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STRATEGIES

Active Transportation

Active Transportation programs foster walking, biking, and other forms of non-motorized mobility to discourage use of personal automobile, promote active lifestyle, improve air quality, and enhance experiences of residents as well as visitors in the region.

The active transportation strategies identified for the GPATS region include:

- Walkways
- Bikeways
- Pathways
- Bikeshare or Scooter-Share Programs

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WALKWAYS

Walkways include sidewalks or other dedicated pedestrian facilities that provide safe infrastructure for people to walk.

Relative Cost

Impact

By providing safe and dedicated facilities, people are more likely to walk to and from their points of interest. It offers the potential to encourage a shift in mindset from auto-centric to walking, especially to cover short distance trips. Connecting residential, employment, and major activity centers with conducive pedestrian facilities promotes alternative transportation options, thereby alleviating congestion on roadways.

Like any other infrastructure expansion effort, planning and funding new sidewalk projects demands dedicated resources from local, state, and/or private organizations. It is important to note that sidewalk occupies space within the right-of-way that may be potentially utilized for other types of transportation facilities, especially with low pedestrian activity. Ideally, pedestrian facilities should be planned in conjunction with other transportation connections and surrounding land uses.

Case Study: Minneapolis, MN - Pedestrian Facilities

Minneapolis is a national leader in walkability thanks to its effective planning policies and commitment to constructing safe pedestrian facilities. Since 2019, the City has implemented multiple strategies to improve walkability, including the Transportation Action Plan, Complete Streets Policy, Americans with Disabilities Act (ADA) Transition Plan, Vision Zero Plan, and Street Design Guide. These plans have resulted in sidewalks being present on both sides of over 92% of Minneapolis' streets, totaling approximately 1,800 miles of sidewalk.

To further promote pedestrian-friendly environments, Minneapolis enforces maximum parking standards and has eliminated minimum parking standards. Additionally, lighting is installed on one or both sides of nearly all arterial and non-arterial streets, enhancing pedestrian safety at night. Marked mid-block crosswalks feature overhead flashing beacons and high visibility striping, while all signalized intersections in the city have marked crosswalks.

BIKEWAYS

Bikeways represent protected or painted bicycle lanes, shared lanes, or "sharrows," or other dedicated bicycle facility types.

Relative Cost

Impact

Bikeways offer safe and efficient means of transportation for people to travel to and from their points of interest. In urban or mixed-use areas, bikeways serve as an alternative to walking or driving for short-distance trips. It is important to consider bicycle-supportive infrastructure in the planning and programming of these facilities to complement the active transportation network. This may include amenities such as bicycle racks, long-term bicycle storage, bicycle repair stations, or other infrastructure that further encourages biking.

In areas with space constraints, incorporating bicycle facilities may pose a challenge given the minimum requirement for a bike lane is four feet wide. Factors such as magnitude of traffic volumes, roadway class, and adjacent land uses play a role in determining the type of bikeway suitable along a congested travel corridor.

Case Study: Charlotte, NC - Uptown CycleLink

To provide safer, more interconnected, and more equitable bike infrastructure, the City of Charlotte, NC has developed the Uptown CycleLink. This network of separated bike lanes spans 7 miles in Uptown and will connect over 40 miles of bikeways across Charlotte once complete. Currently, separated bike lanes are constructed along 5th Street and 6th Street, connecting the Irwin Creek Greenway and Little Sugar Creek Greenway to various entertainment and commercial destinations in Uptown. The remaining sections of the CycleLink are either under construction or in the final design phases.

When complete, Uptown Charlotte will have a comprehensive system of bike lanes that cater to residents of all ages and abilities, enabling them to enjoy cycling and to consider it as a viable travel option.

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PATHWAYS

A pathway can consist of a shared-use path or a sidepath. A shared-use path is a physically separated path that is set apart from vehicular traffic by an open space or other landscaping elements. These paths are designed to be used by pedestrians, bicyclists, and other non-motorized users. Alternatively, a sidepath is located immediately adjacent to a roadway and is separated from it by a narrow barrier.

Impact

A well-connected network of pathways can offer a safe facility for people of all ages and abilities to use and enjoy. A pathway provides a dedicated space for bicycles and pedestrians, making it an excellent option for commuting, recreation, and longer distance trips. Additionally, pathways showcase and leverage the unique environmental features of a community, such as rivers, parks, or wooded areas. To enhance safety and accessibility, pathways are complemented by signage, lighting, and other features.

A pathway requires more space compared to a bicycle lane or other pedestrian facilities. Typically, sidepaths are between 10 to 12 feet in width. Despite requiring more space, pathways provide safe and connected paths for both bicycles and pedestrians within a roadway corridor section. However, it is important to note that a pathway may not always offer the most direct route compared to a conventional sidewalk or bicycle lane. As a result, some cyclists and pedestrians prefer more direct connectivity, especially for commuting trips.

BIKESHARE OR SCOOTER-SHARE PROGRAMS

A bicycle or scooter sharing program allows individuals to borrow vehicles using a membership or credit card. Systems vary greatly and may be either docked or dockless.

Relative Cost

Impact

Bikeways offer safe and efficient means of transportation for people to travel to and from their points of interest. In urban or mixed-use areas, bikeways serve as an alternative to walking or driving for short-distance trips. It is important to consider bicycle-supportive infrastructure in the planning and programming of these facilities to complement the active transportation network. This may include amenities such as bicycle racks, long-term bicycle storage, bicycle repair stations, or other infrastructure that further encourages biking.

In areas with space constraints, incorporating bicycle facilities may pose a challenge given the minimum requirement for a bike lane is four feet wide. Factors such as magnitude of traffic volumes, roadway class, and adjacent land uses play a role in determining the type of bikeway suitable along a congested travel corridor.

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Transit

A well-designed transit system provides a competitive alternative to travel by single-occupancy vehicle, especially if well-coordinated with strong land use policy. A blend of service types and emerging technologies can reduce the number of drivers on the road and help mitigate congestion along major corridors.

The transit strategies identified for the GPATS region include:

- On-Demand Transit Service
- Bus Service
- Bus-On-Shoulder
- Park-and-Ride Lots
- Transit Signal Priority

ON-DEMAND TRANSIT SERVICE

Relative Cost

On-demand transit service is a non-fixed route service that is flexible. On-demand transit provides door-to-door or curb-to curb service for passenger pick-ups and drop-offs. To request a ride, passengers must request and schedule a ride in advance of the trip. An on-demand service is the most cost-effective in low population or low-density areas where fixed-route is not operationally or financially feasible.

Impact

On-demand transit service can provide service to people with disabilities who would otherwise not be able to operate a vehicle or take traditional transit service. The on-demand service provides flexibility in scheduling and enhanced access to and from destinations. As a service, on-demand transit can increase equitable transportation outcomes by increasing mobility to underserved populations. While on-demand service can be a standalone service, if paired with other types of services it can expand transit coverage to fill gaps in the existing transportation network.

The operational cost of on-demand transit is variable and may be either lower or higher than fixed-route service in the same area. While there are several factors that must be considered, the highest cost is to pay transit operators.

Case Study: Reno, NV - Spare Microtransit

With Spare, Reno, NV is providing on-demand microtransit service. The service replaced underperforming fixed routes with microtransit zones and expanded to outlying areas not covered by fixed-route or paratransit service. Additionally, the City leveraged Spare's Open Fleets integration with Uber and Lyft. The modifications doubled their microtransit ridership, enhanced accessibility and convenience, and allowed quick adaptation during driver strikes and shortages.

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BUS SERVICE

Relative Cost

Bus service can provide convenient and accessible public transportation in urban and rural areas. Public transportation agencies can provide a variety of services including local bus service, express bus service, and circulators. Generally, local bus service follows a fixed route, has scheduled stops, and follows a set frequency (how often the bus comes). An express bus service can provide connections at peak hours of the day or to and from a destination and park-and-rides with a limited number of stops. Circulator routes are circuitous and typically provide connections to key destinations in a small area.

Impact

Bus service can provide enhanced access to employment opportunities, education locations, and other important community destinations. Providing an affordable service can also convince more "choice riders" to use public transportation, especially if that service is also frequent and consistent. During commute hours, buses could reduce the number of vehicles along a corridor, in turn expanding the capacity of the existing roadway without widening.

Operating and maintaining quality bus service can be costly for agencies. The demand must align with the service type provided. Local bus service typically runs in mixed traffic, which makes the service susceptible to congestion and delays.

PARK-AND-RIDE LOTS

Relative Cost

A park-and-ride lot is intended to provide commuters or travelers with a place to leave their personal vehicles and transfer to a public transportation system or carpool opportunity.

Impact

Park-and-ride facilities are strategically placed in areas that do not experience congestion. A well-placed park-and-ride lot can help alleviate traffic on congested roadways by providing a transportation alternative, especially during peak hours or for traditional commute trips. These facilities often serve as transfer points for buses, high-frequency transit, or other public transportation services. Park-and-rides can also serve as a first-and-last-mile connection, offering features such as long-term bicycle storage, rideshare staging, or connections to pedestrian or bicycle facilities.

Generally, park-and-rides are located outside of high-congestion areas. The location must be strategic and convenient to entice users to park their car and take transit instead of driving. This requires the associated public transportation option to be reliable and frequent, making it a compelling transportation alternative. Other constraints to consider may include financing or land acquisition.

BUS-ON-SHOULDER SYSTEM

Bus-on-shoulder system, also known as BOSS, is a cost-efficient strategy that allows buses to travel in the shoulder area of arterials and freeways to avoid congestion.

Relative Cost

Impact

Bus-on-shoulder systems can improve speed and reliability along heavily congested corridors. This use of space can be particularly effective during peak hours to ensure transit operators can maintain their schedules. In some contexts, the bus-on-shoulder is dynamic and is only used during specific times of the day or when traffic speeds drop below a certain level. In other systems, it is used continuously to improve travel speed for transit vehicles.

There are certain considerations that may limit the ability of buses to access the shoulder, including road condition, weather, traffic, or other obstructions. These obstacles may delay buses and negatively impact the quality of service. The potential use of bus-on-shoulders should be further considered in a feasibility study to determine the practicality of bus-on-shoulder in specific locations.

TRANSIT SIGNAL PRIORITY

Transit signal priority—or TSP—is a technology that modifies traffic signal timing or phasing for transit vehicles.

Relative Cost

Impact

Traffic signals are generally considered a major source of delay for all types of vehicles, especially public transit vehicles traversing along major commute corridors with relatively long signal cycles. In such a scenario, Transit Signal Priority (TSP) is considered a viable solution to improve flow of transit vehicles and increase system reliability. TSP is particularly successful at roadway intersections with long vehicle queues or extended transit delays. To be effective, TSP is complemented by other strategies such as dedicated bus lanes or bus-only shoulders.

Close coordination among agencies responsible for transit vehicles, transit operations, and traffic signals is essential for the success of TSP strategy. Any plans of transit route modifications and intersection improvements must be considered by agencies prior to implementation. Other considerations include on-board components, right-of-way constraints, intersection spacing, signal cycle length, and pedestrian crossings.

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Capacity Expansion

Capacity expansion is achieved through improvements that enhance the mobility of vehicles along a corridor through the addition of travel lanes or construction of new roadways, the addition of new interchanges, or the modification of existing ones.

The capacity expansion strategies identified for the GPATS region include:

- Alternative Interchange Design
- Grade Separated Crossings
- Lane Additions (Widening)
- New Roadways

ALTERNATIVE INTERCHANGE DESIGN

Alternative interchange designs can reimagine existing interchanges to alleviate congestion.

Relative Cost

Impact

Interchanges are an integral and unique aspect of the nation's surface transportation network. They serve as the interface between the highest order of roadway facilities, such as the Interstates, and local thoroughfares, such as collectors. They also play a vital role in connecting roadways and efficiently moving vehicles across states.

There are various interchange designs that enhances traffic flow and improve safety. Some alternative interchanges include diamond interchanges, diverging diamond interchanges (DDI), displaced left turns, double crossover diamond, double raindrop, single exit (partial interchange), partial or full cloverleaf, or single-point interchange. The choice of alternative design depends largely on the surrounding context.

While the interchange may alleviate congestion at that specific location, it may not address congestion along the entire corridor. Ideally, changes to an interchange improve the flow and safety of the associated corridors. However, it is important to note that some drivers may not be familiar with certain interchange designs, which could lead to confusion. Therefore, the addition of adequate signage is crucial to help drivers navigate any interchange redesign.

New interchanges may also be appropriate to manage and address congestion. The FHWA's Policy on Access to the Interstate System provides the requirements for the justification and documentation necessary to substantiate any proposed changes in access to the Interstate System. This policy also facilitates decision-making regarding proposed changes in access to the Interstate System in a manner that considers and is consistent with the vision, goals, and Long-Range Transportation Plans of a metropolitan area, region, and State. FHWA has two requirements that must be satisfied for a new interchange:

1. An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility or on the local street network based on both the current and the planned future traffic projections.
2. The proposed access connects to a public road only and facilitates all traffic movements.

Planning Criteria - Section 10.11 of the SCDOT Roadway Design Manual mandates six criteria for identifying and evaluating new interchange locations including: access control, safety, site topography, road-user benefits, reduction of bottlenecks, and traffic volumes. Feasibility of new interchanges can be screened by assessing the current interchange spacing, existing and future congestion, environmental constraints, and the connectivity and configurations of the adjacent roadway network.

Case Study: Carmel, IN - Keystone Parkway Corridor Double Rain Drop Interchanges

The Keystone Parkway Corridor in Carmel, IN involved the construction of a four-lane expressway with grade-separated double raindrop interchanges at six existing intersections. The City's use of double raindrop interchanges minimized the footprint and eliminated the need for traffic signals. This design allowed for the free flow of traffic, reducing congestion and improving efficiency. The interchanges also significantly improved the safety of the corridor. Based on research by the Insurance Institute for Highway Safety, accidents with injuries have been reduced by 84% since the completion of the project. In addition, the project had positive environmental impacts. By reducing idling and improving traffic flow, emissions were lowered, resulting in a more sustainable transportation system.

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GRADE SEPARATED CROSSINGS

Grade-separated crossings allow different streams, or modes, of transportation to flow independently of one another.

Relative Cost

Impact

By providing an overpass or underpass, grade separated crossings allow traffic to remain free-flowing. This can also improve safety for drivers, pedestrians, freight, or transit. Its application is typically used to separate rail from vehicles or pedestrians and is particularly effective at high-volume intersections, intersections with more than four approaches, or an active railroad crossing.

Grade-separated crossings are expensive, and the cost to purchase the right-of-way in addition to construction may be a significant barrier. While this is a relatively expensive congestion management strategy, it is a long-term solution for managing different modes of transportation.

LANE ADDITIONS (WIDENING)

Lane widening, or expansion, is the addition of one or more lanes to a roadway.

Relative Cost

Impact

Widening increases the capacity of a corridor by providing more travel lanes for traffic. While it temporarily alleviates congestion concerns, it also attracts more drivers to use the roadway, which, in turn, contributes to more congestion.

Lane widening is not an effective long-term strategy for managing congestion. This strategy also has the potential to exacerbate congestion. With limited right-of-way, it is difficult to continuously widen roadways to meet the travel demands and needs of the community. Other strategies might be more successful in enhancing efficiency than adding capacity.

NEW ROADWAYS

A new roadway consists of constructing a new route for drivers, pedestrians, cyclists, or transit operators.

Relative Cost

Impact

Constructing new roadways is a traditional strategy to alleviate congestion. A new roadway can create redundancy in the network by adding parallel routes. It may be an effective strategy if widening is not an option or if there is projected future growth in a new area. A new roadway can benefit local economies by providing alternative routes or stimulating new growth.

Building a new roadway requires a major financial investment. Limited funding or environmental constraints make it challenging to move from the planning phase to design and construction.

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Transportation Demand Management

Transportation Demand Management (TDM) refers to a set of strategies and measures designed to manage and reduce the demand for travel in order to alleviate congestion, improve transportation efficiency, and promote sustainable transportation options. TDM typically includes a combination of policies and programs that influence travel choice and behavior.

The transportation demand management strategies identified for the GPATS region include:

- Vanpool and Carpool
- Teleworking and Flexible Work Schedules
- Parking Management
- Bicycle and Pedestrian Education
- Safe Routes to School Program

VANPOOL AND CARPOOL

Vanpool is a shared transportation program where a group of four to ten passengers who live and work in close proximity share a van to commute to and from work. Carpooling is a program where a group of people who live and work in close proximity share a car to commute together.

Relative Cost

Impact

Transportation agencies or employers can organize and sponsor vanpools by providing subsidized costs. Participants share the costs of the van, fuel, insurance, and maintenance expenses, making the cost of commuting lower than driving a personal vehicle. Vanpools help reduce congestion, commuting costs, and emissions. By consolidating individual drivers into a single van, vanpool programs eliminate cars on the road, alleviating congestion and reducing auto emissions.

Vanpools are affordable and easy to implement for transportation agencies or employers. However, the success of vanpools relies on interest from local commuters. Employers and agencies can support vanpool usage through incentives, subsidies, marketing, and regulation.

Employers can organize and support carpools by providing benefits, such as subsidized costs and favorable parking programs. Carpooling typically involves individuals taking turns driving their own cars or sharing one car, with each participant sharing the cost of fuel and maintenance expenses. Carpools help reduce congestion, commuting costs, and emissions. By consolidating individual drivers into a single car, vehicles are removed from the road, which alleviates congestion and lowers auto emissions. Carpooling can also leverage HOV lanes that contain less vehicles and potentially allow higher speeds. Utilizing carpools also enables participants to split the costs of travel and vehicle upkeep with multiple people, helping reduce travel costs.

Carpools are affordable and easy to implement by employers or local governments. Carpools are only viable if local commuters are willing to change their personal driving habits. Employers and local governments can persuade commuters to change their driving habits by providing incentives, such as parking incentives, subsidies, guaranteed ride-home programs, and marketing.

Case Study: Raleigh-Durham Area, NC - GoTriangle Vanpool

GoTriangle's vanpool program provides flexible and sustainable transportation options for commuters throughout the Triangle region. Since 2019, GoTriangle has operated in partnership with experts at Enterprise Rideshare, enabling them to expand their operation to over 50 vanpools. Vanpool groups range from 4 to 15 individuals who coordinate their own routes and times through the Enterprise app, typically meeting at a central location in the morning. Each vanpool contains multiple volunteer drivers, making the program more reliable on a day-to-day basis. The program offers each vanpool a monthly subsidy, making vanpooling costs on average 75% less than driving alone. By lowering the number of commuters driving alone, the program also reduces parking congestion, traffic congestion, and emissions.

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TELEWORKING AND FLEXIBLE WORK SCHEDULES

Relative Cost

Flexible work schedules allow employees to choose their own start and end times within a specific range of hours. Teleworking enables employees to work from locations other than the traditional office setting, such as their homes or other remote locations.

Impact

Teleworking and flexible work schedules help reduce congestion by allowing employees to avoid commuting during peak hours or even eliminate commuting altogether. Flexible work schedules and teleworking programs contribute to congestion reduction and emissions reduction by keeping commuters off the roads during busy traffic periods. These programs also offer cost savings for both employees and employers by reducing commute times and enhancing work productivity. However, it is important to note that teleworking and flexible work schedules may not be suitable for all businesses or employees. Employers need to assess whether these strategies can be implemented without compromising their operations. To support teleworking and flexible work schedules, employers can provide incentives, organizational assistance, and increase awareness among employees.

PARKING MANAGEMENT

Relative Cost

Parking management is the tactics used to effectively manage parking spaces and optimize their utilization.

Impact

These strategies aim to address parking challenges such as limited availability, congestion, and inefficient use of parking resources. Parking management strategies include removing parking minimums and enforcing parking maximums (developmental requirements that mandate parking based on development type), improving wayfinding, reducing free parking, and implementing dynamic pricing for on-street parking. These strategies help optimize the use of parking spaces, reducing congestion and improving traffic flow. By implementing measures such as dynamic pricing and improved wayfinding, parking can be utilized more effectively. Additionally, these strategies encourage the use of alternative modes of transportation such as walking, cycling, or public transit, which contributes to reducing traffic congestion and emissions. However, it is important to note that support for parking management strategies from private entities and local community members is limited, especially in areas with low amounts of existing parking. Furthermore, implementing parking management strategies may lead to a reduction in revenue generated from parking facilities, which can worsen local support for parking management initiatives.

BICYCLE AND PEDESTRIAN EDUCATION

Educational programs help improve awareness and safety for all roadway users. Bicycle and pedestrian education help inform people about the rules and laws that apply to drivers, bicyclists, and pedestrians. These programs focus on how all roadway users should interact.

Relative Cost

Impact

Educational programs highlight biking and walking as safe modes of transportation. These programs encourage people to choose biking or walking for shorter trips, such as going to school, work, or the grocery store. By increasing awareness, these programs can also improve safety by helping roadway users understand potential conflict points.

Implementing an education program is a good way to raise community awareness, although it may not be a comprehensive solution for reducing congestion. While the investment required for an education program is relatively low compared to other strategies, it may not reach the intended audience as effectively.

Case Study: Statewide, NC - Watch For Me NC

Watch For Me NC started as a pilot program in 2012 in Wake, Orange, and Durham Counties. Since then it has evolved, and is open to all North Carolina communities. Watch for Me NC provides materials to partner communities aimed at improving pedestrian and bicyclist safety via public education, community engagement, and high visibility law enforcement.

SAFE ROUTES TO SCHOOL PROGRAMS

Safe Routes to School programs are initiatives aimed at promoting and encouraging safe and healthy walking and biking to school. These programs incorporate a combination of education, infrastructure improvements, and encouragement activities to create safer and more accessible routes for students to commute to and from school.

Relative Cost

Impact

By implementing infrastructure improvements such as sidewalks, crosswalks, and traffic calming measures, Safe Routes to School programs create safer routes for students to walk or bike to school, reducing the risk of accidents and injuries. Promoting alternative modes of transportation also helps to decrease the number of cars on the road during peak school hours, leading to less traffic congestion and improved air quality around schools.

Implementing Safe Routes to School programs often requires collaboration between multiple stakeholders, including schools, local government agencies, transportation departments, and community organizations. Coordinating efforts and maintaining consistent communication can be challenging. Additionally, securing sufficient funding for infrastructure improvements and program implementation can be a hurdle. Limited financial resources may hinder the ability to make necessary changes to enhance safety and encourage active transportation.

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Freight

Freight transportation is integral to local, regional, and national economies. Freight strategies minimize adverse impacts of freight activity on regional mobility and facilitate efficient movement of goods while also propelling economic growth.

The freight strategies identified for the GPATS region include:

- Dedicated Truck Lanes
- Weigh-In-Motion Technology
- Truck Incentives and Use Restrictions

DEDICATED TRUCK LANES

Dedicated truck lanes are specific lanes on roadways that are reserved exclusively for use by trucks.

Relative Cost

Impact

Dedicated truck lanes provide the opportunity to allow trucks to travel at a consistent speed, reducing delays and improving travel times. Dedicated space for trucks may also reduce congestion, improve traffic flow, and reduce the potential for crashes caused by the interaction between trucks and other vehicles.

Case Study: GA - 1-75 Commercial Vehicle Lanes

While not yet implemented, Georgia Department of Transportation (GDOT) is working on a project that will add two, toll-free commercial vehicle lanes to I-75 between Macon and McDonough. The lanes will be barrier-separated and extend approximately 41 miles. Once completed, the project is anticipated to reduce delay and travel times for commercial vehicles, as well as passenger vehicles during the peak hours.

WEIGH-IN-MOTION TECHNOLOGY

Weigh-in-motion (WIM) technology is a system that is used to measure the weight of vehicles while they are in motion. It is typically installed on roadways and highways and consists of sensors or scales embedded in the road surface.

Relative Cost

Impact

WIM technology offers several benefits such as improved efficiency, enhanced safety, and enhanced data collection. It eliminates the need for commercial trucks to stop and wait at weigh stations, minimizing delays and travel time. The technology also increases safety by allowing enforcement of weight violations such as overloaded trucks, as well as eliminates the need for trucks to merge and re-enter traffic. It also provides an enhanced level of data that may provide insights on travel patterns, vehicle weights, and axle loads.

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TRUCK INCENTIVES AND USE RESTRICTIONS

Truck incentives encourage commercial vehicles to modify their route, time, or trip for deliveries by providing financial incentives. Use restrictions impose limits on the location or time for trucks to access certain corridors.

Relative Cost

Impact

Truck restrictions are structured to streamline freight trips during non-peak hours. Alternatively, truck incentives are used to encourage deliveries during non-peak or night hours. This strategy is particularly effective in dense areas with heavy traffic exacerbated by truck deliveries. Implementing truck incentives or restrictions helps reduce truck traffic in dense areas during peak times, improving traffic flow for commuters and enhancing the efficiency of deliveries during off-peak hours.

It is important to consider the potential impact on local businesses and companies that rely on deliveries if restrictions are imposed on after-hours deliveries. Additionally, an effective enforcement strategy must be in place to ensure the success of these measures.

Land Use

Land use strategies greatly influence transportation. These strategies can provide increased access, connectivity, and mode choice which in turn can mitigate congestion along our corridors.

The land use strategies identified for the GPATS region include:

- Redevelopment and Infill Development
- Transit-Oriented Development

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REDEVELOPMENT AND INFILL DEVELOPMENT

Infill development encourages the redevelopment of underused or vacant land to create economic or community assets. In urban areas, this type of development can be effective in increasing density on parcels with existing utility and transportation infrastructure. Redevelopment encourages environmental stewardship instead of developing or building on undeveloped land.

Relative Cost

Impact

Infill and redevelopment can revitalize communities, improve transportation, and protect environmental assets. Infill development sites can create compact, walkable spaces that offer a mix of land uses to create and further cultivate a sense of place. In turn, infill or redevelopment can reduce urban sprawl and support community connectivity. This type of development is particularly successful in communities that are already constrained geographically or environmentally.

While infill development is often beneficial to communities, there are challenges associated with infill development. Infill development is typically market driven. To successfully promote infill development in certain areas, local policies must be in place to incentivize developers.

Other challenges associated with redevelopment include potential adverse impacts on adjacent homes or surrounding land uses. These impacts may include near-term impacts from construction, such as disruptions to access or congestion. The character of surrounding neighborhoods could be impacted by infill development, which could be especially challenging if these areas are historic or traditionally underserved. To prevent the alteration of a neighborhood's character, it is crucial to plan for infill development.

Case Study: Montgomery County, MD – Pike & Rose Infill Development

Pike & Rose is an infill development in Montgomery County, MD that transformed a standard strip mall into a livable and vibrant community where walking, biking, and transit flourish. With the use of comprehensive sector plans and flexible floating zones, Montgomery County and the Federal Realty Investment Trust added over 379,000 square feet of retail, 864 residential units, a 177-room hotel, and 300,000 square feet of office space to the site. In addition, the use of special taxing districts funded road network improvements that created a grid network more conducive to transit and active transportation.

TRANSIT-ORIENTED DEVELOPMENT

Transit-oriented development (TOD) creates dense, mixed-use communities around public transportation hubs. It maximizes the amount of residential, service, and employment opportunities around transportation hubs.

Relative Cost

Impact

TOD can have positive impacts on community vibrancy, equity, and connectivity. It blends land use and transportation best practices to plan growth around transportation hubs to maximize community benefits. TOD is linked to increased transit ridership, higher property values, and reduced sprawl.

The barriers to create TOD include financing challenges, regulatory constraints, land use conflicts, or community resistance. Typically, transit agencies must work with private partners to create TOD developments, which can alleviate financial challenges but highlight other challenges. TOD can also change the neighborhood context, which can disenfranchise or disrupt existing communities. Without proper policies in place, TOD can lead to displacement and other unintended consequences such as higher rent and home prices, increased car ownership, and social and cultural homogenization.

Case Study: Arlington, VA - Rosslyn-Ballston TOD Corridor

The Rosslyn-Ballston Corridor in Arlington, VA is one of the most successful transit-oriented development projects to date in the United States. First planned in the 1960 general land use plan, County officials concentrated the highest density uses within a quarter mile of the five existing Metro stations. As a result, development was concentrated around the Metro stations while surrounding single family residential neighborhoods were preserved. County officials also utilized unique sector plans to guide development around each of the five Metro stations. Arlington now contains seven mixed-use urban villages that accommodate 36 million square feet of office space, 6 million square feet of retail space, and over 47,000 residential units.

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Operations

Operations emphasize strategies that aim to optimize existing infrastructure through near-term solutions. These solutions enable active management of transportation systems based on current operational conditions.

The operations strategies identified for the GPATS region include:

- Managed Lanes
- Channelization or Delineation
- Access Management
- Special Event Management
- Traffic Incident Management (TIM)

MANAGED LANES

Managed lanes provide special access to vehicles based on high-occupancy vehicle (HOV), toll lanes, or high-occupancy toll (HOT) lanes, or vehicle type such as bus- or truck-only lanes. Managed lanes can also include additional access control measures to minimize turbulence in the flow of vehicles, or dynamic lane reversals.

Relative Cost

Impact

Managed lanes are effective in heavily congested areas with few travel alternatives, or in situations where there is a need to separate different types of vehicles. They can be a viable solution when traditional roadway improvements, such as widening, are no longer feasible or desirable. By providing dedicated spaces for trucks or buses, a managed lane strategy can enhance the efficiency of the current transportation network. Reversible lanes serve as dynamic lanes that can adjust to the demand of traffic flow. High-occupancy vehicle lanes can encourage carpooling and discourage single-occupancy vehicle use during peak hours.

Implementing managed lane strategies is considered challenging due to public acceptance and knowledge. It is essential for local, regional, and state planners and engineers to actively engage the public throughout the discussion of managed lanes. Operational issues, such as signage, lane access, and enforcement, should also be carefully considered.

Case Study: Roswell, GA - Reversible Lanes

For over 30 years, Roswell, Georgia has effectively utilized reversible lanes on South Atlanta Street to overcome spatial restrictions and improve capacity during peak travel times. Since South Atlanta Street is surrounded by historic properties, widening the road was not a feasible option. Instead, a one-mile segment of South Atlanta Street was configured as a three-lane facility with a reversible center lane. The reversible lane is equipped with overhead illuminated signs to clearly communicate the directionality of the lane. This reversible lane is used to optimize commuting into and out of Atlanta, with the lane supporting southbound traffic into Atlanta in the mornings and northbound traffic during the afternoon and evening. The implementation of the reversible lane has significantly improved capacity for the direction it is operating in, effectively preventing major congestion for commuters.

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CHANNELIZATION OR DELINEATION

Channelization and delineation utilize physical elements and visual cues to enhance traffic flow.

Impact

The physical elements include barriers or raised medians to separate traffic. The visual elements include vertical reflectors or cones, raised pavement markings, signage, or dynamic/variable messaging signage (DMS). Channelization and delineation increase mobility by reducing conflicts and improve safety by discouraging certain traffic movements. In particularly congested areas, channelization or delineation may impact emergency response vehicles, pedestrians, or bicyclists, as well as maintenance operations. Considering multimodal impacts is crucial to supporting the movement of other modes of transportation.

ACCESS MANAGEMENT

Access management refers to street design techniques that control where vehicles may enter or exit a roadway to enhance traffic flow and improve safety.

Impact

When driveways are closely spaced, it negatively impacts the flow of cross-street traffic. Access management techniques help alleviate this issue by improving traffic flow, reducing conflict points, and enhancing the overall appearance of the corridor through landscaping. Implementing access management strategies promotes better traffic circulation, creates more efficient street networks, and minimizes slowdowns. These strategies are applied at varying scales; however, it is crucial to strike a balance between mobility needs and facilitating access to activities.

Retrofitting existing roads is challenging and costly, which can serve as a barrier to implementing access management. To address these challenges, it is important to coordinate with developers during the early stages of site development. This approach requires collaboration with local governments to ensure that ordinances provide opportunities to address retrofitting access.

SPECIAL EVENT MANAGEMENT

Special event management refers to the coordination and organization of traffic movement for large, planned events. These events include concerts, sporting events, conventions, or fairs held at large venues.

Relative Cost

Impact

Special events have the potential to significantly disrupt traffic and worsen congestion in other parts of the road network. To mitigate these effects, event travel is coordinated to minimize the impact on traffic. For recurring events, agencies develop standard traffic plans to inform the community, enhance safety, and manage congestion effectively. Event management may involve changing normal traffic directions or adjusting signal timing. Proper planning for special events enhances safety, improves traffic flow for all modes of transportation, and garners community support for large-scale events.

Implementing a special event plan requires early coordination among various agencies involved in traffic control and parking management. These agencies must coordinate with event staff to ensure efficient traffic circulation. Additionally, it is crucial to communicate any changes or special event plans to the public.

TRAFFIC INCIDENT MANAGEMENT (TIM)

Traffic Incident Management (TIM) refers to planned and well-coordinated multidisciplinary processes implemented to respond to and clear traffic incidents.

Relative Cost

Impact

TIM programs are planned and well-coordinated processes aimed at reducing duration of traffic incidents, improving safety, and minimizing the chance of secondary crashes. These programs typically involve the implementation of procedures, operations, and effective communication among TIM responders. In addition, TIM incorporates the use of technology to enhance traffic response and clearance. These programs are typically managed out of traffic management centers that have access to real-time data and traffic conditions. TIM programs may also focus on detecting incidents before they occur in order to proactively manage traffic. Training programs are available to address different aspects of incident detection, response, and clearance.

Due to the collaborative nature of TIM, coordination among various agencies is essential. TIM primarily addresses non-recurring congestion caused by incidents on roadways and strives to address them in a timely and safe manner. These programs are often combined with other technology and operational strategies to achieve optimal results.

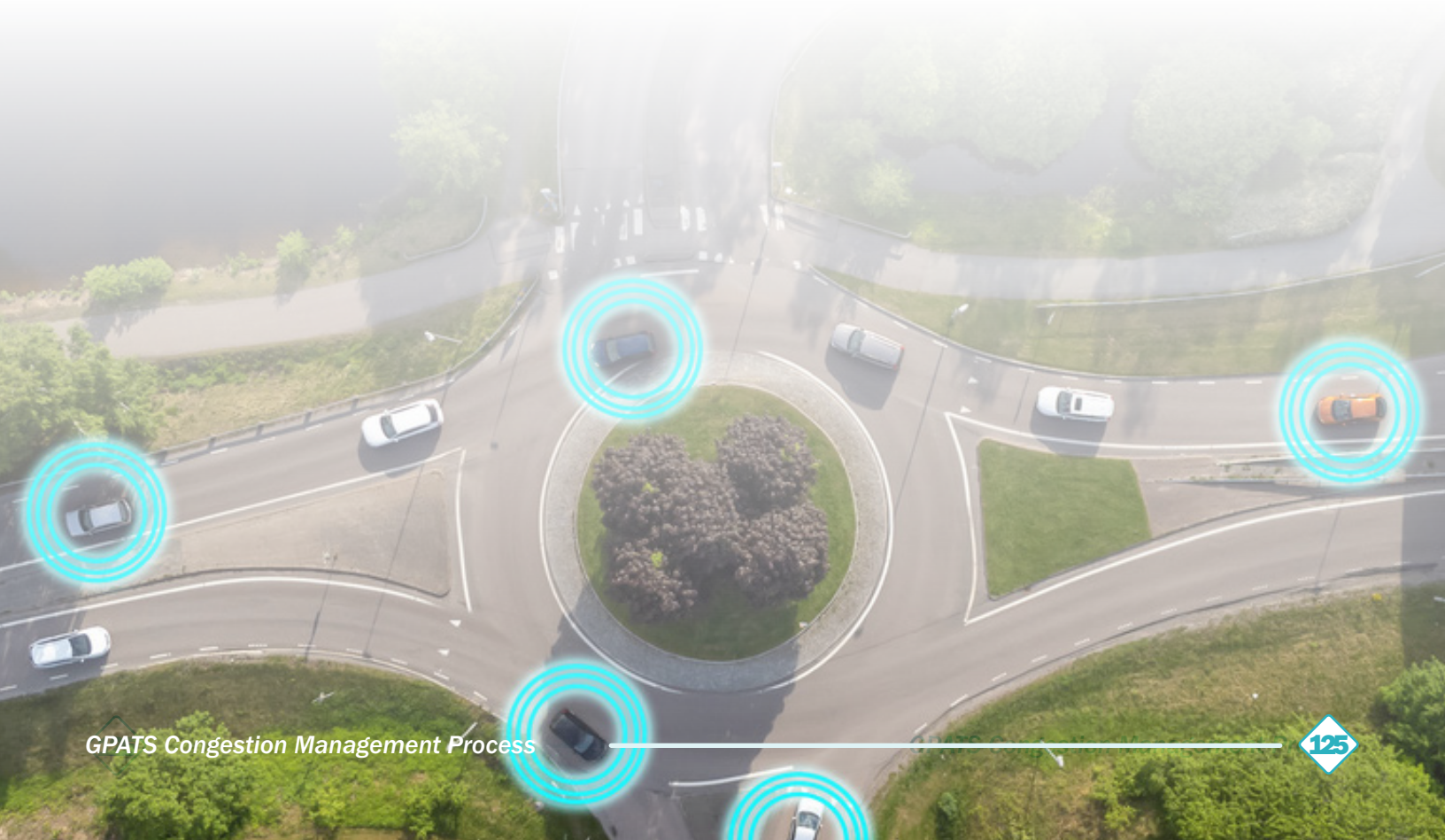
APPENDIX B

Technology

Intelligent Transportation Systems (ITS) leverage technology-based solutions to improve travel time reliability and safety in an organized, coordinated, and cost-effective way.

The technology strategies identified for the GPATS region include:

- Queue Warning
- Ramp Metering and Management
- Traffic Signal Coordination
- Integrated Corridor Management
- Real-Time Traveler Information



QUEUE WARNING

A queue warning is a system that uses signage or flashing lights to alert drivers to upcoming stop-and-go traffic.

Relative Cost

Impact

Advanced queue warning messages relayed via DMS allow drivers to slow down and avoid emergency braking or swerving on congested roadways. The messaging is updated automatically or managed remotely by a traffic operations center. The system may be complemented by dynamic speed limits or lane control signage and is particularly beneficial to warn drivers about presence of work zones ahead of time. Clear and consistent signage is key to optimizing its benefits especially on roadways with frequent queuing and poor sight distances. Queue warning systems are most-effective when implemented in conjunction with other strategies.

RAMP METERING AND MANAGEMENT

Ramp metering uses controlled access to regulate the flow of vehicles onto a freeway. Ramp metering is also known as ramp flow control.

Relative Cost

Impact

Ramp metering allows one or two vehicles to enter the mainline, typically freeways, at regular intervals so the flow and speed of vehicles on the mainline is minimally disrupted and remains consistent. It is proven to minimize congestion and stop-and-go traffic conditions downstream. There are two approaches to ramp metering: pre-timed systems and adaptive systems. Both systems control the speed and number of vehicles entering a ramp. While ramp metering may not completely eliminate congestion, it can delay or mitigate its impact. Ramp metering helps prevent crashes in signal-controlled areas, reduces travel time, and is a cost-effective and low-maintenance solution for mitigating congestion.

Case Study: Phoenix, AZ - SR-51 Ramp Metering

The Arizona Department of Transportation (ADOT) implemented an adaptive ramp metering project on SR-51. The implementation resulted in significant increases in traffic speed and flow during the morning peak hours. The average speed increased by over 4.8 mph and the traffic flow rate increased by 152 vehicles per hour, per lane.

APPENDIX B

TRAFFIC SIGNAL COORDINATION

Traffic signal coordination is a cost-effective strategy used to synchronize traffic signals along a corridor or network of roads. The coordination reduces delays by minimizing the number of stops at traffic signals.

Relative Cost

Impact

Traffic signal coordination is a convenient and low-cost strategy to improve street efficiency and assist with special event management. Upgrading signal equipment reduces congestion, and re-timing signals improves traffic flows. Newer signal technologies automatically re-time themselves to coordinate traffic across a corridor. Traffic signal coordination upgrades are particularly effective on major streets, around activity centers, and during special events or in work zones.

Upgrading a signal system along a corridor is a time-consuming process and many communities lack the resources to assess or implement traffic signal re-timing and synchronization. Signals are typically re-timed every three years, and ensuring adequate funding and staffing to upgrade and coordinate signaling systems more-frequently is crucial to maintaining an optimal system along major corridors.

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REAL-TIME TRAVELER INFORMATION

Real-time traveler information provides information on current roadway conditions to drivers.

Relative Cost

Impact

Real-time traveler information systems give drivers the information they need to make more informed decisions about their travel plans, resulting in reduced travel times and a better driver experience. Real-time information is provided via dynamic message signs (DMS), mobile devices, or media broadcasts. Drivers may be able to optimize their routes to avoid congestion and reduce overall fuel consumption and emissions.

Using sensors, transportation agencies collect real-time information to actively manage traffic conditions at the traffic management centers. Real-time traveler information allows transportation agencies and emergency responders to effectively manage traffic and respond to crashes.

INTEGRATED CORRIDOR MANAGEMENT

Integrated Corridor Management (ICM) aims to improve the efficiency and reliability of traffic flow by integrating various technologies and their operations. It bundles many of the other strategies into a concerted effort.

Relative Cost

Impact

ICM includes specialized signal timing, dynamic message signs, and multi-corridor-multi-jurisdictional coordination. These strategies offer the ability to improve incident response times, provide real-time information, and move people and goods more efficiently. ICM requires multi-agency coordination to perform traffic operations and integrate their systems. Long-term planning and budgeting for the operations and maintenance of ICM are essential. System issues and updates need to be addressed for successful implementation. ICM is particularly beneficial in corridors where widening is not an option or non-recurring congestion occurs.

Case Study: Nashville, TN - 1-24 Smart Corridor

Tennessee Department of Transportation (TDOT) is currently developing and implementing the I-24 SMART Corridor Project. Phase 1 and 2 launched in June of 2023 and included additional fiber, overhead DMS for Active Traffic Management System, and upgraded detection between I-24 and connecting arterials. Phase 3 is anticipated to be completed in the summer of 2024 and includes ramp meeting along I-24, updated fiber along arterials, CCTVs and DMS along connecting arterials, and an automated Decision Support System.