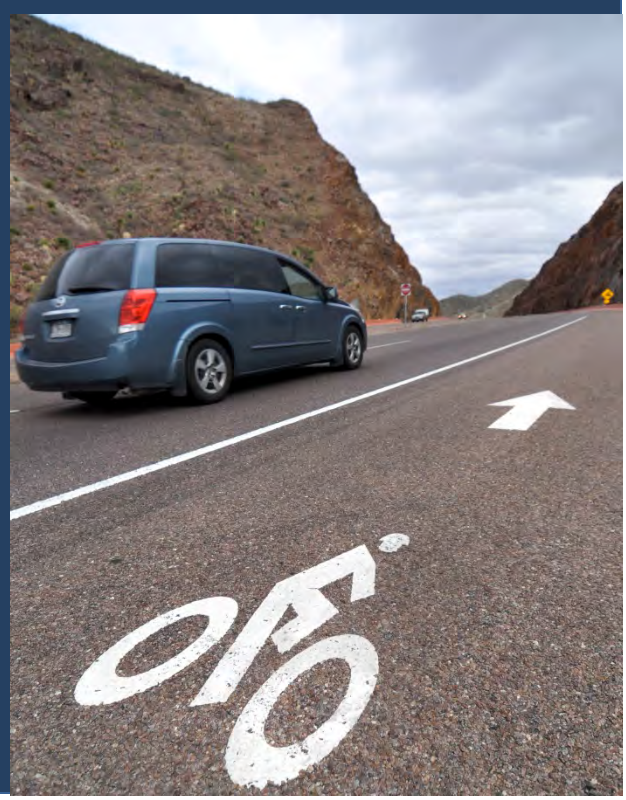
Alternative Transportation Modes and Technology Applications for Multimodal Transportation Planning in the El Paso Region



El Paso Metropolitan Planning Organization

Texas A&M Transportation Institute

ALTERNATIVE TRANSPORTATION MODES AND TECHNOLOGY APPLICATIONS FOR MULTIMODAL TRANSPORTATION PLANNING IN THE EL PASO REGION

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LIST OF ACRONYMS

AASHTO	American Association of State Highway Officials
BMI	Body mass index
BRT	Bus Rapid Transit
CMAP	Coordinated Mobility Action Plan
CMP	Congestion Management Process
DOT	Department of transportation
FHWA	Federal Highway Administration
ITS	Intelligent Transportation Systems
LOS	Level of service
M&O	Management and operations
MAP-21	Moving Ahead for Progress in the 21st Century Act
MMS	Multimodal score
MPO	Metropolitan Planning Organization
MTP	Metropolitan transportation plan
O-D	Origin-destination
PMT	Person miles traveled
POE	Port of Entry
RMPC	Regional Multimodal Planning Committee
RTS	Rapid Transit System
SLRTP	Statewide Long-Range Transportation Plan
SOV	Single occupancy vehicle
STIP	Statewide transportation improvement program
TAZ	Traffic analysis zone
TDM	Transportation demand management
TIP	Transportation improvement program
TMO	Transportation management organization
TTI	Texas A&M Transportation Institute
TxDOT	Texas Department of Transportation
UTEP	University of Texas at El Paso
VMT	Vehicle miles traveled
WTEP	West Texas/El Paso
ZCTA	Zip Code Tabulation Area

DISCLAIMER AND ACKNOWLEDGMENTS

This research was performed by the Center for International Intelligent Transportation Research, a part of the Texas A&M Transportation Institute, in cooperation with the Texas Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein.

The research team thanks the City of El Paso's Department of Transportation for providing sidewalk inventory data and the Texas Department of Transportation for providing bike lane infrastructure data and for their expertise and assistance in the performance of project activities.

EXECUTIVE SUMMARY

This report provides the El Paso Metropolitan Planning Organization (MPO) with methodologies, data, analysis, and tools to develop a regional multimodal transportation plan for alternative transportation modes (i.e. transit, bicycling, and walking).

A multimodal transportation plan examines the key centers and corridors in a region and ensures that there is a connected circulation network for all these alternative travel modes. With multimodal transportation improvements, a region gains more efficient and safer transportation choices for travelers.

To develop these methodologies, analysis and tools for a multimodal transportation plan, TTI researchers collected and analyzed:

- A population sample survey for the El Paso MPO region, which included statistics on:
  - Residence.
  - Work/school destinations.
  - Exercise.
  - Biking and walking habits.
  - Transit use.
  - Well-being perception.
  - General demographics.
- A literature review of the factors that influence active transportation (walking, biking).
- An analysis of methods to promote active transportation.
- A detailed analysis of active travel in the El Paso MPO region.
- Data on sidewalk, transit, and bike connectivity in the El Paso MPO region.
- The influence of international bridges.
- Relevant technology applications that aide in active transportation, such as carsharing, bikesharing, and ridesharing.
- A transportation network's performance measures.

Researchers also held seven open houses for public input on pedestrian, bicycle, and transit connectivity issues and opportunities.

Since active travel data results in El Paso were consistent with active transportation literature reviewed, many of the active transportation models used around the world are applicable to this area.

TTI researchers developed a multimodal scoring methodology that could be applied to a region based on the connectivity results. Using this methodology, TTI was able to generate heat maps that show areas in the El Paso region that are lacking multimodal infrastructure or connections among the various multimodal travel modes. Researchers used pilot projects to demonstrate the multimodal score methodology.

Researchers proposed specific policy issues and recommendations for the MPO to develop, adopt, and implement as part of a multimodal plan. Researchers then developed a 10-step action plan and four-year schedule for the El Paso MPO to develop a multimodal plan.

CHAPTER 1: BACKGROUND

The Texas Department of Transportation (TxDOT) tasked the Texas A&M Transportation Institute (TTI) to provide assistance to the El Paso Metropolitan Planning Organization (MPO) in the development of a regional multimodal transportation plan for alternative transportation modes. TTI developed and implemented the methodologies, data, analysis, and tools that allowed the El Paso MPO develop the plan. Researchers began the project by:

- Reviewing federal and state statutes and local ordinances concerning multimodal transportation options.
- Reviewing local policies and plans related to supporting alternative modes of transportation that aim to increase individual mobility and accessibility.
- Reviewing best practices and state-of-the-art methodologies for multimodal transportation planning and implementation.
- Researching the use of intelligent transportation technologies to support pedestrian, bicycle, and transit legislation.

MULTIMODAL TRANSPORTATION PLANNING

The Federal Highway Administration (FHWA) defines multimodal as “the availability of transportation options using different modes within a system or corridor” (*1*). A multimodal plan is an integrated land use and transportation plan that shows the key centers and corridors in a region and ensures that there is a connected circulation network for all travel modes. Typically, the development of a multimodal plan is a mapping and analysis exercise that compiles existing plans and policies, rather than the establishment of a whole new policy framework. It assembles existing land use and transportation policies onto a single unified plan that serves as the basis for making decisions about more detailed multimodal planning at the scale of streets and centers.

Multimodal centers are current or future centers of activity within a region where future growth may be targeted to provide many destinations within walking distance. These centers are also where good travel options and well-connected street grids are present and where transit service may be provided. In particular, these centers are areas that would most benefit from multimodal improvements, and given limited transportation funds, may be target areas for multimodal investments.

When communities invest in multimodal transportation improvements, they can experience many benefits:

- More transportation choices and streets are often safer for all travelers.
- Cost-efficiency – multimodal transportation investments focus on moving more people instead of more vehicles, and can make better use of the transportation facilities in place instead of building new ones.
- Reducing travel demand by automobile lessens congestion, lowers emissions, and improves air quality.
- Addressing equity and social disparities by providing more travel choices for those with physical issues affecting their mobility.

- Encouraging more daily physical activity and providing access to a wider range of goods and services.
- Improving quality of life – streets can become places of social interaction and promote a greater sense of community pride.

Multimodal transportation planning is complicated because modes differ in various ways, including their availability, speed, density, costs, limitations, and most appropriate uses (Table 1). They are not perfect substitutes; each is most appropriate for specific users and uses.

Table 1. Mode Profiles.

Mode	Availability	Speed	Density	Loads	Costs	Potential Users			Limitations	Appropriate Uses
	Portion of locations and times served	Typical Speeds	Space requirements	Ability to carry baggage	User Costs	Non-drivers	Poor	Handicapped		
Walking	Wide (nearly universal)	2–5 mph	High	Small	Low	Yes	Yes	Varies	Requires physical ability. Limited distance and carrying capacity. Sometimes difficult or unsafe.	Short trips by physically able people.
Wheelchair	Limited (requires suitable facilities)	2–5 mph	Medium	Small	Med	Yes	Yes	Yes	Requires suitable sidewalk or path. Limited distance and carrying capacity.	Short urban trips by people with specific physical disabilities.
Bicycle	Wide (feasible in most roads and paths)	5–15 mph	Medium	Small to Medium	Med	Yes	Yes	Varies	Requires bicycle and physical ability. Limited distance and carrying capacity.	Short to medium length trips by physically able people on suitable routes.
Taxi	Moderate (in most urban areas)	20–60 mph	Low	Medium	High	Yes	Limited	Yes	High costs and limited availability.	Infrequent trips, short and medium distance trips.
Fixed Route Transit	Limited (most urban areas)	20–40 mph	High	Small	Med	Yes	Yes	Yes	Limited availability. Sometimes difficult to use.	Short to medium distance trips along busy corridors.
Paratransit	Limited	10–30 mph	Medium	Small	High	Yes	Yes	Yes	High cost and limited service.	Travel for disabled people.
Auto driver	Wide (nearly universal)	20–60 mph	Low	Medium to Large	High	No	Limited	Varies	Requires driving ability and automobile. Large space requirements. High costs.	Travel by people who can drive and afford an automobile.
Ridesharing (auto passenger)	Limited (requires motorist, matching services)	20–60 mph	High	Medium	Low	Yes	Yes	Yes	Requires cooperative motorist. Consumes driver’s time if a special trip (chauffeuring).	Trips that the driver would take anyway (ridesharing). Occasional special trips (chauffeuring).
Carsharing	Limited (requires nearby services)	20–60 mph	Low	Medium to Large	Med	No	Limited	Varies	Requires convenient and affordable vehicle rental services.	Occasional use by driver who don’t own an automobile.
Motorcycle	Wide (nearly universal)	20–60 mph	Medium	Medium	High	No	Limited	No	Requires riding ability and motorcycle. High fixed costs.	Travel by people who can ride and afford a motorcycle.
Telecommute	Wide (nearly universal)	N/A	N/A	N/A	Med	Yes	Varies	Varies	Requires equipment and skill.	Alternative to some types of trips.

Source: (2)

Multimodal analysis is even more complex because each mode includes various subcategories with unique characteristics. For example, "pedestrians" include people standing, walking alone and in groups, using canes and walkers, jogging and running, playing, walking pets, carrying loads, and pushing hand carts. Their actual needs, abilities, impacts, and value to society can vary significantly, as indicated in Table 2.

Table 2. Facility Uses Comparison for Pedestrians.

Mode or Activity	Facility Requirements	Risk to Others	Basic Mobility
	Quality and quantity of pedestrian facilities	**Danger these users impose on others**	**Whether the mode provides basic mobility benefits)**
People standing	Minimal	None	NA
People sitting at benches or tables	Seats or benches	None	NA
Individual walkers	Minimal	Low	High
Walkers in groups	Medium	Low	High
Walkers with children	Medium	Low	High
Children playing	Medium to large	Medium	Medium
Walkers with pets	Medium to large	Low	Medium
Human powered wheelchairs	Medium	Low	Very High
Motor powered wheelchairs	Medium to large	Medium to high	Very High
Joggers and runners	Medium to large	Medium	Medium
Skates and push-scooters	Large	Medium	Low
Powered scooters and Segways	Large	Medium	Low to high
Human powered bicycle	Medium to large	Medium to high	Medium
Motorized bicycle	Large	High	Low
People with handcarts or wagons	Medium to large	Low to medium	Medium
Vendors with carts and wagons	Medium to large	Low	Sometime (if the goods sold are considered basic)

Source: (2)

State-of-the-art multimodal transportation planning practice explicitly recognizes the interrelationship of transportation and land use planning, the importance of multimodal investments in managing transportation demand, and the need for coordinating land use strategies with modal investments. The planning process has the following characteristics:

- Context-Sensitive – looks at the broader context rather than focus on solutions within the right-of-way, a single roadway, or a few intersections.
- Holistic – identifies transportation solutions that address broader land use issues and integrates land use and transportation for long-term viability of a corridor and community.

- Collaborative – forms intergovernmental partnerships to identify and implement strategies that leverage the full value of all infrastructure investments.
- Multimodal – examines pedestrian, transit, bicycling, automobile, rail (freight and passenger), air, and water modes of transportation and identifies supporting land use and programmatic strategies.

Shifting from an automobile-oriented planning process to one that supports all modes of travel involves a change in focus from moving cars to moving people and goods. Mobility is viewed comprehensively, as noted below, rather than only in terms of maximizing through movement of vehicles:

- Accessibility – An area-wide measure of the ease of travel between locations within a defined geographic area (e.g., the ability to reach a given location from numerous other locations, or the ability to reach other locations from a given location).
- Mobility – The ability of people to make trips to satisfy their needs or desires by walking, driving, riding a bicycle, riding public transit, or any combination of modes of transportation.

This shift in focus involves placing less emphasis on relieving auto congestion in urban core areas or activity centers (often a sign of vitality) and more emphasis on expanding and reinforcing mode choice in those areas, improving walkability, and promoting a diverse and compatible mix of land uses in close proximity. Dense, connected streets with narrower cross-sections and wider, continuous sidewalks are among the determinants of walkability, and also help to make activity centers functional, vibrant, and appealing. Somewhat less priority is placed in the plan on preventing future congestion through lane expansion and fringe highways that induce exurban growth, and higher priority is placed on managing the existing arterial system.

Intergovernmental coordination, particularly at a regional level, plays an important role in multimodal transportation planning. A local transportation plan should be consistent with and integrate the future plans and visions of a number of transportation planning entities.

FEDERAL STATUTES

Federal planning law (49 U.S.C. 5303) calls upon state and local officials and transit providers in metropolitan areas to undertake a continuing, comprehensive, and cooperative <u>multimodal</u> transportation planning process. Also, 49 U.S.C. 5304 requires each state to develop a <u>multimodal</u> long-range statewide transportation plan and statewide transportation improvement program (STIP).

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires both statewide and metropolitan transportation plans (MTPs) and statewide/transportation improvement programs (TIPs) to provide for the development of and integrated management and operation of transportation systems and facilities, including accessible pedestrian walkways and bicycle facilities. It is also federally required to solicit and consider the participation of representative users of pedestrian and bicycle transportation facilities in the development of plans and STIPs and TIPs. MAP-21 also requires the publication of an annual listing of projects, including investments in pedestrian walkways and bicycle transportation facilities for which federal funds have been obligated in the preceding year.

Planning Emphasis Areas for Federal Fiscal Year 2015

On April 24, 2014, the Deputy Administrators of FHWA and the Federal Transit Administration disseminated a letter to MPO directors that provides a number of planning emphasis areas for federal fiscal year 2015. Planning emphasis areas are planning topical areas that the U.S. Department of Transportation (DOT) wants to place emphasis upon as state DOTs and MPOs develop their respective planning work programs. Three of the emphasis areas relate to the current multimodal planning process in El Paso: regional planning cooperation, use of scenario planning, and access to essential services.

Regional Planning Cooperation

The first emphasis area promotes *cooperation and coordination across MPO boundaries and across state boundaries*, where appropriate, to ensure a regional approach to transportation planning. This is particularly important as regional planning in El Paso requires working with New Mexico transportation agencies.

This cooperation could occur through the metropolitan planning agreements that identify how the planning process and planning products will be coordinated, through the development of joint planning products, and/or by other locally determined means. Coordination includes the linkages between the transportation plans and programs, corridor studies, projects, data, and system performance measures and targets across MPO and state boundaries. It also includes collaboration between state DOT(s), MPOs, and operators of public transportation on activities such as: data collection, data storage and analysis, analytical tools, target setting, and system performance reporting in support of performance based planning.

Use of Scenario Planning

Use of scenario planning by MPOs is emphasized as part of developing MTPs. MPOs may use scenario planning to improve decision making by providing information to the public and to decision makers on the performance outcome tradeoffs of various investment decisions when developing the MTP. This technique could prove useful in proposing multimodal transportation solutions.

Access to Essential Services

As part of the transportation planning process, MPOs and state DOTs are encouraged to identify transportation connectivity gaps in access to essential services. Essential services include housing, employment, health care, schools/education, and recreation. This emphasis area could include identification of performance measures and analytical methods to measure the transportation system's connectivity to essential services and the use of this information to identify gaps in transportation system connectivity that preclude access of the public, including traditionally underserved populations, to essential services. It could also involve the identification of multimodal solutions to address those gaps. One of the possible outcomes of multimodal planning is addressing equity and social disparities by providing more travel choices for those with physical issues affecting their mobility.

System Management and Operations

System management and operations (M&O) analyzes regional transportation as an interconnected set of services and systems to improve system performance through better management and use of the multimodal transportation network. M&O is an integrated approach to optimize the performance of existing infrastructure through the implementation of multimodal, intermodal, and often cross-jurisdictional systems, services, and projects. This includes regional operations collaboration and coordination activities between transportation and public safety agencies. M&O strategies aim at improving service efficiency, enhancing public safety and security, reducing traveler delays, and improving access to information for travelers.

Federal requirements call for consideration of M&O in the metropolitan and statewide transportation planning processes. Legislation also states that transportation plans shall include M&O strategies to improve the performance of the existing transportation system to relieve vehicular congestion and maximize the mobility of people and goods. Some examples of system M&O tools related to multimodal planning and implementation include:

- Intelligent Transportation Systems (ITS).
- Traffic signal coordination.
- Preferential treatment for transit/ride-shares.
- Special event traffic management.
- Pricing of transportation services.
- Customer information services.
- ITS applications for transit.
- Traveler information systems.

Federal guidance is given to the role MPOs can play in enhancing system M&O. These include:

- Identifying M&O strategies and benefits – the MPO should consider using M&O strategies as one method of improving mobility for constituents. Those programs and projects should then be given high priority in the TIP.
- Agency coordination – many different agencies assist in system M&O in a typical metropolitan area. The MPO can provide regional leadership in establishing a decision-making framework by bringing parties together, by helping to determine how M&O decisions will be made in an area, and by asking for input on M&O issues as part of the planning process. This allows agencies to develop M&O strategies in common.
- Performance measures – develop system performance measures that take into account the desires and expectations of transportation users, and can be used to decide how funds should be spent. The MPO can then work to improve the system through future plans and TIPs.

STATE STATUTES AND POLICIES

The *Texas Statewide Long-Range Transportation Plan 2035* (SLRTP) contains six TxDOT Strategic Plan goals (*3*). Goals 5 and 6 relate directly to multimodal planning:

5. Enhance system connectivity.
6. Facilitate the development and exchange of comprehensive multimodal transportation funding strategies with transportation program and project partners.

Recommendation A of the SLRTP encourages TxDOT to refine the current project selection procedures to investigate comprehensive multimodal options. The decision process should "consider qualitative impacts, perhaps using cost-effectiveness rankings. Since quantitative benefits are based on forecasts of future traffic flows that are subject to uncertainty, the process should include a risk analysis. Qualitative benefits should also be considered, particularly as part of multimodal alternatives analysis. Any decision process should consider the six SLRTP goals." (*3*).

The plan goes on to develop performance measures for department goals and objectives. For development of organizational structure and strategies designed to address the future multimodal transportation needs of all Texans, it uses the number of projects let to construction with more than one mode of transportation as a metric. For congestion relief strategies, the metric used is the effectiveness of multimodal congestion management projects and strategies in large urban areas.

The state of Texas has recognized that bicycle and pedestrian modes have a place in its transportation system and has committed to their expansion and improvement. Texas Transportation Code, Section 201.902 directs TxDOT to enhance the state highway system for use by bicyclists. As a result, accommodation of bicycle traffic shall be considered in all TxDOT transportation projects.

Issues of safety and ample bicycle access on Texas roads are of high priority to the department. The Texas State Bicycle Program recognizes the increased use of bicycles as a mode of transportation. TxDOT has adopted the American Association of State Highway Officials (AASHTO) *Guide for the Development of Bicycle Facilities* as official design criteria for bicycle facilities. The state has also taken advantage of new sources of funding for bicycle and pedestrian facilities available in federal legislation.

Additionally, the 25 MPOs in Texas address cyclist and pedestrian needs in their respective MTPs. Several Texas MPOs have extensive bicycle and pedestrian networks that they promote in stand-alone plans. Within these plans, some basic goals identified include:

- Improve access to the downtown, including municipal, cultural, and shopping locations.
- Improve access to local recreational opportunities.
- Provide for safe crossing of major highways.
- Provide access to key intermodal transit centers.
- Improve bicycle and motor vehicle operator education.
- Promote opportunities for bicycling in the city.

Within its organizational structure, TxDOT has three positions that address bicycle and pedestrian programs and policies at the state and district levels: State Bicycle Program Coordinator, District Bicycle Coordinator, and State Pedestrian Coordinator.

State Bicycle Program Coordinator

TxDOT has charged the State Bicycle Program Coordinator with the responsibility of raising awareness of the need to consider bicycles in all stages of planning, design, and construction of roadway and enhancement projects.

The State Bicycle Program Coordinator routinely acts as an internal resource for the department. The coordinator focuses on leading, teaching, and educating department employees and citizens outside the department on various aspects of bicycles and their presence on Texas roads. The coordinator is active behind the scenes monitoring developments in the department that may in some way impact bicycles and the bicycling community. During project planning and development, the coordinator may inquire about who is involved (i.e., planner, consultant, designer) and their level of knowledge and experience in developing bicycle facilities. The general responsibilities of the State Bicycle Program Coordinator include:

- Coordinate the integration of bicycling into the operational policies, plans, and programs of the department, MPOs, and local government entities by providing encouragement, supplying expertise, and promoting training.
- Determine the needs and concerns of bicyclists.
- Represent the department at the state and national levels, respond to letters, telephone calls, email, requests, inquiries, and visits from citizens on bicycle related issues.
- Conduct site visits to make project recommendations.
- Coordinate with District Bicycle Coordinators.

District Bicycle Coordinator

Each TxDOT district has appointed a District Bicycle Coordinator to provide input and direction during the planning and development of roadways. This ensures that bicycles are acknowledged as a viable mode of transportation on roadway facilities where use by bicyclists is feasible. The general responsibilities of the District Bicycle Coordinator include:

- Coordinate with the State Bicycle Program Coordinator.
- Respond to telephone calls and letters concerning local bicycle matters.
- Act as department representative in meetings with local bicycle groups and coordinate organized bicycle events on state roads.
- Coordinate with other district and division staff concerning possible improvements to increase safety and access for bicyclists (i.e., design, maintenance, and construction of transportation facilities).
- Work with Public Affairs Officer and Traffic Safety Specialist to promote bicycle safety education and district safety improvements.

State Pedestrian Coordinator

Accommodation of pedestrian traffic shall be considered for all TxDOT transportation projects. As a result, TxDOT also has a State Pedestrian Coordinator. The position’s general responsibilities include:

- Acts in the capacity of an internal resource for TxDOT.
- Advocates the integration of pedestrian facilities into the operational policies, plans, and programs of the department, MPOs, and local government entities by providing coordination and promotion of training.
- Responds to letters, telephone calls, email, requests, inquiries, and visits from citizens on pedestrian related issues.

LOCAL POLICIES AND PLANS

In the El Paso region, three agencies have provided the most effort in pursuit of multimodal transportation planning. Most explicit has been the City of El Paso primarily through its recent comprehensive *Plan El Paso* and 2011 adoption of the SmartCode zoning tool. Next is the city's Sun Metro transit agency through development of rapid transit routes and implementation of park and ride lots. The El Paso MPO is required to address all travel modes in the region in its plans and programming. It has adopted multimodal criteria in the project assessment process in its Congestion Management Process (CMP).

Plan El Paso

The overall goal of the City in *Plan El Paso* is to "become the least car-dependent city in the Southwest through meaningful travel options and land use patterns that support walkability, livability, and sustainability" (*4*). Upon implementation, the plan will have helped to create one of "the most walkable and transit-rich metropolitan areas in the country."

Sun Metro Rapid Transit System

Implementation of Sun Metro's Rapid Transit System (RTS) is declared to be the City's top transportation priority. The RTS includes ITS, signal prioritization, diamond-striped lanes, and transit terminal interfaces. Sun Metro plans to create the RTS incrementally, starting with an arterial corridor and four extension corridors. The Mesa RTS, designated Mesa Brio, implemented service in fall 2014. Future RTS corridors include:

- The Alameda Corridor will extend from the Oregon Street Mall to University Medical Center and on to the Texas Tech School of Medicine complex by 2015.
- The Montana RTS Corridor is scheduled to be implemented by 2025 and would connect the Central Business District to George Dieter Drive.
- The Dyer RTS Corridor is planned to be implemented by 2025 and would connect US 54 to Sun Valley Drive.

Through implementation of Brio and its companion effort *Connecting El Paso*, the City intends to reclaim major portions of the four RTS corridors as walkable complete streets, restoring their historic function as community main streets that serve adjacent neighborhoods (*5*). This will set the stage for longer-term multimodal transportation investments that support the City's future land use vision.

The *Connecting El Paso* effort creates detailed plans for the redevelopment of the closed ASARCO smelter plant and adjacent industrial properties along with plans for three transit-oriented development sites around the City's newly constructed and renovated bus transfer centers. Each of the sites will be connected to Brio lines.

Bicycle Planning

The El Paso MPO created the Comprehensive Bikeways Plan in 1982, the region's first bicycle master plan. Although primarily policy language, it affirmed the importance of bicycling as a viable and important mode of transportation in the region. Following this effort, the El Paso MPO adopted the 1997 Regional Bikeways Plan. This is the last formal planning effort for bicycles in the region. There have been state and local efforts and programs proposed and implemented by agencies, including bike lanes, but not under the umbrella of a formal regional plan. The City of El Paso, through *Plan El Paso*, proposes an updated bicycle master plan to be developed in order to support the plan's vision of right-sizing corridors. As a result, the new plan will require a different approach to determining what types of bikeways are consistent with the City's transportation and land use goals.

Currently, there are more than 90 miles of bikeway facilities in the City of El Paso, including more than 50 miles of mountain bike trails. Approximately half of the existing network was implemented following the El Paso MPO's 1997 Regional Bikeways Plan.

The current bikeway network is comprised of four types of bikeways:

- Signed bike routes.
- Conventional bicycle lanes.
- Off-street shared use paths.
- Off-street mountain bike trails.

The bicycle network lacks connectivity and the majority of the City's existing bikeway miles consist of bicycle lanes located along high-speed arterial thoroughfares. This makes it difficult to attract potential riders who were previously single-occupant automobile drivers crucial to regional air quality programs.

The 1997 Plan recognized various bicyclist types and their preferences, the need to change subdivision design regulations to be more bicycle-friendly, a proposed network of bikeways with detailed segment descriptions, bicycle parking recommendations, improving bicycle-transit integration, hiring a bicycle coordinator, and detailed funding and cost estimates.

The plan employed Bicycle Level of Service (LOS) as a way to rank the safety and experiential quality of all existing and proposed bikeways.

The plan did produce several accomplishments:

- Addition of 42.6 miles of bikeway facilities.
- Amended zoning to require bicycle parking for numerous land use types (*6*).
- Installed bicycle parking at key locations (City Hall, schools, transit hubs, etc.).
- Addition of bicycle racks to all Sun Metro buses.
- Established an El Paso Police Department Bicycle Patrol in Downtown El Paso.
- Promoted bicycling and healthy living practices through the City's Open Streets program, entitled Scenic Sundays.

However, the City notes that some the 1997 Plan's objectives have yet to be met. These include:

- Establishing a full-time bicycle coordinator to oversee the implementation of the bicycle master plan and other related bicycle planning efforts.
- More aggressive pursuit of federal funding to expand and improve bicycle facilities.
- Developing and distributing a regional map of bikeways, facilities, and services.
- Enforce bicycle and pedestrian-friendly design in the City's land use and subdivision design regulations.

In the last three years, there have been several efforts by the City and regional agencies to expand bicycling options. In May 2014, El Paso City Council approved a resolution establishing a Bicycle Advisory Committee for the purpose of advising the City of El Paso on matters related to bicycle planning and infrastructure. In August 2014, the El Paso City Council approved four new bike lanes in the city, pending MPO approval and funding.

The Camino Real Regional Mobility Authority is in the process of initiating a bike share program. The agency needs approval to access the federal funding to begin procurement for the program. The bike share program will have five stations downtown, two stations at the University of Texas at El Paso (UTEP), and one station at El Paso Community College's downtown campus. The program will have a fleet of 80 bikes for its first phase, and then the agency will pursue sponsorship and funding to add additional stations in the following phases.

In the current 2013–2016 TIP, based on the regional *Horizon 2040* MTP, total funding programmed for bicycle infrastructure and programs is over $2.9 million (*4*).

Pedestrian Planning

In *Plan El Paso*, the City declares "decreasing auto-dependence is a primary goal of the City of El Paso" (*4*). The most effective way to achieve this goal, according to the plan, is to improve walkability. This is the extent to which places are useful, inviting, and safe for pedestrians, cyclists, and transit users.

El Paso's downtown and historic neighborhoods were developed before automobiles became commonplace, so their network patterns and street designs are more walkable than later developments. Many other neighborhoods have benefitted from efforts by the City and Sun Metro to build new sidewalks, eliminate sidewalk gaps, install bus stop pads, and improve accessibility for the disabled.

Grading a location's walking environment is basic to assessing its total mobility. This is performed through development of a Walkability Index. The index produces a block by block, pedestrian LOS score. This score is also closely related to bicycle and transit mobility potential for a given block. The Walkability Index is considered to be a useful multimodal counterbalance to the conventional, automobile-oriented LOS grading system for thoroughfares.

The City has conducted a walkability audit for several areas of the City. Its purpose was to gain a general understanding of El Paso's walkability by measuring typical streets within the City. The walkability of Stanton Street downtown, Alameda Street in the Ysleta area, and a portion of Zaragoza Road was measured to assess total mobility. These three locations were selected as representative of three typical conditions within the city: historic downtown, historic mission neighborhood, and auto dominant suburban arterial. This would make comparison of development types more feasible.

Senior Citizens

Meeting the mobility needs of senior citizens is a challenge for regional transportation agencies. Continued mobility has a direct effect on the quality of life for seniors and can either enable or prevent seniors from remaining independent and in their own homes longer as they age. The lack of transportation options hurts the ability of some older adults to participate in the life of their communities. Development of multimodal transportation plans must take into account the mobility needs of an aging population.

According to the American Association of Retired Persons, changes in transportation options to better accommodate senior transportation needs can be supported by a three-fold, multifaceted approach:

- Structural changes in the built environment.
- Changes to facilitate access to transportation services.
- Programmatic and public policy changes that diminish or eliminate barriers to mobility.

Plan El Paso provides the AARP recommendations, all of which factor into multimodal planning. From the report (*4*):

- Structural Changes:
  - Communities should embrace a Complete Streets policy to guide the design of all roadways to be accessible to all users of the transportation system regardless of age and ability.
  - Communities should have land-use plans that encourage walkable communities.
  - New communities should be designed to be more walkable.
  - Communities should improve existing sidewalks to ensure adequate width, curb cuts, and lighting as well as eliminate discontinuous and disjointed walking routes.
  - Communities should give special attention to the design of intersections to ensure safe crossing by persons on foot.
  - Communities should provide sufficient numbers of appropriately designed places along sidewalks for pedestrians to rest.
- Changes to Facilitate Access:
  - Providers of both public and senior transportation need to extend service in the evenings.
  - Public transportation providers should explore innovative services such as neighborhood bridge routes and route deviation service.
  - Transportation providers (especially medical transportation) should improve the quality and reliability of their services.
- Program and Public Initiatives:
  - Cities, counties, and private nonprofit organizations should be pro-active in addressing the future transportation needs of older adults, particularly those with lower incomes or living in rural areas.
  - State and local governments in partnership with nonprofit organizations should design and implement educational campaigns to improve pedestrian and driver safety.
  - State and local governments should facilitate integrated land-use and transportation planning to ensure that the design and layout of new communities and their transportation networks are accessible to all residents.

Land Use Ordinances

In 2008, the City of El Paso adopted the El Paso SmartCode (*7*). SmartCode is a model form-based code that folds zoning, subdivision regulations, urban design, public works standards, and basic architectural controls into one smaller document. The purpose of the code is to enable, encourage, and qualify the implementation of smart growth development patterns that include walkable neighborhoods with a mix of densities and uses. Sections of the ordinance are of particular importance to multimodal transportation planning in the city (and the region):

- New development should be organized in the patterns of Clustered Land Development, Traditional Neighborhood Development, or Regional Center Development (21.10.030, A.2).
- Transportation corridors should be planned and reserved in coordination with land use. (21.10.030, A.4).
- The region should include a framework of transit, pedestrian, and bicycle systems that provide alternatives to the automobile (21.10.030, A.6).
- Thoroughfares are intended for use by vehicular and pedestrian traffic and to provide access to lots and open spaces (21.30.070, A.1).
- Thoroughfares may include vehicular lanes in a variety of widths for parked and for moving vehicles, including bicycles (21.30.070, B.1).
- A bicycle network consisting of bicycle trails, routes, and lanes should be provided throughout and allocated as specified. The community bicycle network shall be connected to existing or proposed regional networks wherever possible (21.30.070, B.2).

In addition, the City of El Paso adopted a Bicycle Module to the SmartCode. The module adds bicycle policies and regulations by coordinating more than 20 bike way facility and parking types within the logic of the land use basis of the code.

The City of El Paso, as included in *Plan El Paso*, has also modified its land use classification system in order to account for multimodal development. An additional area type called compact urban is designated in order to distinguish it from the remainder of the urban area called drivable suburban. In compact urban areas, multimodal transportation design will become the norm. Character and function will be more important than capacity; the street network will be sized to yield smaller blocks with greater people moving capacity.

In compact urban areas, the Institute of Transportation Engineers Practice's design parameters for walkable urban thoroughfares can be applied, as can the thoroughfare assemblies in the El Paso SmartCode. Both are intended for both automobile and pedestrian efficiency, with narrower lane widths, lower target speeds, on-street parking, and shorter curb radii. Existing streets can usually be retrofit within their curb lines to reduce reconstruction costs.

Three groups of neighborhoods are being assigned as compact urban. These are:

- Existing Walkable Neighborhoods – this includes neighborhoods in the city where the original development pattern was laid out in eras when walking was commonplace or during the streetcar era when public transit was more common than private automobiles. These areas are well-suited for continued evolution with a mix of uses and transportation options.
- Planned walkable communities – the City owns large tracts of developable land that are within the city limits and are being master-planned for potential urban expansion using

smart growth principles. One tract adjoins the El Paso International Airport and two others are on land managed by the Public Service Board on opposite sides of the Franklin Mountains. Although development is not imminent on these tracts, they are situated and being planned for urban expansion during the next 20 years. They should be served with walkable streets to match the planned character of the development.
- Future redeveloped and infill neighborhoods – these are areas in the plan identified as having strong potential for infill development and for redevelopment, including land near RTS stops and Sun Metro transfer stations.

Sun Metro

Sun Metro provides public transit service throughout El Paso and surrounding areas, including fixed route (local bus) service, demand response/paratransit service, and the RTS Brio network. Sun Metro is formally known as the Mass Transit Department and is part of the City's municipal government. Sun Metro operates 63 fixed routes in the City, one in the county, and one into Sunland Park, New Mexico. One intercity route between El Paso, Anthony, and Las Cruces is operated by the New Mexico DOT. Other unique elements of Sun Metro's bus network include the free Golden Horseshoe Circulator and the Union Plaza Circulator serving Downtown El Paso. Job Express, another service of Sun Metro, provides support to individuals transitioning from welfare to work through job training, education, employment, and childcare destinations.

Sun Metro is in the process of changing from a conventional hub-and-spoke system, with routes radiating from downtown to a node system anchored around satellite transfer centers. Given the physical expanse of El Paso, this change is intended to provide shorter routes and faster travel times throughout the City.

Sun Metro has a number of terminals and transfer centers. These include:

- Downtown (Bert Williams).
- Westside (Al Jefferson).
- Mission Valley (Nestor A. Valencia).
- Glory Road.
- Five Points (Robert McKee).
- Union Plaza.
- Northgate.
- Eastside.

As part of RTS Brio implementation, two more transfer centers will be built. The Northgate terminal will be replaced with a new Northeast Transfer Center on the old Northgate Mall property and a new terminal on the far eastside serving the future Montana RTS corridor.

El Paso Streetcar Project

The City of El Paso, in collaboration with TxDOT-El Paso District, is proposing the El Paso Streetcar Project as an alternative means of transport in the downtown area. The main goals of the project are to enhance mobility, promote economic development and new urbanism, and preserve the historical aspects of downtown El Paso.

The proposed project consists of a two-mile, double-tracked corridor, beginning in the area near the downtown shopping district and international bridges, traveling north through downtown to the UTEP area, the Cincinnati Entertainment District and back. The tracks would be positioned within existing traffic lanes along the right lane, adjacent to the curb or parking lane. The streetcar stops would be located two to three blocks apart along the right edge of traffic.

Park-n-Ride System

There are currently eight park and ride facilities in El Paso region. Six of the eight facilities offer free parking and are located at transit terminals and/or transfer centers. Park and ride services in El Paso are provided by Sun Metro. The locations for the facilities include:

- Union Plaza Transit Terminal (Downtown El Paso).
- Northgate Terminal (Northeast).
- AI Jefferson Westside Transfer Center.
- Glory Road Transfer Center (Westside).
- Eastside Transit Terminal.
- RC Poe Park and Ride (Eastside).
- Vista Hills Park and Ride (Eastside).
- Nestor A. Valencia Mission Valley Transfer Center.

New Mexico DOT Park and Ride's Gold Route, partially funded by TxDOT through the County of El Paso, operates between the Las Cruces Transit Center in New Mexico and downtown El Paso.

According to the *2040 Horizon* MTP Project List, there are three proposed, additional park and ride facilities in El Paso. Two of the three locations include:

- Far East El Paso at Montwood near Loop 375/Zaragoza.
- West El Paso at I-10 and Transmountain Rd.

The third location is the Bridge of the Americas Port of Entry (POE), which will be used to promote the use of mass-transit for cross-border travel and improve air quality.

El Paso County Transit

Rural transit service in the region is currently provided by the County of El Paso. It operates five routes in outlying areas of the MPO planning area.

WTEP Vamonos Dos Regional Transportation Coordination Plan

The Far West Texas/El Paso (WTEP) *Vamonos Dos* Regional Transportation Coordination Plan vision statement holds that all persons of the six-county Far West Texas region will have access to customer-centered, dependable, convenient, and safe transportation services and choices (*8*). WTEP's coordination committee promotes this vision by facilitating the planning and coordination between transportation providers, health and human service agencies, and advocacy organizations in the six-county region to maximize mobility and the efficiency and effectiveness of public transportation resources.

The El Paso urbanized area has the highest concentration of users within that six-county region. WTEP and MPO staffs have coordinated planning strategies and efforts to implement these strategies. Efforts have been made for the seamless transfer of public transit between El Paso County Transit and Sun Metro services. WTEP staff has developed a matrix to compare both County Transit and Sun Metro routes to ascertain a strategy on providing a more efficient transfer system from a county route to a Sun Metro route and vice versa. This project attempted to examine transfer logistics, fare policies, and other issues associated with passenger transfers between El Paso County Transit and Sun Metro. All five County Transit routes were analyzed including schedules/timetables, shared terminals, terminal pull-in locations, and fares. These efforts will help create a more efficient transfer from each system to help reduce wait times and increase ridership.

Southern New Mexico Disadvantaged Population Planning Initiatives

Southern New Mexico's health and human services planning group is the Coordinated Mobility Action Plan (CMAP) Steering Committee. CMAP will develop a regional plan for all of Doña Ana County, which includes the communities of Santa Teresa, Berino, and Chaparral, and the cities of Anthony and Sunland Park, NM. CMAP has accumulated a strong membership in its steering committee of regional service professionals and already the group is directing their efforts in collecting data for their goals and objectives within the region. El Paso MPO staff coordinates and assists the group in its development and will be coordinating with them and the Mesilla Valley MPO to provide services to the entire region.

Fort Bliss

The Fort Bliss military installation is addressed in *Plan El Paso*. The base is a major economic, social, and organizational entity in the region. In the context of multimodal transportation planning for the region, the plan identifies two projects in the base area that would have an effect on regional network connectivity and activity.

The new William Beaumont Army Medical Center is being built in the southwest quadrant of Loop 375 and the Liberty Expressway. Without convenient access to public transit, nearly all access will be by private car and eliminate opportunities for nearby housing and commercial services.

The second project is the site proposed for a new El Paso Community College campus, immediately south of the new Army hospital. Although this site will be convenient for military personnel stationed at East Fort Bliss, its accessibility is poor for faculty and for civilian students, again forcing most of the access to be by private vehicles.

El Paso MPO

The primary current mechanism for multimodal transportation planning the El Paso MPO is its 2013 CMP (*9*). The CMP is a way of systematically considering congestion-related issues using a set of technical tools and basing evaluations on a discrete set of locally determined performance measures. A CMP provides for the systematic review of performance of multimodal transportation systems in larger metropolitan areas and identification of strategies to address congestion through the use of management strategies focused on both the use and operation of facilities and services.

The 2013 CMP adopts a set of goals and objectives that promotes multimodal transportation development in the region. Three out of four goals (1, 2, and 4) directly relate to multimodal planning:

1. Provide a transportation system that serves the public with mobility choices including pedestrians and bicycles.
    a. Increase and improve bicycling options and facilities in the region.
    b. Increase and improve pedestrian facilities in the region.
    c. Increase and improve transit system and facilities.
    d. Improve the reliability and efficiency of buses.
    e. Continue ITS improvements in the region.
2. Identify and mitigate congestion on the transportation system.
    a. Identify, diagnose, and address highway bottlenecks and travel delays.
    b. Reduce travel delays on major arterial roads for all alternative modes.
    c. Reduce travel delays at traffic signals.
    d. Increase and improve the regional incident management program.
    e. Enhance border crossing road operations to improve facilitation of truck traffic.
    f. Increase efforts to reduce crash rates and improve safety on the system.
    g. Enhance partnerships between regional transportation system providers.
3. Minimize air quality impacts of congestion.
    a. Create and enhance shared ride programs in the region (e.g., carpools, vanpools).
    b. Promote transit options to citizens in the region.
    c. Promote transportation demand management (TDM) programs in the region.
4. Promote accessibility to an efficient transportation system for all citizens.
    a. Improve connectivity between all modes in the system.
    b. Improve border crossing activities for all users of the system (pedestrian, automobile, trucks).

Table 3 presents the CMP's set of performance measures to assess progress toward the goals and objectives.

Table 3. 2013 El Paso MPO CMP Performance Measures.

Objective	Performance Measure
1a) Increase and improve bicycling options	Length of bike lanes per corridor mile (system)
	Number of buses with bike racks
	Number of transit facilities with bike parking facilities
1b) Increase and improve pedestrian facilities in the region	Length of sidewalks per corridor mile (system)
1c) Increase and improve transit system and facilities	System/route accessibility and expansion
	Construction of multimodal facilities
1d) Improve the reliability and efficiency of buses	Schedule adherence
1e) Continue ITS improvements in the region	Number of miles of highway and major arterial CMP network with traffic detectors, closed circuit television, and dynamic message sign coverage
2a) Identify, diagnose, and address highway bottlenecks and travel delays	Volume to capacity ratios and delays per link of Highway on CMP Network
2b) Reduce travel delays on major arterial roads for all alternative modes	Volume to capacity ratios and delays per link of major arterial roads on CMP Network
2c) Reduce travel delays at traffic signals	Intersection LOS at peak-hour
2d) Increase and improve the regional incident management program	Number of incidents on state highways, incident response time, incident resolution time
2e) Enhance border crossing road operations to improve facilitation of truck traffic	Average truck border crossing time
2f) Increase efforts to reduce crash rates and improve safety on the system	Number of accidents (e.g., fatalities or injuries) on state highways on the CMP Network (on street network if data available from police department)
2g) Enhance partnerships between regional transportation system providers	Regional incident management program participation
3a) Create and enhance shared ride programs in the region (e.g., carpools, vanpools)	Number of vehicles in vanpool/carpool programs
	Number of riders on vanpool/carpool program
3b) Promote transit options to citizens in the region	System/route accessibility–marketing programs developed and implemented
3c) Promote TDM programs in the region	Number of large employers in the region with official alternative work schedules (e.g., City of El Paso, UTEP)
4a) Improve connectivity between all modes in the system	Number of park and ride lots
	Number of transfer centers
4b) Improve border crossing activities for all users of the system (pedestrian, automobile, trucks)	Border wait times
	Number of pedestrians crossing the border

Citizen Issues

While developing *Plan El Paso*, City of El Paso staff conducted numerous public outreach meetings and surveys to ascertain public sentiment on transportation issues and alternative modes of travel in the region. City staff compiled the comments and presented them in the plan. They are included here as background to the multimodal plan and as a baseline for the Task 3 survey of the current project:

- *Expand Transportation Choices and Options* – The over-arching transportation theme connecting almost all input was to expand and increase personal mobility choices and options. Residents and stakeholders emphasized the desire to have greater access to convenient and safe walking, bicycling, and transit opportunities.
- *Invest in Transit* – A specific element of expanding travel choices is broad support for investing both near-term and long-term in public transportation and high-capacity transit (RTS and rail). Sun Metro's ongoing investment in its local bus service, attractive regional transfer centers, and especially RTS service were strongly supported for increasing personal mobility and for their revitalization potential along key corridors. Residents similarly emphasized longer-term investment in streetcars, light rail, and commuter rail to connect and integrate El Paso and its adjacent cities and communities.
- *Expand Safe Walking and Bicycling Environments* – As with transit, residents strongly supported expanded walking and bicycling for both utilitarian and recreational use. Nonmotorized transportation is highly valued in El Paso. Residents and stakeholders recognized that safe, convenient, and attractive walking (and bicycling) environments are also a key to successful transit, as most transit passengers are "pedestrians on buses."
- *Revitalize Major Corridors, Especially Alameda* – The City has already prioritized to leveraging RTS investment within the system's four major corridors—Alameda, Mesa, Dyer, and Montana—to promote transit oriented development and street design along each corridor. These efforts in turn are focused on locally appropriate economic development, neighborhood revitalization, community character, and increased transit access.

PEDESTRIAN, BICYCLE, AND TRANSIT INTEGRATION

Increases in the functionality of communications technology has provided opportunities increase connectivity between travel modes in a region. Larger amounts of transportation system information made available to citizens in more efficient ways have led to innovative uses of the system.

Intelligent Transportation Systems

In the Texas SLRTP 2035, TxDOT recognizes these advances in the use of ITS technologies. The agency mentions two uses:

- Transit ITS – As rail and bus rapid transit (BRT) options become commonplace throughout Texas cities, ITS technologies such as automatic vehicle location and travel-time displays can be used to assist passengers with planning trips. Combining transit and roadway management will be vital to efficient multimodal operations.

- Wireless Technology – Wireless connections allow ITS equipment to be implemented on a wider scale with less cost. This will allow important information to be transmitted quickly to travelers and give traffic management officials a broad range of information.

Smartphones

The increase in the speed and efficiency of communications technology has led to the development of transportation services that provide new options for millions of Americans. The U.S. Public Interest Research Group (U.S. PIRG) has recently catalogued the various options now available to urban residents (*10*):

- Carsharing services offer vehicle access on-demand, lowering the cost of vehicular mobility for many while still preserving on-demand access to a car. Options include fleet-based services such as Zipcar or peer-to-peer networks that provide cars for round-trip and, increasingly, one-way trips.
- Ridesharing services provide a tool for riders and drivers to find one another. Potential riders can find drivers who are already going in the same direction and use these services to coordinate pick-up location, costs, and schedules.
- Ridesourcing services, such as Lyft, Uber, and Sidecar, enable users to solicit a ride from their current location from a pool of drivers using a smartphone. These services differ from taxis in that the drivers are not commercially licensed taxi drivers and, as such, are not permitted to pick up passengers off the street.
- Taxi hailing services provide technology to help users locate and call taxis with their smartphone, and (in some locations) pay through the smartphone as well, eliminating the need for cash on hand.
- Bikesharing systems increase options for short journeys (for example, trips too long for walking), and can serve as first and last mile connections between transit locations and travelers' final destinations. They also provide a fun and active way to travel without concern for fixed schedules.
- Static transit data improve usability of transit services by enabling users to access schedules and route maps online via desktop, smartphone, or other Internet-connected devices. When accessible on the go, schedule and routing data help riders navigate transit systems effectively, even when their plans change.
- Real-time transit information builds on the benefits of open static data by providing users real-time information on arrival/departure times and delays. This gives riders the ability to avoid unforeseen wait times or to change routes at the last minute.
- Multimodal apps knit the transportation landscape together by offering users the opportunity to see side-by-side comparisons of routes and services for making their trip, including biking, carsharing, public transit, driving, and walking.
- Virtual ticketing gives users the opportunity to avoid lost tickets and long wait times at the ticket counter by buying tickets directly through an Internet-connected device such as a smartphone. Riders can set up an account to look after expenses and track ticket validity.

Technology-enabled transportation services have the potential to reduce driving and car ownership, especially among young people:

- Studies have shown that tools such as carsharing and ridesharing reduce vehicle ownership and the number of miles driven. Other tools, such as real-time transit information, improve the experience of riding transit and have been shown to give a modest boost to ridership.
- Residents in cities that have access to a portfolio of technology-enabled tools are better able to construct car-free and car-light lifestyles that are less dependent on car ownership.
- Cities with more abundant transportation-enabled services are able to complement public transit by providing mobility options from the train or bus station, and by providing alternatives during unusual times when weather or the need to carry bulky packages make walking, biking, or transit less practical or desirable. **Policy-makers should explore ways to tap the potential of technology-enabled services to address transportation challenges and increase the number of people with the option to live car-free or car-light lifestyles** [emphasis added].

These tools have been expanding rapidly, yet public agencies have been slow to integrate these new systems into their planning and policy toolbox. Local, state, and federal governments should explore ways to expand access to these tools and incorporate them into strategies for reducing the congestion, public health, and environmental impacts of urban transportation systems.

U.S. PIRG recommends that governments should:

- Adopt clear regulations for new services such as ridesourcing that fully protect the public while allowing the services to operate.
- Require, when negotiating regulatory arrangements for these new transportation tools, that providers share their data with public officials, who can then better integrate these services into their planning.
- Adjust municipal policies, including planning and zoning rules, to encourage the use of these services, such as by reducing parking fees for carshare users, reducing or eliminating minimum parking requirements for new developments that incorporate shared-use transportation, or allocating existing parking spaces for carsharing services.
- Encourage complementarities between public transit and new technology-enabled mobility options, especially by encouraging bikesharing, ridesharing, and carsharing around transit stops.
- Support multimodal transportation options by creating universal payment mechanisms that work for various modes of transportation, and expand the availability of real-time information, especially with public transit.
- Conduct studies on the impact of these services and integration of them into transportation models and plans.
- Explore the potential of new tools to meet the mobility needs of those currently poorly served by the transportation system, including the young, the old, the disabled, and those in low-income households.
- Adopt open data and open source software policies in conformity with federal mandates.

Millennials

Adoption of new mobile communications devices is increasing across all income levels, races, ages, and education levels. But young Americans have consistently been the first to adopt new technologies and the first to incorporate many technology-enabled tools into their lifestyles. Internet use is now nearly universal among young people, with 97 percent of young adults between the ages of 18 and 29 using the Internet on a daily basis. As of January 2014, 83 percent of young adults (18–29 years old) owned some variety of smartphone, compared to 53 percent of adults nationally, and 89 percent of young people used social networking sites.

Members of the Millennial generation (those born between 1983 and 2000) are also among those most attracted to the sharing economy, using online services to rent anything from clothes to vacation apartments. Not coincidentally, Millennials have been the most likely to report having used these new, technology-enabled transportation services. Millennials are driving less, and according to a 2013 Zipcar study, new technology-enabled services are helping them do it.

A survey of users of the Capital Bikeshare system in Washington, D.C., found that 55 percent of annual members and 43 percent of short-term users were between 25 and 34 years old. The age demographic of bikeshare users was found to be younger than that of area bicyclists in general. A 2010 study of carsharing demographics and impacts found that 38 percent of U.S. carsharing members were between 20 and 30 years of age, while an additional 30 percent were between 30 and 40 years old.

MULTIMODAL TRANSPORTATION PLANNING AND IMPLEMENTATION: BEST PRACTICES

Numerous multimodal plans around the country were reviewed along with several research reports focused on good multimodal planning. Highlighted below are the three best examples found in the review. Note that El Paso MPO and agencies in the region are already performing some of the recommended actions, programs, and policies.

The Victoria Transport Policy Institute in Canada provides an overview of multimodal planning with recommendations for good planning. The following are the most pertinent recommendations from the report (*2*):

- Consider all significant impacts, including long-term, indirect, and non-market impacts such as equity and land use changes. This should at least include:
    - Congestion.
    - Roadway costs.
    - Parking costs.
    - Consumer costs.
    - Traffic accidents.
    - Quality of access for non-drivers.
    - Energy consumption.
    - Pollution emissions.
    - Equity impacts.
    - Physical fitness and health.

    - Land use development impacts.
    - Community livability.
- Impacts that cannot be quantified and monetized should be described.
- Multimodal comparisons should be comprehensive and marginal, and should account for factors such as transit system economies of scale and scope.
- Special consideration should be given to transport system connectivity, particularly connections between modes, such as the quality of pedestrian and cycling access to transit stops and stations.
- Special consideration should be given to the quality of mobility options available to people who are physically or economically disadvantaged, taking into account universal design (the ability of transportation systems to accommodate people with special needs such as wheelchair users and people with wheeled luggage) and affordability.
- Indicate impacts with regard to strategic objectives, such as long-range land use and economic development.

The next recommendation is especially noted:

- People involved in transportation decision making (public officials, planning professionals, and community members) should live without using a personal automobile for at least two typical weeks each year that involve normal travel activities (commuting, shopping, social events, etc.) in order to experience the non-automobile transportation system.

The USDOT VOLPE Center provides six aspects of good TDM planning that is also relevant for multimodal planning (*11*):

1. Identify internal and external champions that will raise the profile of (multimodal planning) in the region.
    - Build upon the efforts of multimodal champions in member communities.
    - Support non-governmental keystone events and initiatives as ways to promote multimodal transportation.
    - Build MPO support for local efforts into the MPO's vision and long-range transportation plan.
    - Highlight multimodal options in scenario planning efforts.

2. Proactively coordinate the work of local partners to promote a regional approach to multimodal planning.
    - Evaluate the coverage of multimodal efforts and nonmotorized transportation infrastructure and promotion across the region that is provided or managed by Transportation Management Organizations (TMOs) and local governments to identify successes, gaps, and opportunities for expansion.
    - Establish a consistent funding structure for communities and TMOs to apply for funding for multimodal investments.
    - Clearly document the roles and responsibilities of organizations providing multimodal services in a regional context.

3. Engage the private sector in planning for multimodal and support private multimodal investments.
    - Identify innovative employer-based multimodal programs and encourage other business to institute similar programs.
    - Provide information about regional and local multimodal initiatives to employer-based transportation benefit coordinators to promote and expand their use.

4. Incorporate multimodal performance measures in the decision-making process for identifying transportation investments.
    - Modify TIP selection criteria for all transportation investments to reward multimodal projects and roadway projects that provide multimodal options.
    - Include trip-reduction performance measures in the selection criteria for all projects eligible for certain competitive funding programs.
    - Develop competitive dedicated funding mechanisms for innovative multimodal projects.
    - Develop stand-alone multimodal and nonmotorized transportation plans to guide investment decisions.

5. Implement data-collection programs for multimodal to determine the effectiveness of certain strategies and to measure success over time.
    - Enhance and standardize data collection of performance measures for multimodal to inform the MPO's process for selecting multimodal projects to fund.
    - Evaluate existing multimodal systems and services in the region to identify opportunities for improvement, and prioritize projects that address them for funding.

6. Create a direct link between multimodal and land use planning, as well as between multimodal and nonmotorized transportation planning.
    - Link land use and transportation options in long-term visioning exercises to illustrate the effect of land-use decision-making on the types of transportation options that are suitable for different development patterns.
    - Provide tools, funding, and technical assistance to member communities to support better land-use planning, streetscape design, and development regulations.
    - Recognize nonmotorized transportation as a trip-reducing, multimodal strategy in the long-range transportation plan, CMP, and other key planning documents.

The National Center for Transit Research at the University of South Florida recently published a report that provides a gold standard for consideration of best practices in multimodal planning and implementation. The practices are presented as a planning model for use by cities and agencies. Emphasis is placed on ensuring a multimodal transportation system appropriate to the community, providing for and promoting public transportation, improving accessibility and connectivity between modes (transit stations, intermodal terminals, bicycle, and pedestrian facilities), and coordination with land use.

The steps have been modified to fit the El Paso context, items such as coastal resources were removed. This example can serve as a checklist both for the current effort and future multimodal plans by the El Paso MPO. As noted above, several of these steps are already done or being done by the MPO and agencies in the region. The model is presented in its entirety (*12*):

1. **Community Vision and Priorities**
   Briefly describe the community's vision and priorities as drawn from public meetings and other local and/or regional plans or visions and prepare a conceptual vision or mission statement.

   Discuss principal findings and identify strategic areas of improvement from the existing conditions analysis as they relate to the vision and priorities. (*Plan El Paso used as an example of best practice*.)

   Look at the state transportation vision and the regional vision for the area. Consider preferred scenarios and any incompatibilities resulting from differences in visions and priorities from those of other plans and agencies.

2. **Inventory and Analysis of Transportation and Land Use Conditions**

Inventory of Regional and Modal Plans

Inventory agency and modal plans and document data and information on all issues of importance to the local multimodal element, such as, but not limited to:

a. Quality/LOS for various modes and identified deficiencies.
b. Crash analyses that have been conducted.
c. Land use issues related to the transportation system.
d. Access conditions along major thoroughfares.
e. Network continuity and gaps.
f. Freight movement objectives and needs.
g. Projects with committed funding within the next three years.
h. Funding commitments, prioritization, and partnering opportunities.
i. Inconsistencies with existing state, regional, and local government plans.

Land Use and Multimodal Environment Conditions

Map existing land use in relation to existing roadways and public transportation, including major generators/attractors (e.g., employment centers, shopping centers, hospitals, schools, parking facilities, airports, ports, and intermodal logistics centers); urban core(s); activity centers; and density and intensity of uses.

Identify and discuss issues with the current transportation system with regard to existing land use and the multimodal environment, including the following:

a. Land use organization/location efficiency (e.g., key centers, land use separations).
b. Land use mix/balance (e.g., significant land uses, land use ratios, jobs to population ratios).
c. Density/intensity (e.g., residential, employment density).

Identify and discuss land development and access conditions on major routes, such as:

a. Shallow commercial strip development and zoning.
b. Presence/absence of supporting street network and any gaps that should be connected.
c. Possible changes to the supporting street and site circulation system to improve roadway safety and operations.
d. Presence/absence of internal access connections allowing circulation between properties and opportunities for joint access or interparcel circulation.
e. Substandard driveway design conditions, such as driveways with excessive grades or slopes, inadequate widths or radii, or inadequate throat lengths.
f. Sites with open frontages or too many driveways and opportunities to reduce superfluous access points.

Identify land use densities, building intensities, and transportation management programs to promote public transportation in designated public transportation corridors. Document whether population densities are sufficient to support public transportation.

Identify and discuss parking management issues relative to public transportation and the multimodal environment, including park and ride facility locations, capacities, average usage/vacancy, and transit connections.

Identify and discuss freight movement issues relative to the existing and planned multimodal environment.

Public Transportation Routes and Conditions

Identify and map public transportation routes by type and exclusive transit rights-of-way or corridors and facilities, such as bus and rail stops and station areas, transfer locations, and system connections.

Describe transit service area and operating characteristics, including quality of service for public transportation as detailed in transportation disadvantaged service plans, transit development plans, MPO long-range transportation plans, and regional transportation authority plans.

Identify and evaluate issues associated with land use and accessibility (e.g., bicycle/pedestrian access to transit stops and stations, densities/intensities on transit corridors or key destinations, park and ride facility locations and transit connections).

Major Roadways, Evacuation Routes, and Conditions

Develop a list and/or map series to identify the following:

a. Major existing and programmed/committed roadways.
b. Current functional classification and maintenance responsibilities.
c. Special corridor designations, such as:

1. Demand management corridors, such as managed lanes.
2. BRT corridors.
3. Regional goods movement corridors and local truck routes.

Note or map and evaluate information on travel patterns, characteristics, and issues. Considerations include:

a. Mode split.
b. Origin-destination (O-D) patterns.
c. Average commute times and lengths.
d. Average trip length.
e. Vehicle miles traveled (VMT) and person miles traveled (PMT).

Identify and discuss transportation demand management services, programs, and impacts, such as:

a. Services (vanpool/rideshare, carsharing, bike share).
b. Parking management.
c. Employee transportation coordinators for large employers.

Document safety and operational concerns noted in other reports (MPO CMP, corridor studies, safety audits or reports), such as:

a. High crash locations and crash indicators (3- to 5-year timeframe).
b. Bottlenecks (locations subject to frequent congestion, compare to crash data).

Bicycle and Pedestrian Conditions

Document locations and characteristics of bicycle and pedestrian ways and facilities, such as:

a. Lane miles of arterials and collectors along with the lane miles (or linear feet) of sidewalk on both sides and only one side of these streets.
b. Lane miles of exclusive pedestrian ways and/or multi-use trail system (physically separated from roadway network) high use area/facilities.
c. Lane miles of bike lanes on arterials and collectors.
d. Lane miles of exclusive bicycle ways and/or multi-use trail system (physically separated from roadway network).
e. Special facilities, such as bike boulevards (a continuous through street for bicycles, but short distance travel (local access) for motor vehicles).
f. Bicycle parking, requirements and types and characteristics of facilities available.
g. Bicycle accommodations on public transportation (e.g., bikes on bus).
h. High use areas/facilities.

Document and identify deficiencies in the multi-use trail network and those relative to other bicycle and pedestrian facilities, such as:

a. Accessibility to major generators and gaps in the bicycle and pedestrian network where bike and pedestrian travel is most likely, such as:

    1. Along arterial or collector streets serving areas of relatively high residential density or commercial intensity.
    2. Areas with a compact, mixed land use pattern (residential and non-residential) within a 1 mile biking distance.
    3. Areas in proximity to transit routes/stops, public schools, public parks, and other major demand generators.

Pedestrian and bicycle safety

a. Identify issues related to crosswalks, including mid-block crossing locations (controlled and uncontrolled).
b. Identify safety data, including crash indicators, injuries, and fatalities.

Ports, Aviation, Rail, and Related Conditions

Identify roadway facilities providing access, rail corridors, transit services, intermodal terminals, and related circulation needs for people and freight.

Identify and map existing airports, related facilities, and areas subject to land use compatibility requirements around airports. Identify noise contours and runway protection zones.

Describe future need for airports and related facilities as detailed in airport master plans or as identified in the system analysis.

Identify issues impacting freight movement into and out of the community, including key points of access to rail, ports, airports, and intermodal centers and connections. Note freight hot spots.

Identify and document existing conditions information or airport land use compatibility studies relative to compatibility of land uses around airports.

Intermodal Facilities and Conditions

Intermodal facilities to identify in a map or list and describe in the plan include:

a. Key connections to ports, airports, rail, and trucking.
b. Intermodal logistics centers and roadway connectors.

c. Key existing and planned connections between automobile, transit, bicycle, and pedestrian modes (e.g., park and ride lots, bus transfer locations/centers, bike share locations, major bicycle parking areas, pedestrian networks surrounding transit stops, passenger terminal/stations).
d. Other facilities, such as electric vehicle charging infrastructure.

3. System Analysis and Future Needs

Quality/Level of Service Analysis for all Modes

Identify and describe future needs on major roadways as detailed in state of Texas plans, MPO long-range transportation plans, and TIPs.

Forecast future travel demand on local thoroughfares. Determine existing and future transportation system performance (e.g., Q/LOS, bottlenecks) for the identified thoroughfares and transportation routes.

Describe future need for public transportation as detailed in transportation disadvantaged service plans, transit development plans, MPO long-range transportation plans, and regional transportation authority plans, and examine potential alternative strategies to address that need.

Estimate additional future local public transportation system needs, such as circulators, additional routes, headways, service hours, etc. Work with transit service providers to use tools to evaluate the effectiveness of transit alternatives and for prioritization purposes.

Sketch Planning Analysis for Network Planning

Estimate future transportation system needs for locally identified thoroughfares and transportation routes, including connectivity, continuity, access, spacing, and capacity needs.

Identify needs for other locally identified thoroughfares and transportation routes, including connectivity, continuity, spacing, capacity, and safety needs.

Evaluating Bicycle and Pedestrian Needs

Many tools are available to help local governments evaluate the quality of the bicycle and pedestrian system and identify deficiencies and possible improvement strategies, including the Walk Friendly Community Assessment Tool, a Walkability Rating System, and count tools.

4. Future Multimodal Transportation System

Address Regional Coordination and Consistency

Elaborate on the extent to which the comprehensive plan integrates transportation needs and priorities identified in plans of other transportation agencies and local governments.

Integrate Future Land Use and Transportation

Begin by identifying which centers in the metropolitan area have the most potential to accommodate non-auto modes and focus investment on enhancing walkability and connecting pedestrian, bicycle, and transit facilities within those centers.

Categorize and Manage Future Corridors

Define the functional categories or typologies to be used and prepare purpose and function statements describing each category, including modal priorities and access versus through movement characteristics. Identify desired alternative cross-section types for each roadway category.

Assign roadway categories to each segment of the existing and planned network, through maps and/or lists. Identify any special corridor designations.

Identify generalized right-of-way needs for future thoroughfares and collector roadways, and assign through maps, policies, and/or lists (e.g., right-of-way needs identification map).

Integrate Connections to Aviation, Rail, Ports, and Intermodal Facilities

Identify all rail and roadway corridors used to access a port or airport facility. Corridor management plans or strategies should be applied to these facilities where necessary to improve truck operations or throughput.

Integrate Bicycle and Pedestrian Networks

A variety of alternative approaches can be considered for improving the connectivity, continuity, and safety of bicycle and pedestrian routes (see BP 2-44, for example). Key considerations in establishing the bicycle plan include:

a. Bicycles extend access to transit to a larger area. Look for opportunities to enhance the connections between bicycles and buses and provide for bicycle parking as needed at both ends of the trip.
b. Good locations for bicycle parking are high demand bus stop and station areas. These locations can be identified through consultations with local bicycle groups and transit rider surveys and will include all BRT stops.
c. Make sure the area around existing and proposed transit stops is highly accessible by bicycle (as well as by foot).

d. Provide adequate bicycle parking facilities.
e. Bicycle lanes should be placed to the left of bus travel lanes where possible, as buses stop and start and bicyclists need to maintain momentum.
f. Connect key travel destinations as directly as possible with bicycle lanes, paths, or shared streets.

Identify Desired Safety and Operational Projects

Include safety and operational/capacity projects, programs, and services across the various transportation modes. The plan should identify and strategically prioritize and phase projects for inclusion in the capital improvements element. Examples may include medians, intersection redesign, mid-block crossings, and so on.

Set Future Q/LOS Standards, Performance Measures, and Benchmarks

Establish Desired Multimodal Strategies and Services

5. Goals, Objectives, and Policies

Regional and Internal Consistency

Plan consistency is essential when addressing regional transportation facilities to ensure appropriate timing and coordination of facility modifications. Each local government comprehensive plan, including the transportation element, should be consistent, to the extent feasible, with the plans and programs of the MPO, transportation authorities, transit agencies, and TxDOT as they relate to the jurisdiction.

Land Use and Multimodal Environment

Land use organization, location, mix, and density/intensity paired with multimodal policy contribute to a multimodal environment.

Multimodal Quality/Level of Service

Multimodal LOS standards go beyond roadway LOS to ensure that the operating characteristics of other modes are maintained or improved to a locally desirable level. Standards may relate to a variety of operational characteristics of importance to each mode, and may be simple or complex depending upon the planning capacity of the community.

Major Roadway Network

In coordinating with other agencies or planning additional local roadways, keep in mind the following strategies:

a. Adopt a complete streets policy and guidelines to guide the functional classification of roadways and their design.

b. Designate transportation corridors requiring additional right of way and/or corridor management and include corridor management policies to preserve right-of-way needed for all transportation modes and to provide for dedication of land or conveyance of easements to local governments for planned transportation projects.
c. Provide for construction of parallel relievers or service roads along major highway corridors or within interstate interchange quadrants.
d. Provide for construction of new interstate highway overpass crossings to preserve continuity of street networks.
e. Include grade separated intersection improvement(s) when appropriate for major roadway intersections.
f. Provide for construction of additional travel lanes and/or turn lanes to address existing or anticipated motor vehicle traffic volume where appropriate.
g. Include new arterial or major collector roadways to relieve motor vehicle traffic congestion and increase network connectivity.
h. Include design elements to increase bicycle and pedestrian safety and mobility.
i. Include network enhancements and design elements in support of managed lanes and modal priorities (e.g., truck routes, BRT routes, complete streets).
j. Provide park and ride facilities that accommodate carpooling and/or regional transit service.
k. Direct appropriate departments to perform safety audits as needed.

Access Management

Careful control of access along major roadway corridors reduces traffic conflicts and flow interruptions, while improving safety for drivers, pedestrians, and bicyclists. Access levels for the state highway system are established by TxDOT. Local governments may assign access levels to locally maintained thoroughfares or establish access location, spacing and design criteria in roadway functional categories. Goals, objectives, and policies, plus roadway and access design standards and land development regulations, are used to implement the access management program.

Minor Street Network

The following criteria are aimed at improving the connectivity and availability of local and collector street networks and promoting increased connection of activity centers to surrounding neighborhoods to enhance local mobility and reduce local trips on major roadways:

a. Include network-enhancing local and minor collector street projects.
b. Promote direct connections between activity centers and surrounding residential areas.
c. Include policies and strategies to increase street network connectivity.
d. Include measures to increase pedestrian safety at intersections, mid-block crossings, and while walking along the road.
e. Include measures to increase bicycle safety.
f. Include measures to provide safe routes to schools. Coordinate with school board and local law enforcement on Safe Routes to Schools within a two-mile walking distance

from schools. Effort should focus on physical improvements as well as educational and enforcement activities.

Public Transportation Network

A key issue for transit is providing adequate connections to/from one's origin and destination, also known as first mile/last mile connectivity. Small-scale services such as local circulators may be beneficial for this purpose and a focus for future planning efforts. Funding is another challenge, in particular funding for ongoing operations. Strategies include:

a. Identify and use land use strategies to reinforce statewide/regional transit and express transit service traveling through or with endpoints within plan boundaries.
b. Address existing and planned local transit within plan boundaries, including route locations, headways, span of service, and infrastructure and land use strategies.
c. Improve the quality of service for transit, considering the potential for enhanced route and destination connectivity via locally provided transit circulators that connect to the larger transit system. Shelter amenities, safety and security at transit stops, and quality of maintenance at transit stops are other important issues in this regard.

Transportation Demand Management

Local planning strategies that could be considered in the development of goals, objectives, and policies for TDM include:

a. Provide for high quality transit service operating in managed lanes.
b. Incorporate ITS strategies.
c. Establish institutional strategies such as a transit use/carpooling incentive program for employees.
d. Establish commuter financial incentives.
e. Provide infrastructure, policies, and financial incentives designed to encourage alternatives to single occupant vehicle travel.
f. Establish pricing strategies.
g. Provide for safer travel for all modes, through engineering, enforcement, and education.
h. Establish a commute trip reduction strategy to be implemented via a commute trip reduction ordinance.

Bicycle and Pedestrian Network and Safety

Local planning strategies and issues to consider in the development of goals, objectives, and policies include:

a. Identify opportunities to implement bicycle lanes and ADA accessible sidewalks of appropriate width on or near all collector and arterial routes where appropriate.
b. Include planned projects to address gaps in the bicycle and pedestrian network and improve connectivity.

c. Address the continuation of, or establish new, shared use paths.
d. Require new development to maintain continuous pedestrian networks, including connections to transit stops, adjacent lots, and between building entrances and the internal and external sidewalk network.
e. Require new development to maintain continuous bicycle networks, including connections to transit stops and adjacent properties, and to provide bicycle parking at all non-residential uses, multifamily uses, and other key destinations.
f. Adopt bicycle and pedestrian quality of service standards and/or performance measures.

Aviation, Rail, and Intermodal Facilities

A freight system based on rail, aviation, and the intermodal connections between each of these modes is crucial to an effective multimodal transportation system:

a. Align planning for aviation, rail, and intermodal connections with the future land use element.
b. Coordinate with applicable plans (airport master plan, port master plan, etc.).
c. Designate local routes intended for freight movement by large trucks and establish appropriate roadway design and operational measures for their efficiency.

CHAPTER 2: DATA COLLECTION AND ASSESSMENT

INTRODUCTION AND BACKGROUND

This chapter details the data collection and assessment. Various forms of data were collected such as sidewalk, transit, and bike lane GIS layers. TTI already had access to roadway GIS layer and the El Paso MPO's travel demand model. Literature review yielded existing data extensive and specific location multimodal LOS methodology. This methodology for scoring multimodalism cannot be applied at a regional level due to the amount of roadway and traffic data that would be necessary. A new methodology was needed that could analyze at a regional level. TTI developed a multimodal score (MMS) methodology that could be applied to a region. The new multimodal-score methodology is based on the connectivity between transit, bicycling, and sidewalks (walking). Through this new methodology, TTI was able to generate heat maps that show areas in the region that are lacking multimodal infrastructure or connections among the various multimodal travel modes. This gap analysis will provide additional input to the development of the overall Multimodal Plan. Two pilot projects were selected to further explain the application of this new MMS methodology and its relation to multimodal improvements.

Multimodal transportation involves connections of various modes, among them walking, cycling, and public transport are very common. The basic goals of a multimodal transportation system are to achieve support for multiple modes and users, reduce vehicle ownership and usage, and promote mixed-use development. Planning for multimodal transportation requires consideration for transport demand, mobility, transportation options, user information, integration, affordability, mobility substitutes, land use factors, transport network connectivity, roadway design and management, prioritization, and inaccessibility (*13*). All of these factors are basic ingredients for accessibility provisions made in transportation planning. Studies have shown that the availability, accessibility, and convenience of public transport are critical for sustaining multimodal commuter trips in a city (*14*). With multimodal transportation system becoming desired for the millennial generation in America, the "multimodal could be a game changer for public transportation and America's transportation network as a whole."

In the United States, cities and MPOs are making investments and efforts in multimodal transportation improvements and integrating transit systems with bicycling and pedestrian facilities. Most of the multimodal transportation plans made by government entities involve gathering information about "the existing physical conditions of the transportation system and concerns of the residents and City staff" (*15*).

In order to model the service quality of a transit system along with the available facilities for first/last transport connectivity, researchers select a set of performance measures that need to be improved. Improving the performance measures of a transit system involves balancing the equilibrium between operating costs and service quality (*16*). Often, the performance measures are decided based on determinants identified through surveys or interviews and interpretations from data collection related to potential transit ridership, bike, and pedestrian counts around a transit station. However, within a city with extensive transit network system and thousands of stops, the data collection is often limited to fewer representative stops and budget availability for the survey execution.

Literature and guiding documents for planners and policy makers on carrying out a preliminary assessment of multimodal facilities consisting mainly of walking, bicycling, and transit, and without involving extensive data collection are currently very few or less known. In particular, existing measures of transportation performance are of some help in carrying out the assessment, but are of limited help when only used for analyzing LOS standards for individual mode, “which can be used to indicate problems and ways to improve each mode” (*13*). The proposed framework has a MMS with public transit stops treated as nodal points of transfers. The methodology proposed in the framework requires information on population and employment, and the bike, sidewalk, and transit network data for an area.

WALK SCORE

Several factors affect multimodal transportation. One of the main factors that this study will focus on is infrastructure or lack thereof. Another important factor that affects multimodal transportation, specifically walking, is having attractive destinations within walking distance, typically one quarter mile. The website www.walkscore.com provides a walk score from 0 to 100 based on an address, neighborhood, or city. This information is available for the larger metropolitan regions in the United States. The walk score is an aggregate of scores based on the density of the following items near the location being considered:

- Average block length.
- Street intersections.
- Car shares.
- Bike shares.
- Transit stops.
- Culture locations.
- Dining and drinking locations.
- Grocery stores.
- Parks.
- Schools.
- Shopping locations.

This site ranks the top three walkable cities in the United States as New York (walk score: 87.6), San Francisco (walk score: 83.9), and Boston (walk score: 79.5). This site gives the city of El Paso a walk score of 39 with the most walkable neighborhoods being Chihuahuita, Union Plaza, and South Central. TTI requested the walk scores from this site (*17*) for 500 points within the El Paso MPO region. Figure 1 shows these 500 points and corresponding walk scores. The most walkable area in the region based on the walk score is the City of El Paso downtown area. The figure also shows that there are areas throughout the region that need more amenities to make it more attractive to walk or bike. It may appear the that the outer, smaller communities would have much lower walk scores, but the figure shows that there are areas in the smaller communities that have sizeable walk scores even as far south as Fabens and Tornillo.

Having more sidewalk or bike lane infrastructure may not be enough if there are minimum places to access by walking or cycling.

Figure 1. Walk Scores in El Paso MPO Region.

FRAMEWORK

Literature reviewed on multimodal systems showed considerations for an individual mode's LOS, but lacked evaluations for the entire trip involving multiple modes. This is important since independent evaluations of modes neglect operational elements of travel such as waiting times, transfer inconveniences, total travel impedance, etc. Several methods exist to determine objective priorities by providing a multimodal LOS or score. These methodologies are described in the National Cooperative Highway Research Program Report 616, the *Highway Capacity Manual* and the *Transit Capacity and Quality of Service Manual* (*18*). These methodologies provide a score or LOS for a specific mode at a certain roadway segment location or intersection. The analysis requires a great number of inputs such as vehicular, cyclist, and pedestrian counts; roadway and amenity dimensions within public right of way (ROW); and public opinion of the various modes being analyzed. The need for all these data makes these methodologies impractical and expensive if considering multimodal analysis of a region.

The framework presented here addresses the missing research in multimodal LOS analysis by presenting a score that captures total trip experience of a multimodal user. For commuter trips (involving bicycling, walking and public transit use), a trip-based score should consider the following sequence of events: walking/biking from trip origin to a transit stop, waiting at the stop, riding the transit, transfers with walking/biking (if any), and walking/riding to the final trip destination.

In developing the score, accessibility has been considered as the base for assessing the performance measure for a multimodal transportation system. The transit stops serve as primary O-D point locations for commuters in a multimodal environment. Thus, the score is developed at each transit stop being treated as the focal point of waiting, boarding, and transfer activities. The following formulation for the score is presented below, which is the ratio of the actual multimodal component to the ideal multimodal component. (Note that the assumptions for population or employment data availability are being made at the traffic analysis zone [TAZ]): Actual MMS component at a transit stop *s* =

$$\alpha \times \sum_{r=1}^{R} \frac{P_{b,r,a,s}}{(Biking\ Impedence\ from\ the\ TAZ\ centroid\ r\ to\ the\ trant\ stop\ s)^{\theta}}$$

$$+\beta \times \sum_{l=1}^{L} \frac{P_{w,l,a,s}}{(Walking\ Impedence\ from\ the\ TAZ\ centroid\ l\ to\ the\ trant\ stop\ s)^{\mu}}$$

$$+\gamma \times \sum_{j=1}^{J} \frac{\sum_{r=1}^{R} Z_{b,r,a,s} + \sum_{l=1}^{L} Z_{w,l,a,s}}{(Impedence\ from\ transit\ stop\ i\ to\ stop\ j\ on\ a\ given\ transit\ route\ connecting\ s\ to\ j)^{\varphi}}$$

$$+\alpha \times \sum_{k=1}^{K} \frac{E_{b,k,a,j}}{(Biking\ Impedence\ from\ the\ transit\ stop\ j\ to\ TAZ\ centroid\ k)^{\lambda}}$$

$$+\beta \times \sum_{m=1}^{M} \frac{E_{w,m,a,j}}{(Walking\ Impedence\ from\ the\ transit\ stop\ j\ to\ TAZ\ centroid\ m)^{\rho}} \quad (1)$$

Ideal MMS component at a transit stop s =

$$\alpha \times \sum_{r=1}^{R} \frac{P_{b,r,i,s}}{(Euclidean\ Impedence\ from\ the\ TAZ\ centroid\ r\ to\ the\ trant\ stop\ s)^{\theta}}$$

$$+\beta \times \sum_{l=1}^{L} \frac{P_{w,l,i,s}}{(Euclidean\ Impedence\ from\ the\ TAZ\ centroid\ l\ to\ the\ trant\ stop\ s)^{\mu}}$$

$$+\gamma \times \sum_{j=1}^{J} \frac{\sum_{r=1}^{R} Z_{b,r,i,s} + \sum_{l=1}^{L} Z_{w,l,i,s}}{(Euclidean\ from\ transit\ stop\ i\ to\ stop\ j\ on\ a\ given\ transit\ route\ connecting\ s\ to\ j)^{\varphi}}$$

$$+\alpha \times \sum_{k=1}^{K} \frac{E_{b,k,i,j}}{(Euclidean\ Impedence\ from\ the\ transit\ stop\ j\ to\ TAZ\ centroid\ k)^{\lambda}}$$

$$+\beta \times \sum_{m=1}^{M} \frac{E_{w,m,i,j}}{(Euclidean\ Impedence\ from\ the\ transit\ stop\ j\ to\ TAZ\ centroid\ m)^{\rho}} \quad (2)$$

MMS =

$$\left(\frac{Actual\ multimodal\ score\ compontent}{Ideal\ multimodal\ score\ component}\right) \times 100 \quad (3)$$

Where,

$P_{b,r,a,s}$ = Population of TAZ (*r*) around a stop *s* accessible by bicycle (using bike network) for actual case.

$P_{w,l,a,s}$ = Population of TAZ (*l*) around a stop *s* accessible by walking (using sidewalks) for actual case.

$Z_{b,r,a,s}$ = Population or employment of TAZ (*r*) around a stop *s* accessible by biking (using bike network) for the actual case. (Population is used for morning trips [i.e., work-based trips] and employment for evening trips [i.e., home-based trips]).

$Z_{w,l,a,s}$ = Population or employment of TAZ (*l*) around a stop *s* accessible by walking (using sidewalks) for the actual case. (Population is used for morning trips [i.e., work-based trips] and employment for evening trips [i.e., home-based trips]).

$E_{b,k,a,j}$ = Employment of TAZ (*k*) around a stop *j* accessible by bicycle (using bike network) for actual case.

$E_{w,m,a,j}$ = Employment of TAZ (*m*) around a stop *j* accessible by walking (using sidewalks) for actual case.

$P_{b,r,i,s}$ = Population of TAZ (*r*) around a stop *s* accessible by bicycle (using Euclidean metric) for actual case.

$P_{w,l,i,s}$ = Population of TAZ (*l*) around a stop *s* accessible by walking (using Euclidean metric) for actual case.

$Z_{b,r,i,s}$ = Population or employment of TAZ (*r*) around a stop *s* accessible by biking (using bike network) for the ideal case. (Population is used for morning trips [i.e., work-based trips] and employment for evening trips [i.e., home-based trips]).

$Z_{w,l,i,s}$ = Population or employment of TAZ (l) around a stop s accessible by walking (using sidewalks) for the ideal case. (Population is used for morning trips [i.e., work-based trips] and employment for evening trips [i.e., home-based trips]).
$E_{b,k,i,j}$ = Employment of TAZ (k) around a stop j accessible by bicycle (using bike network) for ideal case.
$E_{w,m,i,j}$ = Employment of TAZ (m) around a stop j accessible by walking (using sidewalks) for ideal case.
R and K determined for bicycling by a defined threshold around a transit stop.
L and M determined for walking by a defined threshold around a transit stop.
J determined by maximum travel distance or travel time threshold around a transit stop for commuters.
α = weight attached with bicycling.
β = weight attached with walking.
γ = weight attached with transit use.
θ = Impedance decay parameter for bicycling from trip origin *to* a transit stop (obtained using calibration from travel demand data).
μ = Impedance decay parameter for walking from trip origin *to* a transit stop (obtained using calibration from trip travel demand data).
φ = Impedance decay parameter for transit use *from* an origin transit stop to a destination transit stop (obtained using calibration from trip travel demand data).
λ = Impedance decay parameter for bicycling to trip destination *from* a transit stop (obtained using calibration from trip travel demand data).
ρ = Impedance decay parameter for walking to trip destination *from* a transit stop (obtained using calibration from trip travel demand data).

In the formulation presented above, the inconvenience caused due to transfers and waiting times can be adjusted within the impedance values used. Alternatively, adjustments in the weights for walking or bicycling can be made to reflect inconvenience caused by transfer and waiting times.

CASE STUDY OF EL PASO

Data Collection – Demographics and Network

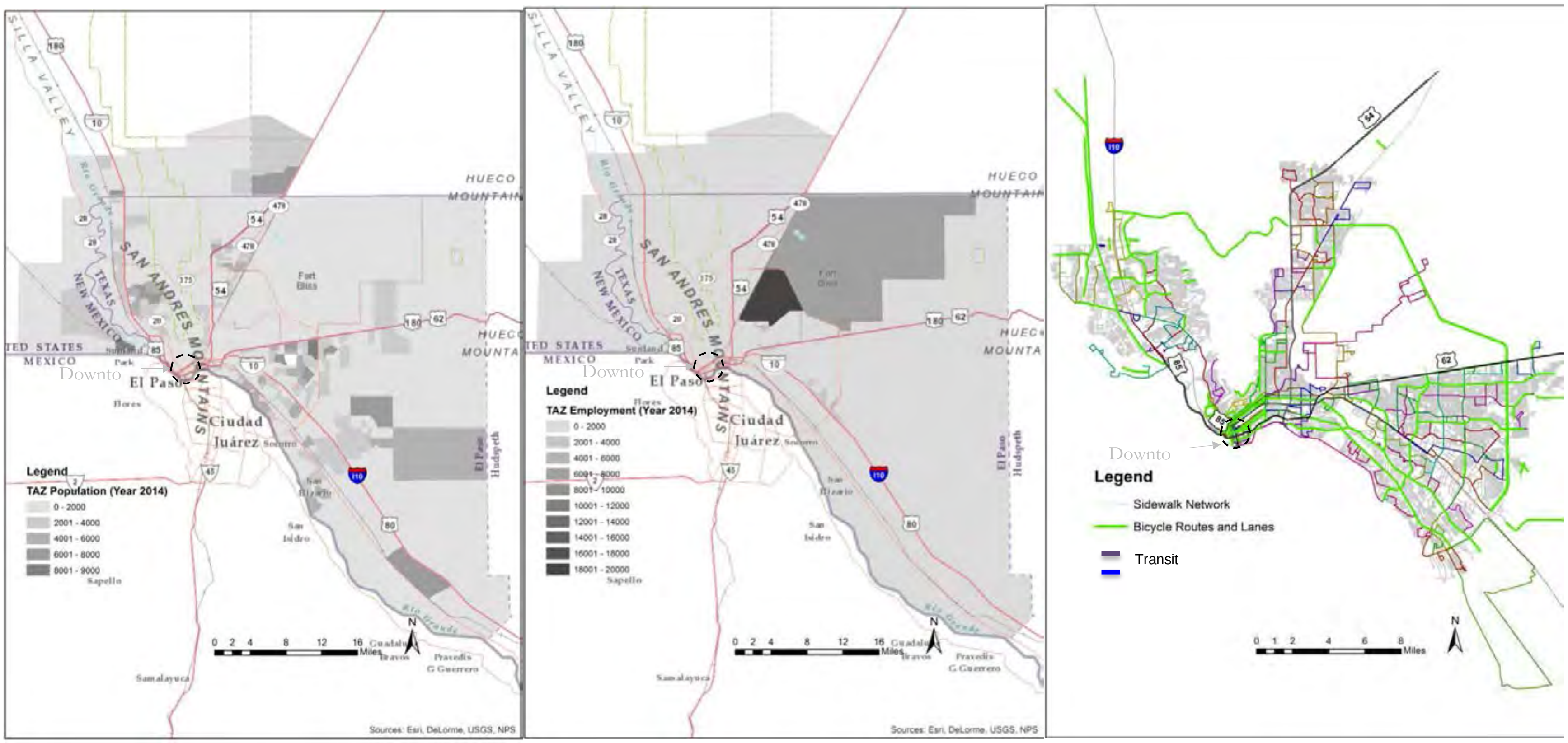
The authors studied the application of the framework model developed in Eq. (3) with the data for El Paso and the cities within the jurisdiction of the El Paso MPO. Data collection consisted of the population and employment data (both for the age groups of 18–55 years) at the resolution of TAZ level. The data were provided by the El Paso MPO for the year 2014. The maps in Figure 2(a) and (b) show the spatial distribution of population and employment, respectively, for TAZs for the year 2014.

The transportation network data for the year 2014 for 84 transit routes (consisting of 2873 transit stops) were provided by the Sun Metro transit agency operating in and around El Paso. The transit route information contained the minimum, the maximum, and the mean bus route speeds. In this research, only the mean speed of the transit routes were used for simplification in the calculation of travel times between stops.

The sidewalk data were collected from the City of El Paso DOT. The data consisted of the individual sidewalk segment length (later converted into time units). Average pedestrian walking speed of 3.1 mph was used for calculating the travel time involved in walking over the sidewalks (*19*).

The bicycle network data were obtained from the City of El Paso MPO. The data contained only segment lengths (converted into time units) of individual lanes and routes. For calculating travel times over the bicycle network, an average biking speed of 10 mph was used (*20*).

The map in Figure 2(c) shows the network for the sidewalks, bike lanes and routes, and the transit routes. Although the sidewalk network appears to be dense in Figure 2(c), there are missing sidewalk links at several places around the transit stops in the map. As far as the bicycle network in Figure 2(c) is concerned, bike lanes and routes are not connected to most transit stops and appear to facilitate mostly recreational trips than for commuting trips. This is evident with the presence of bicycle lanes in mountainous areas and several isolated places of El Paso that are not the employment centers or population hubs. The transit network in Figure 2(c) with various routes appears to be well laid out and connects most areas across El Paso.



(a) (b) (c)

Figure 2. Spatial Distribution of (a) Population, (b) Employment and (c) Transportation Network (Sidewalks, Bicycle, and Transit Routes) across El Paso and Surrounding Areas.

Parameter Estimation

The willingness to use transit decreases with increase in travel distance to the stop or the station (*21*). In fact, the threshold for travel distance from a stop location to O-D depends on the last mile mode used and it is often assumed that the action radius of walking is significantly smaller than that for the bicycle (*22*). In this paper, around each transit stop, catchment areas of a quarter-mile threshold for walking are assumed for accommodating the last mile needs of both potential or latent choice and captive riders (*23*). Although there has been limited research on the definition of a similar threshold around a stop for bicycling, studies assuming a half-mile catchment radius around bicycle stations have been quite common in estimating bicycle-parking demand (*24*), and hence assumed to be thresholds for bicycling around the stops in this report.

TAZ polygon layers with the centroids were translated into point layers, which facilitated the calculation of the number of TAZs lying within a quarter-mile walking distance for sidewalk network and a half-mile distance for biking thresholds around each transit stop. From trip data analysis, researchers observed that majority of the transit trips (almost 60 percent) to stops by walking and bicycling occurred within these two thresholds, which corroborated the use of respective thresholds of quarter-mile and half-mile for the two modes. Both the thresholds of quarter-mile and half-mile distances were eventually converted into travel times using the individual modes' mean speeds mentioned earlier. Transit travel time was used for transit impedance. Travel demand data obtained from Sun Metro operating transit bus fleet in El Paso showed that a significant percentage (almost 20 percent) of commuters had in-vehicle travel time of up to 45 minutes between origin and destination stops, which could be considered to be almost 20 minutes more than the national average commuting time of 25 minutes for the Americans (*25*).

The numerical values of parameters used for equations 1 and 2 were estimated assuming an exponential function (i.e., impedance = $e^{(\text{parameter * travel time})}$). In most research involving accessibility studies for non-motorized transportation, similar impedance functions with exponential impedance relationships have been used (*26*).

Table 4 summarizes the findings for the values of the parameters and the variables that have been estimated using the above analysis. The values are used as input for the MMS calculations for a transit stop. Note also that due to aggregate travel demand data for both walking and bicycling, the parameters θ and μ have the same numerical value as that of λ and ρ, respectively.

Table 4. Variable and Parameter Values Estimated from Travel Demand Data for El Paso.

Parameter Symbol/Variable	Mode Affiliation	Estimate/Value	R^2
θ	Bicycling	0.08	0.8948
μ	Walking	0.08	0.8948
φ	Bus transit	0.02 (morning peak hour, 6 a.m.–9 a.m.) 0.04 (afternoon peak hour, 4 p.m.–7 p.m.)	0.6441 0.7977
λ	Bicycling	0.09	0.9058
ρ	Walking	0.09	0.9058
α	Bicycling	3.0*	-
β	Walking	1.9*	-
γ	Bus transit	1.0*	-
R	Bicycling	3 mins (with 0.5 mile distance threshold and bicycling speed = 10 miles per hour)	-
K	Bicycling	3 mins (with 0.5 mile distance threshold and bicycling speed = 10 miles per hour)	-
L	Walking	5 mins (with 0.25 mile distance threshold and bicycling speed = 3 miles per hour)	-
M	Walking	5 mins (with 0.25 mile distance threshold and bicycling speed = 3.1 miles per hour)	-
J	Bus transit	45 min (source: El Paso travel demand data)	-

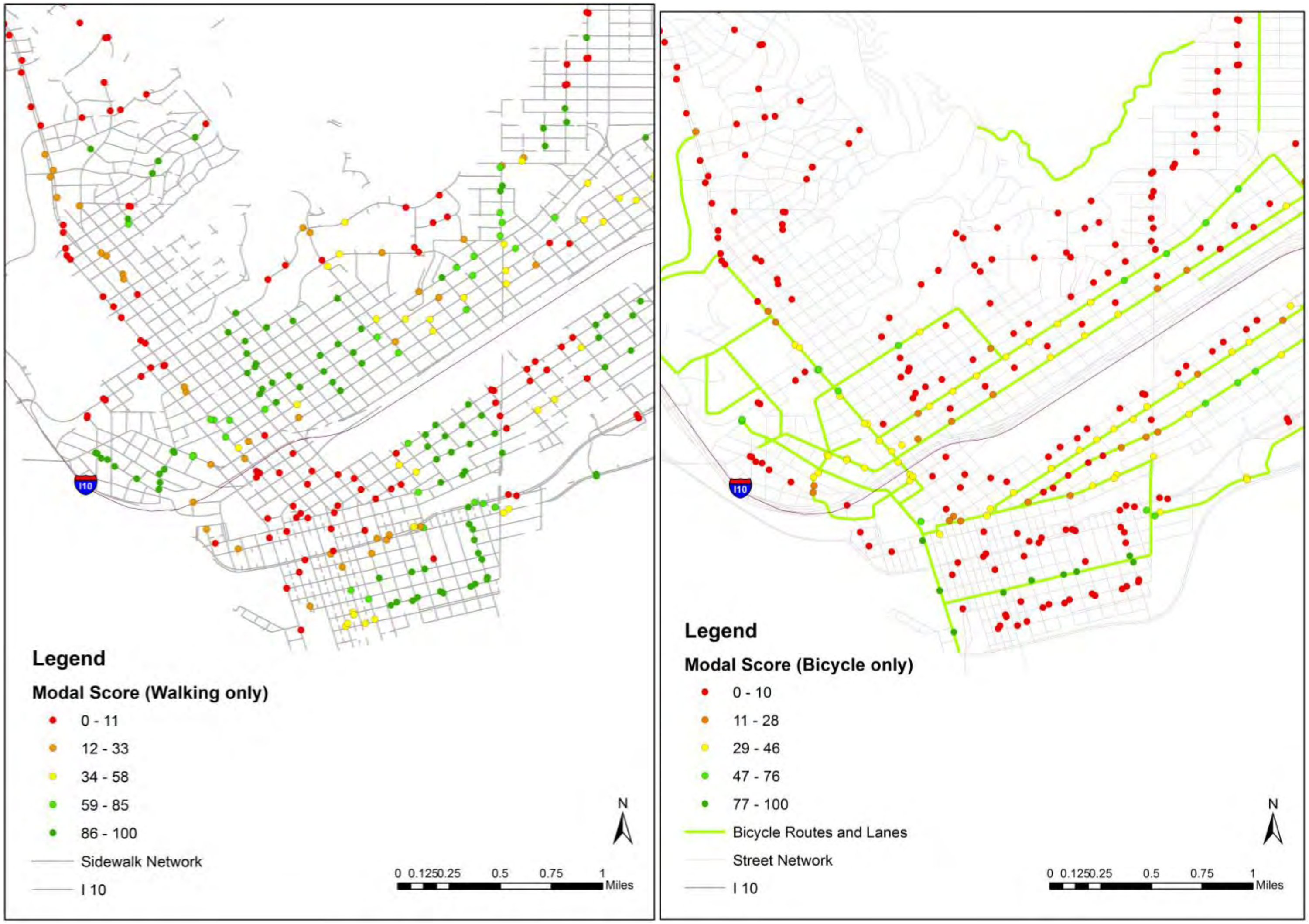
*Studies have shown that transit users value bicycling and walking time with the following weights α = 3, β = 1.9 and γ= 1 (*27*), which have been used in this paper.

Validation

The formulation for the MMS proposed in Eq. (3) was validated by carrying out comparisons for the spatial distribution of individual modal scores for walking, bicycling, and transit modes at the stops with the observed connectivity for network in downtown El Paso. Recent statistics available from the El Paso MPO showed that transit mode share constitutes only 2 percent of the trips in El Paso (*28*), but with the El Paso downtown area serving as the hub of multimodal activities. Recently, there have been city plans to improve and upgrade transportation infrastructure in the downtown area through streetcars (*29*) and bike share programs, which also justify the selection of the downtown area for validation purposes (*30*). As per the Office of Resilience and Sustainability, City of El Paso, there are at least five bike stations for downtown to facilitate bicycling in the area. So any information on the bicycle network connectivity along with the multimodal transportation performance consisting of bicycling, walking, and public transport in the downtown area would provide useful insight for city officials and planners.

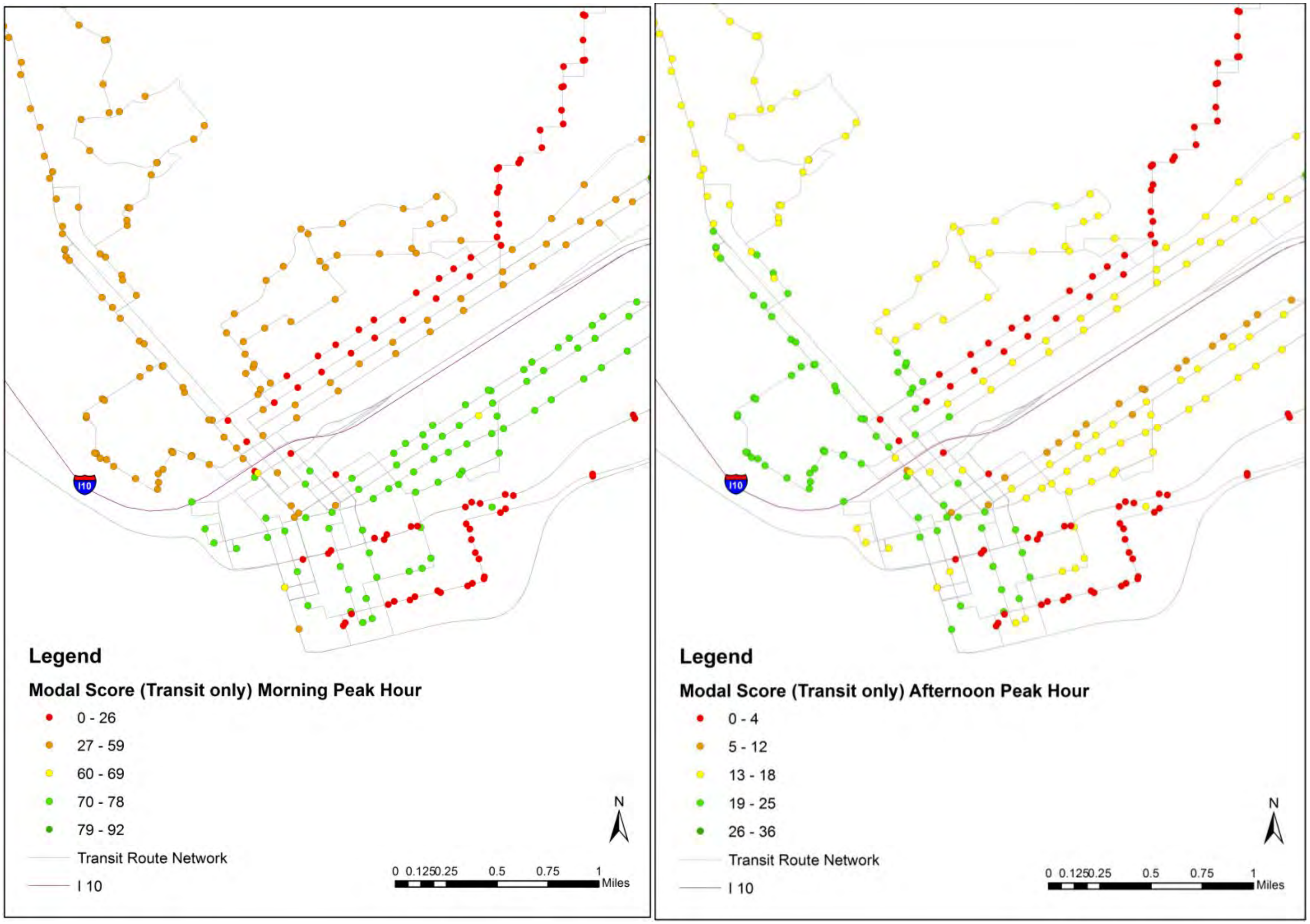
The maps in Figure 3 and Figure 4 show variation in scores over a section of network from the sidewalks, bike, and transit routes in downtown El Paso. The higher values of modal-specific scores for walking and transit occur in the selected downtown area due to high connectivity provided by the sidewalk and transit network around the high employment concentrations around the transit stops (see Figure 3[a]) and Figure 4). However, in case of bicycling, the transit stops other than those along the bike network appear to have low modal values reflecting lack of good connectivity to employment hubs in the downtown area responsible for the values. This is also validated from poor bicycle network density in the downtown area (see Figure 3[b]). Transit scores for the morning peak hours appear to be higher than that during the afternoon peak hours across the stops (compare Figure 4[a]) and 3[b]). This shows transit facility during morning peak hours (Figure 4[a]) is better as compared to that during the afternoon peak hours (Figure 4[b]). This is mainly due to trips originating from the low population concentrations in TAZs in the downtown area and not having adverse impacts on the scores. However, due to high employment numbers in TAZs in the downtown area, and the poor infrastructure of the bicycle routes and lanes with a lack of straight-line or direct routes (bus grids) via sidewalks from TAZs to transit stops, the transit scores in particular are lower in value for the afternoon peak hours than the morning peak hours.

As noted above, the key observations that relate to the score values with the existing demographics and network infrastructure characteristics in downtown El Paso area partially serve as validation for the MMS developed in Eq. (3). Further, the findings reported above provide some useful information for policy makers and city planners on the level of connectivity needed in future around stops for the multimodal system consisting of sidewalks, bicycle, and transit network infrastructure in the downtown area of El Paso.



(a) (b)

Figure 3. (a) Walking and (b) Bicycling Scores for Transit Stops in Downtown El Paso.



(a) (b)

Figure 4. Transit Only Scores for (a) Morning Peak Hour, and (b) Afternoon Peak Hour for Stops in Downtown El Paso.

Results and Discussions

The maps of Figure 5(a) and (b) show that the majority of the stops in El Paso have scores below 20, indicating a poor existing multimodal transportation system. With few isolated transit stops scoring as high as in the range of 81–99 during the morning peak hours and 81–85 during the afternoon peak hours, there are certainly some exceptions in isolated pockets of west, northwest, and central parts of El Paso.

The maps in Figure 5(a) and (b) also show that the majority of stops have score values higher for the morning peak hours as compared to the afternoon peak hours. This shows city planners would need to focus on improving the multimodal transportation facility for the afternoon peak hours more than the morning peak hours, especially for the bicycling mode that is weighed higher than walking and transit for commuting.

In Figure 5(a) and (b), several areas in the downtown have stops having scores higher than 80 during the morning and the afternoon peak hours. This is due to the presence of bicycle lanes and routes (albeit sparse) with a well-connected network of sidewalks leading to those high scoring bus transit stops. However, this also means that not all stops in the downtown area have high MMSs whether for morning or afternoon peak hours, which is also evident from the maps in Figure 5(a) and 4(b). In order to promote walking and bicycling to and from transit stops for commuting during the peak hours of travel, the city planners and engineers would need to provide transportation facilities for high employment concentrations in the downtown. This would particularly be important to achieve the best performance of the bike share programs and streetcar systems in the downtown area in future.

The areas around the confluence of US 54, US 62, and US 85 northeast of the downtown also show comparatively higher scores during the morning peak hours than the afternoon peak hours. The differences in score values between the two peak hours are primarily due to population concentrations higher than the employment concentrations of the TAZs in those areas. Note that from Eqs. 1–3, it is clear that the population counts (and not the employment counts) from TAZs around stops are more important for the morning peak hours than for the afternoon peak hours. This is because several stops are covered within 45 minute transit travel threshold adding all the population covered around the stops.

(a) (b)

Figure 5. MMS at Transit Stops during (a) Morning Peak Hours and (b) during Afternoon Peak Hours.

SENSITIVITY ANALYSIS: SUPPLY-DEMAND ASSESSMENT

An important component of multimodal analysis is to understand the extent of supply provided by an integrated system of sidewalks, bike, and transit facilities to meet the demand. Thus, the demand should cater to the transportation needs of potential commuters of a multimodal system that should be matched with supply provided to meet those transportation demands.

The mean MMS for all transit stops within each TAZ is the assumed proxy for supply, and the normalized population density for each TAZ is assumed to be the proxy for the demand. Population density (for morning trips) and employment density (for afternoon trips) of a TAZ are normalized over a 0–100 scale. The normalization is carried out with respect to the TAZ with the highest population density value from among all the TAZs. The normalized population (or employment) density value of a TAZ is compared to the mean MMS of the corresponding TAZ. The chart in Figure 6(a) and (b) shows this comparison.

The demands used in the charts of Figure 6 are the proxies for the potential multimodal users for future. Each data point in these charts is also an indicator of the supply deficiency that policy makers and city authorities need to focus on in order to match the potential demand needs. In an ideal scenario, most of these points should be as close as possible to a supply score of 100. Irrespective of the demand, a TAZ with its supply-demand point close to a score of 100 can be considered better in multimodal service. Certainly, TAZs that have high population (or employment) density but poor supply have potential for improvement in modal connectivity, either in sidewalks network and/or in bicycle lanes and route network. This has also been validated by Dill et al. in their research, which shows that cities with higher level of bicycle infrastructure have higher levels of commuting trips as well (*31*). However, a proper quantification in the supply-demand relationship is needed.

The relationship between a given demand value (the normalized population or employment density) needs to be established with corresponding supply values (the MMS) in order to understand deficient and surplus areas for facilitating multimodal trips. This would require establishing a correlation between the supply and demand proxies using some parameters. For example, as expressed in Eq. (4), for a given weight (say, *w*), population or employment density and the MMS would be equal indicating supply equals demand. Thus, a sensitivity analysis over *w* is proposed to capture the equilibrium when supply equals demand given by:

$$\underbrace{\text{Multimodal Score}}_{\text{Supply}} \leftrightarrow \underbrace{w \times (\text{Normalized Population or Employment Density})}_{\text{Demand}} \qquad (4)$$

where, '↔' signifies the relationship between the left hand side and the right hand side terms.

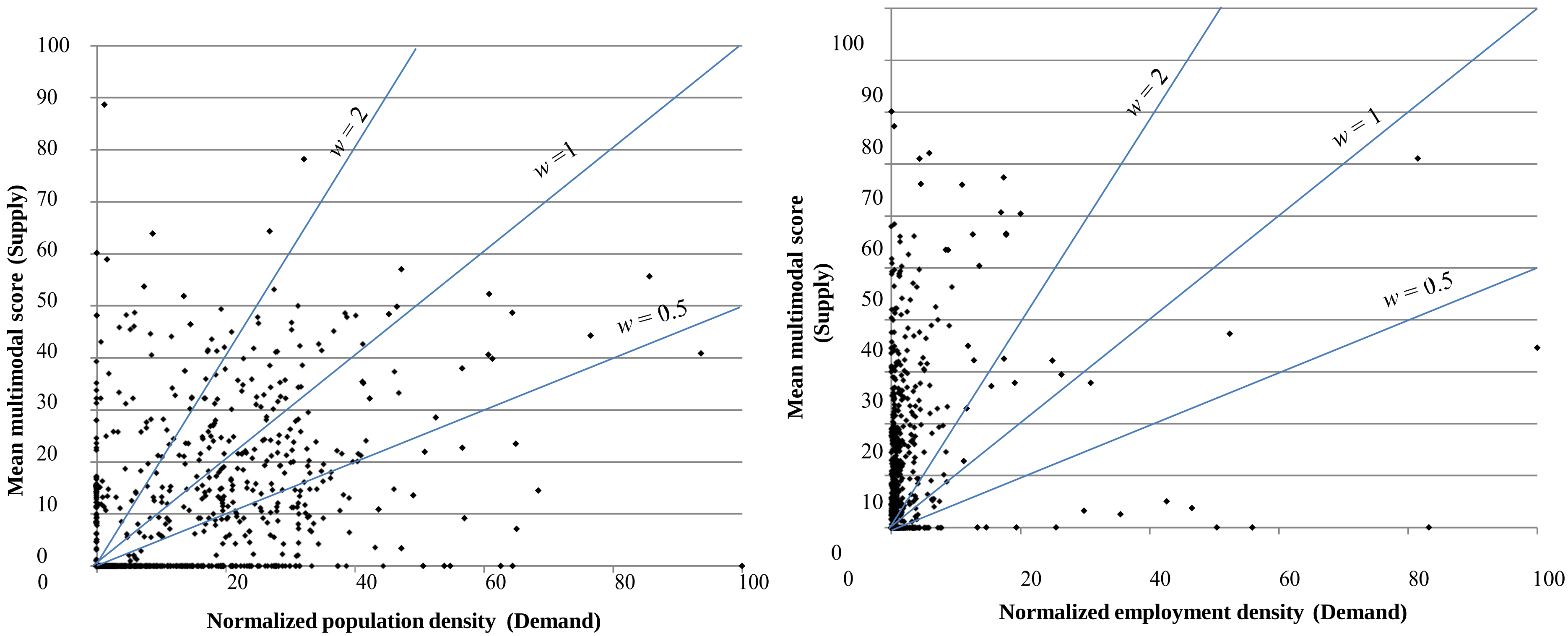
Assuming three different values of $w = 0.5$, 1, and 2, supply and demand equilibriums for each TAZ are established and represented using heat maps in Figure 7 and Figure 8.

Both in Figure 7 and Figure 8, the high supply or demand areas are represented using color codes with dark green indicating high supply and dark red indicating high demand. The light yellow indicates supply meets the demand. For example, in both the charts of Figure 6(a) and (b) for $w = 1$, the supply-demand curve is a straight line passing through the origin. Thus, for $w = 1$, a TAZ is supply (or demand) dominant if the supply (or demand) score is above (or below) the straight line for $w = 1$. This indicates that the farther a point is from w=1 straight line in Figure 6(a) and (b), the corresponding TAZ is either very high in supply (if point above the line) or very low in demand (if point below the line). In nutshell, the colors in Figure 7 and Figure 8 represent the relative magnitude of the distance of a given point from the straight line for w=1.

The heat maps in Figure 7 and Figure 8 show the majority of the areas within El Paso to be demand dominant or supply deficient for the multimodal transportation availability during the morning and the evening peak hours of commuting. It is also evident from visual observations from Figure 7 and Figure 8 that the demand for an integrated multimodal system consisting of walking, bicycling, and transit are particularly high in those areas that are along I-10 spanning the rural cities of Socorro and San Elizario toward southeast and the areas toward the west and northwest away from downtown in rural cities of Anthony and Vinton. This is reflected through the presence of large dark yellow areas in the maps. However, the heat maps in Figure 8 show low supply (i.e., higher demand) areas for multimodal facilities during afternoon peak hours as compared to the morning peak hours.

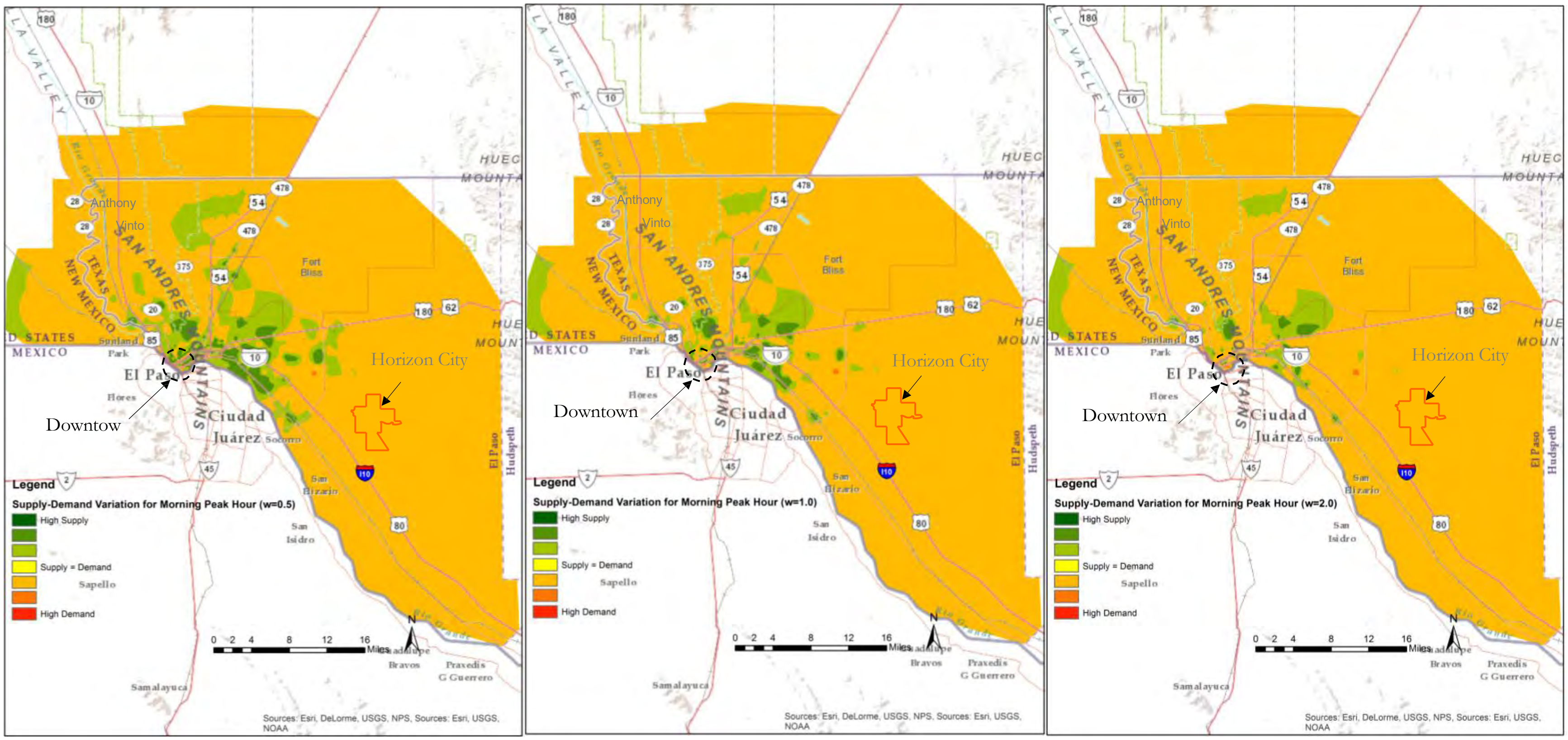
With increase in values of w the demand for multimodal infrastructure steadily grows as shown by the increasing red color patches. The rural cities of Horizon City, San Elizario, Anthony, and Vinton appear to be demand dominant for multimodal infrastructure for both the morning and evening peak hours (as seen in Figure 7 and Figure 8, respectively) for all values of w.

Preliminary investigations based on demographic data in Figure 2(a) and (b) and network data in Figure 2(c) show that poor connectivity provided by the existing bicycle routes are mainly responsible for producing high demand areas in El Paso and the adjoining cities. Broken sidewalk network infrastructure also contributes to diminished values in the MMSs at several isolated transit stops, which add to supply deficiency in overall multimodal needs. Lack of transit connectivity creates demand deficient areas mainly in the rural cities around El Paso, such as Socorro and Anthony.



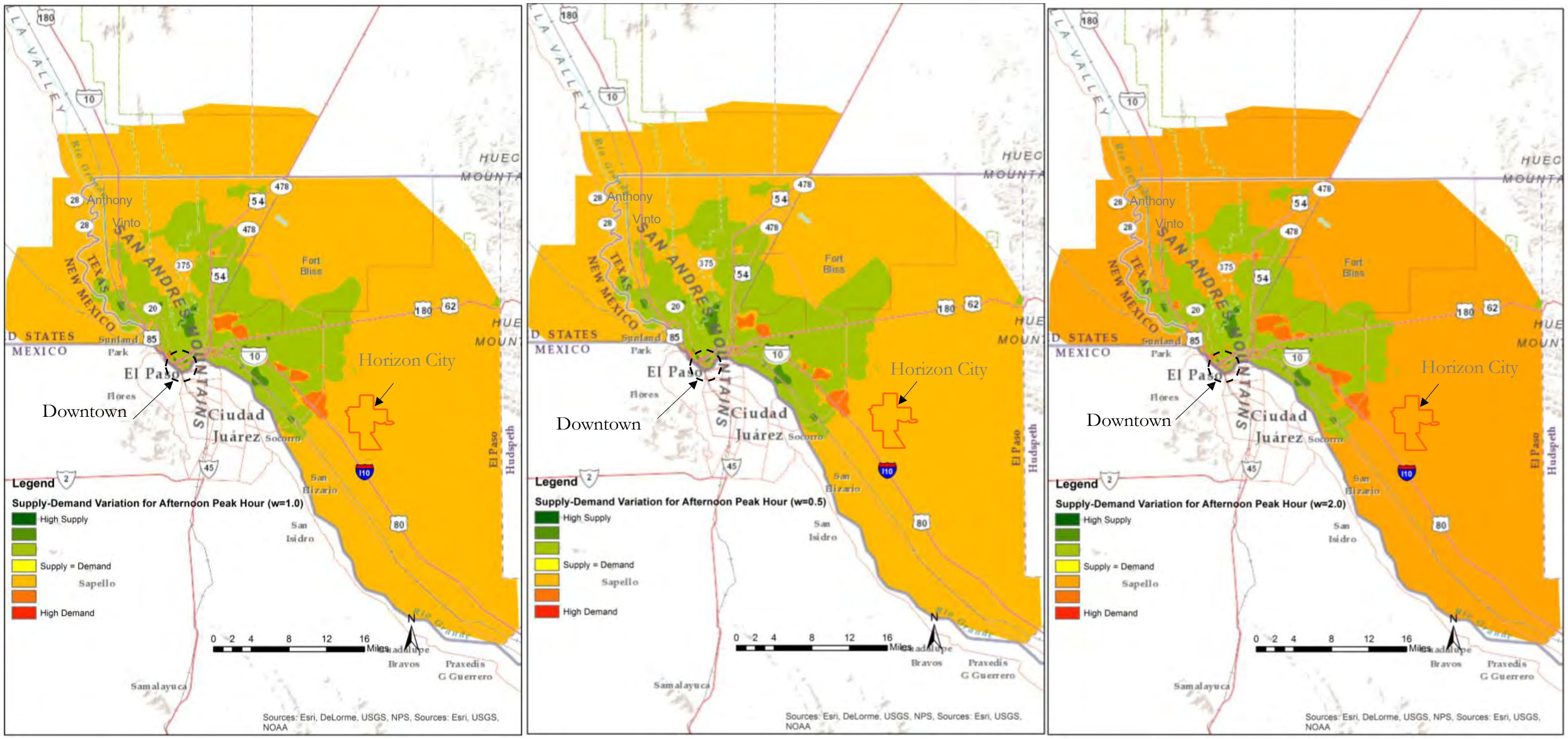
(a) (b)

Figure 6. Variation of Mean MMS (Supply) for (a) Morning and (b) Afternoon Peak Hour versus the Normalized Population and Employment Density (Demands), Respectively, for TAZs in El Paso, TX.



(a) $w = 0.5$ (b) $w = 1.0$ (c) $w = 2.0$

Figure 7. Supply-Demand Variation during Morning Peak Hours with Variable Weights (a) w = 0.5, (b) w = 1.0, and (c) w = 2.0.



(a) $w = 0.5$ (b) $w = 1.0$ (c) $w = 2.0$

Figure 8. Supply-Demand Variation during Afternoon Peak Hours with Variable Weights (a) w = 0.5, (b) w = 1.0, and (c) w = 2.0.

PILOT PROJECTS

As noted before, accessibility has been the base for assessing performance of a multimodal transportation system and developing a MMS. The transit stops serve as primary O-D point locations for commuters in a multimodal environment. The score is developed at each transit stop being treated as the focal point of waiting, boarding, and transfer activities. The multimodal system considers each transit stop and its connectivity to the other transit stops. The MMS is a regional aggregate in terms of the connectivity of one transit stop with the rest of the transit system.

Two pilot or virtual projects were selected to expound the MMS concept at a single multimodal trip level and its relation to multimodal improvements. An MMS was calculated before and after multimodal improvements. This single trip approach for the MMS calculation for these two pilot projects is simplistic but it shows the type of repetitive calculation that is done in the aggregate. The following describes the multimodal trips for each pilot project:

- Pilot project No.1:

1. Trip Origin = 1673 Hermit Thrush Place (Residence).
2. Bus stop origin = Near intersection of Helen of Troy Drive and Nardo Goodman Drive.
3. Bus stop destination = Near intersection of Sunland Park Drive and Cadiz Street.
4. Trip Destination = 5930 Cromo Drive (Sonic Drive-In).

- Pilot project No. 2:

1. Trip Origin = 1673 Hermit Thrush Place (Residence).
2. Bus stop origin = Near intersection of Helen of Troy Drive and Nardo Goodman Drive.
3. Bus stop destination = Near intersection of Doniphan Drive and Bird Avenue.
4. Trip Destination = 4445 Sleepy Willow Drive (Residence).

The detailed analysis of these pilot projects may be found in Appendix A.

CONCLUDING REMARKS

Based on accessibility concepts widely used in transportation planning, a simple formulation for a MMS at a transit stop is proposed. A score of 0 means poor multimodal transportation facility while a score of 100 indicates the desired or perfect multimodal facility. With the proposed formulation, researchers present an integrated framework of assessing the multimodal facility for any area that lacks information on bicyclist and pedestrian counts that use transit for commuting. The MMS developed ranks transit stops and stations across the transit network, taking into account the influence of sidewalks and the bicycle network facilities to population and employment around the stops. Validity of the proposed score has been established through an example of a section of transportation network (from bicycle lanes and routes, sidewalks, and transit routes) selected from the downtown area of El Paso. Majority of the stops across the El Paso region are found out to score below 20 in their multimodal value for the morning and evening peak hours of commuting. Afternoon multimodal peak hour scores are less compared to the morning peak hour score values as the region lacks in network infrastructure (especially in bicycle lanes and routes) for commuters from their employment centers to their homes.

Through sensitivity analysis, this research captures the most difficult component of quantifying supply-demand assessment of the multimodal transportation facility. The sensitivity analysis for the supply-demand assessment with the scores developed for transit stops in El Paso shows the majority of the rural cities such as Socorro, Horizon City, Vinton, San Elizario, and Anthony within El Paso MPO's jurisdiction to be supply deficient in terms of multimodal infrastructure for sidewalks, bicycling, and transit.

In summary, this research provides guidance for city planners and engineers to carry out a similar methodological process (as presented in this paper) in the assessment and evaluation of any existing multimodal transportation system in an area that lacks detailed information on its multimodal users, such as pedestrians and bicyclists using transit.

CHAPTER 3:
A BRIEF SYNOPSIS ON DATA COLLECTION AND SURVEY RESULTS

BACKGROUND

This chapter discusses a behavioral analysis by TTI researchers, which necessitated inputs on the behaviors or motivations for using or not using the various modes of transportation, with a particular focus on walking and cycling. To gather these inputs, researchers developed a population sample survey for the El Paso MPO region. The specific study area included all of El Paso County, Texas, and parts of Doña Ana and Otero Counties, New Mexico.

This chapter:

- Summarizes the methods used to design and implement this survey.
- Provides details on how the data were processed prior to analysis.
- Describes the information collected by the instrument via descriptive statistics.
- Presents some high level findings for how these data might be used to inform transportation planning in the El Paso region particularly from the perspective of alternative travel modes.

SURVEY METHODS

Researchers designed the survey instrument to be administered simultaneously in phone, mail, and web formats, with an average telephone interview length of no more than 20 minutes. The questionnaire focused on eight core areas:

- Residence/neighborhood.
- Work/school.
- Lifestyle.
- Biking habits.
- Walking habits.
- Public transportation habits.
- Well-being.
- Demographics.

Once the instrument was finalized and approved by the El Paso MPO, it was provided to the survey contractor for programming in English and Spanish.

An address-based sample was used to get a representative sample of individuals age 18+ in the El Paso metropolitan area. The address-based sample was matched to phone number to the extent possible, resulting in a survey sample where 100 percent of all sample records have a mailable address and approximately half have a phone number. The half with a phone number were actively recruited (mailed a letter directing them to an online survey or mailable survey, followed up with a phone recruitment call) while the other half would be passively recruited (mailed a letter and directed to an online survey or asked to participate via mail).

SURVEY IMPLEMENTATION

Assuming an overall 20 percent response rate for this project, the survey contractor sampled a total of 9,564 addresses within the survey region, 65 percent of which was matched to a phone number. Two mailings were conducted during the data collection period. The first mailing took place on August 28, 2015, and was administered to 7,500 addresses. The second took place on September 25, 2015, and was administered to 8,500 addresses, of which 7,500 acted as a reminder to the initially mailed addresses. Telephone numbers were dialed from September 5, 2015, through October 16, 2015, with up to five attempts made to each, prior to the sample being considered dead. A total of 1,505 surveys were completed, with the majority coming via mail (62 percent), followed by phone (33 percent) and web (5 percent). The overall participation rate was approximately 18 percent. Approximately 8 percent of all surveys were completed in Spanish, with the remainder completed in English. Table 5 shows a distribution of surveys by survey week and mode.

Table 5. Completed Surveys by Mode.

Week	Mail Completes	Phone Completes	Web Completes	Total Completes
11-Sep-15	211	84	21	316
18-Sep-15	469	188	23	680
25-Sep-15	543	356	26	925
2-Oct-15	772	411	32	1215
9-Oct-15	893	434	32	1359
16-Oct-15	932	499	74	1505
% of Total	62%	33%	5%	100%

DATA PROCESSING

The survey dataset was reviewed for inter-variable logic, skip patterns, reasonableness of data ranges, etc. Upon verifying the accuracy and completeness of the data, the process of survey data weighting began. Data weighting is the process of creating statistical adjustment factors that can be applied to the data to help overcome the effects of various forms of survey bias (including, but not limited to, non-response and self-selection). More information on survey data weighting can be found here: http://www.applied-survey-methods.com/weight.html.

A review of key demographic variables often used for survey data weighting (income, age, ethnicity, education) revealed some item non-response. Missing values or cases where respondents had refused to provide this information were imputed using linear regression and hot deck imputation. More information on survey data imputation can be found here: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3130338/.

After trying multiple weighting schemes, the combination of age, ethnicity, and education yielded the best results. Table 6 presents a comparison of the weighted survey data and U.S. Census data for the survey area. With the exception of the following demographic segments, the difference between the U.S. Census distribution and the weighted survey distribution is ±5 percentage points: Hispanics (slightly over represented), whites (slightly under represented), household size = 1 (slightly under represented), and household size = 4+ (slightly over represented).

Ten respondents provided so little demographic information, that imputation for these cases was not possible. As such, these cases were assigned a weight of zero, essentially removing their influence on the survey results.

Table 6. Comparison of Weighted Survey Data to U.S. Census Data.

Demographic	***Weighted Survey Data***	***U.S. Census Data for the Survey Area***
Gender		
Male	47%	49%
Female	53%	51%
Age		
18–24	22%	17%
25–34	16%	20%
35–44	16%	18%
45–54	17%	17%
55–64	12%	14%
65+	17%	14%
Ethnicity		
Hispanic	87%	82%
White	8%	13%
Black	2%	3%
American Indian	1%	0%
Asian	1%	1%
Native Hawaiian	0%	0%
Other/Mixed Race/Non-Hispanic	1%	1%
Education		
Less than high school diploma	23%	25%
High school graduate, diploma or equivalent	27%	25%
Some college, no degree	28%	26%
Associate’s or technical degree	6%	6%
Bachelor’s degree	11%	12%
Graduate or professional degree	5%	6%
Income		
Less than $15,000	15%	18%
$15,000–$24,999	18%	14%
$25,000–$34,999	15%	13%
$35,000–$49,999	13%	16%
$50,000–$74,999	15%	17%
$75,000–$99,999	9%	9%
$100,000–$124,999	4%	6%
$125,000–$149,999	4%	2%
$150,000 or more	7%	5%
Tenure		
Own	66%	62%
Rent	34%	38%
HH Size		
1	11%	21%
2	28%	26%
3	19%	19%
4+	42%	34%

UNIVARIATE DESCRIPTIVE STATISTICS OF THE SURVEY DATA[1]

Residence/Neighborhood

The first section of the survey presented respondents with a series of questions on their specific home location and residential neighborhood. Figure 9 suggests a fairly even distribution for the length of time respondents have lived in their home residence. Half of all respondents (50 percent) have lived in their current residence 15 or fewer years, and 49 percent have lived in their current residence at least 16 years.

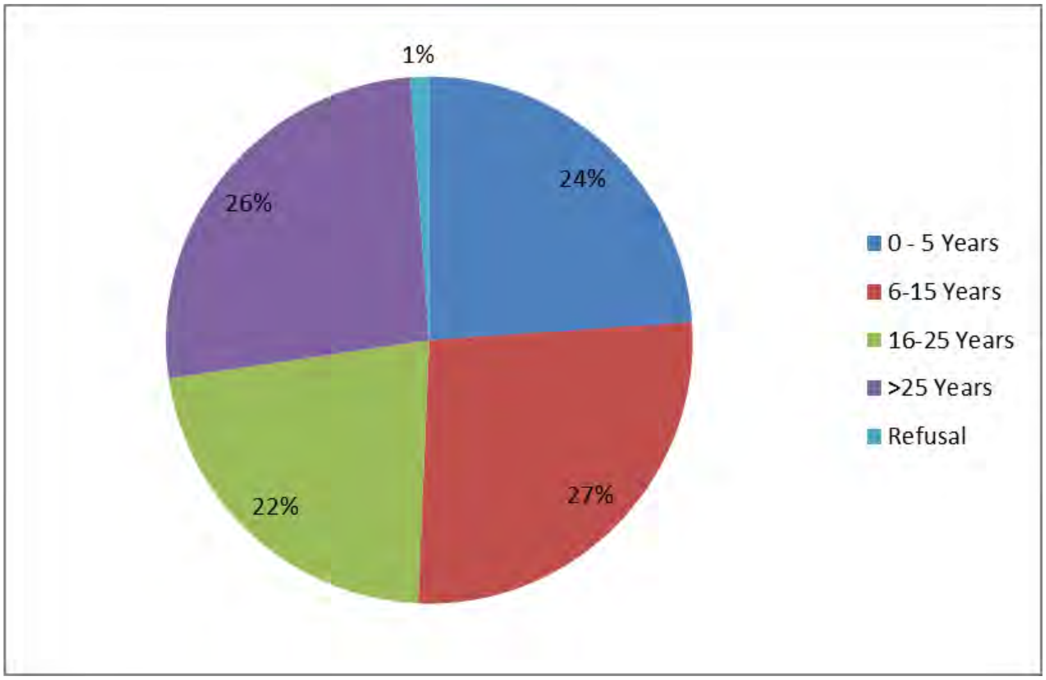


Figure 9. Time at Current Residence (N=1,495).

Respondents were next presented a list of 11 neighborhood specific statements and, using a scale from 1 to 5, asked to assess their level of disagreement (1) or agreement (5) with each. Figure 10 shows that "neighborhood is safe from crime for walking/biking" received the highest agreeable proportion of respondents (60 percent). This was followed closely by "there are shops and/or restaurants within walking or bicycling distance" (58 percent agreement) and "there are parks or trails to walk, run or bike" (57 percent agreement). Conversely, "there are dedicated bicycle storage facilities" received the highest disagreeable proportion of respondents (71 percent).

[1] The information presented here includes the key characteristics of the survey data, and all descriptive statistics are based on the weighted survey data. Additional detailed analyses are ongoing.

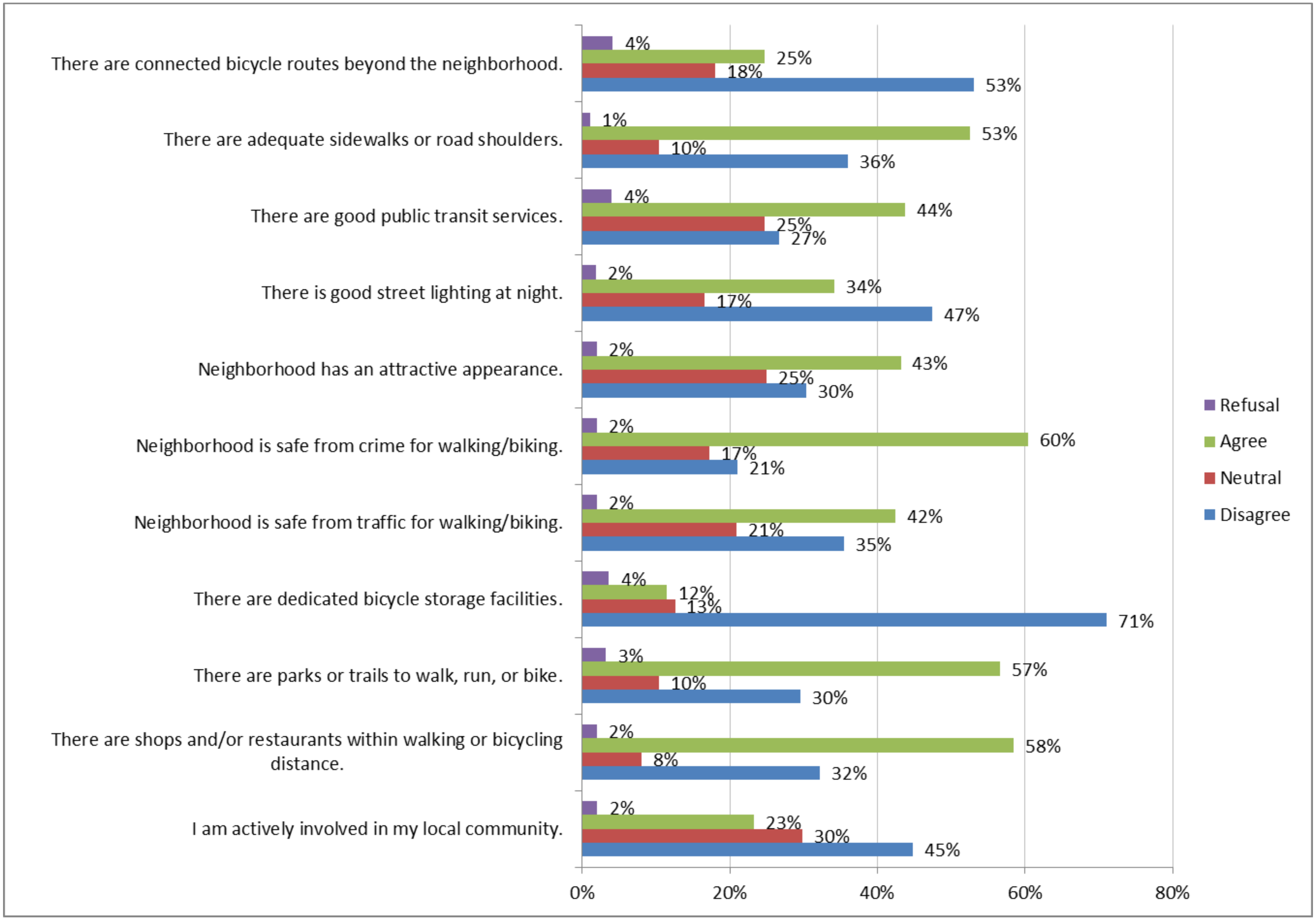


Figure 10. Opinion of Neighborhood Attributes (N=1,495).

Work/School

Respondents were asked to select employment descriptors from a list that described their current situation. Figure 11 presents a distribution of all responses. The majority of responses was either "employed full time" (33 percent) or "retired" (23 percent).

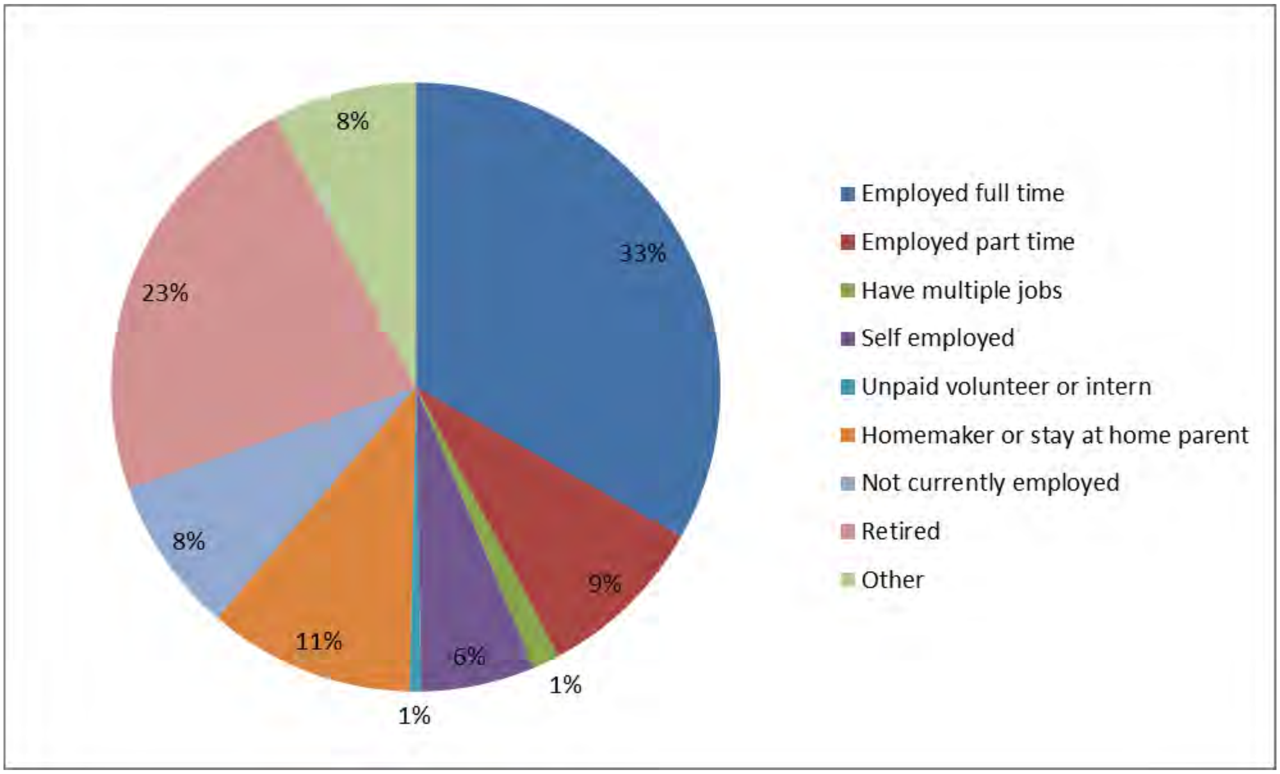


Figure 11. Respondent Status (N=1,506 Responses).

Employed respondents (full or part time) and students were asked to provide some details about their work or school commute. Figure 12 and Figure 13 present a summary of commute distances and times, respectively. For commute distance, approximately half of employed respondents (48 percent) have a commute of 15 miles or less, compared to 61 percent who report school commutes of this distance. For commute time, approximately two-thirds (64 percent) of employees report travel times to work of a half hour or less, while slightly more than three-fourths (77 percent) of students report travel times to school of this duration.

Employees and students often use a variety of modes (either independently or in combination with one another) to travel to and/or from work and/or school. Respondents were presented eight different modes and asked how many times per week they used each mode on their commute. Figure 14 suggests that, like the vast majority of Texans, El Paso regional respondents are highly dependent on the single occupancy vehicle (SOV) as their means of commuting. Seventy-two percent reports SOV as their commute mode at least 4 days per week, and more than 8 of 10 rely on this mode at least one day per week. Thirteen percent reported walking to or from work or school at least once per week, and 8 percent reporting using public transportation or telecommuting with the same frequency on their commute.

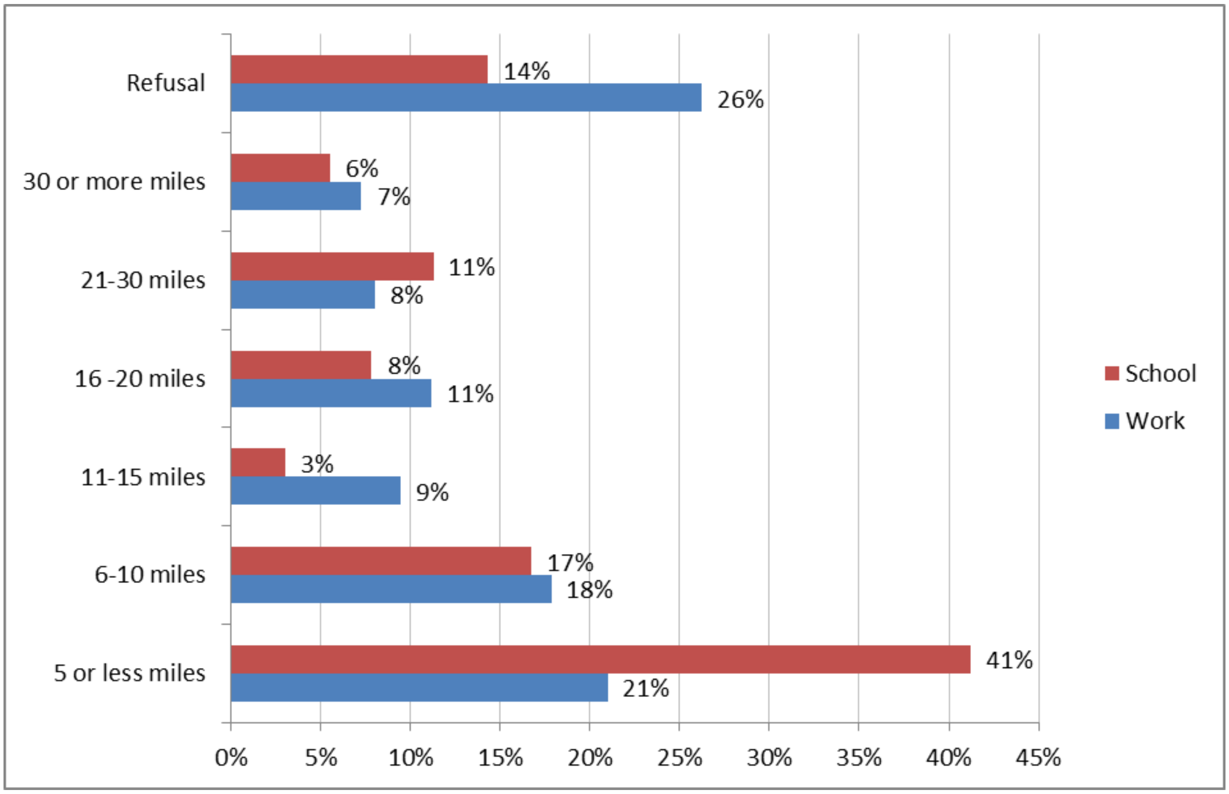


Figure 12. School or Work Commute Distance (N=239 and N=742, Respectively).

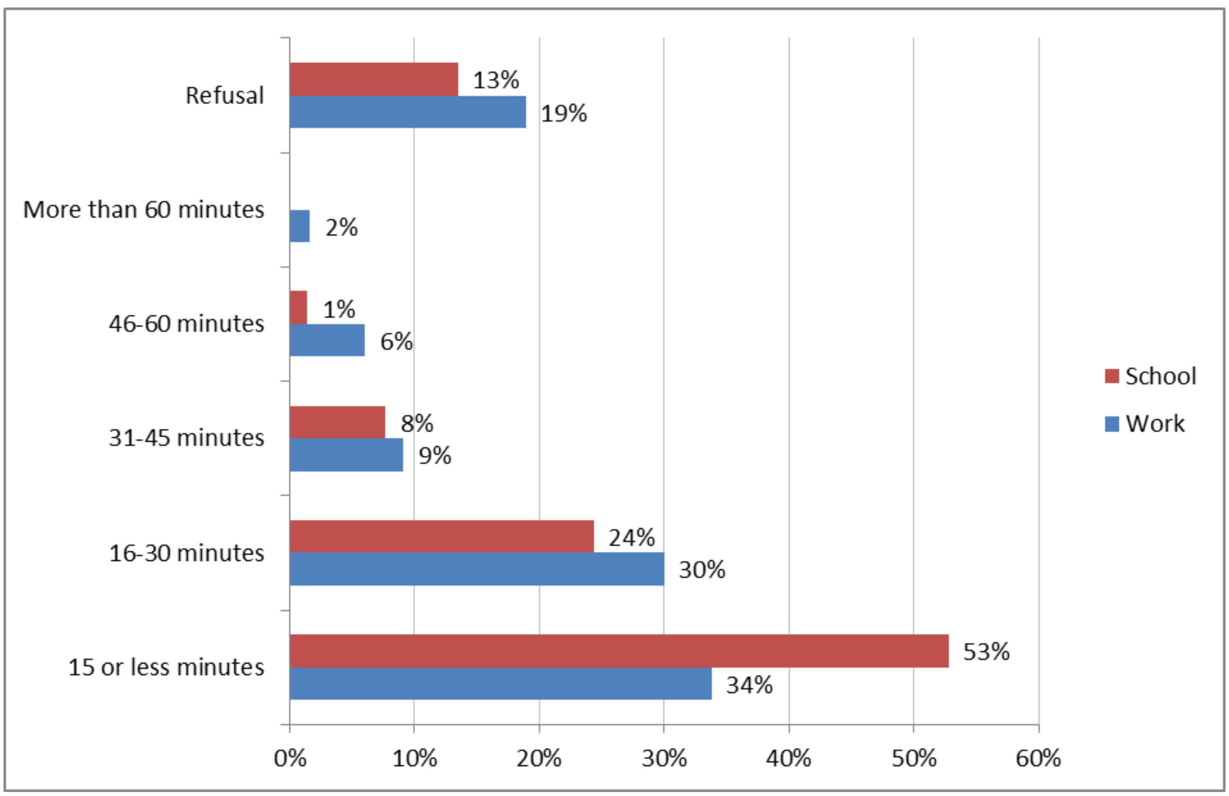


Figure 13. School or Work Commute Time (N=239 and N=742, Respectively).

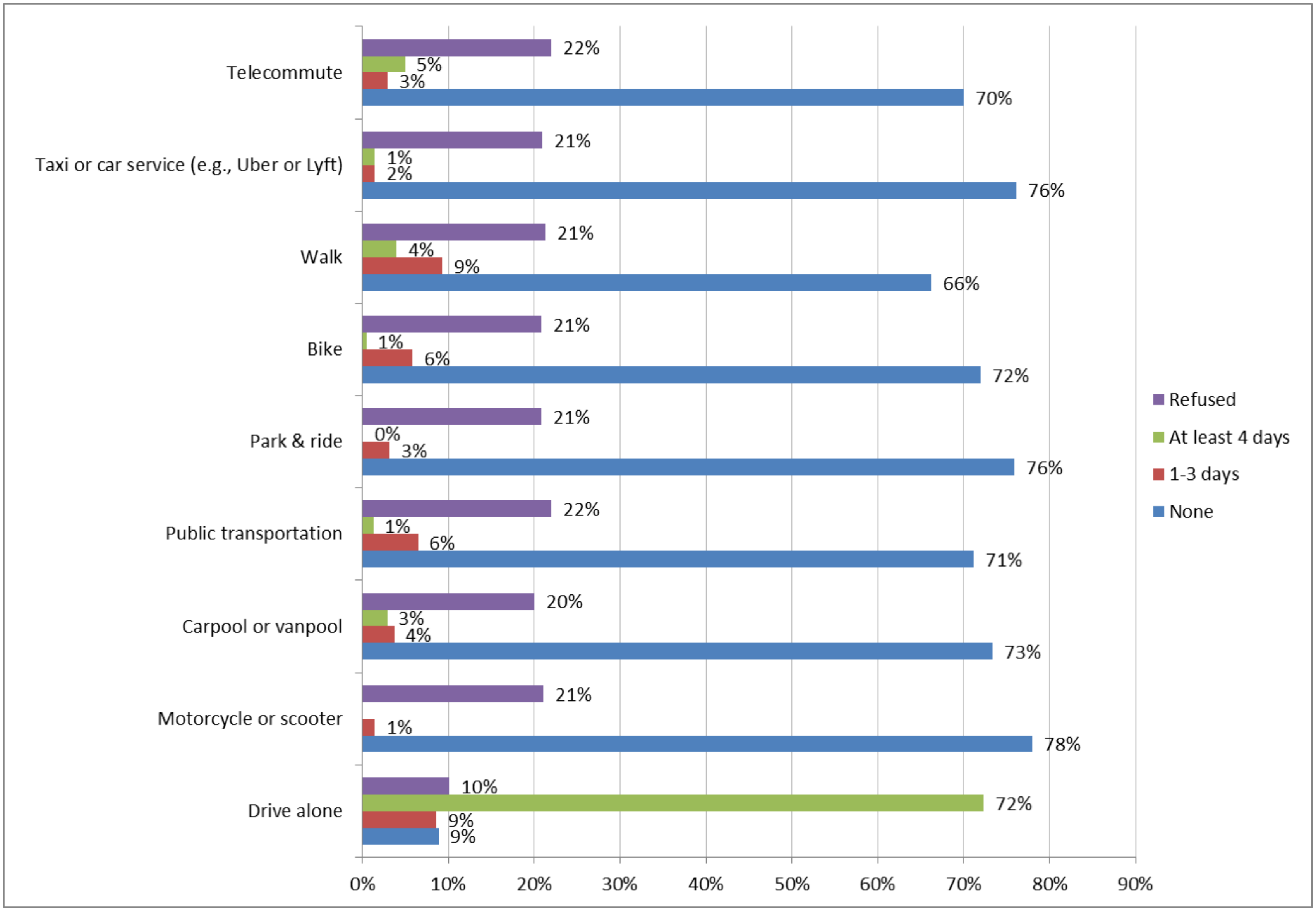


Figure 14. Frequency of Use for Various Modes – School or Work Commute (N=873).

Still thinking about their work or school commute, survey participants were asked to provide some details about the stops they typically make. They were presented a list of stop types and allowed to select as many as were indicative of their unique travel behavior. When these responses are analyzed “I do not make any regular stops during my commute” was most often mentioned (38 percent of all responses). Stops for “beverage/food” were mentioned in 27 percent of all responses, with “gym/exercise” and “child care” mentioned in 8 percent of all responses, each. See Figure 15 for further detail.

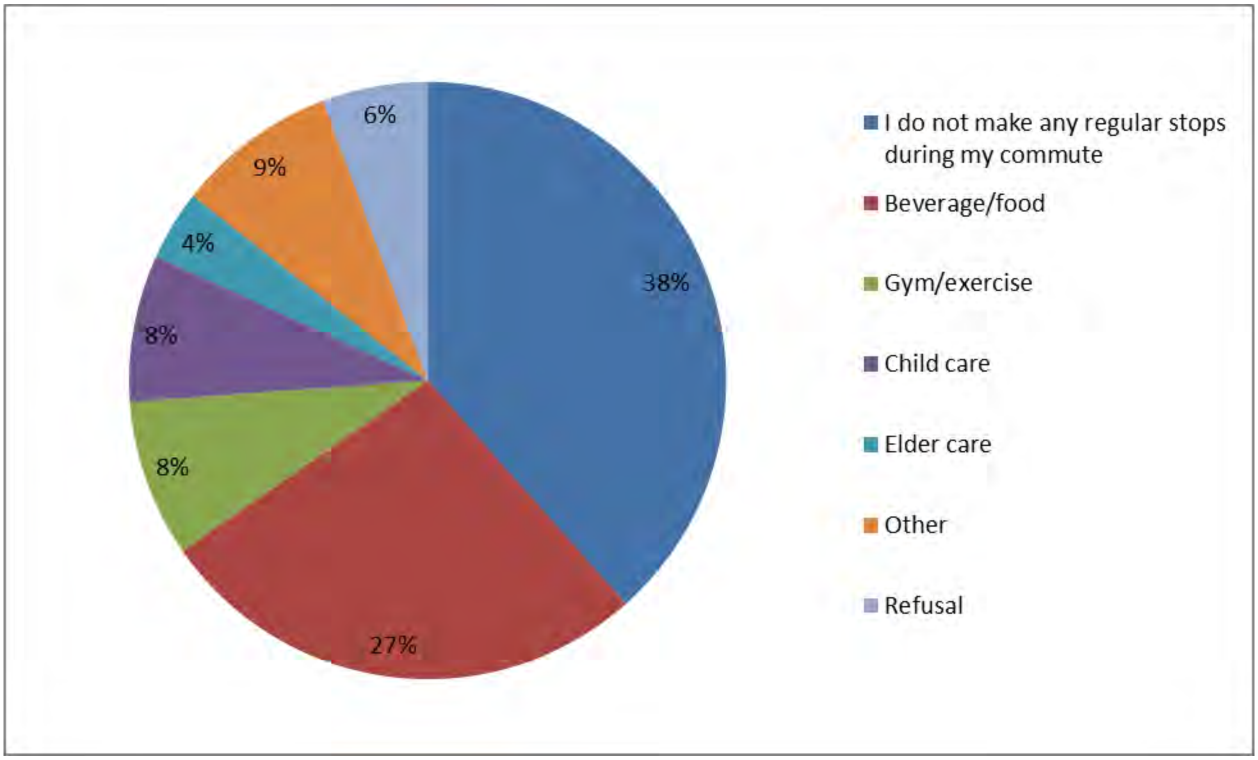


Figure 15. Types of Stops on School or Work Commute (N=1,000 Responses).

When full and part time employees were asked about any commute related benefits offered by their employer, around 4 of 10 (43 percent) reported that flex time was an option. Eighteen percent stated that their employer allowed them to work from an alternative work location, rather than driving to a traditional work place, and only 4 percent were offered public transit assistance in the form of discounted or subsidized fares. See Figure 16.

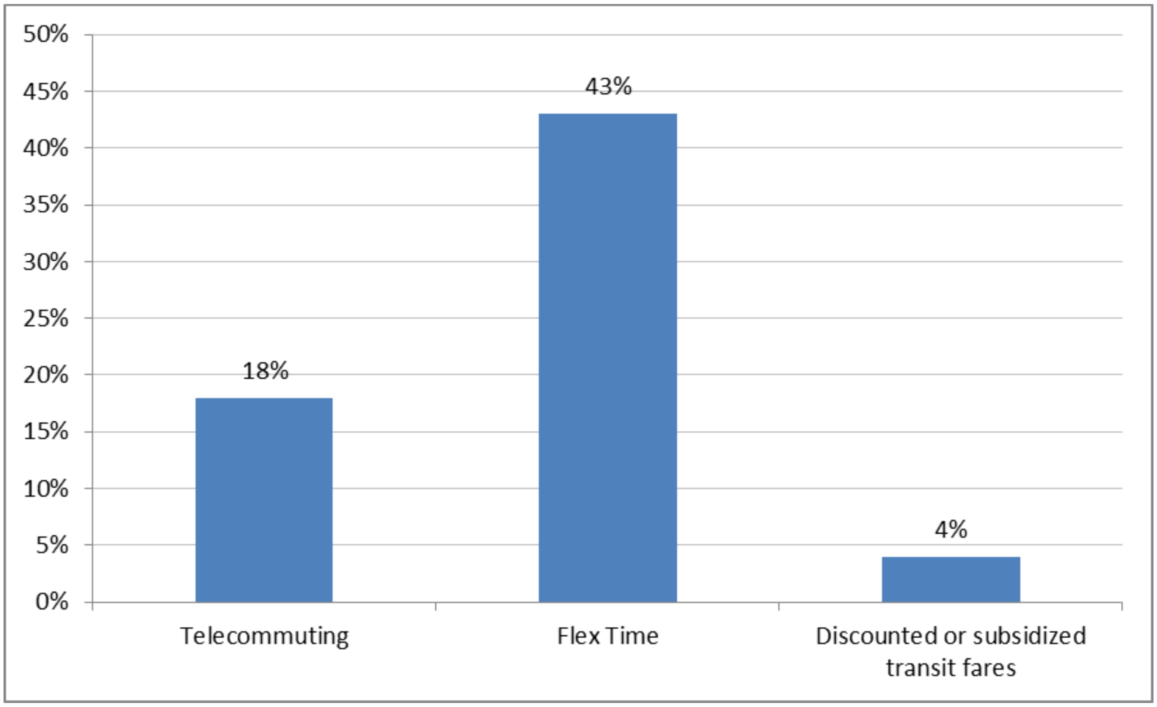


Figure 16. Commute Benefits Offered by Employer (N=746).

Of the respondents that were permitted to telecommute, 40 percent reported doing so almost every day, and approximately one-third (31 percent) reported doing so rarely or never. This is somewhat indicative of an all or nothing employee culture toward telecommuting. See Figure 17 for further detail.

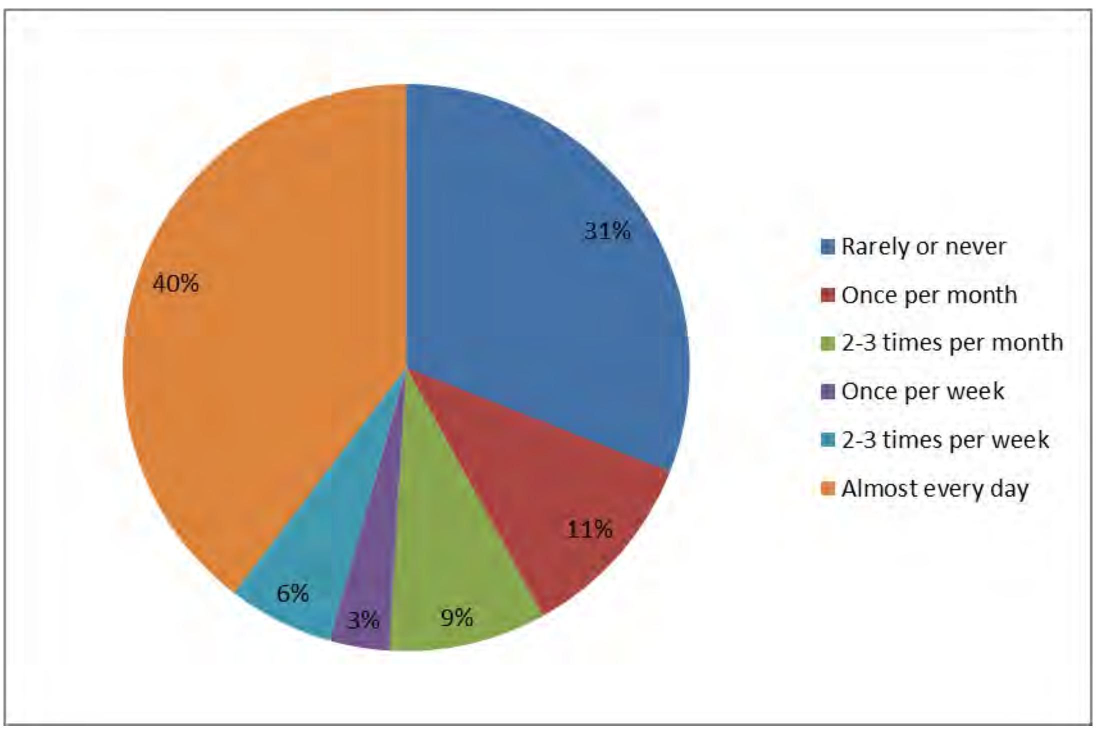


Figure 17. Telecommuting Frequency (N=131).

As seen in Figure 18, when asked if they had an existing physical condition that prohibits them from performing specific activities, biking was mentioned by 15 percent of all respondents. Exercising was the next most mentioned (14 percent), followed by walking (10 percent) and taking public transit (7 percent).

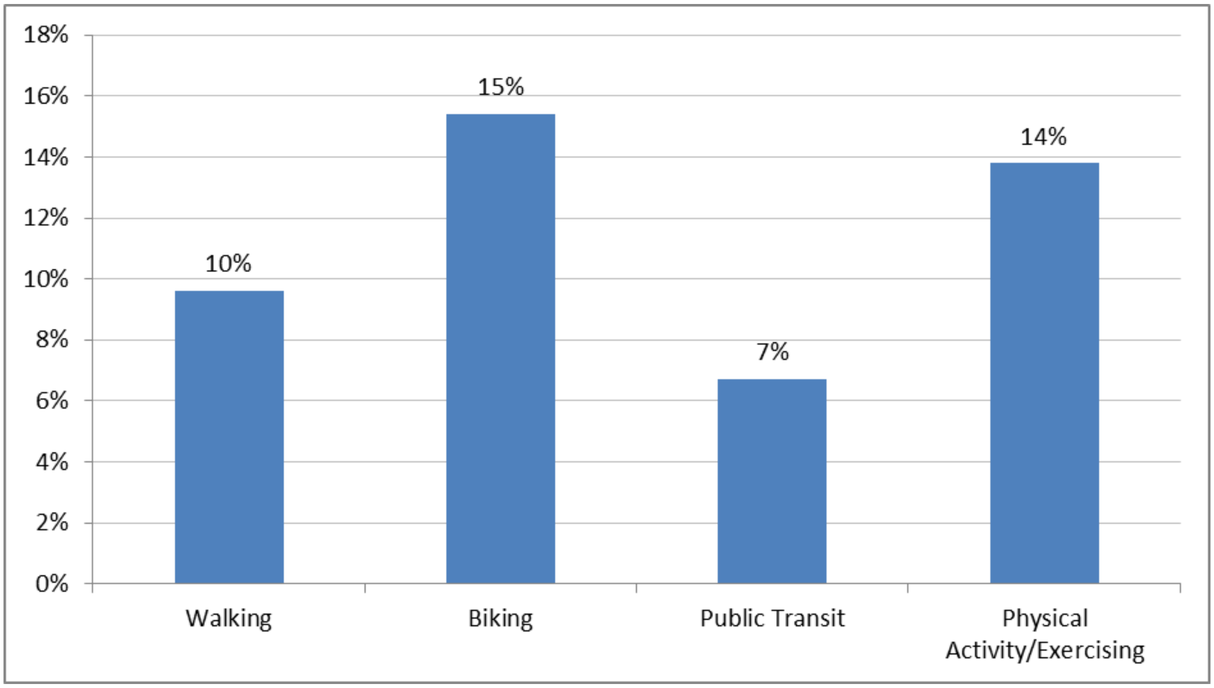


Figure 18. Activities Prohibited by Existing Physical Condition (N=1,495).

Lifestyle

Regular regiments of moderate exercise (e.g., such as fast walking, hiking, ballroom dancing, general gardening) or vigorous exercise (e.g., running, jogging, mountain climbing, competitive sports) can have significant health benefits. Figure 19 presents the monthly frequency of moderate and vigorous activities in which survey respondents engage, while Figure 20 presents the average duration of each moderate and vigorous activity episode. On average, respondents were nearly twice as likely to engage in moderate exercise (11.5 episodes per month) than vigorous (6.5 episodes per month). The average duration of moderate exercise was also longer (49.4 minutes per episode) than vigorous activity (35.7 minutes per episode).

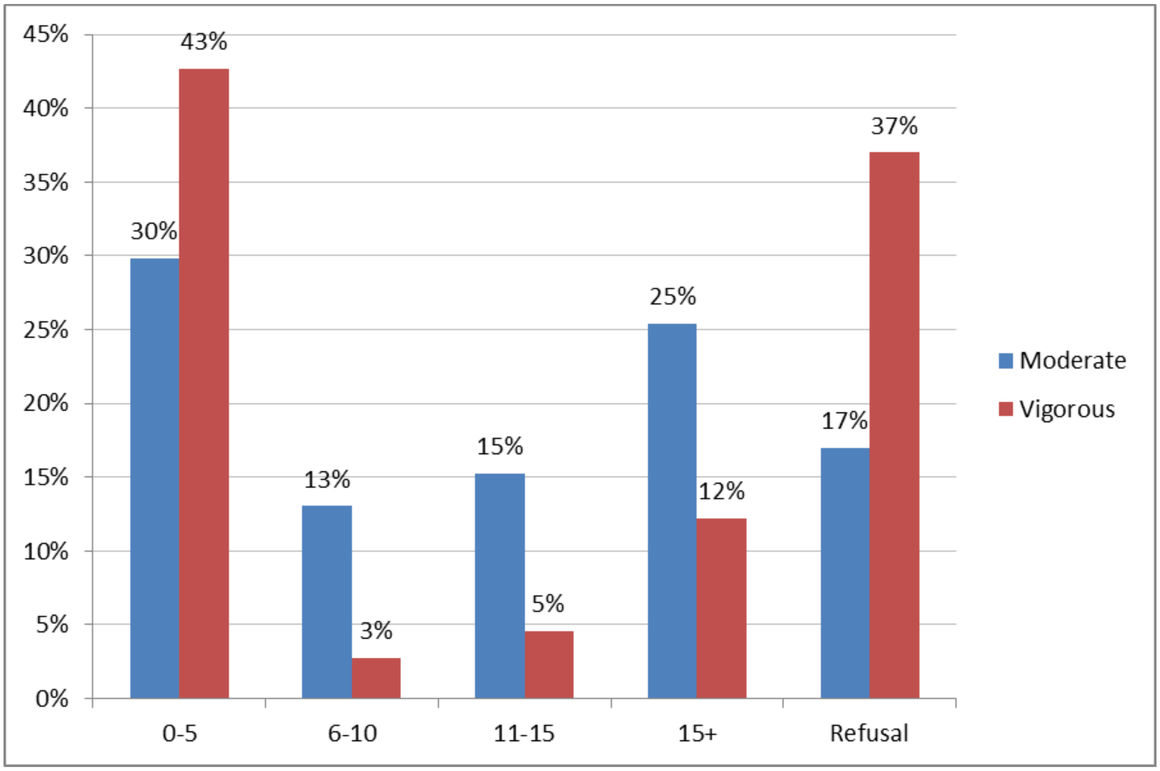


Figure 19. Monthly Frequency of Moderate and Vigorous Activity Episodes (N=1,495).

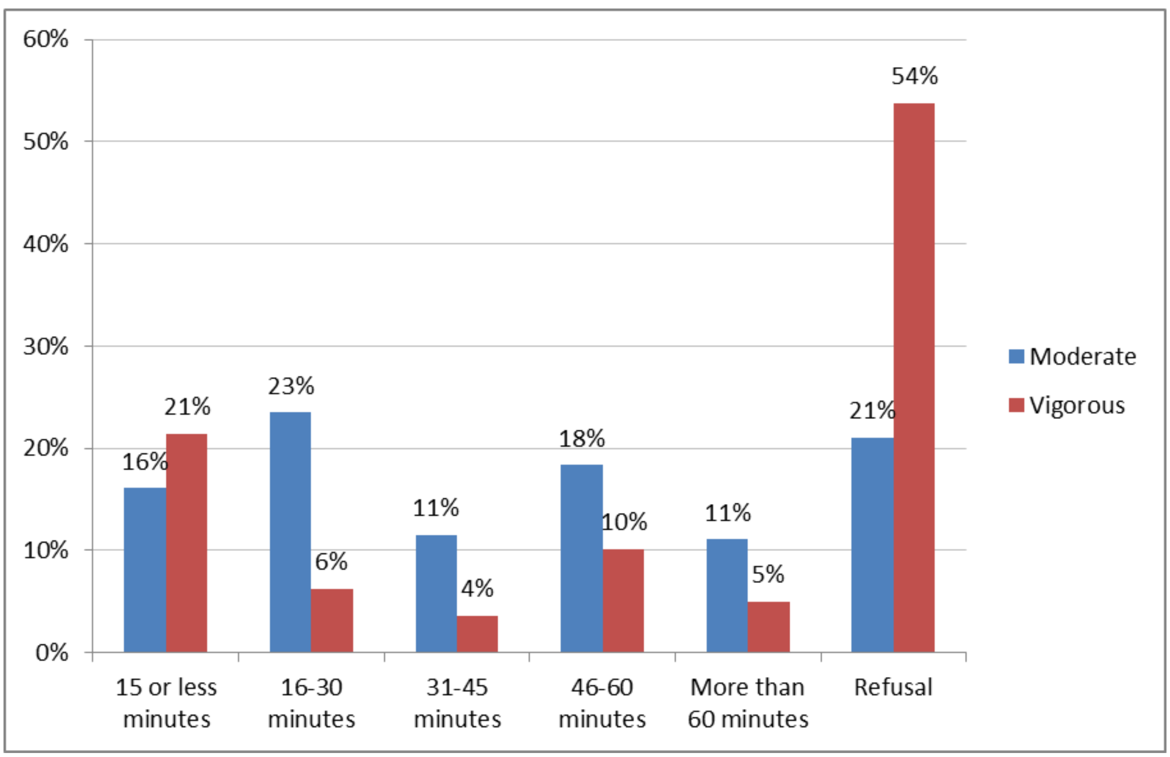


Figure 20. Average Duration of Moderate and Vigorous Activity Episodes (N=1,495).

Respondents were next presented with a series of statements on some aspects of their lifestyle, including diet, physical activity, and travel behavior. Using a scale from 1 to 5, they were asked their level of disagreement (1) or agreement (5) with each. “Transit should be the focus for new transportation infrastructure” and “we need to expand or build new highways to reduce congestion” were the two statements that received the highest levels of agreement (71 percent each). Conversely, “I eat out frequently” and “I go to parks, playgrounds, golf courses, or hiking trails frequently” were the two statements that received the highest levels of disagreement (47 percent and 46 percent, respectively). “I eat healthy and pay attention to my nutrition” was the statement characterized by the highest level of neutrality (28 percent). See Figure 21 for further details.

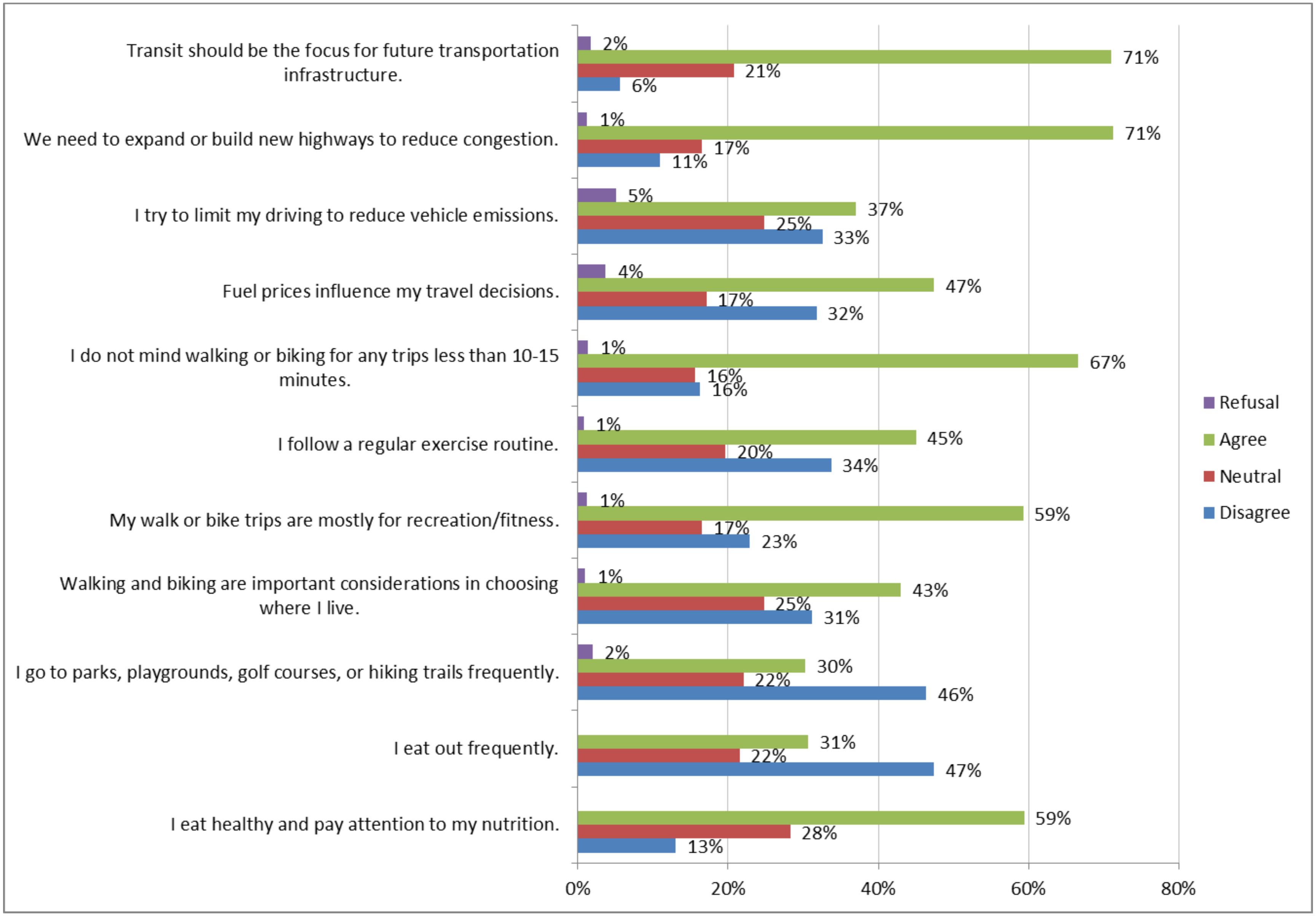


Figure 21. Opinions on Diet, Exercise, and Travel (N=1,495).

As suggested by Figure 22, "safer walking routes" motivated 72 percent of all respondents either somewhat (24 percent) or a lot (48 percent) in considering travel alternatives. This was followed by "more reliable transit service" (66 percent overall motivation). "More information about ride share programs" was identified by the highest proportion of respondent (42 percent) as having no effect on their motivation to consider alternative modes.

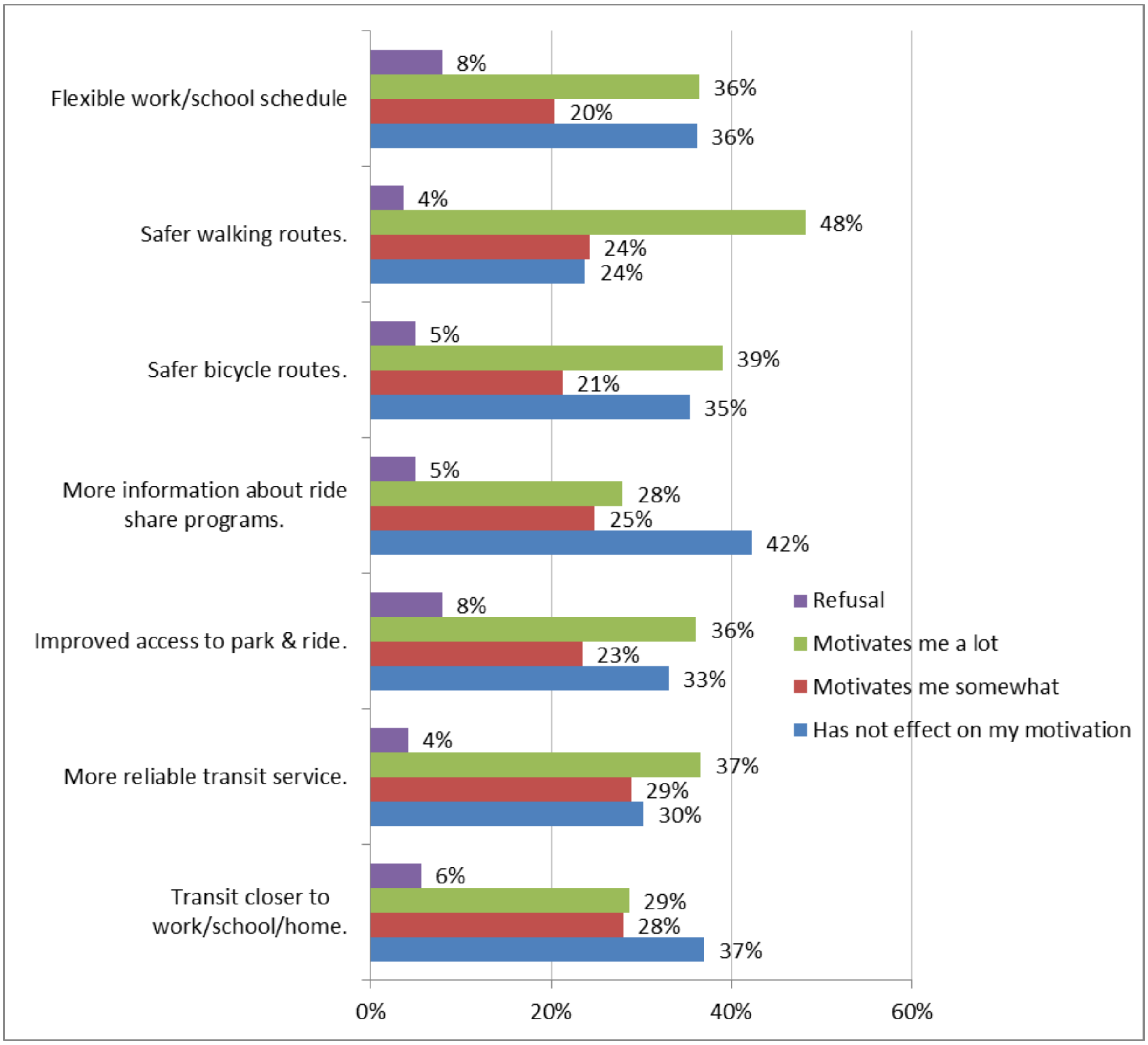


Figure 22. Travel Alternative Motivators (N=1,495).

Similar to the pattern observed with commute mode choice, SOV (drive alone) was the most often mentioned non-work commute mode choice as well (62 percent of all responses). Walking (11 percent of all responses) and carpool or vanpool (11 percent of all responses) were the next most often mentioned responses. Public transportation was mentioned in 6 percent of all responses. See Figure 23 for further detail.

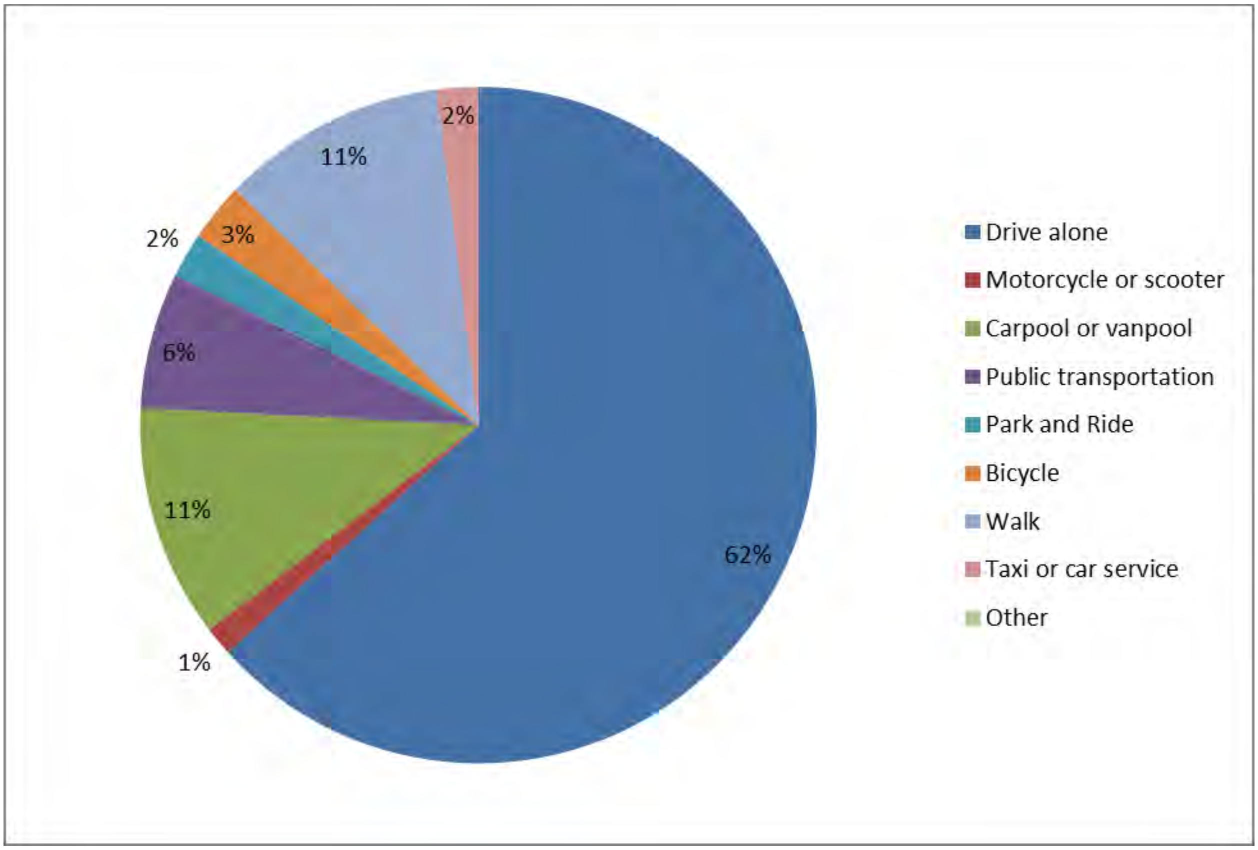


Figure 23. Non-Work Trip Mode (N=1,827 Responses).

Biking Habits

Respondents were next asked to think about their bicycling habits. They wereasked to select from a list of five bicycling related statements that represented their attitudes toward bicycling. Roughly two-thirds of all responses were either “I am not interested in bicycling” (36 percent) or “I am not currently a bicycler, but might consider bicycling in the future” (28 percent). Approximately one of five responses was “I like to bike, but only on trails or off main road bike paths. On road bike paths make me nervous.” See Figure 24 for details.

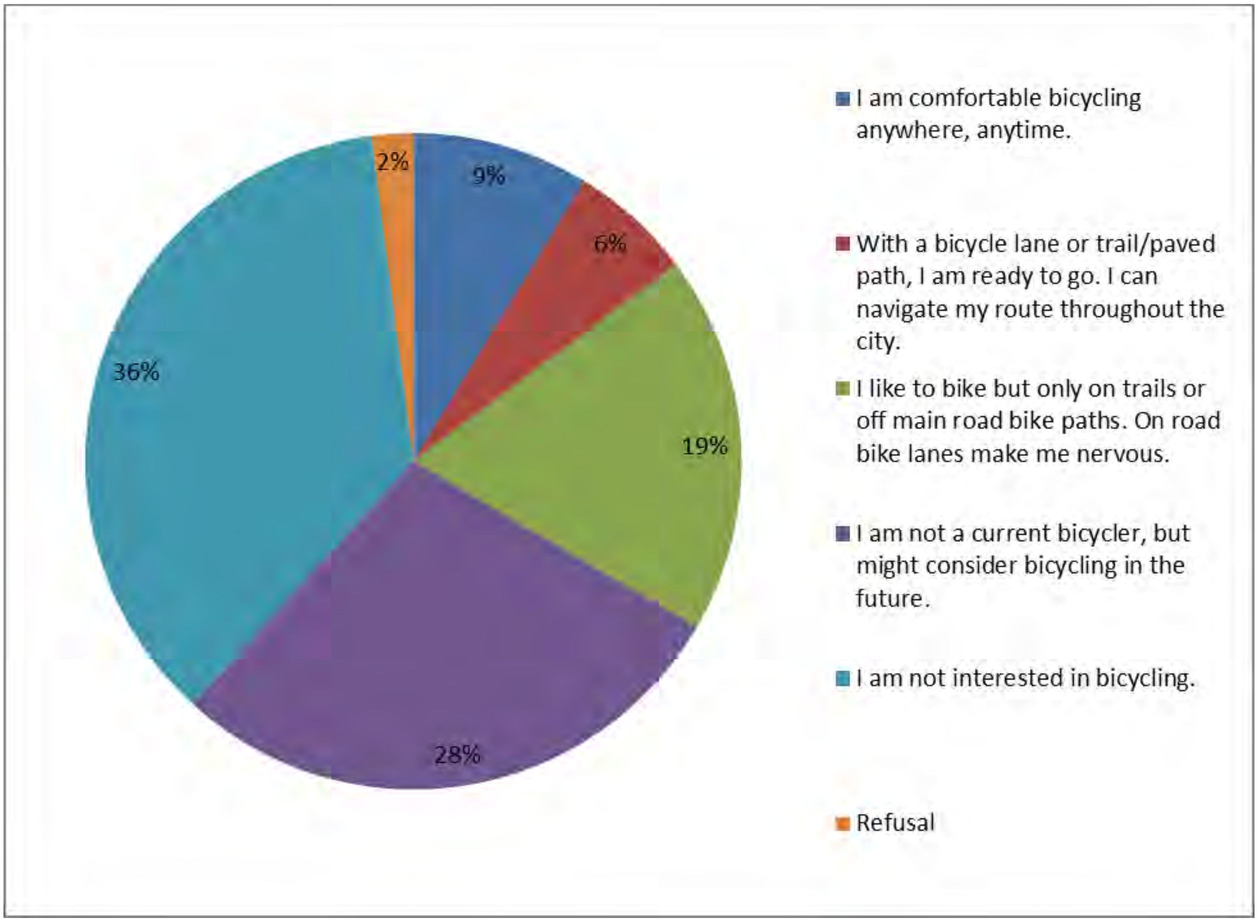


Figure 24. Biking Habits (N=1,556 Responses).

While a majority of respondents (84 percent) agree that bicycling is good for their health, a majority (54 percent) disagrees that they choose bicycling instead of driving whenever possible. Nearly half (47 percent) agreed that “bicycling means I don’t have to worry about parking.” More than one-third agreed that “bicycling is less stressful than driving” (38 percent) even though approximately one-third agreed that “bicycling takes too much time” (34 percent). See Figure 25 for further details.

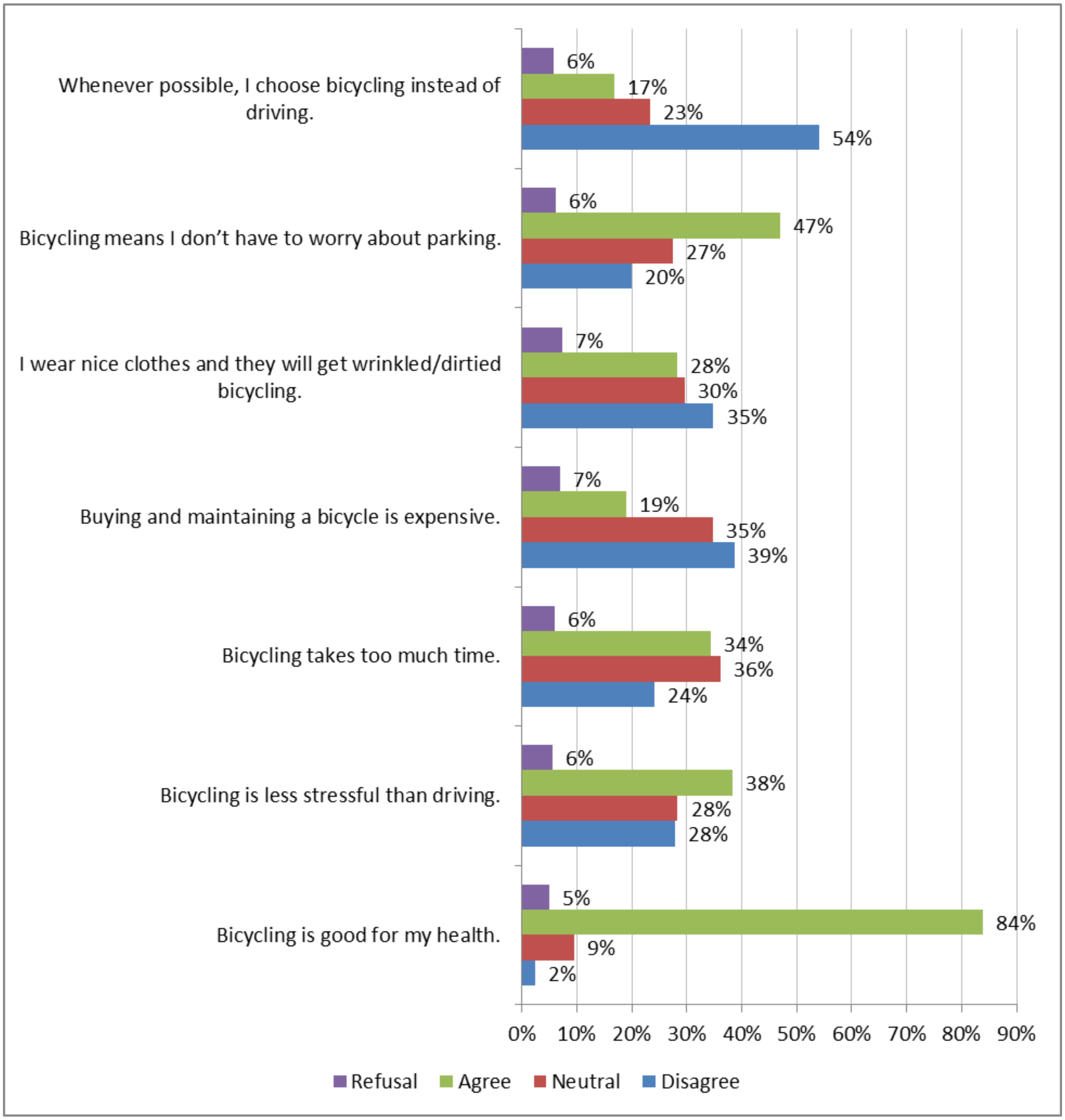


Figure 25. Bicycling Opinions (N=1,495).

Individuals may choose not to increase the number of bicycle trips they make for a number of reasons. When respondents were asked to identify the top three reasons they do not make any (more) bicycle trips, "not feeling safe from traffic" (25 percent of all responses), "too far a destination from biking" (20 percent of all responses), and "unable to carry personal items" (15 percent of all responses) were the most prevalent. See Figure 26 for other reasons why respondents choose not to make any (more) bicycle trips.

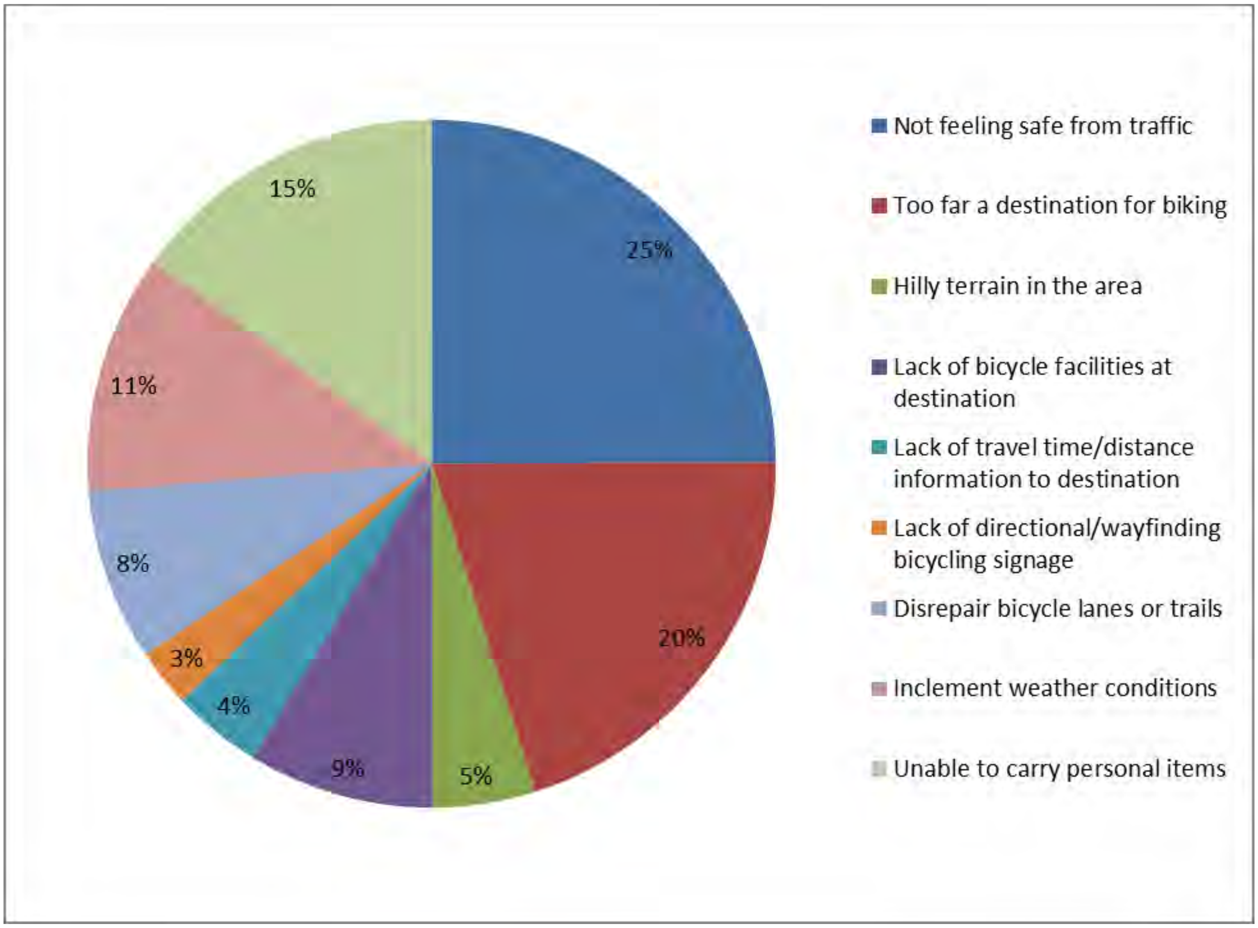


Figure 26. Factors That Prevent More Biking (N=3,390 Responses).

When presented with a list of potential influencers and asked which might most influence them to bicycle more, nearly 3 of 10 responses suggested that "nothing would encourage me to bike more" (29 percent of all responses). "More connected bicycle lanes" was identified as a significant influencer (26 percent of all responses), and "more aesthetics" (13 percent of all responses), "more available amenities" (12 percent of all responses), and "more business with bicycle storage facilities" (11 percent of all responses) were mentioned with almost equal frequency. See Figure 27 for further detail on potential biking influencers.

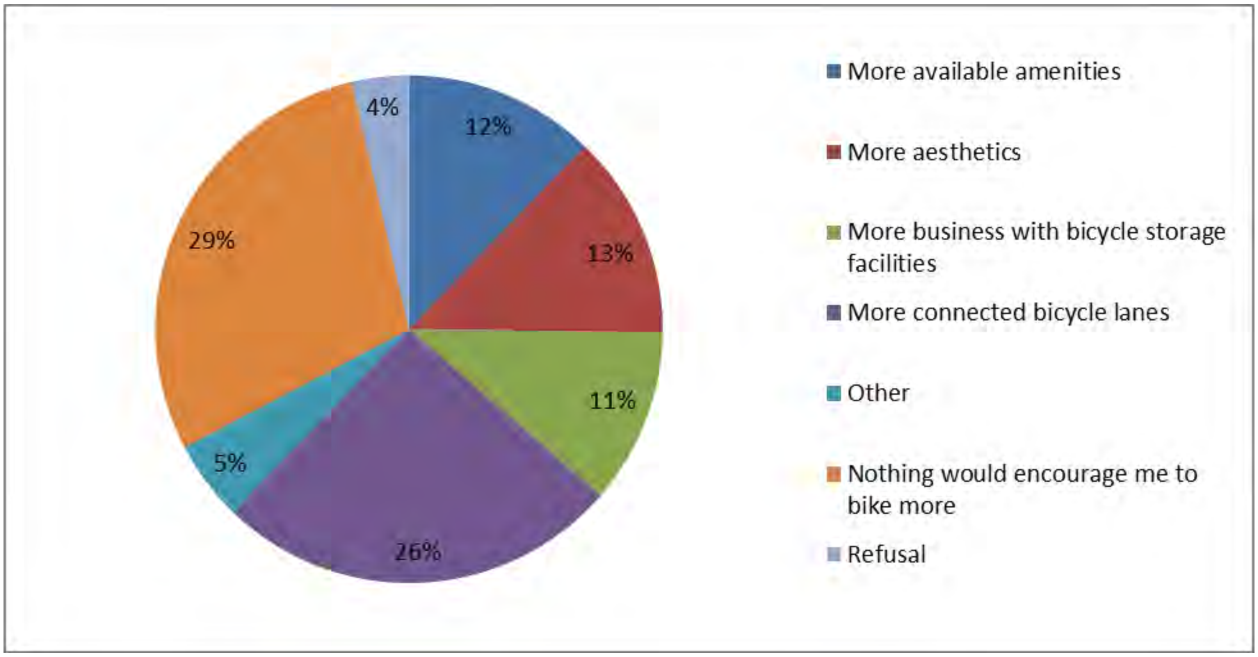


Figure 27. Factors That Could Lead to More Biking (N=1,860 Responses).

Survey participants were told that a bicycle share system is a transportation program designed for short distance point-to-point trips, where an individual can pick up a bicycle at one station and return it to another. They were then presented a list of potential influencers and asked to identify which would most motivate them to use a bicycle share system.

Figure 28 shows that the most often mentioned response (28 percent of all responses) was “nothing would encourage me to use a bicycle share system.” “Increases your overall health levels and physical condition” was mentioned in 23 percent of all responses, while “saves you money on transportation costs” was mentioned in 18 percent of all responses.

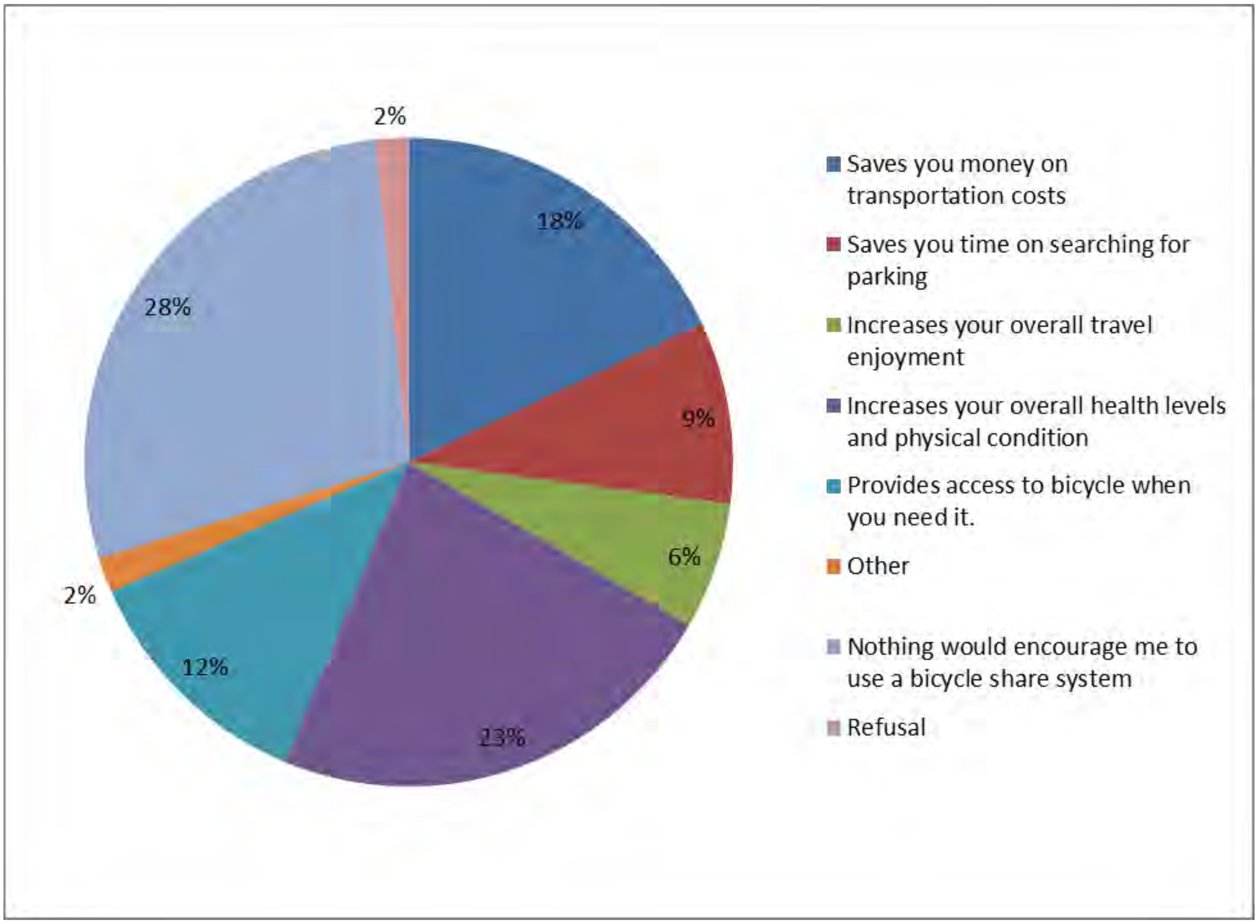


Figure 28. Factors That Influence Use of Bike Share Systems (N=1,929 Responses).

Walking Habits

At this point in the survey, respondents were asked to transition from thinking about their biking habits to their walking habits. A strong majority of respondents (96 percent) agrees that walking is good for health, and that "walking means I don't have to worry about parking" (72 percent). Nearly equal levels of agreement and disagreement were observed with the following statements: "whenever possible, I choose walking instead of driving," "walking takes too much time," and "walking exposes me to air pollution more than driving." See Figure 29 for further details.

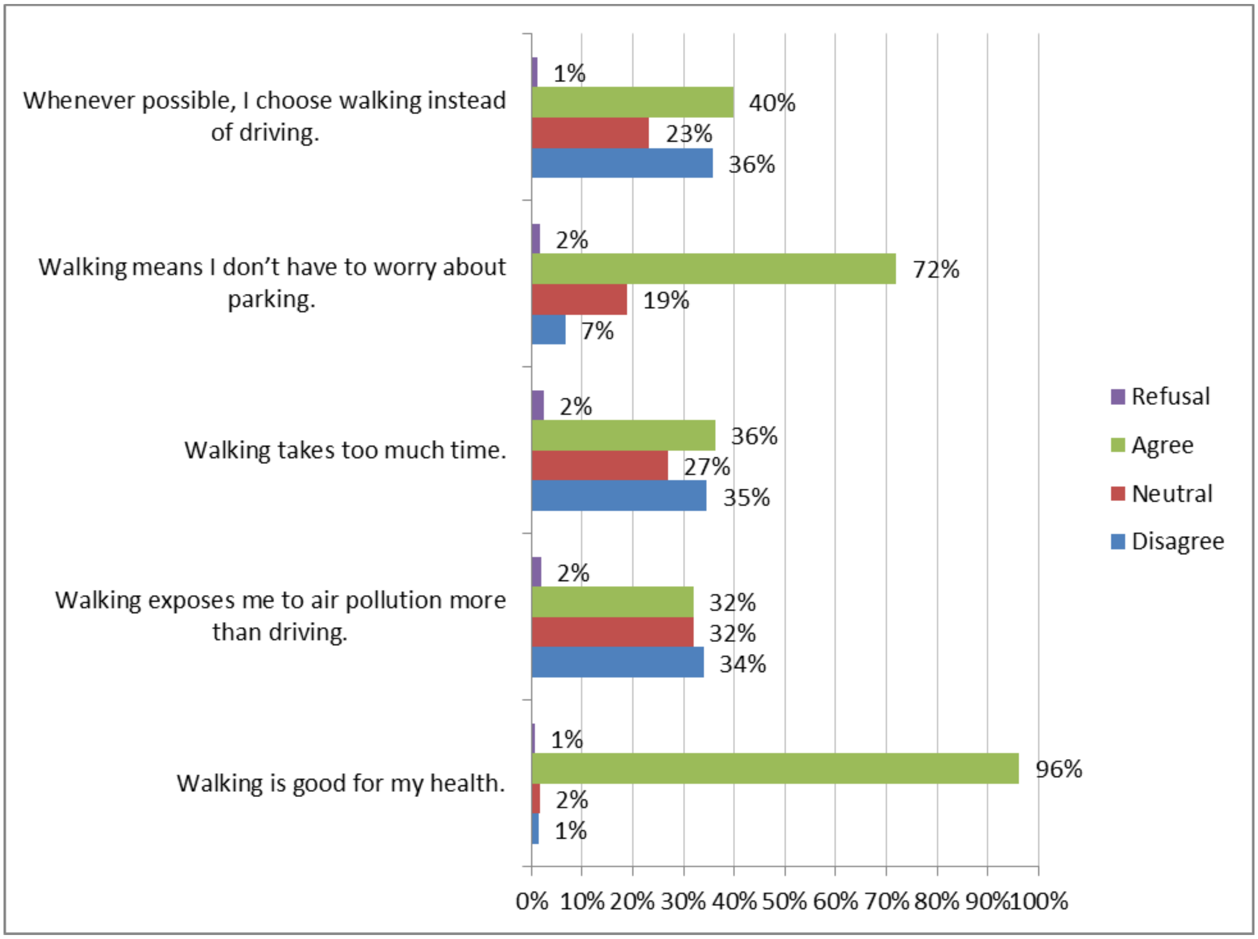


Figure 29. Walking Opinions (N=1,495).

Individuals may choose not to increase the number of walk trips they make for a number of reasons. When respondents were asked to identify the top three reasons they do not make any (more) walk trips, "not feeling safe from traffic" (23 percent of all responses), and "inclement weather conditions" (18 percent of all responses) were the primary and secondary reasons. "Unable to carry personal items" (14 percent of all responses) and "lack of sidewalks to destinations" (14 percent of all responses) were tied for third most prevalent. See Figure 30 for other reasons why respondents choose not to make any (more) walk trips.

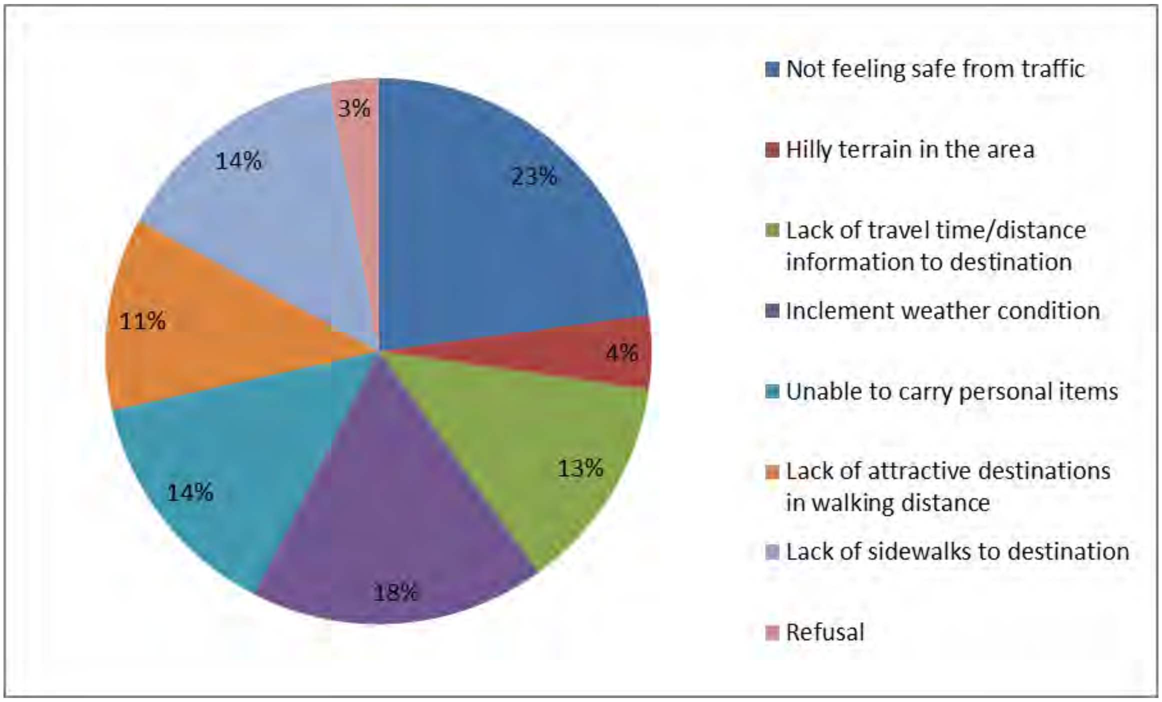


Figure 30. Factors That Prevent More Walking (N=3,501 Responses).

When presented with a list of potential influencers and asked which might most motivate them to walk more, nearly 3 of 10 responses suggested that "more available amenities" (28 percent of all responses). "More aesthetics" was identified as a significant influencer (25 percent of all responses), as was "more businesses with a walkable environment" (24 percent of all responses). See Figure 31 for further detail on potential walking influencers.

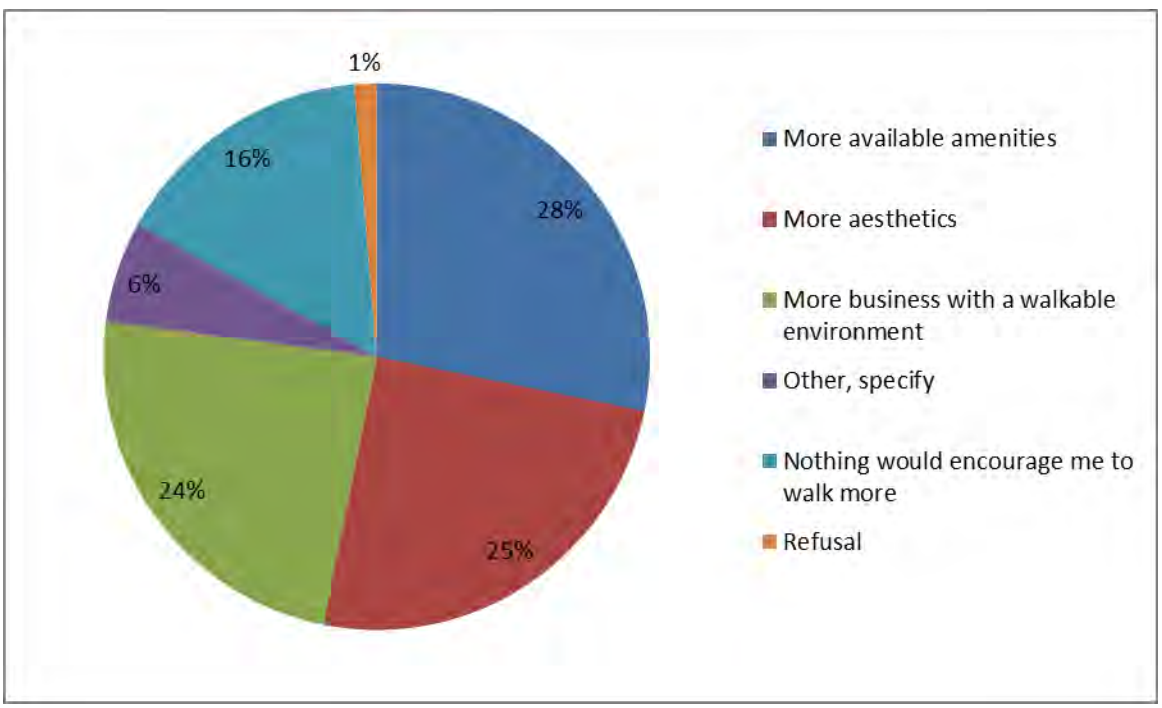


Figure 31. Factors That Could Lead to More Walking (N=1,913 Responses).

Public Transportation Habits

Following the battery of walking related questions, the survey instrument progressed to a brief section on respondent use and opinion of regional public transportation. Initially, survey participants were presented with a list of regional public transportation services and asked about their use of each. Figure 32 suggests that nearly 7 of 10 respondents (69 percent) had not used any of the presented services. Among the listed services, Sun Metro Regular Bus Service was the most frequently used (25 percent of all responses).

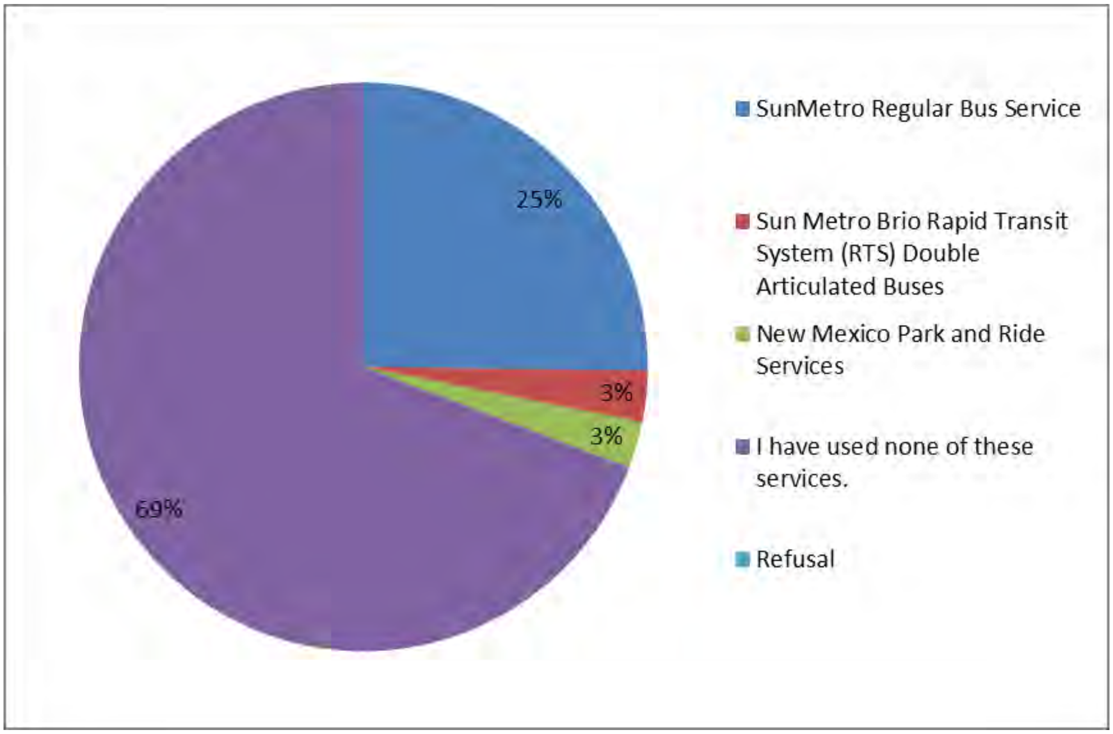


Figure 32. Use of Regional Public Transportation Services (N=1,524 Responses).

Next, respondents were presented a series of statements about regional public transportation services. Using a scale from 1 to 5, they were asked to assess their level of disagreement (1) or agreement (5) with each. Figure 33 suggests that "it takes longer than driving" was not only the statement that received the highest levels of agreement (60 percent) but also the lowest levels disagreement (9 percent). "It is not disability friendly" was not only the statement that received the highest levels of disagreement (42 percent) but also the lowest levels agreement (7 percent). This series of questions was characterized by fairly high levels of neutrality across the board (ranging from 20 percent to 46 percent). This may be a result of the high proportion of respondents that have never used any regional public transportation service (and lack knowledge thereof).

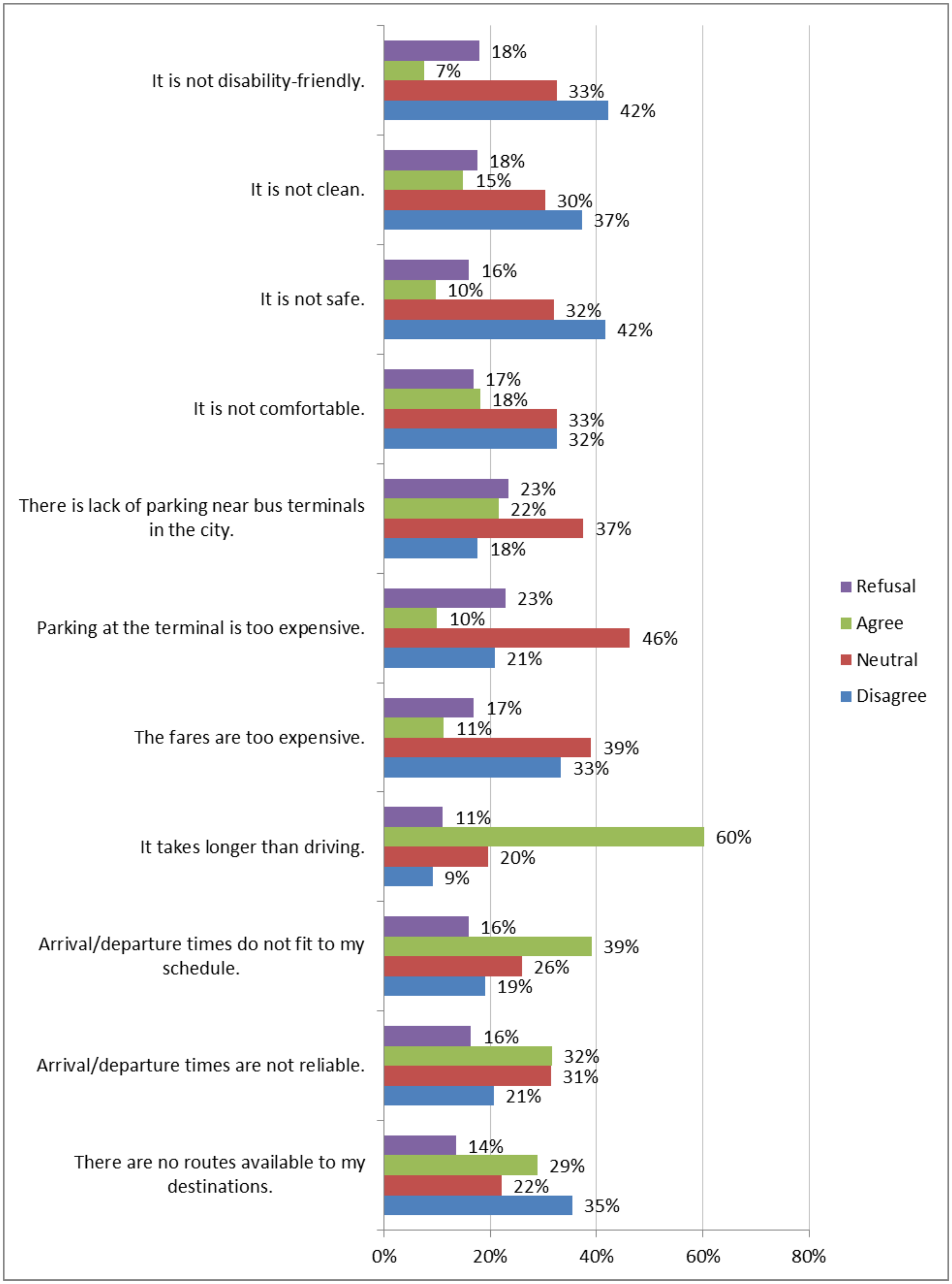


Figure 33. Opinion of Regional Public Transportation Services (N=1,495).

When asked about factors that might influence survey participants to use regional public transportation services more, respondents mentioned that "nothing would encourage me to use public transportation more" in 21 percent of their responses. "A stop closer to home or [my] destination" was mentioned in 20 percent of responses, and "more consistent arrival and departure times" constituted 13 percent of all responses. See Figure 34 for further details on factors that might influence participants to use regional public transportation services with greater frequency.

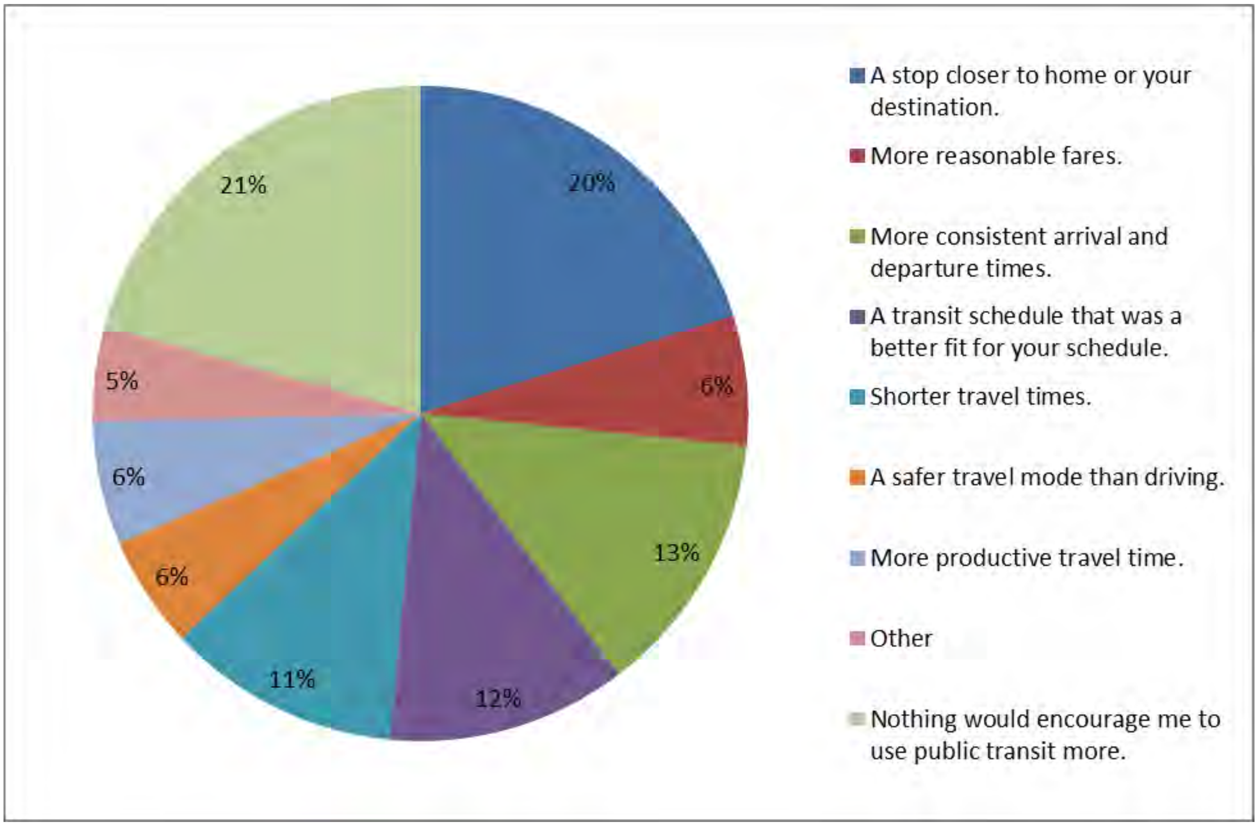


Figure 34. Factors That Could Lead to Increase Use of Public Transportation (N=2,227 Responses).

Well Being

Participants were asked two brief questions on their physical and mental well-being. Figure 35 suggests that one-third (33 percent) perceive their physical health as either excellent (9 percent) or very good (25 percent). Approximately 4 of 10 (41 percent) think their health is good, while the rest (25 percent) think their health is either fair (21 percent) or poor (4 percent).

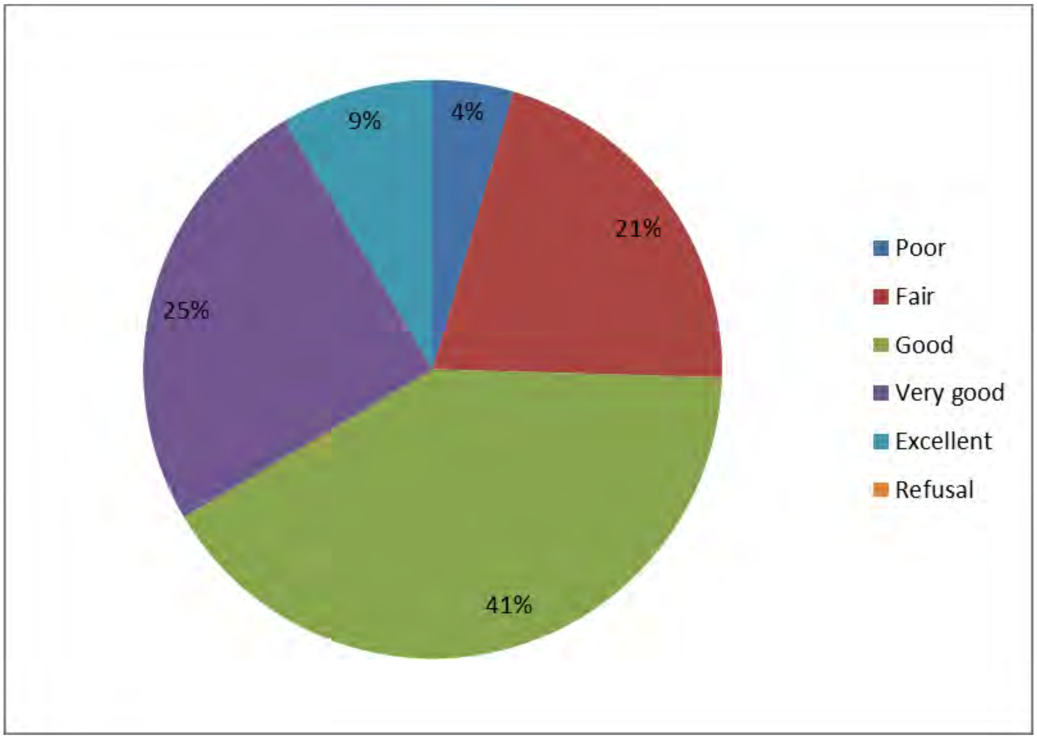


Figure 35. Assessment of Physical Health (N=1,495).

When asked about their mental well-being, approximately 8 of 10 (79 percent) said they were at least satisfied with their personal life, while only 5 percent were dissatisfied. Fifteen percent were neither satisfied nor dissatisfied with their personal life. See Figure 36 for detail.

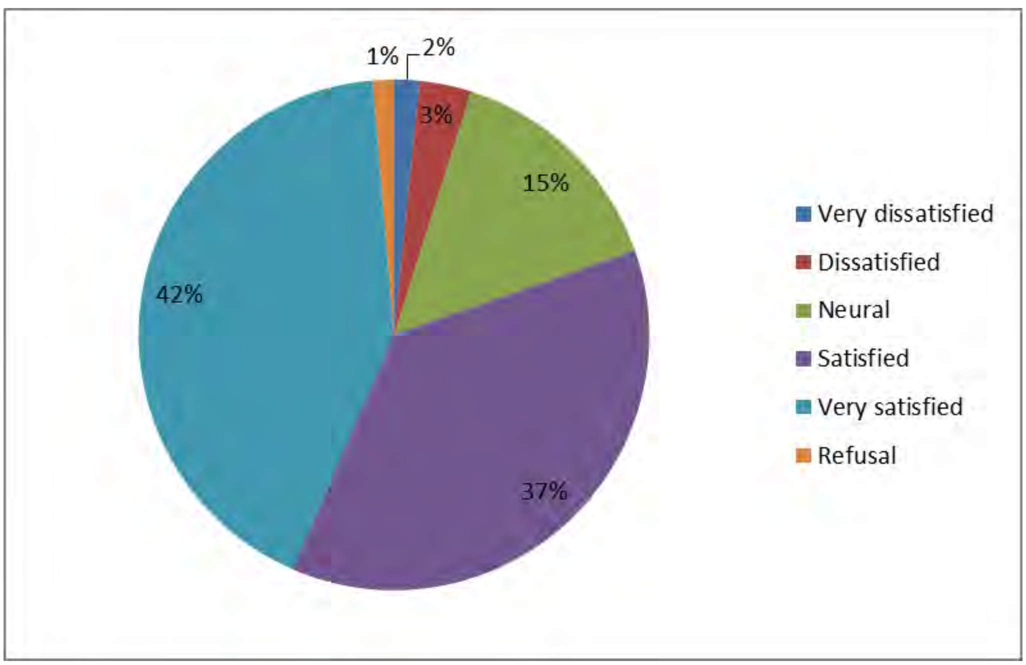


Figure 36. Assessment of Personal Life (N=1,495).

Finally, respondents were also asked for their weight and height. Using this information, the corresponding body mass index (BMI) was computed. More information on BMI can be found at http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm. Figure 37 shows the distribution of BMI categories. The results indicated that more than one-third (35 percent) of respondents were overweight. About 3 of 10 (29 percent) were normal weight and slightly less (28 percent) were obese. Six percent were underweight and 2 percent refused. See Figure 37 for further details.

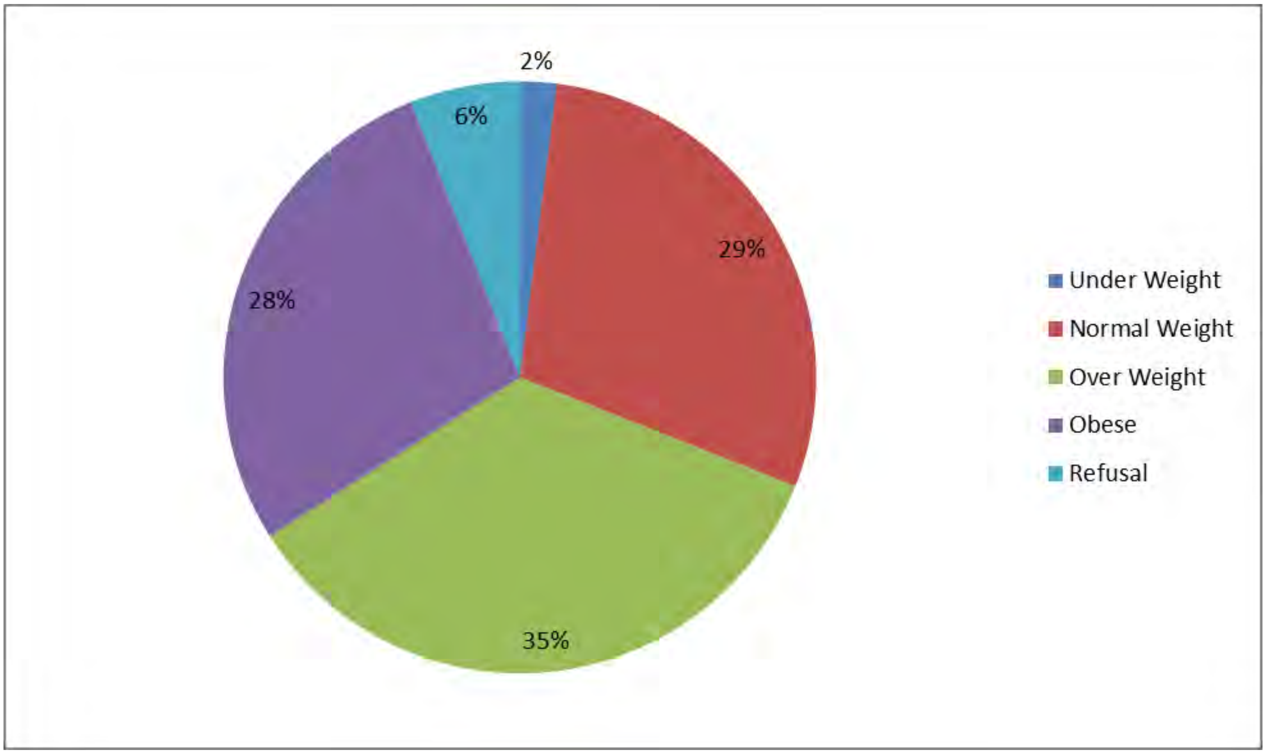


Figure 37. Body Mass Index (N=1,495).

Demographics

The final section of the survey asked respondents to provide a wealth of demographic information about not only themselves, but also their households. Table 7 presents a summary of the weighted survey demographic variables, and Figure 38 presents details on technology and social media use. These estimates suggest that approximately three-fourths of the population use (rarely, sometimes, often, or all of the time) "text messaging" (75 percent), "other internet searching" (74 percent), or "e-mailing" (74 percent). The least used option was a smartphone or transportation app (54 percent of respondents never using an app of this type).

Table 7. Demographic Distributions of Survey Participants (N=1,495).

Gender		***Relationship Status***	
Male	47%	*Single, never married*	22%
Female	53%	*Divorced*	8%
Ethnicity		*Married or domestic partnership*	55%
Hispanic	87%	*Separated*	3%
White/Caucasian	8%	*Widowed*	8%
African American	2%	*Refusal*	4%
American Indian/Alaska Native	1%	**Licensed Driver**	
Asian/East Indian	1%	*Yes*	87%
Native Hawaiian/Pacific Islander	0%	*No*	13%
Mixed Race - Non Hispanic	1%	**Household Vehicles**	
Annual Household Income		*0*	3%
Less than $15,000	15%	*1*	23%
$15,000–$24,999	18%	*2*	35%
$25,000–$34,999	15%	*3+*	34%
$35,000–$49,999	13%	*Refusal*	5%
$50,000–$74,999	15%	**Tenure**	
$75,000–$99,999	9%	*Own*	65%
$100,000–$124,999	4%	*Rent*	33%
$125,000–$149,999	4%	*Refusal*	2%
$150,000 or more	7%	**Household Size**	
Educational Attainment		*1*	11%
Less than high school diploma	23%	*2*	28%
High school graduate, diploma or equivalent	27%	*3*	19%
Some college, no degree	28%	*4+*	42%
Associates or technical degree	6%	**Household Workers**	
Bachelor's degree	11%	*0*	14%
Graduate or professional degree	5%	*1*	33%
Age		*2*	28%
18–24	22%	*3+*	15%
25–34	16%	*Refusal*	10%
35–44	16%		
45–54	17%		
55–64	12%		
65–74	13%		
75+	4%		

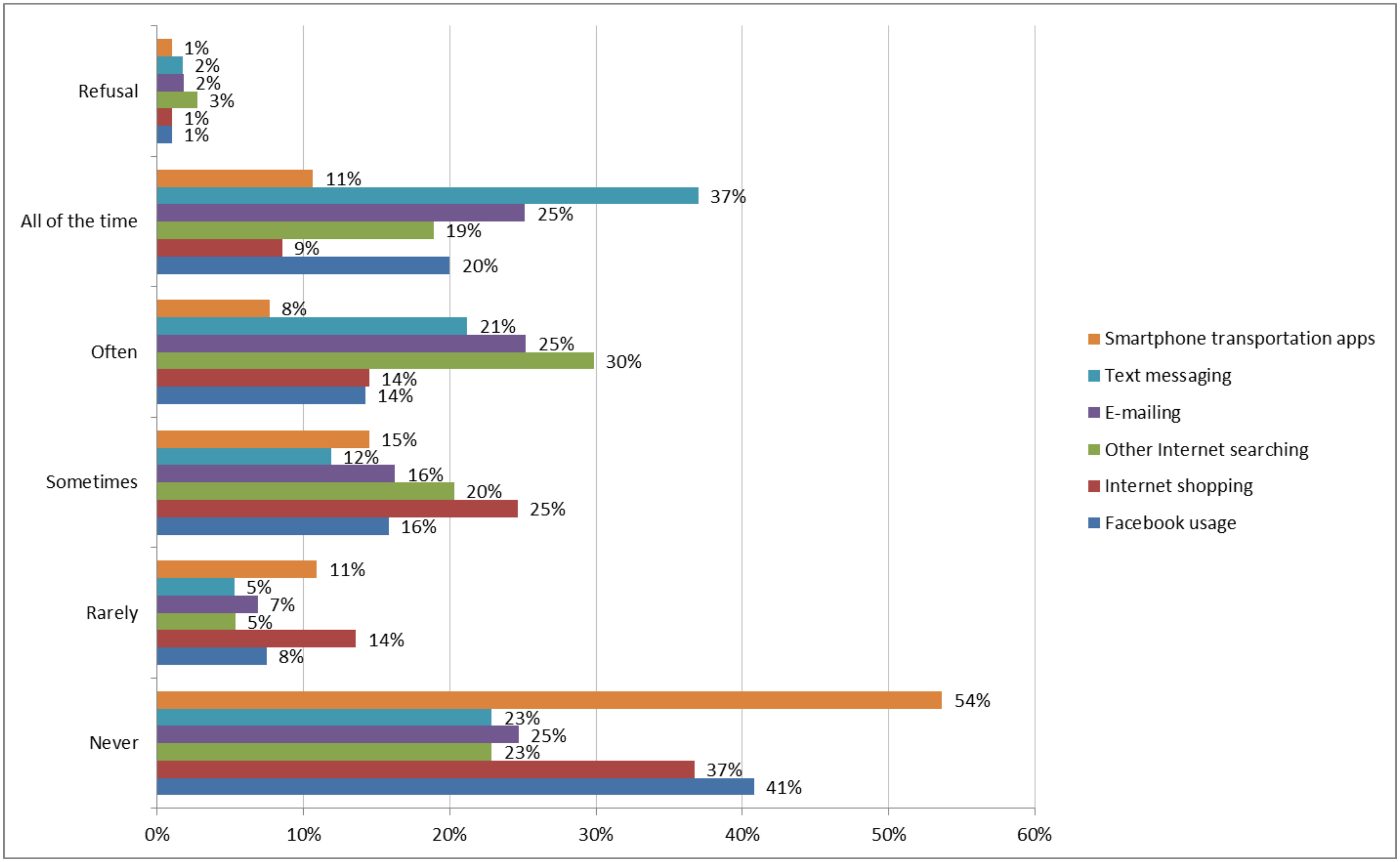


Figure 38. Technology and Social Media Use (N=1,495).

DISCUSSION

Travel behavior in Texas is strongly influenced by reliance on personal autos. The 2014 Texas Transportation Poll suggests that more than 9 of 10 Texans rely primarily on a personal auto as their primary means of transportation. The findings of the El Paso Multimodal Survey support this estimate. This strong reliance marginalized use of alternative modes like bicycling, walking, and public transportation.

Biking

Only approximately 1 of 20 respondents use a bicycle at least once per week on their work or school commute, and typical bike use for non-work trips drops to approximately 3 percent of respondents. While a significant segment of the population may never be convinced to use a bicycle for either commute or non-commute trips (38 percent of respondents are not interested in bicycling, and 36 percent of respondent said nothing would encourage them to bike more), the data suggest that bike use might increase among the balance of the population, if certain key areas are addressed.

Connectivity is a key issue that should be addressed. A majority (53 percent) disagreed that "there are connected bicycle paths beyond the neighborhood," and nearly a third (32 percent) of respondents reported that more connected bicycle lanes would most influence them to bicycle more.

Safety is another key concern for those who might be hesitant to depend more on biking as a means of transportation in the region. Sixty percent of respondents stated that safer biking routes would motivate them to try alternative mode, and nearly two-thirds (63 percent) of respondents reported "not feeling safe from traffic" prevented them from bicycling more. Transportation policy that addresses connectivity and safety may be more affective if accompanied by outreach that reinforces publicly held belief that "bicycling is good for health" (84 percent agreement), "bicycling means [you] don't have to worry about parking" (47 percent agreement) and, to a lesser extent, "bicycling is less stressful than driving" (38 percent agreement).

Walking

Many of the same attitudes and opinions observed in the biking section are also present with regard to walking. Walking is clearly more popular than biking, with 13 percent of respondents walking at least once per week on their work or school commute, and the same proportion reporting typically walking for their non-work trips. Again, **safety** is seen as a significant barrier to increase walking activity. Nearly three of four respondents (72 percent) agreed that "safer walking routes" would motivate them to consider alternative modes, and "not feeling safe from traffic" prevents a majority (52 percent) from walking more. The data suggest that **modification of the built environment** may increase walking in the region in a significant way. These modifications include "more available amenities"[2] (mentioned by 36 percent of respondents), "more aesthetics"[3] (32 percent of respondents), and "more business with walkable environments"

[2] Open green space, playgrounds, rest areas, etc.
[3] More trees, colorful lighting, etc.

(31 percent of respondents). Similar to biking, public outreach highlighting the benefits of walking (primarily, health benefits and removal of parking need) may increase the efficacy of transportation policy changes that are made to increase walking.

Public Transportation

Eight percent reported using public transportation at least once per week on their work or school commute, and an equal proportion reported typically taking public transportation on their non-work trips. It is somewhat paradoxical that while nearly one-third of respondents (31 percent) stated that “nothing would encourage me to use public transportation more” and 7 of 10 respondents have never used any of the listed public transportation services identified in the survey, 72 percent agree that “transit should be the focus for future transportation infrastructure.” These findings, while seemingly inconsistent, are similar to those of the 2014 Texas Transportation Poll, where only 6 percent of registered voters reported using public transportation as their primary means of travel, yet a majority supported investing more public tax dollars in public transportation. While further research is needed to better understand the underlying reasons for high levels of public transportation support, **the findings of the El Paso Multimodal Survey suggest that regional residents see value in regional public transportation.** The data also suggest that respondents may be more apt to use transit, if a stop was closer to their origin and/or destination, if they had improved access to park and ride facilities, and/or if they perceived transit service as more reliable.

CHAPTER 4: FACTORS INFLUENCING ACTIVE TRAVEL: A LITERATURE REVIEW

INTRODUCTION

This chapter summarizes a literature review focused on active travel, which provides additional input for the overall Multimodal Plan. For planners and policy makers interested in improving rates of active transportation, it is first necessary to understand the underlying reasons why active transportation is underused. This chapter examines factors that might affect the decision to walk or bicycle, including the sociodemographic characteristics of active travelers, along with the neighborhood environment, personal, and social factors that affect the decision to use active travel. Policy interventions that can address these factors and encourage active travel are also explored.

BACKGROUND

For the individual, automobiles are a relatively fast, convenient, and reliable mode of transport. On the other hand, it is also undeniable that at a system-wide level, the massive popularity of the automobile is problematic in a number of ways. Growing urban centers are placing more and more cars on constrained transportation networks, resulting in increasingly congested roads. This congestion only exacerbates the automobile's environmental footprint in terms of air pollution, water pollution, and climate change (*32*). From a public health perspective, vehicle accidents are one of the leading causes of death worldwide (*33*) and vehicle emissions contribute to various respiratory and health ailments (*34*, *35*). Additionally, research indicates that there is an association between the amount of time spent driving and being overweight (*36*).

In response to these issues, policy makers are placing an increased emphasis on reducing automobile dependency and encouraging the use of alternative modes of transportation, particularly active transportation modes like walking and bicycling. In addition to being superior to automobiles from an environmental sustainability standpoint, active travel has been linked with higher levels of physical activity and improved health outcomes internationally and at multiple population-level scales of analysis (*37*).

Despite their benefits, rates of walking and bicycling remain low in many cities and countries around the world, including the United States (*38*). Specifically, in El Paso, active travel rates are lower than many other similarly sized urban areas. A 1994 household travel survey revealed that El Paso residents conducted 83 percent of their trips by private vehicle, in comparison to 12 percent of trips by walking (*39*). More recently, American Community Survey data revealed that the vast majority (93 percent) of workers in El Paso drive for their commute (*40*). Nearly 10 percent of these trips are shorter than 10 minutes in length, indicating the potential for a switch to alternative modes. In conjunction with the low rate of active travel, health remains a crucial issue for the City of El Paso as 67.5 percent of residents are overweight or obese and 28.3 percent report zero incidences of leisure time physical activity in the previous month (*41*). Even more strikingly, nearly one quarter of residents (22.8 percent) were without health insurance in 2014 (*42*). These figures point to the value of public health interventions in this region targeting physical activity improvement, which can be greatly facilitated through improvements in active travel.

ACTIVE TRAVEL DECISION: INFLUENTIAL FACTORS

Sociodemographic Characteristics of Active Travelers

Numerous studies have identified utilitarian walkers and bicyclists as having a distinct sociodemographic profile compared to non-active travelers. For example, Agrawal and Schimek modeled walking trips by U.S. travelers using 2001 National Household Travel Survey data, revealing that those who walked for transportation were more likely to be younger, more educated, and have a lower income (*43*). It is not surprising that younger travelers—in particular those not yet able to drive—are more likely to walk given their lower levels of accessibility to other modes. On the opposite end of the age spectrum, walking can be a physically challenging activity for older population groups, thereby increasing the relative utility of motorized modes. The study additionally found that females had a higher likelihood of walking for transportation than males, though other studies have discovered the opposite effect (*44*, *45*). The positive association between education and walking runs counter to the findings of Reis et al. (*46*), though in the latter study, education may have served as an indicator for income, which was not accounted for in their model. In general, walking is more closely linked with lower-income travelers who may not have the same luxury of mode choice as their higher-income counterparts. In a similar vein, unemployment has been linked to a higher walking likelihood in Taiwan (*47*).

Some of the sociodemographic characteristics associated with bicycling for transportation are the same as those for walking, though in other respects the modes differ. Nearly universally, studies have found that utilitarian bicyclists tend to be younger and are predominantly male (*44*, *45*, *48*, *49*). Where bicycling tends to diverge more from walking is in terms of socio-economic effects. Models of utilitarian bicyclists suggest that bicycling for transportation is positively related to income (*50*) and education level (*44*, *45*, *49*). Importantly, these effects may depend on the context of the study area. For example, studies from South America have reported that less-educated travelers (with education likely being indicative of income level) were more likely to conduct trips by bicycle (*46, 48*). These findings make sense in middle-income countries like Columbia and Brazil where bicyclists may be more likely to have chosen their mode out of necessity rather than preference.

Neighborhood Environment Factors

Reviews of utilitarian walking and bicycling associations reveal significant associations between the built environment and active travel. Active travel tends to be more prevalent in urbanized areas where greater residential density, land use mix, connectivity, and transit accessibility are consistently linked with higher rates of utilitarian walking and bicycling (*51*, *52*). Additionally, accessibility to nearby opportunities has a positive relationship with active travel participation. Walking and bicycling rates are higher in areas with good access to attractive destinations such as stores, essential services, and employment centers (*50*, *53*). Situating people and attractive destinations in close proximity and connecting them with direct, convenient routes dramatically increases the utility of walking or bicycling. In contrast, sprawl and auto-oriented network design tend to isolate residents and result in vehicle-dominated roads and neighborhoods.

Distance

Among route characteristics, distance is frequently cited as one of the most significant factors influencing the active mode choice decision (*44*, *49*, *54*, *55*). Because of the relatively slow speeds for walking and bicycling, these modes are particularly sensitive to travel distance. In the rural United States, where destinations are widely spaced and the underlying infrastructure is vehicle-supportive, driving maintains a high utility for the vast majority of trips (*56*). In more urbanized areas, as trip distances shorten and roads become more congested, active modes become much more competitive.

Infrastructure

Unsurprisingly, the availability of bicycle and pedestrian infrastructure such as bicycle lanes or sidewalks is associated with active travel rates (*57*, *58*, *59*). Positive perceptions of neighborhood active travel facilities have also been linked to a stronger likelihood of bicycling (*47*) and walking for transportation (*60*). Other bicycle-supportive amenities may also influence bicycle travel rates. Yang et al. determined that workers in Missouri were more likely to actively commute to workplaces that provided facilities to lock a bicycle (*55*). In contrast to these findings, workplace bicycle amenities had no effect on bicycle commuting likelihood in a study of six small U.S. cities (*61*). Some studies have found small or negligible effects for the provision of pedestrian infrastructure on walking (*62*). It may be the case that bicycle trips are more sensitive to the provision of infrastructure than walking trips. In the United States, where bicyclists tend to be higher-income travelers, it is possible that bicyclists have more travel options available to them than those relying on walking for transportation.

Weather and Terrain

Similarly, bicycling may be more affected by weather-related factors than walking trips. Studies in various climates, such as Vermont, Portland (Oregon), and Melbourne, have indicated that there is a greater likelihood of bicycle travel on warmer days without precipitation (*63*, *64*). Another study conducted in the UK indicated that inclement weather and hills were among the primary barriers to bicycling cited by new cyclists (*65*). While not an issue for flatter study areas, research from hilly cities indicates that the presence of hills is a significant deterrent for cyclists (*48, 49*). For pedestrians, weather effects are less clear. Humpel et al. determined that weather influenced recreational walking, but not walking for transportation (*66*). It is likely that recreational trips are more discretionary—and more prone to external influence—than utilitarian cycling, which is more characterized by invariant obligatory trips. Other studies have linked weather-related variables to walking rates (*67*, *68*), but their aggregation of all walking trips makes it difficult to determine the association with utilitarian trips.

Safety

Neighborhood environment factors may be especially impactful to active travel modes simply due to the higher degree of environmental exposure for pedestrians and bicyclists in comparison to vehicle users. For this reason, researchers have examined neighborhood safety perceptions and measures as a possible deterrent to active travel. Contrary to expectation, Shigematsu et al. reported an inverse relationship between transportation walking and perceived safety from crime in Seattle, Washington, though safety from traffic had the expected sign (*59*). Another study revealed that perceived safety from crime was associated with more frequent walking but did not distinguish between recreational and utilitarian trips (*69*). As with the effects of weather, walking for transportation appears to be less sensitive to safety effects than recreational walking (*70*), while Pikora et al. (*71*) found no relationship between safety and recreational or utilitarian walking trips. Corroborating these findings, a review of European research found little to no impact for safety from crime or traffic on bicycling or walking for transportation (*53*). Another review conducted by Foster and Giles-Corti revealed mixed findings on the relationship between safety and walking (*72*). Effects appeared to be strongest for populations more vulnerable to crime, such as women and older adults.

Aesthetics

Neighborhood aesthetics could support active modes by providing a more pleasant environment in which to travel, though generally that does not appear to be the case. Liao et al. linked positive perceptions of neighborhood aesthetics to utilitarian bicycling rates, but otherwise effects appear to be negligible (*47*). Aesthetics have been linked to recreational walking, but most studies have found no effect on walking or bicycling for transportation (*53, 66, 70, 71*).

Broadly speaking, many neighborhood environment attributes—such as population density, pedestrian infrastructure, and land use mix—contribute to walkability. Walkability represents the attractiveness and ease of walking, and pedestrians rate walkable neighborhoods as being safer, more attractive, and having more pleasant social environments (*73*). Walkability has been associated with utilitarian walking and bicycling in New York City (*74*) and walking for transportation in Curitiba, Brazil (*46*), and Perth, Australia (*71*).

Personal Factors

Beyond the more easily measurable physical environment factors, there are many personal motivations and barriers influencing active mode choice. Travelers may opt to walk or bike to a destination for the perceived health benefits, or perhaps drive due to physical limitations. Giles-Corti and Donovan found that individual cognitive factors like attitude and behavioral control can contribute to the odds of walking (*75*). Another study of walkers in major urban areas of the United States revealed that personal values toward walkable neighborhoods and the environment were significantly associated with walking for transportation (*76*).

Bicycling is also influenced by personal factors and is unlikely to be taken up by those with a negative attitude toward it or lacking the skill or confidence to engage in it. A review of the effects of psychological factors on utilitarian bicycling supports this notion, as attitudes toward cycling, perceived ability and safety, and habits are consistently found to influence the decision to bicycle (*77*). Handy and Xing found that comfort with bicycling and bicycling enjoyment substantially influenced the odds of commuting by bicycle in several small U.S. cities (*61*). Heesch et al. also incorporated psychological factors in their model of bicycling behavior, revealing that self-efficacy and a positive attitude toward physical activity, as well as habitual physical activity behavior, significantly improved the odds of utilitarian cycling (*50*). These factors are all closely linked with the idea of cycling identity, which Lois et al. revealed can play an important role in influencing bicycle commuting intention (*78*). For avid bicycle commuters, self-identification as a bicyclist may be a source of pride and bring about added satisfaction, while non-bicyclists may feel intimidated or repelled by their perceived image of bicycling.

The active travel decision is complex and oftentimes unpredictable because travelers are not necessarily rational economic decision makers. Interviews with commuters in the UK found that there are often many difficulties to determine factors that can result in choosing one mode over another (*79*). For example, some former bicycle commuters were forced to switch their primary mode to driving after the birth of a child, despite a desire to continue bicycling. Other commuters may stay with the same commute mode—despite a potentially higher utility from another mode—simply out of habit.

It can also be instructive to segment travelers depending on their stated willingness to walk or bicycle in order to better understand how to motivate active travelers and non-active travelers alike. Taking this approach, Nkurunziza et al. differentiated respondents in Dar-es-Salaam, Tanzania, by cycling level (*80*). Non-cyclists who expressed an interest in bicycling demonstrated a lack of confidence in their bicycling skills and tended to be concerned with bicycle cost, commute distance, and a lack of showers at work. Existing cyclists responded to a different set of determinants that were primarily utilitarian route characteristics such as bike lanes and distance. Corroborating this work, Bopp et al. confirmed that non-active commuters tend to be less-confident in their bicycling skills than active commuters in the mid-Atlantic region of the United States (*81*).

Social Factors

A growing body of research is now linking walking and bicycling with social influences, as personal and environmental factors by themselves are not necessarily sufficient to explain active travel behavior (*77*). A study of travelers in Perth, Australia, indicated that social environmental influences, such as frequency of engagement in group physical activities, may be nearly as significant to walking as individual or physical factors (*75*). The attitudes of members of one's social group have also been found to affect individual mode choice preferences. Bopp et al. determined that the normative beliefs of one's spouse or co-workers on active commuting had a significant impact on the decision to actively commute to work in the Mid-Atlantic United States (*81*). Similarly, a socially supportive environment increased the odds of being a utilitarian bicyclist (*50*) and walker (*70*) in Australia. Open-ended discussions with walkers in Salt Lake City, Utah, also indicate that more walkable environments tend to be described as having a more positive social environment (*73*).

On the other hand, a negative social environment can discourage bicycle participation. For example, social apprehension was a barrier for non-bicyclists in Dar-es-Salaam, Tanzania, where bicycling has relatively negative connotations (*80*). Compared to more bicycle-supportive areas, bicycling was considered by many to be an activity conducted by poorer travelers. Another study from the United States found that rates of bicycling to work were lower when one's employer disapproved of bicycle commuting, while workplace alternative travel incentives and co-worker orientation had no effect (*61*). Beyond internal cognitive motivations and barriers, external psychological factors can strongly influence active travel behavior.

ACTIVE TRAVEL INTERVENTIONS

There are many interventions that can address the aforementioned motivators and deterrents of active travel and the appropriate strategy will depend on location-specific contextual factors. Ogilvie et al. found that most successful walking interventions have targeted sedentary individuals or travelers who were already interested in walking more (*82*). Additionally, many provided resources or incentives that were customized to the particular neighborhood or population in question. Another review revealed that walking interventions may be most effective when working at both the individual and community levels (e.g., targeted telephone or email-based promotion in conjunction with a mass media campaign) (*83*). A review of bicycle interventions provided a similar recommendation, noting that a combination approach of interventions was most successful in altering bicycling rates. For instance, the provision of a bicycle lane will be significantly more effective when joined with other bicycling amenities, publicity, educational materials, and promotions. Often the effects of a single intervention are small, while the most substantive gains are seen when a comprehensive multilayered approach is taken (*84*), which might be the case given the diversity and unique nature of El Paso.

Most obviously, the installation of sidewalks, bicycle lanes, or other active travel infrastructure elements will encourage active mode choice. The installation of cycle centers is another way to address some of the practical barriers associated with bicycling. Cycle centers such as Bikestation in the United States or cycle2city in Australia provide bicycle amenities such as secure parking, lockers, or showers (*85*). For many commuters, bicycling is impractical because their workplaces do not provide secure storage facilities or a way for them to change or shower. Cycle centers alleviate these barriers and make bicycling a more attractive mode alternative.

Bikesharing is another strategy being used by cities in recent years to help overcome bicycle ownership barriers such as up-front fixed-costs. These short-term bicycle rental systems can be especially effective when paired with transit to better connect bus and rail users by increasing the effective travel shed of transit stops. In 2011, bikesharing programs existed in over 160 cities around the world (*86*). The City of El Paso recently implemented its own bikesharing program in September 2015, with eight stations located near downtown and the university.

Beyond these physical investments, there are other softer approaches that can help encourage active mode use, which include education, marketing, and regulation and financial incentives.

Education

For some, a lack of knowledge may inhibit feelings of self-efficacy and discourage travel by active modes. The TravelSmart program from Perth, Australia, aimed to overcome these barriers by providing bicycle training sessions to employees at their workplace. Analysis of participants indicated that they were more confident bicyclists and commuted more frequently by bicycle following participation in the program (*87*). Sometimes providing an introduction to an active travel mode can be enough to bring about mode adoption. For example, a study conducted by Gatersleben and Appleton had non-bicyclists participate in a two-week bicycling trial, effectively acting as an intervention program (*65*). Follow-up surveys indicated that 8 out of the 22 participants planned to continue bicycling in the future. Mutrie et al. took a less involved approach by providing paper educational materials to workers (*88*). The materials included maps, route information, information on local active travel organizations, and other practical information to support walking and bicycling. Follow-up commute survey data revealed that the intervention appeared to be successful in improving rates of walking to work but had no effect on bicycling, suggesting that the barriers to cycling may be more challenging to overcome.

Marketing

Another strategy is to raise the awareness of the benefits or opportunity for active travel. For example, Reger-Nash et al. used a participatory communitywide process to develop mass-media campaigns promoting walking (*89*). Many media strategies were implemented, including targeted advertisements and promotional websites. Similarly, Wen et al. successfully introduced a targeted marketing campaign at the workplace level to promote active travel (*90*). Results of the intervention revealed reduced levels of vehicle use and increase active commuting rates. The Walk to Work Day media campaign in Australia also resulted in higher walking rates, but as with many interventions, it is unclear whether the program had any lasting long-term benefits (*91*).

Regulation and Financial Incentives

Regulation and financial incentives may also be used by policy makers to either directly encourage active mode use or indirectly do so by discouraging the use of vehicle modes. For instance, increased parking restrictions at the University of Bristol appeared to discourage driving among workers, leading to increased rates of commuting by walking and bicycling (*92*). Money is the great motivator, and strategies such as road pricing schemes or gasoline taxes can be used as a tool to disincentivize vehicle travel and make active modes more competitive (*93*). Similarly, money can be a positive motivator for active travel. The Cycle to Work program in the UK is one such scheme, which worked with employers to minimize the up-front costs of bicycle purchases for employees (*94*).

CONCLUSIONS

This literature review reveals that neighborhood environment, personal and social factors work together to influence active travel participation. For cities looking to increase rates of walking or bicycling, understanding the barriers and motivators is an important first step in designing effective active travel programs and interventions. To address neighborhood environment barriers, it is necessary to upgrade the physical infrastructure. Improvements, such as installing pedestrian and bicycle facilities or improving connectivity, encourage walking and bicycling by creating a more supportive active travel built environment. Because cost and political constraints can derail these types of physical interventions, policy interventions aimed at addressing personal and social barriers to cycling can be an attractive alternative. These include educational programs, marketing and promotion, regulatory measures, and financial incentives. There are various policy measures used to encourage active travel, and not one correct solution but the most effective strategies tend to be customized to the specific target population, work at both the individual and community levels, and incorporate a combination of intervention methods.

CHAPTER 5:
EXAMINING EL PASO MULTIMODAL BEHAVIOR: A FOCUS ON ACTIVE TRAVEL

INTRODUCTION

This chapter summarizes the work and findings of the behavioral analysis conducted using the El Paso Multimodal Survey data. This report provides several insights in understanding mode choice behavior, with particular focus on active travel. Researchers:

- Performed bivariate descriptive analyses to better understand travel mode characteristics of survey respondents. Patterns of mode split were examined by demographic characteristic, attitudes, and wellbeing.
- Explored additional insights on active travel by developing a detailed look at the attitudes toward active travel as well as deterrents and motivators of active travel. Participant responses were also aggregated by home zip code and mapped to identify differences in the spatial patterns of active travel in the study area (Figure 39).
- Developed several multivariate models to better understand active travel behavior. The factors associated with active travel for commute and non-commute trip purposes were examined. An additional analysis of bicycling orientation was also conducted to understand the difference between existing and potential bicyclists.

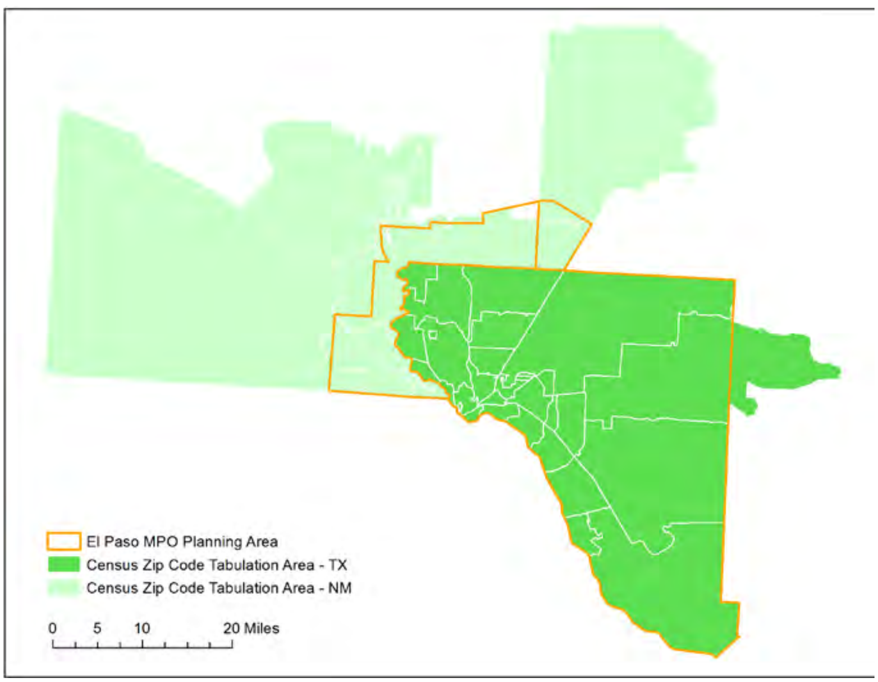


Figure 39. Census Zip Code Tabulation Areas (ZCTAs) in Study Area.[4]

[4] Due to sample sizes too small to calculate summary statistics in some of these areas, the maps presented in the rest of this report omit several ZCTAs.

EXAMINATION OF TRAVEL MODE

Survey participants responded to questions about their mode of transportation. Driving alone was the dominant travel mode. More than 80 percent of respondents indicated commuting by SOV at least once a week. Though at a relatively lower percentage compared to commute trips, SOV was also the most frequently used mode of transportation for non-work trips (more than 60 percent).

Figure 40 presents the differences in commute-mode frequency by self-reported commute trip distance for different modes of travel. Median trip distances tended to be shortest for bicyclists and pedestrians. Commute distance for pedestrians declined with increasing frequency, though the median trip distance for commuters walking every day was still 5 miles. Motorized modes tended to be more strongly associated with commuters traveling longer distances. In particular, commuters traveling by carpool more than 3 days a week had median trip distances of over 20 miles. These longer-distance commuters appeared to be more willing to take advantage of the shared costs and responsibilities associated with carpooling.

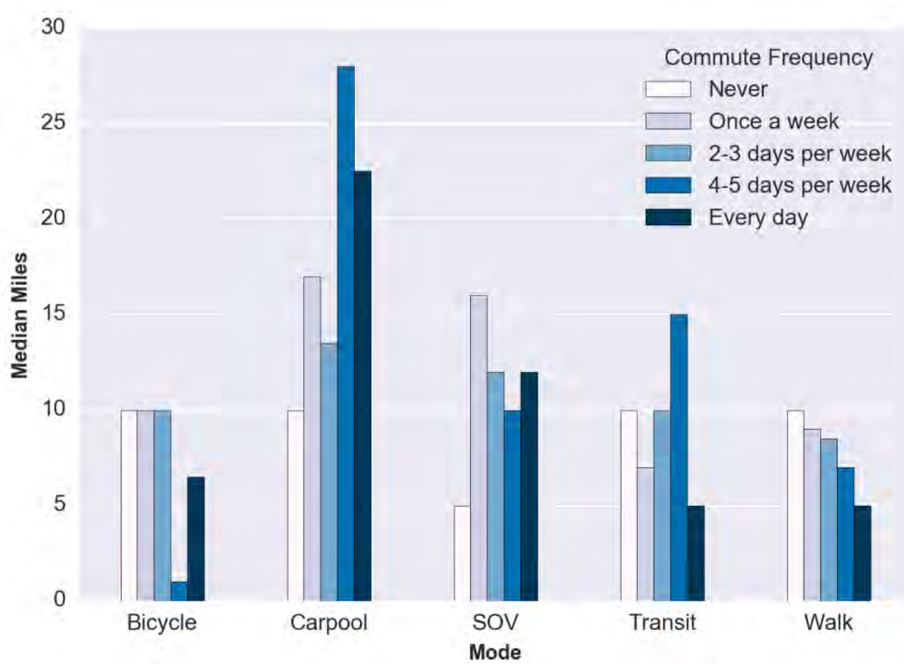


Figure 40. Commute Distance by Mode and Frequency.

Mode Split by Demographic Characteristics

Mode split was examined for four demographic characteristics—age, gender, ethnicity, and household income—for both commuting and non-commuting purposes. In general, the results did not show substantial variations across different market segments.

Figure 41 presents the mode split by age categories. For commuters to work or school, mode split was similar for age groups over 30. The biggest disparity was seen in the youngest age bracket. Respondents 18–29 years old had the lowest rate of commuting by SOV (89.8 percent commuted by SOV at least once a week) but the highest commuting rates for the other modes (bicycle, carpool, transit, and walk). These mode-share patterns differed upon analyzing non-commute trips.

Carpooling and transit were still most prevalent among 18–29 year olds for non-work trips, but rates of active transportation were quite low. Only 5.9 percent selected walking as a frequent non-work mode, and zero respondents selected cycling (n=64), both lower than any other age group. In general, rates of non-commute SOV use increased with age, with the exception of those 70 and older.

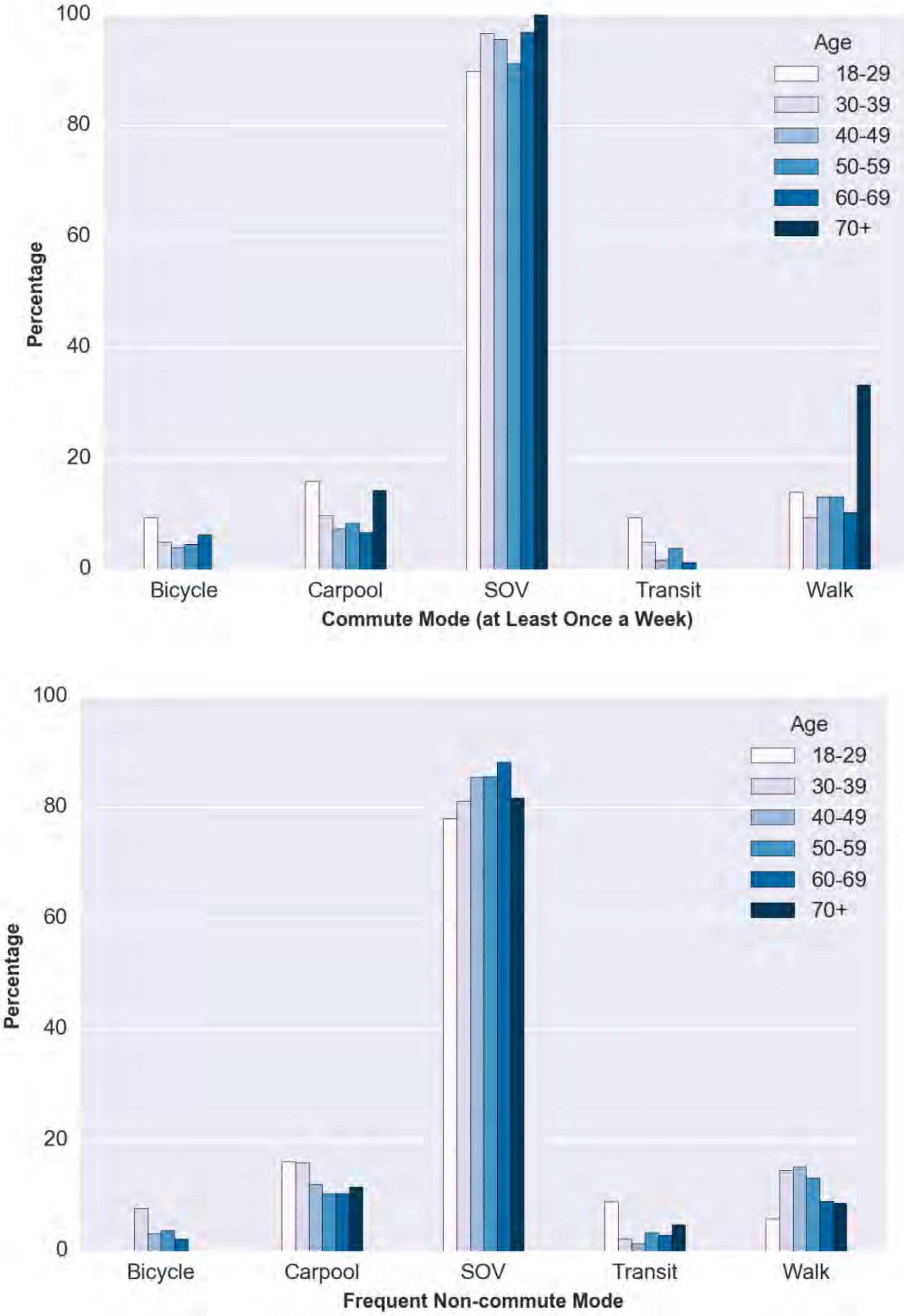


Figure 41. Mode Split by Age.

Mode share by gender was nearly identical for all modes with the exception of walking. A larger share of women reported walking for both commute and non-commute trips than men, with a difference of 3–4 percentage points (Figure 42).

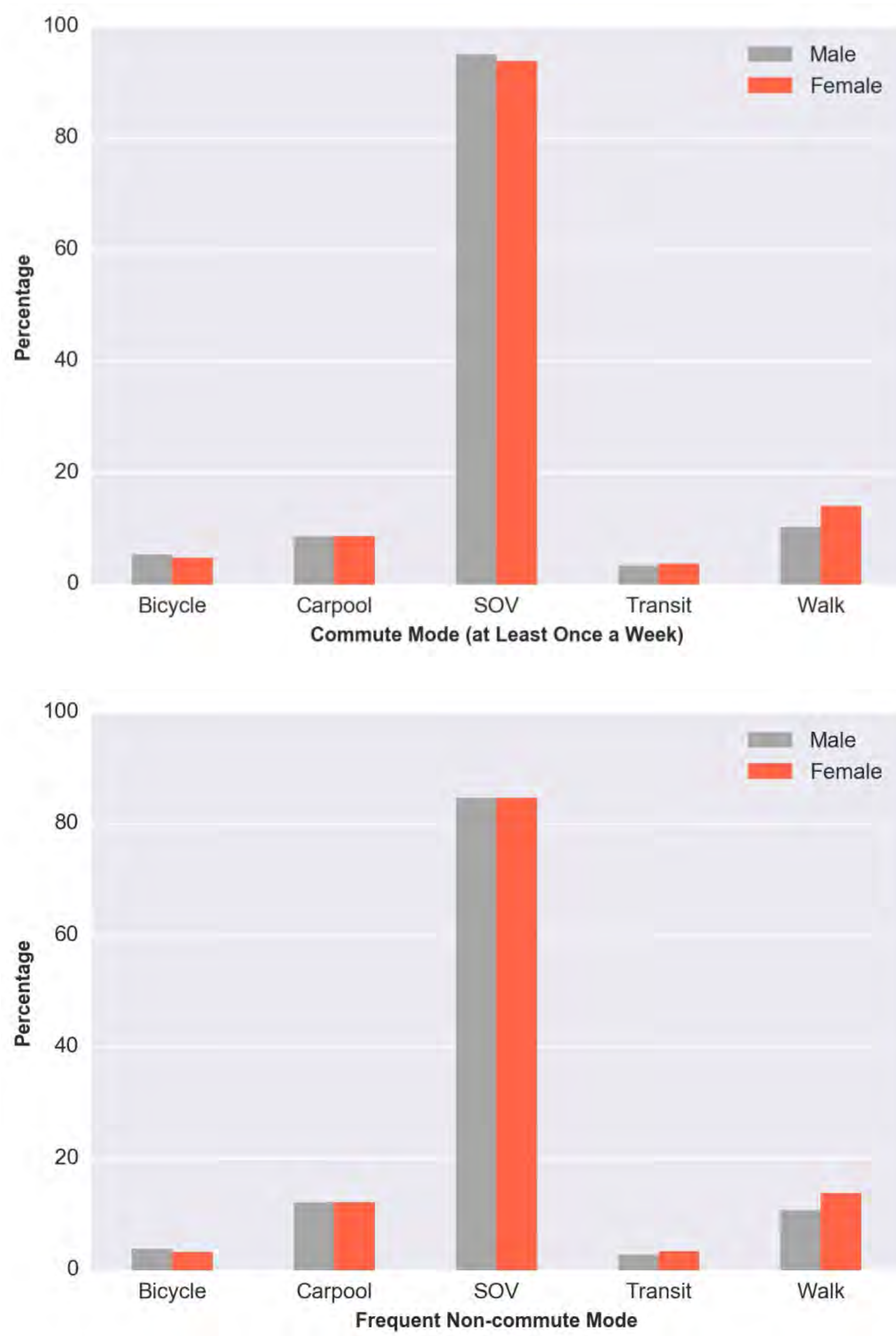


Figure 42. Mode Split by Gender.

Hispanic respondents demonstrated higher rates of walking and transit for commute and non-commute trips than white respondents (Figure 43). Otherwise, modal split was similar between the two groups.[5]

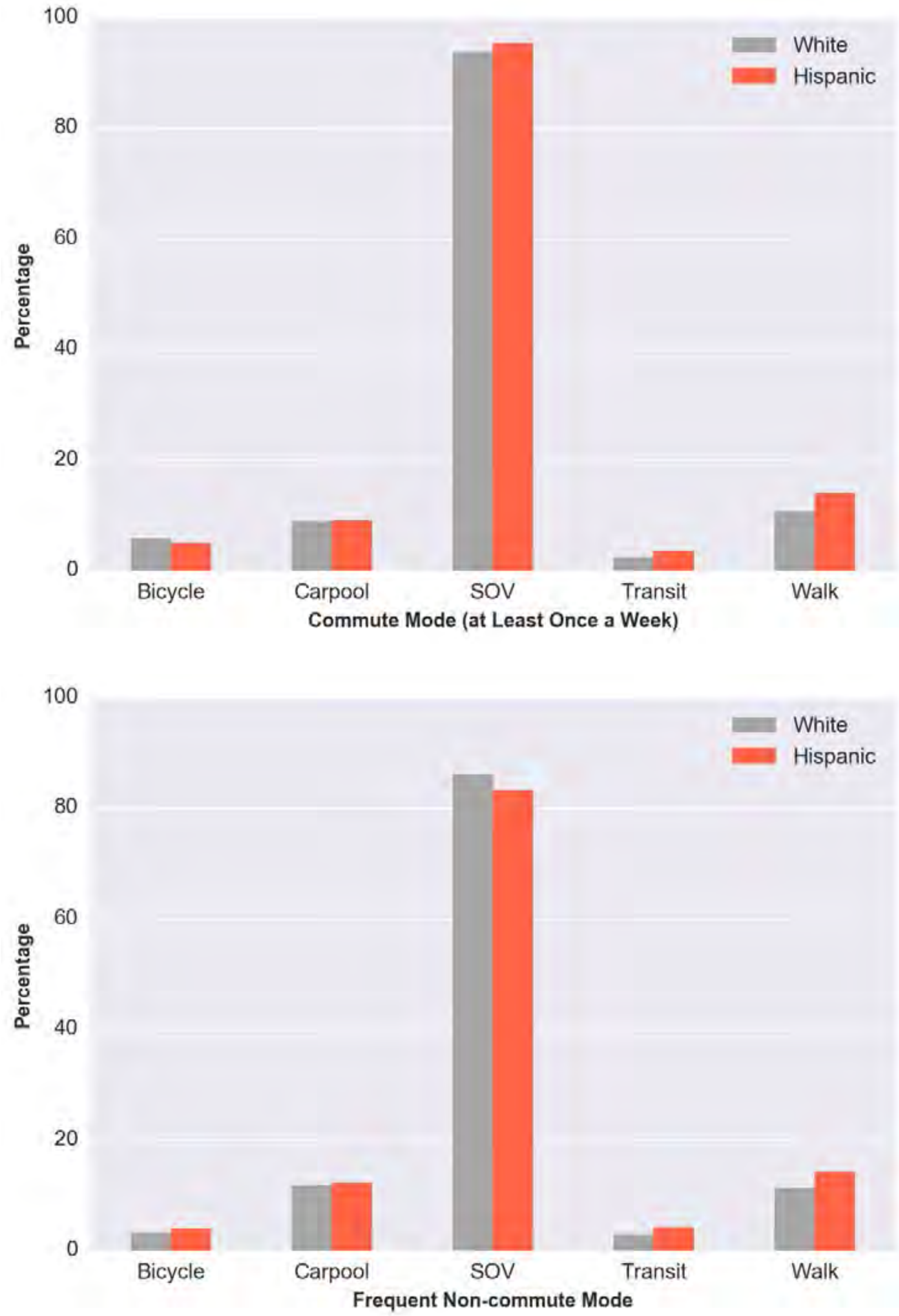


Figure 43. Mode Split by Ethnicity.

[5] Mode share for other racial groups was also explored but is not presented here due to low sample sizes. Additionally, categories were not mutually exclusive; 272 individuals self-identified as both white and Hispanic.

Low-income respondents demonstrated the greatest reliance on alternative modes and the lowest SOV usage rates (Figure 44). In particular, walking and transit were more prevalent for the lowest income brackets. For all other income groups, mode share was relatively similar. Rates of bicycling for non-work travel were consistently low for all groups.

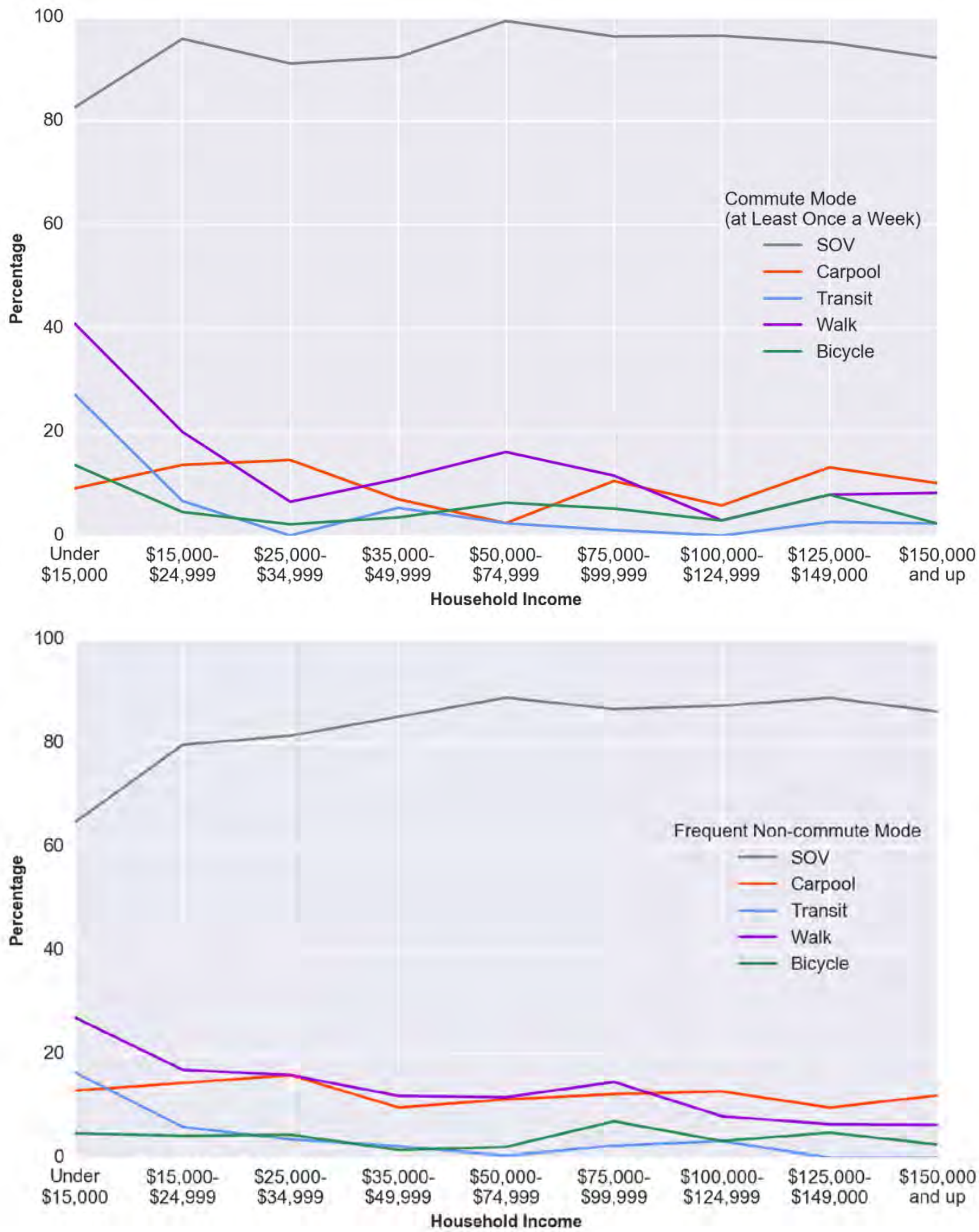


Figure 44. Mode Split by Income.

Mode Split by Attitudes

Respondents' attitudes toward their neighborhood environment, personal health, and transportation were segmented by commute mode and non-commute mode. Higher walking frequency for commute trips was associated with lower agreement on there being adequate neighborhood sidewalks or shoulders (Figure 45). Bicycle commuters (i.e., those who bicycle commuted at least once a week) were distinct in that they rated their neighborhood environments the least safe from crime and traffic. While they may tend to live in less-safe neighborhoods, it is also likely that bicycle commuters are more acutely aware of traffic and crime-related issues.

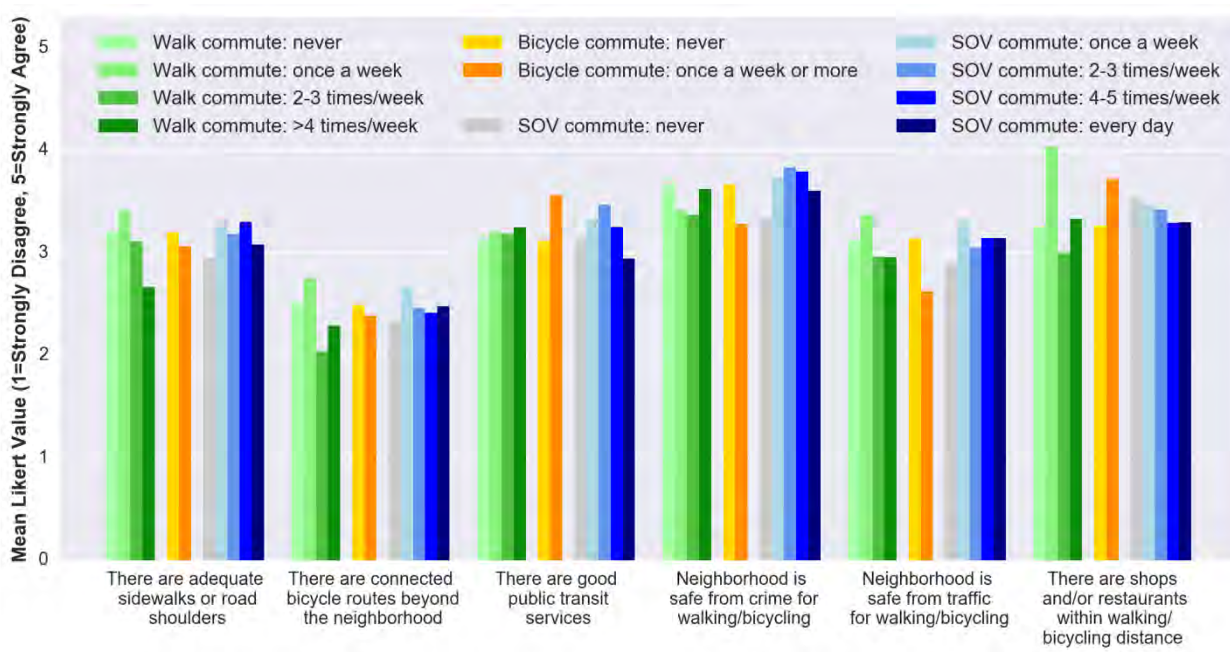


Figure 45. Neighborhood Environment Attitudes by Commute-Mode Frequency.

Looking at differences in attitudes between frequent non-commute modes, transit users, bicyclists, and pedestrians tended to agree more strongly that they had shops and restaurants within walking or bicycling distance (Figure 46). Unsurprisingly, frequent public transit users indicated more strongly that they had good transit services nearby. Frequent bicyclists were more concerned than other groups about a lack of adequate sidewalks or road shoulders in their neighborhood.

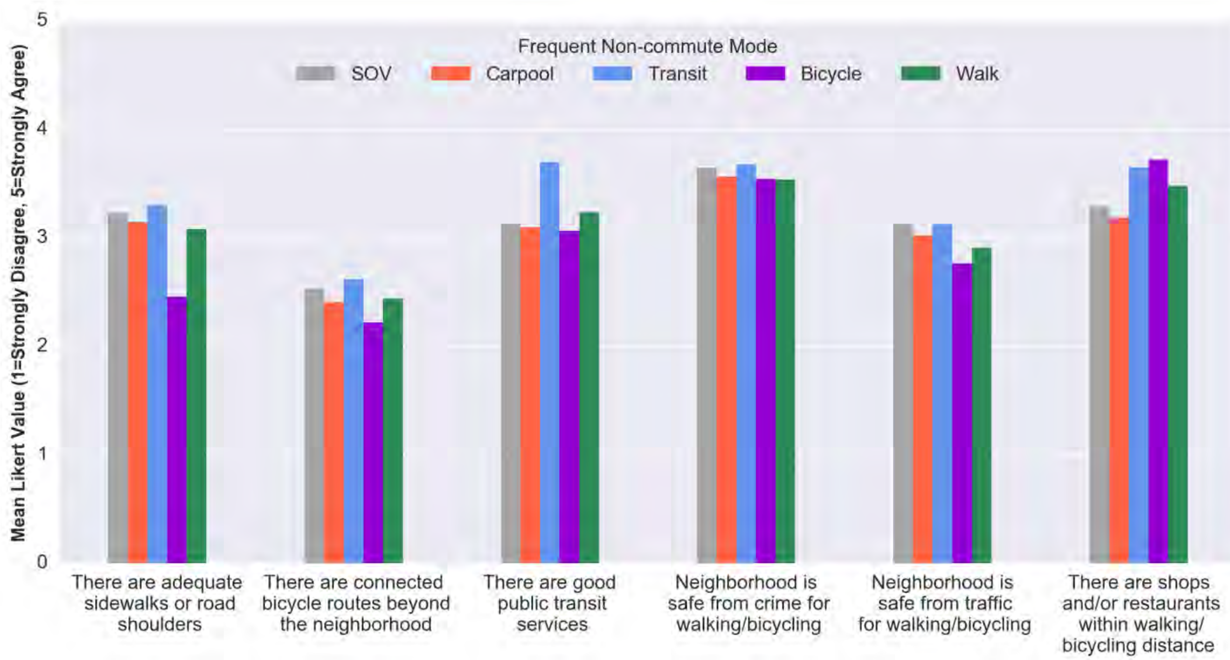


Figure 46. Neighborhood Environment Attitudes by Frequent Non-Commute Mode.

In terms of personal health and transportation, frequent walk and bicycle commuters appeared to be more active and healthy in other areas of their life. They indicated both a stronger propensity for eating healthy and for visiting parks and trails (Figure 47). They also indicated a greater willingness to make short trips by walking or bicycling (Figure 48). In contrast, SOV commute frequency was associated with a greater aversion to making short trips by active modes.

As expected, frequent SOV commuters believed more strongly that highway capacity should be expanded compared to frequent walk commuters. Increased SOV commute frequency was also associated with decreasing concern for vehicle emissions, whereas walk commute frequency exhibited the opposite relationship. While bicycle commuters demonstrated concern for fuel prices and vehicle emissions, they also tended to agree that highway capacity should be expanded to relieve congestion.

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When analyzed by non-commute mode (not segmented by mode frequency), differences in attitudes appeared to flatten out. Frequent bicyclists indicated the highest degree of participation in other physical activities such as visiting parks or recreational areas and following a regular exercise routine (Figure 49). They also appeared to be more sensitive to the effect of fuel prices and vehicle emissions on their travel decisions (Figure 50). Unsurprisingly, frequent transit users agreed most strongly that "transit should be the focus for future transportation infrastructure."

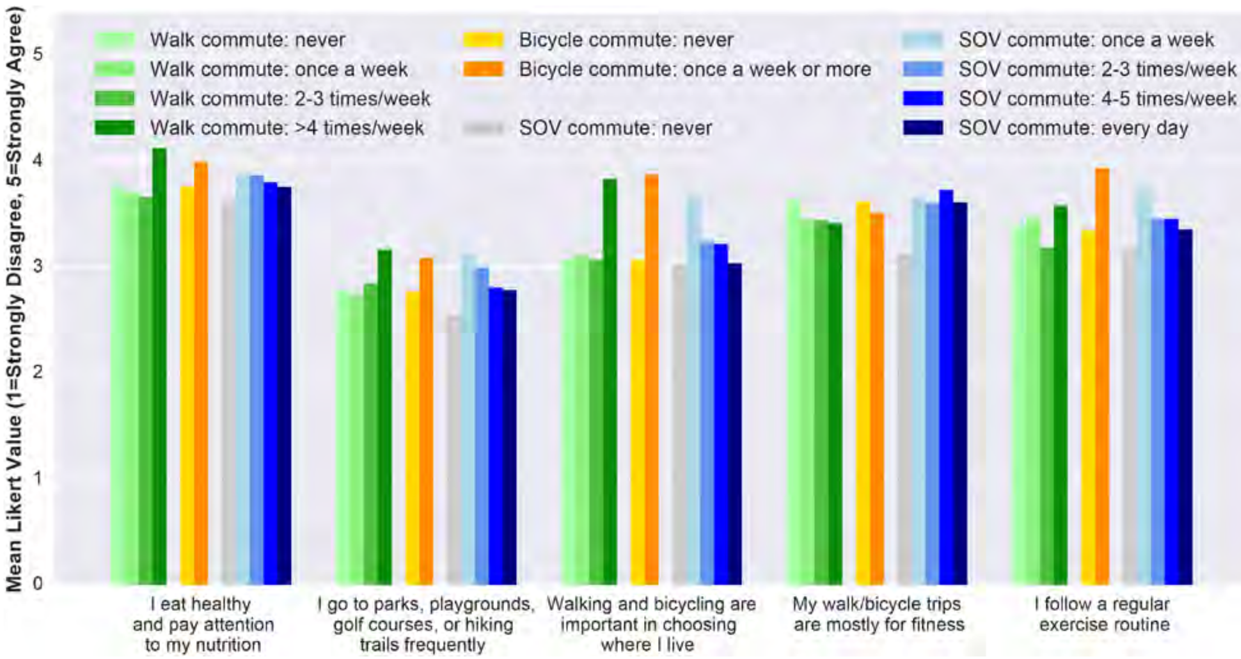

Figure 47. Health-Related Attitudes by Commute-Mode Frequency.

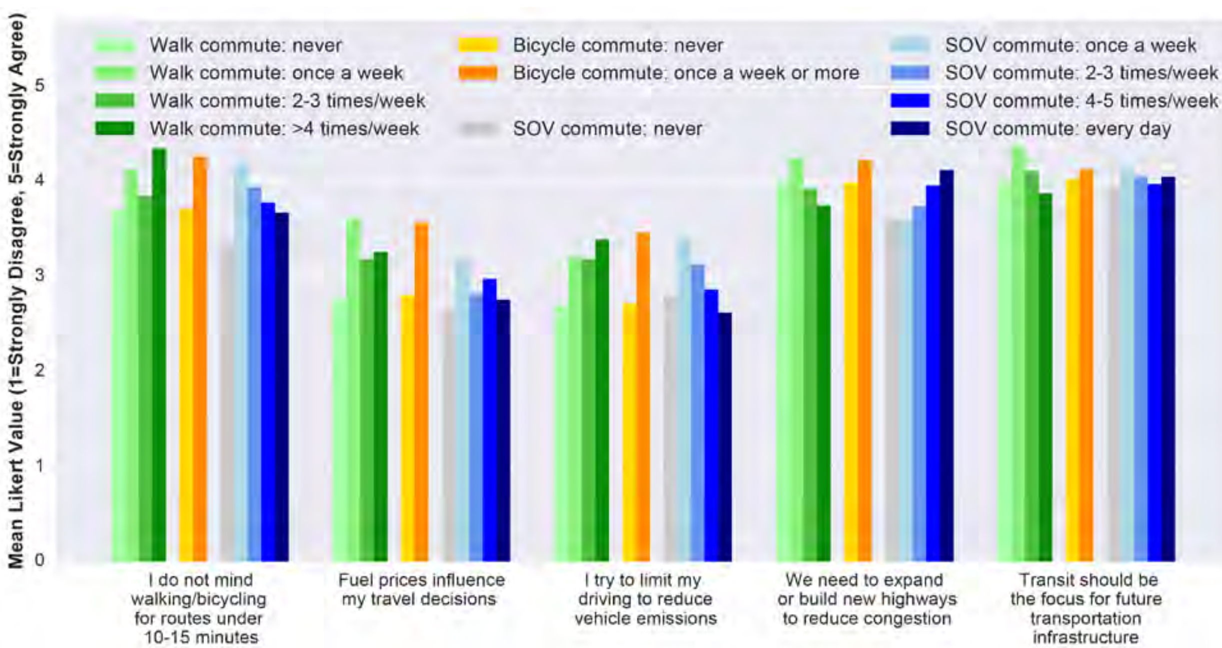

Figure 48. Transportation-Related Attitudes by Commute-Mode Frequency.

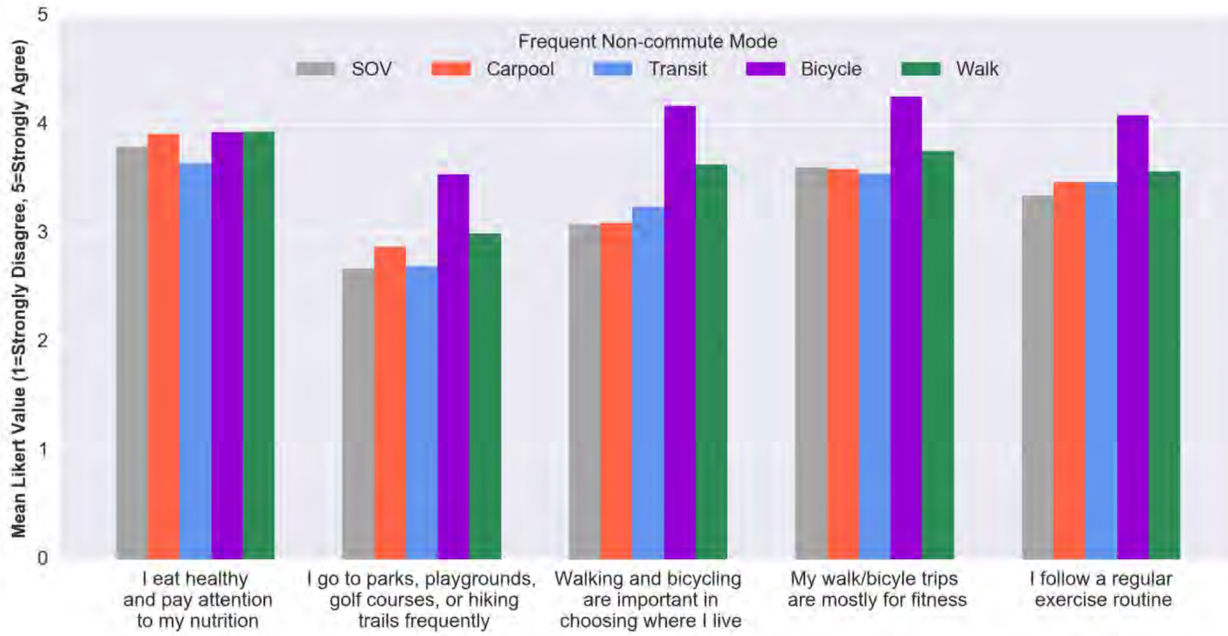

Figure 49. Health-Related Attitudes by Frequent Non-Commute Mode.

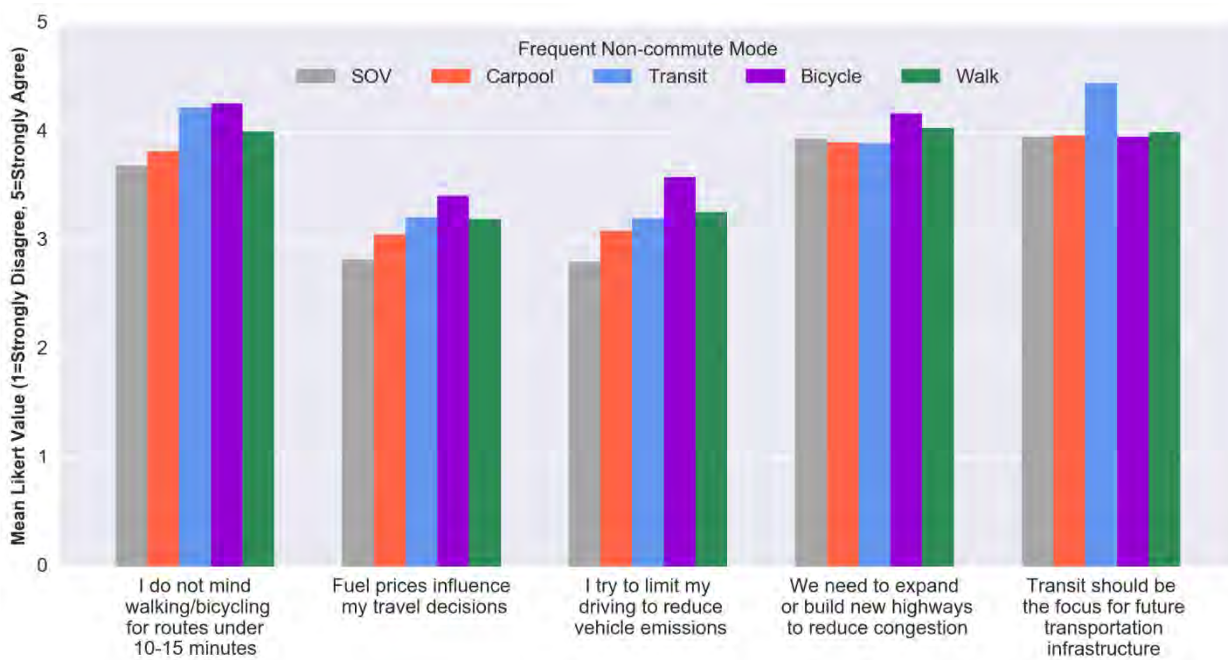

Figure 50. Transportation-Related Attitudes by Frequent Non-Commute Mode.

Mode Split by Well-Being

Several questions were asked to better understand respondents' well-being including self-reported health levels, self-reported life satisfaction, and respondents' weight and height, which were used to compute BMI. Appendix B provides a brief assessment of well-being measures.

Few differences were observed in mean self-reported health levels by commute-mode frequency (Figure 51). Examining each individual health level by frequent non-commute mode was somewhat more revealing. Bicyclists were the healthiest group based on self-reported measures, that is, the highest proportion of respondents who indicated that their health was "excellent" or "very good" (Figure 52). Frequent transit users had the lowest self-reported health levels, with 28.2 percent indicating that their health was "poor" or "fair" compared to 8.9 percent for frequent bicyclists.

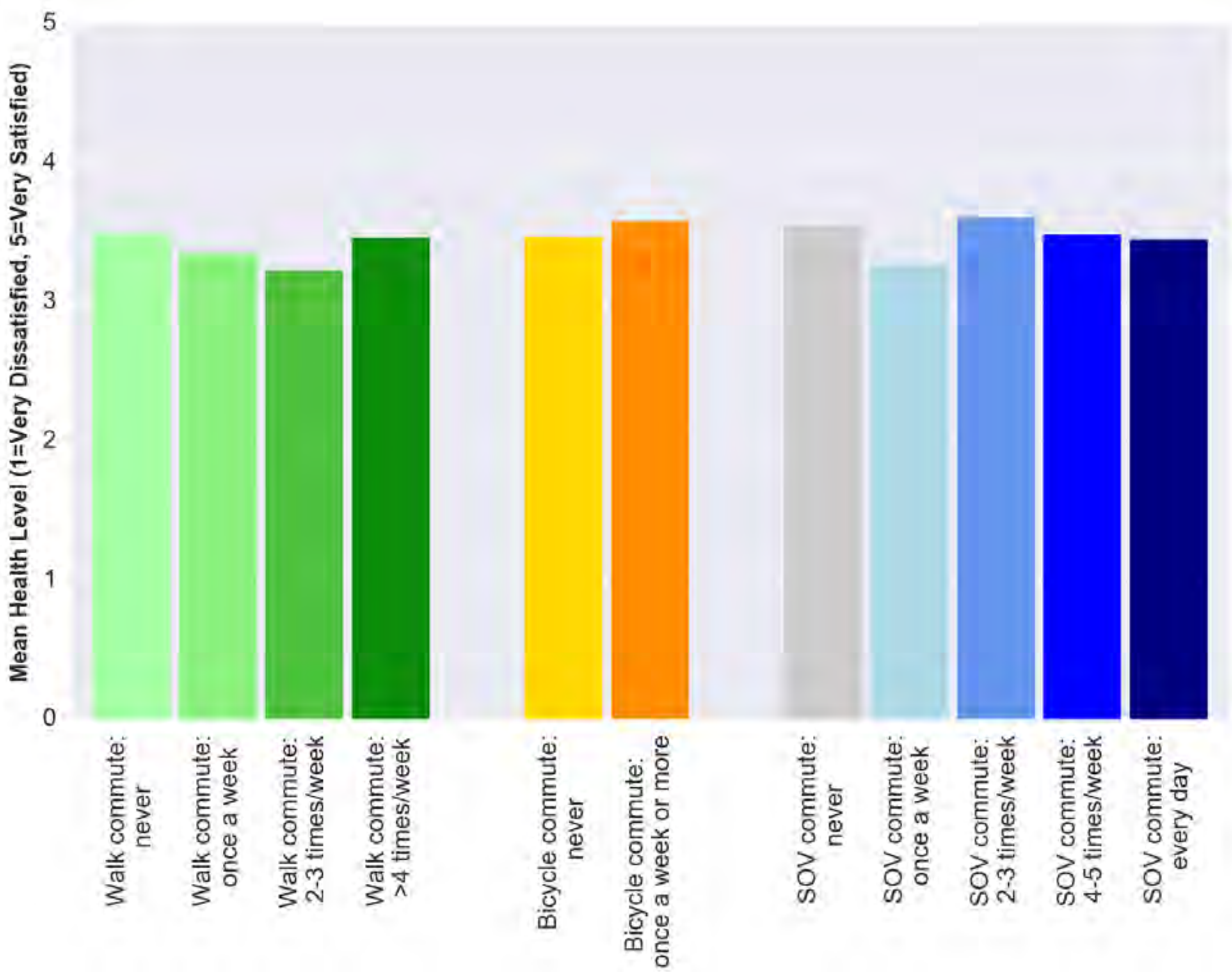

Figure 51. Self-Reported Healthiness by Commute-Mode Frequency.

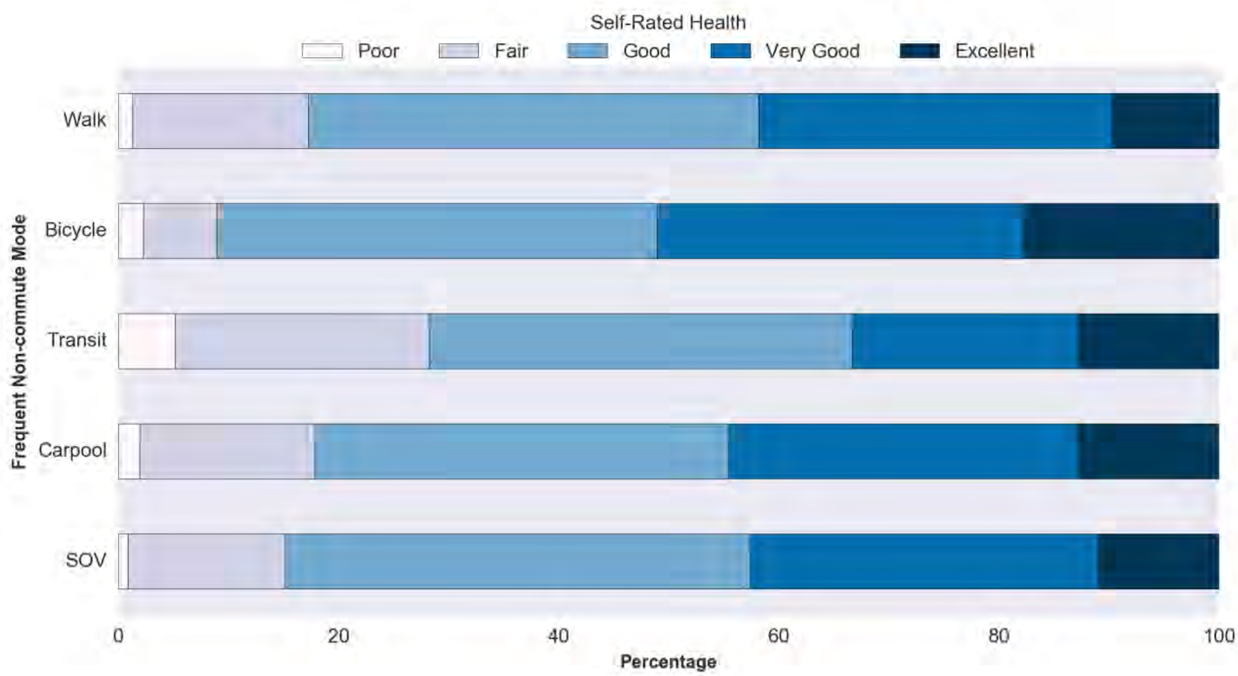

Figure 52. Self-Reported Healthiness by Frequent Non-Commute Mode.

Similar to average self-reported level of health, differences in self-reported life satisfaction were minimal between commute modes (Figure 53). When analyzed for each category among frequent non-commute modes, participants' stated life satisfaction did not necessarily track with their self-reported health. For instance, bicycling was the healthiest non-commute mode but also had the highest proportion of respondents who were "dissatisfied" or "very dissatisfied" with their lives (Figure 54). Vehicles users (SOV or carpool) had the lowest proportion of dissatisfied or very dissatisfied respondents.

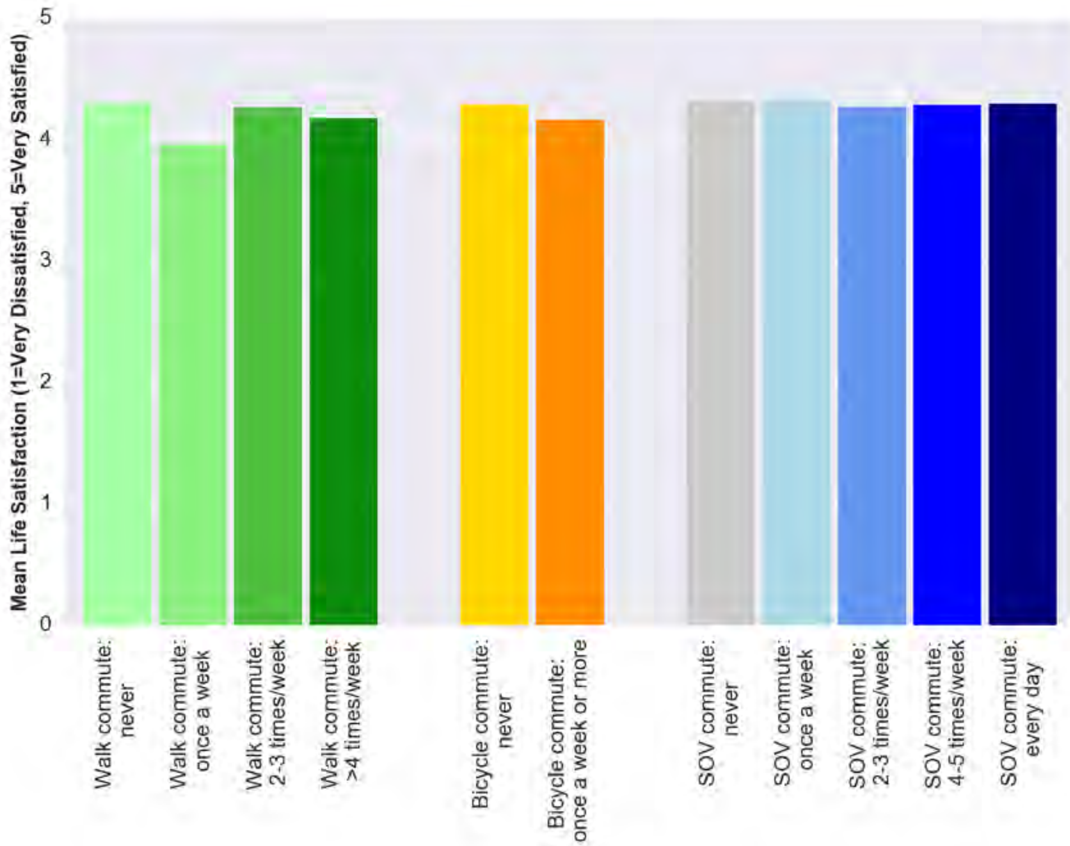

Figure 53. Self-Reported Life Satisfaction by Commute-Mode Frequency.

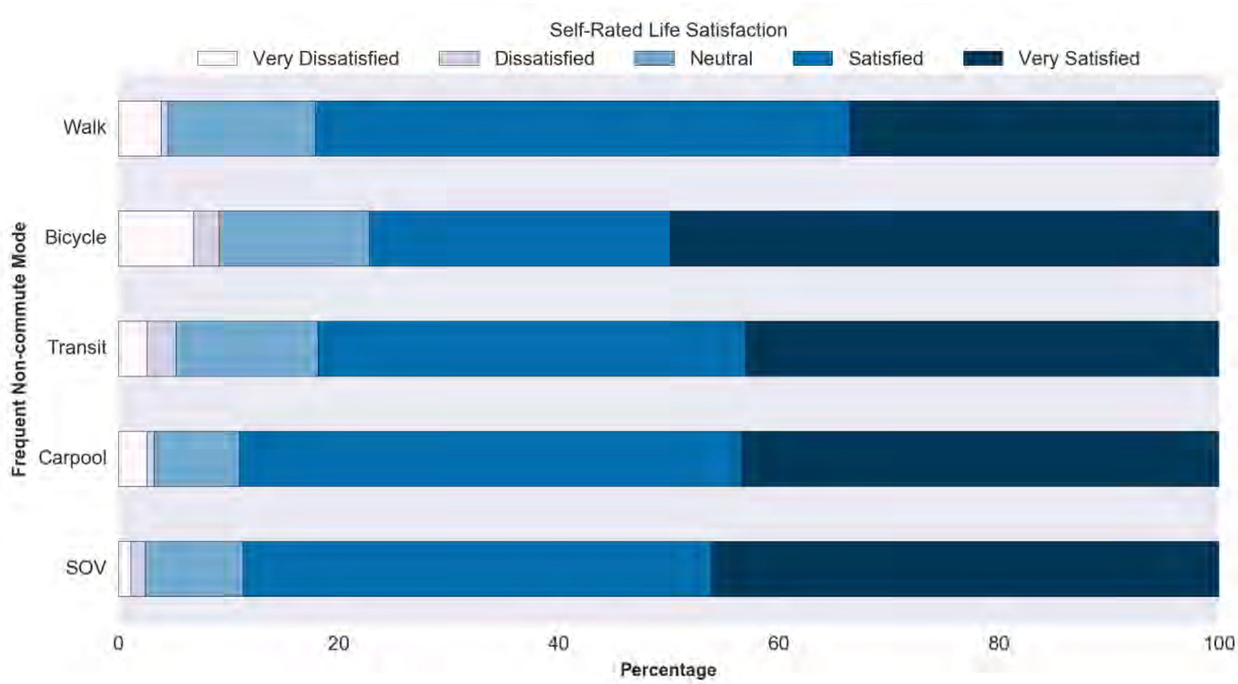

Figure 54. Self-Reported Life Satisfaction by Frequent Non-Commute Mode.

In terms of BMI, it was difficult to establish a distinction between modes, either for commute trips or non-commute trips (Figure 55 and Figure 56, respectively). Mean BMI was nearly identical for frequent non-commute modes, with mean values ranging from 27.2 to 27.6, which falls under the category of overweight (BMI for overweight is 25.0–29.9).

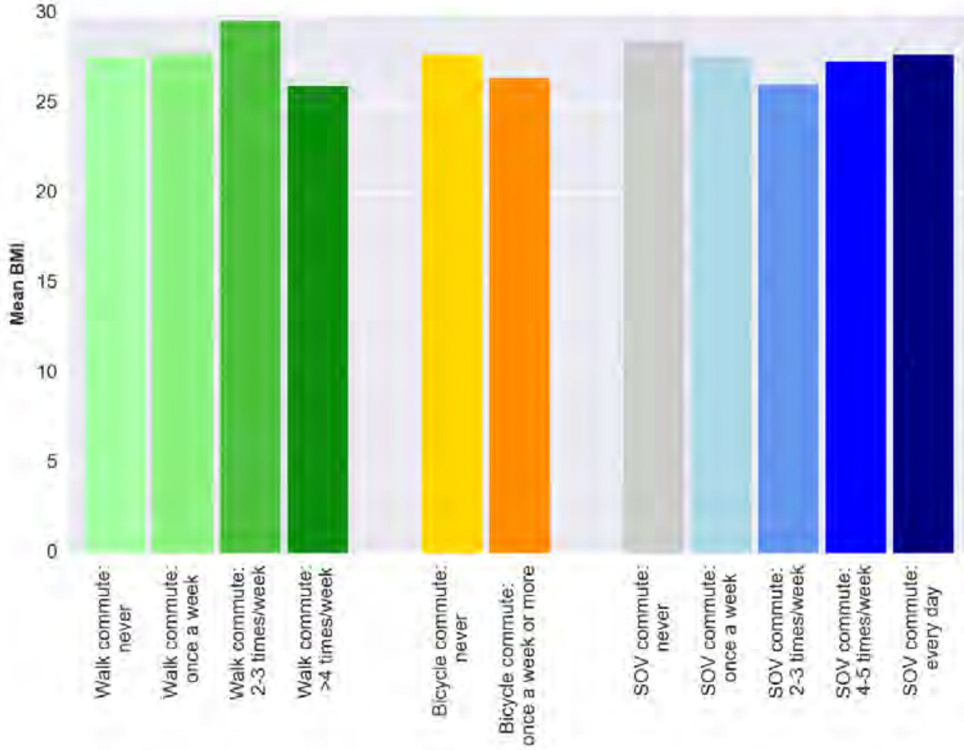

Figure 55. BMI by Commute-Mode Frequency.

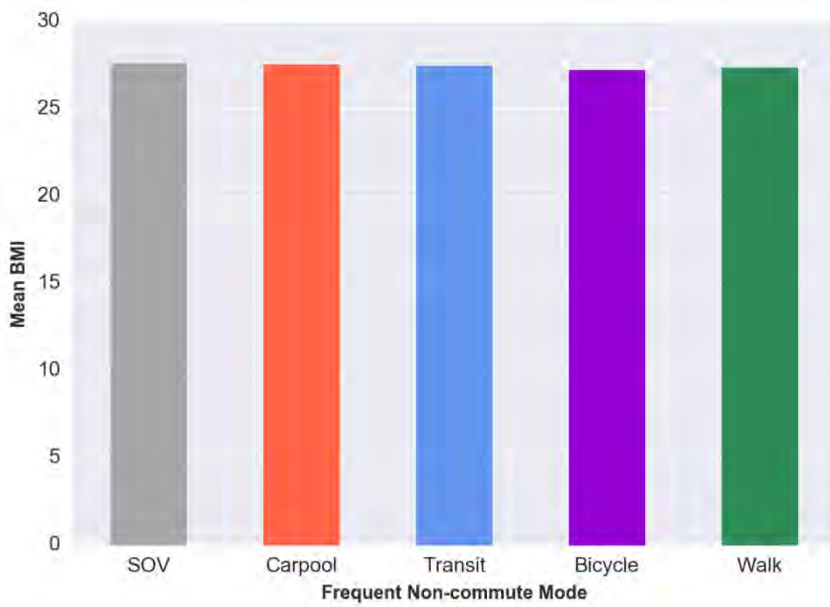

Figure 56. BMI by Frequent Non-Commute Mode.

ADDITIONAL INSIGHTS ON ACTIVE TRAVEL

Attitudes toward Active Travel

Respondents were asked to rate their level of agreement with several walking- and bicycling-related statements on a five-point Likert scale (1=strongly disagree and 5=strongly agree). Mean Likert responses were aggregated by various demographic characteristics.

Walking Attitudes

The results revealed that walking-related attitudes were strongly consistent across age groups as presented in Figure 57. The youngest age bracket (18–29 years old) tended to believe more strongly that "walking takes too much time" and were more likely to agree with the statement, "walking means I don't have to worry about parking." Otherwise, mean responses were nearly identical between age groups.

Similarly, little difference was observed when comparing mean response values for walking-related attitudes by gender and ethnicity (Figure 58 and Figure 59). Some trends were seen for household income. Lower-income respondents were more likely to indicate that whenever possible they walked instead of driving and that walking exposed them to more air pollution than driving (Figure 60).

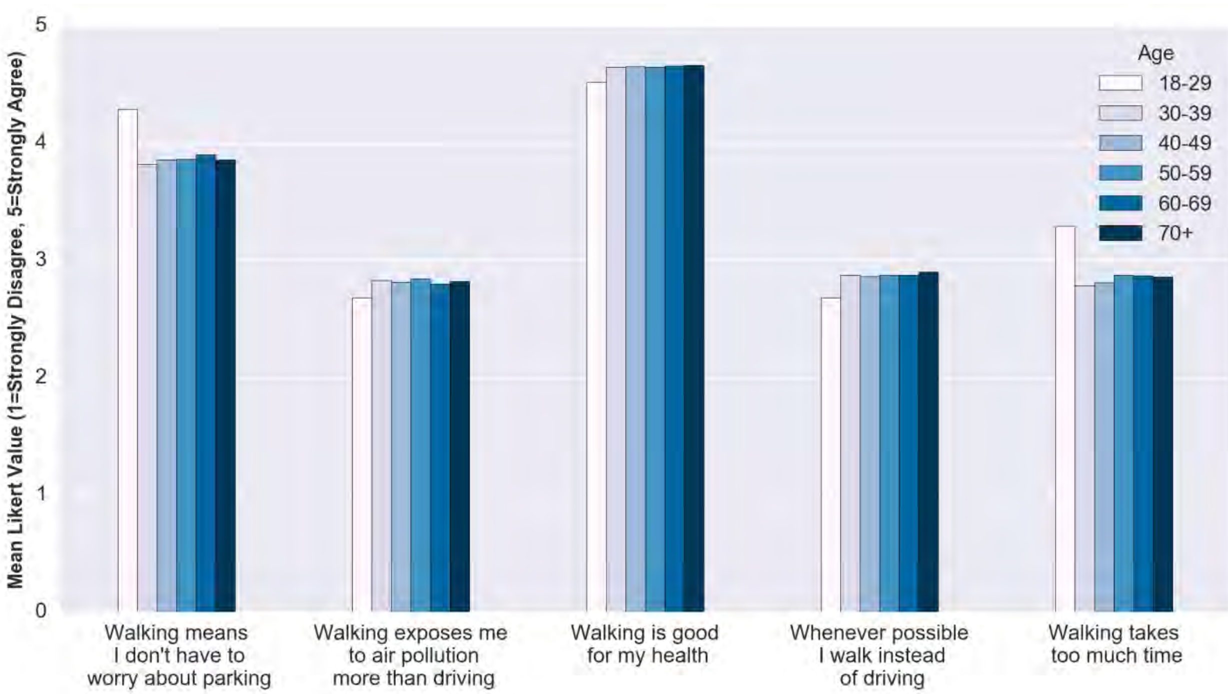

Figure 57. Walking Attitudes by Age.

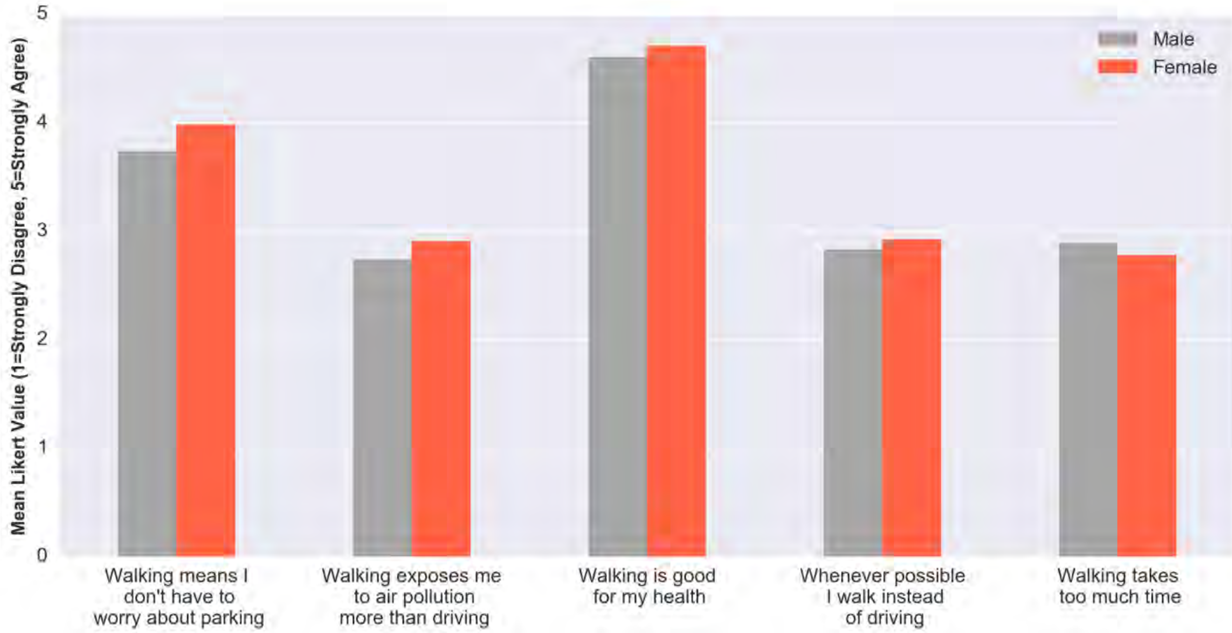

Figure 58. Walking Attitudes by Gender.

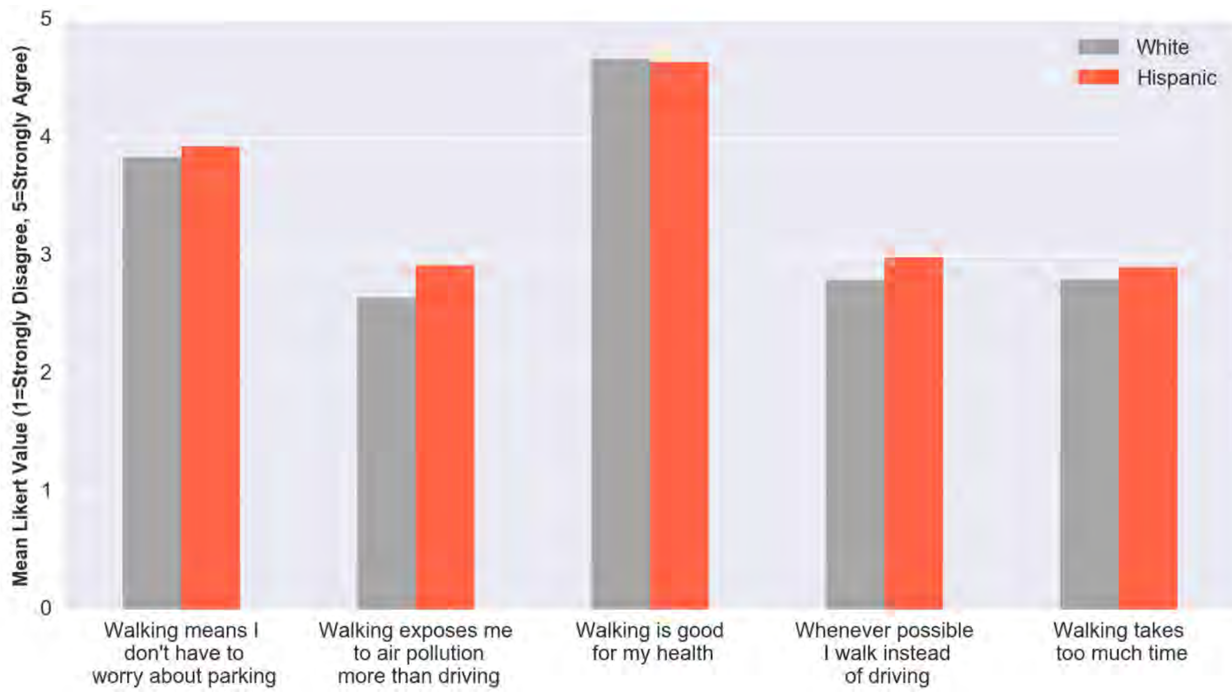

Figure 59. Walking Attitudes by Ethnicity.

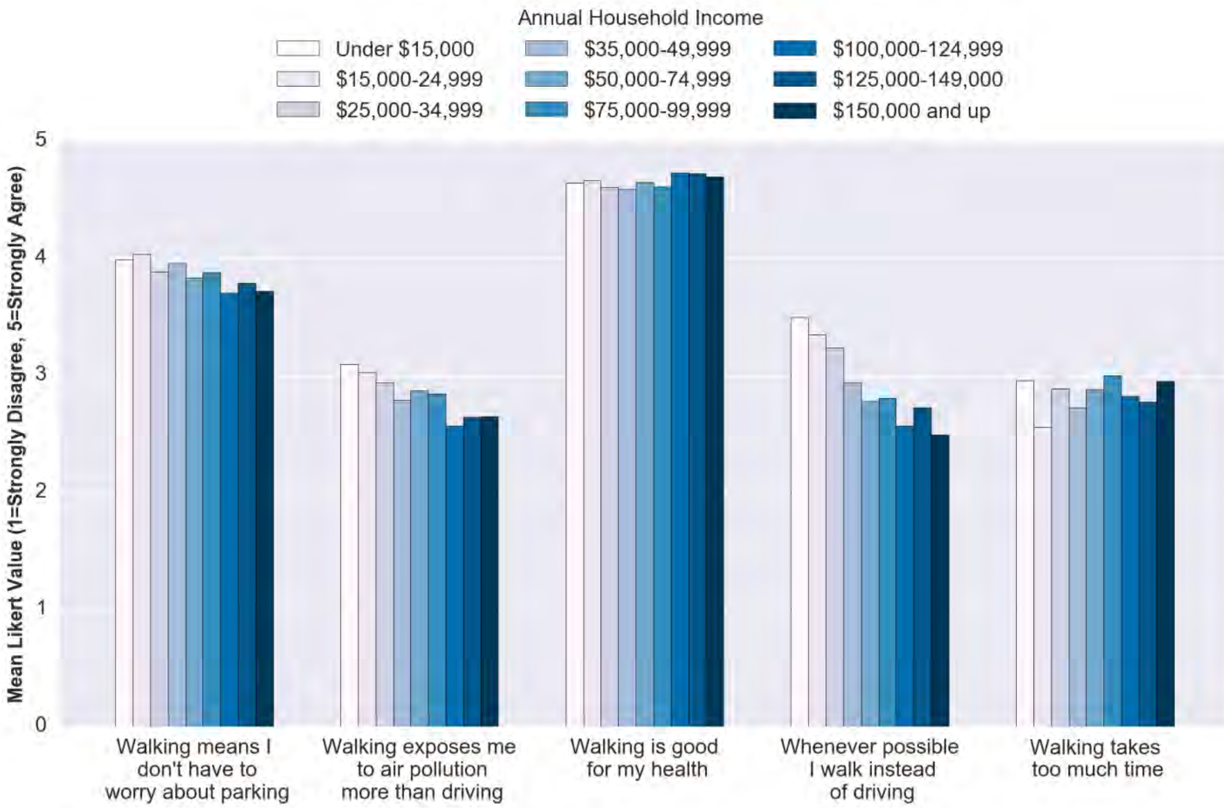

Figure 60. Walking Attitudes by Income.

Bicycling Attitudes

Similar to walking attitudes, bicycling attitudes demonstrated minimal variance by age, particularly for those older than 29 (Figure 61). Those 18–29 years old tended to agree more strongly that bicycling takes too much time, is a healthy activity, and is not associated with parking worries. These younger respondents also demonstrated a slightly stronger preference for bicycling over driving than other age groups. Differences in bicycling attitudes by gender and ethnicity were similarly indistinct (Figure 62 and Figure 63).

As with walking, some differences in opinion were found upon aggregating responses by income group (Figure 64). Having a lower household income was associated with a stronger preference or reliance on bicycling (“Whenever possible I bicycle instead of driving”) and the belief that “bicycling is less stressful than driving.” Higher-income groups tended to agree more strongly with the statement, “I wear nice clothes that will get wrinkled or dirtied bicycling.”

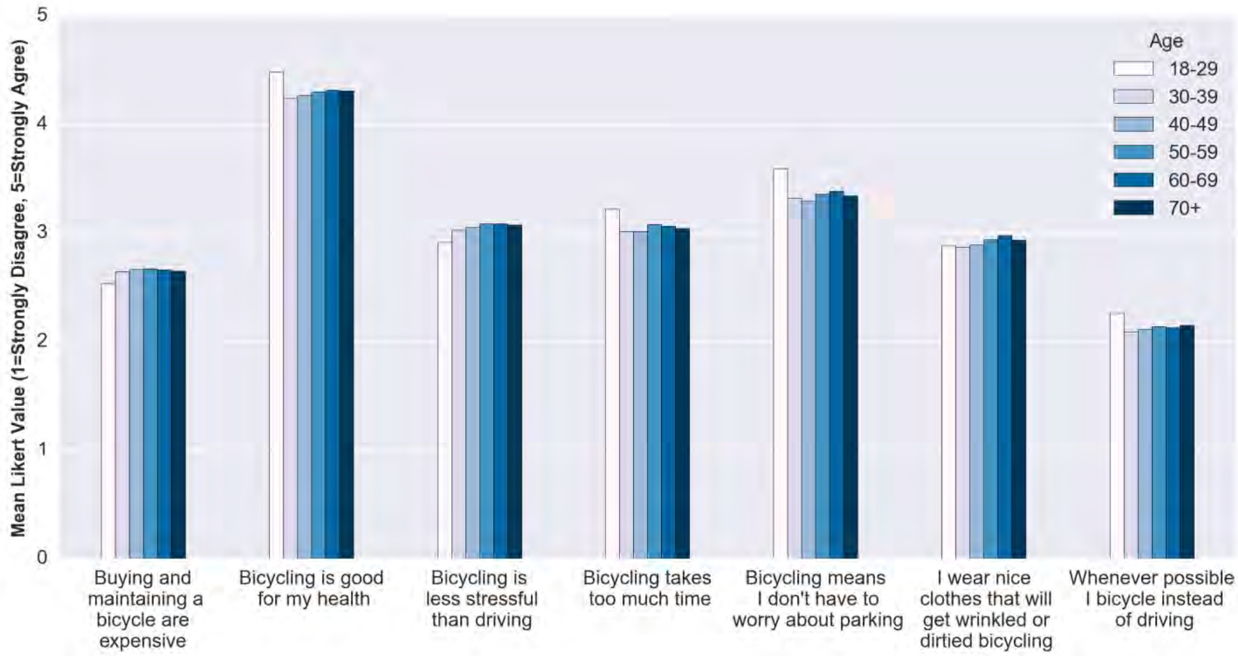

Figure 61. Bicycling Attitudes by Age.

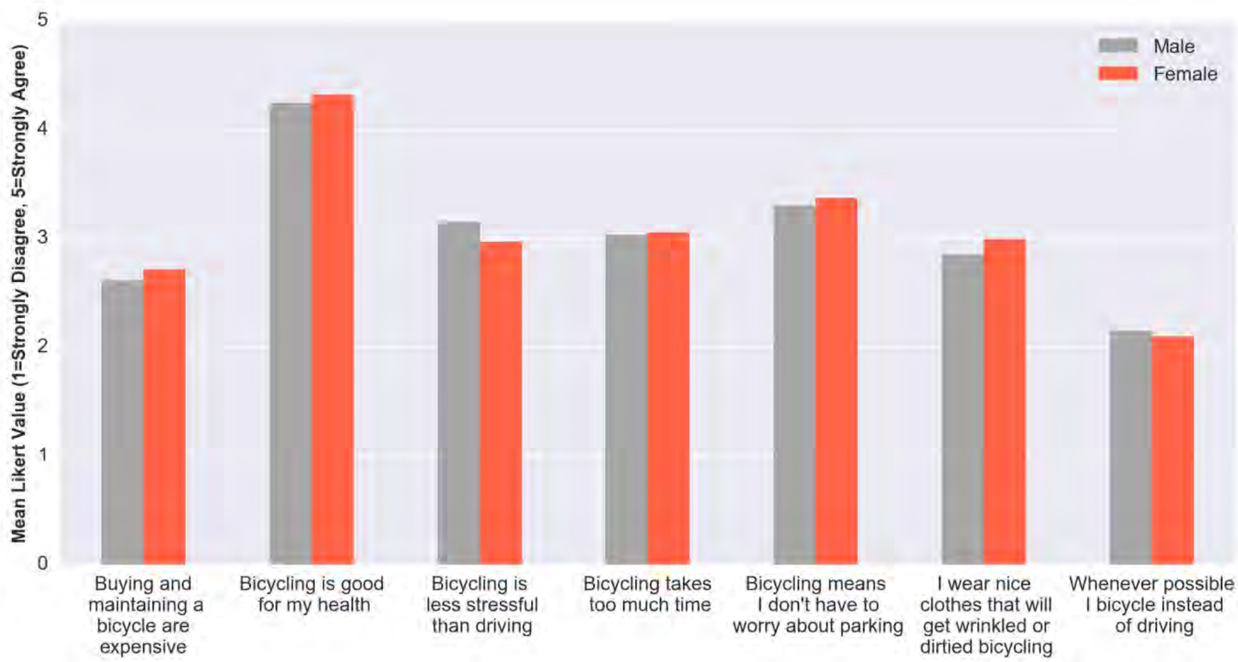

Figure 62. Bicycling Attitudes by Gender.

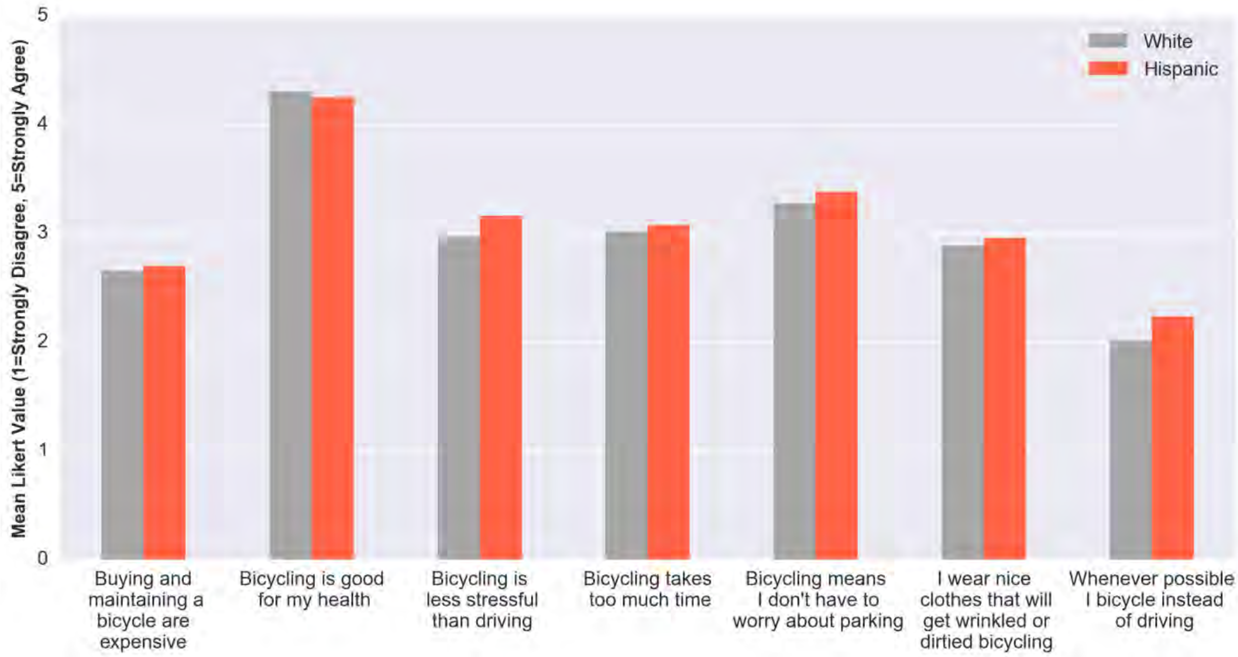

Figure 63. Bicycling Attitudes by Ethnicity.

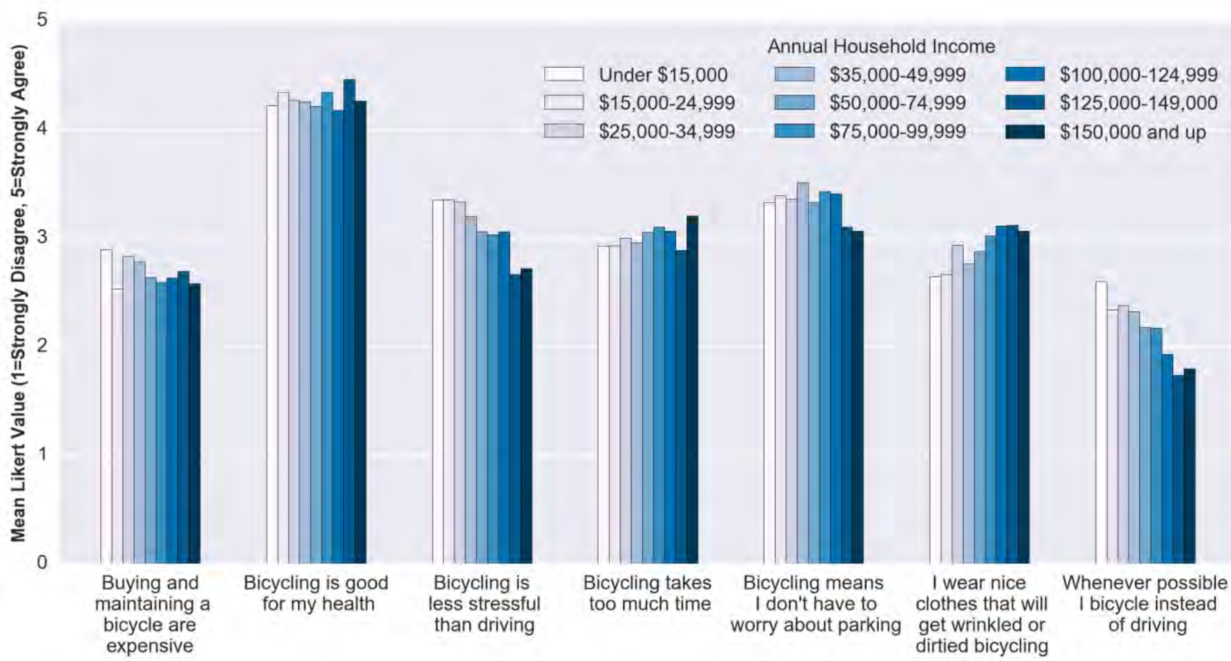

Figure 64. Bicycling Attitudes by Income.

Bicycling attitudes were also explored by bicycling orientation, which segmented respondents into one of five groups based on level of comfort/interest in bicycling: comfortable bicycling anywhere, comfortable bicycling on a bicycle lane/trail, comfortable only on off-road bicycle paths, not a bicyclist but would consider bicycling, and not interested in bicycling. The attitude variables had the expected relationship with bicycling orientation, with non-cyclists associated with more negative bicycling attitudes (Figure 65). In particular, non-cyclists demonstrated greater concern for the travel time and costs associated with bicycling. More enthusiastic cyclists believed more strongly in the positive health effects of bicycling and its lower levels of stress compared to driving.

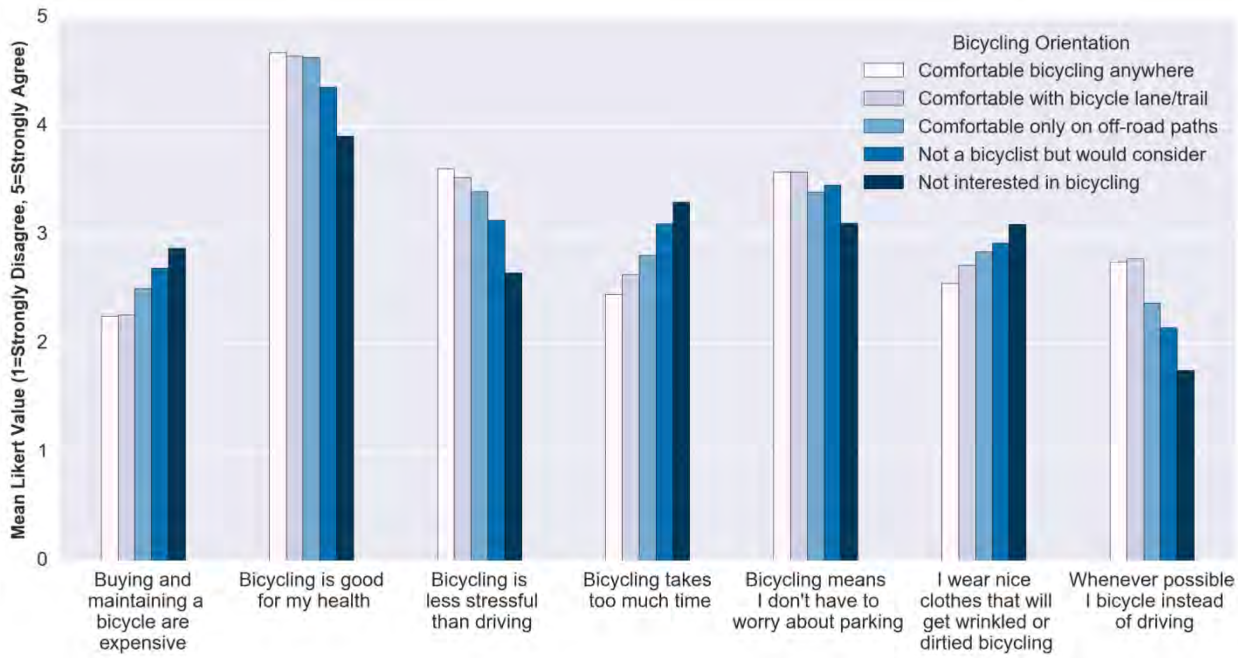

Figure 65. Bicycling Attitudes by Bicycling Orientation.

Deterrents and Motivators of Active Travel

Walking Deterrents and Motivators

From predetermined lists, respondents selected walking deterrents (up to three) that discourage their pedestrian travel and motivators (only one) that encourage their pedestrian travel. Those who frequently walked for non-commute trips tended to be more concerned with traffic safety, a lack of nearby attractive destinations, a lack of sidewalks, and inclement weather than non-frequent walkers (Figure 66). The non-frequent walking group was comparatively more concerned with a lack of travel time/distance information and hilly terrain. For both groups, traffic safety was most frequently cited as a walking deterrent.

Frequent pedestrians appeared to be more influenced by walking motivators than non-frequent pedestrians. A larger proportion indicated that all three motivators would encourage their walking behavior, with "more amenities" and "more aesthetics" being the most commonly selected (Figure 67). Having more amenities and having more walkable businesses were the most influential motivators for non-frequent pedestrians. Of the non-frequent walkers, 24.4 percent indicated that nothing would encourage them to walk more, compared to 10.3 percent of frequent non-commute walkers.

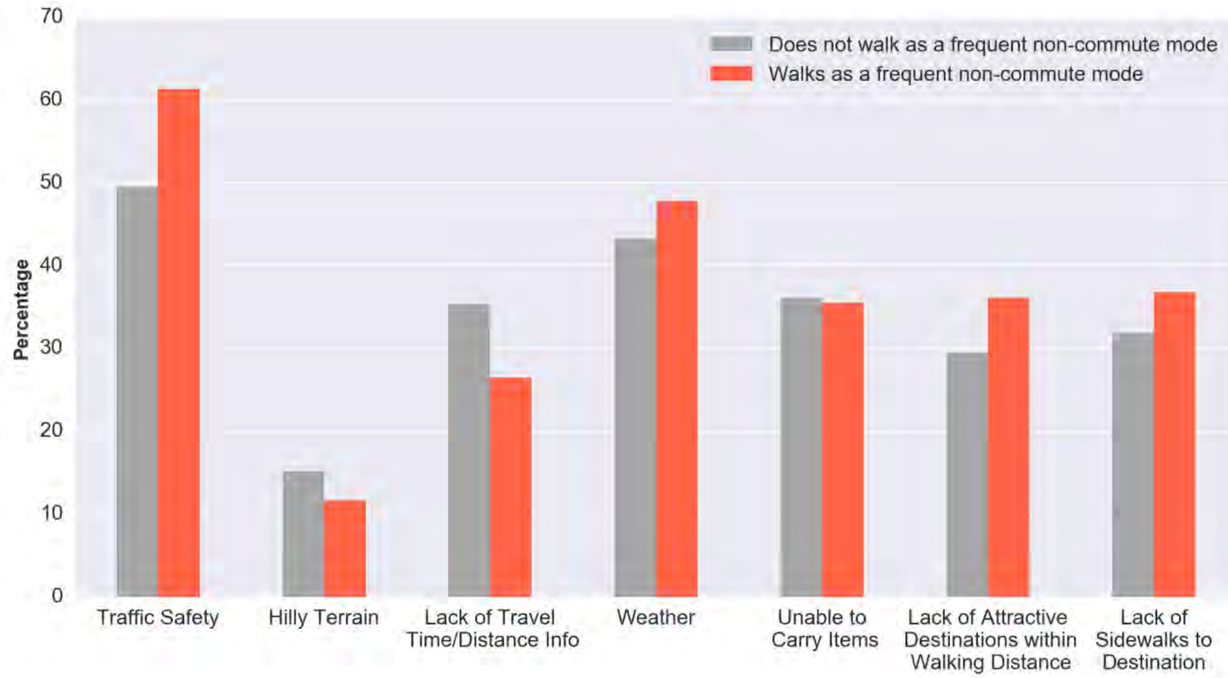

Figure 66. Walking Deterrents by Walking as a Frequent Non-Commute Mode.

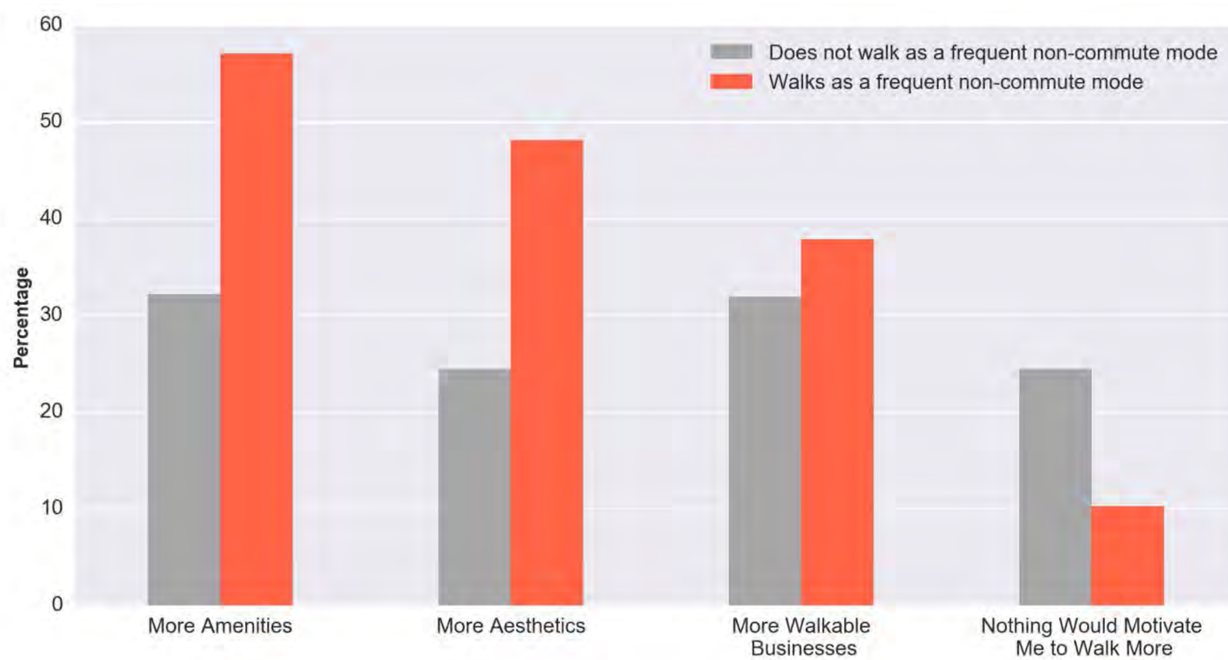

Figure 67. Walking Motivators by Walking as a Frequent Non-Commute Mode.

Bicycling Deterrents and Motivators

Respondents were additionally instructed to select from a list the bicycling deterrents (up to three) and motivators (only one) influencing their decision to bicycle. These factors were explored by bicycling orientation levels. For all respondents except for the "comfortable bicycling anywhere" group, traffic safety was cited most frequently as a bicycling deterrent

(Figure 68). The most comfortable cyclists selected distance as a deterrent slightly more frequently than safety. Aside from traffic safety and travel distance, other commonly cited deterrents were the inability to carry items, weather, and a lack of bicycle facilities at the destination. Hilliness, disrepair of bicycle paths, a lack of travel time/distance information, and a lack of signage were less frequently chosen as deterrents. Looking specifically at respondents that do not currently bicycle but might consider doing so in the future, the inability to carry items was relatively more influential.

The provision of bicycle lanes appeared to be the strongest motivator of bicycling among all groups, excluding those not interested in bicycling (Figure 69). More amenities, aesthetics, and businesses were less frequently selected as bicycling motivators. Nearly 30 percent of cyclists comfortable bicycling anywhere indicated that nothing would encourage them to bicycle more, perhaps because they are already cycling at their perceived maximum level. The lack of respondents selecting "disrepair of bicycle paths or trails" as a deterrent suggests that the condition of bicycle facilities in El Paso is not a primary concern for residents.

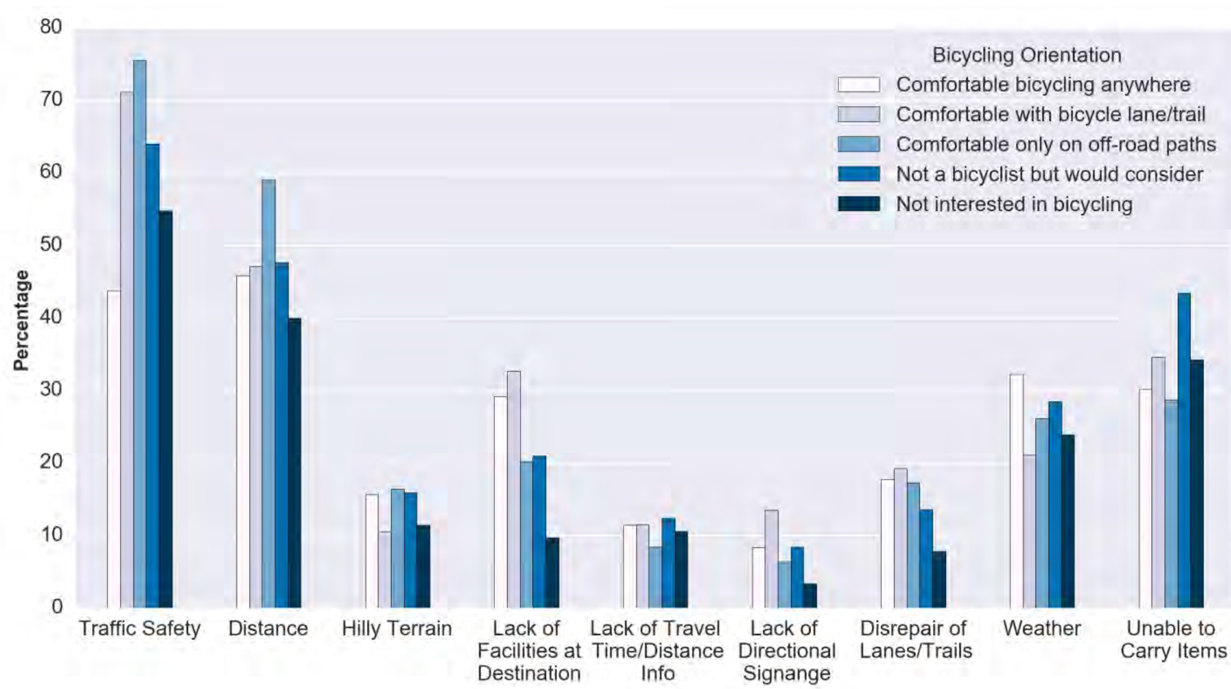

Figure 68. Bicycling Deterrents by Bicycling Orientation.

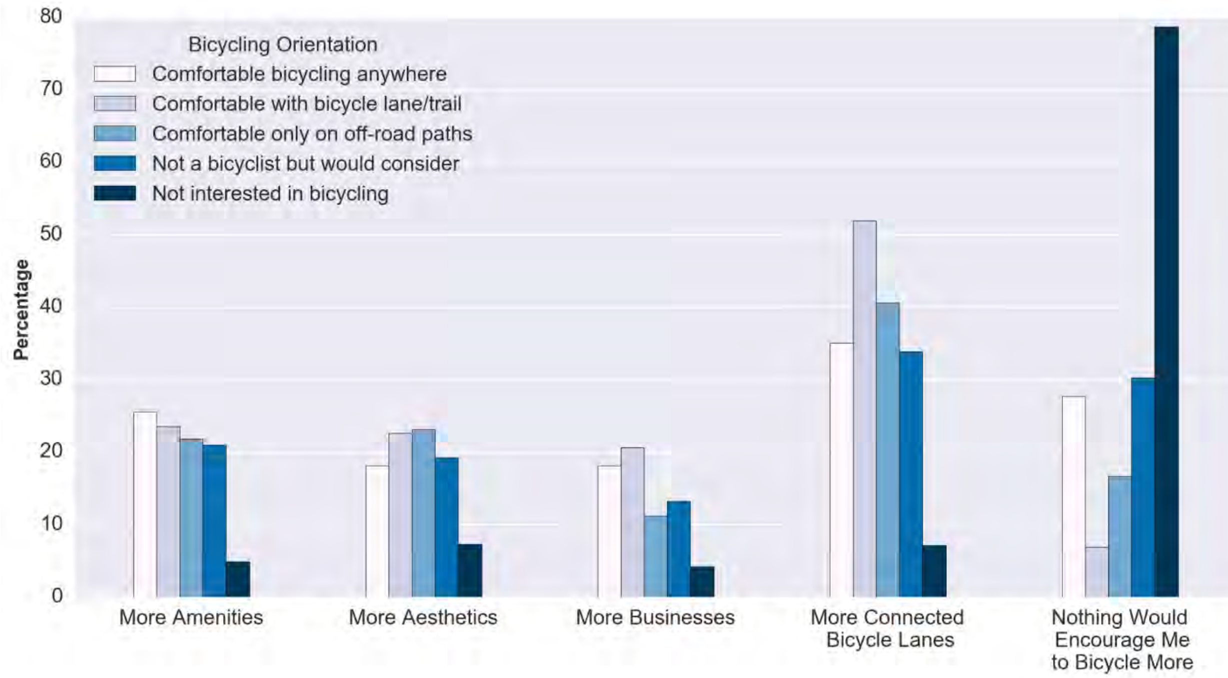

Figure 69. Bicycling Motivators by Bicycling Orientation.

Spatial Distribution of Active Travel

Active Travel Mode Split

The areas with the highest proportion of respondents who frequently walked for non-commute trips tended to be situated along the U.S.-Mexico border (Figure 70). In contrast, walk commuting frequency was primarily concentrated near downtown and the university, demonstrating the connection between density and walkability (Figure 71). Outside of downtown, walk commuting frequency was consistently low.

Higher bicycling rates were also seen in neighborhoods closer to downtown, but overall rates of non-commute bicycling were much lower than for walking (Figure 72). Due to low bicycling rates, bicycling commute trips were not mapped at the ZCTA level. In contrast, significantly higher rates of willingness or comfort with bicycling were seen across the study area. The proportion of respondents who expressed comfort bicycling anywhere, on bicycle lanes, or on off-road paths ranged from 14.6 to 43.5 percent, with high rates seen near the university (Figure 73). The disparity between bicycling rates and apparent comfort or willingness to bicycle under certain conditions implies the potential for increased bicycling given an enhanced cycling environment.

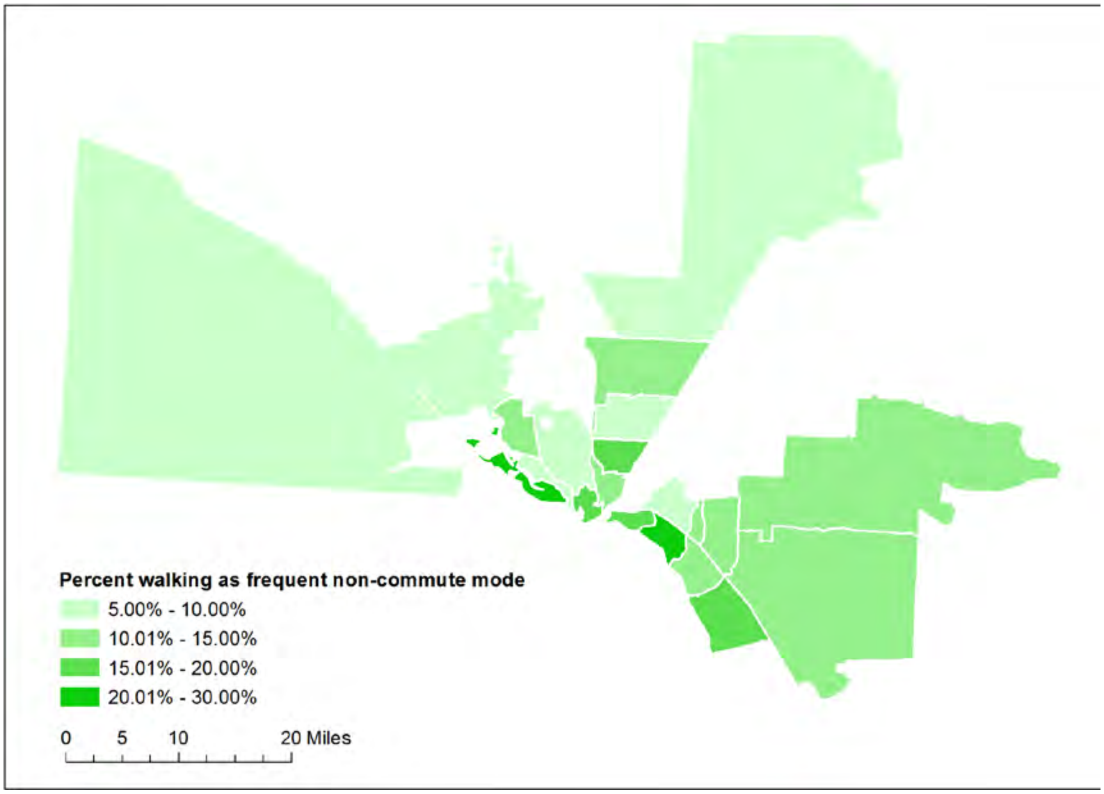

Figure 70. Percent Who Walk Frequently for Non-Commute Trips by ZCTA.

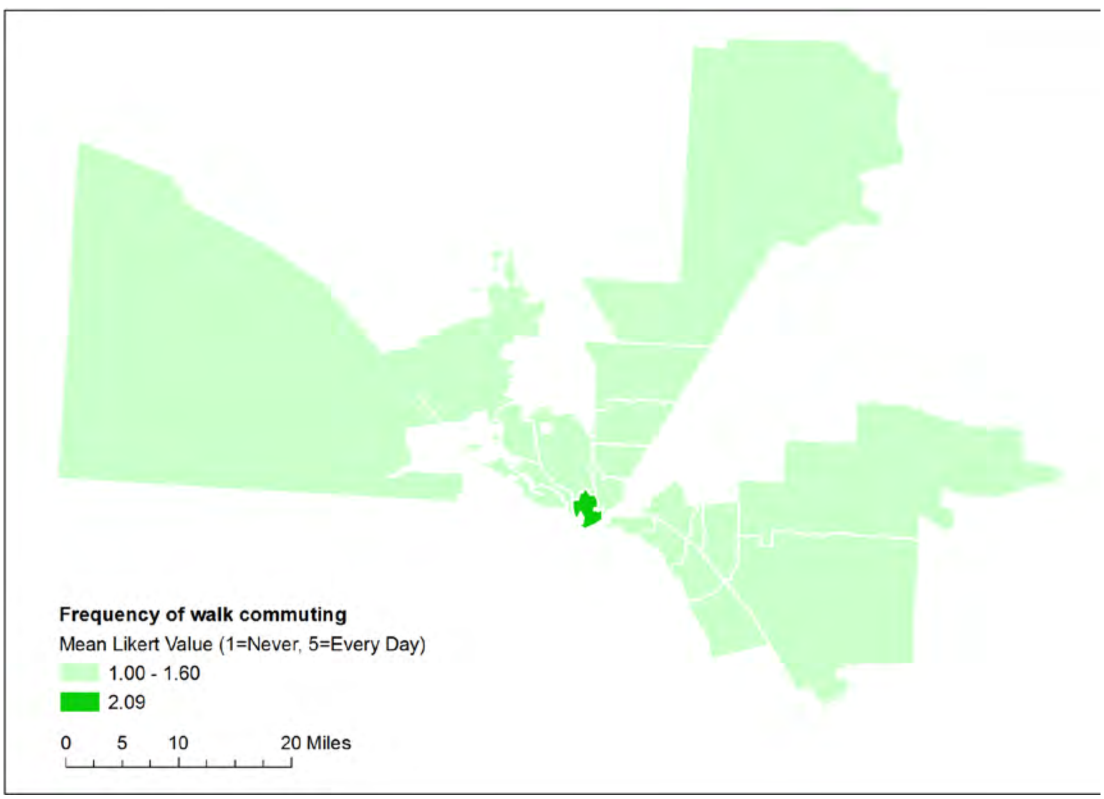

Figure 71. Walk Commuting Frequency by ZCTA.

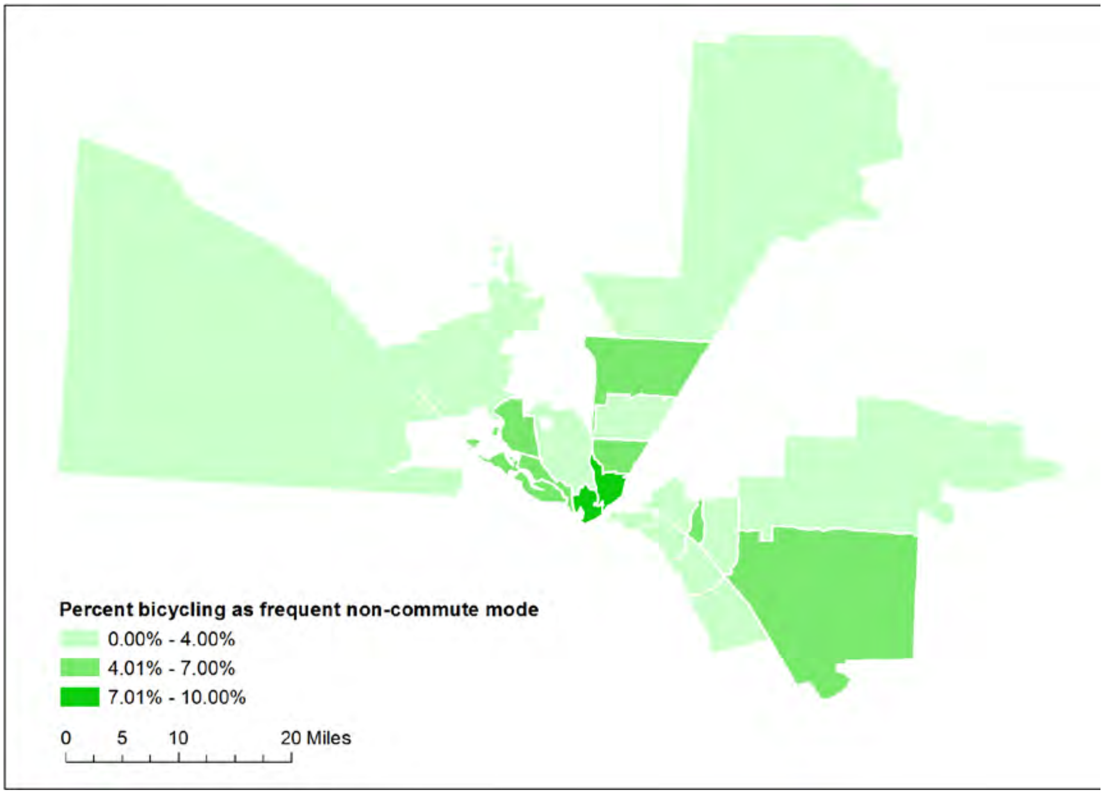

Figure 72. Percent Who Bicycle Frequently for Non-Commute Trips by ZCTA.

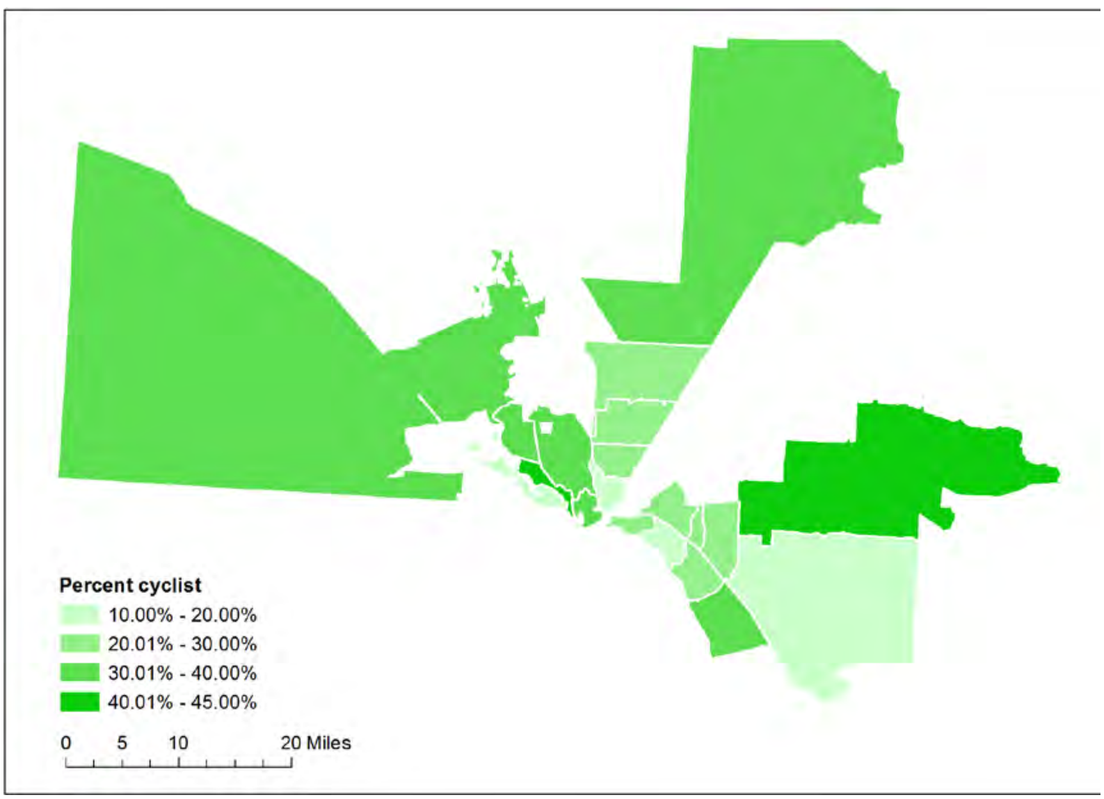

Figure 73. Percent Comfortable Bicycling on Bicycle Paths, Lanes, or Roads by ZCTA.

Active Travel and Neighborhood Environment

Respondents in areas to the east tended to rate their neighborhoods more favorably for having adequate sidewalks or road shoulders (Figure 74). Interestingly, the central/university neighborhood rated as the sixth worst in this respect (mean Likert value = 2.72) despite its relatively higher rates of walking and bicycling.

Respondents in eastern El Paso were more apt to agree that "there are connected bicycle routes beyond the neighborhood" (Figure 75). ZCTAs located in New Mexico were rated the most poorly for having connected bicycle routes. More centrally located respondents agreed more strongly that they had shops or restaurants within walking or bicycling distance (Figure 76). Again, New Mexico neighborhoods rated poorly on this question.

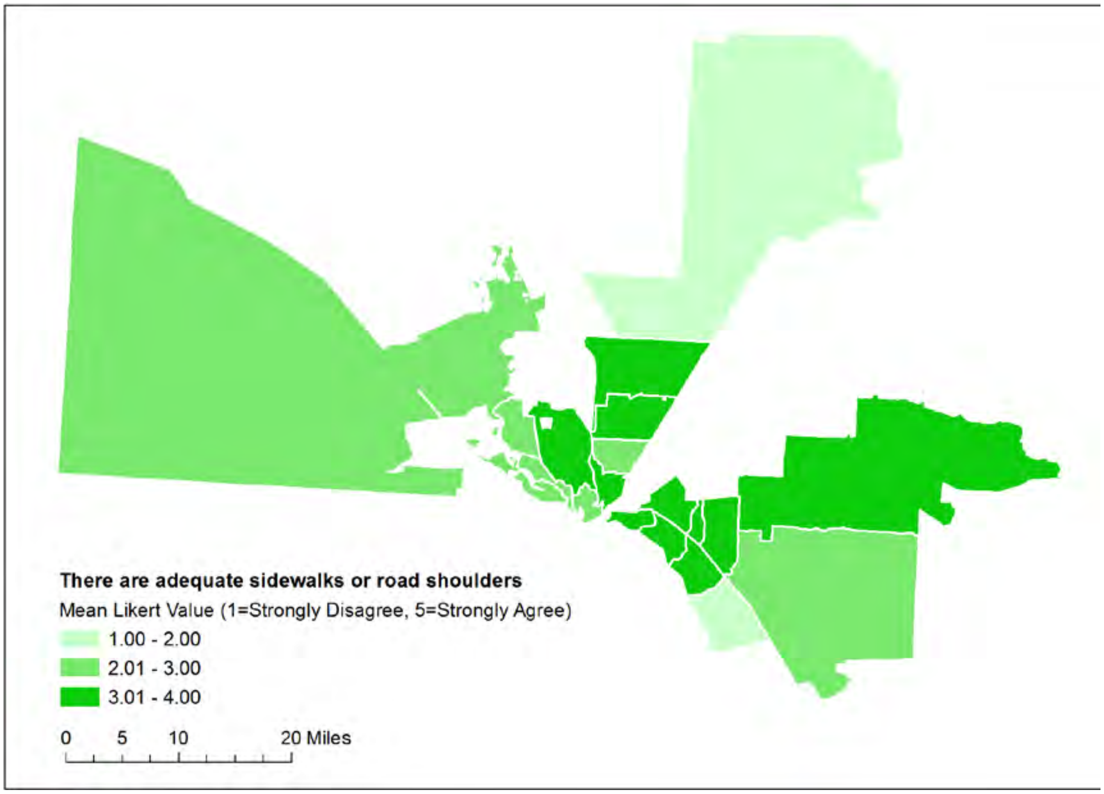

Figure 74. Neighborhood Environment: Sidewalks/Shoulders by ZCTA.

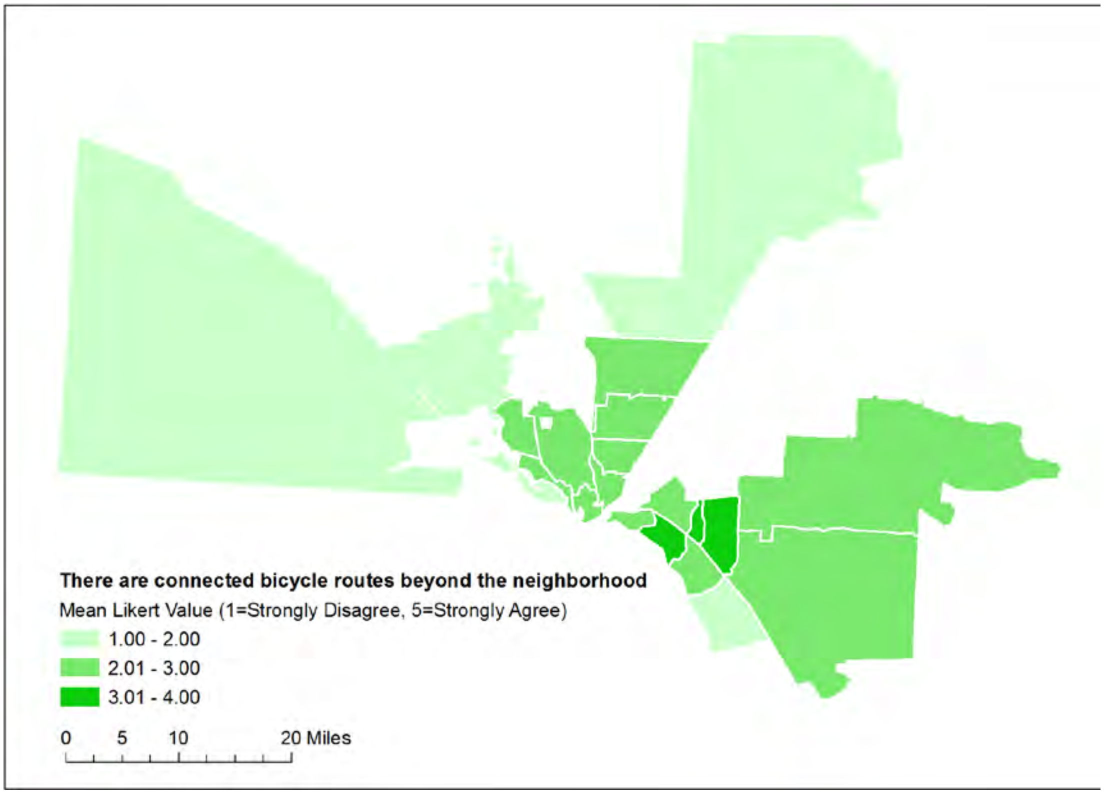

Figure 75. Neighborhood Environment: Connected Bicycle Routes by ZCTA.

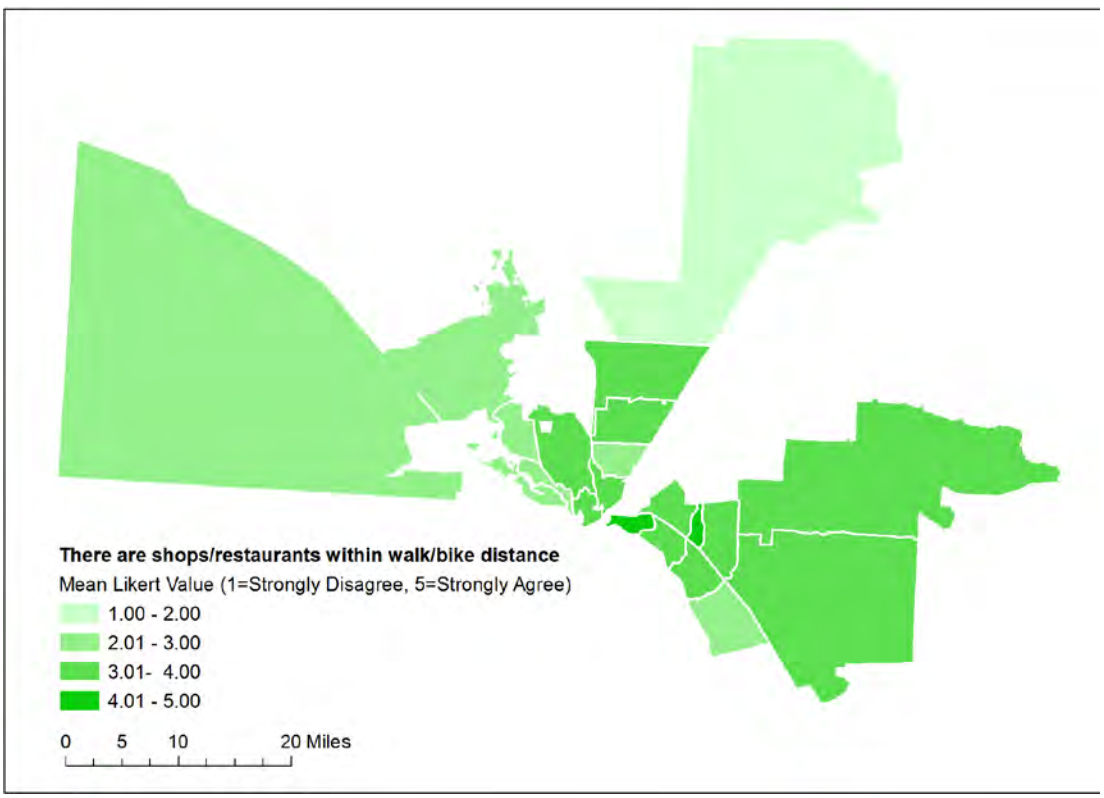

Figure 76. Neighborhood Environment: nearby Shops/Restaurants by ZCTA.

Active Travel Behavior Models

Several multivariate models were estimated to better explore active travel behavior in El Paso. The models examined factors associated with active commuting, non-commute active travel trips, and bicycling orientation. In developing these models, the El Paso Multimodal Survey data were used as a primary dataset to examine the influential factors. Secondary data sources were also examined through spatial variables created using geographical information systems.

Active Commuting Model

Table 8 presents the results of an ordinal logistic regression model used to predict the frequency of walk commuting (segmented into five levels: never, once a week, 2 or 3 days/week, 4 or 5 days/week, and every day) to work or school.[6] Results revealed that full-time workers were associated with lower rates of walk commuting compared to students/part-time workers. Household income was also negatively related to walk frequency, although results were not significant at the 0.05 level.

The factors associated with an increased walking frequency were selecting "more amenities" (e.g., green spaces and playgrounds) as the most important walking motivator, being more sensitive to fuel prices when making travel decisions, and living in neighborhoods with a higher median age. The model also revealed the synergy between walking and transit usage. Frequent non-commute transit users were significantly more likely to be more frequent walk commuters. It is not clear what proportion of these walk commutes were isolated trips or part of a transit trip, though follow-up bivariate correlation analysis revealed that walk and transit commute frequencies were significantly positively related ($r = 0.314$, $p < 0.0001$).

Table 8. Walk Commute Frequency: Ordinal Regression Model Results.

Variable	Estimate	t-stat.	p-value
Full-time worker	−1.008	−3.220	0.001
Annual household income	−0.122	−1.768	0.076
Walk motivator: amenities	0.963	3.321	0.001
Fuel prices influence travel my decisions	0.235	2.080	0.037
Median age (block group)	0.059	3.278	0.001
Frequent non-commute mode: transit	1.875	2.551	0.011
N	547		
−2 Log Likelihood	488.134		

[6] Due to low bicycle commuting numbers, it was not possible to estimate a bicycle commute frequency model.

Non-commute Active Travel Models

The next two binary logistic regression models estimated the likelihood of using active modes for non-commute trips. Sample sizes for these models were considerably larger than for the active commute frequency model given the inclusion of non-working respondents.

Table 9 presents the factors associated with frequently walking for non-commute trips, which were found to be almost entirely different than those for walk commuting. Frequent non-commute walkers indicated a greater tendency to visit parks, playgrounds, or trails frequently but ate out less frequently. As might be expected, frequent walkers were more concerned about exposure to air pollution, had a greater preference for walking over driving, and tended to place more importance on the need for safer walk routes. They were also less likely to select "more amenities" or "more aesthetics" as their main walk motivator, though several indicated a desire for more sidewalks in the "other" category.

Initial model results indicated a negative relationship between life satisfaction and frequent walking. In order to better understand why walking was associated with lower levels of happiness, several interaction effects were tested to determine whether life satisfaction was being moderated by demographic factors such as income, age, race, or gender. The results of the analysis revealed a significant effect for the interaction between life satisfaction and age. For those 60 or older, non-commute walking was negatively related to life satisfaction, but there was a slight positive association for younger respondents. In other words, older respondents who walked frequently were more likely to be unhappier, perhaps because the physicality of walking tended to become more challenging after the age of 60.

Table 9. Walking as Frequent Non-Commute Mode: Binary Regression Model Results.

Variable	Estimate	t-stat.	p-value
Go to parks/playgrounds/trails frequently	0.187	2.309	0.022
Eat out frequently	−0.266	−3.057	0.002
Walk attitude: exposes me to more air pollution than driving	0.223	2.655	0.008
Walk attitude: prefer over driving	0.336	4.253	0.000
Travel motivator: safer walk routes	0.480	3.582	0.000
Walk motivator: amenities	−0.645	−3.359	0.001
Walk motivator: aesthetics	−0.695	−3.620	0.000
Life satisfaction	0.256	0.941	0.348
Age: 60 and up	2.986	2.259	0.024
Interaction: (Life satisfaction)*(Age: 60 and up)	−0.637	−2.145	0.032
Constant	−5.115	−3.795	0.000
N	1205		
−2 Log Likelihood	766.349		

Table 10 presents the results of the non-commute bicycling model. Similar to frequent non-commute walkers, frequent bicyclists tended to visit parks, playgrounds, or trails more frequently than non-cyclists. The neighborhood environment appeared to play a much larger role in determining non-commute bicycling as opposed to walking. Frequent bicyclists tended to live in neighborhoods they rated as attractive, having adequate sidewalks or shoulders, and having shops or restaurants within walking/bicycling distance. They also appeared less concerned with a lack of facilities at destinations or the quality of bicycle paths, but believed more strongly that bicycling was good for their health.

Much like the previous model, initial model results revealed that frequent bicyclists tended to have lower levels of life satisfaction. Again, interaction effects were tested with age, appearing to moderate the effects of happiness. Bicycling tended to have a negative association with life satisfaction for those 50 and older, but the reverse was true for those younger than 50. This age effect was 10 years below that found in the walking model, which seems reasonable given the more physically demanding nature of bicycling compared to walking.

Table 10. Bicycling as Frequent Non-Commute Mode: Binary Regression Model Results.

Variable	Estimate	t-stat.	p-value
Go to parks/playgrounds/trails frequently	0.591	3.694	0.000
Neighborhood environment: attractive	0.310	1.987	0.046
Neighborhood environment: adequate sidewalks or shoulders	−0.652	−4.497	0.000
Neighborhood environment: shops within walk/bicycle distance	0.422	2.910	0.004
Bicycle attitude: good for my health	1.610	3.578	0.000
Bicycle motivator: amenities	−0.825	−2.194	0.028
Bicycle deterrent: disrepair of lanes/trails	−1.340	−3.445	0.001
Bicycle deterrent: lack of facilities at destination	−1.198	−3.247	0.001
Life satisfaction	1.159	1.961	0.050
Age: 50 and up	8.782	2.990	0.003
Interaction: (Life satisfaction)*(Age: 50 and up)	−2.010	−3.196	0.001
Constant	−16.185	−4.576	0.000
N	1125		
−2 Log Likelihood	252.398		

Active Traveler Bicycling Orientation Models

Binary logistic regression models were developed to characterize two segments of the population: existing cyclists and non-cyclists who indicated a willingness to consider bicycling in the future.

Table 11 presents the results of the binary regression for existing cyclists, or those respondents that identified as being comfortable bicycling anywhere, on a bicycle lane or trail, or on bicycle paths only. The model revealed that Asian, male, and younger respondents were more likely to be existing bicyclists. Existing cyclists were additionally tied to several factors associated with higher socioeconomic standing, such as having a high household income and being employed. Existing cyclists also tended to have a greater number of household vehicles and live in neighborhoods with higher levels of education. Existing cyclists indicated a greater likelihood of walking or bicycling for fitness and were more likely to have positive perceptions of bicycling in terms of time, stressfulness, and health benefits. Distance was commonly cited as a bicycling deterrent by existing bicyclists, and having safer bicycle routes was a common travel motivator.

Table 11. Existing Cyclist: Binary Regression Model Results.

Variable	Estimate	t-stat.	p-value
Race: Asian	3.044	2.885	0.004
Male	0.407	2.528	0.011
Age	−0.027	−4.500	0.000
Annual household income: $150,000 and up	0.526	2.248	0.024
Unemployed	−0.881	−2.083	0.037
Household vehicles	0.124	2.340	0.019
Percent with 2 or 4 year degree education or higher (block group)	1.141	2.678	0.007
Walk/bicycle mostly for fitness	0.418	5.359	0.000
Bicycle attitude: takes too much time	−0.446	−5.646	0.000
Bicycle attitude: less stressful than driving	0.223	3.097	0.002
Bicycle attitude: good for my health	0.627	4.860	0.000
Bicycle deterrent: distance	0.349	2.154	0.031
Travel motivator: safer bicycle routes	0.601	6.010	0.000
Constant	−5.429	−6.597	0.000
N	1015		
−2 Log Likelihood	1003.262		

Table 12 presents the results of the binary regression for non-cyclists who indicated a willingness to consider bicycling. In general, being white or younger than 60 was associated with a higher likelihood of being a non-cyclist who would consider bicycling. These respondents also tended to live in less-educated neighborhoods and have lower self-reported health levels.

Contrary to existing cyclists, members of this group demonstrated a tendency to believe more strongly that bicycling takes too much time. They were also more likely to be deterred by the difficulty of carrying items on a bicycle. On the other hand, amenities, aesthetics, and connected bicycle lanes were significant bicycling motivators.

Table 12. Non-Cyclist But Willing to Consider Bicycling: Binary Regression Model Results.

Variable	Estimate	t-stat.	p-value
Race: white	0.315	2.299	0.021
Age: 60 and up	−0.295	−1.891	0.058
Percent with 2 or 4 year degree education or higher (block group)	−0.846	−2.350	0.019
Self-reported health	−0.186	−2.447	0.014
Bicycle attitude: takes too much time	0.159	2.565	0.011
Bicycle deterrent: unable to carry items	0.478	3.567	0.000
Bicycle motivator: amenities	0.615	3.494	0.000
Bicycle motivator: aesthetics	0.372	2.114	0.034
Bicycle motivator: connected bicycle lanes	0.628	4.331	0.000
Constant	−0.846	−2.350	0.019
N	1115		
−2 Log Likelihood	1381.218		

CONCLUSIONS

The results of this study were typically consistent with previous findings from the active transportation literature. Pedestrians tended to be younger and have lower household incomes, while bicyclists were associated with being male, younger, and having a higher income. Model results were also complementary to the findings of the descriptive analysis, though not in every respect. A bivariate analysis between non-commute mode and walking motivators revealed that frequent non-commute walkers appeared to be strongly motivated by the provision of amenities and aesthetics. Upon controlling for other factors in the full model, this relationship was reversed; walkers were actually less concerned with these built-environment factors.

The models additionally provided insight into other factors influencing active travel rates, revealing that attitudes and the neighborhood environment appeared to be more influential than individual sociodemographic impacts. As in previous research, it appeared that enhancements to the active travel infrastructure will be more effective in encouraging bicycling than walking. Bicycling is more dependent on the provision of physical infrastructure than walking. Existing cyclists may also be more likely to have other competitive mode options to choose from (e.g., SOV, transit, and walking), whereas many pedestrians—who tended to be lower-income travelers—may have no choice but to walk due to financial constraints.

Earlier studies have reported mixed findings on the influence of perceived traffic safety and crime on active transportation rates. Here, safety was a significant concern for bicyclists and frequent non-commute pedestrians, but did not have an effect on walking commute trips. Additionally, previous researchers have found that walking and bicycling are typically more prevalent in high-density, centrally located neighborhoods with nearby attractive destinations. Spatial analysis supported this notion, as active transportation rates were highest near downtown and the university. In the models, built-environment measures such as population density and distance to the central business district were not significant, though this may have been due to zonal aggregation error associated with the use of ZCTAs.

Separately modeling the factors associated with different bicycling orientation levels provided further insights that can aid in encouraging bicycle travel. Both existing bicyclists and willing non-bicyclists were strongly associated with bicycling attitudes but responded to a different set of motivators and deterrents. For non-cyclists, connected bicycle lanes, amenities, and aesthetics were the primary motivators, while the inability to carry items was the greatest deterrent. In contrast, these factors were not significant for existing cyclists, who were primarily concerned with route distance and safety. Both of these groups will be important to target in order to improve cycling rates, and these findings point to the different methods needed to do so.

Increasing cycling among existing cyclists will require addressing practical concerns such as distance and safety, which can be accomplished by improving bicycle infrastructure and encouraging mixed land uses to decrease travel distances. Willing non-cyclists were additionally concerned with factors such as aesthetics, amenities (e.g., bicycle racks, cubbies, and showers), and carrying capacity. Successfully reaching this group will require improving the attractiveness of bicycling in order to overcome reservations and competition from other modes. These travelers will likely be most encouraged by interventions that diminish adoption barriers, such as bicycle-friendly neighborhoods, bicycle boulevards, and bicycle facilities at work and other destinations. Education and training programs targeting willing non-cyclists would also be beneficial in increasing confidence and helping to overcome beginner fears. In El Paso, there is a large gap between willingness to bicycle and participation levels. Cycling rates are low, yet a large proportion of respondents indicated that they would be willing to bicycle or would be comfortable bicycling on bicycle lanes or off-road paths. It appears that a latent demand for bicycling exists, which can be exploited with the proper measures.

For pedestrians, the models suggested that improvements to the active travel infrastructure or neighborhood environment are important but less influential than they are for bicyclists. Frequent non-commute walkers were motivated by safer walking routes, indicating that these travelers would be encouraged by the provision of crosswalks, sidewalks, traffic-calming measures, and other pedestrian-oriented design features. Walk commuters indicated that more walking amenities (e.g., open green spaces, playgrounds for kids, and rest areas) would provide a positive effect. Additionally, the inclusion of transit use in the walk commuting model demonstrated the strong link between the two modes. Travel mode analysis often assigns just a single mode to each trip, but it is clear that transit trips often include walking segments at the beginning and end of each ride. Therefore, policy makers and planners may be able to indirectly improve walking rates by promoting transit usage. Tapping into this source of bonus walking trips may have the additional benefit of being a more cost-effective way to encourage pedestrian travel.

In addition, working with employers to develop programs to increase active commuting could be an effective means of promoting walking and bicycling. Rates of active travel to work were quite low, but there is potential for improvement given that 20 percent of workers lived within 4 miles of their workplace. Financial incentives, educational programs, and improved workplace amenities for walking and bicycling would all help encourage active travel among workers.

Though not a main focus, this research study was also interested in exploring the relationship between active travel and health. The descriptive analysis revealed that frequent bicyclists reported the highest health levels, but based on the current model results, there did not appear to be a strong significant relationship between BMI or health and walking/bicycling among El Paso residents. Similarly, frequent active travelers were not found to be associated with significantly higher rates of moderate or vigorous exercise, perhaps indicating that the act of walking or bicycling substituted for physical activity in other areas of participants' lives. Upon comparing life satisfaction between modes, it appeared that many active travelers tended to report low levels of happiness. Further analysis revealed that life satisfaction effects were moderated by age—low life satisfaction was only associated with walking and bicycling for older respondents (50 and older for bicycling, and 60 and older for walking). These findings are important to keep in mind for active travel planners and policy makers. Physical limitations make walking and bicycling infeasible travel options for many older travelers. For this population, it will be important to consider more accessible travel alternatives such as transit or paratransit. Overall, this area of research needs detailed examination in order to paint an accurate picture of what stakeholders envision for connecting health and transportation.

CHAPTER 6:
SUMMARY OF OPEN HOUSES HELD FOR THE EL PASO MULTIMODAL PLAN

INTRODUCTION

This chapter summarizes the open houses that were held for the El Paso Multimodal plan from November 3–7, 2015. The summary includes:

- The purpose of the open houses.
- Where and when the open houses were held.
- The setup and activities that took place at the open houses.
- The outreach and advertisements that were used to publicize the open houses.
- The input that was provided by members of the public for each of the open houses.

PURPOSE OF OPEN HOUSES

As part of the overall planning efforts for the Paseo del Norte region, the El Paso MPO recognized the need to address overall congestion in the area, improve air quality, increase economic development opportunities and improve health. In addition to data collection and analysis, the project team held open houses throughout the El Paso MPO planning region so members of the public and other stakeholders could learn about the plan and provide input on pedestrian, bicycle, and transit connectivity issues and opportunities.

SUMMARY OF OPEN HOUSE LOCATIONS

The El Paso MPO planning region is split into seven planning areas and an open house was scheduled for each area. The following summarizes the seven open houses held:

- **Socorro Planning Area:** Marty Robbins Recreational Center, 11600 Vista del Sol Drive, El Paso, Tuesday, November 3, 2015, 11:00 a.m.–2:00 p.m.
- **Clint/San Elizario Planning Area:** El Paso County Water Improvement District, 13247 Alameda Avenue, Clint, TX, Tuesday, November 3, 2015, 3:30 p.m.–6:00 p.m.
- **West El Paso/Sunland Park Planning Area:** Sunland Park Senior Center, 1010 McNutt, Sunland Park, NM, Wednesday, November 4, 2015, 12:00 p.m.–3:00 p.m.
- **Northeast El Paso Planning Area:** Northeast Regional Command Center, 9600 Dyer Street, El Paso, Wednesday, November 4, 2015, 4:00 p.m.–7:00 p.m.
- **Ysleta Planning Area:** Pebble Hills Regional Command Center, 10780 Pebble Hills Boulevard, El Paso, Thursday, November 5, 2015, 3:30 p.m.–6:30 p.m.
- **Canutillo/Anthony Planning Area:** West Valley Fire Department, 510 Vinton Road, Vinton, TX, Thursday, November 5, 2015, 4:00 p.m.–6:30 p.m.
- **Central El Paso Planning Area:** Armijo Recreation Center, 700 E 7th Avenue, El Paso, Saturday, November 7, 2015, 9:00 a.m.–12:00 p.m.

SUMMARY OF OPEN HOUSE LAYOUT AND ACTIVITIES

The open houses were designed as informal events, where the public could visit numerous stations and speak with project representatives to learn about the plan and provide input about pedestrian, bicycle, and transit connectivity challenges and opportunities in their planning area. Figure 77 provides a diagram of the layout that was used for the open houses. Project representatives were stationed at each table to provide instructions and take input from attendees.

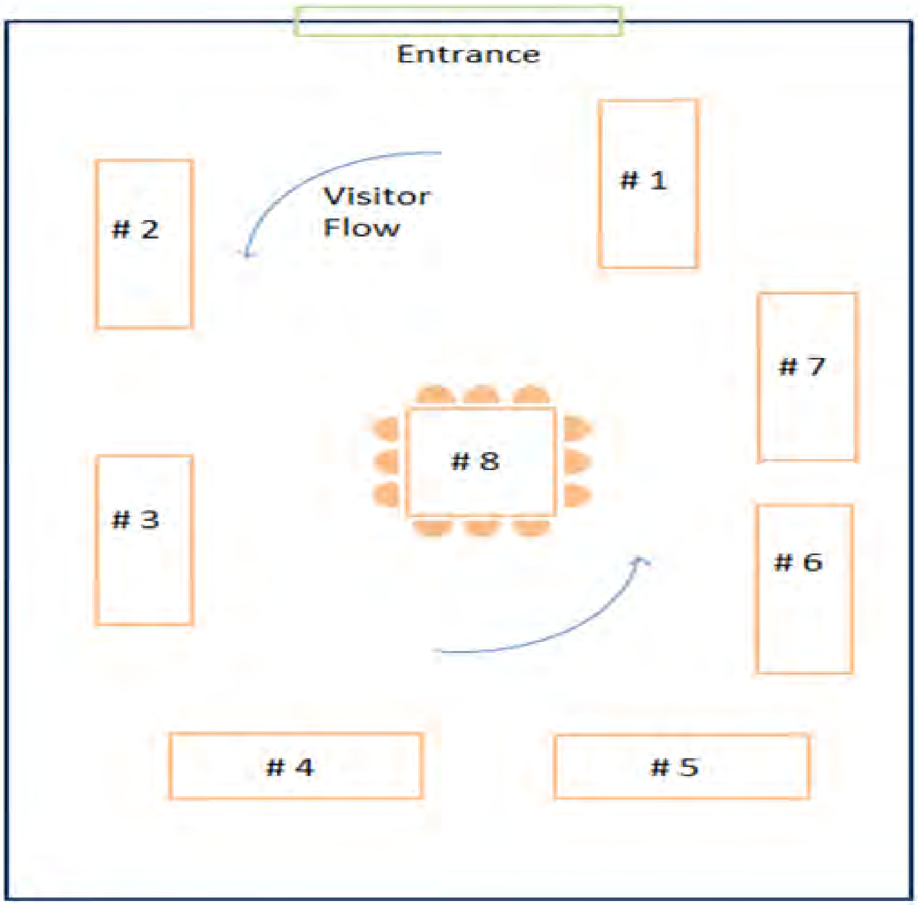

Figure 77. El Paso Multimodal Plan Open House Layout.

The following is a description of the activities that took place at each of the eight tables in Figure 77:

- **Table # 1: Welcome table**. The welcome table included sign-in sheets and also provided project representatives the opportunity to share information on the project purpose, project history, project progress, work to date, and next steps for the plan with open house attendees. In addition, this table included a handout with the plan background and purpose.
- **Table # 2: Sidewalk connectivity exercise.** The sidewalk connectivity exercise table featured a map (or maps) of the sidewalks in the planning area where the open house was being held. Attendees of each open house were asked to provide input on pedestrian

connectivity issues and opportunities in this planning area by marking directly on the maps or providing comments on sticky notes.

- **Table # 3: Bicycle connectivity exercise.** The bicycle connectivity exercise table featured a map (or maps) of the bicycle facilities in the planning area where the open house was being held. Attendees of each open house were asked to provide input on bicycle connectivity issues and opportunities in this planning area by marking directly on the maps or providing comments on sticky notes.
- **Table # 4: Transit connectivity exercise.** This transit connectivity exercise table featured a map(s) of the transit routes in the planning area where the open house was being held. Attendees of each open house were asked to provide input on transit connectivity issues and opportunities in this planning area by marking directly on the maps or providing comments on sticky notes.
- **Table # 5: Air quality calculator.** This table had a program that allows users to enter information about their trips and modes to assess the impacts on air pollutants. Attendees were encouraged to experiment with different modes to understand the impact of their choices. This table also featured additional handouts on air quality standards for the El Paso Region.
- **Table # 6: El Paso Multimodal Plan survey.** This table invited interested attendees to complete the El Paso Multimodal Plan Survey, which asked a range of questions on multimodalism in the El Paso Region. Attendees were provided printed versions (English and Spanish) of the survey to complete there or take it home and mail it.
- **Table # 7: Feedback table.** At this table, attendees could provide additional written comments or take comment cards with them to get input from family members and friends and return through the mail.
- **Table # 8: Kid's activity table.** The kid's activity table provided a place for attendees' children to play while their parents visited with project representatives and provided input. The kid's activity table was located in the middle of the room so parents keep an eye on their children. The table featured a coloring activity, which was created specifically for the El Paso Multimodal Plan Open Houses (shown as Figure 78) along with crayons and candy.

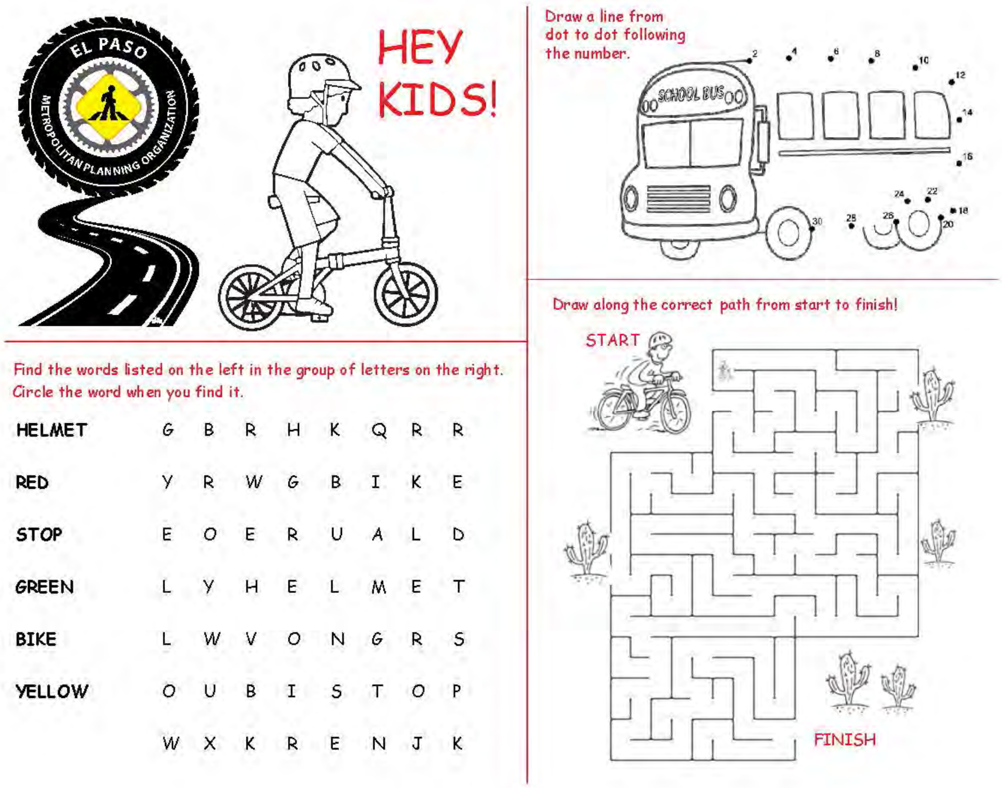

Figure 78. El Paso Multimodal Plan Open House Kid's Activity.

SUMMARY OF OUTREACH AND ADVERTISEMENTS USED TO PUBLICIZE THE EL PASO MULTIMODAL PLAN OPEN HOUSES

The El Paso Multimodal Plan Open Houses were publicized through the following channels:

- The El Paso MPO's website.
- The *El Paso Times* and *El Diario* (both English and Spanish).
- Public announcements on all public radio stations, the City of El Paso public access cable channel, and on their public announcement video screens televised within their city office buildings.
- A flyer (Figure 79) (in Spanish and English) emailed to the El Paso MPO distribution list; distributed by hand at the event locations and other popular bicycle shops, grocery stores, public libraries, and recreational centers; and posted at schools.
- The El Paso MPO Facebook Page.
- Transportation Policy Board members' websites.

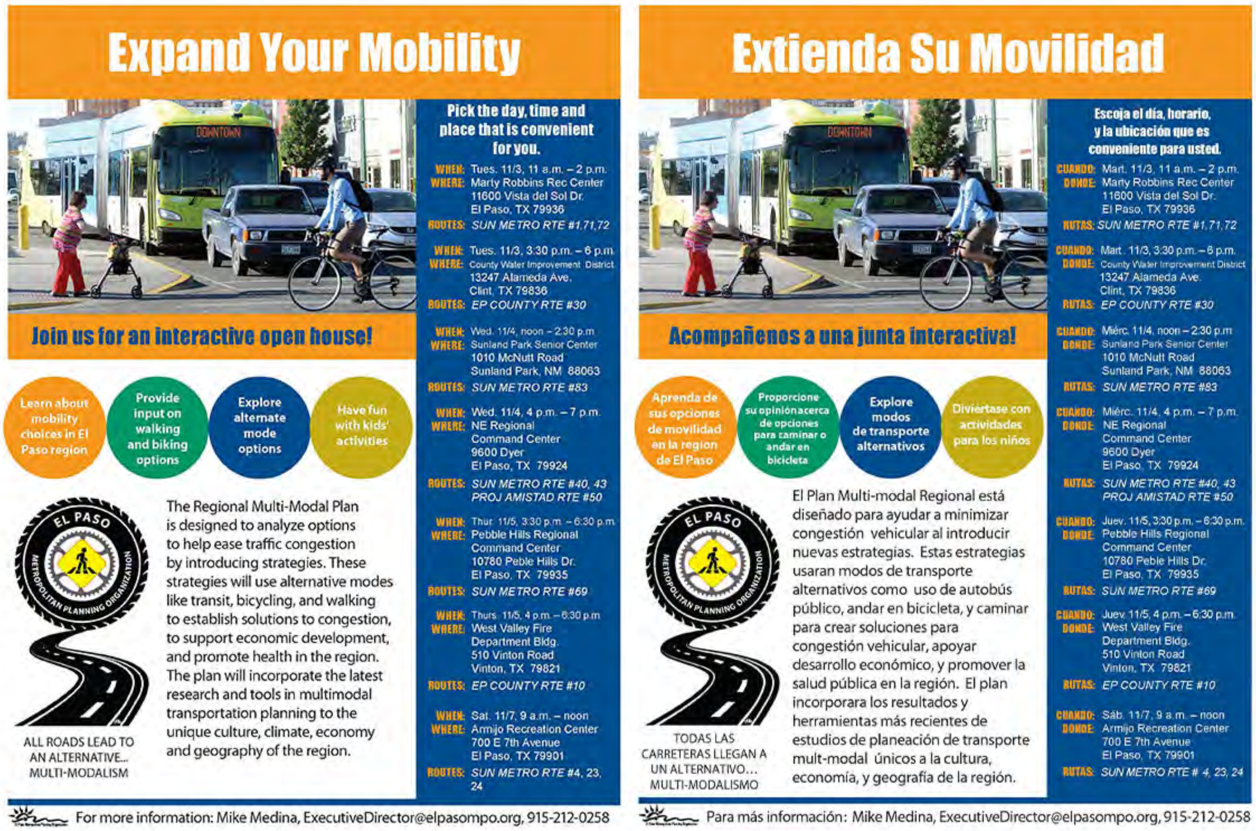

Figure 79. El Paso Multimodal Plan Flyers (English and Spanish Versions).

SUMMARY OF PUBLIC INPUT PROVIDED AT OPEN HOUSES

Appendix C provides a detailed compilation of all public comments, including pictures of the maps used for the pedestrian, bicycle and transit connectivity exercises. Table 13–Table 19 summarize input received at each open house:

- Socorro Planning Area Open House (Table 13).

Clint/San Elizario Planning Area Open House (

- Table 14).
- West El Paso/Sunland Park Planning Area Open House (Table 15).

Northeast El Paso Planning Area Open House

- Table 16).

Ysleta Planning Area Open House (

- Table 17).

Canutillo/Anthony Planning Area Open House (

- Table 18).
- Central El Paso Planning Area Open House (Table 19).

Table 13. Summary of Input Received at Socorro Planning Area Open House.

Pedestrian Input	Sidewalks need to be wide enough to be American's Disabilities Act (ADA) accessible (perhaps wider).
	All parks should be connected to sidewalks.
	Consider policies that create more walkable environments (reducing setbacks for commercial properties, parking behind buildings).
Bicycle Input	IH10 is a barrier for bicycle connectivity. Crossings that are safe and accessible must be considered to make this area more bicycle-friendly.
	Maintenance issues (such as vegetation overgrowth) prohibit biking in this area.
	Bicycle facilities should connect parks.
	Explore the conversion of abandoned irrigation canals and utility access areas (power lines, etc.) to multi-use paths.
	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or at least unpleasant.
	Many bike lanes disappear at major intersections.
Transit Input	No comments provided.

Table 14. Summary of Input Received at Clint/San Elizario Planning Area Open House.

Pedestrian Input	No comments provided.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or at least unpleasant.
	Explore the conversion of abandoned irrigation canals and utility access areas (power lines, etc.) to multi-use paths.
Transit Input	No comments provided.

Table 15. Summary of Input Received at West El Paso/Sunland Park Planning Area Open House.

Pedestrian Input	This area has many elderly citizens so pedestrian and transit facilities are extremely important to their mobility.
	Sidewalks in this area lack continuity and need regular maintenance as many are falling apart.
	Crosswalks need to be built throughout this area, especially near bus stops.
	All pedestrian amenities need to be ADA accessible.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or at least unpleasant.
	The Rio Grande River canal is major east/west barrier. There are some connections across the levy, but more are needed.
	This area needs better connections to east/downtown El Paso.
Transit Input	This area has many elderly citizens so pedestrian and transit facilities are extremely important to their mobility.
	There are numerous locations in this area that could benefit from increased transit service (local banks, clinics, industrial park, etc.).

Table 16. Summary of Input Received at Northeast El Paso Planning Area Open House.

Pedestrian Input	Consider policies that require local construction to provide alternative pedestrian routes. Enforcement of these policies must also be considered.
	Sidewalks in this area lack continuity and need regular maintenance as many are falling apart.
	There are numerous locations (amenities, schools, etc.) in this area that need pedestrian access.
	This area needs increased lighting on sidewalks and bike facilities.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or unpleasant.
	Bicycle facilities need to connect to bus terminals.
	This area needs increased lighting on sidewalks and bike facilities.
Transit Input	No comments provided.

Table 17. Summary of Input Received at Ysleta Planning Area Open House.

Pedestrian Input	Sidewalks in this area lack continuity and need regular maintenance as many are falling apart and/or are have vegetation growing into the sidewalk.
	Parks in this area need bicycle and pedestrian connectivity.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or unpleasant.
	Bicycle groups need to use bike lanes to encourage others to use those facilities as well.
	Parks in this area need bicycle and pedestrian connectivity.
	Consider bike boxes or bike priority lights at busy intersections.
	Bike lanes disappear at many large intersections in this area.
Transit Input	This area needs bus bays and benches at bus stops on major arterials.

Table 18. Summary of Input Received at Canutillo/Anthony Planning Area Open House.

Pedestrian Input	Doniphan Street has many businesses and schools and there is currently a large amount of foot traffic but there is a lack of continuous sidewalks and sufficient crosswalks, especially in the business district.
	Consider lowering speeds on main arterials to promote safer pedestrian connectivity.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or unpleasant.
	There are major parts of this area that have no bicycle connections (e.g., Vinton Road and Doniphan Drive).
	Bicyclists need end-of-ride amenities (i.e., bike racks, lockers to change, showers).
	Consider opportunities for hike and bike trails in this area (near streams).
Transit Input	New hospital being built on Resler Street will need transit service.
	There is a need to easily transfer from county buses to Sun Metro buses in this area. Fares should be transferable.
	Consider discounted rates for elderly and students.
	There are many bus stops with no bus shelters or benches in this area.

Table 19. Summary of Input Received at Central El Paso Planning Area Open House.

Pedestrian Input	Numerous locations in this area lack continuous sidewalks, and many areas with sidewalks need more regular maintenance and vegetation control.
	Consider increased enforcement for motorists that don't yield to pedestrians.
	Consider underpasses at busy streets to increase accessibility to destinations such as the baseball park.
	Need to evaluate the need for safer crosswalks on busy roads (e.g., Mesa Street).
	Many cars park so their vehicle hangs over sidewalk (consider parking barriers to avoid this).
	Cars frequently stop in crosswalks at intersections, need better striping to make sure vehicles are aware of where they are supposed to stop.
	Several locations have utilities or other barriers in the crosswalk.
Bicycle Input	Consider parallel routes for biking as some roads may have bicycle facilities (wide shoulders) but the high volumes of traffic make bicycling unsafe or at least unpleasant.
	Numerous locations in this area need buffered/protected bike lanes as roads are narrow and traffic is heavy.
	Wayfinding signs in this area would be helpful for bicyclists.
	Need bicycle facilities and amenities at the end of trip such as showers, lockers, bike lockers, benches, shade structures, water fountains, bathrooms, and bike parking.
	City and MPO should work to acquire rights of way for the rail road utility easements, which could be used for hike/bike paths connecting the region.
Transit Input	Route 75 needs shorter headways and should extend hours of operation.
	Numerous opportunities to increase transit service in this area, especially with express routes to areas of interest (e.g., 5 Points transit station).
	Need to get feedback directly from bus passengers and drivers to understand how to improve the service.

CHAPTER 7:
POLICY RECOMMENDATIONS

This chapter proposes specific policy direction for the MPO to develop, adopt, and implement a robust, multifaceted plan for a multimodal transportation system for El Paso region.

ISSUE: REGIONAL AND INTERNAL PLAN CONSISTENCY

Rationale

Plan consistency is essential when addressing regional transportation facilities to ensure appropriate timing and coordination of facility modifications. Each local government comprehensive plan, including the transportation element, should be consistent, to the extent feasible, with the plans and programs of the MPO, transportation authorities, transit agencies, and TxDOT as they relate to the jurisdiction.

Recommendations

The recommendations are:

- The MPO should establish and promote a Regional Multimodal Planning Committee (RMPC) as a platform to discuss and evaluate for consistency the transportation plans developed and adopted by entities in the region. The Committee can also serve as a forum for discussion of multimodal planning issues in the region.
- The MPO should seek to be an educational resource for multimodal planning for citizens in the region.

ISSUE: LAND USE AND MULTIMODAL ENVIRONMENT

Rationale

Land use organization, location, mix, and density/intensity paired with multimodal policy contribute to a multimodal environment.

Recommendations

The recommendations are:

- The MPO should continue to support the City of El Paso's Complete Streets initiative.
- The MPO should encourage multimodal options when evaluating transportation projects in the El Paso region.
- Adjacent land uses and forms as opportunities for increased multimodal options should be encouraged by the MPO.

ISSUE: MULTIMODAL QUALITY/LEVEL OF SERVICE

Rationale

Multimodal LOS standards go beyond roadway LOS to ensure that the operating characteristics of other modes are maintained or improved to a locally desirable level. Standards may relate to various operational characteristics of importance to each mode, and may be simple or complex depending upon the planning capacity of the community.

Recommendations

The recommendations are:

- The MPO should establish and adopt quality standards for the transportation modes in the region. This effort may incorporate existing standards (roadways, transit, airport) and could require efforts by the agency to develop standards for bicycle and pedestrian.
- Quality indexes for bicycle and pedestrian modes should be developed and updated with effective data collection programs. Existing LOS ratings generated in the region should be monitored and evaluated in the context of multimodal improvement.

ISSUE: PUBLIC TRANSPORTATION NETWORK

Rationale

A key issue for transit is providing adequate connections to/from one's origin and destination, also known as first mile/last mile connectivity. Small-scale services such as local circulators may be beneficial for this purpose, so a focus for future planning efforts. Funding is another challenge, in particular funding for ongoing operations.

Recommendations

The recommendations are:

- The MPO will continue to support and encourage land use strategies to reinforce statewide/regional transit and express transit service traveling through or with endpoints within plan boundaries.
- Continue to support Sun Metro, El Paso County Transit, and the Far WTEP Regional Transportation Coordination efforts in addressing existing and planned local transit within plan boundaries, including route locations, headways, span of service, and infrastructure and land use strategies.
- The MPO will continue to support, encourage, and promote strategies and projects that support first mile/last mile connectivity, including bike share, car share, circulator services, transit accessibility, shelter amenities, safety and security at transit stops, and quality of maintenance at transit stops.

ISSUE: TRANSPORTATION DEMAND MANAGEMENT

Rationale

TDM is a strategy used to balance the need for transportation improvements with management of the demand on the transportation system. Improving the management and utilization of the existing system becomes a priority when cost, community, or environmental impact limit expansion of the transportation system.

Recommendations

The recommendations are:

- The MPO will continue to support implementation of ITS strategies throughout the region.
- The MPO will continue to support infrastructure, policies, and financial incentives designed to encourage alternatives to single occupant vehicle travel in the region.
- The MPO will continue to provide for safer travel for all modes, through engineering, enforcement, and education programs.

ISSUE: BICYCLE NETWORK AND SAFETY

Rationale

Development, implementation, and promotion of bicycle modes is one of the primary methods in multimodal transportation planning. Providing these alternatives to citizens supports TDM, higher density development, transit, public health, social equity, and has been shown to increase land values.

Recommendations

The recommendations are:

- The MPO will support efforts by the City of El Paso in developing a master bicycle plan.
- The MPO will identify opportunities to implement bicycle lanes of appropriate width on or near all collector and arterial routes where appropriate.
- The agency will include planned projects to address gaps in the bicycle network and improve connectivity.
- The MPO will identify opportunities to address the continuation of, or establish new, shared use paths.
- The MPO will require new development to maintain continuous bicycle networks, including connections to transit stops and adjacent properties, and to provide bicycle parking at all non-residential uses, multifamily uses, and other key destinations.
- The MPO will support, develop, and implement local and regional measures to increase bicycle safety.
- The MPO will adopt bicycle network performance measures.

ISSUE: PEDESTRIAN NETWORK AND SAFETY

Rationale

Development, implementation, and promotion of pedestrian modes is one of the primary methods in multimodal transportation planning. Providing these alternatives to citizens supports TDM, higher density development, transit, public health, social equity, and has been shown to increase land values.

Recommendations

The recommendations are:

- The MPO will identify opportunities to implement ADA accessible sidewalks of appropriate width on or near all collector and arterial routes where appropriate.
- The agency will include planned projects to address gaps in the pedestrian network and improve connectivity.
- The MPO will identify opportunities to address the continuation of, or establish new, shared use paths.
- The MPO will require new development to maintain continuous pedestrian networks, including connections to transit stops, adjacent lots, and between building entrances and the internal and external sidewalk network.
- The MPO will seek opportunities to include measures to increase pedestrian safety at intersections, mid-block crossings, and while walking along the road.
- The MPO will adopt pedestrian network performance measures.

ISSUE: ROADWAYS OF REGIONAL SIGNIFICANCE

Rationale

The major roadway network is the backbone of transportation in the region and will continue to be the primary influence on planning. However, there are several ways in which the MPO can influence the existing and future roadway network in El Paso region in order to enhance multimodal options.

Recommendations

The recommendations are:

- The MPO will continue to support the City of El Paso Complete Streets policy and guidelines to guide the functional classification of roadways and their design.
- The MPO will research and designate transportation corridors requiring additional right of way and/or corridor management and include corridor management policies to preserve right-of-way needed for all transportation modes and to provide for dedication of land or conveyance of easements to local governments for planned transportation projects.

- The MPO will seek to provide for construction of parallel relievers or service roads along major highway corridors or within interstate interchange quadrants.
- The MPO will seek opportunities to provide for construction of new interstate highway overpass crossings to preserve continuity of street networks.
- The agency will include grade separated intersection improvement(s) when and where appropriate for major roadway intersections.
- The MPO will provide for construction of additional travel lanes and/or turn lanes to address existing or anticipated motor vehicle traffic volume where appropriate.
- Include design elements to increase bicycle and pedestrian safety and mobility in all roadway projects.
- The MPO will seek to provide additional park and ride facilities that accommodate carpooling and/or regional transit service.
- The MPO will promote direct modal connections between activity centers and surrounding residential areas.
- Policies and strategies to increase street network connectivity will be encouraged.
- The MPO will continue to support projects and strategies to provide safe routes to schools. It will coordinate with school board and local law enforcement on Safe Routes to Schools within a two-mile walking distance from schools. Its efforts should focus on physical improvements as well as educational and enforcement activities.

ISSUE: ACCESS MANAGEMENT

Rationale

Careful control of access along major roadway corridors reduces traffic conflicts and flow interruptions, while improving safety for drivers, pedestrians, and bicyclists. Access levels for the state highway system are established by TxDOT. Local governments may assign access levels to locally maintained thoroughfares or establish access location, spacing, and design criteria in roadway functional categories. Goals, objectives, and policies, plus roadway and access design standards and land development regulations, are used to implement the access management program.

Recommendation

The MPO will develop and adopt an access management program and support existing TxDOT and local policies.

ISSUE: AVIATION, RAIL, AND INTERMODAL FACILITIES

Rationale

A freight system based on rail, aviation, and the intermodal connections between each of these modes is crucial to an effective multimodal transportation system.

Recommendations

The recommendations are:

- The MPO will seek to align planning for aviation, rail, and intermodal connections with the future land use element.
- The MPO will coordinate with applicable plans (airport master plan, port master plan, etc.).
- The MPO will designate local routes intended for freight movement by large trucks and establish appropriate roadway design and operational measures for their efficiency.
- The agency will support efforts by federal, state, and local agencies, including Sun Metro, to enhance multimodal travel options at international bridges in the El Paso region.

CHAPTER 8:
ACTION PLAN FOR PRIORITIZATION AND IMPLEMENTATION

INTRODUCTION

This chapter serves as the Action Plan and provides additional input to the development of the overall Multimodal Plan by providing specific steps to be taken by the MPO to effectively implement the plan.

EL PASO MULTIMODAL PLAN – ACTION PLAN

1. Monitoring Progress

Progress of the El Paso Multimodal Plan will be evident not only by the implementation of this Action Plan, but also by many other decisions, investments, policies, and programs that will be guided by El Paso MPO, partner agencies, and individual users of the transportation system. Tracking progress is essential for knowing when the plan is on target or when shifts in direction are needed. El Paso MPO will regularly monitor and document progress in implementing the multimodal plan.

1.1 Multimodal Progress Report

The MPO will develop and publish the *Multimodal Progress Report* every two years. The first report will be published in March 2018. The report will include trend data and analysis for all measurable objectives in the plan. The report will be published results on the MPO's webpage.

1.2 Online Multimodal Dashboard

Collaborate with other agencies to develop a web-based dashboard and report timely metrics on the dashboard on an ongoing basis.

2. Regional and Internal Plan Consistency

Plan consistency is essential when addressing regional transportation facilities to ensure appropriate timing and coordination of facility modifications. Each local government comprehensive plan, including the transportation element, should be consistent, to the extent feasible, with the plans and programs of the MPO, transportation authorities, transit agencies, New Mexico Department of Transportation, and TxDOT as they relate to the jurisdiction. Coordination is also critical to ensure the region's funding allocations are used to the fullest by agencies complementing each other's multimodal projects.

2.1 Establish Regional Multimodal Planning Committee

The MPO will establish an RMPC within 4 months of the adoption of the plan. This committee will be established through the Transportation Project Advisory Committee. This is necessary since the creation of any committee dealing with transportation issues requires approval of the Transportation Policy Board. Committee meetings will occur every six months. One key task of this committee will be to define roles/responsibilities of the regional participants of this action plan.

2.2 Establish the MPO as the Promoter of Multimodal Planning

Identify and implement opportunities for the MPO to elaborate on the extent to which the multimodal plan integrates transportation needs and priorities identified in plans of other transportation agencies and local governments.

2.3 Identify Gaps in Regional Plans

The MPO, through the auspices of the Transportation Project Advisory Committee, will perform a gap analysis of the various agency plans in the region for multimodalism and collaborate with the RMPC to then develop recommendations to agencies to minimize them. This is also an opportunity for agencies to be aware of proposed multimodal projects at a regional level and complement each other in timing and funding allocations.

3. Multimodal Quality/Level of Service

Multimodal LOS standards go beyond roadway LOS to ensure that the operating characteristics of other modes are maintained or improved to a locally desirable level. Standards may relate to a variety of operational characteristics of importance to each mode, and may be simple or complex depending upon the planning capacity of the community.

3.1 Quality Standards

Promote quality standards for the transportation modes in the region. This may mean incorporating existing standards (roadways, transit, airport) or could require efforts by the agency to develop standards for bicycle and pedestrian.

3.2 Promote Quality Indexes

1. Promote quality indexes for bicycle and pedestrian modes. The AASHTO publications *Guide for the Planning, Design, and Operation for Pedestrian Facilities* and *Guide for the Development of Bicycle Facilities* and the National Association of City Transportation Officials may assist in the further development of these indexes. These publications provide new and innovative solutions for pedestrians and cyclists for the varied urban settings across the country.
2. Updated with effective data collection programs.
3. Existing LOS ratings generated in the region should be monitored and evaluated in the context of multimodal improvement. TTI’s multimodal scoring methodology developed for this multimodal plan may be continued to be used and improved.

4. Data Collection and Analysis

The success of the El Paso Multimodal Plan depends on the robust collection and analysis of transportation data to monitor plan implementation, identify plan deficiencies, and provide decision makers with clear metrics in order to provide effective solutions. Technology development has also provided transportation planners with alternative data sources and collection methods.

4.1 Incorporate Smartphone Data

Develop, test, and implement smartphone applications to collect travel data to measure the effectiveness of programs and track plan performance metrics. This may include development of new applications or modification of ones that are already being used in the region (i.e., Metropia). The ideal application will collect all modes of multimodal travel data: walking, cycling, transit, and carpooling (carsharing).

4.2 Improve Transit Data

Develop real-time transit information, multimodal trip planning, and wayfinding standards for multimodal access using both innovative electronic technology to traditional signage. Real-time transit information will allow for seamless interconnectedness among multimodal travel modes and transit.

4.3 Bicycle/Pedestrian Data Collection

Expand the use of technology for bicycle, pedestrian, and vehicle counts to measure the effectiveness of programs and track plan performance metrics. TTI is currently working with TxDOT, El Paso District, to test pedestrian and cyclist counters. The next phase of this work will include determining best locations to begin and maintain pedestrian and cyclist counts. This work is the start of the region's bicycle/pedestrian data collection.

5. Land Use and Multimodal Environment

Land use organization, location, mix, and density/intensity paired with multimodal policy contribute to a multimodal environment.

5.1 Integrate Future Land Use and Transportation

Identify which centers in the metropolitan area have the most potential to accommodate non-auto modes and encourage investment on enhancing walkability and connecting pedestrian, bicycle, and transit facilities within those centers. Access to pedestrians/cyclists may be improved in existing residential areas by adding multiuse paths to existing utility easements, irrigation canals, or drainage canals that extend through several neighborhoods. Linear parks in new developments would provide the same connectivity as the multiuse paths placed in existing utility easements or canals. Besides improving connectivity, the multiuse paths allow for additional opportunities to improve health through recreational walking and cycling in a safer environment not adjacent to vehicle streams. The current development practices minimize vehicular entrances to residential neighborhoods to minimize vehicular pass through of non-residents. Minimizing access to vehicles also minimizes access to pedestrians and cyclists.

6. Public Transportation Network

6.1 Planning Collaboration

Establish and maintain an ongoing collaborative process with transit partners to improve decision making in service change implementation and enhance public involvement. Planning collaboration with the transit partners is critical to ensure interconnectedness among the multimodal travel modes. Transit is the main component for long distance multimodal travel.

6.2 Bus Rapid Transit Development

Continue to support planning and funding for implementing BRT in the region.

6.3 Support Development of a Real-Time Information Implementation Plan

In terms of transit, real-time information details approximate arrival time of a bus at a specific location(s). Real-time transit information will allow for seamless interconnectedness among multimodal travel modes and transit.

6.4 Regional Safe Routes to Transit Program

Encourage development and implementation of a regional Safe Routes to Transit Program to reduce physical barriers to transit use, making access to transit more convenient.

6.5 Develop Transit Stop and Facility Standards and Design Guidelines

Provide standards, guidelines, and conceptual designs for stop and station facilities, including BRT, local, and regional transit services. The Federal Transit Administration provides internal and links to external guidance, for example:

- *Guidance to Bus Stops, Spacing, Location and Design* (*95*).
- Transit Cooperative Research Program Report 19, *Guidelines for the Location and Design of Bus Stops* (*96*).
- BRT Reports (*97*).

7. Transportation Demand Management

TDM is a strategy used to balance the need for transportation improvements with management of the demand on the transportation system. Improving the management and utilization of the existing system becomes a priority when cost, community, or environmental impact limits expansion of the transportation system.

7.1 Expand Employer Outreach TDM Program

Continue to support and coordinate activities with the existing transportation management organizations and create opportunities for program expansion.

7.2 Vanpool and Ridesharing Subsidy Program

Design and implement new subsidy program for vanpooling and ridesharing in partnership with local agencies.

7.3 Promote Carsharing and Bikesharing

Promote carsharing and bikesharing as options to address first and final miles issues and reduce vehicle trips and VMT by residents, employees, and visitors.

7.4 Integrate TDM and Parking Management Strategies in Existing Land Uses and New Developments

1. Identify policy changes to integrate TDM and parking management within existing districts and community-wide.
2. Evaluate strategies for on/off street and public/private parking areas utilizing the shared, unbundled, managed, and paid principles.
3. Consider new/revised parking codes and policies that integrate TDM and parking management.

7.5 Develop TDM Transportation Options Toolkit

1. Develop a TDM Transportation Options Toolkit to be used by developers to design TDM Plans for new developments based on best practices and policy review.
2. Create and enhance evaluation and enforcement measures for longer-term program effectiveness.

7.6 Enhance Regional Van and Carpool Service

Highlight and promote existing vanpool and carpool/ridesharing services. This can be done at the same time when promoting multimodal travel through public involvement or media outreach. This can also be done directly to existing businesses at major career fairs held throughout the region. Robust and growing vanpool/ridesharing services may be used as an attractor to bring new business to the region.

8. Bicycle Network and Safety

A variety of alternative approaches can be considered for improving the connectivity, continuity, and safety of bicycle routes.

8.1 Bicycle and Transit Connections

Seek opportunities to enhance the connections between bicycles and buses and provide for bicycle parking as needed at both ends of the trip.

8.2 Encourage Provision of Adequate Bicycle Parking Facilities

1. Identify optimal locations for bicycle parking in high demand bus stop and station areas through consultations with local bicycle groups and transit rider surveys.
2. Promote bike parking requirements for new development to be calculated based on land use and square footage (commercial) or units/bedrooms (residential) and that a ratio of short-term bike parking and long-term bike parking be required. The National Association of City Transportation Officials provides an example of bicycle parking guidance through the Oregon Bicycle and Pedestrian Facility Design Standards (*98*) and City of Davis Comprehensive Bike Plan (*99*).
3. Consider and adopt a Bike Corral program to convert on-street parking space(s) to bike parking corrals.

8.3 Connect Key Travel Destinations

Support connection of key travel destinations in the region as directly as possible with bicycle lanes, paths, or shared streets.

8.4 First and Final Mile Bicycle Connections

1. Support first and final mile bicycle connections to regional transit to encourage and enable multimodal trips.
2. Support the role bikeshare role to provide first and final mile connections with transit. Partner with city departments, agency partners, and private sector to build out the network of bikeshare stations.

8.5 Increase Public Engagement about Bike Issues

1. Form a Bicycling Community Coalition to coordinate educational and encouragement activities.
2. Host a Youth Walk and Bike Summit to gather input on initiatives that resonate with this target market population.

8.6 Improve Wayfinding

Create an app for helping cyclists with route finding navigation and other strategies such as signage, maps, and other tools to link walking, biking, and transit.

8.7 Advance Integrated Planning Initiatives That Encourage Bicycling to Special Events

Consider TDM policy to promote special event access plans to include bicycle parking and messaging with suggested routes to arrive by walking, biking, and taking transit.

8.8 Promote the Health and Social Benefits of Bicycling through Events and Activities

Plan, host, and evaluate events that will create a utilitarian cycling and walk friendly community with an aim toward increasing trips by women, older adults, and families.

9. Pedestrian Network and Safety

A variety of alternative approaches can be considered for improving the connectivity, continuity, and safety of pedestrian routes.

9.1 Preserve and Expand Maintenance of Walking Facilities

Promote an outreach campaign to raise awareness of property owner's responsibility to maintain and repair adjacent sidewalks.

9.2 Conduct Neighborhood Based Walkabouts

Conduct neighborhood based walkabouts to engage community members, identify points of interest, and create walking maps containing these to encourage walking and fostering neighborhood relationships. FHWA's report *A Resident's Guide for Creating Safer Communities for Walking and Biking* provides a guide to make communities more attractive to walking and bicycling, including recommendations on how to perform a walkabout (*100*).

9.3 Establish a Sidewalk Missing Links Program

Create a sidewalk missing links program to include a region-wide assessment of project needs and guide prioritization of future capital projects.

9.4 Promote 15-Minute Neighborhoods

Encourage development of a 15-minute neighborhood plan to prioritize strategies that will increase the percentage of El Paso neighborhoods that provide residents with daily services within a 15-minute walk of home. The company Walk Score (*101*) provides an actual score on the 15-minute neighborhood concept based on an address or city. The site shows neighborhood information including an amenities map and travel time map that depicts the 15-minute (time may be modified from 10 to 60 minutes) walking range from the address in question. The score is from 0 to 100. According to the site, El Paso is the 32nd most walkable large city in the United States with an overall walk score of 40.

9.5 Increase Public Engagement about Pedestrian Issues

1. Implement a walk mode–specific task force to guide educational and encouragement programs and events as well as ensure that pedestrian issues remain balanced with other modes.
2. Establish a Community Accessibility Coalition to understand and prioritize initiatives to increase mobility for people with disabilities.
3. Host a Youth Walk and Bike Summit to gather input on initiatives that resonate with this target market population.

9.6 Improve Multi-use Path Safety and Security

1. Develop a Multi-use Path Etiquette Campaign to raise awareness and support path users about rights and responsibilities.
2. Complete a security needs assessment to determine locations for increased lighting and other security measures along the path system.

9.7 Improve Wayfinding

Create an app for helping pedestrians with route finding navigation and other strategies such as signage, maps, and other tools to link walking, biking, and transit.

9.8 Advance Integrated Planning Initiatives That Encourage Walking to Special Events

Consider TDM policy to promote special event access plans to include messaging with suggested routes to arrive by walking, biking, and taking transit.

9.9 Promote the Health and Social Benefits of Walking through Events and Activities

Plan, host, and evaluate events that will create a walk friendly community with an aim toward increasing walking trips by women, older adults, and families.

10. Integrate Connections to Aviation, Rail, Ports, and Intermodal Facilities

10.1 Identify All Rail and Roadway Corridors

Identify all rail and roadway corridors used to access a port or airport facility in El Paso region.

10.2 Develop Corridor Management Plans

Develop corridor management plans or strategies for these facilities, where necessary, to improve truck operations or throughput. One corridor management plan is already being developed by TTI for the MPO and TxDOT using a grant from FHWA. TTI is currently exploring ITS technologies to advise the traveling public of incidents and shifting traffic to parallel routes.

REGIONAL COORDINATION AND CURRENT EFFORTS

It will take effort and commitment from all the transportation agencies in the region for this multimodal action plan to be successful. The MPO has taken the very important first step in that direction by providing this vehicle of the action plan to all the agencies to reach the common goal of multimodal transportation. The step of "Regional and Internal Plan Consistency" is very important to ensure that all agencies are on the same page and express their concerns or priorities. The ultimate goal of this MPO multimodal plan is to be molded into the Regional Multimodal Plan that all the agencies are following. The following are some examples of the existing commitment to multimodal transportation from various agencies/communities:

- B-Cycle Bike Share.
- City of El Paso Bicycle Plan.
- Sun Metro's Park and Ride.
- Sun Metro's BRIO (RTS).
- TxDOT, El Paso District, Bicycle Plan.
- Transport 2040: Las Cruces MPO (*102*).
  - Pedestrian System Priorities Plan.
  - Public Transportation Priorities Plan, planning feasibility study of connecting Las Cruces, NM, and El Paso, TX, via light rail.
  - Bicycle System Priorities Plan.
  - Trail System Priorities Plan.
- New Mexico 2040 Plan: New Mexico Department of Transportation's Long Range, Multimodal Transportation Plan (programs, policy and projects) (*103*):
  - Promote physical activity through transportation infrastructure and policy to proactively improve health (e.g., health impact assessments) (*104*).
  - Promotion of pedestrian, bicycle, and trail systems and public transportation priorities plans.
  - Evaluate feasibility of commuter rail between El Paso and Las Cruces.
- Several smaller communities in the region are increasing priority for pedestrians through addition of sidewalks.

Table 20 shows the recommended schedule of this action plan. The schedule may also be molded to fit the needs of the overall region.

Table 20. Action Plan Recommended Schedule.

El Paso Multimodal Plan - Action Plan		2016			2017				2018				2019			
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Monitoring Progress**															
1.1	Multimodal Progress Report (First due March 2018)								■							
1.2	Online Multimodal Dashboard	■	■	■												
2	**Regional and Internal Plan Consistency**															
2.1	Establish Regional Multimodal Planning Committee (Within 4 months of plan adoption)	■	■													
2.2	Establish the MPO as the Promoter of Multimodal Planning		■													
2.3	Identify Gaps in Regional Plans			■												
3	**Multimodal Quality/Level of Service**															
3.1	Quality Standards				■											
3.2	Develop Quality Indexes				■	■										
4	**Data Collection and Analysis**															
4.1	Incorporate Smartphone Data			■	■	■	■									
4.2	Improve Transit Data					■	■									
4.3	Bicycle/Pedestrian Data Collection						■	■	■							
5	**Land Use and Multimodal Environment**															
5.1	Integrate Future Land Use and Transportation									■	■					
6	**Public Transportation Network**															
6.1	Planning Collaboration										■	■				
6.2	Bus Rapid Transit Development										■	■				
6.3	Support Development of a Real Time Information Implementation Plan										■	■				
6.4	Regional Safe Routes to Transit (SR2T) Program										■	■				
6.5	Develop Transit Stop and Facility Standards and Design Guidelines										■	■				
7	**Transportation Demand Management**															
7.1	Expand Employer Outreach TDM Program						■	■	■							
7.2	Vanpool and Ridesharing Subsidy Program						■	■	■							
7.3	Promote Carsharing and Bikesharing						■	■	■							
7.4	Integrate TDM and Parking Management Strategies in Existing Land Uses and New Developments						■	■	■							
7.5	Develop TDM "Transportation Options" Toolkit						■	■	■							
7.6	Enhance Regional Van and Carpool Service						■	■	■							
8	**Bicycle Network and Safety**															
8.1	Bicycle and Transit Connections											■	■	■		
8.2	Encourage provision of adequate bicycle parking facilities											■	■	■		
8.3	Connect Key Travel Destinations											■	■	■		
8.4	First and Final Mile Bicycle Connections											■	■	■		
8.5	Increase Public Engagement About Bike Issues											■	■	■		
8.6	Improve Wayfinding											■	■	■		
8.7	Advance Integrated Planning Initiatives That Encourage Bicycling to Special Events											■	■	■		
8.8	Promote the Health and Social Benefits of Bicycling Through Events and Activities											■	■	■		
9	**Pedestrian Network and Safety**															
9.1	Preserve and Expand Maintenance of Walking Facilities												■	■	■	
9.2	Conduct Neighborhood Based Walkabouts												■	■	■	
9.3	Establish a Sidewalk Missing Links Program												■	■	■	
9.4	Promote 15-Minute Neighborhoods												■	■	■	
9.5	Increase Public Engagement about Pedestrian Issues												■	■	■	
9.6	Improve Multi-use Path Safety and Security												■	■	■	
9.7	Improve Wayfinding												■	■	■	
9.8	Advance Integrated Planning Initiatives That Encourage Walking to Special Events												■	■	■	
9.9	Promote the Health and Social Benefits of Walking Through Events and Activities												■	■	■	
10	**Integrate Connections to Aviation, Rail, Ports, and Intermodal Facilities**															
10.1	Identify all rail and roadway corridors														■	■
10.2	Develop corridor management plans														■	■

APPENDIX A: DATA COLLECTION AND ASSESSMENT, PILOT PROJECTS

Introduction

A framework for evaluating a multimodal transportation system in an area for commuters bicycling or walking to transit stops makes sense. A MMS formula based on trip experience during morning and afternoon peak hours at a transit stop is developed and proposed. The score requires basic data necessary for its calculation, namely, travel demand information, population, employment, and the transportation network for the considered modes within the multimodal context. Another benefit of this MMS formula is to score candidate multimodal projects virtually. Candidate projects may be scored at a very basic level, one origin and one destination. There are differences between the regional analysis shown in Chapter 2 to a single trip analysis that will be discussed later. The MMS formulas and all variables are also described in Chapter 2. The regional analysis shows that current land development practices limit sidewalk connectivity. This is something that the MPO region needs to address for future, more accessible development.

This section will first explore methods of improving multimodal connectivity of existing development. Limiting vehicular access to residential areas restricts all modes of travel.

MMSs for two different pilot multimodal projects will be developed virtually. The pilot projects will be described fully and how the multimodal methodology applies to each project. MMSs will be calculated and sensitivity analysis will be done on a few variables to determine if any particular one has more effect on the MMS value.

OPPORTUNITIES TO IMPROVE CONNECTIVITY WITHIN EXISTING DEVELOPMENT

Increasing connectivity within existing development is a bit more complicated, but several opportunities do exist to accomplish this. There are several utility easements and drainage or irrigation channels that may provide additional sidewalk and bike path connectivity to existing neighborhoods. One such example is seen in Figure 80. This easement is in West El Paso and it extends from 500 ft north of Redd Road to Brays Landing Drive, a total length of approximately 2.2 miles. It is approximately 100 ft wide. Portions of this strip are easements and others are owned by El Paso Natural Gas Company (*105*). Figure 81 shows another such utility easement. This easement is in East El Paso and it extends from Karl Wyler Drive to 475 ft south of Francis Scobee Drive, a total length of approximately 1.1 mi. It is approximately 30 ft wide. Portions of this strip also have a private owner and easement sections.

Figure 80. Utility Easement in West El Paso.

Figure 81. Utility Easement in East El Paso.

A third option in the El Paso region is the use of the berms adjacent to drainage or irrigation canals. Figure 82 shows the Franklin Canal in El Paso's Lower Valley. On the western end, the Franklin Canal connects to the Rio Grande near the intersection of Delta Drive and Cole Street (central El Paso). The Franklin Canal conveys water to the El Paso Valley and is 28.4 miles long. It is owned by the Bureau of Reclamation (*106*).

Figure 82. Franklin Drainage Canal in El Paso Lower Valley.

There are other easements and canals within the El Paso MPO region that provide opportunities to improve pedestrian and cyclist connectivity. Improved connectivity needs to be high priority with new land development and roadway projects to continue to improve multimodal transportation in the region.

DESCRIPTION OF PILOT PROJECTS

Two pilot projects will be evaluated using the MMS formula. The pilot projects are explained in detail below.

Pilot Project No. 1 with Improvements at the Origin

The first pilot project considers an addition of a multi-use path to the utility easement shown in Figure 80 in West El Paso. The trip considered for the MMS formulation is the following:

1. Trip Origin = 1673 Hermit Thrush Place.
2. Bus stop origin = Near intersection of Helen of Troy Drive and Nardo Goodman Drive.

3. Bus stop destination = Near intersection of Sunland Park Drive and Cadiz Street.
4. Trip Destination = 5930 Cromo Drive (Sonic Drive-In).

A pedestrian will start this multimodal trip at 1673 Hermit Thursh Place. Then, the pedestrian will use the existing sidewalk infrastructure to get to the closest bus stop as seen on Figure 83.

Figure 83. Walk from Origin to Bus Stop Using Existing Infrastructure.

The pedestrian will then board the bus at the bus stop near the intersection of Helen of Troy Drive and Nardo Goodman Drive. The pedestrian will need to use Sun Metro routes 19 and 14 to get to the destination bus stop near the intersection of Sunland Park Drive and Cadiz Street. The last leg of this multimodal trip is to walk from destination bus stop to trip destination at 5930 Cromo Drive, Sonic Drive-In, as shown in Figure 84.

Figure 84. Walk from Destination Bus Stop to Trip Destination Using Existing Infrastructure.

Pilot Project No. 2 with Improvements at the Origin and Destination

The second pilot project considers an addition of a multi-use path to the utility easement shown in Figure 80 in West El Paso. It also considers addition of sidewalk that connects the destination bus stop to the to the destination neighborhood. The trip considered for the MMS formulation is the following:

1. Trip Origin = 1673 Hermit Thrush Place (Residence).
2. Bus stop origin = Near intersection of Helen of Troy Drive and Nardo Goodman Drive.
3. Bus stop destination = Near intersection of Doniphan Drive and Bird Avenue.
4. Trip Destination = 4445 Sleepy Willow Drive (Residence).

A pedestrian will start this multimodal trip at 1673 Hermit Thursh Place just like in Pilot Project No. 1. Then, the pedestrian will use the existing sidewalk infrastructure to get to the closest bus stop as seen on Figure 83. The pedestrian will then board the bus at the bus stop near the intersection of Helen of Troy Drive and Nardo Goodman Drive. The pedestrian will need to use Sun Metro routes 19 and 20 to get to the destination bus stop near the intersection of Doniphan Drive and Bird Avenue. The last leg of this multimodal trip is to walk from destination bus stop to trip destination at 4445 Sleepy Willow Drive as shown in Figure 85.

Figure 85. Walk from Destination Bus Stop to Pilot Project No. 2 Trip Destination Using Existing Infrastructure.

APPLICATION OF MULTIMODAL METHODOLOGY TO PROJECTS

Application of Variables to Multimodal Pilot Project No. 1

As detailed in a previous section, the MMS is made up of an actual and an ideal component. The following will detail the variable values used, including some of the reasoning behind it, for this first multimodal pilot project.

Entire TAZ populations of the O-D matrix within the MPO Travel Demand model within the parameters of the analysis are used for the entire region multimodal calculations. The population data were complemented with employment data from ESRI Business Analyst tool. Arbitrary, small numbers will be used for the pilot projects for population variables to simplify calculations and explanation of MMS equation application. Since there are no bike lanes in the pilot projects' vicinity, the variables related to cycling are removed from the equations.

It will be assumed that a total population of 200 commuters has access to the origin bus stop. These commuters use various modes of transportation to access various parts of the region. The ideal would be for all 200 of these commuters to be multimodal commuters (walk and use transit). This makes the variable for population, P walking ideal, equal 200 commuters.

Within this total population of 200 commuters that has access to the origin bus stop, 30 commuters are employed within walking distance of the destination bus stop in this example. These commuters also use various modes of travel to reach their destination. The ideal would be for all 30 commuters to be multimodal commuters. This makes the variable for employment, E walking ideal, equal 30. Out of these 30 commuters, only 8 actually use transit. This makes the variable for employment, E walking actual, equal 8.

The variable Z in the multimodal equation represents population for a morning trip and employment for an evening trip. It also represents the mode split between pedestrians and cyclists. In this pilot project example, the multimodal calculation is being done for a single trip. This being the case, and since no cycling component is being considered, Z walking ideal = E walking ideal. The same applies to Z walking actual. Z walking actual = E walking actual = P walking actual.

The impedance variables of the equation represent the travel times. Figure 83 shows that the travel time from trip origin to origin bus stop for this example using the existing sidewalk infrastructure is 18 minutes, so the variable impedance, IMP walking origin actual = 18 minutes. The ideal impedance is determined by the direct distance between trip origin and origin bus stop as also shown on Figure 83. The ideal path distance is 0.3 mi and at a pedestrian average speed of 3 mph, the ideal variable impedance becomes IMP walking origin ideal = 6.4 minutes. A similar exercise is done between the destination bus stop and trip destination as shown in Figure 84. This figure shows that the travel time from destination bus stop using the existing sidewalk infrastructure is 3 minutes, so the variable impedance, IMP walking destination actual = 3 minutes. The ideal impedance is determined by the direct distance between destination bus stop and trip destination, 0.1 miles, at an average walking speed of 3 mph. The ideal variable impedance becomes IMP walking destination ideal = 2 minutes. Figure 86 shows the travel time for the transit route from origin bus stop to destination bus stop using the roadway infrastructure. The variable impedance for this portion of the trip is IMP transit actual = 35 min. The ideal impedance is determined by the direct distance between the origin bus stop and the destination bus stop, 4.2 miles, at an average speed of 35 mph. The ideal variable impedance becomes IMP transit ideal = 7.3 minutes. The variables and their values are summarized for the MMS calculations for the existing conditions in Table 21**Error! Reference source not found.**.

Table 21. Variables for MMS Calculation for Existing Conditions.

Variable	Value
P walking ideal	200 commuters
P walking actual	8 commuters
E walking ideal	30 commuters
E walking actual	8 commuters
Z walking ideal	30 commuters
Z walking actual	8 commuters
IMP walking origin actual	18 minutes
IMP walking origin ideal	6.4 minutes
IMP walking destination actual	3 minutes
IMP walking destination ideal	2 minutes
IMP transit actual	35 minutes
IMP transit ideal	7.3 minutes

Figure 86. Transit Route from Origin Bus Stop to Destination Bus Stop.

As mentioned, before this pilot project consists of adding a multiuse path to the existing utility easement as shown in Figure 87. All the variables for the improvement remain the same as the existing conditions except for the new travel time between the trip origin and the origin bus stop. The new path is 0.4 miles. The variable impedance becomes IMP walking origin actual = 8 minutes for the improvement. This cuts the travel time 10 minutes from the original 18 minutes. Table 22 summarizes the variables and their values for the MMS calculations for the improved conditions.

Figure 87. Walk from Origin to Bus Stop Using Improved Infrastructure.

Table 22. Variables for MMS Calculation for Improved Conditions.

Variable	Value
P walking ideal	200 commuters
P walking actual	8 commuters
E walking ideal	30 commuters
E walking actual	8 commuters
Z walking ideal	30 commuters
Z walking actual	8 commuters
IMP walking origin actual	**8 minutes**
IMP walking origin ideal	6.4 minutes
IMP walking destination actual	3 minutes
IMP walking destination ideal	2 minutes
IMP transit actual	35 minutes
IMP transit ideal	7.3 minutes

Calculation of Multimodal Scores for Pilot Project No. 1

Using the variables from the previous section, the MMS values are calculated for the existing and improved conditions. Table 23 shows that for existing conditions, MMS equals 0.0812. MMS equals 0.0832 for the improved conditions. These scores are not very high because they are only a component or one trip of the overall MMS score of a bus stop and all possible connections to the rest of the bus stops in the region. These scores show that the MMS score may be increased by decreasing the travel time. This table also shows that MMS score increases considerably if this improvement would generate an additional mode shift to transit from 8 to 15 commuters. The MMS increases to 0.1559.

Table 23. MMS Calculations for Various Scenarios for Pilot Project No. 1.

Scenario	P walking ideal	P walking actual	E walking ideal	E walking actual	MMS
Existing Conditions	200	8	30	8	0.0812
With Improvement	200	8	30	8	0.0832
With Improvement and additional mode shift	200	15	30	15	0.1559

Application of Variables to Multimodal Pilot Project No. 2

In order to maintain the simplicity of the example, the same population/employment assumptions used for Pilot Project No. 1 will be used for Pilot Project No. 2. This trip is different than Pilot Project No. 1 because it is from residential origin to residential destination. Pilot Project No. 1 is from residential origin to business destination. In a regional MMS analysis, this trip would also be part of the aggregate MMS for the origin bus stop. The true component of the MMS for this trip may be very low or zero because it is residential to residential having a very low possibility of business attractors.

It will be assumed that a total population of 200 commuters has access to the origin bus stop. These commuters use various modes of transportation to access various parts of the region. The ideal would be for all 200 of these commuters to be multimodal commuters (walk and use transit). This makes the variable for population, P walking ideal, equal 200 commuters.

Within this total population of 200 commuters that has access to the origin bus stop, 30 commuters are employed within walking distance of the destination bus stop in this example. These commuters also use various modes of travel to reach their destination. The ideal would be for all 30 commuters to be multimodal commuters. This makes the variable for employment, E walking ideal, equal 30. Out of these 30 commuters, only 8 actually use transit. This makes the variable for employment, E walking actual, equal 8.

The variable Z in the multimodal equation represents population for a morning trip and employment for an evening trip. It also represents the mode split between pedestrians and cyclists. In this pilot project example, the multimodal calculation is being done for a single trip. This being the case, and since no cycling component is being considered, Z walking ideal = E walking ideal. The same applies to Z walking actual. Z walking actual = E walking actual = P walking actual.

The impedance variables of the equation represent the travel times. Figure 83 shows that the travel time from trip origin to origin bus stop for this example using the existing sidewalk infrastructure is 18 minutes; therefore, the variable impedance, IMP walking origin actual = 18 minutes. The ideal impedance is determined by the direct distance between trip origin and origin bus stop as also shown on Figure 83. The ideal path distance is 0.3 mi and at a pedestrian average speed of 3 mph. The ideal variable impedance becomes IMP walking origin ideal = 6.4 minutes. A similar exercise is done between the destination bus stop and trip destination as shown in Figure 85. This figure shows that the travel time from destination bus stop using the route provided by Google Maps is 28 minutes, so the variable impedance, IMP walking destination actual = 28 minutes. The majority of this route through Bird Avenue and River Bend

Drive does not have sidewalk infrastructure. The ideal impedance is determined by the direct distance between destination bus stop and trip destination, 0.86 miles, at an average walking speed of 3 mph. The ideal variable impedance becomes IMP walking destination ideal = 17 minutes. Figure 88 shows the travel time for the transit route from origin bus stop to destination bus stop using the roadway infrastructure. The variable impedance for this portion of the trip is IMP transit actual = 55 min. The ideal impedance is determined by the direct distance between the origin bus stop and the destination bus stop, 3.7 miles, at an average speed of 35 mph. The ideal variable impedance becomes IMP transit ideal = 6.3 minutes. Table 24 summarizes the variables and their values for the MMS calculations for the existing conditions.

Table 24. Variables for MMS Calculation for Existing Conditions for Pilot Project No. 2.

Variable	Value
P walking ideal	200 commuters
P walking actual	8 commuters
E walking ideal	30 commuters
E walking actual	8 commuters
Z walking ideal	30 commuters
Z walking actual	8 commuters
IMP walking origin actual	18 minutes
IMP walking origin ideal	6.4 minutes
IMP walking destination actual	28 minutes
IMP walking destination ideal	17 minutes
IMP transit actual	55 minutes
IMP transit ideal	6.3 minutes

Figure 88. Transit Route from Origin Bus Stop to Destination Bus Stop for Pilot Project No. 2.

The variables have been determined, but it still remains that the sidewalk network at the destination does not exist. This shows a critical flaw in Google Maps and other mapping applications that roadways are associated with sidewalks or walking paths, which is not necessarily the case. The regional MMS calculation uses Network Analyst. Network Analyst is an extension for ArcMap GIS software. This tool allows users to analyze and complete several network tasks such as shortest path analysis (from point A to point B), the number of houses within five minutes of a given location, market areas near to a business, incident teams response in the network, among others options. This analysis depends extensively on the representation of the physical infrastructure or transportation network. After the network is complete, the working layers on the network dataset can be added and ultimately solve different network tasks to find solutions to network problems. The network analysis layer contains the parameters, inputs, and outputs for a network problem. For the pilot studies, the TTI team used a single origin and a single destination for demonstration purposes. Figure 89 shows the selected origin and destination and the shortest path analysis provided by Network Analyst. The blue line represents the shortest path and the green squares represent the bus stops.

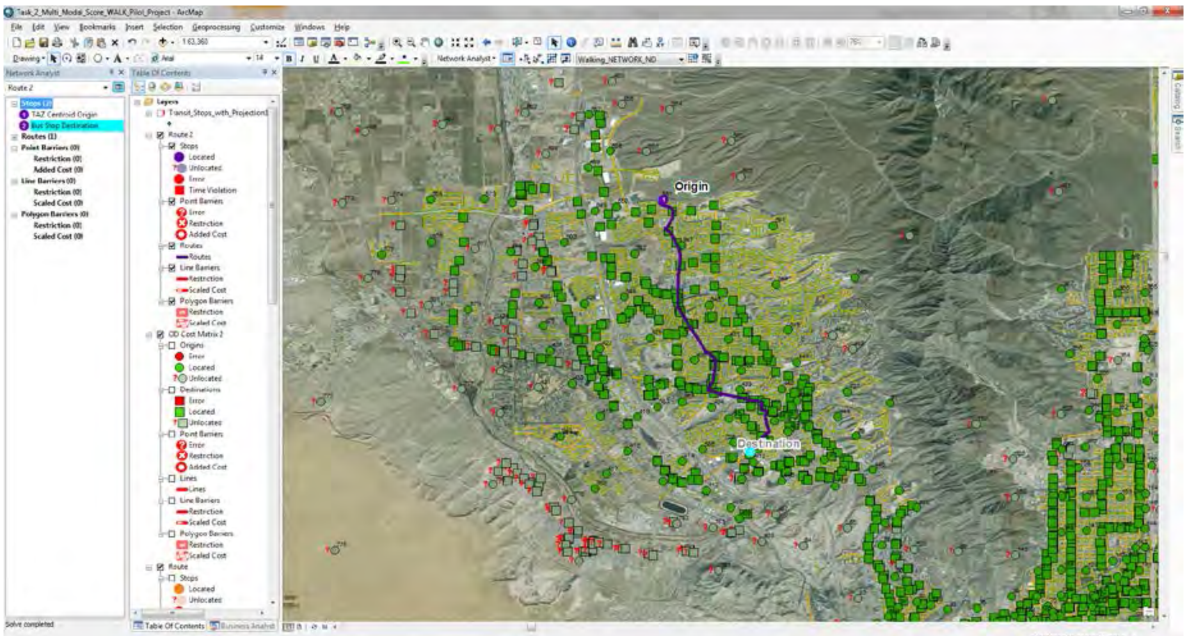

Figure 89. Shortest Path between Origin and Destination.

Figure 90 shows the lack of walking infrastructure (sidewalk) at the destination of the trip. This lack of infrastructure causes a gap in the network, resulting in a connectivity problem that cannot be evaluated using Network Analyst. Since the IMP walking destination actual cannot be calculated by Network Analyst, for this calculation a value of 0 will be used, IMP walking destination actual = 0. Table 25 summarizes the revised variables and their values for the MMS calculations for the existing conditions.

Figure 90. Lack of Sidewalks on Bird Avenue (Destination of Pilot Project No. 2).

Table 25. Actual Variables for MMS Calculation for Existing Conditions for Pilot Project No. 2.

Variable	**Value**
P walking ideal	200 commuters
P walking actual	8 commuters
E walking ideal	30 commuters
E walking actual	8 commuters
Z walking ideal	30 commuters
Z walking actual	8 commuters
IMP walking origin actual	18 minutes
IMP walking origin ideal	6.4 minutes
IMP walking destination actual	**0 minutes**
IMP walking destination ideal	17 minutes
IMP transit actual	55 minutes
IMP transit ideal	6.3 minutes

As mentioned, before this pilot project consists of adding a multiuse path to the existing utility easement as shown in Figure 87 at the origin and placing sidewalk infrastructure at the destination. All the variables for the improvements remain the same as the existing conditions except for the new travel time between the trip origin and the origin bus stop. The new path is 0.4 miles. The variable impedance becomes IMP walking origin actual = 8 minutes for the improvement. This cuts the travel time 10 minutes from the original 18 minutes. The proposed improvement at the destination will be adding the sidewalk infrastructure through the path given by Google Maps. Now the variable impedance IMP walking destination actual = 28 minutes may be used.

Calculation of Multimodal Scores for Pilot Project No. 2

Using the variables from the previous section, the MMS values are calculated for the existing and improved conditions. Table 26 shows that for existing conditions, MMS equals 0.0. Having the variable IMP walking destination actual = 0 generates the MMS equation to have a division by 0 situation that has no defined solution. Even though the solution is not defined, in this case, a value of 0 will be assigned to the existing conditions MMS value. MMS equals 0.0849 for the improved conditions. These scores are not very high because they are only a component or one trip of the overall MMS score of a bus stop and all possible connections to the rest of the bus stops in the region. These scores show that the MMS score may be increased by decreasing the travel time and/or additional improvements to the multimodal infrastructure (e.g., sidewalks, bike lanes, and additional transit routes). This table also shows that the MMS score increases considerably if these improvements would generate an additional mode shift to transit from 8 to 15 commuters. The MMS increases to 0.1475.

Table 26. MMS Calculations for Various Scenarios for Pilot Project No. 2.

Scenario	P walking ideal	P walking actual	E walking ideal	E walking actual	MMS
Existing Conditions	200	8	30	8	0.0
With Improvement	200	8	30	8	0.0849
With Improvement and additional mode shift	200	15	30	15	0.1475

CONCLUSIONS

Two pilot projects were used to demonstrate how to apply the new MMS formula. A single trip analysis was used for each pilot project, as well as arbitrary (smaller) variables, were used to simplify the demonstration. Chapter 2 details the results for the regional MMS analysis. The regional analysis shows that current land development practices limit sidewalk connectivity. Possible solutions to increase multimodal connectivity within existing communities are adding multiuse paths within existing utility easements and drainage or irrigation channels. Multimodal development policies are being recommended with this overall Multimodal Plan that need to be implemented to ensure that multimodal connectivity in future development.

Pilot project No. 1 shows the benefit of taking advantage of an existing utility easement to improve connectivity and reduce walking (or bicycling) travel time to transit. It also showed what the variables mean and provided context. Pilot project No. 2 shows the benefit of having multimodal improvements both at the origin and destination of a multimodal trip. Pilot project No. 2 also showed that mapping applications do not provide the full connectivity picture because they are not considering sidewalk infrastructure to determine walking routes. Both pilot projects showed that the MMS is greatly influenced positively by increasing the multimodal commuters. In addition to implementing new multimodal projects, it is important for the MPO and other regional stakeholders to continue the conversation of the benefits of multimodal travel with the public, as well as taking the opportunity to showcase the new multimodal projects at the same time.

This approach of a single trip MMS calculation should not be used to compare proposed multimodal projects because it is only one component of what should be an aggregate (regional average) score. The benefit of this MMS methodology is that it shows the value of a multimodal improvement or group of improvements at a regional level. The goal of the El Paso MPO is to support multimodal projects that provide the most benefit to the region, and this multiscore methodology is a start toward this endeavor.

BIVARIATE DESCRIPTIVE ANALYSIS

Around 75 percent of respondents identified their health as at least good, and around 80 percent were at least satisfied with their life. Overall, there was a clear link between self-reported levels of health and life satisfaction; participants who rated themselves as being in better health were also happier overall (Figure 91).

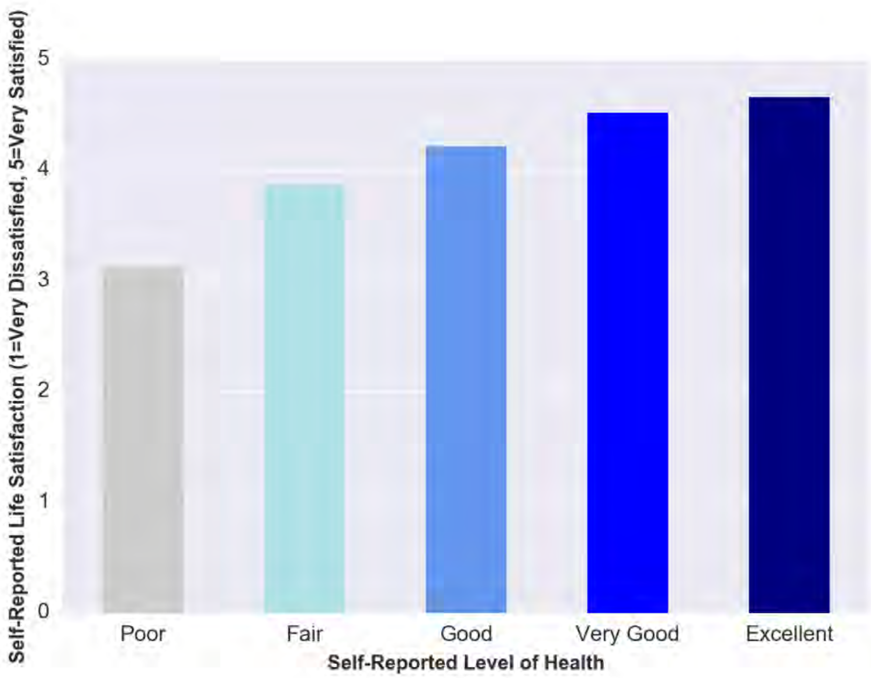

Figure 91. Self-Reported Life Satisfaction by Self-Reported Health.

BMI appeared to have little association with life satisfaction (Figure 92), but a clear negative correlation was observed between BMI and self-reported health (Figure 93).

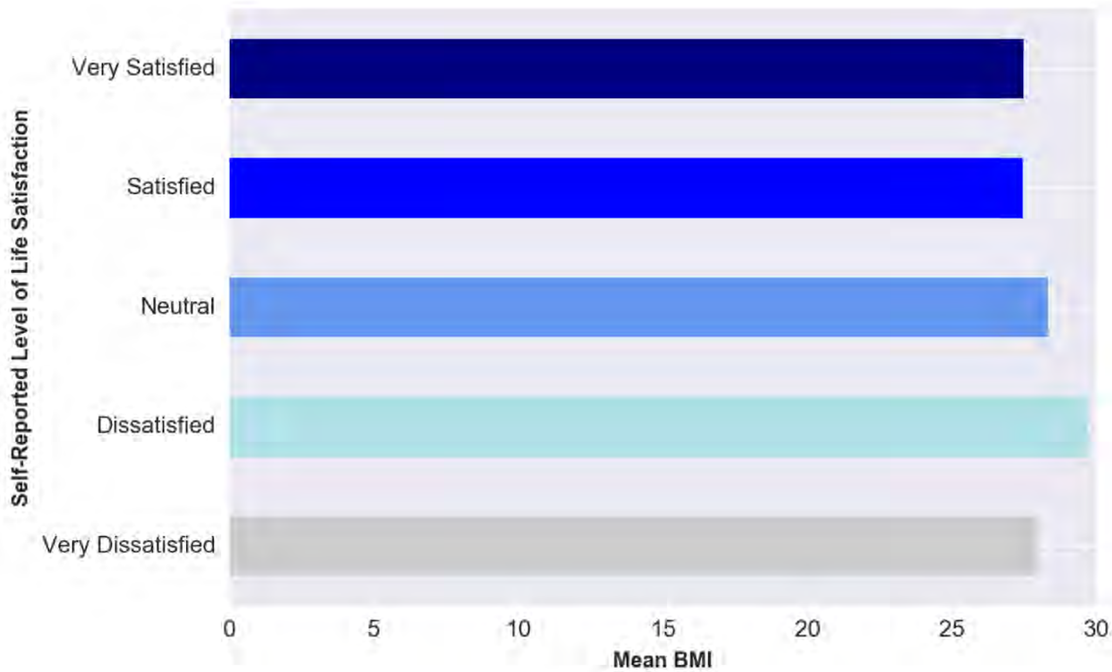

Figure 92. BMI by Self-Reported Life Satisfaction.

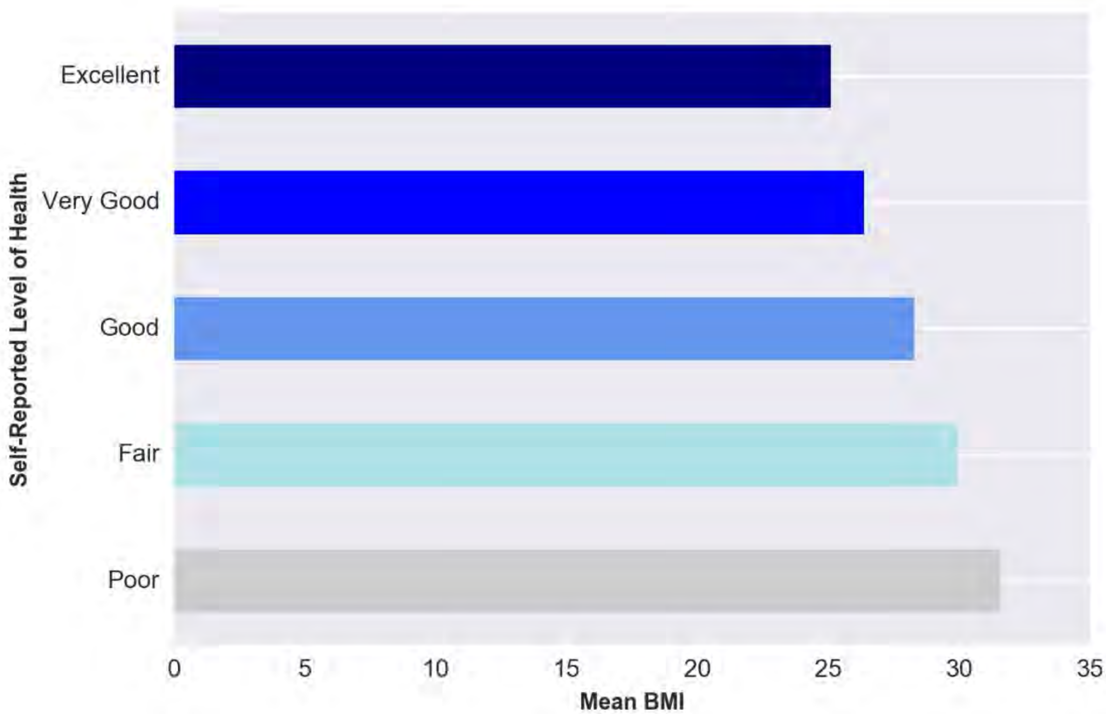

Figure 93. BMI by Self-Reported Health.

SPATIAL ANALYSIS

Self-reported levels of health were highest in centrally located areas, particularly near downtown and the university (Figure 94). Central neighborhoods also rated relatively highly for average self-reported life satisfaction, as did several other neighborhoods (Figure 95). In general, ratings for life satisfaction were more consistent and demonstrated lower variance than those for health. Similar to self-reported health levels, the lowest levels of mean BMI were found near downtown and the university (Figure 96).

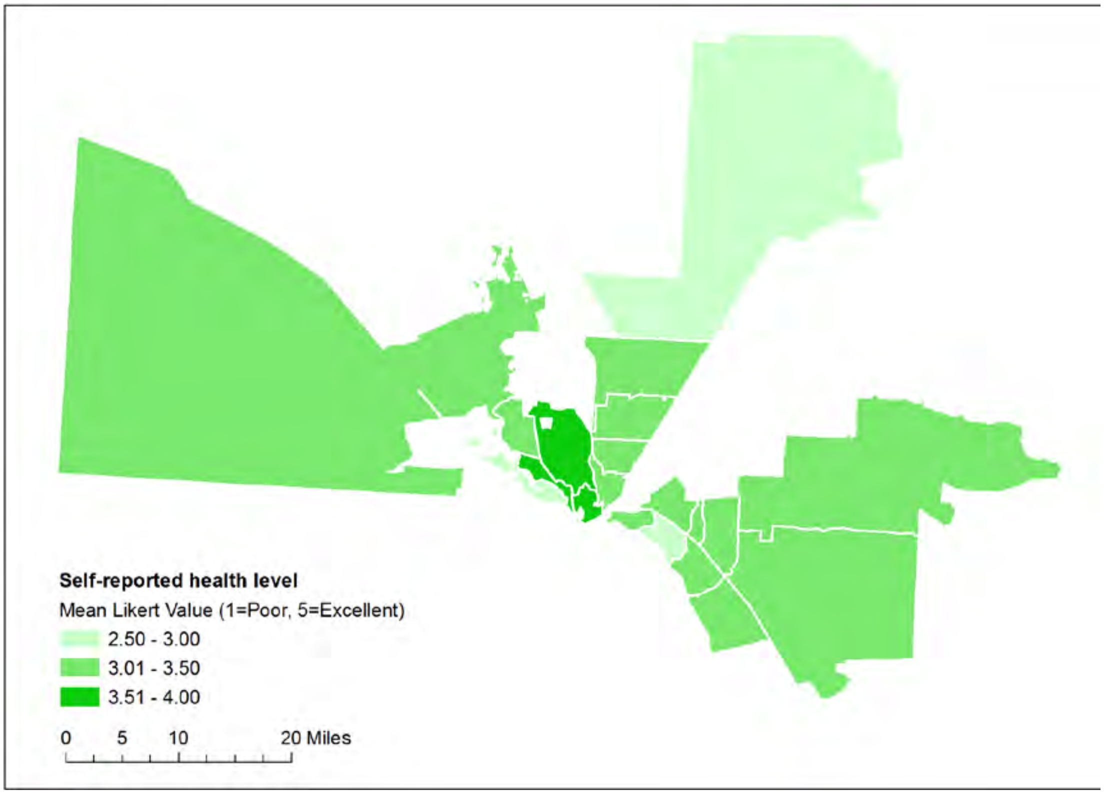

Figure 94. Self-Reported Health by ZCTA.

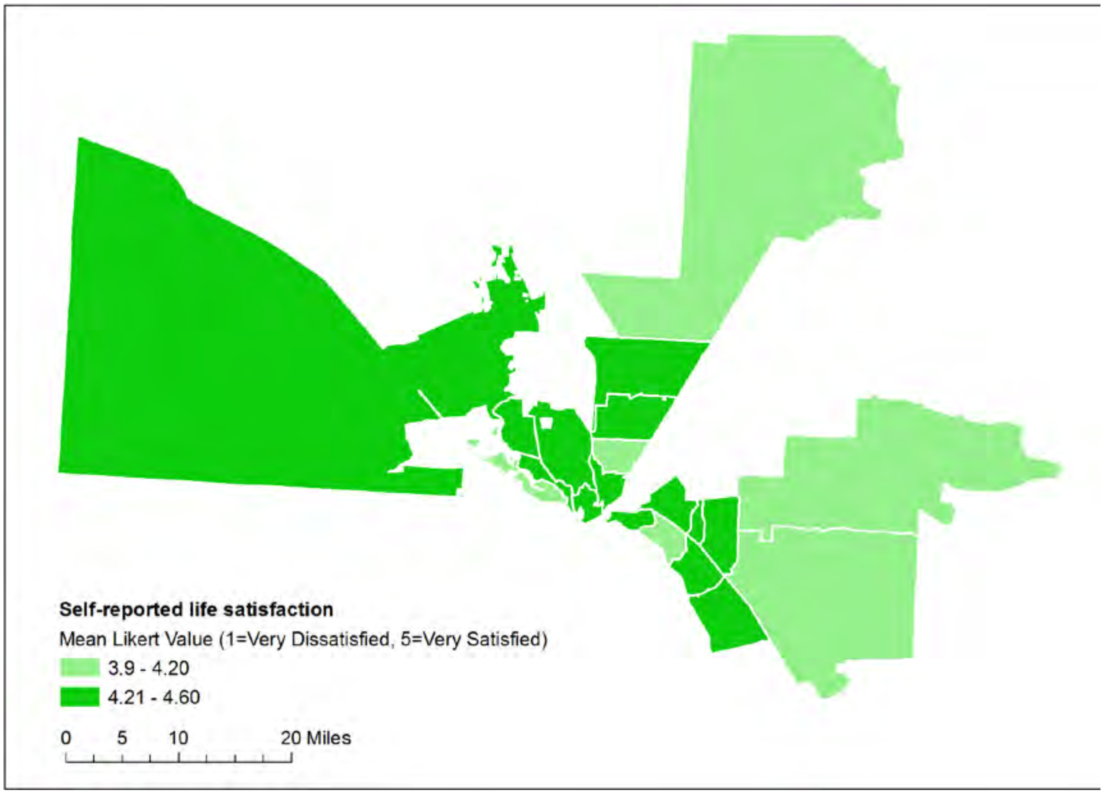

Figure 95. Self-Reported Life Satisfaction by ZCTA.

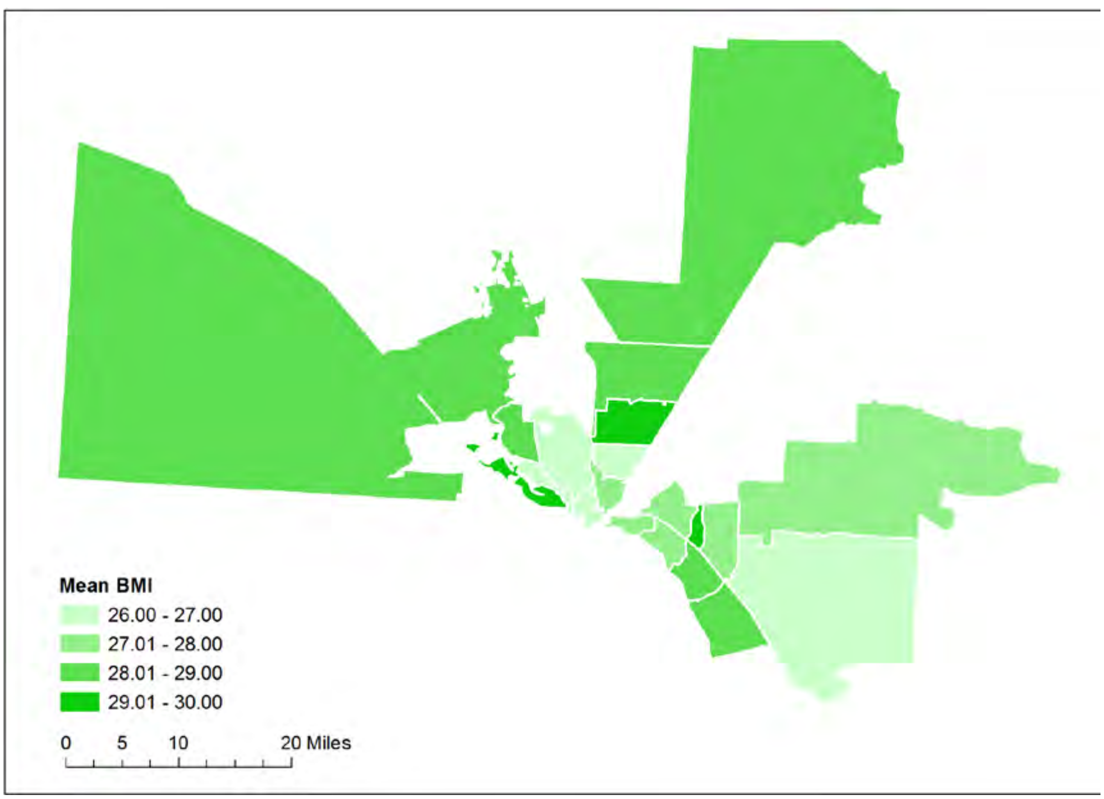

Figure 96. Mean BMI by ZCTA.

APPENDIX C:
COMPILATION OF INPUT FROM EL PASO MULTIMODAL PLAN OPEN HOUSES

This appendix compiles the input received from attendees of the seven open houses held for the El Paso Multimodal Plan on November 3–7, 2015.

OPEN HOUSE #1: SOCORRO PLANNING AREA

The first open house was held on November 3, 2015, between 11:00 a.m. and 2:00 p.m. at the Marty Robbins Recreational Center, 11600 Vista del Sol Dr. in El Paso.

Socorro Planning Area Pedestrian Connectivity Input

Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 97 provides the pedestrian connectivity map. Note that for this planning area no comments were written directly on the map about pedestrian connectivity.

Figure 97. Socorro Planning Area Pedestrian Connectivity Map.

The following comments were written on sticky notes by the public about pedestrian connectivity in the Socorro Planning Area:

- Cross walks on George Dieter Drive and Lee Trevino Drive are not implemented correctly.
- In commercial zones, there should be zero seatbacks and 10-ft sidewalks. Parking should be moved behind commercial buildings.
- Alameda Avenue, North Loop Drive, and Socorro Road are missing sidewalks.
- Sidewalks throughout this planning area should be wider.
- All sidewalks should be at least a 10 ft wide along arterials.
- All public parks should be connected by sidewalks and bike routes.
- North Loop Drive needs sidewalks to be extended east.
- There are no crosswalks on Alameda Avenue between Horizon Boulevard and Passmore Road.

Socorro Planning Area Bicycle Connectivity Input

Open house attendees were provided a map of existing bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 98 provides the bicycle connectivity map.

Open house attendees used a black marker to make dashes where bicycle traffic currently travels, but additional connections should be made to increase bicycle connectivity in the area. Figure 99 provides a close-up of comments made on the map in the northern portion of the Socorro Planning Area bicycle connectivity map (Figure 98).

Figure 98. Socorro Planning Area Bicycle Connectivity Map.

Figure 99. Close-up of Comments on Socorro Planning Area Bicycle Connectivity Map.

The following summarizes comments that were written on the map shown in Figure 99:

- Bike lanes do not continue under I-10 – connections under I-10 are high priority.
- An alternate north/south route to Loop 375 would be useful.
- Currently a good bike route (indicating route by Shreya Road).

The following comments were written on sticky notes by the public about bicycle connectivity in the Socorro Planning Area:

- I-10 acts as barrier for bike routes in this region as there are no connections for bicycles across I-10.
- Trees or other vegetation extend into bake lane and prohibit safe riding.
- Signage should be used to direct bike traffic on parallel routes as opposed to directing bicycles onto busy arterials.
- Use (convert) irrigation canals as multi-use paths.
- There is an opportunity to convert utility access areas to multi-use paths.
- The new park at Hueco Valley Drive and Montana Avenue needs to have bike and pedestrian facilities that connect to it.
- Intersection at Tierra Este Road and Zaragoza Road is very intimidating as there are many big trucks and lots of traffic.
- Bike lanes disappear at intersection between Edgemere Boulevard and North Zaragoza Road.
- Due to improvements on the road at Loop on Zaragoza Road, there is lots of traffic now, which prohibits safe riding.

Socorro Planning Area Transit Connectivity Input

Open house attendees were provided a map of existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 100 provides the transit connectivity map. Note that for this planning area no comments were written directly on the map provided on sticky notes about transit connectivity.

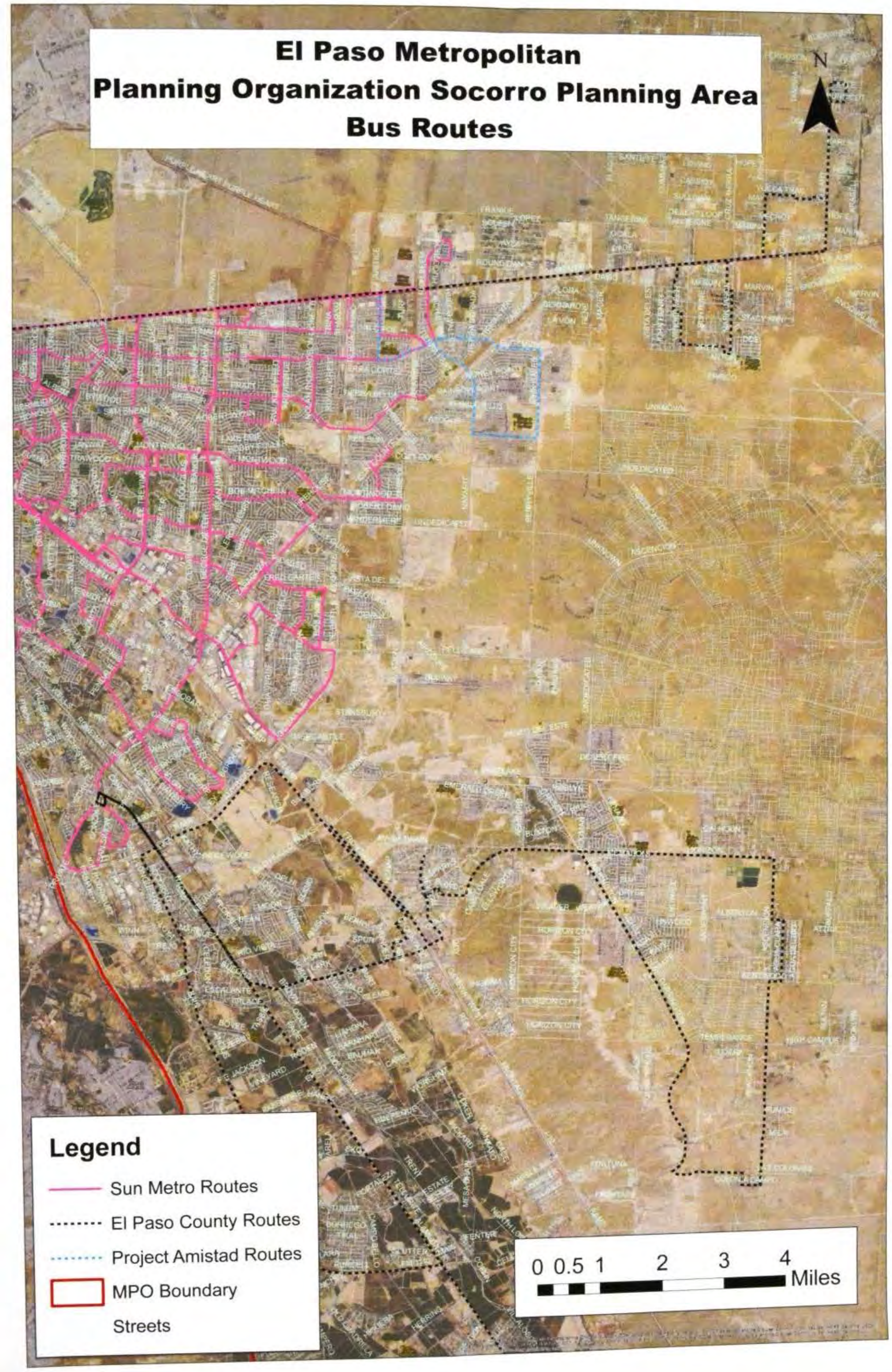

Figure 100. Socorro Planning Area Transit Connectivity Map.

OPEN HOUSE #2: CLINT/SAN ELIZARIO PLANNING AREA

The second open house was held on November 3, 2015, between 3:30 p.m. and 6:00 p.m. at the El Paso County Water Improvement District, 13247 Alameda Ave. in Clint.

Clint/San Elizario Planning Area Pedestrian Connectivity Input

The following section details input provided by the public about pedestrian connectivity in the Clint/San Elizario Planning Area. Open House attendees were provided maps of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the maps. Figure 101 and Figure 102 provide the pedestrian connectivity maps. Note that no comments were written on the maps or provided on sticky notes.

Figure 101. Clint/San Elizario Planning Area I Sidewalk Connectivity Map.

Figure 102. Clint/San Elizario Planning Area II Sidewalk Connectivity Map.

Clint/San Elizario Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the Clint/San Elizario Planning Area. Open house attendees were provided maps of the bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the maps. Figure 103 and Figure 104 provide the bicycle connectivity maps.

Figure 103. Clint/San Elizario Planning Area I Bicycle Connectivity Map.

Figure 104. Clint/San Elizario Planning Area II Bicycle Connectivity Map.

Figure 105 provides a close-up of the input provided on the Clint/San Elizario Planning Area II bicycle connectivity map (Figure 104). The black dashed lines shown on Figure 105 indicate routes that would benefit from increased bicycle access and connectivity. In some locations dashed lines are written on abandoned drainage canals that could be repurposed as multi-use paths.

Note that there were no comments recorded on sticky notes about bicycle connectivity in the Clint/San Elizario Planning Area.

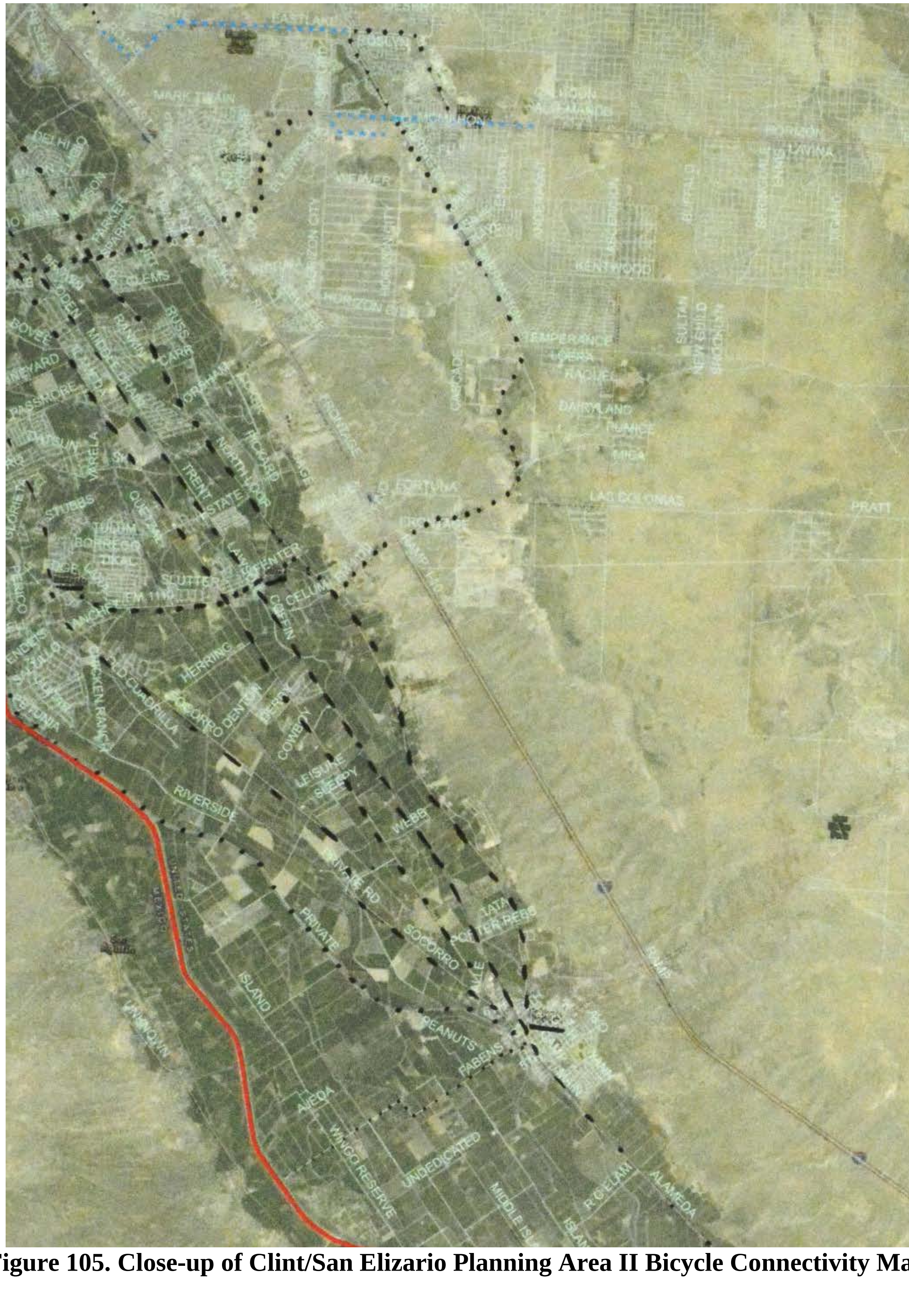

Figure 105. Close-up of Clint/San Elizario Planning Area II Bicycle Connectivity Map.

Clint/San Elizario Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the Clint/San Elizario Planning Area. Open house attendees were provided maps of existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the maps. Figure 106 and Figure 107 provide the transit connectivity maps for the Clint/San Elizario planning area. Note that no public comments were made about bus routes on the transit connectivity maps or provided on sticky notes.

Figure 106. Clint/San Elizario Planning Area I Transit Connectivity Map.

Figure 107. Clint/San Elizario Planning Area II Transit Connectivity Map.

OPEN HOUSE #3: WEST EL PASO/SUNLAND PARK PLANNING AREA

The third open house was held on November 4, 2015, between 12:00 p.m. and 3:00 p.m. at the Sunland Park Senior Center, 1010 McNutt Road, Sunland Park, New Mexico.

West El Paso/Sunland Park Planning Area Pedestrian Connectivity Input

The following section details input provided by the public on pedestrian connectivity in the West El Paso/Sunland Park Planning Area. Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 108 provides the pedestrian connectivity map for the West El Paso/Sunland Park planning area. Figure 109 provides a close-up of the input written on the West El Paso/Sunland Park area pedestrian connectivity map (Figure 108).

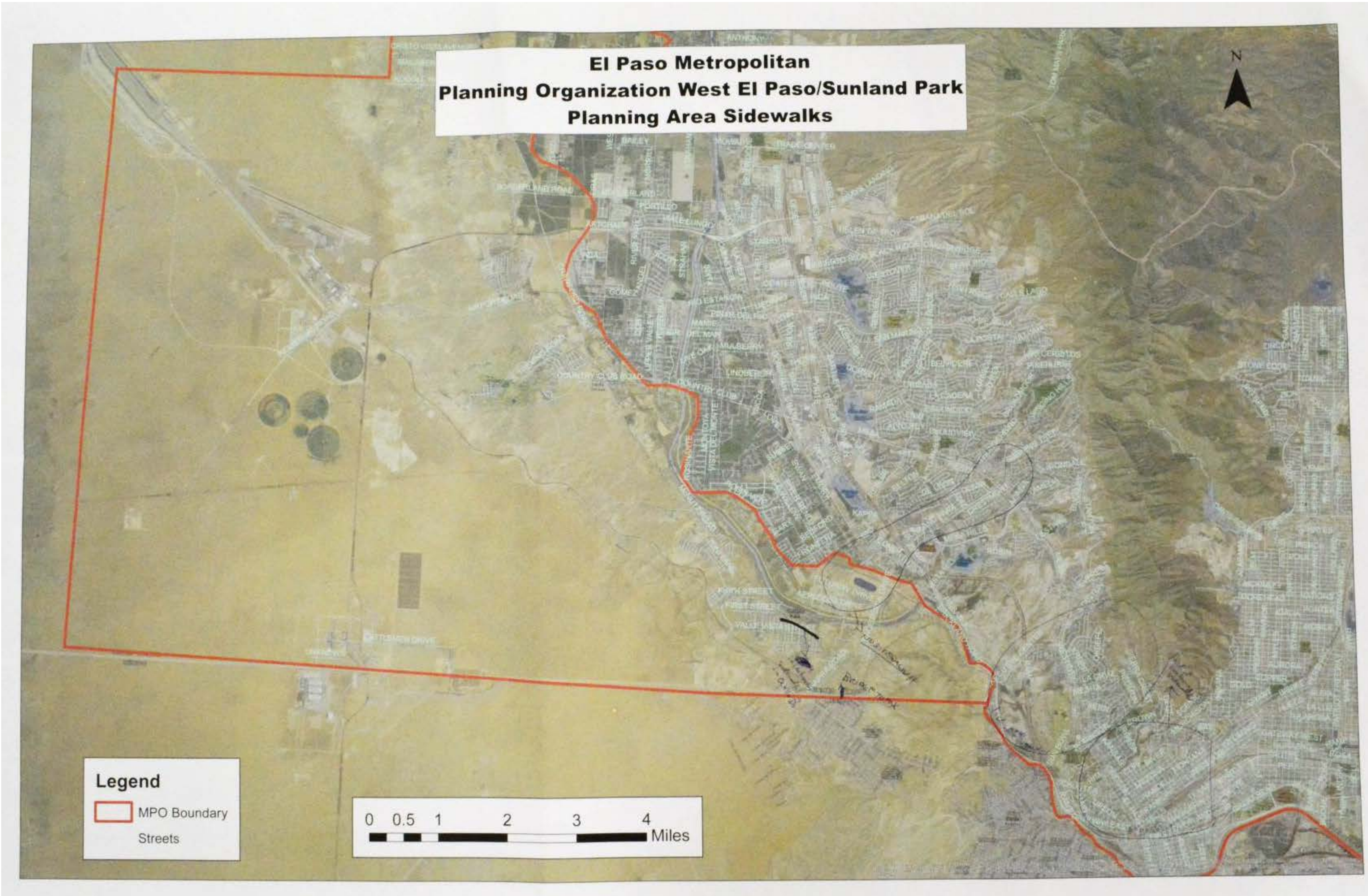

Figure 108. West El Paso/Sunland Park Area Pedestrian Connectivity Map.

Figure 109. Close-up of Comments Made on West El Paso/Sunland Park Area Sidewalk Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 109:

- Circled area on top left side of map indicates area with no sidewalks.
- Lack of continuous sidewalks on Ocotillo Drive.
- Bridge to Mexico would be helpful in the Sunland Park area.
- Circled areas on lower right area of map lack continuous sidewalks and connectivity to nearby neighborhoods and amenities.

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the West El Paso/Sunland Park planning area:

- Sidewalks need better maintenance.
- No sidewalks in many areas in Sunland Park.
- Property owners make their own sidewalks; sidewalks are needed throughout the region.
- Need street lights and crosswalks at intersections in Sunland Park region.
- Mid-street crosswalks need signals in all Sunland Park area.
- Need crosswalks no more than 100 yards from bus stops in all locations.
- Increase intersection walk times appropriate for wheelchair and assistive device use for the population.
- All of Sunset Heights has missing or crumbling sidewalks.
- Make parallel multi-use paths along main arterials.
- Lack of crosswalks on Mesa St. near the UTEP leads to a lot of dangerous crossings.
- Big trucks are deteriorating Magnut (McNutt) Road from Santa Teresa, NM, to Sunland Park, NM.
- Lack of sidewalks, there are only three routes from downtown El Paso to west side including the Mesa St., Paisano Dr., and IH10, and none are pedestrian friendly.
- There are no sidewalks on Paisano Drive or on Union Station leading to the racetrack.

West El Paso/Sunland Park Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the West El Paso/Sunland Park Planning Area. Open house attendees were provided a map of the bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 110 provides the bicycle connectivity map for the West El Paso/Sunland Park planning area. Figure 111 provides a close-up of comments made on the West El Paso/Sunland Park planning area bicycle connectivity map (Figure 110).

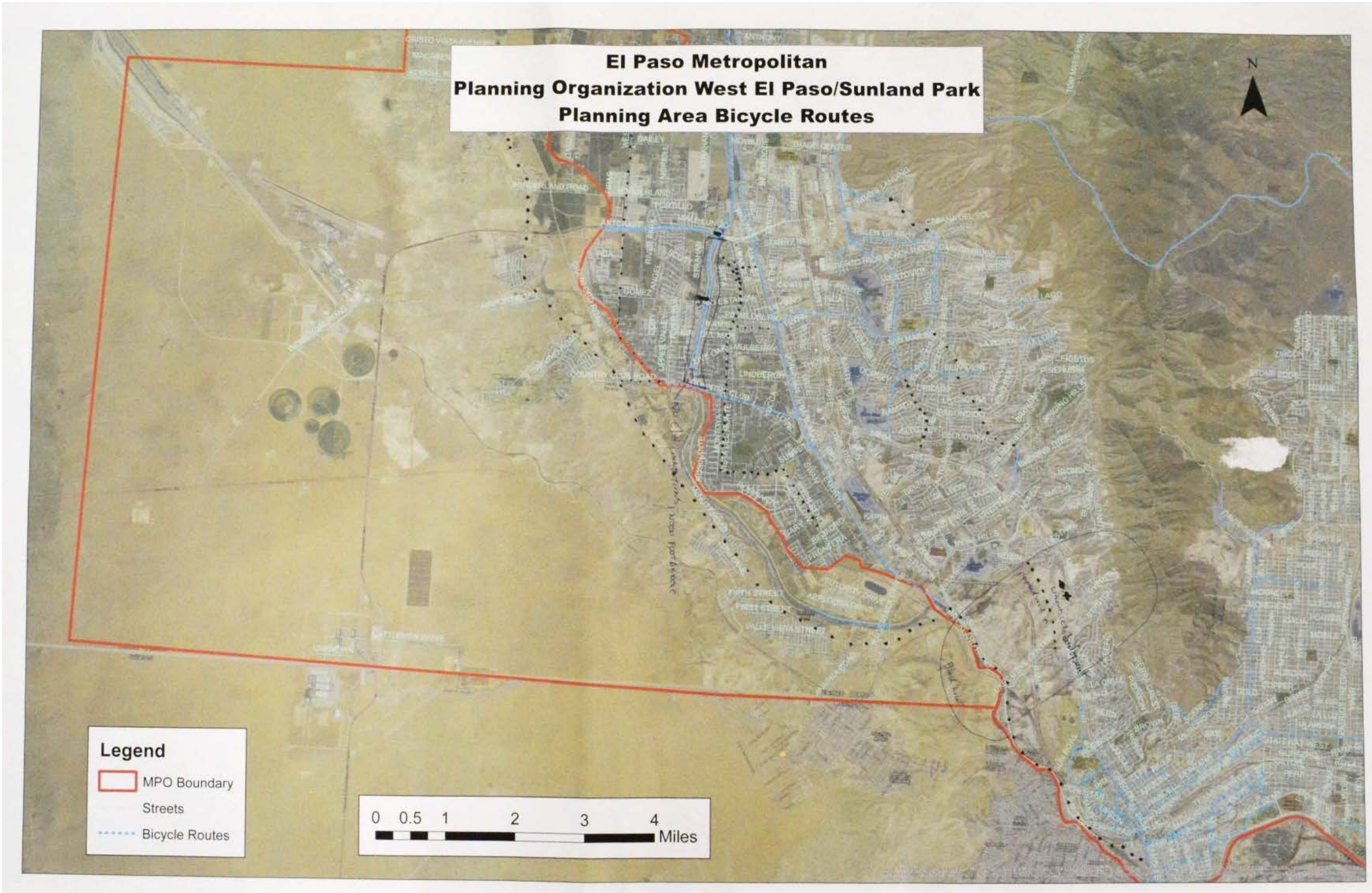

Figure 110. West El Paso/Sunland Park Planning Area Bicycle Connectivity Map.

Figure 111. Close-up of Comments Made on West El Paso/Sunland Park Planning Area Bicycle Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 111:

- Dashed black lines on corridors indicate locations where bicyclists currently travel but improved bicycle facilities could improve bicyclist access and safety.
- Circled area on lower right of map is a black hole where there are very few connections through this area.
- Circled area on the top right of map is a canal that blocks east/west connections for bikes and pedestrians.
- Dashed line within circled area on lower right of map is an area where a proposed road would help.
- Monticello Development does not have good bike or pedestrian paths connected to it.

The following summarizes comments that open house attendees wrote on sticky notes about bicycle connectivity in the West El Paso/Sunland Park planning area:

- The multi-use path on Rio Grande should be on both sides with connections across the river.
- There are limited bike routes in this area. There are only three routes from downtown El Paso to the west side including Mesa Street, Paisano Drive, and IH10, and none are bike friendly.
- In the long term, Paisano Drive could be reclaimed for bike/pedestrian/transit facilities.
- There is one trail head to cross the levy but there are not parallel routes on either side of the levy so connectivity among locations on either side of the levy is restricted.
- The bridge at Anapra is closed minimizing connectivity.
- There are drainage issues in this area that affect bicycle connectivity.

West El Paso/Sunland Park Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the West El Paso/Sunland Park Planning Area. Open house attendees were provided a map of existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 112 provides the transit connectivity map for the West El Paso/Sunland Park planning area. Figure 113 provides a close-up of comments made on the West El Paso/Sunland Park Planning Area Transit Connectivity Map (Figure 112).

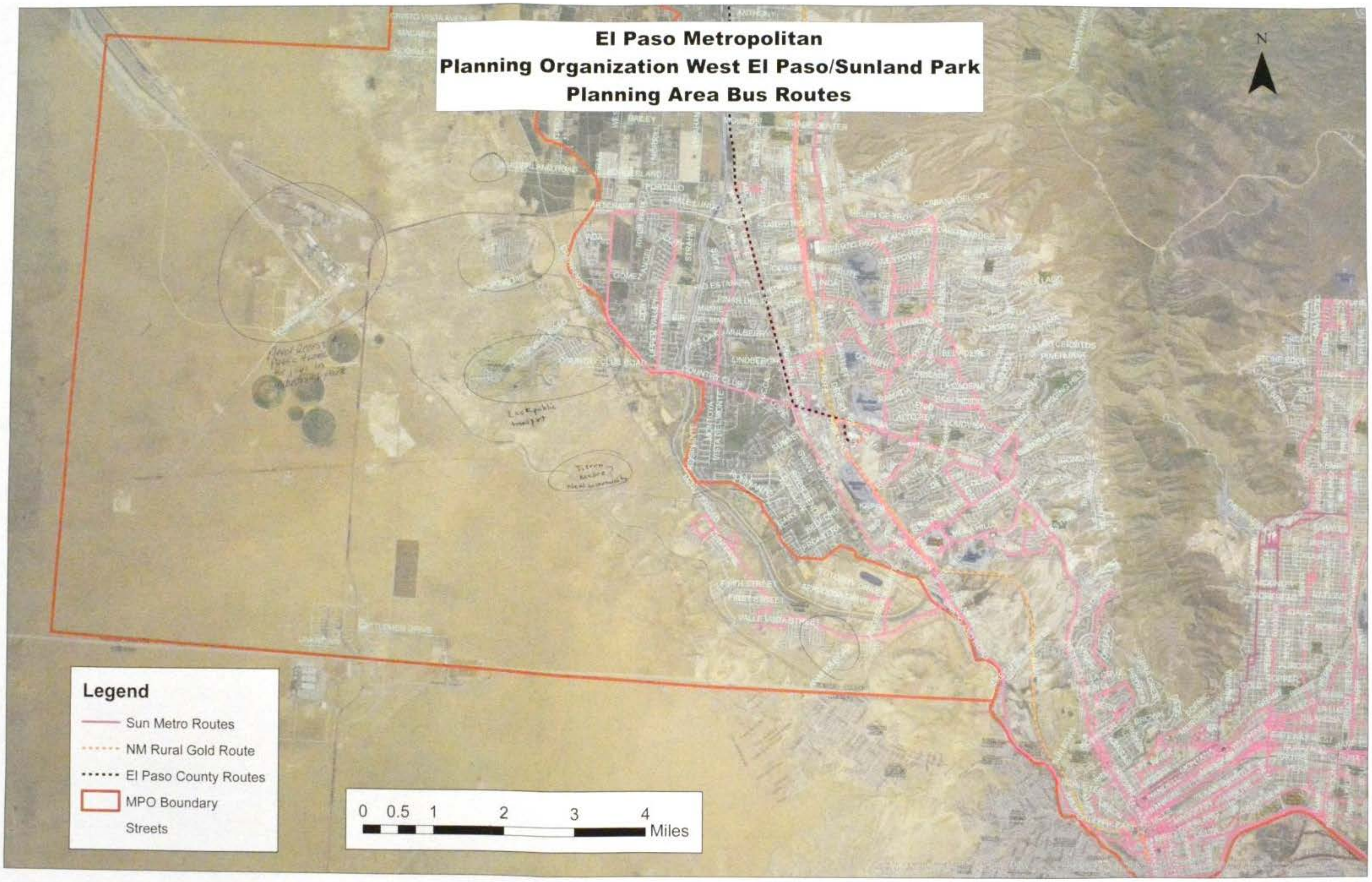

Figure 112. West El Paso/Sunland Park Planning Area Transit Connectivity Map.

Figure 113. Close-up of Comments Made on West El Paso/Sunland Park Planning Area Transit Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 113:

- Need access to public transportation for jobs in the industrial park.
- Lack public transportation in the Country Club Road neighborhood.
- Tierra Madre is a new community that will need public transportation.

The following summarizes comments that open house attendees wrote on sticky notes about transit connectivity in the West El Paso/Sunland Park planning area:

- This area is an elderly community. This presents both opportunities and challenges for increased transit connectivity.
- There is no bus service to the local bank or clinic.
- Connect outer communities to existing but routes farther east.
- Sunland Park is working with Sun Metro to extend existing Sun Metro Service farther north to Country Club Road and to Remcon Center Station.
- What is the senior discount on Sun Metro?
- St. Teresa should look at the Transportation for Elderly Persons and Persons with Disabilities (5310) funding for elderly service to connect to county/city routes. If not available, this should be pursued through New Mexico funds.

OPEN HOUSE #4: NORTHEAST EL PASO PLANNING AREA

The fourth open house was held on November 4, 2015, between 4:00 p.m. and 7:00 p.m. at the Northeast Regional Command Center (El Paso Police Department), 9600 Dyer Street, El Paso.

Northeast El Paso Planning Area Pedestrian Connectivity Input

The following section details input provided by the public about pedestrian connectivity in the Northeast El Paso Planning Area. Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 114 provides the pedestrian connectivity map for the Northeast El Paso planning area. Figure 115 provides a close-up of comments made on the Northeast El Paso planning area pedestrian connectivity map (Figure 114).

Figure 114. Northeast El Paso Planning Area Pedestrian Connectivity Map.

Figure 115. Close-up of Comments Made on Northeast El Paso Planning Area Pedestrian Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 115:

- The power line corridors could provide an opportunity for multi-use paths.
- New retail being developed in the northern section of this map – need connections (pedestrian, bike, transit).
- Need sidewalks on major corridor in planning area (Dyer Street).
- A lot of new development (circled on map) on northern section of Dyer Street that will create more walking trips.

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the Northeast El Paso planning area:

- Construction to private property in this area causes sidewalk closures without alternative routes provided.
- The code enforcement office needs to be more closely involved with private construction companies so that rules on temporary pedestrian facilities are followed.
- There are no sidewalks on the north side of Hondo Pass Drive west of US54.
- West Line Drive and Galena Drive have gaps in sidewalks.
- In many locations sidewalks are old and in need of maintenance.
- There are lots of opportunities to introduce multi-use paths on utility lines or abandoned irrigation/drainage canals.
- Many driveways do not have ADA ramps.
- There are gaps in sidewalks at drainage channels on Hondo Pass Drive.
- There should be sidewalk access to all schools, shopping centers, and other important locations in the area.
- The entire planning area needs better lighting for pedestrians and bicyclists.

Northeast El Paso Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the Northeast El Paso Planning Area. Open house attendees were provided a map of the bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 116 provides the bicycle connectivity map for the Northeast El Paso planning area.

Figure 116. Northeast El Paso Planning Area Bicycle Connectivity Map.

The black dashed lines in Figure 116 show roadways where bicyclists currently travel, but facilities could be improved to increase bicyclist safety. Many members of the public mentioned that protected bicycle lanes on routes parallel to busy arterials are preferable to unprotected bike facilities on busy facilities.

The following summarizes comments that open house attendees wrote on sticky notes about bicycle connectivity in the Northeast El Paso planning area:

- There are conflicts with buses at bus stations with bike routes in this area.
- Many cars drive in the bike lane on Hondo Pass Drive. A protected bike lane would help.
- There needs to be more bike facilities at Magnetic Drive and Hondo Pass Drive.
- Need bike connections to:
    - Fort Bliss.
    - Loop 375.
    - Spur 601.
    - Fred Wilson.
    - Chaffee Road.
- Schools have pilot programs where bikes were provided to children, need to ensure safe routes.
- Bike lanes need to connect to bus terminals.
- The entire planning area needs better lighting for pedestrians and bicyclists.

Northeast El Paso Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the Northeast El Paso Planning Area. Open house attendees were provided a map of the existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 117 provides the transit connectivity map for the Northeast El Paso planning area. Note that no comments were provided by the public on transit connectivity in the Northeast El Paso planning area.

Figure 117. Northeast El Paso Planning Area Transit Connectivity Map.

OPEN HOUSE #5: YSLETA PLANNING AREA

The fifth open house was held on November 5, 2015, between 3:30 p.m. and 6:30 p.m. at the Pebble Hills Regional Command Center, 10780 Pebble Hills Boulevard, El Paso.

Ysleta Planning Area Pedestrian Connectivity Input

The following section details input provided by the public about pedestrian connectivity in the Ysleta planning area. Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 118 provides the pedestrian connectivity map for the Ysleta planning area. Figure 119 provides a close-up of the input provided on the Ysleta Planning Area pedestrian map (Figure 119).

Figure 118. Ysleta Planning Area Pedestrian Connectivity Map.

Figure 119. Close-up of Ysleta Planning Area Pedestrian Connectivity Map.

The comment written directly on the map shown in Figure 119 was “There are utilities blocking the sidewalk on North Yarborough.”

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the Ysleta planning area:

- Sidewalks are needed at Ponder Park at Viscount Boulevard.
- There is a need for hike and bike trails (as well as landscaping) on Viscount Boulevard and Airway Boulevard to Montwood Drive.
- There are gaps in the sidewalks on the north side and on Viscount Boulevard.
- A website providing up-to-date infrastructure including bus stops and interesting routes (museums, restaurants, etc.) would be useful to motivate people to use sidewalks.
- For longer blocks, there needs to be paths between buildings and houses for pedestrians.

Ysleta Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the Ysleta planning area. Open house attendees were provided a map of the bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 120 provides the bicycle connectivity map for the Ysleta planning area.

Figure 120. Ysleta Planning Area Bicycle Connectivity Map.

The black dashed lines on Figure 120 show roadways where bicyclists currently travel, but facilities could be improved to increase bicyclist safety. Many members of the public mentioned that protected bicycle lanes on routes parallel to busy arterials are preferable to unprotected bike facilities on busy facilities.

The following summarizes comments that open house attendees wrote on sticky notes about bicycle connectivity in the Ysleta planning area:

- There is a need for increased bike parking in this area, not the squiggle design though.
- Maybe closing streets to cars for extended periods of time on Saturdays and Sundays could increase bicycle riding.
- Adabel Street does not have protected bike routes.
- Lighting is needed.
- Need bike lanes on Rojas Drive west of George Dieter Drive and Pellicano Drive.
- Bike lanes need to continue through intersections.
- Bike priority signals at intersections would make safer to pass through.
- More bike boxes at stop lights with signs for cars describing to stop behind bicyclists and yield to bikes.
- When possible cluster trash in only one location.
- Add bike routes on Pebble Hills Boulevard east of Yarbrough Drive.
- Have bike routes on Saul Kleinfield Drive.
- More connectivity to parks and recreational areas.
- Should take advantage of safe routes to schools program.
- Should we add bike lanes when we repave roadways?
- Pavement bumps and debris make bike lanes unsafe.
- Bicycle groups should be encouraged to use bike lanes to encourage everybody else to use those lanes as well.
- Cyclists and drivers need education to communicate with each other.

Ysleta Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the Ysleta planning area. Open house attendees were provided a map of the existing bus routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 121 provides the transit connectivity map for the Ysleta planning area. Figure 122 provides a close up of the input provided on Ysleta Planning Area transit connectivity map (Figure 121).

Figure 121. Ysleta Planning Area Transit Connectivity Map.

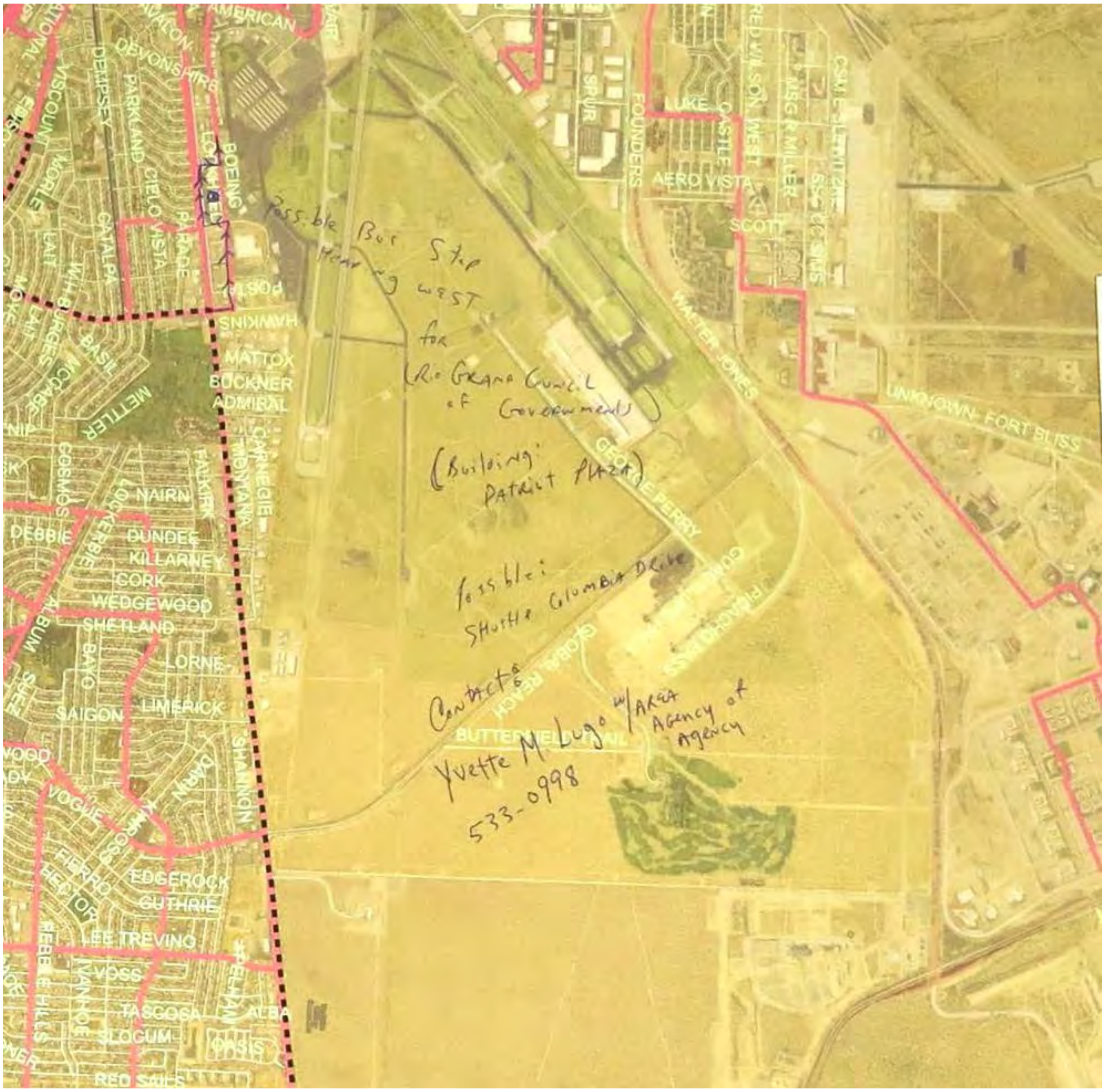

Figure 122. Close-up of Ysleta Planning Area Transit Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 122:

- Possible bus stop heading west for (comments is for Rio Grande Council of Governments) to Patriot Plaza.
- Possible shuttle along Columbia Drive.
- Contact: Yvette M. Lugo with Area Agency on Agency 533-0998.

The following summarizes comments that open house attendees wrote on sticky notes about transit connectivity in the Ysleta planning area:

- There should be more benches at bus stops. Current benches are private; the canopies are Sun Metro's.
- Consider more bus stops to increase accessibility.
- Residents may request bus stops; Sun Metro will study the situation and may add them.
- Place more bus bays at bus stops on major arterials.
- Implement billboards and ad campaigns promoting bus transit as viable transportation.

OPEN HOUSE #6: CANUTILLO/ANTHONY AREA

The sixth open house was held on November 5, 2015, between 4:00 p.m. and 6:30 p.m. at the West Valley Fire Department, 510 Vinton Road, Vinton, Texas.

Canutillo/Anthony Planning Area Pedestrian Connectivity Input

The following section details input provided by the public about pedestrian connectivity in the Canutillo/Anthony planning area. Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 123 provides the pedestrian connectivity map for the Canutillo/Anthony planning area. Figure 124 provides a close-up of the comments written on the Canutillo/Anthony Planning Area Pedestrian connectivity map (Figure 123).

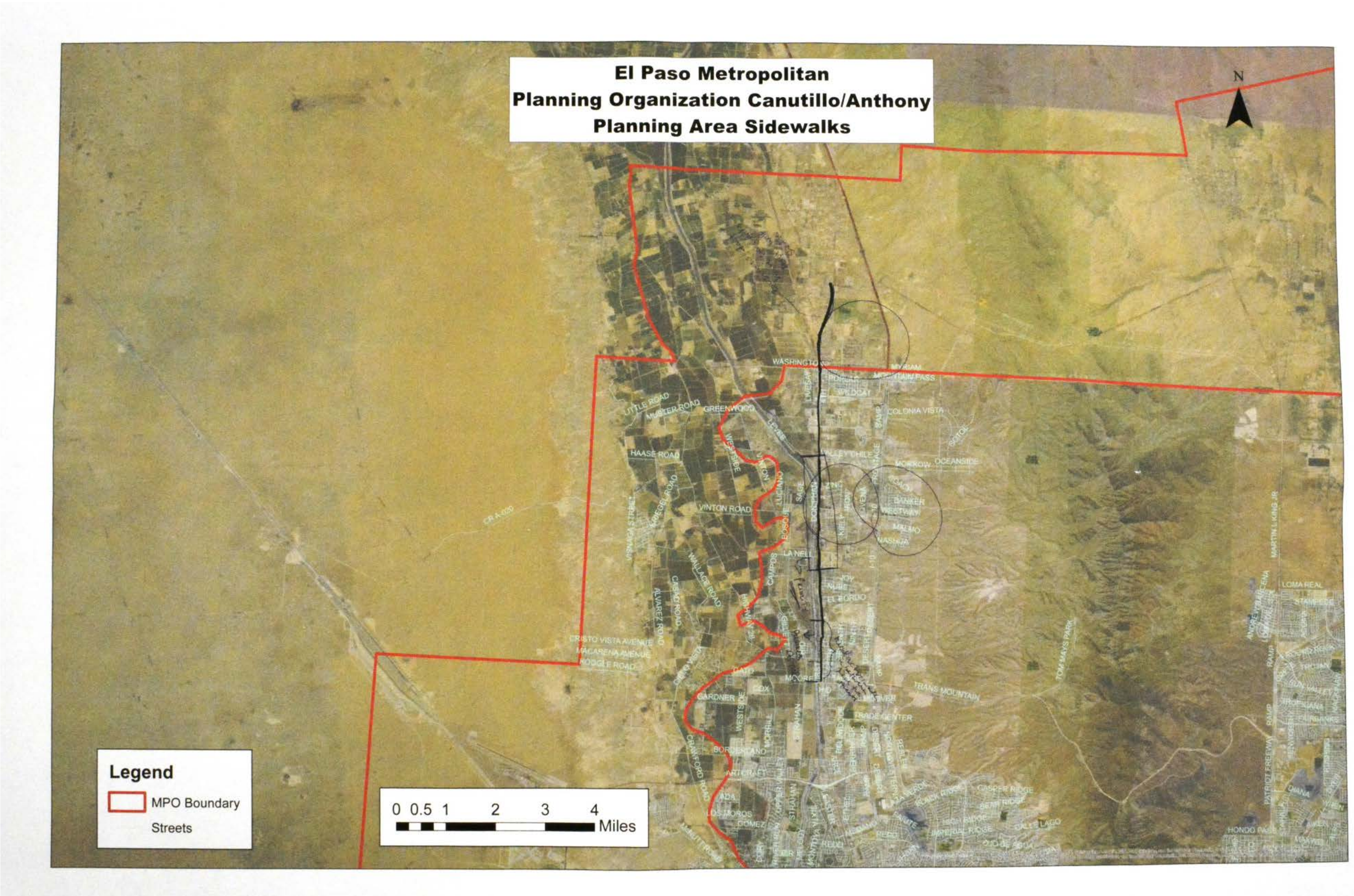

Figure 123. Canutillo/Anthony Planning Area Pedestrian Connectivity Map.

Figure 124. Close-up of Comments on Canutillo/Anthony Planning Area Pedestrian Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 124:

- Need crosswalks in business district on Doniphan Street.
- Need sidewalks all along Doniphan Street (boxed area is a priority).
- Circled areas need sidewalks.

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the Canutillo/Anthony planning area:

- Doniphan Drive should be highest priority for adding sidewalks.
- Where there are bus stops, there should be crosswalks so people can get across the street to/from the stop.
- At McCombs Street between Lisa Drive and Gateway North Boulevard, the many different vehicle modes mix with bicyclists, making it very dangerous for all modes.
- Need pedestrian routes for residents to get to shops, schools, etc. on Vinton Road, and Doniphan Drive. Consider lowering speed on Doniphan Drive, Vinton Drive and surrounding roads.
- Need a policy that requires the consideration of pedestrian facilities in road projects, and if they are not built, there should be a justification made as to why they were not built.

Canutillo/Anthony Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the Canutillo/Anthony planning area. Open house attendees were provided a map of bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 125 provides the bicycle connectivity map for the Canutillo/Anthony planning area.

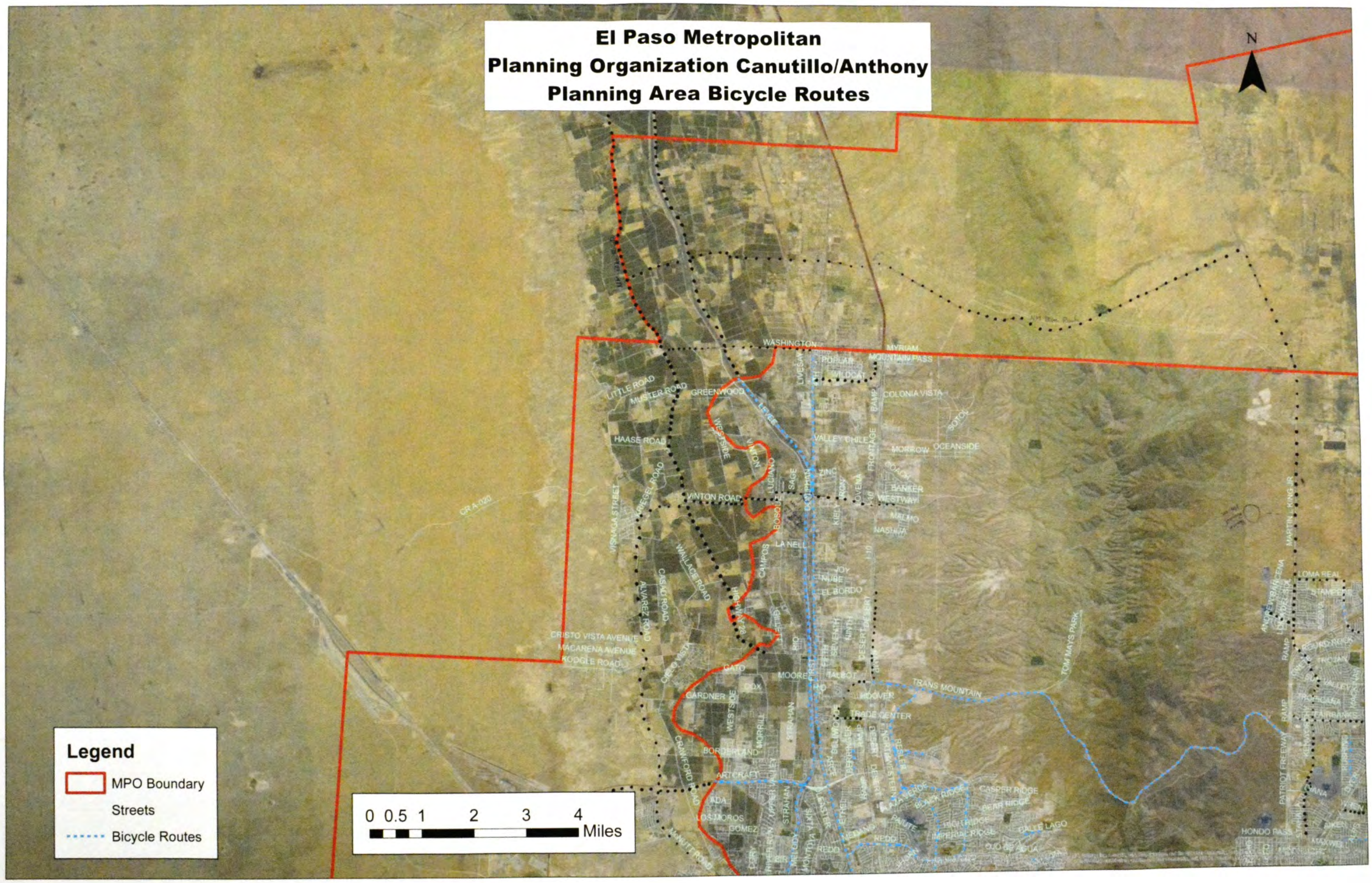

Figure 125. Canutillo/Anthony Planning Area Bicycle Connectivity Map.

The black dashed lines on Figure 125 show roadways where bicyclists currently travel, but facilities could be improved to increase bicyclist safety. Members of the public indicated that the route marked on the northeast section of the map is safe as there is little traffic on that roadway.

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the Canutillo/Anthony planning area:

- Move ramps off of IH10.
- Need routes on Vinton Road that connect with bike routes on Doniphan Drive.
- Need bike routes for residents to get to shops, school, etc. on Doniphan Drive, Vinton Drive, and surrounding roads. Consider lowering speeds on Doniphan Drive, Vinton Drive, and surrounding roads.
- Bike lanes/routes are important, but cyclists need end of ride amenities as well (i.e., bike racks, lockers to change, showers).
- Utilize streams for hike and bike as part of TxDOT's hike and bike plan.
- Need a policy that requires the inclusion of bike facilities in road projects, and if they are not built, there should be a justification made as to why they were not built.

Canutillo/Anthony Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the Canutillo/Anthony planning area. Open house attendees were provided a map of existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 126 provides the transit connectivity map for the Canutillo/Anthony planning area. Figure 127 provides a close-up of comments made on the Canutillo/Anthony planning area transit connectivity map (Figure 126).

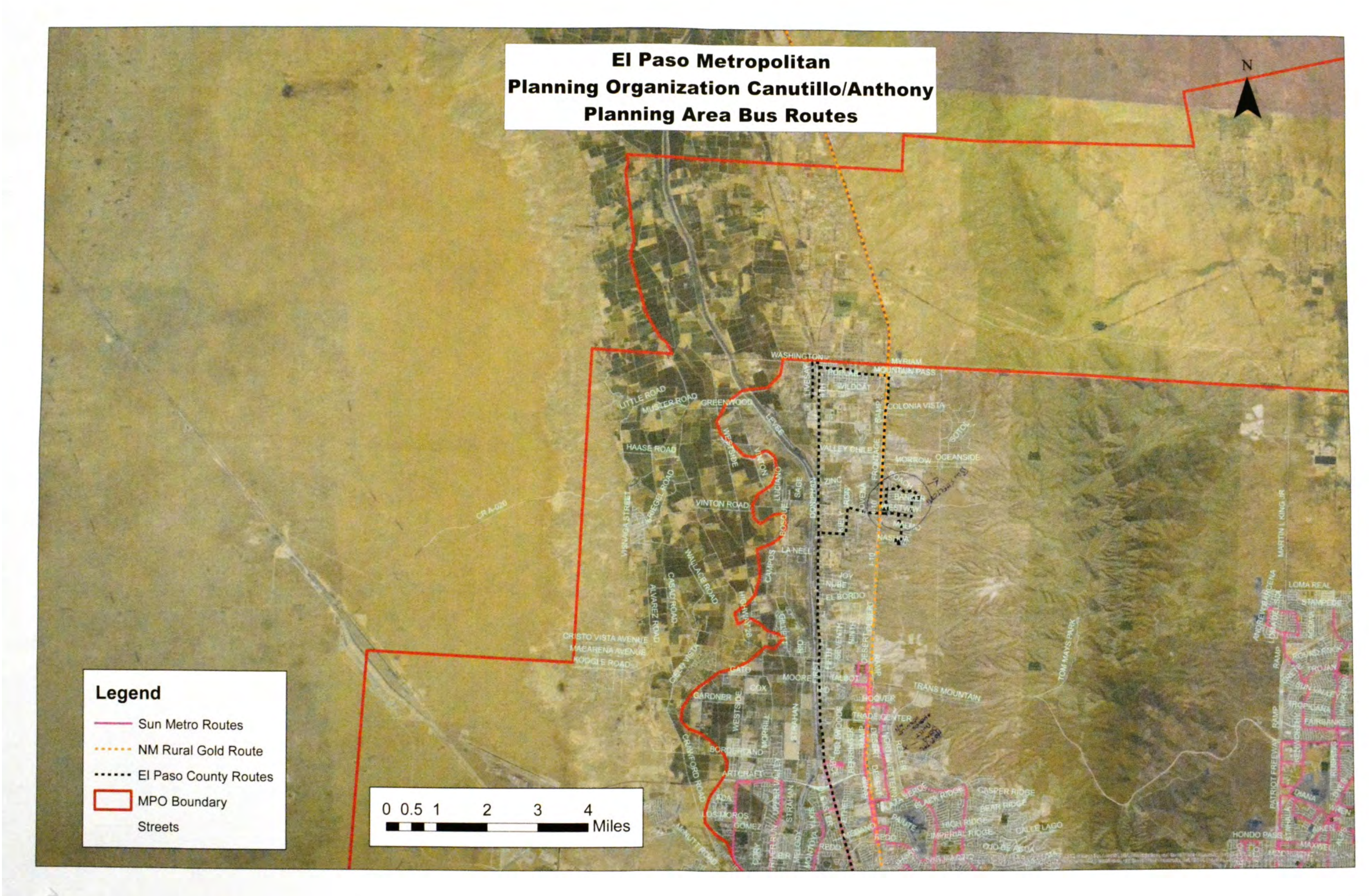

Figure 126. Canutillo/Anthony Planning Area Transit Connectivity Map.

Figure 127 Close-up of Comments Made on Canutillo/Anthony Planning Area Transit Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 127:

- Hospital being built on Resler Drive – will need north/south transit service.
- Circled area on left side of the map needs bus shelters.

The following summarizes comments that open house attendees wrote on sticky notes about transit connectivity in the Canutillo/Anthony planning area:

- There should be benches or shelters at locations where people wait for buses.
- There needs to be the ability to transfer from county buses to Sun Metro buses, with transferable fares.
- There needs to be discounted fares for elderly and students.
- There should be a policy that requires the inclusion of bus transit facilities when building road projects.

OPEN HOUSE #7: CENTRAL EL PASO PLANNING AREA

The seventh open house was held on November 7, 2015, between 9:00 a.m. and 12:00 p.m. at the Armijo Recreation Center, 700 E. 7th Avenue, El Paso.

Central El Paso Planning Area Pedestrian Connectivity Input

The following section details input provided by the public about pedestrian connectivity in the Central El Paso planning area. Open house attendees were provided a map of the sidewalks in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 128 provides the pedestrian connectivity map for the Central El Paso planning area.

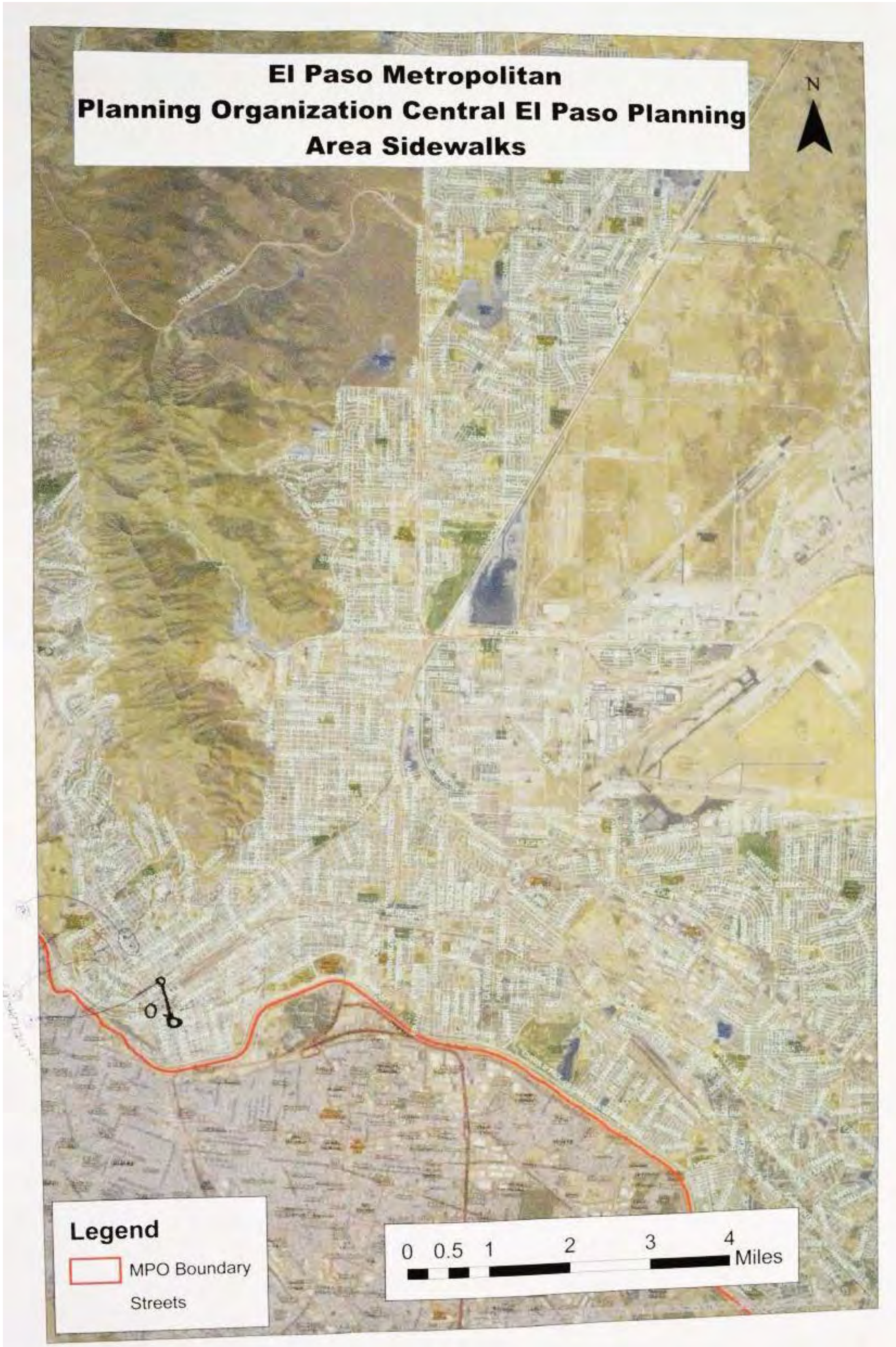

Figure 128. Central El Paso Planning Area Pedestrian Connectivity Map.

Note that the circles drawn on the southwest section of the map shown in Figure 128 are locations that the public indicated would benefit from pedestrian underpasses. The locations are noted below as well.

The following summarizes comments that open house attendees wrote on sticky notes about pedestrian connectivity in the Central El Paso planning area:

- Need connected sidewalks that are safe, advantageous, convenient, and comfortable.
- Need underpasses for pedestrians in the following locations (improve access to baseball field):
    - Under Paisano Drive at Stanton Street.
    - Under Paisano Drive at El Paso Street.
    - Under Santa Fe between Main Street and Franklin Street.
    - Under Mesa Street near Cincinnati Avenue.
- Numerous sidewalks are in need of maintenance:
    - Many sidewalks in this area are buckling/cracked due to tree roots.
    - Sidewalk is falling apart at Stanton Street from Cliff Drive to Schuster Avenue.
    - Sidewalks are falling apart at Prospect Street and Los Angeles Drive intersection.
- Numerous locations in this planning area are missing sidewalks:
    - Sidewalks are missing in the area between Barranca Drive and Pellicano Drive.
    - Sidewalks are missing on Country Club Road in the Upper Valley area to Doniphan Drive.
    - Sidewalks are missing on Sunland Park Drive from Crestmont Drive to Chermont Drive. These are currently only gravel.
- Please place pedestrian safety as the first priority in every traffic situation.
- Mesa Street needs better and safer crosswalks.
- Consider increasing enforcement for motorists that do not yield to pedestrians.
- Need to ensure the forecasting of pedestrian needs and facilities for all modes as opposed to having to go back and have to build pedestrian facilities after a road has already been built.
- Cars park up against, and often over sidewalks. The overlapping cars block sidewalk access (see Figure 129 for example).
- Cars park too close to (and sometimes on) the crosswalk. This reduces the visibility of pedestrians and increases the probability that drivers will not yield to them during right turns (see Figure 130 for example of issue on N. Oregon Street and E. Franklin Street).

Figure 129. Photos of Cars Overlapping Sidewalk.

Figure 130. Photo of Car Parking too Close to Crosswalk.

- Replace the pedestrian pass that was removed by Spur 1966.
- Shuster Avenue has to be crossed twice to access the pedestrian crossing at Paisano Drive.
- Program traffic lights so they are timed with elderly pedestrians in mind.

- Need a complete connected network of sidewalks that feel safe and are comfortable, convenient, maintained at 10–20 ft wide.
- Some areas may have wide sidewalks but walking next to 4 high-speed car lanes does not feel safe or enjoyable (see Figure 131 for an example).

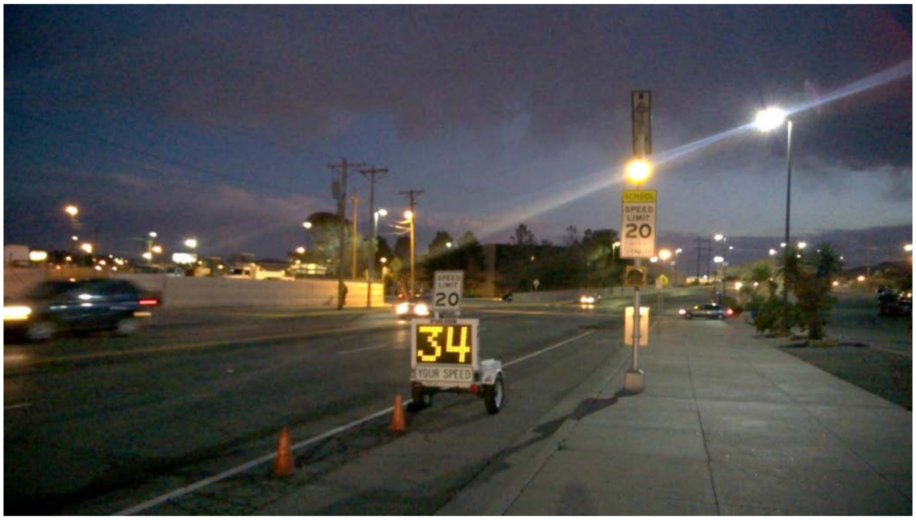

Figure 131. Example of Sidewalk near High-Speed Travel Lanes.

- Need to improve education for pedestrian crossing for "x" crossing signs.
- Some locations have missing connections between sidewalks and crosswalks (see Figure 132 for example at 4900 N. Mesa Street).
- Several locations have utilities or street signs in the sidewalk, restricting connectivity and accessibility (see Figure 133 for example).

Figure 132. Example of Missing Connection between Sidewalk and Crosswalk.

Figure 133. Examples of Locations with Impediments in the Sidewalk.

Central El Paso Planning Area Bicycle Connectivity Input

The following section details input provided by the public about bicycle connectivity in the Central El Paso planning area. Open house attendees were provided a map of the bicycle facilities in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 134 provides the bicycle connectivity map for the Central El Paso planning area.

Figure 134. Central El Paso Planning Area Bicycle Routes Map.

The black dashed lines on Figure 134 show roadways where bicyclists currently travel, but facilities could be improved to increase bicyclist connectivity and safety.

The following summarizes comments that open house attendees wrote on sticky notes about bicycle connectivity in the Central El Paso planning area:

- Need bike route from Horizon City (Eastlake Boulevard and Darlington Drive) to Downtown El Paso and to UTEP.
- Need protected bike ways that connect all over the city to all destinations.
- Should consider effective bicycle programs from other cities as Albuquerque, Portland, Paris, and Madrid.
- Need wayfinding signs at rider level, as opposed to 8 ft high.
- Consider a municipal bicycle shop at the Segundo Barrio like in Albuquerque, NM.
- Need safer intersections that cross major north and south corridors.
- Currently there are no safe routes from the Lower Valley to the Upper East Side.
- Need bicycle facilities and amenities at the end of trip such as showers, lockers, bike lockers, benches, shade structures, water fountains, bathrooms, and bike parking.
- Need bike boulevards with wayfinding and signage with travel times for cyclists.
- Need more equity for all wheeled mobility including wheelchair and bicycle riders.
- Need more trees and vegetation lining the sidewalk to shade riders.
- Need more protected bike ways.
- Need buffered bike lane on Montana Avenue.
- There is a problem in speed difference between cars and bicycles on Montana Avenue, which is 40–45 mph.
- City and MPO should work to acquire rights of way for the rail road utility easements that could be used for hike/bike paths connecting the region.
- Need network of connected hike/bike trails that parallel major roads including IH10, Texas State Highway Loop 375, US Highway Route 54, Spur 601, Dyer Street, and Doniphan Drive. It would also be useful to repurpose abandoned drainage and irrigation canals throughout the city and the region as multi-use paths.

Central El Paso Planning Area Transit Connectivity Input

The following section details input provided by the public about transit connectivity in the Central El Paso planning area. Open house attendees were provided a map of the existing transit routes in the planning area and asked to provide comments by writing on sticky notes or directly on the map. Figure 135 provides the transit connectivity map for the Central El Paso planning area.

Figure 135. Central El Paso Planning Area Transit Connectivity Map.

The following summarizes comments written directly on the map shown in Figure 135:

- Route 75 needs more trips.
- Could use express route from:
    - Mission Valley to R.C. Poe.
    - North Gate to R.C. Poe.

The following summarizes comments that open house attendees wrote on sticky notes about transit connectivity in the Central El Paso planning area:

- Extend hours of operation for Brio on weekends.
- Sun Metro Route #75 needs more trips, should extend the hours of operation.
- Should have the sun Metro and Brio Terminals closer together so users can choose either system based on which is faster.
- Sun Metro Route #14 should extend hours of operation (earlier and later).
- Need expansion of Sun Metro routes #4 and #9 to outer downtown areas.
- On the west side of El Paso, buses need to be more frequent and should expand of hours of operation until midnight (at least Monday–Saturday).
- Add express route from Downtown El Paso to 5 Points transit station.
- Add more express routes out of 5 Points transit station.
- Add more express routes to more destinations.
- Extend hours for certain hot spots.
- Bring back Montana Avenue route to Geronimo Drive outbound.
- Need to get feedback directly from bus passengers and drivers to understand how to improve the service.
- All bus stops should have connecting sidewalks (see Figure 136 for example at 7800 Helen of Troy).

Figure 136. Example of Bus Stop with No Sidewalks.

APPENDIX D:
INTERNATIONAL BRIDGES

This appendix assesses the influence of the international bridge upon multimodal transportation in the region. El Paso region has three international bridges linking it with Mexico:

- Bridge of the Americas – the primary POE in the El Paso region, handling more than half of all international crossing traffic (passenger and commercial); it has four separate structures, the four bridges include two bridges for northbound and southbound commercial traffic, and two bridges for northbound and southbound passenger vehicles. The bridges provide a total of eight lanes for passenger vehicles, four lanes for trucks, and two sidewalks for pedestrians.
- Good Neighbor Bridge – commonly known as the Stanton Street Bridge, a five-lane bridge with four lanes for southbound traffic and one for northbound traffic.
- Paseo del Norte Bridge – a four-lane bridge used for northbound, non-commercial traffic only; and for northbound and southbound pedestrian traffic.

In 2013, an average of 1,500 northbound buses per month crossed at Paseo del Norte, 850 at the Bridge of the Americas. An average of 344,000 pedestrians per month cross at Paseo del Norte into the City of El Paso, 73,300 cross north at the Bridge of the Americas.

Sun Metro Transit operates its Downtown Transfer Center near the Paseo del Norte POE. In addition to several routes serving the transfer center, the agency operates two downtown circulators, Routes 4 and 9.

The City of El Paso, in collaboration with TxDOT El Paso District, is proposing the El Paso Streetcar Project, a project that will enhance mobility, encourage economic development, help to create new urbanism and smart growth, and pay tribute to the historical nature of the downtown district by using a streetcar modeled after the El Paso streetcar from the early 1900s. The streetcar line consists of a 2-mile, double-tracked corridor, beginning in the area near the Downtown Shopping District and International Bridges, traveling north through downtown to the UTEP area, the Cincinnati Entertainment District, and back.

TTI researchers established the importance of cross-border pedestrian traffic to the El Paso region. Over 3 million Mexican citizens enter the United States each year for myriad reasons: tourism, shopping, social visits, health care, education, and work. Noted by the researchers, a significant amount of their travel in the region is intermodal, transferring to and from other modes on either side of the border.

But as researchers discovered and a current review confirmed, there is still no comprehensive research study explicitly focused on pedestrian travel behavior at international bridges. There is very little research attempting to analyze the connection between international bridge crossings and multimodal transportation. This research gap is interesting as pedestrians (and subsequent transit riders) are a very important market segment for the region. They have unique needs different from motorized travelers, and understanding those needs can empower policy makers to improve mobility at the POEs (*107*).

However, that lack of transportation alternatives is not identified as a problem when the bridge crossings are studied. In the TTI study, POE operational characteristics (including wait time), currency issues, and perception (and reality) of personal safety were noted as significant influences on travel behavior at the border. Nevertheless, TxDOT has identified two needs for the Paseo Del Norte bridge: improvements for traffic flow approaches and departures and safety improvements for pedestrians using the bridge to access bus stations nearby (*107*).

One research report was found to have relevance to the subject. Researchers and practitioners in the Øresund, or Öresund Region, a transnational metropolitan area in northern Europe, centered on the cities of Copenhagen, Denmark, and Malmö, Sweden, have initiated the EcoMobility Project in their region. It brings transportation stakeholders together in an attempt to find sustainable solutions to the region's transportation issues.

The concept of sustainability necessitates revision of traditional decision-making processes, where the generally acknowledged cost-benefit analysis (CBA) is used for a systematic quantification and comparison of the various benefits and costs generated by a project. Decision making based on CBA is often found to be inadequate to incorporate and assess multiple, often conflicting objectives, criteria, or attributes like environmental or social issues, which are usually intrinsically difficult to quantify (*108*).

Researchers presented the EcoMobility (EM) modeling framework through a case study in the Øresund region considering the alternatives for a new fixed link between Helsingør (Elsinore) in Denmark and Helsingborg in Sweden (referred to as the HH-connection). The EM modeling framework consists of two parts: a decision conference and an Excel-based software model (entitled the EMmodel). The latter employs the use of two multicriteria decision analysis (MCDA) techniques, REMBRANDT (ratio estimation in magnitudes or deci-bells to rate alternatives that are non-dominated), which is based on pair wise comparisons, and SMARTER (simple multi-attribute rating technique exploiting ranks), which is based on criteria rankings. The concept of a decision conference (DC) is introduced in order to formalize and operationalize group processes that enable the assessment of non-quantifiable impacts/criteria within a decision support context (*108*).

This is an example of transnational agencies attempting to achieve consensus on a sustainable solution to a border crossing project.

APPENDIX E: TECHNOLOGY AND ALTERNATE MODES

This appendix identifies technologies with the highest potential to encourage behavioral changes to support the use of alternate modes (e.g., bicycle routing and multimodal commute planning web and mobile applications)

Transportation public information systems have two primary goals; first, they should help minimize the inconvenience of using public transport by simplifying the trip planning and implementation. Second, the system design should minimize the sense the trip taken is disjointed and awkward to the extent the intermodal travel experience becomes closer to that of a trip by private car. To accomplish this second goal, an accurate and efficient way to manage transfers is needed because transfers are one of the biggest inconveniences perceived by users of multimodal networks. Useful, accurate, and robust travel information becomes necessary in order to guarantee successful intermodal trips. In addition, the efficiency of these kinds of systems requires the existence of truly integrated multimodal information services, including not only a priori information, but also information on public transport alternatives (*109*).

Qualitative and quantitative increases in the functionality of communications technology have provided opportunities to improve connectivity between travel modes within a region. Larger amounts of transportation system information made available to citizens in more efficient ways have led to innovative uses of the system.

Hallock and Inglis catalogued the various options now available to urban residents:

- Carsharing services offer vehicle access on-demand, lowering the cost of vehicular mobility for many while still preserving on-demand access to a car.
- Ridesharing services provide a tool for riders and drivers to find one another. Potential riders can find drivers who are already going in the same direction and use these services to coordinate pick-up location, costs, and schedules.
- Ride-sourcing services, such as Lyft, Uber, and Sidecar, enable users to solicit a ride from their current location from a pool of drivers using a smartphone.
- Bikesharing systems increase options for short journeys and can serve as first- and last-mile connections between transit locations and travelers' final destinations.
- Static transit data improve usability of transit services by enabling users to access schedules and route maps online via Internet-connected devices. When accessible during travel, schedule and routing data help riders navigate transit systems effectively.
- Real-time transit information builds on the benefits of open static data by providing users real-time information on arrival/departure times and delays. This gives riders the ability to avoid unforeseen wait times or to change routes at the last minute.
- Multimodal apps tie the transportation network together by offering users the opportunity to see side-by-side comparisons of many routes and services for making their trip, including biking, carsharing, public transit, driving, and walking.
- Virtual ticketing gives users the opportunity to avoid lost tickets and long wait times at the ticket counter by buying tickets directly through an Internet-connected device such as a smartphone (*110*).

Research on technology and multimodal transportation indicates progress in the development of information tools and systems that promote use of alternative modes. The research does not provide recommendations for specific apps, but does highlight approaches and techniques in the underlying technology that practitioners can build on.

Baird and Zhao apply behavioral principles to active transportation research and, in doing so, create a model approach for use of technology to promote sustainability and health by increasing the value of other policies and infrastructure investments targeting active travel. Their ideal toolkit for behavioral interventions would have the capacity to gather fine-grained data on active and motorized trips from large groups of users over long periods of time; to deliver motivating messages and feedback; and to compare the results of different interventions (*111*).

Activity tracking applications for platforms such as iOS and Android provide a means of low-cost, individual-level, objective, and highly detailed travel data, especially on active modes. Using GPS and accelerometer readings, these apps can accurately recognize trips by different modes and log when, where, and how a person has traveled. Users can view their activity record and share this information with other individuals (friends, family, coworkers) or organizations (researchers, transportation agencies). A key strength of this approach is that the app can be distributed at zero marginal cost to large numbers of users, whose travel activities (origins, destinations, times, and routes) can be passively recorded without any active user effort for periods of months or even years. Examples of this type of app include *Moves* (not the emission model), *Quantified Traveler*, *TripZoom*, and the *Future Mobility System* (*111*).

For delivering motivating messages and feedback, the mobile app and parallel streams of communication (e.g., email, SMS, social media) provide the means of communicating to users, but behavioral research can provide compelling clues to designing content. They note that travel behavior is heavily driven by habit, routine, and considerations like convenience and simplicity. Interventions that make certain travel options more attractive or highlight the non-monetary costs of an auto-dependent routine may be equally or more effective than monetary incentives. Active travel advocates, transit agencies, municipalities, and employers might all implement insights from behavioral interventions across different programs, including bike to work challenges, educational efforts, and bike friendly business programs. Under the umbrella of this approach, researchers and practitioners can test a large number of different interventions designs, varying by mechanisms, schedules, timescales, and levels of detail and specificity (*111*).

Technologies for recording travel data through smartphones are still emerging, and room for improvement and innovation still exists in this field. However, the technology is sufficiently mature to serve as a powerful tool for promoting healthful and sustainable transportation behavior, and robustly testing hypotheses about behavioral influences on travel decisions.

Recent years have seen a trend toward incorporating Web 2.0's participation notion into location based services. These applications, such as *Geonotes*, *E-Graffiti*, *CityFlock*, and *Hycon* enable users to annotate their personal experiences and feelings to physical places or objects while using the systems. Users can also access other user-generated content. These systems might be viewed as a new form of computer-mediated communication (information exchange), which is location based (*112*).

The ubiquity of mobile devices has led to the introduction of location based services. Current mobile navigation systems often ignore the social navigation aspect (i.e., using other people's experiences), which is often used in daily life. The methods can make use of user-generated content (reflecting other navigators' wayfinding experiences) and provide navigators with the least complex and/or most efficient routes (*112*).

A European team of researchers reported on SMART-WAY, a seamless public transport navigation system based on mobile devices that give passengers the possibility to act as they normally do with common navigation systems in their cars. Once the trip destination is entered, passengers are able to get into a vehicle and to board or exit in order to change or interrupt their trips as often as they like to. Passengers are not bound to a printout of the route; the system will always guide them to the desired destination even if a change of vehicles is needed or the route is interrupted or modified. Commuters and locals are able to switch to alternative routes if their bus or train is late, and tourists have the chance to find the quickest route to their hotel or to the main city sights. The GPS/Galileo-based navigation system is developed together with seven partners from five European countries, demonstrated in the cities of Turin, Italy, and Dresden, Germany, and implemented in 2012 (*113*).

Figure 137 shows the parts that make up the SMART-WAY application in order to gain a better understanding of the requirements, intricacies, and scale of one multimodal transportation app (*113*).

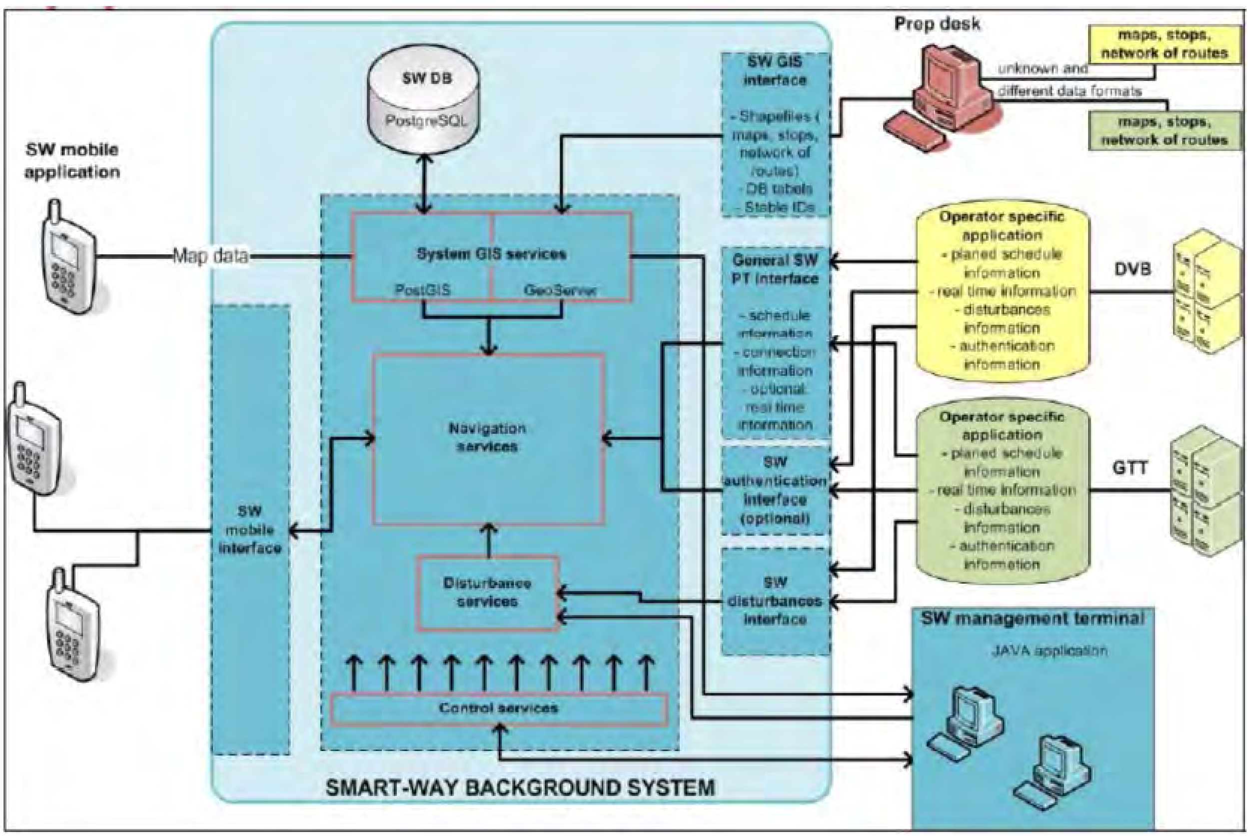

Figure 137. SMART-WAY Components.

Technology-enabled transportation services have the potential to reduce driving and car ownership, especially among young people:

- Studies have shown that tools such as carsharing and ridesharing reduce vehicle ownership and the number of miles driven. Other tools, such as real-time transit information, improve the experience of riding transit and have been shown to give a modest boost to ridership.
- Residents in cities that have access to a portfolio of technology-enabled tools are better able to construct car-free and car-light lifestyles that are less dependent on car ownership.
- Cities with more abundant transportation-enabled services are able to complement public transit by providing mobility options from the train or bus station, and by providing alternatives during unusual times when weather or the need to carry bulky packages make walking, biking, or transit less practical or desirable (*110*).

Hallock and Inglis recommend that governments should:

- Adopt clear regulations for new services such as ride-sourcing that fully protect the public while allowing the services to operate.
- Require, when negotiating regulatory arrangements for these new transportation tools, that providers share their data with public officials, who can then better integrate these services into their planning.
- Adjust municipal policies, including planning and zoning rules, to encourage the use of these services, such as by reducing parking fees for car share users, reducing or eliminating minimum parking requirements for new developments that incorporate shared-use transportation, or allocating existing parking spaces for carsharing services.
- Encourage piggy-backing between public transit and new technology-enabled mobility options, especially by encouraging bikesharing, ridesharing, and carsharing around transit stops.
- Support multimodal transportation options by creating universal payment mechanisms that work for various modes of transportation, and expand the availability of real-time information, especially with public transit.
- Conduct studies on the impact of these services and integration of them into transportation models and plans.
- Explore the potential of new tools to meet the mobility needs of those currently poorly served by the transportation system, including the young, old, disabled, and low-income households.
- Adopt open data and open source software policies in conformity with federal mandates (*110*).

APPENDIX F: PERFORMANCE INDICATORS

Using research on sustainability performance measures for El Paso's RTS, this appendix develops performance indicators for non-motorized trends and traveler behavior to increase sustainable transportation modes cross different market segments.

FHWA guidance on selecting performance measures requires considering what specific metric will be used and how measurements will be taken. In selecting performance measures, several factors should be considered:

1. *Does it represent a key concern?* – The performance measure that is selected should play a role in decision making within planning and programming and relate clearly to goals established in a performance-based planning process. Many measures are available and reflect data that can be collected, but it is important to focus on selecting the few that will be most important in driving decisions. Measures should be selected carefully to reflect key concerns of the public.
2. *Is it clear?* – Is the measure understandable to policy makers, transportation professionals, and the public? It is helpful to make sure that measures are clear and readily understood by the general public, avoiding technical terms if not necessary.
3. *Are data available?* – Transportation staff needs to consider the feasibility and practicality to collect, store, analyze data, and report performance information for the selected measures. Moreover, there should be a reasonable level of confidence that the data will be available for future analyses. The cost of data is also an important consideration. However, while data availability is important, it is important to also remember to not simply define the measure based on what data are readily available, but to consider what data could be collected that will best reflect issues of importance to the public and decision makers.
4. *Can it be forecasted?* – Are there realistic methods to compare future alternative projects, investment approaches, or strategies using the measure?
5. *Is the measure something the agency and its investments can influence?* – A good measure does not need to be something that an agency controls. Most outcome-based measures of performance reflect system-wide considerations and may be influenced by many factors. At the same time, it will be important to select measures that can be influenced through policy and investment decisions in order for the measure to be useful in supporting investment decision making.
6. *Is the measure meaningful for the types of services or area?* – While consistency in metrics can be valuable, it is also important to make sure that a measure is meaningful to the area or system to which it is applied. Care must be taken to keep the focus on customers (such as on people and rather than facilities and vehicles) to avoid unintended consequences (*114*).

In 2012, TTI researchers conducted an exercise with City of El Paso staff to conceptualize the relevance of sustainability to transit corridors in El Paso and to identify performance measures that El Paso can implement. The City's transit agency, Sun Metro, was developing a new bus RTS called BRIO. City staff was interested in developing metrics to evaluate the RTS corridors in El Paso. In the course of several workshops, a set of 25 potential sustainability performance measures for bus RTS corridors was identified. The performance measures were to be applied to:

- Communicate the value of BRT projects to the public and decision makers.
- Measure and track sustainability indicators before and after implementation of the projects.
- Provide support for decision making on specific corridors or project configurations.

Table 27 presents the final set of goals, objectives, and performance measures.

Table 27. Final Goals, Objectives, and Performance Measures for City of El Paso BRT Corridors.

Goal	Objective	Performance Measure
1. Reduce car dependence	1.1 Increase the number of persons with access to RTS service	1.1.1 Number of residents within corridor influence area
2. Mitigate traffic congestion	2.1 Improve mobility on RTS corridor	2.1.1 Travel time index on the RTS corridor
	2.2 Shift single-occupant car trips to other modes	2.2.1 Ratio of daily PMT to VMT on the RTS corridor
3. Improve international mobility	3.1 Provide mobility for travelers who cross the border	3.1.1 Percentage of RTS users who are cross-border travelers
4. Increase livability	4.1 Support pedestrian and bike modes	4.1.1 Length of sidewalks per corridor mile
		4.1.2 Length of bike lanes per corridor mile
		4.1.3 Quality of sidewalks along the corridor
	4.2 Promote mixed land uses	4.2.1 Land use entropy index in influence area
	4.3 Promote safety and security	4.3.1 Annual severe injuries and fatalities on corridor
		4.3.2 Presence of pedestrian-scale lighting in station areas
5. Promote economic development	5.1 Revitalize RTS corridors	5.1.1 Number of jobs in corridor influence area
		5.1.2 Average value of commercial property in influence area
		5.1.3 Tax revenue generated from commercial establishments in influence area
6. Ensure system effectiveness and efficiency	6.1 Ensure effective fare recovery	6.1.1 Fare recovery ratio on the RTS corridor
	6.2 Ensure that the RTS system operates efficiently	6.2.1 Number of passenger trips per revenue hour
	6.3 Complete RTS and feeder system on schedule	6.3.1 Percentage of project milestones met to date
7. Promote equity	7.1 Provide RTS access to low-income demographics	7.1.1 Low-income census tracts with access to RTS or feeder service
		7.1.2 Affordable housing presence in the corridor influence area
	7.2 Provide access to critical destinations	7.2.1 Number of accessible critical and quality-of-life destinations
	7.3 Provide affordable RTS service	7.3.1 Ratio of average cost of a round-trip by RTS to average daily personal income in influence area
		7.3.2 Ratio of combined housing and transportation costs to household income in influence area
8. Improve the environment	8.1 Reduce criterion pollutant emissions	8.1.1 Daily emissions of PM per PMT on RTS corridor
		8.1.2 Daily emissions of CO per PMT on RTS corridor
		8.1.3 Daily emissions of ozone precursors (NOx and VOCs) per PMT on RTS corridor
	8.2 Reduce GHG emissions	8.2.1 Daily emissions of CO_2 per PMT on RTS corridor

NOTE: PM = particulate matter; CO = carbon monoxide; NOx = oxides of nitrogen; VOC = volatile organic compound; GHG = greenhouse gas; CO_2 = carbon dioxide

One aspect noted by the researchers was the separation out of equity to enhance its focus as a goal.

In the course of developing its 2013 CMP update, the El Paso MPO adopted a set of goals and objectives that promotes multimodal transportation development in the region. They are listed below (numbers are goals, letters are objectives):

1. Provide a transportation system that serves the public with mobility choices including pedestrians and bicycles:
    a. Increase and improve bicycling options and facilities in the region.
    b. Increase and improve pedestrian facilities in the region.
    c. Increase and improve transit system and facilities.
    d. Improve the reliability and efficiency of buses.
    e. Continue ITS improvements in the region.

2. Identify and mitigate congestion on the transportation system:
    a. Identify, diagnose, and address highway bottlenecks and travel delays.
    b. Reduce travel delays on major arterial roads for all alternative modes.
    c. Reduce travel delays at traffic signals.
    d. Increase and improve the regional incident management program.
    e. Enhance border crossing road operations to improve facilitation of truck traffic.
    f. Increase efforts to reduce crash rates and improve safety on the system.
    g. Enhance partnerships between regional transportation system providers.

3. Minimize air quality impacts of congestion:
    a. Create and enhance shared ride programs in the region (e.g., carpools, vanpools).
    b. Promote transit options to citizens in the region.
    c. Promote TDM programs in the region.

4. Promote accessibility to an efficient transportation system for all citizens:
    a. Improve connectivity between all modes in the system.
    b. Improve border crossing activities for all users of the system (pedestrian, automobile, trucks) (*9*).

Although CMPs traditionally focus on engineering solutions and roadway congestion relief, three out of the four goals (1, 2, and 4) directly relate to multimodal planning. As with the City's efforts, particular attention was given to equity issues and promotion of alternative transportation modes. Performance measures for the goals and objectives were developed in the context of data availability to the MPO and the ability of staff to collect, analyze, and report.

Table 28 presents the MPO's CMP goals, objectives, performance measures, and data sources related to multimodal planning.

Table 28. El Paso MPO 2013 CMP Performance Measures.

Goals	*Objectives*	*Performance Measures*	*Data/Sources/Estimation*
1. Provide a transportation system that serves the public with mobility choices including pedestrians and bicycles	a. Increase and improve bicycling options and facilities in the region	a. Length of bike lanes per corridor mile (system); Number of buses with bike racks; Number of transit facilities with bike parking facilities	a. MPO compiles from cities and county
	b. Increase and improve pedestrian facilities in the region	b. Length of sidewalks per corridor mile (system)	b. MPO compiles from cities and county
	c. Increase and improve transit system and facilities	c. System/Route Accessibility and expansion; Construction of multimodal facilities	c. The number of residents within ½-mile from a bus stop/Sun Metro, MPO
	d. Improve the reliability and efficiency of buses	d. Schedule adherence	d. Percentage of On-Time Vehicles/Sun Metro Performance Indicators
	e. Continue ITS improvements in the region	e. Number of miles of highway and major arterial CMP network with traffic detectors, closed circuit television, and dynamic message sign coverage	e. TxDOT, DOT City of El Paso
3. Minimize air quality impacts of congestion	a. Create and enhance shared ride programs in the region (e.g., carpools, vanpools)	a. No. of vehicles in vanpool/carpool programs; No. of riders in vanpool/carpool program	a. El Paso County Van Pool program
	b. Promote transit options to citizens in the region	b. System/Route Accessibility – marketing programs developed and implemented	b. Sun Metro
	c. Promote TDM programs in the region	c. No. of large employers in the region with official alternative work schedules (e.g., City of El Paso, UTEP)	c. MPO
4. Promote accessibility to an efficient transportation system for all citizens	a. Improve connectivity between all modes in the system b. Improve border crossing activities for all users of the system (pedestrian, automobile, trucks)	a. No. of park and ride lots, No. of transfer centers b. Border wait times; No. of pedestrians crossing the border. (Length of sidewalk at crossings; pedestrian safety improvements; reduction in idling times)	a. Cities/Sun Metro b. CBP website, City of El Paso International Bridges

In comparing the two sets of performance measures, the MPO set addresses four out of the eight goals established by the City: numbers 1, 3, 4, and 7. However, not all objectives within those four goals are addressed; only 1.1, 3.1, 4.1, and 7.2 are reflected in the MPOS objectives. Only 4 out of 25 performance measures are used by the MPO: 1.1.1 number of residents within corridor influence area, 4.1.1 length of sidewalks per corridor mile, 4.1.2 length of bike lanes per corridor mile, and 7.1.1 low income housing tracts with access to RTS corridor.

FHWA planning guidance notes that it is very important to engage the public and stakeholders in developing performance measures. For some issues, such as safety, key concerns are generally well documented. For other issues, such as sustainability, livability, quality of life, and economic development, the most appropriate way to define an objective and associated performance measures is often unique to each state or region, so it is important to gain input from the public on what is most important to them (*114*). The City of El Paso performance measures were developed through an interactive workshop that included brainstorming sessions with key city staff (*115*). The performance measures for the CMP were developed by researchers and MPO staff before presenting them to its planning board for review.

The recommendations are:

- The MPO should review and re-evaluate its current set of performance measures in comparison to those developed by the City. Staff capabilities and data availability and analysis may lead to more robust indicators being considered.
- Stronger indicators could include bicycle and pedestrian indices, utilization rates for alternative transportation services, travel time index, and land use metrics.
- If new performance measures are considered in development of the multimodal plan, it must be done with direct public input. This can take the form of a citizen committee, surveys, town hall meetings, etc.

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