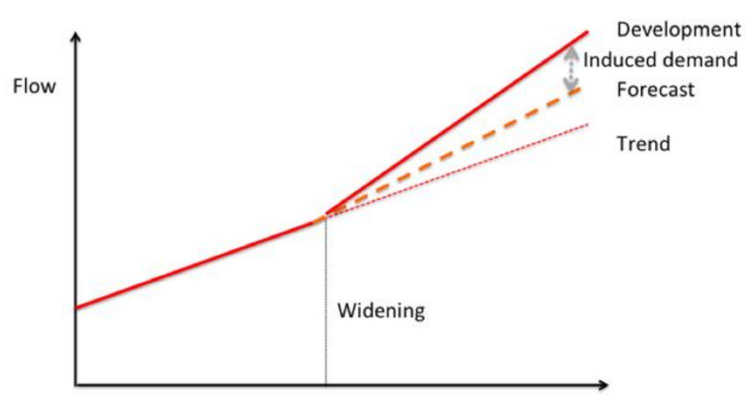
CHAPTER 8 – CONGESTION & SYSTEM MANAGEMENT

Cover page: Smart-driving technologies are changing the landscape of transportation. Substantial mobility, crash reduction, and environmental benefits may ultimately emerge from these technologies, which enable safer and less burdensome road travel. However, in order to optimally capitalize on such benefits for Texas' transportation systems, thoughtful operational strategies, predictions, policymaking, and infrastructure innovations are needed.

CHAPTER 8

Rapidly increasing congestion, constraints on capacity expansion and limited financial resources both locally and nationally are causing concern for transportation agencies and their customers. During the 20 years of this Metropolitan Transportation Plan traffic volumes around the region are projected to increase by almost 50%. The Corpus Christi MPO metropolitan transportation planning process has traditionally focused on constructing new roadways and widening existing highways to address congestion. However, current challenges associated with funding for operations and maintenance, along with transportation-system safety, reliability, and security require additional strategies to improve the existing system. It is also recognized that "…we can't build our way out of congestion." Induced demand will use up the additional capacity provided by new lanes much faster than the forecasts, which are already based upon additional growth in population and jobs. This is because existing trips will divert to take advantage of the new temporarily faster route.

Exhibit 8-1. Chart of Induced Travel Demand



Traffic congestion is the result of too many people wanting to move at the same times each day for efficient operation of both the economy and school systems. These all require people to work, go to school, and even run errands during about the same hours, so they can interact with each other. Traffic congestion cannot be "cured", only managed. In the Corpus Christi MPO, an overwhelming majority of people seeking to move during rush hours use private automotive vehicles, for two reasons: One is that most reside in low-density areas that public transit cannot efficiently serve. The second is that privately-owned vehicles are more comfortable, faster, more private, more convenient in trip timing, and more flexible for doing multiple tasks on one trip than almost any form of public transit. They are also solely responsible for road congestion.

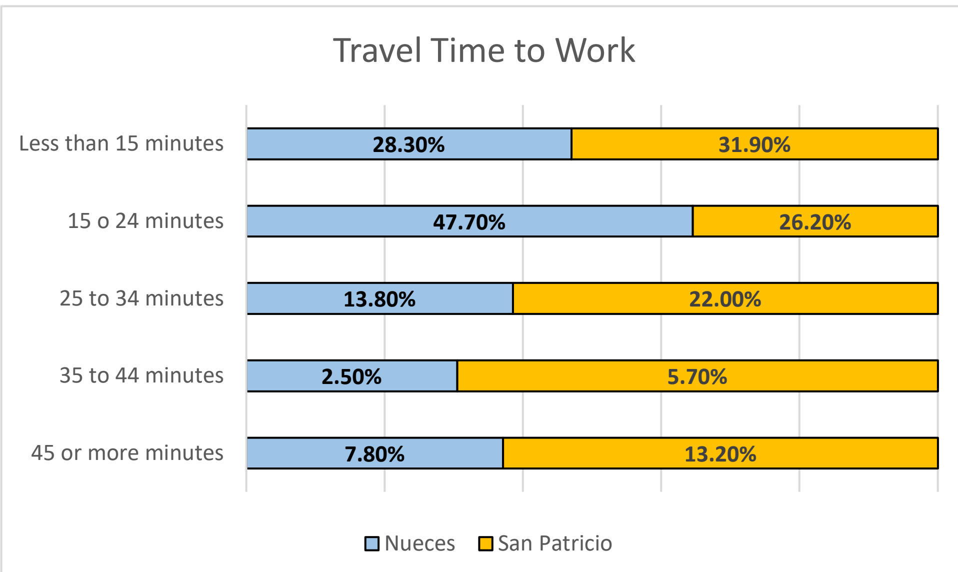
Research into travelers' views of congestion has shown that predictable travel times are a primary concern. Having reliable travel time is a crucial factor affecting traveler behaviors, including choices of route, departure time, and mode. One commonly accepted definition of travel time reliability, given by the Federal Highway Administration, states that "Drivers are used to congestion and they expect and plan for some delay, but most travelers are less tolerant of unexpected delays. Travel time reliability measures the extent of this unexpected delay." Travelers and firms may account for the variability in their trips and transport of goods by building in time-buffers as insurance against late arrival. This implies that the consequences of late arrivals are costly. Not only are these buffers inefficient, the productivity lost represent a cost that travelers and firms absorb due to unreliability, but also stress, late arrivals, missed connections, missed appointments and early arrivals are themselves costly. Thus, congestion is broadly categorized as either recurring (predictable) or non-recurring (unpredictable) congestion. Congestion, both recurring and non-recurring, vary significantly depending on the season, day of the week, and even time of day. Furthermore, both recurring and nonrecurring congestion may occur at the same time, exacerbating any event.

Regional growth in traffic volumes often means that even small disruptions can significantly change transportation-system performance. There is also an increasing recognition locally of the significance of traffic crashes, road construction, weather conditions, special events, and emergency situations on the reliability of the transportation system. It is estimated that about half of regional traffic congestion is caused by temporary disruptions that take away part of the roadway from use ("non-recurring" congestion).

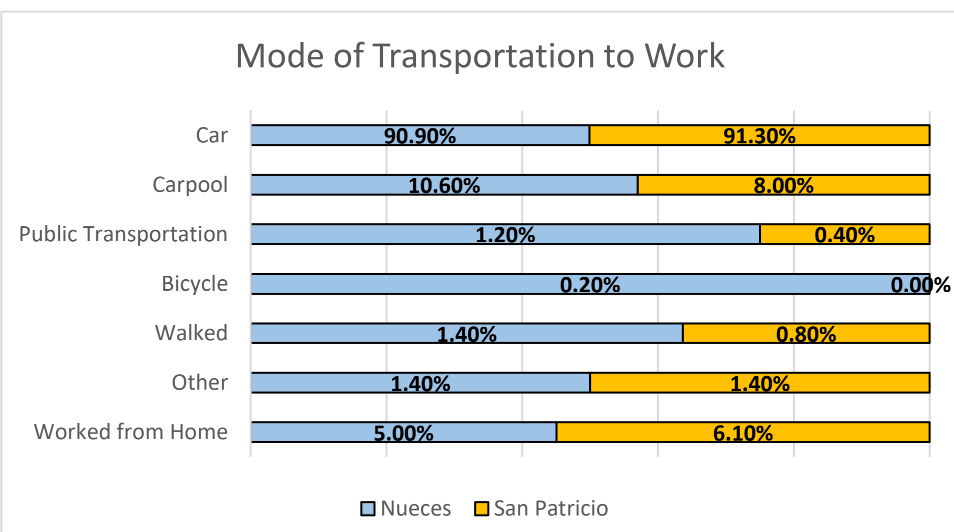
The Corpus Christi MPO adopted Congestion and System Management Goals are:

1. Significantly reduce traffic fatalities and serious injuries on all public roads
2. Reduce congestion on Regionally Significant Corridors
3. Efficiently invest in and operate the surface transportation system
4. Improve regional freight transportation facility performance

Exhibit 8-2. Chart of Travel Time and Mode to Work



Source: 2018-2023 American Community Survey 5YR-Estimates, Table S0801



Source: 2018-2023 American Community Survey 5YR-Estimates, Table S0801

TRANSPORTATION SYSTEM MANAGEMENT AND OPERATIONS

Transportation System Management and Operations (TSMO) is an integrated approach to optimize the performance of existing infrastructure by implementing multimodal, intermodal, and often cross-jurisdictional systems, services, and projects. The intent is to maximize the use of existing facilities, not construct new ones, and to cost-effectively improve regional mobility. This includes coordinating regional operations among transportation and public safety agencies. TSMO is not routine road maintenance like resurfacing or guardrail replacement. TSMO strategies improve system efficiency, enhance public safety and security, reduce traffic delays, and improve access to information for travelers. The emphasis of TSMO is using an outcome-driven, performance-based system to reduce congestion with policies or projects before the decision is made to build a new or wider road. This is the same purpose as the Congestion Management Process (CMP), found in Appendix M. Improving transportation system management and operations can support other goals. For instance, TSMO strategies can:

- Support economic vitality by improving system reliability, which is valued by the freight and business communities.
- Increase safety through driver education, speed enforcement, and technologies to improve pedestrian safety.
- Increase security by improving communication and coordination between transportation agencies and law enforcement.
- Improve accessibility and mobility by implementing strategies that reduce recurrent and non-recurrent congestion and improve the efficiency of operations such as transit priority, signal timing, and pricing.
- Enhance the environment, energy conservation, quality of life, and consistency with planned growth by implementing programs to manage travel demand, providing traveler information to help avoid and reduce traffic delays.
- Avoid the need to develop new transportation infrastructure with negative impacts to the environment and communities.
- Enhance integration and connectivity to allow seamless travel between transit and other modes.
- Preserve the existing transportation system by focusing resources on optimizing existing capacity, rather than building new capacity.

CORPUS CHRISTI MPO CONGESTION MANAGEMENT PROCESS

A major component of TSMO is the Corpus Christi MPO CMP, updated in February 2025. The CMP is required as part of the metropolitan planning process in metropolitan areas with over 200,000 residents. The Corpus Christi Metropolitan Planning Organization CMP:

- Identifies Regionally Significant Corridors (RSCs)
- Defines congestion
- Identifies congested locations
- Determines the causes of recurring and nonrecurring congestion
- Provides a toolbox of policies and projects to manage congestion
- Evaluates the potential of these policies and projects for each individual RSC
- Lists regional performance measures and adopts specific targets to assess the effectiveness of policies and projects against
- Establishes a program for data collection to measure system performance; and
- Sets priorities among projects for incorporation into the 20-year Metropolitan Transportation Plan (MTP), the 10-year Unified Transportation Plan (UTP), and the 4-year Transportation Improvement Program (TIP).

The Federal Highway Administration (FHWA) defines a CMP as "a systematic and regionally accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meets state and local needs." The Congestion Management Process analyzes all reasonable travel demand reduction and operational management strategies for every National Highway System (NHS) corridor or other regionally significant corridor in which single-occupant vehicle capacity will significantly increase. The CMP is also intended to maximize benefits from previous capital investments in transportation. Intelligent Transportation System (ITS) technologies, are vital to this effort. Projects that do physically add lanes to increase Single Occupant Vehicle (SOV) capacity must result from the CMP unless a safety audit has identified the project as a necessary safety improvement.

The Corpus Christi MPO CMP partnership continually monitors and improves the efficiency of the RSCs. RSCs are analyzed every two years during the TIP updates for specific performance and improvement strategies identified for consideration. Performance measures are derived from the National Performance Goals, and objectives established to support the Texas Department of Transportation Performance Goals. The CMP is designed to put into action the Metropolitan Transportation Plan relating to congestion by transforming the goals into specific objectives, identifying locations where goals are not met, and identifying solutions to achieve the goals.

The Corpus Christi Regional ITS Architecture plan, completed in partnership with TxDOT in 2024, is an up-to-date to incorporate the changes in technology that have since occurred since the 1999 document.

Corpus Christi MPO CMP Corridor Identification

The CMP network includes the physical infrastructure which supports multiple modes of mobility, including personal and freight vehicles, transit, and active modes. The CMP focuses on all Regionally Significant Corridors (RSCs) identified for the 2045 MTP Update. The RSC designation allows the Corpus Christi MPO to focus the very limited transportation funding on projects that improve regional travel. In general, congestion in the region occurs on the RSCs. The following criteria were used to identify the Corpus Christi MPO Regionally Significant Corridors:

- National Highway System (NHS)
- Strategic Highway Network (STRAHNET)
- National Highway Freight Network
- State Highway Freight Network
- TxDOT Evacuation Routes
- TxDOT Statewide Connectivity Corridors
- Roadway Functional Classification of Minor Arterial and above

Exhibit 8-3. Map of NHS and STRAHNET

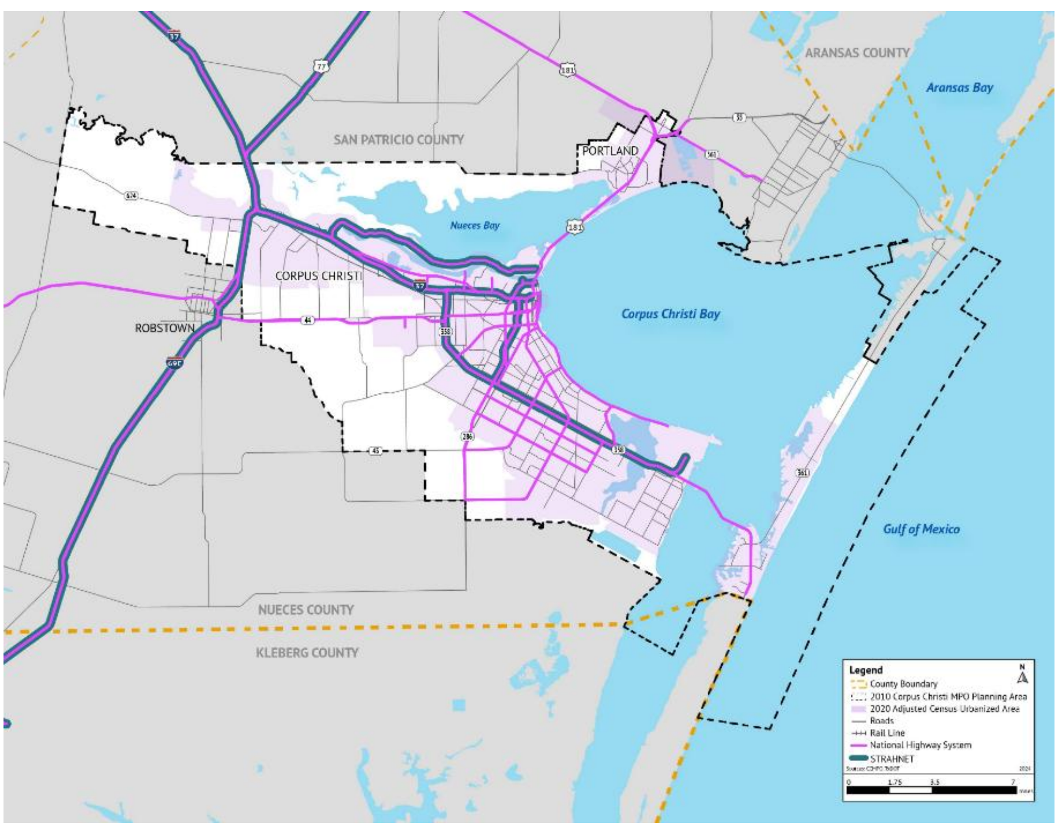


Exhibit 8-4. Map of National and State Freight Route System

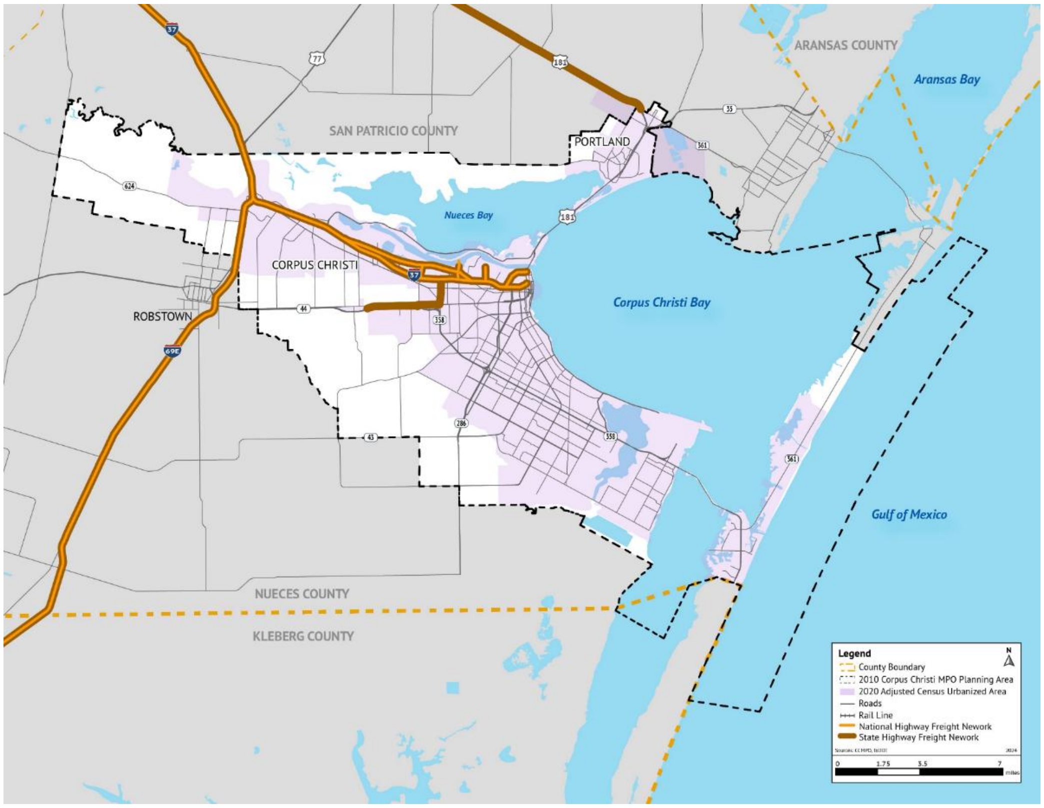


Exhibit 8-5. Map of Hurricane Evacuation Routes

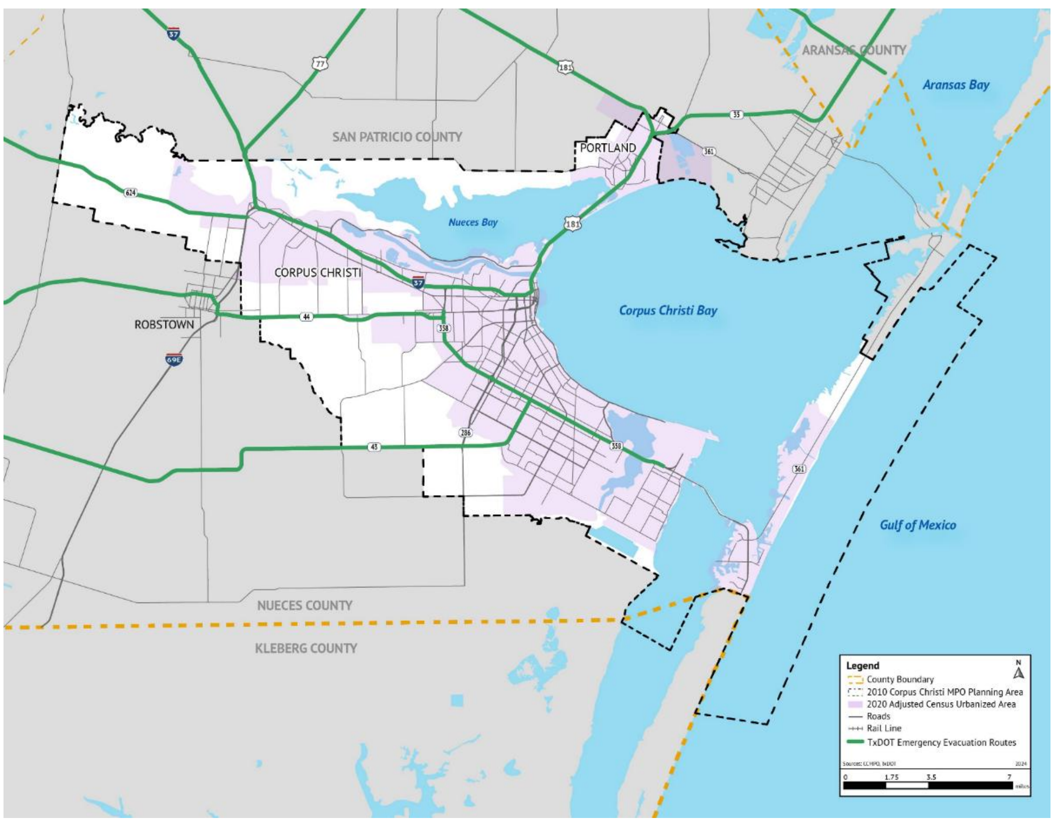


Exhibit 8-6. Map of TxDOT Statewide Connectivity Corridors

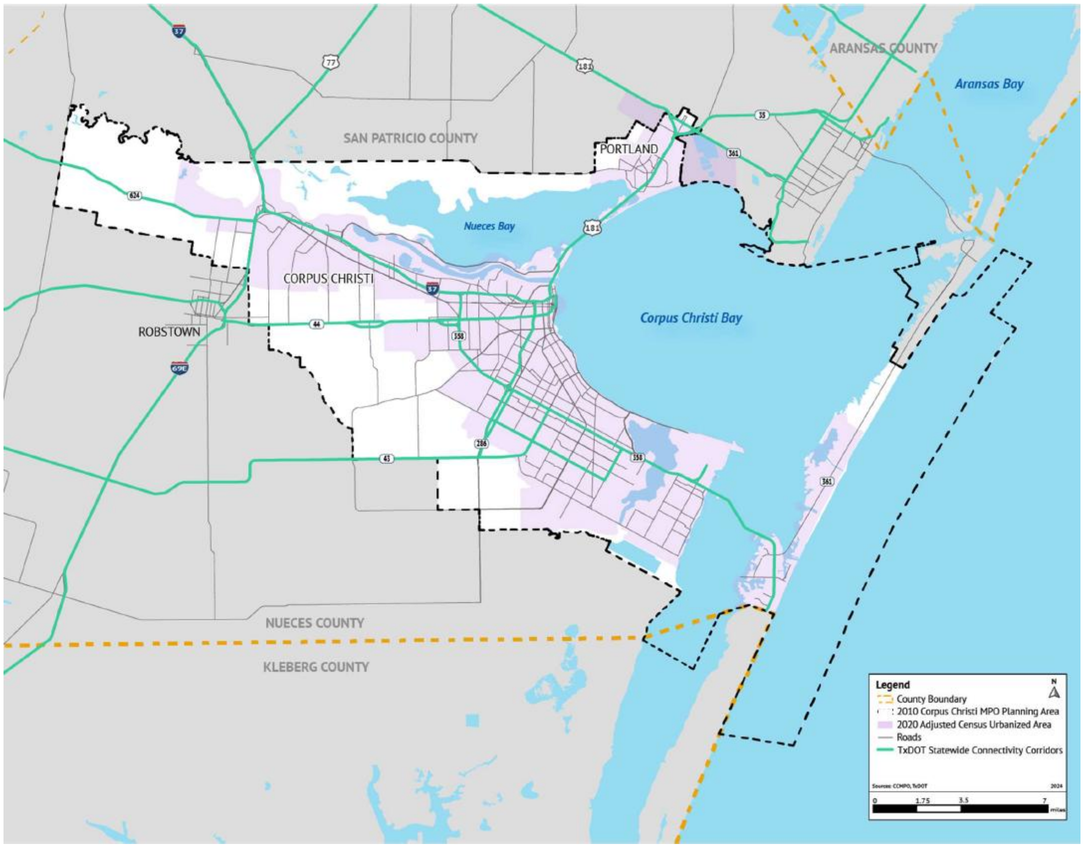
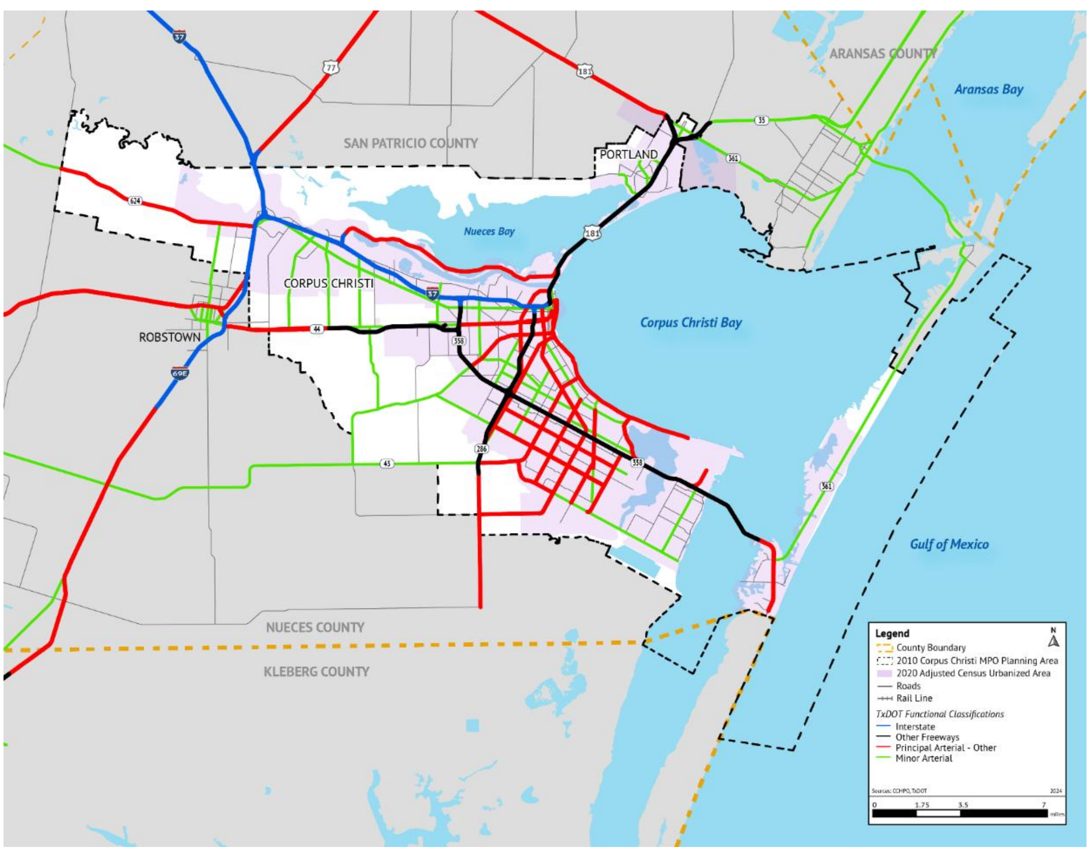


Exhibit 8-7. Map of Roadway Functional Classification of Minor Arterial and above



Corridors of Concern

The Corridors of Concern are congested now and will become more congested during the next 20 years without intervention. Corridors of Note are also important corridors. They have lower levels of congestion and need monitoring to avoid unacceptable congestion. The CMP corridors in the Corpus Christi region are displayed in Exhibit 8-8 and listed in Exhibit 8-9 and 8-10.

Exhibit 8-8. Map of Regional Significant Corridors

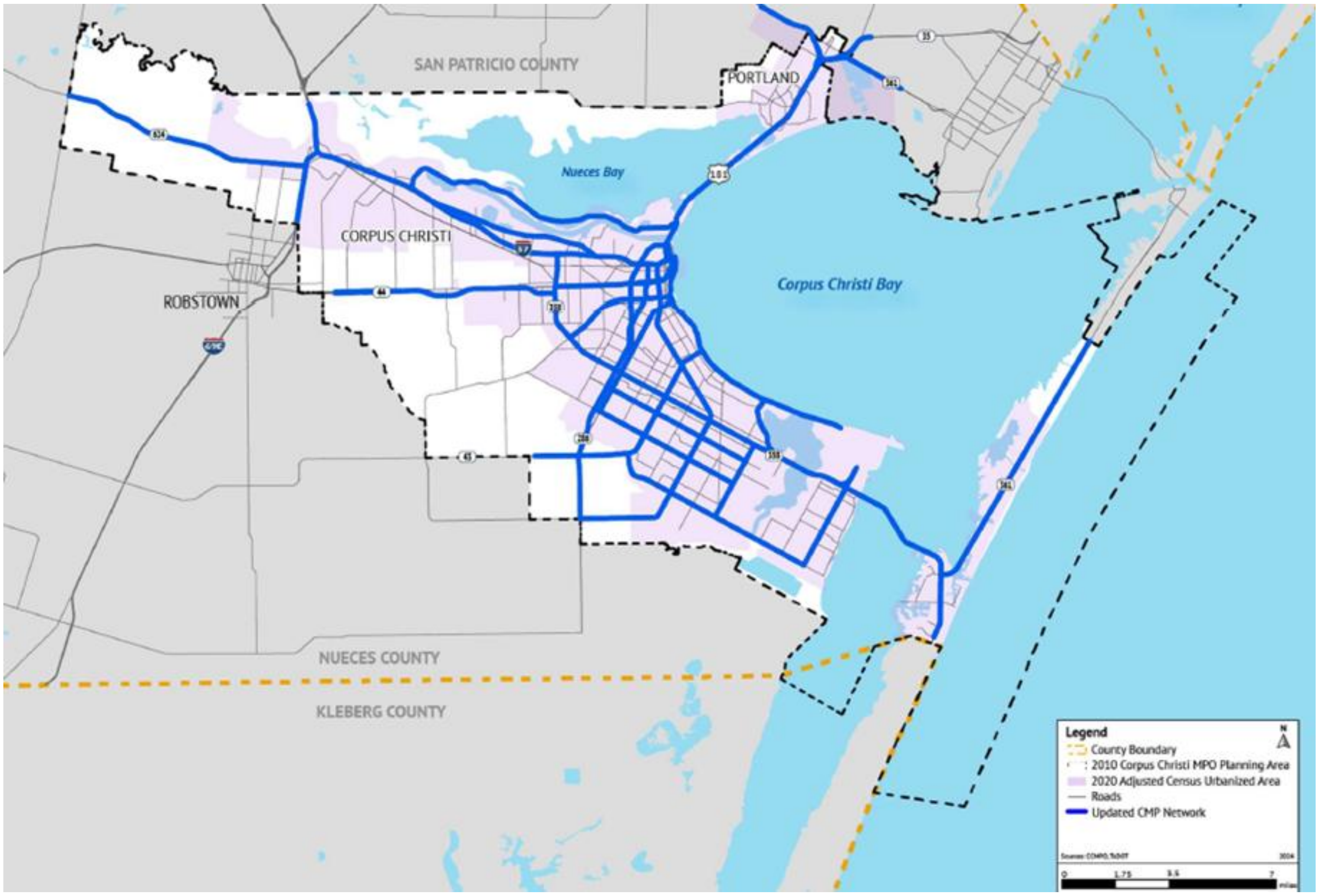


Exhibit 8-9. Table of Regionally Significant Corridors (RSCs)

ID	Road	From Limit	To Limit
RSC-001	I-69E	CR 48 Exit	I-37
RSC-002	I-37	I-69E	Nueces River
RSC-003	I-37	I-69E	Exit 9 Sign
RSC-004	I-37	Exit 9 Sign	SH 358
RSC-005	I-37	SH 358	US 181
RSC-006	US 181	I-37	US 181 / E Causeway Blvd Ramp
RSC-007	US 181	US 181 / E Causeway Blvd Ramp	Houston St.
RSC-008	US 181	Houston St.	CR 3667
RSC-009	SH 35	US 181	4th St.
RSC-010	Up River Rd.	I-37	I-37
RSC-011	SH 358	I-37	SH 286
RSC-012	SH 358	SH 286	S. Staples St.

Exhibit 8-9. Table of Regionally Significant Corridors (RSCs) (continued)

ID	Road	From Limit	To Limit
RSC-013	SH 358	S Staples St.	NAS Ramp
RSC-014	PR 22	NAS Ramp	Aquarius St.
RSC-015	SH 358 / NAS Dr.	NAS-CAD Ramp	NAS Gate
RSC-016	Holly Rd.	SH 286	Weber Rd.
RSC-017	Holly Rd.	Weber Rd.	S. Staples St.
RSC-018	Holly Rd.	S. Staples St.	Rodd Field Rd.
RSC-019	Saratoga Blvd.	SH 286	Weber Rd.
RSC-020	Saratoga Blvd.	Weber Rd.	S. Staples St.
RSC-021	Saratoga Blvd.	S. Staples St.	Rodd Field Rd.
RSC-022	FM 43	Loxley Dr.	SH 286
RSC-023	FM 43	SH 286	Yorktown Blvd.
RSC-024	Weber Rd.	Yorktown Blvd.	Saratoga Blvd.
RSC-025	Weber Rd.	Saratoga Blvd.	Holly Rd.
RSC-026	Weber Rd.	Holly Rd.	SH 358
RSC-027	Weber Rd.	SH 358	S Staples St.
RSC-028	Doddridge Rd.	S. Staples St.	Ocean Dr.
RSC-029	Rodd Field Rd.	Saratoga Blvd.	Holly Rd.
RSC-030	Rodd Field Rd.	Holly Rd.	SH 358
RSC-031	Ennis Joslin Rd.	SH 358	Ocean Dr.
RSC-032	PR 22	Aquarius St.	Commodore St.
RSC-033	PR 22	Commodore St.	Whitecap Blvd.
RSC-034	PR 22	Whitecap Blvd.	Sea Pines Dr.
RSC-035	N. Staples St.	Antelope St.	Agnes St.
RSC-036	S. Staples St	Laredo St.	Morgan Ave.
RSC-037	S. Staples St	Morgan Ave.	Six Points
RSC-038	S. Staples St	Six Points	Baldwin Blvd.
RSC-039	S. Staples St	Baldwin Blvd.	Weber Rd.
RSC-040	S. Staples St	Weber Rd.	SH 358
RSC-041	S. Staples St	SH 358	Holly Rd.
RSC-042	S. Staples St	Holly Rd.	Saratoga Blvd.
RSC-043	S. Staples St	Saratoga Blvd.	Yorktown Blvd.
RSC-044	S. Staples St	Yorktown Blvd.	Kitty Hawk Dr.
RSC-045	S. Staples St	Kitty Hawk Dr.	SH 286
RSC-046	Old Brownsville Rd.	SH 358	Airport Rd.
RSC-047	Morgan Ave	Airport Rd.	S Port Ave.
RSC-048	Morgan Ave	S Port Ave	SH 286
RSC-049	Morgan Ave	SH 286	S Staples St
RSC-050	Morgan Ave	S Staples St	Ocean Dr
RSC-051	Ayers St	Saratoga Blvd	Holly Rd
RSC-052	Ayers St	Holly Rd	SH 358
RSC-053	Ayers St	SH 358	Six Points
RSC-054	Ayers St	Six Points	Ocean Dr
RSC-057	SH 44	CR 24	SH 358
RSC-058	Agnes St	SH 358	S Port Ave
RSC-059A	Agnes St	S Port Ave	SH 286 Frontage SB
RSC-059B	Laredo St	SH 286 Frontage SB	S Port Ave
RSC-060A	Agnes St	SH 286 Frontage NB	S Staples St

Exhibit 8-9. Table of Regionally Significant Corridors (RSCs) (continued)

ID	Road	From Limit	To Limit
RSC-060B	Laredo St	S Staples St	SH 286 Frontage NB
RSC-061	SH 286	FM 2444	SH 286 On Ramp
RSC-062	SH 286	SH 286 On Ramp	SH 358
RSC-063	SH 286	SH 358	I-37
RSC-064	FM 624	CR 73	I-69E
RSC-065	S Port Ave	Ayers St	SH 286
RSC-066	S Port Ave	SH 286	Morgan Ave
RSC-067	S Port Ave	Morgan Ave	Agnes St
RSC-068	N Port Ave	Agnes St	Hirsch St
RSC-069	Joe Fulton International Trade Corridor	I-37	US 181
RSC-070	Ocean Dr	Morgan Ave	Doddridge St
RSC-071	Ocean Dr	Doddridge St	Ennis Joslin Rd
RSC-072	Ocean Dr	Ennis Joslin Rd	Sand Dollar Blvd
RSC-073	Ocean Dr	Sand Dollar Blvd	NAS Gate
RSC-074	I-37	US 181	N Shoreline Blvd
RSC-075A	Agnes St / N Chaparral St	S Staples St	Coopers Alley
RSC-075B	N Mesquites St / Laredo St	Lomax St	S Staples St
RSC-076A	John Sartain St	N Mesquite St	N Water St
RSC-076B	Lomax St	N Shoreline Blvd	N Mesquite St
RSC-077	N Water St	John Sartain St	I-37
RSC-078A	N Shoreline Blvd	I-37	Coopers Alley
RSC-078B	N Shoreline Blvd	Coopers Alley	I-37
RSC-079	S Shoreline Blvd	Coopers Alley	Morgan Ave
RSC-080	FM 624	FM 666	CR 73
RSC-081	Yorktown Blvd	Weber Rd	S Staples St
RSC-082	Yorktown Blvd	S Staples St	Rodd Field Rd
RSC-083	Yorktown Blvd	Rodd Field Rd	Waldron Rd
RSC-084	Waldron Rd	Yorktown Blvd	Purdue Rd
RSC-085	Waldron Rd	Purdue Rd	SH 358 Frontage EB
RSC-086	Waldron Rd	SH 358 Frontage WB	Claride St
RSC-087A	Waldron Rd	Claride St	NAS Dr / Scotland Dr
RSC-088	SH 361	PR 22	Access Road 2
RSC-089	SH 361	Access Road 2	Mariners Dr
RSC-090	N Chaparral St	Coopers Alley	I-37
RSC-091	N Chaparral St	I-37	Hirsch St
RSC-092	SH 35	US 181 Ramp	McKamey Rd
RSC-093	Rodd Field Rd	Yorktown Blvd	Saratoga Blvd

Corpus Christi MPO CMP Toolbox

A 4-tier Toolbox of Strategies was identified for managing congestion on each of the CMP RSCs. Each congested area has specific characteristics that benefit from certain improvements. While every category of strategies within individual corridors is not applicable for every situation, it is important to consider the alternatives when they are applicable. The goal of these strategies is to get the most performance out of the transportation facilities without new construction. This requires knowledge, skills, and techniques to administer comprehensive solutions that can be quickly implemented at relatively low cost. This may enable transportation agencies to “stretch” their funding to benefit more areas and customers.

The Toolbox is shown in Exhibit 8-11. Many of these strategies are complementary but need verification to determine applicability to any specific corridor. The application of these strategies to CMP corridors will be analyzed for specific improvements. Effectively managing congestion over time requires a multi-faceted approach. Though roadway expansion increases capacity in the short term, this strategy induces Single Occupant Vehicle (SOV) travel demand for the treated corridor in the long-term and therefore should not be considered as a standalone solution. Longer-term congestion-management strategies include reducing transportation demand, often referred to as transportation demand management (TDM) and improving the overall efficacy of the existing system through improvements to operational management and implementation of Intelligent Transportation Systems (ITS). The following subsections highlight several potential strategies for reducing congestion in the region.

The adopted CMP policies and projects are centered on four tiers of strategies. They are:

Exhibit 8-11. List of Corpus Christi MPO CMP Toolbox of Strategies

Tier 1 Demand Management	Tier 2 Traffic Operations	Tier 3 Public Transportation	Tier 4 Roadway Improvements
Ridesharing programs	Traffic control devices	New transit services/amenities	Geometric improvements
Carsharing programs	ITS technologies	Improved transit services/amenities	Intersection improvements
Pedestrian & bicycle improvements	Traffic management centers	Enhanced access to transit	Interchange improvements
Shuttle programs	Traveler information systems	Transit signal priority	Acceleration/deceleration lanes
Telework programs	Ramp metering	Dedicated transit rights-of-way	Overpasses and underpasses
Alternative work schedules	Managed lanes	Real-time transit information	Complete Streets
Parking cash-out programs	Freight management	Transit benefit programs	Access management
Parking management	Work zone management	Fare pricing strategies	Road diets
Congestion pricing	Road weather management	Integrated Payment Systems	Traffic calming
Policies/strategies for land use, zoning, or development	Traffic incident management		Roadway widening
	Emergency management		Construction of a new roadway
	Special event management		

NATIONAL HIGHWAY SYSTEM

The National Highway System (NHS) includes the Interstate Highway System as well as other roads important to the nation's economy, defense, and mobility. The NHS is composed of approximately 220,000 miles of rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. The NHS was developed by the Department of Transportation (DOT) in cooperation with the states, local officials, and Metropolitan Planning Organizations (MPOs), comprising:

- Interstate: The Eisenhower Interstate System of highways retains its separate identity within the NHS.
- Other Principal Arterials: These are highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.
- Strategic Highway Network (STRAHNET): This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity, and emergency capabilities for defense purposes.
- Major Strategic Highway Network Connectors: These are highways which provide access between major military installations and highways which are part of the Strategic Highway Network.
- Intermodal Connectors: These highways provide access between major intermodal facilities and the other four subsystems making up the National Highway System. A listing of all official NHS Intermodal Connectors is available.

The NHS has a federal funding program, the National Highway Performance Program, that is solely and specifically to achieve adopted performance goals. This funding pool had nearly $30 Billion for distribution in year 2024 nationwide, making it the largest single federal transportation funding source.

At Congress' mandate, the FHWA established measures to assess performance of the National Highway System and freight movement on the Interstate system, effective May 20, 2017. This FHWA congestion performance measure rule (PM3) established three performance measures applicable to the Corpus Christi MPO, describe below:

National Highway System Performance:

1. Percent of person-miles on the Interstate system that are reliable
2. Percent of person-miles on the non-Interstate NHS that are reliable

Freight Movement on the Interstate:

3. Truck Travel Time Reliability Index (TTTR)

Federal System Performance Measures

The two System Performance measures assess the reliability of travel times on the Interstate or non- Interstate NHS system. The performance metric used to calculate reliability is the Level of Travel Time Reliability (LOTTR). LOTTR is defined as the ratio of longer travel times (80th percentile) to a normal travel time (50th percentile) over all applicable roads during four time periods (AM peak, Mid-day, PM peak, and weekends) that cover the hours of 6 AM to 8 PM each day.

The LOTTR ratio is calculated for each segment of applicable roadway, essentially comparing the segment with itself. A segment is deemed to be reliable if its LOTTR is less than 1.5 during all four time periods. If one or more time periods has a LOTTR of 1.5 or above, that segment is unreliable. The measures are expressed as the percent of person-miles traveled on the Interstate or non- Interstate NHS system that are reliable. Person-miles considers the number of people traveling in buses, cars, and trucks over these roadway segments. To determine total person miles traveled, the vehicle miles traveled (VMT) on each segment is multiplied by average vehicle occupancy. To calculate the percent of person miles traveled that are reliable, the sum of the number of reliable person miles traveled is divided by the sum of total person miles traveled. segment, the highest TTTR value among the five time periods is multiplied by the length of the segment. The sum of all length-weighted segments is then divided by the total length of Interstate to generate the TTTR Index.

Exhibit 8-12. Table Level of Travel Time Reliability on Interstates

LOTTR-I	2018	2019	2020	2021	*2022	*2024	*2026
Region	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %
Corpus Christi MPO	100%	100%	99%	99%	97%	97%	97%
State Total	81%	82%	91%	86%	70%	70%	69%

TxDOT forecasted values

Exhibit 8-13. Table Level of Travel Time Reliability on Non-Interstates

LOTTR-NI	2018	2019	2020	2021	*2022	*2024	*2026
Region	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %	Reliable %
Corpus Christi MPO	95%	93%	95%	95%	80%	80%	80%
State Total	83%	84%	92%	91%	70%	70%	69%

TxDOT forecasted values

Exhibit 8-14. Table Level of Truck Travel Time Reliability on the National Highway System

LOTTTR	2018	2019	2020	2021	*2022	*2024	*2026
Region	Index Value	Index Value	Index Value	Index Value	Index Value	Index Value	Index Value
Corpus Christi MPO	1.19	1.09	1.14	1.14	1.35	1.35	1.38
State Total	1.43	1.43	1.33	1.37	1.76	1.76	1.84

TxDOT forecasted values

National Performance Targets

Performance for the PM3 measures is assessed and reported over a four-year performance period. For the PM3 measures, the second performance period began on January 1, 2022 and will end on December 31, 2025. TxDOT reported baseline PM3 performance and targets to FHWA and will report updated performance information at the midpoint and end of the performance period. The third four- year performance period will cover January 1, 2026, to December 31, 2029, with additional performance periods following every four years. The PM3 rule requires state DOTs and MPOs to establish two-year and/or four-year performance targets for each PM3 measure. For all targets, the current two-year and four-year targets represent expected performance at the end of calendar years 2023 and 2025, respectively. TxDOT established targets as follows:

- Percent of person-miles on the Interstate system that are reliable – two- year and four-year targets

- Percent of person-miles on the non-Interstate NHS that are reliable – four-year targets
- Truck Travel Time Reliability – two-year and four-year targets

MPOs in Texas establish four-year targets for the System Performance and Freight Movement by establishing targets by either agreeing to programs and projects that will support the statewide targets or setting quantifiable targets for the MPO's planning area that differ from the state targets. TxDOT enlisted the Texas Transportation Institute (TTI) to establish a statewide methodology and recommend future year travel time reliability performance targets for all MPOs within Texas. The Corpus Christi MPO adopted the initial TxDOT statewide PM3 targets on October 26, 2023. The Corpus Christi MPO and TxDOT will, on or before October 1, 2025, revisit the four-year PM3 targets.

The Corpus Christi MPO recognizes the importance of linking goals, objectives, and investment priorities to stated performance objectives, and that establishing this link is critical to the achievement of national transportation goals and statewide and regional performance targets. As such, the Corpus Christi MPO 2045 MTP Update planning process directly reflects the goals, objectives, performance measures, and targets as they are available and described in other State and public transportation plans and processes; specifically, the Texas Freight Mobility Plan, the current statewide Texas Transportation Plan 2050 (TTP), and 2025 UTP.

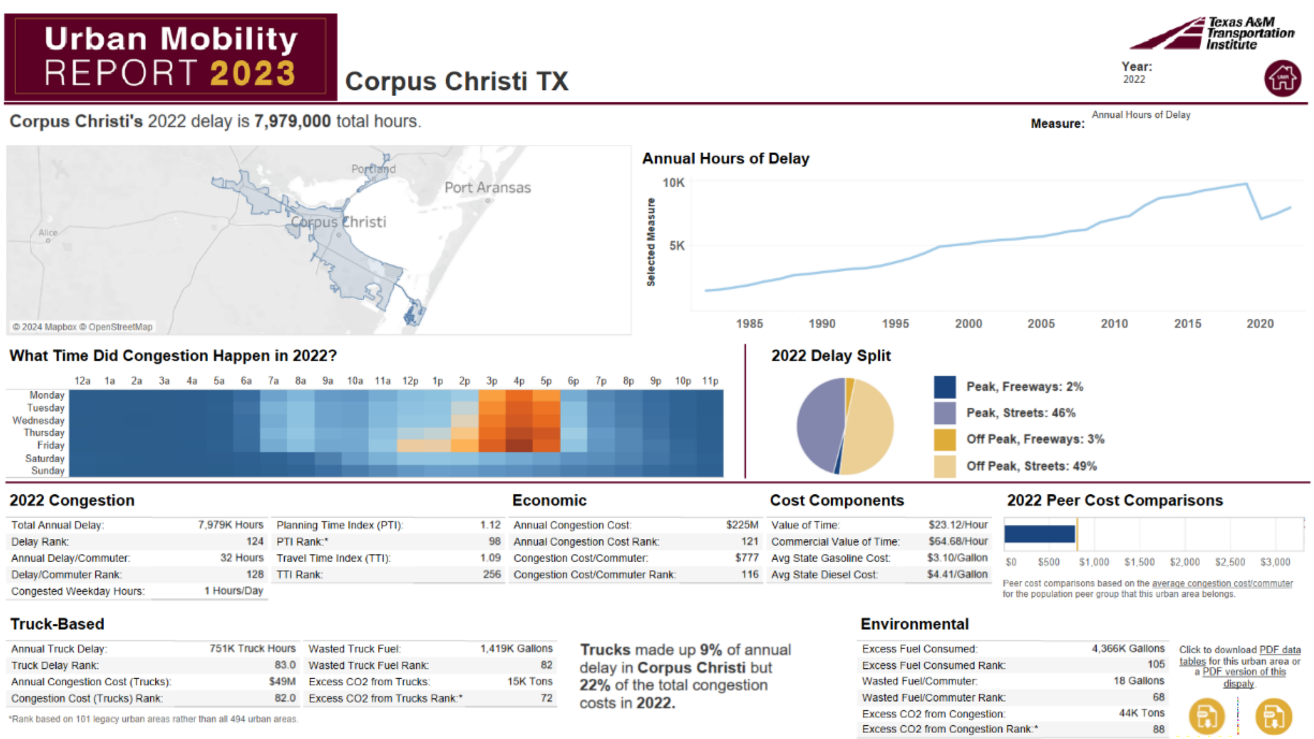
- The Texas Freight Mobility Plan defines the conditions and performance of the state freight system and identifies the policies and investments that will enhance Texas highway freight mobility well into the future. The Plan identifies freight needs and the criteria Texas will use to determine investments in freight and prioritizes freight investments across modes.
- The TTP 2050 summarizes transportation needs across the state and identifies future funding projections for projects across transportation modes over the 25-year plan horizon.

Another adopted National Goal is to achieve a significant reduction in congestion on the National Highway System. There are two primary performance measures for this goal.

- Annual hours of peak-hour excessive delay per capita
- Percent of non-single-occupant vehicle travel

The current performance of the NHS system is displayed in Exhibit 8-15.

Exhibit 8-15. Illustration of Urban Mobility Report 2023

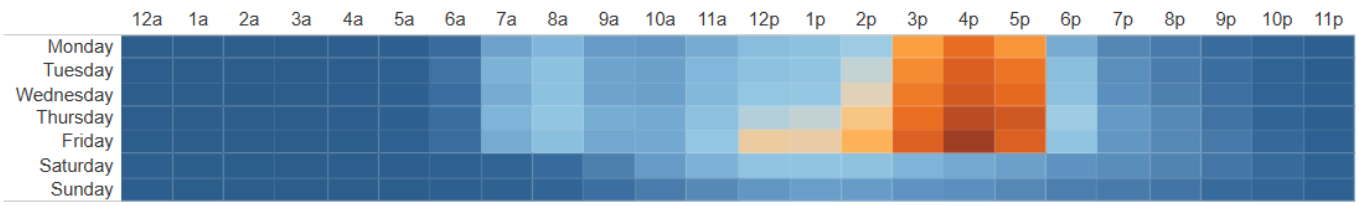


DEFINITION OF CONGESTION

One of the critical and complex tasks of the CMP is to define congestion. Studies have shown that congestion is a relative rather than an absolute condition. People “feel” roads are congested at different levels of operations. Technically, congestion occurs when the number of vehicles on a facility exceeds the maximum number of vehicles a roadway or intersection can accommodate at that point in time, whether because of the physical limitations of the facility or because an event (such as rain) has temporarily hindered vehicular movement.

The actual capacity of a given road cannot realistically be expressed in an absolute number (i.e., 2,400 vehicles per lane per hour) because the traffic stream is not uniform in weather conditions or driver behavior. Friction from traffic entering or leaving a highway can affect the through-put of traffic, as does a road's operating speed, number of lanes, width of lanes, shoulder width, sight distance, horizontal (left or right) curvature, and vertical curvature (up and down, or grade.) Traffic speed and flow on urban streets are determined primarily by intersection capacity, which is affected by traffic volumes on cross streets and left turn signal phases.

Exhibit 8-16. Chart of Congestion Occurrences



The Corpus Christi MPO defines roadway congestion using the concept of Level-of- Service. Level-of-Service examines the relationship between traffic speed / delay at intersections / volume of traffic / space between cars and assigns a “grade” for the flow of traffic. What that means is that there are six Levels-of-Service possible for each facility. They are given letter designations from A to F, with LOS A representing the best possible operating conditions and LOS F the worst.

Traditionally, the concept of congestion has only been applied to motor vehicles. This leads to pressure on traffic engineers to add lanes at intersections. However, changing expectations about the physical and operational design of intersections and how a signalized intersection should perform for ALL travelers (bicycle and pedestrian) is leading to increasing the threshold volume-to-capacity ratio for motor vehicles.

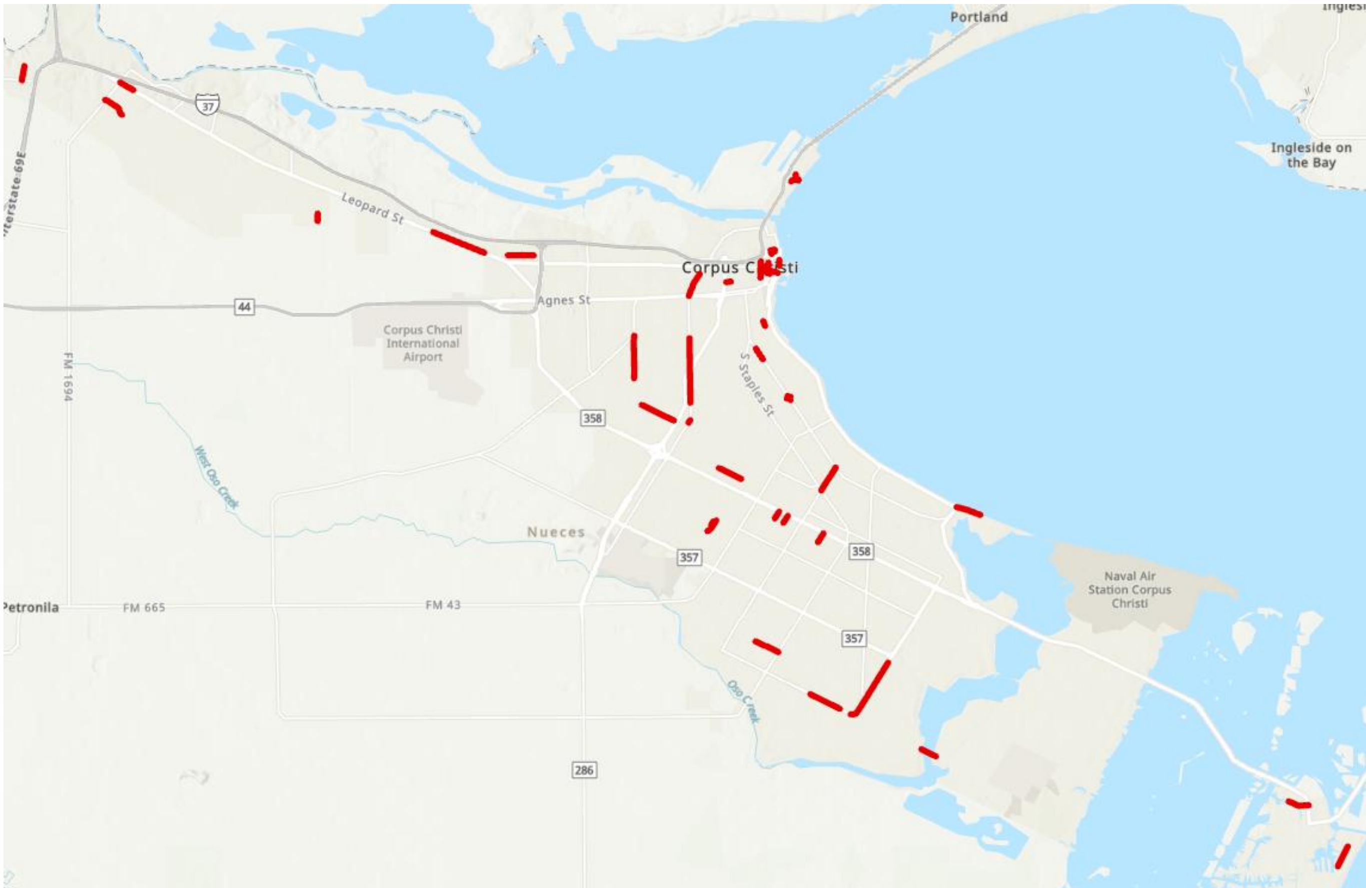
Categories of Congestion

Congestion is broadly categorized as either recurring (predictable) or non- recurring (unpredictable) congestion. Congestion, both recurring and non- recurring, vary significantly depending on the season, day of the week, and even time of day. Furthermore, both recurring and nonrecurring congestion may occur at the same time, exacerbating the event.

Recurring congestion is congestion that occurs repeatedly at predictable times and locations, e.g. at bottlenecks or on corridors with poorly coordinated traffic signals, usually during the peak hour periods. Simply put, recurring congestion occurs because travel demand exceeds system capacity. There are many strategies available to mitigate this type of congestion through demand management, operational improvements, and multimodal strategies. Integration of land use and transportation decisions enables agencies to coordinate efforts to address this demand side of congestion. Elimination of all recurring congestion may not be either feasible (due to physical and financial constraints) or desirable (in terms of the implications to community of unfettered vehicular travel). Recurring congestion is generally considered the least frustrating because its effects are known and can be planned for.

In contrast, non-recurring congestion incidents can occur at any time, including during non-peak travel times, and is often associated with traffic crashes, work zones, weather events, special events, and other emergencies. This is the congestion that most often frustrates people. It is especially bad when a non- recurring incident (crash) magnifies the magnitude and extent of congestion during “normal” recurring congestion. Non-recurring congestion is difficult to address without proper prior planning. Exhibit 8-17 shows road closures as of 12-18-2024 in the City of Corpus Christi.

Exhibit 8-17. Map of Road Closures as of December 18, 2024



Intersection Congestion

Intersections are the most common location of congestion in a road system. Intersection Levels of Service can measure congestion for signalized intersections in terms of both control delay, which is a measure of driver discomfort or frustration, and increased travel time. The delay experienced by the motorist is made up of a number of factors that relate to control, geometrics, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period, see Exhibit 8-18 for LOS description. Delay is a complex measure and depends on a number of variables, including the quality of the progression, the cycle length, the green ratio and the ratio of actual traffic passing through the intersection divided by the estimated capacity of the number of lanes in the intersection.

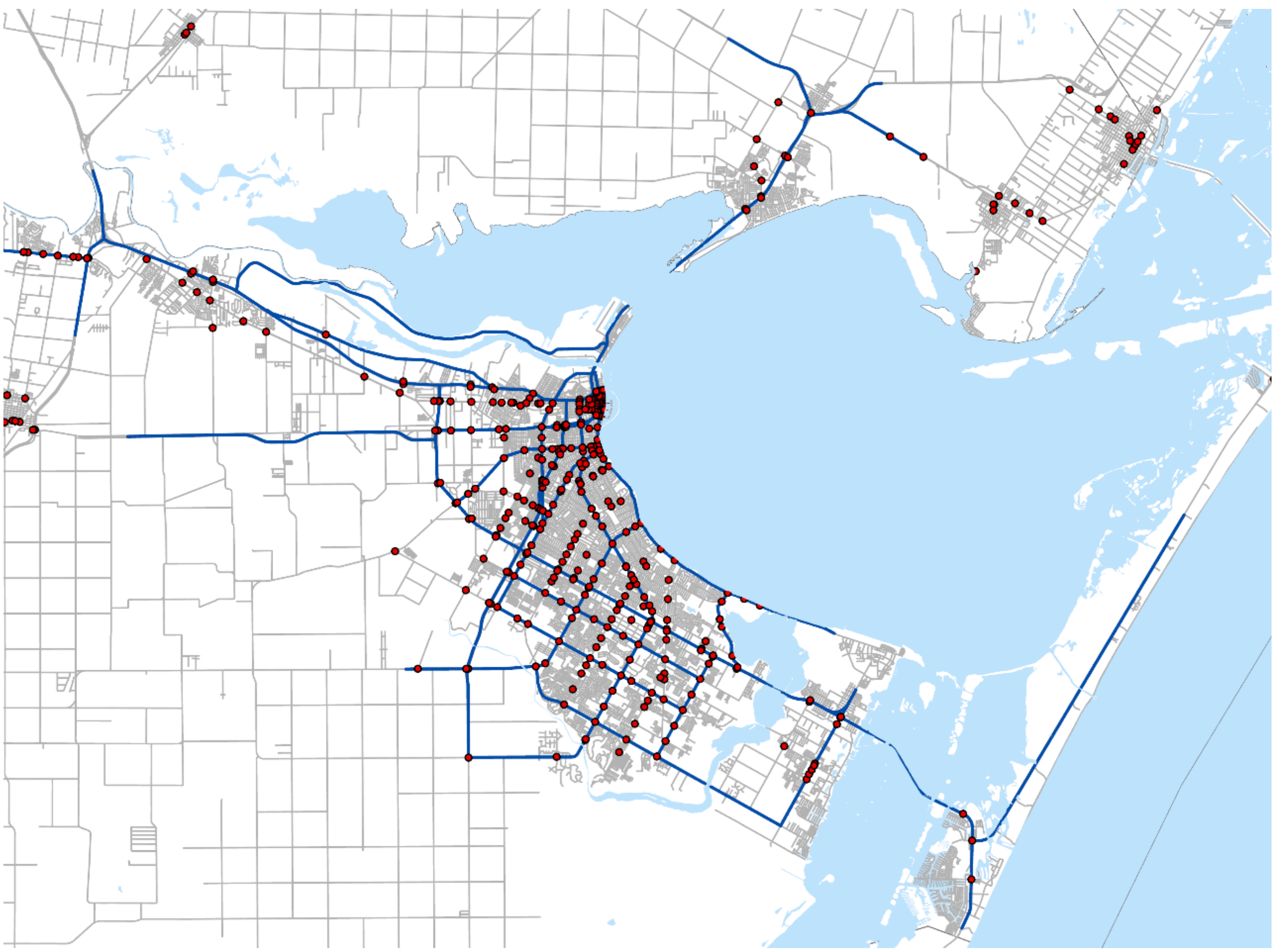
Signals in modern cities are timed using optimization models that analyze factors including traffic volume and speed to safely get as many vehicles as possible through intersections. Researchers have collected data and run computer simulations to determine that adjusting the signals at intersections in bad weather could reduce delays by up to 20 percent. New innovations include adaptive signal control systems that are capable of adjusting signal timing in response to real time changes in vehicle demand.

Careful consideration of the likely impacts of intersection improvements on pedestrians, cyclists and adjacent land uses before finalizing design helps meet mobility and accessibility goals for all modes of transportation.

Exhibit 8-18. Table of Intersection LOS Description

LOS A	Describes operations with low delay, which is described as 10 sec/vehicle or less. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all.
LOS B	Describes operations with delays greater than 10 and up to 20 sec/vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.
LOS C	Describes operations with average delay of vehicles entering the intersection greater than 20 and up to 35 sec/ vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many vehicles pass through the intersections without stopping.
LOS D	Describes operations with delay greater than 35 sec/vehicle and up to 55 sec/vehicle. Congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths and high v/c ratios. Many vehicles stop and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
LOS E	Describes conditions with delay greater than 55 sec/ vehicle and up to 80 sec/vehicle. These higher delays indicate poor progression, long cycle lengths and high V/C ratios. Individual cycle failures are frequent.
LOS F	Describes operations with a control delay in excess of 80 sec/vehicle. This level considered unacceptable to most drivers, one occurs with over saturation, that is, when arrival flow rates exceed the capacity of the lane groups. It may also occur at high V/C ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

Exhibit 8-19. Map of Signalized Intersections



DATA ANALYSES AND SYSTEMATIC REPORTING

To describe congestion conditions and trends systemwide, the collected data are analyzed, and the outputs are summarized using informative graphics, including pictograms, maps, tables, and other charts. A key effort to upgrading the Corpus Christi MPO's regional and corridor modelling capabilities is to efficiently and effectively take advantage of new technologies and data sources. This will also facilitate data visualization and improve the resolution of analyses.

Recurring congestion performance measures:

- Travel time index and comparison result against baseline conditions on all corridors.
- Truck Travel Time Index on designated freight routes.
- Planning Time Index on all CMP Corridors.
- V/C ratio and comparison against baseline conditions.
- Level-of-Service (LOS) analyses for both intersections and corridors.
- Transit route/frequency, ridership, and peak-hour passenger/seat ratio.
- LOS Scores for pedestrian, bicycle, and transit modes.

Nonrecurring congestion performance measures:

- High crash intersections by crash rate, the number of crashes, and incident severity.
- High crash corridors by crash rate, the number of crashes, and incident severity.
- Future planned utility and roadway maintenance locations that are coordinated among jurisdictions.

Part of the TIP update process and performance-based planning and programing reporting process, the regional data are examined, and locations identified as problematic are examined in more detail. For the motorized traffic congestion analysis, a weighted ranking system is applied to the existing and projected congestion measures. The TTI, Estimated Time of Completion severity of existing congestion is 80% of weight and the severity of projected congestion with financially committed improvements is 20% of weight in the rank system.

Once the congested corridors and locations are ranked, the top 13 ranked areas are reported for problem identification, strategy review and project prioritization. The high crash intersections and corridors for nonrecurring congestion are also ranked and reported for identifying the cause of problems. The performance measurement in the area of pedestrian & bicycle, transit, freight, and security will be analyzed independently. It is preferable that a single report for all measures is developed.

Intelligent Transportation Systems (ITS) is a combination of data and communication technologies that are used by transportation and traffic management systems to improve the safety and efficiency of transportation networks, to reduce traffic congestion and to enhance drivers' experiences. The Corpus Christi MPO will complete an ITS master plan in 2024 with TxDOT and update the regional ITS architecture.

ADOPTED CONGESTION AND SYSTEM MANAGEMENT GOALS AND PERFORMANCE MEASURES

The Corpus Christi MPO adopted Congestion and System Management Goals are continued from the previous 1-3:

4. Significantly reduce traffic fatalities and serious injuries on all public roads.
5. Reduce congestion on Regionally Significant Corridors.
6. Efficiently invest in and operate the surface transportation system.
7. Improve regional freight transportation facility performance.

Recurring congestion performance measures for the CMP are identical to the performance measures for the MTP:

- Travel time index and comparison result against baseline conditions on all corridors.
- Truck Travel Time Index on designated freight routes.
- Planning Time Index on all CMP Corridors.
- V/C ratio and comparison against baseline conditions.
- Level-of-Service (LOS) analyses for both intersections and corridors.
- Transit route/frequency, ridership, and peak-hour passenger/seat ratio.
- LOS Scores for pedestrian, bicycle, and transit modes (Multi-Modal Level of Service).

Nonrecurring congestion performance measures for the CMP are identical to those on the MTP:

- High crash intersections by crash rate, the number of crashes, and incident severity.
- High crash corridors by crash rate, the number of crashes, and incident severity.
- Future planned utility and roadway maintenance locations that are coordinated among jurisdictions.

The approved performance measurement of real-world data will establish a baseline and on-going remeasurement will show changes over time to regional and corridor conditions. This will reveal the impact that the chosen projects and policies have had on the system. Corpus Christi MPO has access to the following data sources:

- National Performance Management Research Data Set (NPMRDS).
- Congestion Management Process Assessment Tool (COMPAT)
- Texas Department of Transportation Statewide Traffic Analysis Reporting System (STARS II).
- Crash Records Information System (C.R.I.S)
- Corpus Christi MPO Regional Modelling System

This data can be supplemented as needed using direct collection or by purchasing from data compilation companies.

REGIONAL PREFORMANCE MEASURES

According to the 2023 Urban Mobility Report from the Texas A&M Transportation Institute, the average auto commuter in the Corpus Christi MPO spent an extra 36 hours per year commuting to and from work due to congestion. This ranks 98th in the United States for average levels of congestion and costs the average Corpus Christi MPO area commuter an extra $648 per year. The average for metropolitan areas similar to Corpus Christi (between 200,000 and 500,000 in population) was 36.4 hours of delay per auto commuter.

THE MOST CONGESTED ROADWAYS IN TEXAS – CORPUS CHRISTI

Currently, there are no roadways within the Corpus Christi MPO area listed in the Texas' 100 Most Congested Roadways for 2022. TTI's full list of congested roads in the Corpus Christi MPO area are shown in Exhibit 8-21. All of the roadways listed in Exhibit 8-21 were examined and incorporated into the development of the Corpus Christi MPO's CMP network of Regionally Significant Corridors (RSC) where appropriate.

Exhibit 8-21 Table of Most Congested Roadways in Corpus Christi MPO

RSC ID	Rank	Road Name	From	To	Delay/ Mile	CSI	PTI (95th%)	Annual Congestion Cost
041-043	155	S Staples St	S Padre Island Dr / SH 358	Yorktown Blvd	88,022	1.20	1.36	$7,769,686
019-021, 029, 030	213	Saratoga Blvd / Rodd Field Rd	Greenwood Dr	S Padre Island Dr	69,951	1.28	1.47	$15,917,447
N/A	271	Airline Rd	Ocean Dr	Rodd Field Rd	61,011	1.26	1.44	$8,320,719
024-028	281	Weber Rd / FM 43	Ocean Dr	Aaron Dr	59,742	1.24	1.39	$7,769,939
N/A	311	Kostoryz Rd	Brawner Pkwy	Holly Rd	55,585	1.25	1.39	$2,754,308
064	371	Northwest Rd	Ware Rd	US 77	50,024	1.18	1.31	$3,631,088
035-040	377	N Staples St / S Staples St	IH 37	S Padre Island Dr / SH 358	49,123	1.25	1.43	$8,810,770
N/A	388	Everhart Rd	S Alameda St	Yorktown Blvd	48,480	1.18	1.30	$5,941,047
N/A	421	Cimarron Blvd	Airline Rd	Lens Dr	45,341	1.23	1.34	$3,955,127
084, 085	592	Waldron Rd	SH 22	Yorktown Blvd	34,644	1.25	1.44	$3,327,589
016-018	920	Holly Rd	SH 286	SH 357	21,463	1.11	1.18	$3,577,271
N/A	954	Horne Rd	Greenwood Dr	Kostoryz Rd	20,504	1.11	1.18	$1,105,812
N/A	1065	S Alamenda St	Doddridge St	SH 3 Spur	17,552	1.11	1.21	$1,773,616
N/A	1123	Baldwin Blvd	Leopard St	S Staples St	16,238	1.10	1.20	$1,733,533
031	1265	Ennis Josline Rd	Sand Dollar Dr	SH 358	13,097	1.04	1.09	$1,224,417
081, 082, 083	1300	Yorktown Blvd	FM 43	Roscher Rd	12,273	1.09	1.16	$2,275,479

Exhibit 8-21 Table of Most Congested Roadways in Corpus Christi MPO (continued)

014, 032-034	1343	S Padre Island Dr	Waldron Rd	Viento del Mar Dr	11,622	1.03	1.05	$2,387,602
005	1405	IH 37	N Padre Island Dr / SH 358	Carrizo St	10,474	1.02	1.04	$1,199,303
070-071	1428	Ocean Dr	Morgan Ave	Ennis Joslin Rd	9,954	1.04	1.08	$1,689,233
063	1430	Crosstown Expy / SH 286	IH 37	Greenwood Dr	9,895	1.01	1.02	$1,832,850
N/A	1453	Violet Rd	IH 37	CR 44	9,531	1.06	1.14	$1,014,821
008, 009	1463	US 181 / SH 35	E 4th St / SH 202	Moore Ave	9,341	1.03	1.06	$1,409,605
N/A	1475	Leopard St	FM 1694	FM 24	9,187	1.05	1.09	$347,277
N/A	1486	Road Morgan Rd	IH 37	McNorton Rd	9,050	1.10	1.26	$399,063
N/A	1510	Flour Bluff Dr	SH 358	Caribbean Dr	8,586	1.08	1.16	$641,577
045, 046	1566	S Staples St	Chapman Ranch Rd	Yorktown Blvd	7,377	1.06	1.09	$804,447
009	1586	SH 361	SH 35	Main St	7,038	1.05	1.11	$1,041,980
046-050	1592	Old Brownsville Rd / Morgan Ave	Saratoga Blvd / SH 357	Ocean Dr	6,943	1.05	1.10	$1,382,628
058, 059A, 059B, 060A, 060B, 075A, 075B	1594	Agent St / SS 544	N Padre Island Dr / SH 358	Kinney St	6,897	1.04	1.11	$1,069,346
N/A	1663	Main St	Business SH 35	8th St	5,673	1.06	1.11	$767,509
006, 007	1681	US 181 / SH 35 / Harbor Bridge	Carrizo St	Moore Ave	5,259	1.01	1.02	$1,172,787
012-014	1706	S Padre Island Dr / SH 358	Crosstown Expy / SH 286	Waldron Rd	4,646	1.01	1.02	$1,308,536
061, 062	1783	Chapman Ranch Rd	Ayers St	S Staples St	3,449	1.04	1.08	$309,603
N/A	1788	McKinzie Rd / FM 3386	IH 37	SH 44	3,280	1.04	1.09	$464,298
011	1814	Padre Island Dr / SH 358	IH 37	Crosstown Expy / SH 286	3,035	1.01	1.02	$585,207
004	1951	IH 37	Rand Morgan Rd / FM 2292	N Padre Island Dr / SH 358	993	1.00	1.01	$166,688
001	1961	IH 69E / US 77	IH 37	SH 44	926	1.01	1.02	$221,537
003, 004	1980	IH 37	US 77	Rand Morgan Rd / FM 2292	712	1.00	1.01	$227,224
057	2011	Agnes St / SH 44	FM 3386	Padre Island Dr / SH 358	461	1.00	1.01	$123,665

CONNECTED AND AUTONOMOUS VEHICLES

Connected and automated vehicle technology (CAV) is a rapidly growing part of everyday transportation. Autonomous Vehicles (AVs) are typically equipped with an array of sensors and cameras including light detecting and ranging (LiDAR) systems, laser, ultrasonic, and radar sensors that enable perception of the roadway and ambient conditions. These systems support Advanced Driver Assistance Systems (ADAS) technologies and work together to provide assisted and automated driving functions. While it will be years before the majority of vehicles on the road are fully autonomous, it will occur before the end year of this 2045 MTP Update. Most new vehicles today include some level of autonomous technology and the National Highway Traffic Safety Administration (NHTSA) has begun the rulemaking process that could lead to CAV technology being mandated in new vehicles by 2023. These technological advancements in CAV could rapidly improve roadway safety, transportation efficiency, and to change the way we organize our cities and transportation networks.

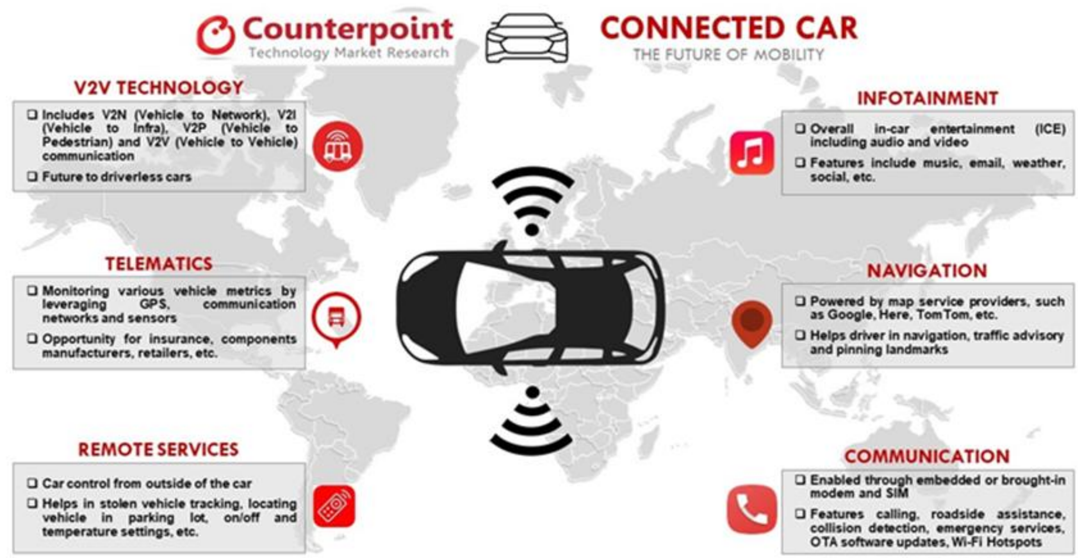
As stated in the USDOT CAV Basics report, connected vehicles are vehicles of all types that have technology to "…enable cars, buses, trucks, trains, roads and other infrastructure, and our smartphones and other devices to 'talk' to one another. Cars on the highway, for example, would use short-range radio signals to communicate with each other so every vehicle on the road would be aware of where other nearby vehicles are. Drivers would receive notifications and alerts of dangerous situations, such as someone about to run a red light as they're nearing an intersection or an oncoming car, out of sight beyond a curve, swerving into their lane to avoid an object on the road."

There is national consensus that accommodating CAV's requires placing considerable emphasis on maintaining a state of good repair for existing infrastructure, including accurate and visible signage, striping and crosswalks, and pavement in good condition. The research and development of autonomous vehicles is not assuming a transportation system that looks vastly different from existing conditions and improving these conditions benefits both autonomous vehicles and non-motorized users.

Prior to adoption of the 2050 MTP the Corpus Christi MPO staff will undertake a regional effort to examine CAV issues and suggest a policy framework to maximize opportunities and minimize negative impacts of these new and potentially disruptive transportation technologies upon the region. It is important that this CAV planning and policy initiative has broad participation from various interests and decision-makers, including the state, local governments, chambers of commerce, economic development agencies, educational and research institutions, trade associations, major employers, transportation authorities and leaders in innovation and entrepreneurship. It is also important to engage a broad cross-section of stakeholders who are already working together on related initiatives and plans within the Corpus Christi MPO.

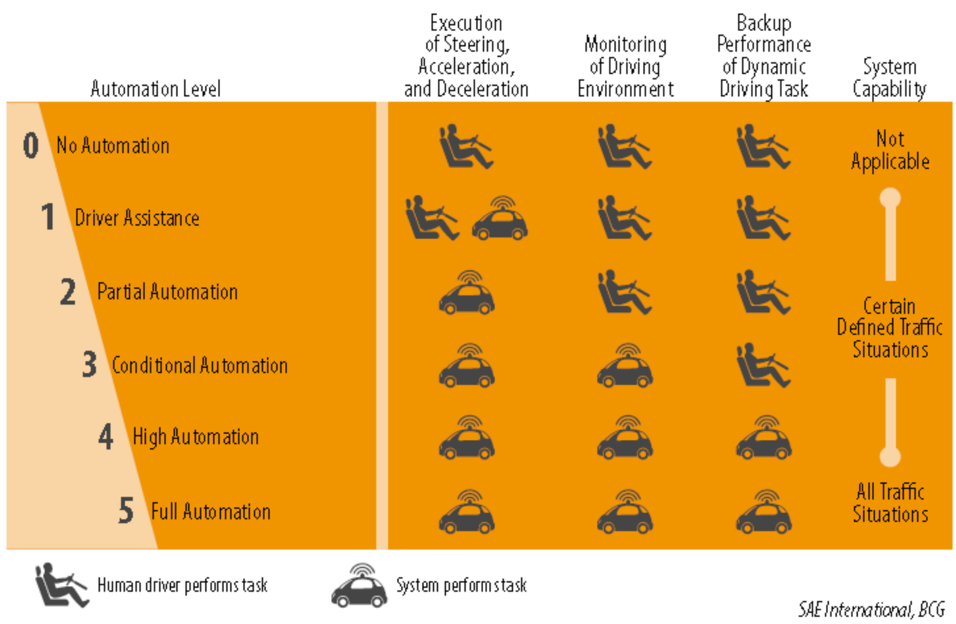
Connected Vehicles (CV) and Infrastructure (V2X) are vehicles equipped with technology that allows the vehicle to communicate with each other and road infrastructure to share real-time transportation information between systems.

Exhibit 8-22. Illustration of Connected Vehicles



Autonomous Vehicles (AV) perform a driving function, with or without a human actively monitoring the driving environment. Current levels of automation can span from "assisted" driving to "full automation." We are now between level 2 and 3.

Exhibit 8-23. Illustration of Levels of Vehicle Automation



A generally accepted estimate of adoption of this technology is that Level 4 AVs will drive 10% of all miles nationwide by 2030 and at least half of all miles by 2050. Level 4 automation includes automated driving features that do not require human support in limited situations. Level 5 automation does not require human support and can operate as such under all conditions. The following factors could spur or slow the rate of adoption:

- Technology: Platooning and other technologies may allow C/AVs to use road space more efficiently, as would reducing road closures due to traffic accidents. SAE Level 4 vehicles are currently being publicly tested and are expected to be ready for commercial use between 2020-22. It remains unclear what range of environments & conditions a Level 4 vehicle will capable of driving in at that time, and there is no consensus timeline for when Level 5 automation will be ready.
- Legal Environment: C/AV developers, all levels of government, the insurance industry, and many other partners must coordinate to ensure safety while promoting innovation. Some delays are likely.
- Shared Mobility: Many analysts see C/AV adoption linked to a rise in shared mobility companies like Uber or Lyft taking the place of privately- owned cars for some households, but this new business model is untested. The success of these companies affects both the AV adoption rate and its impacts on cities.
- Public Enthusiasm: As the graphs below show, much of the public is currently skeptical of C/AV technology. Ultimately C/AV adoption will be driven by perceptions of safety, reliability, and need.

The IIJA increased the FAST Act provision of greater latitude for MPO investment into ITS infrastructure, implementing new CV infrastructure, and testing of C/AV vehicles. The National V2X Plan's safety and congestion benefits from C/AV technology are most concentrated when C/AVs are separated from human-driven vehicles.

IMPLEMENTATION PROGRAM

The Corpus Christi MPO, as the Metropolitan Planning Organization for the Corpus Christi metropolitan area, recognizes that implementation of the majority of congestion management strategies must rest with local operating agencies. In fact, most actions are initiated and implemented without the involvement of the MPO. However, coordinating these efforts among agencies in the region so that they reinforce one another and are aimed toward the resolution of regional problems will yield more benefit than individual implementation.

The Corpus Christi MPO and associated local governments in the metropolitan planning area will participate in the identification of activities to address congestion problems on individual facilities through established planning processes: the Metropolitan Transportation Plan, the Unified Transportation Program, the Transportation Improvement Program, and congested-corridor studies. The RSCs are profiled with the relevant "action packages" and responsible parties and can be viewed at the end of the chapter. Through the metropolitan transportation planning process, the Corpus Christi MPO will continue refining congestion performance measures, collecting data, and identifying needs.

Other Proposed Actions

- Institute a Congestion Management Committee (CMC) to coordinate activities and provide advice to TAC and the TPC.
- Update the Regional ITS Architecture Plan/Create a Regional Smart Mobility Plan.
- Develop and Implement a Regional Incident Management Process.

TSMO addresses safety, security, mobility, recurring and nonrecurring congestion, and other issues, resulting in a mix of infrastructure and operational strategies founded on measurable, performance-based regional-operations objectives. The Corpus Christi MPO agencies will improve system performance and reduce congestion using an objective-driven and performance-based transportation- planning processes that deliberately implement TSMO strategies.

Unless otherwise noted, the CMP strategies and their benefits have NOT been applied to corridors in the future year networks. The applicability and benefit of each of these strategies for each corridor will be evaluated during future life-cycle investment needs and project identification processes. Fiscally constrained projects adding additional travel were coded into the Travel Model and the resulting level of services was identified.