

Appendix F

GHG Emissions Reduction Strategies

Transportation-Related Greenhouse Gas Mitigation Strategies and Potential Applications in Central New Mexico

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Overview and Purpose

Planning for global climate change requires both adapting our human environment to emerging climate conditions and mitigating our contribution to climate change from greenhouse gas (GHG) emissions. This paper focuses on this second component. Scientists are in consensus that climate change has already begun; if we continue to emit GHGs from fossil fuels at rates similar to today, the severity and rate of change in the climate will increase.

Findings discussed at the Warsaw Climate Change Conference in 2013 included the need to reduce GHG emissions quickly in order to stave off a potentially devastating warming of the planet's mean temperature (i.e., 2°C or 3.6°F) before the end of this century. If the world collectively waits too long to begin significant GHG emissions mitigation efforts, the strategies that will need to be employed to avoid this difficult future will be more costly, politically challenging, and extreme because the rate of emissions reduction will need to be considerably higher.

The transportation sector accounts for roughly 30 percent of the overall GHG emissions in the United States. The other biggest emitters are electricity generation, much of it from buildings, and industry. Agricultural activities and residential and commercial land use make up the majority of the rest.

The Central New Mexico Climate Change Scenario Planning Project aims to help central New Mexico identify workable strategies to reduce the region's GHG emissions. Transportation and land use scenarios developed as part of the Mid-Region Council of Governments (MRCOG's) Metropolitan Transportation Plan can be evaluated for their ability to both mitigate emissions and adapt the region to new climate change futures expected during the next 30 years or more.

Due to these challenges and opportunities, the Project created a Greenhouse Gas Emissions Mitigation Technical Committee to:

1. Determine which transportation-related GHG emission reduction strategies could work/be effective in the central New Mexico region;
2. Prioritize identified strategies on potential impact and on feasibility;
3. Identify what data/tools are available to MRCOG and regional partners to measure strategies; and
4. Work with the consultant team to integrate these strategies into MRCOG's modeling environment for evaluation.

The list of strategies in this document is derived from those described in the Federal Highway Administration's *Reference Sourcebook for Reducing Greenhouse Gas Emissions* (http://www.fhwa.dot.gov/environment/climate_change/mitigation/resources_and_publications/reference_sourcebook/) and the Cambridge Systematics report *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions* published by the Urban Land Institute in 2009, as well as additional strategies discussed by members of the Mitigation Technical Committee for the Project.

Transportation-related strategies to reduce GHG emissions include 1) vehicle technology and policy strategies to improve the fuel-efficiency and reduce emissions from vehicles, 2) fuel technology strategies to reduce the carbon content of fuels, 3) travel activity strategies that seek to reduce the vehicle miles travelled (VMT) of the population, and 4) vehicle and system operations strategies that

improve traffic flow and reduce emissions from vehicle idling. The first two strategies are important for meeting GHG emission reduction targets but for the most part are being addressed at a nationwide or global scale and are not significantly influenced by regional planning with a couple of exceptions mentioned later in this paper. Therefore, the final two strategies are those that the Project is primarily interested in investigating for applicability to Central New Mexico.

Travel activity is influenced by the land use that generates trips and the modes of transportation available to individuals who make those trips. For this reason, both transportation and land use strategies can be effective in reducing vehicle miles travelled and will be considered for analysis in the scenario planning project. The effects of strategies on GHG emission reduction will range in size and cost to implement and will be effective at different time scales. The scenario planning work will evaluate transportation and land use development scenarios on per-capita GHG emission rates in the region for 2020, 2030, and 2040. The region can evaluate GHG emission reduction strategies on 1) the degree to which they reduce per capita emissions, on 2) their cost-effectiveness in doing so, and on 3) how quickly they can be implemented.

For each general strategy listed in this document, there is a short synthesis of current and expected policy and programmatic activity in the Central New Mexico region and its potential to help implement these emissions reduction strategies. These potential applications were developed by consulting existing plans and policy documents, through discussions with technical stakeholders in the region, and from the discussion of the Greenhouse Gas Emissions Mitigation Technical Committee in winter 2013-14. These strategies have different implementation horizons and costs associated with them and most have other benefits beyond GHG emissions reduction, which are characterized in this document by the 2040 Draft Objectives for the 2040 Metropolitan Transportation Plan that they support beyond air quality and emissions reduction. As of March 2014, these objectives include:

- Maintain existing infrastructure
- Manage congestion and enhance operations
- Expand multimodal transportation options
- Support efficient freight movement
- Promote development in activity centers and key corridors
- Enhance the flow of goods and services
- Ensure affordable housing and transportation options
- Improve air quality
- Conserve water resources
- Prepare for climate uncertainties
- Minimize footprint of new development
- Improve access to employment sites, services, and recreational opportunities
- Encourage a mix of land uses in appropriate locations
- Provide healthy, safe, and convenient travel options

In general, most of the strategies described in this document will be considered for potential application in Central New Mexico and, with MRCOG's concurrence, could be included in the region's Metropolitan Transportation Plan. The matrix at the end of this document (Appendix A) summarizes several of the strategies for quick reference and how they may be evaluated for their effectiveness in reducing GHG emissions in the region using the region's integrated land use/transportation models or through off-model analysis.

Land Use Strategies

Some land use patterns are more transportation-efficient, in terms of the number and distance of trips they generate in order for people to conduct regular business, than others. A more efficient land use pattern in a defined area would be characterized by a higher overall residential population density and a high diversity of land use types (residential, commercial, employment) with urban design elements that connect these uses and activities together in such a way as to reduce the distance between trip origins (i.e., home) and destinations (i.e., work or shopping), thereby reducing the need and appeal of driving, which in turn would increase the appeal of other modes of transportation. Land use strategies like these may include:

- **Zoning changes** at the municipal level to allow for greater densities and a mix of land use types in areas with high quality transit service. Zoning changes to allow for more flexible and high density development could be pursued throughout the region. For example, to encourage transit-oriented development (TOD), a municipality can create a TOD overlay district in the city's zoning plan, or can require extra review through a planned unit development process. Some cities have partially replaced traditional Euclidian zoning in favor of form-based zoning, which considers the relationship between buildings and the public realm from an urban design perspective, which can be useful in creating the walkable communities required for successful TOD. However, TOD can be successful in any zoning paradigm. Form-based zoning could also be used to allow for higher residential densities and greater mix of use in existing neighborhoods, particularly near existing activity centers.
1. **Potential Program in New Mexico:** Zoning is the purview of local governments; however the development of the transportation strategies in the MTP can be an excellent opportunity for cities to reconsider existing zoning. MRCOG's Land Use Integration Committee was set up to better link transportation and land use strategies. The City of Albuquerque, for instance, could conduct station-area planning around any proposed new high capacity transit investment, like Bus Rapid Transit.

The City of Albuquerque and Bernalillo County will begin an update to their comprehensive plan in 2014. The plan update may also result in a Unified Development Ordinance which would address issues such as parking requirements, density, and overly burdensome regulations in some of the sector development plans.

The City recently updated its zoning code to allow for up to 75 units/acre of multi-family development in C-1 and C-2 zoning within 660' of transit corridors, or in designated activity centers or Metropolitan Redevelopment Areas. The policy change removes some barriers to development, including an expedited review process. There are signs the policy change is being utilized, but it is still early in the process.

2. **Responsibility of:** Municipalities.
3. **Timeframe:** A comprehensive plan update will occur in the near-term. The timing of the update will allow for recommendations from the 2040 MTP to be fully integrated. The results from an emissions standpoint would not be realized until the long-term.
4. **Rough Cost Estimate:** NA.

5. Other Benefits:

- a. Promotes development in centers and corridors
- b. Minimizes footprint for new development
- c. Encourages a mix of land uses in appropriate locations
- d. Provides healthy travel options because of the reduction in distances for many trips

- **Encouragement of urban infill development** in areas that are already transportation-efficient or have the potential to become so through various means such as tax incentives for brownfield cleanup and public-private partnerships to create the right market conditions for development to thrive.

1. **Potential program in New Mexico:** The City of Albuquerque has identified Metropolitan Redevelopment Areas in which the City can purchase land, declare it blighted, and donate the properties to developers to stimulate reinvestment. This form of public-private partnership is leading to new development Downtown and along critical transit corridors.

Accessory dwelling units are one way to gently increase density. Many sector plans have made them allowable; however, the City's zoning code does not currently allow for an additional kitchen in a detached unit. Changes may be considered in the upcoming Unified Development Ordinance, or through an amendment to the 2C zoning classification.

The City of Albuquerque's Development Process Manual provides standard guidelines for development and contains parking and other requirements that can make infill development challenging. The DPM may be revised to create more flexible design standards to encourage infill.

Impact fees in most parts of the region have been waived or substantially reduced in response to the recession to encourage near-term development.

The Village of Los Lunas has established mixed-use districts around transit stations but has not observed resulting investments. The Village is investing in alternative modes and civic infrastructure in those areas to try to stimulate development.

2. **Responsibility of:** Local jurisdictions including the City of Albuquerque and Bernalillo County, private developers, local Chamber of Commerce, and the Urban Land Institute could be partners in creating an effective infill development encouragement strategy in the old urban core.

3. **Timeframe:** Medium-term.

4. **Rough Cost Estimate:** NA.

5. Other Benefits:

- a. Promotes development in centers and corridors
- b. Minimizes footprint for new development
- c. Encourages a mix of uses

- **Transit-oriented development** entails planning for new neighborhoods along existing or proposed high capacity transit lines to encourage transit usage and allow some of the characteristics found in older walkable transit-oriented neighborhoods.
1. **Potential program in New Mexico:** Limited transit-oriented planning has been undertaken at the municipal level. The Albuquerque-Bernalillo County Comprehensive Plan does identify transit centers and corridors around which higher density development may be pursued. However, development costs along many of these corridors are higher than the potential revenue.

Rio Metro conducted a series of station area plans around Rail Runner stations, some of which have been implemented to a greater degree than others. There are also three ongoing BRT studies that contain land use components to understand redevelopment potential along the proposed transit lines. These three potential BRT lines along with the Rail Runner Commuter Rail can be the resource around which new development in the region can be targeted. These three lines are a) the Central Avenue Rapid Ride, b) Paseo del Norte, and 3) UNM-Sunport. Much of these corridors traverse existing developed neighborhoods but there are some potential alignments that include areas with development potential. These new developments can be carefully planned for high residential densities, land use mix, and well-connected walking paths.

There have not been many coherent long-range transit planning efforts to date. However, the 2040 MTP can be a first step towards identifying the role transit can play in the region. Rio Metro is also about to undertake a visioning process to determine its long-term priorities.

2. **Responsibility of:** The City of Albuquerque, private developers, local Chamber of Commerce, and the Urban Land Institute and Rio Metro could be partners in creating a strategy for the development of land around Rail Runner and proposed BRT station areas.
 3. **Timeframe:** Medium-term.
 4. **Rough cost estimate:** NA.
 5. **Other benefits:**
 - a. Expands transportation options
 - b. Promotes development in centers in corridors
 - c. Considers water resources
 - d. Minimizes footprint for new development
 - e. Encourages a strategic mix of land uses
 - f. Offers affordable housing and transportation options
 - g. Improves access to employment sites, services, and recreational opportunities
 - h. Provides healthy transportation options by enabling more nonmotorized trips to and from transit
- **Building design standards** that require new and retrofitted buildings to have “pedestrian-friendly” design elements, such as short building setbacks and high window to façade ratios.

1. **Potential program in New Mexico:** While the responsibility of regulating building design standards lies with the most local jurisdictions and not in regional planning, the Metropolitan Transportation Plan could identify pedestrian commercial corridors along transit lines and recommend design elements that support a healthy pedestrian environment. MRCOG has developed a Pedestrian Composite Index that measures barriers and generators of pedestrian activity along a corridor, while the under-development LRTS guide will provide guidance on more pedestrian-friendly design. Ultimately, the local jurisdictions would need to develop such a code change to require new buildings to be designed with a pedestrian orientation. These design elements are best if they are vague enough to allow for a variety of approaches to building design so long as they retain a few important features that help make a street inviting to walk along. The MTP could recommend that efforts to revise the zoning code to include some guidance or requirements for pedestrian-friendly design in a future Unified Development Ordinance.
 2. **Responsibility of:** Local municipalities.
 3. **Timeframe:** Short-term.
 4. **Rough cost estimate:** NA.
 5. **Other benefits:**
 - a. Expands transportation options
- Development of **urban growth boundaries or infrastructure dependent growth policies** that limit the areas within which future urban development can occur can keep VMT growth down by supporting higher-density infill development.
 1. **Potential program in New Mexico:** The Albuquerque metropolitan area is already partially bounded by various sovereign Pueblos, Kirkland Air Force Base, and the Sandia and Manzano Mountains. The existence of these undevelopable areas helps to hold in some development within a certain footprint. However, it has also led most development to expand out to the west of the urban core across the Rio Grande where there are few geographic limits to new development. This is a development pattern that is difficult to service with transportation infrastructure because of the presence of the river. In addition, the pattern of development in this area has been highly dispersed and unconnected. The drawbacks to such a land use development pattern include traffic congestion, since a disproportionate amount of traffic must use a few main arterials, and inefficient water consumption. The City of Albuquerque and Bernalillo County have an opportunity to guide development more carefully through their comprehensive planning process and can consider such tactics.

Urban growth boundaries may not be viable in New Mexico. However, the region can explore concentrating growth in urban growth investment areas where infrastructure already exists and through general infrastructure-dependent growth policies. For example, Albuquerque's water utility authority only serves certain water zones that are based on elevation because it is a gravitational system. Similarly, the water authority will only authorize leapfrog developments that have a well. Rio Rancho has a similar system of water zones and development does not occur when there is no water available. The combination

of water zones, tribal lands, and physical boundaries therefore create a series of de-facto growth boundaries.

The notion of return on investment of infrastructure is also relevant and agencies are increasingly limited in available funding for infrastructure maintenance and improvements. One approach the region could take is to enable local municipalities to better account for the lifecycle costs of infrastructure to support different kinds of development, not just the costs of initial construction which are often borne by developers.

2. **Responsibility of:** Bernalillo County and cities.
3. **Timeframe:** Medium-term.
4. **Rough cost estimate:** Infrastructure-dependent growth policies and urban growth boundaries both may result in lower costs for providing public infrastructure to serve growing communities. However, urban growth boundaries, when not applied with aggressive affordable housing programs, may result in higher housing costs.
5. **Other Benefits:**
 - a. Maintains existing infrastructure
 - b. Considers water resources
 - c. Prepares for climate uncertainties
 - d. Minimizes footprint for new development

Integrating Transportation Investments with Land Use Strategies

For land use strategies like those described above to reduce energy consumption and GHG emissions, they must be complemented with investments in transportation infrastructure that support the use of modes of transportation other than driving in single-occupant vehicles (SOV). Some of these strategies could be pursued without complimentary land use strategies but they will have less impact on per-capita vehicle miles traveled if the automobile orientation of the land use in the region does not change. These investments may include:

- **Bicycle and pedestrian infrastructure improvements** to increase the appeal and safety of walking and bicycling. These investments may involve retrofitting existing streets to include sidewalks and safer roadway crossings for pedestrians. The investments could also include developing a network of on-road bicycle facilities like bike lanes, cycle tracks, and traffic calming complemented by the construction of off-road bicycle trails. Retrofitting the urban environment for safer and more comfortable walking and bicycling will also improve the conditions for successful transit operations as more people would be likely to take transit if there were safe and comfortable pathways to it.
1. **Potential program in New Mexico:** MRCOG already has a good base from which to identify investments in better roads and trails for bicycle commuting and walking through its Project Prioritization Process. The last MTP included a proposed bicycle system which has been mapped. This system includes the existing network plus planned investments. It also identifies gaps and barriers for which no treatment has been proposed but that require attention:

[http://www.mrcog-nm.gov/images/stories/pdf/transportation/2035_mtp/Final Approved/2035 Poster LRBS Adopted Doc.pdf](http://www.mrcog-nm.gov/images/stories/pdf/transportation/2035_mtp/Final_Approved/2035_Poster_LRBS_Adopted_Doc.pdf). The region can improve its bicycling network for transportation by prioritizing these investments, particularly those that improve connectivity to areas of greater land use concentration like TODs or other focus areas that the plan identifies.

2. **Responsibility of:** City public works departments and planning departments will have primary responsibility for implementing the bicycle plan. MRCOG plays an important role in the development of a bicycle system by programming Federal funding for transportation projects. These projects may receive STP, CMAQ HSIP or TAP funds from MAP-21, but they can also be funded through local initiatives.
 3. **Timeframe:** Medium-term. Bicycle and pedestrian projects can be programmed in the TIP upon completion of the MTP and be developed as early as 2020.
 4. **Rough cost estimate:** Trails have a moderate to high cost so should be carefully considered before prioritizing investment in them. Better allocation of space on roads with the addition of bike lanes through lane narrowing or road diets and other on-road treatments are comparatively inexpensive ways to improve the bicycling environment in the city though they may not appeal to as wide a range of the bicycling public. Albuquerque already has experience with these kinds of treatments that both make the bicycling network safer but also help to identify it to potential bicyclists.
 5. **Other benefits:**
 - a. Manages congestion and enhances operations
 - b. Expands transportation choices
 - c. Improves access to employment sites, services and recreational opportunities
 - d. Provides safe travel options
 - e. Provides healthy travel options
 - f. Offers affordable transportation and housing options
- **Improving public transportation** with high-frequency, reliable, and fixed route transit service. Investments in expanding public transportation may include a denser network of bus service operating at higher frequencies, or may include the construction of a light rail (LRT) or bus rapid transit (BRT) network to serve high-density mixed-use areas and connect major employment centers, activity centers, and residential areas. Investments in fixed public transit like BRT or LRT have been shown to better influence land use development than relying solely on improving regular bus operations, but both improve the effectiveness of the transit system to meet regional travel needs.
1. **Potential program in New Mexico:** The Albuquerque metro area has seen a dramatic rise in overall public transit usage in the last decade, which indicates that transit can serve a critical role in reducing dependency on single-occupancy vehicles in the region. The Rail Runner provides long-distance north-south commuter service from communities south of Albuquerque to Santa Fe, while three BRT-like Rapid Ride routes were introduced by ABQ Ride between 2004 and 2009. Three BRT studies are ongoing (two led by the Rio Metro Regional Transit District and a third led by ABQ Ride).

The 2035 MTP established river crossing mode share goals where 10% of all trips across the river should be made by transit by 2025 and 20% of all trips by 2035. To support that goal the Metropolitan Transportation Board approved a policy to sub-allocate 25% of Federal discretionary funds programmed through the Transportation Improvement Program to transit projects that support the mode share goals.

Rio Metro RTD is funded in part by a 1/8-cent GRT. The RTD has the authority to tax up to ½-cent to generate additional revenue, but any increase must be approved in a countywide vote.

Two of the three BRT studies could result in a Small Starts application for FTA funding in fall 2014. The scope of the application(s) is yet to be determined, although it is likely that only one proposal will be submitted for the region.

2. **Responsibility of:** Rio Metro and ABQ Ride are the transit providers who are responsible for the planning and operations of their systems. Successful applications for Federal funding include significant land use coordination to ensure that new BRT lines will result in transit-oriented development that will reduce per-capita VMT. Land use planning at this scale is the responsibility of city planning departments.
 3. **Timeframe:** Medium term.
 4. **Rough cost estimate:** Medium. BRT is proving to be a more popular concept in the region than light-rail. One advantage of BRT is that it has a relatively low implementation cost and can have many of the same benefits as rail. Proper BRT planning requires coordination between jurisdictions, public works departments and planning departments. Both Rio Metro and ABQ Ride receive FTA 5307 operating funds. Additional revenue for ABQ Ride comes from the City of Albuquerque while Rio Metro generates about \$20 million per year in GRT revenue (one half is allocated for Rail Runner operations, while the other half funds regional bus transit and demand response services). The TIP sub-allocation now provides an additional \$6.5 million annually in reliable capital funding.
 5. **Other Benefits:**
 - a. Expands transportation options
 - b. Promotes development in centers and corridors
 - c. Improves access to employment sites, services and recreational opportunities
 - d. Offers affordable transportation and housing options
- Instituting **routine accommodation of bicycles and pedestrians or establishing a Complete Streets Policy** can ensure that future roadway construction and reconstruction investments result in better environments for walking and bicycling except in a handful of cases where they are not appropriate. This policy process approach is being adopted by many cities, counties and states as a way to institutionalize multimodal approaches to transportation facility design.
1. **Potential program in New Mexico:** Complete Streets ensures roadways are designed with full consideration of the comfort and safety of all users and of all abilities. The Metropolitan Transportation Board passed a Complete Streets resolution in 2011 that directs creation of policy and roadway design guidelines. However, none of the member agencies have passed

the resolution for their jurisdictions. MRCOG has incorporated Complete Streets principles into its Project Prioritization Process which is utilized in the selection of projects for Federal funding. Projects that incorporate multi-modal aspects tend to receive higher evaluation scores and are more likely to receive funding.

The Future Albuquerque Area Bikeways and Streets (FAABS) document is being revised to include Complete Streets design guidance. The FAABS will be replaced by the Long-Range Transportation System (LRTS) Guide, which will likely be adopted for the 2040 MTP. LRTS is intended to provide guidance on roadway design based on the surrounding context, adjacent land uses, and the role of the facility in the regional transportation network.

2. **Responsibility of:** Since this is a policy-based strategy for creating multimodal streets, agencies at every level can institute these policies to apply to processes for which they are responsible. Cities and statewide transportation agencies can institute a checklist that requires documentation of the consideration of all users in each project development phase of every transportation project, and funding agencies like MRCOG can make multimodal consideration a requirement for receiving funding.
3. **Timeframe:** Short-term. This is an approach that can begin to show results once a good policy is developed.
4. **Rough cost estimate:** Low. One of the benefits of a Complete Streets approach to multimodal transportation development is that by incorporating bicycling and walking into routine project development, decisions about the proper type of bicycle and pedestrian infrastructure can take into account the full range costs and benefits early in the scoping of projects. Early planning like this typically results in more cost-efficient multimodal transportation investments than adding in infrastructure after a road is built.
5. **Other Benefits:**
 - a. Maintains existing infrastructure
 - b. Expands transportation options
 - c. Improves access to employment sites, services and recreational opportunities
 - d. Provides safe travel options
 - e. Provides healthy travel options

Transportation and land use strategies present the classic chicken and egg conundrum: more transportation-efficient land use patterns will only have a marginal influence on vehicle travel without improving public transit and walking and bicycling conditions; however, improvements in transit and non-motorized conditions will not significantly affect travel behavior if future land use retains the automobile orientation of the status quo. Pursuing an integrated land use and transportation plan that ties future transit and non-motorized transportation investments with transportation-efficient land use patterns will likely have a great effect on per capita GHG emission rates in the future. However, it will take many years for the full benefits of this approach to be realized. In other words, these strategies may be the most effective in the long-term to reduce per capita GHG emissions in the region, but only pursuing these strategies will not likely show much benefit in the short-term (2020) and modest benefit in the medium-term (2030). MRCOG has the robust capability to test these land use and transportation strategies in their modelling environment using a sophisticated land use model (UrbanSim) and a travel demand model (Cube Voyager).

Transportation Demand Management (TDM) Strategies

TDM strategies seek to reduce the demand for driving single-occupant vehicles through various mechanisms that include incentives to choose alternatives or actions that influence the relative attractiveness or price of travel by SOVs versus alternatives. TDM strategies often accompany an investment in an alternative transportation mode such as the provision of a High Occupant Vehicle (HOV) or High Occupant Toll (HOT) lane or the construction of a new transit line. TDM strategies are most effective in reducing VMT when implemented as a suite of strategies as opposed to standalone strategies. While these strategies will not by themselves have as much impact on vehicle travel as integrated land use and transportation strategies discussed above, they can be implemented relatively quickly and at a low cost and can begin to show some results much sooner than more ambitious plans. TDM strategies include:

- **Road pricing** (sometimes referred to as “congestion pricing”) partially monetizes the cost of adding to a congested corridor or area. A handful of large cities have implemented cordon pricing in their central districts, which are typically historic pre-automobile neighborhoods in order to reduce the number of vehicles travelling in them. These efforts, which can be found in London and Stockholm, charge drivers a variable amount to pass through a cordon into the central district. They have been successful in reducing traffic and resulting congestion and pollution and increasing alternatives to driving in those few places where they have been implemented.

Cordon pricing has not been adopted in the United States but several regions here have constructed HOT lane systems. These systems, which can be found in Southern California, Denver, and Minneapolis-Saint Paul among others, charge SOV drivers a variable amount to use a congestion-free lane on the freeway that is free to use for HOVs like carpools or transit vehicles. The lane is kept free of congestion by increasing the price to SOVs using the lane when there is higher demand for it and lowering it to little or nothing when the highway is not congested. Road pricing strategies have been proven to be effective in reducing emissions at different amounts depending on the context, by incentivizing travel by HOVs, and by marginally reducing congestion. Some regions, such as Minneapolis-Saint Paul are pursuing regional highway strategies that restrict any expansion of the highway system to only priced lanes. These strategies do not attempt to solve congestion through highway building but instead aim to provide a congestion-free alternative to those who value it enough to pay when faced with the choice. They also can complement transit improvements by providing congestion-free travel for express buses that do not pay to use the lane and can incentivize people to make ridesharing arrangements when traveling in the peak period.

In sum, road pricing strategies provide for a more efficient use of the highway system and can be an effective means to incentivize travel alternatives. They can also be implemented relatively quickly compared to many transportation system investment strategies if an existing lane is converted to a HOT lane. The Urban Land Institute’s Moving Cooler report indicated pricing as one of the most promising methods for reducing GHG emissions when an existing general purpose lane is converted to a HOT lane. MRCOG has the ability to evaluate the effect of implementing HOT lanes through its travel demand model.

1. **Potential program in New Mexico:** Because the Albuquerque region does not have an extensive amount of congestion on its freeway system, this type of strategy may not make sense in the short-term but can be an approach to consider for future highway investment. Instead of expanding the number of general-purpose lanes on the freeways to accommodate traffic growth, the region could instead only construct new lanes as part of a managed system that is restricted to HOVs and those willing to pay a variable rate toll. NMDOT is looking at a potential future managed lane system to handle the increased freight traffic expected through the Albuquerque area.
 2. **Responsibility of:** New Mexico Department of Transportation.
 3. **Timeframe:** Medium and long-term. Priced lanes only work as a partial solution for congested corridors.
 4. **Rough cost estimate:** Medium. Pursuing a managed lane strategy is less expensive than pursuing a highway expansion strategy. These strategies allow for a congestion-free alternative to exist without continuously building more miles of pavement, which is expensive to build and to maintain. The revenue from the priced lane can be used to fund its management and to provide express transit service that uses the lane.
 5. **Other Benefits:**
 - a. Maintains existing infrastructure
 - b. Manage congestion and enhance operations
 - c. Expands transportation options
 - d. Supports efficient freight movement
 - e. Improves network efficiency to enhance the flow of goods and services
- **High Occupant Vehicle (HOV) facilities** include HOV lanes on freeways and carpool incentive programs at parking garages. HOV lanes are similar to HOT lanes described above except that they are not priced and are only available for use by vehicles that have a certain number of occupants. Some regions have 2-person HOV lanes, while others have 3-person HOV lanes. The severity of congestion on the corridor typically determines the passenger threshold of an HOV lane. HOV lanes are also used by transit vehicles. Because most vehicle travel is by single-occupant vehicles, the HOV lane is typically a more reliable and faster alternative to the general purpose lanes, but unlike HOT lanes, they can become congested if they experience enough demand.

Areas with high demand for parking and limited space may also provide special rates or parking spaces to registered carpools. These kinds of programs are typically managed by an employer-based transportation program and are common on university campuses where the university controls transportation and land use. These programs offer lower rates to registered carpools at preferred parking locations.

1. **Potential program in New Mexico:** HOV lanes have been studied at the project level by NMDOT on various occasions along portions of the Interstate system in the Albuquerque metro area. This bottom-up approach generally leads to the conclusion that HOV facilities on a finite portion of the Interstate would not be appropriate. However, if the region were to develop a plan for a connected HOV network to handle projected travel demand

increases, implementation would be more feasible and allow for it to occur on an incremental basis if necessary. MRCOG's regional travel demand model could be used to identify the most feasible HOV network based on projected traffic and congestion levels.

NMDOT is realistically considering managed lanes as an option on I-40 through Albuquerque due to the high level of projected demand, particularly for freight travel. Signage would indicate depending on the time of day if lanes are open to all users, trucks only, or potentially HOV only.

2. **Responsibility of:** NMDOT, with support from MRCOG and ABQ Ride or Rio Metro.
 3. **Timeframe:** Medium.
 4. **Rough cost estimate:** Medium-High.
 5. **Other benefits:**
 - a. Maintains existing infrastructure
 - b. Manages congestion and enhances operations
 - c. Expand transportation options
 - d. Improves network efficiency to enhance the flow of goods and services
- **A parking management and parking pricing** strategy is similar to that of road pricing in that it uses market feedback principles to result in a more efficient use of space, in this case for parked cars rather than cars traveling along the roadway. Parking spaces are not free to build or to maintain but this cost is not always passed directly on to users of parking spaces for various reasons including zoning code regulations that require developers of buildings to include a minimum number of free parking spaces. Such policies effectively encourage driving by subsidizing a portion of the trip for SOVs. Cities could instead adopt policies and regulations that reverse this incentive. An emerging policy idea includes "performance-managed parking" in which the availability of unoccupied spaces is at 15 percent during peak periods through variable pricing and "smart parking" in which technologies provide drivers real-time information on space availability. Parking management and pricing strategies likely have a mixed record in terms of reducing GHG emissions. They are necessary components of transit-oriented developments (as described above) and encourage more dense development. Reducing parking availability may marginally increase emissions if it results in drivers spending more time searching for parking, but this may be able to be managed with other services like real-time information.
1. **Potential program in New Mexico:** Managed parking is appropriate in transit-oriented development districts, downtowns, universities and any other location with a high demand for travel and little space for parking. This is a strategy that can go along with a TOD plan.

The most logical locations for parking management programs in the Albuquerque metropolitan area are the UNM/CNM district and Downtown. In particular, the Downtown 2010 Sector Development Plan eliminates all parking requirements within the planning area. However, parking is still requested by developers and lenders. Other employment centers and shopping districts feature a generous supply of parking. Due to the lack of easily

accessible parking, many businesses have decided to relocate from Downtown to more suburban-style office parks where parking is abundant.

A more structural approach could be to reduce required parking demands for new development region-wide or eliminate parking requirements altogether, thus limiting oversupply and making overall parking management strategies more effective. In addition, incentives could be offered to redevelop existing surface lots.

2. **Responsibility of:** City government, business improvement districts.
 3. **Timeframe:** Short-term.
 4. **Rough cost estimate:** Low.
 5. **Other benefits:**
 - a. Maintains existing infrastructure
 - b. Improves network efficiency to enhance the flow of goods and services
 - c. Promotes development in centers and corridors
 - d. Minimizes footprint for new development
 - e. Encourage a mix of land uses
- **Car sharing** is a successful recent phenomenon in the United States but its adoption rates vary considerably by location. There are several models of car sharing but they all share in common the use of one or more vehicles by members of a car sharing organization. Car sharing effectively reduces the demand for car ownership allowing individual members of a car sharing organization the ability to forego the purchase of a car or providing multiple driver households an alternative to purchasing a second vehicle. These arrangements can save households significant amounts of money and support use of alternative travel modes like transit and bicycling as people who belong to these organizations do not drive as often as car owners. Car sharing is a service provided by the private sector but the public can help these organizations to succeed by offering incentives such as free municipal parking spaces.
 1. **Potential program in New Mexico:** Car sharing companies have some small operations in Albuquerque such as Enterprise at the University of New Mexico. The City of Albuquerque could help to create better market conditions for more car sharing in the region by offering car sharing services free parking spaces in busy areas and at transit stations. Government agencies can also participate as employer members of car sharing services in place of an agency vehicle fleet.
 2. **Responsibility of:** Car sharing is always a private enterprise and there are both for-profit and non-profit models that have proven to be successful in a range of cities. City government and business improvement districts can help to provide some incentives for car sharing adoption.
 3. **Timeframe:** Short-term.
 4. **Rough cost estimate:** Low.

5. Other benefits:

- a. Expands transportation options
- b. Promotes development in centers and corridors
- c. Minimizes footprint of new development
- d. Ensures affordable transportation and housing options

- **Bike sharing** programs are flourishing in communities throughout the United States. These systems allow users to purchase a subscription or a daily pass which allows them access to a fleet of bicycles located within a defined area of a city. There are a handful of bike sharing models but most are public-private partnerships that cities and regions can facilitate through funding and/or supporting the installation of infrastructure.

- 1. Potential program in New Mexico:** Bike sharing systems are only successful when there is a high enough density of bicycles in its service area. The region may want to explore supporting the development of a bike sharing program in Downtown and the university area. Eventually, the transit system could be integrated with a bike share program in transit-oriented developments so that transit riders could use the bikes to complete the last legs of their journeys.

A bike share program was nearly implemented in Albuquerque in 2008 with a program scope and operator identified. Ultimately the program was not implemented and few formal discussions have followed in the past five years. Interest has been raised recently by City Council members as well as the Albuquerque/Bernalillo County Air Quality Control Board. A privately funded and operated program may be the most feasibly approach near-term.

- 2. Responsibility of:** Bike sharing systems are privately operated but require a lot of coordination with city public works departments and can be in partnership with the transit agency.

- 3. Timeframe:** Short-term.

- 4. Rough cost estimate:** Low for public agencies.

5. Other benefits:

- a. Expands transportation options
- b. Improve access to services and recreational opportunities
- c. Provides healthy transportation options
- d. Ensures affordable transportation and housing options

- **Ridesharing** is the sharing of one vehicle by more than one individual and takes many forms. Public agencies can encourage ridesharing through implementing road pricing which gives drivers an incentive to carry passengers during peak hours. The most widespread ridesharing in the United States occurs along toll corridors such as the Bay Bridge in Oakland-SF, California.

- 1. Potential Program in New Mexico:** MRCOG is not aware of any formal ridesharing programs in the region. However, there are several new technologies that use social media that are beginning to show promise in facilitating ride-matching so organizations that operate TDM

programs such as the University of New Mexico and the Rio Metro TDM program may want to explore this area further.

2. Responsibility of: Rio Metro, University of New Mexico, private firms.

3. Timeframe: Short-medium term.

4. Rough cost estimate: Low.

5. Other benefits:

- a. Manage congestion and enhance operations:
- b. Ensures affordable transportation and housing options

- **Employer commuter programs and transportation management associations/organizations** (TMAs, TMOs). Public agencies can directly provide or encourage ridesharing and other travel modes by facilitating the activities of transportation management associations (TMA). TMAs are associations of employers in an area that has congestion and/or limited parking. These organizations promote TDM strategies to encourage ridesharing, the use of transit and other alternatives to SOVs through incentives such as free or reduced-cost parking for carpools, incentives for buying transit passes, and other programs aimed at easing the transition to commuting by alternative modes. Some states, such as Washington, require large employers to enact a commute trip reduction program using these kinds of incentives.

1. Potential program in New Mexico: ABQ Ride and Rio Metro operate Smart Business Partnership programs, which both incorporate many TDM-related components. The programs began as a partnership but progress has not been made on creating a unified TDM program between the two agencies.

The Rio Metro Smart Business Partnership program includes over 60 employers and offers three levels of participation. Businesses are asked to provide transit information and/or bike maps, alternative transportation options, incentives for carpooling, and other measures in exchange for free advertising on the Rail Runner and other forms of recognition. The program does not include discounted passes or a guaranteed ride home program for transit commuters. Rio Metro is in the process of updating its Smart Business Partnership program and increasing emphasis in newly served markets. Ticket processing is also being updated which may allow for more flexibility in passes, including discounts and special offers.

ABQ Ride offers discount passes to employers through its version of the Smart Business Partnership program. The program, which has 161 participating government agencies and private businesses, only requires interested parties to sign-up but does not require any additional efforts to participate. ABQ Ride does offer a guaranteed ride home program for regular transit users who need alternative transportation in the case of an emergency.

Other Rio Metro efforts include marketing, a bike locker program, a summer youth pass, and special events. The bike locker program includes 130 units across 6-8 stations which are available for \$25 for six months. Usage rates vary with a wait list in several locations. The summer youth pass offers a highly discounted pass for riders age 10-17 during the summer months on ABQ Ride, the Rail Runner, and Santa Fe Trails transit system. Participation was

low in 2013 but the pass will be reestablished in 2014. Special events include National Train Day, a Christmas-themed ride to Santa's Village, and additional service for events such as the Bernalillo Wine Festival. Rio Metro is currently developing a vision for its TDM program for 2014.

The City of Albuquerque also operates a bicycle TDM program and a bicycle safety education program to encourage use of alternative modes. The TDM program installs bike lockers and provides bicycle route maps to area businesses, and installs other bicycle parking facilities in public spaces.

MRCOG is not aware of location or employer-based TDM programs in the region, other than the University of New Mexico. It may be advantageous for the business areas from the downtown area to the Central Avenue corridor to develop a locally-oriented commuter services program to market ridesharing, transit, bicycling, and walking. The cities or county can also develop an ordinance to require large employers or building developers to institute commute trip reduction programs to maintain a certain level of vehicle trips as a condition for development approval.

2. **Responsibility of:** Transit agencies, business improvement districts, local government.
 3. **Timeframe:** Short.
 4. **Rough cost estimate:** Low.
 5. **Other benefits:**
 - a. Promotes development in centers and corridors
 - b. Offers affordable transportation and housing options
- **Providing transit incentives** such as reduced transit fares and transit promotions can result in GHG emission reductions when they result in more individuals switching to transit from driving, particularly during the most congested period of the day. One way that some regions have achieved this is to provide discounted transit packages to major employers, TMO/TMAs, and schools or to major events.
1. **Potential program in New Mexico:** Much of the jump in transit ridership in the Albuquerque region in the last ten years can be attributed to the subsidized transit passes for students and staff at the University of New Mexico and Central New Mexico Community College.

Reduced transit fares can also be applied to other kinds of well-served locations with high concentrations of employees. However, there may not be significant room to reduce fares beyond current levels. Fares for ABQ Ride are quite low compared to other transit providers (\$1 per fare; \$2 day passes; \$30 monthly pass). Since 39% of ABQ Ride users are students, and most of whom utilize free passes, farebox revenue is a concern. Similarly, farebox revenue for the Rail Runner accounts for only 11% of operating costs. Fares were increased in spring 2012, resulting in a drop in ridership but a larger increase in revenue.

- ABQ Ride does offer discount passes to employers as part of a TDM program. There are opportunities to expand this program and for Rio Metro to offer discount passes on the Rail Runner as part of its Smart Business Partnership program.
2. **Responsibility of:** ABQ Rides and Rio Metro.
 3. **Timeframe:** Short.
 4. **Rough cost estimate:** These types of programs must be approached carefully as the reduced revenue from the farebox can be unsustainable if not applied in the most optimal way. Since much Federal transit operating assistance is based on ridership, however, increasing your riders through reducing the fares can allow the region to receive more Federal funding to help offset the reduction in farebox revenue.
 5. **Other benefits:**
 - a. Expands transportation options
 - b. Improves access to employment sites, services and recreational opportunities
 - c. Ensures affordable transportation and housing options
- **A statewide mileage-based user fee or “wheels” tax** on automobiles instead of a fuel tax has not been successfully implemented in the United States but is being studied by a handful of states including Oregon and has been recently considered in the San Francisco Bay area. A mileage-based tax would charge drivers a fee based on the amount of miles they travelled rather than the amount of gasoline they purchase. The idea behind this strategy is twofold: to better tie the fee charged to users to their use of the system (the miles they travelled on it) and to create a more sustainable transportation funding source. Because it has not been widely adopted throughout the world, the effect of such a funding scheme on VMT and emissions is unknown but several preliminary studies indicate that there would be a significant effect.
 1. **Potential program in New Mexico:** This kind of strategy has not been implemented to a great effect anywhere in the United States but New Mexico could begin testing the feasibility of a mileage-based fee for driving versus a fuel consumption tax. The Statewide Long-Range Transportation Plan is considering alternative financing approaches and acknowledges the unsustainability of reliance solely on gas tax revenue.
 2. **Responsibility of:** The fuel tax is collected by the State of New Mexico so any change to revenue collection in this area would need to be the purview of the State.
 3. **Timeframe:** Medium term.
 4. **Rough cost estimate:** NA.
 5. **Other benefits:**
 - a. Maintains existing infrastructure
 - b. Manages congestion and enhances operations
 - c. Supports efficient freight movement
 - d. Improves network efficiency to enhance the flow of goods and services

Transportation System Management (TSM) Strategies

Transportation system management (TSM) refers to a set of strategies that largely aim to reduce GHG emissions by reducing congestion, primarily by improving transportation system efficiency. Congestion can lead to greater levels of GHG emissions from vehicles because they release more emissions when idling than when travelling. Some TSM strategies are designed to reduce total and systemic congestion and improve system-wide efficiency, while other strategies target particularly problematic areas where improvements could greatly affect congestion, safety, efficiency, and GHG emissions.

- **Traffic signal enhancement** is the process of improving the operations, maintenance, timing, and location of traffic signals to promote smoother traffic flow, which simultaneously reduces GHG emissions. The reason for this effect is that stop-and-go traffic is less fuel-efficient and produces more emissions than free flow traffic at speeds below 50 mph. Fuel economy begins to worsen at speeds much higher than this level. Traffic signal optimization includes the coordination of signals to maximize the green light time for vehicles traveling at the speed limit. Optimization programs include dynamic optimization whereby a traffic management center uses real-time traffic data to adapt signal timing to changing conditions. Traffic signal optimization programs are popular with the public and produce many benefits but can be challenging to coordinate across different roadway jurisdictions. GHG emissions reductions have been shown to be in the range of six to 15 percent on corridors where the effect of implementing optimization has occurred, but varies considerably based on the traffic conditions and urban context.

Strategies such as traffic signal enhancement that reduce the travel time for vehicles can have the effect of inducing more vehicle travel as it has the same overall effect on a transportation corridor as adding capacity. However, pursuing strategies like traffic signal enhancement along highly traveled corridors can reduce the need to provide additional capacity on the regional highway system, which results in more efficient use of existing infrastructure. The effect on energy consumption and emissions would therefore be highest when traffic signal enhancement is pursued as part of a congestion management process in place of highway expansion.

1. **Potential program in New Mexico:** MRCOG has organized an Intelligent Transportation Systems (ITS) Subcommittee that is charged with the task to maintain a regional ITS architecture and to advise on the deployment of regionally-significant ITS elements. Signal timing plans are most effective if they are operated exclusively by one jurisdiction or through inter-jurisdictional coordination because roads of different jurisdiction intersect with one another and major roads travel through multiple cities. A Regional Traffic Management Center is being established which should help in the coordination of traffic signals across jurisdictional lines. The TMC is designed to integrate corridor and incident management plans, coordinate monitoring systems and incident response, and centralize traveler information services.

Adaptive traffic signals were recently installed on Alameda Blvd, a key regional river crossing and the most congested corridor in the region. The project led to clear reductions in delay and generated interest among some agencies in wider implementation. Funding for regional projects could be allocated through the TIP to install and maintain adaptive signals on key corridors, or support a regional signal optimization program. This effort could be overseen by the existing MRCOG ITS subcommittee.

2. **Responsibility of:** Signal timing plans are carried out by the jurisdiction who owns the signals. A new regional TMC will co-locate traffic engineering staff from multiple jurisdictions and should allow for greater coordination in signal timing plans. There is also room for a regional body such as MRCOG to prioritize ITS-related investments.
 3. **Timeframe:** A coordinated traffic signal program begins with a traffic signal timing plan which is followed by the purchase of equipment or the installation of a traffic management center. Federal funds are available for the TMC in 2016-17, although efforts are being made to advance the construction.
 4. **Rough cost estimate:** Traffic signal optimization programs are low cost compared to other congestion relieving methods like road construction. A typical signal optimization program would include the purchase of a traffic signal controller at a cost of about \$10,000 per intersection. The cost to update it including staff may cost roughly \$3,000 per year per intersection. Funding is a concern for both implementation and maintenance of regional systems, such as adaptive signals. Regional funds could be applied to address concerns over increased maintenance costs.
 5. **Other benefits:**
 - a. Maintains existing infrastructure
 - b. Manages congestion and enhances operations
 - c. Supports efficient freight movement
 - d. Improves network efficiency to enhance the flow of goods and services
- **Incident management** is the process of quickly detecting and clearing incidents on freeways that are causing congestion such as accidents or breakdowns. Such programs can reduce the time travelers sit in congested conditions because of incidents and therefore reduce fuel consumption and GHG emissions. These programs can be managed by state DOTs or cities and can be funded by MPOs. Such programs involve law enforcement and emergency service officials.
1. **Potential program in New Mexico:** Successful incident management programs involve a significant degree of interdisciplinary and interagency coordination. These programs include the involvement of law enforcement, emergency services, towing companies, departments of transportation, emergency management agencies, insurance companies and trucking companies. If New Mexico wished to improve its incident response in the metropolitan area, it would be best to begin with a task force to help all parties understand their individual requirements and mandates as they can sometimes be in conflict.

NMDOT has pursued various initiatives over the last decade with less than ideal participation from first responders. Draft incident management plans have been prepared for various NMDOT facilities, including the Interstates, but have not been adopted by stakeholder agencies. A recent draft plan for I-40 considers regional and local detour routes for commercial and passenger vehicles for incidents at various points, including those affecting the river-crossing portion of the Interstate. The inauguration of the regional TMC could help ensure that incident management plans become adopted by local agencies and are integrated into first responder practices.

- NMDOT offer courtesy patrol service along I-25 and I-40, as well as Paseo del Norte. There are discussions on expanding the service to other corridors in the metropolitan area.
2. **Responsibility of:** MRCOG could convene a task force of representatives of each of the agencies and private sector parties that would need to be involved in an incident management program. Ultimately such a program would likely reside at the New Mexico Department of Transportation as they have jurisdiction over the interstate system but the task force may identify a different owner of the program if local conditions warranted it.
 3. **Timeframe:** Short-term. Such a program could get off the ground relatively quickly as it requires no construction.
 4. **Rough estimate of cost:** The cost would be relatively low compared to the benefit to reducing incidental congestion. The program could be set up so that the public sector could recover some of its costs through the insurance policies of at-fault drivers. These programs are eligible for some Federal transportation funding.
 5. **Other benefits:**
 - a. Manages congestion and enhances operations
 - b. Improves network efficiency to enhance the flow of goods and services
 - c. Provides safe and healthy travel options
- **Intersection improvements** such as turn lanes and roundabouts are primarily constructed to reduce serious injury crashes but they can reduce traffic idling and congestion. Roundabouts are being widely adopted throughout the United States because they can often manage to move traffic more efficiently and at lower emissions than traffic signals. Roundabouts are circular road junctions in which traffic enters a continuous one-way stream around a central island. Roundabouts reduce idle times and improve traffic flow, thereby reducing fuel consumption and emissions. To estimate the fuel savings from roundabouts, it is necessary to know the fuel consumption from the replaced intersection as well as the type of intersection being replaced.
 1. **Potential program in New Mexico:** Roundabouts already exist in the region. Bernalillo County, Rio Rancho, Albuquerque, and the New Mexico DOT have experience with planning, designing, and constructing them. They are frequently controversial because they require some adjustment among drivers unfamiliar with how to navigate them and they have a few drawbacks as opposed to traditional traffic signals. Proposed roundabouts at two intersections in Albuquerque have been the subject of intense scrutiny and a mix of both neighborhood support and opposition. Typically, roundabouts are constructed because they reduce severe T-bone accidents as they require all cars to enter the intersection at an angle and at a slow speed. However, they also reduce congestion and have air quality benefits that are typically not the primary reason they are constructed. Guidance on roundabouts will be provided at the state-level as part of the Strategic Highway Safety Plan.
 2. **Responsibility of:** Roundabouts may be funded using local or Federal funds. In the latter case, MRCOG would be involved in the administration of funds and the selection of projects through a competitive process. They are typically going to be the responsibility of the local jurisdiction or New Mexico DOT if located on a state road. The cities of Albuquerque and Rio

Rancho may also have intersections that could be candidates for roundabouts.

3. **Timeframe:** Short to medium-term. Roundabouts require a fair amount of construction and it is not uncommon for them to require a significant amount of right-of-way purchase, which can add to the time it takes to build them and their cost.
 4. **Rough estimate of cost:** The cost of installing roundabouts can be similar to modifying a traditional signalized intersection if that modification includes construction of turn lanes, and they have lower maintenance costs than signalized intersections. A typical intersection would cost in the range of \$500,000 to \$1,500,000 depending on complexity and land acquisition requirements.
 5. **Other benefits:**
 - a. Manages congestion and enhances operations
 - b. Improves network efficiency to enhance the flow of goods and services
 - c. Provides safe travel options
- **Establishing roadway connectivity standards** can help to improve the efficiency of the roadway network, reduce VMT, and result in less congestion on arterial roads. Roadway network designs that feature cul-de-sacs instead of a grid-like pattern are inefficient at distributing traffic and overburden regional transportation facilities. Cities can establish standards that require new development to be better connected and can also pursue strategies to improve connectivity in existing developments.
 1. **Potential program in New Mexico:** Several cities throughout the country have established roadway connectivity standards for all new developments. Such standards are best developed with participation from the real estate development interests in the region because they can have an impact on their business models. A roadway connectivity standard may be a requirement that limits block area size or block length size and limiting the road length that serves new cul-de-sacs. Another more flexible connectivity standard that a city could require is to establish a connectivity index and apply it to an approval process for new development.
 2. **Responsibility of:** Cities have the authority to impose ordinances on new developments.
 3. **Timeframe:** Short to medium-term. If a city were to pass a connectivity standard ordinance for new development, it could take effect in short order.
 4. **Rough estimate of cost:** A more connected roadway network should result in less of a burden on regional transportation infrastructure, which could lower transportation costs.
 5. **Other benefits:**
 - a. Manages congestion and enhances operations
 - b. Improves network efficiency to enhance the flow of goods and services

Vehicle Improvement Strategies

Vehicle improvement strategies seek to reduce GHG emissions by improving the efficiency of the vehicle fleet on the road in the region. These strategies typically involve influencing the market for cars and trucks. States can explore programs like vehicle scrappage programs (vehicle buy-back), tax incentives for cleaner vehicles, and taxing inefficient vehicles while subsidizing efficient ones. Most of these programs are effective at the State or Federal level but can be explored by MRCOG as strategies to advocate in New Mexico. Their effect on GHG emissions is difficult to quantify because so many factors influence consumer behavior. Three specific strategies could be considered by the region for funding eligibility to reduce GHG emissions:

- **Electric vehicle infrastructure support:** Many regions throughout the country have taken steps to support the market for electric and hybrid-electric vehicles. Such support has taken the form of tax incentives on the purchase of electric vehicles or the private sector installation of electric vehicle charging stations as well as direct infrastructure investments like installation of electric vehicle charging stations at strategic locations.
 - **Heavy-duty vehicle retrofit:** Heavy trucks and other large vehicles like school buses are highly inefficient vehicles compared to passenger cars and have been the subject of many emerging emissions reduction strategies. Effective retrofits include changes to the tires to reduce roll resistance and changes to the body to reduce drag, as well as programs to switch to cleaner fuel vehicles or engines. States can pass regulations requiring the use of retrofits or subsidize retrofits to voluntarily encourage their use. California regions have the most extensive experience with programs to subsidize retrofits but many other regions have implemented them and they are eligible for Federal transportation funds.
 - **Truck-stop electrification (TSE) technologies** provide long-haul truckers with heating, cooling, and other amenities at truck stops without requiring vehicle idling, thereby reducing GHG emissions. Agencies can encourage the adoption of TSE through funding and partnerships with private companies. Such a strategy could be effective if the region has a significant amount of pass-through freight traffic using the region's highways. State DOTs, MPOs, and other agencies (e.g., state environmental protection or energy agencies) can explore providing funding and strategic planning support to truck stop operators and truck operators to implement on-board and off-board TSE.
- 1. Potential program in New Mexico:** These above strategies as well as other potential vehicle improvement strategies can be carried out without government support. However, the adoption of such strategies is likely to be difficult when there is not a financial incentive for operators of large trucks and buses to retrofit them.

The City of Albuquerque's Environmental Health Department manages the air quality program for Albuquerque and Bernalillo County, while the State of New Mexico's Environment Department manages those responsibilities for the rest of the state as mandated by the Environmental Protection Agency. Both the Albuquerque program and the State program could support direct vehicle improvement strategies, such as these heavy-duty vehicle strategies, through new funding if it were made available. There are a growing number of diesel retrofit strategies and the City of Albuquerque has taken advantage of an EPA grant to retrofit solid waste trucks. However, there is limited funding for these types of

programs.

Albuquerque is under a Limited Maintenance Plan for carbon monoxide which expires in 2016 because the area has maintained attainment status for 20 years. The current pollutant of concern for the area is ozone, not because of nonattainment issues, but because current readings are approaching the legal standard. If or when the area goes into nonattainment status a plan may be required to be submitted and approved by EPA under which the area expects to bring the area back into attainment. Depending on the severity of the ozone violation, the City of Albuquerque Air Quality Program may have 3 years from designation of nonattainment to develop and submit the plan. Bernalillo County may be an excellent candidate to participate in EPA's Ozone Advance program. This program is designed for regions that are near the ozone threshold that wish to take proactive steps to limit ozone. The program requires a region to identify ozone monitors throughout the region, specify the area boundaries and put together an action plan identifying measures, dates of implementation, and responsible parties for implementation, both public and private. EPA administers a Clean Diesel grant program under the Diesel Emissions Reduction Act (DERA) and regions with Ozone Advance Programs get extra points when they apply for these grants.

Some strategies listed in this document, as well as direct vehicle improvement strategies potentially could be listed in action plans as control measures. Being designated as non-attainment for certain pollutants allows the area to be eligible for regional transportation funding (likely CMAQ) for MRCOG to distribute, should that funding be made available.

2. **Responsibility of:** Primarily the City of Albuquerque, working in conjunction with MRCOG and New Mexico Environment Department.
3. **Timeframe:** four years out from date of designation (unknown at this time).
4. **Rough estimate of cost:** These strategies are seen as fairly cost-effective strategies for the explicit purpose of reducing emissions but they do not have additional transportation benefits such as reducing congestion or providing mobility options. Also many retrofit strategies have primarily been designed to reduce particulate matter pollutants from vehicles and the GHG emissions reduction benefits are less well-known.
5. **Other benefits:** These strategies are entirely geared toward reducing emissions but have other benefits in that they reduce local air pollution as well as GHG emissions.

Other Considerations

As discussed earlier, the type of transportation available affects the type of land use that will flourish in an area and vice versa. Therefore, transportation investment strategies can indirectly affect the amount of energy consumption and therefore emissions levels from non-transportation sources like buildings. The region may be interested in measuring the effect of land use and transportation strategies not only on the transportation emissions reductions but also from the reductions from different types of land use.

Finally, agencies in charge of maintaining and constructing transportation facilities can pursue management strategies that can reduce energy consumption and GHG emissions through changes to their operations. Two strategies that the region and State could explore are to set goals for reducing the emissions from construction activities and to institute programs to reduce energy consumption from street lighting or providing excess space for renewable energy generation.

- **Construction activities** produce a significant amount of GHG emissions. It may be advantageous to subtract an estimate of these emissions from any benefit that is expected from a transportation investment when it involves a lot of construction. For instance, roundabouts are proven to reduce idling and thereby improve fuel efficiency and reduce GHG emissions but they involve a lot of heavy construction as opposed to other strategies that improve intersections like signal enhancements. These construction activities produce a lot of emissions by themselves. Agencies can reduce the emissions from construction activities by pursuing policies that eliminate truck idling, switch to more efficient transportation equipment and to use materials that require less energy to produce or to install.
 1. **Potential program in New Mexico:** Public agencies in New Mexico can reduce the emissions from construction activities by instituting programs to reduce high emissions construction vehicles as well as pavement and structural materials.
 2. **Responsibility of:** New Mexico DOT, city and county public works departments.
 3. **Timeframe:** Short.
 4. **Rough estimate of cost:** Low-medium.
 5. **Other benefits:** This kind of strategy is entirely geared toward reducing emissions.
- There are an increasing number of strategies available to state and local governments to **reduce emissions associated with electricity generation from fossil fuel use**. A few of these strategies include reducing facility energy intensity by implementing new energy conservation projects; conducting regular energy assessments; re-commissioning dated technologies to ensure efficient facility operations; and pursuing renewable energy generation during renovation and new construction projects.
 1. **Potential program in New Mexico:** Agencies in New Mexico could follow the lead of other cities in more efficient energy use in their operations. Several cities and agencies nationwide, such as the City of Los Angeles, have implemented programs to replace older model streetlights with more energy-efficient LED technology streetlight fixtures. Los Angeles has nearly completed retrofitting its streetlights—an effort that should continue to deliver cost savings beyond the seven years it is expected to take to pay for itself, while also reducing carbon dioxide emissions by about 40,000 tons per year. The program was paid for through a combination of loans and city funds.

Similarly, some transportation agencies are exploring the feasibility of using highway right of way to generate electricity from renewable resources. The FHWA Office of Real Estate Services has created a [website and map](#), that compiles information on the existing highway renewable energy projects across the country. The approaches that early adopters of

highway renewable energy projects have taken and the goals they set out to achieve for such projects have varied. Nevertheless, renewable energy generation in the highway context is a potential GHG mitigation strategy that transportation agencies in New Mexico could consider. Potential first steps could be to assess an agency's land holdings to identify promising sites and to begin developing partnerships with area utility companies.

2. **Responsibility of:** New Mexico DOT, city and county public works departments.
3. **Timeframe:** Short (7-10 years).
4. **Rough estimate of cost:** Low. The City of Los Angeles streetlight retrofit is expected to save the city lifecycle costs over conventional street lighting.
5. **Other benefits:** This kind of strategy is entirely geared toward reducing emissions. However, improving the energy mix of the region can help it to be more resilient to potential impacts to energy supply in the future.

Appendix A: Summary of potential GHG-mitigation strategies in Central New Mexico

The following table summarizes several of the strategies discussed in the document cross-walked with co-benefits based on MRCOG’s Draft 2040 Metropolitan Transportation Plan Goals & Objectives. This table also includes the type of evaluation method likely to be useful for each strategy.

Strategy	Responsibility	Timeframe	Evaluation	Scale	Notes	Co-benefits*
New BRT Lines	Rio Metro, ABQ Ride	Medium	Model	Corridor Specific	The region has identified 3 potential BRT corridors that would complement the Rail Runner service. The exact locations of these corridors for inclusion in the 2040 MTP would need to be agreed upon.	
Increased transit frequency	Rio Metro, ABQ Ride	Medium	Model	Regional	An alternative strategy to increase transit ridership. This strategy would require the identification of additional transit funding.	
Complete Streets policy adoption	Cities, counties, NMDOT	Short	Off-model	Regional	MRCOG has such a policy and could influence this discussion through funding incentives.	
Additional Bicycle Facilities	Cities, MRCOG	Medium	Off-model	Corridor Specific	MRCOG identified and mapped the LRBS that includes the existing network completed by the construction of additional facilities.	
Create Transit Oriented Development Districts	City of Albuquerque, private developers, Rio Metro	Medium-Long	Model	Location/Corridor Specific	There has been some work completed through a partnership between the Urban Land Institute and local government agencies to identify areas of TOD potential along the planned BRT and Rail Runner corridors. These locations would have to be identified and refined during the planning for the 2040 MTP and would need to include input from the City, Rio Metro and private developers. The components of successful TOD include a connected pattern of pedestrian-friendly streets, building code changes and a higher density of mixed commercial/residential land use.	

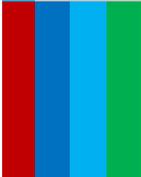
Transportation-Related Greenhouse Gas Mitigation Strategies and Potential Applications in Central New Mexico

Strategy	Responsibility	Timeframe	Evaluation	Scale	Notes	Co-benefits*
Infill Development/ Zoning Changes	Cities	Short-Medium	Model	Regional/ Location Specific	Many land development patterns that would reduce vehicle travel, such as infill development, the encouragement of accessory dwelling units, and transit-oriented development, could be better encouraged through zoning changes and updates to Albuquerque’s Development Process Manual.	
HOV Network/ HOT or Managed Lane Network	New Mexico Department of Transportation	Medium	Model	Corridor Specific	As opposed to expanding general-purpose lanes on the region’s freeway system, the NMDOT will consider management of existing lanes and the expansion of managed lanes for freight or HOV travel on I-40 and I-25. The MTP can be an opportunity to identify a network of managed lanes, which would make sense in the parts of the freeway system that are expected to experience the most congestion.	
Traffic Signal Enhancement	Cities, counties, NMDOT, MRCOG’s ITS Subcommittee	Short-Medium	Off-model	Regional	A Regional Traffic Management Center is being established to coordinate traffic signals across jurisdictions. The TMC will integrate corridor and incident management plans, coordinate monitoring systems and incident response, and centralize traveler information services. Adaptive traffic signals were recently installed on Alameda Blvd, which resulted in reduced delay.	
Intersection Improvements/ Roundabouts	Cities, counties, NMDOT	Short-Medium	Off-model	Regional/ Location Specific	Bernalillo County, Rio Rancho, Albuquerque and the NMDOT all have experience with designing and constructing roundabouts. Guidance on roundabouts will be provided by the state as part of the state’s Strategic Highway Safety Plan.	
Incident Management	NMDOT, MRCOG, law enforcement, emergency services	Short	Off-model	Corridor Specific	Incident management plans have been prepared for various NMDOT facilities but have not been adopted yet. The inauguration of the regional TMC may be an opportunity to adopt these plans and integrate them into first responder practices.	

Transportation-Related Greenhouse Gas Mitigation Strategies and Potential Applications in Central New Mexico

Strategy	Responsibility	Timeframe	Evaluation	Scale	Notes	Co-benefits*
Commuter trip reduction strategies using TDM	Rio Metro, UNM, private firms, City of Albuquerque	Short	Off-model	Regional/ Location Specific	Rio Metro has a TDM program that markets alternative transportation and provides some infrastructure to support it. Rio Metro is in the process of updating its Smart Business Partnership program and exploring new markets. The City of Albuquerque also has a TDM program focused on encouraging bicycling. The downtown-Central Avenue area could be a candidate for the establishment of a transportation management association of businesses to market alternatives to driving alone.	
Mileage-based fee	State of New Mexico	Medium	Off-model	Regional	The current method of funding transportation through fuel taxes is becoming unsustainable as vehicles become more fuel-efficient. A mileage-based or “wheels” tax has not been implemented anywhere in the United States yet but is being carefully studied in a handful of locations. The Statewide Long-Range Transportation Plan is considering alternative financing approaches.	
Bike Sharing Program	Private firms, City of Albuquerque and UNM	Short	Off-model	Location Specific	There have been recent discussions about establishing a bike share program, most likely located near UNM and the downtown area. This program would have to be privately operated but could receive some infrastructure and programmatic support from local agencies.	

Transportation-Related Greenhouse Gas Mitigation Strategies and Potential Applications in Central New Mexico

Strategy	Responsibility	Timeframe	Evaluation	Scale	Notes	Co-benefits*
Vehicle Improvement Strategies	City of Albuquerque, NM Environmental Health Dept	Short	Off-model	Regional	The City of Albuquerque’s Environmental Health Division has the capability and interest in expanding the vehicle inspection program, and pursuing other strategies to replace high-emission vehicles with low-emission ones. The primary impediment to implementing some of these strategies is lack of funding. There is a possibility that the region may exceed national standards for ozone, which would result in requirements to adopt control measures to be developed in cooperation with MRCOG and the State of New Mexico.	
Roadway Connectivity Standards	Cities, counties, with cooperation from private developers	Short	Off-model	Regional	A city could establish roadway connectivity standards for all new developments and re-development. A roadway connectivity standard may be a requirement that limits block area size or block length size and limits the road network that can serve new cul-de-sacs or a city could establish a connectivity index and apply it to a development approval process.	
Reducing Non-renewable energy consumption	Public agencies (cities, NMDOT, counties)	Short-Medium	Off-model	Regional	One option for transportation agencies to consider in order to reduce energy consumption from non-renewable energy includes retrofitting street lights to be energy-efficient LED lighting. Another option is to explore using highway right of way to generate electricity from renewable resources like solar.	
Infrastructure-dependent growth policies	Cities, counties	Short-Medium	Off-model	Regional	The region can concentrate growth in urban areas where infrastructure already exists and through general infrastructure-dependent growth policies based on water services and lifecycle cost analysis of providing and maintaining new infrastructure.	

***Co-benefits Color Key**

Maintain Existing Infrastructure -----	
Manage Congestion and Enhance Operations -----	
Expand Multimodal Transportation Options -----	
Support Efficient Freight Movement -----	
Promote Development in Activity Centers and Key Corridors -----	
Enhance the Flow of Goods and Services -----	
Ensure Affordable Housing and Transportation Options -----	
Conserve Water Resources -----	
Prepare for Climate Uncertainties -----	
Minimize Footprint of New Development -----	
Improve Access to Employment Sites, Services and Recreational Opportunities -----	
Encourage a Mix of Land Uses in Appropriate Locations -----	
Provide Safe Travel Options -----	
Provide Healthy Travel Options -----	