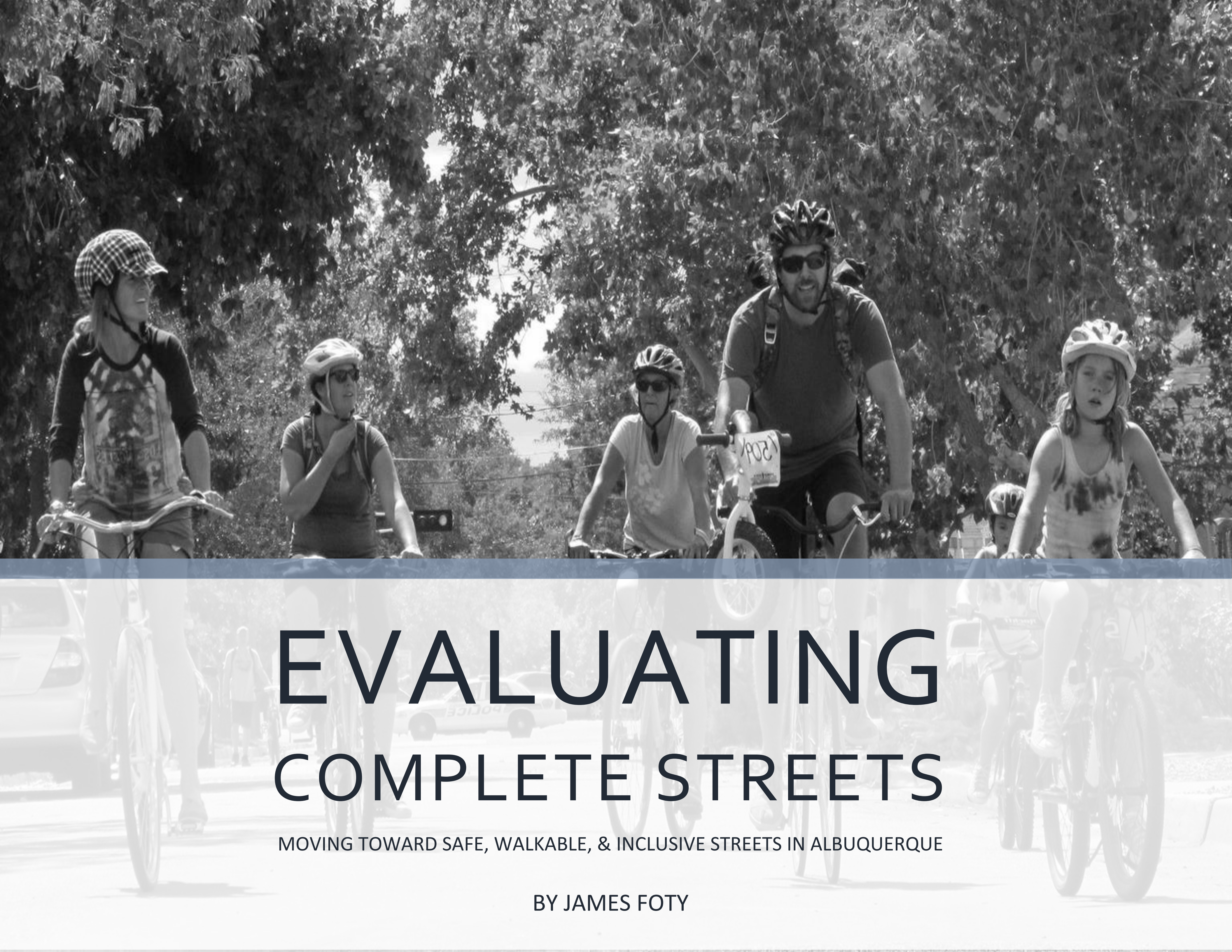

EVALUATING
COMPLETE STREETS

MOVING TOWARD SAFE, WALKABLE, & INCLUSIVE STREETS IN ALBUQUERQUE

BY JAMES FOTY

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CONTENTS

1 INTRODUCTION

Gold Street, Downtown Albuquerque, Source: MRCOG

Chapter 1 Introduction to Complete Streets

Simply put, complete streets are great places: they are places with character and activity; places where people want to walk, converse, stop, play, dance, celebrate, protest, and live (Gehl, 2010). They are also safe, comfortable places, where pedestrians, bicyclists, and other users can amicably participate in the life of the city.

Unfortunately, most of the streets in the United States have none of these qualities. They are better described as "mean streets" or "automotive sewers" designed for the sole purpose of moving automobiles quickly and efficiently to the detriment of other users (Duany et al., 2000). Transportation engineers have long promoted such a mono-functional view of streets, and ignored the many additional roles traditionally played by streets, including their role as a convivial civic space that promotes community identity (Dover and Massengale, 2014; Speck, 2012; Childs, 2004).

The good news is that there has been a gradual paradigm shift in transportation planning surrounding the purpose and possibility of streets. Movements such as New Urbanism, Smart Growth, Ecological Urbanism, and Complete Streets all emphasize that cites must now plan for infrastructure systems that promote and enhance not only traffic flow and mobility, but pedestrian and bicycle safety, walkability, accessibility, community health, economic development, and sustainability (Litman, 2014; McCann, 2013). Together, these renewed roles of the street are transforming the way transportation projects are selected, funded, designed, and built (Litman, 2014; McCann, 2013).

This is a welcome paradigm shift. It signals a return to the art of designing, engineering, and constructing streets as fundamentally public spaces that support the life of the city.

Streets in Albuquerque

Although global trends are leading to innovative designs and projects, the Albuquerque Metro Region as a whole has been slow to adopt this new paradigm when it comes to transportation planning. Recently, however, many plans have begun to incorporate complete streets principles either explicitly (in their policy language) or implicitly through the plans' goals and projects (MRMPO, 2014a). Most recently, Albuquerque's City Council passed a Complete Streets ordinance that mandates all roadway reconstruction, restriping, and construction projects utilize and

Complete Streets Projects

Some of the recently completed or planned Complete Streets projects in Albuquerque include:

- Lead/Coal Reconstruction (2012)
- Martin Luther King (2012)
- West Central Pilot Project (2011)
- Girard Blvd (proposed)
- Yale Blvd (proposed)
- San Pedro (proposed)
- Zuni Road (proposed)
- Bridge Blvd (proposed)

implement Complete Streets practices (City of Albuquerque, 2014). This ordinance is a crucial first step in ensuring more complete streets projects are built in Albuquerque.

Although many new complete street projects have been undertaken recently or are proposed (see list at left), very few establish performance measures to evaluate the successful long term implementation of the project's goals. For example, only a few projects have had before and after analyses performed to evaluate whether they have fulfilled their original objectives. This means that despite the apparent success of many of these projects, most have not been thoroughly evaluated to determine which complete streets interventions have been most effective.

Part of the reason for this is that there is currently no standard methodology to evaluate projects, either before or after they are built. In addition, although some projects and plans include performance measures to evaluate success, there is no agency charged with collecting and maintaining data. Those projects that have been evaluated, have relied on expensive, ad-hoc studies. This makes it difficult to provide recommendations for upcoming roadway reconstruction projects, especially restriping and routine maintenance projects that do not usually involve in-depth studies or redesigns.[1]

Issues

These core problems are compounded by a list of ongoing issues that hamper efforts to evaluate complete streets projects.

First, there seems to be a lack of interest in using non-automobile performance measures. Many planners and transportation engineers are not yet acquainted with multi-modal level of service indicators or ways to measure walkability. In essence, there exists a gap between more nuanced evaluation methodologies and the current practices of many transportation planning organizations.

Second, there is a gap in readily available information and planning capacity. Planners are really good at counting cars, but not so good at counting pedestrians or bicyclists. This is tied to a related issue of data management: who should maintain the data, and how should data be distributed to a wider audience?

Third, there is a lack of understanding on how performance measures can be useful. In essence, performance measures allow us to base decisions on objective criteria that can be measured throughout the project's lifetime – both before and after construction. If the project does not perform as expected, changes can be made to ensure future efforts are more successful. Yet, the potential of these newer evaluation tools has not been harnessed in a systematic way.

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[1] Currently, routine repaving projects are handled by Albuquerque's Department of Municipal Development, which will tear up a roadway and repave it to the previous specifications, regardless of whether or not simple modifications such as narrower lanes could be implemented without additional cost. The biggest reason for this is that changes to the roadway specifications usually require traffic studies, which results in higher costs or delays. Providing a way to recommend quick, easy changes to DMD would go a long way to make sure maintenance projects (with their steady sources of funding) can be rebuilt as Complete Streets.

These issues point to the need to create an evaluation system that can successfully evaluate roadway projects within their larger context. Such a methodology needs to be comprehensive, replicable, easy to understand, and grounded in a holistic view of streets as a multi-functional form of public infrastructure. Creating such an evaluation system has several key benefits, chief among them the ability to compare and contrast different projects, which can lead to better designs. These in turn can lead to secondary benefits that promote wider planning goals such as economic development, environmental sustainability, and land use compatibility.

In addressing some of these issues, this report has five main goals: 1) to provide an overview of Complete Streets as a movement; 2) to provide examples of Complete Streets and their respective design elements; 3) to review various performance measures that can be used to evaluate these streets; 4) to provide a synthesis evaluation framework and checklist that can be applied to roadway projects in the Albuquerque Metropolitan Area; and 5) to provide recommendations on how this framework and research can be applied to MRMPO's policy, process, and daily practice.

WHAT IS A COMPLETE STREET?

Although definitions vary, complete streets are generally defined as *streets that are designed and operated to enable safe access for all users of all ages and abilities regardless of how they are traveling* (Complete Streets Coalition, 2014). In other words, complete streets are roads that are accessible, multimodal, diverse, and safe for all users (McCann, 2013). In practice, this translates into streets that have wider sidewalks, bike lanes, traffic calming features, slower speeds, street trees and landscaping, as well as many other pedestrian- and bicyclist-oriented design elements.

The Complete Streets Movement has gained a lot of momentum since it was launched in 2006, and has helped lead a larger paradigm shift in transportation planning (McCann, 2013). Complete Streets advocates have brought new energy to the discussion of the purpose, role, and function of streets in America. The complete streets movement has been successful because it effectively reframes the conversation on how streets are planned, designed, and constructed (McCann, 2013).

Overall, complete streets advocates' message has been effective because it is simple, direct, and appeals to a wide audience regardless of politics or disciplinary approach. Complete Streets advocates have placed an emphasis on gaining support among multiple departments, developing Complete Streets policies at the local level, and engaging residents in the planning, design, and retrofitting of streets.

Although the complete streets movement has been successful, underlying many of the movement's arguments is as a focus on the *process* of choosing transportation projects, instead of placemaking or civic design. This is a conscious omission, because advocates are aware that design plays a huge role in the safety, inclusiveness, and accessibility of our roadways (McCann, 2013). However, they also understand that shifts in thinking will be slow and that long term changes will involve the incremental updating of design manuals and engineering

Figure 1.1 Complete Street rendering for Central at Atrisco, show several complete streets interventions. *Source: MRCOG.*

standards to incorporate more progressive best practices.

However, the movement's focus on process also means that local agencies must determine which design objectives are most important to achieve complete streets in their communities. In other words, as design manuals and engineering standards are slowly updated, local governments are still grappling with larger questions of how their streets can be best retrofitted, redesigned, and reimagined.[2]

Expanding the Definition of Complete Streets

Given the multiple roles that streets play in the life of the city and the need to emphasize the urban design aspect of complete streets, this report uses an expanded definition:

> Complete Streets are streets that accommodate all users, of all ages and abilities, are context sensitive, and enhance the environmental, social, and economic characteristics of a place.

This expanded definition builds on the Complete Streets ideal that streets need to be designed for multiple users of all ages and abilities. But it also seeks to define streets in their relationship to their entire physical context – as public infrastructure that supports multiple functions and fulfills multiple roles. The definition emphasizes that streets are not just about moving cars or people, but have a larger role to play in the life of the city. This role includes (1) accommodating all modes of travel regardless of user ability, (2) responding to the surrounding context, and (3) supporting social, environmental, and economic goals.

In many ways, this definition borrows from a larger discussion of "great streets" or "living streets," that focuses on the urban design details of roadways, as

[2] Some municipalities, such as Boston, have developed their own definitions of Complete Streets that emphasize the additional roles of the street. Boston's Complete Streets model, for example, has three components that make up a complete street: multimodal, green, and smart (Boston Transportation Department, 2014). This model emphasizes the additional functions of Boston's streets as places for both green and smart infrastructure.

well as their context and history.[3] This approach emphasizes the sensuous, experiential aspects of the street – that is, how it feels to walk down the street, ride your bike along it, stop for a coffee or meal at a sidewalk café, or shop a local neighborhood store.

While this definition introduces key urban design objectives (and questions), it still focuses on *the process* used to plan, design, and construct roadways as part of a large multimodal transportation network.

In addition, this definition introduces a new set of questions: What does it mean to be "context sensitive" and how might this be measured and discussed? What does it mean to "enhance" the environmental, social, and economic characteristics of a place? And, are there readily available, replicable measures that may be used to evaluate how well streets fulfill these goals?

This document seeks to answer some of these questions and make the above definition of complete streets a realizable planning objective.

BENEFITS OF COMPLETE STREETS

Many of the advantages of building complete streets seem obvious when one compares a lively, walkable street to most of the streets that have been constructed in the United States since World War II. Unfortunately, until recently most of the discussion on streets and street design has focused on how well streets move cars – a rather mundane and unimpressive (although vital) function of urban streets. Such a focus has led to streets that have few benefits beyond supporting automobile mobility.

The complete streets movement, by shifting the focus from moving automobiles to moving and accommodating people, has unveiled the numerous benefits of good street design. These benefits are not only mutually supportive, but they often achieve wider societal goals, including economic development, improved public health, improved safety, placemaking, and expanded transportation options (McCann and Rynne, 2010: 4).

A recent comprehensive review of 37 complete streets projects by the National Complete Streets Coalition underscored this point, finding that complete streets projects "tended to improve safety for everyone, increased biking and walking, and showed a mix of increases and decreases in automobile traffic. […] Compared to conventional transportation projects, these projects were remarkably affordable, and were an inexpensive way to achieve transportation goals" (National Complete Streets Coalition, 2015).

These benefits are also good *arguments* for supporting complete street policies. They provide a clear rationale for pursuing complete streets in the face of opposition from those who say such policies are too costly or have little benefit. As more and more cities adopt complete streets policies and learn from past experiences, further benefits will surely be seen.

Accessibility and Choice

Complete streets are by definition multimodal and accessible to all users. By adding multimodal facilities,

[3] For more on great streets, please see Chapter 2, which outlines Allan Jacobs' Great Streets Criteria.

Figure 1.2 Lead Ave after its Complete Streets retrofit. Wider sidewalks and landscape buffers have dramatically improved the pedestrian orientation of the street. *Source: MRCOG*

such as bike lanes, improved sidewalks, and more transit amenities, users have more transportation options, which allows users to choose the most cost-effective or convenient mode for each trip. This in turn can help decrease disparities between population groups by providing new (and often better) options for marginalized communities that depend on transit, bicycling, or walking. And, adding multimodal facilities has been shown to increase the use of these alternative facilities as a whole (National Complete Streets Coalition, 2015; Alliance for Biking and Walking, 2014). For example, for every lane mile of new bicycling facilities added, there is a corresponding increase in bike ridership (Parker et al., 2013; Alliance for Biking and Walking, 2014).

Improving transportation options through increased investment in multimodal facilities is also supported by changing demographics, with both Millennials and Baby Boomers demanding walkable, multimodal communities (Cortwright, 2009). Corresponding demographic shifts, including an increasing non-driving population of the elderly and children, are a further reason to invest in multimodal facilities (Burton and Mitchell, 2006).[4] These population groups need access to safe and efficient transit, bicycling, and walking networks that afford them the same mobility as those with access to automobiles.

Safety and Public Health

Complete Streets, with their emphasis on slower roadways, traffic calming features, and multimodal options, are inherently safer streets by design. In their review of 37 complete streets projects, the National Complete Streets Coalition found that crashes and crash severity had decreased in 70% of the complete streets projects they studied (National Complete Streets Coalition, 2015).

In addition to reducing the number and severity of crashes, complete streets can improve public health outcomes (McCann and Rynne, 2010). Health outcomes are improved when people drive less and walk more – something that complete streets enable (Alliance for Biking and Walking, 2014). This is

[4] These two population groups are making up an increasing proportion of the population in many communities. It is estimated that by 2020, 20% of the United States population will be over 65. (Burton and Mitchell, 2006).

achieved by providing expanded active living options, including more options for transit, biking, walking, and enjoying open space.

Economic Development

Although harder to quantify, complete streets have been shown to support economic development by increasing property values, increasing property tax revenue, and incentivizing new development (National Complete Streets Coalition, 2015). Complete streets projects, like any sound public investment, can lead to virtuous cycles that promote increased private investment (McCann and Rynne, 2010). Usually, these investments can be made at a fraction of the cost of investment in a conventional urban arterial project, meaning big results can be seen for low costs (National Complete Streets Coalition, 2015). For example, the construction of Bus Rapid Transit (BRT) service has been shown to promote new private investment along the entire BRT corridor, especially when connecting existing activity centers (Hook et al., 2013).

Reinvestment efforts such as these also have a huge potential to transform suburbia, through "suburban retrofits."[5] These retrofits allow communities to reevaluate their often overbuilt and auto-centric roads that do not support pedestrian or bicyclist activity (Dunham-Jones and Williamson, 2011). By taking a complete streets approach, suburban communities can find ways to redesign their streets to support new users and more varied land uses.

Placemaking

Complete streets have the potential to support placemaking efforts by creating street designs that are human scaled, lively, unique, and context sensitive (Dover and Messengale, 2014). In practice, this means considering not only the functional aspects of the road, but the aesthetic and sensory qualities one experiences as a traveler or user of the street. Depending on the context, placemaking can involve highlighting the history of the area through public art, the use of local materials, and street festivals (Childs, 2004). In other cases, placemaking may involve accentuating the landscape elements of the place, by reintroducing street trees and adding well-designed green infrastructure with native plants.[6]

Sustainability

A fifth benefit of complete streets is that they promote urban sustainability (McCann and Rynne, 2010). They can achieve this through their physical design (more street trees, improved stormwater runoff capture) and through their overall role within the transportation network (lowering VMT through expanded choices, improving air quality, reducing congestion). Streets in some cities can make up 25% of the total land area, most of which is impervious surfaces that create runoff and water quality issues (NYC DOT, 2009). Changing how these streets are designed to allow for increased stormwater capture can reduce the negative

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[5] Retrofitting Suburbia (2011) and The Sprawl Repair Manual (2010) are two guides that highlight suburban retrofit projects around the county.

[6] Placemaking can often be kitschy and contrived. "Festive" banners along a street do not constitute placemaking. Two books that discuss more "authentic" examples of placemaking are Ronald Lee Fleming's, *The Art of Placemaking* (2007), and Mark Childs', *Squares* (2004).

impacts this large amount of impervious surface coverage.

THE CLIENT

The Mid-Region Metropolitan Planning Organization (MRMPO) is the transportation planning arm of the Mid-Region Council of Governments (MRCOG) – an umbrella organization that that handles regional planning issues for the Albuquerque Metropolitan Region. As part of its federal mandate, MRMPO is required to update its Long Range Metropolitan Transportation Plan (MTP) every four years. This plan considers the transportation needs of the region and makes recommendations on how the transportation system should develop given current trends such as population growth, economic growth, and land use changes (MRMPO, 2015).

Beginning with the 2035 MTP, MRMPO included language calling for a focus on complete streets in MRMPO's policy and planning documents (MRMPO, 2011). However, no policy or design guidelines were adopted at the time to help guide local agencies in implementing complete streets.

Since that time, MRMPO has completed a draft of the 2040 MTP, which includes the Long Range Transportation System Guide (LRTS Guide). This guide updates an earlier document that traditionally controlled new roadway development for the region.[7] As part of this update, the LRTS Guide includes specific Complete Streets recommendations for new roadways, including right-of-way (ROW) requirements, design specifications for sidewalks and bikeways, and recommendations on ensuring network connectivity (MRMPO, 2015a). It is hoped that these updated design specifications will help member agencies plan and design future streets and inform ongoing street retrofit projects.

The Role of MRMPO

The National Complete Streets Coalition lists 10 features of successful Complete Streets policies (National Complete Streets, 2014).[8] Although most MPOs do not have the regulatory power of city or county governments, they still have an important role to play in adopting Complete Streets policies. MRMPO can help with all ten of these policy features, with four features that are especially relevant to the MPO's existing work and mandate.

First, MRMPO has a clear role to play in supporting a *vision for how and why the community wants to complete its streets.* As the regional transportation planning organization for the region, MRMPO can provide leadership to show the benefits of adopting complete streets policies.

Second, MRMPO can show how complete streets policies *encourage street connectivity and aim to create a comprehensive, integrated, connected network for all modes.* MRMPO can provide guidance on how complete streets can be integrated into the

[77] The new LRTS Guide updates an older FAABS document that has been historical produced by the MPO since it was founded. This plan is unique among other MPO documents, in that it has been used by member agencies to direct the expansion of their transportation networks as new development occurs. In effect, this document has directed both the initial alignment of new streets, as well as their functional classification, which includes ROW set aside requirements.

[8] For a full list of policy elements please visit: http://www.smartgrowthamerica.org/complete-streets/changing-policy/policy-elements

Metro region's existing transportation network, including examples of where complete streets projects may be most needed or have the most benefit. MRMPO can also support this goal through its policy documents, including the MTP and the Long Range Transportation System Guide, which has recommendations for connectivity.

Third, the MPO can *support complete streets designs for both new and retrofit projects, including design, planning, maintenance, and operations.* Once again, the MPO can support this policy objective through the MTP, specific design standards in the LRTS Guide, and comments provided during development review.

Fourth, MRMPO can *establish performance standards with measurable outcomes to evaluate Complete Street's projects.* This is clearly one area that MRMPO can provide guidance, as the MPO already does extensive transportation analysis and evaluation, reviews transportation and development plans, and has the data and personnel available to support these policy objectives.

OUTLINE OF THIS DOCUMENT

Chapter 1 (this chapter) provides an overview of Complete Streets and their benefits. It then introduces the goals of the document, and the role of the client.

Chapter 2 expands on the definition of Complete Streets by introducing concepts from urban design theory that can help inform street design. The chapter then provides examples of complete streets in Albuquerque and the United States, pointing out salient elements that contribute to making complete streets. The chapter ends by discussing different *roadway contexts*, in terms of functional classification, character area, roadway typology, and development phase.

Chapter 3 covers existing performance measures and methodologies. This chapter reviews several evaluation procedures being used by other transportation planning agencies, and then discusses the usefulness of each performance measures for different planning purposes. Performance measures are then grouped into "five key indicator areas", which correspond to crucial areas that should be considered during transportation planning projects. Each performance measure is described in detail, including what it measures, the data requirements, and how it can help inform street designs.

Building off the previous chapter*, Chapter 4* introduces the *Complete Streets Checklist* – a tool that provides a baseline analysis of existing conditions along roadways, helps identify project priorities, and allows the consideration of potential design strategies. The checklist utilizes the performance measures discussed in Chapter 3, while attempting to integrate the urban design theory outlined in Chapter 2.

Finally, *Chapter 5* lays out a series of recommendations that are aimed at changing MRMPO's policy and planning practice to better integrate complete streets into the organization's day-to-day work. This chapter reiterates the need to develop robust evaluation tools that can better inform member agencies.

2 ELEMENTS

Public Art in Paris, outside Pompidou Center, Source: Self

Chapter 2 Elements of Complete Streets

Trying on different definitions of complete streets is useful for planners who are discussing the best policy approach or best practices, but what do complete streets actually look like? What are their defining features, and how do they function differently than “incomplete” streets? What are some examples of complete streets that fulfill both a general definition of complete streets and this document’s more rigorous criteria?

Boiling down those elements that are crucial to complete streets can be a tall order, especially if these elements are talked about in normative terms (often defined differently depending on discipline). People will then disagree on the essential features of the street, often taking a discipline-specific position. For example, an engineer may define the street as complete because it has been built to current best practices in the latest design guidelines, while a landscape architect may worry more about the possibility of including green infrastructure and pleasant landscape design.

The following authors and sources take different approaches to understanding what contributes to a complete street. A variety of distinct disciplines are represented in this review, which lends itself to a more holistic appreciation of the multiple qualities that can (and should) be considered when asking what contributes to a complete street. It also lays the groundwork for understanding how we can go about measuring some of these essential qualities.

LEADING DESIGN MANUALS

Design manuals are often consulted by engineers, planners, public officials, and advocacy groups alike to decide specific street design principles, specific dimensions and essential design elements. These manuals provide a wealth of design ideas and best practices on everything from crosswalk design to the appropriate dimensions of buffered bike lanes. At their best, they provide sensible design specifications that can be applied flexibly depending on land use and transportation contexts. At their worst, they are applied indiscriminately, without considering the context of the roadway or the needs of the street’s users. Some of this variation can be seen in the following design guides published by nationally recognized transportation engineering groups that together set policy for urban street design in the United States.

AASHTO Guides

The American Association of State Highway and Transportation Officials (AASHTO) publishes several guidebooks that are used by transportation engineers around the country to design roadways. The organization's main guide, the *Geometric Design of Highways and Streets* (The Green Book), is laden with engineering specifications that are most appropriate for highways and limited access roads. This guide covers everything from curb turning radii to exact grading requirements needed to facilitate safe turning movements. As has been pointed out by many Complete Streets advocates, these standards, although extensive in scope, can be applied indiscriminately, which can lead to poorly designed streets in urban contexts (McCann, 2013).

Fortunately, AASHTO's scope has broadened to include standards for bicycle and pedestrian infrastructure, which is a welcome addition. The organization's newer guides, such as the *Guide for the Development of Bicycling Facilities* and the *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, have excellent advice on how to construct roadways that are multimodal and safe for all users. Used as a supplement to the Green Book, these guides offer specific design guidance for transportation engineers who are looking to create safer, multimodal roadways. However, despite their focus on multimodal facilities, these guides still have little to say about placemaking, urban design, or the social uses of the street.

ITE's Context Sensitive Solutions

The Institute of Transportation Engineers (ITE) lit a fire when they published *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach (2010).* This was one of the first design guidebooks written for transportation officials that directly addressed the needs of all roadway users and the multiple roles of the street. The guide directly acknowledges that mobility is one function of roads, but should not be overshadowed by social and economic functions (ITE, 2010: 3). For these reasons, the guide has quickly become a standard design guide for complete streets advocates who see it as an alternative to AASHTO's traditionally auto-centric approach.[9]

Like AASHTO's guides, ITE's guide outlines best engineering practices, but it also includes recommendations for better planning processes, more robust project evaluation, and more inclusive community engagement. At heart, the guide promotes "Context Sensitive Solutions" or design solutions that are appropriately scaled to the context of the roadway and its surrounding land uses (ITE, 2010: 3). Specific areas the guide addresses using this approach include: design specifications for the travelled way, streetside design elements, intersection design, design controls, creating walkable urban areas, and the overall design process.

NACTO Urban Street Design Guide

The National Association of City Transportation Officials' *Urban Street Design Guide* and *Urban Bikeways Design Guide* are newer design guides that

[9] ITE's manual has been adopted as a design guide in many complete streets ordinances, include the City of Albuquerque's.

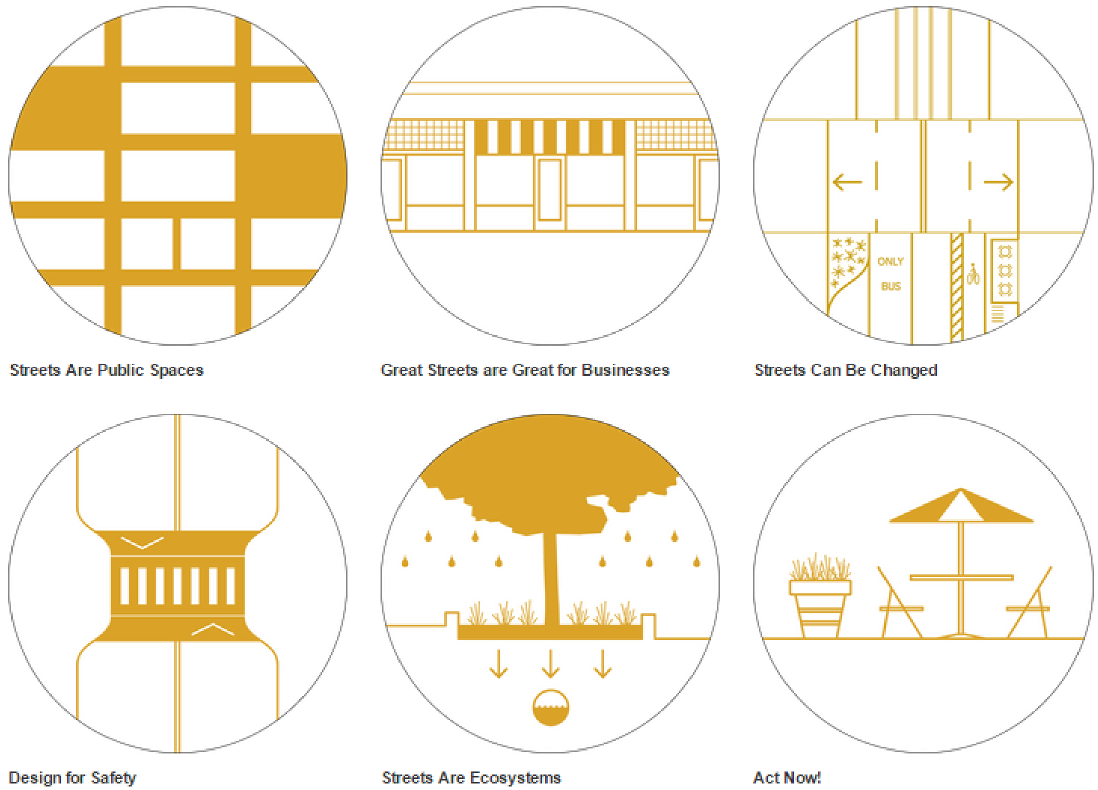


Figure 2.1 NACTO's Urban Streets Design Principles. *Source: http://nacto.org/usdg/streets/street-design-principles/*

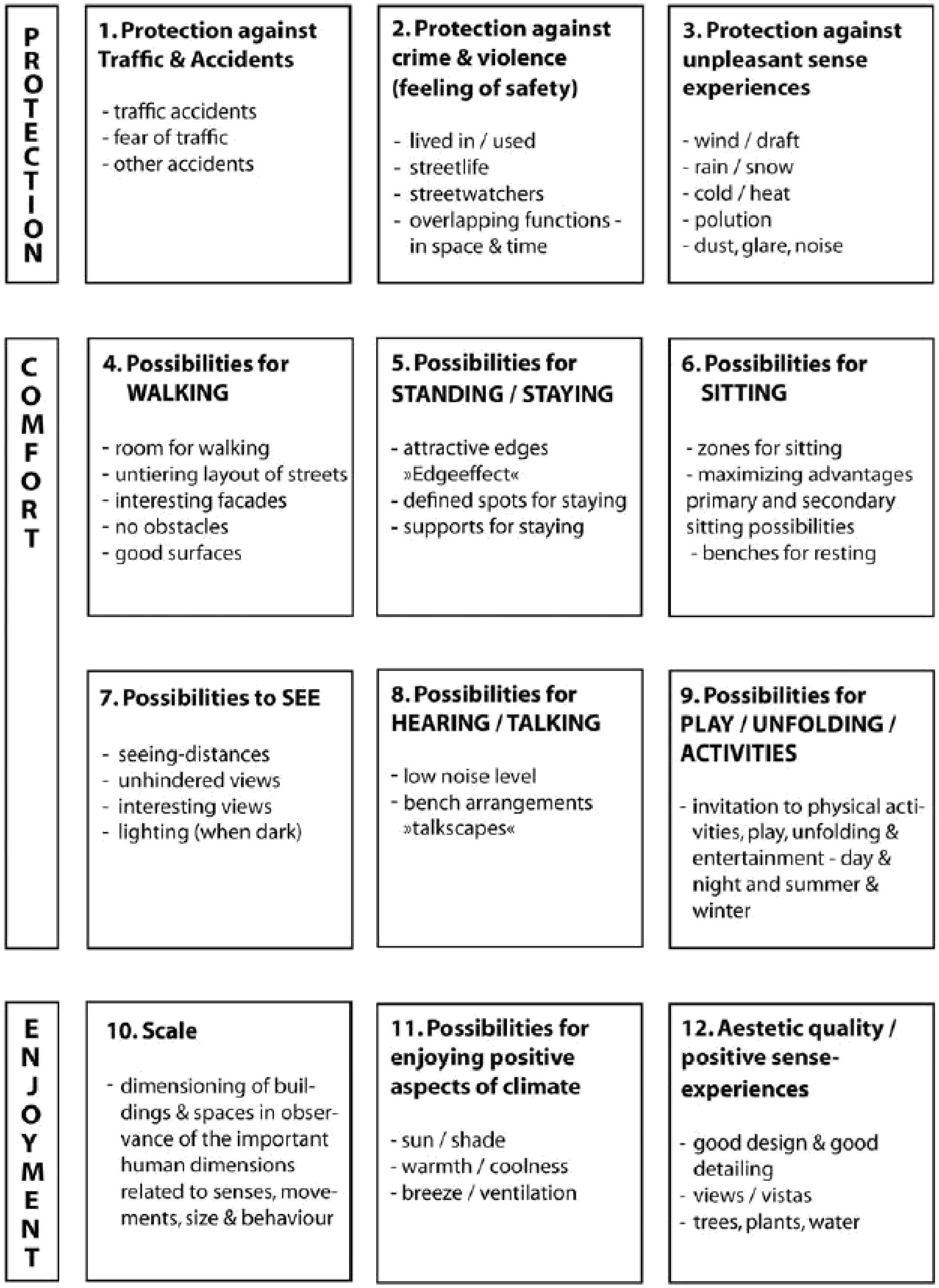
include progressive design guidelines that prioritize pedestrians and bicyclists. The guides embrace the mission of complete streets and translate the goals of complete streets into prescriptive, although flexible design guidelines. These guidelines have been used as the recommended guides in several Complete Street's policies (Alliance for Biking and Walking, 2014).

Overall, NACTO's standards are graphically elaborate, user friendly, and approach streets as a holistic system, not just an engineering problem. In some ways, this makes the guides less technical than the manuals produced by ITE and AASHTO, although NACTO has a wider reaching vision for the multifaceted role played by urban streets. Six key principles guide NACTO's approach: 1) Streets are public spaces; 2) great streets are great for business; 3) streets can be changed depending on their context; 4) streets should be designed for safety; 5) streets are ecosystems; 6) temporary/pilot projects can be implemented quickly and at low cost (NACTO, 2013: 5). (Please see Figure 2.1.) Together, these principles embrace a progressive, flexible view of streets as a key to every successful city.

Local Design Guides

A number of local governments, including MPO's and municipal governments, have released Complete Streets design guidelines. These guides often adapt national best practices to fit their local context. As with national design manuals, these guides cover everything from recommended number of lanes, to how to implement traffic calming measures. A few standout examples include: Los Angeles County's *Model Design Manual for Living Streets* (2011); New Jersey DOT and Pennsylvania DOT's *Smart Transportation Guidebook: Planning and Designing Highways and Streets that Support Sustainable and Livable Communities* (2008); Boston's *Complete Streets Design Guidelines* (2013); and METRO's *Creating Living Streets* (1997/2002). And, most recently, MRMPO has released the LRTS Guide (see introduction), which includes specific complete streets design guidance for new roadways.

Figure 2.2 Jan Gehl's Urban Quality Criteria



Source: Gemzøe, Lars. (2006). Quality for people: A set of quality criteria for the design of pedestrian places and networks - with people in mind.

URBAN DESIGN THEORY

Another approach to street design has evolved from the work of many urban theorists who are concerned about livability and making great places. Their emphasis has been on human-scaled design that creates positive and memorable experiences (Dover and Massengale, 2014).

Jan Gehl's Urban Quality Criteria

One champion of human-scaled, livable places is Jan Gehl, a Danish architect and urbanist who has written extensively on urban livability, especially as it relates to civic spaces. In his first book published in English, *Life Between Buildings* (1987), Gehl argued that the spaces between buildings – namely the street and civic spaces – mattered more than buildings for the life of the city. This was due to the fact that these spaces enabled human interaction and engagement (Gehl, 1987). Throughout his work, he takes a decidedly human-scaled, pragmatic approach to show that the best streets are the ones that respond to basic human needs. Like Complete Streets advocates, he argues for a reprioritization of planners' priorities to focus on people.

Gehl's work relies on several public life studies that he and others have conducted since the 1960's to study how people inhabit and interact within urban spaces (Gehl, et al. 2013). This is seen most recently in *Cities for People* (2010), where he develops *12 Quality Criteria* for urban spaces (see Figure 2.2). These criteria provide a simple, yet useful set of considerations to approaching street design as subset of good urban form.

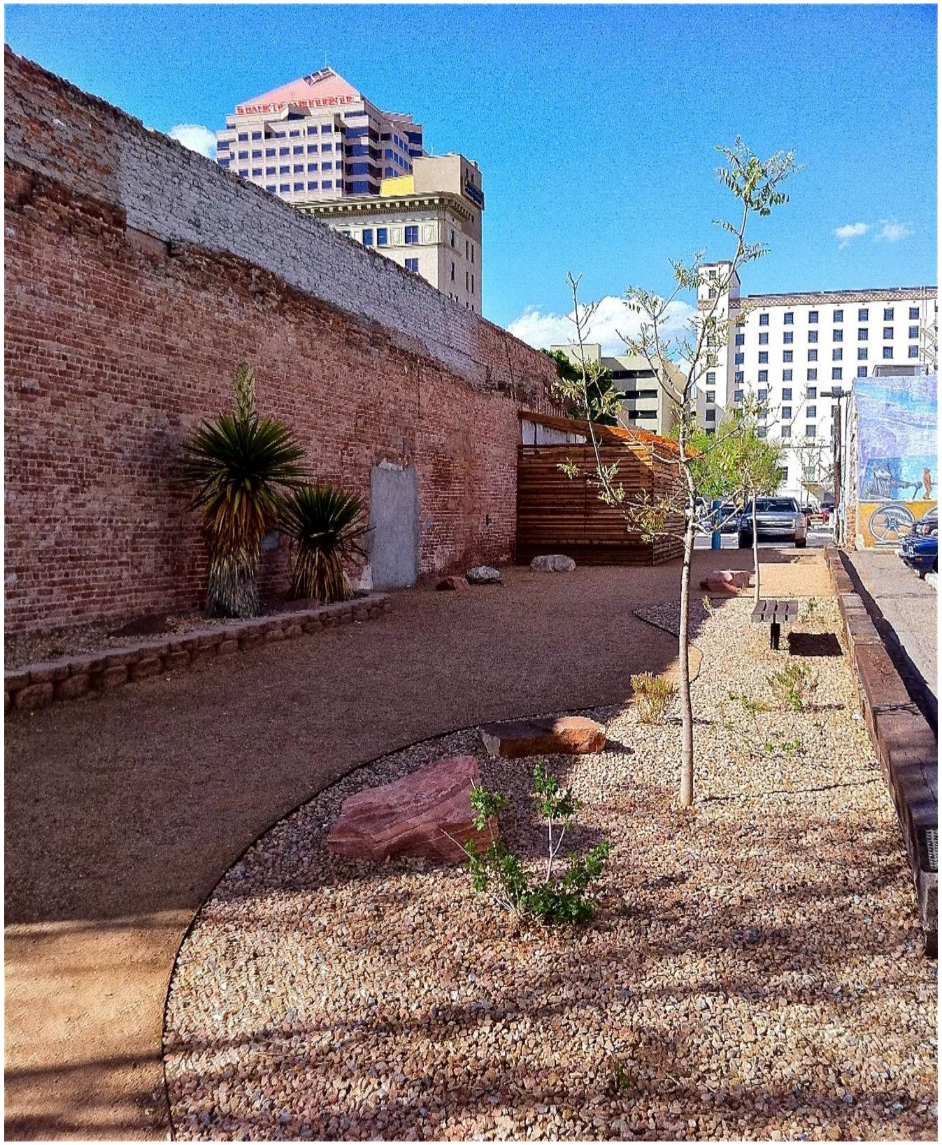


Figure 2.3 Pocket Park in Downtown Albuquerque that demonstrates human scaled design using simple, high quality materials. *Source: MRCOG*

Each quality consideration is organized into one of three categories – protection, comfort, and delight – to reflect the essential needs of the space's users.

Unlike the prescriptive manuals of urban design guides, however, these criteria can be applied to any place, and emphasize the basic human needs of the space's users. These considerations therefore amplify the complete street's principle of accommodating all users by showing the multifaceted needs of the street's users (especially pedestrians). They are are directly related to several livability goals such as valuing and supporting existing communities; providing more transportation options; and enhancing the characteristics of every neighborhood (EPA, 2015).

Protection

The first consideration for any street (or public place) is to ensure "reasonable protection against risk, physical injury, insecurity and unpleasant sensory influences" (Gehl et al., 2012: 238). This includes 1) protection against traffic and accidents; 2) protection against crime and violence; and 3) protection against unpleasant sensory experiences such as weather, pollution, noise, etc. (Gehl, 2012: 239). Without fulfilling these criteria, the street will not be a successful public space.

These three qualities also mirror the considerations of Complete Streets policies, with their heavy emphasis on safety. Gehl, however, goes one step further and argues that safety includes a feeling of security from crime, unpleasant human interactions, and environmental hazards. These additional considerations add a level of nuance to the idea of roadway safety that is often missing in transportation planning discussions.[10]

[10] It is also worth noting that Complete Streets projects in Albuquerque could do more to incorporate Crime Prevention Through Environmental Design (CPTED) practices into their design considerations.

Comfort

After protection has been ensured, there are six qualities of urban spaces that promote comfort: opportunities to walk, stand/stay, sit, see, talk/listen, and play (Gehl et al., 2013). In design terms, this translates into adding active public spaces, street furniture, bollards, street trees, and other elements that satisfy basic human needs to rest, see and be seen, and communicate. Providing places along the street where these activities can happen therefore helps enhance the social aspects of a place.

Such considerations are also crucial to consider from a complete streets perspective because these design elements contribute directly to the walkability of an area and whether the roadway is inviting to other users of the road. In other words, opportunities for comfort should not be thought of as "additional" or "extra" design features that are unimportant. Instead, they are essential to the creation of truly multimodal roadways that can be used by people of all ages and abilities.

Delight

Finally, Gehl argues that there are three qualities that allow people to take delight in a place. These include: 1) providing appropriately scaled buildings and details; 2) creating opportunities to enjoy the positive aspects of the climate; and 3) providing positive sensory experiences through high quality design details, fine views, etc. (Gehl et al., 2013). Once again, having these qualities helps enhance the social aspects of a place, contributes to walkability, and leads to more memorable experience. These criteria are directly related to several livability goals that seek to support existing communities and places.

Allan Jacobs' *Great Streets* Criteria

Allan Jacobs, following Jan Gehl, applies urban design theory to specific streets. In his book, *Great Streets* (1995), he lists streets from around the world that he has visited and considers great streets. He provides sketches, descriptions, and data to reveal the qualities that make streets on his list model examples. His approach is one of participant-observer: he explores streets as an inquisitive visitor, traveling on foot and seeking to understand the elements that he, and other pedestrians, find most important and memorable.

What Allan Jacobs points out again and again in his vivid descriptions is that the truly great streets have a changing character that evolves within the context of the entire city. The best streets are those that not only function well or have high quality urban design elements, but are those that are intimately tied to the history, culture, and identity of a place (Jacobs, 1993). Put another way, great streets are those that contribute to the life of the city by being places that people actively make part of their daily lives.

Jacobs' pedestrian-level, urban design emphasis is useful because it addresses the complexity and nuance of pedestrian needs using concrete examples and a comprehensive framework. Rather than introducing a level of design mystification to what goes into making a great street, this view is actually quite practical and easy to understand.

He encapsulates this framework into eight requirements for great streets. These are design elements that are "directly related to social and economic criteria having to do with building good cities: accessibility, bringing people together, publicness, livability, safety, comfort, participation, and responsibility" (Jacobs, 1993: 270). These elements are simple, yet essential; all great streets fulfill these criteria in some way. They also strive to be explicit in description, without being overly prescriptive or formulistic. As such, these elements form the basic framework for street design and "provide knowledge […] for designs of future great streets" (Jacobs, 1993: 271).

Places for People to Walk at a Leisurely Pace

Jacobs' first requirement follows Gehl's basic requirement for urban spaces: people need to have a comfortable place to walk at various paces, without feeling overcrowded or unsafe. Translated into urban design practice, this means that sidewalks need to be adequately sized and buffered from automobile traffic. Such sizing depends on the context, including the number of pedestrians using the street and the volume of traffic (Jacobs, 1993: 272).

Overall, this requirement aligns well with the Complete Streets view that streets should accommodate all users of all abilities. The first step towards this goal, of course, is providing basic infrastructure for all users. And, although adequate physical features are required to physically enable walking, perhaps more importantly, they *enable public interaction*, because only on foot do we have the chance to see people's faces and communicate with each other (Jacobs, 1993: 272).

Physical Comfort

A second requirement that Jacobs outlines is physical comfort, by which he means relative comfort from the local climate (excessive heat, sun, cold, wind, etc.). The best streets make use of microclimates, using orientation, street trees, arcades, and shade structures to achieve ideal comfort for those walking (Jacobs, 1993: 276). Again, this requirement echoes Gehl's criteria that good civic spaces offer protection from the environment and add to the overall enjoyment and pleasantness of the street.

Definition

A third component of great streets is *physical definition*. By *definition*, Jacobs is referring to the boundaries of the street that "communicate clearly where the edges of the street are, that set the street apart, that keep the eyes on and in the street, [and] make it a place" (Jacobs, 1993: 277). In other words, these are the features of the street that frame it and provide a sense of enclosure. Jacobs argues that a consistent building wall is crucial in creating definition for the street, although sometimes street trees may play a similar role. Overall, Jacobs says that building height to street width ratios of 1:3 or lower usually create adequate definition (Jacobs, 1993: 280). Lower ratios, such as 1:2 or 1:1 can create even more definition, without seeming oppressive or claustrophobic.

Jacobs also champions street trees as crucial to create definition and enhance comfort. He goes so far to say that, "Given a limited budget, the most effective expenditure of funds to improve a street would probably be street trees" (Jacobs, 1993: 293). Jacobs has in mind larger tree species that form majestic canopies that provide shade and a clear physical buffer between the road and the streetside.

Qualities That Engage the Eyes

A fourth component of great streets is providing details that create visual complexity and stimulation.

Figure 2.4 High quality façade details, a strong building wall, and buildings with fewer stories lend themselves to human scaled design along Regent Street, London. *Source: Flickr, Tony Webster (2013).*

These details can include architectural components, such as cornice lines, multiple windows and doorways, signs, street trees, the street armature (furniture, lighting, etc.), and perhaps most importantly, people. Having these details sustains pedestrians' interest in exploring the street, which in turn can enhance walkability and sense of place. Although adding details may be easy to achieve, too many details can be overwhelming, such as when shop signs seem chaotic or too numerous (Jacobs, 1993: 282). Jacob says these details should also be thought of at different times of day: how the street will look at twilight versus during the day, or at night versus early morning.

Transparency

Related to providing visual details, Jacobs argues that streets need to have transparent edges, which includes many windows, multiple doorways, and other hints of worlds to explore off the street. Blank façades are uninviting, and do little to attract or retain edge life. Lively shop windows, or sidewalk cafes, on the other hand, allow users of the street to know that other activities are happening off the street which they may want to explore.

A similar argument is made by Gehl (2010) that buildings should have "active facades." Gehl develops a grading to measure façade features system using a 1-5 scoring system. These grades include, from highest to lowest: active, friendly, mixture, boring, and inactive (Gehl, 2010: 241).

Complementarity

A sixth element of great streets is complementarity between buildings. Each building along the street should continue the conversation between built elements and provide a sense rhythm and pattern. This does not mean that all buildings must follow the same architectural style; they should simply share similar massing, materials, heights, and color (Jacobs, 1993: 289). As streets evolve, styles will change, but the overall character of the buildings should remain cohesive. Such a consideration is especially important along streets that have had many development phases spanning many architectural periods.

Well Maintained

Jacobs argues that the best streets are also the best maintained. They are clean, well landscaped, and not run down. Broken or damaged elements are fixed, and building owners keep up a standard of care for

Table 2.1 Density Requirements for Urban Livability

Source	Units/Acre
Jane Jacobs	100
Steve Belmont	25-100
Kevin Lynch	12-20
Allan Jacobs	15
Peter Calthorpe	10-15
Pushkarev & Zupan	7-11*

*Transit only

Source: Adopted from Ewing and Bartholomew, 2013

their properties. This standard of care contributes to safety, perceptions of ownership, and overall aesthetic appeal (Jacobs, 1993: 289). Such a consideration is important during complete street projects that often seek to address basic maintenance issues such as crumbling sidewalks, neglected street trees, and cracked paving materials – all of which detract from the street instead of adding to its character.

High Quality Materials

Finally, Jacobs argues that great streets have a high standard of design quality, which includes quality materials and workmanship in everything from the street furniture to the paving materials. These elements contribute to a sense of identity, usually last longer, and are generally more aesthetically pleasing.

PLANNING THEORY

Planning theory also has a lot to teach us about what contributes to good urban form and well-designed public spaces. Two authors, Jeff Speck and Reid Ewing, are planning pioneers who have contributed to the discussion of what goes into walkable, pedestrian-centered places.

Reid Ewing's Essential Characteristics

Reid Ewing, a professor of urban design at the University of Utah, takes a more evidence-based, quantitative approach to street design than Jan Gehl or Allan Jacobs. Like Jacobs, he believes there are essential elements that constitute well designed streets. Unlike Jacobs, however, Ewing attempts to verify the assumptions of leading urban design texts (like *Great Streets*) with current empirical research. He shows that many of the theoretical arguments put forward by the great urban design theorists (including such giants as Kevin Lynch, Christopher Alexander, Jane Jacobs, and Jan Gehl) are corroborated by actual studies.[11] Ewing's findings are that many factors of good urban design can be quantified, more or less, but that there can be significant variation in factors that professionals consider essential.[12]

In *Pedestrian- and Transit-Oriented Design* (2013) and *Measuring Urban Design* (2013), Ewing synthesizes these various theoretical approaches to develop a list of 10 essential features of the street.[13] Many items on Ewing's list have extensive overlap with the criteria listed by Jacobs, Gehl and others. However, there are a few additional considerations that Ewing argues are essential to successful pedestrian and transit friendly streets. These mainly relate to land use and development, not necessarily street design. However, the importance of these criteria cannot be understated, and should be considered in any complete streets project.

[11] Ewing's methodology involves an extensive literature review of urban design theory, tied to visual preference surveys of pedestrians. He has found that the urban design qualities cited in the urban design literature are supported by stated user preferences in terms of what is important for creating attractive, inviting urban environments (Ewing and Clemente, 2013).

[12] As part of his work, Ewing has helped develop a sophisticated system to create a list of eight objective urban design criteria that produce great urban places using an empirically backed statistical model (Ewing et al., 2013). This list includes: 1) Imageability; 2) Enclosure; 3) Human Scale; 4) Transparency; 5) Complexity; 6) Coherence; 7) Legibility; 8) Linkage.

[13] He also lists several less essential features that contribute to pedestrian friendly environments. This list is a nice complement to his 10 essential features, and once again mirrors many of the points brought up by Allan Jacobs and Jan Gehl.

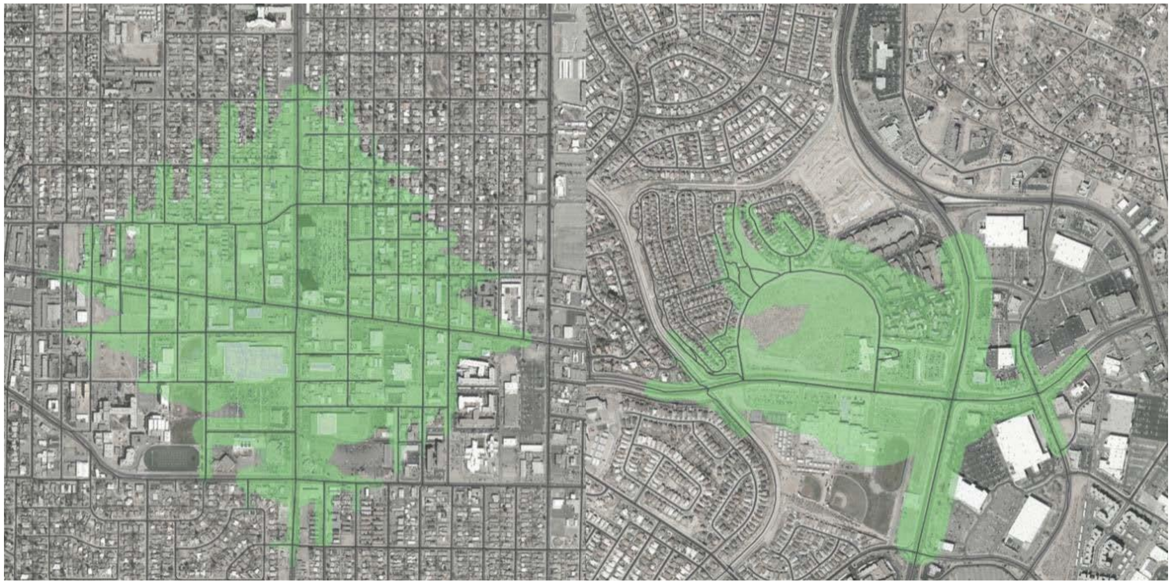


Figure 2.5 Comparison of a 15 minute walk from a bus stop in with a traditional, gridded network (left) and a conventional network (right). *Source: MRMPO (2015).*

Medium to High Densities

Ewing considers medium to high densities essential in "promoting walking and transit use" (Ewing and Bartholomew, 2013: 21). This is because higher densities allow for more residents and employees within walking distance of shopping and services, which in turn creates high levels of activity, more street life, higher levels of perceived security, and more opportunities for public interaction. Higher densities also allow for cost-effective transit, investment in bicycling infrastructure, higher rents, and more walkable urban amenities (Ewing and Bartholomew, 2013; Cortwright, 2009).

Mixed Use

Ewing also argues strongly for mixed use developments and an end to segregated zoning practices. From his research, Ewing has found that a finer grain of mixed uses "has a stronger influence on rates of both walking and transit use than does density" (Ewing and Bartholomew, 2013: 25). This makes sense, as having high residential densities means there are many potential users within walking distance of transit, including residents, shoppers, and office workers. Mixed use development is also important because it supports the goal of creating a jobs and housing balance, by placing housing and jobs together initially, instead of trying to change established land use patterns later on.

Block Length

A third essential feature that Ewing discusses is block length. Block length, Ewing argues, is just as important as density and mixed uses to promote walking (Ewing and Bartholomew, 2013: 28). This is because, in general, pedestrians value shorter block lengths, as they allow those walking to pick more direct routes, change direction, explore, and offer more opportunities to cross the street. Having shorter blocks has also been correlated with higher property values (Ewing and Bartholomew, 2013: 28).

Essentially, block length and block design are crucial for connectivity and network legibility. Having shorter block lengths directly corresponds to more intersections per square mile, which increases network density and walkability (see Figure 2.5). This can disperse traffic across a wider network, which lowers traffic volume on individual streets. And, as Allan Jacobs, says, the best streets focus and order the surrounding environment through their block patterns. By completing a pattern or by breaking rhythm, they organize the built environment and act as a focal point that aids in orientation, navigation, and legibility (Jacobs, 1993: 257-258).

Direct Routes and Transit Stops

Related to block length is the directness of a route, which Ewing argues is also essential. Direct routes to destinations allow for shorter travel distances, which is extremely important for pedestrians who are only willing to walk short distances to reach their destinations. On average, studies have found that most people are only willing to walk between ¼ to ½ miles to reach a destination (such as a transit stop) (Ewing and Bartholomew, 2013). If the distance is longer, they will not take the trip or choose an alternative mode. For this reason, having a network that offers direct routes, coupled with shorter block lengths, is essential to increase the walkability of an area.

It is also an essential consideration when planning transit stops, which should be within walking distances of residences and businesses. For streets with transit service, Ewing argues that it is crucial that bus stops are spaced every half-mile or closer. Spacing further than this means transit users have to walk more than ¼ mile to reach a bus stop. This is the maximum walking distance that most studies have found people are willing to walk. Distances further than this are perceived as too far and therefore discourage walking to transit (or other amenities).[14]

Jeff's Speck's General Theory of Walkability

Many of Ewing's essential characteristics for creating pedestrian friendly environments are directly related to walkability, which has been championed as a key to creating vibrant streets and neighborhoods. Jeff Speck, a walkability guru, has provided consultation to numerous cities on how to make their downtowns more walkable.

In his 2012 book, *Walkable City: How Downtown Can Save America, One Step at a Time,* Speck lays out his "general theory of walkability" which are basic principles that are necessary for creating walkable areas. For an area to be walkable, Speck argues, the walk must be comfortable, safe, interesting, and useful (Speck, 2012). In other words, people need to: 1) have a comfortable place to walk (i.e., wide sidewalks and other infrastructure); 2) the walk needs to offer protection (from both traffic and crime); 3) the walk needs to be interesting (e.g., with high quality design details or many storefronts); and 4) the walk needs to be purposeful and connect destinations. This general theory is further supported by Speck's 10 Steps of Walkability, which cover everything from making streets safe for all users to the importance of planting street trees (Speck, 2012).

What is important about Speck's emphasis on walkability is that the concept is about more than getting people to walk: it has numerous co-benefits that are tied to the creation of good urban form, increased safety, and placemaking. For him, walkable streets are also well designed places that support the life of the neighborhood (and possibly the entire city).

Essentially this mirrors the quality considerations for urban spaces outlined by Jan Gehl and builds off Allan Jacobs' Great Streets model to argue that walkability

[14] Interestingly, this maximum distance changes depending on city. See Kittelson & Associates 2003, which measured walking distances in several large cities. Coverage area is also important for ridership. One study found that for every 1% increase in transit coverage there is a corresponding .86% increase in transit ridership (Ewing and Bartholomew, 2013: 33).

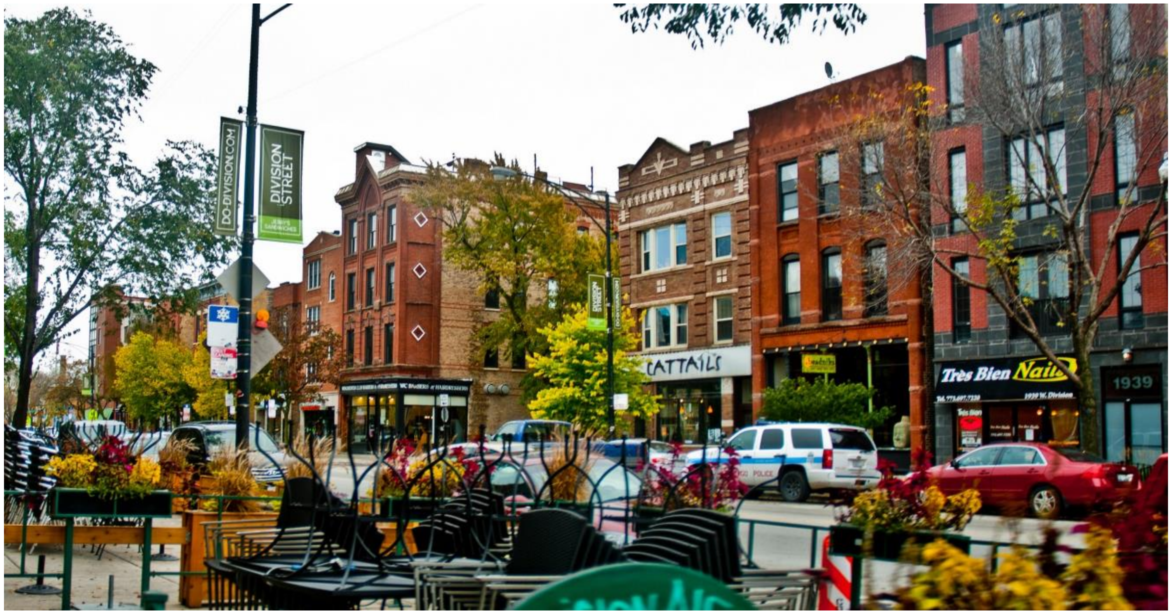


Figure 2.6 Division Street in Chicago. *Source: Flickr, City Clock Magazine (2014).*

is related to a larger question of what constitutes good urban form. It also adds to the conversation of complete streets to emphasize that our streets will not be complete unless we address the nuanced needs of pedestrians and strive to make our cities truly walkable places.

EXAMPLES OF COMPLETE STREETS

The previous list of design elements and considerations is by no means exhaustive or even representative of the wide range of features that make up complete streets around the world. However, they highlight some of the crucial components that go into making a complete street. For example, it is clear that providing basic pedestrian and bicycle infrastructure is essential to enable more walking and biking. However, it is also clear that providing this infrastructure alone is not sufficient to generate high levels of diverse activity. Addressing the larger context of the roadway – e.g., issues with crime, noise, and uninviting storefronts – is just as important as providing wider sidewalks or more generous bicycle infrastructure.

The following are a few streets that have characteristics of complete streets, although not all of them can be considered complete. Instead, they are streets from major cities around the United States that exhibit characteristics that make them more complete and memorable than their neighbors. Studying these streets can help reveal the exciting reemergence of pedestrian-centered cities and human-scaled urban design, which can then be applied to complete streets projects here in New Mexico.

Division St, Chicago

Although not a complete street, Chicago's Division Street, as it runs through the Wicker Park neighborhood, is a quintessential mixed use, multimodal, urban shopping street. The street has two travel lanes, bike lanes, on-street parking, and wide sidewalks. The street's focal points are the many sidewalk dining areas in front of the street's many restaurants. These outdoor seating areas create a bustling sense of activity along the edge of the street, taking the focus off traffic (*see Figure 2.5*).

Chicago has more interesting architecture than it is commonly given credit for and Division Street is no exception. The street's façades are unformally interesting, complementary, and provide a clear sense of definition. Old and new buildings blend in well together, and support the street's primary role as a

Figure 2.7 Valencia Street in San Francisco. *Source: Flickr, potential past (2013).*

mixed-use shopping destination. The buildings are supported by a series of large street trees that provide excellent shade canopies and visual interest. Together, these elements all create a pleasant street that supports its surrounding land uses, provides protection against traffic and unfavorable sensory experiences, and functions as a complete, multimodal street for all users.

Valencia St, San Francisco

Valencia Street in San Francisco's Mission District has gone through many transformations in the last 20 years. Most recently, the road underwent a road diet that narrowed the road to two travel lanes and added bike lanes and on-street parking (*see Figure 2.6*).

The street is also memorable for its street festivals, where the road is closed to automobile traffic.

Complete Streets in Albuquerque

Unfortunately, there are not yet many good examples of complete streets in Albuquerque or New Mexico. There is a short list of streets that fulfil the criteria of our first definition of complete streets, but few that fulfill an expanded definition of complete streets as a complete, evolving, and integrated public infrastructure.[15]

For example, Lead and Coal are often seen as a standout Complete Streets project from a multimodal perspective. Both street have bike lanes, wide sidewalks, landscaped buffers, enhanced intersection lighting, and support high volumes of automobile traffic. However, neither street is memorable or interesting. As one-way couplets, they support longer distance regional travel, not community uses. As such, they do not contribute to pedestrian scale placemaking, or convivial social uses of the street.[16]

While there are few standout projects that can be considered complete streets in Albuquerque, there are several streets that exhibit many of the qualities elaborated on by Jacobs and Gehl that lend themselves to consideration.

Central Avenue

[15] Part of this has to do with density and land use patterns. Albuquerque has a very low housing and jobs density that makes it difficult to support high quality transit, and encourage walking. This is discussed further in Chapter 4 and in the conclusion of this document.

[16] Consider: would Lead or Coal ever be home to a street parade or a CiQlovia event? Probably not, which goes to show these streets do not have the same qualities that make Central and Silver more memorable and interesting streets.

Figure 2.8 Gold Avenue in Downtown Albuquerque. This street's buildings and land uses lend themselves to an urban atmosphere that is unique in downtown Albuquerque. *Source: MRCOG*

Central is an interesting street to consider as a complete street because it remains the most active, vibrant corridor within Albuquerque, with many distinctive segments that correspond to different periods in Albuquerque's development. Each includes interesting elements, from the mixed-use, walkable sections of Nob Hill, to the bustling activity around UNM. What Central Avenue lacks in good design, it makes up with history, activity, and its central location.

However, Central is not a typical complete street in the sense that it is not entirely multimodal. Most segments, excluding a portion between 8th Street and Rio Grande, do not have bike lanes, and have narrow, un-buffered sidewalks that do not encourage walking. This is a huge problem because the roadway, along some segments (notably Nob Hill and UNM), is full of pedestrian and bicycle activity that is not adequately supported by existing infrastructure. In addition, the street is the most traveled transit corridor in the region and will soon include Bus Rapid Transit service. Hopefully, this project and several new developments will bring additional investment and activity to the entire corridor, while also addressing some of the ongoing issues with the street's walkability and bike friendliness.

Gold Avenue

Gold Avenue, along many segments, feels like it belongs to another world. In Downtown, sections of the street feel very urban, with active façades, a well-defined building wall, and mixed uses. The area around between 1st Street and 4th Avenue, for example, has a convivial atmosphere that is unique to Downtown Albuquerque.

The road has a different character further east, between Broadway and I-25. Here, the road features a gentle climb past distinctive houses representing several architectural styles. Many of the houses have interesting design details including expansive porches that create a sense of transparency – it is easy to see people interacting from their porches as well as imagine life happening behind the homes' windows. The interesting homes are enhanced by the street trees that line most blocks. These trees are large, old, and create a canopy that is missing from most streets in Albuquerque. The street also features on-street parking along much of its length, which lends itself to

Figure 2.9 Edith Blvd as it passes through Martineztown between Lomas and Mountain Rd. Although the street has narrow sidewalks and wide travel lanes, the street's old school character, gentle curves, and central location all lend themselves to an interesting street. *Source: Self*

a sense of activity, urbanity, and protection. From the top of the hill at I-25, looking westward, the street feels well-defined, mysterious, and almost as if it belongs to another era, if not another city entirely.

Edith Boulevard

Edith Boulevard, as it passes through Martineztown/Santa Barbara, feels like old school Albuquerque. Although the sidewalks could be wider and more pedestrian friendly, the low traffic volumes, speed humps, and shared bike route make the street slow paced in comparison to bustling Broadway to the west or I-25 to the east. A variety of older buildings, coupled with slightly dilapidated, undersized infrastructure, add to the pedestrian-scaled environment in a way that is reminiscent of streets in Santa Fe or Las Vegas, NM. As with streets in these towns, much of Edith's character seems to emanate from the road's gentle curves and slope, which were shaped by a now buried acequia that meandered through the neighborhood once upon a time. Together, these elements add to an interesting, multimodal street with a laid back character that is missing from other roads in Albuquerque.

Bernalillo Main Street and NM 550

Bernalillo's main street, Camino del Pueblo, is a good example of an complete street in a rural main street context (see discussion of rural main street contexts below). The roadway is a continuation of NM Highway 313, and unlike some rural main streets that have been ruined by engineering standards more conducive to highways, Camino del Pueblo's current design complements the town's slow paced, semi-rural character. The roadway has received a number of upgrades in the past few years, including new street lights, curb extensions, and a flashing pedestrian beacon near the Range Café. These improvements have beautified the street, but the true focal points of the streetscape remain anchor businesses such as the Range Café and the T&T supermarket. Gas stations, as with many rural towns, are also clear nodes that seem to emanate a sense of activity that is absent from most of the rest of town.

Camino del Pueblo's laid back character is in sharp contrast to NM 550 – Bernalillo's busiest street and, one could argue, new main street. The fast food establishments, gas stations, huge highway-scaled business signs, and general disorder all add to a cacophony of activity that make the street almost impossible to use as a pedestrian of any age or ability.

CONTEXTS

From this cursory list of examples, it is clear that Compete Streets come in many manifestations depending on their context. Clearly, not all Complete Streets have the same features, nor should they, as they each exist with a unique land use context and an evolving transportation system. Each serves a different regional transportation purpose, and carries a wide range of users with differing needs.

The issue is further complicated by the numerous forms complete streets can take in rural to urban contexts. A complete urban street, for example, will be different than a complete rural one. The urban street may include protected bike lanes and expanded sidewalks, while the rural street may only include a wide shoulder that accommodates bicyclists and pedestrians. The point in both these cases is that complete streets are context sensitive because they are appropriately melded with their surroundings.

Unfortunately, context in transportation planning is rarely considered comprehensively. Too often, context is defined simply as the transportation context, which usually means the street’s functional classification. However, the need to address surrounding land uses means that any classification system needs to be able to identify, categorize, and highlight the relevant features of the roadway depending on the land use context.

The following four classification schemes attempt to tease out the nuance of differing contexts by looking at both transportation and land use contexts as an integrated whole. The point of the following classification systems is to show that streets exist in a complicated land use, transportation, cultural, and political matrix that should be considered during each project.

Using such a classification is helpful in determining which Complete Streets projects may provide the most benefit or be the most successful. It also points to areas that may need the most investment given existing conditions such as narrow or obstructed sidewalks in an area that sees a lot of pedestrian activity.

Functional Classification Systems

Functional classification, as traditionally used, relies on an *access versus mobility model* that places streets within an easy to understand system of limited access freeways to full access local roads (Litman, 2014).

Table 2.2 MRMPO Character Areas

Type	Description
Rural	Rural areas primarily have very low residential densities (< 3 DU/acre), and often include large amounts of agriculture and open space. Examples includes parts of the North and South Valleys, as well as the East Mountains.
Suburban	Suburban areas primarily contain single family residential land uses (< 8 DU/acre) with scattered commercial. Densities are generally lower than in more urban areas. The Coors corridor is a good example.
Urban	Urban areas generally have moderate residential and employment densities (> 8 DU/acre) with a fairly high number of different land uses within short distances.
Activity Centers	These areas exist in both urban and suburban areas but generally are planned to have a higher intensity of use than general urban or suburban areas. This includes increased pedestrian traffic, retail activity, or core job centers.
Main Streets	Main streets often function as the heart of historic towns, or as the "living room" of a neighborhood where people come to shop, eat, and congregate.

MRMPO's existing functional classification expands on this model and includes the types of trips typically taken on these roads (in terms of length and user) to determine functional classification (MRMPO, 2015a). For example, MRMPO's classification distinguishes between two types of principal arterials: community principal arterials and regional principal arterials. The former supports shorter, neighborhood trips, while the latter is for long-range (commuting) trips. The full classification scheme involves 6 street types, each with slight variations depending on character area (see below).

Character Areas and Transects

In addition to the roadway classification system, MRMPO has developed a land use classification scheme based on a rural to urban transect model. This model seeks to distinguish different "character areas" that have varying uses, users, and densities (see Table 2.2) (MRMPO, 2015a). The model relies on three measures: activity density, land use mix, and housing density. Together, these measures help inform whether an area is rural, suburban, or urban. Overlayed on top of these simple transect classifications are activity centers, which have varying geographies and support different types of activities.

The character area model introduces another consideration for roadways that is directly linked to land use. In practice, roadways with the same functional classification, but within different character areas should have different design specifications. This includes differences in minimum ROW requirements, such as roadway width, lane width, sidewalk width, and bicycle infrastructure.

Street Typologies

Transects measure basic land use variables such as density, roadway connectivity or intensity of uses. However, they don't always distinguish between finer grain land uses, such as the difference between a commercial corridor and a residential street, or an

Table 2.3 Albuquerque Street Typologies

Type	Description and Examples
Suburban	Hierarchical street network with low connectivity, high traffic volumes, large setbacks, and wide ROW. Examples include Coors, NM 528, and parts of Unser.
General Urban	Fast roads, with high traffic volumes, wide ROW, and few pedestrian amenities. Retail uses are scantily spread along the street. Lomas is a good example.
Commercial Strip Corridors	Urban roads with strip malls, large setbacks with lots of space devoted to parking, high volumes, and high speeds. Examples include San Mateo and parts of Louisiana.
Mixed Use Activity Streets	These roads serve mixed land uses, and generally have traffic calming features, on-street parking, a strong building wall, and more pedestrian activity. Central in Nob Hill or Edo are two prime examples.
Shared Streets	Slower streets that are often shared by multiple users, and may be designated as bicycle boulevards. Silver Avenue is the best example in the city.
Downtown Streets	Albuquerque's downtown streets are varied in dimension, traffic volumes, and surrounding land uses. However, many are prototypically two or three lanes, include some on-street parking, and have room for additional bicycle infrastructure. Gold Avenue is a good example.
Main Streets	Similar to the rural main street character areas, main streets may existing in a rural or urban context as the centers of neighborhoods. In general, these streets emphasize slower speeds, commercial activity and include on street parking. 4th Street in Barelas is a good example of a main street in an urban context
Residential Streets	These streets generally serve (or run through) residential land uses. Parts of San Pedro, Pennsylvania, Washington, and Carlisle are all examples.
Semi-Rural Streets	Semi-rural roads run through suburban or rural character areas but carry a high amount of traffic and may have wider ROWs than "true" rural roads. Isleta and Rio Grande are two examples.
Rural Roads	Roads that run through a rural character area. NM 313 through Sandia Pueblo is one example.

urban jobs center verses an urban retail center. These places may all be classified as urban, but their corresponding land uses, trip generation, and users may all be different. Hence, the design of the street should change to support the varied activity and users of the street. When this is done successfully, the integration between the roadway and its surrounding land uses can be stronger and mutually supportive.

To distinguish between streets that travel through or along different land uses, street design guides such as NACTO's *Urban Street Design* (2014) propose roadway typologies based on the land use function the streets support. Other design guidebooks use a simpler classification scheme that distinguishes between 6-8 street types. These often include parkways, rural roads, boulevards, avenues, streets, alleys and lanes (ITE, 2010).

These street typologies are quite different than the functional classification system this traditionally used, but fulfills a different purpose. Although potentially complicated, the strength of this model is that it responds to a more nuanced appreciation of the land use context, and also provides a clear urban design vision for these streets.[17] There is a clear difference between a residential street and an industrial one, for example, in both function and appearance. As such, there are different considerations and approaches that should be used when discussing these streets. Recognizing the street's typology as grounded in its land use context also allows one to understand the most beneficial changes that may occur along the street.

Albuquerque Area Street Typologies

Applying this approach in the Albuquerque Metropolitan Area provides an interesting list of different street typologies that currently exist or may be currently evolving (*see Table 2.3*). Each of these has a prototypical set of features that distinguishes it from other streets. And unlike the model examples offered by NACTO, these street typologies are not idealized, complete streets. Many lack complete streets features in their current incarnations, although this could change with modified design practices.

Development Phases

A fourth contextual factor to consider during roadway projects is the development stage of the roadway. Is it a new road or a retrofit project? Is it simply up for routine maintenance or will the whole street be rebuilt and possibly function very differently than before? And, what is the lifetime evolution of the street? Was the street once a lonely rural road that has now evolved into a congested suburban arterial due to rapid development? The important thing to remember is that streets are in a constant state of evolution, and should be routinely reevaluated to see whether they are supporting their users and surrounding land uses.

Considering the phase of development is important because it constrains what is possible, both in terms of budget and planning goals, but also in terms of potential opportunities to introduce new, imaginative, and possibly transformative elements to the street. (Please see Table 2.4 for a list of potential design interventions by development phase.)

For example, during *routine repaving*, very little reconfiguration occurs. Lanes and lane widths remain the same, sidewalks are untouched, and additional complete streets modifications are not considered. This is often done for expediency and cost-efficiency, but is also a missed opportunity. Even during these projects, there are a range of possibilities to bring the street closer to a Complete Streets ideal. In many cases, this may just mean updating the street's specifications to current best practices. This includes reducing lane widths, properly marking bike lanes, marking crosswalks, and filling in any gaps in the sidewalks. Small scale, incremental changes such as these can begin to address larger issues over time (McCann, 2013).

Longer term *reconstruction projects* introduce more possibilities for transformations of the street. For

[17] This scheme is similar to transect-based street typologies that have been developed by transportation planning agencies. This typology runs on a continuum from rural to urban and distinguishes between streets in their various contexts; e.g., suburban residential street vs urban retail street (NJDOT, 2009). Some of these models expand on the transect model to include a 2 dimensional matrix that runs rural to urban on the X axis and regional to local on the Y axis. This produces close to 25 street typologies!

Table 2.4 Sample Appropriate Design Strategies by Development Phase

Strategy	Roadway Maintenance	Reconstruction Projects	Corridor Plans & Studies	Sector & Master Plans	New Roads
Narrower Lanes	X	X	X	X	
Lower Posted Speed	X	X	X	X	
Road Diet		X	X	X	
Fill in Sidewalks	X	X	X	X	
Widen Sidewalks		X	X	X	X
Plant Street Trees		X	X	X	X
Improve Crosswalks	X	X	X	X	X
Pedestrian/Transit Amenities		X	X	X	X
Improved Lighting		X	X	X	X
Curb Extensions		X	X	X	X
Median Improvements		X	X	X	X
Shoulder Changes	X	X	X	X	
Bike Lanes	X	X	X	X	X
Signals and Signal Timing	X	X	X	X	X
Green Infrastructure		X	X	X	X
Expanded Transit Service			X	X	

example, during these projects, it may be possible to consider road diets, wider sidewalks, or the installation of curb extensions. In addition, these projects are often tied to larger sources of money, which makes more expansive changes possible. They also allow for more community involvement in the planning process.

Corridor and sector plans offer even more opportunity to change how the roadway looks and functions. They allow more challenging questions to be asked, such as: are there ways this project can meet environmental, social, and economic goals? Are there specific parties that should be involved in the design process? Is there a way to change the way we think about the role of streets in our city?

And, of course, *new roads* are a blank slate, with the most possibility for implementing multimodal designs. Unfortunately, this is often taken as an opportunity to acquire excessive right-of-way and build roads to engineering specifications that do too many things at one time, without doing any one thing particularly well. Such an approach can be seen with some of roads on Albuquerque's west side, which have sidewalks that meet minimum requirements, and have generous bike lanes, but still do not support diverse users or land uses.

3 EVALUATION

Better Block Event, Showing Temporary Changes to an Intersection, Source: Better Block

Chapter 3 Evaluating Complete Streets

The discussion of defining Complete Streets, cataloging their essential design elements, and understanding their context is a starting point to a broader paradigm shift in thinking about transportation projects as a holistic process that brings together policy, design, and practice. An additional step is to consider ways we can go about evaluating roadway projects to understand which designs interventions support complete streets goals most effectively.

When evaluating transportation projects, there are a multitude of factors to consider. There are standard transportation planning factors, such as the roadway's functional classification, Level of Service (LOS), the travel time index, or intersection delay. There are safety factors to consider such as design speed of the roadway and the crash rates at an intersection. These are coupled to accessibility factors, such as how well the road accommodates bicycles and pedestrians, or how well the network connects destinations. There are environmental factors such as vehicle miles traveled (VMT), stormwater runoff rates, and air quality indicators. There are process factors, such the level of public involvement or how planning agencies choose to evaluate and justify specific interventions. And, there are always financial factors at the heart of every project.

Combining all these factors into a comprehensive framework is a tall order, given the complexity of addressing all these factors in tandem. Added to this complexity are the multitude of interested parties who have their own priorities when it comes to roadway projects. Bicycle advocates, for example, often have strong opinions about the need for more bike infrastructure, while motorists may care primarily about reducing congestion and lowering travel times (Speck, 2012). Operating in this manner leads to a siloed approach that fails to capture the needs of all users.

The good news is that performance measures that can quantify the positive, sometimes transformative, qualities of great streets are being employed to evaluate streets using a more holistic, multi-disciplinary approach (National Complete Street Coalition, 2015; EPA, 2011).

EVALUATION METHODS

Several of these emerging evaluation systems rely on robust, multi-disciplinary evaluation methodologies that use a wide range of performance measures.

RSA Master Prompt Areas

These are just a few of the areas addressed by a road safety audit using its master prompt list.

Pedestrian Facilities

- Presence, design, and placement of sidewalks and paths.
- Quality, Condition, and Obstructions of sidewalks and paths.
- Continuity and Connectivity of streets.
- Availability and Safety of Crossings
- Lighting for pedestrian safety and visibility.
- Visibility at crossing locations.

Traffic

- Access management and driveway placement.
- Traffic volumes, speeds, and conflicts.

Traffic Control Devices

- Signs and Pavement Markings to indicate routes and safety information.
- Signal timing, placement and phasing.

Source: Federal Highway Administration, Pedestrian Road Safety Audits Guidelines and Prompt Lists, 2007

These methodologies often combine a quantitative assessment (e.g., width of sidewalks) with a qualitative performance assessment (e.g., relative walkability of wider sidewalks). Other methods are more data intensive, using scoring systems to rank the relative merits of different projects.

Increasingly, evaluation methodologies are utilizing an *inputs, outputs and outcomes model*, which correspond to different stages in a transportation planning context (McCann, 2013). *Inputs* refer to quantifiable investments, which can include money spent, policies passed, or number of community participants. *Outputs* refer to the direct, tangible results of these inputs, including miles of new roads built, miles of new bike routes, or number of new trees planted. *Outcomes* refer to how the roadway functions after it is built or reconstructed. This includes operating levels of service, changes in traffic volume, number of bicyclists, or number of crashes. This *inputs, outputs and outcomes* approach can be applied to evaluate specific projects, or it can be used to track the progress of various planning objectives.

A comprehensive review of all methodologies being employed by transportation planning departments is beyond the scope of this document, but a few methodologies are outlined below. Overall, evaluation methodologies may be characterized into five main types: 1) checklists and inventories; 2) scoresheets; 3) modeling programs; 4) before and after studies; and 5) qualitative analyses.

Checklists and Inventories

Checklists offer an easy way to compile an inventory of existing conditions. Checklists are usually focused on cataloging a series of inputs, which can later be used to inform recommendations on expected outputs and outcomes. Several Complete Streets specific checklists have also been developed that look at Complete Streets gaps and opportunities.

Road Safety Audits

One well established checklist tool is the Federal Highway Administration's *Road Safety Audit* (RSA). Road Safety Audits are formal safety examinations conducted by a multi-disciplinary team of roadway experts (FHWA, 2007). Using a checklist, the evaluation team conducts a walking inventory of street conditions, recording gaps in the pedestrian infrastructure – everything from missing curbs to poor lighting conditions.[18] This inventory usually addresses a series of "prompts" aimed at recording specific, measurable criteria. Each prompt is nested within a series of master prompts that evaluate the condition of key features such as the presence/condition of sidewalks, issues with lighting, and more (see box at left). This inventory is then used to create a formal report addressing issues with the roadway's safety.

The strength of RSAs is that they allow agencies to conduct an objective assessment that directly considers the safety of pedestrians. One downside, however, is that RSAs do not address additional barriers to walking, such as issues with accessibility, urban design, aesthetics, etc. Nor do they rank projects using an objective scoring framework.

[18] RSAs can also be used to evaluate conditions for cyclists and transit users.

Overall, this is a great tool to assess issues with pedestrian safety and comfort along a street segment.

Complete Street Checklists

Several municipalities have created complete streets checklists to identify existing complete streets gaps during roadway projects. Most of these, like Seattle's Complete Streets Checklist, are used to evaluate maintenance and reconstruction projects to ensure they incorporate complete streets principles (Seattle DOT, 2015). Seattle's tool helps collect data on existing conditions, with the "goal of identifying specific improvements that can be incorporated into the project to support and balance the needs of all users" (Seattle DOT, 2015).

Overall, this tool provides a centralized place for Seattle's DOT to collect information and share it with other agencies involved in a roadway reconstruction project. It also provides a way to ensure projects are commensurable with regulating plans for streetscape design, bikeways master plans, green stormwater infrastructure, and climate change mitigation.

Other Complete Streets Specific checklists include New Jersey DOT's Complete Streets Checklist; Pennsylvania DOT's Bicycle and Pedestrian Checklist; and Metropolitan Transportation Commission for the San Francisco Bay Area's Project Checklist.

Health Impact Assessments

Health Impact Assessments refer to a wide variety of evaluation methods that seek to understand the health effects of a policy, program, or design on a target population (World Health Organization, 2015). Such assessments can be performed on roadway projects to evaluate barriers to walking, bicycling, or transit use. Like road safety audits, these assessments usually involve an inventory of physical conditions, but link these conditions to specific social indicators, including health outcomes of a target population; economic conditions, or specific land use issues.

A local health impact assessment was conducted along the Central Corridor between San Mateo and Wyoming in 2012. This assessment looked at environmental barriers to walking using 12 main indicators. During the assessment, an inventory of built environment features was conducted, including an inventory of sidewalk conditions, obstructions on sidewalks, street lights, issues with perceptions of safety, visibility issues, and vacant properties within the study area (McEntire et al., 2012).

Scoring Tools

Scoring tools expand on the simple checklist model to produce an index score or ranking based on various criteria. Usually, these index scores are tied to a weighted model that awards points for the presence of various design features and/or the condition of these features. Like checklists, scoring tools usually consist of an inventory of existing conditions (inputs), such as sidewalk widths, traffic volumes, surrounding land uses, etc. The value of scoring systems is they can be used to quickly compare the relative merits of different street segments, transportation networks, or other areas of analysis. This is an easy way to evaluate various outputs based on alternative design strategies.

MRMPO's Project Prioritization Process

MRMPO's Project Prioritization Process is a tool that has been developed to score transportation projects,

Hall's Walkability Index and Alternative Walkability Measures

Hall's Index

- Traffic Speed
- Street Width
- Presence of On Street Parking
- Sidewalk Width
- Intersection Distance:
- Pedestrian Amenities
- Building to Height Ratio
- Land Use Mix
- Façade Design
- Transit and Bicycle Features

Alternative Index Measures

- Walkscore, Bikescore, and Transit Score
- Presence and Quality of Street Trees
- Presence of Traffic Calming Features
- Amount of Public Art
- Condition of Sidewalks
- Condition of Buildings
- Number of vacant or uncared for properties along the street segment.

Source: Hall and Associates (n.d.)

using a set of objective, quantitative performance measures (MRMPO, 2014). The tool was primarily developed to score short term Transportation Improvement Plan (TIP) projects, but can also be used to evaluate transportation projects for how well they address a number of key goals. These goals include improving quality of life (air quality, safety, etc.), improving mobility (for all users), and increasing economic activity and growth.

The goals are each tied to specific performance measures that rely on traditional roadway performance measures, demographic information, and a few "in-house" metrics that MRMPO has developed.

Overall, the PPP is effective for evaluating area wide projects in terms of how well they address region wide transportation goals. However, the methodology does not provide detailed analysis of specific roadway projects including the tradeoffs with different design details or the addition of specific Complete Streets elements.

LEED ND

Although not a transportation planning methodology, LEED's standards for neighborhood development (LEED ND) provide guidance on how streets in new developments should be laid out to maximize connectivity, walkability, and sustainability (LEED ND). Like LEED's standards for buildings, these standards provide guidance and incentives to developers to create efficient transportation networks within their developments. The easy to understand metrics are tied to research on smart growth and sustainable transportation.

The guide has a scoring system that awards "credits" in various categories for different design components that promote these goals. For example, developments that have a broad mixture of land uses are awarded more points than those with single uses.

Walkability Indices

Scoring systems to measure walkability from an urban design standpoint have also been developed. These seek to measure aspects of the urban environment that are important for creating pedestrian friendly places. Unlike pedestrian LOS indicators, walkability indices seek to address more subjective measures of pedestrian comfort, safety, interest, and destination choice. These methodologies acknowledge that pedestrians have a complex range of needs that vary among individuals. However, there are a few key indicators that have been shown to be important to most users and can be compiled to create a walkability index for an area.

One walkability index methodology is *Hall Planning and Engineering's Walkability Index.* This index measures 10 physical factors that can be compared using a semi-quantitative scoresheet system that scores street segments on a 0-100 point system (please see box at left). Alternative features can also be considered in this system given the unique local context of an area.

The strength of this system is that it relates basic, objective physical design features to actual pedestrian perceptions of comfort, safety, and interest. It also synthesizes existing variables that are traditionally inventoried in transportation projects to produce a score that can be used to compare different roadway segments.

Pedestrian Environmental Quality Index

Another methodology that catalogues pedestrian features along a street to produce an index score is the Pedestrian Environmental Quality Index (PEQI).[19] This scoring system combines a checklist with a semi-quantitative ranking system to score five areas: intersection safety, traffic, street design, land use, and perceptions of safety and walkability. The PEQI system catalogues many of the same features as road safety audits, and has overlap with various walkability indices. Additional indicators that are used in the PEQI assessment include:

- Rating of perceived walkability: visual attractiveness, safety, odors, noise, and overall walkability
- Presence of traffic calming features
- Crossing times
- Land uses

The methodology is unique in that it uses a smartphone app to collect data in the field. The app allows multiple users to collect data on existing conditions along roadway segments and at intersections (COEH UCLA, n.d). The compiled data can then be uploaded automatically and combined with other users' data to produce a PEQI map for a surveyed area. Such a map can reveal street segments that are less walkable than others, or point to gaps in the pedestrian network.

Before and After Studies

Before and after studies refer to various methodologies that seek to compare performance before and after an intervention is applied. Unlike checklists or ranking systems, these studies are longer term, longitudinal, and seek to measure the *outcomes* of a project. They usually rely on several different indicators that can be monitored over time, such as changes in traffic volume, changes in crash rates, changes in speed, and changes in route choices among users. Although there is no standard methodology used to measure success, the strength of these studies is that they can reveal which interventions have had the most noticeable impact using both quantitative, objective indicators, and through ongoing qualitative assessment.[20]

It is worth pointing out that although studies of *before* conditions are common, *after* studies are much rarer, even if they are just as valuable. For example, $50,000 was spent on the initial Zuni Road study to collect baseline data and develop a conceptual design alternative (Vector Engineering, 2011). Although this project has yet to be implemented, it will be extremely beneficial to the City of Albuquerque if an analysis of Zuni Road is carried out after the street is reconfigured. An after study could help reveal if challenges and issues pointed out in the initial transportation study have been successfully addressed.

One before and after study that looked specifically at a Complete Streets project in Albuquerque is the *West Central Complete Street Test Project Performance Monitoring Study*. This study looked at the effects of a

[19] A Bicycle Environmental Quality Index (BEQI) has also been developed to measure features of the bicycling infrastructure.

[20] A great compendium of before and after projects was compiled by the University of Oregon's Sustainable Cities Imitative: http://www.rethinkingstreets.com/download.html. A more recent study was conducted by the National Complete Streets Coalition as well: http://www.smartgrowthamerica.org/documents/safer-streets-stronger-economies.pdf

NYC Sustainable Streets Performance Metrics

Safety
- Crashes
- Traffic Speeds

Access/Mobility
- Traffic Speeds
- Parking Utilization
- Traffic Volumes
- Pedestrian, Bicycle and Transit Counts

Economic Vitality
- Number of businesses, employment
- Retail sales

Public Health
- Rates of Physical Activity
- Rates of obesity, asthma, etc.

Environmental Quality
- Air Quality
- Water Quality
- Urban Heat Island Effect
- Energy Use

Livability
- User Satisfaction
- Public Space Usage

Source: NYC DOT, The Economic Benefits of Sustainable Streets (2013).

pilot road diet on West Central between 8th Street and San Pasquale/Lomas that reduced the number of lanes from 4 to 2, and added a central turn lane and bike lanes. The report collected baseline data before the road diet was implemented, and then compared this data 1 year later after the project had been completed. Generally, changes along the corridor were positive after the intervention, although some residents expressed concerns about increased congestion and wait times (City of Albuquerque, 2012).

Public Life Studies

One subset of before and after studies are public life studies. These refer to a broad spectrum of observation methods that are designed to better understand how people intact with the built environment. This can mean simple counting how many people walk through an area, to observing how people use public furniture depending on its arrangement (Gehl and Svarre, 2013). These studies can reveal interesting user behaviors that can then be used to inform better urban design. For example, one study by Jan Gehl researched how pedestrians respond to different façade details. It was found that people are more likely to stop and look at active, interesting façades with many doors, windows, and detail than blank, inactive façades (Gehl and Svarre, 2013: 104).

Several public life study methods are outlined in Jan Gehl's (2013) recent book, *How to Study Public Life*. For the most part, Gehl's methods rely on simple field observations to count, track, and map activity before and after a design intervention (Gehl and Svarre, 2013). Usually, this involves manual counting, but analysis may also be performed using video studies[21], automatic tracking (e.g., with smartphone apps), or through inventories. Such analysis, performed before and after a design intervention, can show how that intervention has enabled (or disenabled) new types of user behavior.

New York City's *Sustainable Streets Initiative*

New York City's Department of Transportation has taken a more comprehensive approach to before and after studies, and reviews the performance of roadway projects each year as part of its *Sustainable Streets Initiative.* This initiative was started in 2008 to help support a strategic vision of New York's streets as multi-modal, safe, and complete (New York City DOT, 2009). As part of this initiative, NYC DOT releases a benchmarking report each year that highlights successful projects. This report is easy to understand, graphically appealing, and uses a variety of performance measures to communicate the transformative changes happening as the result of roadway improvement projects. These performance measures rely on six indicator areas, each with several easy to understand performance measures that can be applied to individual roadway projects or citywide initiatives (see box at left).

As part of its sustainable streets initiative, the NYC DOT has released several additional reports addressing the performance of the city's roadways. These include *Measuring the Street* (2012), the *New York City Street Design Manual* (2009), and *The*

[21] William Whyte's pioneering video studies of urban life in New York City is a well-known example. For more, please see, *The Social Life of Small Urban Spaces* (1980).

Economic Benefits of Sustainable Streets (2013). Together, these documents support a holistic vision of New York City's streets as vibrant public spaces.

CHOOSING INDICATORS

The overview of existing evaluation systems in place shows there a variety of methods to evaluate roadways. Most rely on standard indicators such as Vehicle Miles Traveled (VMT), Average Daily Traffic (ADT), and crash statistics. These are all standard measures collected by transportation planning agencies. Hence, there are routine data collection practices in place and measures can be compared across cities to reach useful conclusions.

Additional methodologies that use newer, more exotic indicators can also be useful when evaluating transportation projects. However, choosing the best methodology to employ is an art. Often, thinking about the *usefulness* of the indicator to answer specific questions may be the best way to determine which measures to use. Depending on the project, some questions to ask about the usefulness of an indicator include:

1. Does the indicator provide a way to *measure the success of the project* and evaluate the goals and objectives of the project have been met? Useful indicators provide a way to show whether interventions have successfully addressed issues and fulfilled project goals.
2. Is there *available data* to measure the indicator accurately? Is there an existing dataset that can be used, or will new data have to be collected? How long will it take to acquire a new dataset if one does not currently exist?
3. How *complex is the indicator*? The complexity of analysis varies depending on the analysis methodology and the complexity of the project. In general, more complex models require more data, but are more accurate at predicting outcomes (National Complete Streets Coalition, 2015). However, this increased accuracy has a crucial tradeoff – as models become more complex, they also become more data intensive, which requires more time and computational capacity to produce useable results. This in turn can make the models harder for non-specialists to evaluate. Simpler models, that rely on fewer inputs, are often quicker to employ and can provide useful, if less accurate, results.
4. Can the indicator be easily *revaluated* to reveal positive and negative changes? Will new data have to be captured during reevaluation, or this there ongoing data collection? How long will it take for changes to be seen with this indicator?
5. Can the indicator *be understood by non-specialists*? Is it easy to share the findings of the model/methodology in a manner that makes sense to the general public? This consideration is important because directly communicating the benefits of a project to a non-specialized audience helps broaden support for future efforts.
6. Is the indicator *supported by empirical evidence and research* (i.e., is it objective)? Has the indicator been used as a practical tool to help better inform projects? Although having objective, empirical indicators is a worthy goal, indicators run on a spectrum from clearly objective (measured the same by everyone) to more

subjective (open to disagreement and interpretation).[22]

Five Key Indicator Areas

In an attempt to provide a comprehensive framework that addresses the dynamic, multifunctional nature of roadways, this document looks at five indicator areas that each utilizes several performance measures. Each indicator area is designed to address a central concern of every complete streets transportation project.[23] Using these indicators can help inform a project's scope, priorities, and ultimate design. They can also help lead to a shift in planning thinking and practice that embraces a more holistic approach that is about accommodating all users equitably, and not just about moving cars.

The list of measures includes standard quantitative and qualitative measures such as level of service, travel times, and crash rates, while also incorporating newer measures such a multi-modal level of service (MMLOS), walkscore, and stormwater runoff. In addition, there are some "homebrewed" measures such as the pedestrian composite index (PCI) and a modified Walkability Index. The idea is to provide an overview of performance measures that can be used, their basic data needs, and their overall usefulness in different transportation planning contexts.

Indicator Considerations

One important limitation to keep in mind is that these measures are mostly for evaluating *street segments,* not transportation networks or area-wide projects. This limitation is due to the fact that the impacts of individual users are spread across the entire transportation network, and cannot be attributed to single street segments. Certainly denser, better connected networks help lessen driving distances and enable more walking, bicycling and transit use, but the cumulative effects of these changes are hard to evaluate at the scale of the individual street. Usually, this type of analysis is only meaningful at the neighborhood or city level, and can only be evaluated using sophisticated modeling programs. As such, these measures do not directly address larger network or area wide indicators such as vehicle miles traveled (VMT) or changes to emissions or energy use even though these indicators are extremely important.[24]

An additional consideration for these measures is that they are mostly *simple indicators* that do not involve comprehensive modeling or rigorous data collection. Most involve simple input variables, such as Average Daily Traffic (ADT) and sidewalk width. As such, they do not have the accuracy of more sophisticated modeling techniques. However, they are more feasible to use because they involve less data collection and single calculations.

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[22] Reid Ewing addresses this question by arguing that there are objective qualities to design (street dimensions, widths of sidewalks, presence or absence of features), and subjective reactions to these features. Subjective reactions to objective conditions may vary, but we can still study how the majority of people will respond to different design elements (Ewing & Clemente, 2013).

[23] These indicator areas follow NYC DOT's Sustainable Streets indicator areas, but are adapted to the Albuquerque Metropolitan Region context.

[2424] The PPP addresses many of these larger issues on an area- or neighborhood-wide basis.

Table 3.1 Indicator Areas and Associated Performance Measures

Area	Measures	Scale(s)
Accessibility	Auto LOS: Traffic Counts, Peak Volumes, V/C	Street/Intersection
	Multimodal LOS (MMLOS)	Street
	Travel Times: Travel Time Index, Average Traffic Speeds	Street
	Change in Travel Patterns	Area
	Mode Utilization: Pedestrian Counts, Bicycle Counts, Transit Ridership	Street/Area
	Connectivity Measures: Block Length, Intersections per Square Mile	Area
Walkability and Urban Design	Walkscore, Bikescore, Transit Score	Area
	Walkability Indices	Street
	Walk Times	Area
	Pedestrian Composite Index	Area/Street
	User Satisfaction	Area
Safety and Security	Crashes and Crash Rates	Street/Area
	Average Traffic Speeds	Street
	Crime Rates and Perceptions of Crime	Street/Area
Land Use Integration	New Businesses	Street/Area
	Business Sales	Street/Area
	Private Investment and Development	Street/Area
	Activity Density	Street/Area
	Utilization of On-Street Parking	Street
Sustainability	Impervious Surface Coverage	Street/Area
	Street Trees Planted, Use of Native Vegetation	Street
	Sustainable Materials Use and Energy Efficiency	Street

Finally, these indicators are classified by input, output, and outcome categories, to differentiate the variables used, and at what stage in an evaluation system they can be measured, evaluated, and used as an indicator. Indicators are also tagged by projects they may be useful for, and at what scale they become relevant (see box at left). A full matrix of these indicators and their requisite variables, scale, and outputs can be found in the appendix.

ACCESSIBILITY & EFFICIENCY

Accessibility and roadway efficiency are two of the most common indicator categories used to gauge a roadway's performance. Transportation planning has slowly moved from a "*mobility model*" to one focused on *accessibility* (Litman, 2014). The new paradigm places its emphasis on enabling *people* to reach desired services and activities, not on the physical challenge of moving the most automobiles the most quickly (Litman, 2014). This paradigm shift is right in line with Complete Streets principles, as it expands the range of transportation planning concerns to address multimodal accommodations, ways to maximize accessibility, increased awareness of safety issues, an increased focus on connectivity, and ways to encourage new behaviors through demand management.

Motor Vehicle Level of Service Measures

Measurable Outputs: motor vehicle level of service; intersection delay; vehicle to capacity ratio; peak traffic volumes

Scale: street/intersection

Relevant Projects: most projects, especially reconstruction projects and corridor studies.

Motor Vehicle Level of Service (LOS) is a standard metric used to measure a roadway's performance in terms of the amounts of congestion and delay. LOS values are rated on a semi-qualitative scale from "A" (best) to "F" (worst). Each ranking corresponds to both capacity levels of the roadway, average speed, and drivers' perceptions of comfort and delay. Although higher LOS ratings (above C) are possible, they are often not always achievable along urban roadways with a steady flow of vehicles. This is especially important to consider during peak periods, when roadways experience the most traffic and delay. Transportation engineers have designed roadways to achieve high levels of service at peak periods, meaning the roadways are often underutilized during non-peak hours.

Overall, LOS provides a useful tool to quantify levels of congestion along roadways. However, various studies have shown that LOS models do not always accurately predict users' own perceptions of comfort and safety. Other methods for measuring congestion and traffic conditions include looking at the *vehicle to capacity ratio* of the roadway (physical lane capacity under ideal conditions to actual traffic volumes); *peak traffic volumes* during morning and evening peak periods; and *intersection delay*.

Travel Times and Average Speeds

Measurable Outcomes: travel time index; average travel speeds; incidents of speeding; transit travel time

Scale: street

Relevant Projects: lane reduction; speed reduction; extensive corridor reconstruction projects

Related to Motor Vehicle LOS are several useful measures that look at how well the roadway supports mobility. One is the travel time index (TTI), which measures differences in free flow speed to actual speeds observed along a roadway. Lower actual speeds ay correspond to higher levels of congestion, and roadways that are approaching capacity.[25] Additional indicators that may be measured include *average speed* before and after an intervention, and *transit travel times*. It can also be useful to measure before and after speeds to gauge the *incidents of speeding*. This is an important indicator if a

[25] MRMPO has developed an online tool (TAQA) that allows users to compare travel times along different roadway segments. This makes it easy to see how congested a roadway segment is, and whether the roadway is supporting traffic flow at its design speed.

reconstruction project was designed to calm traffic or lower speeds for safety reasons.

Multi Modal Level of Service (MMLOS)

Measurable Outputs: bicycle level of service; pedestrian level of service; transit level of service

Scale: street

Relevant Projects: most projects, especially reconstruction projects and corridor studies.

Several multi-modal level of service (MMLOS) models have been developed in the past decade to evaluate how well roadways accommodate all user groups. These include various models that seek to measure the level of comfort and safety of pedestrians, bicyclists and transit users in addition to motorists. Often these tools require additional planning studies and data collection that focus on pedestrian, bicyclist, and transit specific features of the roadway to calculate a MMLOS score. As with motor vehicle LOS, scores are based on an A to F scoring range, with lower scores (e.g. A or B) indicating a higher LOS.

MMLOS models vary, but updated MMLOS models are included in the Highway Capacity Manual (HCA), the Transit Capacity and Quality of Service Manual, and Florida DOT's Quality/Level of Service Handbook. A report produced by the Transportation Research Board entitled *National Cooperative Highway Research Program Report 616: Multimodal Level of Service Analysis for Urban Streets*, synthesizes these different models and shows how they may be applied to urban roadways.

Bicycle Level of Service

There are several methodologies to calculate bicycle level of service. Most of these measure variables such as presence of a bike lane, bike lane width, traffic speed and volume, presence of on-street parking, number of conflict points, and pavement condition. These measurements can be used to calculate LOS for bicycling infrastructure along streets, as well as along multiuse paths. As can be expected, wider bike lanes are correlated with higher levels of service, although the presence of higher vehicle speeds (or heavier vehicles) may lower this score. Overall, bicycle level of service scores can be used to ensure bicycling facilities are adequate to fit the context of the street (e.g., by showing wider bike lanes should be used on streets with higher traffic volumes or on-street parking).

Transit Level of Service

On-time transit performance is a key factor in transit level of service measures. This includes the frequency, reliability, service hours, and passenger loads of specific routes. In addition, current transit LOS models seek to not only measure the transit service quality, but also the quality of the environment these services operate in. These models take into consideration bust stop amenities, distance between stops, and stop security.

Pedestrian Level of Service

Various models have been developed to calculate pedestrian level of service based on studies of stated pedestrian preferences and actual behavior. These models often take into consideration basic design features such as sidewalk width, traffic speed and volume, pedestrian volume, presence of obstructions, and number of conflict points (e.g., driveways). Unlike vehicle level of service measures, pedestrian level of service is not necessarily dependent on volume or capacity considerations such as spacing between pedestrians, pedestrian walking speed, or delay at intersections. Other physical design elements are just as important and can lead to higher or lower pedestrian LOS scores. Like bicycle LOS, pedestrian LOS metrics allow pedestrian facilities to be sized correctly to the context of the street.

Mode Utilization

Measurable Outcomes: change in auto trips; bicycle trips; pedestrian trips; transit ridership; utilization of on-street parking

Scale: street/area

Relevant Projects: most projects, but especially projects that add multimodal components or expand transit service.

Creating targeted transportation investment in high activity areas can help expand mode choices for all users, which allows people the opportunity to change their transportation behaviors. These modal shifts can be seen with an increasing percentage of trips being taken by pedestrians, bicyclists and transit riders in response to these expanded options. Such changes can be measured by counting the number of pedestrians, bicyclists, transit users, and motorists before and after projects are constructed. A change in the utilization of on-street parking can also be measured before and after a project.[26]

Traffic Pattern Shifts

Measurable Outcome: changes in traffic volumes on adjacent streets

Scale: area/street

Relevant Projects: lane reduction; speed reduction; extensive corridor reconstruction projects

After roadway reconstruction projects are completed, traffic patterns may shift as drivers take advantage of expanded capacity or find alternative routes that optimize their travel times. Therefore, for any roadway project that reduces capacity, or slows speeds, it is helpful to see if traffic has shifted to alternative routes. This can be done with traffic modeling before an intervention, or by looking for shifts in travel behavior on adjacent streets after the project is completed.

Connectivity Measures

Measurable Outputs: block length; intersection density

Scale: area

Relevant Projects: area-wide assessments; new roadways; master plans

Street connectivity is a crucial measure of network performance and has broad implications on how well individual streets function within the larger transportation network. There are numerous benefits to well-connected networks: they ensure efficiency, reduce congestion, reduce vehicle miles traveled, create direct routes for multiple users, encourage

[26] Trip generation models can also be used to project the expected number of motorists or transit users that will result from a project, although methods for calculating increased pedestrians and bicyclists are still being developed.

walking and bicycling, and provide more direct access to businesses.

Intersection Density

Intersection density is one way to measure the relative connectivity of a road network. It describes the number of true intersections per unit area (usually square miles). This is a useful measure of how well connected a road network is because it excludes dead end streets (such as cul de sacs) and indirectly measures average block length. For example, gridded networks generally have higher scores than traditional single-family subdivision layouts, but this also dependent on average block length and access points from major roadways to local developments. Allan Jacobs points to 150 intersections per square mile or more as being favorable for creating walkable places (Jacobs, 1993).[27] Intersection density can be calculated by counting the number of true intersections in a given area, and dividing this by the area size, which is usually converted to square miles.

Block Length

As mentioned in Chapter 2, block length and block design are crucial for connectivity and network legibility. Having shorter block lengths directly corresponds to more intersections per square mile, which increases network density. This can disperse traffic across a wider network, which lowers traffic volume on individual streets. Reid Ewing recommends block lengths of no more than 600 feet to promote walkability, with Jeff Speck recommending even shorter block lengths on the order of 300 feet (Ewing, 2013; Speck, 2012). Block length can be calculated by measuring individual blocks and averaging their lengths, or by dividing a segment's length by the number of blocks along that segment.

WALKABILITY & URBAN DESIGN

Walkability, as discussed in Chapter 2, is another key factor to consider when evaluating complete streets projects. As outlined above, walkability has as much to do with urban form as it does about the transportation network. Therefore, considering ways to measure the amenities in an area, the overall pedestrian network, and the street's urban design elements, are all essential when evaluating complete streets projects.

Urban Network Analysis

Measurable Outputs: Walkscore, Bikescore; Transit Score; travel distance by mode; pedestrian composite index (PCI)

Scale: area/street

Relevant Projects: most projects, especially those with a multimodal component.

Several *network analysis* methodologies have been developed to measure connectivity and route choice among users of a network. These methodologies can also reveal gaps in a network, which can show where investment may be most beneficial. A few proprietary models include *Walkscore* (see below) and *Space Syntax.* Both have been developed to assess the likely

[27] Jacobs lists several cities and their average intersections per square mile. Venice, with 1725 per square mile, has the most, with a business complex in Irvine, CA having only 15 (Jacobs, 1993: 262).

routes that users will take, although their emphases are different (Space Syntax, 2015).[28]

Walkscore

One measure of walkability that has gained widespread use is *Walkscore*, an online tool that evaluates the number of walkable destinations in an area and relates this to street connectivity (Walkscore, 2015). Walkscore works by analyzing walking routes to nearby amenities, and awarding points based on the distance and mixture of amenities (stores, schools, restaurants, banks, etc.) to a given location. Fewer points are awarded to further locations, based on a decay function that does not award points for amenities that are further away than a 30 minute walk (Walkscore, 2015).[29] Overall, the tool provides a quick, easy way to see which locations have a mixture of urban amenities nearby, and a well-connected pedestrian network.

Travel Distance

MRMPO uses the TRAM modeling tool to compare the travel distance of various modes based on the network design. This tool can reveal the relative efficiency of a roadway network to support multiple users. For example, the TRAM model can be used to find the areas that can be reached in five minutes from the Alvarado Transportation Center by walking, bicycling, driving, or taking the bus. This allows for quantifying the number of people who can access certain services, how many services fall within a certain transportation shed, or how much ground a person can cover in a given time using various modes. TRAM can be used to contrast current and proposed road networks to identify alignments that provide the most access different users by mode.

Pedestrian Composite Index

Another way to evaluate the walkability of a street is to see the number of pedestrian generators and deterrents along the street. MRMPO employs the Pedestrian Composite Index (PCI) as a way to measure these variables. The index looks at pedestrian generators (schools, commercial land uses, transit stops) as well as pedestrian deterrents (number of crashes, traffic volume and speed) to compare roadways relative accessibility to pedestrians. This can help reveal streets that have both high pedestrian generators, as well as a number of deterrents

As a methodology, it is useful because it can point to streets that could benefit the most from increased investment in pedestrian infrastructure, as people are already using these streets, but could be better accommodated.

Walkability Indices

Measurable Outputs: walkability index score; pedestrian environmental quality index; bicycle environmental quality index

Scale: street

Relevant Projects: most projects, especially those with a pedestrian component.

As outlined above, there are several methodologies that can be used to score street segments based on factors that affect walkability or lend themselves to

[28] http://www.spacesyntax.com/our-approach/our-unique-methodology/)

[29] The website now also includes a transit score and a biking score for locations, using a similar methodology.

good urban design. Such scores can be used to compare street sections and provide an easy way to see how walkable a street segment may be.

User Satisfaction

Measurable Outcome: user satisfaction survey results

Scale: area/street

Relevant Projects: reconstruction projects, corridor studies and sector/master plans

User satisfaction surveys are an invaluable tool to gain insight into the qualitative, subjective reactions of users to design interventions. These surveys can show how well the intervention has worked for all users and can reveal hidden, unstated preferences of users. It may also be used to explain why users act in an unexpected (or novel) way to a change in the roadway. And, because local governments are engaged with protecting the public interest, understanding constituents' needs is a matter of good governance.

SAFETY & SECURITY

Safety is increasingly being seen as a uniting cause among transportation engineers, planners, citizens, and public officials to construct complete streets (McCann, 2013). Many cities have begun to invest heavily in improving pedestrian safety, and have set ambiguous goals for reducing pedestrian crashes (Maciag, 2014). For example, New York City has set an ambiguous "Vision Zero" campaign that envisions zero pedestrian fatalities and injuries from crashes with automobiles (NYC DOT, 2015).

As agued by Jan Gehl, feelings of security are extremely important for creating active public spaces. Residents of an area are less likely to use certain spaces if they are perceived to be unsafe, even if rates of actual crime may be low. As with crashes, the causes of crime are complex; however, one the types, frequency, and severity of crimes in an area are understood, measures can be taken to mitigate their effects.

Crashes and Crash Rates

Measurable Outputs: number of crashes; crash rate; crash severity

Scale: street

Relevant Projects: most projects, especially those that have a safety component.

Evaluating crash statistics along existing roadways is important to understand where, why, and how crashes along different roadway segments occur. These statistics can reveal areas with higher overall crash rates, which can then be attributed to specific design features of the street that contribute to lower user safety. Such calculations are especially important for improving intersection safety, where the majority of accidents occur.

One method to evaluate intersection safety is to compare the number of crashes at each intersection to the volume of cars passing through the intersection in a given time period. Comparing these two factors generates a crash rate, showing the relative likelihood of a crash happening at a given intersection. This can be used to measure the relative safety of an intersection for motorists, pedestrians and bicyclists by comparing reported crashes from all users.

Security

Measurable Outcomes: crime rate; crime severity; community perceptions of crime

Scale: area/street

Relevant Projects: projects where crime is identified as a community concern or issue that can be alleviated through changes in the built environment.

Although perceptions of crime and security vary, one way to measure security in an area is to evaluate crime rates employing a similar method to evaluating crash rates. Such an analysis can map hotspots of crime, and compare the relative number of incidents to rates of crime in other neighborhoods. Tracking the type, severity, and frequency of crimes, as well as community perceptions of security, can show which areas would benefit from crime prevention strategies.[30]

LAND USE COMPATIBILITY & ECONOMIC ACTIVITY

Roadways are embedded in a transportation and land use matrix that is mutually supportive. Changes in land uses (e.g., increased densities, more housing, more retail space) can generate increased trips from pedestrians, motorists, transit users, and bicyclists. These in turn can create positive feedbacks, leading to increased business sales, new development, new businesses, expanded public interactions, increased property values, and a more accessible public realm. Similarly, disinvestment from adjacent land uses (higher vacancies, dilapidated buildings, lower densities) can lead to fewer trips from all users.

Roadways, by supporting the users and activities of their adjacent land uses, can help foster positive feedbacks that lead to a stronger integration between these land uses and the transportation network. Integration means increasing the choices available to all users by ensuring the roadway supports a diverse range of modes, activities, and travel patterns. For example, transit investment (such as a new BRT route) can be added along a corridor with higher densities and fewer car owners to enable these users to reach more destinations more quickly. Such investment can lead to increased ridership, more pedestrian activity around transit stops, and higher business sales, creating a virtuous cycle of increased activity and investment. Other positive feedbacks may be initiated by adding on-street parking, investing in bicycle infrastructure, facilitating freight movement, and improving walkability in key areas.

Generally, these changes happen incrementally over time and at various scales, making it hard to evaluate the effects of a single transportation project on surrounding land uses. Often, effects may lead to only marginal improvements instead of massive new investment. Overall, improvements to network efficiency (less congestion, increased safety, fewer VMT) are easier to calculate than projects that seek to improve access (increased mode choice, improved

[30] Although beyond the scope of this document, Crime Prevention Through Environmental Design (CPTED) is one approach that has been used to increase security in an error through proactive design practices that address crime. These include creating more transparent edge spaces, putting more eyes on the street, increasing visibility of spaces with lighting at night, and more ().

transit service). However, there are several proxy measures to evaluate the potential of a redevelopment project to support surrounding land uses.

New Development Projects

Measurable Outcomes: new development projects; change in vacancy rates; change in density; change in land use mix; change in activity density

Scale: area/street

Relevant Projects: projects with an extensive land use component; large scale transit projects; corridor and sector plans

When addressing issues with land use or economic development, roadway projects can be evaluated to see how well they stimulate increased investment along a corridor. Investment in roadway projects may spur new development along a corridor by increasing investment potential and market attractiveness (National Complete Streets Coalition, 2015; NYC DOT 2013). Such an evaluation can show whether the investment of public funds has led to a corresponding response of private investment that is cost-efficient (Garvin, 2002).

For example, new Bus Rapid Transit routes have been shown to increase investment along corridors, especially those that connect major job centers (Hook et al., 2013). New development can also be seen in decreased *vacancy rates*, increased *building permits*, and the number of *new businesses* along the street. It may also be inferred indirectly through *changes in density* or an increased *land use mix*.

Increased Economic Activity

Measurable Outcomes: change in sales dollars; increased business investment; increased property values; increased tax revenues

Scale: area/street

Relevant Projects: projects with an extensive land use component; large scale transit projects; corridor and sector plans.

Along with new development along a corridor, existing businesses may see an increase in sales and land values, which may in turn lead to higher tax revenues. It may also incentivize or spur private business investment additional public amenities or building upgrades (New York DOT, 2013).

Business Sales

Local businesses may see *increased sales* along streets that redeveloped to support additional modes. For example, studies have shown that the addition of bike lanes and/or on street parking can lead to increased retail activity and sales.

Business Investment

Increased sales or public investment in the street may lead to a corresponding increase in *business investment.* This can take the form of investment in façade upgrades, additional public amenities, expansion of floor space, or the introduction of new products or services.

Land Values and Tax Revenue

Land owners may see *increased property values*, which is usually beneficial and may lead to further reinvestment.[31] Roadways may increase property values of adjacent properties. For example, walkability improvements, including the installation of street streets, better lighting, and wider sidewalks, have been shown to increase property values along these streets as compared to streets without these improvements (Leinberger, 2012). Improvements in property values can lead to *increased tax dollars* from properties being assessed at higher values.

SUSTAINABILITY

A fifth indicator area to address is the street's overall environmental sustainability. When it comes to evaluating the sustainability of the street design itself, is harder to know which design elements are most environmentally friendly. Certainly, many of the performance measures listed above are also related to sustainability. For example, increasing the number of people biking, walking and taking transit lowers VMT, which in turn lowers emissions and energy use (Growing Cooler). But, these are area-wide outcomes that, although enabled by individual streets, can only be understood as cumulative benefits to the entire transportation network.

When it comes to the individual street, however, there are certainly design elements that can have a measurable effect on the sustainability of the street. These are most strongly related to: storm water runoff, water quality, the type of construction materials, the benefits of street trees, and energy use as it relates to the street's infrastructure. Such considerations require looking at the integration of green infrastructure along the street, the use of smart streets technologies, and an overall paradigm shift towards *ecological design*.[32]

Impervious Surface Coverage

Measurable Outputs: stormwater runoff quantity; impervious surface coverage

Scale: area/street

Relevant Projects: projects that add additional vegetation, landscaping, or green infrastructure

Roadways make up a large amount of the impervious surface coverage in cities, which has many negative environmental effects including: issues with increased stormwater runoff due to lower rates of water infiltration, faster runoff rates, and water quality issues from non-point source pollutants picked up along the roadway (Watershed Management Group, 2010). In addition, impervious surface coverage contributes to the "urban heat island effect" which leads to increased temperatures in the city and a corresponding rise in energy use for air conditioning. Impervious surface coverage and its effects can be simply measured by the ratio of imperious surface coverage (roadways, sidewalks) to pervious surfaces (landscaping, tree canopies, and porous surfaces). Stormwater quantity can then be measured using several different methods, including the "Rational Method" (Quantity = Runoff Coefficient(s) x Rainfall

31 Gentrification is a side effect of increased property values, which along with higher property taxes, can sometimes lead to the displacement of established residents or businesses. Overall, however, increased property values benefit land owners in a positive way that leads to increased (sometimes disruptive) investment.

32 A useful introduction to ecological design is provided by Nancy Rottle in her book *Ecological Design* (2010).

Intensity x Area) or more sophisticated methods such as TR 55.

Use of Native Plants, Vegetation and Green Infrastructure

Measurable Outputs: number of street trees planted; coverage of native plants; green infrastructure features installed

Scale: street

Relevant Projects: projects that add additional vegetation (e.g., street trees), landscaping or green infrastructure

Quantifying the amount or number of street trees and new native plants is a useful measure to investment in attractive landscaped areas that also provide ecological services.

In a recent book on street design, Dover and Massengale (2014) argue for the importance of planting a single tree species along the street and choosing species that form majestic canopies. This is due to the fact that a single species creates clear definition for the street, as well as a unified identity. Large canopies in turn allow for more shade, and also capture more stormwater runoff, which helps with water quality. Although the size of some tree species may be limited by lack of water and maintenance issues in the Southwest, there are native or hybrid species that can be used as street trees and which can form larger canopies. There are countless other native plants that may be used in addition to street trees that may also be planted in landscape buffers or the median.

Sustainable Materials & Energy Efficiency

Measurable Outputs: use of sustainably sourced materials; use of energy efficient lighting;

Scale: street

Relevant Projects: new roadway construction; retrofit projects

Measuring the investment is sustainable construction materials and roadway infrastructure can highlight best practices in reducing energy consumption, materials use, or waste production. Urban street lights, for example, can be measured in terms of its energy efficiency and use of recycled materials in construction. Different lighting systems can then be rated to determine the most energy or resource efficient technology that should be installed along the street.

Gold Street Parklet, Source: MRCOG

4 CHECKLIST

Chapter 4 Complete Streets Checklist

Taking into consideration the plethora of performance measures available, it is clear that some are easier to measure than others. Some involve more complicated analysis or require larger amounts of data, which are often unavailable. Still others require the passage of several years to be evaluated properly.

To help facilitate a quick, easy, and effective analysis of roadway projects, this document involved the creation of a *complete streets checklist* – an excel spreadsheet that allow for centralized data collection and analysis. This checklist combines some of the features found in the checklists and evaluation tools discussed in Chapter 3, but applies them to the specific needs of MRMPO.

METHODOLOGY

The checklist is based on the input, outputs, and outcomes model. In essence, the checklist is a single place to gather *inputs* (existing conditions, indicators, etc.); brainstorm potential *outputs* (new design features); and point the way to a long term evaluation of *outcomes*. Each step is designed to simplify data collection and analysis, all while keeping in mind the complexities of many roadway projects.

Unlike MRMPO's project prioritization process, this checklist does not rank projects using a scoring system. Instead, it allows for the comparison of *conceptual design alternatives*[33] of street segments, which can be used to help inform later design recommendations. The checklist, as an integrated tool, has several additional objectives:

1. To collect a baseline inventory of existing conditions that rely on readily available data. This helps consolidate data collection into a single place.
2. To allow for a basic evaluation of roadway performance using existing conditions and a list of priority considerations.
3. To record basic project concerns and issues – for example complete streets gaps along existing segments or specific issues raised by the community.
4. To allow for the comparison of different conceptual roadway designs by providing a simple

[33] Conceptual design, as defined here, refers to designs that outline general goals, priorities and possible alternatives. They are not to be seen as exact specifications of what can or should be built.

palette of design options, cross section comparison, and cost estimates.
5. To point the way to a long term evaluation strategy using accessible, replicable performance measures.
6. To act as a discussion point for roadway projects that brings a holistic view to streets as being a form of public infrastructure that ideally promotes people movement, economic activity, and sense of place.

Data Sources

Several data sources were consulted to construct the checklist. In addition to the performance measures covered in Chapter 3, the checklist relies on the urban design theory discussed in Chapter 2. Design elements were compiled from various design guidebooks, including NACTO's *Urban Streets Guide*, ITE's *Designing Walkable Urban Thoroughfares*, Allan Jacobs' Great Streets criteria, and other best practices. Cost estimates for complete streets design features were taken from Pedbikesafe.org – an online clearinghouse of pedestrian and bicycle safety countermeasures produced by the Federal Highway Administration.[34] Additional methodological approaches and sources are addressed in the checklist directly.

Checklist Limitations

The checklist allows for the comparison of roadway projects – specifically how they are related to complete streets, walkability, and urban design. Although useful in some cases, the tool may not be relevant to all roadway projects. One limitation is that the checklist was designed to evaluate *street segments,* not intersections or area-wide projects. This limitation is due to the fact that the impacts of individual users are spread across the entire transportation network, and cannot be attributed to single street segments.

There are several other limitations to the checklist that are worth noting:

1. To be used effectively, the checklist requires a *baseline inventory* of existing conditions. If data is not available, default values can be used, but the accuracy and usefulness of the checklist suffers accordingly.
2. As with any tool, the usefulness of the checklist will depend on how it gets used. For these reasons, the checklist has been designed to be *modular and expandable*; additional design elements and performance measures can be added as they become practical or necessary.
3. The checklist is a *simple tool* that does not account for complex roadway design challenges. Intersections, for example, given their complex turning movements and exacting design specifications, are beyond the checklist's purview.
4. The checklist is *not a modeling tool*. It can only provide basic guidance on simple inputs, such as how changing the width of the sidewalk affects pedestrian level of service.
5. The checklist only address changes in land use indirectly. The main focus is on changes within the roadway itself, not on longer term changes to surrounding land uses.

[34] For more information, please visit http://pedbikesafe.org/

CHECKLIST COMPONENTS

The checklist's evaluation procedure relies on four main components: 1) an inventory of existing conditions; 2) an assessment of priorities; 3) the comparison of conceptual design alternatives; and 4) a list of performance measures that may be used for long term monitoring. The components are designed to be simple, easy to understand, and follow a natural progression from data collection to analysis to longer term monitoring. They can also be used separately or together, depending on the scope of the project.

Existing Conditions

The first section of the checklist looks at existing conditions, such as traffic counts, crash data, the transportation context, future travel demand projections, the roadway's role, and existing levels of service. The intent is to collect a baseline inventory of existing data and identify the roadway's regional role. This provides an opportunity to understand the context of the project, in terms of development phase and surrounding land uses.

Data for this section of the scoresheet can come from any available source, although many of the indicators are tied to existing tools or data products produced by MRMPO. For example, traffic counts and travel time indices can be accessed online using MRMPO's Transportation Analysis & Querying Application (TAQA). Other indicators rely on MRMPO's travel demand model, land use projections, crash data analysis, and transit data.

Priorities

To help facilitate roadway projects that will provide the most benefit, this section outlines priority areas that may be important to consider. Each priority consideration addresses one component of complete streets. By selecting initial considerations to explore further, MRMPO and member agencies can begin to identify issues along the roadway such as issues with pedestrian safety, walkability, and congestion.

The considerations follow the five key indicator areas outlined in Chapter 3, with several sub-categories addressing additional concerns such as transit options and connectivity issues. In general, these considerations follow prompts from traditional walking audits, such as "are there obstacles to pedestrian travel?" or "are existing sidewalks ADA compliant?" The prompts are answered using a yes/no/maybe framework to identify priority considerations. The count of these considerations is then averaged for each indicator area to determine which factors are the highest priorities to address.

Design Strategies

There are inherent tradeoffs with different roadway design choices. Often, these have direct effects on specific roadway users that should be balanced with the goals for the overall street network. For example, attempting to expand sidewalks, add generous bike lanes, and maintain the same number of travel lanes along a constrained right-of-way may lead to a design that lowers the level of service for all users, instead of enhancing user options.

Therefore, before settling on a final conceptual roadway design, alternatives should be evaluated to see how well each meets specific performance goals.

The checklist provide a simple way to compare alternatives, by allowing the user to enter alternative cross section geometries and add or remove roadway design elements. The alternative cross section elements are further supported by a list of conceptual design ideas that are linked to priority considerations. For example, if traffic calming has been identified as a priority along the roadway, several strategies are listed that may help achieve this goal. Selecting initial strategies to explore further allows the user to identify possible design alternatives, which in turn can guide the planning process as it evolves.[35]

After being entered, roadway cross sections can be compared to one another to determine which conceptual design best addresses the needs of the streets users using a short list of performance measures, including: MMLOS, a walkability index, and cost. These indicators are tied to specific, *changeable* physical design elements such as roadway width, traffic volume, traffic speed, sidewalk width, presence of bicycle infrastructure, and the presence of on-street parking.

A more qualitative set of measures is also provided to show the relative merits of different roadway designs. These measures compare the merits of different design configurations using a ranking system that awards 0-4 points for each design intervention's relative effectiveness in meeting the five performance objectives. The goal is to provide a framework that allows the best design option to be chosen in a constrained right-of-way.

Indicators

The fourth section of the checklist allows users to choose indicators to use in evaluating long term outcomes. This section allows for baseline conditions to be compared to measurable project objectives, and to see if additional performance indicators may be useful for long term evaluation. Such analysis can help inform future projects by showing which interventions were most effective or identifying limitations with the project's original design.

The goal of this section of the scoresheet is to help the user choose useful performance measures that can be successfully evaluated long term. Not all performance measures are worth the data collection effort as they do not reveal how or why the roadway is functioning the way it is. Instead, a few key indicators, such as change in traffic patterns, changes in crash rates, changes in investment or development, or changes in mode choices may be more important to reveal whether design interventions have been successful.

[35] These design strategies were compiled from multiple sources, including standard design guides and manuals on urban design (see Chapter 2). Strategies were selected based practicality of implementation, and relevance to Albuquerque streets.

5 RECOMMENDATIONS

CiQlovia Event in Downtown Albuquerque, September 2014, Source: ABQ CiQlovia

Chapter 5 Recommendations

MRMPO is well positioned to provide guidance as the region moves forward with more complete streets projects. In addition to utilizing the complete streets checklist described in Chapter 4, MRMPO can continue to support complete streets by adopting the policies and practices outlined below.

Open Data

MRMPO has a clear role to play in project evaluation and monitoring, given the organization's existing data collection efforts and the technical expertise of MRMPO's staff. Yet, the explosion of available datasets creates several challenges in terms of how easily data can be collected, maintained, and shared with multiple audiences. To help facilitate the sharing of data that can be used to inform projects in the future, MRMPO can:

- Continue to develop publically available tools and datasets using ESRI Online and the Transportation Analysis and Querying Application (TAQA).
- Make existing publically available GIS data more accessible for download through ESRI Online.
- Research online community participation portals where MRMPO's work can be shared interactively. The use of ESRI Online story maps is a great start and should be continued for future MRMPO projects. Community participation platforms can also be used to gather feedback on projects and elicit ideas.
- Contribute data periodically to open data sites such as Community Commons or statewide data cooperative efforts.

Sharing data and ideas in this manner can provide member agencies with easy access to MRMPO's datasets, which in turn can be used to better inform projects. The sharing of data may also help spur innovative solutions by enabling new forms of analysis that help reveal hidden trends or potential opportunities.

Performance Monitoring

Through its existing data collection and analysis efforts, MRMPO is in a great position to support the ongoing performance monitoring of plans and projects through development review and continued data collection. To help facilitate a sustainable performance monitoring program, MRMPO can:

- Develop a standardized way to collect before and after data for roadway projects in one place. The Complete Streets checklist outlined above is one tool, but additional methodologies should be explored to ensure that collected data is useful and can be evaluated longitudinally.
- Develop an area wide assessment tool that can be used to measure connectivity, walkability, health outcomes, accessibility, and other indicators. This tool should expand on the complete streets checklist presented here to include a network based analysis that can move the region towards more complete networks. Such a tool would have application in development review, conceptual roadway design projects, and ongoing studies (such as measuring the effects of the upcoming BRT line on Central).
- Support inventories of key street features such as trees, sidewalks, building conditions, and pavement conditions during each project's scoping period. These inventories can later be used to inform performance measures or area-wide analyses.
- Reinstitute a pedestrian and bicycle counting program. These counts can show were investments in pedestrian and bicycle infrastructure are having the most effect on a city-wide scale. To make this program practical, MRCOG can invest in more automated counters, and/or buy existing proprietary datasets such as Strava's recreational bicycle data.

Benchmarking Report

Taking a similar approach to New York City's Sustainable Streets Initiative, MRMPO is in a great position to develop a complete streets benchmarking report to be released every year. The report can highlight successful projects and provide updated data on long-term efforts. As with NYC's Sustainable Streets initiative, this report can quantify, in easy to understand terms, how complete streets projects are benefiting the city and fulfilling their objectives. Such a report can help convince local officials and residents that complete streets are a worthy investment.

Urban Design Standards

Along with context sensitive solutions and policy, MRMPO can continue to develop and revise complete streets design standards through the LRTS Guide. The evolving nature of this guide makes it a great place to provide flexible, expandable design recommendations that utilize best practices. These guidelines can also be provided online using an interactive online design guidelines portal similar to the ones developed by NACTO, Boston's DOT, and METRO. Additional design standard recommendations include:

- Expand MRMPO's roadway design standards from engineering best practices to encompass a larger urban design vision for Albuquerque's streets as truly multimodal, complete, public spaces. This includes thinking about additional streetside elements in the public right-of-way, as well as emphasizing the role streets play in contributing to urban form and functioning as public places.

- Pursue a green streets model as an option for handling stormwater, and creating more attractive streetscapes. MRMPO can help member agencies develop standards for region-specific green infrastructure, following Tucson and Santa Fe.
- Additionally, MRMPO can pursue an inclusive/universal design vision for streets that includes an increased emphasis on accommodating young children, disabled persons, and the elderly. ADA compliance is a worthy goal, but is a legalistic mechanism, and not a holistic design vision of how our streets could accommodate all users.[36]
- Continue to hone the character area model in the LRTS Guide to incorporate guidelines for specific street typologies (e.g., residential street vs mixed use commercial corridor). Developing typology specific recommendations can make design interventions more context sensitive, and potentially more beneficial and effective.

Picking Winners

Jeff Speck concludes his book on walkability with a discussion of “picking winners”, by which he means picking transportation projects that will provide the most benefit for the least cost (Speck, 2012: 254). His argument is not only that investment needs to be targeted, but that some areas do not have the latent ability to benefit from walkability (or complete street) interventions. Because of low densities, lack of pedestrian generators, few useful places to walk, or negative perceptions (high crime, low security), some streets simply do not have the ability to spontaneously become vibrant, multimodal thoroughfares, regardless of the multimodal infrastructure that is added.

Such concerns are important to acknowledge in Albuquerque. The city’s generally low density is a challenge as it precludes investing in transit in some places. It also makes it harder to justify spending money on walkability improvements on roads where people are unlikely to walk. And, as is the case for most cities, limited funding and a lack of political support for innovative projects is an ongoing issue for new roadway projects in Albuquerque.

However, there are certainly corridors that would benefit the most from investment and complete streets retrofits. In some cases, these are the streets that are least safe currently. Roads with a high number of pedestrian crashes such as Zuni Road (which is in the process of being reconstructed), are prime targets for complete streets retrofits. Other roads, such as those that pass through activity centers, could also benefit from a complete street’s retrofit. The area around Uptown, for example, could benefit from a complete redesign to make the area more walkable. Other corridors, such as North 4th Street and Rio Grande, have already been identified as having potential to be redeveloped. And, as Jeff Speck has outlined in his assessment of Downtown Albuquerque, the streets in downtown have the highest potential to become truly multi-modal, economical vibrant, places that support the rest of the city.

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[36] Inclusive street design is described by Burton and Mitchell (2006). Their book describes the importance of accommodating all users and how this can be achieved.

MRMPO can help its member agencies “pick winners” by continuing to provide comments during development review that address holistic land use and transportation planning issues.

Test, Don’t Study

Choosing additional roadways that could benefit from a complete streets approach should not be difficult, nor does it need to be expensive. As Jeff Speck says, “test, don’t study” (Speck & Associates, 2014). Studies are expensive and often unnecessary. Roadways are not rocket-science, which makes it all the more mind-boggling that they have been so poorly designed time and again. There is flexibility in Albuquerque’s roads to take this test-first approach, as many have additional capacity to spare for testing innovative ideas.

Reimagine, Don’t Reengineer

Adding to Jeff Speck’s approach, complete streets are about more than a new way of engineering our roads. As outlined in the opening chapters, there is a lot more to streets than engineering standards. It is time to move away from the tired discussion of 10 foot vs 12 foot lane widths and truly *reimagine* our streets as places that support diverse uses and users. Complete Streets, as a movement and as a policy, can help support additional community goals such as economic development, placemaking, public health, urban design, and livability. Planners, as community facilitators and visionaries, have the ability to move the planning conversation in this direction.

6 APPENDIX

Shopping along the Champs Elysees, Source: Self

APPENDIX

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LIST OF PERFORMANCE MEASURES

Indicator	Indicator Area	Type	Scale	Input Variables	Data Needs/Complexity
Auto LOS	Efficient & Accessible	Output	Street	AWDT, Lanes, Speed, Travel Times	Simple
Peak Volumes	Efficient & Accessible	Outcome	Street	Peak Volumes	Simple
Traffic Speeds	Efficient & Accessible	Outcome	Street	Speed	Simple
Traffic Pattern Shifts	Efficient & Accessible	Outcome	Area	AWDT on adjacent Streets	Moderate
Bicycle LOS	Efficient & Accessible	Output	Street	AWDT, Lanes, Speed, On-Street Parking, Lane Widths, Freight %	Moderate
Pedestrian LOS	Efficient & Accessible	Output	Street	AWDT, Lanes, Speed, On-Street Parking, Sidewalk Widths, Tree Spacing	Simple
Transit LOS	Efficient & Accessible	Output	Street	Frequency, Stop Amenities, Direct Routes, Service Hours	Simple
Travel Times	Efficient & Accessible	Outcome	Street	Speed, Delay	Moderate
Intersection Density	Efficient & Accessible	Output	Area	Intersections per Square Mile	Moderate
Average Block Length	Efficient & Accessible	Output	Street	Block Lengths, Number of Intersections	Simple
Route Directness Index	Efficient & Accessible	Output	Area	Network Geometry	Complex
Pedestrian and Bicycle Counts	Efficient & Accessible	Outcome	Street	Pedestrian Counts, Bicycle Counts	Moderate
Transit Ridership	Efficient & Accessible	Outcome	Street	Transit Ridership	Moderate
Activity Density	Land Use Integration	Outcome	Area	Population Density, Employment Density	Moderate
Increased Economic Activity	Land Use Integration	Outcome	Street	Sales Dollars, Assessed Values	Moderate
New Development	Land Use Integration	Outcome	Street	New Development Projects, New Development Dollars	Moderate
Land Use Mix	Land Use Integration	Outcome	Street	Primary Land Uses	Moderate
On-Street Parking Usage	Land Use Integration	Outcome	Street	On-Street Parking	Simple
Vacancy Rates	Land Use Integration	Outcome	Street/Area	Vacancies, Vacant Properties	Simple
Absolute Crashes	Safety	Outcome	Street	Number of Crashes	Simple
Crash Rate	Safety	Outcome	Street	Number of Crashes, AWDT	Simple

Ped Intersection Safety Index (Ped ISI)	Safety	Output	Intersection	Number of Lanes, AWDT, Speed, Land Use Mix, Signalized Intersections	Simple
Crime Rate	Safety	Outcome	Area	Number of Crimes, Population Density	Moderate
Stormwater Capture	Sustainability	Output	Street	Impervious Surfaces, Rainfall Intensity, Runoff Coefficient, Tree Spacing, Presence of Green Infrastructure	Simple
Energy Efficiency	Sustainability	Output	Street	Energy Usage per Lighting Unit	Simple
Sustainable Materials	Sustainability	Output	Street	Materials Source	Simple
Impervious Surfaces	Sustainability	Output	Street	Tree Space, Green Infrastructure, Types of plants	Moderate
Air Quality	Sustainability	Outcome	Area	AWDT, Mode Utilization,	Complex
Walkability Index	Walkability	Output	Street	Speed, Street Width, Sidewalk Width, On-Street Parking, Block Length, Pedestrian Amenities, Building to Height Ratio, Land Use Mix, Façade Design, Transit and Bicycle Features	Moderate
Walkscore	Walkability	Output	Area	Location	Simple
Pedestrian Composite Index	Walkability	Output/Outcome	Area	Pedestrian Generators and Deterrents, Network Geometry	Complex
User Satisfaction	Walkability	Outcome	Area	Survey Results	Varies

CHECKLIST