in Romance Languages & Literature
Harvard College, 2008

*Submitted to the Department of Urban Studies and Planning
in partial fulfillment of the requirements for the degree of*

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Signature of Author

Department of Urban Studies and Planning

May 24, 2012

Certified By:

Eran Ben-Joseph

Professor of Landscape Architecture and Urban Planning
Department of Urban Studies and Urban Planning

Thesis Supervisor

Accepted By:

Professor Alan Berger
Chair, MCP Committee

Department of Urban Studies and Planning

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By
Jeremy Steinemann

Thesis Supervisor:
Eran Ben-Joseph
Professor of Landscape Architecture and Urban Planning

Thesis Reader:
P. Christopher Zegras
Ford Career Development Associate Professor of
Transportation and Urban Planning

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Abstract

Over the past decade, local transportation agencies have increasingly re-designed urban arterials, their cities' major surface streets, to better accommodate a wide range of users. At the same time, a growing number of agencies are using performance measurement, the tracking and reporting of specific transportation-related variables, to evaluate and document their impacts. This report attempts to understand the role that performance measurement plays in design decision-making for urban arterial streets.

First, the report examines how the selection and prioritization of performance measures shape urban arterial forms. While agencies in the mid-20th Century prioritized automobile performance in arterial design, present-day agencies attempt to balance performance across a broader range of street users and performance goals.

Second, the report explores how local agencies can use performance-based planning for urban arterial projects at the same time as they engage in community-focused design processes. Research in transportation policy defines performance-based planning as a framework for agencies to use performance goals and measurement to guide decision-making. Existing research largely neglects the use of performance-based planning for project-level decisions and local transportation agencies. Since performance measurement systems hold agencies accountable to well-defined

goals, performance-based planning may have value for both stakeholders and local officials in urban arterial design processes.

To understand the potential role of performance-based planning for project-level design, this report examines four cases of urban arterial design: two in New York City (Prospect Park West in Brooklyn and 34th Street in Manhattan), and two in Portland, OR (North Williams Avenue and East Burnside). The cases were chosen because, in each, local officials faced community conflict about design and employed some form of performance measurement.

The case study analysis finds that agencies can use performance-based planning to both guide design decisions and to actively engage community stakeholders. Among the cases considered, most employed only some features of performance-based planning, primarily to evaluate impacts and to make modifications to preliminary designs. One case, North Williams in Portland, was unique, however, in using a complete form of performance-based planning as a tool to increase participation by community stakeholders in the design process. Building upon the lessons from North Williams and the other cases, this report recommends a new framework for performance-based planning that attempts to empower stakeholders to participate in design decision-making, but recognizes that performance-based planning alone cannot resolve community conflicts.

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Contents

| | |
|--|-----------|
| Chapter 1. Introduction | 8 |
| Opportunities and Challenges for Urban Arterial Design | 8 |
| Examining the Role of Performance-Based Planning | 11 |
| Overview of Report | 14 |
| Methods | 15 |
| Section I. Processes for Performance | 18 |
| Chapter 2. Introduction to Performance Measurement for Transportation and Streets | 19 |
| Overview | 19 |
| Using performance-based planning in transportation decision-making | 23 |
| Benefits of Performance Measurement | 26 |
| Chapter 3. Performance Measurement in Theory and in Practice | 29 |
| Institutional history | 29 |
| What to Measure: A Shift in Focus | 31 |
| Practical Challenges | 33 |
| The Role of the Performance-Based Planner | 36 |
| Engaging Community Through Performance Measurement | 39 |
| Section II. Definitions of Performance | 41 |
| Chapter 4. Prioritizing Automobile Performance in Arterial Design | 42 |
| Introduction | 42 |
| The Urban Traffic Problem | 43 |
| Standardizing Transportation Planning | 45 |
| Performance for Automobiles | 47 |
| Performance for Pedestrians and Transit | 50 |
| Performance for Safety | 53 |
| Adoption on the Local Level | 55 |

| | |
|--|------------|
| Chapter 5. Broadening and Balancing Performance for Urban Arterials | 61 |
| Introduction | 61 |
| Alternative Conceptions of Street Performance | 62 |
| New Policies and Processes | 67 |
| New Measures for New Goals | 72 |
| Balancing Performance Objectives on the Local Level | 76 |
| Section III. Case Study Analysis | 81 |
| Chapter 6. The Cases | 82 |
| Introduction to the Case Study Analysis | 82 |
| East Burnside, Portland | 86 |
| Prospect Park West, Brooklyn | 100 |
| Thirty-Fourth Street, Manhattan | 113 |
| North Williams Avenue, Portland | 128 |
| Chapter 7. Synthesis | 144 |
| Design Form: Strategies & Features | 144 |
| Design Process: Performance-Based Planning | 149 |
| Design Process: Performance-Based Planning for Community Engagement | 154 |
| A New Framework for Performance-Based Planning | 158 |
| Implications for Theory | 160 |
| Chapter 8. Conclusion | 164 |
| Performance and Form | 164 |
| Performance-Based Planning | 165 |
| Further Study | 168 |
| Works Cited | 171 |

Chapter 1. Introduction

Opportunities and Challenges for Urban Arterial Design

Opportunities

Over the past fifteen years, urban arterials across the United States have taken increasingly diverse forms. Along some of the most heavily trafficked surface streets in American cities, local agencies have departed from earlier designs that prioritized automobile traffic and embraced a wide array of alternative design options. From Boston to Cleveland to San Francisco, cities have replaced vehicle lanes and parking with dedicated lanes for cyclist and buses. From Philadelphia to Portland, OR, cities have replaced small sections of street with drainage gardens and bio-swales that improve air quality and mitigate storm-water runoff. And from New York to Seattle, cities have carved out new spaces for walkers, some as small as a sidewalk extension and some as big as the European-style pedestrian plaza in Times Square.

These various design strategies come under many different and overlapping labels, such as complete streets, green streets, livable streets, transit-priority streets, pedestrian-oriented design, shared streets, and traffic-calming, just to name a few. In general, most of their primary design features, like bike lanes and pedestrian-only streets, are not new ideas. Nevertheless, local transportation agencies are demonstrating increased willingness to use these forms on major streets. New York City and Portland, OR, which will be

referred to as core examples throughout this report, are indicative of this trend. In 2009, the NYC Department of Transportation (DOT) issued its first ever *Street Design Manual*, which illustrates a broad set of design options for city streets, including six possible treatments for a bicycle right of way. In the agency's 2008 strategic plan, *Sustainable Streets*, DOT pledged to add over 200 miles of bicycle lanes and to implement five new BRT lines (New York (N.Y.) Dept. of Transportation, 2008).

At the opposite end of the country, officials in Portland have shown a similar enthusiasm for new design options. For example, the city's most recent bicycle master plan (2010), proposes the addition of approximately 600 miles of new bicycle infrastructure, including over 300 miles of separate, dedicated bicycle lanes on city streets. In April 2007, the Portland City Council passed a "Green Streets" resolution requiring that all future infrastructure projects include design features to increase green space and reduce storm-water run-off.

Unique challenges

For most cities, the re-design of urban arterials is a challenge. The introduction of new design forms, like bike lanes and bus lanes, has been met with strong opposition in many cities, particularly in NYC. In a well-publicized case in 2011, two local community groups took DOT to court over a new bike lane on Prospect Park West in Brooklyn. The groups contended that the bicycle lane had exacerbated traffic congestion and made it more dangerous for pedestrians to cross the street. In Portland, bike lanes have also proven contentious. Along North Williams Avenue, in the northern section of Portland, plans to improve to an existing bike-lane have been delayed for over a year as community stakeholders iron out an agreement that balances design for bicycles, automobiles and transit.

The redesign of arterials is complicated by the multiple roles these streets inevitably play. The term 'arterial' may refer to both limited-access freeways, like the U.S. Interstate



Figure 1-1. NYC Arterials

In NYC, DOT is employing new forms for its urban arterials, including bus lanes (top), bike lanes (center), and stormwater gardens (bottom). Top photo: NYC DOT.



Before



After (2009)

Figure 1-2. Broadway in Times Square

In 2009, NYC DOT constructed a pedestrian plaza along Broadway in Times Square, replacing space for vehicles with new space for pedestrians to sit and gather. Photos: NYC DOT.

system, and high-volume surface streets. It is misleading, however, to apply the term arterial to both freeways and major surface streets, since arterial streets are unique among surface-level roads in that they generally perform two competing roles: mobility and access. Unlike smaller roads, which serve primarily local residents and businesses, arterial streets must provide mobility to city-wide and regional travelers, by forming connections between neighborhoods and commercial centers. Unlike freeways, however, which have limited entry and exit points, urban arterials must also provide access to the commercial and residential development that generally lines the street. The roles of mobility and access conflict because the design features that facilitate access, such as good pedestrian infrastructure or vehicle driveways, can limit capacity for through-traffic. Conversely, design features for mobility, like higher vehicle speeds and few traffic signals, may worsen access for pedestrians and vehicles seeking to reach destinations along the street. In this report, the term ‘urban arterial’ refers to higher-volume surface streets that serve local and non-local travelers and are located in relatively high-density areas that constrain the right-of-way.

As cities re-envision their urban arterials, their designs are limited by the legacy of centuries of urban development. Historically, urban arterial streets structured the growth of American cities. Streets like Broadway in NYC, Lancaster Avenue in Philadelphia, and Washington Street in Boston were once agricultural and trade routes and later adapted as major thoroughfares in the street grids that grew around them. In cities and neighborhoods developed

later, arterials are the broad avenues and boulevards of 19th Century grid systems, like Burnside Street in Portland, OR, Washington Boulevard in Los Angeles, and the avenues and major cross streets of Manhattan. In the past, many of these arterials served as primary commercial corridors and neighborhood centers. After a decline in the 20th Century, many of these streets now offer logical sites for commercial redevelopment and investments in the public realm. Nevertheless, their form and right-of-way reflect the social, technological and economic circumstances of when they were built.

The historic legacy of urban arterials is particularly challenging in the way that it limits street space for competing modes. In re-designing arterials, local agencies must address the inevitable conflicts between users of the street. In the early 20th Century, many urban arterials served streetcar lines. By the mid-20th Century, street design policies paid heed to the performance of various modes, but often prioritized automobiles at the expense of pedestrians and transit riders. Now, as cities implement new design forms, like bike lanes and curb extensions, agencies are redistributing streets space among multiple modes, sometimes at the expense of the automobile. Unlike their suburban counterparts, however, the width of urban arterials is generally constrained by building lines, making capacity expansion difficult or unfeasible. The limited street space creates a potentially zero-sum game in which increases in space for one mode may come at the expense of another.

Examining the Role of Performance-Based Planning

The rise of performance measurement

At the same time as many agencies have explored a broader set of design options for urban arterials, some cities have adopted ‘performance measurement’ to evaluate their impact and report their results. These strategies have departed from past practices by measuring performance not only in terms of automobile congestion, but also in terms of a broad range of transportation-related variables, like the traffic volumes of bicycles, pedestrian accident rates, and the quality of the natural environment.

In NYC, DOT has used performance measurement to broaden the set of goals that guide design decisions and to broadcast the results of complete projects. In 2007, the City Council of New York, upon urging from the Mayor’s office and DOT, amended city law to direct the agency to assess the performance of non-automobile transportation. Although the law does not define specific variables for the agency to measure, it directs the DOT to develop and annually report quantitative and qualitative measures of “high performance modes . . . buses, ferries, bicycling and walking, that more efficiently [use] roadways and waters to move people” (The New York City Council, 2008). In 2009, DOT released its first Sustainable Streets Index, an annual report card of city streets focused on performance in all modes. Through

these changes, DOT has made itself accountable to a broad set of performance measures that include ‘traditional’ street performance, like automobile congestion, as well as ‘alternative’ measures, including non-automobile travel rates, environmental impacts, and transportation-related economic activity.

Local officials in Portland have followed a somewhat similar approach. In 2010, the city signed off on the *2035 Regional Transportation Plan* (RTP), issued by Oregon Metro, the area’s metropolitan planning organization (MPO). The RTP establishes performance goals in ten areas, including supporting compact urban growth, multimodal travel and safety (Oregon Metro, 2010). The local-level agency, the Portland Bureau of Transportation (PBOT) has a relatively long history of measuring performance for cycling and pedestrians. PBOT has conducted bicycle counts since the 1980s and in the 1990s developed measures for the quality of pedestrian infrastructure its first Pedestrian Master Plan (City of Portland, 1998). In addition to employing new measures, the city is also setting targets for performance. PBOT’s most recent Bicycle Master Plan (2010) for bicycles calls for one-quarter of all trips in the city to be made by bicycle by 2030 (Portland Bureau of Transportation, 2010).

Understanding performance-based planning for urban arterial design

For arterial design, the implications of this increased use of performance measurement are unclear. An extensive amount of guidance for transportation agencies, much of it funded by federal

research programs, argues that performance-measurement can influence decision-making through a specific process framework, termed performance-based planning. Following the performance-based planning framework, agencies define a set of performance goals, implement strategies to achieve those goals, and then assess the results, in an ongoing feedback loop (Cambridge Systematics, 2000). The majority of this guidance, however, focuses primarily on performance-based planning for agency-level decisions by state and regional agencies, and less for project-level decisions by local agencies, like urban arterial design.

Despite this lack of attention, urban arterial design may benefit from the use of performance-based planning as a template for the design process. Macdonald et al. (2010), for example, propose the use of performance-based planning for arterial design in California. Advocates of so-called “Complete Streets” design argue that performance-based planning can hold agencies accountable to performance goals in areas like cycling and walking (McCann & Rynne, 2010). Furthermore, the existing research on performance-based planning points to potential value for urban arterial design. For example, performance-based planning can facilitate the analysis of tradeoffs between various design alternatives by providing a consistent evaluation framework (Macdonald, et al., 2010). Tradeoff analysis may be particularly useful for the designers of urban arterials who seek to address the conflicts between competing transportation modes. For example, if a set of project alternatives are evaluated relative to their impact on two competing modes, like bicycles and

automobiles, a performance evaluation can enable a designer to choose a design that promotes one over the other or achieves some desired balance that minimizes performance declines.

The challenge of community engagement

In considering the role of performance-based planning for project-level design, however, special attention must be paid to the issue of community engagement. As this report shows, local agencies like DOT and PBOT are committed to creating designs that incorporate community feedback and are sensitive to the desires and needs of community stakeholders (i.e. those not affiliated with public agencies).

If agencies rely primarily on their own performance goals and accompanying measurement systems to guide design decisions, however, they run the risk of shutting community stakeholders out of the design process. Alan Altshuler (1965) argues, for example, that public planners cannot rely on objective measurements to make decisions, a style of planning he refers to as “technical rationality.” According to Altshuler, public planning decisions must reflect the subjective values of community members, which inherently defy easy measurement. Among the consequences of relying on technical rationality, Altshuler suggests, are the heavy-handed transportation projects that tore through low-income urban communities in the 1950s and 60s. Transportation and urban planners, focused on measures of automobile congestion and, in turn, economic

development, paid little heed to the values of the residents they displaced.

In the first decades of the 21st Century, local agencies appear to pay far more attention to local community interests. This shift toward a more community-oriented design process puts the role of performance measurement in question. Again, the case of Prospect Park West (PPW) provides a useful example. As opposition to the street’s new bike lane rose in 2010 and 2011, DOT countered criticism with performance measurement results that described the project’s success. According to DOT, the re-design of PPW has increased bicycle traffic and reduced accident rates among pedestrians. For some critics of the design, however, these performance results have done little to alter their perception of the project. Where these performance results appear to fail is their inability to address the conflict in values among community stakeholders. Unlike DOT, critics of the PPW bike lane do not value the increase in bicycle performance highly enough to merit the loss they perceive to pedestrian and automobile performance. By focusing its measurement on a set of transportation-related performance goals, DOT’s performance report has little to say about such conflict. If agencies wish to use performance measurement to guide design decisions, while still addressing the interests of community stakeholders, then performance-based planning must be able to successfully respond to a diverse and potentially conflicting set of community values.

Overview of Report

Research questions

Due to the relative gap in the current research on performance-based planning, there is little or no reported use of performance-based planning to guide project-level design. As a result, this report attempts to understand the role that performance measurement plays in the design process for urban arterial streets and its relationship to design form.

First, this report asks, how do the selection and prioritization of performance measures alter the form of urban arterials? As agencies adopt measures for new goals, it is likely that forms must adapt. For example, if cities wish to increase performance for cyclists, then agencies will pursue bicycle infrastructure on urban arterials.

Second, this report asks, how are local agencies using performance measurement to guide design decision-making – particularly as they focus on adapting designs to meet the needs and desires of local community stakeholders? On the one hand, performance-based planning may provide designers with a tool for refining designs toward well-defined performance goals. On the other hand, community engagement activities, which seek to collect the subjective views of community stakeholders, may be incompatible with the objective nature of performance-based planning.

Organization of the report

To answer these questions, this report conducts both an historical analysis and a case-study analysis. Following this introduction, the report is organized in three sections.

Section I, *Processes for Performance*, reviews the literature on performance measurement for transportation planning. Chapter 2 defines the specific features of the performance-based planning framework. Chapter 3 outlines the practical and theoretical implications of performance-based planning. A review of guidance policy researchers and federal agencies on the user of performance-based planning for transportation identifies the practical benefits and challenges described by researchers and practitioners, while a review of planning theory proposes how performance-based planning might relate to several theoretical questions, particularly the role of so-called technical rationality in planning, design and community engagement.

Section II, *Definitions of Performance*, completes an historical analysis of the changing conceptions of performance that govern arterial design. This section attempts to understand how the selection and prioritization of performance goals shape arterial form. Chapter 4 argues that during the 1950s, 60s, and 70s, national policies and local arterial design projects in NYC and Portland considered multiple performance goals but generally prioritized the reduction of automobile congestion. Chapter 5 argues that design theorists, transportation researchers and policy makers, from the 1960s to the present, have embraced broader conceptions of arterial

performance and that recent arterial design projects in NYC and Portland focus on achieving a balance among multiple performance goals.

Section III, *Case Study Analysis*, applies the findings of the previous section to identify and describe the use of performance-based planning for project-level design. Chapter 6 conducts case study analyses of four street design projects, two each in Portland and NYC, which identify the ways in which the project used performance-based planning to engage local stakeholders and describe how design forms reflect performance considerations. Chapter 7 synthesizes the case studies and recommends a new framework for performance-based planning on the project level based on the case study findings. In addition, this synthesis considers how the cases inform the theoretical debates about the role of technical rationality in planning and design.

Overall, the report finds that changes in conception of performance lead to new urban arterial forms. The case study analysis suggests, however, that urban arterial form reflects a balance of performance goals that is determined dynamically for each project. The report also finds that performance-based planning can facilitate community participation in urban arterial design. All of the cases uniformly relied on community input to guide decision-making. Only one case demonstrated the use of performance-based planning in the complete sense. Nevertheless, all of the cases used features of performance-based planning in various ways to guide specific design choices and to engage with the public. One case,

North Williams Avenue in Portland, was unique in demonstrating how performance-based planning can be a highly effective tool for enabling community stakeholders to participate in design decision-making. This example points to a new model of performance-based planning that can increase participation by community stakeholders in urban arterial design.

Methods

The research methods correspond with the report's three main sections: (1) review of current transportation policy, (2) historical analysis of design policy, research and theory, and (3) case study analysis.

Throughout this report, examples are taken primarily from two cities: NYC and Portland, OR. I selected these cities because they represent a contrast in city form (large and small) and because early research indicated that they offered a possible comparison between a city with a longer history of performance measurement (Portland) and one with a shorter history (NYC). The case study analysis suggests, however, that a comparison between these two cities defies such a simplistic framing. Instead, both cities face a common set of challenges, particularly incorporating community input into design decision-making. As a result, the report does not perform a city-level comparison, but rather a case-level analysis that considers each case separately.

Reviewing current policy

To identify the form and function of performance-based planning as a specific framework, I reviewed guidance on performance-based planning from governmental agencies, including the Federal Highway Administration (FHWA, 2009), the Federal Transit Administration (FTA) (TCRP, 2003), and the Environmental Protection Agency (EPA, 2011). In addition, I reviewed research on best practices, much of which was funded by the National Cooperative Highway Research Program (Cambridge Systematics, 2000, 2010; NCHRP, 2004; Weisbrod et al., 2007). I also reviewed the reports of three national conferences on performance-based planning for transportation, which included research on best practices presented at the conference and the remarks made by public agency officials and other practitioners on their experience using performance-based planning (Cambridge Systematics, 2010; Peyrebune, 2001; Turnbull, 2005).

Finally, I compared the performance-based planning framework with theoretical concepts defined by Altshuler (1965), Davidoff (1965), and Schön (1983).

Historical analysis

This analysis compared policies, research and theory on urban arterial design from the mid-20th Century and those from recent years. For national policy, I examined design guidelines from the American Association of Highway and Transportation Officials (AASHO, 1957, 1973; AASHTO, 2001, 2011), the Highway

Capacity Manual published by the Transportation Research Board (Highway Research Board, 1965, 1950; TRB, 2010), and the Traffic Engineering Handbook and other guidance from the Institute of Traffic Engineers (ITE 1965, 2006). For local policy, I examined various reports published by city agencies, such as annual reports and city-wide transportation plans from the 1940s and 50s (New York (N.Y.). Traffic Commission., 1949) and strategic plans and annual reports from the 1990s and 2000s (City of Portland, 1996; New York (N.Y.) Dept. of Transportation, 2008; Portland Bureau of Transportation, 2010). In addition, I examined individual arterial design projects in each city from both time periods, using project plans, agency reports and historical photos.

Analysis of transportation research relied on multiple journals and industry publications, although a large number of articles from the 1950s and 60s were taken from *Traffic Quarterly*, published by the Eno Foundation.

To analyze theory on arterial design, I completed a literature review on urban design theory from the 1960s to the present, including the works of J. Jacobs (1961), Rudofsky (1969), Appleyard (1981), Lynch (1981), Spirn (1984), A. Jacobs (1993), Southworth & Ben-Joseph (2003), and the Congress for the New Urbanism (Duany, Speck, & Lydon, 2010).

Case study analysis

For this report, I examined four street design projects located in Portland and NYC. To *document* each case, I gathered

information on the project's development and the rationale behind design decision-making. For each project, I examined the project documentation released by the relevant local agency, including scoping documents, preliminary plans, alternatives analysis reports, final plans, presentations to community groups, *ex-post* (i.e. post-project) evaluation reports, and the recorded minutes from community stakeholder meetings. For each agency, I completed interviews with officials responsible for various performance measurement-related activities. These interviews provided useful background information, but are not referenced in this report. For each project, I completed interviews with each project manager and several other agency officials responsible for project development. Finally, I examined media reports on each case to better understand the political and social context that may have influenced project development.

To *analyze* each case, I evaluated both the design form and the design process for each case. With respect to form, I outlined the major changes in each project and assessed their performance consequences. With respect to process, I compared the project's development with the performance-based planning framework defined in Chapter 2 and identified the ways in which performance-based planning is used as part of a community engagement process. I more fully describe the case study methods in Chapter 6, including the rationale behind case selection and the details of the process analysis.

Section I. Processes for Performance

Chapter 2. Introduction to Performance Measurement for Transportation and Streets

Overview

Performance measurement

Generally speaking, performance measurement is a tool for ensuring results. A seminal report from 1997, released by the National Performance Review (NPR) Federal commission, defines performance management as, “a process of assessing progress toward achieving predetermined goals,” (National Performance Review, 1997, p. 6). Performance measurement, thus, has two basic features: (1) defining a set of goals; and (2) monitoring progress toward achieving them. Performance measurement, however, is not a one-size-fits-all process. In practice, performance measurement must be “implemented in the context of organizational realities” (NPR, 1997, p. 4). In other words, each organization must adapt performance measurement to fit its particular needs.

Performance-based planning: Using performance measures to inform decision-making

An extensive literature explains how public-sector, transportation agencies can and should adapt performance measurement to suit their needs. While this literature is less focused on street design specifically, much of it is directed toward the local and state departments of transportation responsible for design decision-making. Overall, this literature indicates that transportation

agencies generally use performance measurement as part of a larger framework referred to as ‘**performance-based planning**.’

In 2000, the National Cooperative Highway Research Program (NCHRP) released a report, authored by Cambridge Systematics, that guides transportation agencies in implementing performance measurement and provides a basic definition of performance-based planning. According to the report, transportation performance measurement is used internally or externally, depending on who is using it. When agencies use performance measurement, the use is internal and qualifies as performance-based planning: the use of performance measures to guide decision making. When other entities, like higher-level governments, use performance measurement to assess the efficacy of an agency or program, the use is external (Cambridge Systematics, 2000). This thesis is primarily concerned with internal use, performance-based planning, in order to understand how the user of performance measurement can impact design decision-making.

A framework for performance-based transportation planning and design

In transportation, performance-based planning is a multi-step process described in the literature as a framework. (See Figure 2-1) According to the 2000 NCHRP report, performance-based planning is a continuous feedback loop between agency decisions and performance results. Furthermore, performance measurement is an activity itself, which requires the collection of data and the use

of analytical methods (Cambridge Systematics 2000). In order to be worthwhile, therefore, the cost of performing this activity must outweigh the benefits (Meyer, 2001).

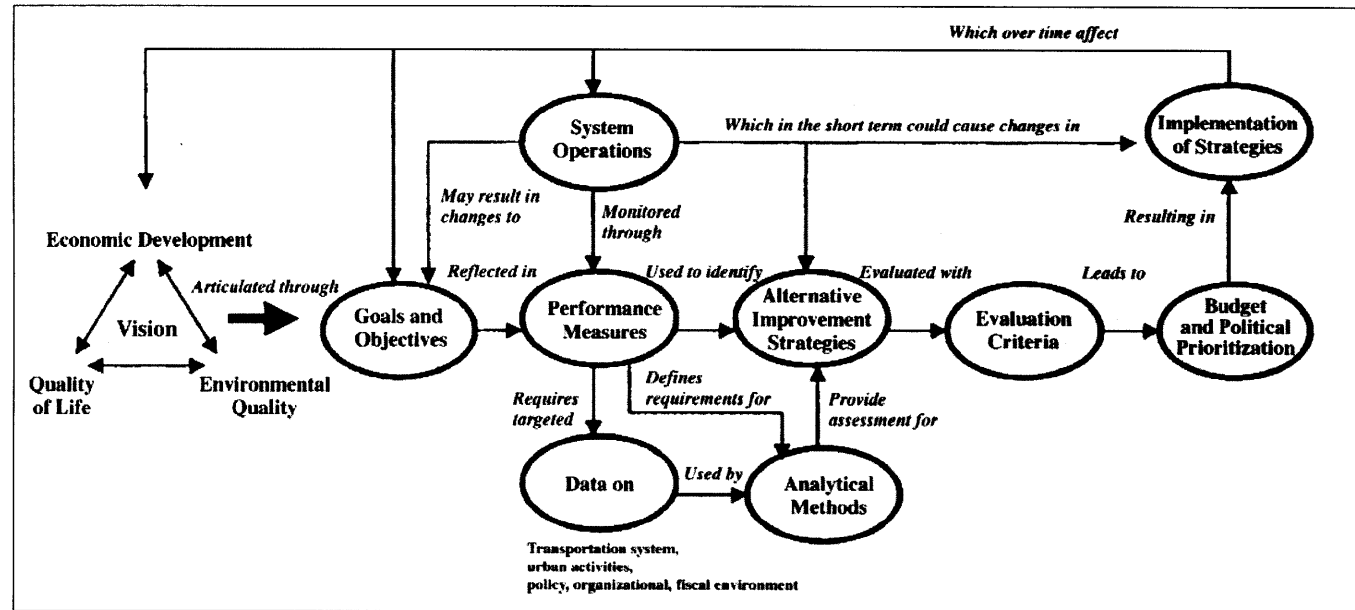
In 2000 the Transportation Research Board (TRB) convened its first national conference on performance measurement in transportation. At the conference, Pickrell and Neumann (2001) presented a resource paper providing an overview of performance-based planning, which explains this framework in greater detail. The researchers outline seven features common to implementations of performance-based planning (which correspond to Figure 2-1). These concepts will be referred to throughout this thesis:

1. **Goals:** the broad, socially driven aims that guide overall decision-making, focused primarily on the areas of economic development, quality of life and the environment.
2. **Objectives:** the specific aims that support the broader goals and can potentially be quantified to measure progress.
3. **Performance measures:** the actual indicators, either quantitative or qualitative, used to assess progress toward pre-determined objectives.
4. **Analytical methods and data needs:** the process by which agencies collect data on performance and use that data to calculate performance.
5. **Decision support:** a system for using performance measures to identify potential consequences of decision-making.

Figure 2-1. Performance-Based Planning Framework

Performance-based planning is a feedback loop. The performance results of prior choices help influence future decisions.

Source: Meyer & Miller, 2000.



6. **Monitoring and feedback:** an ongoing process of assessing performance and communicating performance to decision-makers.

7. **Reporting:** the communicating of results (a component of the monitoring-and-feedback process), which establishes accountability in the agency or staff member responsible for performance to respective reporting audiences

According to this framework, agencies first set goals, then related objectives, and finally the related performance measures, which ensures that agency goals are dictating the performance-based planning framework (Macdonald et al., 2010). Figure 2-2 provides

an example of how performance measures can be aligned to objectives and a goal.

Performance standards for planning and design

Absent from this framework is a system of “**performance standards**,” a set target for each performance measurement (Cambridge Systematics, 2000). Performance standards, sometimes referred to as “performance targets,” are different from **performance benchmarks**, which are also target values, but are meant to compare agencies with one another (Pickrell & Neumann, 2001). The literature suggests that standards are a useful but non-

| | | |
|--------------|-------------------|---|
| Goal: | | Provide the safest transportation system in the nation for users and workers. |
| ↳ | Objective: | By 2008, reduce the fatality rate on the California state highway system to 1.00 per 100 million vehicle miles traveled and continuously reduce annually thereafter toward a goal of the lowest rate in the nation. |
| | ↳ | Measure: Fatalities per 100 million VMT on the California state highway system. |

Figure 2-2. Aligning Goals, Objectives and Measures

In performance-based planning, every goal is defined by one or more objectives. For each objective, agencies identify one or more measures to track progress toward the objective. Source: Macdonald et al., 2010, from CalTrans Performance Measurement framework.

essential component of performance-based planning. Multiple authors recognize that standards can serve as powerful levers for change. Looking at several state DOTs, Larson (2005) found that performance standards can be effective in pushing agencies to reform strategy, even if they are too optimistic to actually be achieved (Larson, 2005). Macdonald et al. (2010) cite the U.S. Department of Energy (1995), which recommends that agencies set targets high enough to encourage a deliberate effort to achieve them, but low enough to be attainable in a given time frame.

The challenge in using performance standards is that it may be difficult to determine a reasonable expectation for performance and improvement (Pickrell & Neumann, 2001). In transportation,

many performance measures may be impacted by variables that are challenging to predict or are beyond the control of the transportation agency, obscuring the relationship between agency actions and performance (Meyer, 2001). For example, while a local transportation agency may wish to reduce automobile congestion, many factors outside of the agency’s control, like gasoline prices, parking supply, transit service, land use patterns, and others, will impact results. In order to create performance standards, the 2000 NCHRP guide recommends that agencies determine their **baseline performance**, the current level of performance, and observe initial progress over time to determine what kind of change can be reasonably achieved under various circumstances.

Separate from the performance-based planning framework, performance standards have been proposed on their own as a tool for street design. Southworth and Ben-Joseph (2003) explain that performance standards can replace the traditional design and engineering standards. Instead of dictating the form, a performance standard approach authorizes a range of design solutions so long as they meet pre-defined performance targets. According to the authors, “working from a set of performance standards ... a vast number of alternative engineering solutions can be formulated to provide designs more suited to local conditions” (p 147).

Kendig (1980), for example, proposes replacing traditional land use policies with “performance zoning,” which regulates development not by use and form, but by attempting to control the “by-products” that uses produce (by means of regulating four

variables: open space ratio, impervious surface ratio, density, and floor area ratio). In theory, this approach shows promise, but has been applied primarily to land use regulations and not street engineering or design (Southworth & Ben-Joseph, 2003).

Using performance-based planning in transportation decision-making

Decision-making contexts

Performance-based planning – the feedback loop in which performance results impact goals and decisions – operates in multiple decision-making contexts. Pickrell and Neumann (2001) provide an overview of potential decision-making contexts and their related planning processes:

1. **Policy analysis:** Transportation agencies develop **strategic plans** to outline their broadest goals (i.e. **strategic goals**) and the policies they will employ to achieve them. Performance measurement can be utilized to determine if all agency decisions (including those from the contexts below) are promoting progress toward strategic goals.
2. **Planning:** Transportation agencies will create a vision for realizing their strategic goals in the form a **long-term transportation plan**. For example, federal funding requires that state-level DOTs complete plans every five years, usually with a 20-year horizon (Pickrell & Neumann, 2001). Performance measurement can assess the impact of previous plans and facilitate the development of a plan that will maximize performance in the future.
3. **Resource allocation and programming:** With a limited set of resources, transportation agencies must identify where investments should be made in the near-term. For example, state DOTs and MPOs regularly complete transportation improvement plans (TIPS) that identify projects to completed over a three-year horizon. In addition, state and local DOTs and transit agencies prepare annual **capital plans** that also outline future investments, usually over a five- to ten-year horizon. Performance-measurement helps planners determine which projects to include in capital plans and offers a framework for **project selection**, the process of choosing which projects from a plan to pursue next.
4. **Corridor and project analysis:** Performance measurement assists planners in developing goals and strategies for specific corridors or individual projects. In **alternatives analysis**, the process for comparing multiple approaches to a given project, performance measurement enables planners to choose the alternative that maximizes performance.
5. **System operations:** Performance based planning can assist agencies in monitoring how frequent or ongoing decisions,

like pricing, maintenance and service levels, are impacting overall system performance.

As depicted in Figure 2-3, these contexts vary in scope, specificity and relevant time horizon. If the scope of a decision-making context is wide, then its goals may be broad and its performance may be measured over a long period of time. Conversely, contexts with a narrower scope may have narrower goals with short-term impacts on performance (Meyer, 2001). For example, a strategic plan may direct an agency to improve transportation safety overall, which will inevitably require a longer period of time. In contrast, an individual project may seek to decrease accident rates in a specific area soon after it is completed.

In order to be effective, the performance frameworks of these contexts must be vertically and horizontally integrated (Pei, Amekudzi, Meyer, Barella, & Ross, 2010). **Vertical integration** requires that the goals for all contexts be aligned with an agency's strategic goals. According to Pickrell and Neumann (2001), "performance objectives and measures can be used to tie policies, plans, programs and projects together to achieve progress at multiple levels together to achieve progress at multiple levels toward a broadly held set of goals." Ideally, vertical integration extends beyond an agency. For example, a district's transportation plan should be coordinated with the state-level transportation plan (Larson, 2005). **Horizontal integration** requires that the performance measures of a specific context are aligned with the goals and objectives of that context (Pei et al., 2010).

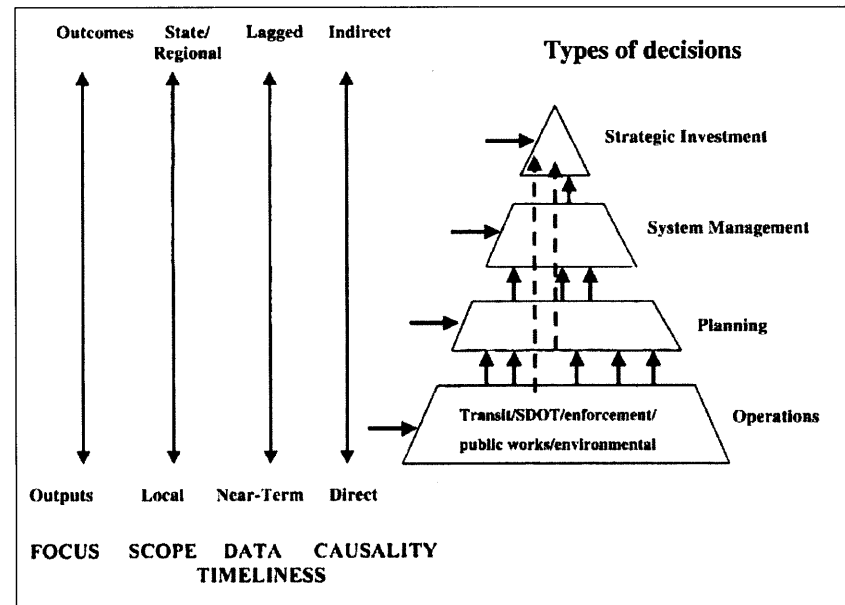


Figure 2-3. Decision-Making Contexts: Multiple Levels

Performance-based planning can be used at multiple levels of agency decision-making. Performance measurement systems must be "vertically integrated" so that lower-level performance goals align with those being used at the top.

The literature is emphatic that performance-based planning does not replace all planning processes but may complement or improve them. Meyer explains, "performance measures position you well to engage in debate, but may not necessarily be the determining factor in a decision. . . Measures sharpen and focus the debate" (cited in Larson, 2005, p. 119). For example, when choosing among various design alternatives, political considerations are likely to play a role. Performance measurement, however, can inform this process

by forecasting – and later documenting – the consequences of a politically-motivated decision (Pickrell & Neumann, 2001).

Performance-based planning for design decision-making

In the literature, there is little attention paid to using performance measurement for project-level decisions in street design. One explanation may be that much of the guidance from the NCHRP, FHWA and others is directed at state-level DOTs and MPOs and, thus, focuses less on project design and more on corridor-level planning (which may be a greater priority for these agencies). In a 2009 guide, the NCHRP states that performance measures are used infrequently during the design process and, when they are, are more likely used to assess **project delivery**, the time and resources expended in developing and completing a project (Cambridge Systematics et al., 2009).

The literature does not, however, ignore performance measurement for design decision-making altogether. Macdonald et al. (2010) proposes a set of performance measurements for the design of urban arterials in California. In a 2004 guide to performance measurement, NCHRP (2004) recognizes that project-level analysis may be resource-intensive for DOTs, but explains that certain performance goals may be inherently tied to project-level design. For example, performance goals for context-sensitive design (explained in more detail in Chapter 5) require that decision makers project potential performance results during the design process. In its 2009 guide, NCHRP also recommends that

performance measures be incorporated when they are useful in making specific design choices (Cambridge Systematics et al., 2009). For example, Meyer (2001) argues that project evaluation criteria should be aligned with performance goals and measures. In this way, performance measures can influence design evaluation.

If design decision-making must reflect performance concerns, as these authors suggest, then the transportation literature appears to have neglected an additional decision-making context for performance-based planning: the development of design guidelines and engineering standards for street design. Just as a strategic plan guides an agency, **design guidelines and engineering standards** help guide the physical form of street design. Design guidelines often outline the goals they seek to achieve, while engineering standards are established to ensure specific goals, like safety and efficient operations. At the 2000 TRB conference, state transportation officials asserted that the goals associated with performance measurement systems sometimes conflict with engineering standards for street design (Peyrebune, 2001). If standards and guidelines were vertically integrated (i.e. aligned with agency goals), as Meyer (2001), Pickrell and Neumann (2001), and others recommend, then such conflicts would be mitigated. Since local and state agencies often cannot control these guidelines, however, they are unable to pursue such integration.

Benefits of Performance Measurement

Overall, performance-based planning is recommended as a tool for agencies to clearly articulate goals and continuously refine decisions toward achieving them. According to the Federal Highway Administration (FHWA), performance measures help agencies set goals and standards, detect problems, manage and improve processes, and document accomplishments. Pickrell and Neumann (2001) explain that performance measurement makes agencies accountable for progress, improves communication between all stakeholders, assesses the efficiency and effectiveness of an agency, provides clarity to the decision-making process, and, thanks to ongoing feedback, encourages continuous improvement. Focusing on street design, several important benefits are described more fully below.

Create accountability

In an overview of public sector economics, Brealey et al. (1997) argue that, while the private sector can be judged on its financial performance, “no simple yardsticks are available with which to judge a government’s performance.” Performance-based planning fills this gap, by offering external stakeholders a snapshot of performance. Federal transportation funding programs, for example, are increasingly tied to program and agency performance

(Cambridge Systematics, 2010). Furthermore, citizens gain a better understanding of how agencies function and the way their tax dollars are being spent (Halachmi & Holzer, 2010).

This accountability can play an important role in street design policy. In an overview of best practices for implementing ‘Complete Streets’ (a term described in detail in Chapter 5), the American Planning Association (APA) argues that performance measurement is necessary to ensure that progress is achieved. It is not enough for a jurisdiction to simply issue new design policies. There must be a mechanism of accountability in place (McCann & Rynne, 2010).

Increase efficiency and effectiveness

Performance measurement can improve efficiency and effectiveness by identifying the strategies that do (or do not) improve performance. Just as performance measures can indicate where programs are successful, they also identify where programs are failing and need to be corrected (Osborne & Gaebler, 1993). Performance results can also be compared to **inputs** (the resource expended to achieve results), in order to determine which decisions or programs are most resource-efficient (Macdonald et al., 2010).

Resource efficiency is highly pertinent to street design for a number of reasons. First, agencies may have little capital funding available, particularly for non-automobile infrastructure like bike lanes. As a result, agencies must identify cost-effective approaches. Second, streets themselves represent a constrained resource. In

mature urban contexts, there is a limited right-of-way along streets in which to accommodate all users. With performance measures, agencies can evaluate their use of that limited space relative to agency and project-level goals. For example, an agency could compare performance impacts of converting an automobile lane into space for pedestrians, cyclists or buses. Different configurations will result in different performance gains.

Broaden strategic goals

Performance measurement can be a useful tool for agencies or stakeholders interested in incorporating new considerations into transportation planning and street design. In 2004, for example, the EPA argued that performance measures can push transportation agencies to incorporate sustainable design practices. Meyer (2001) argues that performance-based planning provides a framework for moving agencies from considering their internal activities to considering their impact on broad social goals, like the environment, economic development, and equity.

Communicate Results

Performance-based planning entails regular **performance reports**, documents that communicate performance results to internal and external audiences. Performance reports help ensure accountability of agencies and individuals. According to Pickrell and Neumann (2001), “The audiences for performance-related information will vary from the agency staff responsible for

delivering certain aspects of system performance to management, elected officials, and customer and stakeholder groups” (p. 19). The literature recommends that communication reports be tailored to target specific audiences (NPR, 1997). Besides creating accountability, performance reports can influence public perception and political debate about transportation agencies and funding. Successful performance reports may create a “perception of success,” that may foster political will for additional investments (NCHRP, 2004, p. 6). In addition, performance measurement can “strengthen trust with stakeholders and customers” (NCRHP 2004, p 6).

These general benefits are relevant to all street design agencies. However, performance reporting can also play an important role when design strategies break the *status quo* or may be confronted by public opposition. Performance reporting offers agencies the chance to ‘make the case’ for their design choices, by communicating the positive benefits of the project.

Clarify decision-making

Within the performance-based planning framework, performance measures clarify decision-making by providing a consistent framework for assessing choices. Macdonald et al. (2010) explain, “ideally, performance measures will clarify the trade-offs that occur between design alternatives, thus providing transportation professionals with an accepted ‘neutral’ guidance system” (p. 34). In other words, all design options are subject to the same evaluation, enabling planners to easily compare them. During this kind of

tradeoff analysis, agencies can also compare the performance gains associated with different design alternatives and the resources necessary to achieve them (Larson, 2005). This kind of tradeoff analysis of costs and benefits may be useful where resources like street space are limited, such as urban arterials. For example, it may be inefficient to dedicate street space to benefit a relatively small number of cyclists, if the result is a performance loss for a larger number of automobiles.

Chapter 3. Performance Measurement in Theory and in Practice

Institutional history

Origins

Much of the research on performance-based planning for transportation planning credits the private sector with its development. NCHRP's 2003 guide, for example, cites "Total Quality Management" (TQM) as the precursor of public-sector performance measurement. Developed in Japan during the 1950s for the industrial and manufacturing sectors, TQM was innovative in directing firms to develop measurable goals and monitor them over time. According to Neely et al. (2000), private sector firms increasingly adopted performance measurement practices in the 1970s and 80s after recognizing the shortcomings of relying solely on measures of cost-effectiveness. Rejecting this narrow approach, many industries developed frameworks that introduced additional performance criteria. For example, many private firms have adopted a "balanced scorecard" approach – "balanced" because it measures performance in a broad set of pre-determined goals, not simply cost-effectiveness (Neely et al., 2000, p 1120).

Poister (2003) argues, however, that performance measurement has deep roots in the public sector. In the early 20th century, Poister explains, government reformers were interested in measuring the capacity and efficiency of public workers, and as early as 1943, the International City Management Association published materials instructing local governments in how to measure their

activities (Ridley & Simon, 1943 as cited in Poister, 2003). In the proceeding decades, various governments at all levels experimented with performance, but it wasn't until the 1970s, Poister explains, that performance measurement became widespread. Throughout that decade, the Urban Land Institute began to release a series of reports, executed primarily under the leadership of Harry Hatry, on performance measures for the public sector. By the 1980s, performance-measurement began to decline in the public sector, as many considered the results too meager to justify the effort. A general attitude was that agencies suffered from “DRIP” – data-rich but information poor (Poister, 2003, p. 6).

Growth of performance-based planning in transportation

Looking at the transportation sector specifically, the growth of performance-based planning was ignited by the Federal government in the early 1990s. During the rise of performance measurement in the 1970s, transportation departments and transit agencies had gained experience tracking the cost-effectiveness of their activities (Poister, 2003). During the 1990s, two pieces of Federal legislation encouraged a more complete shift to performance-based planning.

First, in 1991, U.S. Congress passed the *Intermodal Safety Transportation Equity Act* (ISTEA), the primary legislation authorizing federal transportation spending until 1999. While ISTEA changed many critical aspects of federal transportation policy, it served as a landmark for performance measurement policy. ISTEA

recommended that state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) create so-called multiple “management systems” for the transportation network. Although optional, each management system entailed monitoring the performance of a specific aspect of the transportation system, such as congestion, safety, intermodal travel, public transit, and conditions of pavement and bridges (NCHRP, 2004).

Second, in 1993, U.S. congress passed the *Government Performance and Results Act*, which required that federal agencies establish performance measures and monitor the performance of all large federal programs. The legislation had its roots in transportation, since the plan was based off of the success of several earlier efforts by state-level DOTs and regional MPOs (NCHRP, 2004).

The federal push for performance-based planning also extended beyond legislation. Also in 1993, then-Vice President Al Gore commissioned the National Performance Review (NPR). Its final report, *Serving the American Public: Best Practices in Performance Measurement*, explains how federal and local programs can successfully adopt performance measurement practices (NPR, 1997).

Since this legislation and guidance, national research programs and federal agencies have become active promoters of performance-based planning for transportation on the state, regional and local levels. Research by NCHRP has recommended performance-based planning since 1996 (Cambridge Systematics, 1996). Furthermore, virtually every federal or national-level agency in the transportation sector has sponsored research about or issued

guidance on performance-based transportation planning. The list includes the Federal Highway Administration (Herbel et al., 2009), the Federal Transit Administration (FTA) (TCRP, 2003), and the American Association of State Highway and Transportation Officials (AASHTO, 2007), as well as the Environmental Protection Agency (2004).

Local and state adoption of performance measurement

A 2010 report, from a national forum on performance measurement organized by NCHRP, provides a state of the practice of performance-based planning at state DOTs and regional MPOs. According to the report, all state DOTs utilize performance-based planning, though they vary in their capacity or style. For example, while all state DOTs establish goals, not all set performance targets and the sophistication of their data analysis is mixed. The report suggests that MPOs do not utilize performance-based planning as consistently as state DOTs. While most MPOs set goals and objectives, only a small proportion have specific performance measures or performance targets. Furthermore, MPOs use performance measures primarily to evaluate investment decisions, and less as a means of reviewing past investment (Cambridge Systematics, 2010).

On the local level, there is less documentation of the use of performance measurement in transportation on the local level. As described above, reports from FHWA and NCHRP recommend performance measurement for local transportation agencies. State

DOTs, like CalTrans, have stated their intent to increase performance measurement on the local level (CalTrans., 2011).

The cities featured in this report, NYC and Portland, demonstrate that performance measurement has grown on the local level, but slowly and at various policy levels. Thanks to state and regional leadership, Portland has been a forerunner. In 1991, the state passed the Transportation Planning Rule, which, among other changes, requires Portland to set measurable performance goals (City of Portland, 2006). Portland Metro, the region's MPO, set further performance measurement requirements for the city in its 2000 *Regional Transportation Plan* (City of Portland, 2006). In contrast, NYC adopted its current performance measurement much later and with direction from the city, not the state. In 2008, the city council passed Local Law 23, which directed NYC DOT to begin measuring so-called “high-performance modes,” specifically pedestrians, cyclists, buses, and ferries (The New York City Council, 2008).

What to Measure: A Shift in Focus

Existing research on performance-based planning describes several trends in the use of performance measurement by transportation agencies. While a concise summary is provided

below, this transition is described in greater detail in Chapters 4 and 5.

From prioritizing automobiles to a balanced approach

While performance measurement became an important focus among transportation agencies around the 1990s Poister (2005), Macdonald et al. (2010), Meyer (2001) and others argue that measurements practices have been around since around the 1960s. According to Macdonald et al. (2010), transportation agencies traditionally focused measurement on automobile congestion and traffic safety, reflecting the dominant concerns of the field of transportation engineering. Indeed, according to Meyer (2001), the most popular criteria for evaluating transportation system plans in the 1960s and 70s were the estimated usage of a system relative to its capacity (so-called volume-to-capacity ratios, a measure of congestion), the projected number of crashes, and costs.

More recently, agencies have greatly widened the focus of performance measurement practices. First, agencies are now considering a wider range of transportation users, like cyclists, pedestrians and transit users (Macdonald et al., 2010). In addition, agencies are measuring their performance relative to broader societal goals, like economic growth and environmental sustainability (Meyer, 2001). The literature also points overwhelmingly to an increased attention to customer satisfaction (Larson, 2005; NPR, 1997; Pickrell & Neumann, 2001).

From outputs to outcomes

Poister (2005) explains that performance measurement practices have become more sophisticated by adopting the formal features of a performance-based planning framework. According to Poister's (2005) review of the state of the practice, state DOTs have shifted from using narrow goals and internal measures, to using broad goals and both internal and external measures that are aligned with long-term objectives.

This transition is best demonstrated by a shift from looking solely at outputs, to a consideration of outcomes. As illustrated in Figure 3-1, measures can assess the level of outputs, which are the activities completed (e.g. how many streets paved) and outcomes, which are the direct or indirect byproducts of transportation investments (e.g. the impact of transportation on the environment). According to Meyer (2001), "Outcome measures relate to the ultimate effect of the transportation system on a community, such as quality of life, environmental health, equitable distribution of benefits and costs, economic development, safety, and security." As a result, measurement of outcomes ensures that performance measurement is connected to the broad, societal goals guiding an agency.

In order to monitor progress toward long-term goals, there is widespread agreement that agencies must track both outputs and outcomes (Cambridge Systematics 2000, 2004; Pickrell & Neumann, 2001; NPR 1997; Meyer, 2001; Macdonald et al., 2010). Agencies have

| Concern Area | Output Measures | Outcome Measures |
|--------------------|---|--|
| Safety | Tons of salt applied | Number of ice-related accidents or number of hours of road closure |
| | Money spent on alcohol education programs | Percent of accidents that are alcohol related |
| Maintenance | Miles resurfaces | Lane-miles improved to defined service quality |
| | Tons of asphalt applied | Number of pothole complaints. |
| Mobility | Volume to capacity ration | Change in average travel time |
| | Delay | Percent of jobs within X minutes of airport |
| Environment | Number of environmental control measures funded | Number of air-quality related illnesses on exceedence days |
| | Vehicle miles traveled (VMT) | Effluent quality after rainstorms |

Figure 3-1. Outputs and Outcomes
Rather than measure outputs - the activities performed by an agency - Meyer (2001) and others argue that agencies must also measure outcomes, the impacts of their activities.
 Source: Cambridge Systematics, 2000

heeded these calls. Prior to the 1990s, most state DOTs focused on their internal performance, assessing the production of outputs and cost efficiency. From the 1990s onward, state DOTs not only began adopting a wider set of measures, but also began focusing more on outcomes, including those considered impacts related to but outside of transportation (Poister, 2005). In 2010 Portland Metro, Portland’s regional MPO, adopted a performance-based planning framework that serves as a useful example. Metro is unique among MPOs, as it is the only MPO that is directly elected, and the agency is responsible for both land use and transportation planning. Metro’s *2035 Regional Transportation Plan* specifically adopts an “outcomes-

based framework to guide planning and decision-making” (Oregon Metro, 2010, p 2-1). As figure 3-2 demonstrates, goals range from improving transportation, protecting the environment, ensuring safety, and promoting public health.

Practical Challenges

Following the first national conference in 2000, the TRB convened a second national conference on performance measurement in 2004. The reports from these conferences indicate

that transportation agencies and researchers have identified several common challenges to implementing performance-based planning.

Identifying measures

While most transportation agencies have a long track record of measuring automobile congestion, they have less experience in tracking alternative modes, like walking or biking, or in less well-defined outcome measures, like sustainability or quality of life (Peyrebune, 2001). To broaden their scope beyond automobiles, agencies face a new challenge in measuring all modes and identifying measures that can assess all modes together without bias (Poister, 2005). To tackle broader objectives, like quality of life, some goals may not be quantitatively operationalized – they cannot be captured in a number. Instead, agencies must also consider qualitative measures, which may be highly subjective or difficult to compare over time. For example, agencies may measure a street design’s impact on quality of life through surveys, but the qualitative data may not be comparable to survey results from other projects.

Currently, there is a growing amount of research and recommendations by federal agencies on what some of these measures might look like and how they can be tracked, they often represent a departure from traditional practices. Recognizing this challenge, available guidelines recommend that agencies forego attempts to measure everything, and instead select a limited set of measures (Larson, 2005; Pickrell & Neumann, 2001; Meyer, 2001). Meanwhile, in areas like economic development and sustainability,

| Portland Metro: Goals for 2035 Regional Transportation Plan | |
|---|---|
| 1 | Foster Vibrant Communities and Efficient Urban Form |
| 2 | Sustain Economic Competitiveness and Prosperity |
| 3 | Expand Transportation Choices |
| 4 | Emphasize Effective and Efficient Management of the Transportation System |
| 5 | Enhance Safety and Security |
| 6 | Promote Environmental Stewardship |
| 7 | Enhance Human Health |
| 8 | Ensure Equity |
| 9 | Ensure Fiscal Stewardship |
| 10 | Deliver Accountability |

Figure 3-2. Goals: 2035 Regional Transportation Plan, Portland Metro
 Portland Metro’s goals reflect concerns about performance in many areas beyond transportation mobility.

there may simply be few measures that can be practically incorporated into performance-based planning, either because measurement is difficult or because the impacts of decisions are not well understood or have a long time-horizon (Meyer, 2001). For areas that are difficult to measure with precision, Meyer (2001) suggests employing “surrogate measures” that model transportation’s role.

For example, while the sustainability impacts of a street design may be difficult to project or measure quantitatively, the direction of its impacts – either positive or negative – may be easier to determine.

Data collection

The selection of performance measures is also complicated by the availability of data. Collecting data can be resource intensive and, unlike the core activities of most agencies, doesn't yield any significant outputs for users. During a workshop at the 2000 national conference, practitioners at several state and local agencies recommended that their peers develop strategies for utilizing existing, available data in order to facilitate implementation of performance measurement (Peyrebrune, 2001). At the same conference, however, practitioners saw the shortcomings of relying on existing data and suggested that new technology provides opportunities for additional data collection. During a panel, Tarek Hatata, the president of transportation consulting group System Metrics, suggested:

Even though relying on existing data makes it faster to implement, we are going through a revolution of information technology and information data sources. . . It may be why things haven't changed in 50 years – because there is a reluctance at every level, the regional, state, and federal levels to think outside the box and say, "Let's collect new data, brand new data that may give us brand new answers."

(Peyrebrune, 2001, p. 127; as cited in Macdonald et al., 2010, p 39).

If local agencies are interested in tracking performance in non-automobile transportation or in areas beyond transportation, it may be necessary for them to adopt new collection and analysis processes (Macdonald et al., 2010) or to be strategic in accessing data from other agencies that may be already be collecting it (Meyer, 2001).

Assigning value

In order to use performance measures to guide decision-making, agencies must be able to make relative judgments about different performance goals. In street design, certain performance measures for street design may conflict with each other. For example, new street capacity may reduce congestion and lower travel time, but may harm pedestrian safety and perceptions of quality of life. As a result, practitioners need a system to compare and balance different interests (Peyrebrune, 2001, p. 6).

In a report sponsored by the NCHRP, Weisbrod et al. (2007) recommend that performance measures be compared by assigning them monetary values that recognize the benefits and costs of each performance measure. For some measures, there is a logical rationale for monetization. For example, safety can be monetized based on the cost to society stemming from property damage, health cost, lost productivity, and death. Each improvement in safety is worth the savings it produces. For some measures, however, monetization

is difficult. Weisbrod et al. (2007) admit, for example, that it is not clear how place a monetary value on customer satisfaction (as cited in Macdonald et al., 2010).

More problematic, however, may be the challenges agencies face when asking community stakeholders how they value performance. As the cases of this thesis show, community stakeholders often fail to find a consensus around the value they place on different goals.

The Role of the Performance-Based Planner

Defining values through performance measures

While researchers, including Macdonald, accept Weisbrod's fiscal approach to sorting performance goals, Macdonald also argues that there is no universal method to compare performance measures or place them in a hierarchy. The problem, Macdonald explains, is that "for different stakeholders, different aspects of a transportation system may be prioritized" (p. 42). On a given street, local residents may wish to slow automobile traffic to improve quality of life and safety, while drivers may wish to reduce congestion. The overall lesson Macdonald draws is that "subjectivity is almost always involved in the quantification of [performance] impacts" (p. 42).

Despite this subjectivity, performance-based planning asks transportation and street agencies to define goals that relate to potentially broad social objectives (Meyer, 2001). Who, however, is responsible for determining these goals? The literature says very little definitively about this process, other than to indicate that it is flexible. Legislative policy, funding guidelines, public participation processes, or an internal agency process can all play a role in establishing strategic or project-level goals. Regardless of how they are established, therefore, goals and their related measures reflect what decision-makers have identified as important to citizens. Meyer (2001) explains that "measures carry a judgment about what the system user, or perhaps society in general, perceives as acceptable or desirable" (p 111). To set goals therefore is, in a way, to determine the values that guide decisions.

The limits of the performance-based planner and designer

With a set of goals in place, planners and designers are limited in the choices they can pursue and in their ability to influence performance goals. Much of the guidance on performance-based planning suggests that transportation agencies should behave, at least in part, autonomously from the public they are meant to serve. This is most evident when researchers highlight performance reporting as an opportunity for agencies to influence the public debate on transportation investments. Altshuler (1963) explains, however, how that the autonomy of planners is limited in two critical ways. Since a great deal of Altshuler's analysis deals with and is relevant

to transportation planning, we can apply his lessons to project-level street designers and planners operating in a performance-based framework (referred here as the “performance-based designer”).

First, Altshuler’s analysis suggests that the performance-based planner is inherently constrained by pre-determined goals. The problem, Altshuler explains, is that planners have few methods for promoting their own set of goals. “The first is to challenge the theoretical foundations of popular beliefs with which they conflict,” and the second “is to adapt one’s own arguments and objectives to the beliefs, attitudes, and political customs already prevalent” (p 319). According to Altshuler, the first method is controversial, slow and presents the risk that no results will be produced. As a result, he argues that planners are primarily stuck with the second option; their own goal proposals must hue closely to popular sentiment.

Second, Altshuler exposes the performance-based planner as inherently unequipped to make all decisions in the performance-based process. Instead, planners/designers must rely on additional models of decision-making, including political and ethical judgments, in order to make choices that weight performance measures against one another. Altshuler’s analysis suggests that performance-based planning attempts to achieve what he describes as “technical rationality.” According to Altshuler, in a rational analysis, all goals are fully operationalized, meaning they can be measured. “Give any number of pure experts the same operational objective,” Altshuler argues, “and they should come out with the sets of specific recommendations that differ insignificantly at all”

(p. 335). When advocates of performance-based planning suggest that it can help inform the decision-making process, they are thus suggesting that it provides a technically rational explanation for various decisions. While political motivations may ultimately guide choices, performance measures indicate the rational consequence.

In Altshuler’s view, however, the pursuit of technical rationality handicaps the planner’s ability to assign goals relative value. By relying on operational goals, Altshuler argues, the planner has “no obvious theoretical basis for claiming to know better than other specialists how far each specialist goals should be pursued, and with what priority” (p. 324). Altshuler explains this problem by distinguishing between “variables” and “values.” He explains:

Values in principle are of ethical significance; variables are not. Variables in principle are measurable; values are not. That is, although men can rank alternatives with regard to a value, they cannot express the implicit measuring process by which they do so. Consequently, observers are forced to treat values not as qualities of objects but as projections of the minds of human subjects. (p. 338)

Macdonald et al.’s argument, thus, echoes Altshuler, who argues that the process of prioritizing performance goals is inherently subjective. Since performance measures rely inherently on variables, they do not provide any objective information for pursuing one performance goal over another. When it comes to resolving conflicts between

performance goals the performance-based planner/designer cannot and does not have all the right answers.

The consequences of these limitations can be illuminated in the context of street design. Operating in a performance-based framework, street designers have a limited set of options. First, since they must adhere to a pre-determined set of goals, their creativity is largely limited to identifying new strategies to achieve those goals. If reducing congestion remains a primary objective, then the designer must find design solutions that can further this goal (while potentially fulfilling whatever other goals, like pedestrian safety, that the designer may carry on his/her own). Second, and perhaps more importantly, the street designer cannot rely on performance information to resolve conflicts between various goals. If improvements in pedestrian or transit infrastructure will hurt automobile and parking performance, the valuation of these two goals remains a subjective and likely political decision. Altshuler argues, for example, that politicians prefer to hear their constituents discuss conflict before prioritizing goals (p. 321). Indeed, project-level designers, agency leaders and politicians will likely wish to retain control over decisions to prioritize pedestrians over cars or visa versa. Such an arrangement ensures that each project can flexibly respond to its stakeholder context, while still pursuing stated performance goals.

Performance-based planning and reflective practice

Donald Schön's (1983) model of reflective practice also provides a useful contrast with performance-based planning. The contradiction between the two methods lies in the contrast that Schön draws between technical rationality and reflective practice. Like Altshuler, Schön's conception of technical rationality bears a strong resemblance to performance-based planning. According to Schön, technical rationality consists of "instrumental problem solving," which he defines as a "technical procedure to be measured by its effectiveness in achieving a pre-established objective" (p. 165).

Schön identifies the same consequences as Altshuler to this approach. Technical rationality, he argues, is overly concerned with "problem solving" and ignores "problem setting" (p. 40). Schön explains, "when ends are confused and conflicting, there is as yet no 'problem' to solve. A conflict of ends cannot be resolved by the use of techniques derived from applied research. It is rather through the non-technical process of framing the problematic situation that we may organize and clarify ... the ends to be achieved" (p. 41). Schön's analysis, therefore suggests the same limitations as Altshuler. Performance-based planning provides no tools for placing values on goals, resolving conflicts between them and prioritizing them.

In a departure from Altshuler, however, Schön's presents reflective practice as an answer to these limitations. In a reflective practice model, the design process is viewed as a repeated "frame-experiment" in which "means and ends are framed interdependently" (p 165). As designers create multiple design iterations, they identify

new relationships of meaning and, in doing so, re-define and re-order the goals they seek to achieve. Street design provides a lens to consider how iterative design can reshape practical goals, while taking into account performance concerns. For example, a street designer can explore how a novel design choice may impact pedestrians or automobiles; in doing so, he or she could discover that the goal does not have to be to promote one performance objective or another, but can be to promote both. In Schön's view, it is in the process of reflection during the design process that such possibilities can emerge. While performance-based planning is a tool for implementing a set of pre-determined goals, reflective practice asks the designer to question them.

Engaging Community Through Performance Measurement

The use of performance measures is not confined to the role played by the planner or designer. Research on performance measurement and examples from transportation advocacy groups indicate that community stakeholders can gain influence over decision-making through performance measurement.

Halachmi and Holzer (2010) argue that performance measurement provides an opportunity for citizen participation in the public sector. When citizens are involved in selecting performance

measures and have access to performance data, they are better able to hold agencies accountable and, over time, increasingly trust that public sector decisions reflect citizen-driven performance goals (Halachmi & Holzer, 2010). While citizen power may increase under these circumstances, their influence is limited to the extent that decisions are based on performance data.

Even if citizens have not participated in the development of performance-based planning framework, however, performance measures can still provide citizens with a tool to advocate for themselves. The seminal work of Davidoff (1965) provides insight into community-level advocacy. According to Davidoff, community groups need the technical expertise to put forth plans of their own to counter those being pushed upon them from above. Community groups can use performance measurement, Holzer and Kloby (2005) suggest, to similar effect. Rather than wait to participate, community groups can use performance measurement on their own. For example, Holzer and Kloby cite the NYC Straphangers Campaign, an advocacy group for subway riders, which released a set of performance reports defining problems in the system. The reports “gave riders, communities and officials information they would need to press the transit authority for better service” (Holzer and Kloby, 2005, p 525). While these reports are described as “comprehensive,” the Straphangers Campaign also utilizes less sophisticated performance reports to promote their agenda. Every year the Campaign delivers its satirical Pokey and

Schleppie Awards respectively to the slowest and least reliable buses in NYC (Straphangers.org).

In the area of street design, advocates for bicycle and pedestrian facilities have also utilized performance information to further their agenda. Also in NYC, *Streetsblog*, a media site that reports on local transportation policy, releases a “Weekly Carnage” report that lists the automobile-related accidents, injuries and property damage that have occurred in the NYC region. The purpose of these reports is two-fold: “we do it because by drawing attention to the scope of the problem of the death and destruction caused by automobiles, we hope to also draw attention to the solution: pursuing policies that cause people to reduce the amount they drive, while promoting mass transit, walking and cycling” (Streetsblog.org). In other words, by demonstrating the negative impacts of pursuing one goal – better service for automobiles – *Streetsblog* aims to show the value of pursuing other performance goals – for transit riders, pedestrians and cyclists. These examples demonstrate that advocacy groups can use performance measurement in two ways: first, to hold agencies accountable through their own performance evaluations; and, second, to disseminate and promote a new set of performance goals. If these evaluations and performance goals are adopted by many, they have the potential to influence formal decision-making.

Section II. Definitions of Performance

Chapter 4. Prioritizing Automobile Performance in Arterial Design

Introduction

In the decades following World War II, from about 1950 to the mid-1970s, cities adopted a limited range of goals for urban arterials, which tended to prioritize automobile performance over other modes.

In the middle of the 20th Century, city officials and researchers grappled with the “urban transportation problem,” the high degree of automobile congestion on city streets. Some researchers asserted that traditional urban form was inadequate for the automobile. City officials responded by creating new agencies dedicated to improving traffic conditions.

National policy-makers responded by promoting the adoption of a more systematic approach to transportation planning, which attempted to use empirical data to guide decision-making, and with new guidelines for the design and engineering of highways and streets. Overall, these policies defined street performance narrowly by its efficiency in moving vehicles. As a result, these policies offered many design recommendations for increasing automobile capacity and speed, often at the expense of convenience and safety for pedestrians and transit riders. In the late 1960s, national policy broadened its performance focus with an increased attention to driver safety, but resulting policies continued to minimize performance concerns for other street users.

In NYC and Portland, city-wide transportation plans and specific arterial projects demonstrate this narrow conception of street performance. Changes to urban arterials, like the narrowing of sidewalks and conversions to one-way streets, aimed to reduce congestion, but arguably damaged the experience of pedestrians and transit riders. City officials did not ignore other performance concerns, such as pedestrian safety, but generally prioritized automobiles in design decisions.

The Urban Traffic Problem

Shifts in performance concerns have long influenced transportation planning. In the late 19th and early 20th centuries, for example, the rapid growth of the bicycle helped spark the Good Roads Movement. Led in part by the National League for Good Roads, a coalition of bicycle groups and agricultural interests, the movement launched a campaign to “lift our people out of the mud” (St. Clair, 1986, p. 22). The movement’s primary goal was to promote the paving of rural roads. Their performance goals were thus fairly modest: a basic, but consistent level of mobility for any vehicle. The earliest federal road legislation reflected the rural nature of these interests. The first federal legislation, the Federal Road Act in 1916, offered funding to road construction, but only in rural areas, a restriction that lasted until the 1930s (St. Clair, 1986).

By the middle of the 20th Century, however, most cities’ transportation concerns focused primarily on the automobile. Concern about automobile congestion in cities began nearly as soon as the car itself was introduced. In many cities, early engineering and design changes to streets were meant to address vehicular congestion. For example, over several decades cities experimented with different solutions to coordinating traffic at intersections. After relying on policemen to direct traffic at each intersection, cities began to introduce signals, which grew in popularity after advancements in lens technology in the 1920s (McShane, 1994). Signals were meant to improve congestion at intersections by reducing conflict. As early as the 1910s, however, NYC also saw signals as a strategy for synchronizing traffic flow. Along Fifth Avenue, the city installed electric signals at major intersections and directed policemen at the remaining intersections to synchronize their controls with the signals (McShane, 1994).

By the 1940s, urban government and business groups had identified automobile traffic as one of the most serious concerns facing cities. According to a 1948 report from the 34th Street Association, a group of property and business owners in Midtown Manhattan, virtually every city (the report includes New York and Portland, OR) was drawing up plans to address severe automobile traffic. “Urban centers throughout the nation realize that traffic congestion and the concomitant lack of adequate parking facilities are among their most pressing problems. This congestion is costing cities untold millions of dollars, accelerating the decentralization of

commerce, and driving trade outside of the urban centers” (Thirty Fourth Street-Midtown Association, 1948, p 5).

The first step in many cities was to create new departments or advisory boards focused on traffic. New York City is illustrative. After creating a Special Traffic Committee in 1946 (Mayor’s Special Traffic Committee, 1947), New York Mayor William O’Dwyer established the city Traffic Commission and the Department of Traffic Engineering in 1949. A mayoral report that same year celebrated that the city, “for the first time in its history, has an agency devoted exclusively to the betterment of traffic conditions and the relief of traffic congestion” (Mayor O’Dwyer, 1949, p 7). The purpose of the agency was to think both small- and large-scale. By the end of that year, the agency had already put forward proposals for improving traffic on existing streets, including the city’s first fee-based parking meters and the expanded implementation of traffic signals and pavement markings on streets. The agency had also adopted a proposal for a system of urban expressways put forward by the Tri-Borough Bridge Authority under the leadership of Robert Moses (Traffic Commission, 1949).

Around this time, automobile congestion was seen as both a part and a major cause of urban decline. The independent Eno Foundation, which had a long history of supporting transportation investments, published extensive literature on urban traffic problems. Writing in the foundation’s journal *Traffic Quarterly*, many researchers questioned the viability of city form in the face of congestion. In a 1959 article on urban street capacity, Bellis (1959) argues that severe

traffic is the inevitable result of urban density. “Because of intense congestion, decentralization has been taking place and will continue until there is a balance between the desire to live close together and the desire for freedom of movement” (p 75). The problem, Bellis explains, is that “Far too many people live, work, and perform other activities within too small an area” (Bellis, 1959, p 75). In an analysis of changes in New Haven titled with the question “Can cities survive the automobile age,” Logue (1959) answers “maybe” – so long as cities follow New Haven’s lead in investing in highways. Others, like Stonier (1957) declared that decentralization of commercial activity had rendered the structure of cities “obsolete.” “American cities’ basically rectangular street systems,” Stonier complains, “were not designed primarily to accommodate the flow of vehicular traffic. Streets are generally too narrow” (p 215).

Since traffic problems were considered part of larger failures in urban form, urban renewal projects aimed at housing or economic development also included transportation investments. The 1958 guidebook from the National Committee on Urban Transportation argued, “it will have to be recognized that the transportation problem cannot be divorced from the problems of urban renewal and suburban development” (National Committee, 1958). By providing an opportunity to radically re-think the use of space, urban renewal was seen as “American cities’ first chance to reform themselves in response to the automobile age” (Steiner, 1959, p 6).

Standardizing Transportation Planning

Following World War II, national policy-makers, seeking to improve transportation conditions in cities, promoted the standardization of transportation planning in the United States. This shift is best demonstrated by the National Committee on Urban Transportation, which was created by Congress in 1954. In 1958, after several years of development, the Committee published a seminal guidebook, *Better Transportation for Your City*, the first fully documented set of procedures for systematic urban transportation planning (Weiner, 1992). The guidebook describes its mission as both urgent and profound. “Only decisive action,” the guide asserts, “can stem the rising tide of traffic congestion, confusion, and accidents threatening the economic and social health of our communities” (National Committee, 1958, p 1).

The most important aspect of the guide is its shift toward a model of technical rationality. The guide explains, “There are two main reasons why cities have failed to plan comprehensively to meet their transportation needs. One was lack of funds for extensive capital improvements. The other was a lack of essential facts” (National Committee, 1958, p 1).

The first problem, “a lack of funds,” had already been addressed two years earlier by the Federal Aid Highway Act of 1956. A major turning point for American transportation investments, the

1956 legislation created a federal tax on vehicle fuel and established the Federal Highway Trust Fund, both of which persist in current transportation policy. The bill was essential to stimulating the creation of the Interstate Highway System, which had been launched in 1948 but had not been adequately funded. In doing so, the 1956 legislation also shifted federal transportation priorities from rural to urban mobility. The growth of the Interstate Highway System brought freeways and their related infrastructure into urban centers. This introduction brought with it an entire system of transportation planning geared toward ensuring the efficient flow of automobiles into, out of, and through American cities.

The second problem, “a lack of facts,” was to be addressed by the systematic collection and application of data. Facts, the report argued, were essential for defining and measuring the extent of problems, determining and selecting solutions, and giving legislators and the public a “clear picture of needs” (National Committee, 1958, p 1). In the years leading up to the guide, several pioneering transportation studies offered models for urban transportation planning. Key studies, including the 1953 Detroit Metropolitan Area Traffic Study (DMATS) and the 1955 Chicago Area Transportation Study (CATS) were the first to employ all elements of transportation planning – from data collection to demand forecasting to system proposals – in a single, comprehensive study (Weiner, 1992).

The standardization and rational approach to transportation planning is also evident in the rise of several important publications concerning the design of highways and urban streets. First, in

1950, the Highway Research Board produced the first edition of the Highway Capacity Manual (HCM). A second edition followed in 1965. The forewords of these early editions begin in identical terms, stating that the manual offers a “rational and practical method” of determining highway capacity both for the “design of new highways” and “the adaption of the many existing roads and streets” (Highway Research Board, 1950, p. iii). As a tool for design, the Manual was meant to enable engineers to determine how much capacity to build into a design to ensure specific traffic performance or to estimate the traffic performance that could be expected from a given facility. In these early editions, the HCM, which the Highway Research Board continues to publish, places strong emphasis on data and research, using research studies and available data to determine various relationships between traffic variables like traffic volume, road width and vehicle speed.

In parallel to the development of the HCM, the American Association of State Highway and Transportation Officials (AASHTO) led the standardization of street design. (Until 1974, AASHTO was known as the American Association of State Highway Officials or AASHO; lacking a “T” for “Transportation,” AASHO was first focused mostly on highways and automobiles.) The organization’s major guides, which have become known as the “Green Book,” offer a detailed set of design criteria for highways and major streets. Officially, the “Green Book” is not a set of standards, but rather a “Policy” of suggested guidelines. However, numerous state and local departments of transportation have adopted these

guidelines as part of their own standards for geometric design. AASHO published its first edition in 1954, which was meant specifically for rural highways. In 1957, AASHO published its first policy for urban roads, “A Policy on Arterial Highways in Urban Areas.” In 1973, AASHO released the next major update to the urban edition, “A Policy on Design of Urban Highways and Arterial Streets” (AASHO, 1973b).

Upon their introduction HCM and the Green Book joined the Manual of Uniform Traffic Control Devices (MUTCD), a set of standards for the design and placement of traffic control devices like signs, signals and pavement markings. Initially developed by AASHO under a different name in the 1920s, with separate guides for rural and urban areas, the National Committee on Street and Highway Safety published the first MUTCD for all roads in 1935 (Federal Highway Administration, 2009). Like the Green Book and HCM, the MUTCD originally had only semi-official status. In 1966, however, the Federal Highway Administration adopted the MUTCD as official policy. As a result, all states must comply with its standards. The HCM, the Green Book and the MUTCD all rely heavily upon and reference each other. Together, they offer a comprehensive set of tools for highway and street design that continues to the present.

Performance for Automobiles

The design and engineering guidance during this period, including AASHO’s design recommendations and the Highway Capacity Manual, define road performance narrowly to include only automobile-related measures. In addition, this guidance specifically recommends that designers maximize automobile performance. As a result, specific design recommendations for automobiles, pedestrians and transit indicate that designers should sacrifice performance for pedestrians and transit riders for the benefit of automobiles. Additional users, namely bicyclists, are not considered at all.

Functional classification

A dominant example of this automobile-oriented approach is found in the concept of “arteriality,” the idea that streets should fall into a hierarchical system based on traffic flow (Marshall, 2005). In the 20th Century, arteriality marked a departure from the approach of the 19th Century grid-iron, like the one found in NYC, in which streets vary but demonstrate a high degree of uniformity and connectivity.

AASHO promoted arteriality through a system known as “Functional Classification,” which it developed and refined between 1954 and 1973. In its earliest guidance for urban roads, in 1957, the guide classifies arterials as either “major streets” or “expressways.”

By 1973, AASHO developed the “functional classification” system, still in use, which organizes streets into four categories. Both the functional classification system and AASHO’s earlier approach are based on the idea that any road has two basic but opposing functions: enabling through-traffic and providing access to abutting properties. While local roads are dedicated entirely to providing access, expressways are dedicated to through-traffic. Facilities in the middle – arterials, connectors and the earlier designation, “major streets” – must perform both.

The functional classification system is important for an understanding of performance because it narrowly defines the purpose of roads. From AASHO’s perspective, roads are primarily for automobile traffic traveling through or to a place. A road’s performance for transit or pedestrians is not a defining feature. Furthermore, by placing access and mobility in opposition, the functional classification system suggests a zero-sum game. Facilities that are best at accommodating through-traffic are necessarily those that cut off access to adjacent property. In this way, major urban streets are implicitly seen as functionally inferior to rural roads that are better able to control access.

Performance measures for automobiles

Despite the dual role of through-put and access, the HCM defines performance solely in terms of a street’s ability to carry through-traffic. In general, access is considered a necessary evil that should be minimized, as appropriate, to increase automobile

capacity. This desire is best seen in the development of Level of Service (LOS), a deceptively simple measure for evaluating a street's automobile performance, which the HCM adopted in its 1965 edition.

Prior to the adoption of LOS, the HCM relies on a broad set of automobile performance measures. In one category, physical conditions, streets are measured with respect to capacity – their ability to carry traffic (measured as vehicles per unit space per unit time). Starting in 1950 and continuing in its most recent volumes, the HCM details methods for measuring capacity for various kinds of streets and intersections. For example, the HCM indicates that on urban arterials, capacity is a function of intersection capacity and the width of the roadway. In a second category, “prevailing conditions,” streets are measured with respect to actual traffic volume, using various relevant metrics, including: average annual daily volume (AADV), peak hour volume, running speed (how fast cars travel while moving), average speed (how fast cars travel including stopping time), and overall travel time. Finally, these categories are combined in a volume-to-capacity ratio (v/c ratio), which compares a road's actual traffic volumes to its estimated capacity, thereby measuring the degree to which available capacity is being used.

In 1965 the HCM does not dispense with these measures, but uses LOS to describe them in a single measure. The LOS values take the abstract form of letters, ranging from “A,” the highest, to “F.” According to the HCM, “Level of service is a qualitative

measure of the effect of a number of factors, which include speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs” (Highway Research Board, 1965, p 7). Despite this inclusivity, the HCM says that on roads with intersections interrupting flow, LOS is principally determined by two key variables: speed and v/c ratio. “The operating speed provides an indication of the overall performance on a roadway,” the HCM explains, while “volume to capacity ratios provide some indication of the densities and freedom to maneuver” (Highway Research Board, 1965, p 79).

The appeal of LOS lies in part in its universality and simplicity. During this period, researchers argued that the single LOS measure was necessary to create a consistent system for comparing facilities both within and across geographies (Hall & George, 1959). In addition, the HCM recommends using LOS to evaluate alternatives for a single project. Even in 1965, however, the HCM questions whether an LOS can be practically measured on downtown streets in urban areas, yet still asserts that at least a rudimentary minimum LOS is useful for evaluating existing traffic flow (Highway Research Board, 1965, p 333).

Implications for the arterial street

By embracing LOS as a principle tool for design and engineering, AASHO and the HCM prioritize automobile performance measures. Both speed and capacity are used to guide design and engineering decisions. According to the HCM, engineers

can use a desired LOS and an estimated traffic volume to identify the necessary capacity (Highway Research Board, 1965). For each functional class, AASHO recommends specific speeds and capacities necessary to achieve specific LOS values.

Beyond using these measures as tools, however, AASHO and the HCM explicitly recommend maximizing automobile performance through design. According to the 1973 Green Book, “the highway agency should strive to provide the highest level of service feasible” (AASHO, 1973, p 306). For urban arterials, the HCM and AASHO suggest that an appropriate LOS is “C,” since urban streets with intersections and closely spaced traffic cannot achieve the fast speeds of arterials unencumbered by the frequent intersections found in cities (Highway Research Board, 1965). Urban arterials approach capacity at “D” and are considered failing at levels “E” and “F.”

The focus on these criteria appears to be a response to assumptions about automobile drivers and their tolerance for certain road conditions. According to the HCM and AASHO, drivers will not accept traffic congestion, slow speeds or delays. In the 1973 Green Book, for example, AASHO asserts that from the user’s point of view, “the most significant indication of the degree of congestion is travel speed.” On facilities with intersections, however, “the highway user is not so much concerned with attaining a high travel speed as he is in avoiding lengthy stops” (AASHO, 1973, p 291). While a driver will accept some congestion, AASHO asserts, “he will never accept without protest the type of operation that

occurs when the volume of traffic approaches the capacity of the facility” (AASHO, 1973, p 294).

To achieve an acceptable LOS, AASHO and the HCM provide numerous design recommendations to increase travel speeds and street capacity. Both guides during this period recommend converting streets from two-way to one-way. According to AASHO, “one-way streets generally have higher overall speeds, higher capacity, and fewer accidents than two-way streets” (AASHO, 1957, p 33). In addition, the guides promote progressive signaling, which entails coordinating traffic signals so that a driver traveling at a prescribed speed will not encounter a stop signal. Later, the guides explain that while progressive signals do not actually increase capacity, despite earlier claims, they can increase average travel speed by eliminating stops (Highway Research Board, 1965, p 324). The HCM and AASHO recommend a 12-foot minimum width for vehicle lanes. According to the HCM, lane width limits capacity by slowing automobiles down. The wider the lane, the more freely a car can travel. Finally, the HCM (1965) also notes that parking limits capacity, not only by taking up road space but by limiting ‘lateral clearance,’ the space extending from the side of the roadway. Objects along the side of the road, including parking, slow travel speeds. As a result, AASHO (1957) recommends the removal of curbside parking. Where absolutely necessary, AASHO explains, parking should only be parallel, since head-on parking creates a greater disruption to traffic flow.

By relying so heavily on LOS to guide decisions, this design approach displays an almost exclusive concern with automobile performance interests. According to this approach, the process for determining optimal road capacity relies on only two variables. Specifically, the 1950 guide recommends that agencies weigh the cost of construction against the projected benefits to drivers (the financial value of time saved). Almost 25 years later, in 1973, AASHO says much the same thing. “The matter of deciding upon the degree of congestion that should be used as a goal in planning and designing highway improvements is resolved by weighing the desires of motorists against the resources available for satisfying those desires” (p 294). These balances are problematic because they confine the performance of streets to automobile-related concerns. On the cost/resources side, there is no consideration of long-term maintenance costs or automobile-related externalities. On the benefits/desires side, there is no consideration of the potential gains (or losses) to non-automobile users.

Performance for Pedestrians and Transit

Despite their reliance on LOS, HCM and the Green Book do not ignore other performance concerns. Although biking facilities are not mentioned anywhere in any of the AASHO or HCM documents analyzed between 1950 and 1975, the major

guidance materials offer recommendations for both pedestrian and transit facilities. These recommendations, however, tend to prioritize automobile travel over performance for walkers and transit riders. In general, pedestrians and transit riders are often viewed as hindrances to improved traffic operations. The 1965 HCM, for example, lists a set of “problem elements” responsible for damaging LOS on urban arterials and urban streets, which includes “pedestrian interferences” and “transit operations.” The guidance tends to deal with these “problems” in two ways. First, in many cases the Green Book and the HCM implicitly or explicitly favor the automobile. In other cases, the guides propose a balance aimed at “efficiency,” which fundamentally ignores many of the goals inherent in pedestrian or transit infrastructure.

Implications for pedestrians

The guidance suggests that the design of pedestrian infrastructure should be shaped by its potential impact on automobile traffic. Between 1957 and 1973, the AASHO guidance on pedestrian infrastructure remains virtually unchanged. Overall, AASHO’s approach to pedestrian infrastructure is aimed at separating pedestrians and automobiles as much as possible. “Since it is rarely feasible on major streets to eliminate pedestrian movements or provide separation structures for them, the pedestrian handling problem is one of control for maximum freedom and safety” (AASHO, 1950). Despite this assertion, it is clear that AASHO means freedom for automobiles, not pedestrians.

In both editions, AASHO implies that the benefits to pedestrians are to be weighed against the benefits to automobiles. In some cases, AASHO settles such calculations by explicitly ruling in the car's favor. The recommended placement of pedestrian cross-walks provides a clear example. In 1957 and 1973, AASHO repeats the same basic principle: "At grade pedestrian crossings should be located where the least amount of conflict results between pedestrians and vehicles" (AASHO, 1957, p 181, 1973, p 421). While such a recommendation is arguably meant to keep pedestrians safe, AASHO reveals that its primary goal is to protect traffic flow. Pedestrians alone are not justification enough to stop traffic. Mid-block pedestrian crossings, for example, are entirely disregarded. The 1957 guide even goes so far as to propose a future of major urban streets with no pedestrians-automobile conflicts at all. The guide offers a tantalizing glimpse of "future possibilities" of "elevated sidewalks along the faces of buildings ... and elimination of normal pedestrian movements from the surface" (AASHO, 1957, p 231). AASHO's point is clear. For the safety of the driver and of the pedestrian, the roadway is not an appropriate place for the pedestrian.

The more pragmatic recommendations for pedestrian infrastructure are consistent in the AASHO literature between 1957 and 1973, and further demonstrate a bias toward automobile performance. For example:

In and near downtown districts, pedestrian-vehicular conflicts at intersections may be so great as

to seriously impede arterial traffic. Attention should be given to all possibilities to increase efficiency in traffic operation such as conversion from two-way to one-way street operation, elimination of turns, separate signal phases for pedestrians and elimination of some cross walks (AASHO, 1957, p 181).

On the one hand, these recommendations are not all bad for pedestrians. Separate phases for pedestrians, during which no cars move, are arguably safest for pedestrians crossing streets. On the other hand, such recommendations offer potential declines in pedestrian safety and convenience, for the sake of improving automobile performance. For example, the conversion of two-way streets to one-way, as described above, is recommended to increase automobile speeds. AASHO makes no recognition, however, of the potential risks that higher speeds pose to pedestrians. Several of AASHO's other design standards for arterials, such as a 12-foot-minimum lane width, were also meant in part to ensure faster movement.

Another of these recommendations, the proposed elimination of some cross-walks, also poses a potential safety risk for pedestrians and more clearly demonstrates AASHO's willingness to let pedestrian performance suffer for the sake of automobile performance. As demonstrated in the 1957 and 1974 guides, the elimination of a single crosswalk increases walking distance threefold. Recognizing that pedestrians would resist

the elimination of a sanctioned crosswalk, AASHO asserts that newly illegal “crossings should be prevented by physical barriers” (AASHO, 1973, p 423).

In 1973 AASHO places a stronger emphasis on grade-separations for pedestrian crossings, including pedestrian subways (underpasses) and overpasses. Such facilities, the 1973 guide explains, “may be warranted where there are heavy peak pedestrian movements, such as central business districts, ... in combination with moderate to heavy vehicular traffic” (AASHO, 1973, p 231). Even in 1957 AASHO saw problems with these facilities, noting that some pedestrian underpasses had been closed because they were difficult to police. In 1973, AASHO admits that pedestrians will not use a grade-separated facility “unless it is obvious to the pedestrian that it is easier to use” than attempting to cross the street at grade (AASHO, 1973, p 425). Rather than question the logic behind asking only pedestrians to climb a ramp or a set of stairs to cross the street, the guides offer a long set of tips for making these facilities more attractive to the hesitant pedestrian.

Overall, these various recommendations suggest that AASHO’s design guidelines were willing to sacrifice pedestrian convenience in order to increase automobile capacity and speed.

Implications for transit

As with pedestrian infrastructure, the guidance from this period suggests that decisions on transit infrastructure should largely be based on their impact on automobile traffic. Although

AASHO provides few recommendations for transit infrastructure, it does provide recommendations for the location of transit stops. In looking at stops, AASHO’s 1957 recommendations display a strong bias against streetcars, which at the time were well in decline in most American cities or already replaced by buses (McShane, 1994). AASHO complains that when streetcars operate in automobile lanes, “the full efficiency of the lanes cannot be maintained. A bus or streetcar stopping for passenger loading not only blocks traffic in that lane but hinders operation in all lanes” (AASHO, 1957, p 233). Despite its nod to the streetcar, AASHO’s recommendations are aimed entirely at the bus. To solve the problem of transit-automobile conflicts, AASHO recommends that all bus stops be clear of traffic by placing them at the curb. While a curb-side bus stop might benefit automobile drivers, AASHO does not recognize the potential negative impact on bus-riders. A trip to the curb requires that buses re-enter traffic, a potential source of delay.

While bus stop locations may prioritize automobile performance over bus performance, the recommendation to convert roads to one-way poses another, more subtle problem for bus service. As streets undergo these conversions, bus routes that travel in two directions along a single arterial become separated across two one-way arterials. As Jane Jacobs noted, bus companies in NYC saw a decline in patronage after avenues were converted from two-way to one-way. One potential explanation is that bus routes on one-way streets are less easily identifiable, particularly by

infrequent users, and face greater interference with higher volumes and faster moving traffic (J. Jacobs, 1992).

Overall, AASHO plays little attention to bus routes, but does offer some consideration of exclusive bus lanes. In 1973, in a section on “reserved bus lanes,” AASHO explains that exclusive bus lanes can offer “some improvement in transit service,” but the success of such a regulatory measure is rather limited in most instances” (AASHO, 1973, p 666). Earlier, in 1965, the HCM displays similar skepticism, suggesting that exclusive bus lanes would offer little benefit to operations and traffic flow (Highway Research Board, 1965, p 345). According to AASHO (1973), the problem is that vehicles making right-turns must occupy and share the right-most lane. The 1973 guide offers only one solution, contra-flow bus lanes, in which buses run in the opposite direction of one-way automobile traffic. The guide fails to offer any alternative design possibilities, like placing exclusive bus lanes in the center of the street or using separate signal phases for buses and cars (which could solve the right-turn problem).

While AASHO’s recommendations favored automobiles over bus performance and remained skeptical of possibilities to improve bus performance, the guidance from this period also defines transit solely as a source of potential efficiency. In 1957, AASHO commends public transportation: “Efficient and rapid forms of public transit can do much toward relieving congestion and increasing capacities of old and new highways in terms of passengers carried” (AASHO, 1957, p 15). AASHO makes no

mention of any other role for transit, such as providing mobility for those who do not own a car. Furthermore, the HCM suggests that bus transit makes sense, so long as it mitigates congestion and increases overall capacity of a street (Highway Research Board, 1965, p 338).

The guidance relies on transit’s impact on efficiency to determine planning decisions. In 1973, AASHO explains that exclusive bus lanes “may be justified for relatively few buses,” since “the carrying capacity of a bus is many times that of a passenger car” (AASHO, 1973, p 667). While subtle, this example points to the constant balancing act AASHO aims to achieve. The decision to incorporate transit is only justified when the increase in bus passengers is enough to merit the potential decline in automobile capacity. This balance-for-efficiency approach ignores many additional benefits to the transit system.

Performance for Safety

Controlling pedestrians

In the earliest AASHO guides, the issue of safety appears frequently with respect to pedestrian collisions. According to the standards and research reports from the Eno Foundation, pedestrians were considered the primary cause of automobile accidents. To address the issue, pedestrian safety campaigns generally focused on the three E’s: engineering, education, and enforcement (Lee, 1952).

According to this approach, engineering could make pedestrian movements safer, while educational programs and policing could ensure compliance with traffic safety laws. While it was up to local governments to initiate “education” and “enforcement” programs, the design standards addressed “engineering.” As described above, pedestrian-design recommendations sought safety through “control,” by attempting to segregate pedestrian movements and limit interactions between pedestrians and automobiles.

Despite decades of repeating the message of “control,” AASHO persistently complains about pedestrians’ disregard for traffic safety laws. The 1973 guide asserts, “One of the major problems of pedestrian control is to overcome the apathy of pedestrians, as individuals, to the problems of pedestrians as a group. Continuing education and good enforcement is necessary to change personal habits and attitudes toward traffic safety” (AASHO, 1973, p 425). In AASHO’s view, pedestrians are most threatened by themselves – by their individual and collective inability to follow traffic regulations. As a consequence, the design recommendations during this period make little attempt to alter automobile behavior to mitigate potential risks to pedestrians.

Passive safety for automobiles

In the 1960s, safety performance gained greater prominence in design decision-making. Under a new, “passive” approach to safety, policy-makers accepted the risky nature of driving, but

sought to accommodate it as safely as possible through the design of vehicles and streets.

In the mid-60s, consumer advocate Ralph Nader and civic leaders like Senator Daniel Patrick Moynihan led a campaign to improve highway safety through design (Dumbaugh, 2005). Nader’s highly influential *Unsafe at Any Speed* (1965) described the poor safety record of the American automobile industry, including what Nader called the “designed-in dangers” on streets and highways. The highway safety campaign had roots in the research of William Haddon, at the Harvard School of Public Health, who argued in the 1950s that it was virtually impossible to prevent drivers from engaging in unsafe behavior. As a result, Haddon proposed the “passive” approach to safety, in which street design should not rely on changing driver behavior, but should instead focus on creating streets that would ensure a “crash without an injury” (Gladwell, 2001 in Dumbaugh, 2005).

The consequences of the highway safety campaign came in the form of new laws and revised design standards. New federal legislation included the National Transportation Safety Act (1965), the National Highway Safety Act (1966), and the creation of the National Highway Traffic Safety Administration (1970). New design standards included AASHO’s (1967) “Highway design and operational practices related to highway safety,” which was updated in 1974 and renamed the Roadside Design Guide (2002) in subsequent editions.

The new standards embraced a design philosophy that accepted driver error and attempted to mitigate the worst possible crash scenario. AASHO's 1974 roadside guide explains, "Highways built with high design standards put the traveler in an environment which is fundamentally safer because it is more likely to compensate for the driving errors he will eventually make" (AASHTO, 1974, p. 15 in Dumbaugh, 2005). For example, AASHO recognized that single-vehicle, run-off-roadway crashes were the source of a high number of fatalities (Dumbaugh, 2005). To address this problem, AASHO adopted the findings of Kenneth Stonex at General Motors, who had designed the "Proving Ground," a supposedly "crash proof" highway developed by the company. Stonex argued that "What we must do is to operate the 90% or more of our surface streets just as we do our freeways . . . [converting] the surface highway and street network to freeway and Proving Ground road and roadside conditions" (Dumbaugh, 2005, p. 147 in Weingroff & Seabron, 2003). Stonex had found that most vehicles came to a stop within 30 feet of a roadway. As a result, in 1967, AASHO adopted a 30-foot "clear zone" standard, which dictated that no fixed objects should be placed within 30 feet of a street (Shaw & Ben-Joseph, 2007).

While the move toward passive safety requirements is perhaps laudable for improving conditions for drivers, it is notable for its exclusion of other street users. For example, by requiring the removal of 'hazards' from the side of the road, clear-zone requirements actually make pedestrians less safe. As detailed in Chapter 5, some researchers argue that features like street trees and

curb parking make pedestrians safer by offering a protective buffer from moving automobiles. Without this protection, pedestrians become more vulnerable to an automobile collision (Dumbaugh, 2005).

Adoption on the Local Level

The performance concerns described above, particularly the overwhelming concern for improving automobile performance, are well demonstrated on the local level. Both Portland, OR, and NYC provide useful case studies. Both cities adopted a strategy of imposing "arteriality" on their grid-iron street patterns to increase automobile capacity on major streets.

The economic imperative

Civic groups and government officials in both NYC and Portland, OR, saw traffic as an economic problem. As early as 1927, officials in Portland viewed their existing street system as an impediment to economic growth. In a report that year, the City Planning Commission estimated that the city was losing \$35,000 per day due traffic congestion. The solution, the Commission argued, was a new road system. "If the business of a city is to be economically conducted, there must be arteries connecting the principal sections which will at all times permit travel at fairly high

speed. The design of major streets of the city is one of the most important features affecting its prosperity” (Portland (Or.), 1927, p. 7).

In the 1940s, civic groups and public officials in NYC came to similar conclusions. In 1948, the Midtown Association (1948), a Manhattan business group, complained that “congestion is costing cities untold millions of dollars, accelerating the decentralization of commerce, and driving trade outside of the urban centers” (p. 5). In 1949, Mayor William O’Dwyer set out to address the problem by establishing the city’s first Traffic Commission and the Department of Traffic Engineering. The department was to be a “full-time agency charged with the duty of solving traffic problems and staffed with especially experts” (Mayor O’Dwyer, 1949). The Commission, which oversaw the department, was to recommend to the Mayor a comprehensive City traffic plan.

Robert Moses and the streets of NYC

As these new institutions were being formed, NYC began to aggressively promote design changes on urban arterials, which were aimed at increasing automobile performance. Many of these changes are expressed in the plans of Robert Moses, who wielded a great deal of influence over the city’s transportation plans. In addition to serving as the head of the Tri-Borough Bridge and Tunnel Authority (TBTA) and the city Construction Coordinator, Moses was given a position on the board of the Department of Traffic. Recognizing that NYC’s street grid lacked the kind of arteriability promoted by AASHO and others, Moses proposed adding new facilities and converting existing streets. Moses’s campaign to add expressways in the city is well documented by Robert Caro (1975) winner of both the Pulitzer and the Francis Parkman prizes, *The Power Broker* tells the hidden story behind the shaping (and mis-shaping) and others. Some of these projects, like the Cross-Manhattan Expressway along 30th Street, proposed replacing local streets altogether with elevated expressways.

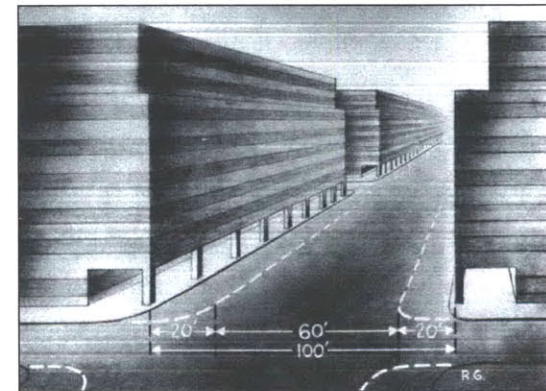
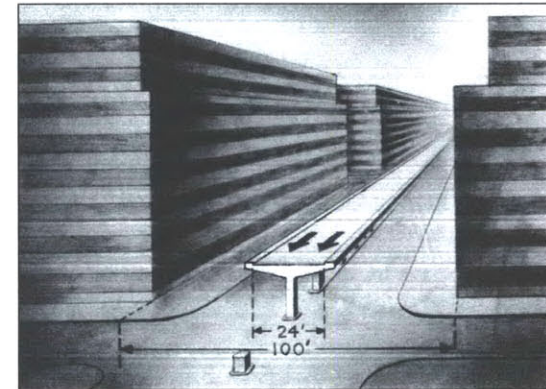


Figure 4-1. 1945 Street Recommendations.

In a 1945 article in the NY Times Sunday Magazine, Robert Moses proposed improving traffic flow on streets in Midtown Manhattan. Proposals included placing sidewalks inside buildings (left) and adding elevated structures along major cross-town streets (right). Source: NY Times Magazine.

Moses's proposals for small-scale changes to existing streets, however, are less documented. In a 1945 article in the *NY Times*, Moses provides engineering strategies to solve the "Midtown Manhattan traffic problem," including widening streets, synchronizing traffic lights, and adding a small, elevated roadway above major streets. To widen roadways where buildings are too valuable to be torn down, Moses recommends "arcades within the buildings which would throw present sidewalks into the vehicular roadways, and thus give two additional lanes" (Moses, 1945, p. 2). In Moses's view, all aspects of urban form, including sidewalks and buildings, must yield to the automobile. In fact, Moses goes so far as to recommend roadways through buildings themselves, a proposal he admits had few backers.

NYC implemented many of Moses's basic concepts by attempting to impose arteriability on its street system. While the TBTA built new expressways, like the South Bronx and Brooklyn-Queens expressways, the city's Department of Traffic (and several other local agencies) made changes to many existing streets. In 1949, the Department of Traffic issued its first major report, which detailed its strategy. While much attention was paid to the issue of parking, the department's plans for existing streets focused on increasing capacity and rationalizing movement. The plans included progressive signalization on major avenues, converting streets from two-way to one-way, restrictions on turning movements, new controls on curb parking and the introduction of parking meters,

and the expanded installation of road signs and pavement markings (NYC Traffic Commission, 1949).

A useful example can be seen on Ninth Avenue in Manhattan. (See Figure 4-2). In 1940, the city removed the avenue's elevated railway and, shortly thereafter, the streetcar tracks that had lain beneath it. In 1949, the city converted the avenue from two-way to one-way. In addition, the city implemented "progressive signaling," the coordination of traffic signals to lower travel time by minimizing the need to stop at red lights (Moses, 1945). Around this time, the city also painted lane markers, explicitly marking the roadway as the domain of automobiles. Sometime later, the city changed the boundaries between pedestrians and automobiles by narrowing the sidewalks to provide more space for traffic (Figure 4-2E).

The impacts of these design choices on pedestrians were apparent to city officials even in the early 1950s. In a report in 1952, the Commissioner of Traffic, T.T. Wiley, suggested that changes to Manhattan's avenues were making pedestrians feel unsafe. According to him, pedestrians complained that one-way operation and progressive signaling had turned avenues into "speedways" (Wiley, 1952). Wiley explains:

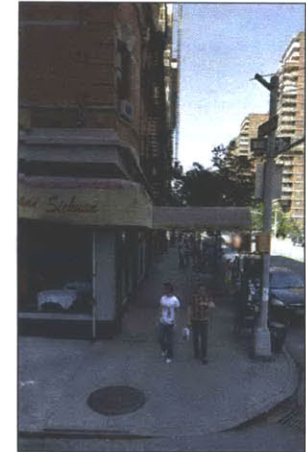
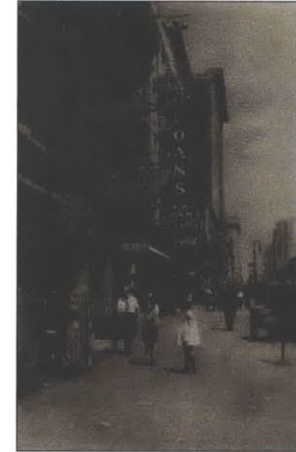
Under progressive timing, if [pedestrians] start across too late, they see a platoon of vehicles moving down upon them and therefore are under the impression that their green period is too short. It will require some time and wide-spread use of progressive signal timing on short cycles before



A. 1905. Horse-drawn streetcars and carriages travel beneath the early elevated railway. Source: NYPL Digital Collection.



B. 1940. Automobiles, the elevated railway and pedestrians all share street space. Source: NYPL Digital Collection.



E. Sidewalk Narrowing at 9th Avenue & 24th Street. Between 1941 (left) and 2012 (right), the city drastically reduced the width of the sidewalk on 9th Avenue. Source: NYPL Digital Collection (left), Google Earth (right).



C. c1941. The elevated railway is torn down, but wide sidewalks remain. Automobile traffic runs in two-directions. Source: NYPL Digital Collection.



D. 2007. Following changes in 1949 and thereafter, 9th Avenue is converted to one-way and sidewalks are narrowed. Source: NYC DOT.

Figure 4-2. Development of Ninth Avenue.

New York pedestrians learn how to walk safely with respect to signal indications. (Wiley, 1952, p. 23)

Wiley's comments reveal the altered power dynamic on city streets. "Platoons" of vehicles now control the center of the roadway. If pedestrians wish to be safe, they must get out of the way.

Promoting highways in Portland

Like NYC, Robert Moses also influenced transportation planning in Portland. In 1943, Moses produced the "Portland Improvement" report, which recommended investments in bridges across the Multnomah River (which bisects the city between its eastern and western halves) and upgrading state highways in the city with grade-separated interchanges (Moses, 1943).

While Moses's plan was considered influential, in the 1950s Portland adopted a more comprehensive plan that aggressively pursued a reduction in automobile congestion. In 1955, the Oregon State Highway Commission released a plan for a "Freeway and Expressway System" for the Portland Metropolitan area. The plan utilized traffic data to estimate future traffic demands; streets were to be designed to accommodate travel patterns in the year 1975. The report complains that Portland's existing streets had become "inadequate to accommodate not only future loads but present peak demands" (OSHC, 1955, p. 24). The plan's solution is a hierarchical network based on three types of roads in AASHO's 1954 guide: expressways, freeways and major streets.

While expressways and freeways were largely new investments, major streets were largely existing ones. The plan promotes converting these roads to AASHO specifications for major streets. (Under AASHTO's current framework, these streets would generally be classified as "arterials.") The plan dictates that all major streets must have four lanes of vehicle traffic and prohibits parking if it prevents achieving this minimum width. The plan also promotes strategies for increasing capacity. For example, the plan recommends utilizing a parallel street to convert major, two-way streets into a pair of one-way roads billed as a "one-way couplet" (OSHC, 1955, p. 25). The plan also offers speed specifications to increase capacity and satisfy the driver, and appears to indicate that major streets should have the same speed rules as expressways and freeways. According to the report, "Optimum capacity occurs when the speed range is 35 to 40 miles per hour: therefore, this speed range was selected for computing capacities on urban, multi-lane facilities. Speed studies have demonstrated that motorists in urban areas generally prefer that range" (OSHC, 1955, p. 18).

Plans for Portland's Burnside Street provide a useful example of the city's attempt to improve automobile performance through design. Burnside is an urban arterial that runs through the center of the city and serves as the central dividing line between its north and south sides. On the east side of the city, the 1955 plan proposed widening the street and prohibiting parking to create four-lane capacity along its entire length. In the 1960s, the city continued with this overall approach. On the west side of the city, including

the central business district, the city's Bureau of Traffic Engineering adopted a plan (which was never completed) to convert Burnside into a one-way couplet in order to meet traffic demand in the year 1980 (Portland (OR), 1966).

Portland's transportation planning indicated that automobile performance was its primary design concern. The needs of other street users are disregarded. The city did, however, address the issue of pedestrian safety, but its strategy hewed to the concepts of pedestrian control and acquiescence to automobile movement. In 1952, for example, Portland Mayor Dorothy McCullough Lee delivered a report to *Traffic Quarterly* describing the city's success in increasing pedestrian safety. According to Lee, pedestrians were responsible for both the safety problem and its solution. Portland saw two facts in its traffic data: "the majority of those killed in traffic accidents were pedestrians" and "in a majority of cases, the pedestrian was at fault" (Lee, 1952, p. 284). The solution was a "balanced program of Education, Enforcement and Engineering" (Lee, 1952 p. 293). The city created a traffic safety school for pedestrians and aggressively promoted safety rules in print and radio.

Engineering strategies included the widespread installation of "walk-wait" signals that controlled pedestrian crossings and painted cross walks. Interestingly, the city took a nuanced stance on cross-walk markings. According to Lee, traffic officials rejected a wide-spread program of cross-walk marking, fearing that motorists would forget that they needed to yield to pedestrians even when

cross-walks were not marked. As a result, the city only painted cross-walks at "complicated intersections" and high-volume crossings necessitating "control of movement" (Lee, 1952, p. 291). According to Lee, cross-walks could actually worsen safety. "The pedestrian is inclined to place too much confidence in the painted markings," Lee explains, "whereas the motorist inclined to ignore them" (pp. 291-2). The rationale behind cross-walk marking indicates that while the city's overall safety program was primarily aimed at controlling pedestrian movement, the program was aimed in part at keeping motorists alert to the risk of hitting pedestrians.

Prioritizing automobiles

The examples from New York City and Portland demonstrate that local agencies took steps to improve automobile performance on urban arterials. This emphasis on automobiles does not indicate a lack of concern about other modes. Indeed, the remarks by Commissioner Wiley on pedestrian safety show a real concern for walkers on NYC streets. The strategies these cities employed, however, such as narrowing sidewalks, placing buses at the curb, and increasing speeds on one-way streets, all arguably resulted in performance declines for non-drivers. These choices indicate, thus, that agencies had narrower definitions of street performance focused on efficiency in movement and generally prioritized the automobile over other modes.

Chapter 5. Broadening and Balancing Performance for Urban Arterials

Introduction

In the mid-20th Century, the national and local policies emphasizing the automobile were not the only perspective on street design and performance. During the 1960s, for example, writers like Jane Jacobs (1961) and Bernard Rudofsky (1969) celebrated the street not as an automobile thoroughfare, but as a primary setting of urban activity and residential life.

In the final decades the 20th Century, urban theorists and designers offered alternative design paradigms for city streets aimed at serving a broad set of users and goals. During this period, Donald Appleyard (1983), echoing Jane Jacobs, popularized the concept of “livable streets” that mitigate the automobile’s impact on residential living. Allan Jacobs (1993), like Rudofsky, celebrated the aesthetic values of urban streets and their ability to sustain active street life. An increased attention to ecological systems, promoted by writers like Anne Whiston Spirn (1984), offers an intellectual foundation of so-called “Green Streets” strategies that mitigate the impact of urban streets on the environment. Finally, the Congress for New Urbanism promotes the concept of “Complete Streets” that can accommodate not only automobiles, but pedestrians, cyclists, and transit riders.

Over the past twenty years, policy-makers have largely adopted these paradigms, providing new strategies, guidelines and processes that no longer so heavily prioritize the automobile in

arterial design. Both AASHTO and ITE, for example, offer design guidelines that better incorporate pedestrian, bicycle and transit infrastructure than earlier guidelines. Meanwhile, federal and local agencies have formally adopted context-sensitive design, a design process that introduces flexibility in arterial design and gives equal weight to the performance objectives of all stakeholders. Finally, agencies have also adopted performance-based planning processes that explicitly articulate a broad set of performance goals, including multi-modal transportation, residential livability, environmental sustainability, place-making and sensitivity to community concerns.

The rise of performance-based planning, however, has created new challenges for agencies seeking to measure results. Goals like livability have proven difficult to define and measure. While theorists like Appleyard (1983) and Kevin Lynch (1981) resist relying heavily on quantitative analysis, transportation researchers, like Ewing (1995) and Cervero (1996), offer new quantitative measures for new goals. Most notably, researchers shift planning's focus away from the automobile Level of Service (LOS), which measures pieces of infrastructure, toward concepts like livability, sustainability and accessibility, which consider the people and places transportation systems are meant to serve.

In local practice, the most recent result of these changes in theory and policy are a broader set of performance goals for urban arterials. In Portland and New York City (NYC), city transportation agencies have introduced design guidelines and projects that demonstrate a re-thinking of the role of the urban arterial. While

these projects promote non-motorized transportation as well as other non-transportation goals, they have also paid attention to maintaining or improving automobile performance. In this way, these agencies demonstrate a balancing of multiple performance objectives.

Alternative Conceptions of Street Performance

Through a series of writings on city form and street design, many urban theorists and designers have largely rejected the automobile prioritization embedded in the policies of the 1950s and 60s. The result is a series of design paradigms focused on key ideas including livability, the street as urban place, environmental sustainability and social justice.

Design for livability

During the late the 1950s and 1960s, several writers and key policy-makers began promoting the idea of protecting streets as the primary space of urban, residential life. In attempting to create more “livable” streets, these writers emphasized and explored performance characteristics for pedestrians and nearby residents.

In the book *Death and Life of Great American Cities*, Jane Jacobs (1961) argues that anti-congestion measures, like street widening and one-way conversions, were causing the “erosion of cities” (Jacobs,

1961, p. 349). Rejecting these strategies, Jacobs describes streets as a city's "most vital organs" (p. 29) and embraces a broad conception of the role of the street and the sidewalk. "Streets in cities serve many purposes besides carrying vehicles, and city sidewalks – the pedestrian parts of the streets – serve many purposes besides carrying pedestrians" (p. 29). For Jacobs, well-designed sidewalks promote safety, support social contact among neighbors and offer a space for children to first encounter the world.

To facilitate these roles, Jacobs calls for a re-prioritizing of pedestrian performance concerns in design decision-making. While some of Jacobs' design ideas are unrelated to street design *per se*, like mixed land use and higher densities, other proposals relate to the street's physical profile. For example, Jacobs argues that narrow setbacks for buildings and street-level windows can provide beneficial "eyes on the street" and that building stoops offer informal social spaces. Looking at the roadway, Jacobs argues that cities give too much space to automobiles. On residential streets Jacobs suggests an optimal sidewalk width of "thirty or thirty-five feet," but complains that sidewalks are "invariably sacrificed for vehicular width." The problem is that cities fail to recognize sidewalks "as the uniquely vital and irreplaceable organs of city safety, public life and child rearing that they are" (Jacobs, 1961, p. 87).

In 1963, Colin Buchanan, an official in the UK, further promoted street design specifically to improve space for pedestrians and local residents. Leading a special Steering Group for the UK Ministry of Transport, Buchanan authored the influential report

Traffic In Towns. Unlike Jacobs, Buchanan offers design proposals to alter the network of city streets. The center of Buchanan's proposal is the concept of the "environmental area," a kind of "urban room" that is to be protected from automobile through-traffic. Under the scheme, higher-volume "distributor" streets would line each environmental area and link them together in a network, while lower-volume "access" streets would serve the interior of the environmental area. The defining feature of the access street is its limited connectivity to the distributor network, which Buchanan proposed would limit traffic to local residents and business and thereby eliminate through-traffic.

Buchanan's proposal bears some resemblance to Clarence Perry's 1929 proposal for neighborhood units, which would carry through-traffic on the periphery, and later concepts of the superblock, promoted by Henry Wright and Clarence Stein in projects like Sunnyside Gardens, NY, and Radburn, NJ, (Appleyard, Gerson, & Lintell, 1981). In fact, Buchanan commends the "Radburn layout" and suggests that its record will be more successful in the U.K. than in the U.S. While there are important differences among these approaches, they all share a desire to mitigate the automobile's impact on pedestrian space. Buchanan argues that on access streets, the pedestrian must have "a large degree of freedom, including the freedom to cross the road whenever and wherever he pleases" (Minister of Transport. Steering Group, 1963, p. 203).

Buchanan is unique, however, in explicitly detailing a new set of performance concerns for design. According to Buchanan,

planners should accommodate automobile movement without sacrificing a “satisfactory standard of environment” (Buchanan, p. 40, in Appleyard, 1981). Buchanan asserts that every street has an “environmental capacity,” some acceptable volume of traffic that reflects its users and physical context. Although Buchanan defines environmental capacity primarily for residential streets, he asserts that non-residential streets should follow similar principles. According to his framework, the environmental capacity of a street is determined by three key aspects: (i) the vulnerability of pedestrians (i.e. the percentage of children and elderly), (ii) physical conditions (i.e. how well the street can protect pedestrians), and (iii) levels of pedestrian activity. By addressing pedestrian safety, Buchanan argues that design can simultaneously address the impact of traffic noise and fumes. According to the framework, streets with high numbers of walkers, high rates of vulnerable users, and poor physical conditions should accommodate fewer vehicles. Through the concept of environmental capacity, thus, Buchanan uses pedestrian safety and comfort to guide street design.

Donald Appleyard’s *Livable Streets* (1981) embraces Buchanan’s core argument that high automobile traffic is bad for pedestrians and residents. Appleyard uses real world cases to document the negative impact of the automobile and to identify principles for creating more “livable” streets. Appleyard avoids giving a narrow definition of “livable.” Instead, like Jacobs and Buchanan, Appleyard argues that streets play many different roles. He explains

that only residents can determine whether they are satisfied with degree to which their street successfully performs them.

To gauge residents’ perception of their street, Appleyard not only introduces unorthodox performance concerns, but also attempts to uncover the performance concerns that matter most to residents. Through a broad mix of strategies, including surveys, interviews and drawings, Appleyard explores residents’ image of their street, their levels of satisfaction and fear, and their most critical needs for street design and maintenance. The residents’ views largely confirm Appleyard’s hypotheses. Appleyard finds that residents ignore automobile access as the most pressing need on the street. Furthermore, residents cite automobile traffic as their streets’ most bothersome aspect. Where traffic volumes are higher, residents express lower satisfaction and higher levels of fear.

Appleyard argues that these findings undermine the importance placed on automobile traffic in design decision-making. Focusing primarily on residential streets, Appleyard argues that design should promote safety, limit the impacts of vehicle noise and fumes, offer spaces for community gathering and play, support plant life, and reflect local history. To these ends, Appleyard embraces the “protected neighborhood,” a concept based on Buchanan’s proposals, and the *woonerf*, a Dutch design in which pedestrians and automobiles share the entire roadway. More specific policy recommendations for residential streets include lowering vehicular speeds to 15 mph and limiting traffic volume to 2,000 vehicles per hour. Despite his focus on the residential street, Appleyard’s

argument has implications for residential and semi-residential arterials, by asserting that the quality of life for residents, however it is defined, should guide design decision making. Indeed, many of his concepts have been formalized in “traffic-calming” practices, various design strategies aimed at slowing automobile speeds. On arterial streets, ITE (2006) suggests features like curb extensions and narrower lanes to slow automobile traffic.

Design for place

In explaining the diverse natures of city streets, both Appleyard and Jane Jacobs identify the street’s role not just as a transportation thoroughfare, but as a place – a destination for city residents. These writers, along with several others, explain this role in both aesthetic and functional terms. Jacobs, for example, argues that “a lively street always has both its users and pure watchers” (J. Jacobs, 1961, p. 37).

The concept of street-as-place is perhaps best documented by Rudofsky’s (1969) *Streets for People*. While Appleyard focuses heavily on the automobile problem and Jacobs on the need for diversity of uses, Rudofsky focuses heavily on architecture’s role in street design. Rudofsky describes American streets as ugly, repetitive, dirty, and unsafe – in short, “the entrails of the city” (p. 16). Like Jane Jacobs, Rudofsky believes that streets should promote activity. For Rudofsky, the “the street is where the action is,” the appropriate stage for the “drama and comedy . . . supplied by daily

life” (Rudofsky, 1969, p. 123). Looking outside the U.S., Rudofsky celebrates alternative design concepts, like porticos, steps and pedestrian malls, and praises aesthetic details, including pavement styles, music and street naming, all of which, he argues, can contribute to a distinct, multi-sensory and active social experience on the street.

Allan Jacobs (1993) also celebrates the aesthetic function of the street, not just as a means of encouraging human interaction, but as an end in itself. Like earlier writers, he criticizes the use of “efficiency, technology, and speed” as “prime determinants of street design” and argues that streets should encourage social activity and the creation of community (A. B. Jacobs, 1993, p. 311). A. Jacobs goes further, however, by suggesting that the visual experience should be a primary consideration in design decision-making. He asserts, “the best streets create and leave strong, lasting, positive impressions; they catch the eyes and the imagination” (p. 312). After analyzing a set of cases from around the world, A. Jacobs offers a set of physical “requirements” and “contributing qualities” of great streets. While some of A. Jacobs’ recommended design features are functional, like those meant to provide utility and comfort for pedestrians, others are strictly visual. For example, requirements include “definition” (such as a well defined street wall) and “transparency” (visibility into buildings that line the street), while contributing qualities include visual features like diversity in architecture and unique design details, such as specially crafted street lamps.

Design for sustainability

While many of these writers, including J. Jacobs, A. Jacobs and Rudofsky, extoll the virtues of street trees and plant life as an important amenity, few address the link between street design and environmental sustainability. Writers like Ian McHarg and Anne Whiston Spirn, however, advocate for including environmental considerations in design decision-making at all scales of urban planning and design.

In *The Granite Garden*, Spirn (1984) argues that plans for urban streets can and should address environmental concerns, including air pollution, contaminated soil, flooding, and struggling plant life. For example, Spirn argues that “every new building, street, parking lot, and park within the city should be designed to prevent or mitigate flooding and to conserve and restore water resources” (p. 167). For Spirn, the most critical concept is that each project, including street design, should be considered as part of and in relation to a local and larger environmental system.

Recognizing this need, some advocates and transportation planners have adopted the strategy of “Green Streets,” the employment of design features to mitigate the environmental impact of streets and urban form. Portland, OR, for example, has been a leader in promoting Green Streets. Through a special program led by the city’s Bureau of Environmental Services, in coordination with PBOT, the city has retrofitted sidewalks with swales that filter rainwater into the ground and reduce stormwater runoff, a source of flooding.

Designing for everyone

While writers like Appleyard and Rudofsky focus heavily on pedestrians and local residents, writer Kevin Lynch takes an even broader perspective. In *A Theory of Good City Form*, Lynch (1981) defines a set of “dimensions of performance” for generalizing successful urban design. Two of these performance dimensions are particularly relevant to street design: “fit,” how well form matches customary or desired activities; and “access,” how well form enables individuals to reach people, activities, and places (Lynch, 1981, p. 118). On top of these dimensions, Lynch offers two meta-criteria to assess all others: efficiency (the reduction of cost) and justice (an optimal distribution of benefits and costs). While the nature of justice depends on societal values, Lynch argues that justice often requires sacrificing efficiency. Using “access” to evaluate transportation, for example, these meta-criteria imply that urban form may need to sacrifice efficient movement and fast speeds in order to accommodate all potential users of the street.

Although Lynch speaks generally about urban form, a concern for justice in transportation planning has entered the rhetoric of advocates of “Complete Streets,” who argue that streets should benefit all users, not just drivers. The Congress for New Urbanism (CNU), for example, promotes street designs that purposefully accommodate many different users. In the *Smart Growth Manual*, Duany, Speck and Lydon (2010), argue that automobile-oriented street design has caused the decline of pedestrian and bicycle use. Looking at the street network, the authors advocate for

an interconnected grid, in contrast with Buchanan and Appleyard’s proposals for dead-end spaces, and reject strong curves. According to the *Manual*, the “complete street” includes facilities for pedestrians, bicycles and cars, offers amenities for walkers, like street trees, lighting and narrow setbacks, and reduces speed through posted limits, on-street parking and narrower lanes. On urban arterials, which correspond to the authors’ concept of the “avenue,” the authors suggest that design should encourage “free-flow,” but still use lower posted speeds (25 mph), modest lane widths (10 feet), and on-street parking lanes (8 feet) (Duany et al., 2010).

One notable omission from Duany et al.’s vision of the complete street is transit. In contrast, advocates like the National Complete Streets Coalition assert that complete streets policies accommodate all anticipated users, including public transportation users (Seskin, 2011). In a compilation of best practices for complete streets, McCann and Rynne (2010) detail specific design features for transit users, including “bus bulbs” (i.e. curb extensions), which enable buses to remain in a vehicle lane while making stops, exclusive bus lanes, where buses do not compete with automobile traffic, and signal prioritization for buses.

In the complete streets paradigm, it is unclear, however, to what degree each street should accommodate every mode of travel. To solve this problem, McCann and Rynne argue that planners should take a “network approach,” that can emphasize different modes on different streets, while still creating an overall complete network. For example, planners in Portland, OR, have created

“bicycle boulevards” by locating bicycle facilities on lower-traffic streets, to create safe cycling routes that avoid heavily trafficked arterials (McCann & Rynne, 2010).

In addition to serving different travel modes, the “Complete Street” concept has also been adopted to promote environmental goals. In the (2007) report *Growing Cooler*, for example, Ewing et al. recommend that local and regional governments adopt the complete streets as part of a larger “Smart Growth” strategy. According to the authors, complete streets can increase pedestrian and transit use, which reduce carbon emissions by lowering vehicle miles traveled (VMT) and protect open space by supporting compact development (Ewing et al., 2007).

New Policies and Processes

For existing urban arterials, these design strategies for streets – whether they are livable, place-making, Green, Complete or transit-equipped – all challenge the prioritization of the automobile in earlier design policies. In order to implement these strategies, policy-makers offer more flexible guidelines and processes that enable designers to balance multiple performance concerns.

National standards

In comparison to the official guidelines from the 1950s to the 1970s, the most recent guidelines for arterial design, issued by

AASHTO and ITE, embrace a broader set of concerns for street design. In the most recent version of the Green Book, AASHTO (2011) does not display so heavy a prioritization of automobile performance. In discussing pedestrian infrastructure, the 2011 Green Book explains that although vehicular traffic makes it difficult, “adequate provisions for pedestrians” must be made, “because pedestrians are the lifeblood of our urban areas, especially in downtown and other retail areas” (AASHTO, 2011, p. 2-78). Like earlier policies, AASHTO continues to offer a set of strategies to minimize pedestrian-vehicular conflicts, but unlike the policies from the mid-20th Century, the list of strategies includes measures that will diminish vehicular capacity, such as prohibiting turns on red. To more fully address pedestrian facilities, AASHTO (2004) released a *Guide for the Planning, Design and Operation of Pedestrian Facilities*.

AASHTO’s more detailed guidance on pedestrian facilities, however, does not indicate a uniform prioritization of pedestrians, but a more inclusive attention to multiple performance concerns. For example, the guide recommends minimizing the width of crossings for pedestrians, especially senior citizens. AASHTO explains, however, that this strategy has two benefits: increasing pedestrian safety and shortening the time vehicles need to wait for pedestrians to cross. Automobile efficiency is thus not ignored, but placed on a more equal footing with other concerns.

For cyclists, which AASHTO ignored altogether in the 1950s and 60s, the 2011 Green Book offers explicit support. The guide asserts, “bicycle usage can be expected on most urban arterials

and should be considered in arterial street design” (AASHTO, 2011, p. 7-41). The guide notes a range of potential bicycle applications including markings in shared vehicle lanes, exclusive bike lanes, and shared paths. As with pedestrians, AASHTO’s increased attention to bicycle infrastructure is demonstrated by specific guidance: *Guide for the Development of Bicycle Facilities* (1999).

While AASHTO (2011) takes a more neutral stance with regard to mode and performance priorities, the Green book does not explain how competing performance aims can be resolved. The guidelines for bus facilities on urban arterials further demonstrate the guide’s support of additional modes beyond private vehicles. For example, while the guide is relatively hesitant about reserved bus lanes, it admits that there are some circumstances where such facilities can achieve worthwhile improvements to service. The guide also explains that traditional signal optimization, focused on benefiting private vehicles, has hurt transit service and discouraged bus patronage. To remedy this problem, the guide recommends that designers consider emerging strategies to alter signals to benefit buses with minimal impact on other vehicles. For the placement of bus stops, the guide is explicit that “bus stops should be located primarily for the convenience of patrons” (AASHTO, 2011, p. 7-52).

Although AASHTO recognizes that some of these design benefits for buses may hurt private vehicle performance, the Green Book does not explain how to balance transit and automobile performance. Unlike the guides from the 1950s and 60s, AASHTO

(2011) does not rely on the concept that buses are more efficient for through-put to justify improvements. Instead, the Green Book suggests an abstract compromise. “Because some of the design and control measures that are beneficial to bus operation have an adverse effect on other traffic, and vice versa,” the Green Book explains, “a compromise that is most favorable to all users is appropriate” (p. 7-52). What such a compromise should be or how it should be estimated, however, is not defined.

Context sensitive design

Context Sensitive Design (CSD) offers a potential solution to the question of balance and compromise. Formalized in the late 1990s, CSD (also known as context sensitive solutions or CSS) is a design process defined by inclusiveness and flexibility (FHWA, 2009). Unlike the Green Book, CSD explains how to incorporate community input in the process of defining project goals, developing the project concept, developing alternatives and choosing a final design (AASHTO, 2004; FHWA, 1997). Stakeholder input begins at the earliest stage of the design process to fashion a broad set of project goals, and design guidelines are implemented flexibly to accommodate social and physical context. An ideal final design reflects the compromise and balance forged by all stakeholders.

For urban arterials, CSD offers a new set of design options to fit alternative performance goals, particularly pedestrian safety and community livability. For example, both AASHTO and ITE have embraced flexibility and CSD. In 2004, AASHTO (2004)

released *A Guide to Flexibility in Highway Design*, which explains how engineers can develop context-sensitive streets using the Green Book guidelines. The *Guide to Flexibility* explains that the Green Book provides ranges of acceptable values for various design criteria and geometric features (like design speed, lane width, or turn radius). Certain circumstances may justify using the lower values of such ranges or reaching outside of the range altogether. For example, the guide indicates that urban arterials normally have a design speed of 30 – 60 mph, but recognizes that the resulting operating speeds may be too high for some urban areas. According to the guide, “The notion of designing a high-quality, low-speed road is counter-intuitive to some highway engineers. Yet it is in many cases the appropriate solution to a sensitive neighborhood or other street design problem” (AASHTO 2004, p. 19).

While AASHTO’s (2004) guide focuses heavily on process and identifies a general set of design options, ITE’s (2006) guide, *Context Sensitive Solutions to Walkable Major Urban Thoroughfares*, was developed with the CNU and more clearly articulates how guidelines can be flexibly applied to fit the context of and community goals for arterial streets. First, ITE employs Duany’s transect schematic (Duany & Talen, 2002) to describe four urban contexts for street design, from suburban to highly urban. This approach is more specific than AASHTO’s, which merely distinguishes arterials as urban or rural. Second, similar to CNU’s *Smart Growth* manual, ITE refines AASHTO’s functional classifications system, dividing urban arterials into four types of “thoroughfares”: high-speed boulevard,

low-speed boulevard, avenue, and street. In addition to invoking historical and distinctly urban conceptions of the arterial, ITE's system offers designers a broad but well-defined set of potential models for each community.

Like AASHTO, ITE (2006) explains how a flexible use of standards can accommodate pedestrians. For example, both ITE and AASHTO reject utilizing design criteria to accommodate unusual or extreme conditions. For establishing the turn radius at intersections, for example, ITE (2006) argues, "Curb return radii should be designed to accommodate the largest vehicle type that will frequently turn the corner," which "assumes that the occasional large vehicle can encroach into the opposing travel lane" (p. 161). Both ITE and AASHTO also recognize that some passive safety guidelines for roadside conditions are impractical in urban settings, where narrow rights of way, aesthetic features and pedestrian amenities create necessary obstructions.

The *Context Sensitive Solutions* guide also offers a range of potential solutions for accommodating transit services and cyclists. Looking at bus service, for example, ITE (2006) recognizes that "bus turnouts," which force buses leave the stream of traffic to make passenger stops, "introduce significant travel time penalties to bus patrons" (p. 178). The guide offers several solutions absent in AASHTO's guidance, including "queue jumpers" (bus stops that enable buses to jump ahead of stopped traffic) and curb extensions that enable buses to stop in the stream of traffic (pp. 178-9).

The growth of CSD clearly demonstrates that automobiles are no longer consistently prioritized in the design of urban arterials. The Federal Highway Administration, which formally endorsed CSD in 2002 (Southworth & Ben-Joseph, 2003), defines CSD as "an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions" (FHWA, 2009). Through CSD, performance concerns like livability and aesthetic preservation are thus given the same weight as mobility, safety and economic development (Southworth & Ben-Joseph, 2003). By giving voice to a diverse set of participants, the CSD process removes predetermined priorities for design and reorders authority in street design. Through CSD, local community interests theoretically wield the same power as the recommendations of officials. In this way, CSD also adds community responsiveness as an essential performance concern for design.

Performance-based planning

In comparison to CSD, performance-based planning provides an arguably stronger policy tool to broaden design performance concerns. Despite offering an inclusive process, CSD is by no means a guarantee of a broadly focused design process, since any CSD process is necessarily constrained by the stakeholders who participate. In contrast, performance-based planning establishes a pre-determined set of goals that all projects are subject to during the design process, regardless of stakeholder input. (This is not to

say that stakeholders and officials cannot reject certain performance concerns, but that they must be considered.)

On the national level, federal research promotes performance-based planning as a means of ensuring the incorporation of non-automobile performance concerns, including community responsiveness. For example, in *Performance Measures for Context Sensitive Solutions – A Guidebook for State DOTs*, the NCHRP (National Cooperative Highway Research Program (NCHRP), 2004) argues that performance goals and measures can ensure a more inclusive approach to design. As opposed to using just *outcome* measures, the *Guidebook* offers a set of *process* measures that enable agencies to evaluate the design process itself (Macdonald et al., 2010). For example, the guide suggests considering whether the project’s “statement of problems, opportunities and needs” represents all stakeholders and whether stakeholders thoughtfully considered multiple design speeds. In this way, NCHRP suggests that performance-based planning can both entail and ensure context-sensitive design.

On the state and regional level, state DOTs and MPOs have begun to use performance measurement and reporting to track progress toward a broad set of performance goals, although to varying degrees. The Oregon Department of Transportation (ODOT) provides a strong example. The agency’s mission is: “To provide a safe, efficient transportation system that supports economic opportunity and livable communities for Oregonians” (Macdonald et al., 2010; ODOT, 2011). To that end, ODOT uses

26 performance measurements in five goals: safety, preservation (maintenance), mobility, sustainability, and stewardship (economic development). For each measure, the agency’s *Annual Performance Progress Report* reports results for each measure, evaluates whether success has been achieved and identifies “what needs to be done” to improve performance.

For urban arterials, Macdonald et al. (2010) have promoted the use of performance measurements by state transportation agencies pursuing complete streets and green streets policies. According to Macdonald and her fellow researchers, Oregon joins several other state DOTs, including Vermont, Washington and Florida, in measuring outputs and outcomes for pedestrians and bicyclists. For example, ODOT’s performance measures include the “percent of urban state highway miles with bike lanes and sidewalks” and the “percent of Oregonians who commute to work during peak hours by means other than Single Occupancy Vehicles” (ODOT, 2011). Other ODOT measurements are notable, according to Macdonald, because they take a neutral stance to mode. The measure for delay is “hours of Travel Delay per capita per year in urban areas,” which captures person delay instead of vehicular delay (ODOT, 2011, p. 33). ODOT’s strategies for improving its measurement results in these areas include new sustainable transportation options “to preserve air and water quality” damaged by vehicle delay and new transportation options to promote travel by “modes other than single occupancy vehicles (SOVs)” (Macdonald et al., 2010; ODOT, 2011).

On the local level, there is evidence that cities are adopting performance-based planning to pursue street designs that look beyond the automobile. In 2008, the NYC Department of Transportation (DOT) released its strategic plan *Sustainable Streets* (NYC DOT, 2008). The plan included a broad set of goals and the promise that the agency would measure and report its results annually. The shift in the agency's performance measurement strategy can be seen in the development of the Sustainable Streets Index (SSI), NYC DOT's annual performance report. In 2008, just as DOT began to implement its strategic plan, the first SSI provided information primarily on transit ridership and automobile traffic into the Central Business District of Manhattan. After a year of progress, however, the 2009 SSI reported city-wide data as well as performance results for fifteen key bus, bicycle, pedestrian and automobile projects, using performance indicators in areas like pedestrian and automobile safety, traffic congestion, bus speeds and transit ridership.

New Measures for New Goals

The changing conceptions of the street have created new challenges for transportation planners seeking to use performance measurements to optimize design and engineering decisions. Many of the urban theorists who introduced these new conceptions actively discouraged relying too heavily on quantitative data or

measurement. Unlike traffic congestion, which is easy to define and measure, newer goals like livability, sustainability and multi-modal travel are more difficult to define and measure. Furthermore, they require a shift away from a reliance on older measures, particularly automobile Level of Service (LOS). Despite these problems, policy-makers and researchers have developed and promoted new sets of measures to evaluate newly important goals. Although these efforts provide no clear consensus, they offer a broader set of options for local agencies interested in incorporating new performance measures.

Rejecting technical rationality

In demanding a broader perspective in urban design, both Appleyard (1981) and Lynch (1981) criticize the use of quantitative data to guide design decision-making. Lynch, for example, argues that an over-reliance on quantitative data obscures other design concerns, which may be less measurable. According to Lynch, planners “are attracted to numerical data, which are so much more precise, firm, and impressive than the soft, subjective stuff of patterns and feelings” (p. 152). As a result, quantitative data take precedence in planning decisions, including street design. “The numbers that stand for traffic congestion,” Lynch asserts, “outweigh the frustrations of pedestrians who cross the street” (p. 152). In order to create spaces for all users, Lynch argues that designers must move beyond quantitative analysis, by observing people and asking them directly about how well the space fits their needs.

In *Livable Streets*, Donald Appleyard largely embraces this approach for his assessment of residential streets in San Francisco. Over all, Appleyard is concerned with gauging residents' perception of traffic's impact on their street. In his view, there is no easy way to go about measuring concepts like "satisfaction" or "annoyance" among residents. Measures of satisfaction, Appleyard argues, are unreliable, since they are often influenced by what respondents recall at the time, and cannot be compared across different locations, since satisfaction is often relative to expectation or past experience. While Appleyard does gather quantitative data, using surveys of residents' perspective on the street, he attempts "street portraits" in which photographs, descriptions, and personal detail, using the words and drawings of residents, convey a more comprehensible feel for the effects of traffic than provided by numbers alone" (p. 12).

New measures for transportation

Transportation researchers have embraced ideas of Appleyard and others in proposing new transportation performance measures, but still aim to systematize and quantify performance measurement.

As part of this shift, there has been a call to abandon the use of Level of Service (LOS) as the primary tool in street engineering and design. Cervero (1996), for example, proposes a "paradigm shift" in transportation planning away from "automobility" toward "accessibility." According to Cervero, "the difference between planning for automobility versus accessibility is the difference

between planning for movement versus planning for people and places" (p. 2). Improvements for automobility, Cervero argues, are predominately supply-side strategies that aim to expand capacity for the driver. In contrast, improvements for accessibility are predominately demand-side strategies that aim to manage demand to better fit existing capacity.

Writing in the Eno Foundation's now defunct journal *Transportation Quarterly* (which rather fittingly replaced its earlier name *Traffic Quarterly*), Ewing (1995) echoes Cervero's criticism of LOS, but articulates a broader range of options for performance measurement, including accessibility. According to Ewing, planning for improved automobile LOS is equivalent to planning for increased vehicular speed: too narrow a goal, Ewing argues, for the transportation system. Instead, Ewing proposes four kinds of measures: mobility of people (ability of individuals to get around), accessibility of land use (ability to reach activities from a given location), livability of communities (the reduction of the harmful effects of the automobile), and sustainability of developments (conserving resources and protecting the natural environment).

The benefits of these approaches lie in whom they serve. While LOS looks at the facility, alternative measurements of accessibility and sustainability look at people and places (Ewing, 1995; Cervero, 1996). As a result, these measures do not presume that any one mode is inherently preferable to any other. Furthermore, as Cervero explains, measures of accessibility or mobility can be disaggregated across various socio-economic groups, revealing

facts that LOS data cannot, such as whether individuals can reach job locations. Travel time and congestion, prime determinants of LOS, may be meaningless values if an individual does not have to an automobile.

Despite this rejection of LOS, the Highway Capacity Manual continues to employ the measure, although its recent approach signals a shift in performance concerns. In earlier decades, the HCM introduced LOS values for each mode: private vehicle, transit, bicycle and pedestrians. In the most recent HCM, the TRB (2010) has refined its definitions of LOS to better describe both the quantitative and qualitative aspects of service for each mode, including user perceptions.

The 2010 changes were the product of a two-year study by the NCRHP (Dowling et al., 2008), *Multimodal Level of Service Analysis for Urban Streets*, which had the goal of developing LOS measures for complete streets and context sensitive designs. According to the report, the HCM's earlier LOS definitions had a number of shortcomings, including a failure to consider safety, economic conditions and, critically, user perceptions. The report also explains that previous measures ignored many of the inter-relationships between modes, like the effect of vehicle volumes on adjacent bike or pedestrian facilities. As a result, the most distinguishing feature of the report is a new “multimodal LOS framework” that takes into account the conditions of all modes together when calculating the individual LOS values for each mode. Using this framework, a pedestrian LOS, for example, reflects not

only the number of walkers and the conditions of the sidewalk, but also the disturbances caused by the volumes and design features of other modes. Furthermore, the framework can compare various design alternatives to determine which will result in the highest LOS for all users (Elias, 2011).

Of the NCHRP's proposals, the 2010 HCM incorporated the new definitions for bike and pedestrian LOS and altered the definition of automobile LOS to include user perceptions (Roess, Vandehey, & Kittelson, 2010). In addition, the 2010 edition included the “multimodal LOS framework.” For urban arterials, the more recent definition of LOS thus better reflects all users on the street and the relationships between them.

Operationalizing abstract goals

Although researchers have promoted new kinds of measures, there remains considerable flexibility in how those measures can be defined. This problem is evident in the definition of livability, an abstract concept that researchers and policy-makers have operationalized (i.e. made measurable) in various ways.

The measurement of livability depends on how it is defined (Fabish & Haas, 2011). In *Livable Streets*, Appleyard (1981) argues that there is no single definition, since each community has its own values and needs. Nevertheless, Appleyard's emphasis on the harmful effects of the automobile has influenced definitions of livability. For example, Lowe (1990, p. 5 in Ewing, 1995) defines livable communities as those that put the “automobile

in its rightful place as one among many options for travel.” As a result, some livability measures focus on evaluating the impact of the car (e.g. traffic volumes and speeds, emissions, noise, etc.) and the performance of alternative modes (e.g. pedestrian, bicycle and transit volumes, pedestrian safety, etc.). Like Appleyard, some practitioners have argued that livability cannot be quantified, and instead recommend qualitative measures, such as whether an elderly person can safely cross the street (Cambridge Systematics, 2010). Other researchers have focused on the economic implications of livability, by measuring, for example, the impact of “livable” transportation projects on land values through hedonic pricing (White, 2010). For example, Whitehead, Simmonds and Preston (2006, as cited in Macdonald et al., 2010). Sanders, Anderson, & University of California (System found that improved pedestrian facilities resulted in higher property values in a downtown business area.

Some measurements of livability have focused not just on transportation but also on the related issue of land use. For example, some “livability” programs are comprehensive, integrated initiatives, like transit-oriented development and smart growth, which entail many non-transportation goals. As such, these programs measure their impact on a broad set of measures, including economic development, quality of life, environmental impacts, public health, safety, and land use patterns (Fabish & Haas, 2011). In this way, livability can incorporate various transportation-related outcomes.

An extensive literature has grown that reflects the broad conception of street performance. Whether this research is construed as describing livability, quality of life, or sustainability, its diversity demonstrates a broad set of potential indicators of street design outcomes. For urban arterials, Macdonald et al. (2010) provide an overview of some of this literature. For example, some researchers have explored the relationship between street design and psychological well-being. Along high-volume corridors, researchers found that roadside landscaping is associated with reduced stress for both travelers and residents (Cackowski & Nasar, 2003; 2003; Parsons, et al., 1998; in Macdonald, 2010). 160 college-age participants, both male and female, viewed one of four different video-taped simulated drives through outdoor environments immediately following and preceding mildly stressful events. Overall, it was anticipated that participants who viewed artifact-dominated drives, relative to participants who viewed nature-dominated drives, would show greater autonomic activity indicative of stress (e.g. elevated blood pressure and electrodermal activity). In another example, researchers have focused on street design’s role in public health questions, like daily exercise, the incidence of disease, and obesity rates.

Balancing Performance Objectives on the Local Level

In contrast to earlier years, when Portland and NYC appeared to prioritize automobile performance, recent decades have seen a shift toward a more balanced approach to performance goals. In strategic plans, design guidelines, and specific projects, both cities are rethinking the role of their urban arterials to accommodate a diverse set of transportation users and pursue inter-related goals like sustainability, place-making, and economic development.

Urban arterial performance in New York City

Under the leadership of Commissioner Janette Sadik-Khan, the NYC DOT has aggressively shifted away from prioritizing automobile performance in arterial street design. DOT's activities are guided by two strategic plans. The first is the city-wide strategic plan, *PlaNYC: A Greener Greater New York*, which was released in 2007 and updated in 2011. The plan promotes multi-modal transportation options and reductions in negative impacts on the environment. Specific initiatives related to street design include exclusive bus lanes to improve bus service, bike lanes and signage to increase bicycling rates and safety, and new features to improve pedestrian safety and access, including new crossing signals with countdown clocks and neighborhood way-finding systems (Bloomberg, 2011, pp. 92-6). While the plan specifically seeks to

reduce automobile and truck congestion, it does not propose any increases in capacity. Instead, the 2011 plan recommends piloting traffic demand management strategies, like congestion charging and variable parking rates.

The second strategic plan, *Sustainable Streets*, governs DOT directly and was released by the agency in 2008 with a progress report in 2009. *Sustainable Streets* supports the objectives of PlaNYC, but provides a clearer set of goals for DOT. While the 2008 plan includes extensive short-term and long-term goals for outputs (e.g. roads paved), the plan includes fewer goals for outcomes (e.g. reduction of accidents). The plan is strong evidence of DOT's focus on pursuing a broad set of performance objectives. Goals are organized under seven major headings: mobility, safety, "world class streets," infrastructure, "greening," customer service, and global leadership. The "world class streets" section promotes non-automobile street activity, recommending complete street design for multiple modes, public plazas, and aesthetic improvements. The "customer service" section details DOT's commitment to community outreach and context-sensitive design, including the launch of DOT Academy, a program to train community leaders in DOT's core programs, including traffic calming, sidewalk maintenance and repairs.

As described earlier, DOT uses performance measurement in its annual performance report, the *Sustainable Streets Index* (SSI). The SSI fulfills DOT's obligations under Local Law 23, enacted by the city council in June 2008, which directs the agency to track progress in "high-performance modes" other than automobiles, specifically

“buses, ferries, bicycling and walking” (NYC Council, 023/2008). The SSI provides extensive city-wide data on mobility, offering data on automobile, transit, bicycle and pedestrian travel patterns. Performance in other areas – specifically safety, transit mobility, congestion reductions, and parking – are reported for specific projects. In the 2010 SSI, DOT provides no results pertaining to sustainability, although several projects aimed to improve air quality by reducing traffic congestion (NYC DOT, 2011).

In 2009, DOT released the NYC Street Design Manual, the city’s first set of street design guidelines. The 2009 Manual explains that its purpose is to move away from the prioritization of the automobile in design, asserting that “the focus on autos resulted in unsustainable land development patterns, fewer transportation choices, increased noise, pollution, and greenhouse gases, as well as a decline in social, civic, physical, and economic activity on streets” (p. 19). In contrast, the Manual seeks offer “a more balanced idea of street design, giving equal weight to transportation, community, and environmental goals” (p. 19).

To that end, the Manual outlines a design process explicitly embracing context-sensitive design, indicating that “appropriate stakeholders should be involved in projects from project conception to implementation” (p. 29) and that surrounding land use should be a primary design criteria. The Manual dispenses with functional classification of streets and offers five street typologies: general street, boulevard, transit street, slow street, and pedestrian-only street. Since urban arterials are typically “general streets” under the

system, the Manual is not highly prescriptive in form. According to the manual, “Although this design frequently emphasizes motor vehicle access and movement, the street may also include dedicated facilities for buses and/or bicyclists” (NYC DOT, 2009, p. 31).

Instead of being prescriptive, the Manual offers a broad and well-illustrated set of design options for arterials (Figure XX). The Manual is unique compared to other guides, like ITE’s (2004) *Walkable Major Urban Thoroughfares*, by dedicating not only a chapter on geometric design elements, but also individual chapters on materials, street furniture, and lighting. In the section on geometric design, the manual offers multiple strategies for incorporating bus and bike facilities, traffic calming, and landscaping options. The section on materials explains how permeable surfaces can mitigate storm-water run-off and improve aesthetics.

On the project level, DOT has implemented designs that demonstrate the agency’s balanced approach to urban arterials. According to the SSI, the city has made substantial investments in new infrastructure for bicycles, pedestrians and transit riders. In Manhattan alone, for example, DOT has introduced protected bike lanes, with buffers, on several arterials, including First and Second Avenues (2010) and Eighth and Ninth Avenues (2008-2009). Between 2008 and 2011, DOT introduced Select Bus Service (SBS), faster bus service in dedicated bus lanes, along Fordham Road (the Bronx), 34th Street, and First and Second Avenues (Manhattan).

Despite improving facilities for non-automobile travel along arterials, DOT has not ignored automobile travel. The agency’s

work on Broadway, an arterial that cuts diagonally across the grid of Midtown Manhattan, demonstrates how the city is accomplishing new performance objectives, while still striving to accommodate the automobile. Improvements in automobile performance, however, have not come from capacity expansion. Below 59th Street, DOT has also added bike lanes, as well as new pedestrian refuge islands, shortening crossing distances. More noticeably, DOT has closed Broadway to automobile traffic at several major intersections, including the busy commercial and tourist areas of Times Square (42nd Street) and Herald Square (34th Street). By adding café seating and benches, landscaping, and new surface treatments, these projects arguably resemble the active, Italian plazas celebrated by Rudofsky (1969) and embrace the concept of ‘street as place.’ According to DOT, these projects were not meant solely for pedestrians. Introduced under the name “Green Light For Midtown,” DOT argued the new plazas would improve automobile travel times by simplifying traffic movements. According to a 2010 evaluation, travel speeds have generally improved (NYC DOT, 2010c).

More recently, DOT has also publicized the project’s impact beyond transportation outcomes. According to the 2009 *Sustainable Streets Plan*, “The improvements on Broadway have created more space for people, a better streetscape and provide an economic shot in the arm by encouraging New Yorkers and tourists to visit and spend more time in an area whose streetscape will begin to equal the world-famous destinations it serves” (p. 31). In remarks in 2012 at the TRB Forum, Commissioner Sadik-Khan touted economic

impacts, explaining that, “Retail rents have doubled in two years and Times Square has turned into one of the top 10 retail locations on the planet” (Szczepanski, 2012).

Urban arterial performance in Portland

In recent years, Portland’s transportation program has also benefited from strong leadership. Current mayor Sam Adams formerly served as the head of the office of transportation and, according to the Mayor’s website, multi-modal transportation options, like biking and walking, are a priority. Over the past two decades, Portland has aggressively pursued transportation planning to reduce vehicle-miles traveled (VMT) and to expand multi-modal travel on the city’s major arterials. Evidence includes a long list of design guidelines, master plans, performance measures and individual arterial projects that indicate the city’s attention to a broad set of performance goals.

The strategic plan of the Portland Bureau of Transportation (PBOT) is the Transportation System Plan (TSP) (City of Portland, 2006). The TSP provides design recommendations through a new set of classifications for urban streets. Unlike AASHTO’s system of functional classification, the TSP introduces “design classifications” that “identify the preferred modal emphasis and design treatments” for major streets (p. 2-18). Design classifications for urban arterials include “Regional Main Streets” and “Community Main Streets”

which are meant to “accommodate motor vehicle traffic, with special features to facilitate public transportation, bicycles, and pedestrians” (p. 2-19). These classifications depend not only on transportation patterns, but are sensitive to surrounding land use contexts. The TSP also includes various design stipulations focused on improving conditions for non-automobile travel, such as including sidewalks on all new investments and defining a maximum spacing of 330 feet between bicycle and pedestrian crossings along all streets.

The TSP also asserts that planners should rely on a broad range of design tools. Altogether, these guidelines offer a diverse set of arterial design options that enable the city to flexibly balance multiple performance objectives through a context-sensitive design process. In addition to a list of city policies and guides, the TSP recommends two design guidelines issued by Portland Metro: *Creating livable streets: Street Design for 2040* (2002) and *Green Streets: Innovative Solutions to Stormwater and Stream Crossings* (2002). For urban arterials, the *Green Streets* guidelines provide design features, like swales and permeable surface treatments, to mitigate stormwater runoff. The *Livable Streets* guidelines utilize a broad definition of livability, focused on multi-modal transportation, safety, community life, mitigating traffic disturbances and land values. PBOT also recommends design guidance on specific modes. The city adopted its first *Pedestrian Master Plan* in 1997 and a *Bicycle Master Plan* in 1996 (the first was in 1972), followed by the *Portland Bicycle Plan for 2030* in 2010. Both the 1996 bicycle and 1997 pedestrian plans include design guidelines for incorporating new infrastructure on existing

urban arterials. The 2010 bicycle plan, however, recommends new design guidelines for bicycle infrastructure, pointing out that the 1996 bicycle plan does not include design approaches new to Portland, like buffered bike lanes that provide separation between bike lanes and cars.

The city’s planning documents adopt a set of performance measures that explicitly articulate the agency’s attention to a broad set of performance concerns. The TSP is relatively vague in defining performance measures, though affirms that planners should not rely only on LOS alone. Instead, the TSP indicates that it must comply with the performance measurement requirements of the *Regional Transportation Plan* (RTP) issued by Portland Metro. The most recent RTP, the *2035 Regional Transportation Plan*, fully adopts a performance-based planning approach. The plan defines 10 goals (Figure 3-2), a set of measurable objectives for each goal focused on outcomes instead of outputs, and performance benchmarks for each objective. In addition, the RTP defines a set of fourteen performance measures for evaluating the overall regional transportation system, which also correspond to the plan’s primary goals. While overall the plan’s appears aimed at reducing automobile driving (VMT), promoting alternative modes, and encouraging compact urban development, the plan’s performance measures demonstrate concerns about traffic congestion and travel time during peak hours. In this way, the RTP’s approach to performance explicitly seeks to balance more recent goals, like livability and sustainability, with longer-standing goals, like minimizing automobile congestion.

On the project level, Portland has implemented a series of arterial designs that attempt to improve and balance performance for multiple modes, in addition to goals of sustainability and economic development. Between 2000 and 2011, for example, BOT made investments in new pedestrian, transit and cycling infrastructure on several key thoroughfares, including Sandy Boulevard (2007), Killingsworth (2008), Russell (2009) and East Burnside (2010) Streets.

The case of East Burnside, classified by the TSP as a “major traffic street,” demonstrates the city’s balanced approach to urban arterial design. Through the project, the city attempted to improve performance in multiple areas without sacrificing automobile performance. Employing a strategy proposed by AASHTO in the 1950s, BOT converted a ten-block stretch of East Burnside from two-way street to a one-way pair with parallel Couch Street. Unlike projects from the mid-20th Century, however, the agency did not attempt to create new automobile capacity through the conversion. Instead, PBOT used the resulting extra capacity on East Burnside to implement curb extensions at pedestrian crossings and transit stops. Furthermore, as part of the city’s Green Streets program, BOT installed bio swales in curb extensions at various intersections. In addition to meeting transportation and environmental objectives, the project was also conceived as part of an economic development initiative for the neighborhood (Hoffman, 2012). Similar to the case of Broadway in NYC, along Burnside Portland sought to achieve multiple performance objectives through the project and

improvements to automobile performance did not come at the expense of other modes.

Prioritizing balance

When considering Portland and NYC, it is clear that each city is taking a broader and more balanced approach to design. This is certainly a marked shift from the mid-20th Century, when both cities appeared to prioritize automobile performance, occasionally at the expense of other street users. Despite striving for balance, both Portland and NYC have expressed a desire to reduce vehicle-miles traveled. As demonstrated by both Burnside and Broadway, design proposals to improve automobile performance lie less in capacity expansion and more in encouraging use of other modes. Although neither city wishes to exacerbate traffic congestion, both do not wish to accommodate additional growth of the automobile. While cities may be striving for balance, therefore, that balance seems rarely pursued through the prioritization of the automobile.

Section III.

Case Study Analysis

Chapter 6. The Cases

Introduction to the Case Study Analysis

The case study analysis examines the design process and resulting form of four street design projects, two each in NYC and Portland. While each case employs performance-based planning in different ways and to varying degrees, the cases share common features that demonstrate how performance-based planning can be used as a part of a context-sensitive design process. Furthermore, the cases continue to demonstrate how agencies attempt to balance multiple and potentially conflicting community interests through street design.

Projects in Portland were led by the Portland Bureau of Transportation (PBOT). Projects in NYC were led by the New York City Department of Transportation (DOT). The case studies include:

- East Burnside Street, Portland, OR (Constructed, 2007)
- Prospect Park West, Brooklyn, NY (Constructed, 2010)
- 34th Street, Manhattan, NY (Proposed, 2012)
- North Williams Avenue, Portland, OR (Proposed, 2012)

The case study analysis attempts to answer the two primary questions of the thesis. First, the case studies perform a *form analysis* that continues to explore how the selection and prioritization of performance goals impact design form, with particular attention to the ways in which community input influences design form through

this process of selection and prioritization. Second, the case studies perform a *process analysis* that attempts to determine what role performance-based planning can play in a design process that actively engages community input.

Case selection

Case selection was based on three primary criteria.

Performance measurement. First, I chose projects where I identified early evidence that planners/designers had used performance measurement (or some feature of performance-based planning) at some point during or after the project's development. For example, in each case, the local agency reported performance data in project plans or released an *ex-post* performance report after construction. I chose these cases to assess the role that performance-based planning played in design decision-making and community engagement.

Community conflict. Second, I chose projects that resulted in some form of conflict among project stakeholders during or after the design process. For example, in each case, stakeholders expressed strong resistance to city plans or disagreed among one another about the project's vision. Such cases demonstrate, as Altshuler argues, that community values are subjective and potentially difficult to interpret or measure. By looking at these cases, the analysis considers how performance-based planning, as an objective tool, can play a role in

design decision-making when agencies are committed to responding to subjective community values.

Mobility & access. Third, I chose projects that dealt with arterials or, in two cases (N Williams and Prospect Park West) “connectors.” In the AASHTO system of functional classification, such roads are “higher order,” since, unlike “lower-order,” residential streets, they serve both local and non-local traffic. As a result, these cases provide the chance to examine the tension between providing access to abutting properties and providing mobility to through-travel, and to consider how that tension is treated in both the design process and resulting form. All of the streets fit the general definition of urban arterial that has been used throughout this report.

It should be noted that the cases are not used to perform a city-level comparison. Generally, the cases do not reveal any major contrast between the two cities, but exhibit qualities unique to the case or shared among cases across both cities.

Evaluating community engagement

In each of these cases, agency officials actively collected community feedback to inform street design. To understand the role of community input, the design process is compared against the context-sensitive design (CSD) framework defined by the FHWA (2009). This framework has two key dimensions by which to evaluate the role of community stakeholders (i.e. those not affiliated with a public agency). The first dimension is timing; the framework entails that community engagement be both early and continuous.

The second dimension is participation; the framework indicates that all decision should be based on a consensus among all stakeholders. Looking at these two dimensions, only some of the cases used the CSD framework, but all used community participation to guide design.

To further understand the nature of ‘participation,’ I considered the various roles performed by community stakeholders. These roles included:

- *Initiate*: to cause or compel the agency to begin work on the project;
- *Scoping*: to define the project’s goals;
- *Advisory*: to provide feedback used by agencies to guide design;
- *Design decision-making*: to choose the final design among several alternatives or request and select specific design features;
- *Approval*: to have formal power to endorse or reject the agency’s final design; and
- *Measurement*: to have some opportunity for community stakeholders to perform their own evaluation of the project.

The more stakeholders embody all of these roles, the greater their level of participation in the project. For example, stakeholders who play only an ‘advisory’ role have less influence over the design process than those who play a ‘design decision-making’ and ‘approval’ role. Furthermore, stakeholders who play a ‘measurement’

role can influence the project design to the extent that agencies use performance measurement to guide design choices.

Evaluating design

For each case, the analysis describes how physical changes (both those completed and currently proposed) impact performance in specific areas, focusing primarily on vehicle capacity, access to parking, cycling safety, pedestrian safety and comfort, and bus speeds and convenience. Through project plans, community outreach records, and interviews with project leaders, the analysis examines how specific design features were employed to achieve performance goals and to address conflicts and concerns that arose during the community engagement process. In each case, agencies pursued designs that improved performance in new areas, like cycling or transit, but made design modifications to preserve or enhance performance in areas identified by stakeholders as important, particularly automobile performance.

Evaluating performance-based planning

To explore the use of performance-based planning, the case study identifies what elements of performance-based planning were used by project officials and explores how those elements facilitated community engagement.

First, the analysis determines the extent to which each case study used performance-based planning, by comparing the project development with the features of the performance-based

planning framework, as it is defined by Meyer and Miller (2001) and elaborated by Pickrell and Neumann (2001) (fully described in Chapter 2). The analysis generally considers three contexts in which performance measurement is performed: (a) *ex-ante* (pre-design) measures to define project needs; (b) design decision-making prior to construction; and (c) *ex-post* (post-project) performance evaluation after construction.

Second, the analysis considers how specific features of performance-based planning were used. While this analysis attempts to describe all features in each case, the analysis specifically attempts to identify those features that played a role in engaging the community, either by collecting community input or by empowering community stakeholders in the decision-making process. The analysis focused on community engagement is based on multiple concepts in the literature on performance based planning. First, agencies are increasingly using “customer-oriented measures,” which enable them to gauge the satisfaction and other perceptions of stakeholders (Poister, 2005). Second, stakeholders can increase accountability in public agency decision-making by playing a role in determining performance measures (Halachmi & Holzer, 2010). Stakeholders groups, independent of agencies, can also use their own performance measurement reports to demonstrate the success or failure of an agency (Holzer & Kloby, 2005). Finally, according to NCHRP’s (2004) report, *Performance Measures for Context Sensitive Solutions*, agencies can use performance-based planning to assess the role of community input, by incorporating both process measures

(e.g. was public input sought and used at key decisions?) and outcome measures that evaluate stakeholder satisfaction.

Organization of each case

Each case is presented in chronological order, followed by a synthesis of all four cases. The analysis of each case has five basic parts. First, I review the *context* of each street, describing the corridor’s role in the city transportation network and its surrounding land use. Second, I review the *project development*, identifying the project’s main performance goals, the key conflicts that arose during the design process and the ways in which each local agency engaged community stakeholders. Third, I evaluate the *final design*, explaining how design features relate to performance goals and/or the community engagement process. Fourth, I evaluate the general *use of performance based planning* during and after the design process. Finally, I analyze how the use of performance based planning contributed to the *community engagement process*. (Note: For one case, N Williams, where the use performance measurement significantly contributed to changes in the final design, the analysis on the ‘use of performance-based planning’ precedes the analysis of the ‘final design.’)

East Burnside, Portland

In 2010, PBOT completed major renovations on Burnside, the major East-West connector street of Portland. The re-design converted a portion of E Burnside, historically a two-way street, into a one-way street as part of a one-way pair (with Couch, the parallel street to the north). The project also incorporated Complete Streets and Green Streets elements, by dramatically increasing infrastructure for pedestrians and cyclists and incorporating stormwater runoff mitigation features. In terms of process, E Burnside project planners actively engaged community stakeholders through a CSD process. Performance-based planning was largely confined to post-project evaluation, but demonstrates how performance measurement can be used to measure residential satisfaction. In terms of form, the one-way pair mitigated potential conflicts between different street users by improving performance for new users, without sacrificing capacity for automobiles. The project, thus, demonstrates PBOT’s attempt to balance the performance of arterials among multiple users.

Context

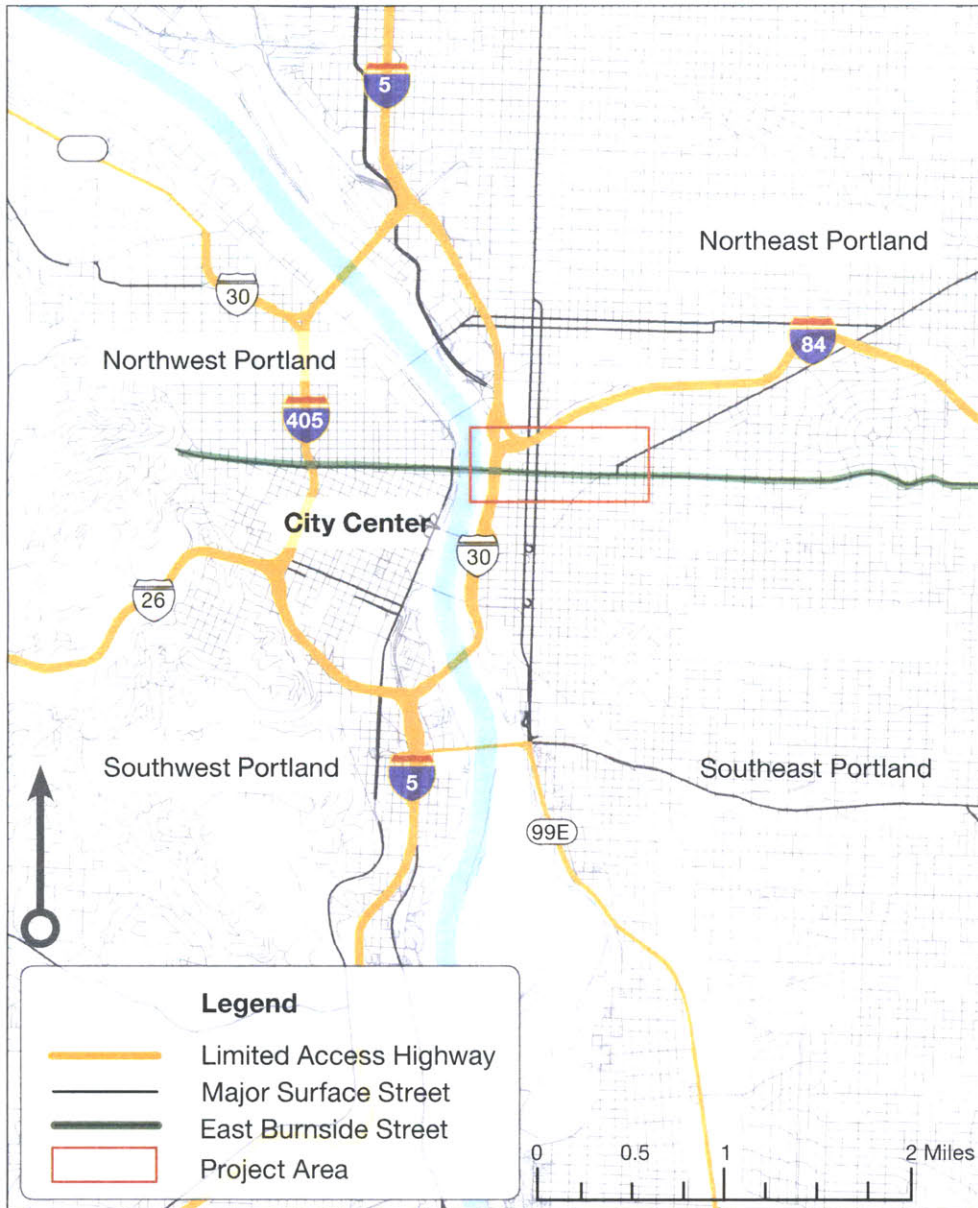
East Burnside acts as the dividing line between the North and South sides of Portland. (All streets above Burnside receive the designation “north,” while all below receive the designation “south.”) Like the city of Portland itself, the East and West sides of Burnside are separated by the Willamette River. The Burnside

| | Before | After |
|------------------------------------|---------------------------------|---------------------|
| Physical features | | |
| Project Length | 0.6 mi | |
| Right of Way Width | 84 ft. | |
| Roadway Width | 54 ft. | |
| Roadway Direction | Two-way | One-way (Eastbound) |
| Operational Characteristics | | |
| Vehicles | 1,900-2,300 vph | 1,600-1,900 vph |
| Bus Routes | 3 routes | 3 Routes |
| Bus Passengers (Alighting) | 1,572 per day (Eastbound) | 1,385 per day |
| Bicycles | 1000 (approx.) | |
| Land Use (General) | Retail | |
| Land Use (Ground-floor) | Mixed (Commercial, residential) | |

Figure 6-1. Context Table: East Burnside

Bridge, which connects each side, is a major link between the East side of the city and Portland City Center, the downtown commercial center. (See Figure 6-3.)

The project area extended over a 10-block section of East Burnside from the eastern end of the Burnside Bridge to East 14th



Top: Figure 6-2. Images: East Burnside

Top. East Burnside looking west toward Portland City Center. Bottom. East Burnside looking east.

Left: Figure 6-3. Context Map: East Burnside

Basemap: City of Portland

Street. This stretch (and its western analog) is sometimes referred to as “Lower Burnside.” The project area also included NE Couch Street, a narrower street running parallel to the north. The right-of-way of E Burnside is approximately 84 feet wide for the majority of the project length and Couch approximately 60 feet.

Historically, both land use patterns and transportation planning have shaped the development of Burnside. For many years, this stretch of Burnside – and the street in general – had a reputation as the city’s “skid row” (Oregon Historical Society, 1979). As early as 1860, for example, the street became notorious for its liquor and card rooms, which were popular with sailors. In the early and mid-20th Century, traffic concerns prompted design changes. The Burnside Bridge opened in 1926 to improve access to the city’s downtown. In 1932, the city replaced the original sidewalks on the east side of the Bridge with vehicular lanes and converted the first floors of the adjacent buildings with a pedestrian arcade, which is still visible in many remaining buildings (Figure 6-4) (City of Portland Office of Transportation & Portland Development Commission, 2002).

Land use and urban Form. As of 2012, E Burnside is lined primarily by commercial uses, which is characterized by a mix of both auto- and pedestrian-oriented businesses. Parking lots, motels, and repair shops (all with driveways and lots) are mixed in with retail stores and restaurants along the sidewalk. As of 2000, the city’s zoning code designates the blocks immediately along E Burnside “Exd,” which stands for light industrial (“Ex”) with a design overlay (“d”) that requires a development review process to preserve historic character. The larger surrounding neighborhood appears predominately residential north of E Burnside and light industrial to the south. Some blocks along the street feature a visually distinct, uninterrupted street wall that is composed of three- to four-story buildings (from the late-19th and early-20th century) and a two-story arcade for pedestrians. Other blocks feature parking lots and later construction with irregular setbacks, driveways, and parking. Some blocks feature both – either side-by-side or across from each other, creating a varied



Figure 6-4. Land Use and Sidewalk Conditions

Ground-floor land use on East Burnside is a mix of street-level retail and auto-oriented businesses. The street’s oldest buildings include an arcade.

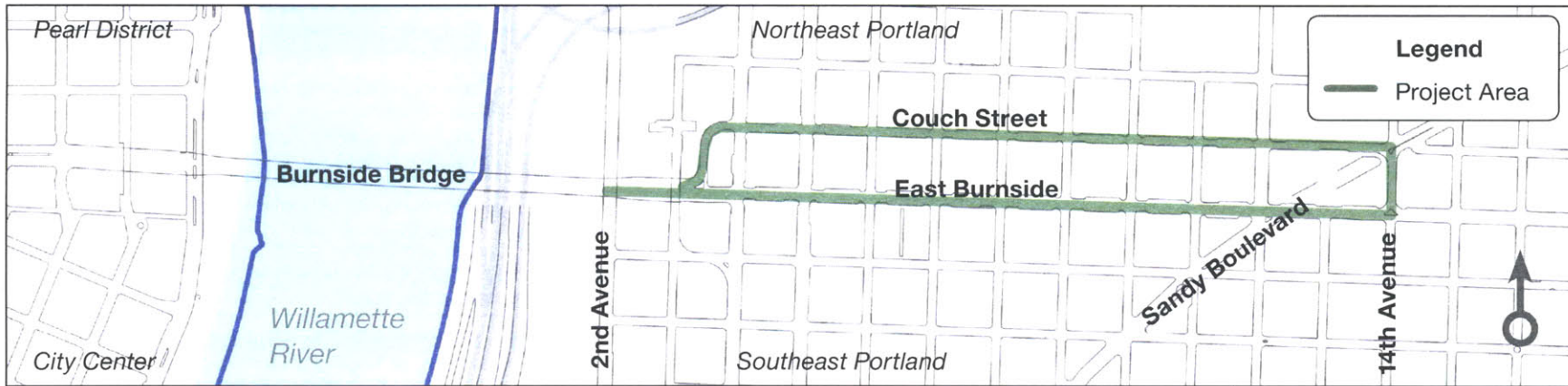


Figure 6-5. Project Map: East Burnside

Base map: City of Portland.

visual experience. For example, on some blocks the pedestrian arcade stops halfway along the block.

Transportation. The project entailed major physical changes to Burnside, which impacted its role in the transportation network (described more fully below). Nevertheless, several key aspects of the corridor remain unchanged. Thanks to the Burnside Bridge, the project area serves as a major vehicular connection between the East Side of the city and Portland City Center (Figure 6-5). The *Transportation System Plan* (TSP) classifies the street as a “major city traffic street” (its highest non-freeway classification), and the street carries approximately ten to fifteen thousand vehicles per day (Haberman, 2009). In addition to carrying traffic along East Burnside, which serves the residential neighborhoods to the east of the project area, the project area also provides a vehicular connection

to Sandy Boulevard, a diagonal arterial extending northwest, at 14th Street.

East Burnside also serves a principal route for other street users. The project area serves three city bus lines that connect the eastern and northwestern neighborhoods to Downtown. The 2011 project also included the addition of a dedicated bike lane for eastbound cyclists. Finally, both Couch and Burnside include sidewalks, serving pedestrians reaching ground-floor businesses.

Project development

PBOT and the Portland Development Commission (PDC) developed the East Burnside project jointly. Although PBOT managed the project, PDC provided funding for planning, and the project thus focused on both the corridor’s transportation function and economic development role. The physical scope of the project originally included a section of West Burnside, stretching from West 23rd Avenue to the Burnside Bridge (along the north edge of Portland City Center). That section of the project remains in planning, after encountering several political obstacles (Hoffman, 2012), particularly financing its \$80 million price (which included a proposed west side street car route). The East Burnside project, however, benefited from a diversity of funding sources, including \$4.6 million in city funds, \$5.4 million in tax-incremental financing (TIF) from the PDC, a \$7.6 million federal grant, and \$250 thousand grant from Oregon DOT (Anderson, 2010). Overall, project development began in 1999 and construction finished in 2010.

Context-sensitive design. The design process employed a CSD approach. At the start of the project, PBOT convened a Stakeholder Advisory Committee (SAC), which included residents, business owners, landowners and representatives of business and community groups. Instead of defining the project, PBOT initiated a pre-planning phase that gathered community input to define the scope of the project. This pre-planning work also built off of plans previously developed for each neighborhood through a community engagement process (Hoffman, 2000). Subsequently, each additional

| Development of East Burnside Project | |
|--------------------------------------|---|
| 1999-2000 | Pre-Planning and Scoping |
| 2000 - 2001 | Stakeholder Advisory Committee (SAC) meets regularly with PBOT to develop project jointly |
| December 2002 | PBOT releases Transportation & Urban Design Plan with final proposed design |
| August 2005 | PBOT updates its design in a Technical Refinements report |
| April 2007 | City council resolution approves preliminary engineering of the East Burnside work |
| August 2009 | PBOT begins construction |
| September 2010 | PBOT completes construction on East Burnside |
| November 2011 | PBOT releases East Burnside Performance Measurement Evaluation |

Figure 6-6. Project Timeline: East Burnside

phase of the project (goal setting, developing alternatives, selecting a project concept, city approval), were led by the SAC and PBOT. Throughout the project’s development, the SAC met regularly and each phase of the project included a workshop, open to the community, to gather additional input (City of Portland Office of Transportation (POT) & Portland Development Commission (PDC), 2002).

During the early scoping phase, stakeholders expressed a desire to mitigate the impacts of the automobile and to improve the pedestrian realm. A primary concern was that Burnside acted as a barrier between neighborhoods, making it difficult for pedestrians

and vehicles to cross between the north and south sides of the city (Hoffman, 2012). At a May 2000 community workshop during the pre-planning phase, recommendations included “slow traffic, make [Burnside] less attractive/more difficult to drive” and, for pedestrians, “wider sidewalks,” “curb extensions,” “street trees and furniture,” and “ornamental lighting” (Hoffman, 2000, p. 17). For other modes, some recommendations indicated that there was concern that improvements to non-motorized travel, while desired, could worsen traffic congestion. Recommendations for bikes, for example, were in conflict, suggesting the addition of bike lanes as well as removing cyclists from Burnside altogether by requiring that riders use parallel streets.

The project’s goals reflected this input. According to PBOT project manager, Bill Hoffman (2012), the project was aimed primarily at “humanizing” Burnside, while avoiding increases in traffic congestion or delay. The planning process culminated in the (2002) *Burnside Transportation & Urban Design Plan*. The plan articulates a single goal statement for the project and four design principles. The latter, which are described more fully in the 2002 report, effectively served as the plan’s design criteria (Hoffman, 2012). Altogether, the goal statement and principles express a desire to improve the experience for non-drivers without negatively impacting automobile performance. For example, one of the plan’s four design principles embraces multi-modal travel, but in its description for each mode states a desire to “recognize Burnside as an important carrier of local and regional traffic into, through, and

out of downtown Portland” (POT & PDC, 2002, p. 8). Burnside was thus to be “humanized,” without sacrificing its role as an automobile arterial.

Economic development. The Burnside project was part of larger economic revitalization plan for the Burnside corridor. According to Bill Hoffman, it was PDC that requested PBOT to extend the project to the east side, where a tax-incremental financing (TIF) district was already in place that could generate potential revenue for public projects (Hoffman, 2012). A PDC (1999) plan for the east side neighborhood surrounding Lower Burnside sought to revitalize the corridor with a mix of land uses, expanded transit service, and investments in street life. The 1999 plan identified the street’s traffic as an economic problem for the neighborhood, remarking that “traffic dominates street life and is out of balance with other on-street uses” (Portland Development Commission et al., 1999, p. 8).

The 2002 Burnside plan not only attempted to address the issue of automobile traffic, but also to spur new real estate development. The plan, released by both PBOT and PDC, identifies “Catalyst Development Areas,” key locations where public investments on Burnside could encourage re-development. On the east side, the plan identified the three-street intersection of Sandy Boulevard, East 12th Avenue and Burnside as a catalyst development area. The plan proposed converting the complicated crossing into two new city blocks. While the plan was meant to simplify the intersection, which city planners had struggled to improve for decades (Hoffman, 2012), the two new blocks were

meant to “provide an opportunity for ‘signature architecture’” that could “stimulate additional employment-based development” (POT & PDC, 2002, p. 16). The investments in East Burnside, thus, had an interest in both economic development and transportation.

Participation. The PDC’s role in shaping the boundaries of the project is one indication that community participation played only a limited role in guiding design decision-making. The CSD process involved the SAC in all stages of the design process, but city officials controlled several important parts of the design process, such as when PDC prompted PBOT to incorporate the east side of Burnside and when the City Council approved the project’s final design in 2007.

The status of the project on the *west* side of Burnside also suggests that the design process failed to incorporate all community interests. The west side work had clear support from at least some area businesses. In 2003, a group of business- and property-owners formed the Friends of the Burnside/Couch Couplet (FBCC). This non-profit group has been led by Michael Powell, the owner of Powell Books, a major business and well-known landmark on Burnside (Pein, 2007). The city awarded FBCC a contract to work with fellow businesses and property-owners to create a financing scheme for the project that would pool their private resources. In contrast to FBCC, other local stakeholders resisted the project, particularly due to its impact on Couch. A group of residents, businesses and property owners formed the Better Burnside Alliance specifically to fight the one-way couplet on the west side. According to the Alliance’s

website, the one-way street conversion would increase traffic on Couch, damaging the pedestrian experience and hurting businesses.

Although this conflict has slowed progress on the west side, along with a lack of available funding (Hoffman, 2012), the east side experienced significantly less resistance. Unlike West Couch, the section of East Couch in the project area does not include many ground-floor businesses and, thus, was not an active pedestrian space prior to the project. For this reason, local stakeholders on the east side may have considered the couplet less threatening. Nevertheless, the conflict on the west side indicates that the original, final design does not address the concerns of all stakeholders.

Project design

The project entailed construction on East Burnside and the parallel street Couch, from NE 3rd Avenue (at the entrance to the Burnside bridge) to NE 14th Avenue.

Prior to construction, East Burnside was a four-lane, two-way street, with signals and pedestrian crossings placed irregularly at only few intersections. Parking lanes were provided on each side of the street, but were open to through-traffic during peak hours (the westbound parking lane open to traffic in the AM peak, and eastbound in the PM peak). Burnside offered no bike facilities and was not designated by the city’s Transportation System Plan (TSP) as a cycling route. At several intersections, left turns were prohibited to reduce traffic delays (Hoffman, 2012). Bus stops were located

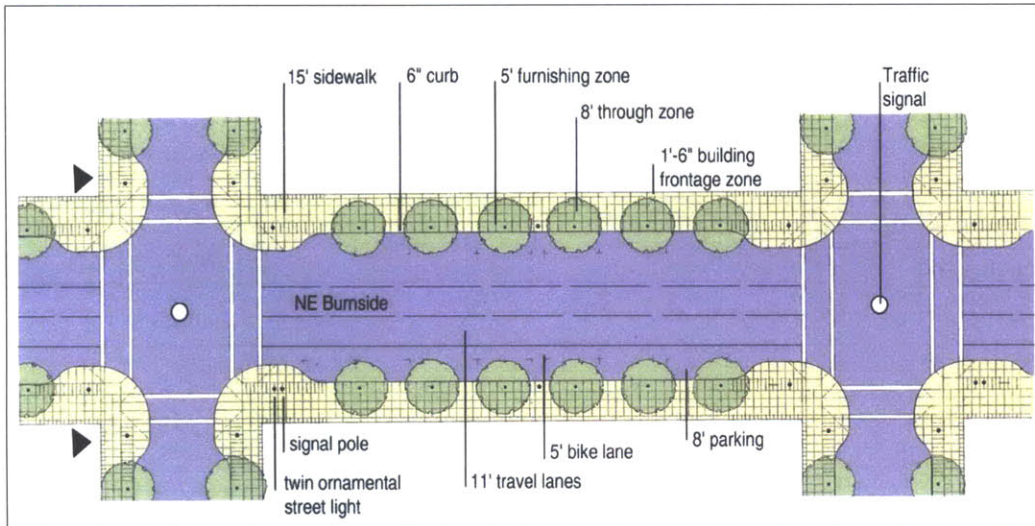


Figure 6-7. Street Plan: East Burnside

The re-design of East Burnside added signals and curb extensions to every intersection. Plan: PBOT.

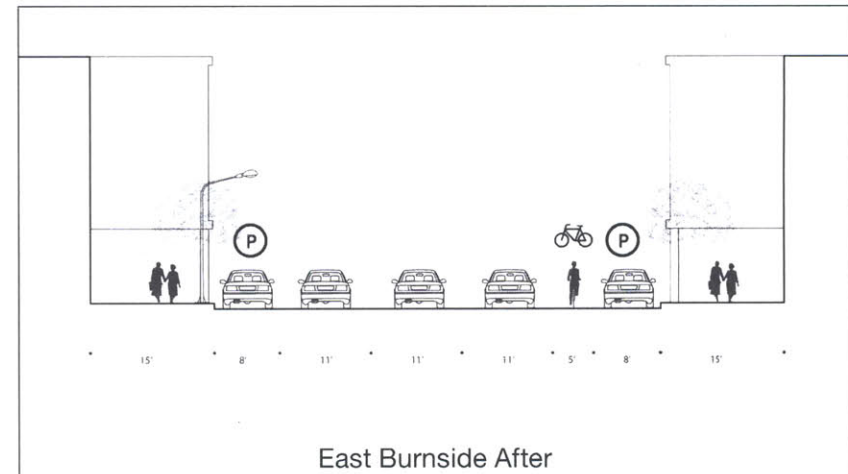


Figure 6-8. Image: East Burnside After

The re-design of East Burnside converted the street to one-way and added a bicycle lane.



East Burnside Before



East Burnside After

Figure 6-9. Street Section: East Burnside

The re-design of East Burnside reduced the number of general vehicle lanes from four (plus two part-time lanes) to just three and made the parking lanes full-time.

in the parking lane adjacent to the curb, which used bus turnouts to remove stopped buses from traffic (except during peak periods when the parking lane served through-traffic).

As mentioned above, the project converted Burnside and Couch into a couplet, or pair, of one-way streets. The changes enabled PBOT to make dramatic changes to the ROW of each street, without suffering an overall loss of capacity (Hoffman, 2012). On Burnside, PBOT converted the street to one-way eastbound, but reduced the number of vehicle lanes from four to three and added a dedicated, unprotected bike lane. Parking lanes were preserved on both sides of the street, but were made full-time both through signage and curb extensions that effectively ‘cap’ the parking lane at each intersection. Finally, the city added sidewalk extensions that increase the width of the sidewalk by up to eight feet at every intersection. The project did not make major changes to the street lights, which features a mix of highway-style lamps and historic-style lights that are more pedestrian in scale, or trees, which already lined both sides of the street of each block. (See Figures 6-7 to 6-9.)

The project’s changes, however, included many new features designed to benefit pedestrians. Signals and pedestrian-crossing lines were added to eight intersections on Burnside and ten on Couch, making every intersection in the project area signalized and marked for pedestrians (Figure 6-10). The sidewalks on Burnside were widened from approximately 12.5 to 15 feet in several sections (specifically between NE 3rd Ave and NE 6th and between NE 12th Ave and NE 14th) and the eight-foot extensions at each corner

| East Burnside | Before | After |
|-----------------------------------|-----------------------------------|---|
| Cross-Section Elements | | |
| Roadway Direction | Two-way | One-way (Eastbound) |
| Sidewalk Width | 10-15 ft. | 15 ft. |
| General Vehicle | 6 lanes (2 part-time) | 3 lanes (11 ft.) |
| Parking | 2 lanes (2 part-time) | 2 lanes (8 ft.) |
| Dedicated Bike Lane | N/A | One-way, 5 ft. wide, un-protected, no buffer, right-hand side |
| Dedicated Bus Lane | No bus lane | |
| Plan Elements | | |
| Signalized intersections | 25% | 100% |
| Marked pedestrian crossings | 25%, Every 1,000 ft. | 100%, Every 250 ft. |
| Max. pedestrian crossing distance | 62 ft. | 38 ft. |
| Special Features | N/A | Curb Extensions, Bio-swales |
| Sidewalk Amenities | | |
| Transit | Stop markers | Benches, weather protection |
| Pedestrian | N/a | Outdoor restaurant seating |
| Bike | Some bike racks | Additional bike racks |
| Lighting style (height) | Historic (12 ft.), Cobra (40 ft.) | |
| Trees (height) | Consistent (15-30 ft.) | |

Figure 6-10. Design Features: East Burnside

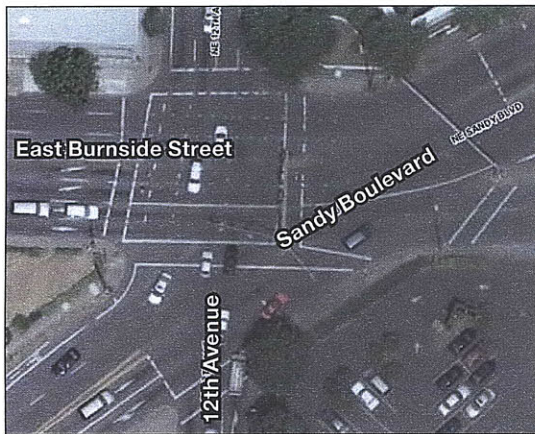
reduced the crossing distance over Burnside from 60 to 38 feet. The city did not add any furniture, but ground-floor businesses have taken advantage of the wider sidewalks, adding their café furniture and benches in various styles. While the vehicle lane widths increased from 9 to 11 feet, the frequent signals and curb extensions are both meant, in part, to slow vehicle speeds (Hoffman, 2012).

In addition to aiding pedestrians, the sidewalk extensions are also employed to pursue other transportation and non-transportation aims (Figure 6-11). In the extensions, PBOT has installed bike racks, bus stops and bio-swale gardens. As bus stops, the extensions remove the old bus turnouts, allowing buses to remain in the traffic lane while discharging and collecting passengers. The city has also installed 19 bio-swales at almost every intersection (predominately on the east side of each cross street where sunlight from the south and west is not in shadow). The bio-swales not only mitigate stormwater runoff, but



Figure 6-11. Images: Re-Design of East Burnside

Top left: Curb extensions reduce the distance required to cross the street. Top right: Local restaurants have placed furniture on the expanded sidewalks. Bottom left: Curb extensions offer space for bus stops with benches and weather protection. Buses stay in the lane of traffic when making stops. Bottom right: On every block, curb extensions feature bio-swales for stormwater runoff.



Before



After

Figure 6-12. Intersection of Sandy Boulevard and East Burnside

The re-design of East Burnside created two new city blocks by removing Sandy Boulevard between 12th and 14th Avenues.

Images: PBOT

feature colorful landscaping that creates a pleasant environment and forms a buffer between pedestrians and traffic.

The project's biggest change to the street structure occurs at the intersection of East 12th Avenue, Sandy Boulevard, and Burnside, where the project removed Sandy Boulevard altogether between East 12th and East 14th, directing westbound Sandy traffic onto Couch and eastbound Sandy traffic onto Burnside. The change dramatically simplified traffic patterns. At East 12th and Burnside, for example, the intersection reduced turning movements from six to four (S. Cohen, 2011). (See Figure 6-12.) While new development has not yet occurred at the site, PBOT has made investments in the area as a destination, including a small public garden that offers additional stormwater drainage and is filled with landscaped plantings, public art and stone walls for seating.

Use of performance-based planning

Performance-based planning was not used extensively during the project's development, but was used to help guide certain decisions, as described below. Instead, performance measurement was used primarily as an *ex-post* evaluation tool. East Burnside was the subject of a 2011 performance evaluation report by PBOT official Scott Cohen (2011). In an interview, Cohen (2012) reports that Burnside is the second of only three projects that have undergone an extensive performance evaluation relative to original project goals, and was completed to comply with the regulations of the federal grant that helped fund the project. While the evaluation measured performance before and the project, Cohen (2012) indicates that the "evaluation was brought in in the background and did not really inform the project decisions."

Bill Hoffman, the project manager at PBOT, shed light on how performance concerns helped shape the project development. Hoffman indicates that the SAC and PBOT developed several alternatives for the project, including two that did not employ the couplet approach,

and assessed them using the project’s criteria. For example, planners considered how well each alternative mitigated Burnside as a barrier for pedestrians. The project development, however, operated under a single performance constraint: to maintain the capacity of the street to move traffic. “More than anything,” Hoffman reports, “that is what drove us to the couplet” (Hoffman, 2012). The shift to the one-way pair vastly simplified other performance concerns by erasing the need to make major trade-offs. According to Hoffman, the couplet resulted in excess capacity on Burnside that enabled the project to add improvements to other users without hurting automobile capacity. As a result, Hoffman reports, “we were pretty much able to nail everything.”

The *ex-post* evaluation report identified specific measurements, both quantitative and qualitative, to assess progress relative to the project’s goals. These goals only roughly correspond to the original goal statement and design principles articulated in the 2002 plan, which is likely a result of the separation between the design and measurement processes (Figure 6-13) (Cohen, 2012). The goals in the evaluation report are more clearly measurable than the 2002 design principles. While the evaluation assesses the major goals of the 2002 plan, including improving the pedestrian realm while accommodating vehicles, it does not attempt to measure impacts on economic development (Principle 4 in the 2002 plan). The evaluation uses a mix of methods, including a survey of businesses and households, video recordings of pedestrian

| Transportation & Urban Design Plan (December 2002) | East Burnside Couch Project Performance Measures Final Report (November 2011) |
|--|---|
| Design Principles | Goals |
| 1. Recognize and Enhance Burnside’s Diverse Character | 1. Enhance Vehicle and transit access and flow |
| 2. Support and Encourage a Mix of Business and Uses | 2. Reduce traffic conflicts between autos and bicycles |
| 3. Eliminate Burnside as a Barrier | 3. Significantly improve pedestrian safety |
| 4. Recognize Burnside as a Multi-Modal Transportation Corridor | 4. Improve access to businesses |
| | 5. Improve community perception of the streetscape |

Figure 6-13. Comparison: East Burnside Goals & Design Principles

The original design principles for East Burnside from 2002 (left) do not correspond to goals used to evaluate project in 2011 (right).

and vehicle movements at key intersections, and counts of traffic volumes and travel times for automobiles and transit.

The report indicates mixed results. On the positive side, the evaluation found fewer conflicts between cyclists and vehicles, increases in pedestrian safety and improved perceptions of the streetscape. For example, survey results indicated pedestrians found the street both more attractive and safer to cross. A video analysis showed that crossing gaps – when pedestrians can safely cross the

street – had increased at one intersection from 3 to 110 gaps in a two-hour span. On the negative side, the evaluation found deterioration in automobile and bus performance and no improvements to business access. For example, the evaluation found that travel times had stayed the same or increased for automobiles and cars.

Although economic development was articulated as a primary project goal in the 2002 plan, the ex-post evaluation report does not measure this explicitly. The only business-related measure is an evaluation of improvements in “access to businesses.” The PBOT officials suggested that the 2011 evaluation, completed only a year after the project’s completion, could not provide a complete assessment of the project’s results (Hoffman, 2012; Cohen, 2012). Economic development may take a considerably longer time to materialize.

Performance-based planning and community engagement

Measuring community perception. The project’s *ex-post* evaluation report demonstrates how agencies can use measurement as a two-way communication tool. For PBOT, the report was an effective means of demonstrating the project’s success. According to Cohen (2012), “what performance measurement showed was the project did the things we wanted it to and did it objectively.” Despite this endorsement, Cohen questions the value of using performance measurement to promote progress with residents, suggesting that the public process is robust regardless of whether performance data is released.

For community stakeholders, however, the evaluation report provided an uncommon opportunity to express their own reaction to the project. The report is notable in that it attempted to measure community perceptions. Instead of relying solely on easily measurable data, like traffic delays, the evaluation report’s surveys attempted to measure the views of local residents and businesses. In this way, performance measurement can, thus, shift planning and evaluation beyond looking solely at transportation outcomes.

Just as Appleyard (1981) argues, however, the measurement of subjective perceptions was a challenge. Cohen (2012) reported, “It’s hard to gauge the change in satisfaction with the commercial and streetscape environment. How do you ask people if they think it’s better now than it was then? How do you get at that objectively?” Subjective measures are also subject to many variables, which can be difficult to identify. The survey in the 2011 evaluation, for example, found no changes in perceptions of Burnside’s “convenience” for accessing businesses, despite data that indicated an increase in the availability of parking (Cohen, 2011). Without collecting more free-form feedback, the survey was unable to identify what additional variables were impacting “convenience.”

Creating a measurable plan. While performance-based planning was primarily confined to post-project evaluation, the project officials recognize its potential as a tool during the design process. To unlock that potential on E Burnside, the plan would have needed

measurable goals from the start (Hoffman, 2012; Cohen, 2012). According to Cohen, “For a better way for a performance-driven process, we would have looked at the goals, made them measurable, and then found the infrastructure changes to flow from that.” The differences between the project’s original design principles and the goals in the evaluation indicate, however, that that was not the case.

The E Burnside officials suggest that creating measurable plans may be particularly difficult in a CSD design process. First, objective measurement may not be compatible with community input. According to Cohen, it’s possible that PBOT and other local agencies are more focused on creating goals that represent the community’s needs than those that are easily measurable.

Second, community input may destabilize project goals over time. According to Hoffman, the community engagement process for Burnside saw a shift in the priorities placed on various design criteria. During the project’s development, PBOT created several alternatives, each of which favored certain design criteria over others. As the SAC examined each alternative, they were better able to understand the physical consequences of pursuing one goal over another. Hoffman explains, “at the front end, every design criteria looks good, until you realize that to get wider sidewalks you have to get rid of parking. All of a sudden, as great as it was in the beginning, that criteria becomes a little less exciting.” According to Hoffman (2012), the result is that the most important criteria can change over time: “As you go through this process, you are learning. There is an evolution of understanding. You don’t really know the

criteria which will come to the forefront and those that drop to the back. People’s thoughts aren’t static.” During the community engagement process, then, performance goals can change over time. Furthermore, not all performance goals are likely to be pursued equally – only those that are valued by the community

Prospect Park West, Brooklyn

In 2010, NYC DOT completed a re-design of Prospect Park West in Brooklyn. In addition to numerous changes, the project’s most visible work was the addition of a protected, two-way bicycle lane. Shortly after being completed, the project – specifically the bike lane – was criticized by some local residents and eventually became the subject of a court case brought by two community groups against DOT.

With respect to form, the project’s final design demonstrates an attempt to balance multiple street users, but leaves open the question of which community interests design should respond to. Although DOT and local leaders have agreed to keep the bike lane in place, it is clear that some local residents remain very much opposed to the project.

With respect to process, the PPW case did not use the CSD framework, but was initiated and largely guided by community leaders. Although the project did not employ all features of the performance-based planning framework, DOT used an ex-post evaluation to respond to opposition by demonstrating that the project had successfully achieved the community’s goals. In addition, several public polls, independent of DOT, indicated that the project had a broad base of support among community stakeholders. Through these examples of measurement, ex-post evaluation and public polling, the case shows how performance-based planning

| Prospect Park West | Before | After |
|------------------------------------|----------------------|-------------------|
| Physical features | | |
| Project Length | 0.6 mi | |
| Right of Way Width | 93 ft. | |
| Roadway Width | 49 ft. | |
| Roadway Direction | One-way (Southbound) | |
| Operational Characteristics | | |
| Vehicles (peak) | 800-1,000 vph | 800-1,000 vph |
| Bus Routes | None | None |
| Bus Passengers | N/A | N/A |
| Bicycles | 350 per day | 800-1,000 per day |
| Land Use (General) | Residential | |
| Land Use (Ground-floor) | Residential | |

Figure 6-14. Project Context: Prospect Park West

Data: NYC DOT.

can serve as an effective tool for two-way communication between agency and stakeholders.

Context

Prospect Park West (PPW) is a one-way street running southbound. The street runs at along the western border of Prospect Park, which lies at the geographic center of Brooklyn. In addition,

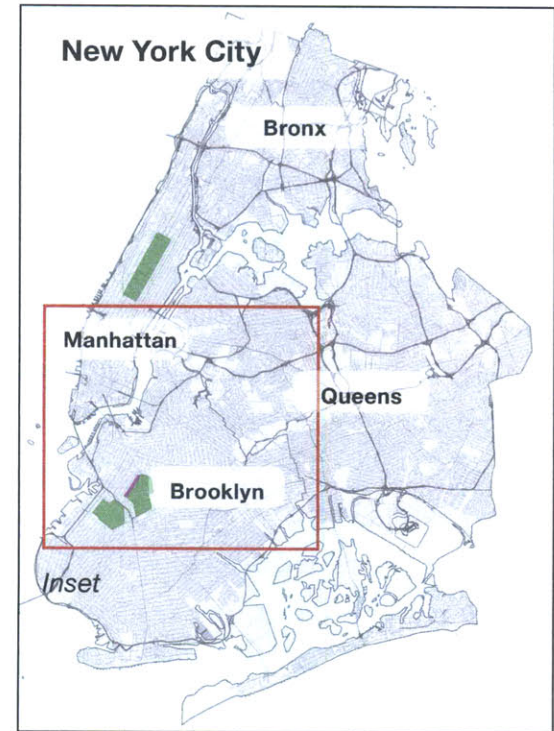
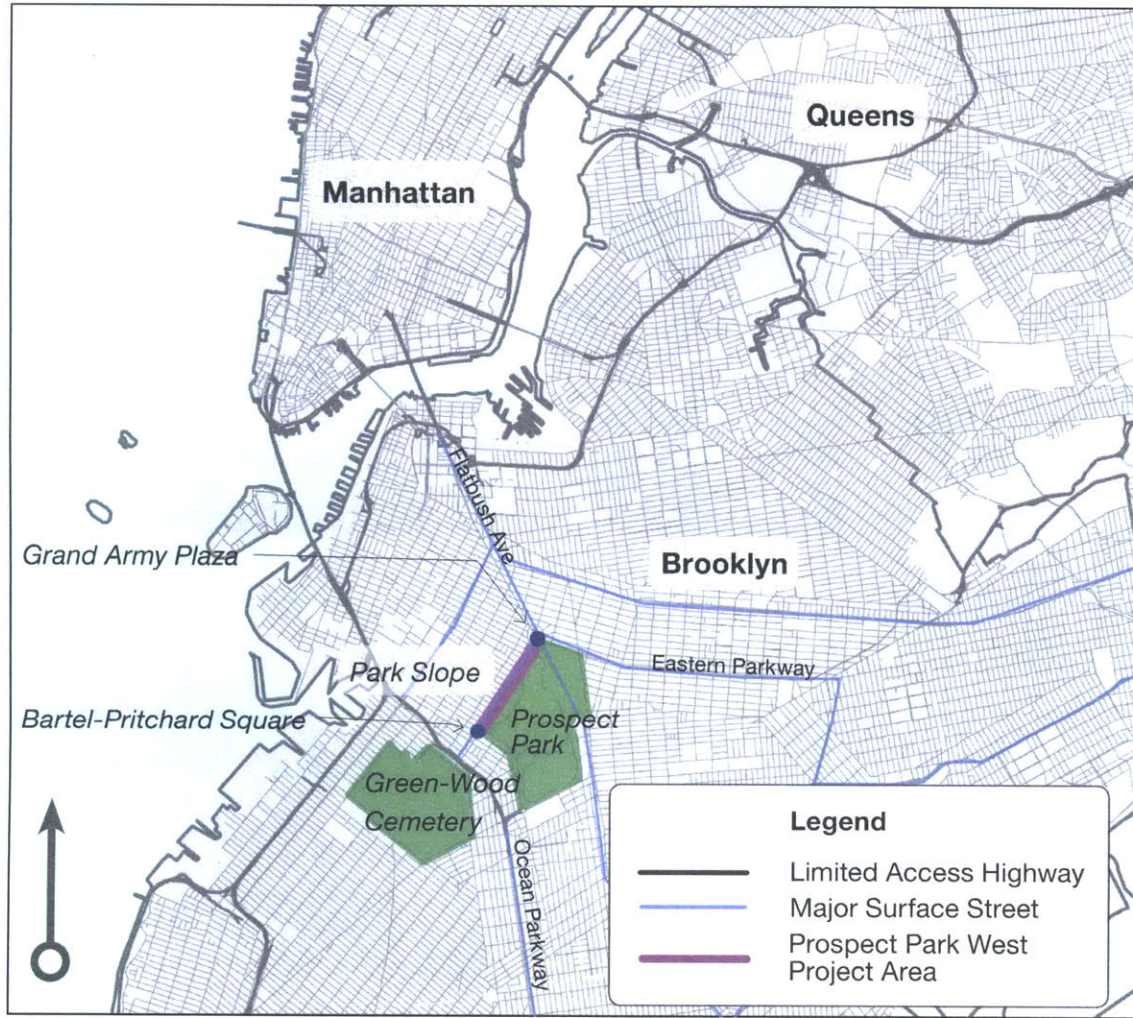


Figure 6-15. Context Map: Prospect Park West
Basemap: NYC.gov.

the street serves the eastern border of Park Slope, a predominately higher-income residential neighborhood just west of the Park. (See Figure 6-15.)

The street begins at Grand Army Plaza, a large intersection of Brooklyn’s major surface streets and the main pedestrian entrance to Prospect Park, and ends at the Green-Wood Cemetery to the south. The street is short, running just under 1.5 miles. With a roadway of approximately 50-feet (but a right-of-way as wide as 80-feet) PPW may also be narrower than some arterials and, thus, in AASHTO terminology, might be more accurately described as a “connector.” Nevertheless, the street offers a convenient route for non-local traffic, by forming a connection between the high-volume streets running in the north through Grand Army Plaza (Eastern Parkway and Flatbush Avenue) and Prospect Expressway/Ocean Parkway in the south.

Project Development

For the re-design of PPW, DOT did not initiate an ongoing, context-sensitive design process led by a group of community stakeholders. For example, community stakeholders did not perform a formal scoping process to identify project goals or develop multiple project alternatives. However, according to Joshua Benson (2012), who oversaw the project at DOT from the Office of Bicycle & Pedestrian Programs, the project was initiated by local community leaders. Specifically, in 2007, Brooklyn Community Board 6 (CB6), which represents Park Slope and other nearby neighborhoods, sent a

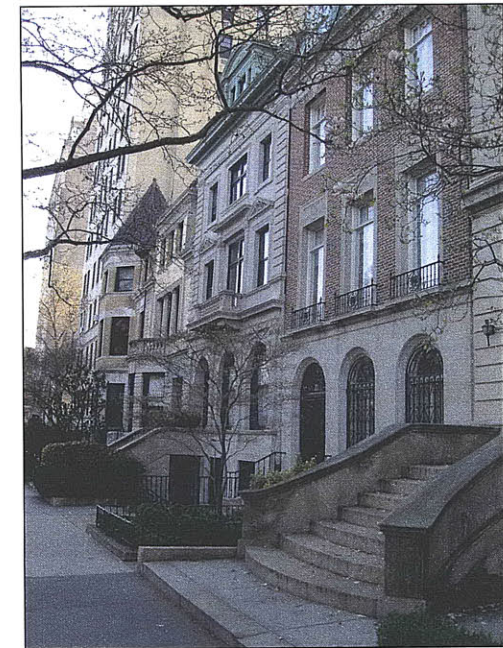


Figure 6-16. Images of Prospect Park West.

Top: View northward toward Grand Army Plaza.

Right: The majority of the land use on Prospect Park West is residential.

| Development of Prospect Park West | |
|-----------------------------------|---|
| June 2007 | CB6 requests bike lane in letter to DOT |
| April 2009 | DOT presents plan to CB transport committee |
| May 2009 | CB6 approves project but requests specific modifications |
| April 2010 | Community open-house |
| April 2010 | DOT presents modified plan to CB6, which approves the project |
| June 2010 | DOT completes construction of project |
| July 2010 | City Council Member Brad Lander requests that DOT monitors project impacts |
| January 2011 | DOT presents project impact report to CB6 |
| March 2011 | CB6 holds public hearing to hear community response to project |
| March 2011 | Two community groups, Seniors for Safety and Neighbors for Better Bike Lanes, introduces court case against DOT |
| April 2011 | CB6 votes to re-affirm project with specific design modifications |
| August 2011 | NY State Supreme Court dismisses primary claim against DOT |
| September 2011 | Bike lane opponents file appeal against NYS Supreme Court decision |

Figure 6-17. Project Timeline: Prospect Park West

letter to DOT Commissioner Janette Sadik-Khan requesting traffic safety measures and a new bicycle path along PPW from Grand Army Plaza to Bartel Pritchard Square (Bashner, 2007).

The 2007 letter indicates that CB6’s request was motivated by two key concerns: conflicts between pedestrians and cyclists/ speeding vehicles. The letter’s primary purpose was CB6’s response to a separate DOT proposal to install a bike lane on 9th Street, which intersects with PPW. While CB6 supported that project, they wished to discourage cyclists in the area from using the pedestrian entrances to the park along PPW. As a result, CB6 requested the bike lane along PPW to connect bicycle infrastructure on several cross-streets to the vehicular (non-pedestrian) entrances to Prospect Park at Grand Army Plaza. According to the letter, DOT also saw the bike lane as a means of improving safety for other street users. The letter requests that DOT perform a “study of traffic-calming measures on PPW, including the possible installation of a one-way or two-way Class I bicycle path on the eastside of PPW” (Bashner, 2007, p1). When the project’s development began, its title reflected CB6’s main concerns. In its presentations to CB6 and the public, DOT referred to its work as the “Prospect Park West Bicycle Lane and Traffic Calming” project (NYC DOT, 2009).

Following CB6’s 2007 request, DOT developed the PPW project very slowly and refined the project in response to community feedback. (See Figure 6-17.) DOT presented its first plan for PPW to the CB6 transportation committee in April 2009, and the Board approved the project with several requested modifications in May

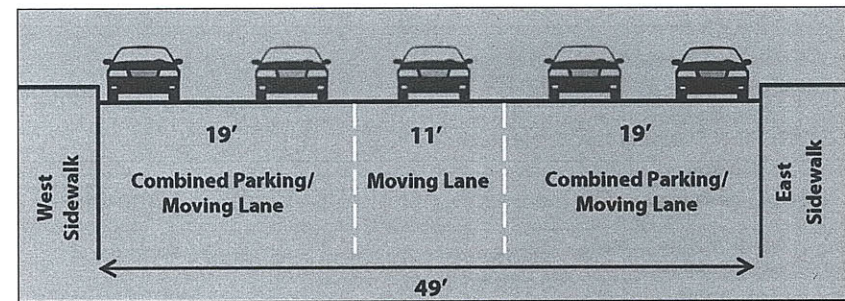
2009. One year later, in April 2010, DOT held a community open-house to present the plan and collect feedback. Later that month, DOT presented a modified design to CB6, which was supported.

Overall, community stakeholders enjoyed a great deal of participation in decision-making. First, community input played a strong advisory role in helping DOT modify the design. Second, although the project was not a CSD process, CB6 still controlled most aspects of the design process, including initiating the project, recommending its basic design (a protected bike lane), and issuing its formal support of the project.

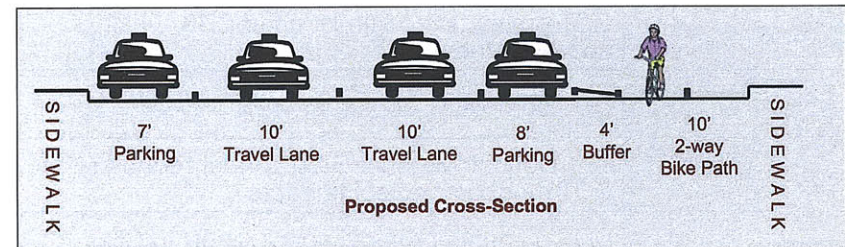
Project Design

Prior to construction, PPW included three vehicle lanes, two parking lanes, and sidewalks, including a very generous pedestrian right-of-way along the park. In accordance with CB6's request, DOT installed a two-way bicycle lane along the park border, which resulted in the elimination of one vehicle lane. (See Figures 6-18 and 6-19.) Using a model based on earlier projects, particularly the Hudson River Park bike path and Ninth Avenue in Manhattan (Benson, 2012; NYC DOT, 2010d), DOT placed the bicycle lane between the parking lane and the sidewalk, to protect cyclists from motor vehicle traffic, and installed a buffer space between the bicycle lane and parking, to enable vehicles to open doors without hitting cyclists.

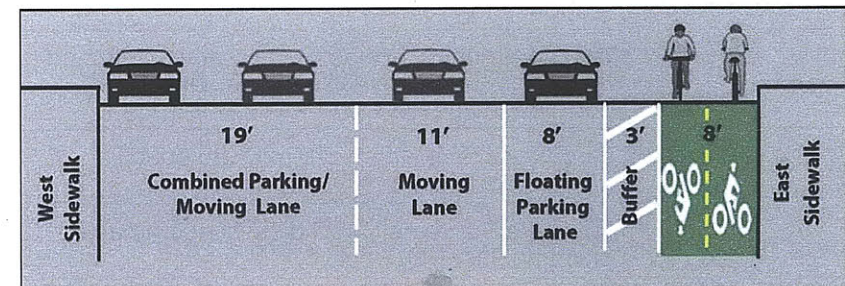
While this general plan remained consistent throughout project development, the final design (April 2010) attempted to



Pre-Construction (pre-2010)



Preliminary Design (2009)



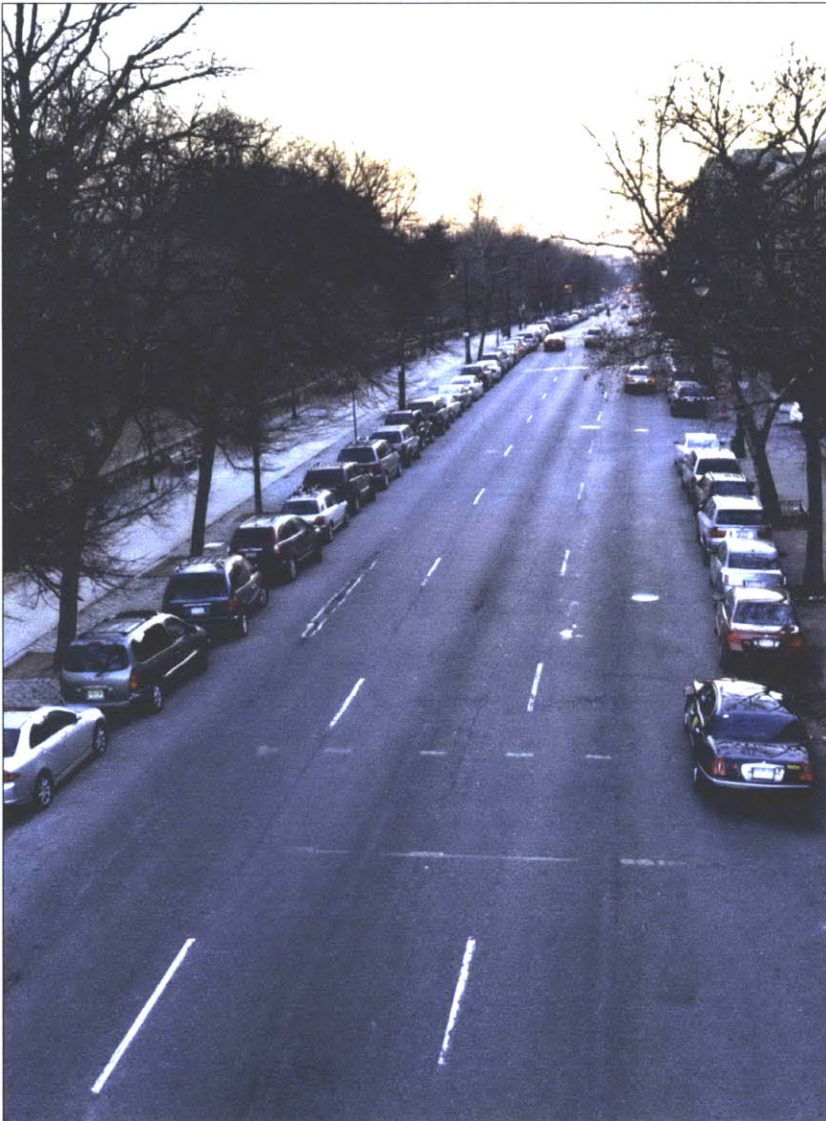
Final Design (2010)

Figure 6-18. Street Sections: Prospect Park West

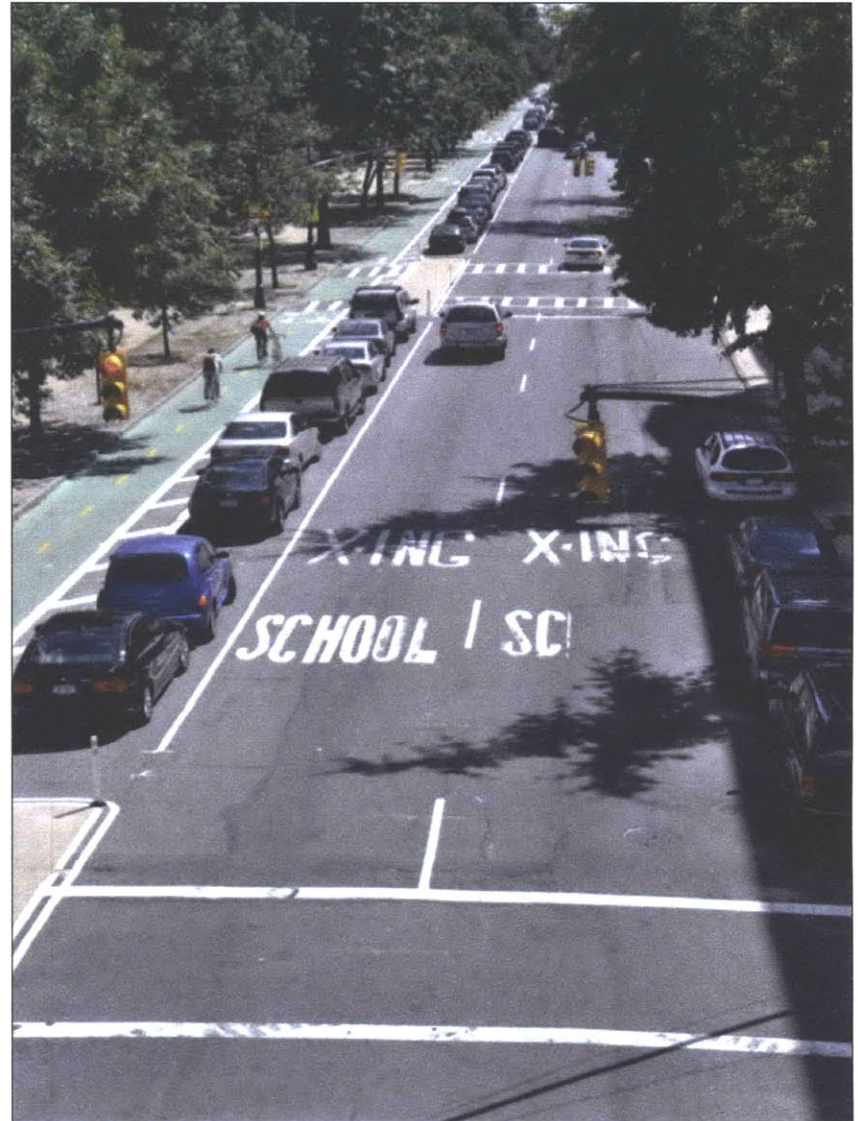
Top: The layout of Prospect Park West prior to 2010.

Center: In 2009 DOT introduced plans to add a two-way bicycle lane protected from traffic by a buffer and a parking lane.

Bottom: In 2010, DOT's final design kept the bicycle lane, but made it narrower to give more space for vehicles. Sections: NYC DOT.



Before



After

Figure 6-19. Images: Prospect Park West Before & After
Photos: NYC DOT.

address key community concerns articulated by residents and CB6. Although the bicycle path promised performance improvements for cyclists, modifications focused on performance issues for pedestrians and vehicles. According to a 2010 DOT presentation, major concerns included the safety of pedestrians crossing the bicycle path, double-parked vehicles blocking traffic, and the narrow widths of the proposed parking lanes (NYC DOT, Office of Bicycle & Pedestrian Programs, 2010). To address the issue of pedestrian crossings, DOT had already proposed new signage and markers for cyclists and pedestrians. (See Figure 6-21.) While CB6 also requested adding bike signals to every intersection, DOT compromised by adding flashing-yellow lights at only signalized intersections, which the agency argued would communicate to cyclists to yield to pedestrians. To address double-parking, DOT added loading zones at four locations, which would be dedicated to short-term stops by delivery trucks. Finally, to address the width of the parking lanes, DOT modified its original proposal by redistributing the roadway space among all modes. From the initial proposal to the final design, DOT narrowed the bicycle lane (from 10 to 8 ft.), narrowed the buffer (from 4-feet to 3-feet), widened the left-hand vehicular lane (from 10 to 11 ft.), and used a “combined parking/moving lane” (19 ft.) that effectively widened the right-hand parking lane (from 7 to 8 ft.) and the right-hand vehicular lane (from 10 to 11 ft.) (See Figure 6-18.) These final modifications, which shifted space from bicycles to vehicles, demonstrate that DOT sought not only to support

| Prospect Park West | Before | After |
|-------------------------------------|--|---|
| Cross-Section Elements | | |
| Roadway Direction | One-way (Southbound) | |
| Sidewalk Width | East 29ft./West 15 ft. | |
| General Vehicle | 3 lanes (11 ft.) | 2 lanes (11 ft.) |
| Parking | 2 lanes (8 ft.) | 2 lanes (8 ft.), Delivery zones |
| Dedic. Bike Lane | None | Two-way, protected, 11 ft. (3 ft. buffer), left-side |
| Dedicated Bus Lane | No bus lane | |
| Plan Elements | | |
| Signalized Intersections | 50% | |
| Ped. Crossings - Marked, Signalized | 50%, Every 450 ft. | |
| Max. Pedestrian Crossing Distance | 49 ft. | 32 ft. |
| Special Features | | Pedestrian refuge islands, pedestrian warning lights for cyclists |
| Sidewalk Amenities | | |
| Transit | N/A | N/A |
| Pedestrian | 10 ft. amenity zone on east side with benches, water fountains, trash cans | |
| Bike | No | |
| Lighting style (height) | Historic, park style (12 ft.), NYC Type M (27.5 ft.) | |
| Trees (height) | Consistent (15 ft.) | |

Figure 6-20. Design Features: Prospect Park West

bikes, but to achieve a balance among all modes that reflected community concerns.

DOT's changes to the PPW roadway, however, do not fully describe the resulting form on the complete right-of-way. The eastern sidewalk of PPW was already very wide (29 ft.), including a large buffer area (9.5 ft.) paved with cobblestone and lined with trees, a typical concrete walking area (10 ft.) and an amenities zone (9.5 ft.) also paved with cobblestone and lined with benches. Although the wide space is separated from the park by a short, stone wall, the unconventional surface materials, mature trees, abundant seating and other park-like amenities (water fountains, pedestrian-scale lighting, etc.) make the area feel like an extension of the park itself. (See Figure 6-21.) The introduction of the bike lane has likely increased this sense, by shifting all automobiles westward by 11-feet. Not only are moving vehicles further away from the space, but all walkers and cyclists on the eastern side of the street now enjoy an unbroken right-of-way (40

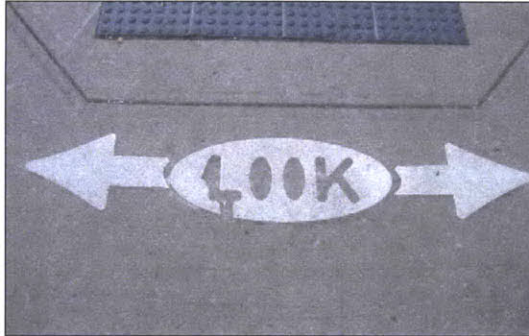


Figure 6-21. Images: Re-Design of Prospect Park West

Top: New signage is directed specifically at pedestrians and cyclists

Bottom: The new bike lane creates a broad, 40 ft. right of way for biking, walking and sitting.

ft.) that is roughly the same as that afforded to moving and parked vehicles (38 ft.).

Use of Performance-Based Planning

The project development of PPW does not exemplify performance-based planning. At its start, project planners did not define a set of goals or measurable objectives for the project. Furthermore, there is no evidence that planners utilized performance measures to examine trade-offs between various design proposals. According to Benson (2012), the project focused on the feasibility of CB6's main requests, and, thus, DOT considered only one other alternative: a no-build option.

Performance reporting. Despite eschewing performance measurement for design decision-making, DOT relied on measurement reports to demonstrate the benefits of the project and generate support among local leaders. During the project's early development, for example, DOT used performance results to explain the project's potential benefits to CB6. When presenting its first set of plans to the board, DOT compared PPW to Ninth Avenue, where, the agency reported, a left-hand side, protected bicycle lane had increased bicycle traffic and reduced traffic related injuries (NYC DOT, 2009). Furthermore, DOT presented traffic data on PPW, arguing that the high rate of illegal speeding merited the installation of traffic calming measures.

DOT took much greater advantage of performance reporting, however, after the PPW project completed, when several

neighborhood stakeholders emerged as vocal opponents to DOT's changes. According to WNYC's Andrea Bernstein (2011), for website *Transportation Nation*, the fight that ensued involved several high-powered civic leaders, including Brooklyn Borough President Marty Markowitz, Iris Weinshall, the previous transportation commissioner under Mayor Michael Bloomberg, and Norman Steisel, a former deputy mayor and sanitation commissioner under Mayor Ed Koch. Bernstein reports that Markowitz and Weinshall, who both lived on PPW (though Markowitz moved away in 2009), were concerned that the new bicycle path would create traffic congestion and exacerbate parking shortages in the area.

According to Matthew Shaer (2011) in *New York Magazine*, several additional PPW residents formed opposition groups focused on removing the bike lane. Louise Hainline, then dean of Brooklyn College, formed Neighbors for Better Bike Lanes (NBBL), and neighbor Lois Carswell founded Seniors for Safety (SFS). (Bernstein, Shaer, and others have completed more detailed analyses of this conflict elsewhere; this report includes only relevant points.)

For these opponents, the performance results along PPW became a key point of criticism. For example, in a letter to the editor on December 17, 2010, in the *NY Times*, Weinshall, Steisel and Hainline criticized the results of the project. "When new bike lanes force the same volume of cars and trucks into fewer and narrower traffic lanes," they argue, "the potential for accidents between cars, trucks and pedestrians goes up rather than down. At Prospect Park West in Brooklyn, ... our eyewitness reports show collisions of one

sort or another to be on pace to be triple the former annual rates.” In addition, the letter alleged that DOT’s early statistics on bicycle ridership were inflated. (Putting these performance arguments aside, at least one of these opponents’ claims was misleading, since the project’s final design had made no changes to width of the remaining vehicular lanes.)

During the project’s development, NYC Council Member Brad Lander, who continues to represent the Park Slope neighborhood, emerged as a champion of the project. Recognizing the need to address performance concerns, Lander requested in July 2010 that DOT measure the performance impacts of the project and report the results following several months of operation. DOT agreed, and in January 2011 the agency presented the results of its performance report to CB6 (NYC DOT, Traffic Management Division, 2011).

DOT’s performance report did not articulate the project’s specific goals, but provided detailed results in two major areas: bicycle traffic and safety. For bicycles, DOT reported that weekday bicycle volumes more than tripled on PPW and that the percentage of cyclists using the sidewalk fell from 46% to 3%. For safety, DOT found that illegal speeding fell from 74% of vehicles to just 20%. Furthermore, both the overall accident rate and the severity of accidents declined for all users. In addition to evaluating these performance gains, DOT also addressed concerns about negative impacts to automobiles. According to DOT, despite the loss of one

vehicle lane, both traffic volumes and travel time remained virtually constant.

The impacts of DOT’s performance report are not clear. For bicycle advocates, the results were strong evidence of the project’s success. Civic leaders, however, were more hesitant. In April 2011, CB6 voted unanimously to support small modifications to the PPW bike lane, which DOT had presented alongside their performance report. According to a letter to DOT from Daniel Kummer (2011), then CB6 chairperson, the board remained divided on the bike lane and achieved unanimous support by *not* voting on the overall project. Nevertheless, according to the letter, the decision to support modifications presumed that the bike lane would stay. Whether performance measurement shaped CB6’s decision or not, however, it’s clear that DOT utilized performance reporting to articulate the value of the project.

Public polling. Performance reporting was not the only measurement tool that benefited PPW. According to Benson, media attention on PPW and other bicycle projects had fostered a city-wide debate on the value of bike lanes. A series of public opinion polls, however, demonstrated strong support for the PPW project among local residents and for bike lanes city-wide.

In October 2010, CB6, Councilmember Brad Lander, and Councilmember Stephen Levin performed the *Prospect Park West Reconfiguration Survey* (2010). The survey attempted to measure local residents’ own evaluation of the project, including whether the project had achieved key goals (reduce speeding, create a safe place

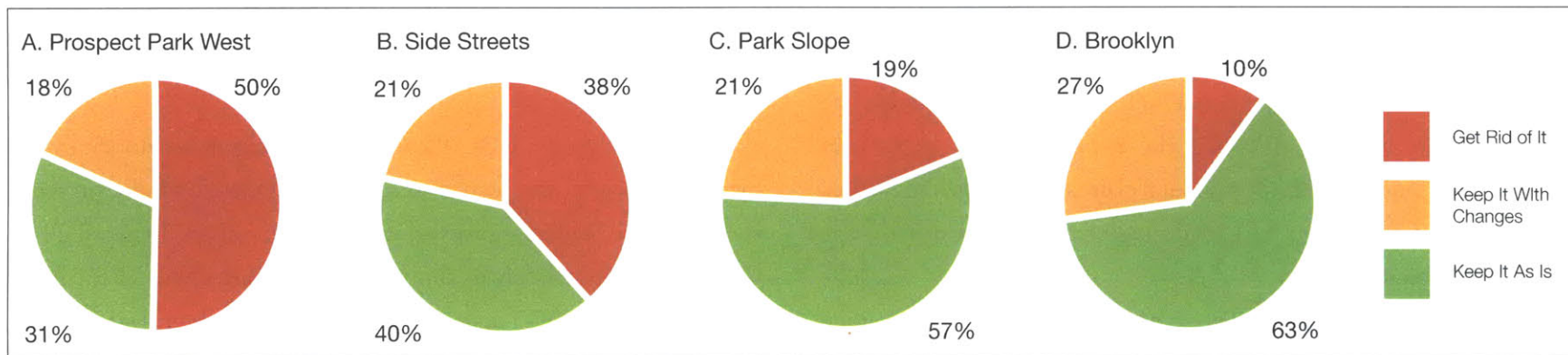


Figure 6-22. Poll: Reactions to the Prospect Park West Bike Lane
 Public polling data from fall 2010 showed that residents living on Prospect Park West and nearby side streets were less supportive of the bike lane than residents across the neighborhood and the borough. Data: NYC Council Member Brad Lander.

to bike, and make it easier to cross the street) and had improved perceptions of safety. The survey results largely confirmed DOT’s own assessment of the project and indicated broad support of the project (See Figure 6-22), but signaled an ongoing concern about pedestrian crossings. In July 2011 a Quinnipiac University poll supplemented these local results with a city-wide poll, which found that “59 percent of New York City voters say bike lanes are good because they are greener and healthier while 35 percent say they are bad because they increase traffic” (Quinnipiac University Polling Institute, 2011, p. 2).

These polls became valuable for DOT when opponents raised the question of support for DOT’s project. In February 2011, NBBL and SBS, with organizational support from Weinshall,

sued DOT over the PPW project (Bernstein, 2011). Among several claims, the community groups asserted that DOT did not properly consult with the community prior to construction. In August 2011 the NY State Supreme Court dismissed the case’s main claim against the bike lane, ruling only that the opponents had filed the case too late to be considered. Nevertheless, DOT used the polling data to publicly refute the groups’ claims. In a press release following the ruling, Transportation Commissioner Sadik-Khan asserted, “this decision results in a hands-down victory for communities across the city. ... This project was requested by the community, they voted repeatedly to support it, and their support has registered in several opinion polls. Merely not liking a change is no basis for a frivolous lawsuit to reverse it” (Cardozo, 2011). Furthermore, as of 2012,

DOT's website for the project cites both the city-wide and local polling results. By taking advantage of these polls, thus, DOT used measurement of local opinion to demonstrate support for the PPW project.

Performance-based planning and community engagement

Framing the issues. On PPW, the use of performance-based planning was primarily confined, with some exceptions, to ex-post evaluation reports. Nevertheless, the performance measures in these reports helped frame the key issues of project design during community discussions. Both DOT and project opponents used performance measures to clarify their conception of the purpose the street's design and its impact. For example, DOT's performance report defined the project in terms of its impacts on bicycle volumes, automobile traffic and safety. Conversely, project opponents claimed that the project had resulted in a higher number of collisions and failed to increase bicycle ridership. In this way, performance measures became a kind of language in the debate among the various stakeholders.

Making the case. In dealing with community stakeholders, DOT attempted to turn this language into a form of currency, by using performance reports to justify project design. Prior to construction, DOT used performance data to describe the problem of poor safety along PPW and to identify a successful design solution from earlier city projects (e.g. Ninth Avenue in Manhattan). Following construction, performance reports countered opposition

with evidence of both the project's success toward the project's principal aims and the support among local residents. As described above, the report's impacts on decision-makers is unclear, but its results clearly buffeted opponents' claims of the project's failure.

Measuring community perceptions. In addition, DOT benefited from the public polls, which, although they had been conducted independently, provided the agency with a means of demonstrating that the project was responsive to community desires. While it is difficult argue definitively that these polls played a direct role in influencing decision-making, Benson suggests that, in the face of opposition, the evidence of city-wide support was beneficial for PPW and for DOT. Benson reports, "at the same time as there were objections, we benefited from polls to get the picture, 'Do people like this? Do they want it?' ... It was surprising how strong of a majority of New Yorkers like bike lanes. It enabled us to take a step back, and say, there are some very vocal opponents, but we're doing the will of the people" (Benson, 2012). The measurement data on stakeholder satisfaction and perceptions, thus, was valuable in demonstrating that DOT's design was sensitive to community interests.

Resolving conflict. Since the performance measures used in these reports were not selected through a community engagement process, however, they do little to address the conflict among stakeholders. Even though DOT's performance reports were connected to CB6's original goals for the project, the agency did not define a set of measurable goals for the project at the outset. It is possible that the

performance results would have been a more powerful lever in the decision-making process if performance goals had been articulated earlier or had been established in a formal, community engagement process. Although DOT referred to public opinion polls to show public support for the changes, they had no document in which stakeholders formally endorsed specific performance objectives.

For PPW it is unclear how a consensus on performance and design could have been achieved. In the debate that followed the project, some stakeholders indicated they did not wish to see a bike lane on PPW at all. For these opponents, no performance gains for bikes appeared to justify the perceived degradation of performance for pedestrians and vehicles.

Furthermore, the case fails to resolve the question of whose performance goals should matter most in project design. As a major street with connections to other major thoroughfares, PPW serves communities of different scales, including Brooklyn, the neighborhood of Park Slope, and residents of the street itself. These communities expressed conflicting views of the project. Although public polling showed a strong support for the project among a majority of neighborhood residents, the question of support among PPW residents specifically was more mixed. Many of the project's most vocal opponents, including the leaders of NBBL and SFS, were residents of the street itself, and the poll sponsored by Councilmembers Lander and Levin found PPW residents evenly split on whether to keep the lane. The decision to retain the bike lane, thus, suggests that a broader set of interests – not just those on

PPW – influenced CB6 and DOT. For PPW, this decision may have been easy, since many PPW residents supported the project. For cases where conflict between groups is stronger, however, the PPW case does not explain how agencies can determine which interests to prioritize.

Thirty-Fourth Street, Manhattan

In 2008, NYC DOT announced plans to re-design 34th Street in Manhattan to dramatically improve bus service along the street. The earliest proposals for the corridor included the introduction of a so-called “transit-way,” a separated, two-way corridor for buses, which transit advocates argued would have amounted to NYC’s first, true Bus-Rapid Transit (BRT) line. In 2011, after working closely with area businesses and residents, DOT announced that it would pursue a more conventional design. Instead of a dedicated transit-way, buses on the new 34th Street will run in un-protected lanes, a design, DOT asserts, that can best accommodate the street’s existing users.

With respect to form, the proposed design for 34th Street is evidence of DOT’s attempts to achieve a balance in performance that is supported by community interests. While the final proposed design promises performance improvements for bus riders, as DOT originally planned, the design also makes strides toward increasing performance in areas identified by community stakeholders as important. Most notably, the proposed design creates new space for vehicles to park along the street and access the curb.

With respect to process, DOT did not employ the CSD framework, but modified its design based on community input. Although the project did not employ all features of the performance-based planning framework, planners used performance data to guide

| 34th Street | Current | Proposed |
|------------------------------------|---|----------|
| Physical features | | |
| Project Length | | 0.9 mi |
| Right of Way Width | | 100 ft. |
| Roadway Width | | 60 ft. |
| Roadway Direction | | Two-way |
| Operational Characteristics | | |
| Bus Routes | Local service (2 routes), City-wide service (Multiple) | |
| Local Bus Passengers | 18,000 passengers per day (M34 and M34A only) | |
| Express Bus Passengers | 16,000 passengers per day | |
| Land Use (General) | Residential (East Side), Commercial (Mid-Town, West Side) | |
| Land Use (Ground-floor) | Commercial retail (East Side, Midtown), Commercial office (West Side) | |

Figure 6-23. Project Context: 34th Street

Ridership data: NYC DOT & NYCT, 2012.

specific design decisions and identify design elements that would balance performance improvements for multiple users. As part of DOT’s community engagement activities, performance data on the technical needs of local businesses and residents provided a channel for stakeholders to communicate their technical needs on the street.

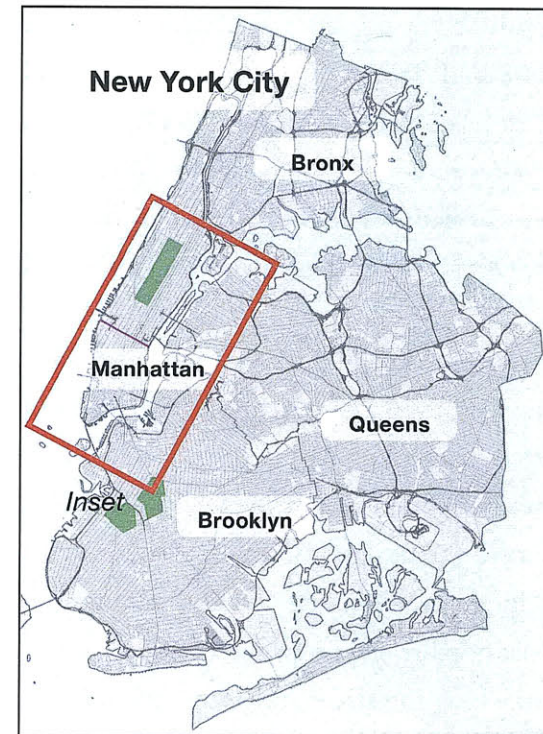
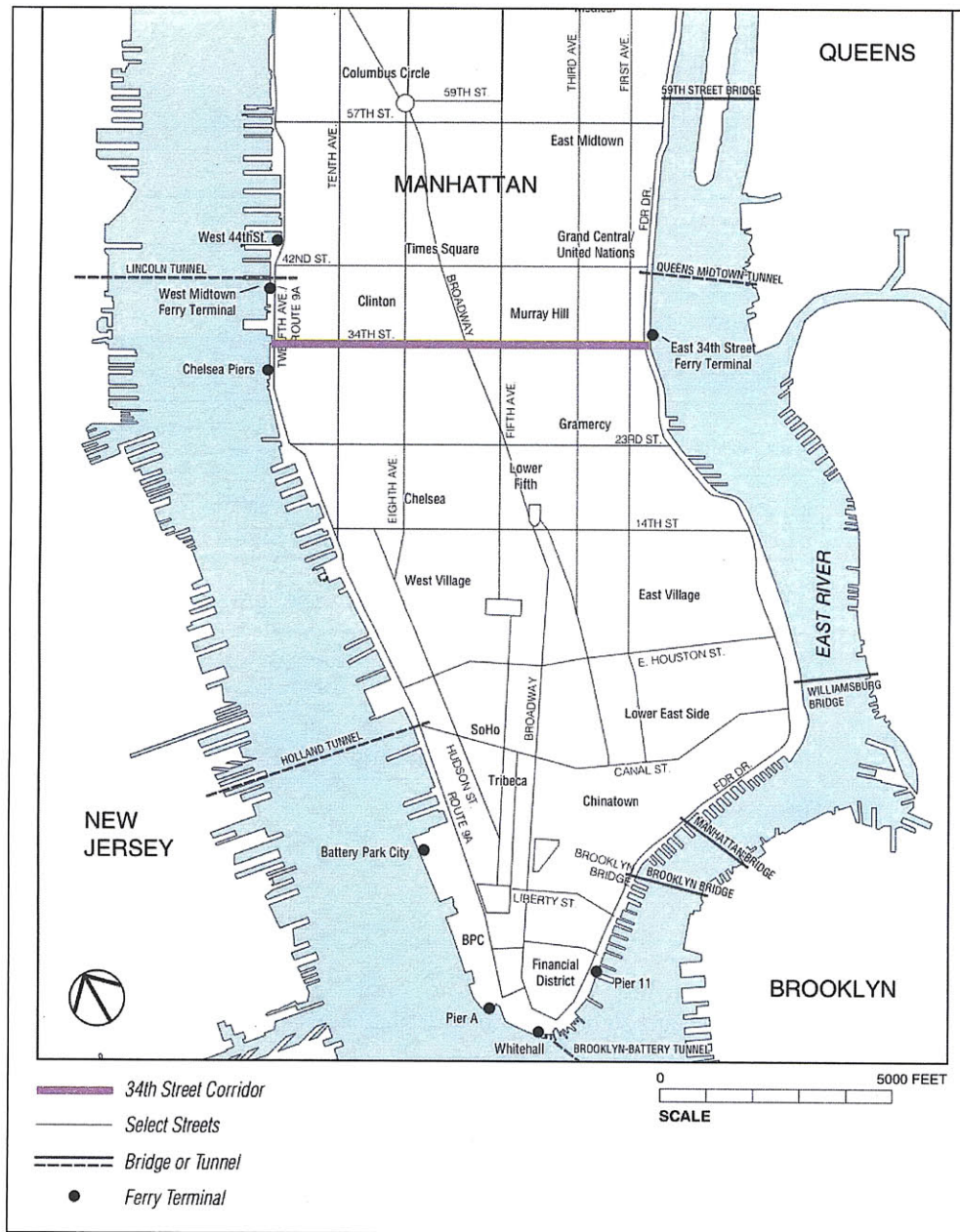


Figure 6-24. Context Map: 34th Street
 Left: NYC DOT & NYCT, 2012. Right: NYC. Gov.

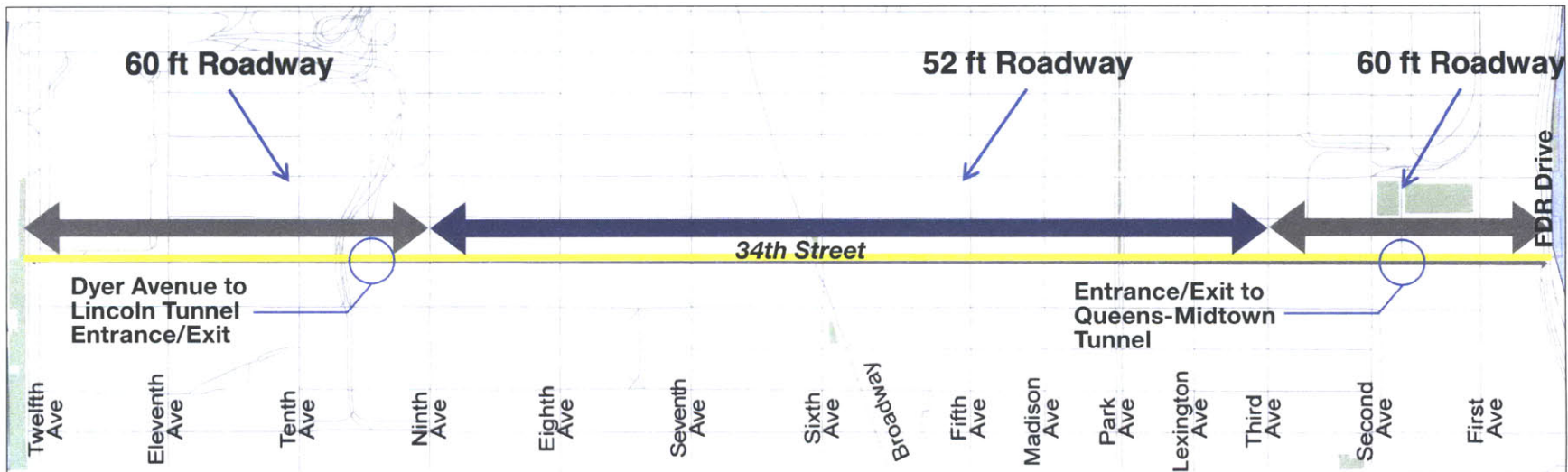


Figure 6-25. Detail Map: 34th Street
 NYC DOT & NYCT, 2012.

Context

34th Street is a major cross-town arterial in Midtown Manhattan. The project area spans its entire length (2 mi), which runs across Manhattan from the Hudson River to the East River. DOT has been the lead agency in the project, but has developed the plan in partnership with New York City Transit (NYCT), an agency within the Metropolitan Transportation Authority (MTA), which provides local bus service. DOT expects to construct the project in late 2012 and 2013.

In January 2012, DOT and the MTA issued the *34th Street Select Bus Service Project Analysis Report* (NYC Dept. of Transportation & Metropolitan Transportation Authority (MTA) New York City

Transit (NYCT), 2012). In addition to providing an overview of the planned design, the report provides a detailed technical overview of the street's current conditions. Like most of the major cross-streets in Manhattan (14th, 23rd, 42nd, etc.), 34th Street runs in two-directions. While the entire right-of-way remains roughly consistent (approx. 100 ft.), the street's roadway is 60 ft. in the east and west, but 52 ft. in the center (between Third and Ninth Avenues) where sidewalks are wider (up to 24 ft.) (See Figure 6-25). In its current form, the road includes five to six travel lanes. The curbside lanes are designated for bus service but are available for parking during select hours.

Land use and urban form. 34th St can be roughly divided into three main sections. The street passes through the districts of three

Community Boards: CB4 (west), CB5 (Midtown), and CB6 (east), which roughly correspond to shifts in the street's character as well as the changes in roadway width (at Ninth and Third Avenues). The eastern section is predominately residential, with ground-floor retail uses, along with several institutions (hospitals). The Midtown section is predominately commercial, with ground-floor retail uses (many of which extend upwards several stories), office space and hotels. The western section is mostly office space, with little or no ground-floor retail activity, along with several parking lots. (See Figure 6-26.)

Vehicles. 34th St serves as a key connection between several major higher-volume arterials and highways. The street connects NY State Route 9A (Twelfth Avenue) in the west to the FDR Drive in the east. Furthermore, the street has entrances from and exits to the Queens-Midtown Tunnel between First and Third Avenues and access to the Lincoln Tunnel via Dyer Avenue (between Ninth and Tenth Avenues). Each of these four facilities provides a connection to the region's Interstate Highway system. (See Figure 6-25.)

Transit. 34th Street plays a major role in the city and regional transportation network, serving riders of virtually every mode of transit. The street includes New York City Transit (NYCT) Subway stops on five major lines as well as a terminal for the PATH subway to New Jersey. On the west side of 34th Street at Seventh Ave, Penn Station, the nation's busiest passenger rail terminal, deposits commuter and intercity travelers, many traveling to the CBD on the east side. The street also connects to ferry services on both the

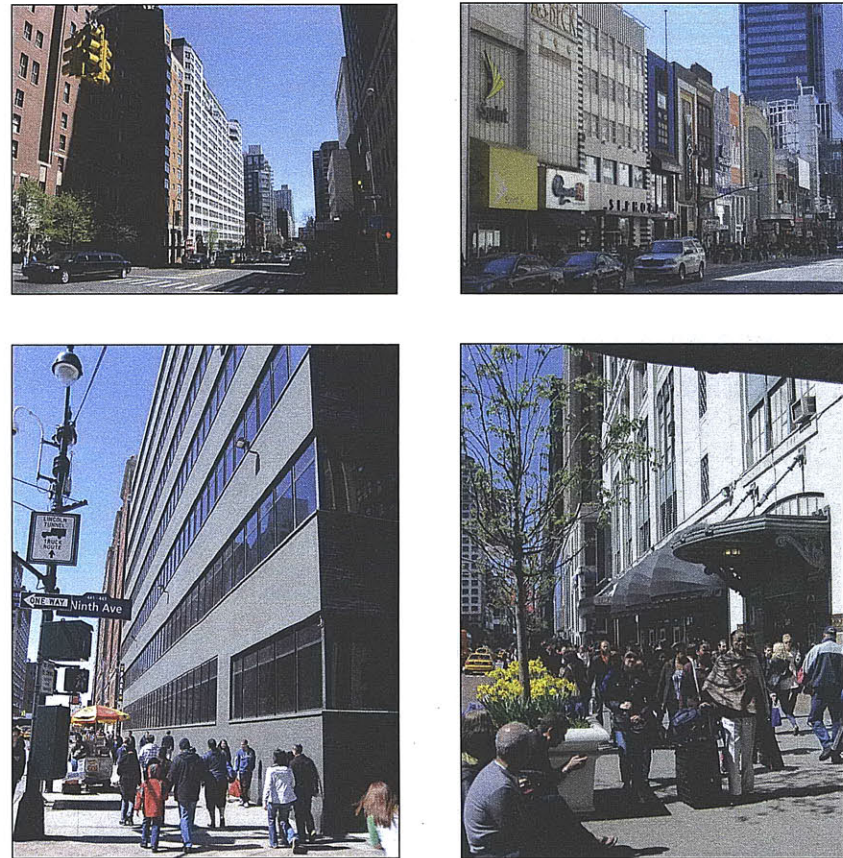


Figure 6-26. Land Use on 34th Street

Top left: The east side of 34th Street is predominately residential with ground floor retail.

Top right: The central part of Midtown is predominately commercial with extensive ground-floor retail.

Bottom right: Also in central Midtown, 34th Street sees very high pedestrian volumes.

Bottom left: The west side of 34th Street is primarily commercial with little ground-floor retail space.

Hudson and East Rivers. Finally, the street serves express buses, most run by the MTA, which carry passengers from other boroughs and make multiple stops along the street (NYC DOT & MTA NYCT, 2012).

For local service, NYCT runs two bus services along the corridor, the M34 and M34A (formerly referred to as the M16). While the M34 runs the entire length from river to river, the M34A runs only as far west as Ninth Avenue and extends north to 43rd Street (Figure 6-27). As of 2008, buses run in painted bus lanes along the curb, which are reserved for buses on weekdays between 7AM and 7PM (Figure 6-28). As of November 2011, when DOT introduced the first features of its new design for the street, passengers use fare payment machines, installed on the sidewalk, to buy tickets prior to boarding.

Pedestrians. 34th Street experiences extremely high pedestrian volumes, which occasionally spill onto the roadway. The sidewalks along 34th Street vary in width (from 12 ft. to 24 ft.). Although they span both sides of the street, in some areas the width on side is greater than the other. The busiest pedestrian areas can be found between Sixth and Eighth Avenues, near both Penn Station and Macy’s Department store (NYC DOT & MTA NYCT, 2012).

Bike. 34th Street has no dedicated bicycle infrastructure along its length. Several bike routes along the north-south avenues, however, cross the street (on First, Second, Sixth, and Eighth Avenues and Broadway). 34th Street marks a physical transition point for several of these routes. Specifically, the routes on Second and

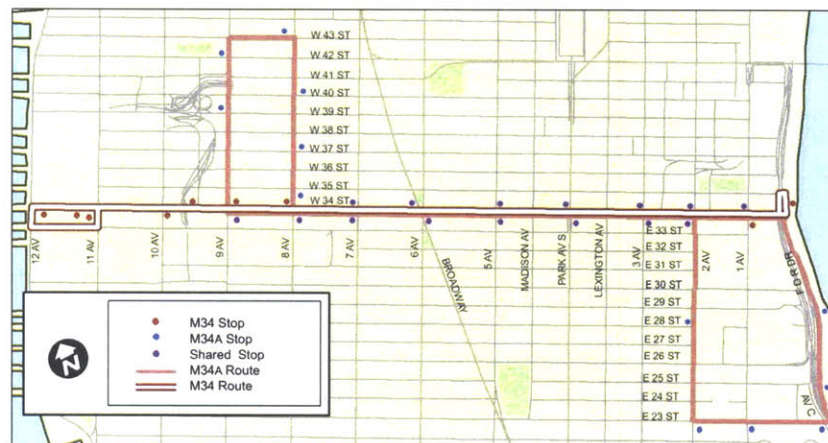


Figure 6-27. Local Bus Service on 34th Street
 Map: NYC DOT & NYCT, 2012.



Figure 6-28. Existing Bus Lanes on 34th Street
 In its current configuration, buses run along the curb of 34th Street.

| Development of 34th Street | |
|----------------------------|---|
| April 2008 | Introduction: DOT introduces plans for 34th Street, including short-term “Bus Prioritization” improvements and a longer-term “Transit-way” concept for ‘true BRT’ |
| September 2008 | Bus Prioritization: DOT completes modest improvements, which add designated bus lanes (painted in red) along each curb |
| April 2010 | Transit-way concept: DOT holds first community Open-House; early design concept includes transit-way |
| June 2010 | DOT convenes first meeting of the project’s Community Advisory Committee (CAC) |
| November 2010 | Curbside access: DOT holds several community forums on curbside access and completes curbside access study |
| March 2011 | Revised design: DOT presents a revised design that does not include the transit-way concept or pedestrian plaza |
| September 2011 | Traffic analysis: DOT refines project based on results of traffic analysis |
| September 2011 | 2012 Plan: DOT presents a mostly finalized design proposal to the CAC |
| November 2011 | Early construction: DOT installs off-board fare payment system and re-brands bus service as M34 SBS and M34A SBS |
| March 2012 | Construction schedule: DOT presents a phased timeline for project construction, which is expected to begin in late 2012 with the final phase completed in 2014 |

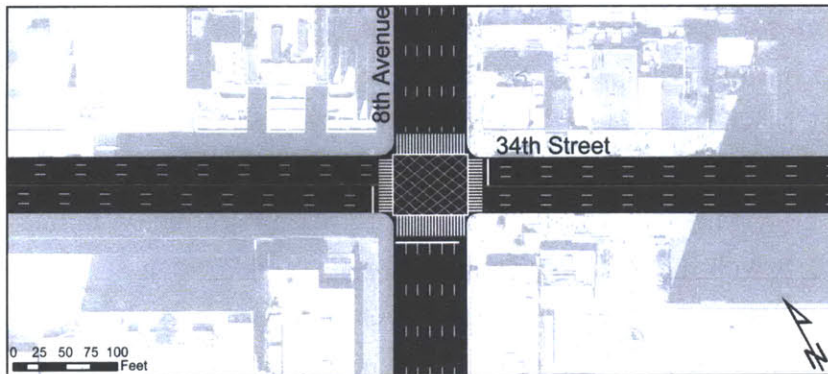
Figure 6-29. Project Timeline: 34th Street

Eighth Avenues are “protected” south of 34th Street and continue as either un-protected lanes or routes in mixed traffic on the north side (although the protected lane on Eighth Ave is currently being extended north of 34th Street).

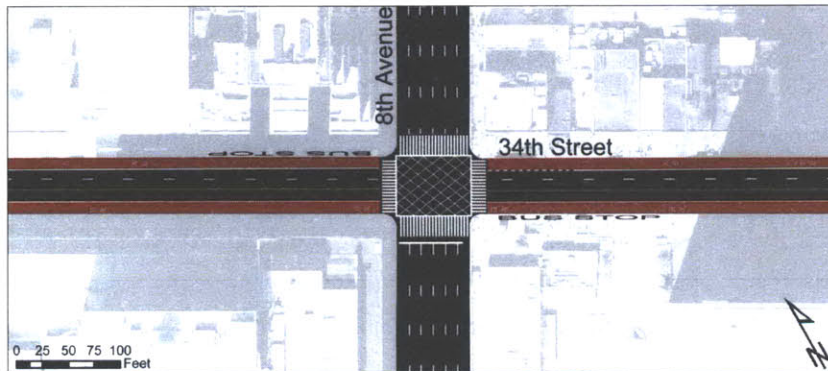
Project development

The re-design of 34th Street is part of DOT’s larger program to introduce and expand bus-rapid transit (BRT) services to NYC. Starting in 2008, DOT’s program has upgraded several routes under the title “Select Bus Service” (SBS) with features designed to speed up service, like off-board fare payment, dedicated bus lanes and signal prioritization. Phase I of DOT’s program includes five routes, including 34th Street, of which three have been implemented (NYC DOT & MTA NYCT, 2010). Eric Beaton, DOT’s Director of Transit Development, is responsible for the BRT program for DOT and was previously the project manager for the 34th Street SBS project (Beaton, 2012a).

Community Engagement. Throughout development, both community input and technical concerns have shaped the project’s design. For community input, DOT has employed several strategies. DOT convened a Community Advisory Committee (CAC) for the project, composed of elected officials and representatives from the local Community Boards, major institutions, business groups, and residential and civic organizations (NYC DOT, 2010b). According to the project website, DOT has held five community-wide open-houses at three key points in the project’s development. Furthermore,



Pre-2008



2008 Bus Prioritization Project

Figure 6-30. 2008 Bus Prioritization Project

Plans: NYC DOT.

DOT conducted a survey of businesses and residents on curbside access issues, which is discussed more fully below.

Despite this extensive input, DOT did not employ the CSD framework as its defined by transportation guidance (FHWA, 2009). According to DOT's presentation materials and notes from

the CAC meetings, the role of the CAC was primarily to provide input and represent their larger community (NYC DOT, 2010d). While CAC feedback appears to have played a large role in shaping design, the CAC did not define the scope of the project, establish the project goals, or hold the power to approve the final design in a formal sense.

Transitway Concept. DOT first introduced the 34th Street project in April 2008 at a transportation forum sponsored by several transit advocacy groups. The 2008 project included two key phases. First, under the label “Bus Prioritization,” DOT proposed adding curbside bus lanes, painted in red, which would be designated for transit service (through new signage and police enforcement). DOT completed these changes in September 2008, which replaced two of the street's five-to-six general travel lanes with the new bus infrastructure. (See Figure 6-30.)

Second, DOT introduced the 34th St “transit-way,” a two-way bus corridor, separated from vehicles by concrete barriers, running along one side of the street (Figure 6-31). In addition, between Fifth and Sixth Avenues, DOT proposed closing off 34th Street to all vehicular traffic (except the transit-way) to create a new pedestrian plaza (Figure 6-32). Under the initial concept, vehicle traffic would no longer run in two directions, but would be split into two one-way segments, each running outward from the pedestrian plaza toward the river. (Later alternatives, however, would consider various traffic configurations to complement the transit-way.) Following the presentation, Brad Aaron (2008), writing for the pro-transit site

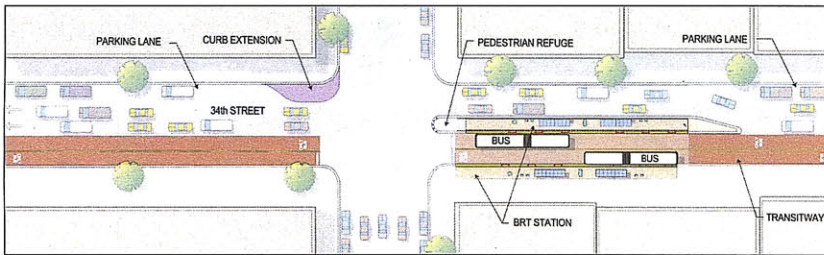


Figure 6-31. 2008 Proposal: Transitway Concept for 34th Street

DOT's 2008 proposal for a transitway would have placed buses in a two-way, protected corridor. Rendering and plan: NYC DOT.

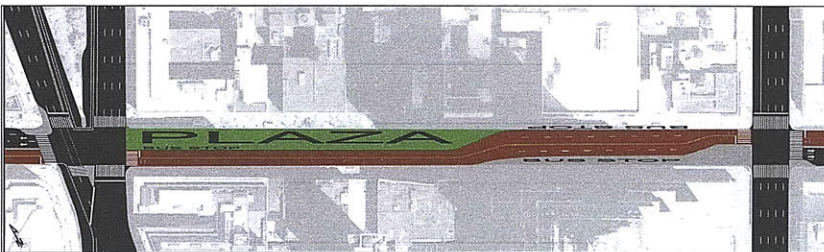


Figure 6-32. 2008 Proposal: Pedestrian Plaza for 34th Street

The 2008 Transitway proposal included a pedestrian plaza between Fifth and Sixth Avenues. Plan: NYC DOT.

Streetsblog, described the transit-way as a “transit miracle.” According to Jim O’Grady (2011), for WNYC’s *Transportation Nation*, Janette Sadik-Khan described the project as “the only true bus rapid transit plan” in NYC.

The public planning process for the project began in mid-2010, with the project’s first open-house (April 2010) and the first meeting of the CAC (June 2010). As this process continued, the transit-way concept proved controversial among residents and the press. For example, the Murray Hill Neighborhood Association, representing residents along the East Side of the street, organized a campaign titled, “Stop the 34th Street Transitway,” which was featured in several local media reports. According to the campaign’s website (2011), the residents argued that the dedicated bus lanes would block access to their buildings, create traffic congestion, and result in “blight” by obstructing views and reducing the desirability of adjacent properties. Several major media outlets concurred. The editors of the daily newspaper *The New York Observer* (2011) argued that the pedestrian plaza would result in “chaos” for Midtown traffic. In a column in the *New York Post*, Steve Cuozzo (2011) argued that DOT had “consistently ignored community objections” and that the plan would “ruin 34th Street from end to end.”

In its own planning and in its discussions with the CAC, DOT paid special attention to the issues of curbside access and vehicular traffic. In the fall of 2011, DOT completed a curbside access study that surveyed businesses and residents on access needs. In addition, DOT conducted a traffic analysis, completed

in 2012, which modeled the project's impacts on congestion. During meetings with the CAC, DOT initiated discussions about these topics, but the CAC confirmed and elaborated on them. For example, in an early meeting (September 2010), the CAC expressed various curbside access concerns, including commercial deliveries, emergency vehicles, and oil deliveries to buildings (NYC DOT, 2010d). In this way, the CAC played a role in shaping DOT's design considerations.

Off-set Bus Lanes. The CAC's influence can be seen in DOT's major modification to the 34th Street design. In March 2011, DOT presented a revised project design that dropped the transit-way concept and eliminated the pedestrian plaza between Fifth and Sixth Avenues. (See Figure 6-33.) Under the revised proposal, 34th St would continue to run in two directions. Buses would not run in a two-way, protected corridor, but would run in two separate and unprotected lanes offset from the curb by zones dedicated to building access (e.g. loading, deliveries, and parking). Transit advocates decried DOT's decision. Following the March proposal, Brad Aaron (2011), writing again for *Streetsblog*, complained that DOT had let automobile traffic dictate the project, describing the design as a "sad statement reflecting the lack of will to enact changes that bring the greatest benefit to the greatest number of New Yorkers." Benjamin Kabak (2012), writer of the well-cited transit blog *Second Avenue Sagas*, suggested that DOT had catered to a "vocal minority" of "NIMBYs."

Beaton explains, however, that transit advocates have somewhat mischaracterized the decision. According to Beaton,

the transit-way and pedestrian plaza were never a foregone design conclusion, but one of several options DOT was considering for the project. Furthermore, the design change was not motivated by specific interest groups, but by the larger technical questions of curbside access. Indeed, counter to Aaron's assessment, it is unlikely that DOT aimed to cater specifically to automobiles given the proposed design's reduction in space for general vehicles even without the transit-way. Instead, Beaton (2012) explains, "there were many technical reasons that gave us pause for concern [about the transit-way]." For example, the planners were never able to solve the question of oil deliveries to buildings, which, unlike other kinds of deliveries, are long and cannot take place during off-hours. According to Beaton, DOT "never figured out what the bus does [during a delivery]." While various individual interests were skeptical of the earlier design, larger technical concerns along the length of the entire corridor, thus, played a role in the adoption of the off-set lane approach.

In September 2011, DOT announced plans to start construction of the transit improvements. In November 2011, DOT and NYCT completed early construction items, specifically the installation of off-board fare payment along 34th Street and the re-branding the bus routes under the "Select Bus Service" label (Figure 6-35). According to the most recent CAC meeting (March 2012), DOT plans to construct the project in several phases covering different sections of the street. The agency expects to start

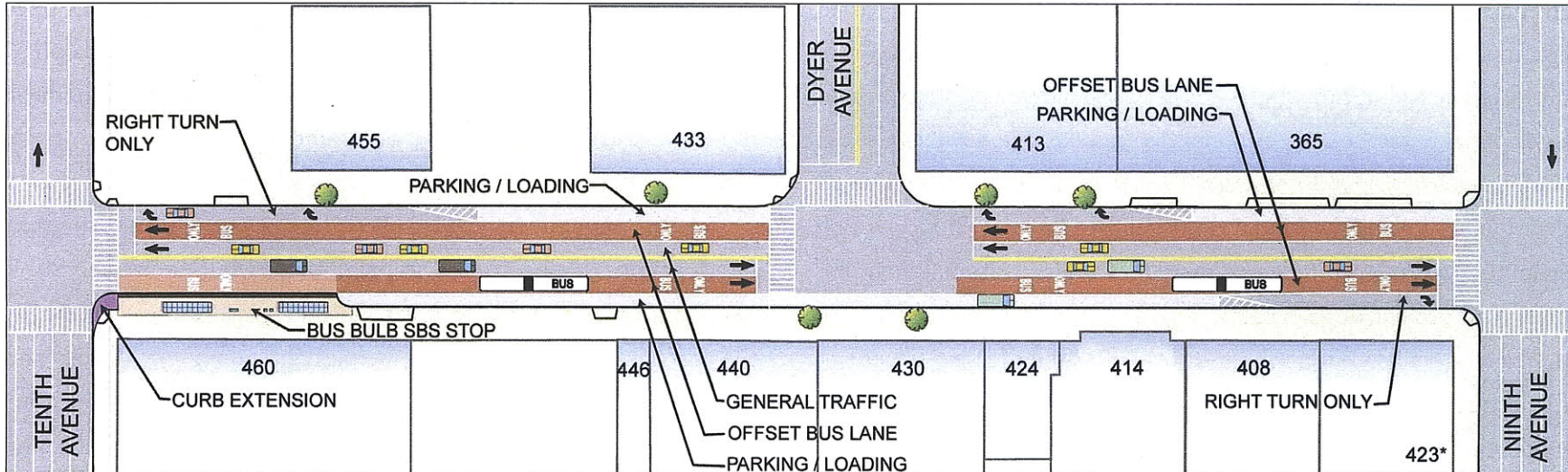
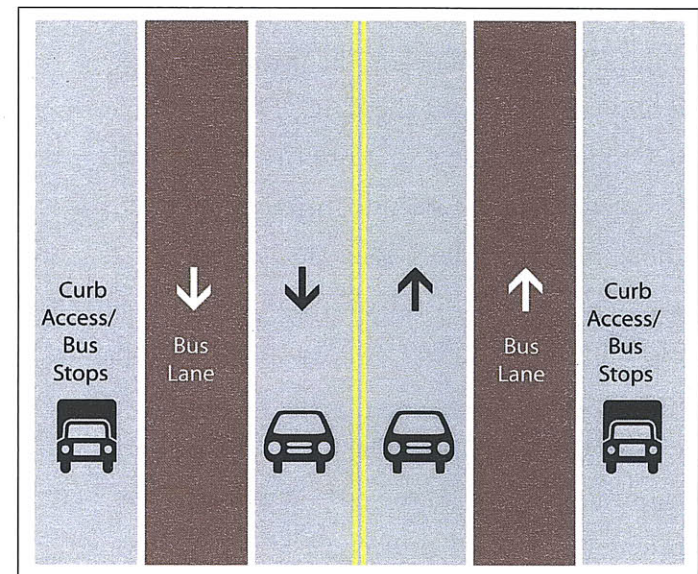
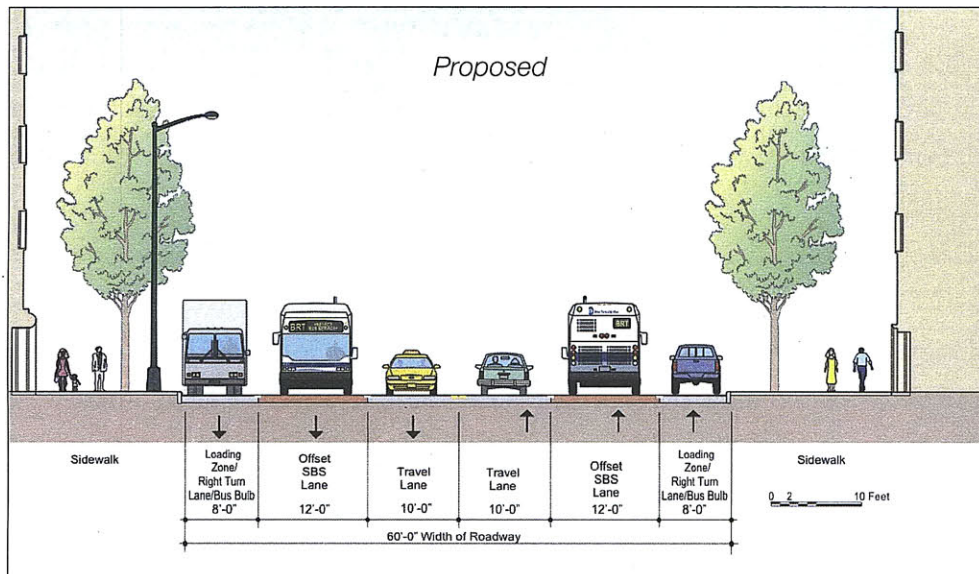


Figure 6-33. Final Proposal: Off-set Bus Lanes on 34th Street

Source: NYC DOT.

construction in late 2012 and to complete phases in 2013 and 2014 (NYC DOT, 2012).

Project design

Although transit advocates were disappointed by DOT’s design changes, the current proposed design for 34th Street amounts to a dramatic redistribution of street space, particularly away from general vehicular traffic. While the project is detailed in several DOT materials, the following description is based on DOT and NYCT’s 2012 *Project Analysis Report*. This proposed design is notable with respect to the community engagement process, because it specifically addresses one of the community’s primary concerns about the project: curbside access needs. According to the 2012 report, DOT will reduce the number of general vehicle lanes from three-or-four to just two, and construct two off-set bus lanes and new curbside access areas along each block for activities like deliveries, collecting passengers and parking. (See Figure 6-33.)

The design of the street differs between sections with a 52-ft. roadway and those with a 60-ft. roadway. The 60-ft. roadway, with six lanes, offsets both bus lanes with a curbside-activity lane. The 52-ft. roadway, with just five lanes, includes only one curbside-access lane, leaving one of the two bus lanes running adjacent to the curb.

For transit riders, the new bus lanes offer improvements over the current design. When offset from the curb, buses will no longer face obstructions from vehicles attempting to access buildings.

| | Current | Proposed |
|-------------------------------------|--|-------------------------------------|
| Cross-Section Elements | | |
| Roadway Direction | Two-way | |
| Sidewalk Width | 14 - 24 ft. | 14 - 24 ft. (Widened in key areas) |
| General Vehicle | 6 Lanes (2 Part-time) | 4 Lanes (2 Part-time) |
| Parking | 0 - 2 Lanes (Part-time) | 2 Curbside Access Lanes (Full-time) |
| Dedic. Bike Lane | No Bike Lane | |
| Dedicated Bus Lane | Curbside, 2 Lanes, Un-prot. Part-time | Offset, 2 Lanes, Un-prot. Part-time |
| Plan Elements | | |
| Ped. Crossings - Marked, Signalized | 100%, 400-900 ft. | |
| Max. Pedestrian Crossing Distance | 52 - 60 ft. | 44 - 52 ft. |
| Special Features | No | Curb extensions, Refuge islands |
| Sidewalk Amenities | | |
| Transit | Benches, Weather protection, Real-time arrival | Adds off-fare payment |
| Pedestrian | Benches, Trash cans, Landscaped planters | |
| Bike | No | |
| Lighting (height) | Contemporary (West Side, Midtown, 20 ft.) Cobra (East Side, 30 ft.) | |
| Trees (height) | Most blocks (20 - 35 ft.) | |

Figure 6-34. Design Features: 34th Street



Figure 6-35. Early Changes on 34th Street

In 2011, DOT re-branded local bus service on 34th St. under the Select Bus Service label (left) and introduced off-board fare payment (right).

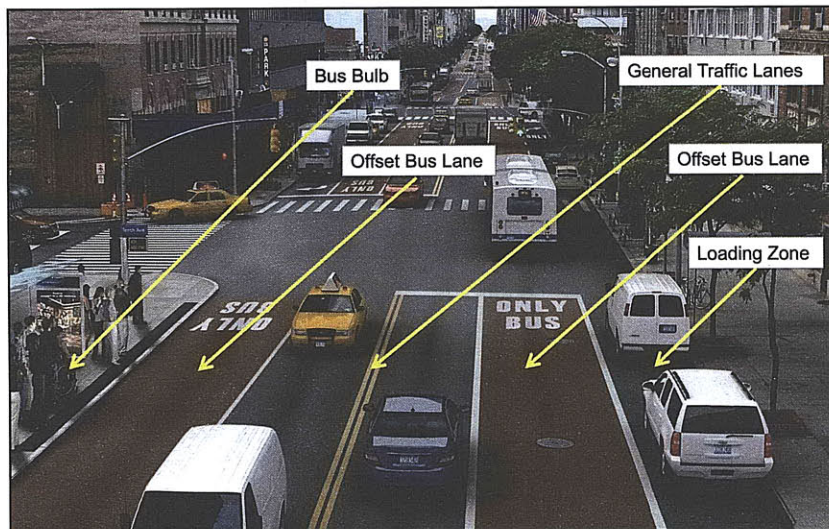


Figure 6-36. Rendering: Off-set Bus Lanes on 34th Street
NYC DOT.

| Goals for 34th Street | |
|-----------------------|---|
| 1 | Improve Crosstown Mobility |
| 2 | Improve Pedestrian Safety and Comfort |
| 3 | Minimize Capital and Operating Concerns |
| 4 | Enhance Community Character |
| 5 | Minimize adverse impacts on the built and natural environment |

Figure 6-37. Project Goals: 34th Street

Text: NYC DOT and MTA NYC Transit, 2012.

Unlike the current lanes, the off-set lanes will also be in operation 24 hours a day. (Lanes remaining along the curb will remain designated for buses between 7AM and 7PM on weekdays, as they are now.) Furthermore, at all stops along the off-set bus lanes, the project adds “bus bulbs” that extend the sidewalk to the off-set lane (Figure 6-36). This design provides more space for pedestrians and waiting riders, and allows buses to remain in their lane while making stops. Along the entire corridor, DOT also plans to replace all bus stops with new shelters, benches, signage and electronic information.

For pedestrians, the project adds over 20,000 square feet of pedestrian space. Improvements pay special attention to crossings, including widening all cross-walks (15 ft. minimum) and shortening crossing distance through bus bulbs and curb extensions.

For residents and businesses concerned about curbside access, the project introduces street space that for the first time

is dedicated to serving curb-related activities. On every block, the project adds mid-day loading zones for delivery trucks, taxis, paratransit and other vehicles making short-duration stops. During weeknights and weekends, loading zones will be available for parking, which adds parking spaces to several blocks in Midtown that previously had no such space.

Use of performance-based planning

The development of the 34th Street design did not employ all features of the performance-based planning framework. The 2012 *Project Analysis Report*, however, includes a list of project goals, which somewhat follows the performance-based planning framework. While each goal includes a series of objectives, only few are measurable outcomes (e.g. “reduce transit travel time”) and most are loosely defined or vague outputs (e.g. “provide for passenger amenities to enhance transit operations”) (p. 1-8).

Furthermore, as for evaluating alternatives, Beaton (2012) indicates that DOT did not use an assessment of performance impacts to compare options and choose a final design. According to Beaton, project planners were interested in advancing performance goals, particularly transit speed, transit reliability and the pedestrian experience, but did not use performance estimates to guide design. “We create matrices where we assess each plan and talk,” Beaton explains, but “we don’t give a number to each plan and compare them.”

Project selection. Project documents indicate, however, that performance data did play a role in project selection. According to Beaton, the five projects in DOT’s BRT Phase I program were selected for numerous reasons, including community-level support and desire for a diversity of projects. All of the initial projects, however, were those where benefits would improve transit’s performance along the corridor. Indeed, DOT’s early presentations to the CAC defined the 34th Street project in terms of its performance problems, including the very slow speeds for buses (4.5 mph) and high pedestrian traffic (5,000 pedestrians per hour at Herald Square). Part of the problem, DOT suggested, was the poor distribution of street space among users. For example, while pedestrians accounted for 58% of the street’s users, they accounted for only 37% of the street space (NYC DOT, 2010a).

Project-level decision-making. Project planners also utilized performance data to guide some design decisions. These decisions demonstrate DOT’s desire to advance and balance multiple performance aims, particularly by mitigating the project’s impact on curbside activity and traffic congestion.

First, DOT’s curbside access study in 2010 collected data on access needs from residents and business owners, and mapped out curbside access activities along the corridor. According to Beaton (2012b), this data helped guide the placement of the loading/parking zones in the 52-ft. roadway section. For example, high curbside access needs justified placing a loading zone in front of the NYU Clinical Cancer Center (just west of 3rd Avenue). In other cases,

since the zones also included bus bulbs, high pedestrian volumes determined the zone's placement, such as in front of Penn Station.

Second, DOT's traffic analysis modeled the project's impact on congestion at each intersection in the area. Overall, the analysis indicated the project would have a minimal impact, but DOT used the results to make several refinements to minimize delays for general vehicles and buses. According to the 2012 *Project Analysis Report*, DOT prohibited specific turning movements at three intersections, added a traffic lane to one intersection (34th Street eastbound & Second Ave), and increased the green time of the street's signals (NYC DOT & MTA NYCT, 2012). Furthermore, prior to the traffic analysis, DOT incorporated right-turn lanes along the curb of certain intersections, so that turning vehicles would not conflict with transit vehicles in the bus lane (Beaton, 2012b) (Figure 6-33). By responding to the curbside access study and traffic analysis, thus, DOT's design modifications used performance data to guide decision-making and ensure that the project improved performance not only for transit riders and pedestrians, but also for vehicles and users accessing the curb.

Despite the value of performance data, the experience of the project planners suggests that objective measurement was inadequate for some design choices. According to Beaton, there is a limit to using data to assess the trade-offs between various options. The sheer height of activity on 34th Street emphasizes the number of environmental variables impacting the pedestrian experience. Echoing Appleyard (1981), Beaton suggests that many of these

variables defy quantitative measurement. "When looking at car lane versus a bus lane, you can do a throughput per hour analysis," Beaton explains, "but you can't really do that for pedestrians, where you're more focused on comfort. A lot of it comes down to professional judgment." In other words, just as Altshuler (1963) asserts, when faced with a problem that is not measurable, a planner may need to rely on some form of professional expertise to identify effective solutions. On 34th Street, several design decisions, like the particular placement of the loading zones and bus bulbs, attempted to accomplish specific performance goals, but were not based solely on well-defined measurement. In this sense, when goals were difficult to define, the planners relied on their professional experience to guide choices, not performance measures.

Performance-based planning and community engagement

Empowering stakeholders. Since the 34th Street project did not employ performance-based planning in the formal sense, the project speaks more to a general use of performance data to inform project design decisions. For example, DOT used the curbside access study to understand the street's current performance and thereby create a design that would maintain or improve the levels of curbside access.

The issue of curbside, access, however, provides an example of community stakeholders using performance-based planning to influence design decision-making. Local residents and businesses were vocal about the need for DOT to preserve and improve curbside access, which in part prompted DOT to perform its access

study and then to modify the design accordingly. By urging DOT to incorporate curbside access as a performance consideration, community stakeholders shaped the design. This example is limited, however, since DOT may have performed the curbside access study regardless of community input. Furthermore, the influence of community stakeholders was somewhat indirect, since it is arguable that stakeholders did not so much recommend that DOT incorporate curbside access into the design process as much as they rejected the original transit-way concept in response to the curbside access issue.

Community values. Despite illuminating the potential for community stakeholders to influence design through the selection of performance goals and concerns, the 34th Street case demonstrates the difficulty agencies face in prioritizing performance goal. Groups of stakeholders valued performance goals quite differently. For example, transit advocates saw the potential loss in curbside access caused by the transit-way design as a worthwhile tradeoff for the improvements in bus performance. Conversely, some local residents and businesses valued curbside access over the improvements to transit. If the distribution of street space can be interpreted as a proxy for relative value, then the final design appears to have given both performance concerns relatively equal value. Nevertheless, transit advocates continue to describe the final design as a disappointment, suggesting the conflict over the relative value of the streets' performance goals remains unresolved.

North Williams Avenue, Portland

Since the fall of 2010, PBOT has pursued the North Williams Avenue Traffic Operations Safety Project. The primary aim of the project, which has not yet been constructed, is to improve travel conditions for all users by eliminating the operational conflicts among buses, cyclists and automobiles that are exacerbated by the street’s current design. The project’s development was marked by a conflict between community members in favor of expanding the street’s bike lane and residents concerned about the bike lane’s impact on automobile traffic.

With respect to form, the project’s design, as it is currently proposed (April 2012), reflects a consensus achieved through a contentious, but ultimately productive, community engagement process, which addressed not only transportation issues, but also neighborhood gentrification and Portland’s historic legacy of racial discrimination in transportation planning. The resulting design strikes a balance between the various performance goals supported by different groups of the community, most notably by removing the N Williams bike lane in one segment of the project area to mitigate any degradation of the street’s automobile performance.

With respect to process, the N Williams case is an example of the CSD framework, with stakeholders playing an early, consistent and highly-participatory role in design. The case not only demonstrates all features of the performance-based planning

| North Williams | Current |
|------------------------------------|---|
| Physical features | |
| Project Length | 2.0 mi |
| Right of Way Width | 60 ft. |
| Roadway Width | 40 ft. |
| Roadway Direction | One-way (Northbound) |
| Operational Characteristics | |
| Vehicles (peak) | 700 - 1,000 vph |
| Bus Routes | 3 Routes |
| Bus Pax. (Alighting) | 1,100 per day |
| Bicycles | 3,000 (approx. per day) |
| Land Use (General) | Mixed (Commercial, Light indust. Residential) |
| Land Use (Ground-floor) | Mixed (Retail, Residential) |

Figure 6-38. Project Context: North Williams Avenue

Data: North Williams Existing Conditions Report, Kittelson & Associates and PBOT, 2011.

framework, but also shows how performance-based planning can be used to empower stakeholders as part of a CSD process. The dispute among stakeholders demonstrates that performance-based planning can play a role in conflict resolution by informing stakeholders through objective measurement, but cannot resolve fundamental conflicts over subjective, community values.

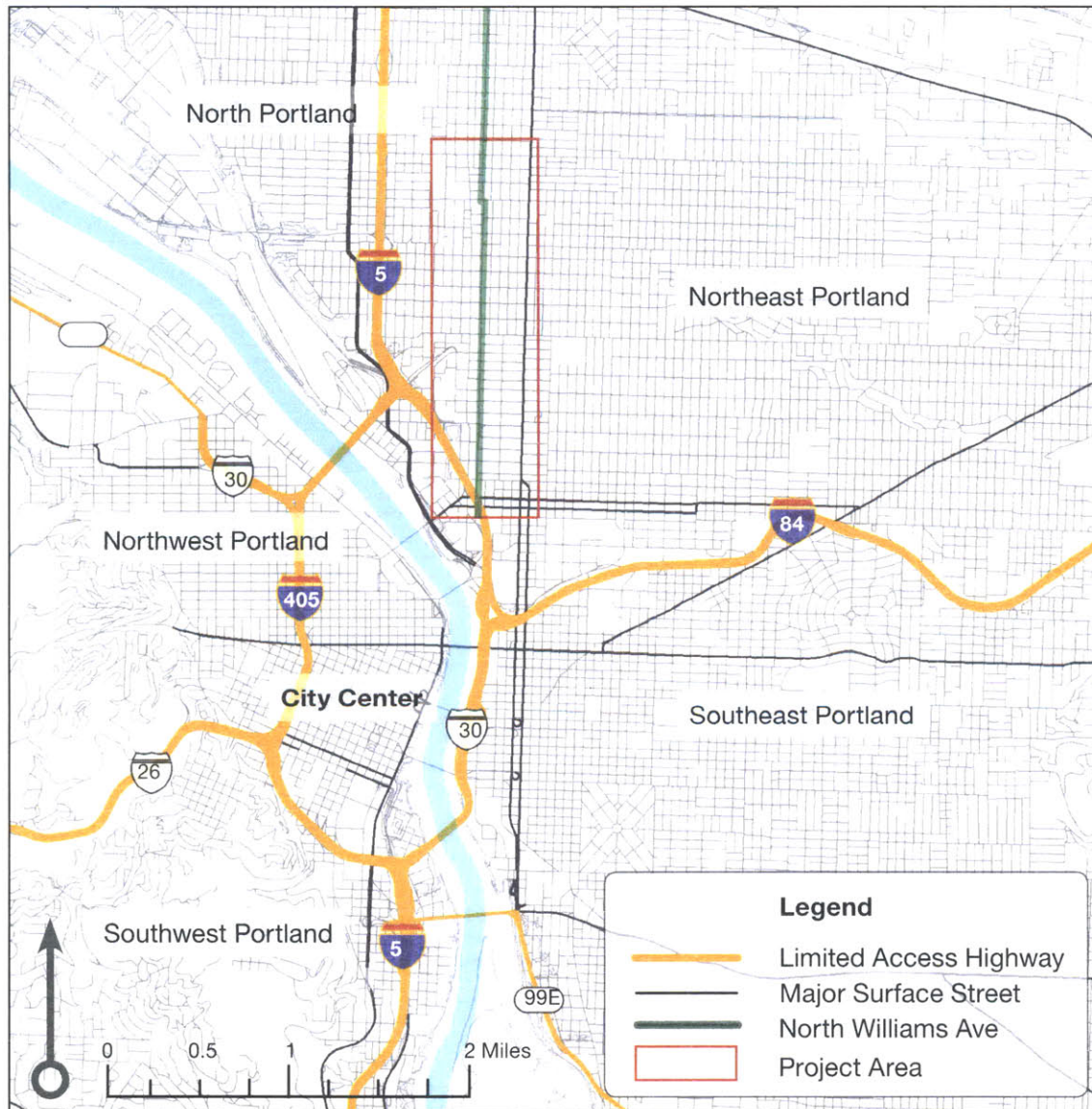


Figure 6-39. Context Map: North Williams Avenue
 Basemap: City of Portland.

Context

North Williams Avenue (N Williams) runs along a north-south axis and is located in the north-central section of the city. The project area extends from Weidler Street in the south to Killingsworth in the north (28 blocks covering just under 2 miles). The project area runs through a series of neighborhoods historically considered the center of Portland’s African American community. In recent years, the area has seen new development and gentrification (Vanderslice, 2012).

Unlike most of the avenues to its east, N Williams does not extend below the northern half of the city, thus it does not provide a link to Portland City Center. Instead, the street’s southern terminus lies near the Willamette River and adjacent to exit- and entrance-ramps to Interstate 5, the freeway that cuts through the center of the city also on a north-south axis (Figure 6-39).

N Williams runs one-way northbound. In the AASHTO nomenclature, N Williams is best described

as a “connector” since it is relatively narrow (60 ft.) and is paralleled by Martin Luther King Boulevard, a wider, higher-volume, and two-way street, less than one-half mile to the east. Despite its narrow width, the roadway of N Williams is dedicated to a mix of users (Figure 6-41). For most of the project area, the roadway includes sidewalks (10 ft.), two parking lanes (7-ft.), two vehicular lanes (10.5-ft), and an unprotected bicycle lane (5-ft.) on the right-hand side of the street. The entire street is lined with mostly mature trees along its entire length. The project planners divided the street into five segments, which are useful for the description of the street herein. (See Figure 6-40).



Above: Figure 6-41. Image: Multi-Modal Travel on North Williams
Bicycles traveling in the bike lane conflict with buses making stops.

Below: Figure 6-40. Map: North Williams in Five Segments
Basemap: City of Portland.

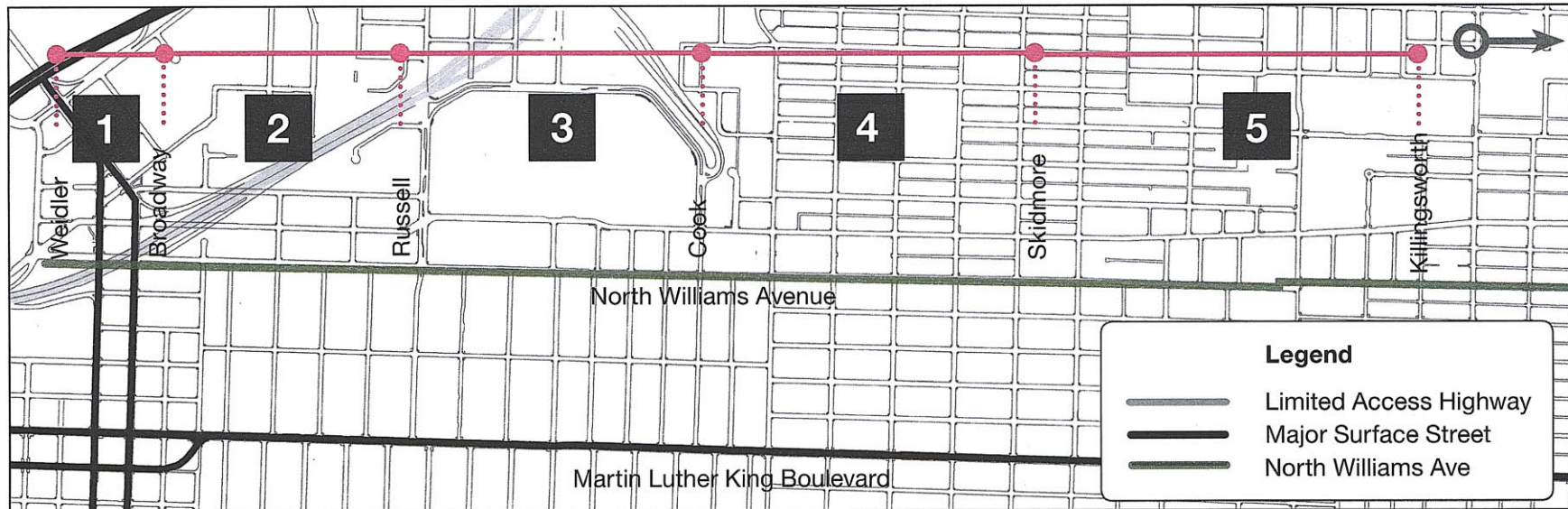




Figure 6-42. Land Use on N Williams

Above: Each segment of N Williams is mixed but has a different predominant land use. Pockets of vacant space mark the entire corridor.

Left: In Segment 4, North Williams is seeing signs of change, with new residential and retail development.

Land use and urban form. Overall, the street features a varied mix of building types and uses. While each segment can be characterized by a concentration of a certain building type, all segments see a mix of buildings with different heights and setbacks from the street. The southernmost segments (one and two) feature a concentration of commercial and light industrial buildings, several parking lots, and a hospital. Segments 3 and 5, along with most of the cross streets in the project area, feature a concentration of detached, one- and two-story residential houses (mostly in a mid-20th Century or craft style architecture with set-backs of 30 - 40 ft.).

Of all areas of the street, Segment 4 offers the greatest sense of pedestrian street life and also appears to be the most in transition. The area includes several new apartment complexes either recently completed or under construction. Segment 4 is also the most heavily commercial section of the street, featuring a busy row of brightly painted restaurants and small stores. The area also has some light-industrial buildings, such as garages and car repair shops, some of which appear to have been converted to storefronts. In general, Segment 4 also has the most consistent street wall, with a long interrupted row of one- and two-story commercial buildings. Several restaurants have placed tables and benches on the sidewalk, and some stores have placed merchandise in occasional setbacks between the sidewalk and their building.

Vehicles. Although N Williams is easily accessible from I-5, the street sees moderate traffic volumes (700-1,000 vehicles per hour) and has relatively low congestion. Consultants to the PBOT

indicate that no intersection falls below a LOS “A” or “B” (Kittelson & Associates, Inc., 2011). The street is classified by the TSP as a Neighborhood Collector (two classifications lower than a Major City Traffic Street).

Bicycles. Despite being a relatively lower-order facility for vehicles, N Williams is a more principal route for cycling. According to a 2010 count, the intersection of N Williams and Russell had the fifth highest bicycle volume in the city (over 3,000 daily trips). The corridor has also been estimated to have one of the top-ten highest percentages of female riders citywide, which PBOT consultants suggest may indicate a high perception of safety among cyclists (Kittelson & Associates, Inc., 2011). In several locations, PBOT has replaced a parking space with high-density bike parking.

Pedestrians. Although N Williams has consistent sidewalks and street trees, it provides little else in the way of pedestrian amenities. Most transit stops, for example, have no benches or weather protection, and all street lamps are tall floodlights that are arguably out of scale with pedestrians. Very few intersections are signalized and marked crosswalks are only provided at some cross streets (Figure 6-43).

Transit. N Williams has three bus routes operated by TriMet, which have service headways of ten to thirty minutes in the peak hour. In several locations, buses are located at curb extensions, requiring that buses stop in the bike lane on the right-hand side of the street, which forces cyclists to move into vehicle lanes (Kittelson & Associates, Inc., 2011).



Figure 6-43. Pedestrian Crossings on N Williams

Top left: Many crossings, like the intersection of N Williams and Failing, are not marked for pedestrians. Those that are marked vary. *Top right:* A marked crossing with no signal. *Bottom right:* A marked crossing with signage telling drivers to yield. *Bottom left:* A traditional signalized crossing at Fremont Street.

Project development

Community Engagement. The development of the N Williams project provides a unique case study in context-sensitive design. The SAC and the project manager at PBOT, Ellen Vanderslice, took unusual and bold steps to ensure that the project had a broad base of community support. Although the project initially began as a bicycle improvement project, the project expanded to address larger concerns, focusing not only on transportation problems, but also on addressing long-standing social conflicts in the community.

The issues of inclusion and community support played a major role in shaping the project's development. In fact, PBOT effectively doubled the length of the community engagement process in order to achieve greater inclusion. According to initial project documents (Vanderslice, 2011), PBOT expected project development to last less than a year. The agency began the process of community outreach in fall 2010 (Vanderslice 2012) and convened the first SAC meeting for the project in February 2011. The agency planned to complete community planning and to finish some early construction items by the end of the summer.

Just as the project's development was reaching its planned completion, however, the SAC and PBOT recognized that the development process failed to represent significant voices, particularly the local African-American community. At the June 2011 SAC meeting, for example, the committee discussed the concerns of local African-American leaders and heard from residents about the lack of representation in the development process. One

| Development of North Williams | |
|-------------------------------|---|
| Fall 2010 | Project Initiated |
| February 2011 | First SAC Meeting |
| June 2011 | Project planning extended indefinitely |
| August 2011 | SAC formally expanded |
| December 2011 | Revised project objectives |
| January 2012 | New "Guiding Statement for the Project" |
| February 2012 | Project outcomes and measures selected by SAC |
| February 2012 | Project alternatives presented by PBOT |
| March 2012 | Preferred alternative selected by SAC |

Figure 6-44. Project Timeline: North Williams Avenue

attendee remarked, "the African American community is not against bicyclists or change, but they would like a larger voice in the planning process. They would like to be at the table and [be] providing input regarding the future development of the neighborhood and street" (N Williams Traffic Operations and Safety Project (NWTOSP), 2011, p. 3). Recognizing the need to add more voices to the SAC, in June 2011 PBOT decided to extend project development, and in August, the SAC added 9 new members, including residents and leaders of local community groups.

According to Vanderslice (2012), the issue of cycling on N Williams had also brought to the fore larger concerns about gentrification in the area. The surrounding neighborhood had long served as the historic heart of Portland's African-American community. The rapid growth in cycling on N Williams since the late 1990s occurred at the same time as gentrification and physical changes, including a new commercial district of boutiques, cafes and restaurants (in Segment 4) and higher-end residential development. At the June 2011 meeting, Vanderslice reported feedback from a meeting with local religious leaders: "The community is trying to adjust to gentrification, and needs time to adjust. 'Green' is good, but cyclists seem to have a big voice, and that is irritating. From the presentation, this project seems to be all about bikes, despite its name. There needs to be more sensitivity to the fact that the community has been invaded" (NWTOSP, 2011, p. 2).

Addressing History. The issue of representation on the N Williams SAC also promoted a larger discussion of Portland's planning legacy and its impacts on the African-American community. According to Vanderslice, the nearby residential neighborhoods had borne the brunt of several decades of destructive projects, including urban renewal and freeway construction. "Several times the urban renewal projects were unsuccessful and sat empty," Vanderslice (2012) explains, "so, there is a great feeling of bitterness and a feeling that the city has not been a good steward."

The SAC explicitly addressed this history and affirmed the value of community involvement in the public planning process.

In January 2012, the SAC approved a new "Guiding Statement" for decision-making, written by the Honoring History Working Group formed within the SAC (NWTOSP, 2011b, p. 2). In the document, the SAC recognizes the failures of past city planning and issues its own apology, stating, "We understand the legacy of these processes and we're deeply sorry for the history of insensitivity that has taken place as it relates to neighborhood change" (North Williams Stakeholder Advisory Committee (SAC), 2012, p. 1). The document also describes a balance between local knowledge and technical expertise, asserting that "members of the community are the experts in their neighborhoods" while "the City has expertise in traffic planning and engineering" (p.1).

Project Goals. As the SAC underwent these changes, the principle design concerns of the project remained fairly consistent. In December 2011, the SAC issued a new set of objectives for the project (NWTOSP, 2011b), which were largely identical to objectives defined by PBOT at the start of the process (Vanderslice, 2011). The only change was the addition of objective seven: "To honor the history of North Williams Avenue through elements of the transportation project." Most of the remaining objectives express a desire to improve conditions for all street users and to support access to local businesses.

According to Vanderslice (2012), the project has been focused particularly on addressing two key problems: conflicts between bicycles, vehicles, and bus service, and the difficulty

| Goals for North Williams | |
|--------------------------|---|
| 1 | To conduct an open planning process through which all voices can be heard by the City. |
| 2 | To reduce or manage traffic conflicts between people bicycling, people driving, and buses operating on North Williams. |
| 3 | To improve conditions for bicycling on North Williams. |
| 4 | To maintain or improve conditions for walking on or across North Williams. |
| 5 | To explore innovative solutions and strategies in the North Vancouver/Williams corridor. |
| 6 | To create conditions for transit service, traffic flow, parking and active transportation that support existing businesses and future business development. |
| 7 | To honor the history of North Williams Avenue through elements of the transportation project. |

Figure 6-45. Project Goals: North Williams Avenue

Goals: North Williams Stakeholder Advisory Group, revised and approved December 2011.

pedestrians face in crossing N Williams. The current design of the street exacerbates both issues.

First, since both bus stops and the bike lane are located on the right side of the street, buses must frequently cross the bike lane to reach curbside stops. At several locations, stops are located at curb extensions, requiring buses to stop in the bike lane itself to service passengers and forcing cyclists to stop or enter the vehicle lane to go around (Kittelson & Associates, 2011). Some cyclists have reported that a bus and a cluster of cyclists will repeatedly

leapfrog one another as the bus makes its stops. Furthermore, buses sometimes have difficulty finding a gap in the high bicycle volumes to safely cross the bicycle lane (Vanderslice, 2012).

Second, pedestrians have expressed dissatisfaction with the lack of infrastructure to cross the street. Except for the section closest to I-5, only three intersections out of 24 are signalized. Of the remaining cross-streets, crosswalks are marked about only every-other crossing (approx. 500 ft. apart). In some areas, the distance between marked crosswalks can be much larger (up to 0.3 miles between Hancock and Page in the southern half of the project area). The existing crosswalks, however, have proven inadequate. Vanderslice reports, “pedestrians find that it is very difficult to get motorists or bicyclists to yield to them at non-signalized intersections.”

Use of performance-based planning

The N Williams case demonstrates all features of performance-based planning. The case used performance-based planning in a way that is not discussed in the literature. Specifically, performance measurement not only guided decision-making, but served as a means of communication between community stakeholders and public officials.

Identifying goals. First, the SAC used performance-based planning to identify and agree upon a specific set of outcomes for the project. A special Outcomes Working Group within the SAC identified a set of 20 possible outcomes. The larger SAC

then ranked all of the alternatives to identify a list of the top-ten “collective” outcomes. To better understand what these outcomes meant, however, the Outcomes Working Group adopted specific measures, proposed by PBOT, to assess any potential design’s impact on a given outcome. For example, to assess improvements to pedestrians’ ability to cross the street (Outcome 1), the Working Group adopted both output and outcome measures, like the distance of pedestrian crossings (output) and pedestrian satisfaction and the rate of opportunities for pedestrians to cross (outcomes). This framework of goals, outcomes and measures, is identical to the framework described by Pickrell & Neumann (2001), MacDonald (2010), and others. It should be noted, however, that these measures did not included any “process measures” for assessing the project’s development.

Identifying strategies. Second, the definition of outcomes helped the SAC members understand the relationship between design and performance. After the SAC approved its set of outcomes, PBOT presented a “tool-box” of design strategies for each outcome, which the SAC then debated for N Williams (NWTOSP, 2012a). PBOT then designed a set of alternatives for the project based on the desired outcomes.

Evaluating alternatives. Finally, the SAC used their outcomes to choose a final design. Through this process, the SAC’s use of performance-based planning exceeded PBOT’s own expectations. In a February 2011 SAC meeting, PBOT presented its first set of project options (i.e. alternatives). The overview of each option

| North Williams: Collective Outcomes | |
|-------------------------------------|---|
| 1 | Increase convenient pedestrian opportunities to safely cross Williams |
| 2 | Mitigate conflicts between all modes |
| 3 | Reduce motor vehicle speeds |
| 4 | Improve visibility of pedestrians |
| 5 | Reduce the risk of cyclists being struck by opening vehicle doors |
| 6 | Create opportunities for people bicycling to pass other cyclists without entering the motor vehicle travel lane |
| 7 | Manage conflict between bus and bicycle operations |
| 8 | Reduce all crashes in the N Williams corridor |
| 9 | Maintain or improve ease of transitions for bicyclists making turns |
| 10 | Maintain access and operability for TriMet LIFT vehicles and private lift-equipped vans |

Figure 6-46. Collective Outcomes: North Williams

The North Williams SAC adopted a set of collective outcomes to guide their design decision-making.

included a box with small colored squares – red, yellow, or green – describing its impact on each of the ten outcomes. (See Figure 6-47.) During the meeting, members indicated that this method was confusing and obscured the individual measures that comprised each outcome (NWTOSP, 2012; Vanderslice, 2012). PBOT addressed these concerns in two ways. First, in each option overview page,

Outcomes Addressed by this Option

| | |
|--|---|
| 1 Pedestrian crossing opportunities | 6 Bicycle passing opportunities |
| 2 Mitigate conflicts | 7 Manage bus/bike conflict |
| 3 Reduce motor vehicle speeds | 8 Reduce crashes |
| 4 Improve visibility of pedestrians | 9 Transitions for bikes making turns |
| 5 Reduce risk of cyclists being struck by vehicle doors | 10 Access for lift vans |

■ Supports Outcome

■ Somewhat Supports Outcome

■ Does Not Support Outcome

Left: Figure 6-47. Evaluation Method 1

At first, PBOT provided the SAC with an alternatives analysis that described each design alternative's outcomes using colored squares. SAC members argued this method obscured the measures they chose to evaluate each outcome. Source: PBOT.

Bottom: Figure 6-48. Evaluation Method 2

In response to the SAC feedback, PBOT provide the group with a detailed evaluation matrix that describes each alternative's performance across not only the collective outcomes, but also the individual measures the SAC chose for each outcome. Instead of colored squares, the evaluation matrix uses pie charts. Source: PBOT.

EVALUATION CRITERIA MATRIX

| North Williams Traffic Operations Safety Project | | | CONCEPT OPTIONS | | | | | |
|--|---|--|-----------------|-----|-----|-----|-----|-----|
| DESIRED OUTCOME | ASSESSED CHANGES | TOOLS TO FACILITATE CHANGE | 1A | 1B | 2A | 2B | 2C | 3 |
| 1 Increase convenient pedestrian opportunities to safely cross Williams | Are there more gaps in vehicle flow at key crossing points? | Signal progression, RRFB crossings | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Do motorists and bicyclists yield to crossing pedestrians more often? | Slower speeds for motor vehicles; single motor vehicle lane; RRFB crossings | ● | ☐ | ● | ☐ | ☐ | ☐ |
| | Do pedestrians have shorter distances to cross at key crossing points? | Curb extensions; refuge islands | ☐ | ☐ | ● | ☐ | ☐ | ☐ |
| | Are pedestrians more satisfied? | Curb extensions; slower speeds for motor vehicles; single motor vehicle lane; beacons; education/enforcement | N/A | N/A | N/A | N/A | N/A | N/A |
| | Do more pedestrian crossings fall below the threshold for improvements? | Curb extensions; refuge islands | N/A | N/A | N/A | N/A | N/A | N/A |
| | Have the number of crosswalk enforcement actions increased? | Education/enforcement | ● | ● | ● | ● | ● | ● |

PBOT replaced the colored circles with pie charts, to better describe the option’s impact on each outcome. Second, as requested by the SAC (Vanderslice, 2012), PBOT provided a full evaluation matrix, that described how options performed relative to individual, measures identified for each outcome. (See Figure 6-48.)

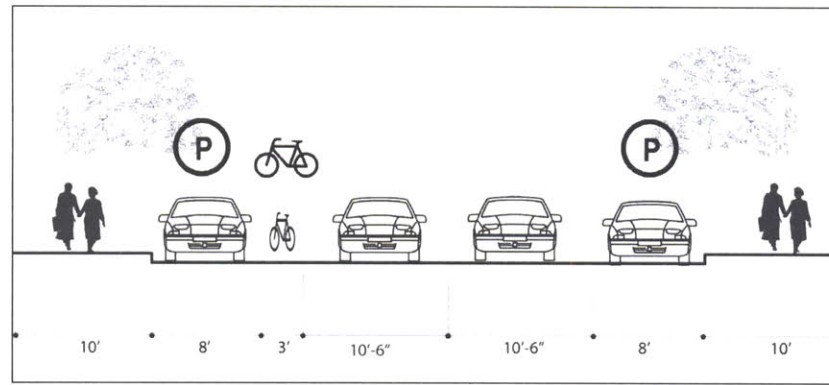
Proposed design

In March 2012, the SAC recommended what was known as “Option 4B” – a design alternative prepared by PBOT in response to performance concerns at earlier SAC meetings. Option 4B includes a left-side bicycle lane and buffer, a parking lane on both sides of the street, and a single vehicle lane along the majority of the project area. The distinguishing feature of Option 4B, however, is a shared travel lane – for bicycles and vehicles – in Segment 4, resulting in *two* vehicle lanes through this area.(See Figures 6-50 and 6-51.)

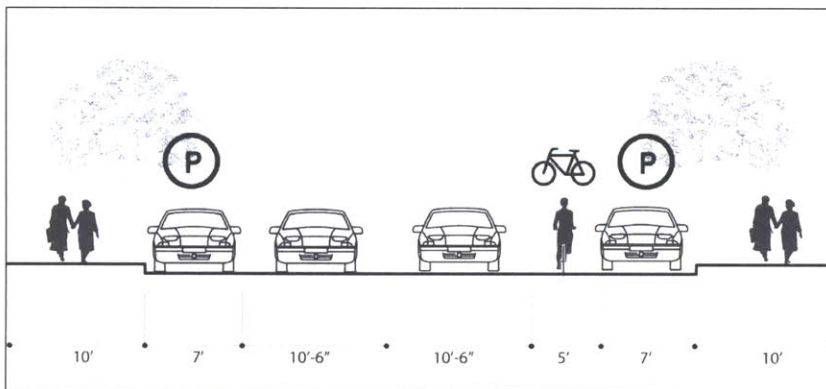
The issue of reducing N Williams from two vehicle lanes to one had been much debated throughout the project development. Early on, PBOT expressed hesitance to move toward a one-lane design (Maus, 2012). Early public outreach, however, indicated support for one bike lane. The Portland’s Bicycle Transportation Alliance, for example, threw its support behind the one-lane design in May 2011 (Peithman, 2011). Several members of the SAC, however, expressed concern about potential congestion and traffic delays, particularly in Segment 4, which has been the site of recent development and experiences the highest traffic volumes in the

| | Current | Proposed |
|-------------------------------------|---|---|
| Cross-Section Elements | | |
| Roadway Direction | One-way (Northbound) | |
| Sidewalk Width | 10 ft. | |
| General Vehicle | 2 Lanes (10.5 ft) | 1 Lane (12 ft); 2 Lanes in Segment 4 |
| Parking | 2 Lanes (7 ft.) | 2 Lanes (8 ft.) |
| Dedic. Bike Lane | One-way, right-hand side | One-way, left-hand side |
| Plan Elements | | |
| Signalized Intersections | Major streets only (Every 300-1500 ft.) | |
| Ped. Crossings - Marked, Signalized | 12% (Every 300 - 1500 ft.) | 25% (Every 300 - 800 ft.) |
| Max. Pedestrian Crossing Distance | 45 ft. | |
| Special Features | Bio-swales, Curb extensions | Add'l. curb extensions, pedestrian signalization, bike boxes for cyclists turning |
| Sidewalk Amenities | | |
| Transit | Most stops have no bench or shelters | |
| Pedestrian | Cafe seating from local restaurants | |
| Bike | Ample bicycle parking | |
| Lighting (height) | Corba (30 ft.) | |
| Trees (height) | Consistent (15 - 30 ft.) | |

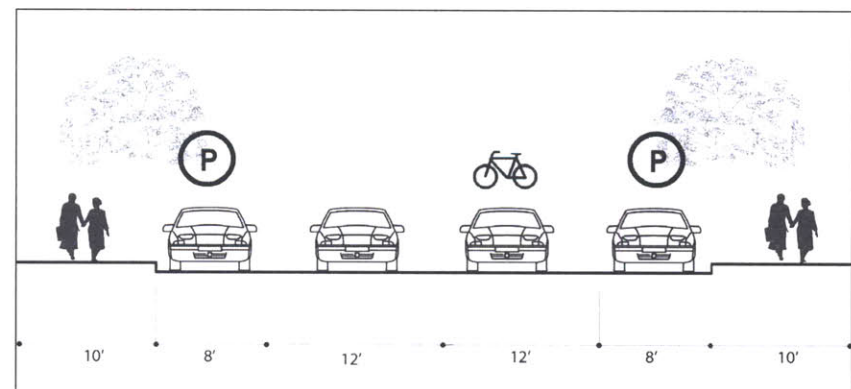
Figure 6-49. Design Features: North Williams



Current



Proposed: Shift Bicycle Lane to Left-Hand Side



Proposed for Segment 4 - Shared Bicycle and Vehicle Lane

Figure 6-50. Street Sections: North Williams Avenue

In the final design proposal, the North Williams bike lane will move from the right-hand (east) side of the street to the left-hand (west) side. In Segment 4, however, the bike lane will be removed and replaced by a shared lane for vehicles and cyclists.

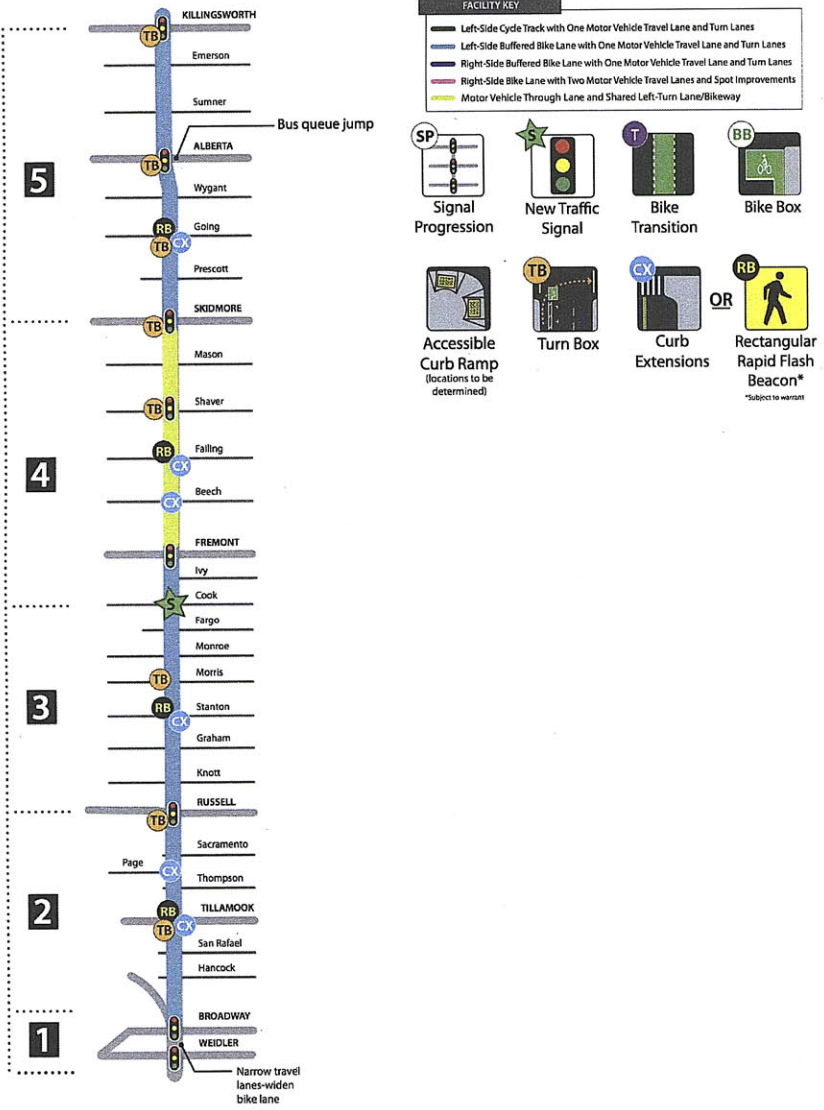


Figure 6-51. Design Schematic

The final design proposal adds numerous amenities for cyclists and pedestrians. In Segment 4, the bicycle lane will be replaced by a lane shared by vehicles and pedestrians. Source: PBOT.

project area (between 950 to 1,100 vehicles and 400 bicycles in peak hours) (Maus, 2012).

The outcomes and measurement evaluation demonstrated the efficacy of Option 4B, which was estimated to increase performance toward most of the outcomes, but attempts to also address the issue of automobile traffic. Specifically, the placement of the bicycle lane on the left side of the street reduces conflicts between bikes and other vehicles, while the shared-lane treatment preserves existing vehicle capacity in Segment 4.

Option 4B also includes additional, smaller elements that improve performance for all users. For pedestrians, for example, Option 4B reduces the speed limit from 30 to 20 mph and adds curb extensions, shortening the crossing distance at six intersections. The design also includes “rapid flash beacons,” flashing lights that pedestrians and cyclists activate to alert vehicles and cyclists of their crossing, at several non-signalized intersections. Furthermore, Option 4B employs strategies to solve specific design challenges, like conflicts between modes. For example, the placement of the bicycle lane on the left side of the street makes it difficult for cyclists to turn right, since they must go in front of vehicles who may be continuing straight. As a result, PBOT incorporated bicycle turn boxes, which mark spaces for bikes to cross in front of stopped vehicles, at all intersections with traffic signals or pedestrian rapid flash beacons.

Performance-based planning and community engagement

Empowering stakeholders. The N Williams case demonstrates that performance-based planning is not only compatible with a highly participatory design process, but can serve as a tool for increasing the decision-making power of community stakeholders. By participating in the definition of the project's outcomes and measures, the SAC played a large role in dictating the project's design. For example, the SAC discussed various design strategies for achieving each outcome and each associated measure, enabling them to consider the design impacts of highly specific design choices, such as the location of the bike lane and the inclusion of bike turning boxes.

When choosing a final design, the SAC was also able to use a tool of its own creation, the outcome evaluation, rather than rely solely on the guidance of PBOT officials. While the outcome evaluation could have constrained the SAC by forcing them to choose the project that scored best, the tool informed the SAC's choices rather than dictated them. At a February 2012 SAC meeting to discuss project alternatives, one SAC member asserted that, "the SAC should also do their own evaluation of how the options meet the outcomes" (NWT SOP, 2012b, p. 7). Indeed, in an interview, another SAC member indicated that while the outcomes evaluation was helpful, Option 4B was chosen primarily because "it had features that everyone on the SAC could live with" (Anonymous, 2012).

The ability of performance-based planning to empower community stakeholders, however, had limits. First, the SAC took most of its performance measures from PBOT, who supplied

various measures in line with the SAC's goals. Without a background in transportation planning, it's unlikely the SAC could have identified measures on its own.

Second, for this same reason, the outcome evaluation process was not always accessible to all members of the SAC. In an interview, one SAC member described the evaluation matrix as "useful but also overwhelming and confusing. Most SAC members [were] overwhelmed with so many options to consider and in a setting with 27 people asking questions it made it even harder" (Anonymous, 2012). It seems that PBOT attempted to address this problem, in part, by simplifying the outcomes evaluation through graphical representations, like colored circles (red, yellow, or green) and, later, pie charts. How useful these strategies were, however, remains unclear. In the end, more accessible tools and an environment away from the PBOT may have played a bigger role than the outcomes evaluation in SAC decision-making. The same SAC member reports, "what was really helpful was when several members of the SAC offered to host a separate meeting for all SAC members (exclusive of PBOT) in a less stressful environment, have dinner, socialize, not be hurried to get back to work and look at the options in a virtual reality computer program. This virtual reality computer program is what brought it home to the nine members who were able to attend" (Anonymous 2012).

Increasing Transparency. Separate from the issue of participation, the use of performance-based planning also increased the transparency of PBOT's decisions. According to one SAC

member, there was concern that the agency would ignore the SAC's goals. "Selecting measures and outcomes was helpful," the member explains, "however, I was concerned that the City would take the results and display them in a manner that would best meet their needs" (Anonymous, 2012). As described above, the SAC pushed PBOT to use their outcomes and measures to explain the rationale behind the project alternatives. According to the same SAC member, "it wasn't until after the outcomes [were] placed within each design option box that we were able to see the results."

Evaluating process. The issue of representation on the N Williams SAC suggests that there may be value in using process measures to evaluate community engagement. After struggling to achieve broad representation of the local community, the SAC identified the need for mechanisms to evaluate the community engagement process. In its January 2012 Guiding Statement, the SAC specifically requested that the PBOT evaluate N Williams "utilizing a formal facilitated evaluation process, to guide new policy on engagement processes that ensure that all voices are heard" (North Williams SAC, 2012, p. 2). Despite this desire, the SAC considered stakeholder satisfaction in only one project outcome and failed to vote "achieve satisfaction among all stakeholders" as a top-ten outcome. Vanderslice explains that this outcome may have been of little value to the committee, since many believed that no option could fully satisfy everyone. Due to this omission, SAC's outcomes evaluation left little opportunity for evaluating process.

Outcomes measures, therefore, are potentially inadequate for assessing community engagement.

Community values. The differences among N Williams stakeholders underscore the difficulty in using performance-based planning to resolve community conflict. For the N Williams project, the outcomes evaluation process was complicated by subjective interpretations of performance. The SAC did not attempt to choose the design option that resulted in the greatest improvements for all outcomes. Instead, the committee debated various options to find a balance that satisfied everyone. In other words, the community stakeholders had no objective means of determining the value of each performance goal. For community members in conflict over the avenue's bicycle lane, for example, there was no agreement about the value of improving performance for bicycles over vehicles.

Vanderslice explains that the N Williams project was less about maximizing performance than it was about reconciling community narratives. According to Vanderslice, as planners attempt to empower local stakeholders, they must recognize that objective measurements may play a small role in decision-making. "The process has been quite satisfying," Vanderslice reports, "because it's not just about the modes or conflicts between modes. It also has this interesting quality of having so much of the project be about different narratives. The city has been trying to honor all of these narratives. And of course we have our own narrative too which we call the facts, but we have to recognize that that's just another story." As the experience of the SAC shows, while performance-based

planning helped informed decision-making on N Williams, design choices were ultimately subject to a complex and conflicting set of community values.

Chapter 7. Synthesis

Design Form: Strategies & Features

These four case studies provide further evidence that cities have adopted a broader conception of performance for the design of urban arterials. In all cases, automobile congestion was never the primary motivation for design. Instead, agencies started these projects to address performance concerns for alternative modes, specifically pedestrians (E Burnside), cyclists (PPW and N Williams), and transit (34th Street). In addition, these projects demonstrate a concern for larger issues like livability and economic development.

The cases demonstrate a common set of strategies that agencies are using to achieve a balance across multiple performance goals through design. The cases do not point to a universal definition of balance, but suggest that agencies use community input to create a balance based on the performance goals that are valued by community stakeholders. The four cases also employ a set of common design features that reveal how these agencies are changing the user experience on these major streets. Overall, the cases appear to focus heavily on improving access to buildings along the street through new pedestrian and parking infrastructure. While the cases do improve mobility, the improvements in ease of movement are

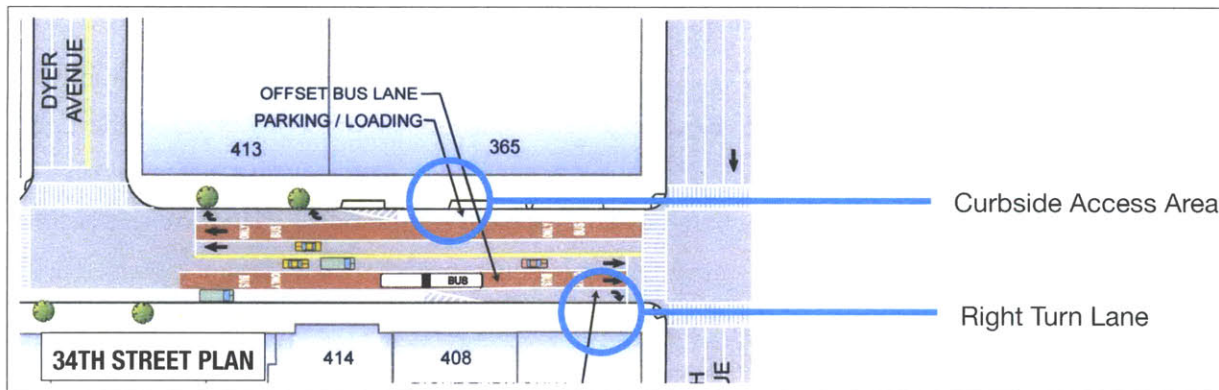


Figure 7-1. Addressing Modal Conflicts

Through Design

For each case, agencies employed various design features to mitigate potential conflicts between modes. On 34th Street, new curbside access areas and turning lanes keep the bus lanes clear of turning and parked vehicles. Source: NYC DOT.

generally confined to bicycles and transit, and not automobiles or trucks.

Common strategies

The cases use two common strategies for achieving balance in performance. While these strategies manifest themselves physically in different ways for each case, they follow similar approaches in process and form. First, in all of the cases, the agencies used community input to introduce new performance goals that shaped design. In general, the agencies did not abandon their original performance goals, such as mobility for buses or cyclists, but modified designs to achieve community-driven performance goals. On N Williams, for example, the final design removed the dedicated bike lane in the most heavily trafficked section of the street after community stakeholders expressed concern about vehicle congestion. On 34th Street, the final design restored two-way

traffic along all of the corridor (after earlier proposals for one-way movement) and created new spaces for curbside access and parking. Concerns from community stakeholders about traffic congestion and parking needs prompted both changes.

Second, most of the cases used design to mitigate conflicts between modes. Since street space was necessarily limited in all of the cases, designers faced the challenge of improving performance for new users, without placing unacceptable burdens on other users. In all of the cases (with perhaps the exception of E Burnside) the introduction of dedicated space for new modes threatened to create or exacerbate conflicts. For example, on 34th Street, the offset bus lanes threatened to create conflicts at intersections between buses going straight and vehicles making right turns. Normally, vehicles turning are allowed to occupy the bus lane, which can limit the performance of buses and may be difficult for drivers. To solve this problem, DOT added turning lanes along the curb, which take

general vehicles out of the bus lane when turning right (Figure 7-1). As another example, on N Williams, the left-hand side bicycle lane will require cyclists to cross in front of vehicles when turning right. To address this challenge, the city added bike boxes where cyclists can cross safely in front of stopped vehicles. While many of these solutions may be found in existing guidance, such as ITE's (2006) *Major Urban Thoroughfares* guide or NYC DOT's (2009) *Street Design Manual*, these cases may provide further evidence of best practices.

It is interesting to note that these small-scale, conflict-mitigating features are generally not employed on E Burnside. Unlike all of the other cases, E Burnside was the only case where street space was *not* effectively limited, since project designers effectively expanded the corridor's capacity by pairing it with Couch.

Although each case uses different design features to reduce conflict, one design approach is worth mentioning as a potential emerging best practice. On both N Williams and PPW, the agencies placed the bicycle lane on the *left* side of one-way traffic. For two-way traffic, this is tantamount to placing dedicated lanes on the *inside* lanes of streets. According to project designers for N Williams and PPW, this approach reduces conflicts in turning movements between modes, since right-turning vehicles will not conflict with cyclists going straight. The conflict between left-turning vehicles and bikes continuing straight is easier for users to manage, since drivers can view oncoming bicyclists on the left-hand side using their mirror (as opposed to turning their head to see bicyclists on the right-hand side) and since drivers may be more accustomed to waiting to turn

left until there is an opening in traffic (as is the case on two-way streets). On N Williams, the left-hand side placement also removed conflicts between cyclists and transit, since buses serve the right-hand side of the street. Since this approach was not used on 34th Street, where bus lanes remain on the outside lanes of traffic flow, turning movements remain a problem that designers solved with special turning lanes. On E Burnside, the bicycle lane was placed on the right-hand side of one-way traffic, where it necessarily conflicts with buses making stops at the curb and any right-turning vehicles.

Common features

In addition to these shared strategies toward achieving a performance balance, the final designs of all of the cases have several design features in common. (See Figure 7-3.)

First, all of the projects used similar features to increase pedestrian safety, particularly at crossings (Figure 7-2). Three of the four projects, for example, employed curb extensions to increase sidewalk space and shorten crossing distance. The sole exception is the design on PPW, which, like some intersections in the proposed final design of 34th Street, employ pedestrian islands to a similar effect as curb extensions. When the space immediately adjacent to the sidewalk cannot be blocked due to moving traffic (e.g. the bicycle lane on PPW or a turning lane on 34th Street), the pedestrian island still shortens crossing distance and creates a raised space in the middle of the roadway where pedestrians are more visible to other users.



Figure 7-2. Curb Extensions and Pedestrian Refuge Islands

All of the cases extended the pedestrian realm with new infrastructure.

Top: DOT added pedestrian refuge islands on PPW.

Bottom: PBOT added curb extensions on East Burnside.

Second, all of the cases have reduced the amount of space dedicated to automobiles and trucks. In all four cases, agencies reduced the number of general vehicle lanes, from as much as six lanes to three (E Burnside). Despite this reduction, most of the cases (with the exception of N Williams) do not change the width of general vehicle lanes. Nevertheless, on each street, the final design reduces the percentage of the full right-of-way dedicated to moving, motorized vehicles. The result varies in each case, but generally the final designs shift moving vehicles farther away from pedestrians by creating effective buffer areas (through new parking areas or bicycle lanes).

Third, the cases pay special design attention to parking and curbside access. Even when vehicle lanes are being sacrificed for other users, the agencies consistently preserved parking in all of the designs. On 34th Street and E Burnside this design emphasis was particularly apparent, since both agencies actually increased parking on both streets. (On E Burnside, parking lanes were converted from part-time to full-time; on 34th Street, the final design creates new parking areas in Midtown and converts existing areas from part-time to full-time.) The cases also show how parking areas are being used flexibly to solve various performance issues, specifically in NYC. On 34th Street and Prospect Park west, curbside areas are programmed. For example, on both streets some areas are explicitly marked for short-term stays to facilitate commercial delivery vehicles that might otherwise double-park.






| |  |  |  |  |  |
|---------------------------|---|--|---|---|--|
| East Burnside | + - - Implemented couplet to preserve capacity Increased signals Reduced speed limit | + Two parking lanes converted from part-time to full time | + New dedicated bike lane (unprotected, un-buffered, right-hand side) | + Signalized, pedestrian crossings at all intersections Max. crossing distance reduced from 62 to 38 ft. | + Curb extensions enable buses to stay in moving lane during stops New bus stops with benches and weather protection |
| Prospect Park West | - Number of lanes reduced from 3 to 2 | + - Created new designated delivery areas Loss of some spaces on each block | + New dedicated bike lane (two-way, protected, 4-ft. buffer, left-hand side) | + New crossings added at key locations Pedestrian signal lights Refuge islands | N/A - no bus routes |
| 34th Street | - Number of lanes reduced from 4 to 2 (from 7AM - 7PM) | + Created new designated curbside access areas Parking converted from part-time to full-time | = No dedicated bicycle infrastructure added | + Curb extensions & refuge islands Wider sidewalks in key locations Cross-walks widened Reduced max. crossing dist. | + Turning lanes reduce conflict between buses and vehicles Dedicated bus lanes offset from the curb Fare pre-payment system |
| North Williams | - Number of lanes reduced from 2 to 1 (except in one segment) | = Parking spaces and timing unchanged | + - Bike lane widened, moved from right to left-hand side Bike lane removed in one segment | + New pedestrian crossings and signalization Curb extensions reduce max. crossing dist. | + Curb extensions enable buses to stay in moving lane during stops Placement of bike lane reduces conflicts with cyclists |

Figure 7-3. Case Study Comparison: Design Form + Improved performance - Reduced performance + - Mixed results = No change

On the one hand, these common design features all suggest an increased attention to *access* on major streets over *mobility*. While reduced vehicle space might slow traffic through each neighborhood, improved parking and delivery areas help vehicles reach destinations along the street. For pedestrians, improved crossings and more generous sidewalks arguably improve both pedestrian mobility and access. It's arguable, however, that pedestrian access was improved more than mobility. While all cases had sidewalks running parallel to traffic prior to their re-design, most of the projects improve crossings, which enable walkers to reach the other side. In this way, these improvements appear to have a greater impact on pedestrians' ability to reach destinations on the street and less on their ability to move along it.

On the other hand, these common features do improve mobility, but only for select users. Since the design of all of the cases improves or implements bicycle lanes or bus lanes, the mobility for these users arguably improves. Mobility for automobiles was not disregarded altogether, since many of the cases made design modifications, like special turning lanes, to mitigate any harmful impacts on vehicular mobility. None of the projects, however, actually increased vehicular mobility. Even on E Burnside, where PBOT implemented a two-way couplet similar to projects seen in the 1950s, the project only maintained existing capacity and has slowed vehicular traffic by adding signals to every intersection. Furthermore, on N Williams, where the final design removes the existing bicycle lane on one segment of the street, the project adds

no vehicular capacity and the fact that cyclists will share space with vehicles will arguably reduce vehicular capacity (albeit not so much as removing the vehicular lane altogether).

Design Process: Performance-Based Planning

While all of the cases used some features of performance-based planning, the extent to which the cases employed performance-based planning as a decision-making framework varied considerably (See Figures 7-4 and 7-5). With respect to the performance-based planning framework, the cases fall on a spectrum. On the low end lies E Burnside, where project officials did not identify specific

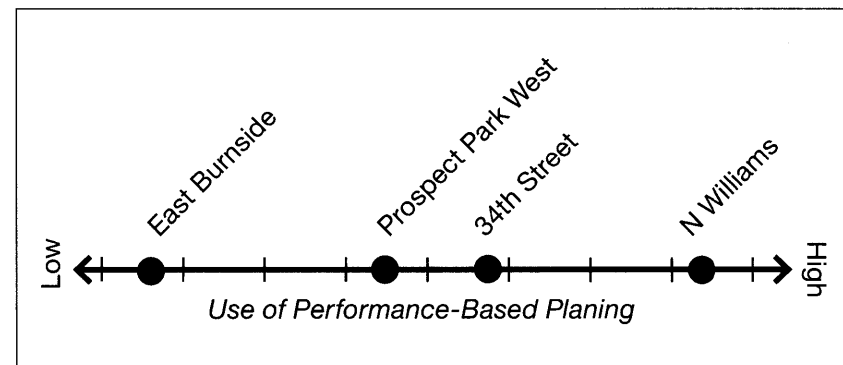


Figure 7-4. Spectrum of Performance Based Planning

The individual cases used the features of performance-based planning to varying degrees.

| | East Burnside | Prospect Park West | 34th Street | North Williams |
|--|--|--|---|--|
| Features of Performance-Based Planning | | | | |
| Explicit goals | Yes | Yes | Yes | Yes |
| Operational objectives | No | No | No | Yes |
| Related measures | No | No | No | Yes |
| Decision-support | No | No | Yes | Yes |
| Ex-post evaluation | Yes | Yes | N/A | N/A |
| Timing: When was performance measured? | | | | |
| Ex-ante | Yes Baseline, existing conditions | Yes Project selection, Baseline | Yes Project selection | Yes Existing conditions |
| Design Phase | No | No | Yes Modifications for traffic flow and curbside access | Yes Alternatives analysis |
| Ex-post | Yes Project evaluation | Yes Project evaluation | N/A | N/A |
| Content: What was measured? | | | | |
| Subjective measures (e.g. community satisfaction) | Yes Surveys of community perceptions | Yes Public polling of community perceptions | Yes Curbside access needs of residents and business-owners | No SAC rejected "satisfaction" as a collective outcome |
| Objective outcomes (e.g. change in travel time) | Yes Evaluation of travel time, congestion, travel volumes, etc. | Yes Evaluation of accident rates, speeding, traffic volumes, etc. | Yes Preliminary design evaluated in terms of traffic congestion. | Yes Alternatives evaluated in terms of pedestrian safety, modal conflicts, etc. |
| Process features | Part. Project documents list engagement activities | Part. Project website lists engagement activities | Part. Project website lists engagement activities | Part. Project website lists engagement activities |

Figure 7-5. Case Study Comparison: Use of Performance-Based Planning

Yes corresponds to full use; **No** corresponds to no use; **Part.** corresponds to partial use. Of all the cases, N Williams most fully implemented the features of performance-based planning

project goals, objectives and related measures, and did not use performance measurement to evaluate alternatives or refine design. When performance measurement was used, in an *ex-post* evaluation, the measures were defined *after* the project was completed. On the high end lies N Williams, where project officials and community stakeholders identified goals, objectives and measures, and then used performance measurement to evaluate project alternatives and choose a final design. In the middle lie PPW and 34th Street, where performance goals were not well articulated at the start of the project, but performance measurement was used to refine project design.

Despite this variation, the cases demonstrate the use of performance-based planning in the specific decision-making contexts described in the literature. Generally, the cases used performance measurement in one or more of three specific contexts: prior to project design or construction in an *ex-ante* evaluation, during project development to improve design toward performance goals, and after project construction in an *ex-post* evaluation of performance results. It should be noted that all of the cases used, to some extent, outcomes measures, as opposed to just outputs, as advocated for in most of the literature on performance-based planning (Macdonald et al., 2010; M. Meyer, 2001; Pickrell & Neumann, 2001; Poister, 2005). Although the agencies saw value in the use of measurement

during these contexts, the experiences of case planners/designers demonstrate the technical challenges of collecting and using performance data during design decision-making.

Ex-ante evaluation

The respective agencies used performance evaluation prior to project development as part of their method for selecting these cases as priority investments, as is recommended by Pickrell & Neumann (2001). In order for such evaluations to be meaningful, however, agencies had already identified strategic-level performance goals toward which these projects could contribute. Both 34th Street and PPW, for example, both fit within DOT's strategy to improve performance for transit riders through BRT and for cyclists through the expansion of bicycle lanes. As a result, *ex-ante* evaluations demonstrated how these streets were failing and could be improved within those programs. *Ex-ante* evaluation, however, was not used as the only tool for project selection for any of the cases. On PPW and N Williams, community input initiated project development. For 34th Street, DOT was attempting to identify a corridor that had both performance needs and some initial community support for BRT. Finally, on E Burnside, where the performance problem of the pedestrian experience sparked project development, no formal evaluation was performed to select the project or define its various performance shortcomings.

Besides project selection, several of the cases also used *ex-ante* evaluation to create a baseline for *ex-post* evaluation. For

E Burnside and PPW (the two cases that have been constructed), *ex-post* results were compared with *ex-ante* results. For E Burnside, however, these *ex-ante* results were actually measured after the project had been designed and, thus, did not inform project selection or the design process.

Improving project design

These cases also demonstrate how performance-based planning can improve designs during project development. Performance measurement was useful for design to extent that measurement assessed goals that were clearly articulated for the project. Some of the cases used performance evaluation of project alternatives or of preliminary design to improve project design (34th Street, N Williams), while one case used *ex-post* evaluation to make design refinements (PPW). For an example of the evaluation during project development, on 34th Street DOT used the results of the curbside access and traffic studies to mitigate the potentially negative impacts of its proposed design. For an example of *ex-post* evaluation, on PPW DOT used the performance results of earlier projects to identify a successful design strategy and followed the public polling results (which indicated the need to add further improvements to pedestrian crossings) to plan project revisions.

On PPW and 34th St, the use of performance measurement to improve project design suggests that DOT employed a kind of incomplete form of performance-based planning. Although DOT did not articulate measurable objectives at the start of project

development, the agency used performance measurements to refine the design toward a set of goals that evolved or became better articulated during the design process. For example, on 34th Street the issue of curbside access emerged during community engagement and was never defined in any set of measurable objectives. Nevertheless, performance data on how the street's current form serves curbside activity was used to improve the final design's performance in this area. On PPW, the performance results of the completed project pointed to the need to make revisions. Even if measurable objectives are not defined early on, performance data can, thus, help agencies refine project design.

What these cases show is that performance-based planning can inform design decision-making by illuminating the features that help projects achieve their goals. One case, N Williams, also shows how performance-based planning informs decision-making through a comparison of trade-offs, a technique recommended by Larson (2005). For N Williams, the performance evaluation of project alternatives improved design not by maximizing performance, but by enabling stakeholders to identify the most satisfactory combination of performance outcomes.

Ex-post evaluation

Of the two cases that have been constructed, E Burnside and PPW, both have been the subject of an *ex-post* evaluation. Planners on both projects indicated that these evaluations were useful in demonstrating that projects had achieved their goals. PPW,

however, is the only case that demonstrates that performance-based planning is, in fact, a feedback loop. As described above, its *ex-post* evaluation encouraged DOT to make later design changes on the street. Just as Meyer & Miller (2001) describe in their framework for performance-based planning, *ex-post* performance results help agencies determine whether their strategies have succeeded and how they should be changed.

Technical challenges

Although the data from performance evaluation proved useful in guiding design, the cases also demonstrate the challenges agencies face in collecting and using this data. The E Burnside project, which completed the most detailed project evaluation, provides the clearest example. The evaluation team reported difficulty in measuring residents' perceptions reliably, since many factors beyond street design may impact opinions. In addition, the evaluation team was unable to evaluate economic development impacts due to their necessarily long time horizon.

While E Burnside was an *ex-post* evaluation, these lessons are pertinent to projects during the design process. If agencies wish to evaluate proposed designs relative to a goal like residents' perceptions, they face the difficulty of narrowing evaluations to focus on specific variables. For example, if residents offer their perceptions of the safety of various design alternatives, agencies need to be able to determine what design features actually impact perceptions of safety. In other words, it is not simply enough to

gauge perceptions; agencies must also collect information on the features that are shaping them.

In addition, agencies must find ways to evaluate hard-to-define, qualitative measures. On 34th Street, for example, the project manager indicated that it was impossible to define the pedestrian experience in a simple measure like LOS. Measures of concepts like the pedestrian experience present two problems. First, qualitative measures must be defined in terms of specific, measurable attributes. For example, the pedestrian experience might be defined by quantifiable objectives, like the density of pedestrian volumes and pedestrian accident rates, and qualitative objectives, like perceptions of comfort. Second, agencies must find a way to use qualitative measures, which lack a specific numerical value, when evaluating project alternatives. For example, how can two designs be compared in terms of their impact on pedestrian comfort? A case like N Williams may provide a possible solution. Instead of using specific numbers, PBOT evaluated each design based on its *relative* impact toward each outcome, an approach recommended for qualitative measures by Macdonald et al. (2010), and used pie-charts, instead of numbers, to describe these impacts. For example, a project may be projected to increase pedestrian comfort a lot, somewhat, a little, or not at all.

Design Process: Performance-Based Planning for Community Engagement

All of the cases suggest that each agency is interested in employing street designs that are sensitive to their local context and meet the needs of local community stakeholders. In each case, community engagement strategies figured largely in the design process.

Just as the cases vary with respect to their implementation of performance-based planning, however, so too do they vary in the extent to which stakeholders participated in project development activities (See Figure 7-6). The lowest level of participation was found on 34th Street, where stakeholders have predominately played a role only in advising DOT. This is not say that stakeholders have played a small role; as described in detail above, the final proposed design has been shaped by DOT's extensive community outreach. Community stakeholders on 34th Street, however, did not initiate the project, definite its original goals or choose the final design. In contrast, the highest level of participation is visible on N Williams, where stakeholders played a role in all stages of design, in accordance with the CSD framework, and enjoyed a great deal of influence in each of these stages.

Altogether, the cases confirm several points of the existing literature on performance-based planning's value for community

engagement, by providing examples of the ways in which performance-based planning can be used as a communication tool between agencies and community stakeholders. Performance measurement reports helped agencies inform stakeholders and 'make the case' to skeptical audiences (NCHRP, 2004). In NYC, for example, DOT used performance data on earlier bicycle and bus projects to explain the benefits of its design proposals. Furthermore, performance reports helped increase the transparency of agencies (Pickrell & Neumann, 2001), by explaining to stakeholders how project decisions were made and accounting for their impacts. The *ex-post* evaluations of PPW and E Burnside, for example, provided public documentation of each agency's rationale behind the design. For PPW, in particular, this transparency was valuable in the face of political opposition.

The cases, however, go beyond the uses of performance-based planning described in the existing literature, by showing how performance-based planning can play a large role in a CSD process. This is particularly evident on N Williams, the case where stakeholders played the most participatory role and in which project designers most fully employed the performance-based planning framework. Specifically, the cases show that performance-based planning can be used to empower stakeholders in the design decision-making process and to *help* resolve conflicts in values among stakeholders. In addition, the cases also show how agencies can evaluate their success in employing CSD, with respect to both the design process and design form.

Empowering stakeholders

The cases demonstrate that performance-based planning can increase the participation of community stakeholders in design decision-making. Halachmi & Holzer (2010) argue that community stakeholders can influence public sector decision-making by playing a role in the selection of performance measures. These cases go further, however, by demonstrating how stakeholders can gain influence in decision-making by participating in all steps of the performance-based planning framework, not just the selection of measures.

The N Williams case, the only case studied that employed the full performance-based planning framework, best demonstrates this potential. The case is a good example of the CSD process, since stakeholders participated in all major stages of design, including scoping and goal definition, the development of project alternatives, and the selection of the final design. At each of these stages, performance-based planning was a primary tool for stakeholder participation. Specifically, the N Williams stakeholders defined the project's performance objectives, identified various design strategies toward achieving them, and used their own performance objectives to evaluate project alternatives and select a final design. Even while embracing this systematic approach, however, the stakeholders never relinquished their control over the project. While the performance evaluation helped inform their decision, the stakeholders chose the final design based on group consensus, not on performance.

The remaining cases also demonstrate how stakeholders influence design by advocating for specific performance goals. As described above, community stakeholders were responsible for advocating for curbside access on 34th Street, safer pedestrians crossings on PPW (following construction), and, along with public officials, an improved pedestrian experience on E Burnside.

Despite its success in empowering community stakeholders, using performance-based planning as a community engagement strategy appears to face both technical and social challenges. Community stakeholders may be unable to use performance data or uninterested in relying on data to guide decisions. The N Williams case, for example, showed that the SAC found the performance evaluation confusing and relied on renderings to guide decisions. On 34th street, project manager Eric Beaton (2012) suggests this may be common. Beaton explains, “Often, what you show the public, a photo is better than a number.” Furthermore, stakeholders may be unable to select their own performance measures without the help of officials. On N Williams, for example, PBOT supplied a long list of measures, from which the SAC selected. On 34th Street, while stakeholders expressed concern about curbside access, DOT was better able to formalize the concept for measurement purposes, such as distinguishing between short- and long-term commercial deliveries, the pick-up and drop-off of passengers and parking.

Addressing conflict in community values

The cases demonstrate that community engagement subjects performance measures to potentially conflicting interpretations of value. In all of the cases, designers were forced to consider various trade-offs between performance goals. While measurement can help define what those trade-offs might mean, such as changes in accident rates or travel time, the community must decide what those trade-offs are worth. While Macdonald et al. (2010) and Weisbrod (2007) suggest a financial valuation of performance goals, the persistent conflict in cases like PPW and 34th Street indicates that communities have highly subjective determinations of performance values that are not compatible with an objective fiscal approach.

For communities in conflict, performance-based planning can also be useful in framing the debate. For the N Williams case, stakeholders debated the project's goals when they selected and voted upon their final list of performance outcomes. In addition, the same stakeholders debated the merits of each design alternative by using the evaluation based on their performance outcomes. While N Williams provides the clearest example, other cases also used performance measures to describe the issues at stake in design. On both 34th St and PPW, DOT explained each street's problems by reporting its performance in areas that pertained to key project goals, such as bus trip times for 34th Street and illegal automobile speeding on PPW.

As the N Williams case demonstrates, however, agencies cannot rely on performance-based planning alone to resolve conflicts. The N Williams stakeholders did not choose the design that maximizes their chosen performance objectives, but rather the design that “everyone could live with.” If the design of a major street is to be responsive to conflicting values, it is not enough for agencies to simply let stakeholders select performance goals. Instead, there must be a process for stakeholders to identify the balance of performance outcomes that can satisfy everyone.

Evaluating subjective outcomes

Since the respective agencies showed a strong concern for satisfying stakeholders through design, all of the cases indicate that there is value in using subjective measures of stakeholder perceptions as part of an *ex-post* project evaluation. Of the two projects subject to an *ex-post* evaluation, both used some kind of measure of satisfaction among local stakeholders. By treating residents' perceptions as a measurable outcome, agencies gain a potential public relations tool and some kind of indication as to whether the project was successful. On PPW, for example, DOT was able to use the results from public polls to demonstrate that local residents generally supported the project, which was valuable in the face of public opposition. In this way, the cases confirm NCHRP's (2004) guide, *Performance Measures for Context Sensitive Solutions*, which recommends using measures of stakeholder satisfaction to assess projects. In addition, the cases are in accordance with the performance-based planning literature

that finds that agencies are increasingly moving toward customer-oriented measures (Poister, 2005).

Subjective measurements go beyond satisfaction, however, in enabling agencies to evaluate design outcomes that are inherently subjective. For example, on PPW, public polls helped the agency evaluate the perception of pedestrian safety. While objective data, specifically the pedestrian accident rate, indicate that the project had resulted in improvements, the polling data indicated that pedestrians still felt unsafe crossing. As a result, the agency introduced modifications to ease crossings. Similarly, on E Burnside, PBOT used residents' perceptions of safety when crossing the street to evaluate the project's impact on one of its original goals.

Evaluating the community engagement process

In addition to recommending the measurement of subjective outcomes, the 2004 NCHRP guide also recommends that agencies measure the design *process*. All of the cases performed this kind of measurement, although in a more informal manner. The project websites for three of the cases (N Williams, 34th Street, and PPW) and project documents for the fourth (E Burnside) are deliberate in recording community engagement efforts, such as the number of open houses each agency held or the number of meetings of each stakeholder committee.

Several of the cases show that a formalized process for measuring and evaluating the design process could be useful in both documenting required engagement processes and in ensuring

that design processes increase participation for stakeholders. On PPW, project opponents argued that DOT had not properly vetted the project with the community. A set of pre-established process measures used for all projects would have provided a clear record of the agency's activities that could be easily compared with those of other projects. On N Williams, the project's stakeholders expressed a desire to see PBOT formalize community engagement on future design projects and create a mechanism for evaluating participation. A set of process measures, which outline the necessary steps for community engagement, could serve as this mechanism.

A New Framework for Performance-Based Planning

The uses of performance-based planning described above indicate that the performance-based planning framework can be revised in order to increase stakeholder participation and ensure that design is sensitive to community needs. (See Figure 6-46.)

First, community stakeholders can participate at virtually every stage of the framework. As the N Williams case demonstrated best, by enabling community stakeholders to select goals and performance measures and enabling them to select the final design using a performance evaluation, these stakeholders can achieve significant power in design decision-making. It should be noted, however, that agencies will necessarily continue to lead certain stages,

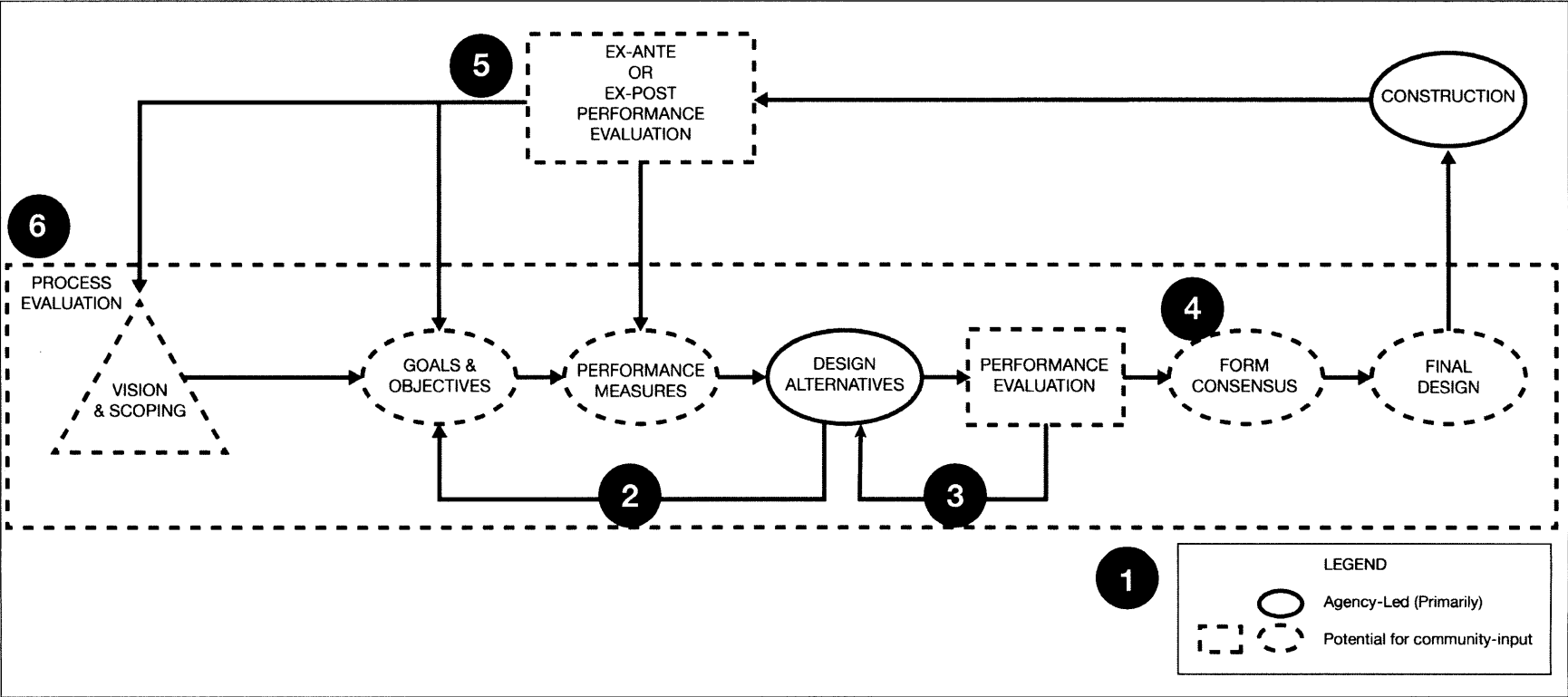


Figure 6-46. A New Framework for Performance-Based Planning

Numbers also correspond to paragraphs in text.
 (1) Community stakeholders can participate in key aspects of process.
 (2) Early designs may prompt changes in goals and, thus, related measures.
 (3) Initial evaluations may prompt changes in design.

(4) Stakeholders will benefit from supplementary processes to form consensus around design decisions.
 (5) Ex-post evaluations can incorporate measures of stakeholder satisfaction and perceptions.
 (6) Agencies can use process measures to evaluate whether the design process has successfully engaged community stakeholders.

such as the design of specific alternatives and construction, and will need to work closely with stakeholders when stages are technically challenging, such as defining specific performance measures.

Second, agencies and stakeholders should formally review project goals after initial designs are created. Once designs are created, community stakeholders may identify new performance concerns or may wish to re-prioritize certain goals. For example, on 34th Street, the issue of curbside access emerged after the release of the early transit-way concept. On E Burnside, project leader Bill Hoffman asserted that performance concerns have a tendency to shift in priority once stakeholders can visualize the physical consequences of various design options. In the current performance-based planning framework, the process of re-considering project goals follows construction. These cases suggest, however, that performance goals should be evaluated and potentially changed after a preliminary design or preliminary set of design alternatives is created. On certain projects, this re-formation could potentially be iterated several times until all stakeholders have achieved a consensus on project goals.

Third, just as the formulation of goals and performance measures is iterative, so too is the development of design alternatives. As stakeholders and agencies evaluate preliminary designs and design alternatives, it is likely necessary for agencies to perform modifications to design to improve performance in specific areas. On 34th Street and N Williams, project designers created new design alternatives after evaluating earlier proposals.

Fourth, agencies should consider what supplementary processes are necessary for choosing final design. If the design of a major street is to be responsive to potentially conflicting values, agencies and stakeholder groups cannot simply choose an alternative that maximizes performance goals. Instead, as the N Williams case shows, there must be a process for stakeholders to identify the balance of performance outcomes that can accommodate everyone.

Fifth, in post-project evaluation, measures of community satisfaction and other perceptions can determine whether a project has met community needs.

Finally, sixth, agencies should consider evaluating not only the outcomes of a design process, but also the activities of the process itself. Such measures can ensure that processes are meeting the objectives of collecting community input and increasing participation. Furthermore, such measures provide agencies with clear documentation of community engagement activities.

Implications for Theory

Technical rationality in planning and design

For the decision-making process of public agencies, the case study analysis both confirms and contradicts Altshuler's (1965) assessment of limitations of technical rationality and public planning.

The cases confirm his arguments, by demonstrating how community input necessarily constrains public planning and design. First, just as Altshuler asserts, in each case the project-level planners and designers were generally bound by the goals of their respective community. In fact, when a project's original goals did not align with the community, as was the case on 34th Street and N Williams, planners were forced to incorporate the community's goals. Second, the cases confirm Altshuler's argument that planners cannot rely on technical rationality, a method in which a planner can create successful plans by objectively measuring their impacts against pre-determined, measurable goals (which Altshuler calls "variables"). Instead, Altshuler asserts, public officials, who are accountable to the public, make decisions based off of subjective "values," the importance that communities place on variables/goals, which Altshuler argues cannot be measured in a rational manner.

The recent literature on performance-based planning echoes Altshuler's analysis by asserting that performance-based planning cannot be the only tool for public decision-making. Transportation decisions are often highly politicized, and, as a result, performance-based planning can inform decisions, but not dictate them (Larson, 2005; Pickrell & Neumann, 2001). Indeed, as the N Williams case shows, performance-based planning does not offer on its own a method for determining the values that a community places on specific goals.

Altshuler does not foresee, however, how objective measurement can facilitate community engagement in public

planning. Performance-based planning can facilitate the incorporation of community values in public design and decision-making in two key ways.

First, by empowering community stakeholders in the decision-making process, performance-based planning also enables community values to shape the performance goals that guide design decisions. When stakeholders participate in the process of selecting and prioritizing measures or evaluate designs using their own measures, they have the opportunity to engage in a collective process of negotiating with one another about the value they, as a group, place on various performance measures. The measures that are chosen and prioritized during group discussions are automatically given higher community value than those that are ignored altogether or given less importance. For example, as the N Williams stakeholders debated their alternatives, vehicle congestion accrued additional community value as a performance goal when stakeholders argued for its importance in project design.

The idea of allowing community stakeholders, and not public officials, to determine performance measures is reminiscent of Appleyard's (1981) approach in *Livable Streets*. Appleyard, who rejects relying on objective measurements for livable street design, argues that designers should ask residents about what they value most about the design of their streets. In fact, the analysis begins with a pilot study that confirms community concern about the negatives of traffic on residential life. Once Appleyard is armed with that information, however, he employs extensive measurement

of factors like traffic volumes and speeds to determine their impacts on residents' perceptions. By placing community input *ahead* of measurement, the objective aspects of Appleyard's approach reflect subjective community values.

Second, performance-based planning can reflect community values by using subjective performance measures. For example, a measurement of stakeholders' perceptions of safety can be as informative to design decision-making as objective measures like accident rates. On 34th Street, for example, low subjective perceptions of safety inspired DOT to alter the design, even though accident rates have significantly declined. In this way, DOT's design choices are reflecting the community's values around pedestrian safety.

Again, this approach resembles Appleyard's, who bases his findings primarily on perceptions. For Appleyard, a high-traffic street is only bad in so far as it damages community perceptions. When performance measures attempt to evaluate subjective concepts, the distinction between Altshuler's "variables" and "values" becomes less clear. If a performance evaluation asks a resident if they are satisfied with a project's impact toward some goal, the resulting satisfaction numbers are both measured variables and values. However, as Altshuler suggests, the measurement of "values" is constrained by the extent to which a value can be operationalized in a measure. While certain aspects of perception can be measured, like pedestrian safety or overall satisfaction, these measures are unlikely to fully capture the nature of these perceptions. The kind of qualitative analysis performed by Altshuler, where respondents

can draw pictures or respond free-form to questions provides a richer set of data upon which to make assessments. It is unclear how such data could be collected as part of a performance-based planning process.

The changing nature of street design

While performance-based planning can facilitate community engagement in public planning and design, the role of technical rationality, empirical analysis and performance-based planning is more ambiguous when it comes to the general development of design for urban arterial streets.

On the one hand, the broadening of performance-based planning to include new concepts appears to make it a more effective tool for designers interested in changing arterial streets. The four case studies represent a departure from the streets forms that they have replaced or will replace in the future and were promoted in part by designers' consideration and measurement of a broad set of performance goals. Furthermore, improvements to measurement practices may enable performance-based planning systems to aid designers in considering abstract goals. The recent research on the psychological impacts of street design, for example, may signal advancements toward identifying empirical ways of measuring abstract concepts. Finally, performance-based planning is meant to be dynamic. The framework is built around the idea that by closely tracking results, a system can continuously improve and adapt to conditions. As a result, it provides a process for agencies to not only

re-think strategies, but also to rethink the goals strategies are meant to achieve. Performance-based planning can, thus, change over time and can facilitate the implementation of new forms.

On the other hand, the historical analysis of arterial design concepts suggests that new ideas often do not come from within an established performance measurement system. Writers like J. Jacobs (1961), Appleyard (1981), and A. Jacobs (1993) were all working outside of the policy framework articulated by the Highway Capacity Manual. Instead, they identified concepts, like street life, livability, and architectural character, that existing policies had generally ignored or had not prioritized. Even Colin Buchanan (1963), who was tasked by British policy-makers to complete his plan, did not influence official policy in the U.K. until much later, when government agencies adopted new goals for transportation planning (Southworth & Ben-Joseph, 2003). Overall, these writers effectively disrupted the performance systems that were then in place.

To the extent that these writers have benefited arterial design by creating more options for the designer, they seem to confirm Schön's argument that successful design comes not through empirical measurement of a design's impact on specific goals, but rather through an iterative and reflective process, in which designers can re-frame the goals that are guiding their choices. A. Jacobs and Rudofsky (1969) seem to exemplify this approach best, since their work relies so heavily on reflection and repeat observation through

many cases across the world. These writers did not define goals and then find examples, but rather explored many examples to identify what constitutes good design.

The four case studies also provide evidence that the source of design innovation lies beyond official measurement frameworks. In several of the cases, like N Williams and 34th Street, community stakeholders effectively disrupted the performance framework that had guided early designs by advocating for other performance concerns. While these stakeholders did not introduce any concepts foreign to public agencies, their disruption was responsible for the ways that agencies broadened the performance goals for the project.

These two trends, 'performance disruption' and 'performance broadening,' thus, both appear to be influencing arterial design. Designers, theorists, researchers – and community stakeholders – disrupt performance measurement systems from the outside by introducing new performance goals. Once agencies broaden their performance systems to reflect these disruptions, designers working within them have more figurative space to create and implement new ideas. While the performance disruptions of the past, like the work Jane Jacobs and Donald Appleyard, have largely rejected performance-measurement, the performance broadening within city agencies, like NYC and Portland, has attempted to embrace it. In this way, performance-based planning is playing a role in inspiring new arterial designs.

Chapter 8. Conclusion

This report attempted to answer two questions. First, how do definitions of performance shape the design form of urban arterial streets? Second, how can project-level designs use performance measurement to guide design decision-making, particularly in the context of a community-focused design process?

With respect to the first question, the report finds that, as agencies have broadened their performance goals and measurement strategies, urban arterial forms have generally taken on new shapes to accommodate additional users and pursue new aims. With respect to the second question, the report finds that performance-based planning is likely unable to resolve conflicts in community values on its own, but may provide a mechanism for empowering community stakeholders in design decision-making and for ensuring that designs are responsive to community interests.

Performance and Form

Since the mid-20th Century, conceptions of performance for urban arterials have broadened. The shift in performance measures has accompanied a shift in urban arterial form. While the national policies and local-level projects of the 1950s, 60s, and 70s did not ignore other users of the street, they generally prioritized the performance of automobiles. For decision-making, transportation planners relied heavily on measures of traffic congestion, focusing designs on reducing travel time for automobiles and improving LOS. The resulting urban arterial forms, adopted by cities like NYC

and Portland, did not exclude other users of the street, but showed a preference for improving performance for cars. On streets like East Burnside in Portland, cities expanded roadways, narrowed sidewalks, and converted streets to one-way. An overall program of controlling pedestrian movements sought to keep pedestrians safe and automobiles moving, but made walking both less pleasant and less convenient. For other users, design decisions like one-way streets and curbside bus stops made transit service less convenient and slow, while cyclists were largely ignored altogether.

In recent decades, particularly the 1990s and 2000s, local transportation agencies have adopted new conceptions of performance for urban arterials. Echoing the work of writers like J. Jacobs (1961), Appleyard (1981), and A. Jacobs (1993), these agencies consider the urban arterial not simply as a transportation thoroughfare, but as an urban place, where people gather, work and live. Furthermore, in keeping with design strategies promoted by the CNU and proponents of Complete Streets, these agencies promote the urban arterial not only for drivers, but also for cyclists, pedestrians, and transit riders. These new conceptions of performance have been codified in new performance measurement strategies, like DOT's *Sustainable Streets Index*, which measures the agency's performance relative to a broad set of goals, including safety, congestion, and mobility for cyclists and transit.

A look at individual cases suggests that agencies are not interested in promoting one transportation mode over another, but in achieving a balance in performance. In projects like E Burnside

and 34th Street, for example, local agencies attempt to improve performance for alternative modes, like pedestrians on E Burnside and bus riders on 34th Street, but also show a concern for mitigating any negative impacts on automobiles. The nature of this balance, however, appears to be unique for each street design project. On 34th Street, DOT has included no bicycle infrastructure at all, for example, while bike lanes figure prominently on PPW. While a case-specific balance may reflect the unique context of each street within the larger transportation network, community engagement also plays a role in shaping this balance. In all four of the cases, community input introduced or emphasized certain performance concerns that in turn guided agency design decisions. In this way, new urban arterial forms pursue a balance among multiple performance goals that is, in part, derived from community feedback.

Performance-Based Planning

Project-level planning and community engagement

The case study analysis shows how agencies can employ performance-based planning on project-level design. Just as the transportation literature on performance-based planning suggests, performance-based planning can guide project selection (*ex-ante*), support decision-making during the design process, and enable agencies to determine whether projects met their stated performance goals (*ex-post*). The cases also confirm many of the challenges

described in the literature, such as the difficulty of operationalizing hard-to-define concepts, like the pedestrian experience.

The case studies go beyond the existing transportation literature, however, by demonstrating how performance-based planning can be used as a tool for community engagement during the design process. If these cases are exemplary of other street design projects, then performance-based planning must be compatible with context-sensitive design processes that base design decisions, at least in part, on community input. Furthermore, performance-based planning must be able to withstand community conflicts about which performance measures should be guiding design and how they are valued.

While writers like Altshuler (1965) might argue that community values make it impossible to rely on objective measurement strategies to guide decisions, the cases show how performance-based planning can incorporate subjective community values into the decision-making process. First, when community stakeholders participate in key stages of the performance-based planning process, such as the selection of measures and the evaluation of project alternatives, these stakeholders can influence project design decisions. Second, when agencies use measures of stakeholder perceptions, project officials can determine whether preliminary designs (during the design phase) or completed projects (in *ex-post* evaluation) are responding to community needs (through measures like stakeholder satisfaction) or whether projects are

meeting performance goals that are inherently subjective (such as the quality of the pedestrian experience).

Reflecting these two primary lessons, this thesis proposes a new framework for performance-based planning for project-level street design. This revised framework empowers stakeholders to participate in identifying performance measures and evaluating projects, through both community engagement activities and through measures of stakeholder perception. Furthermore, this framework ensures that that the performance-based planning process is flexible enough to incorporate community feedback that might destabilize the performance goals and measures that guide design. Finally, the framework embraces so-called ‘process measures,’ as defined by NCHRP (2004), by which agencies and stakeholders can determine whether planning processes are sufficiently inclusive and participatory.

The fact that performance-based planning can facilitate community engagement is important, because it alters the relationship between agencies and community stakeholders (Halachmi & Holzer, 2010). If the performance measurement system of the 1950s and 60s, which relied heavily on LOS and other measures of congestion, ignored the perspective of many stakeholders, then it is possible that more recent performance systems, while much broader in their conception of street performance, could make the same mistake. For example, it is clear that performance improvements in areas like pedestrian safety, bicycle ridership, and bus travel time are not persuasive evidence for some stakeholders of the value of bike

lanes and bus lanes. However, by providing an opportunity for stakeholders to choose performance measures and to define their own balance of performance across multiple goals, agencies can better ensure that their own decision-making processes reflect a diverse set of community values, not solely the community interests that they have identified.

This report does not suggest, however, that performance-based planning is the only tool necessary for public decision-making around street design. Performance-based planning provides a useful framework for describing key design issues and explaining the potential outcomes of various design decisions. This information is certainly helpful for stakeholders in design discussions, but it does not provide a framework for stakeholders to identify a consensus around performance results or design form. Thus, while performance-based planning is valuable, it is not the only solution to achieving context-sensitive design.

Looking beyond street design

The policy recommendations for performance-based planning may have value outside of street design and transportation. The fields that may benefit from this kind of approach, however, are likely to be those where projects can be described in a relatively finite set of measurable outcomes. For street design, for example, measures like traffic congestion, pedestrian accident rates, and even stakeholder satisfaction are obvious candidates for measures of success in design. As Kendig (1980) argues, performance measures

can be used as a tool for land use planning and zoning. This is possible because Kendig is able to define the variables of zoning in terms of a clear set of performance outcomes. Like streets, land uses have clear external effects that can be measured. If agencies and community stakeholders were to use performance-based planning to fashion a new zoning code, thus, then the process could define a set of performance goals for the plan in terms of these measurable variables and fashion the code accordingly.

Like zoning, policies that can be defined in terms of performance outcomes can likely benefit from performance-based planning. In education, for example, there is a strong emphasis among some leaders to think about schools and teachers primarily in terms of their performance. The administration of NYC Mayor Michael Bloomberg, for example, introduced a performance measurement system for city schools, which has identified specific performance goals and rates schools annually on their results. Hypothetically, policy-makers and community stakeholders could design a school (or virtually any social service) using performance-based planning, by defining the set of goals and performance objectives they wish to achieve. In some ways this already happens, since teachers develop their lesson plans around educational outcomes defined by state curriculum standards while standardized tests measure the results. A performance-based planning process that actively engages community input, however, could greatly expand the performance goals that guide the design of a school's curriculum and even its physical structure. In addition to measures of educational outcomes,

measures of student happiness, physical health, and parental involvement could introduce change in the design of schools and education programs.

In design areas beyond streets, however, the use of performance-based planning may be more limited, since pertinent measurable outcomes may be difficult to determine. For example, if community stakeholders were to gather to design a public park, there would be few clear measures to guide the design process. An initial set of goals and measurable objectives could be useful in shaping the park's basic program. If a goal is to encourage children to play and the objective is to increase the number of children playing, then designers can identify the amount of equipment necessary to achieve the objective. The measurement of children playing, however, would probably offer little insight as to what kind of equipment designers should choose, since the choice of a swing or a slide is likely to be subjective. For the performance-based designer/planner, one solution might be to put such a choice up to a vote – to essentially measure stakeholder satisfaction to see which design element is preferred. While this might work for one or two major features, a design-by-vote process is likely not scalable to a whole park. In fact, any design project that, unlike streets, has a seemingly endless array of design options, would pose a similar problem. To the extent that features of design cannot be reduced to a relatively discrete set of measurable outcomes, the performance-based planning approach is less helpful.

Further Study

Information technology and crowd-sourcing

As agencies consider how to empower community stakeholders in the process of identifying performance measures and evaluating projects, changes in information technology may provide new opportunities. Thanks to the increasing ubiquity of the Internet, public and private organizations have a new tool through which to interact with customers and community stakeholders. Through 'crowd-sourcing,' for example, organizations can collect a potentially unlimited number of responses on specific questions. For performance measurement, 'crowd-sourcing' technology has obvious potential as a tool for enabling community-stakeholders to become active measurers. Just as polls proved influential in the PPW case, crowd-sourced data on community perceptions could offer local agencies new insight into the impacts of their design.

In addition, crowd-sourcing could offer a new source of measurement data on objective performance goals that may otherwise be difficult to track. In 2007, Google began offering real-time reports of traffic congestion in its Google Maps application. According to an August 2009 post on the Google Official Blog, the congestion data is based on passive crowd-sourcing data; when users employ the Google Maps application on their phone, the application sends their location and speed to Google's servers, which continuously updates its estimates of congestion. In 2012,

Open Plans, a non-profit planning organization based in NYC that houses *Streetsblog*, launched a platform titled Shareabouts, a cell phone application in which users can suggest physical interventions (e.g. bicycle racks, benches, trash cans, repairs, etc.). By collecting and aggregating that data, decision-makers can determine where the public sees needs for improvement.

Finally, crowd-sourcing could empower community stakeholders in design processes. This thesis was, in part, attempting to explore how agencies can use objective measurement to guide design decisions while still engaging with community residents. It is no longer just agencies who can use data to make a rationale case for their decisions. Just as Holzer and Kloby (2005) argued, community stakeholders can influence public policy when they perform their own performance measurement, by exposing agencies' failures to meet the performance goals they value. Crowd-sourcing and other information technology has made the process of gathering data much faster and more accessible. In other words, crowd-sourcing has democratized the generation and tracking of performance data. As a result, more community stakeholders may be able to influence public decision-making by leading crowd-sourced data collection or participating in it.

Cases

As individual cases and as potential examples of larger trends, several of the cases studies presented in this report merit additional research. In Portland, the N Williams case deserves

additional exploration, since, unlike most street projects, local officials actively engaged issues well beyond transportation, including racial discrimination in past planning practices and neighborhood gentrification. Furthermore, several of the project's achievements, such as the Guiding Statement developed by the community stakeholders and the use of performance-based planning to create design consensus following deep conflict, may serve as models for other projects.

In NYC, the PPW case merits additional research due the high-profile nature of conflict between stakeholders. As reported in this thesis, this conflict entangled many high-level politicians and raised questions about the truthfulness of city agencies. A full documentation of this case could provide insight as to why cycling has become so politically charged in NYC.

For the 34th Street case, this thesis found an unexpected contradiction between the plan's official documents, which show that DOT was responding to a widely shared set of community concerns and technical obstacles, and various transportation advocates in NYC, who assert that DOT caved to a small subset of community interests. Additional research could more fully document DOT's decision-making process and explain why such divergent narratives have emerged.

Overall, these cases paint a complicated picture about the ways in which community stakeholders influence design. In any given case, agencies may choose to empower new or long-time residents (N Williams), bus riders or residents (34th Street), or street-

neighborhood-, or city-level stakeholders (PPW). The stakeholder groups that are empowered in design decision-making – whether they are “community” stakeholders outside the government or local officials – are those whose values will influence design. Furthermore, the resulting design forms in turn empower and disempower, by offering space for specific groups of users and not others. A greater understanding of how agencies determine whom to empower is thus critical to understanding the changing social and physical dynamic on city streets.

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