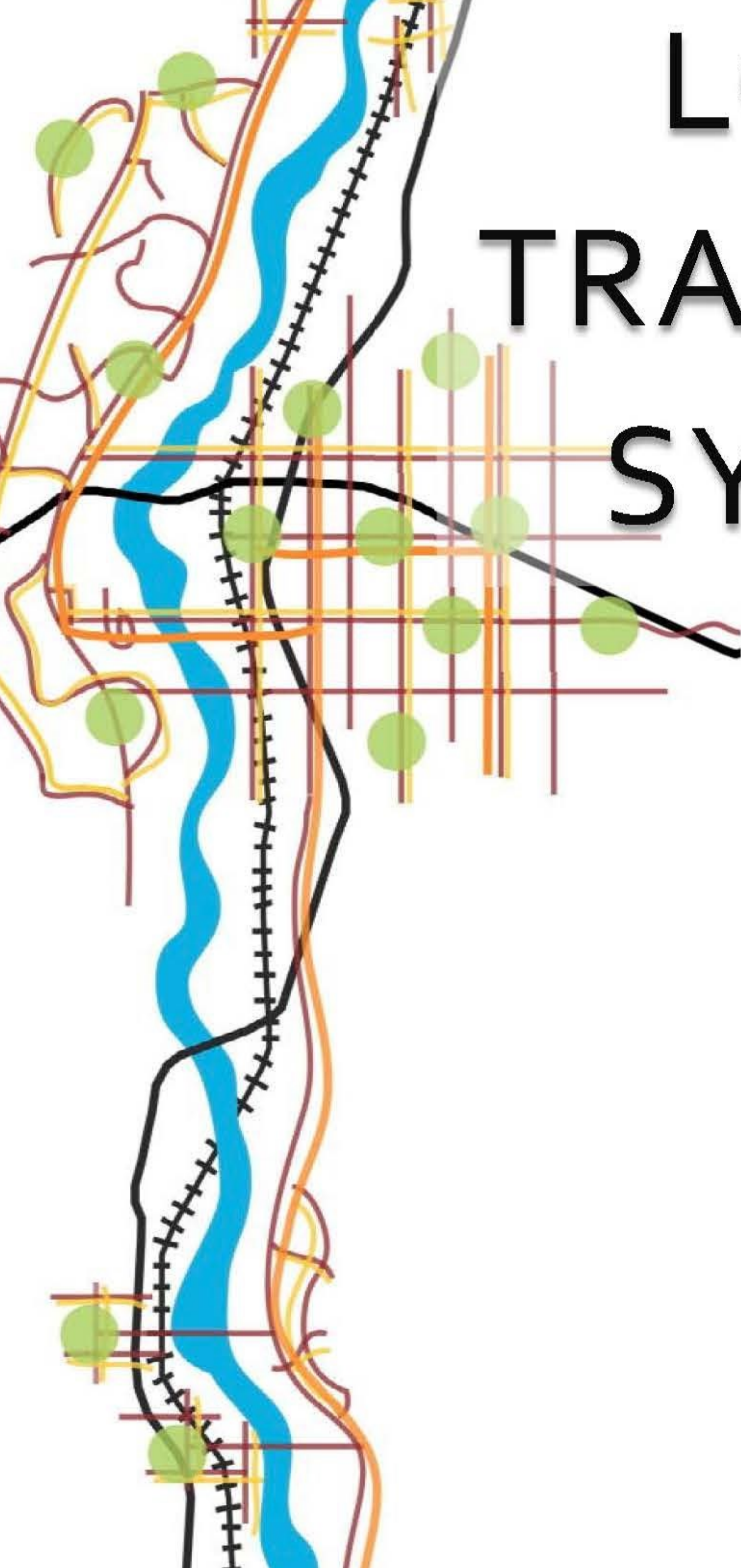
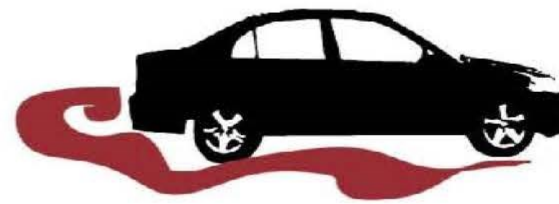


LONG RANGE TRANSPORTATION SYSTEM GUIDE



APRIL 2020

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Mid-Region Metropolitan Planning Organization

Contents

NETWORK DESIGN	CONCEPTUAL DESIGN	EVALUATION
DETERMINING LAND USE CONTEXT **Chapter 2:** Describes character areas within the region, and their role in determining street typologies for future roadways. Character areas are tied to the 2040 Preferred Scenario developed for the 2040 MTP	**CONCEPTUAL DESIGN MATRICES** **Chapter 5:** Matrices outline right-of-way specifications for roadways based on future functional classification and character area.	**COMPLETE STREETS CHECKLIST** **Chapter 6:** Provides a checklist to review roadway projects in terms of their regional and local contexts.
LONG RANGE SYSTEM MAPS **Chapter 3:** Includes maps of future roadways, bikeways, and transit corridors, as well as future activity centers, used to determine regional context of the roadway and future functional classification.	**ROADWAY DESIGN ELEMENTS** **Chapter 4:** Describes basic roadway design considerations, such as lane widths, pedestrian or streetside infrastructure, bicycle infrastructure, and intersection design.	**RETROFITTING STREETS** **Chapter 6:** Examples show how existing roadway redesigns may be compared to fulfill Complete Streets planning goals.
CONNECTIVITY STRATEGIES **Chapter 3:** Describes the importance of connectivity and complete networks and outlines ways to ensure connectivity in new developments.	**STREETSIDE DESIGN ELEMENTS** **Chapter 4:** Describes additional pedestrian streetside design elements that should be considered for new and existing streets.	**PERFORMANCE MEASURES** **Chapter 7:** Provides a list of methods to evaluate performance, including multi-modal level of service indicators, connectivity measures, safety measures, and ways to evaluate land use integration and support.

Chapter 1

INTRODUCTION

Chapter 1

Introduction

The Mid-Region Metropolitan Planning Organization has developed the Long Range Transportation System Guide (LRTS Guide) to respond to the growing need for transportation networks to become more efficient at addressing congestion, providing multi-modal options for all users, supporting economic development, increasing safety, and improving public health. One of the key findings of the *most recent Metropolitan Transportation Plans* was that the strategy of adding roadway capacity was not enough to address congestion across the Albuquerque Metropolitan Planning Area (AMPA). The good news is there are promising alternative strategies that not only address congestion but also have other economic and public health benefits. These strategies involve creating "Complete Streets" and linking land use and transportation planning to improve conditions for all users. The Target Scenario is one example of integrating land use and transportation to improve regional travel.

The LRTS Guide is part of the long range transportation planning process. It is incorporated into the *2040 Metropolitan Transportation Plan* and is developed to support the goals of the MTP. It will remain a part of the MTP and will be updated according to federal transportation planning processes.

The Target Scenario

The *2040 Metropolitan Transportation Plan*'s Target Scenario involves careful examination of how land use affects travel demand. The Target Scenario results in reductions in future travel demand through different types of growth that are publicly acceptable throughout the region.

The LRTS Guide provides recommendations on a second aspect of relating land use to transportation by **providing conceptual roadway designs and well-connected roadway networks that support adjacent land uses**.

Previous Planning Efforts

The LRTS Guide builds upon previous planning efforts. In 1965 the Long Range Major Street Plan laid out a gridded connected network of long range major route improvements. This map eventually became the Long Rang Roadway System and part of the Future Albuquerque Area Bikeways and Streets (FAABS) document. Now, the LRTS Guide replaces the FAABS document and several of the prior elements have transitioned over.

Long Range Maps

The FAABS document included a series of system maps: Long Range Roadway System, Long Range Bikeway System and the Long Range High Capacity Transit System. These system maps are now in the LRTS guide. They show where future roadways, bikeways, and transit lines are planned. It also provides a means to assess connectivity needs and ensure complete, efficient networks.

Future Roadways and Right-of-Way

For future roadways, the LRTS guide builds upon the past right-of-way guidance from the FAABS document, but now incorporates multi-modal accommodations based on national best practices. The intent of this guidance for future roadways is to find the minimum right-of-way needed for good multi-modal accommodation.

Existing Roadways

For existing roadways, the LRTS guide provides methods to evaluate existing roadways for improved multi-modal accommodations, safety, and land use integration.

1.1 GUIDING PRINCIPLES

The LRTS guide has five main guiding principles:

1. TRANSPORTATION AND LAND USE INTEGRATION

Integrating land use and transportation involves understanding how different land uses affect travel demand and then providing roadway designs, and connected roadway networks, that are appropriate for the surrounding context.

Previously, right-of-way guidance was based only on anticipated roadway trips. The LRTS Guide uses both the land use context and the roadway type to provide guidance on conceptual roadway design and right-of-way needs.

Balancing Travel Needs

The goal of the LRTS Guide is to ensure that roadways and adjacent land uses are supportive of each other in addition to providing efficient regional travel. The LRTS Guide intends to avoid mistakes made in the past where incompatible land uses and roadway types were paired together. For example, locations with a high number of pedestrian crashes may indicate that adjacent land uses are generating the need for people to walk, while the roadway is primarily designed to support high speed automobile traffic.

The Impact of Development Patterns

Much of the AMPA's development occurred after WWII when development patterns favored automobile travel and the separation of land uses. This has led to roadways that primarily support automobile traffic (85 percent of all trips in the AMPA are completed in a passenger vehicle)[1].

However, there are many factors that support mitigating this trend. **Of all the trips made by passenger vehicle, 11 percent are under a mile[1].** These short auto trips suggest that the area's roadways do not encourage walking or bicycling even though many destinations are close to their origin.

[1] Mid-Region Travel Survey, 2014

FIGURE 1.1: COMPLETE STREETS SUPPORT ALL USERS OF ALL ABILITIES

Providing roadways that support the surrounding land uses not only reduces the number of short auto trips, but can also boost new investment and the incubation of quality public spaces.

2. COMPLETE STREETS

Complete Streets is a concept that stresses the need to accommodate all users of the roadway: pedestrians, bicyclists, transit users, and motorists. People of all ages and abilities are able to move safely along and across Complete Streets regardless of travel mode. The practice is not limited to design, but involves planning, programming, operating, and maintaining transportation systems.

Complete Streets also involve relating to the surrounding land use by finding the appropriate means of accommodation for the setting. A "complete" rural street will look and feel different than a "complete" urban one.

Opportunities for Complete Streets

There are not enough resources to rebuild all roadways as Complete Streets. However, there are many opportunities to provide multi-modal accommodations that lead to a transportation network that works better for more people.

These considerations vary for new roads and existing roads. For this reason, the LRTS Guide recommends recognizing Complete Streets opportunities in all phases of roadway development from planning, design, engineering, construction, reconstruction, and maintenance.

3. CONNECTIVITY

It can be a challenge for a single roadway to accommodate freight movement, transit use, vehicle traffic, and pedestrian and bicyclist needs at the same time. **An important means of addressing multiple needs simultaneously is through creating "complete networks."** This means designing connected transportation networks that allow people to reach desired destinations – although not always on the same roadway.

Benefits of Connectivity

Creating better connected networks for all modes of travel reduces the potential conflict between different users. Providing low-stress routes for pedestrians and bicyclists improves accessibility by allowing people who are concerned about safety from vehicular traffic to reach destinations. Finally, improving connectivity improves efficiency by making trips more direct, and reduces congestion by providing multiple routes to destinations.

4. SUPPORT THE PRINCIPLES OF THE 2040 TARGET SCENARIO

The LRTS Guide is intended to support the Target Scenario in the *2040 Metropolitan Transportation Plan*. The Target Scenario key elements and guiding principles were developed to help minimize travel demand through more compact and mixed land uses, provide more jobs west of the Rio Grande, and enhance travel options, particularly for transit.

The development of the Target Scenario also involves responding to public feedback about fostering a transportation system that not only addresses congestion, but also supports economic development and creates places where people want to be.

Public Outreach

When reaching out to public stakeholders the responses overwhelmingly heard were about improving the region's economic vitality which included having concentrated activity centers, multiple ways to get around, and being cautious with our water supply. This guide also discusses Green Infrastructure to address water supply and quality concerns. Creating transportation systems that are context appropriate and meet the needs of all users is an important part of supporting the principles of the Target Scenario.

5. SUPPORT OTHER PLANS AND POLICIES

Much of the motivation behind this guide is a convergence of efforts. The LRTS Guide builds upon the comprehensive plans of the municipalities in the region.

Local Planning Efforts

Much of the motivation behind this guide is a convergence of efforts. The LRTS Guide builds upon adopted plans, policies, ordinances, and development standards of the member agencies.

Throughout the region more plans are including Complete Streets principles, bicycle and pedestrian networks, and provisions for mixed–use and higher density residential development, including redevelopment in areas that are supported by multi-modal facilities and public transit.

The LRTS Guide supports putting these concepts into practice and provides design guidance for location-specific plans. In addition, the Complete Streets planning process outlined in this manual will help guide Mid-Region Metropolitan Planning Organization (MRMPO) comments for development review.

1.2 ADOPTION & IMPLEMENTATION

The LRTS Guide is part of the Metropolitan Transportation Plan. The principles, processes, and systems in the LRTS Guide will be updated with the Metropolitan Transportation Plan.

MTB Resolution

In response to the 2035 MTP, the Metropolitan Transportation Board (MTB) issued a resolution requesting regional guidance on accommodation of all modes and integrating land use and transportation. Many aspects of this guide come from locally adopted plans, policies, and development processes.

By adopting the 2040 Metropolitan Transportation Plan, member governments are supporting the intent of the LRTS Guide and the broader Target Scenario.

Updates take place with close coordination from member agencies to ensure that it considers local agency efforts and adopted plans while also addressing regional transportation needs.

Implementation

Implementation of the LRTS Guide occurs in a variety of ways, from new roadway construction in newly developed areas, to projects on roadways with constrained rights-of-way.

New roadways offer the most flexibility in rights-of-way requirements, but it is also essential to ensure adequate connectivity during this development phase.

Projects on roadways with fully developed land uses offer the least flexibility, but often represent the highest need for multi-modal accommodation in the near-term.

The Long Range Roadway System is referenced in the City of Albuquerque's Development Process Manual and Bernalillo County's Streets Standards.

Member governments are encouraged to formally adopt the Complete Streets planning processes outlined in Chapter 2 and refer to the Long Range Roadway System in their policy and regulatory frameworks.

1.3 IMPLEMENTATION OPPORTUNITIES

The LRTS Guide may be applied to a wide range of plans, studies, and projects. Developing a master plan for an area with no infrastructure to resurfacing an existing roadway, all provide opportunities to support surrounding land use, increase safety, and accommodate different transportation modes.

However, the most appropriate type of implementation varies with each opportunity. For example, preserving network connectivity and right-of-way is critical in master plans for undeveloped areas, but evaluating a wide range of detailed roadway designs might not be as important.

Roadway Resurfacing

For roadway resurfacing maintenance, pursuing additional right-of-way is not appropriate, but evaluating the land use, the roadway type, and if excess lane width could be reconfigured to improve shoulders or accommodate the addition of bicycle lanes is very important.

Complete Streets

The LRTS Guide provides a Complete Streets planning process for systematically incorporating land use and multi-modal considerations at a variety of opportunities.

Guidance is also provided on the collection and evaluation of roadway and network measures to better understand different users and their needs, as well as the various benefits and tradeoffs involved with different roadway and network configurations.

The Complete Streets planning process outlined here involves six main steps that move from broad geographic considerations to specific segments. The steps are listed below:

1. Identify considerations and implementation opportunities for the plan or project.
2. Identify the land use character from the Target Scenario.
3. Identify the roadway's regional role and opportunities to improve network connectivity.
4. Evaluate alternatives.
5. Collect and analyze performance measures.

Figure 1.1 shows the LRTS Guide planning process modeled off Complete Streets principles. This process provides the steps for how to go about integrating land use and multi-modal considerations, increased network connectivity, and evaluation of alternatives into roadway design.

Table 1.1 gives more detail on opportunities for implementation, and what sort of questions are appropriate to ask when certain types of plans or processes begin.

FIGURE 1.1: LRTS GUIDE PLANNING PROCESS

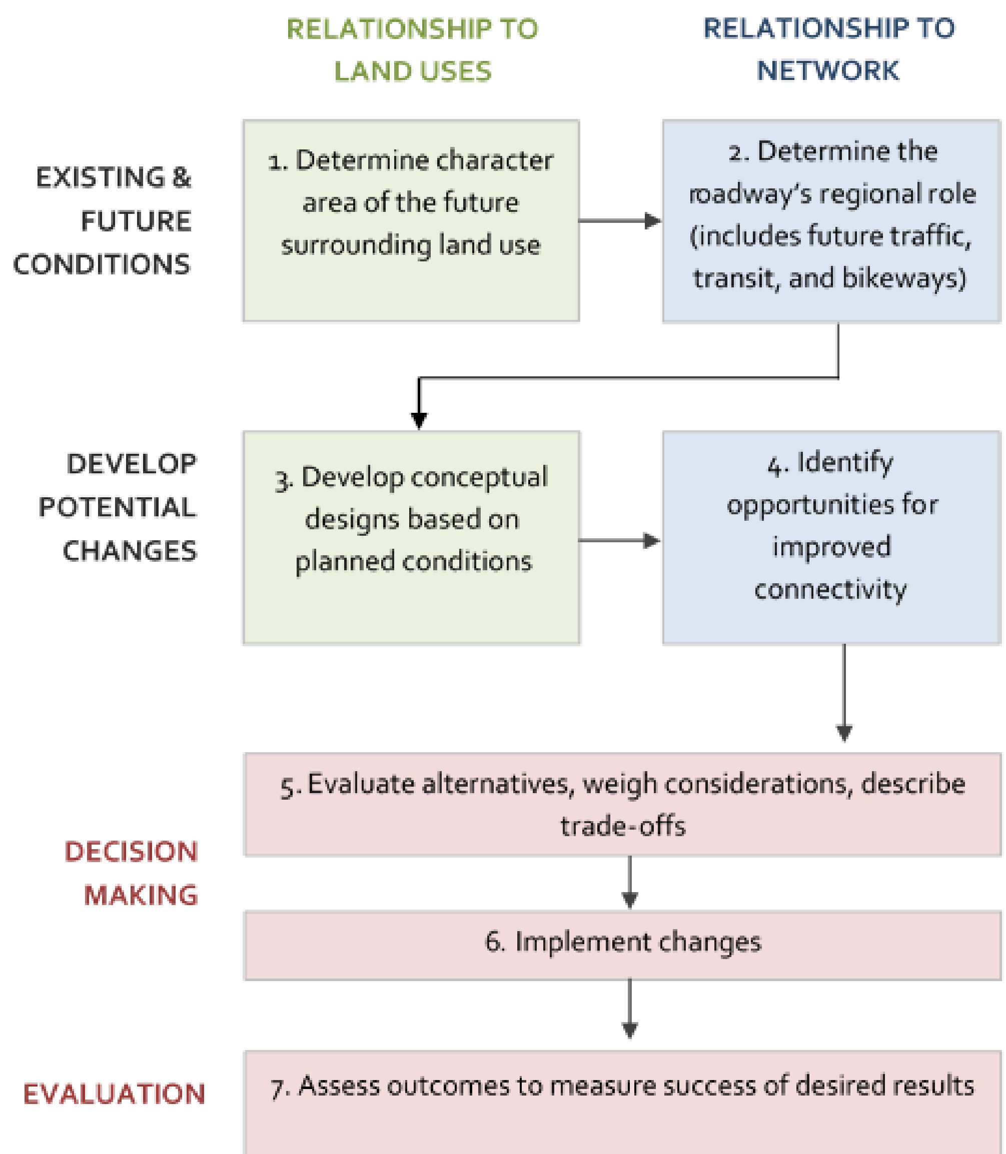


TABLE 1.1: IMPLEMENTATION OPPORTUNITIES & TYPES

IMPLEMENTATION OPPORTUNITY	IMPLEMENTATION TYPE
Sector Plans, Area Plans, Master Plans, Facility Plans These plans address large areas and provide a blueprint for roadways, trails and other facilities. Nearly all of these plans include future land use designations.	**1. Identify & coordinate with planned land use (Ch 3).** • *What are the future land use designations from local plans?* **2. Identify and preserve roadway and trail network connectivity (Ch 4 & 7).** • *Is there sufficient access to planned land uses?* • *Could a denser network of narrower roads be used instead of a sparse network of wider roads?* • *Does the layout of the roadway and trail network support future land use designations?* • *Does the network allow for pedestrians and bicyclists to take alternative roadways?* • *Does the network meet recommended connectivity measures and are there opportunities for improved connectivity?* **3. Develop conceptual roadway designs (Ch 5 & 6).** • *Does the conceptual design and network work together to accommodate all roadway users?*
Corridor Plans, Engineering & Feasibility Studies These efforts tend to focus on a segment of roadway and sometimes include a limited area that includes paralleling roadways.	**1. Identify & coordinate with planned land use (Ch 3).** • *What are the future land use designations from local plans?* **2. Identify and preserve connectivity through easements and parallel routes (Ch 4).** • *Is there sufficient access to planned land uses?* • *Can parallel routes improve access to adjacent land use and better accommodate pedestrians and bicyclists?* • *Are there any easements or other opportunities to improve pedestrian and bicyclist access and mobility?* **3. Develop conceptual roadway designs (Ch 5 & 6).** • *Does the conceptual roadway design and parallel roadways work together to accommodate all roadway users (although not necessarily on the same road)?* **4. Identify corridor issues and considerations (Ch 7 & 8).** • *How is the roadway currently performing?* • *Are there additional opportunities to address issues?*
New Roadway Construction New roadways are typically built in phases. Each phase should provide multi-modal options and support the land use developing around it.	**1. Identify & coordinate with planned land use (Ch 3).** • *What are the future land use designations from and local plans?* **2. Identify and preserve roadway and trail network connectivity (Ch 4).** • *Is there sufficient access to planned land uses?* • *Are approved access points being built along with the development of homes and businesses?* **3. Develop conceptual roadway design (Ch 5 & 6)** • *Does the design allow for all roadway users to be accommodated through each phase of the roadway being built?* **4. Identify corridor issues and considerations (Ch 7 & 8).** • *What are the long-term and short-term goals of the roadway?* • *Are there additional opportunities to address issues?* • *What are the performance measures to evaluate changes to the roadway?*

Roadway Redevelopment & Reconstruction These efforts involve changing an existing roadway or intersection. Typically, a corridor or feasibility study precedes these projects. Given that these roadways are already in use, this is also an opportunity to test out design alternatives with temporary features.	**1. Identify & coordinate with planned land use (Ch 3).** • *What are the future land use designations from local plans?* **2. Identify and preserve roadway and trail network connectivity (Ch 4).** • *Does this roadway provide an important connection between or within activity centers?* • *Are there any small opportunities to improve access to adjacent land use?* **3. Develop conceptual roadway design (Ch 5 & 6)** • *Which modes are prioritized based on the character area and roadway type?* • *Are there opportunities to improve accommodation for prioritized modes?* **4. Identify corridor issues and considerations (Ch 7 & 8).** • *How is the roadway currently performing?* • *Are there additional opportunities to address issues?* • *What are the performance measures to evaluate changes to the roadway?*
Roadway Resurfacing Maintenance Although these projects are limited and should not become full reconstruction projects, they provide unique opportunities to capitalize on small improvements that can make large impacts at much lower costs than a reconstruction project.	**1. Identify & coordinate with planned land use (Ch 3).** • *What are the future land use designations from local plans?* **2. Identify and preserve roadway and trail network connectivity (Ch 4).** • *Does this roadway provide an important connection between or within activity centers?* • *Are there any small opportunities to improve access to adjacent land use?* **3. Develop conceptual roadway design (Ch 5 & 6)** • *Which modes are prioritized based on the character area and roadway type?* • *Are there opportunities to improve accommodation for pedestrians and bicyclists by reducing driving lane widths?* • *Are shoulders being improved along with the rest of the roadway?* • *Are there missing sidewalks that can be filled in or other ADA deficiencies?* **4. Identify corridor issues and considerations (Ch 7 & 8)** • *How is the roadway currently performing?*

Chapter 2

LAND USE AND ACTIVITY CENTERS

Chapter 2

Land Use and Activity Centers

After looking at implementation opportunities, determining the character area is the second step of the LRTS process. The scenario planning effort has shown the significant impact land use patterns have when addressing transportation challenges of the future. Additionally, the design and operation of the roadway contributes as much to the context as the buildings in the area. For this reason, it is important to have a clear idea of the intended future character surrounding the roadway, and then balance transportation demand with the critical need for the roadway to support the activities taking place on the adjacent land use. This chapter describes five character areas and ways to determine each character area. Roadway network connectivity and conceptual design elements are based on these character areas.

2.1 LAND USE CONTEXT

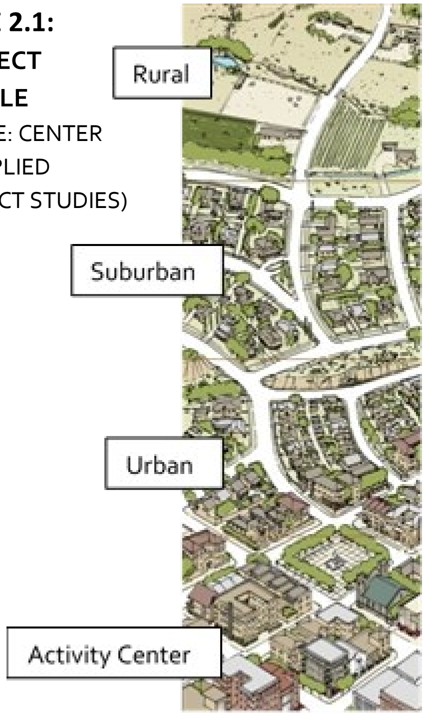
Determining the surrounding character area presents a variety of challenges. Making a detailed assessment of the land use surrounding a roadway is new for many transportation professionals. Adding to the challenge is **that this assessment needs to be for the *future* character area, not the current surroundings** since the lifecycle of the roadway is often much longer than the surrounding environment.

Determining Character Areas

Determining the character area requires examining locally adopted plans and zoning ordinances. The LRTS Guide provides a character area map that gives an overall idea of character areas. **However, in practice, character areas are relatively small, and it is impossible to determine them all at a regional level.**

This is why local plans and the local community vision need to be used when making this determination. This can be difficult since local governments have a wide range of land use designations.

FIGURE 2.1: TRANSECT EXAMPLE (SOURCE: CENTER FOR APPLIED TRANSECT STUDIES)



In order to help this process, the LRTS Guide simplifies character areas into five categories:

1) Activity Centers
2) Urban
3) Suburban
4) Rural
5) Rural Main Streets

Transect Based Model

Overall, this classification follows a transect-based model, moving from a continuum of rural to urban character areas, with increasing densities and intensity of uses (**Figure 3.1**).

Rural main streets are overlaid on top of this transect model to indicate those places with higher pedestrian and/or commercial activity within town and village centers.

Target Scenario

The Target Scenario was created using stakeholder input and has been continually updated with input from MRMPO's Land Use and Transportation Integration (LUTI) Committee.

The Target Scenario provides a vision for the region, but it is not based on current zoning ordinances. **In practice, adopted ordinances and plans should be used in order to assess character areas**. It is impossible at the regional level to come up with an exact model of the variety of contexts a long roadway will pass through.

However, there are measures that can help determine character area. Below are descriptions of these measures. Although all these measures are correlated, it is best to try to determine at least two of them before assigning a character area.

LAND USE MIX

Land use is a common criterion for characterizing development. Common land uses include: (1) single family residential, (2) multi-family residential, (3) commercial retail, (4) commercial services, (5) public/institutional, and (6) parks/open space.

Activity Centers

An area where one can live, work, shop, go to school and have places to congregate is a typical activity center. A successful activity center should include nearly all the land uses listed above. These land uses were tested out on census block groups to understand how well these geographies scored.

Table 2.1 provides general rules on how to measure this mixture. This table also provides land use mix scores based on an entropy formula using the six land use categories listed above.

If each census geography dedicated one-sixth of its total area to each land use, the score would be 1. In practice, this does not happen, and many block groups include all six uses, but do not have scores better than 0.30.

The land use formula is:

$$land\ use\ mix\ score = -\frac{1}{\ln(6)}\sum_{i=1}^{6} p_i \ln(p_i)$$

Where p_i is the proportion that land use i contributes to the overall geography.

NET RESIDENTIAL DENSITY

Net residential density is another way to help characterize development. This is the number of dwelling units per residentially zoned acre. Caution must be used in areas with manufactured homes or group quarters where the land may not be zoned residential, but the census data includes the number of dwelling units.

The net residential density for activity centers is 12 dwelling units per acre. This is also the minimum density needed to support transit[2].

ACTIVITY DENSITY

Activity density is a measure of combined residential and commercial activity. It supplements the net residential density with employment activity.

$Activity\ Density =$

$$\frac{Population_i + Employment_i * X}{Acres_i}$$

For $Data\ Analysis\ Subzone\ i$, where

$$X = \frac{AMPA\ Population}{AMPA\ Employment}$$

The beneficial part of the activity density measure is that MRMPO provides these measures for the 2040 forecast.

Caution must be used in a few instances where the acreage of the data analysis subzone (DASZ) overshadows the population and employment that take place within the zone. For example, Kirtland Air Force Base in Albuquerque and Merillat in Los Lunas have significant concentrated activity, but the DASZ encompasses much more area.

URBAN AND RURAL DESIGNATIONS

The term *rural* in this document refers to *rural character areas* within the federally designated Albuquerque Metropolitan Planning Area (AMPA). Rural character areas have low residential densities and they are interspersed with agriculture and rangeland. Two examples of rural character areas in the AMPA are the Village of Corrales and the Village of Tijeras.

[2] Public Transit and Land Use Policy, 1977

TABLE 2.1: LAND USE CONTEXTS

ACTIVITY CENTERS

Existing and proposed Activity centers are designated in the 2040 MTP and other local comprehensive plans. Activity centers exist in urban, suburban, and rural areas. Characteristics include increased pedestrian traffic, retail activity, and concentrated jobs. The priority for activity centers is accessibility for all modes, with an increased emphasis on pedestrian comfort.

Land Use Mix: Activity Centers often have all of the following land uses: Multi-family, retail, services, parks (includes plazas), public buildings (includes schools), and often nearby single-family units. (LU mix score > 0.22)
Planned Net Residential Density: > 12 dwelling units per acre
Future Activity Density Score: ≥ 25

Examples: Uptown (shown), Downtown Albuquerque, UNM area, Nob Hill, Cottonwood, and Journal Center

GENERAL URBAN

Urban areas generally do not have as high of residential and employment densities as activity centers, but they have a fairly high number of different land uses within short distances.

Land Use Mix: Urban areas often have at least four of the following land uses: single family, multi-family, retail, services, parks, and public/institutional buildings such as schools. (LU mix score > 0.16)
Planned Net Residential Density: ≥ 8 dwelling units per acre
Future Activity Density Score: ≥ 12

Examples: San Mateo & Lomas area (shown), Wyoming Blvd & Montgomery Blvd

GENERAL SUBURBAN

Suburban areas primarily contain single family residential land use with scattered commercial use that support these residences. Future suburban areas should provide for pedestrian and bicycle access to commercial areas, schools, parks, and transit.

Land Use Mix: The predominant single-family land uses in suburban areas often include two or three of the following other land uses: multi-family, retail, services, parks, and public/institutional buildings such as schools. (LU mix score > 0.10)
Planned Net Residential Density: < 8 dwelling units per acre
Future Activity Density Score: < 12

Examples: Coors Blvd, Southern Blvd, Unser Blvd, Harper Rd

RURAL

The primary characteristic of rural areas is very low residential densities. Often rural areas develop into suburban areas. If an area is determined to be rural in the future, there should be evidence that measures are in place to preserve low residential density.

Land Use Mix: Rural areas have very low residential densities and often include agricultural land, and/or open space. (LU mix score < 0.10)
Planned Net Residential Density: ≤ 3 dwelling units per acre
Future Activity Density Score: < 7

Examples: Isleta Blvd (shown), Rio Grande Blvd

RURAL MAIN STREETS

Main streets, like downtown streets, are places that traditionally support retail businesses and pedestrian activity. They often function as the heart of historic towns, or as the "living room" of a neighborhood where people come to shop, eat, and congregate. For this reason, special care needs to be taken to preserve pedestrian comfort and safety. (Also see *Special Streets* in section 5.7.)

Examples: NM 313 in Bernalillo (shown), Corrales Rd, 4th St at Guadalupe Plaza in Los Ranchos, NM 333 in Tijeras

2.2 ACTIVITY CENTERS

Activity centers exist in urban, suburban, and rural contexts, although their form and surrounding land uses may vary. For example, an activity center in a rural context may just be a short stretch of a main street where most of the community's activity takes place.

Activity centers should prioritize pedestrian accessibility and are targeted for higher intensities of mixed-use development and enhanced transit connections. In addition, activity centers promote a "park once" approach where people driving to these locations can park once and walk to a variety of destinations.

The 2040 MTP has identified four types of activity centers. However, pedestrian priority activity centers identified in comprehensive plans and other local plans should also be taken into consideration.

1. REGIONAL ACTIVITY CENTERS

People across the region travel to regional activity centers to access jobs, education, and other services. These centers include transit connections and have the potential to support mixed-use development.

2. REINVESTMENT CENTERS

Reinvestment centers are currently targeted for redevelopment. They often have connections to transit and some mixed-use elements. In some cases, these areas were major destination hubs in the past.

3. OPPORTUNITY CENTERS

Opportunity centers have been identified by local communities as areas that have room for additional development and that have the potential to become mixed-use destinations. Nearly all these locations involve addressing transportation issues by incubating local mixed-use centers with high levels of employment so that nearby residents do not need to travel across the river or traverse other barriers for daily needs.

4. EMPLOYMENT CENTERS

Unlike the other types of activity centers, employment centers consist of a single large employer or business center with no plans for housing, and they are not targeted future land use changes. These locations are not addressed in the LRTS Guide, but they are identified in the Target Scenario.

DOWNTOWN ALBUQUERQUE

Downtown Albuquerque functions as the urban core for the region and remains the region's most dense job center. It is both a regional activity center and reinvestment center. Increased investment in Downtown's pedestrian amenities, bicycle infrastructure, and civic spaces could catalyze further private investment and redevelopment of Downtown's vacant and/or under-utilized infrastructure.

In March 2015, The Downtown Walkability Analysis was adopted by City of Albuquerque a policy for prioritizing multi-modal improvements in Downtown Albuquerque. This study was completed in fall of 2014 by Jeff Speck, the author of *Walkable City: How Downtown Can Save America One Step at a Time.* The Downtown Walkability Analysis is the recommended resource for improvements to streets in Downtown Albuquerque.

Chapter 3

COMPLETE NETWORKS

Chapter 3

Complete Networks

Roadways play many roles *from* carrying freight long distances *to* inviting pedestrians to patronize sidewalk cafes. It is not possible for a single roadway to play all these roles well at the same time. However, a well-connected system of roadways can meet these diverse challenges by assigning different responsibilities to different routes. **No other factor affects a transportation system's overall efficiency more than roadway network connectivity.** Roadway connectivity allows for more route options which disperses congestion and can help avoid major issues when a roadway is closed for construction, incidents, or events.

Regional Consequences

Typically, new developments create disconnected roadway layouts that are site-based and address the interests of a single landowner without taking into consideration the negative regional consequences of a disconnected roadway network. Such a network fails to capitalize on opportunities for local roads, collectors, and minor arterials to make meaningful connections.

Route Redundancy

The redundancy of routes is preferable for pedestrian and bicyclists because they can directly reach their destinations while avoiding conflicts on major roads.

In addition, regularly spaced roadways offer better opportunities for signal synchronization which also increases efficiency and travel times. Finally, the smaller blocks structure allows for development flexibility where land uses can evolve and adapt over time.

Unfortunately, roadways are now planned as fragmented systems with a focus on channeling traffic onto a few arterials, which in turn increases congestion.

The *2035 Metropolitan Transportation Plan* took the first step in seeing how a lack of connectivity can negatively affect future transportation.

The *2040 Metropolitan Transportation Plan* takes the next step by recommending ways to address and improve network connectivity through the LRTS Guide.

The intent is to provide guidance for creating complete networks that offer alternative low-speed, low-volume routes, that help serve communities and the region.

3.1 NETWORK DESIGN

Ensuring high levels of connectivity through careful network planning has numerous benefits including:

- Offers direct routes, which decreases travel time and vehicle miles traveled (VMT).
- Improves air quality and health and safety outcomes by reducing VMT and congestion.
- Reduces congestion by allowing surrounding roadways to absorb excess traffic from other routes.
- Encourages more walking and bicycling by creating shorter, more direct routes.
- Provides more direct access to businesses and residences.[3]

CONNECTED NETWORKS

A gridded network of connected roadways is the best way of achieving high levels of connectivity and addressing the variety of needs of the regional transportation system.[4]

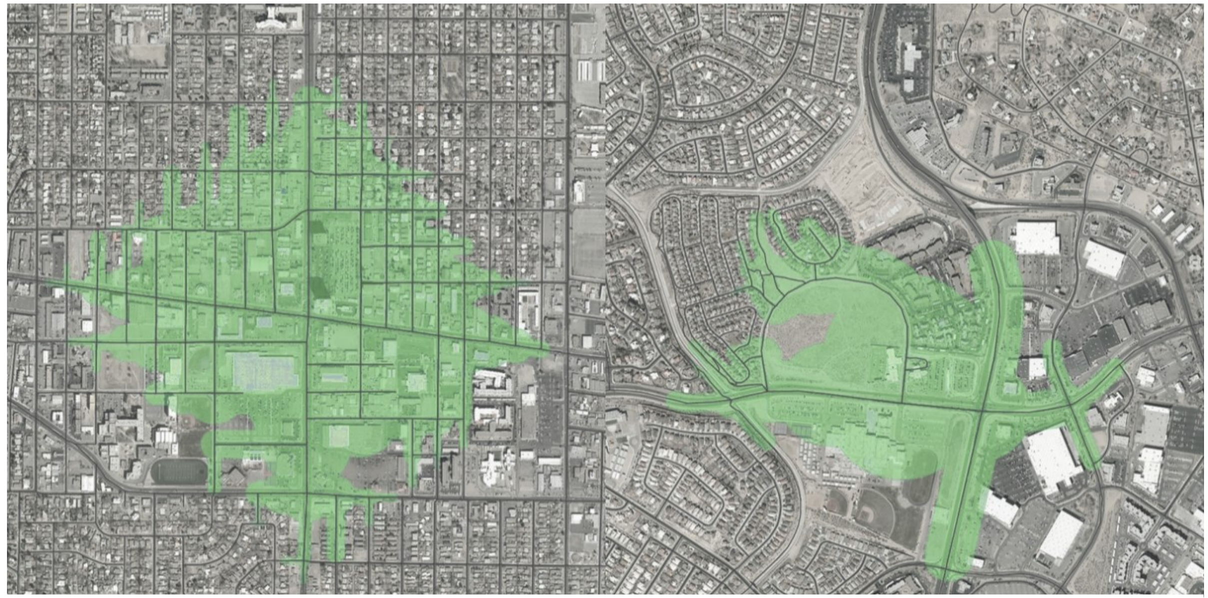


FIGURE 3.1: COMPARISON OF A 15 MINUTE WALK FROM A BUS STOP IN WITH A TRADITIONAL, GRIDDED NETWORK (LEFT) AND A CONVENTIONAL NETWORK (RIGHT)

Although large areas of the region have missed the opportunity to have a gridded roadway network, there are still many ways to improve connectivity and network efficiency. It is still possible to create connected networks for pedestrians, transit, bicyclists, drivers, and freight at a regional scale.

Long Range System Maps

The Long Range System maps provide the designated layers for these different modes.

Each map identifies current and future planned connections that will allow travel by different modes between major destinations.

The Long Range Networks include the:

1. Long Range Roadway System
2. Long Range Transit Network
3. Long Range Bikeways System

[3] ITE. Planning Urban Roadway Systems; Ewing, Pedestrian- and Transit-Oriented Design, 59-60

[4] Ewing, 59

The maps communicate to the wide variety of stakeholders where proposed network connections are recommended.

This helps ensure that important network links (and gaps) are not overlooked as opportunities to improve the roadway arise.

Pedestrian Composite Index (PCI)

In some ways, this map is also considered a long range system map. Although, the Pedestrian Composite Index does not include lines on the map that propose new facilities, rather it evaluates various generators of pedestrian activity and identifies Major Roads that should be prioritized for future investment. Indeed, in some cases the infrastructure is already well-done; however, the map's intention is to guide the region towards important locations and then determine the extent of the improvement needed.

Smaller Opportunities

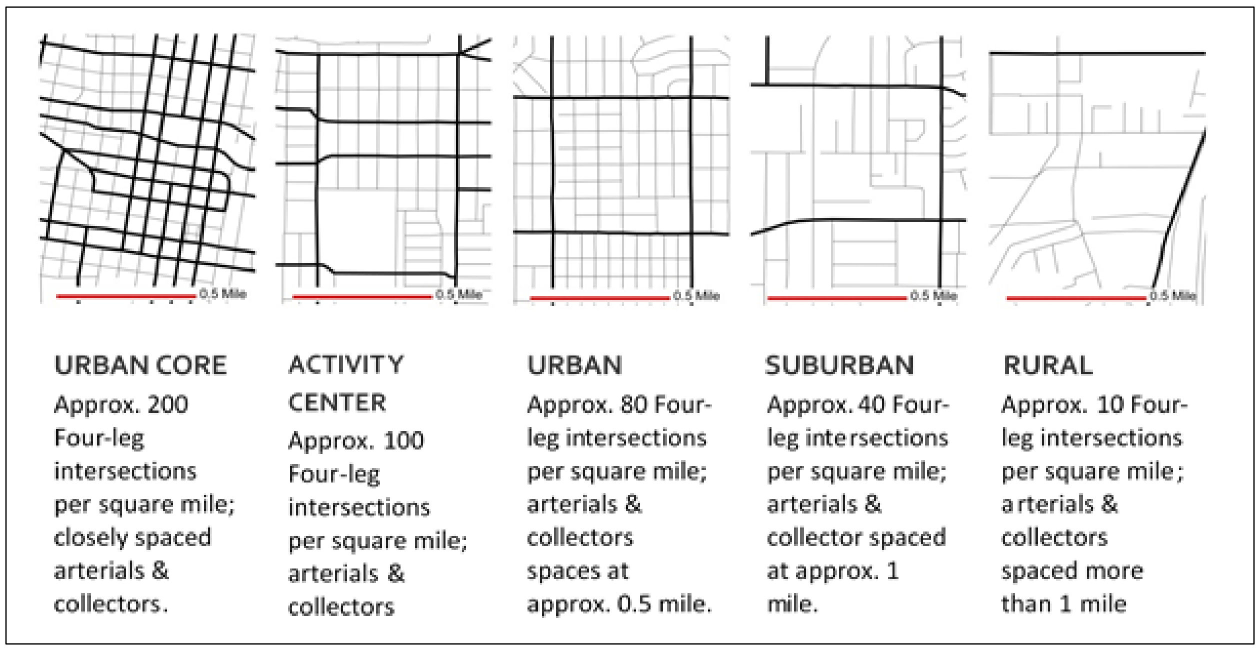
The Long Range System maps provide a foundation for layered network connectivity; however, smaller opportunities for connections also exist. Section 4.5 provides a variety of strategies to improve connectivity. Often these smaller connections are very effective for people traveling by foot, wheelchair, or bicycle.

New Larger Developments

Finally, the region still has opportunities with new, larger developments to establish and preserve a gridded transportation system. These areas are included in the system maps to ensure that important connections are preserved from one development to the next.

Ensuring roadways in new areas are well connected may be the single most important thing we can do as a region to help decrease congestion and make our roadways safer for everyone.

FIGURE 4.2: CONNECTIVITY STANDARDS FOR DIFFERENT LAND USE CONTEXTS



3.2 CONNECTIVITY STRATEGIES

Although past development practices have not provided adequate connectivity to address future transportation demand, there are a number of ways to improve connectivity in developing and existing areas.

1. CONSULT LONG RANGE SYSTEM MAPS

Consult the Long Range System maps for future planned roadways, bikeways, and transit corridors, and their recommended connections and priorities.

2. PROVIDE ADEQUATE ROADWAY CONNECTIVITY

The Long Range Roadway System provides basic minimal connections. As new areas develop, additional connectivity needs to be assessed based on the planned land use and anticipated residential densities.

Often rural areas develop into suburban areas and in some cases suburban areas develop into urban.

In areas with this potential, roadway connections within the area and to surrounding areas need to be preserved and developed in conjunction with land use development.

The following recommendations are based on two ITE documents: *Designing Urban Thoroughfares* and *Planning Urban Roadway Systems* and analysis of future travel demand. Descriptions of the connectivity measures are in section 8.3

Recommended Connectivity:

1. **Activity Centers:** Arterial and collector spacing less than a half-mile apart with a maximum 400' block length with over 90 four-leg intersections per square mile. Albuquerque's urban core is unique in the region. Figure 4.2 shows downtown Albuquerque in comparison to other networks. (Figure 4.2 example urban core: downtown Albuquerque, activity center: UNM area.)
2. **Urban:** Arterial and collector spacing at a half-mile apart with a maximum 600' block length and over 50 four-leg intersections per square mile. (Figure 4.2 example: NE Albuquerque)
3. **Suburban:** Arterial and collector spacing at approximately a mile apart, (but preferably less than a mile apart) with a maximum 800' block length and over 10 four-leg intersections per square mile. (Figure 4.2 example NE Albuquerque)
4. **Rural:** Arterial and collector spacing is often more than a mile apart with approximately 10 or less four-leg intersections per square mile. (Figure 4.2 example: S. Valley)

For all character areas dead-end streets and cul-de-sacs should not be allowed unless connections are physically infeasible.

3. SUPPORT OVERALL NETWORK

Balance neighborhood and regional network needs. New developments should show how all their proposed roadways and trail systems will contribute to the transportation system as a whole by providing routes that allow people to travel not only within the proposed development, but also through it to adjacent developments.

Balance Neighborhood and Regional Needs

This involves balancing neighborhood and regional needs. In many cases, local road networks are planned to only serve the people who live on them; however, neighborhood streets can provide excellent pedestrian and bicycle routes due to slower speeds and low traffic volumes.

Providing more ways for people to travel through the neighborhood allows for the traffic burden to be shared and allows for pedestrian and bicyclist connectivity. Providing this additional connectivity also requires improved traffic calming measures. However, traffic calming measures have the potential to make the neighborhood a more attractive place to live.

Local examples: The Cabezon neighborhood in Rio Rancho took advantage of every existing connection and preserved three connections with the neighborhood to the north of it.

4. ASSESS EASEMENTS

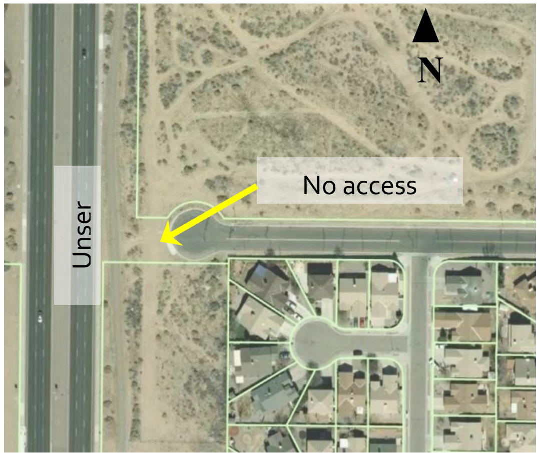
Assess drainage and utility easements as possible trails or local roads.

Local example: This image shows easements in dotted yellow along west Central Ave in the vicinity of Unser Blvd and Coors Blvd. The easements represent additional routes that can connect homes to the SW Transit Center and to shopping. These easements should be preserved and developed into trails or local roadways.

5. ENSURE ACCESS

Connect approved roadways between arterials to neighborhoods before land is developed to preserve future connectivity.

Local Example: This dead-end street was originally intended to access Unser Blvd. However, the connection was not made early in the development and neighbors now oppose the access. As the lot to the north develops into retail new access requests need to be made instead of capitalizing on a single access point that could serve both the neighborhood and the new development.



6. TRANSIT AND TRAIL ACCESS

Provide access to multi-purpose trails, or sidewalks along arterials with transit, that border neighborhoods but are inaccessible due to walls or drainage. These breaks in the wall connect pedestrians and bicyclists to trails and transit that otherwise is infeasible.

Local Example: This break in the wall allows the neighborhood access to a trail that makes regional connections along Unser Blvd in Rio Rancho.

Following are all the core long range maps for the LRTS Guide; the Long Range Roadway System, Long Range Transit Network, the Long Range Bikeways System, and Future Pedestrian Facilities. These long range systems are essential to review prior to reconstructing or building new roadways in the region to help guide design decisions.

3.3 LONG RANGE ROADWAY SYSTEM

The Long Range Roadway System (LRRS) provides future recommended roadway classifications and their regional role. This system should be viewed as an aspirational network.

That is, the map provides a basic, minimal future network that demonstrates how the region's transportation network is envisioned to function, with some roadways closer to their desired functionality than others.

2040 Timeframe

This network includes some roadways that are not expected to be constructed within the timeframe of the 2040 MTP. These roadways are included in the Long Range Roadway System in order to help identify future need. Roadways beyond the scope of the 2040 MTP also provide a means to identify important regional connections. As new areas develop, additional connectivity needs will have to be assessed further.

FUNCTIONAL CLASSIFICATION

This leads to an important distinction between LRRS and current functional classification. Just like the name implies, current functional classification is based on how the roadway currently functions. In addition, current functional classification determines current eligibility for federal funding.

In contrast, the LRRS roadway type builds upon and moves beyond functional classification by considering the character of the roadway and the role it plays in the regional system.

The classifications used in the LRRS were developed with the needs of all users in mind and the types of trips the roadway serves. For example, the LRRS places principal arterials into two groups (regional and community) to differentiate the types of trips these roadways accommodate. These designations can help determine the steps necessary to preserve and improve the transportation system.

LONG RANGE ROADWAY SYSTEM CLASSIFICATIONS

REGIONAL PRINCIPAL ARTERIAL

Trips on regional principal arterials are primarily for traveling longer distances across the region. Regional principal arterials prioritize passenger vehicles and freight.

In general, there are not usually as many destinations along regional principal arterials. These roadways generally have high levels of access management and many are currently included in the region's access management policy.

Regional principal arterials tend to have higher speeds and more lanes. If there are parallel regional and community principal arterials and a person wants to drive to a destination beyond the communities these arterials serve, then they most likely would take the regional principal arterial.

For these reasons, regional principal arterials should only be planned along the edges of activity centers and not through them.

Unfortunately, there are some developed activity centers that are bisected by regional principal arterials. In these cases, modal priorities along these roads need to be balanced.

COMMUNITY PRINCIPAL ARTERIAL

Although these roadways are given the functional classification of principal arterial, these corridors include many destinations with direct access from the arterial.

Travel on community principal arterials tends to be over shorter distances than regional arterials and to destinations with access directly on that arterial. Community principal arterials tend to have lower speeds and fewer lanes than regional principal arterials.

Community principal arterials do not prioritize one mode over another; instead they strive to achieve a balance through several strategies that can include slowing down motorized traffic or improving walking and bicycling facilities.

Higher levels of congestion on community principal arterials is acceptable compared to regional principal arterials since community principal arterials bring people *to* areas and regional principal arterials take people *through*.

MINOR ARTERIAL

Minor arterials provide the connectivity of principal arterials, but they prioritize slower moving traffic, including bicyclists and pedestrians, to allow these modes additional options to reach destinations without needing to be on a principal arterial.

MAJOR COLLECTOR

Major collectors provide additional connectivity between destinations on arterials and neighborhoods. They prioritize bicyclists and pedestrians. Bicyclists should be able to use collectors for long segments of their trips while motorists primarily use them for short segments of their trips. This means that Major Collectors should have comfortable and safe bicycle facilities and sidewalks.

MINOR COLLECTOR

Minor collectors provide additional connectivity between destinations on arterials and neighborhoods.

3.4 LONG RANGE TRANSIT NETWORK

The Long Range Transit Network map shows future planned transit corridors along with the existing bus and commuter rail service and rail stations.

As with the Long Range Roadway System, the Long Range Transit Network is designed to support the principles of the 2040 Target Scenario. Specifically, the network seeks to connect activity centers and support future mixed-use corridors. Expanded transit would also provide increased river crossing options.

Priority Transit Investment Network

The Priority Transit Investment Network is a more focused network of transit corridors with high ridership potential that are eligible to receive a 25% funding set aside by Resolution 15-01 MTB. These routes serve dense parts of the Metro Area and could reach a 20% mode share by 2040.

Target Scenario Transit Network

The Target Scenario Transit Network is a subset of the Long Range Transit Network and the Priority Transit Investment Network, as it covers the high priority corridors and highlights specific routes for a core network of transit to serve activity centers.

3.5 LONG RANGE BIKEWAY SYSTEM

The Long Range Bikeway System (LRBS) includes both existing and future existing bikeways and trails. Proposed facilities include projects beyond the 2040 timeframe.

Since the last rendition of the Long Range Bikeway System map, the identification of the types of bicycle facilities has changed to a stronger focus on creating a network based on encouraging multiple types of users and expanding upon safer on-road bicycle facilities such as protected bicycle lanes. This new system looks beyond our car-centric environment and imagines a future where bicycling is a viable way to get around our region.

Bikeway Facility Type Guidance

As a result, the newly formed Active Transportation committee reviewed the LRBS and established new types of facilities based, in part, on guidance around the existing speeds and traffic volumes of roadways.

This chart was initially based on the National Association for City Transportation Officials (NACTO) guide for Designing for All Ages and Abilities. This chart is meant to serve as a way to recommend and create a connected, "premium," and an all ages and abilities bicycle network.

Bicycle routes are not on this chart because usually only a sign is added to designate it and no other traffic calming features.

Most Desirable Facility

The chart on the next page shows the most desirable bikeway design at the top with additional options below depending on street context, ROW, and funding support or other. For each category, it is recommended to implement the safest bicycle facility possible if ROW is available. The LRBS and the chart should be used with the understanding that it is the most attractive and comfortable bikeway type for the roadway.

Integrating the safest bicycle facility possible could encourage more riders of different ages, genders, and different levels of comfort. Also, adding a bicycle facility could provide an opportunity to narrow the travel lane and slow down traffic speed.

It is not recommended to remove existing bicycle facilities unless there is a clear and consistent conflict with access to commercial destinations and the street already experiences slow vehicular traffic.

Collector Roadways and Parking

On facilities over 6,000 ADT and along a Collector roadway, a bicycle lane should be prioritized over parking unless it is in a highly urban commercial area or an activity center.

Bicycle Boulevards

Creating a bicycle boulevard does not mean just adding 18 mph sign. Bicycle Boulevards are roadways that prioritize bicycle travel over vehicle travel and include design features to slow and calm vehicle traffic to make it more comfortable for bicyclists. Examples include but are not limited to roundabouts on Silver or the mid-block crossings at Silver and Girard, and Summer and San Pedro.

Most Desirable Bicycle Facility Chart

Motor Vehicle Speed	Max Motor Vehicle Volume (ADT)	Key Operational Considerations	Bicycle Facility Proposed
Less than or equal to 25 mph	Less than 6,000	Low Curbside Activity*	Buffered Bicycle Lane, Bicycle Lane, Bicycle Boulevard
Greather than 25 mph	6,000 to 10,000	Low Curbside Activity	Protected Bicycle Lane, Buffered Bicycle Lane, Bicycle Lane
	10,000 or Greater	Low Curbside Activity	Protected Bicycle Lane, Buffered Bicycle Lane
High speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts	Not Applicable	High Pedestrian Volumes	Bike Path with Separate Walkway or Protected Bicycle Lane
		Low Pedestrian Volumes	Shared Use Path or Protected Bicycle Lane

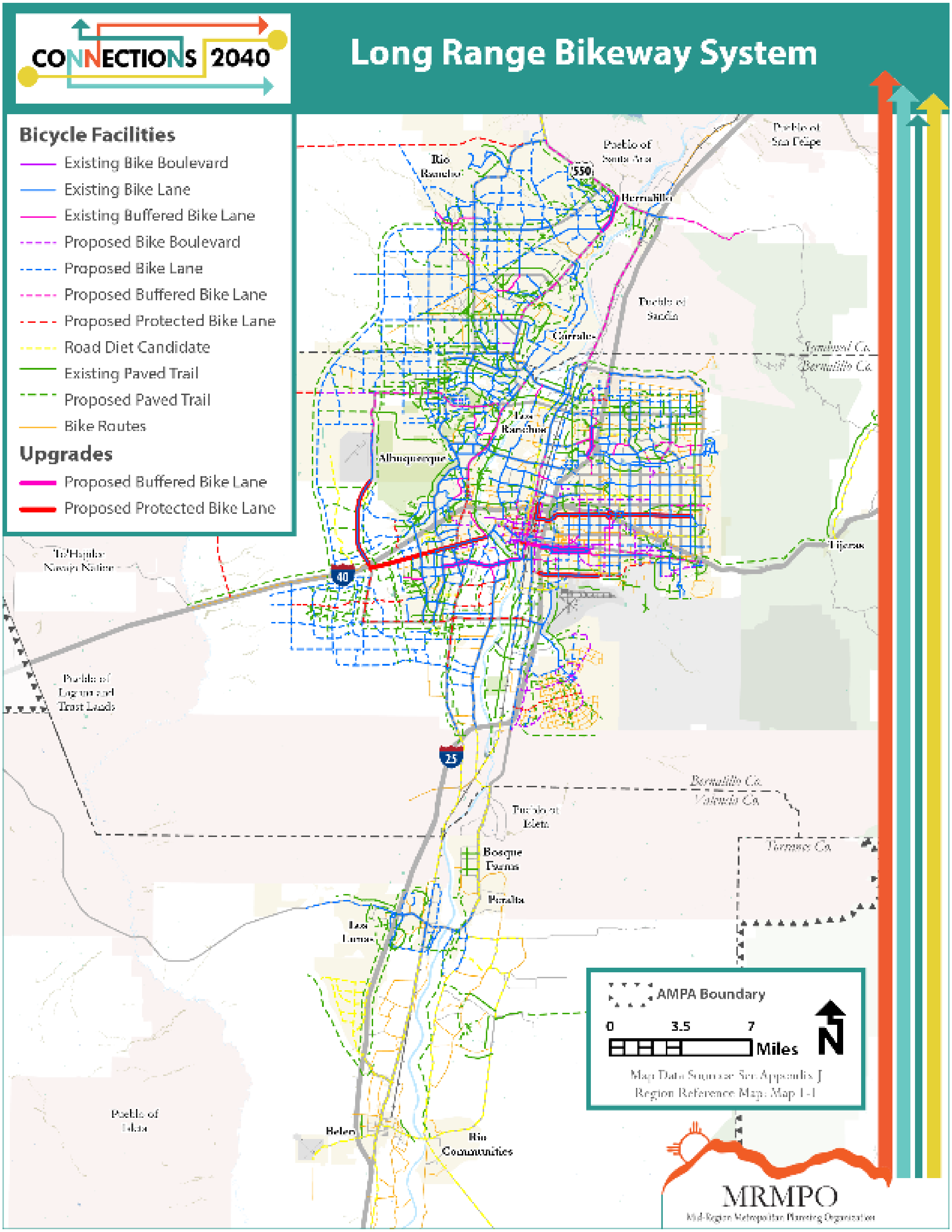
*High Curbside Activity such as frequent buses, high vehicular congestion, or turning conflicts should first consider a Protected Bicycle Lane

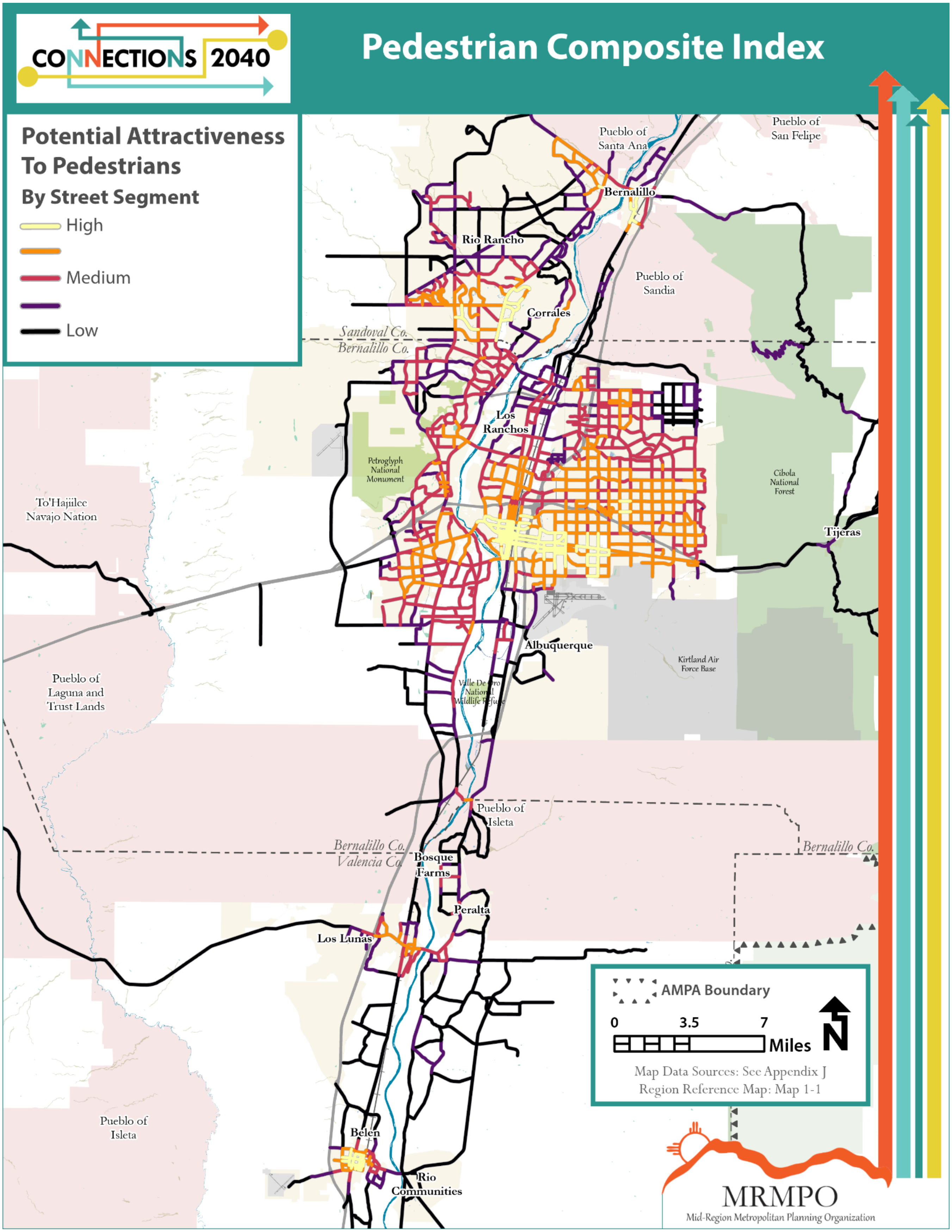
3.6 FUTURE PEDESTRIAN FACILITIES

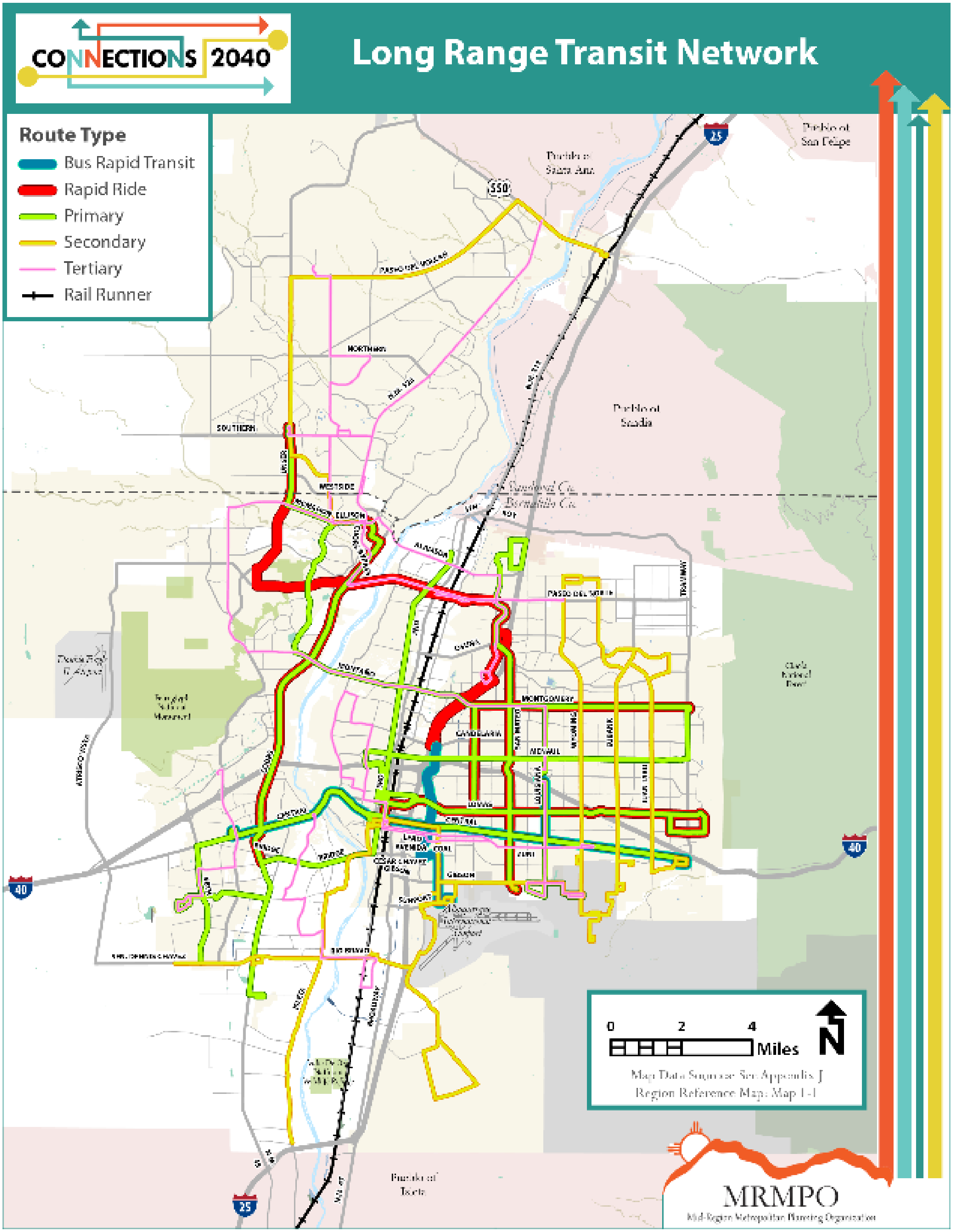
Priorities for improving the pedestrian network and pedestrian facilities in thhe region must focus on developing walkable centers and safer conditions for pedestrians walking. Focusing on areas such as activity centers, schools, parks, transit stops, and where populations live that are reliant on transit or walking areas will help target locations that could benefit most from improvements to the safety and comfort of pedestrian infrastructure. The Pedestrian Composite Index (PCI) is a tool that can be used to inform pedestrian improvements. Because of the high pedestrian fatality rates in this region, it is imperative that we work on bringing different methods, data, partners, and approaches together to ensure the pedestrian network—and pedestrian safety—improves over time.MRMPO updates and maintains the PCI. This Index focuses on roadways with high generator scores.

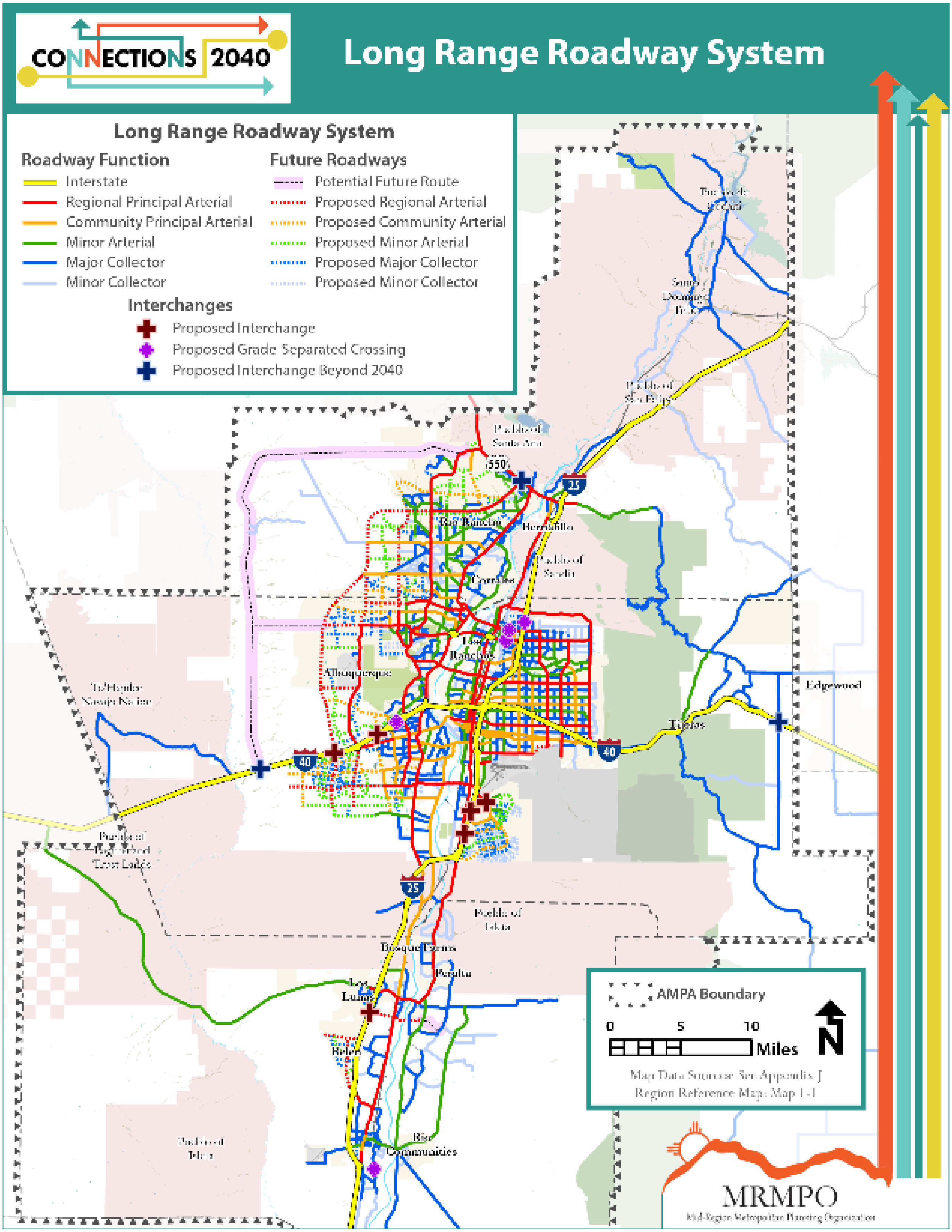
The PCI tool helps compare roadways in the region and provides a wide variety of pedestrian related data for segments of roadways to help show where pedestrian improvements could be most beneficial. However, it does not provide details, such as the presence and width of sidewalks nor does it provide information on future demand for walking. Currently, MRMPO does not have access to sidewalk conditions or a substaintial pedestrian traffic count database, but as local jurisdictions gather this data, MRMPO will be able to expand this assessment to include sidewalk condition and width. Pedestrian Generator Data that is included:

- Proximity to schools, bus stops, parks, community centers
- Proximity to higher density areas of jobs and housing
- Proximity to higher roadway connectivity
- Percent of population 16 years+ who walk or take transit to work (latest ACS data)
- Percent of households with 0 vehicles or fewer vehicles than workers (latest ACS data)


CONNECTIONS 2040
Long Range Bikeway System
Bicycle Facilities
Existing Bike Boulevard
Existing Bike Lane
Existing Buffered Bike Lane
Proposed Bike Boulevard
Proposed Bike Lane
Proposed Buffered Bike Lane
Proposed Protected Bike Lane
Road Diet Candidate
Existing Paved Trail
Proposed Paved Trail
Bike Routes
Upgrades
Proposed Buffered Bike Lane
Proposed Protected Bike Lane
Rio Rancho
550
Bernalillo
Corrales
Albuquerque
Tijeras
40
25
Bernalillo Co.
Valencia Co.
Torrance Co.
Bosque Farms
Peralta
Belen
Rio Communities
AMPA Boundary
0
3.5
7
Miles
N
MRMPO


CONNECTIONS 2040
Pedestrian Composite Index
Potential Attractiveness To Pedestrians
By Street Segment
High
Medium
Low
Pueblo of Santa Ana
Pueblo of San Felipe
Bernalillo
Rio Rancho
Pueblo of Sandia
Corrales
Sandoval Co.
Bernalillo Co.
Los Ranchos
Petroglyph National Monument
Cibola National Forest
To'Hajiilee Navajo Nation
Tijeras
Albuquerque
Kirtland Air Force Base
Pueblo of Laguna and Trust Lands
Pueblo of Isleta
Bernalillo Co.
Valencia Co.
Bosque Farms
Bernalillo Co.
Peralta
Los Lunas
AMPA Boundary
0
3.5
7
Miles
N
Map Data Sources: See Appendix J
Region Reference Map: Map 1-1
Pueblo of Isleta
Belen
Rio Communities
MRMPO
Mid-Region Metropolitan Planning Organization


CONNECTIONS 2040
Long Range Transit Network
Route Type
Bus Rapid Transit
Rapid Ride
Primary
Secondary
Tertiary
Rail Runner
0
2
4
Miles
N
MRMPO
PASEO DEL VOLCAN
NORTHERN
SOUTHERN
WESTSIDE
ELLISON
ALAMEDA
PASEO DEL NORTE
MONTANO
MONTGOMERY
CANDELARIA
MENAUL
CENTRAL
GIBSON
SUNPORT
RIO BRAVO
TRAMWAY
UNSER
COORS
ATRISCO VISTA
ZUNI
BRIDGE
LOMAS


CONNECTIONS 2040
Long Range Roadway System
Long Range Roadway System
Roadway Function
Interstate
Regional Principal Arterial
Community Principal Arterial
Minor Arterial
Major Collector
Minor Collector
Future Roadways
Potential Future Route
Proposed Regional Arterial
Proposed Community Arterial
Proposed Minor Arterial
Proposed Major Collector
Proposed Minor Collector
Interchanges
Proposed Interchange
Proposed Grade Separated Crossing
Proposed Interchange Beyond 2040
550
25
40
Rio Rancho
Bernalillo
Corrales
Albuquerque
Edgewood
Tijeras
Bosque Farms
Peralta
Belen
AMPA Boundary
0
5
10
Miles
N
MRMPO

Chapter 4

ROADWAY DESIGN GUIDELINES

Chapter 4

Roadway Design Guidelines

The following conceptual design recommendations for new roadways build upon character area, the roadway's regional role, and if the roadway is part of the Long Range Transit or Bikeway Systems. Once the surrounding context and the roadway's role in the network has been identified the next step is to determine the conceptual design. These recommendations provide basic guidance on right-of-way (ROW) set-aside width and a means for modal prioritization. The intent is to provide the minimum right-of-way width that also ensures good multi-modal accommodation in order to avoid costly retrofits later. Expressways and interstates are not included in this guidance.

Context Sensitive

The following design recommendations are context sensitive and were developed to be flexible. As such, these design guidelines were created to provide member agencies with a **range of options** depending on transportation needs and land use context.

Each roadway context includes basic roadway specifications such as the number of lanes, driving lane width, sidewalk widths, and bicycling infrastructure.

Best Practices

These design guidelines draw on the best practices recommended by leading design guides, including:

- Institute of Transportation Engineers (ITE)'s Designing Walkable Urban Thoroughfares
- AASHTO's Guide for the Development of Bicycle Facilities 4th Edition
- Pennsylvania DOT's Smart Transportation Handbook
- NACTO's Urban Street Design Guide and Urban Bicycle Design Guide

Further design guidance can be found in each of these guides (please refer to the Appendix for a complete list). Wherever possible, the recommendations are grounded in the latest research of best practices but adapted to the Albuquerque Metropolitan Planning Area's unique context.

4.1 RIGHT OF WAY PRESERVATION FOR FUTURE ROADWAYS

The LRTS Guide provides a range of total right-of-way (ROW), and recommended ROW for individual elements that may be included in the roadway. The minimum ROW standards ensure adequate space is set aside for pedestrians, bicyclists, transit, and motorists. The maximum ROW is provided for roadways where additional ROW may be warranted for elements that require significant space such as transit lanes or adjacent trails, **although in most cases this maximum ROW is not required to accommodate all users.**

TABLE 4.1: Right-of-Way Ranges

Regional Principal Arterial	106’-156'
Community Principal Arterial	96’-130'
Minor Arterial	82’-124'
Major Collector	62’-100'
Minor Collector	48’-84’

Right-of-way flexibility helps to manage the trade-offs between smaller and larger rights-of-way. Smaller rights-of-way have the advantage of allowing for more developable land, lowering maintenance and construction costs, and creating shorter pedestrian crossing distances. However, wider rights-of-way provide more flexibility for multi-modal accommodation and allow for medians, which improve roadway safety and can provide space for mid-block crossings for pedestrians.

Number of Lanes

A critical consideration when developing future roadways is the number of lanes needed for anticipated travel demand. There are two key recommendations.

Parallel Routes

The conceptual design matrices (section 5.7) provide the maximum number of lanes based on roadway type and character area. If the maximum number of lanes is not sufficient to meet projected demand **creating additional, connected, parallel routes is recommended first** instead of adding more lanes beyond the recommended maximum. Expressways and interstates are not included in this guidance.

Future Travel Demand

It is important to look at the differences between the Trend and Target Scenarios when determining future travel demand. A major issue with using the Trend Scenario (and perhaps even the Target Scenario) is that the travel demand is induced demand. Building roadways now, to accommodate traffic 20 years in the future, encourages more trips making capacity improvements less effective. Taking induced demand into consideration, as well as the character area, is recommended when planning for future travel demand needs.

Reducing Right-of-Way Requirements

In some cases, there may be opportunities to *reduce* the minimum ROW set aside. The following options can be used to reduce the amount of ROW dedicated for new roadways. These options can also be used to deal with constrained ROW on an existing roadway.

Multiple Routes

Roadways do not have to be as wide if they are part of a complete network that disperses traffic along many different routes. Creating a network with multiple routes means roads can be narrower, carry less traffic individually, and support additional modes, while, at the same time, maintaining overall network efficiency and capacity.

Fewer Lanes

Reducing the number of lanes along a roadway may be acceptable given projected or actual traffic volumes. Future roadways, especially those embedded in well-connected networks, do not have to include as many lanes to support the same overall traffic volume.

Narrower Lane Widths

Reducing the width of travel lanes can also reduce the ROW requirements. Generally, lane widths of 10 to 11 feet are recommended along all urban roadways.

Provide Parallel Bikeways

Bicycling infrastructure does not need to be included along every roadway if there are parallel routes close by. Providing a bicycle route on a lower volume roadway may be a better option than trying to accommodate bicyclists on a principal arterial.

EXCEPTIONS & AMENDMENTS

In some cases, exceptions to the standard right-of-way requirements, or changes to the system maps, may be acceptable if there are existing constraints or additional considerations.

Circumstances where exceptions may be necessary include:

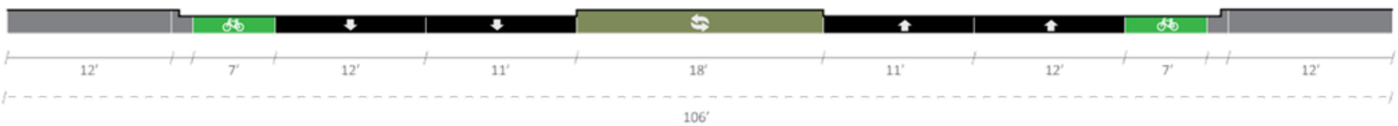
- Environmental considerations
- Disproportionate costs
- ROW constraints on existing roadways
- Explicit preclusion of a certain use along the roadway, such as non-motorized travel
- Additional street design goals as listed in relevant planning documents

FIGURE 4.1: COMPARISION OF ROW FOR EXAMPLE REGIONAL PRINCIPAL ARTERIALS

EXAMPLE 106' REGIONAL PRINCIPAL ARTERIAL - URBAN CONTEXT

Regional Principal Arterial, 4 lanes,
40 MPH, 30K AWDT, 10% HV

Auto LOS: D
Ped LOS: C (3.47)
Bike LOS: C (3.41)



EXAMPLE 124' REGIONAL PRINCIPAL ARTERIAL - ACTIVITY CENTER CONTEXT

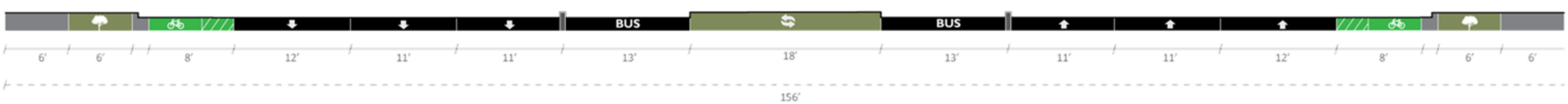
Regional Principal Arterial, 4 lanes,
40 MPH, 30K AWDT, 10% HV

Auto LOS: D
Ped LOS: C (3.16)
Bike LOS: B (1.55)

EXAMPLE 156' REGIONAL PRINCIPAL ARTERIAL - BRT CORRIDOR

Regional Principal Arterial with BRT,
6 lanes, 45 MPH, 50K AWDT, 13% HV

Auto LOS: D
Ped LOS: D (3.80)
Bike LOS: D (4.29)



4.2 TRAVELED WAY DESIGN ELEMENTS

Traveled way is the section of the roadway between curbs.

LANE WIDTH

A standard lane width of 10 to 11 feet is recommended along all urban areas with posted speeds of 35 MPH or lower.

Safety and Decreased Costs

In urban areas, lane widths of 10 to 11 feet provide the same levels of service as wider lanes,[5] while maintaining or improving overall safety compared to wider lanes.[6] Narrower lanes also reduce impervious surface coverage, require less construction material, have lower maintenance expenses, and reduce crossing distances for pedestrians.[7]

Multimodal Options

Using narrower lanes also provides extra room for other roadway users. For example, reducing the lane widths from 12 to 11 feet on a six-lane road creates room for a 3-foot bike lane buffer on each side of the road, increasing bicycle level of service significantly.

Lane widths of 12 feet may be appropriate on roadways with speeds higher than 35 MPH, higher percentages of heavy vehicles (including buses), and in rural contexts.[8]

On slow collectors (30 mph and below), in constrained environments, where there is not enough space for dedicated bicycle lanes, wider outside lanes improve bicycle level of service. Transit usually requires a minimum of 11-foot lane widths with 12 feet preferred.

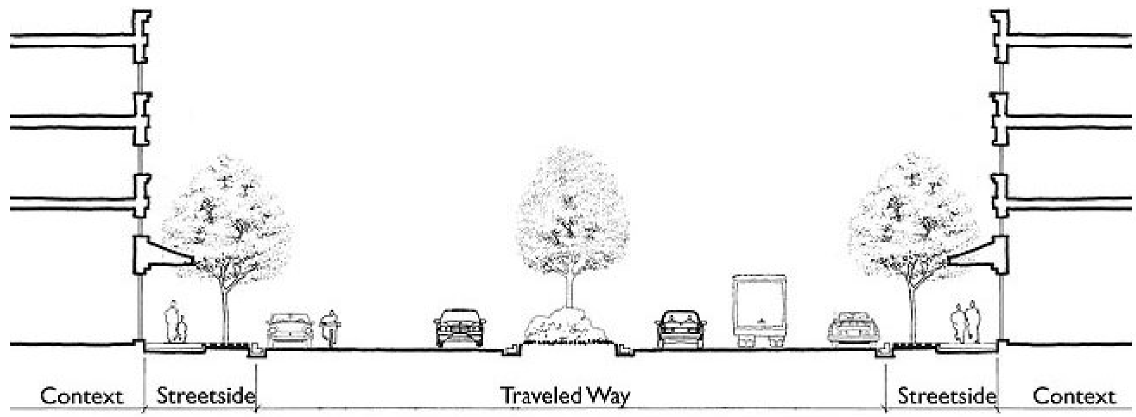


FIGURE 4.2: ELEMENTS OF THE TRAVELED WAY

Table 4.2 Lane Width

10’-11’ for speeds 35 MPH or lower
11’-12’ for speeds above 35 MPH, higher percentages of heavy vehicles and transit

DESIGN SPEEDS

Roadway design, target, and posted speeds should be determined together with the context of the area clearly in mind. **Generally, speeds 35 MPH or below are appropriate in urban areas.**[9] In areas with higher levels of pedestrian or bicycle activity, even lower speeds are appropriate (30 MPH or lower).

[5] Potts, I.B., Harwood, D.W., & Richard, K.R. (2007). Relationship of lane width to safety for urban and suburban arterials. *Geometric design and the effects on traffic operations 2007*, 63-82. Washington, DC: Transportation Research Board

[6] NACTO Urban Street Design Guide 34; Harwood, D.W. (1990). *Effective utilization of street width on urban arterials* (NCHRP Report 330). Washington, DC: Transportation Research Board

[7] NACTO, 34

[8] Highway Safety Manual 2010, 10-24: Lane widths under 12’ result in crash modification factors greater than 1.00

[9] ITE Designing Walkable Urban Thoroughfares, 108

Higher design speeds require more "forgiving" roadway design features: wider lanes, larger turning radii, clear zones, channelized turn lanes, and larger intersection spacing. This in turn reduces the comfort and safety of the street for bicyclists and pedestrians, lowers multi-modal level of service scores, and can encourage speeding vehicles. **Higher speeds are associated with more severe crashes, including more fatalities.**[10]

Given these considerations, posted speed should be consistent with the targeted design speed, using proactive design strategies including traffic calming, narrower lanes, street trees, and shorter signal lengths.

MEDIANS

Medians have many benefits: they facilitate left turns, create pedestrian refuge areas, create an attractive landscape buffer, allow for the installation of street infrastructure (such as lighting), and can increase roadway safety.[11]

ON-STREET PARKING

On-street parking supplements the parking demand of nearby businesses and residences. It also increases the comfort of pedestrians by providing an additional buffer between the sidewalk and traffic.

Parked cars not only create a physical shield between pedestrians and the roadway, but also effectively slow traffic, which can enhance a street's walkability.[12]

However, there are trade-offs with on-street parking. They reduce the capacity of the adjacent lane and introduce an additional hazard for bicyclists, due to drivers opening their doors into occupied bike lanes ("dooring") or due to motorists entering and exiting parking spaces.

TABLE 4.3: Recommended Median Widths for Roadways 35 mph or less[13]

Median Type	Recommended Width
Access control	6'
Pedestrian refuge	8' (minimum 6')
Street Trees and Lighting	10'
<u>Single left turn lane:</u>	
Collector median	14'
Arterial median	16-18'
<u>Dual left turn lane:</u>	22'
<u>Dedicated transit lanes:</u>	22-24'

[10] NACTO Urban Street Design Guide 140; ITE Designing Walkable Urban Thoroughfares 111

[11] Highway Safety Manual,

[12] ITE Designing Walkable Urban Thoroughfares, 109

[13] ITE 141

Parallel Parking

The preferred width of parallel on-street parking is 8 feet wide. A minimum of 13 feet is needed to include both a parallel parking lane and an adjacent bicycle lane. Shared lane markings and buffered bicycle lanes (with the buffer between parked cars and the bicycle lane) are strategies to reduce the risk of "dooring."[14]

Angled Parking

Angled parking should be considered on wide streets with low speeds and volumes and in activity areas. For safety reasons, back angle parking is recommended for all angled parking and particularly for roadways that also include a bike route or lane.

TABLE 4.4: Minimum Dimensions for Angled Parking[15]

Angle	Stall Length	Minimum Width of Adjacent Lane
45˚	17' 8"	12' 8"
50˚	18' 3'	13' 3"
55˚	18' 8"	13' 8"
60˚	19' 0"	14' 6"

FIGURE 5.4: PEDESTRIAN CROSSING AT CENTRAL AVENUE AND 8TH STREET ROUNDABOUT

4.3 INTERSECTIONS

Visibility and predictability are key considerations at intersections: all users should have a clear view of each other so they can safely negotiate the intersection without conflict.

Intersections are also often places where otherwise good street design breaks down: bike lanes end to make way for right turn lanes, crosswalks are not provided at logical crossing points, generous curb radii promote high turning speeds, and crossing signals do not allow adequate time for slower pedestrians to cross safely.

Conflicts at Intersections

Designing safe intersections is a challenge because intersections introduce many conflict points between users: motorists are turning, pedestrians of all abilities are crossing the street, buses are unloading passengers, and bicyclists are attempting to negotiate a safe crossing.

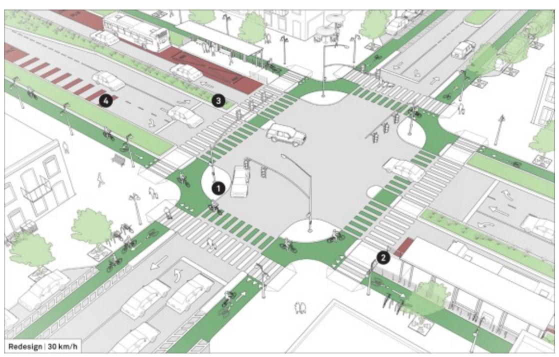
[14] NACTO Urban Bikeway Design Guide 9, 133

[15] ITE Designing Walkable Urban Thoroughfares 147

Along with improving safety for all modes, with the challenges of providing needed roadway capacity under limited available funding and right-of-way, new innovative types of intersections have been developed to meet these challenges.

PROTECTED INTERSECTIONS

This design prioritizes safety for all users and not just motorists. Protected cycle tracks and buffered bike lanes are provided that go through the intersection. Bicyclist turns are two-stage turns, there is leading signal priority, and smaller curb radii to slow vehicles turning. Dedicated transit lanes and stations are designed to facilitate better interactions between cyclists, transit vehicles, and transit riders at stop locations. Sidewalks are extended and the curbs provide safe, short distances for crossing. Signalize turn lanes are added.



MODERN ROUNDABOUTS

Modern roundabouts have been shown to reduce the number of crashes and crash severity at intersections as compared to signal con-trolled intersections, and they don't require the cost of implementing signalization. This is achieved by reducing the number of conflict points at intersections and slowing traffic, while keeping traffic flowing, which can also increase overall intersection capacity.

Proven Safety Countermeasure

FHWA identified roundabouts as proven safety countermeasure with the potential for 82% reduction in severe crashes (two-way stop-controlled intersection to a roundabout) and a 78% reduction in severe crashes (signalized intersection to a roundabout).

Unfortunately, innovative geometry does not have enough historical experience for the establishment of standard design practice. Each type of roadway geometry should be researched to see what other regions and states do. Additionally, the FHWA has guides in place such as Roundabouts: An Informational Guide and Alternative Intersections/Interchanges.

Prioritizing Safety

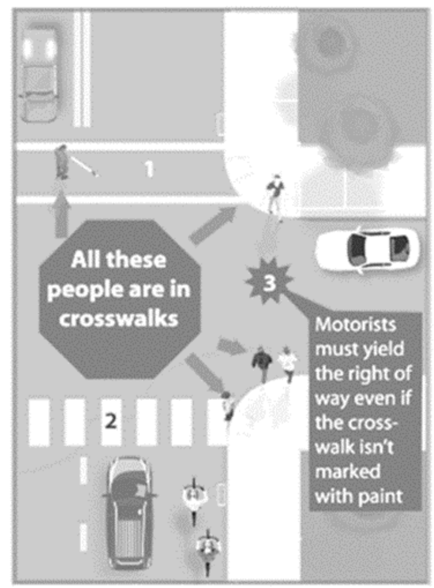
Because intersections introduce many conflict points, the safety of the most vulnerable users (pedestrians and bicyclists) should be prioritized. Many times, this means providing shorter crossing distances for pedestrians, slowing traffic speeds, and enhancing bicycle and pedestrian visibility.

INTERSECTION CROSSWALKS

Highly visible marked crosswalks are essential elements of safe crossings and should be provided at all approaches of signalized intersections.

Unmarked Crosswalks

An unmarked crosswalk is defined as an assumed crosswalk that exists at every intersection and across every leg at that intersection.



Source: Wisconsin Bike Fed

Crosswalks and the Law

By law, pedestrians have the same right-of-way in a marked and an unmarked crosswalk, but all too often this is not made clear to both transportation and enforcement professionals, which ends up in pedestrians being charged as at fault when they have the right-of-way. According to New Mexico state law the driver is supposed to yield to the pedestrian at all marked and unmarked crosswalks.

There are many unmarked crosswalks that should be marked, even at unsignalized intersections. It is especially important that there are marked crosswalks near large pedestrian generators such as schools, high volume transit stops, and commercial areas.

Federal Highway Administration's Safety Transportation for Every Pedestrian (STEP)

FHWA's *Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations* helps agencies select pedestrian crash countermeasures. This guide includes ways to determine and apply a specific set of countermeasure design options to crash types.

Curb Design

Curb design at intersections is important because it demarcates the transition zone between pedestrians and motorists. **Turning movements are one of the top causes of pedestrian crashes at intersections.**[16] Often this can be attributed to higher turning speeds and reduced visibility.

Curb Radii

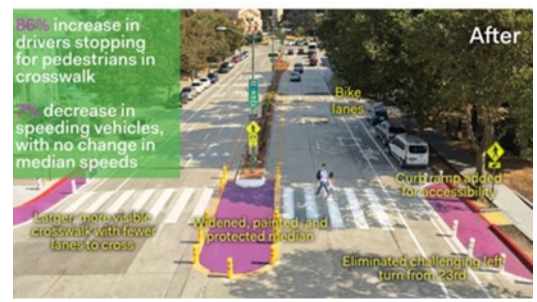
According to NACTO design guides, standard curb radii should be 10–15 feet, however many cities use corner radii as small as 2 feet. In urban settings it is especially important that smaller corner radii are used and NACTO recommends that exceeding 15 feet should be the exception.

Large curb radii (curb returns) promote higher speed turns and increase pedestrian crossing distances. Smaller curb radii can be used to slow vehicles making right turns.

Additionally, channelized right turn lanes reduce driver visibility and introduce additional conflict points. This creates an unsafe environment for pedestrians and increases intersection crossing times.

CURB EXTENSIONS

One way to slow traffic at intersections is to use curb extensions (also known as bulb outs) to extend the line of the curb into the street. This slows traffic and makes crossing distances shorter.[17] Curb extensions also provide a larger waiting area for pedestrians, reduce curb radii, and provide room for more accessible, perpendicular curb ramps.



Curb extensions can be considered at intersections of streets with on-street parking, as well as at midblock crossings.

[16] Ewing, Pedestrian- and Transit-Oriented Design 43

[17] ITE Designing Walkable Urban Thoroughfares 195

Bus bulbs outs can be used at bus stops to define the location of the stop as well as provide a space for transit shelters.

SIGNALS AND SIGNAL TIMING

Modifications to signal timing can be used to better accommodate pedestrians, transit vehicles, or bicyclists. For example, walk signal times can be changed to allow slower walkers, including the elderly, people with disabilities, and people with small children, to cross the street in one cycle. Planning for these users requires calculating walk times based on an average pedestrian speed of 3.0 – 3.5 MPH. Waiting times can also be reduced in high volume pedestrian areas.

Leading Pedestrian Intervals

Another signal design tool that would provide added pedestrian safety and protection at signalized intersection crossings are leading pedestrian intervals (LPIs). LPIs essentially give pedestrians a head start before cars enter an intersection. It gives a pedestrian an opportunity to get into the crosswalk prior to right-turning vehicles entering the crossing area.

No Right Turn On Red (RTOR)

LPIs can further be augmented by a right-turn arrow, which would restrict right-turns on red to minimize vehicle-pedestrian conflicts. The leading pedestrian interval essentially provides pedestrian visibility for those dangerous right-turn/pedestrian conflicts at signalized intersections.

FIGURE 4.5: EXAMPLE OF A LANDSCAPED CURB EXTENSION IN NOB HILL

Proven Safety Countermeasure

This effort is relatively inexpensive and should be deployed at signalized locations with heavy pedestrian crossing demands. According to a Transportation Research Board study, Safety Effectiveness of Leading Pedestrian Intervals by a Before-After Study with Comparison Groups, it has been shown that LPI's have reduced pedestrian-vehicle crashes by as much as 60% (FHWA 2017).

According to FHWA, LPIs should be implemented in conjunction with no RTOR. Other strategies include part-time no RTOR during busiest times of day with high pedestrian volumes.

	Safety Issue Addressed				
Pedestrian Crash Countermeasure for Uncontrolled Crossings	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/ visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement	🚶	🚶	🚶	🚶	🚶
High-visibility crosswalk markings*	🚶		🚶	🚶	
Parking restriction on crosswalk approach*	🚶		🚶	🚶	
Improved nighttime lighting*	🚶		🚶		
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*	🚶		🚶	🚶	🚶
In-Street Pedestrian Crossing sign*	🚶	🚶	🚶	🚶	
Curb extension*	🚶	🚶	🚶		🚶
Raised crosswalk	🚶	🚶	🚶	🚶	
Pedestrian refuge island	🚶	🚶	🚶		🚶
Pedestrian Hybrid Beacon	🚶			🚶	
Road Diet	🚶	🚶	🚶		🚶

*These countermeasures make up the STEP countermeasure "crosswalk visibility enhancements." Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements.

4.4 TRAFFIC CALMING

Efforts should be made to slow traffic on streets with pedestrian or bicycle activity. This includes minor arterials and collectors. This is important because higher speeds are associated with more severe crashes, as well as higher likelihoods of pedestrian and bicyclist fatalities. There are several active measures to reduce speed, some of which are outlined in Figure 5.6.[18]

4.5 TRANSIT

Transit users are pedestrians before they board and when they arrive at their destination, meaning the provision of minimum levels of streetside pedestrian facilities between transit stops and nearby destinations are critical to support higher transit levels of service.

TRANSIT LANES

Dedicated transit lanes can be considered along major transit routes where congestion may increase headways and reduce transit level of service. Generally, dedicated bus lanes should be 12 feet wide and no less than 11'.

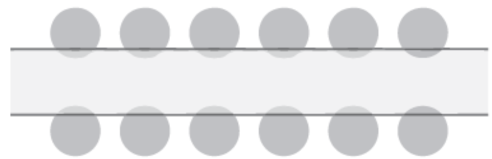
FIGURE 4.6: EXAMPLE TRAFFIC CALMING MEASURES. ADOPTED FROM NACTO's *URBAN STREET DESIGN GUIDE* AND ITE's *DESIGNING WALKABLE URBAN THOROUGHFARES.*

ON-STREET PARKING

On-street parking creates a physical barrier between pedestrians and the roadways. It also visually narrows the roadway for drivers, slowing traffic.

CURB EXTENSIONS

Curb extensions can narrow the roadway, reduce crossing distances for pedestrians, and give a visual indication to drivers to slow down.

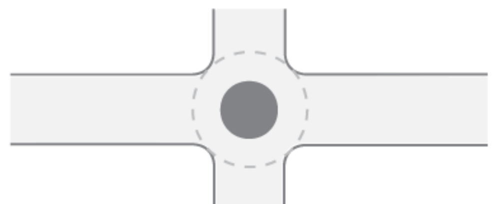


STREET TREES

Like on-street parking, street trees add a visual element to the edge of roadways, perceptually narrowing the roadway for drivers.

MEDIANS

Medians can visually narrow the roadway for drivers, as well as seperate opposing lanes of traffic.

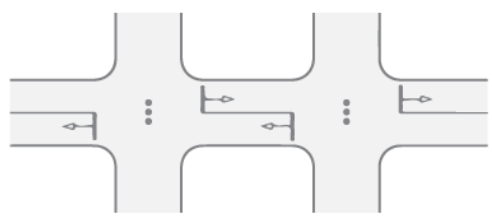


ROUNDABOUT

Roundabouts are a proven safety counter-measure for reducing speeds and conflict points at intersections.

ROADWAY NARROWING

Narrowing roadways by reducing the number of lanes, creating narrrower travel lanes, and adding streetside design elements can effectively slow traffic.



SIGNAL PROGRESSION

Signal progession can reduce target speeds along the roadway.

TWO-WAY TRAFFIC

Two way street traffic can slow traffic by making motorists drive more cautiously thorugh awareness of opposing traffic.

[18] AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 40-41

FIGURE 5.7: EXAMPLE OF BUS FACILITIES IN DOWNTOWN ALBUQUERQUE

BUS RAPID TRANSIT

Bus rapid transit generally requires dedicated lanes, at grade boarding platforms, signal prioritization, and off-board fare collection. In addition, most routes require median transit platforms, which unlike traditional bus stops, require significant space. The recommended added width for transit platforms is 10 feet for each side platform and 30 feet for center platforms.[19]

Although transit in general does not require dedicated transit lanes, dedicated space at intersections for queue jumps may be recommended as well as additional dedicated space at bus stops.

TRANSIT STOPS

All transit users have to walk from their station to their origin or destinations, so the provision of pedestrian facilities between transit stops and nearby destinations is critical to support higher transit levels of service. This includes providing, at minimum, a place to sit. Higher levels of service can be achieved by providing comfortable bus shelters (i.e., shaded and sheltered), service information, real-time service updates, and improved pedestrian level of service.

4.6 BICYCLE & TRAIL INFRASTRUCTURE

Providing safe and well-connected bicycling infrastructure is crucial to encouraging more bicycling. **There is a direct correlation between the amount of bicycling infrastructure that is built and the number of people who choose to bike.[20]**

However, constructing bicycling infrastructure that is safe and accessible to bicyclists of all abilities is often challenging, especially within a constrained right-of-way. In addition, design standards for bicycling infrastructure are rapidly evolving as cities experiment with different configurations to learn what works best.

[19] Bicycle Commuting and Facilities in Major U.S. Cities TRB 2003

[20] Alliance for Biking & Walking. (2014). Bicycling and Walking in the United States 2014 Benchmark Report.

AASHTO's *Guide for the Development of Bicycling Facilities 2012 Edition* and NACTO's *Urban Bicycling Design Guide* provide excellent guidance on current best practices that expand on the considerations below.

Updated AASHTO Guide

More communities are demanding street designs that support all modes of travel, and that are safe and comfortable for bicyclists and pedestrians. The AASHTO guide is currently being updated and includes a now widespread acceptance of bikeway designs for people of all ages and abilities, which means more innovative bikeway designs. For example, according to AASHTO, there is a section in the guide that will help facilitate choosing the best design in constrained rights-of-way such as narrowing travel lanes or reorganizing street space.

It will be important to refer to these guidelines once they are published. At this point, NACTO guidelines are the most up to date and nationally respected design guidelines when it comes to the latest best practices.

BICYCLE LANES

Bicycle lanes provide an exclusive travel lane for bicyclists to use within the roadway. They are generally included on community principle arterials, minor arterials, and major collectors with higher traffic volumes or higher speeds.

FIGURE 4.8: BICYCLE LANE AND PEDESTRIAN CROSSING

Benefits for Bicyclists and Motorists

Bicycle lanes create benefits for both bicyclists and motorists: they provide lateral separation between cyclists and traffic, which increases bicyclist comfort and safety; they enable bicyclists to travel at comfortable speeds without worrying about traffic; and they provide more predictability to both users with regard to positioning and interaction.

AASHTO's *Guide for the Development of Bicycle Facilities* provides a recommended width of 5 feet for bicycle lanes. The LRTS Guide recommends 5 feet (not inclusive of the gutter pan) on roadways with posted speeds of 30 mph or less.

On roadways with higher speeds wider lanes are recommended. For roadways with posted speeds of 35 mph, bike lanes 6 feet wide are recommended. In addition, on streets with on-street parking, wider bike lanes may be appropriate to protect bicyclists from accidental "dooring."

BARRIER PROTECTED BICYCLE LANES (CYCLE TRACKS)

In the case of regional principal arterials and community principal arterials, as well as in areas of higher bicycle traffic, protected bicycle lanes (or cycle tracks) may be appropriate.

Protected bicycle lanes increase the lateral separation between motorists and bicyclists by including a buffer/barrier area between the outside of the bicycle lane and the outside auto lane. This area is usually 3 feet and may include buffered striping along with plastic divider bollards, or other physical barriers. Protected bike lanes can also be considered in areas with on-street parking where the bicycle lane is between the parked cars and the curb.

There was one barrier protected bicycle lane in Downtown Albuquerque, where parking spaces were the barrier to a bicycle lane that was situated adjacent to the sidewalk. This facility has since been taken out.

At first, motorists did not know how to handle this design, but over time it was used correctly. Another section is currently operating on a short section of Carlisle south of Central.

Bike share stations can also provide great barriers between bike traffic and vehicular traffic and would be a great addition to the existing bike share program being operated in Albuquerque area.

Parking and Bike Share Protected Lane in New York

BICYCLE BOULEVARDS & SHARED LANE MARKING (SHARROWS)

Sharrows and Bicycle Boulevards are used for lower volume roadways and to provide better connectivity in the overall bikeway system.

Sharrows

On streets with low traffic volumes (<3,000 ADWT) and with posted speeds 25 MPH or less, sharrows may be used to indicate the presence of bicyclists.[21] Sharrows are on-street markings that indicate a shared lane between motorists and bicycles. They remind both users to expect the presence of bicyclists, without having to add an exclusive bike lane (which is not always feasible in a constrained right-of-way).

Sharrows can be coupled with bicycle boulevards to create connecting, parallel routes for bicycle traffic away from higher volume roadways.

Bicycle Boulevards

Bicycle boulevards are streets that are designated to prioritize bicycle traffic. They utilize lower traffic speeds, traffic calming, unique signage, and pavement markings.

Bicycle boulevards running parallel to major streets can increase the accessibility for riders who are less comfortable riding on major roadways. They also provide a secondary option to create connected routes between primary bicycling routes and the full bicycling network.

[21] NACTO Urban Bikeway Design Guide, 136

FIGURE 4.9: MULTI-USE PATH ALONG PASEO DEL NORTE

MULTI-USE PATHS

The region's multi-use paths are very popular, and several new trails are planned along regional principal arterials.

However, there are many considerations and trade-offs in the development of trails alongside roadways. Trails along roadways involve significant safety considerations[22] and they require a substantial amount of right-of-way. For example, trails are usually at least 10 feet wide and set back, and therefore introduce more potential conflicts when there are multiple driveways or entrances along the roadway.

Trails may be substituted with cycle tracks and sidewalks with buffers in areas where this configuration is vetted as a reasonable alternative. However, it is important to maintain comfort and safety when investigating options that require less space.

BIKEWAY INTERSECTION MARKINGS & SIGNAL DETECTION

Like crosswalks, bicycle intersection markings indicate to motorists the intended path (and implied presence) of cyclists. They also guide cyclists through intersections with additional conflict points or high levels of activity. This helps increase safety, especially where there is the potential conflict for cyclists and motorists making right hand turns.[23]

One example of a newer practice is to install bike boxes at intersections with high volumes of traffic. These allow bicyclists to queue at the front of the intersection, between the crosswalk and cars, which increases their visibility to motorists. They can also facilitate safer left turns by bicyclists.[24]

[22] AASHTO Guide for the Development of Bicycle Facilities, 5-8

[23] NACTO Urban Bikeway Design Guide, 50

[24] NACTO Urban Bikeway Design Guide, 50

Signal Detection Benefits

Often bikeways are on roadways that do not have signal priority or that require a motor vehicle to be detected for the signal to change.

Bicycle detection at signalized intersections provides a means to address cyclists reasons for running red lights. Bicyclist detection can also be used to improve the intersection's safety by providing adequate time for the bicyclist to cross the intersection.

4.7 STREETSIDE DESIGN ELEMENTS

The following section describes elements of the streetside, additional considerations for making walking safe, comfortable, and interesting as well as how the streetside can create 'Green Streets' and aid in stormwater management.

FIGURE 4.10: DOWNTOWN ALBUQUERQUE

The streetside of a roadway refers to the section of the roadway extending from the edge of private property to the face of the curb.

Economic and Environmental Benefits

This area not only provides for pedestrian travel, access to adjacent properties, and locations for transit amenities; the streetside also has significant economic and environmental potential.

In many areas, the streetside offers the opportunity to be public spaces that bring added value to the community and support adjacent business.

The streetside also provides a means to help manage and clean stormwater which helps address the growing environmental need to reuse water and provide a mechanism to clean stormwater before releasing it to the river.

SIDEWALKS AND BUFFERS

For urban and suburban character areas there are three basic elements for streetside guidance; the landscaped buffer, clear sidewalk width, and the building shy zone.

The landscaped buffer provides both a separation from the roadway and a place for bus stops, signage, utilities and lighting.

The pedestrian clear sidewalk width is sometimes referred to as the pedestrian throughway. All urban and suburban roadways should include these two elements in order to provide adequate pedestrian accommodation.

SIDEWALKS

Sidewalks are an essential component to providing pedestrian access to businesses, residences, and public spaces. Sidewalks are part of active transportation networks and should be included in all urban and suburban roads.

The City of Albuquerque's Development Process Manual requires 6-foot sidewalk widths. This is a comfortable width for two people to walk side by side and converse. Larger sidewalk widths should be included in areas of higher pedestrian traffic, such as activity centers, retail streets, active transit stops, and near schools.

Even Surfaces

Creating an even walking surface is also important to facilitate comfortable pedestrian travel. For example, multiple curb cuts along a street that cut into the sidewalk can be consolidated to reduce the number of conflict points between entering and exiting vehicles and pedestrians while also creating a more even walking surface.

BUILDING SHY ZONES

The building shy zone refers to area where buildings or walls adjoin the pedestrian clear sidewalk zone. The conceptual design matrices include two additional feet to the streetside width as a countermeasure to reduce conflicts from people exiting buildings and address the effect of people shying away from walls or other vertical structures which effectively reduces the clear sidewalk area.

Activity centers and urban areas are most likely to have buildings that abut sidewalks. Walls alongside sidewalks is very common in the region. If buildings and walls are setback or if the clear sidewalk area abuts flat landscaping such as a lawn then the extra two feet of width is not necessary.

SIDEWALK BUFFERS

Buffers along sidewalks can be provided to increase pedestrian comfort by increasing the lateral separation between pedestrians and fast-moving cars. These buffers can be landscaped and include street trees, green infrastructure, street infrastructure such as lighting or utility poles, and transit stops. They also provide space for driveway pads while allowing the sidewalk to remain level.

Wide Shoulders in Rural Areas

Although not usually a streetside element, a wide shoulder can be beneficial for bicyclists and pedestrians (as well as slow moving tractors) along low volume rural roads since there is not usually a sidewalk. In rural areas with increased activity, sidewalks should be considered, or right-of-way set aside for future sidewalks, if development progresses.

4.8 PEDESTRIAN INFRASTRUCTURE

Well-designed pedestrian infrastructure is crucial to creating walkable places. Pedestrian facilities include more than providing ample sidewalks and buffers. In general, pedestrians need safe, comfortable, interesting, and well-connected places to walk.[25]

Often, this means focusing on design details that engage all the senses. **Often considered as non-essential, these elements should be crucial parts of the public right-of-way as they can lead to increased pedestrian activity.** For this reason, elements including street trees, landscaping, and street furniture are just as important as providing enough sidewalk space.

STREET TREES

Street trees are a worthy addition to most roadways, especially those with a high level of pedestrian activity. The benefits of street trees are numerous. They provide shade, safety for pedestrians, privacy, enhanced aesthetics, improved air quality, increased stormwater runoff capture, and reduced urban heat island effect.

Property Values

FIGURE 4.11: BUFFERED, LANDSCAPED SIDEWALK ALONG COAL AVE WITH WIDE CLEAR ZONES FOR WALKING

They have also been shown to increase property values of adjacent properties. In addition, a row of street trees, planted together, can form a beautiful, continuous canopy that visually frames the street.

STREET FURNITURE AND LIGHTING

Including ample spaces for people to stop, sit, wait, and rest should be provided along streets with higher levels of pedestrian activity.

[25] Walkable City, 2012

FIGURE 4.12: STREET LIGHTING AND STREET TREES IN DOWNTOWN ALBUQUERQUE

Street furniture can encourage increased activity and interaction along the street, while increasing the comfort level of pedestrians. This in turn can encourage more walking. Walkway lighting adds to safety and visibility at night.

Active Public Spaces

People are attracted to places with other people. Providing public spaces along the streets can bring vibrancy to otherwise lifeless streets by encouraging people to stop and interact. In contrast, "dead spaces" such as parking lots, vacant lots, and blank facades discourage public use, and lead to inactive, less interesting streets.

Creating active public spaces can involve building small plazas or pocket parks, creating sitting areas, improving transit amenities, and installing public art.

4.9 SAFE CROSSINGS

Midblock crossings are effective in areas with long block lengths, areas with a high level of pedestrian activity, and in places where many pedestrians currently cross due to efficiency.[26]

Mid-Block Crossings

Mid-block crossings are generally not necessary where block lengths are short or in areas with little pedestrian activity (unless that pedestrian activity has been deterred by the roadway design). Like intersection crossings, midblock

crossings should emphasize slower speeds, visibility, and safety.

There is ample guidance on selected locations for mid-block crossings, which must be done with care. On some roadways, only marking a crosswalk is insufficient.[27] However, there are additional elements that have been found to be effective at improving pedestrian safety when used in conjunction with a marked crosswalk.

PEDESTRIAN CROSSING ISLANDS

Pedestrian crossing islands (refuges) can be considered for multi-lane arterials and collectors with medians.[28] These islands can allow pedestrians to cross the street in two stages and only worry about one direction of traffic at a time.

[26] NACTO Urban Streets Design Guide, 115

[27] Federal Highway Administration, Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations, 2005

[28] Federal Highway Administration Proven Safety Countermeasures http://safety.fhwa.dot.gov/provencountermeasures/

Refuges have been shown to reduce pedestrian crashes on multi-lane arterials.[29]

Median design can also calm traffic and facilitate slower, safer streets. For example, medians can be extended into the intersection beyond the crosswalk to protect pedestrians and slow drivers making left turns. In addition, medians with trees further helps to calm traffic and provide opportunities to capture increased storm water runoff.

PEDESTRIAN HYBRID BEACONS

Pedestrian beacons and signals can increase the visibility of a crossing. These beacons have been shown to decrease the number of crashes at midblock crossings and can be considered on faster roadways.[30]

[29] Ewing, Pedestrian- and Transit-Oriented Design, 42

[30] Federal Highway Administration Proven Safety Countermeasures.

Chapter 5

ROADWAY DESIGN MATRICES

Chapter 5

Roadway Design Matrices

These matrices provide basic guidance on right-of-way (ROW) set-aside widths for new streets within the Albuquerque Metropolitan Planning Area. Additional right-of-way may be required for special purposes such as intersection widening, drainage, slopes, and landscaping; however, the right-of-way width may also be reduced for a street in a developed area when a different right-of-way has been platted or otherwise publicly acquired for the street. In addition to street typology, this Chapter provides information on Special Streets that may not fit into the standard context sensitive street design and therefore require a more out of the box approach to ensuring that the land use context is integrated into the design elements. Finally, another important aspect of designing and retrofitting streets is using the most up to date ADA recommendations, or above and beyond that, to ensure compliance with federal guidelines and support access to destinations for people with disabilities.

5.1 SPECIAL STREETS

Depending on the land use context of the street, the roadway may also function as a special street – for example, as a multi-way boulevard in a commercial area. These special streets involve unique design considerations that involve more detailed considerations to support existing land uses and users. A few of the special streets referenced in this guide include:

Downtown Streets often handle higher pedestrian volumes, many turning movements, business deliveries, and higher density developments. For these reasons, special care must be taken to ensure that downtown streets support a safe and attractive environment that accommodates pedestrians and bicyclists while supporting surrounding land uses. Often this means keeping speeds low, installing traffic calming features such as curb extensions, and providing a robust network of bicycle infrastructure. Specific considerations include creating wider sidewalks, installing street trees, converting one-way streets to two-way streets, adding on-street parking, and creating attractive, clearly visible transit amenities.

Multi-way Boulevards are a design option for wider principal and minor arterial roadways to support more walkable, bicycle-friendly streets. They often support slower traffic, mixed land uses, and an attractive, pedestrian-oriented public realm. Multi-way boulevards include a central median and a central traveled way bordered by landscape buffers that separate the main thoroughfare from parallel access roads. Access roads often include on-street parking, bikeways, and pedestrian amenities. Street trees and other landscape design features are key elements of traditional multi-way boulevards.

One-way street couplets such as Lead and Coal can function together as a unified corridor for regional travel. These streets, working in concert, can carry a high volume of traffic (from all modes) within a narrower overall right of way without having to squeeze amenities of all modes within a single constrained right-of-way. However, one-way streets can also encourage higher speeds and it is important to consider the impact to the adjacent neighborhoods when implementing these.

Transit Corridors are designed to accommodate high capacity transit services such as bus rapid transit (BRT) along existing arterial streets. They often have dedicated travel lanes for buses, median transit stations, special signal timing, and expanded pedestrian amenities. Given the high number of riders on these lines, special care must be taken to facilitate safe crossings for pedestrians. Because dedicated bus lanes add to the right of way requirements of these streets, these streets can become quite wide, making it challenging to balance the needs of all modes. However, new transit corridors can help catalyze economic development along a corridor by offering expanded mode choices, connecting key job centers, increasing pedestrian traffic, and raising land values.

FIGURE 5.1: RURAL MAINSTREET – LAS VEGAS, NM

5.2 ADA CONSIDERATIONS

Section 504 of the Rehabilitation Act makes it illegal for the federal government, federal contractors and state and local governments receiving federal funds to discriminate on the basis of disability. It requires state and local governments to ensure persons with disabilities have equal access to any programs, services or activities receiving federal funding. This includes pedestrian facilities in the public right-of-way.

Non-Compliant Pedestrian Facilities

Non-compliant pedestrian facilities have the effect of creating boundaries that limit full participation in civic life to individuals with disabilities. It is imperative that local jurisdictions in the AMPA incorporate barrier removal into existing efforts and ensure that new facilities are built to meet ADA compliance standards.

ADA Transition Plans

Most of our local jurisdictions have completed Americans with Disabilities Act, (ADA) Transition Plans that include a complete or partial inventory of pedestrian facilities in the public-right of-way and steps to ensure pedestrian facilities comply with the ADA.

The pedestrian facilities within the public-right of way typically include:

- Curb ramps
- Sidewalks and multi-use trails
- Driveways
- Pedestrian crossings
- Pedestrian signals, beacons, and pushbuttons
- Bus stops
- Alternate pedestrian facilities in work zones

The inventories provide locations and measurements of pedestrian facilities in the public right-of-way and identify barriers, estimated costs to remove barriers, and a schedule for progressively removing barriers and deficiencies.

Prioritization Criteria

These plans include prioritization criteria to rank pedestrian improvement projects for capital improvement funding. The prioritization criteria are generally based on variety of criteria related to population concentration, land use, severity and concentration of access barriers, access to public transit, access to public facilities such as parks, community centers and daily destinations such as schools and grocery stores

The following street typology matrices and basic guidance on right-of-way set-asides meet ADA compliance standards generally but do not provide guidance for specific access requirements. For specific pedestrian improvement projects please refer to the New Mexico Department of Transportation's ADA Pedestrian Access Standard Drawings. These drawings conform to ADA requirements and provide guidance for compliance with the Proposed Accessibility Guidelines for Pedestrian facilities in the Public Right-Of-Way (PROWAG).

5.3 ROADWAY DESIGN MATRICES

The following street typology matrices provide conceptual design recommendations for new roadways based on long range roadway classifications and character area.

REGIONAL PRINCIPAL ARTERIAL

Regional principal arterials prioritize motor vehicle, transit, and freight movement. They are intended to support longer, regional trips. Generally, they carry a higher volume of traffic (15,000 – 50,000 AWDT), have higher speeds, and have larger right-of-way requirements. For these reasons, regional principal arterials should only be planned along the periphery of activity centers. In the cases where a regional principal arterial bisects an activity center, the roadway should slow down and be designed and operated like a community principal arterial.

DESIGN CONSIDERATIONS

LOOK AT AWDT RANGES FOR REGIONAL PRINCIPAL ARTERIALS

1. These roads may carry high capacity transit (such as BRT) traveling longer distances. Dedicated transit lanes may be provided in these cases.
2. Given their higher speeds and volumes, bikeways should only be included on these roadways if there are parallel routes within 1,000 feet or a very well protected facility.
3. These streets may be designed as multi-way boulevards if traveling through areas with increased pedestrian traffic.

BICYCLE INFRASTRUCTURE

Option 1: Given that regional principal arterials carry high volumes of fast traffic, it is recommended to plan bikeways on parallel roadways within 1,000' of a regional principal arterial, preferably on either side of the arterial

Option 2: Adjacent multi-use path

Option 3: Protected or Buffered Bicycle lane (this should only be considered in locations where there is significant land use activity adjacent to the corridor and speeds are lower)

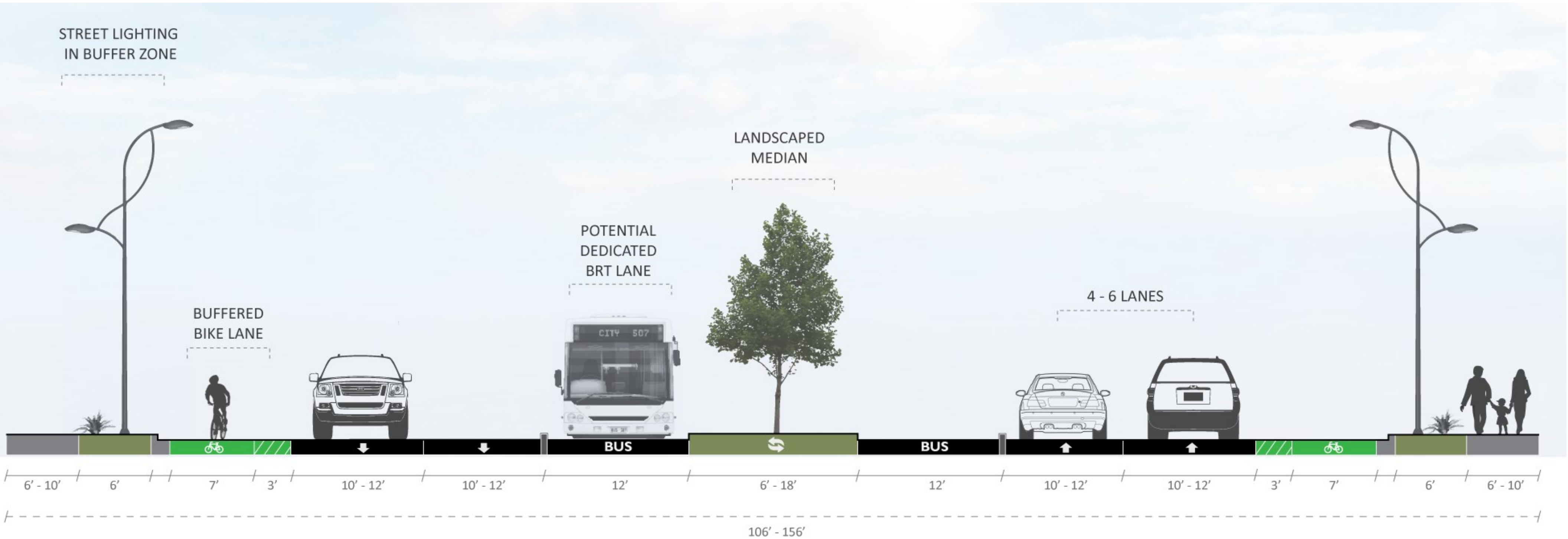


TABLE 5.1: REGIONAL PRINCIPAL ARTERIAL				ROW RANGE: 106'-156'	
Character Area	**ACTIVITY CENTER**	**URBAN**	**SUBURBAN**	**RURAL**	**MAIN STREET**
Examples	Unser at Rio Rancho City Center	Coors & Montaño	Unser & Montaño	Sen. Dennis Chavez	N/A
STREETSIDE MINIMUMS (ONE SIDE)					
Landscape buffer	6'	6'	6'	8'-14' paved shoulder (both sides) and/or an 8-10' multi-use trail with a 5' buffer	*See Community Principal Arterial Main Street*
Clear Sidewalk width	10'	6'	6'		
Building Shy Zone (ingress/egress)*	2’	2’	2’		
Streetside Width (for one side only)	18'	14'	14'		
BIKEWAYS (ONE SIDE)					
Multi-Use Path	*See Long Range Bikeway System*			8’-14' paved shoulder (both sides) and/or an 8’-10' multi-use trail with a 5' buffer from the roadway	*See Community Principal Arterial Main Street*
Multi-Use Path Outside Buffer	5'	5'	5'		
Multi-Use Path Inside Buffer	3'	3'	3’		
Paved Multi-Use Path Width	10’-14'	10’-14'	10’-14'		
Barrier Protected Bicycle Lane (Cycle Track)	*See NACTO Urban Bikeway Design Guide for Cycle Tracks. Barrier protected bicycle lanes may be considered in lieu of a multi-purpose trail as long as the roadway has sidewalks that meet the streetside minimums above*				
Bicycle Lane (widths do not include gutter pan)	Posted Speed 30 mph or lower: 5' bicycle lane Posted Speed 35 mph: 6' bicycle lane; preferably a buffered bicycle lane Posted Speed > or equal to 40 mph: 7' bicycle lane with 3' striped buffer or a Protected Bicycle Lane.				
TRANSIT					
Dedicated Bus Lane	*See Long Range Transit Network: Include 24' for bus rapid transit routes.*				N/A
ROADWAY					
Maximum Number of Through Lanes	2-6	4-6	4-6	4-6	*See Community Principal Arterial Main Street*
Desired Operating Speed	30-35 MPH	30-35 MPH	40-55 MPH	35-55 MPH	
Lane Width	10’-11’	10’-12’	10’-12’	11’-12’	
Outside Lane Width (heavy vehicles)	12'	12'	12'	12'	
Parallel Parking	-	-	-	-	
Median/Center Turn Lane	6’-18’	6’-18’	6’-18’	6’-18’	

*Include 2’ if buildings, walls, or other vertical structures are planned adjacent to public ROW. *Please see Building Shy Zone in Section 6.1.*

COMMUNITY PRINCIPAL ARTERIAL

Community principal arterials do not prioritize one mode over another; instead they strive to achieve a balance. Although these roadways are given the functional classification of principal arterial, these corridors include many destinations with direct access from the arterial. Travel on community principal arterials tends to be over shorter distances than principal arterials and to destinations with access directly on that arterial. Community principal arterials tend to have lower volumes (10,000 – 30,000 AWDT), lower speeds, and fewer lanes than regional principal arterials. Design options for community principal arterials also include multi-way boulevards, or one-way couplets like Lead/Coal Ave.

DESIGN CONSIDERATIONS

1. These streets may be multi-way boulevards if traveling through areas with increased pedestrian traffic.
2. These routes may carry high capacity transit (BRT) traveling longer distances. Dedicated transit lanes may be provided in these cases.
3. On-street parking may be considered in activity centers or suburban and urban areas with commercial activity, and Rural Main Streets.
4. Depending on volume, fewer lanes may be necessary on these streets. Narrower lanes can be considered.

BICYCLE INFRASTRUCTURE

Option 1: Barrier protected bicycle lane/cycle track

Option 2: Bicycle lane with striped buffer for roadways with speeds 40mph or higher

Option 3: Use a gridded network and plan bikeway on parallel roadways within 1,000' of community principal arterial

Option 4: Adjacent multi-use path

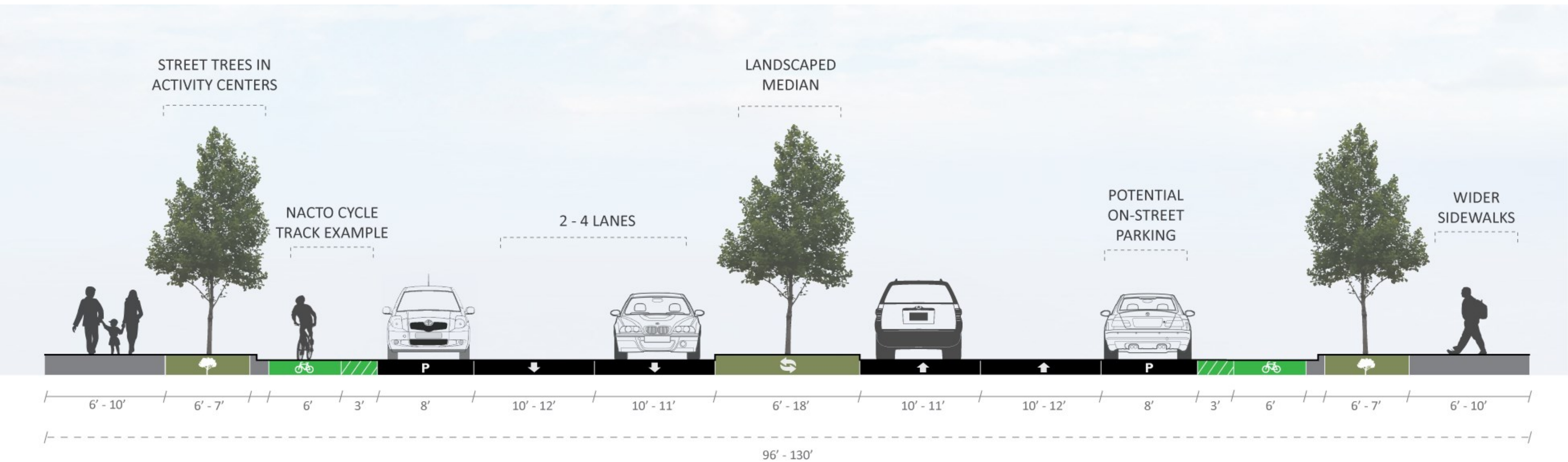


TABLE 5.2: COMMUNITY PRINCIPAL ARTERIAL

ROW RANGE: 96'-130'

Character Area	ACTIVITY CENTER	URBAN	SUBURBAN	RURAL	MAIN STREET
Examples	Central Ave	Osuna & Jefferson	Southern Blvd	Isleta Blvd	4th St at Guadalupe Plaza
STREETSIDE MINIMUMS (ONE SIDE)					
Landscape buffer	7' (tree well)	6'	6'	8'-14' paved shoulder (both sides) and/or an 8-10' multi-use trail with a 5' buffer	6' (tree well)
Clear Sidewalk width	10'	10'	6'		6'
Building Shy Zone (ingress/egress)*	2'	2'	2'		-
Streetside Width (for one side only)	19'	18'	14'		12'
BIKEWAYS (ONE SIDE)					
Multi-Use Path	*See Long Range Bikeway System*			8'-14' paved shoulder (both sides) and/or an 8'-10' multi-use trail with a 5' buffer from the roadway	Consider a barrier protected bicycle lane/cycle track. Otherwise use a minimum 5' shoulder or bike lane.
Multi-Use Path Outside Buffer	N/A	5'	5'		
Multi-Use Path Inside Buffer	N/A	3'	3'		
Paved Multi-Use Path Width	N/A	10'-14'	10'-14'		
Barrier Protected Bicycle Lane (Cycle Track)	*See NACTO Urban Bikeway Design Guide for Cycle Tracks. Barrier protected cycle tracks may be considered in lieu of a multi-purpose trail as long as the roadway has sidewalks that meet the streetside minimums above.*				
Bicycle Lane (widths do not include gutter pan)	Posted Speed 30 mph or lower: 5' bicycle lane (min 13' for combined parallel parking and bike lane.) Posted Speed 35 mph: 6' bicycle lane or buffered bicycle lane Posted Speed > or equal to 40 mph: 7' bicycle lane with 3' striped buffer				
TRANSIT					
Dedicated Bus Lane	*See Long Range Transit Network: Include 24' for bus rapid transit routes.*				
ROADWAY					
Maximum Number of Through Lanes	2-4	2-4	4	2-4	2-4
Desired Operating Speed	25-30 MPH	30-35 MPH	35-40 MPH	30-40 MPH	25-30 MPH
Lane Width	10'-11'	10'-11'	10'-12'	10'-12'	10'-11'
Outside Lane Width (heavy vehicles)	12'	12'	12'	12'	12'
Parallel Parking	7'-8'	7'-8'	-	-	7'-8'
Median/Center Turn Lane	6'-18'	6'-18'	6'-18'	6'-18'	6'-18'

Include 2' if buildings, walls, or other vertical structures are planned adjacent to public ROW. *Please see Building Shy Zone in Section 6.1.*

MINOR ARTERIAL

Minor Arterials provide the connectivity of principal arterials, but they prioritize slower moving traffic, bicyclists, and pedestrians in order to give these modes other safer and more comfortable options to reach destinations. They generally have fewer lanes, lower speeds, and lower volumes (6,000 – 20,000 AWDT) than principal arterials. Given their lower speeds and volume, additional design elements may be worth considering on these streets, such as including on-street parking, bicycle lanes, expanded sidewalks, and landscape improvements, which may include green infrastructure.

DESIGN CONSIDERATIONS

1. On-street parking may be considered in activity centers or urban areas with commercial activity, or Rural Main Streets.
2. Depending on volume, fewer lanes may be necessary on these streets. Narrower lanes can be considered in activity centers with high pedestrian volumes.
3. Two through lanes with a center turn lane may be desirable on these streets.
4. These streets provide opportunities to implement green infrastructure.

BICYCLE INFRASTRUCTURE

Option 1: Bicycle lane

Option 2: Barrier protected bicycle lane/cycle track in activity centers and/or high traffic areas

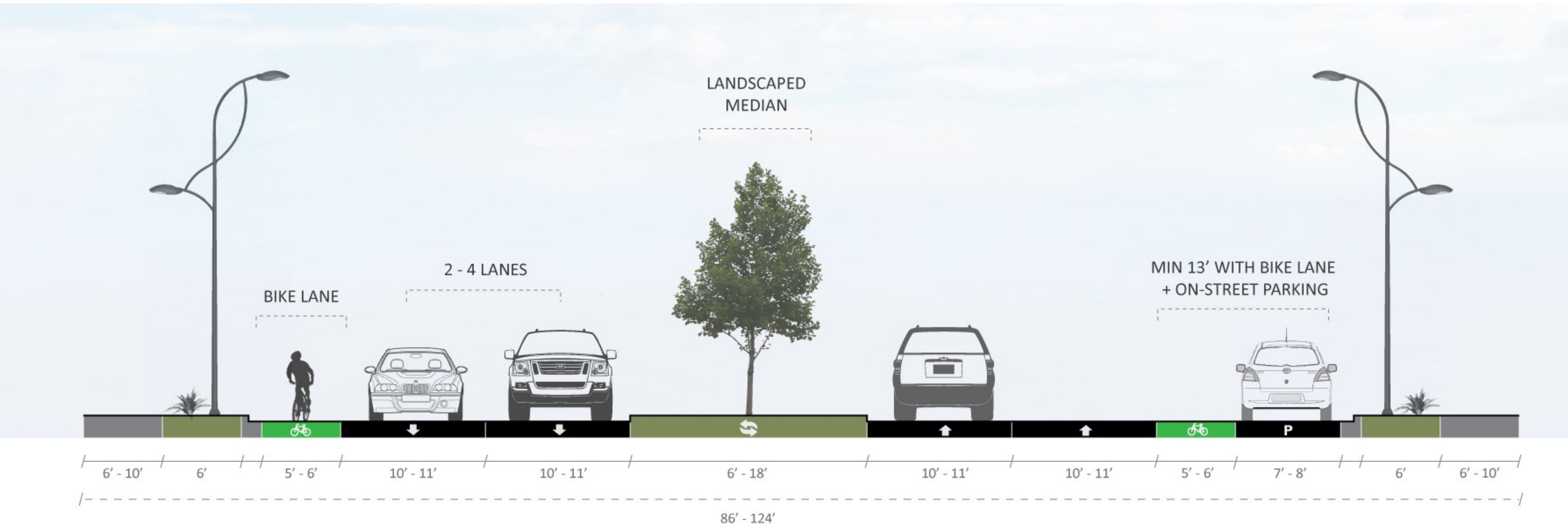


TABLE 5.3: MINOR ARTERIAL

ROW RANGE: 86'-124'

Character Area	ACTIVITY CENTER	URBAN	SUBURBAN	RURAL	MAIN STREET
Examples	Seven Bar Loop in Cottonwood	Candelaria	Harper or Sage	Rio Grande Blvd	Corrales Rd in village Center
STREETSIDE MINIMUMS (ONE SIDE)					
Landscape buffer	6' (tree well)	6'	5'	4' paved shoulder (both sides) and/or 5' buffer with 8' multi-use path (one side)	6' (tree well)
Clear Sidewalk width	10'	6'	6'		6'
Building Shy Zone (ingress/egress)*	2'	-	-		-
Streetside Width (for one side only)	18'	12'	11'		12'
BIKEWAYS (ONE SIDE)					
Multi-Use Path	*See Long Range Bikeway System*			4' paved shoulder (both sides) and/or 5' buffer with 8' multi-use path (one side)	4' shoulder
Multi-Use Path Outside Buffer	N/A	5'	5'		
Multi-Use Path Inside Buffer	N/A	3'	3'		
Paved Multi-Use Path Width	N/A	10'-12'	10'-12'		
Barrier Protected Bicycle Lane (Cycle Track)	*Consider in areas of high bicycle activity.*				
Bicycle Lane (widths do not include gutter pan)	Posted Speed 30 mph or lower: 5' bicycle lane (min 13' for combined parallel parking and bike lane.) Posted Speed 35 mph: 6' bicycle lane or buffered bicycle lane				
TRANSIT					
Dedicated Bus Lane	*See Long Range Transit Network: Include 24' for bus rapid transit routes.*				
ROADWAY					
Maximum Number of Through Lanes	2-4	2-4	2-4	2-4	2
Desired Operating Speed	25-30 MPH	30-35 MPH	30-40 MPH	35-40 MPH	25-30 MPH
Lane Width	10'-11'	10'-11'	10'-11'	10'-11'	10'-11'
Outside Lane Width (heavy vehicles)	12' if on the Long Range Transit Network as a current or future bus route.				
Parallel Parking	7'-8'	7'-8'	-	-	7'-8'
Median/Center Turn Lane	6'-14'	6'-14'	6'-18'	6'-18'	6'-18'

*Include 2' if buildings, walls, or other vertical structures are planned adjacent to public ROW. *Please see Building Shy Zone in Section 6.1.*

MAJOR COLLECTOR

Major Collectors provide additional needed connectivity between destinations located on arterials and within neighborhoods. Collectors usually have 2 to 4 lanes, low traffic volumes (3,000 – 12,000 AWDT), and prioritize bicyclists and pedestrians. Bicyclists should be able to use collectors for long segments of their trips, and motorists will generally use them for short segments of their trips. As with minor arterials, additional design considerations include adding on-street parking, bicycle lanes, expanded sidewalks, and landscape improvements, including green infrastructure.

DESIGN CONSIDERATIONS

1. On-street parking may be considered in activity centers, urban areas with commercial activity, and through neighborhoods with higher density multi-family.
2. Fewer lanes may be necessary on these streets. Narrower lanes can be considered in most locations.
3. Two lanes or two through lanes with a central left turn lane may be desirable on these streets.
4. These streets provide opportunities to implement green infrastructure.

BICYCLE INFRASTRUCTURE

Option 1: Bicycle lane

Option 2: Sharrow/Shared Lane

Option 3: Bicycle Boulevard

Option 4: Buffered or protected bike lane

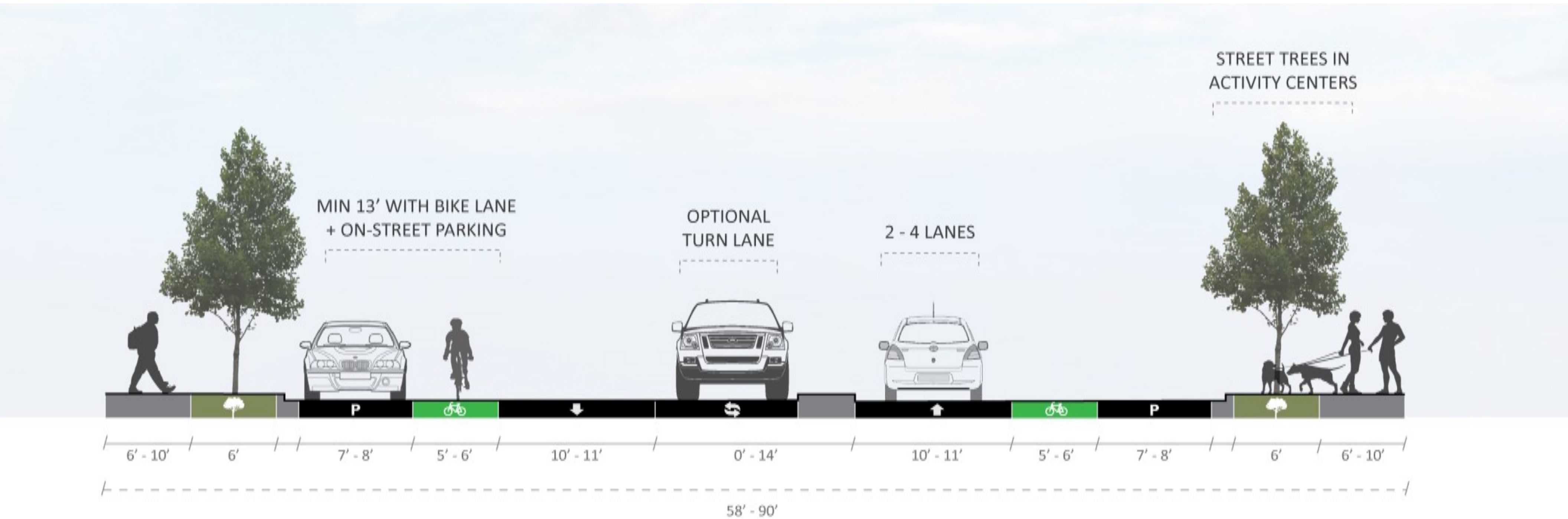


TABLE 5.4: MAJOR COLLECTOR				**ROW RANGE: 58'-90'**	
Character Area	**ACTIVITY CENTER**	**URBAN**	**SUBURBAN**	**RURAL**	**MAIN STREET**
Examples	Seven Bar Loop in Cottonwood	Comanche	Meadowlark	Frost Rd	NM 333 in Tijeras
STREETSIDE MINIMUMS (ONE SIDE)					
Landscape buffer	6' (tree well)	6'	5'	4' paved shoulder (both sides) and/or 5' buffer with 8' multi-use path (one side)	6’ (tree well)
Clear Sidewalk width	9'	6'	6'		6’
Building Shy Zone (ingress/egress)*	2’	-	-		-
Streetside Width (for one side only)	17'	12'	11'		12’
BIKEWAYS (ONE SIDE)					
Multi-Use Path	*See Long Range Bikeway System*			4' paved shoulder (both sides) and/or 5' buffer with 8' multi-use path (one side)	4’ shoulder
Multi-Use Path Outside Buffer	N/A	N/A	5’		
Multi-Use Path Inside Buffer	N/A	N/A	3’		
Paved Multi-Use Path Width	N/A	N/A	10’-12’		
Shared Lane Marking (See NACTO Urban Bikeway Design Guide)	Appropriate only for streets with posted speeds of 25 mph or lower and AWDT less than 3,000.				
Bicycle Lane (widths do not include gutter pan)	Posted Speed 30 mph or lower: 5' bicycle lane (min 13’ for combined parallel parking and bike lane.) Posted Speed 35 mph: 6' bicycle lane or buffered bicycle lane				
ROADWAY					
Maximum Number of Through Lanes	2	2-4	2-4	2-4	2
Desired Operating Speed	25-30 MPH	25-35 MPH	30-35 MPH	35-40 MPH	25-30 MPH
Lane Width	10-11’	10’-11’	10’-11’	10’-11’	10’-11’
Outside Lane Width (heavy vehicles)	12' if on the Long Range Transit Network as a current or future bus route.				
Parallel Parking	7’-8’	7’-8’	7’-8’	-	7’-8’
Median/Center Turn Lane	0’-14’	0’-14’	0’-14’	0’-14’	0’-14’

*Include 2’ if buildings, walls, or other vertical structures are planned adjacent to public ROW. *Please see Building Shy Zone in Section 6.1*

MINOR COLLECTOR

Minor collectors provide additional connectivity between destinations located on arterials and within neighborhoods. They typically have low traffic volumes (under 6,000 AWDT) and prioritized access to residential areas and local businesses. In most cases, due to low speeds and low traffic volumes, bicyclists should be able to share the road comfortably using shared lane markings (sharrows). The streetside environment is like major collectors.

DESIGN CONSIDERATIONS

1. On-street parking may be considered in activity centers or urban areas with commercial activity.
2. These streets provide opportunities to implement green infrastructure.

BICYCLE INFRASTRUCTURE

Option 1: Sharrow/Shared Lane

Option 2: Bicycle lane

Option 3: Bicycle Boulevard

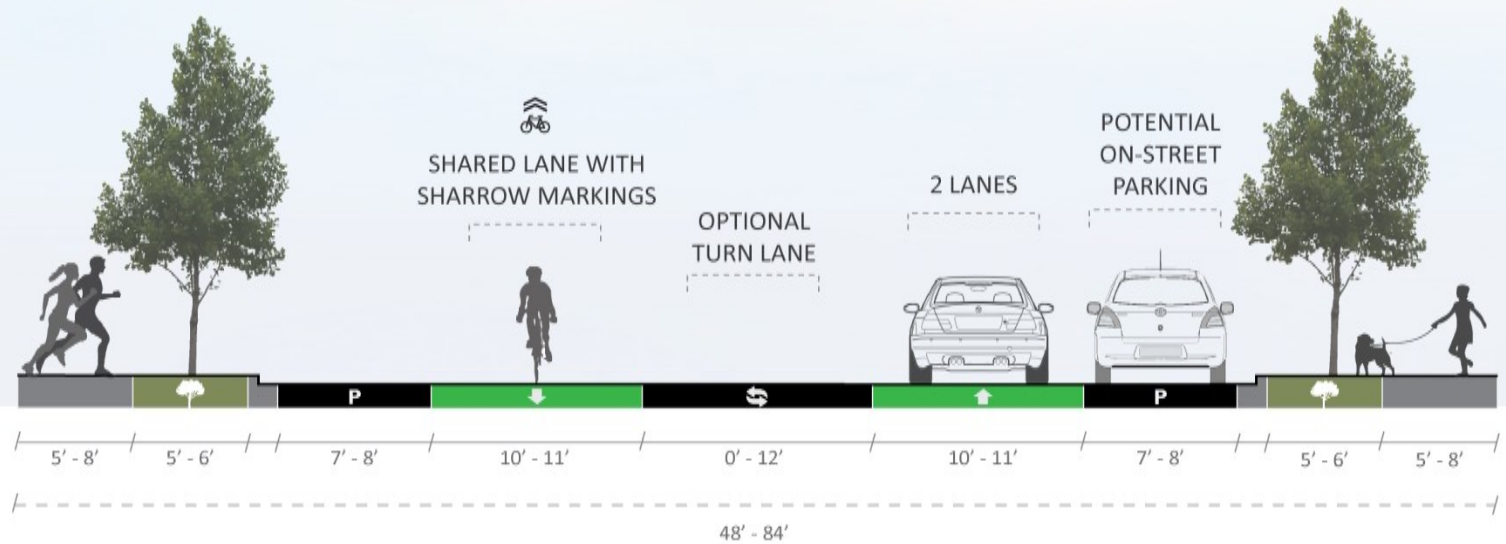


TABLE 5.5: MINOR COLLECTOR				ROW RANGE: 48'-84'	
Character Area	ACTIVITY CENTER	URBAN	SUBURBAN	RURAL	MAIN STREET
Examples	Western end of Lead/Coal	Tingley Rd, Cutler Ave	Western Hills	Todos Juntos Rd, Jarales Rd	N/A
STREETSIDE MINIMUMS (ONE SIDE)					
Landscape buffer	6'	6'	5'	4' paved shoulder (both sides)	N/A
Clear Sidewalk width	8’	6'	5'		
Building Shy Zone (ingress/egress)*	2’	-	-		
Streetside Width (for one side only)	16’	12'	10'		
BIKEWAYS (ONE SIDE)					
Multi-Use Path	N/A			4' paved shoulder (both sides)	N/A
Multi-Use Path Outside Buffer	N/A				
Multi-Use Path Inside Buffer	N/A				
Paved Multi-Use Path Width	N/A				
Shared Lane Marking (See NACTO Urban Bikeway Design Guide)	Appropriate for streets with posted speeds of 25 mph or lower and AWDT less than 3,000.				
Bicycle Lane (widths do not include gutter pan)	Posted Speed 30 mph or lower: 5' bicycle lane (min 13’ for combined parallel parking and bike lane.)				
ROADWAY					
Maximum Number of Through Lanes	2	2	2	2	N/A
Desired Operating Speed	18-25 MPH	18-30 MPH	18-30 MPH	20-35 MPH	
Lane Width	10-11’	10’-11’	10’-11’	10’-11’	
Outside Lane Width (heavy vehicles)	12' if on the Long Range Transit Network as a current or future bus route.				
Parallel Parking	7’-8’	7’-8’	7’-8’	-	
Center Turn Lane	0’-12’	0’-12’	0’-12’	0’-12’	

*Include 2’ if buildings, walls, or other vertical structures are planned adjacent to public ROW. *Please see Building Shy Zone in Section 6.1*

5.4 GREEN STREETS

During storm events, pedestrians, bicyclists, and people using transit are the first to encounter barriers and lose access to the streets and are the last to regain it[31]. "Green street" design tools, which integrate stormwater control and management within the right-of-way, are a critical component of complete street design, ensuring the street remains usable and safe for all people during storm events, regardless of mode.

While a significant source of runoff, roads are also a part of the flood control system conveying stormwater along gutters to in-lets and the buried pipe network. Quickly draining and moving stormwater away has been the design priority in the past, but this approach sends pollutants from the streets directly into the river, and essentially wastes water that can be put to further beneficial use. Green streets function to clean and conserve this precious resource, protecting the Rio Grande and our community.

This approach includes minimizing impervious surface coverage and maximizing the ability of landscaped areas to capture, slow, infiltrate, and filter runoff. Integrating natural systems with the built environment, green streets leverage the freely provided "ecosystem services" of nature to produce multiple benefits.

Green Streets Benefits

- Clean and reduce the amount of storm water runoff
- Replenish ground-water supplies
- Capture CO_2 and produce fresh clean air
- Shade and beautify streets
- Increase property values[32]
- Support mental health and reduce violence[33]
- Create wildlife habitat
- Conserve water and save money by using passive irrigation to water native vegetation and street trees[34]

Flood Control

Photo: Curb cut and bioretention swale on Cherry Ave., Tucson by Watershed Management Group.

[31] Colwell, Shanti, et al. "Complete Streets are Green Streets." *Urban Street Stormwater Guide*. NACTO National Association of City Transportation Officials, 2017, pp. 8-9

[32] *Wolf, Kathleen L, PhD, University of Washington (2007) City Trees and Property Values. Arborist News. 16, 4:34-36.*

[33] Kuo, F.E., & Sullivan, W.C. (2001). Environment and crime in the inner city: Does vegetation reduce crime? *Environment & Behavior*, 33(3), 343-367.

[34] MacAdam, James. (2010). Green Infrastructure for Southwestern Neighborhoods.

Although originally developed for climates in the Northwest and Northeast, the flood control and water conservation benefits of green infrastructure has led to increasing implementation in the Southwest. In our arid environment, seasonal monsoons combine with hardened soils to produce flash floods, and groundwater is in high demand, making Green Streets an even more beneficial application.

Most green infrastructure are designed to supplement existing stormwater systems. Systems can be designed to handle rainfall events up to a specific threshold, then additional overflow water enters the existing storm-water system normally. Additional performance criteria can be used to ensure adequate drainage and infiltration occur, even after heavy rainfall.

Water Quality and MS4 Permit

In 2014, the Environmental Protection Agency issued a watershed-based Municipal Separate Storm Sewer System (MS4) Permit for stormwater in the Middle Rio Grande Watershed. This permit requires all new development and redevelopment projects that disturb greater than or equal to one acre (including projects less than one acre that are part of a larger common plan of development or sale), to evaluate opportunities for the use of Green Infrastructure/Low Impact Development (GI/LID) techniques in site design.

Guidelines for these practices have been developed for Bernalillo County and the City of Albuquerque, such as the Bernalillo County Water Conservation Guidelines and the Design Process Manual (DPM), in which several new standard details for GSI and LID were created. These documents provide detailed background information, implementation, and maintenance guidance for construction of low impact development projects and water conservation techniques.

An abbreviated version of these documents with lots of useful, regionally specific information is the recent publication, *Bernalillo County Green Stormwater Infrastructure: Low Impact Design Strategies for Desert Communities*[35].

Arid LID Coalition

Another local resource, the multi-disciplinary professionals of the Arid LID Coalition work to provide guidance and education specific to designing GSI and LID interventions in our high desert environment. They also facilitate communication and collaboration and support high-quality demonstration and research projects.

They have produced an online map and book showcasing a growing collection of successful regional examples (see aridlidcoalition.org).

DESIGN ELEMENTS OF GREEN STREETS

When building a new street or streets, the layout and street network should be planned to respect the existing hydrologic functions of the land (preserve wetlands, buffers, high-permeability soils, etc.) and to minimize the impervious surface area. If retrofitting or redeveloping a street, **opportunities to eliminate unnecessary impervious area should be explored.**

CURB CUT DESIGN

Curb design alternatives can be used to channel stormwater into bioretention basins, infiltration planters, rain gardens, stormwater bump outs, and street trees. [36] Green street infrastructure can often be integrated with existing traffic calming devices and landscape buffers.

The width and number of inlets determines the stormwater inflow and outflow capacity.

[35] *Prepared for Bernalillo County by Weston Solutions Inc & Sites Southwest,2017. https://www.bernco.gov*

[36] MacAdam, James. (2010). Green Infrastructure for Southwestern Neighborhoods

Inlets should be wide enough to accommodate the expected stormwater volume, but their minimum size is usually related to the type of maintenance equipment that will be used to clean the curb cut (for example, the minimum width of a shovel). Inlets are typically 8–12 inches wide, but inlets up to 24 inches wide are not uncommon[37].

The accumulation of garbage, debris, or sediment at the inlet will prevent runoff from entering the bioretention cell, eliminating its value for flood prevention and runoff capture. Inlets should be designed to resist blockage and simplify maintenance. One example is inclusion of a designated pre-settling zone (such as at the inlet for the first cell in a series) for collecting debris and sediment, and to allow cleaning efforts to focus on a small space within each project.

BIORETENTION SWALES

Swales are open, vegetated channels or depressions with sloped sides, designed to accept sheet flow runoff and convey it in broad, shallow flows which allow it to infiltrate the soil and be treated as it moves downstream. The intent of swales is to reduce stormwater volume, improve water quality through vegetative and soil filtration, and reduce flow velocities by increasing channel roughness.

More runoff can be detained as the flat bottom area is widened, or as the side slopes are made steeper. A minimum 12-inch bottom width is generally necessary but may vary depending upon the bottom slope of the cell and the available space. In some cases, a minimum average bottom width of 18 inches might be a more appropriate criterion.[38]

Swales are most applicable in lower density or lower traffic contexts, as they can have relatively large footprints and little or no vertical separation from the sidewalk and street. Swales are most commonly able to be implemented in areas where more space is available within the planting strip or a curb bulb along the street, such as in residential areas, along shared-use paths, medians, roundabouts, or other unused right-of-way areas. Beyond the simplest roadside grassed form, additional benefits can be attained through the addition of amended or bioretention soils, gravel storage areas, underdrains, weirs, and dense, diverse vegetation.

Swales can support a wide range of plantings to increase beneficial habitat and greenscape. Swales also provide flexibility for planting a variety of street trees on the bottom, on side slopes, or at raised berms between cells.

Plant Species List

Plants are a common concern of municipal staff, whether it is maintenance, salt tolerance, or plant height for safety and security. Cities actively implementing LID practices in public spaces maintain lists of plants which fit the vegetated stormwater management practice niche. These are plants that flourish in the regional climate conditions, are adapted to periodic flooding, are low maintenance, and, if in cold climates, salt tolerant.

Most often these plants are natives, but sometimes an approved non-native will best fit necessary criteria. A municipal plant list should be kept and periodically updated based on maintenance experience, and vegetation health surveys.

PERMEABLE PAVEMENTS

Permeable pavement comes in four forms: permeable concrete, permeable asphalt, interlocking concrete pavers, and grid pavers. Permeable concrete and asphalt are like their impervious

[37] Colwell, Shanti, et al. "Inlet Design." *Urban Street Stormwater Guide*. NACTO National Association of City Transportation Officials, 2017, p. 106

[38] Colwell, Shanti, et al. "Bioretention Swale." *Urban Street Stormwater Guide*. NACTO National Association of City Transportation Officials, 2017, pp. 82-83

counterparts but are open graded, or have reduced fines, and typically have a special binder added. Methods for pouring, setting, and curing permeable pavements also differ.

Concrete and Grid Pavers

These are modular permeable pavement systems, where concrete pavers are installed with gaps between them that allow water to pass through to the base. Grid pavers are typically a durable plastic matrix that can be filled with gravel or vegetation.[39] All such systems have an aggregate base in common which provides structural support, runoff storage, and pollutant removal through filtering and absorption. Aside from a somewhat rougher, unfinished surface, permeable concrete and asphalt look very similar to their impervious versions. Permeable concrete and asphalt and certain pavers are also ADA compliant. A well-designed permeable pavement structure will always drain and never freeze solid.

SIDEWALK TREES AND TREE BOXES

From reducing the urban heat island effect and reducing stormwater runoff to improving the urban aesthetic and air quality, much is expected of street trees. Street trees are even good for the economy. Studies have shown customers are willing to spend 9-12% more in shops on streets lined with trees than on those without trees.[40] Some research suggests that trees may also improve driving safety. One study found a 46% decrease in crash rates across urban arterial and highway sites after landscape improvements were installed.[41] Another study found that placing trees and planters in urban arterial roadsides reduced mid-block crashes by 5% to 20%.[42]

Unfortunately, street trees are often planted in inhospitable environments, without enough space to grow to their full potential. The soil around street trees is often compacted during the construction of paved surfaces and minimized as underground utilities encroach on root space. If tree roots are deprived of air and water this way, their growth will be stunted, their health will decline, and their expected life span will be cut short.

Root Space for Trees

By providing adequate soil volume and a good, uncompacted soil mixture, the benefits of a mature tree, such as shade and air quality improvements are reached sooner than for a tree with confined root space. To obtain a healthy soil volume, trees should be provided larger tree boxes, with structural soils, root paths, or "silva cells" installed under paved areas to effectively expand root zones.

Photo: Silver Street SE, Albuquerque, apartmenthomeliving.com

Silva Cells are plastic milk crate-like frames fit together to act as a supporting structure for a sidewalk while leaving room for uncompacted soil and roots inside the frame. Root Paths can also be used to increase available tree root volume by connecting a smaller root space with a larger subsurface volume nearby. A tunnel-like system extends the growing area underneath the sidewalk by connecting to open space on the other side.

[39] Lukes, Robb, and Christopher Kloss. "Managing Wet Weather with Green Infrastructure: Municipal Handbook, Green Streets." *EPA.gov*. Low Impact Development Center, Dec. 2008. Web.

[40] Wolf, K.L. 2005. Business District Streetscapes, Trees and Consumer Response. *Journal of Forestry* 103, 8:396-400.

[41] Naderi, J.R. 2003. Landscape Design in the Clear Zone: Effect of Landscape Variables on Pedestrian Health and Driver Safety. *Transportation Research Record* 1851:119-130

[42] Mok, J.-H., H.C. Landphair, and J.R. Naderi. 2006. Landscape Improvement Impacts on Roadside Safety in Texas. *Landscape and Urban Planning* 78:263-274.

Permeable Pavement Sidewalks

Permeable pavement sidewalks are another enhancement to the root space. They provide moisture and air to roots under sidewalks. Soils under permeable pavements can still become compacted however, so structural soils are a good companion tree planting practice. When planting a tree in structural soils an adequate tree root volume is excavated and filled with a mix of stone and soil that provides void space for healthy roots and allows for sidewalks, plazas, or other paved surfaces to be constructed over them.

These and several more detailed examples of green street design elements can be found in the previously mentioned guide commissioned for Bernalillo County, and well as in the resources section of the Arid LID Coalition website.

Chapter 6

RETROFITTING ROADWAYS

Chapter 6

Retrofitting Roadways

Picking transportation projects that will lead to the most benefit (for investment dollars spent) means thinking strategically about where and how improvements are implemented. Projects from around the country have shown that street retrofits, including road diets or other roadway reconfigurations, can lead to significant improvements.[43] However, vibrant areas with active street life are also needed. Good urban form, which involves many factors including residential density, commercial activity, and the relationship of the roadways to the surrounding buildings, are essential to developing an economically strong urban environment. A new transit route also needs supporting factors to be successful, such as the requisite density or commercial and employment destinations that will benefit from increased transit investment.

Street Retrofits: A Balancing Act

Sometimes street retrofit projects are controversial because they involve a change in the status quo that can affect travel patterns. Many people may have a hard time envisioning a new configuration for the street, especially if they believe it will increase their travel times or contribute to congestion.

Choosing designs that balance the needs of established roadway users is paramount to ensuring street retrofits are successful. Retrofit projects can also create additional transportation options and they may also be linked to general planning goals to make an area more walkable, or they may be tied to specific objectives such as reducing the number of crashes along an existing corridor.

[43] *Rethinking Streets*, University of Oregon

FIGURE 6.1: EXAMPLE OF A WALKING AUDIT AND SAFETY DEMONSTRATION

6.1 CONSTRAINED RIGHTS OF WAY

In some cases, retrofit projects have inherent tradeoffs. For example, redesigning an existing roadway to accommodate all modes within a constrained ROW can be challenging, given established surrounding land uses, existing travel patterns, and current zoning. Allocating space for new users along such roadways can mean reducing space for others. Sometimes this can lead to an overall improvement in roadway performance, while maintaining vehicle throughput.[44]

Determining trade-offs requires prioritizing the needs of various users and evaluating the most important performance objectives and measures of success.

Evaluation Tools

Using clear, evidence-based recommendations to accommodate users is the first step to ensure that reconstruction projects fulfill Complete Streets goals.

These goals can be measured using various evaluation tools such as multi-modal level of service metrics, crash statistics, traffic models, and connectivity measures.

Other evaluation tools (such as walking audits) can be used to determine how well the street currently meets the needs of users with different abilities. Analyses may find that some roads include too many lanes, could have lower posted speeds, or do not support existing or future land uses. (Details on these performance measures are outlined in Chapter 8.)

6.2 COMPLETE STREETS CHECKLIST

To help facilitate an improved transportation planning process, MRMPO has developed the *Complete Streets Checklist* to provide a baseline analysis of existing conditions, constraints, and opportunities along existing roadways (see Appendix).

[44] ITE, Planning Urban Roadway Systems, 38

This checklist (1) establishes a baseline inventory of existing conditions along the roadway such as traffic counts and existing cross-sections; (2) identifies possible Complete Streets considerations and priorities; (3) identifies possible constraints; and (4) points to possible design opportunities.

The collected data are then used as inputs for a multi-modal level of service metric that provides a comparison between roadway designs. The goal is that the checklist can be used to generate clear conceptual design priorities that can lead to the best overall multi-modal configuration.[45] The checklist includes the following sections.

1. BASIC PROJECT INFORMATION

The checklist includes basic project information, such as project name, location, responsible agency, goals, and development phases.

2. EXISTING CONDITIONS

This section includes existing conditions, such as character area, transportation context, future travel demand projections, the roadway's role and existing levels of service. The checklist includes a section where existing cross section elements and traffic counts can be recorded.

[45] The checklist is not a prioritization process, but a way to evaluate alternative design options.

These elements can be used to calculate multimodal level of service (MMLOS) and compare conceptual designs. The intent is to collect a baseline inventory of existing data and identify the roadway's regional context.

3. PRIORITY CONSIDERATIONS

To help facilitate roadway projects[46] that will provide the most benefits, this section outlines various 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 pedestrian safety, walkability, and congestion.

It also provides a way to understand existing constraints that limit the ability of a project to address identified needs. A few constraints may include: (1) constrained right-of-way; (2) conflicting plans and policies; (3) balancing user needs; (4) preservation of existing infrastructure; (5) environmental considerations.

1. **Expanded Choices and Community Involvement:** Would a reconfigured street have the opportunity to expand mode choices available to residents? Would the addition of bike lanes, or transit service be beneficial to the neighborhood? Would the project improve accessibly to jobs, especially for low income residents? Who will be involved in the design process and whose interests should be considered? What are some ways to increase involvement in the design process?
2. **Land Use Integration:** Does the street support a diverse range of land uses, activities, and users? Does the street run through an existing activity center? If so, does the street support the activity center's users? Would a reconfigured roadway potentially catalyze increased business investment along the street? Is community involvement a priority?
3. **Congestion and Efficiency:** Is addressing congestion a priority? Is the efficiency of the roadway a concern?
4. **Community Health:** Is improving community health outcomes a priority? Does the design encourage active transportation options? Does the project address environmental justice issues in the community, for example, gaps in the neighborhood's sidewalk, transit, or bicycle networks?
5. **Parking:** Is expanded on-street parking a priority?

[46] Roadway projects may include TIP projects, projects outlined in the MTP, or roadway projects and plans developed by member agencies.

6. **Walkability:** Does the street encourage and enable walkability? Can pedestrian needs be better accommodated with expanded sidewalks, safer crossings, landscape buffers, street trees, traffic calming, or other amenities?
7. **Bicycling:** Does the street enable safe bicycling? Are there gaps in the current bicycling infrastructure, such as impassible intersections or other barriers that could be fixed?
8. **Transit:** Does the street support high quality transit? For example, are comfortable transit shelters provided within walking distance of pedestrian catchment areas?
9. **Traffic Calming:** Is traffic safety an issue? How many crashes occur along the street? Are crashes attributable to design features of the street such as high speeds, low visibility, or lack of traffic calming features?
10. **Green Streets:** How well does the street handle stormwater runoff and water quality? Are there ways to incorporate green infrastructure within the roadway?
11. **Connectivity:** Does the street's configuration support the goals of creating complete networks? Does the corridor link activity centers efficiently? Does the current configuration introduce barriers to travel for certain users? Would the project expand connections between anchor institutions or job centers?
12. **Freight:** Is facilitating freight travel a priority for the roadway?

4. COMPLETE STREETS OPPORTUNITIES

After gathering information on existing conditions and understanding the project's priority considerations, the checklist provides a list of conceptual design ideas that are linked to specific 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 allows MRMPO and member agencies to identify possible design alternatives, which in turn can guide the planning process as it evolves.

A few sample retrofit strategies for existing streets include:

- **Narrow Travel Lanes:** restriping travel lanes from 12 feet to 11 or even 10 feet can free up additional space for bike lanes, or expanded pedestrian amenities. Medians can also be reduced to add more space to the pedestrian sidewalks and surrounding area.
- **Lane Reduction:** Reducing the number of travel lanes ("road diets") often involves reassigning space for traffic calming, expanded mode choices, and potentially better land use integration. For instance, reducing the number of lanes on an arterial from 6 to 4 lanes (4 to 3 lanes, with central turn lane on collectors) can free space to add protected bike lanes, on-street parking, and wider sidewalks. Road diets from 4-3 lanes can be considered on roadways with maximum volumes of 15,000 to 20,000 AWDT, as well as streets with safety concerns.[47]
- **Sidewalk and landscaping easements:** Private landowners can provide easements with the incentive that local government will install and, in some cases, maintain landscaping. This can expand the ROW space for streetside pedestrian amenities.

[47] Peak hour volumes should also be considered. (Proven Safety Countermeasures, "Road Diet", Federal Highway Administration, Office of Safety, FHWA-SA-12-013, 2012.)

6.3 ROAD DIETS

A road diet is essentially a reallocation of roadway space that aims to reduce dangerous speeding, improve safety for everyone, and provide infrastructure for more vulnerable road users.

Typical Road Diet Configuration

The most common type of road diet takes an undivided four lane roadway and reconfigures it into a three-lane roadway, with one travel lane in each direction and a two-way left turn lane in the center. This reconfiguration decreases conflict points and provides space for bicycle lanes and/or parking spaces in each direction of travel or sidewalks or wider sidewalks. The bike and/or parking lane also provides pedestrians with a traffic buffer increasing their comfort on the road.

Community Needs

The needs of our communities evolve over time, and our street design should, too. That's the idea behind a road diet, or 'rightsizing streets:' reconfiguring the layout of our streets to better and more safely serve the people who use them, whether they're commuters driving, shoppers walking, or children bicycling. Road diets have become more popular in recent years as evidence of their safety benefits mount.

New Guidance

New guides have been published to support local governments in successfully implementing road diets. In 2014, the FHWA released its *Road Diet Informational Guide*, followed by the New Mexico Department of Transportation's *Road Diet Guide* in 2016. This new guidance and interest spurred MRMPO to further investigate how this strategy could be used in the AMPA.

Benefits of Road Diets

According to the USDOT, road diets can **reduce traffic crashes** to a very large degree. In small urban areas with populations around 17,000 and roadways with traffic volumes up to 12,000 (daily volume), post-road-diet crashes dropped about 47%. In larger metropolitan areas with populations around 269,000 and roadways with traffic up to 24,000 (daily volume), the crash reduction was roughly 19%.

The combined estimate from all the best studies predicts that accidents will decline an average of 29% after a four-to-three-lane road diet.

Other benefits of road diets include an increase in bicycle and pedestrian traffic. This is because road diets open up space for biking and walking and slow vehicle speeds, making biking and walking seem more inviting. The addition of bike lanes and crossing islands also increase safety for bicyclists and pedestrians

Impacts on Automobile Traffic

Post-road-diet vehicle speeds decline. This is especially true for speeders going more than 5 miles per hour over the limit. Traffic volumes, meanwhile, typically stay even in post-road diet situations: some drivers are diverted to other parts of the street network, while the rest quickly soak up any vacated space.

Road Diets can Create Opportunities

Albuquerque has more than 400 miles of bikeways and trails, but many do not connect. Bicycle lanes on the side of roadways often end abruptly, forcing bicyclists to mix with vehicular traffic. This creates dangerous conditions and discourages people on bike from using them, and makes driving uncomfortable as well. Investing in connected and protected or separated bicycling infrastructure increases people's comfort level with this mode of transportation. A national survey of the largest metros found that about 51% of participants are interested in biking, but not confident enough to do so.

Road Diet Costs

The types of changes involved in road diets don't cost very much when compared to other transportation infrastructure investments. When timed with regular road maintenance and repaving, little more than paint is needed to restripe lanes. Road diets are about as cheap and cost-effective as infrastructure improvements get.

One reason why communities are hesitant to implement road diets (aside from general car reliance) may be that caution is suggested when implementing road diets on corridors that carry more than 20,000 cars a day.

But even though some major urban roads can't slim down overnight without creating traffic problems, road diets have worked in places like New York City and on roadways with over 30,000 daily traffic trips. It's critical to review each potential road diet candidate and not deploy a one size fits all application.

SELECTING ROAD DIET CANDIDATES

MRMPO has identified roadways that are good candidates for changing the roadway reconfiguration in the AMPA. In some cases, there may be opportunities for lanes to be narrowed as not every reconfiguration has to include decreasing the number of lanes.

Lane Configurations

The preliminary determination of good road diets candidates is based on a data driven process that considers traffic volume and crash rates on all major roads in the region. Average weekday traffic (AWDT) is the first step in determining locations for possible road diets.

The Federal Highway Administration (FHWA) suggests that roadways with 20,000 vehicles per day or less are good candidates for road diets from four (4) lanes to three (3) lanes, but different agencies across the country have different thresholds that they find acceptable. MRMPO adopted the FHWA suggestion of 20,000 Average Weekday Traffic (AWDT) as the upper limit for four to three lane changes.

The FHWA has no guidance on AWDT thresholds for converting six lane or larger roadways to five lanes (two lanes in each direction and a center turn lane). Analysis found that while many four lane roads in the region support over 35,000 vehicles a day, others are underused.

Road Diet Maps

The Road Diet Recommendations maps on the next page shows roadways with low average daily traffic volumes (compared to their capacity) and high fatal and injury crash rates.

Potential Candidates

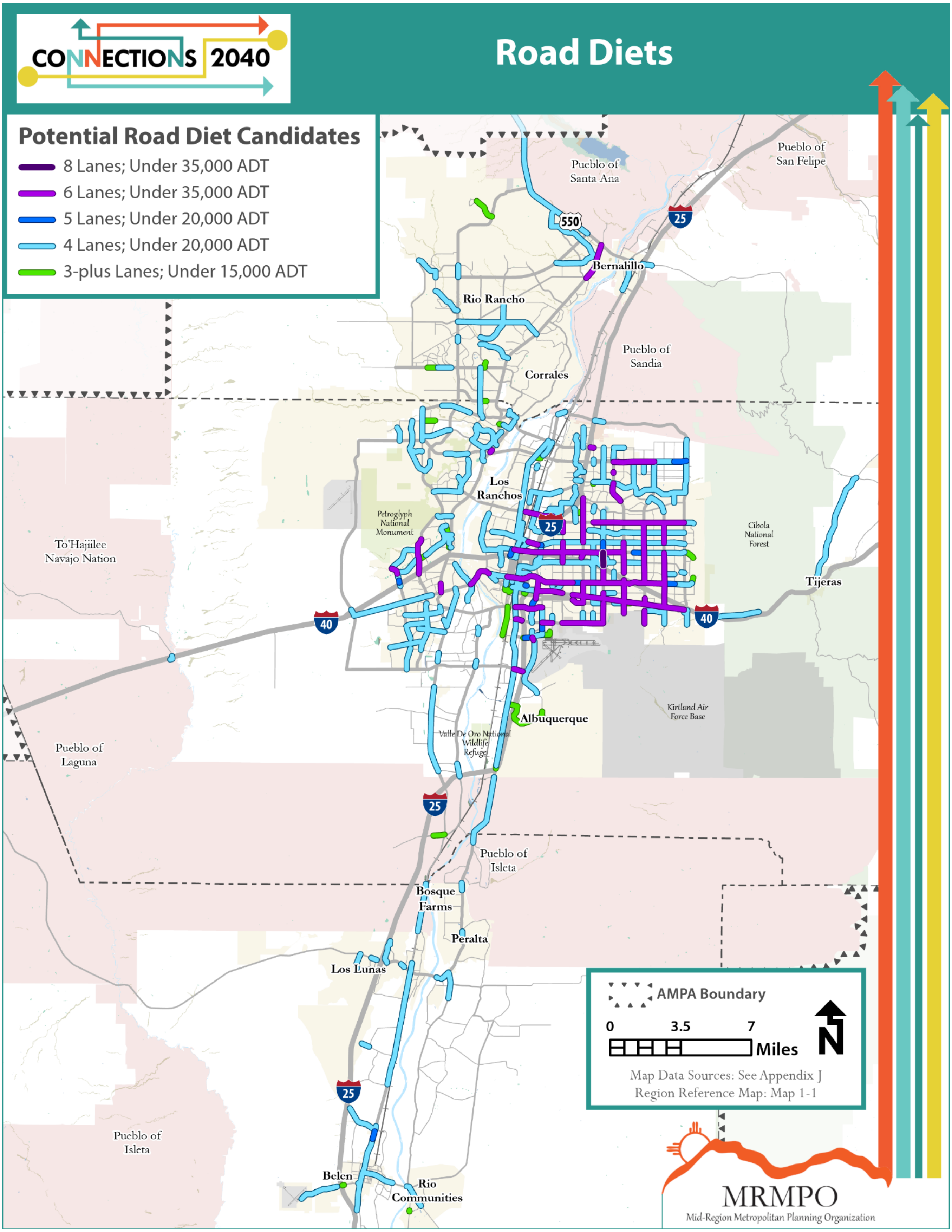
These two factors combined can help regional decision makers find potential road diet candidates. It is important to note that the road diet map only points out potential candidates to be considered for further study. Before a road diet is undertaken, there should be an in-depth analysis of the corridor's suitability for roadway reconfiguration. Other considerations are the land use context, whether there is on-street parking, heavy transit use along the roadway, or if the project might fill a gap in the bike network.

When a road does not experience above-average crashes, implementing a road diet may still be a good decision because of the many benefits that may be provided, including the potential to add facilities for bicyclists and buffers for pedestrians and improved safety.

Indian School is an example of a roadway that provides an important link on the bike system network, which might make it a good candidate for a road diet even though it doesn't have the highest risk ranking.

Comprehensive Plans

Another important policy to look at for roadway design is in local comprehensive plans. For example, in the City of Albuquerque ABC to Z Comprehensive Plan, future roadway characters are identified. Central east of Louisiana and Montgomery are identified as a Major Transit Corridors, and Wyoming and Menaul are identified as Multi-Modal Corridors. These designations should be a part of the decision-making process.


CONNECTIONS 2040
Road Diets
Potential Road Diet Candidates
8 Lanes; Under 35,000 ADT
6 Lanes; Under 35,000 ADT
5 Lanes; Under 20,000 ADT
4 Lanes; Under 20,000 ADT
3-plus Lanes; Under 15,000 ADT
Pueblo of Santa Ana
Pueblo of San Felipe
Bernalillo
Rio Rancho
Pueblo of Sandia
Corrales
Los Ranchos
Petroglyph National Monument
To'Hajiilee Navajo Nation
Cibola National Forest
Tijeras
Albuquerque
Kirtland Air Force Base
Valle De Oro National Wildlife Refuge
Pueblo of Laguna
Pueblo of Isleta
Bosque Farms
Peralta
Los Lunas
Belen
Rio Communities
AMPA Boundary
0 3.5 7 Miles
N
Map Data Sources: See Appendix J
Region Reference Map: Map 1-1
MRMPO
Mid-Region Metropolitan Planning Organization

6.4 COMPARING DESIGNS

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 (or widths) 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. One way to review alternatives is to develop a comparison matrix to review the strengths and weaknesses of different roadway design alternatives.

This can include an appraisal of expected performance outcomes for various modes or can be tied to projected performance measures such as multi-modal level of service (MMLOS).

To work through these tradeoffs and demonstrate how performance measures can be used, a few example comparisons are shown using Bridge Blvd, Zuni Rd and San Pedro Dr as examples.

These comparisons utilize the *Complete Streets Checklist* to provide a baseline inventory of existing conditions. The collected data are then used as inputs for a multi-modal level of service metric that provides quantitative comparison between roadway designs.[48] These indicators are tied to specific 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 positive (+) and negative (-) valuations for each configuration's relative strengths or weaknesses. The goal is to provide a framework that allows the best design option to be chosen in a constrained right-of-way.

The following section illustrates the previously described methodology for comparing alternatives by comparing 3-5 alternative conceptual designs including the existing design for three roadways that have been identified for multi-modal improvements.

ZUNI ROAD RECONSTRUCTION

Zuni Road, a community principal arterial with an average 19,000 AWDT, was evaluated for potential reconstruction that would reduce the number of travel lanes and increase multi-modal travel options. This project had the opportunity to increase safety, create new connections, and improve multi-modal level of service indicators. Although some segments of the road have ample right-of-way, some segments are constrained. The segment between Washington St and San Mateo Blvd is considered below.

1. **Existing:** *6 travel lanes, 18 foot median, 5 foot sidewalks.* The existing configuration did not include bike lanes and had minimal sidewalks.

[48] A simplified model, developed by *Sprinkle Consulting*, has been used to produce the MMLOS scores for these comparisons.

2. **Alternative 1:** *4 travel lanes, 6 ft bike lane, 10 ft sidewalk, 18 ft median, speed reduction to 30 mph.* This option would improve multi-modal options by adding bike lanes and expanding sidewalks.
3. **Alternative 2:** *4 travel lanes, 9 ft buffered bike lane, 10 ft sidewalk, street trees, speed reduction to 30 mph.* This option would add a buffered bike lane to increase the bicycle LOS. Improved landscaped buffers with street trees would also be used to reduce storm water runoff.

SAN PEDRO ROAD DIET

San Pedro, a minor arterial with 15,000 AWDT, was evaluated as a candidate for a road diet. In this scenario, the roadway will be reduced from four through lanes to two lanes and a center turn lane from Lomas to just south of I-40. This roadway reconstruction project creates opportunities to improve traffic flows (by including a central turn lane), expand mode choices, include on-street parking, and introduce traffic calming measures.

1. **Existing:** *4 travel lanes, no median, 6 ft sidewalks.* This configuration did not provide multi-modal options.
2. **Alternative 1:** *2 travel lanes, central turn lane and median, on-street parking, lower speeds.* This option adds on-street parking, which will help with traffic calming and improve access to businesses. It may also improve traffic flow with the introduction of a dedicated left turn lane.
3. **Alternative 2:** *2 travel lanes, no median, on-street parking, bike lane.* This configuration adds a bicycle lane and parking to the street. Although this option provides the most multi-modal options, it also introduces potential conflicts between users. Not including a dedicated left turn lane may affect traffic flow.
4. **Alternative 3:** *2 travel lanes, central turn lane and median, bike lane.* This option prioritizes biking over on-street parking. It may also improve traffic flow with the introduction of a dedicated left turn lane.
5. **Alternative 4:** *2 travel lanes, no median, on street parking, and sidewalk buffers with green infrastructure.* Adds expanded sidewalk buffers with green infrastructure to increase storm water runoff capture. Provides the best pedestrian improvements, but not including a dedicated left turn lane may affect traffic flow.

FIGURE 6.3: ZUNI ROAD CONCEPTUAL DESIGN COMPARISION

ZUNI ROAD (Washington to San Mateo) - 19,000 AWDT - 35 MPH

	ROW Width	AutoLOS	Transit LOS	Bicycle LOS	Pedestrian LOS	Walkability Index	Traffic Calming	Mode Choices	Parking	Land Use Integration	Green Streets	Cost	Strengths/ Weaknessess
Existing	~100'	C	E	3.79 D	2.98 C	Minimal	-	-	-	-	-	+	2/9
Alternative 1	~100'	C	C	1.93 B	2.68 C	Basic	+	+	-	+	-	+	**9/2**
Alternative 2	~100'	C	C	**0.37 A**	**2.32 C**	Basic	+	+	-	+	+	-	**9/2**

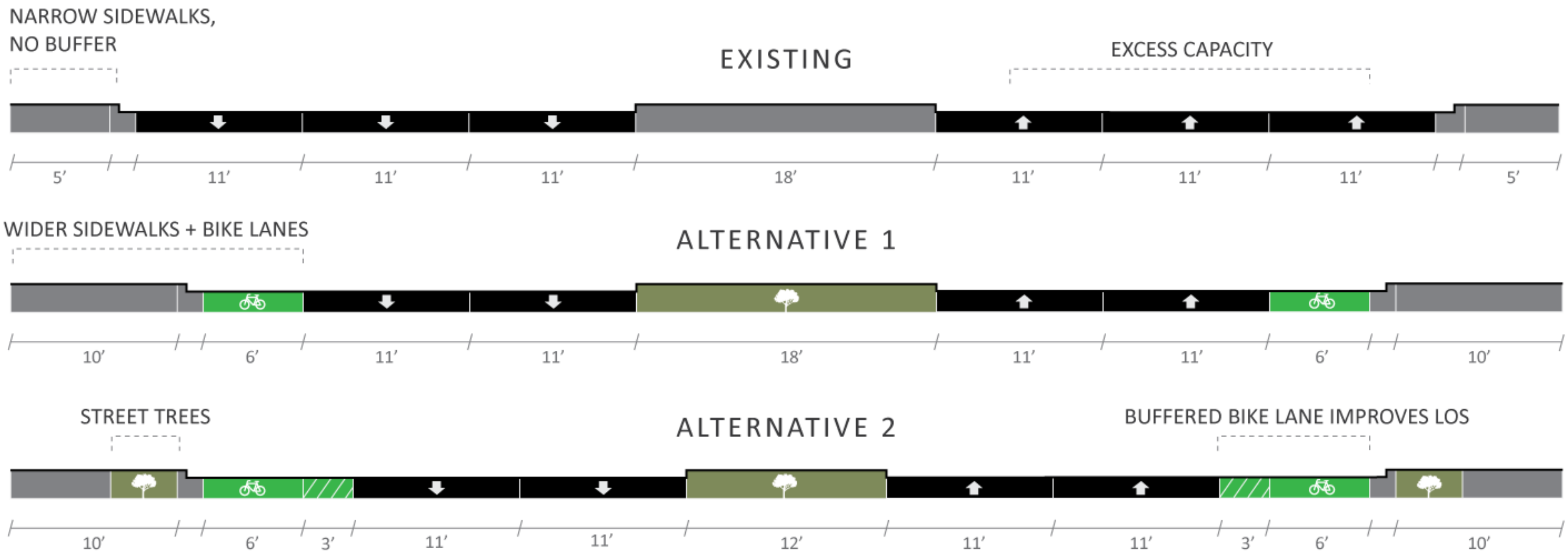
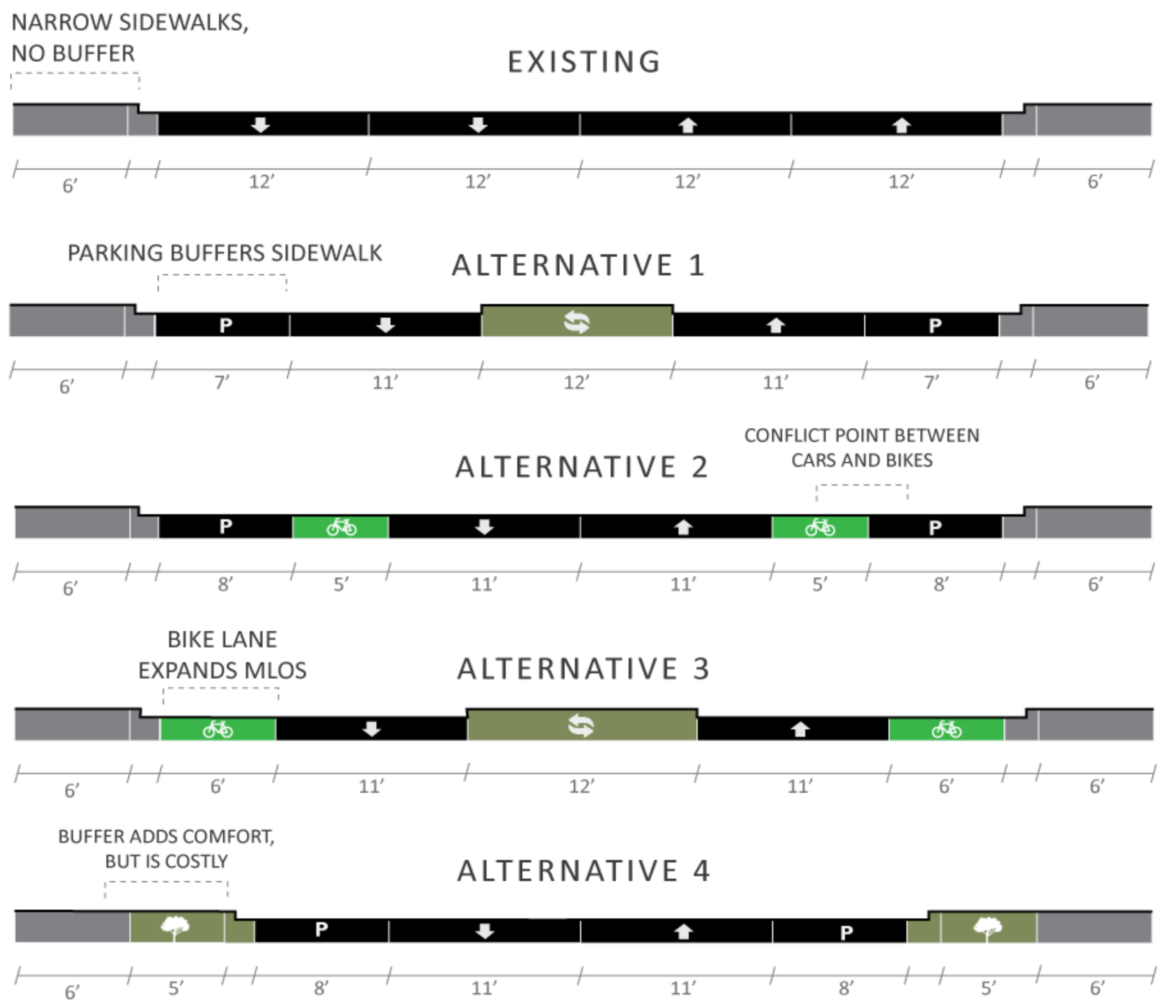


FIGURE 6.4: SAN PEDRO CONCEPTUAL DESIGN COMPARISION

SAN PEDRO (Marble to Haines) - 15,000 AWDT - 35 MPH

	ROW Width	Transit LOS	Auto LOS	Bicycle LOS	Pedestrian LOS	Walkability Index	Traffic Calming	Mode Choices	Parking	Land Use Integration	Green Streets	Cost	Strengths/ Weaknessess
Existing	61'	N/A	C	3.80 D	2.99 C	Basic	-	-	-	-	-	+	3/7
Alternative 1	61'	N/A	D	3.88 D	2.99 C	Moderate	+	-	+	+	+	+	7/3
Alternative 2	61'	N/A	D	3.06 C	2.87 C	Moderate	+	+	+	+	-	+	**8/2**
Alternative 3	61'	N/A	D	**2.22 B**	3.44 C	Moderate	+	+	-	+	+	+	**8/2**
Alternative 4	61'	N/A	D	3.88 D	**2.68 C**	Moderate	+	-	+	+	+	-	6/4



Chapter 7

PERFORMANCE MEASURES

Chapter 7

Performance Measures

Evaluating projects, before and after they are completed, is a crucial step in ensuring that roadways meet the needs of all users. Specific quantifiable performance measures can be used to provide insight into how well the design meets its original objectives. These performance measures can include multi-modal level of service, transit performance, safety, and connectivity. Using performance measures to evaluate innovative projects before and after can also provide evidence to support future projects.

INPUTS, OUTPUTS, AND OUTCOMES

Increasingly, evaluation methodologies are focusing on *inputs, outputs, and outcomes*, which correspond to different stages in a transportation planning context.

Inputs refer to quantifiable investment, which can include money spent, policies passed, and 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, and 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, and number of crashes. An *inputs, outputs and outcomes* approach can be applied to evaluate specific projects, or it can be used to track the progress of larger scale planning objectives.

MONITORING PERFORMANCE

MRMPO collects data and performs analysis on a wide range of transportation projects. Specifically, the MPO evaluates overall system performance primarily as it relates to congestion and crash statistics. MRMPO has also developed tools to better model future land use scenarios, which can assist in making better future development decisions.

Performance Methodologies

As part of these efforts, the LRTS document is designed to complement the 2040 MTP by providing specific, measurable objectives that can be evaluated periodically to ensure the goals of this document and the 2040 MTP are being met.

The following are a set of performance methodologies that can be used to ensure that these guidelines promote multi-modal travel options, connectivity, walkable places, and complete networks.

The intent is that these performance measures can be used to help inform decisions by MRMPO's member agencies, especially those agencies responsible for roadway and network design.

They provide a clear set of methodologies that can be used to evaluate connectivity, multi-modal level of service, walkability, safety, and successful land use integration.

Many of these measures use an inputs, outputs, and outcomes-based approach that requires before and after data collection, as well as specific analytical tools (see table 8.1). MRMPO can provide the analytical tools and data to evaluate each of these measures as they change over time. Member agencies can use these tools to compare specific design configurations, or to ensure their ideas support the principles of the 2040 Target Scenario.

Although such data collection, analysis, and ongoing evaluation can involve a long process, the benefits of evaluation for creating successful projects a roadway network that works better for all users cannot be overstated.

TABLE 7.1: EVALUATION METHODOLOGY APPROACHES

	CONCEPT/DEFINITION	OBJECTIVE	PLANNING PHASES	EXAMPLE MEASURES
INPUTS	Inputs refer to quantifiable investments, which can include money spent, policies passed, and/or number of community participants. As a measure, they refer to data/goals that are used to inform the project process.	To ensure the strategic projects are picked that are resource efficient, context sensitive, and consistent with other plans and goals.	During project selection, comparison, inventory, and prioritization.	• Investment Dollars • High Activity Areas • Plan Consistency • Projected Land Uses • Character Areas
OUTPUTS	Outputs refer to the direct, tangible results of these inputs, including miles of new roads built, miles of new bike routes, and/or new trees planted. As a measure, refers to the expected, quantitative outcomes of the project, using projected and actual performance measures.	To model expected performance before projects are built to ensure they meet goals and objectives. Also, to help evaluate alternatives.	During project comparison, evaluation and design. Can also be used to evaluate projects after they are complete.	• Amount of New Construction • Levels of Service • Walkability Index • Intersection Density • Average Block Length • Directness Index
OUTCOMES	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, and/or number of crashes.	To compare expected performance (from inputs, and built outputs) to actual results. To measure performance over time.	After projects are complete. Some models can project expected outcomes.	• Crash Rates • Congestion • Trips Generated by Mode • Increased Investment • New Development • Observed Speeds

7.1 MULTI-MODAL LEVEL OF SERVICE (MMLOS) INDICATORS

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.

MMLOS Models

Updated MMLOS models are included in the *Highway Capacity Manual (HCM)*, 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: Multi-Modal Level of Service Analysis for Urban Streets*, synthesizes these different models and shows how they may be applied to urban roadways.

Various studies have shown that users' perceptions of LOS vary greatly depending on user group and context (e.g., elderly pedestrians vs. recreational users). However, regression models from survey data have produced models that have been shown to accurately predict user's perceptions of comfort and safety.[49]

BICYCLE LEVEL OF SERVICE

Quantitative Output – Bicycle LOS Score

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 BLOS for bicycle infrastructure along streets, as well as along multi-purpose 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

Quantitative Output – Transit LOS Score

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 bus stop amenities, distance between stops, and stop security.

PEDESTRIAN LEVEL OF SERVICE

Quantitative Output – Pedestrian LOS Score

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

[49] Transportation Research Board. (2008). Multi-modal Level of Service Analysis for Urban Streets. National Cooperative Higher Research Program Report 616. Washington, DC

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 (e.g., including a landscape buffer along streets with more traffic or higher speeds).

7.2 WALKABILITY MEASURES

Walkability has been championed as a key to creating vibrant streets and neighborhoods. Scoring systems to measure walkability have been developed that expand on pedestrian level of service indicators to include additional considerations that are important to creating pedestrian friendly environments.

Unlike pedestrian LOS indicators, walkability methodologies 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 evaluate the walkability of an area.

WALKABILITY INDICES

Semi-Quantitative Output, Outcome – Walkability Index Score

Hall Planning and Engineering's *Walkability Index* measures 10 factors that can be compared using a semi-quantitative score sheet system that scores street segments on a 0 to 100 point system. These measures include:

1. Traffic Speed
2. Street Width
3. Presence of On-Street Parking
4. Sidewalk Width
5. Intersection Spacing Distance
6. Pedestrian Amenities
7. Building to Height Ratio
8. Land Use Mix
9. Façade Design
10. Transit and Bicycle Features

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.

More walkable segments score above 50 points on this score sheet. For example, Central Ave, as it runs through Nob Hill (with its many pedestrian friendly features), scores approximately 75 points whereas Lomas from 14th Street to I-25 scores approximately 30 points.

7.3 CONNECTIVITY

Street connectivity is a crucial measure of network performance and has broad implications on how well individual streets function within the larger transportation network.

As outlined in Chapter 4: Complete Networks, there are numerous benefits to well-connected networks. **They ensure efficiency, reduce congestion, reduce vehicle miles traveled, create direct routes for multiple users, encourage walking and bicycling, and provide more direct access to businesses.**

There are several methodologies to measure the connectivity of different development patterns. Most of these methodologies compare physical features of the existing network, including block length, number of intersections, and route directness.

These measures can provide replicable standards to compare connectivity between different development patterns. In addition, the benefits of connectivity can be measured individually as positive outcomes of well-connected networks.

INTERSECTION DENSITY

Quantitative Output – Four-leg Intersections per Square Mile

Four-leg intersection density describes the number of intersections with four adjoining streets 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 (e.g., cul-de-sacs) and t-intersections and indirectly measures average block length.

Higher scores (greater than 100 intersections/square mile) generally indicate more favorable for creating walkable places.[50] 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.

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.

AVERAGE BLOCK LENGTH

Quantitative Output – Average Block Length

Average block length is an additional measure of connectivity that is especially relevant for pedestrians. In general, pedestrians' value shorter block lengths, as they allow for pedestrians to pick more direct routes, and offer more opportunities to the cross the street. In urban areas, block lengths of 200 feet to 400 feet are ideal for promoting pedestrian-scaled environments.[51]

Average block length can be calculated by adding the block lengths of each block in a specified area, divided by the number of blocks.

DIRECT ROUTES AND TRIP DISTANCE

Quantitative Output, Outcome – Directness Index

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 mile to reach a destination (such as a transit stop)[52]. If the distance is longer, they will not take the trip or will choose an alternative mode.

For this reason, having a network that offers direct routes, coupled with shorter block lengths, is essential to increasing 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.

Although trip distance may appear to be short and direct on a map, actual trip distance may be much longer if streets do not connect and no direct route is available. This can increase on-the-ground trip distance significantly and make walking inconvenient or simply too long for most pedestrians.

Route directness can be measured using a "directness" ratio that compares actual, on the ground travel distance divided by direct line travel distance. For walkability, a ratio of 1.5 or less is ideal.[53]

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[50] Planning for Street Connectivity, 2003

[51] Ewing, Pedestrian- and Transit-Oriented Design, 28-30

[52] Mid-Region Travel Survey, 2014

[53] MRMPO uses the TRAM modeling tool to compare the travel times 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 analysis can be done at a regional, neighborhood, site-specific scale. In addition to mapping accessible areas for various modes at dif-

7.4 SAFETY

Evaluating crash statistics along existing roadways is important to understanding 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 may contribute to lower user safety. Such calculations are especially important for improving intersection safety, where most crashes occur.

NUMBER OF CRASHES AND CRASH RATES

Quantitative Outcome – Number of Crashes and Crash Rate

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.

In Bernalillo County, some of the intersections with the most pedestrian crashes also have a high vehicle crash rate, including San Mateo and Central, and Central and Louisiana. The high crash rates at these intersections point to a need to understand potential design or operating issues that have contributed to lower user safety. Such analysis can also point to "crash hotspots" where the likelihood of crashes happening is much higher.

Of the top twenty highest fatal and injury intersection locations, all except one fall within the Albuquerque urban area. Some of the areas around the UNM and CNM campuses where many people walk and bike should be priority areas for improving facilities for these modes of travel.

It is currently not possible to calculate pedestrian and bicycle crash rates at intersections because there is not enough data available. This is why the ranking of intersections for pedestrians and bicycle crashes is based on the total number of crashes as opposed to a crash rate.

Lists for the ranking of intersection crash rates and pedestrian and bicyclist crashes for intersections are created every year by MRCOG once the new geo-coded crash date has been received. These lists can provide a starting point to target future infrastructure improvements and serve as potential candidates for intersection showcase projects.

*HIGH FATAL AND INJURY NETWORK (HFIN)

Identifying the most dangerous streets and intersections will allow us to focus our efforts there, ensuring we get the biggest bang for our "safety buck."

The HFIN includes fatal and injury crashes per mile and fatal and injury intersection crash rates for every Major Road in the AMPA. (Interstates were not included because they are maintained and operated by the NMDOT and accounted for in the State Highway Safety Plan.)

The HFIN was developed by reviewing each geographic area: Large Urban, Small Urban, Rural (which includes Tribal) individually then calculating the mean (of either the intersection rate by volume or the crashes per mile). Intersections and roadways included in the HFIN experience 1.5x the mean crash rate. Pedestrian crashes at intersections were analyzed using a total number of crashes as opposed to a rate.

*This map is updated annually.

ferent time increments, TRAM can be used to contrast current and proposed road networks to identify alignments that provide the most access to users for different modes.

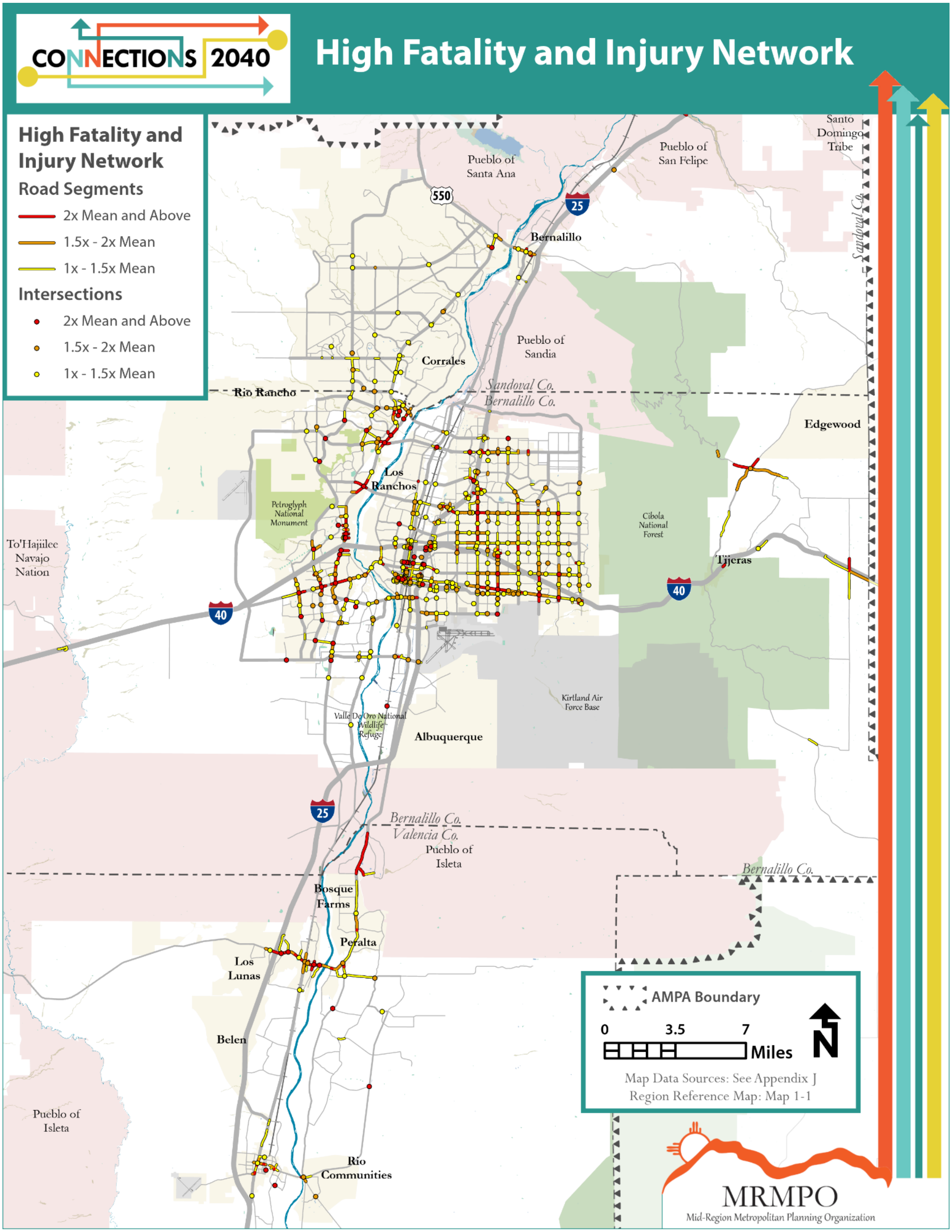
For the most recent 5 years of data, the High Fatal and Injury Network includes only 7% of the Major Roads Network miles (and 2% of all roads), but 64% of the total fatalities and injuries.

PEDESTRIAN INTERSECTION SAFETY INDEX

Quantitative Output – Ped ISI Score

Another way to measure intersection safety for pedestrians is using the Federal Highway Administration's *Pedestrian Intersection Safety Index* (Ped ISI). This methodology uses six basic roadway attributes to determine an intersection's safety: 1) Whether the intersection is signalized or not; 2) whether the intersection includes a stop sign; 3) number of lanes; 4) 85th percentile speed; 5) average daily traffic (ADT); and 6) whether the intersection is surrounded by commercial land uses.

The factors produce a score from 1-6, with higher numbers indicating less safe intersections based on a combination of these factors. For example, San Mateo, with 6 lanes, a posted speed limit of 40mph and 30,000 ADT, scores a 3.6 (less safe), while Ridgecrest, with two lanes, a 25 MPH speed limit, and 2,200 ADT, scores a 1.73 (more safe).


CONNECTIONS 2040
High Fatality and Injury Network
High Fatality and Injury Network
Road Segments
2x Mean and Above
1.5x - 2x Mean
1x - 1.5x Mean
Intersections
2x Mean and Above
1.5x - 2x Mean
1x - 1.5x Mean
Pueblo of Santa Ana
Pueblo of San Felipe
Santo Domingo Tribe
Sandoval Co.
Bernalillo
Pueblo of Sandia
Corrales
Rio Rancho
Sandoval Co.
Bernalillo Co.
Edgewood
Los Ranchos
Petroglyph National Monument
Cibola National Forest
To'Hajiilee Navajo Nation
Tijeras
Kirtland Air Force Base
Valle De Oro National Wildlife Refuge
Albuquerque
Bernalillo Co.
Valencia Co.
Pueblo of Isleta
Bernalillo Co.
Bosque Farms
Peralta
Los Lunas
Belen
Pueblo of Isleta
Rio Communities
AMPA Boundary
0
3.5
7
Miles
N
Map Data Sources: See Appendix J
Region Reference Map: Map 1-1
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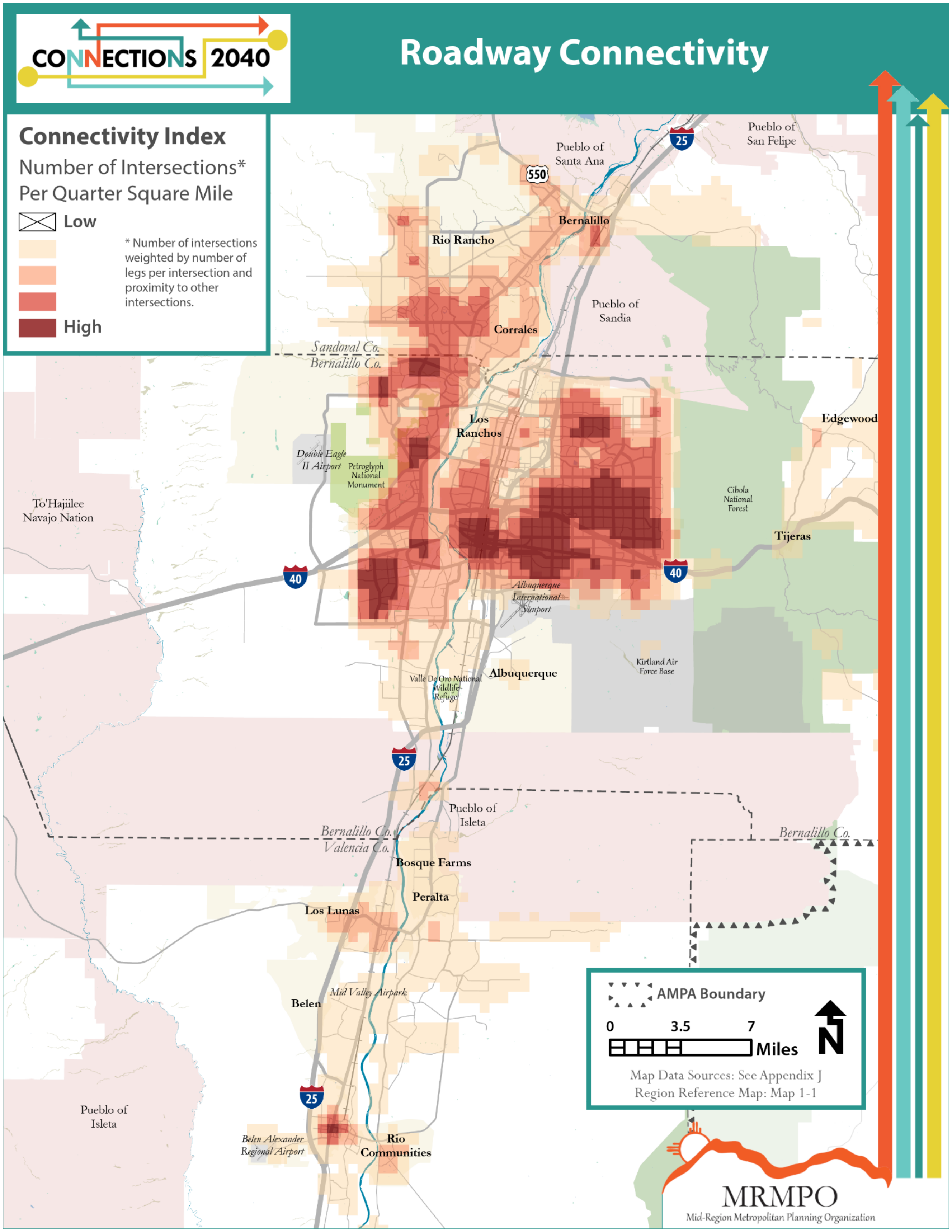
CONNECTIONS 2040
Roadway Connectivity
Connectivity Index
Number of Intersections* Per Quarter Square Mile
Low
High
* Number of intersections weighted by number of legs per intersection and proximity to other intersections.
Pueblo of San Felipe
Pueblo of Santa Ana
Bernalillo
Rio Rancho
Pueblo of Sandia
Corrales
Sandoval Co.
Bernalillo Co.
Los Ranchos
Edgewood
Double Eagle II Airport
Petroglyph National Monument
To'Hajiilee Navajo Nation
Cibola National Forest
Tijeras
Albuquerque International Sunport
Kirtland Air Force Base
Albuquerque
Valle De Oro National Wildlife Refuge
Pueblo of Isleta
Bernalillo Co.
Valencia Co.
Bosque Farms
Peralta
Los Lunas
Mid Valley Airpark
Belen
Belen Alexander Regional Airport
Rio Communities
AMPA Boundary
0
3.5
7
Miles
N
Map Data Sources: See Appendix J
Region Reference Map: Map 1-1
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7.5 LAND USE INTEGRATION AND SUPPORT

Roadways can be designed to support adjacent land uses and the activities taking place there. This in turn helps foster positive feedbacks that lead to a stronger integration between these land uses and the transportation network.

The region has examples where the land use and roadways work together to support economic development and valuable public places (such as Nob Hill); however, the way these effects are measured is new and still developing. This section recommends three measures to begin the process of better understanding land use and transportation integration.

The *Multi-Modal Approach to Economic Development in the Metropolitan Area Transportation Process* by the Federal Highway Administration provided ideas for these measures.

HIGH ACTIVITY AREAS

Quantitative Input – Activity Density Score

Roadway projects can look to catalyze investment in areas with high existing or potential future activity (i.e., higher densities and trip generation potential). MRMPO's Project Prioritization Process includes a simple methodology to calculate activity levels by comparing population density and employment density to a unit area.[54] The formula for activity density is:

$$\text{Activity Density} = \frac{\text{DASZ Population} + \left(\text{Employment} * \frac{\text{AMPA Population}}{\text{AMPA Employment}}\right)}{\text{DASZ Acreage}}$$

This formula can be used to measure both current activity and projected activity in terms of population and job density by Data Area Subzone (DASZ). **In this way, activity density can provide a means to understand which areas are likely to see increased use and benefit the most from infrastructure investment.** It can also be used to compare actual development over time.

INCREASED TRANSIT RIDERSHIP, PEDESTRIAN ACTIVITY, AND BICYCLE ACTIVITY

Quantitative Outcome – Trip Counts by Mode

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. 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.

[54] Please see MRMPO's *Project Prioritization Process Guidelines for Large Urban Areas* (September 2014), page 69

INCREASED INVESTMENT & BUSINESS SALES

Quantitative Outcome(s) – Change in Investment/Sales Dollars

In addition to increased trips and user activity, roadway projects can be evaluated as to how they stimulate increased investment along a corridor. Some ways to measure increased investment include:

1. **Increased Business Sales:** Local businesses may see increased sales along streets that were reconfigured 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.
2. **New Development Projects:** investment in roadway projects may spur new development along a corridor by increasing investment potential and market attractiveness. For example, new bus rapid transit routes have been shown to increase investment along corridors, especially those that connect major job centers. New development can be seen in decreased vacancy rates, increased building permits, and new businesses along the street.
3. **Increased Property Values:** Roadways may increase property values of adjacent properties. For example, walkability improvements, including the installation of street trees, better lighting, and wider sidewalks, have been shown to increase property values along these streets as compared to streets without these improvements.[55]

[55] Ewing, Pedestrian- and Transit-Oriented Design, 65

Appendix

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COMPLETE STREETS CHECKLIST

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MR COG

COMPLETE STREETS CHECKLIST

To help facilitate an improved transportation planning process, MRMPO has developed the Complete Streets Checklist to provide a baseline analysis of existing conditions, constraints, and opportunities along existing roadways. The goal is that the checklist can be used to generate clear conceptual design priorities that can lead to the best overall multimodal configuration.

PROJECT NAME ______________________ RESPONSIBLE AGENCY(S) ______________________

LOCATION ______________________ CHARACTER AREA ______________________

ROADWAY CLASSIFICATION ______________________ POSTED SPEED ______________________

DEVELOPMENT PHASE

- ☐ Sector Plan, Area Plans, and Master Plans
- ☐ Corridor Plans & Studies
- ☐ Engineering & Feasibility Studies
- ☐ New Road Construction
- ☐ Redevelopment and Reconstruction Projects
- ☐ Roadway Resurfacing Maintenance

PROJECT MODE PRIORITIES

- ☐ Transit
- ☐ Bicyclists
- ☐ Pedestrians
- ☐ Freight
- ☐ Motor Vehicles

PROJECT DESCRIPTION

CROSS SECTION ELEMENTS

ELEMENT	DESCRIPTION	WIDTH
THROUGH DRIVE LANES		
MEDIAN		
PARKING		
BICYCLE INFRASTRUCTURE		
SIDEWALK BUFFERS		
SIDEWALKS		
SHOULDERS		
TOTAL		

1

EXISTING CONDITIONS

LAND USE		CURRENT	2040 PROJECTION
	PRIMARY LAND USES		
	LAND USE MIX		
	DU/ACRE		
	ACTIVITY DENSITY		
	PED COMPOSITE INDEX		

TRAFFIC		COUNT	2040 PROJECTION	MODE SHARE %
	AWDT			
	PEDESTRIANS			
	BICYCLISTS			
	FREIGHT			

NETWORKS		EXISTING	FUTURE	DESCRIPTION/CONDITION
	TRANSIT ROUTE			
	FREIGHT ROUTE			
	SIDEWALKS			
	BICYCLE ROUTE			

TRANSIT		WEEKDAY	WEEKEND	RIDERSHIP
	FREQUENCY			
	HOURS OF OPERATION			

CRASHES		CRASHES (LAST 5 YEARS)	FATAL	RATE
	AUTO			
	BICYCLES			
	PEDESTRIAN			

PERFORMANCE		SCORE		SCORE
	AUTO LOS		TRAVEL DELAY	
	TRANSIT LOS		BICYCLE LOS	
	PEDESTRIAN LOS		WALKABILITY INDEX	

ADDITIONAL EXISTING CONDITIONS

2

PRIORITY CONSIDERATIONS

PRIORITY	CONSIDERATION	YES/NO	
EXPANDED CHOICES & INVOLVEMENT	Is there an opportunity to expand mode choices along the roadway?		
	Is community involvement a priority?		
	Are there existing plans that should be consulted?		
LAND USE INTEGRATION	Is economic development along the street a priority?		
	Does the street support a diverse range of land uses, activities, and users?		
	Does the street support the realization of the 2040 preferred scenario?		
CONGESTION & EFFICIENCY	Is addressing existing or future congestion a priority?		
	Is the efficiency of the roadway a concern?		
	Are roadway pavement conditions a concern?		
COMMUNITY HEALTH	Is improving community health outcomes a priority?		
	Does the design encourage active transportation options?		
	Are there gaps in the neighborhood's sidewalk, transit, or bicycle networks?		
	Does the project improve accessibly to jobs, especially for low income residents?		
PARKING	Is expanded parking a priority?		
	Is on-street parking a possibility?		
WALKABILITY	Are the area's sidewalks ADA Compliant?		
	Are crosswalks provided?		
	Are additional pedestrian amenities a priority?		
BICYCLING	Does the street enable safe bicycling?		
	Are there gaps in the current bicycling infrastructure, such as impassible intersections or other barriers?		
	Is bicycle safety a concern?		
TRANSIT	Is expanded transit service a priority?		
	Are improved transit amenities a priority?		
TRAFFIC CALMING	Is traffic calming a priority?		
	Are crash rates higher than other areas?		
	Is intersection crossing safety a concern?		
GREEN STREETS	How well does the street handle storm water runoff and water quality?		
	Are there ways to incorporate green infrastructure within the roadway?		
CONNECTIVITY	Does the street's configuration support the goals of creating complete networks?		
	Would the project expand connections between anchor institutions or job centers?		
	Does the current configuration introduce barriers to travel for certain users?		
FREIGHT	Is freight movement a priority along this roadway?		
	Is this a major freight route?		

COMPLETE STREETS GAPS

ADDITIONAL CONSTRAINTS

3

IMPLEMENTATION OPPORTUNITIES

PRIORITY	POTENTIAL STRATEGIES		FEASIBILITY
LAND USE INTEGRATION & DEVELOPMENT	☐ Walkability Improvements ☐ Façade Upgrades ☐ Infill Strategies	☐ Zoning Changes ☐ Establish BID, Main Street District, etc. ☐ Maintenance Plan	
CONGESTION & EFFICIENCY	☐ Lane Restriping ☐ Roundabouts ☐ Access Management	☐ Travel Demand Management ☐ ITS Solutions ☐ Signals and Signal Timing ☐ Additional Lanes	
COMMUNITY HEALTH	☐ Trail Connections ☐ Bike infrastructure improvements	☐ Fill in Sidewalks ☐ Active Public Spaces	
PARKING	☐ On-street Parking	☐ Public Parking	
WALKABILITY & URBAN DESIGN	☐ Wider Sidewalks ☐ Expanded Landscape Buffers ☐ Street Trees ☐ Improved Crosswalks ☐ Reduce Curb Cuts	☐ Street Furniture ☐ Active Public/Open Spaces ☐ Improved Street Lighting ☐ Public Art ☐ Unique Paving Materials	
BICYCLING	☐ Bike Lanes ☐ Buffered Bike Lanes (Cycle Tracks) ☐ Multi-use paths	☐ Bicycle Boulevards ☐ Intersection Markings ☐ Parallel Bike Route	
TRANSIT	☐ Bus Rapid Transit ☐ Expanded Service	☐ Improved Transit Stop Amenities	
TRAFFIC CALMING	☐ Lower Design/Posted Speed ☐ Narrower Lanes ☐ Lane Reduction ☐ Median Improvements	☐ Roundabouts ☐ Signals and Signal Timing ☐ Pedestrian Beacons ☐ Improved Signage and Lighting ☐ Shoulder Changes	
GREEN STREETS	☐ Street Trees ☐ Pervious Surfaces ☐ Bioretention Basins	☐ infiltration Planters ☐ Rain Gardens ☐ Median Design	
CONNECTIVITY	☐ Denser, grid like network ☐ Side Street Improvements ☐ Parallel Routes ☐ Improved Trail Connections	☐ Limit cul-de-sacs and Dead Ends ☐ Use shorter block lengths ☐ Pedestrian Connections to Adjacent Land Uses	
FREIGHT	☐ Truck Route Signage	☐ Designated Truck Route	

ADDITIONAL OPPORTUNITIES

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