Corpus Christi Metropolitan Planning Organization

REGIONAL SAFETY ACTION PLAN

OCTOBER 2024

CORPUS CHRISTI MPO
METROPOLITAN PLANNING ORGANIZATION

Approved by the Corpus Christi MPO Transportation Policy Committee on October 3, 2024

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DiExSys
Road Safety Analytics

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Chapter One
INTRODUCTION

NEED AND PURPOSE

Each year, there are more than 40,000 traffic related deaths in the United States. In 2022, there were 4,481 fatalities and 15,299 serious injury crashes in Texas alone. Between 2016 and 2022, the Corpus Christi Metropolitan Planning Organization (Corpus Christi MPO) area experienced over 74,057 crashes, of which 1,760 resulted in a serious injury or death. These serious injuries and deaths are often called "accidents," but with the proper planning, design, construction, and implementation, they can be prevented.

As the federally designated Metropolitan Planning Organization (MPO) for the Corpus Christi area, the Corpus Christi MPO is responsible for coordinating regional transportation planning initiatives. In this role, the MPO is positioned to advise and educate its member communities on all transportation topics, including how to address traffic-related deaths and serious injuries.

Implementing this plan is one step towards reaching the Corpus Christi MPO Safety (PM1) Performance Measure adopted goals and targets to significantly reduce traffic fatalities and serious injuries on all public roads. Work towards this goal, and ultimately zero fatalities and serious injuries, will take a collected effort from the region and local partners.

The Corpus Christi MPO prepared this Regional Safety Action Plan (RSAP) to provide local context and recommendations that support the state of Texas' Highway Safety Improvement Program (HSIP) and the State Highway Safety Plan (SHSP). The safety planning process acknowledges that there are many factors that contribute to safe mobility – including the design of the roadways, the speed of travel, enforcement of traffic laws, behavior of travelers, technology, and policies. This RSAP sets clear strategies to achieve the shared goal of zero fatalities and serious injuries. Interventions may include any combination of education, enforcement, engineering and new policies to target the eight region-specific emphasis areas, shown in Exhibit 1, *Figure of Emphasis Areas,* anticipated to have the highest impact on reducing traffic fatalities and serious injuries.

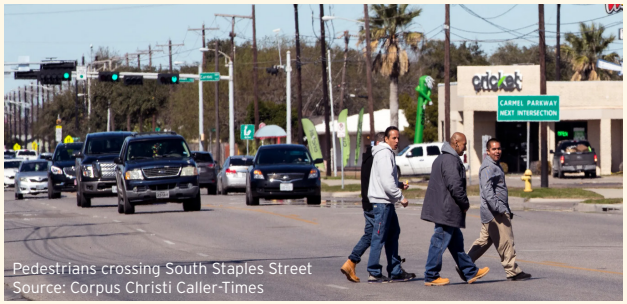
Exhibit 1, Figure of Emphasis Areas

Source: 2023 TxDOT Highway Safety Improvement Program Guidelines

Why Plan Now?

The 2022 *Dangerous by Design* report published by Smart Growth America and the National Complete Streets Coalition highlights an ongoing problem for residents who walk or bicycle on our roadways. According to the report, the State of Texas was ranked 12th for overall pedestrian and bicyclist fatality rates. In the Corpus Christi area, from January 1, 2016 to December 31, 2022, there have been nearly 1,500 crashes involving a pedestrian or bicyclist, 308 of which resulted in a fatality or serious injury. Action must be taken to address these issues to create a safer environment for those who live, work, and play in the Corpus Christi MPO Study Area.

The challenge of bicycle and pedestrian safety is a multi-faceted problem that cannot be solved by funding, design, or paradigm shifts alone. A more comprehensive approach including more enhanced facilities, enforcement, and education is required. This plan builds on existing policies and goals set by partner agencies, such as TxDOT's Road to Zero, to support the recent push to reduce deaths and serious injuries using more than engineering solutions alone. The goal of a Safety Action Plan is to recommend safety countermeasures, infrastructure- and non-infrastructure-related, and identify hotspots for pedestrian and bicycle crashes throughout the Study Area to help reduce the severity and number of crashes.



Pedestrians crossing South Staples Street
Source: Corpus Christi Caller-Times

THE SAFE SYSTEM APPROACH

This Regional Safety Action Plan is designed to supplement and support the Regional Safe System Plan that is being developed as part of the 2050 Metropolitan Transportation Plan (2050 MTP). In an effort to eliminate roadway fatalities and serious injuries, the Federal Highway Administration (FHWA) enacted the Safe Systems Approach. The Safe Systems Approach anticipates that humans make mistakes and provides proven countermeasures that lower the chance of errors and fatal outcomes. The approach is based on a series of principles that set the tone for understanding safety on the roadway including:

Death/Serious Injury is Unacceptable

While no crashes are desirable, the Safe System approach prioritizes crashes that result in death and serious injuries, since no one should experience either when using the transportation system.

Humans Make Mistakes

People will inevitably make mistakes that lead to crashes, but the transportation system can be designed and operated to accommodate human mistakes and injury tolerances and avoid death and serious injuries.

Humans Are Vulnerable

People have limits for tolerating crash forces before death and serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and accommodates human vulnerabilities.

Responsibility is Shared

All stakeholders (transportation system users and managers, vehicle manufacturers, etc.) must ensure that crashes don't lead to fatal or serious injuries.

Safety is Proactive

Proactive tools should be used to identify and mitigate latent risks in the transportation system, rather than waiting for crashes to occur and reacting afterwards.

Redundancy is Crucial

Reducing risks requires that all parts of the transportation system are strengthened, so that if one part fails, the other parts still protect people.

Through holistic planning and coordination of the five elements below, the transportation system can be designed to accommodate and mitigate human mistakes and injury tolerance.

Safe Road Users - The Safe System approach addresses the safety of all road users, including those who walk, bike, drive, ride transit, and travel by other modes.

Safe Vehicles - Vehicles are designed and regulated to minimize the occurrence and severity of collisions using safety measures that incorporate the latest technology.

Safe Speeds - Humans are unlikely to survive high-speed crashes. Reducing speeds can accommodate human injury tolerances in three ways: reducing impact forces, providing additional time for drivers to stop, and improving visibility.

Safe Roads - Designing to accommodate human mistakes and injury tolerances can greatly reduce the severity of crashes that do occur. Examples include physically separating people traveling at different speeds, providing dedicated times for different users to move through a space, and alterting users to hazards and other road users.

Post-Crash Care - When a person is injured in a collision, they rely on emergency first responders to quickly locate them, stabilize their injury, and transport them to medical facilities. Post-crash care also includes forensic analysis at the crash site, traffic incident management, and other activities.

Source: FHWA.

PREVIOUS PLANS AND STUDIES

The process of reviewing previous studies is an important part of the data collection phase and helps to determine opportunities for coordination and implementation. Information gathered from previous studies can inform the project team and prevent duplication of efforts. The following section contains information in the form of summaries as they relate to the Corpus Christi MPO Study Area. The purpose of this overview is to provide a high-level review of the information provided in each study to utilize as a quick reference.

Corpus Christi MPO: Metropolitan Transportation Plan (2045)

The Metropolitan Transportation Plan (MTP) is a regional roadmap for the next 25 years. This long-range transportation plan is required to comply with federal and state laws for regional and statewide planning, for the region to be eligible for federal transportation funding. The primary purpose of the plan is to develop a strategy for the best use of public funds in achieving community goals.

This plan details eight regional goals as they relate to transportation, including the goal to "significantly reduce traffic fatalities and serious injuries on all public roads." The 2045 MTP dives into this through the Regional Safe System chapter, in which it provides a background on safety in the region and state, provides a variety of safety planning approaches, and presents data, trends and analysis of traffic crashes in the region and recommendations to reduce fatalities and serious injuries.

Texas Strategic Highway Safety Plan (2022)

This statewide safety plan strives towards zero traffic fatalities and serious injuries on Texas roadways. TxDOT's safety targets are to reduce fatalities to approximately 1,800 per year in Year 2035 and to 0 fatalities in Year 2050. The plan explores a comprehensive approach to engage all disciplines of roadway planning, construction, and maintenance to prevent crashes and reduce their severity. The targets in this plan are aligned with the Road-to-Zero (RTZ) direction by the Texas Transportation Commission.

Corpus Christi MPO: Congestion Management Process (2020)

The Congestion Management Process (CMP) is a federally required effort for metropolitan areas that are designated as Transportation Management Areas (TMAs), such as the Corpus Christi MPO. The CMP identifies key routes, determines what is recurring and non-recurring congestion, and uses goals and performance measures to identify congestion hotspots along the corridors of concern. The plan then provides a toolbox of possible policies or projects to improve travel within each corridor. The process sets goals that affect regional safety, such as the desire to reduce vehicle miles traveled and install commuter and transit-based programs.

City of Corpus Christi: Plan CC, Comprehensive Plan (2016)

This Comprehensive Plan creates a 20-year policy and strategic framework for the entire city. The plan sets goals, policies, strategies, and implementation actions to guide Corpus Christi for future development and growth. While the plan covers an assortment of topics, it explores transportation and mobility in the City in depth. The plan presents the goal to ensure "Corpus Christi's street system is designed, constructed, and maintained to standards for long-term effective and safe use."

In addition to the citywide comprehensive plan, the City of Corpus Christi has also completed several Area Development Plans (ADPs) that provide specific recommendations concerning future land use, transportation, public services, and environmental protection. Implementation of these projects should help address various safety concerns along Corpus Christi MPO Study Area roadways.

Corpus Christi MPO: Strategic Plan for Active Mobility, Bicycle Mobility Plan (2016)

This plan is intended to foster an environment that is safe and comfortable for bicyclists in the Corpus Christi and Portland area. The plan provides an overview of the existing conditions for bicyclists in the region and future strategies to expand the network. A key goal examined in the plan is to "enhance safety for bicyclists." The plan explores this goal through presenting design of safe facilities, best practices in implementation, case studies, and policies and programs that benefit bicyclists.

PLANNING PROCESS

This plan was a collaborative effort with the Corpus Christi MPO Regional Traffic Safety Task Force and other regional safety partners. This Regional Safety Action Plan is a precursor to the Safe Systems Plan and will provide local context and recommendations that support the state of Texas' Highway Safety Improvement Program (HSIP) and the State Highway Safety Plan (SHSP).
This plan is based on an integrated performance-based planning approach that provides:

- A data-driven determination of priority safety issues
- Goals to support a transportation safety culture
- Multidisciplinary safety solutions to reduce fatal and severe injury crashes

As shown in Exhibit 2, *Map of Study Area,* the Corpus Christi MPO boundary encompasses the cities of Corpus Christi and Portland. However, for the purposes of this Safety Action Plan, the Corpus Christi MPO study area includes Nueces and San Patricio counties. Implementing projects and programs from this plan will take a coordinated effort between partner agencies and will lead to improved safety along the transportation network for residents and visitors.

GOAL & OBJECTIVES

The Regional Safety Action Plan aligns with TxDOT's target of reducing crashes resulting in fatalities and serious injuries by 50 percent by 2035 and zero fatalities by 2050. Additionally, the Regional Safety Action Plan advances the following safety goal and objectives established by the Corpus Christi MPO as part of the 2050 MTP.

2050 MTP Safety Goal

Eliminate fatalities, reduce serious injuries, and improve security of the transportation system using proven countermeasures, technology applications, policy adjustments, education, and other reasonable measures.

2050 MTP Safety Objectives

OBJECTIVE 1: By 2028, achieve a 5% reduction in fatalities and serious injuries compared to the 2023 5-year baseline. By 2034, achieve a 50% reduction in fatalities and serious injuries compared to the 2023 5-year baseline. By 2050, eliminate all traffic fatalities and reduce serious injuries by 50% compared to the 2023 5-year baseline.

OBJECTIVE 2: By 2028, the percentage of safety funding invested in reducing vulnerable road user (a vulnerable road user is a person walking, biking, or rolling) crashes will be proportionate to the previous 5-year average percentage of vulnerable road user fatal crashes in the region.

OBJECTIVE 3: By 2034, reduce the lane closure duration due to crashes by x% compared to the 2023 baseline. This can be accomplished both by reducing the number of crashes and reducing the average time each crash closes lanes (incident management).

OBJECTIVE 4: By 2028, all safety projects in the Corpus Christi metropolitan region that request federal funds are analyzed using crash diagnosis software that includes benefit cost analysis (BCA) and this information is reported to the Corpus Christi MPO Transportation Policy Committee (TPC).

OBJECTIVE 5: By 2028, utilize the AASHTO "Green Book" (version 8), TxDOT's Innovative Intersection Guidebook, and others such as NACTO's Urban Street Design Guide to update, and regularly review, local design and construction standards for federally classified roads that make streets more complete, more efficient, more safe, while reducing vulnerability to, and improving recovery from, stormwater runoff and extreme weather.

OBJECTIVE 24: By 2028, crash analysis in the region will focus on the designated High Injury Network (HIN) with investment into the HIN proportionate to the previous 5-year average percentage of fatal and severe injury crashes on the HIN.

Project Tasks

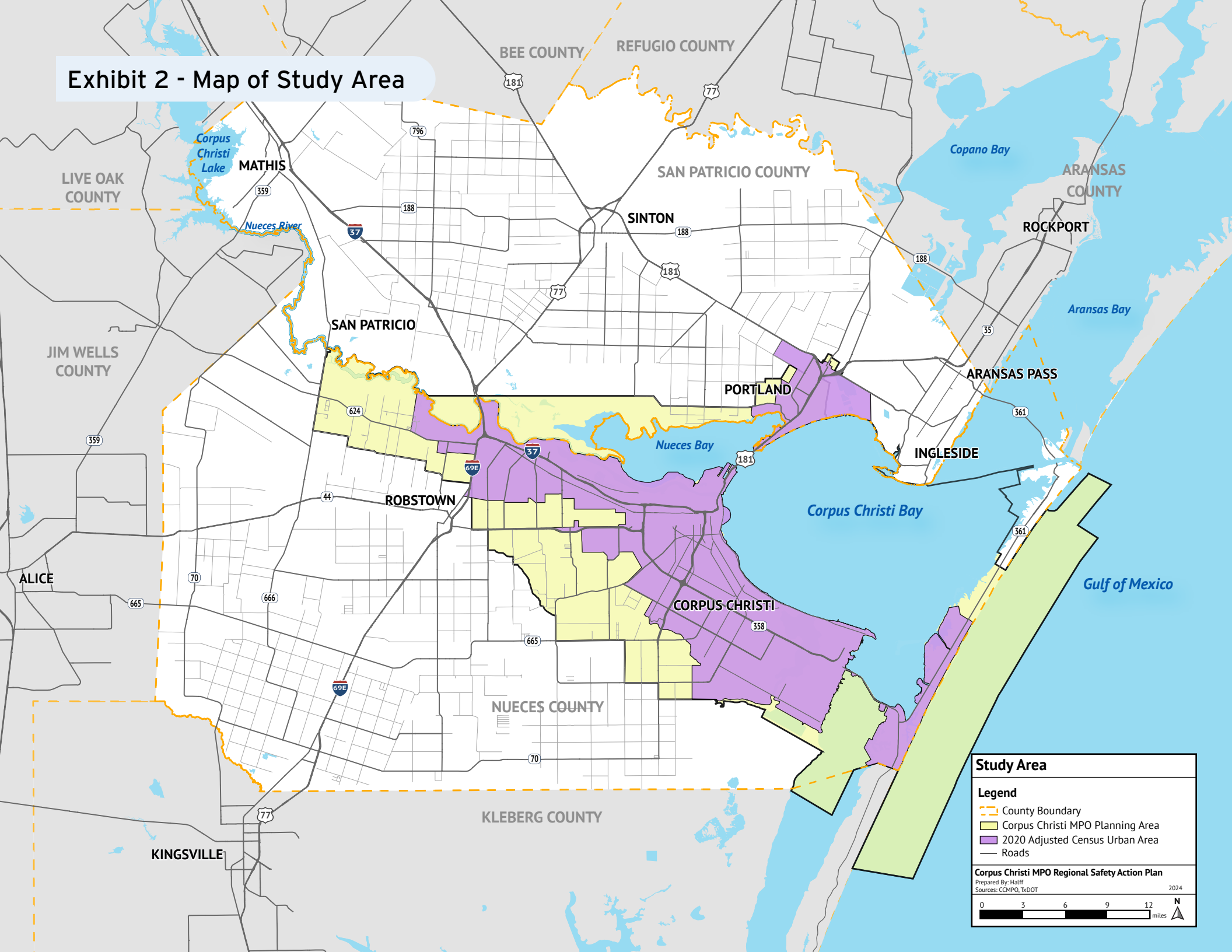
PROJECT INITIATION
- Initial Data Collection
- Regional Traffic Safety Task Force Outreach

PUBLIC ENGAGEMENT
- Regional Traffic Safety Task Force Outreach
- Focus Group Meetings
- Public Outreach

IDENTIFY AND ASSESS INTERVENTIONS
- Network Screening
- Emphasis Area Analysis
- Project Evaluation and Prioritization

STRATEGIES AND RECOMMENDATIONS
- Economic Evaluations
- Policies and Practices
- Review and Approval

Exhibit 2 - Map of Study Area



DEMOGRAPHICS

The demographics of the area have a direct influence on the transportation planning process. These demographics impact travel demand, travel patterns, and roadway safety. This section explores the demographic makeup of Nueces and San Patricio counties.

Population, Race, and Age

Use of the transportation system is directly linked to the population of the area. According to data published by Pew Research Center, Americans who are lower income, African American, Hispanic, or over 50 years of age are likely to rely on public transit, pedestrian, or bicycle infrastructure on a regular basis.[1]

According to the 2018–2022 American Community Survey (ACS) 5-Year Estimates data from the U.S. Census Bureau, there are approximately 422,187 residents in Nueces and San Patricio counties.

Understanding a community's racial and ethnic distribution helps the region ensure that all segments of the population are adequately represented and involved in the planning process and allows planners and policy makers to identify disparities in traffic crashes and fatalities in the area.

As shown in Exhibit 3, *Chart of Race*, nearly two-thirds of the population is white. Over 24 percent of the population is two or more races. The remaining ten percent of the population is Black or African American, Native American or Pacific Islander, or some other race. According to the ACS data, nearly two-thirds of the total population is Hispanic or Latino (64 percent). As shown in Exhibit 5, *Map of Population Density*, most of the population within the Corpus Christi MPO study area live in the City of Corpus Christi, with additional densities in the cities of Robstown and Portland.

As shown in Exhibit 4, *Chart of Age Breakdown*, one-quarter of the population is made up of school-aged children. Middle-aged adults between the ages of 45 and 64 account for almost one-quarter of the population. With a mix of young children and older adults, additional safety considerations must be made to accommodate these road users, as they may be more likely to rely on the pedestrian and bicycle networks in the Corpus Christi MPO study area than other age groups.

Commuting Characteristics

Within the Corpus Christi MPO study area, 188,768 people aged 16 and older are employed in the labor force. Of that, nearly 84 percent commute to work alone using a single-occupancy vehicle (SOV). Approximately 8 percent of workers carpool with more than one person and over one percent of workers in Nueces and San Patricio counties walk or ride a bicycle to work. The remaining workers take public transit, taxi, or work from home.

According to the ACS data, the average commute time for workers in the Corpus Christi MPO study area is 22 minutes. The U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) dataset states that over 50 percent of commutes are less than 10 miles. Due to this commute time and population / employment density being consolidated in several locations, there is an opportunity to improve walking and biking infrastructure as well as roadway network enhancements to provide safer travel alternatives.

1: American Trends Panel. Pew Research Center. 2016.

Exhibit 3, Chart of Race

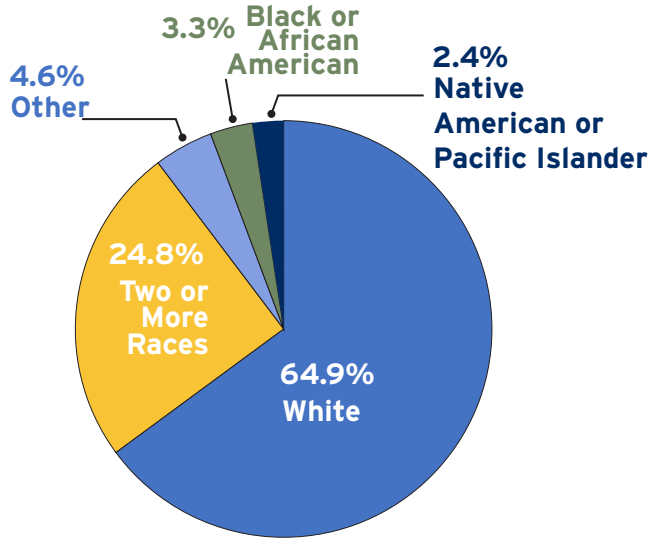


Exhibit 4, Chart of Age Breakdown

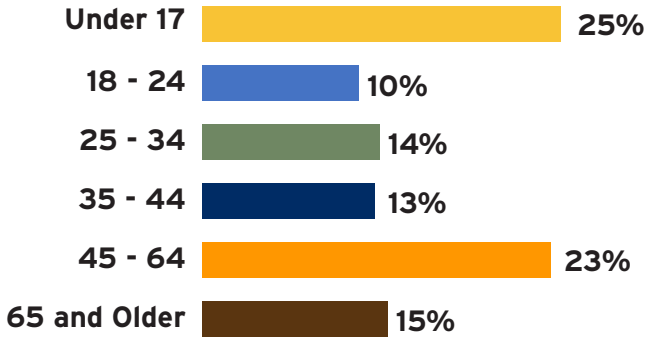
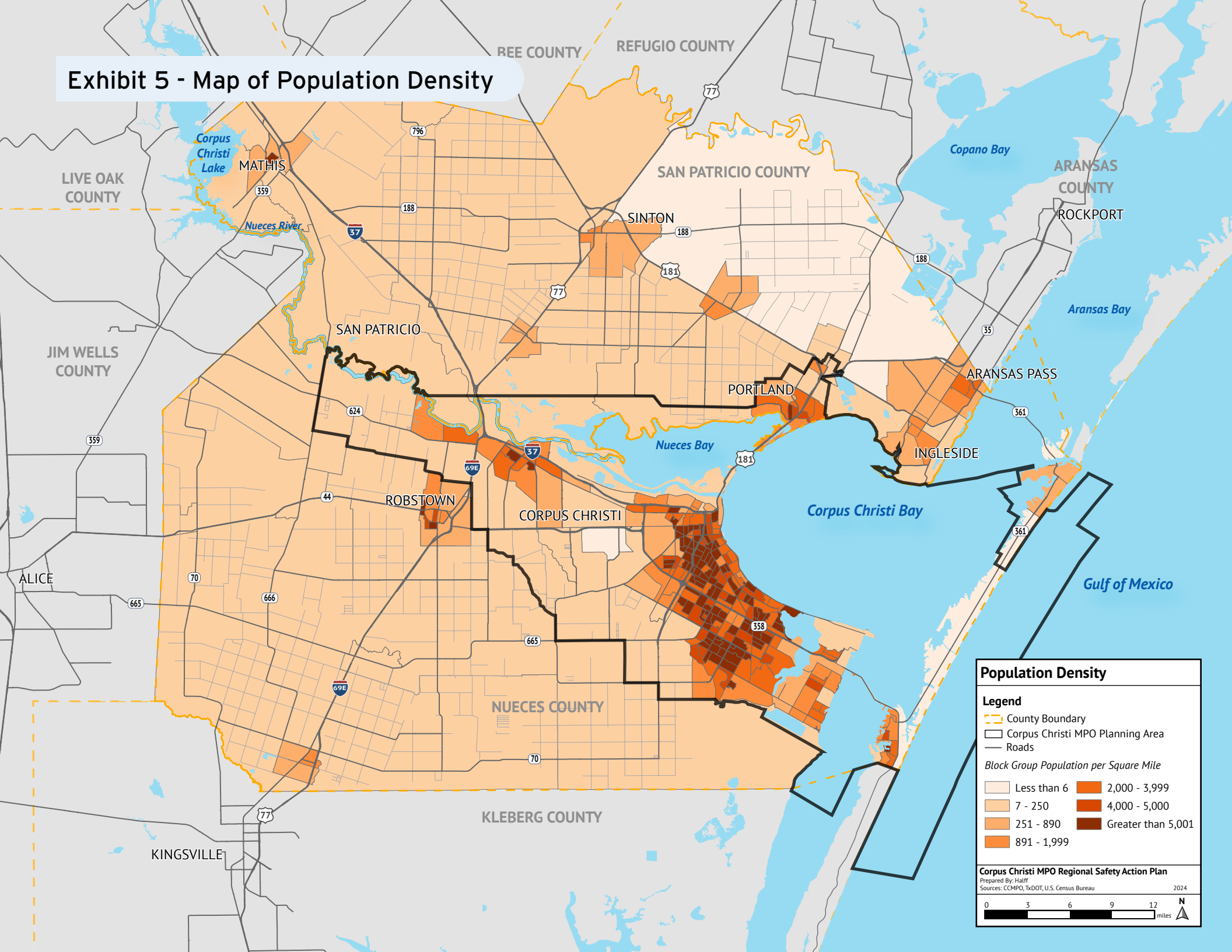


Exhibit 5 - Map of Population Density



Population Density

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- Roads

Block Group Population per Square Mile

Less than 6	2,000 - 3,999
7 - 250	4,000 - 5,000
251 - 890	Greater than 5,001
891 - 1,999	

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff

Sources: CCMPO, TxDOT, U.S. Census Bureau 2024

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Chapter Two
PUBLIC ENGAGEMENT

SAFETY PARTNERS

Overall guidance was provided by the Corpus Christi MPO Regional Traffic Safety Task Force (RTSTF). This group was part of the larger Joint Safety Task Force that included the TxDOT Wrong Way Driver Task Force. This group brings together safety, operations and planning professionals from transportation and transit agencies, local municipalities, and law enforcement to coordinate traffic management and safety activities in the Corpus Christi MPO region.

The Corpus Christi MPO is committed to support the Regional Safety Action Plan through effective engagement with partners, stakeholders, and the public. Without this strong connection to the community, the plan will not have the support to implement the recommended strategies and projects. Due to this desire for connection, several levels of outreach were implemented throughout the Regional Safety Action Plan development process. A summary of the outreach meetings and methods are summarized below.

RTSTF MEETINGS

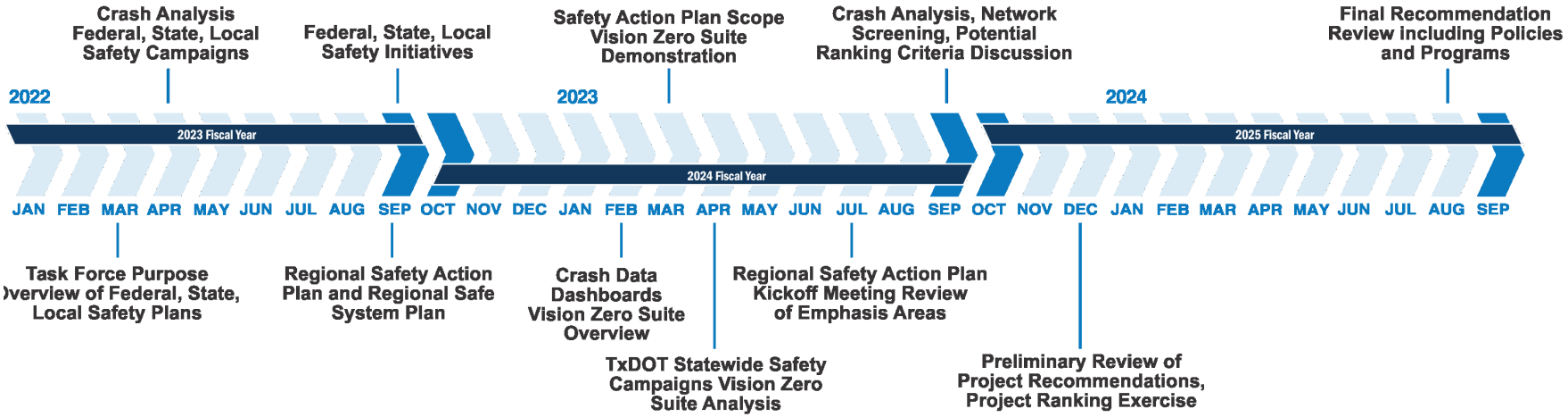
There were a series of RTSTF meetings conducted throughout this planning process. As discussed, the RTSTF members were inclusive of representatives from various local governments, including cities and counties, regional transit agencies, and TxDOT representatives as well as members of law enforcement, fire departments and emergency services. These meetings were held together with the TxDOT Wrong Way Driver Task Force which provided a different perspective on safety issues in the Corpus Christi MPO study area as well as increased knowledge of ongoing and upcoming strategies and efforts to reduce serious and fatal injury crashes throughout the Corpus Christi MPO Study Area.

The consultant team directly reached out to RTSTF members to confirm their response to project, policy and program recommendations. This included email transmittal and in-person meetings. Responses from these meetings included clarification regarding project funding, timeline for implementation, and coordination efforts.

Who are Stakeholders?

Stakeholders are individuals who have a vested interest in a particular policy, program, or project—in this case, roadway safety. Input gathered from stakeholders regarding the public's safety-oriented problems, needs, and opportunities helps shape the policies, practices, and procedures included in the Regional Safety Action Plan. Stakeholder involvement was solicited early and throughout the Regional Safety Action Plan development process with four Focus Group meetings. These focus group meetings were conducted with RTSTF members. In addition, an online survey was provided for the RTSTF members as well as two public surveys for additional input and feedback regarding safety concerns. Additional survey input was provided from concurrent planning studies being completed by the Corpus Christi MPO.

Exhibit 6, Figure of Meeting Timeline



COMMUNITY SURVEY

Corpus Christi MPO led public engagement efforts to gather feedback from community residents, local public agencies, first responders and tow truck drivers, advocacy organizations, and disadvantaged community residents. This included the use of an online community survey that began in February 2024. For the purposes of this effort, the consultant team retrieved responses as of April 30, 2024.

While there was one specific survey related to the Regional Safety Action Plan, Public Safety Survey, there were three additional surveys also being conducted by Corpus Christi MPO. These additional surveys provided additional input related to traffic safety concerns from residents through the Corpus Christi MPO Study area.

The following represents an overview of the responses from the Public Safety Survey along with additional survey responses from other surveys. A full list of responses is provided in *Appendix B, Community Engagement*.

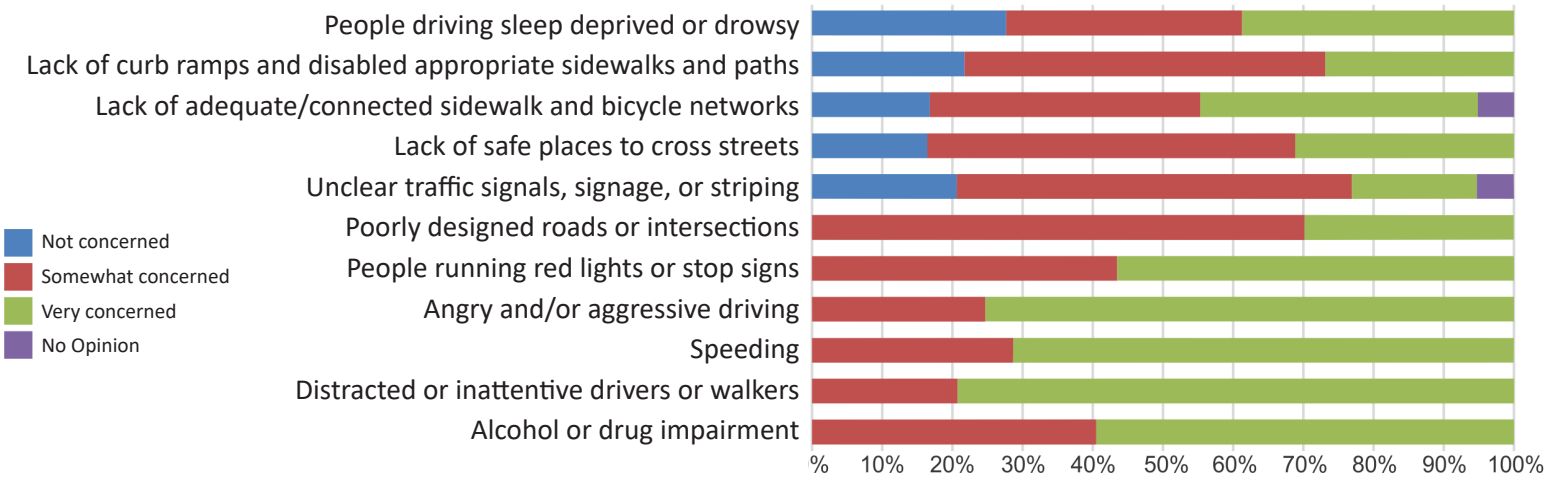
1 How safe do you feel while...

	Not At All Safe	Somewhat Unsafe	Somewhat Safe	Very Safe	Not Relevant to Me
Biking	31%	35%	21%	-	13%
Driving	3%	18%	57%	18%	4%
Taking Transit	28%	-	22%	-	51%
Walking	30%	37%	29%	4%	-

2 I would like to walk or bike to place more often but don't because...

- Distance (5)
- No Trails/Sidewalks (4)
- Speeding (3)

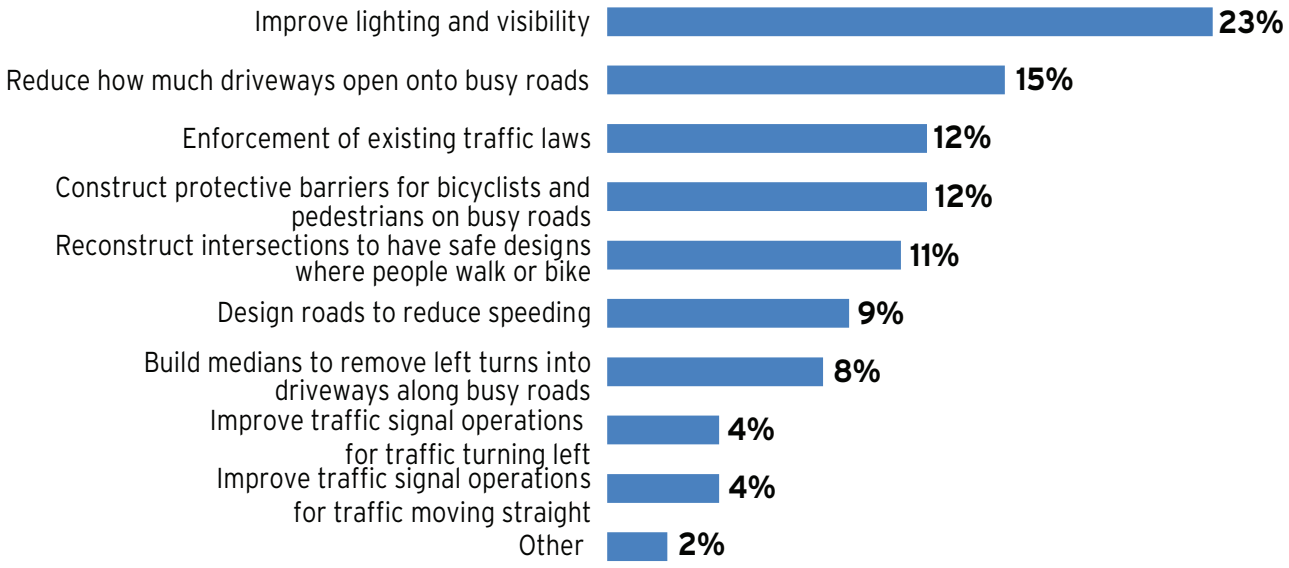
3 How concerned are you about the following factors causing traffic crashes?



4 How much do you agree with the following statements?

	Strongly Disagree	Slightly Disagree	Neutral	Slightly Agree	Strongly Agree
Reducing deaths and serious injuries is the highest priority transportation issue	4%	8%	19%	42%	27%
There has been an increase is unsafe driving since Covid	8%	23%	42%	12%	15%
Streets should be designed to be safer for all types of transportation	-	0%	15%	31%	54%
There should be more enforcement of traffic laws to reduce the number and severity of crashes	-	16%	24%	20%	40%
Eliminating right turn on red in some locations is an appropriate solution to pedestrian crashes	4%	28%	36%	20%	12%
There should be a requirement to retest for a drivers license depending on the age of the driver	12%	8%	19%	31%	31%
Reducing speed limits and enforcing them will reduce how fast people drive	12%	35%	19%	15%	19%

5 When improving roadway safety in Nueces and San Patricio counties, which one or two changes are most needed?



In addition to the Public Safety survey, the Active Transportation and Planning survey also asked questions related to safety in the Corpus Christi MPO study area. When traveling within a neighborhood, residents feel very unsafe when walking/biking and safer while driving a vehicle. Condition and width of sidewalk, distracted/ aggressive drivers, speeding, network connectivity were the primary responses regarding concerns for bicycling and walking in Corpus Christi.

Chapter Three
CRASH ANALYSIS

CRASH TRENDS

Analyzing crash data and trends for an area can play a key role in helping decision makers understand the nature, causes, and injury outcomes of crashes to better inform their decisions regarding infrastructure safety improvements. Crash data can provide much needed context for the design of strategies and interventions for the area that can reduce crashes and their severity for future members of the community.

Local, regional, and state governments can use crash data to:

- Award and target state and federal highway safety funding
- Enforce existing laws to ensure driver/vehicle compliance
- Identify high crash locations and make engineering and construction improvements to roadways
- Improve emergency medical services through processes such as training and deployment of personnel

Available through the Corpus Christi MPO website is the crash data dashboard that was developed using the information presented in this report. This dashboard allows the public and partner agencies to review crash information relevant to various emphasis areas. Crash data for the Regional Safety Action Plan was retrieved from the TxDOT Crash Records Information System (CRIS). While crash record data is a valuable source of information for analyzing crashes, crash records do not account for near misses that may occur on a daily basis or not reported. A near-miss can be a factor in a person's perception of safety along a roadway. Information presented on the subsequent pages was used to inform project recommendations.

Equity Considerations

Equity considerations are required as part of the FHWA Safe Streets and Roads for All (SS4A) Safety Action Plan process. Equity is the consistent and systematic fair, just, and impartial treatment of all individuals, including those who belong to underserved communities that have been denied such treatment in the past.

According to FHWA, incorporating equity into roadway safety should involve working with underserved communities to:

- Collect and analyze data to identify communities experiencing disparities in roadway fatalities and serious injuries
- Engage community representatives to understand their transportation safety needs and build trust
- Implement improvements in safety planning, funding, design, operations, and asset management processes to eliminate disparities in traffic fatalities and serious injuries
- Evaluate impacts by monitoring outcomes and working to continuously improve safety outcomes with communities

As part of the planning process, the project team analyzed areas that have higher than average concentrations of disadvantaged or underserved populations. This analysis provides an overview of Environmental Justice (EJ), Limited English Proficiency (LEP), and Achieving Racial Equity (ARE) concepts and makes certain these are addressed through the transportation planning process.

The Corpus Christi MPO is committed to ensuring that plans and programs equitably meet the needs of people and avoid disproportionately high and adverse human health or environmental effects on disadvantaged populations.

U.S. Census data indicators used in this analysis include the following: households identified as low-income, minority, elderly, children under 17, limited English proficiency, persons with a disability, persons without a high school diploma, unemployed, and zero car ownership. Block groups with high concentrations of one or more of these indicators were mapped and utilized in the RSAP crash analysis process to identify potential crash disparities and hotspots for fatal and serious injuries across the Corpus Christi MPO study area.

Traffic Crash Disparities

There is a growing body of research that identifies disparities in traffic fatalities on the basis of race, ethnicity, income, and mode of travel. National data shows that Black and Hispanic Americans are at higher risk of roadway injury and death than their White or Asian counterparts.

Evidence also shows that people who walk or ride a bike for transportation are killed at a higher rate than individuals who travel by car. These findings lend important implications for policies that support investments in transportation infrastructure, as well as improvements in equitable transportation access and safety that could improve health outcomes through increased outdoor physical activity for populations that could benefit the most. According to the Infrastructure Investment and Jobs Act, addressing disparities in infrastructure, improving road crossings, safety, and enforcing speed are just a few potential interventions to consider.

Crash Analysis

For the purpose of this study, crash data from 2014 to 2021 went through a thorough review to refine crash locations and retrieve additional data through report forms. At the time of this analysis, crash data for year 2022 did not receive this review process; however, data was still utilized to define trends and provide further analysis for project team.

According to the CRIS database, there were 74,057 crashes on all roadways within the Corpus Christi MPO study area between 2016 and 2022. As shown in Exhibit 7, *Figure of Crash Trends,* overall crashes have decreased with the most crashes occurring in 2017 with nearly 12,000 crashes. Between 2019 and 2020, however, the number of crashes declined by nearly 18 percent. This decline is likely attributed to the COVID-19 pandemic, as less people were traveling on roadways in Corpus Christi and nationwide. From 2020 to 2021, however, crashes increased by approximately 15 percent.

Exhibit 7, Figure of Crash Trends

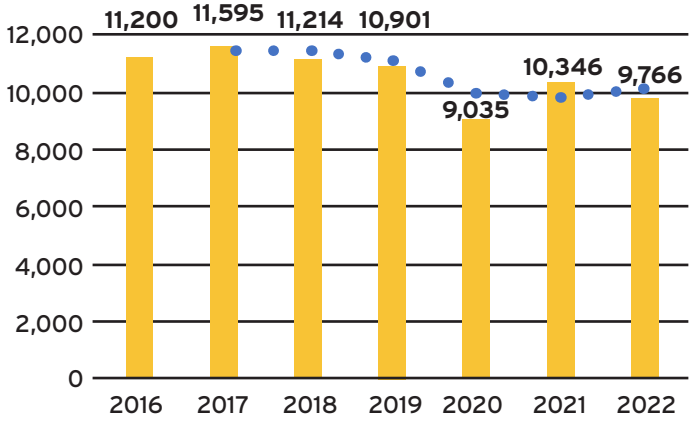
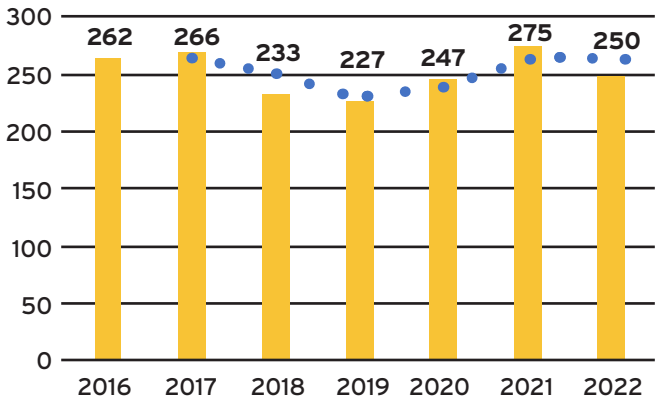


Exhibit 8, Figure of Fatal and Serious Injury Trends



While the number of crashes has declined over the years, crashes that resulted in serious injuries or fatalities have increased, demonstrated in Exhibit 8, *Figure of Fatal and Serious Injury Trends*. This means that even though there are less crashes occurring in the Corpus Christi MPO study area, the crashes that do happen are more dangerous and more likely to result in the death of a driver, passenger, bicyclist, or pedestrian. Between 2016 and 2022, there were over 1,700 crashes that resulted in a serious injury or fatality.

Non-interstate Crashes

Of the 74,057 total crashes within the Corpus Christi MPO study area, 66,468 occurred on non-interstate roadways between 2016 and 2022. According to the crash data, non-interstate crashes account for over 92 percent of all crashes within Nueces and San Patricio counties. Approximately 1,500 crashes along non-interstate roadways resulted in a serious injury or fatality.

The top manners of collision of non-interstate crashes between 2016 and 2022 include:

- One Motor Vehicle - Going Straight
- Same Direction - One Straight, One Stopped
- Angle - Both Going Straight

As shown in Exhibit 9, *Map of Non-Interstate Crashes*, high concentrations of non-interstate crashes have occurred in the Corpus Christi MPO Urbanized Area, particularly in the City of Corpus Christi. This higher concentration of crashes is most likely attributed to higher population densities within Corpus Christi creating greater risk for a crash.

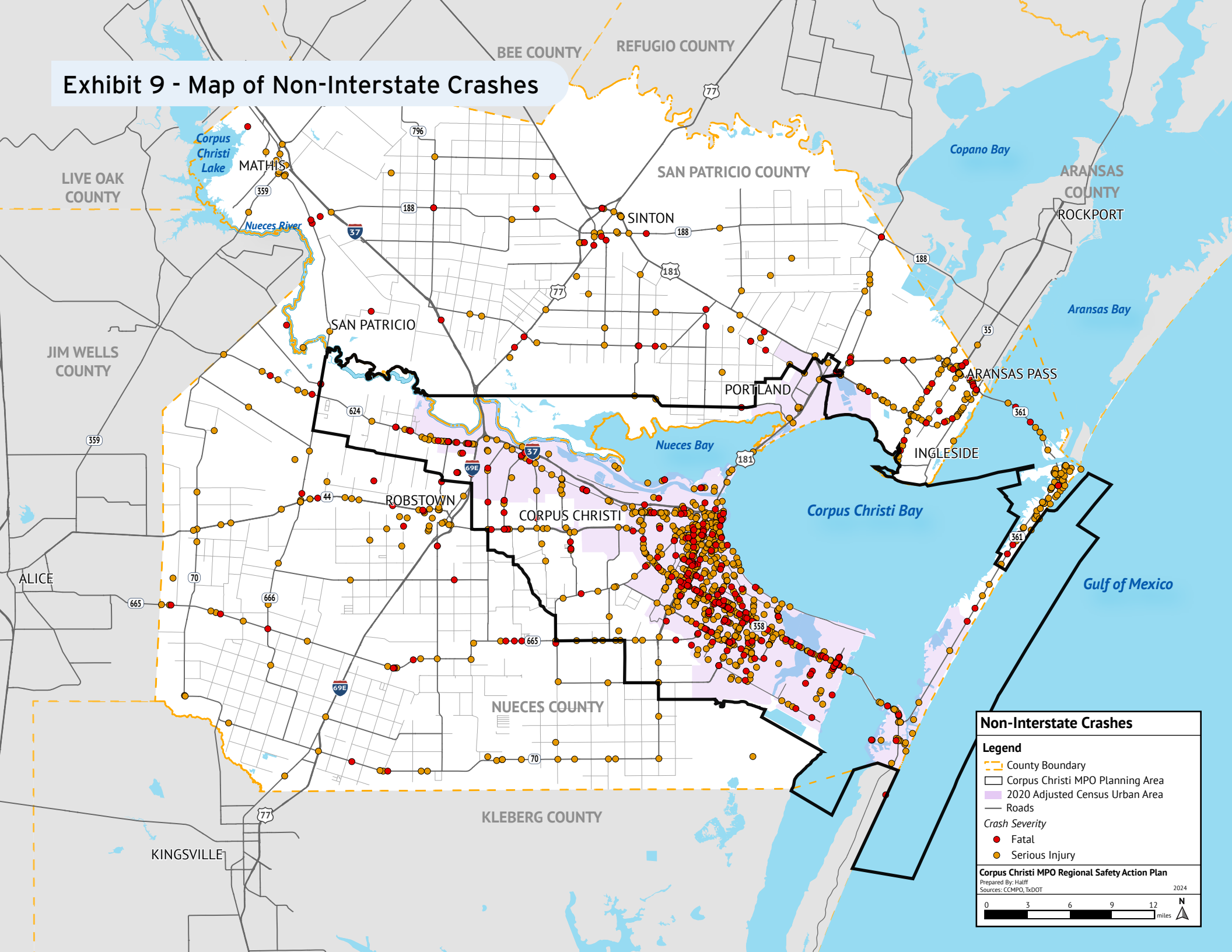
According to the crash record data, 45 percent of non-interstate crashes occurred at an intersection or were intersection-related. Further analysis regarding intersection crashes is provided in the Emphasis Areas and Network Screening sections in this chapter.

Bicycle and Pedestrian Crashes

Between 2016 and 2022, there were nearly 1,500 crashes that involved a pedestrian or bicyclist within the Corpus Christi MPO study area. Of those involving a pedestrian or bicyclist, 204 resulted in serious injury and 104 resulted in fatality. Approximately 16 percent of bicyclist-involved crashes occurred on roadways with existing bicycle infrastructure such as an unprotected shoulder bike lane or bicycle boulevard "sharrows". These facilities are typically not the most comfortable for bicyclists, especially as vehicular speeds increase, as they offer little to no protection or separation from vehicular traffic. Additional information regarding pedestrian- and bicyclist-involved crashes can be found on page 22.

Bike lane along Saratoga Boulevard
Source: Halff

Exhibit 9 - Map of Non-Interstate Crashes



Non-Interstate Crashes

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- 2020 Adjusted Census Urban Area
- Roads

Crash Severity

- Fatal
- Serious Injury

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff
Sources: CCMPO, TxDOT
2024

0 3 6 9 12 miles

N

EMPHASIS AREAS

As part of the Texas Strategic Highway Safety Plan (TSHSP), TxDOT has identified eight Emphasis Areas with the goal of reducing roadway fatalities on Texas highways. Emphasis Areas were identified through analysis of crash record data, vehicle miles traveled, and demographics. Unit-level crash data retrieved from the TxDOT Crash Records Information System (CRIS) was evaluated against the eight Emphasis Areas to identify statistics and trends for all individuals involved in crashes within the Corpus Christi MPO study area between 2016 and 2022. This section provides an overview of each Emphasis Area described in the TSHSP and an analysis of crashes in the Corpus Christi MPO study area. A set of strategies is identified for each emphasis area along with implementing partner agency and subsequent funding source.

Impaired Driving

Impaired Driving includes crashes where at least one driver was identified as having been drinking, having taken medication, been under the influence of alcohol or drugs, a Blood Alcohol Content (BAC) of greater than zero, or a positive drug test.

Vulnerable Road Users

Vulnerable Road Users includes crashes involving a pedestrian or bicyclist as they are more susceptible to fatal or serious injury when they are involved in a crash with a motor vehicle.

Speed Related

Speed Related includes crashes where unsafe speed under the limit or speeding over the limit was cited as a contributing factor.

Distracted Driving

Distracted Driving includes crashes where a distraction in the vehicle, driver inattention, or cell phone or mobile use was cited as a contributing factor.

Intersection Safety

An intersection crash is one that occurs within the boundaries of an intersection or in which the first harmful event occurred on an approach to or an exit from an intersection and is related to movement through the intersection.

Roadway & Lane Departures

Roadway and lane departure crashes encompasses two crash types pertaining to difficulties with lane keeping: single motor vehicles that run off the road and head-on collisions.

Occupant Protection

Occupant protection includes the use of any protective device, such as a seat belt, child safety seat, or booster seat, which prevents death and/or injury in motor vehicle crashes.

Post-Crash Care

Post-crash care involves emergency treatment and trauma care along with rehabilitation which can help reduce the risk of death and serious injuries.

Impaired Driving

State Statistics

From 2017 to 2021, approximately 18 percent of all fatal and serious injury crashes involved a driver that was under the influence of drugs or alcohol across the State of Texas. According to the TSHSP, approximately 34 percent of all fatal crashes in Texas involved an impaired driver. While the suspected serious injury and injury frequency has remained flat, crash trends have increased. The greatest concentration of impaired driving crashes occurs between 10PM and 2AM.

Study Area Statistics

According to the crash record data, 1,328 drivers tested positive for drugs and/or alcohol in the Corpus Christi MPO Study Area, accounting for 1,123 crashes. Crashes involving drugs and /or alcohol represent approximately three percent of all crashes between 2016 and 2022. While crashes involving impaired drivers account for only three percent of all crashes in the Corpus Christi MPO Study Area, these crashes were responsible for nearly 14 percent of all fatal injury crashes.

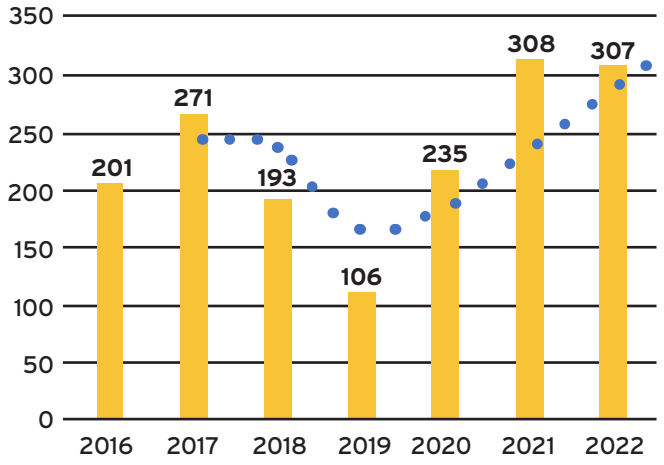
As shown in Exhibit 10, *Figure of Impaired Driving Trends*, between 2017 and 2019, crashes involving intoxicated drivers decreased by approximately 61 percent, from 271 drivers to 106 drivers. From 2019 to 2020, however, the number of intoxicated drivers increased by 121 percent to 235 drivers and another 31 percent from 2020 to 2021.

Impaired drivers were involved in **3%** of total crashes and **14%** of fatal crashes

According to the data, 52 percent of all crashes involving an impaired driver occurred on city streets.

According to the data, male drivers were more likely to be involved in impaired driving crashes than women, accounting for approximately 66 percent of all impaired driving crashes and nearly 73 percent of fatal and serious injury crashes. When reviewing crash information, the orientation and movements of the vehicles involved, or manner of collision, in the first harmful event prior to the crash occurring is a useful piece of information to help paint the picture of crash trends for an area. Manner of collision is determined by reviewing the damage rating, report narrative, and diagrams submitted in the crash report. Similar statewide, the most common manner of collision for impaired drivers was one motor vehicle – going straight (30.17 percent).

Exhibit 10, Figure of Impaired Driving Trends



According to the data, crashes involving drivers under the influence of alcohol and/or drugs were more common on Fridays, Saturdays, and Sundays, each representing 16, 27, and 21 percent of impaired driving crashes, respectively. Most of these crashes occurred in the evening time during dark but lighted conditions.

Emphasis Area Objective

» By 2028, develop and distribute on-going public education campaigns which allow for targeted messaging at particular behaviors or demographics engaging in risky behaviors. Work closely with community partners across the state to promote road safety initiatives and support a range of local initiatives using funding from TxDOTs "Road Safety Grants" program.

Strategies

» Continue to coordinate with Texas Department of Public Safety and Texas Department of Transportation to develop a messaging campaign specifically related to Corpus Christi MPO regarding the impacts of impaired driving (TxDOT DUI Enforcement Grants-Holidays)

» Work with local restaurant, bars, and business owners to increase education and training to better understand prevention of impaired driving.

» **Recommended Strategy Champions**: Texas Alcoholic and Beverage Commission, Texas DPS, and TxDOT

Vulnerable Road Users

State Statistics

Since 2017, pedestrian and bicyclist crash trends have increased, signifying the need for improvements to reduce the number of crash fatalities to zero. Bicyclists and pedestrians account for less than one percent of travel mode statewide and are just two percent of the total crashes statewide. However, bicyclists and pedestrians account for 11 percent of fatal crashes statewide.

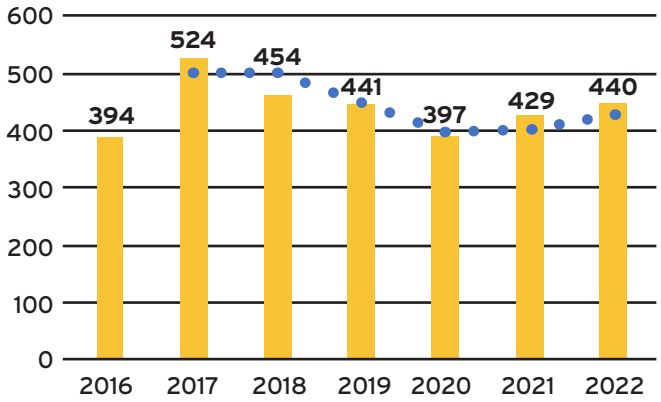
Study Area Statistics

According to the crash record data, 1,303 crashes involved pedestrians or bicyclists between 2016 and 2022. At the crash unit level, that accounts for 2,027 pedestrians and 1,052 cyclists reported as the first injury, or first harmful event. Exhibit 8 demonstrate that while crashes involving a pedestrian or bicyclist represent nearly two percent of all crashes in the Corpus Christi MPO Study Area, these crashes were responsible for approximately 28 percent of all crash fatalities 14 percent of suspected serious injury crashes between 2016 and 2022.

As shown in Exhibit 11, *Figure of Vulnerable Road User Crashes,* pedestrian- and bicyclist-related crashes increased by 33 percent from 2016 to 2017, from 394 to 524. Between 2019 and 2020, pedestrian- and bicyclist-related crashes declined by approximately 10 percent in the Corpus Christi MPO Study Area. This decline in crashes may be attributed to the COVID-19 pandemic causing less vehicles on the road which creates less of a risk to pedestrians and bicyclists.

According to the crash data, 71 percent of pedestrian- or bicyclist-related crashes occurred on city streets within the Corpus Christi MPO Study Area. Exhibit 12, *Map of Vulnerable Road User Crashes* shows high concentrations of pedestrian- and bicyclist-involved crashes in Census Block Groups that have been identified as areas with high numbers of disadvantaged populations. High concentrations of pedestrian- or bicyclist-involved crashes in these areas is likely attributed to large amounts of the population relying on the pedestrian and / or bicycle network for transportation due to low household income and low vehicle ownership. Similarly, elderly adults 65 and older account for over 54 percent of all pedestrian and bicycle crashes and 56 percent of fatal and serious injury crashes. This is especially alarming because elderly adults 65 and older make up nearly 13 percent of the total population, meaning crashes involving elderly pedestrians and bicyclists are overrepresented.

Exhibit 11, Figure of Vulnerable Road User Crashes



According to the unit information, male pedestrians and bicyclists are more likely to be involved in a crash than females. Of all pedestrian- and bicyclist-related crashes resulting in a fatal or suspected serious injury, 62 percent involved males. Male bicyclists were also more likely to not have worn a helmet at the time of a crash, accounting for 31 percent of all bicycle-related crashes between 2016 and 2022. Ethnically, White and Hispanic pedestrians and bicyclists are at greater risk of being involved in a crash than other ethnic groups in the Corpus Christi MPO study area.

Emphasis Area Objective

» By 2028, in cooperation with local municipalities, identify gaps in, and prioritize improvements to, pedestrian and bicycle facilities within all Public Rights-of-Way to create a system of complete streets.

Strategies

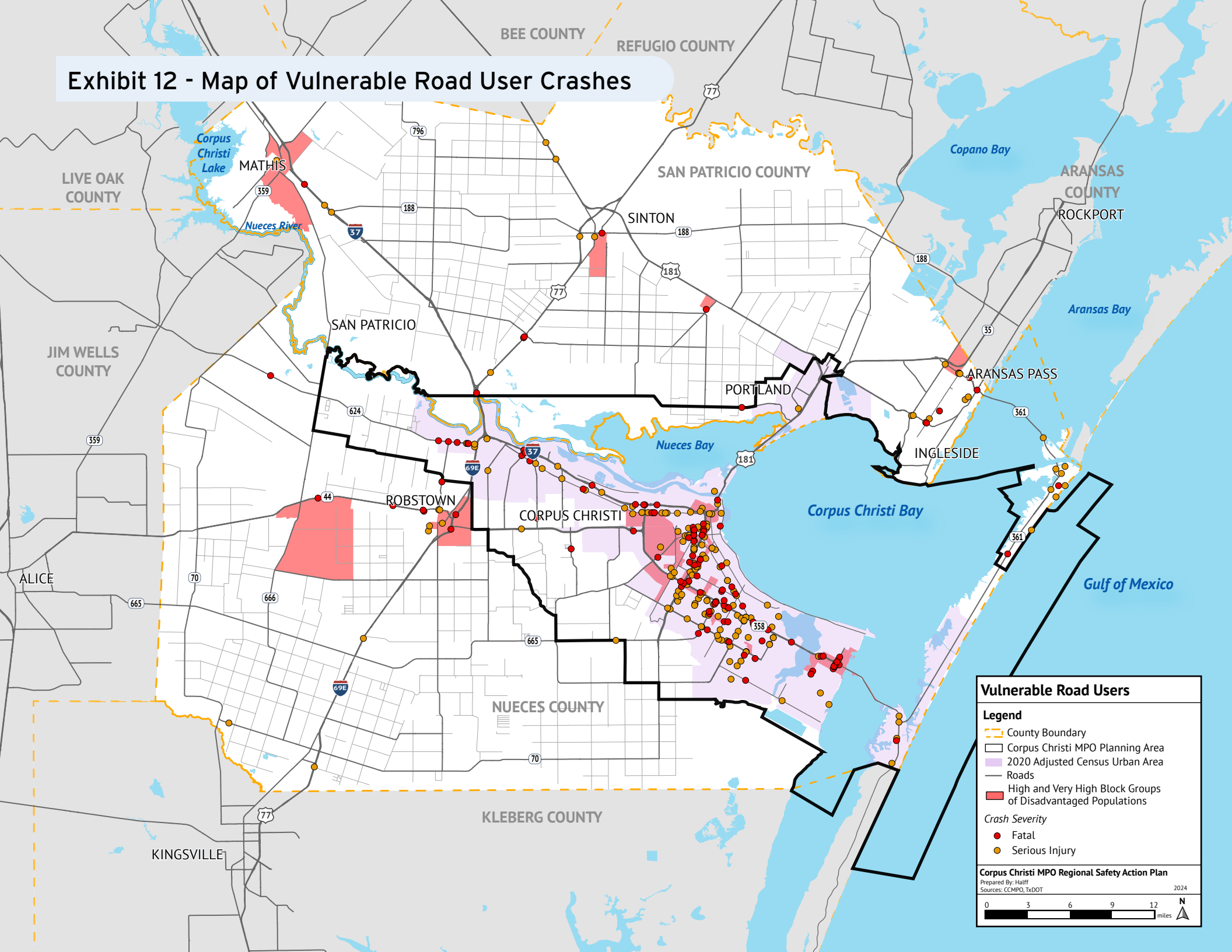
» Improve bicycle and pedestrian connectivity by addressing gaps in the network and providing safe crossings

» Develop a Complete Streets Policy document to guide implementation efforts by local entities.

» **Recommended Strategy Champions**: City of Corpus Christi and City of Portland

Supporting Strategy: *Develop communication and outreach related to safety awareness and behavior (Walk Bike Safe campaigns, Walk/Bike to School/ Work Day, Be Safe. Be Seen Program)*

Exhibit 12 - Map of Vulnerable Road User Crashes



Speed Related Crashes

State Statistics

According to the TSHSP, speed related crashes were identified in 32 percent of all fatal and serious injury crashes between 2017 and 2021. According to the TSHSP, speed related crashes resulted in 6,760 fatalities and 21,530 serious injuries. Nearly 50 percent of these crashes involved a single vehicle. Speed also has an affect on stopping distance as increasing your speed from 50 mph to 60 mph increases the total stopping distance by 40 percent.

Study Area Statistics

According to the crash record data, 65,020 people were involved in speed related crashes in the Corpus Christi MPO Study Area between 2016 and 2022. Speed related crashes account for over 34 percent of all crashes and speed was a contributing factor for nearly nine percent of all fatal and serious injury crashes, accounting for 392 crashes between 2016 and 2022.

Roads with a posted speed limit of 40 MPH or higher comprise **30%** of the total system within the Study Area but experience **61%** of speed-related crashes that result in fatal and serious injuries.

While speed related crashes account for only nine percent of all fatal and serious injury crashes combined, speed was a contributing factor for nearly 30 percent of all crashes that resulted in a fatality. Similarly, 31 percent of serious injury crashes reported speed to be a contributing factor.

Common additional factors contributing to speed related crashes include driver inattention, intoxication, and distraction in the vehicle. The most common first harmful event in speed related crashes were another motor vehicle in transport (94 percent). According to the crash data, speed related crashes involved 99 bicyclists and 84 pedestrians.

As shown in Exhibit 14, *Map of Speed Related Crashes*, hotspots for crashes that noted speed as a contributing factor are located near downtown Corpus Christi along SH 358 as well as Staples Street.

According to the unit data, male drivers are more likely to be involved in speed related crashes that result in a fatal or serious injury. Nearly 64 percent of speed related crashes that resulted in a fatality or serious injury involved a male driver.

Exhibit 13, Figure of Driver's Field of Vision

20 MPH 40 MPH

Emphasis Area Objective

» By 2028, improve the balance between safety and mobility by establishing travel speeds that suit the function and context for road segments. This includes targeted speed reductions in areas where there are high numbers of serious injury crashes or vulnerable road users in the Right-Of-Way. This also includes improving drivers compliance with speed limits and safe driving based on weather and travel conditions.

Strategies

» Encourage the use of complete streets and traffic calming measures that support the roadway context and provide safer mobility for all road users.

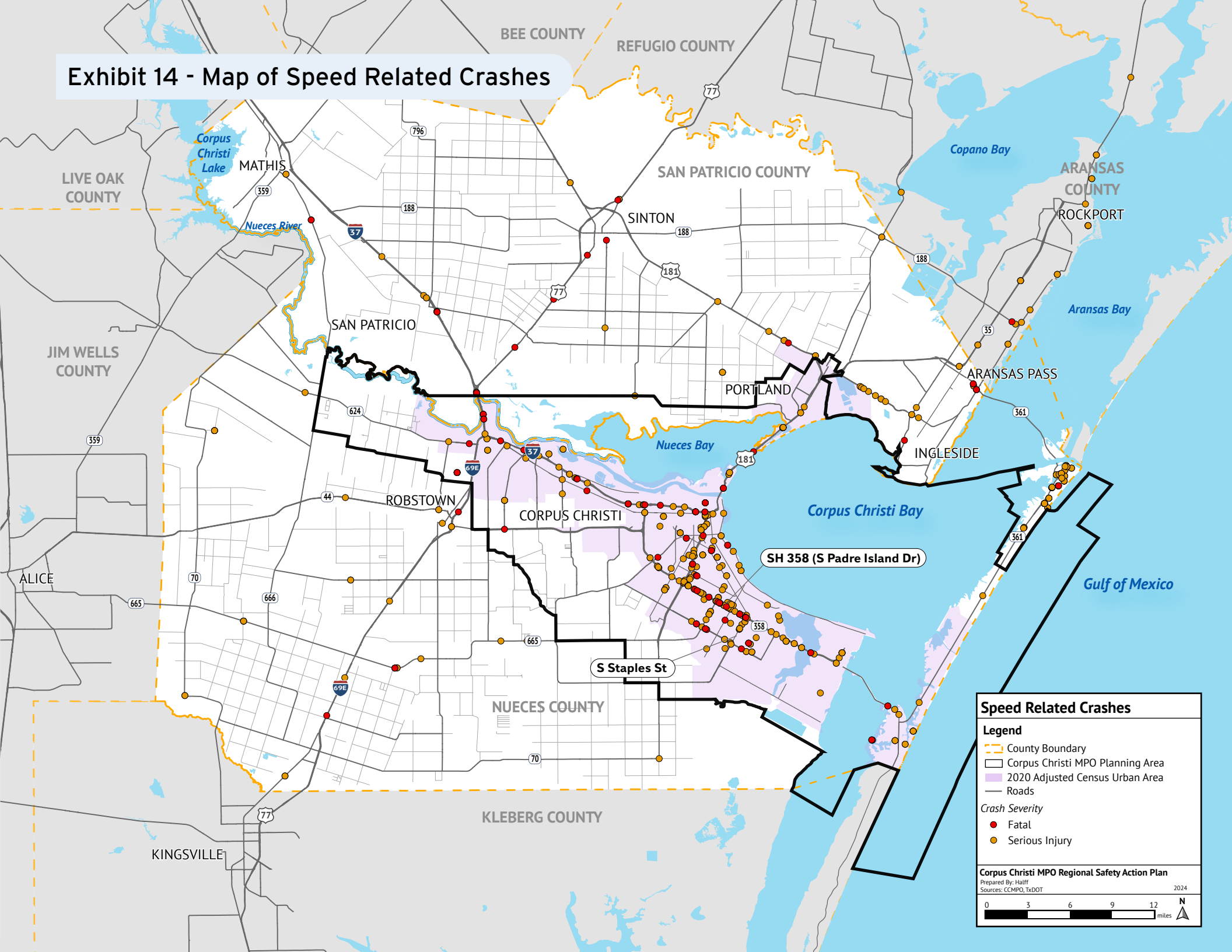
» Improve enforcement measures and employ education tools to increase awareness.

» **Recommended Strategy Champions**: Local law enforcement agencies and TxDOT, city governments, school districts, and counties

Speed Kills

According to the 2020 report, *City Limits: Setting Safe Speed Limits on Urban Streets*, by the National Association of City Transportation Officials (NACTO), speed is a central factor in traffic deaths nationwide. As speed limits and speeds increase, so do fatalities. Researchers from the Insurance Institute of Highway Safety (IIHS) found that a five MPH increase in the maximum speed limit was associated with an eight percent increase in the fatality rate on interstates and freeways, and a three percent increase in fatalities on all other roadways.[2] As shown in Exhibit 13, *Figure of Driver's Field of Vision,* as drivers increase their speed, their field of vision is decreased, limiting their reaction time to potential hazards. At lower speeds, drivers can see more of their surroundings and have more time to react to potential roadway hazards, such as an animal or child running into the street.

Exhibit 14 - Map of Speed Related Crashes



Distracted Driving

State Statistics

According to the TSHSP, there were 12,417 fatal and suspected serious injury crashes attributed to distracted driving across the State of Texas between 2017 and 2021. Distracted driving has resulted in over 2,000 fatalities and nearly 13,000 individuals with serious injuries. Approximately 14 percent of distracted driving crashes involved a pedestrian. Overall, distracted driving accounts for approximately 10 percent of fatalities statewide. Additional contributing factors include speed (38 percent), lane departures (34 percent), and no seatbelt use (33 percent).

Study Area Statistics

According to the crash record data, 10,893 drivers were involved in distracted driving crashes in the Corpus Christi MPO study area between 2016 and 2022.

In the Corpus Christi MPO study area, distracted driving has accounted for 5,383 crashes, 166 of which resulted in a fatality or serious injury. Crashes involving distracted driving represent approximately nine percent of all crashes, as well as 12 percent of crashes resulting in fatalities or serious injuries, that have occurred between 2016 and 2022.

As shown in Exhibit 15, *Figure of Distracted Driving Trends, fatal and serious injury distracted driving crashes has been on the decline with a slight uptick in recent years*. The most common manner of collision for distracted driving crashes in the Corpus Christi MPO study area include:

- Same Direction – One Straight-One Stopped (27 percent)
- Same Direction – Both Going Straight-Rear End (17 percent)
- Angle – Both Going Straight (14 percent)

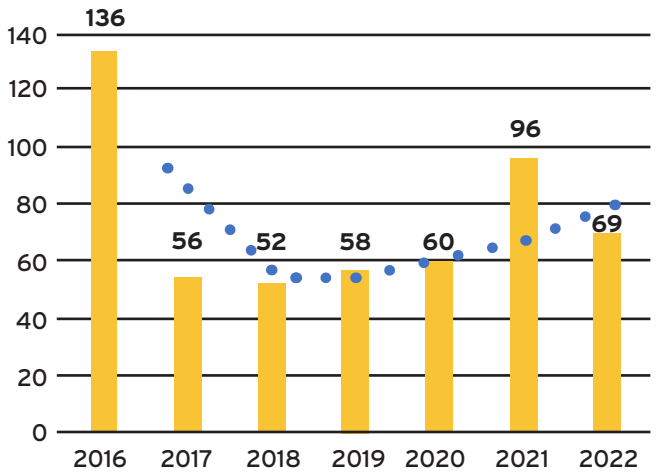
Additional factors that contributed to distracted driving related crashes include failure to control speed, disregard stop light or stop sign, and drug or alcohol intoxication. As shown in Exhibit 16, *Map of Distracted Driving Crashes*, locations for distracted driving crashes includes the intersection of Main Street and SH 361 as well as Staples Street and SH 358. According to the crash data, adults aged 31 to 64 are more likely to be involved in a distracted driving crash in the Corpus Christi MPO study area than younger or older drivers, accounting for over 54 percent of distracted driving crashes between 2016 and 2022. Additionally, 55 percent of drivers involved in distracted driving crashes were males.

Talk. Text. Crash.

TxDOT's *Talk. Text. Crash.* distracted driving awareness campaign is a key component of #EndTheStreakTX, a broader social media and word-of-mouth effort that encourages drivers to make safer choices behind the wheel and help end the streak of daily roadway fatalities. *Talk. Text. Crash.* utilizes paid education, media, social media, and Texas-based influencer programming to spread awareness of the dangers and risks associated with distracted driving.

According to TxDOT, roadway fatalities involving a distracted driver increased by ten percent in 2022. Distracted driving is not only dangerous for all road users, it is also illegal. Since September 1, 2017, it has been illegal to read, write, or send a text while driving in Texas, and violators can face a fine of up to $200.

Exhibit 15, Figure of Distracted Driving Trends



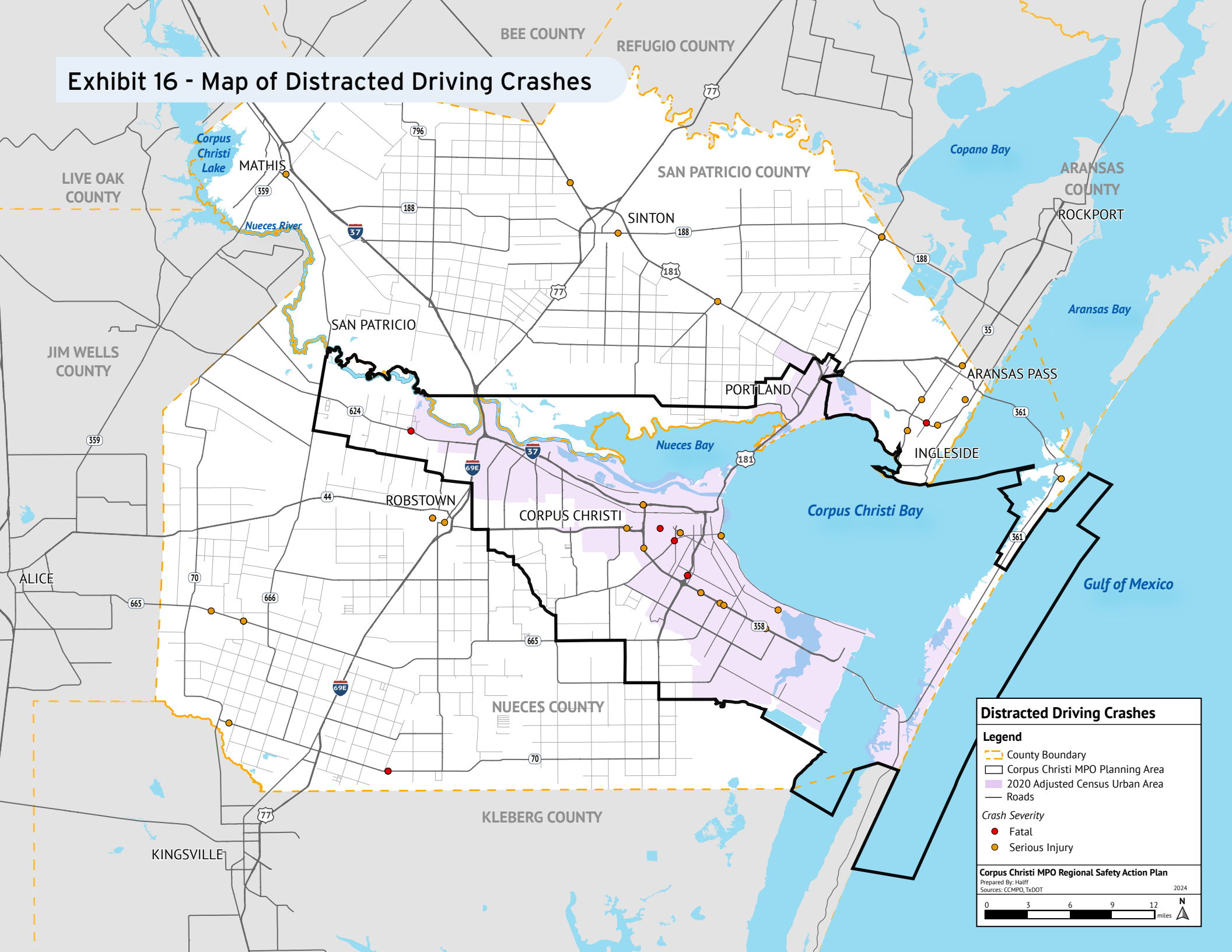
Emphasis Area Objective

- By 2028, develop and distribute on-going public education campaigns which allow for targeted messaging at particular behaviors or demographics engaging in risky behaviors. Work closely with community partners across the state to promote road safety initiatives and support a range of local initiatives using funding from TxDOT's "Road Safety Grants" program.

Strategies

- Develop an information campaign targeted at specific age groups using personal stories and relatable content.
- Through network screening, identify areas associated with distracted driving and implement engineering solutions (edge line, centerline, and traverse rumble strips, lighting, wider and brighter striping)
- **Recommended Strategy Champions**: TxDOT, partner agencies, school districts, and advocacy organizations

Exhibit 16 - Map of Distracted Driving Crashes



Distracted Driving Crashes

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- 2020 Adjusted Census Urban Area
- Roads

Crash Severity

- Fatal
- Serious Injury

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff
Sources: CCMPO, TxDOT
2024

0 3 6 9 12 miles

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Intersection Safety

State Statistics

In the Corpus Christi MPO study area, intersection or intersection related crashes account for approximately 45 percent of all crashes between 2016 and 2022. Between 2017 and 2021, intersection crashes were identified in 26,879 fatal and serious injury crashes, as well as 4,104 fatalities, and 28,480 serious injuries across the State of Texas. According to the TSHSP, intersection crashes account for over 21 percent of all fatalities and 35 percent of all serious injuries that occurred between 2017 and 2021. According to the TSHSP, intersection crashes are more likely to occur on urban roadways than rural roadways.

Improving Intersections for Pedestrians and Bicyclists

According to FHWA, when designed with pedestrians and bicyclists explicitly in mind, all types of intersections can facilitate safe, accessible, convenient, and comfortable walking and biking. At intersections, the Safe System approach involves minimizing risks to all road users by lowering vehicle speeds, separating road users, and reducing conflict point severity. FHWA recommends three grounding principles for planning and designing intersections for pedestrians and bicyclists:

1. Expect pedestrians and bicyclists at all intersections
2. Use a Safe System Approach
3. Provide access for all ages and abilities

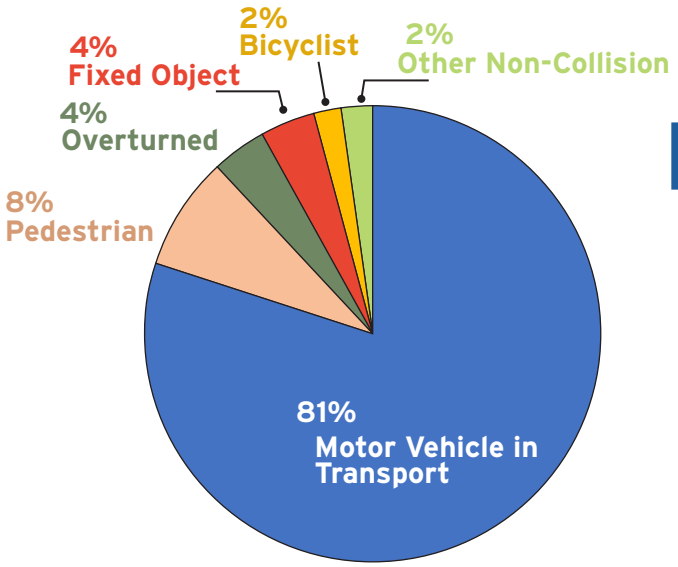
People walk or bicycle for a variety of reasons, including access to jobs, schools, shopping, recreation, or limit environmental impacts. Intersection projects are opportunities to provide safer, more equitable, and more accessible facilities for people walking or biking through the area.

Contributing factors to intersection crashes include failure to yield right of way, speed, and disregard of signal or light.

Study Area Statistics

According to the crash data, 26,623 crashes occurred at an intersection or were intersection related. Of the total number of intersection crashes, 531 crashes resulted in a fatality or serious injury. In the Corpus Christi MPO study area, intersection or intersection related crashes account for approximately 45 percent of all crashes between 2016 and 2022. As shown in Exhibit 17, *Figure of Fatal/Serious Injury First Harmful Event,* the first harmful event for over 80 percent of intersection crashes that resulted in a fatality or serious injury was another motor vehicle in transport. Pedestrian and bicyclist first harmful events account for eight percent and two percent of fatal or serious injury crashes.

Exhibit 17, Figure of Fatal/Serious Injury First Harmful Event



Common contributing factors to intersection crashes resulting in a fatality or serious injury in the Corpus Christi MPO study area include:

- Failed to Yield Right of Way - Stop Sign (10 percent)
- Failed to Yield Right of Way - Turning Left (6 percent)
- Failed to Control Speed (6 percent)

As shown in Exhibit 18, *Map of Intersection Related Crashes*, intersection crash hotspots are located around the City of Corpus Christi, particularly along the SH 358 corridor and SH 286 corridor. High crash intersections include Staples Street/S. Padre Island Drive in Corpus Christi, Wildcat Drive/SH 35 in Portland, and SH 361/Main Street in Ingleside.

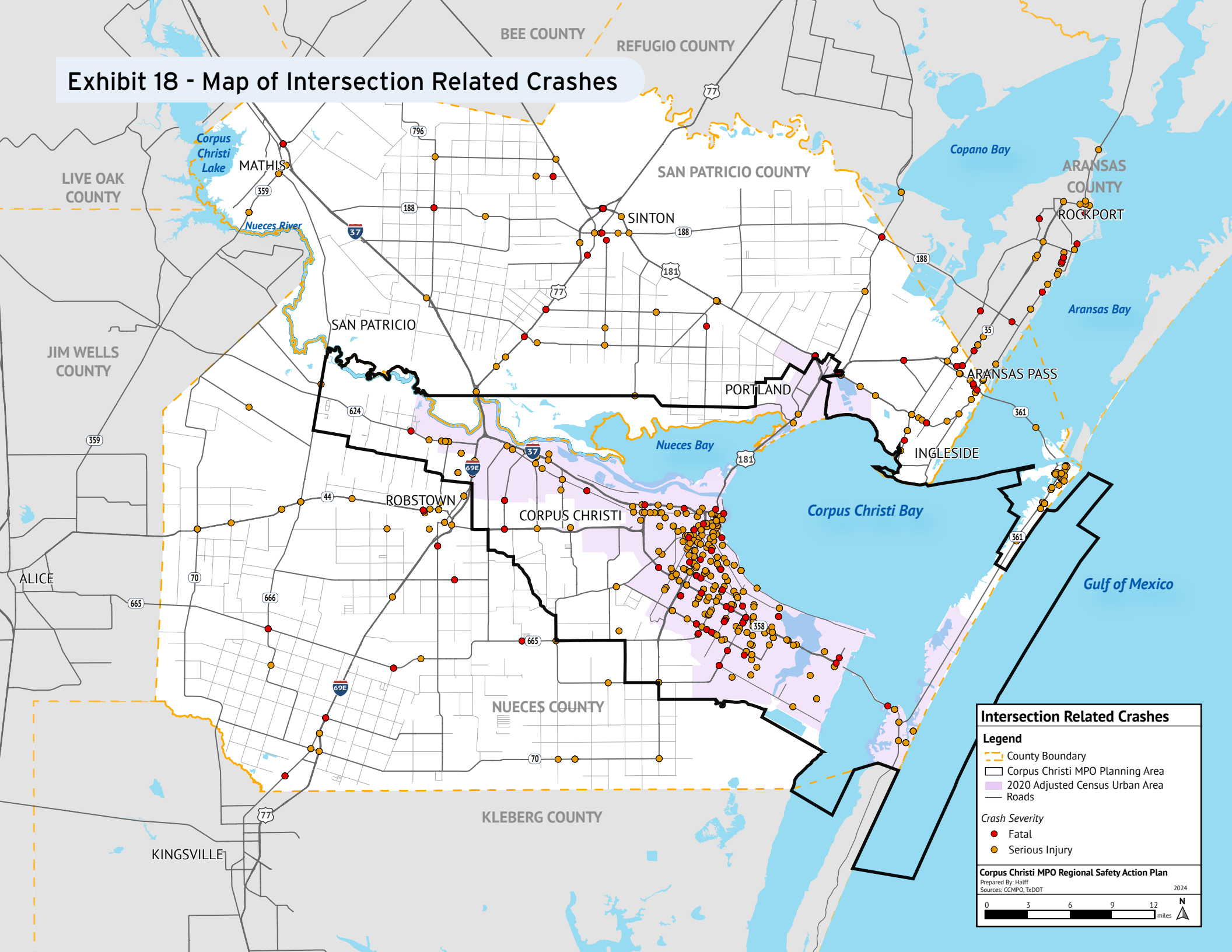
Emphasis Area Objective

- By 2028, utilize AASHTO's Green Book Version 8, TxDOT's Innovative Intersection Guidebook, and others such as NACTO's Urban Street Design Guide to update, and regularly review, local design and construction standards for federally classified roads that make streets more complete, more efficient, more safe, while reducing vulnerability to, and improving recovery from, stormwater runoff and extreme weather.

Strategies

- Through network screening, identify necessary intersection improvements to reduce fatal and serious injury crashes
- Encourage the revision of infrastructure design manual and design standards to support intersection improvements along major arterials and local roadways.
- **Recommended Strategy Champions**: City of Corpus Christi, City of Portland, other local entities, and TxDOT

Exhibit 18 - Map of Intersection Related Crashes



Intersection Related Crashes

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- 2020 Adjusted Census Urban Area
- Roads

Crash Severity

- Fatal
- Serious Injury

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff
Sources: CCMPO, TxDOT
2024

0 3 6 9 12 miles

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Roadway & Lane Departures

State Statistics

According to the TSHSP, these types of crashes were identified in over 29,000 fatal and serious injury crashes as well as 7,685 fatalities. Roadway departures also accounted for 27,137 serious injuries across Texas from 2017 to 2021.

Study Area Statistics

In the Corpus Christi MPO study area, 1,918 people were involved in roadway departure crashes between 2016 and 2021, accounting for 677 crashes. According to the crash data, the most common manner of collision for roadway departure crashes was One Motor Vehicle – Going Straight. Head-on collisions account for approximately 17 percent of roadway departure crashes in the Corpus Christi MPO study area.

As shown in Exhibit 19, *Figure of Roadway Departures by Age*, elderly drivers were more likely to be involved in roadway departure crashes resulting in fatalities or serious injuries, accounting for approximately 54 percent of total crashes. Exhibit 20, *Map of Roadway Departure Crashes*, represent the location and severity of these crashes in the Corpus Christi MPO study area.

Emphasis Area Objective

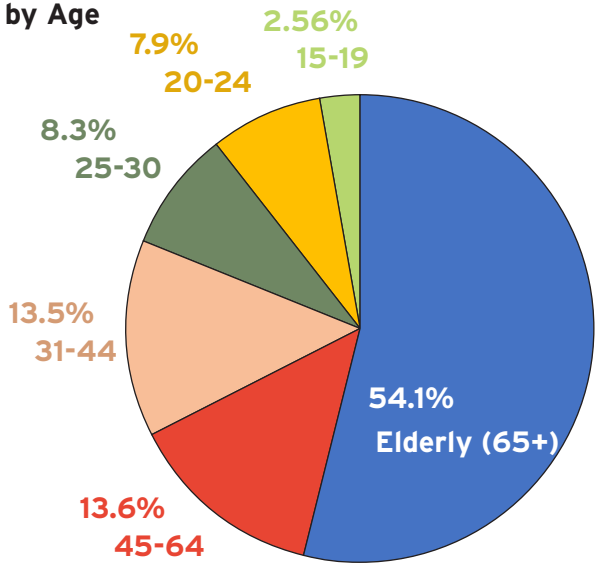
» By 2028, examine the High Injury Network for locations that are susceptible to significant reductions in roadway and lane departure crashes and implement proven countermeasures in those locations. Examine the remaining network and identify locations susceptible to reductions in crashes as part of on-going maintenance activities.

Strategies

» Through Network Screening, identify locations susceptible to roadway and lane departures and implement engineering solutions such as median treatments, chevrons, edge lines, and roadway geometrics.

» **Recommended Strategy Champions**: TxDOT, City of Corpus Christi, City of Portland, Nueces County, and San Patricio County

Exhibit 19, Figure of Roadway Departures by Age



Head-On Crashes

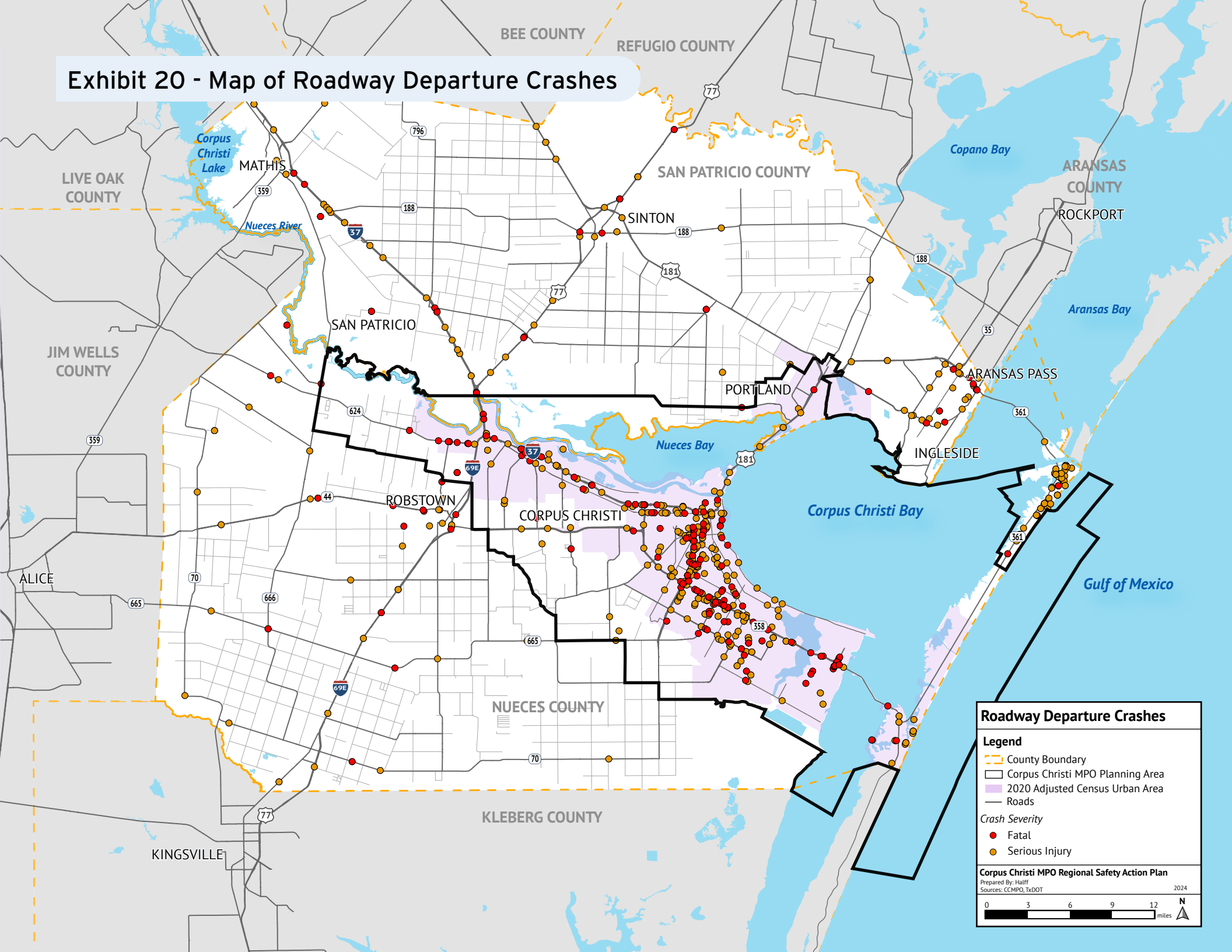
According to FHWA, vehicle head-on collisions are the most harmful event in approximately 14 percent of all U.S. traffic fatalities each year and 27 percent of all roadway departure fatalities.[3] These crashes are more likely to occur on undivided roadways with posted speeds greater than or equal to 50 MPH. To reduce severe roadway departure crashes, FHWA recommends that State and local agencies consider three broad strategies:

1. Keep vehicles in the roadway or in their lane
2. Reduce the potential for crashes when vehicles leave the roadway
3. Minimize the severity of crashes that do occur

Roadway improvements such as pavement markings, curve warning signs, and center line rumble strips can help drivers stay in their lane and expect changes in roadway alignment. According to a FHWA traffic study, center line rumble strips can reduce head-on and sideswipe fatal and serious injury crashes by up to 45 percent on rural roadways. Additional improvements to reduce head-on and lane departure crashes include increasing shoulder widths, providing a center line buffer area, and maintaining vegetation to improve sight distance. By implementing these strategies, safer roadway systems can be established and the number of roadway fatalities and serious injuries can be reduced.

3: "Head-On Crashes" Federal Highway Administration. 2021

Exhibit 20 - Map of Roadway Departure Crashes



Occupant Protection

State Statistics

According to the TSHSP, abundant research has shown that correctly using appropriate child restraints or seatbelts is the single most effective way to save lives and reduce injuries in crashes. Despite high observed seatbelt use rates, many unrestrained people die in crashes across the State of Texas each year.

The TSHSP reports that while seatbelt use is relatively high in the state, the number of people who died in 2020 while not wearing a seatbelt increased by 16 percent over 2019, with 1,073 drivers and passengers killed on Texas roadways. In 2021, 27 percent of fatalities were drivers and passengers who were traveling unrestrained. Common contributing factors to unrestrained fatal and serious injury crashes include impaired driving and single-vehicle, run-off-the-road crashes.

According to the National Highway Traffic Safety Administration (NHTSA), estimates using occupant protection such as lap and shoulder belts reduces the risk of front seat passenger car occupant deaths by 45 percent and front seat passenger car occupant moderate to critical injuries by 50 percent. Occupant restraints improve the chance of survival for individuals involved in a crash. Seat belt usage has remained high increasing to 91.6 percent in 2022.

According to the crash data, three percent of passengers were cited to be unrestrained at the time of a crash. For fatal and serious injury crashes, that percentage increases to 15 percent of passengers failing to wear a seatbelt or other restraint. Unrestrained drivers account for less than one percent of all crashes and approximately seven percent of fatal and serious injury crashes.

Study Area Statistics

According to the crash record data, 2,193 people involved in crashes within the Corpus Christi MPO study area between 2016 and 2022 were not wearing a seatbelt or other restraint at the time of the crash. No seatbelt use was cited for approximately one percent of total crashes in the Corpus Christi MPO study area. While no seatbelt use is low for all crashes, nearly 13 percent of fatal crashes included at least one unrestrained driver and/or passenger. Unrestrained occupants account for approximately seven percent of all crashes resulting in a suspected serious injury.

In the Corpus Christi MPO study area, approximately 56 percent of unrestrained crashes occurred in non-intersection locations and 68 percent of crashes involved another motor vehicle in transport. Common contributing factors to crashes that involved unrestrained persons include failure to control speed, failure to drive in a single lane, and alcohol intoxication. As shown in Exhibit 21, *Figure of Unrestrained Drivers by Age,* elderly drivers aged 65 and older account for over 52 percent of unrestrained crashes. Exhibit 22, *Map of No Seatbelt Crashes*, shows the various locations throughout the Corpus Christi MPO study area where these types of crashes occurred.

Emphasis Area Objective

- By 2028, reduce the number of severe (KA) unrestrained occupant crashes by 5% compared with the 2018-2022 baseline.

Strategies

- Work with local entities to support and enforce Click It or Ticket Campaigns
- Increase education and training efforts by certified professionals, instructors, and technicians
- **Recommended Strategy Champions**: Healthcare and Education Providers, TxDOT, and Texas DPS

Exhibit 21, Figure of Unrestrained Drivers by Age

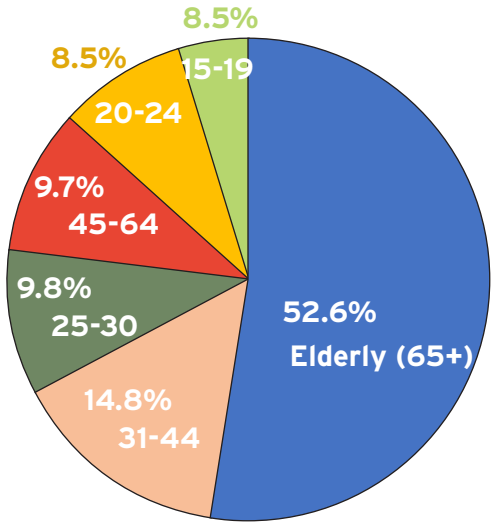
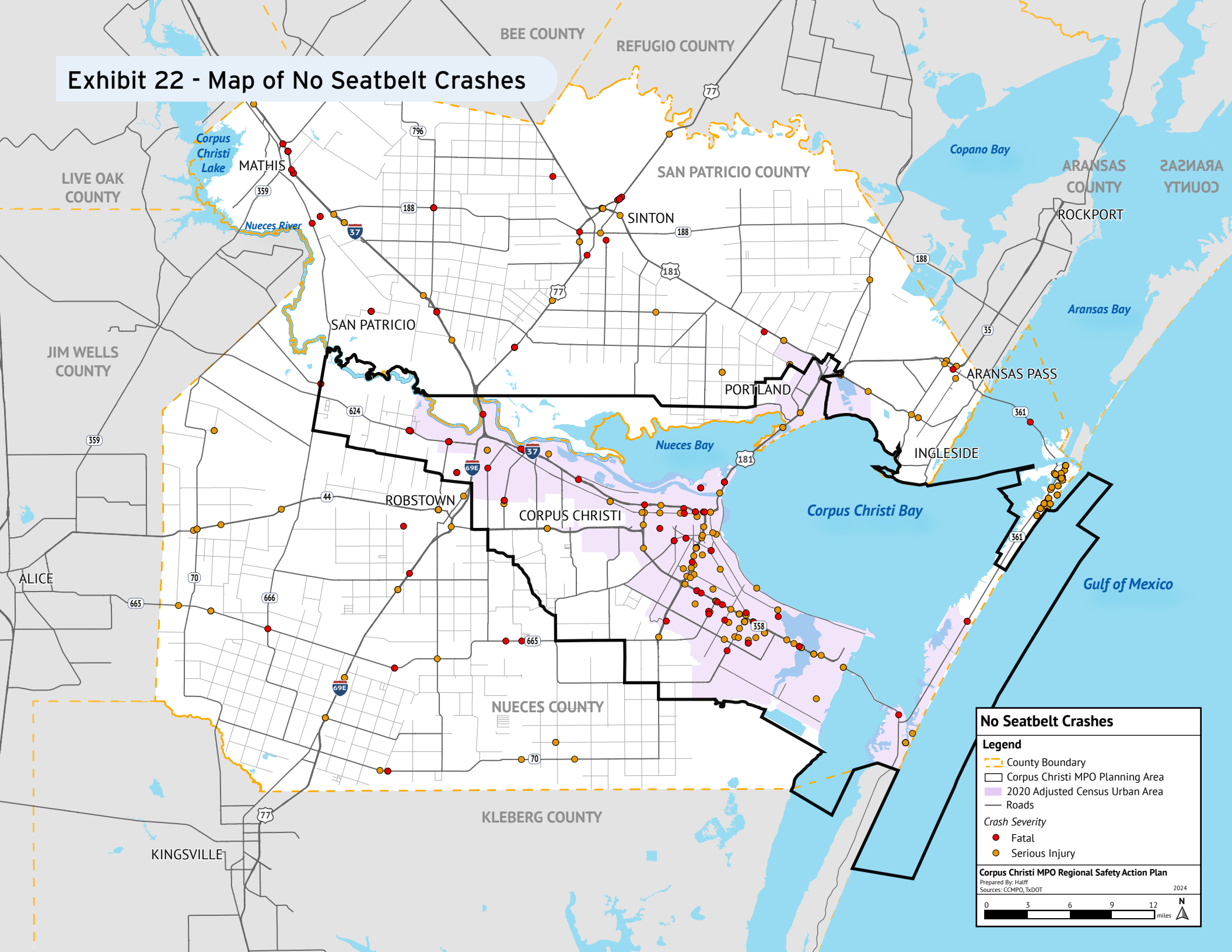


Exhibit 22 - Map of No Seatbelt Crashes



Post-Crash Care

State Statistics

As one of the critical elements of a safer road system, post-crash care is essential in determining the difference between a serious injury and a fatality. Rapid and efficient emergency medical services (EMS) and incident management best practices can lead to improved safety for all road users. Faster response times is directly related to the increased likelihood of crash survival. Quickly clearing the crash minimizes the risk of secondary crashes and improves emergency response access to the crash scene.

While data statewide was not available for this emphasis area, emergency response times and medical treatment is an important aspect to reducing crash fatalities. Post-crash care should not only consider medical treatment but also first responders, crash investigation, traffic incident management, and justice.

Saved by the Belt

According to TxDOT's *Click it or Ticket* campaign, wearing a seatbelt reduces the risk of dying in a crash by 45 percent for people in the front seat of passenger cars. For those in pickup trucks, seatbelts reduce the risk of fatality by 60 percent, since trucks are more likely to roll over than passenger vehicles. In a crash, a seatbelt ensures motorists are not thrown into a fast-opening airbag – a force that could lead to serious injury or death.

Driver or passenger, front seat or back, State law requires everyone in a vehicle to be buckled up. Not buckling up could cost up to $200 in court costs and fines; even worse, it could cost someone's life.

Study Area Statistics

As represented in Exhibit 23, *Map of Emergency Facilities*, locations for emergency services vary throughout the Corpus Christi MPO study area. Proximity of the emergency services to crash clusters or areas with limited services directly correlate to crash survivability.

According to crash data, 80 percent of crashes occurred within a five-mile radius of an EMS facility or hospital. Of the 1,851 total crashes that resulted in a fatality or serious injury, 623 were within a 2-mile radius of an emergency facility (hospital or urgent care facility), 516 were within a 5-mile radius of an emergency facility, and 289 were within a 10-mile radius of an emergency facility. It will be important to consider ways in which access to medical treatment is received by individuals involved in crashes as well as the safety of medical personnel tending to these crash locations.

While fatal and serious injury crashes are considered for this planning process, other crashes may warrant emergency medical care and first responders. It will be important for the Corpus Christi MPO to work with local emergency first responders to identify routes and alternatives to consider as well as usage of dynamic message signs for improved safety.

Emphasis Area Objective

» By 2028, develop, implement, and track performance of the Corpus Christi Metropolitan Regional Traffic Incident Management Plan.

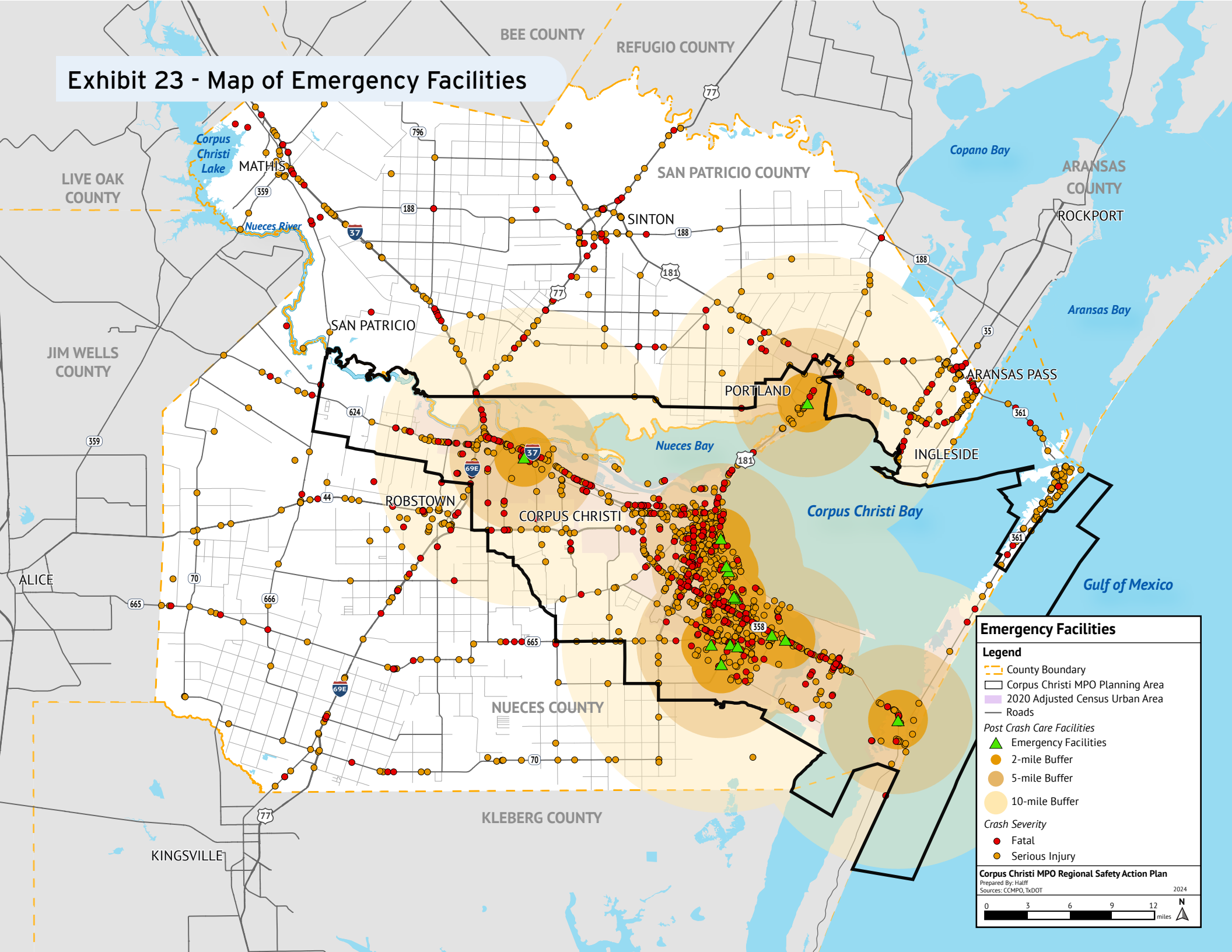
Strategies

» Develop a Tow and Go program to efficiently and safely move vehicles from area roadway to prevent secondary crashes and congestion.

» Work with local emergency first responder and healthcare providers to improve data collection

» **Recommended Strategy Champions**: TxDOT, Local Healthcare Providers, Tow Truck Companies, and HERO Roadside Assistance Program

Exhibit 23 - Map of Emergency Facilities



Emergency Facilities

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- 2020 Adjusted Census Urban Area
- Roads

Post Crash Care Facilities

- Emergency Facilities
- 2-mile Buffer
- 5-mile Buffer
- 10-mile Buffer

Crash Severity

- Fatal
- Serious Injury

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff
Sources: CCMPO, TxDOT
2024

0 3 6 9 12 miles

N

NETWORK SCREENING

The efficient and responsible investment of resources in addressing safety problems is a difficult task. Since crashes occur on all roadways in use, it is inappropriate to say a roadway is unsafe. However, it is correct to say that roadways can be made to be more or less safe with changes in design or operational policies. Road safety is a matter of degree. When making decisions effecting road safety it is critical to understand that expenditure of limited available funds on improvements in places where it prevents few injuries and saves few lives can mean that injuries will occur, and lives will be lost by not spending them in places where more crashes could have been prevented. It is the objective of Corpus Christi MPO to maximize crash reduction within the limitations of available budgets by making road safety improvements at locations where it does the most good or prevents the most crashes.

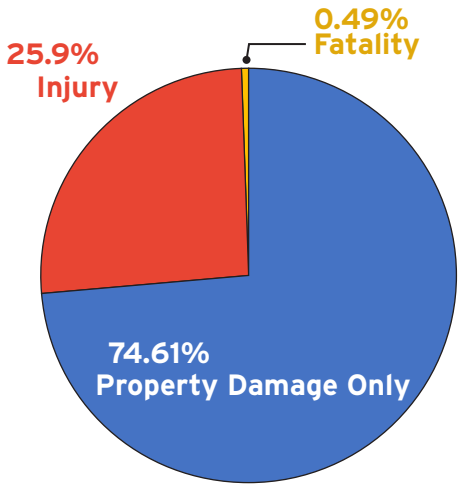
Introduction

The focus of the Safety Analysis component is to provide data-driven assistance to Corpus Christi MPO with planning and prioritization of safety improvement projects on roadways. It accomplishes this by identifying opportunities for cost-effective road safety improvements. Its emphasis is primarily, but not exclusively, on intersections with some consideration of segments because, in the urban environment such as most of the Corpus Christi MPO, the most cost-effective safety projects are primarily found at intersections.

The guiding principle behind an effective highway safety program is that the resources should go to where they achieve the greatest safety effect. The cost-effectiveness is measured by the Benefit-Cost (B/C) ratio which represents the ratio of the benefits derived from crash reduction expressed in dollars to the cost of construction and maintenance over the life cycle of the project. The primary goal for the program/project selection criteria is to select projects in such a way that following construction they will maximize crash reduction in the Corpus Christi MPO within constraints of the available budgets. The study was conducted using six years of crash data from 1/1/2016 to 12/31/2021 focused on Nueces and San Patricio counties only.

Corpus Christi is the eighth most-populous city in Texas. The 2022 population was 317,773, increasing by a little over 4 percent from 2010. Over the 6-year study period, there were 64,292 crashes recorded in Nueces and San Patricio counties and 51,475 crashes in the 2010 Corpus Christi MPO Planning Area. Exhibit 24, *Figure of Crash Severity*, shows crashes that resulted in property damage only, injuries, and fatalities.

Exhibit 24, Figure of Crash Severity

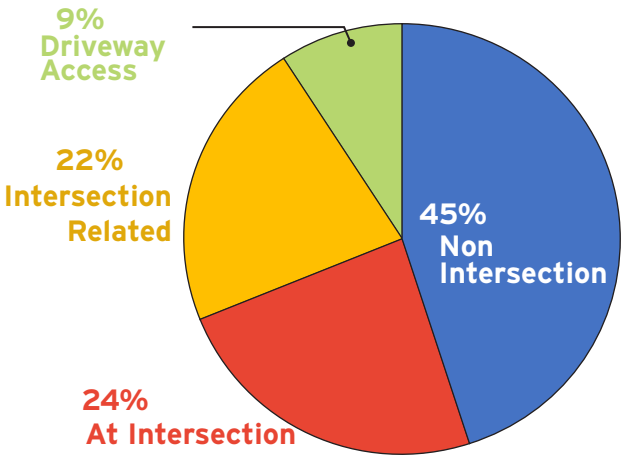


The study focused on the following infrastructure related emphasis areas from the Texas Strategic Highway Safety Plan:

- Speed related crashes
- Intersection safety
- Vulnerable users: pedestrians
- Vulnerable users: bicyclists

An overview of all injury and fatal crashes, which are the primary focus for screening, by location type shows that in general there is an even split between the proportion of crashes occurring on segments (non-intersection) and those occurring at intersections, or which are intersection related. Exhibit 25, *Figure of Crashes by Road Description,* shows that approximately 45 percent of all injury and fatal crashes were on segments, while approximately 46 percent were at intersections or intersection related.

Exhibit 25, Figure of Crashes by Road Description



Screening Approach

As outlined previously, the network screening process is focused on treating the most serious crash types (injury and fatal level crashes), with cost-effective countermeasures which provide the maximum benefit-cost return in order to ensure money is spent where it has the greatest benefit to safety. As such, network screening was primarily conducted through the lens of injury and fatal crash history, patterns and trends.

Countermeasures with Promise

The Countermeasures with Promise (CWIP) approach begins by choosing an effective countermeasure first and then looks for sites where it can be applied cost-effectively.

For example, we may screen the entire network for high severity broadside crashes at intersections, with a goal of making minor signal modifications, minor geometric modifications or signal timing changes. Alternatively, we may look for locations with Approach Turn collisions where minor signal modifications could support revised left turn phasing.

How to Measure Safety

To quantitatively assess and qualitatively describe the magnitude of the safety problem at selected sites in the Corpus Christi MPO Planning Area, the Texas-specific Safety Performance Functions (SPF) recently developed by the Texas Transportation Institute (TTI) was utilized, representing intersections and segments. The SPF reflects the relationship between traffic exposure measured in Annual Average Daily Traffic (AADT), and crash count for a unit of road section, measured in crashes per mile per year for segments, and crashes per year for intersections.

The SPF models provide an estimate of the normal or expected crash frequency and severity for a range of AADT among similar facilities. Two kinds of Safety Performance Functions were developed. The first one addresses the total number of crashes and the second one looks only at crashes involving an injury or fatality. Together they allow us to assess the magnitude of the safety problem from the frequency and severity standpoints.

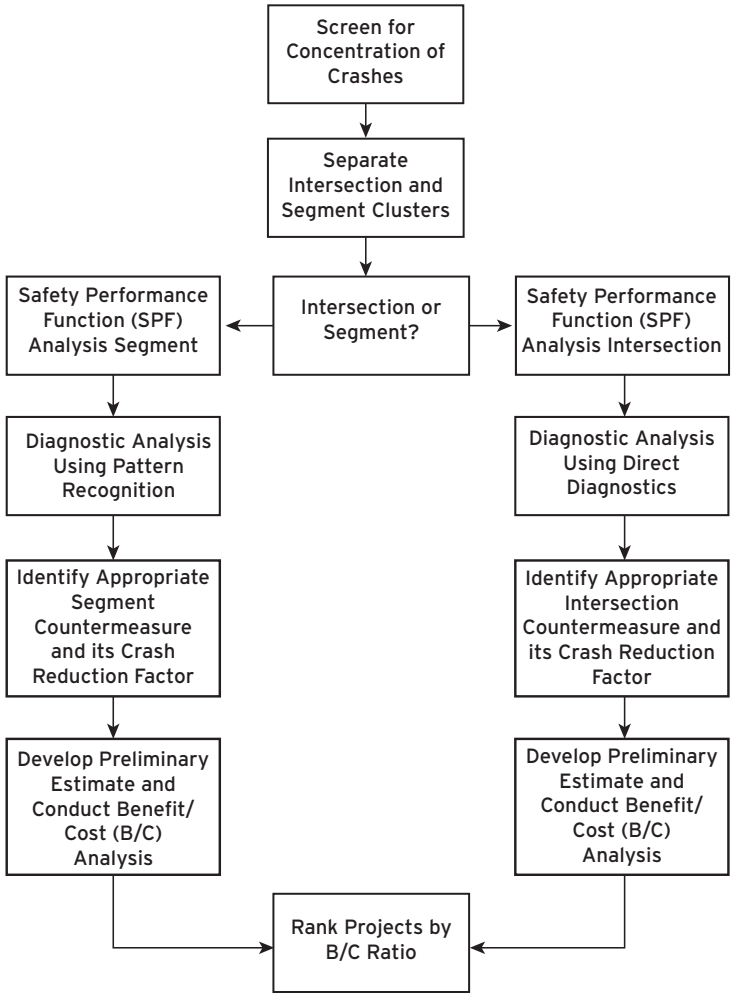
Level of Service of Safety

Development of the SPF lends itself well to the conceptual formulation of the Level of Service of Safety (LOSS). The concept of level of service uses quantitative measures and qualitative description that characterize safety of a roadway segment or an intersection in reference to its expected frequency and severity. The mean predicted by the SPF represents a normal or expected number of crashes at a specific level of AADT, and the degree of deviation from the norm is stratified to represent specific levels of safety.

The levels of safety described by LOSS include:

- LOSS I - Indicates low potential for crash reduction
- LOSS II - Indicates low to moderate potential for crash reduction
- LOSS III - Indicates moderate to high potential for crash reduction
- LOSS IV - Indicates high potential for crash reduction

Examples of crash frequency and severity for a four-lane, four-leg signalized intersection can be referenced in Appendix A, *Corpus Christi MPO-Wide Safety Study*.



Non-Intersection Crashes

Rear-end collisions at intersections tend to be intractable, while they are more susceptible to cost-effective countermeasures on segments. From a geographical point of view, we can observe that SH 358 (S Padre Island Drive) corridor exhibits a pronounced pattern of injury rear-end collisions that are densely and continuously recorded.

Rear-end collisions occurring on urban freeway segments such as SH 358 can be due to high-speed, high-density operations and are susceptible to cost-effective crash reduction through the implementation of real-time variable speed limits. As the detailed analysis which follows later in this report for SH 358 shows, a pattern of rear-end collisions was identified as well as a LOSS IV, suggesting high potential for crash reduction on the segment. As such, this location was selected as a priority for addressing speed-related rear-end collisions occurring on segments within the Corpus Christi MPO study area, shown in Exhibit 26, *Map of Non-Intersection Rear End Crash*.

Intersection and Intersection Related Crashes

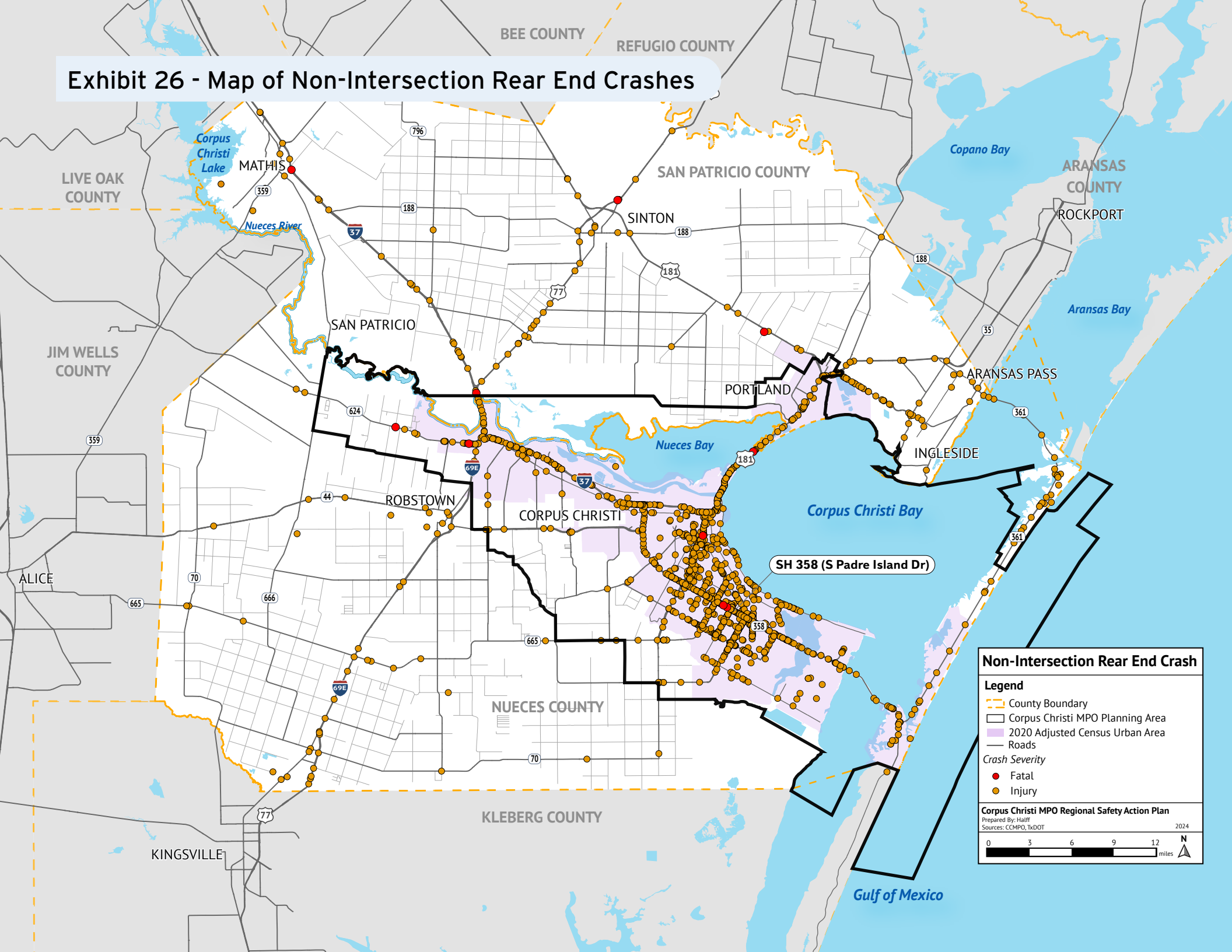
At-intersection and intersection-related severe crashes comprise a significant proportion of all the severe crashes recorded within the Corpus Christi MPO study area over the six-year study period. According to the data, the most common injury and fatal crash type at intersections was rear-end collisions. However, rear-end collisions in urban areas such as this tend to be somewhat intractable and not susceptible to cost-effective crash reduction countermeasures.

Crash data also shows that broadside and approach turn crashes were the next most common injury and fatal crash types recorded at intersections. Broadside and approach turn crashes tend to result in more severe crashes at intersections and are more susceptible to cost-effective crash reduction countermeasures, such as signal re-timing and signal control modifications.

As such, the primary focus of network screening has been on identification of intersections within the Corpus Christi MPO study area that displayed patterns of broadside and approach turn crashes. Locations were initially selected based on the degree of severity of crash history at these locations, i.e., locations displaying broadside patterns were ranked according to the number of injury and fatal crashes exhibited over the study period, as were locations displaying approach turn patterns.

In some cases, regarding approach turn and vulnerable road user crash types, available street imagery sometimes showed that recent improvements have been made to signals. For example, as discussed earlier, in the case of approach turn crashes, the intersection of Kostoryz Road and SH-357 / Saratoga Boulevard is listed as the seventh most severe location for approach turn crashes; however, recent changes have been made which converted signals to provide fully protected left turn movements, to very good effect, removing that particular intersection from further consideration within this effort.

Exhibit 26 - Map of Non-Intersection Rear End Crashes



Vulnerable Road User Crashes

The screening process continued with a more detailed analysis of the information regarding fatal and injury vulnerable road user crashes at the preliminary stages. When only fatal crashes are considered over the study period, pedestrian crashes are the second most common crash type, representing a substantial 26 percent of fatal crashes. Pedestrian crashes are typically more common at intersections, however data reveals that most crashes involving pedestrians within the Corpus Christi MPO study area occurred at non-intersections.

This pattern is suggestive of crashes involving pedestrians crossing at mid-block locations. The information suggests that the pattern of fatal pedestrian mid-block crossings is systemic across the Corpus Christi MPO study area rather than displaying a concentrated pattern. As such, a systemic countermeasure, such as deployment of Rectangular Rapid Flashing Beacons (RRFBs), which is an FHWA Proven Safety Countermeasure, on appropriate mid-block locations might be a suitable countermeasure.

On facilities such as SH-358 and SH-286 these fatalities are more intractable. However, locations such as Weber Road, Waldron Road and Port Avenue, might be more susceptible locations for application of low-cost systemic countermeasures such as RRFBs to be applied.

Bicycle Involved Crashes

Exhibit 27, *Map of Non-Intersection Bicycle Crashes*, represents locations where fatal and serious injury bicycle-involved crashes on segments were recorded. When a closer examination of the information was made, there were two segments which displayed a history of five severe bicycle-involved crashes over the six-year study period:

- Holly Rd. between Carroll Ln. and Ennis Joslin Rd.
- Santa Fe St. between Oleander Ave. and Santa Monica Place

The sections of Holly Rd. and Santa Fe St. demonstrate instances of non-intersection severe bicycle-involved crashes which may be susceptible to low-cost countermeasures.

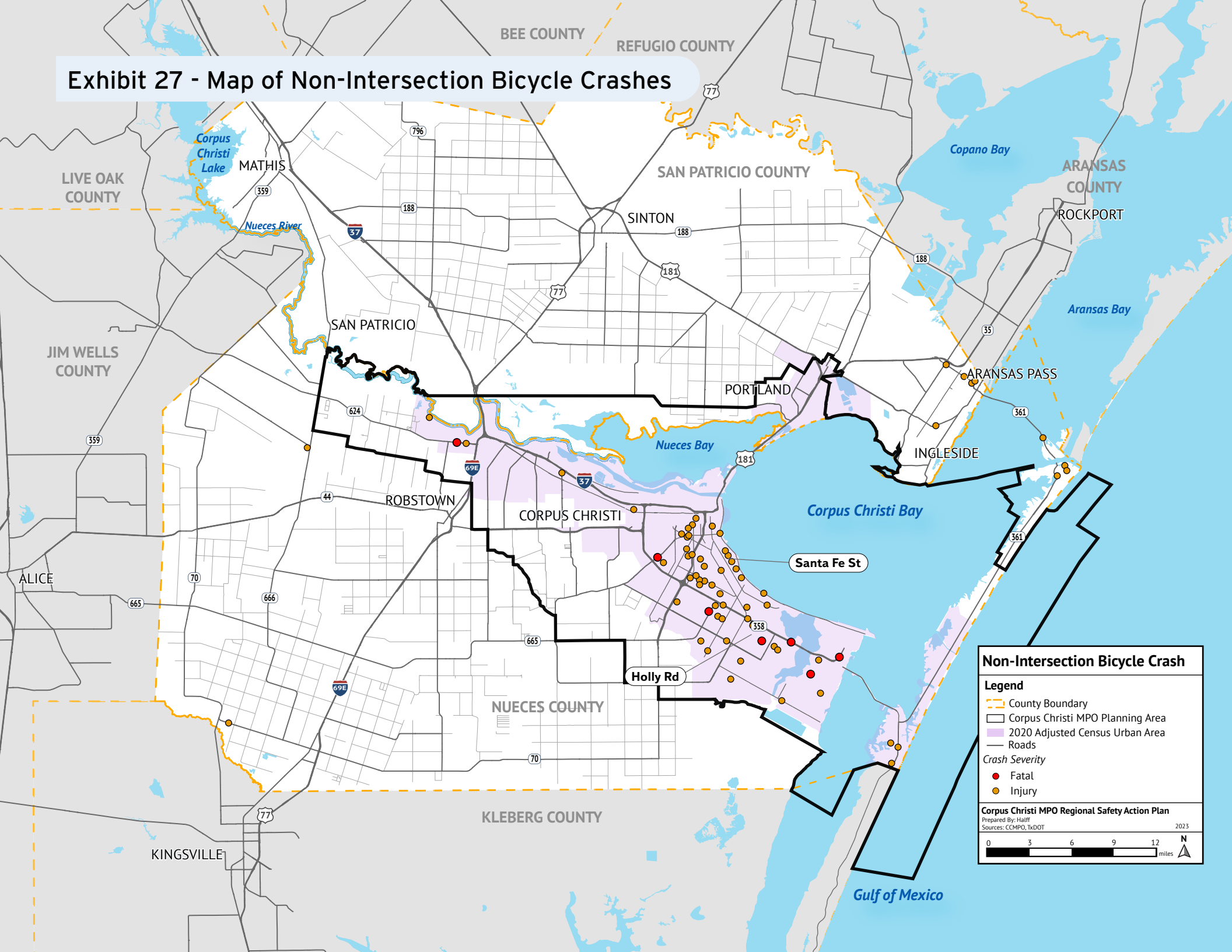
Vulnerable Road User Crashes at Intersections

In general, vulnerable road user crashes (pedestrian and bicycle) tend to be more susceptible to treatment with low-cost safety countermeasures at intersection locations. As such, an analysis of severe crashes involving vulnerable road users at intersections was made.

The screening process followed the same approach as that for broadside and approach turn crashes: locations were selected from a list of intersections where pedestrian and bicycle-involved crashes had occurred which were ranked according to the number of injury and fatal crashes which were recorded.

As was the case with locations for approach turn crashes, in some instances modifications had already been made recently to signals and pedestrian controls at the intersection, in which case another location further down the list was selected to maximize benefit-cost return. A detailed analysis of the intersections which were selected based on pedestrian and bicycle crash history is referenced in Appendix A, *Corpus Christi MPO-Wide Safety Study*.

Exhibit 27 - Map of Non-Intersection Bicycle Crashes



HIGH INJURY NETWORK

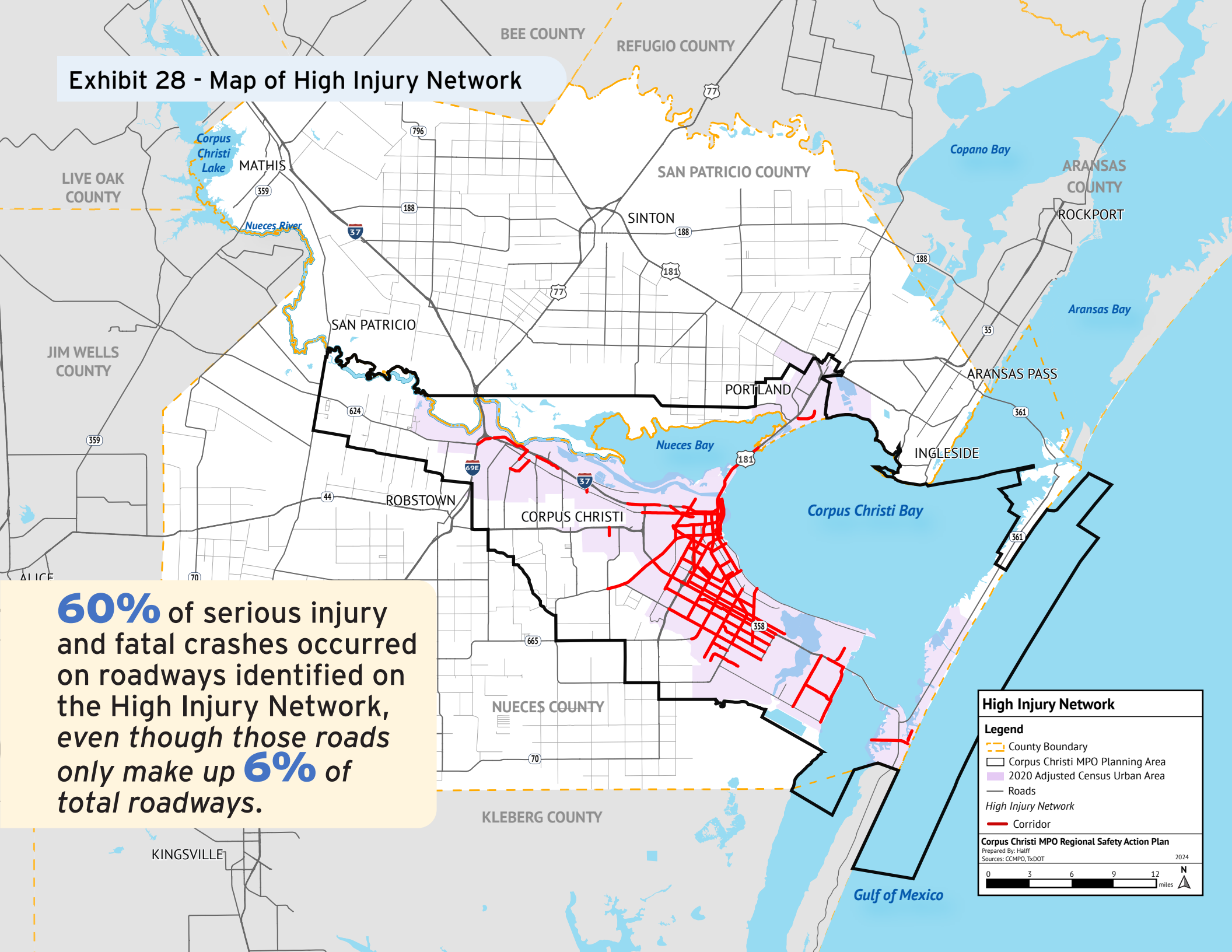
According to FHWA's Safe Streets and Roads for All (SS4A) grant program, comprehensive Safety Action Plans are the basic building block to significantly improve roadway safety. Action Plans that are eligible for SS4A grant funding must include analysis of existing conditions and historical trends that provide a baseline level of crashes involving fatalities or serious injuries across a jurisdiction, locality, or region. The safety analysis results in a geospatial identification of high-risk locations, also known as a High Injury Network (HIN), or equivalent.

HINs have become a widely used tool intended to assist agencies charged with improving the safety of streets and highways. Their utility in prioritizing the application of finite resources may be limited in some cases when an individual site's magnitude of deviation from crash levels observed at similar sites is not accounted for.

To address this issue, the development of a High Injury Network for the Corpus Christi MPO region using Texas-specific Safety Performance Functions (SPFs) in the evaluation of all arterial and freeway corridors within the MPO boundaries is proposed. Exhibit 28, *Map of High Injury Network*, identifies roadway segments throughout the Corpus Christi MPO area that have crash frequencies greater than average.

The HIN identified 198 roadway segments comprising the MPO region's roughly 440 centerline miles of arterial and freeway facilities. Each of these segments was analyzed using Texas statewide arterial and freeway SPFs and the most-recent five years of available crash data to determine its Level of Service of Safety (LOSS). As represented in Exhibit 29, *Table of High Injury Network Corridors*, 74 segments totaling 153 centerline miles have been identified as having severe (injury and fatal) crash frequencies greater than the crash frequencies of 80 percent of similar road segments in Texas (LOSS IV, high potential for crash correction). **This road network comprises roughly 6 percent of the MPO region's total road network but contains nearly 60 percent of its injury and fatal crashes.**

Exhibit 28 - Map of High Injury Network



60% of serious injury and fatal crashes occurred on roadways identified on the High Injury Network, *even though those roads only make up* **6%** *of total roadways.*

High Injury Network

Legend

- County Boundary
- Corpus Christi MPO Planning Area
- 2020 Adjusted Census Urban Area
- Roads

High Injury Network

- Corridor

Corpus Christi MPO Regional Safety Action Plan

Prepared By: Halff

Sources: CCMPO, TxDOT

2024

0 3 6 9 12 miles

N

Exhibit 29, Table of High Injury Network Corridors

HIGH INJURY NETWORK					Severity		
					Crashes 2017-2021		
Name	To	From	Segment Length (Mi.)	AADT	Severe	Total	Fatal-Serious Injury
3rd St	Elizabeth St	Hancock Ave	0.38	3,978	7	18	0
Agnes St	Baldwin Blvd	SH 286	1.9	9,273	15	49	4
Airline Rd	Wooldridge Rd	Ocean Dr	3.24	27,177	125	585	2
Ayers Rd	SH 358	Ocean Dr	3.59	12,918	77	255	10
Baldwin Blvd	Agnes St	S Staples St	2.76	17,040	51	173	3
Brawner Pkwy	Ramsey St	S Almeda St	2.25	6,167	10	34	1
Broadway St	Railroad Ave	Colonial Dr	1.26	4,438	6	16	0
Carancahua St	I-37	Laredo St	0.67	4,654	3	18	0
Carancahua St	Laredo St	Hancock Ave	0.52	4,853	5	18	1
Chaparral St	John Sartain St	Hirsch St	1.12	3,394	3	32	2
Corona Dr	Flynn Pkwy	Everhart Rd	0.5	7,044	4	25	0
Doddridge Rd	S Staples St	Ocean Dr	1.02	10,073	11	46	0
Everhart Rd	Yorktown Blvd	S Almeda St	4.61	24,193	95	365	2
Flour Bluff Dr	SH 358	Division Rd	1.21	19,957	20	59	2
Flour Bluff Dr	Division Rd	Yorktown Blvd	2.25	8,643	12	32	1
Glenoak Dr	Flour Bluff Dr	Laguna Shores Rd	1.79	4,443	6	20	1
Gollihar Rd	SH 296	S Staples St	3.12	12,688	24	124	0
Gollihar Rd	S Staples St	Airline Rd	1	5,722	9	23	1
Greenwood Dr	Holly Rd	S Port Ave	3.55	10,696	31	124	4
Holly Rd	Greenwood Dr	SH 286	0.75	5,581	6	10	0
Holly Rd	SH 286	Rodd Field Rd	6.24	17,643	81	279	18

Exhibit 29, Table of High Injury Network Corridors (cont.)

HIGH INJURY NETWORK					Severity		
					Crashes 2017-2021		
Name	To	From	Segment Length (Mi.)	AADT	Severe	Total	Fatal-Serious Injury
Horne Rd	Greenwood Dr	Ayers St	1	18,890	26	93	2
Horne Rd	Ayers St	Kostoryz Rd	1.05	11,000	9	42	1
I-37	Corn Products Rd	N Navigation Blvd	1.99	59,172	106	464	13
I-37	Buddy Lawrence Dr	N Carrizo St	1.9	68,869	93	283	9
International Blvd	SH 44	Airport Rd.	0.49	3,740	2	4	0
Kostoryz Rd	Saratoga Blvd	S Staples St	3.72	17,230	57	234	1
Laguna Shores Rd	Yorktown Blvd	S Padre Island Dr	3.57	3,236	11	33	1
Leeward Dr	Winword Dr	St Bartholomew Dr	0.61	1,741	2	3	0
Leopard St	Lantana Rd	N Upper Broadway St	4.74	9,817	41	100	8
Lipes Blvd	Yorktown Blvd	Cimatron Blvd	2.07	3,614	6	25	1
Louisiana Ave	S Staples St	Ocean Dr	1	4,500	5	16	1
McArdle Rd	Ayers St	Ennis Joslin Rd	6.49	8,057	70	288	5
Morgan Ave	Airport Rd	Ocean Dr	2.79	12,420	35	139	4
Nueces Bay Blvd	Leopard St	N Broadway St	1	6,028	5	11	0
Old Brownsville Rd	Agnes St	SH 358	3.04	6,614	17	34	4
Old Brownsville Rd	SH 358	FM 763	2.82	11,376	20	42	3
Old Robstown Rd	Agnes St	Leopard St	0.9	6,950	7	14	2
Padre Island Dr	Jones St	Laguna Shores Rd	1.06	31,750	20	76	5
S Port Ave	Ayers St	Agnes St	2.79	12,557	46	183	5
Santa Fe St	Weber Rd	S Tancahua St	2.88	8,596	20	51	2
Saratoga Blvd	SH 286	Rodd Field Rd	6.22	29,755	145	551	12

Exhibit 29, Table of High Injury Network Corridors (cont.)

HIGH INJURY NETWORK					Severity		
					Crashes 2017-2021		
Name	To	From	Segment Length (Mi.)	AADT	Severe	Total	Fatal-Serious Injury
SH 286	S Port Ave	I-37	2.55	94,494	151	585	18
SH 358	SH 286	Concord St	2.26	79,777	99	351	3
SH 358	Lakeside Dr	Lexington Blvd	1.9	151,435	209	735	26
SH 358	S Staples St	Rodd Field Rd	2.31	123,760	336	1382	23
SH 358	Concord St	S Staples St	2.03	85,994	123	614	15
SH 358	Old Brownsville Rd	SH 286	0.8	17,582	12	41	1
SH 544 Spur	SH 286	I-37 Access Rd	1.76	4,674	7	22	1
Shoreline Blvd	Craig St	Hughes St	2.01	11,792	16	98	2
Snow Goose Dr	Everhart Rd	Timbergate Dr	0.57	4,307	2	15	0
Staples St	Saratoga Blvd	McArdle Rd	0.68	8,001	4	11	0
Staples St	Ayers St	Doddridge St	2	36,511	159	737	4
Staples St	Laredo St	I-37	2.25	24,835	62	235	2
Staples St	Doddridge St	McArdle Rd	3.61	14,616	58	223	4
Starlite Ln	Violet Rd	Leopard St	1.39	1,759	3	17	0
Tarlton St	Greenwood Dr	Ayers St	1	9,013	9	42	2
Texan Tr	S Staples St	Santa Fe St	0.8	8,680	17	36	3
Tiger Ln	Kostoryz Rd	Flynn Pkwy	1.55	5,317	8	41	1
Timbergate Dr	Glasgow Dr	S Staples St	0.45	6,019	3	12	0
Tuloso Rd	Leopard St	Up River Rd	0.78	1,923	2	3	0
Up River Rd	US 77	Violet Rd	1.53	2,952	10	34	4
Up River Rd	McKinzie Rd	Morrow Drive	3.84	1,662	9	25	1

Exhibit 29, Table of High Injury Network Corridors (cont.)

HIGH INJURY NETWORK					Severity		
					Crashes 2017-2021		
Name	To	From	Segment Length (Mi.)	AADT	Severe	Total	Fatal-Serious Injury
US 181	Brewster St	Sunset St	0.71	62,195	55	227	4
US 181	Brewster St	Carizo St	4.04	57,893	127	410	21
Violet Rd	Blades St	I-37	0.7	13,771	18	63	1
Weber Rd	Yorktown Blvd	SH 358	2.71	26,180	119	461	6
Weber Rd	SH 358	Staples St	1.38	18,539	44	165	4
Whitecap Blvd	Bonasse Ct	Windward Dr	2.21	3,586	9	36	6
Williams Dr	Everhart Rd	Rodd Field Rd	3.01	5,173	28	98	3
Wooldridge Rd	Everhart Rd	S Staples St	1.06	3,531	3	11	0
Wooldridge Rd	S Staples St	Rodd Field Rd	2	8,996	13	47	1

Chapter Four
IMPLEMENTATION & EVALUATION

INTRODUCTION

The purpose of the Regional Safety Action Plan is to create a document that can be used as a resource for not only Corpus Christi MPO staff but also member organizations to make certain projects that are implemented address critical safety needs. To achieve the goal of zero deaths and serious injuries by 2050 and 50% reduction in deaths and serious injuries by 2035, it will be important to utilize the following resources to implement project recommendations, policies, and programs.

The screening process to identify locations that are susceptible to correction began with an analysis using the Countermeasure with Promise (CWP) approach. This process begins by choosing an effective countermeasure and looks at sites where it can be applied cost-effectively. The study focuses on the following emphasis areas from the Texas Strategic Highway Safety Plan:

- Speed Related Crashes
- Intersection Safety
- Vulnerable Users: Pedestrians
- Vulnerable Users: Bicyclists

Problems susceptible to correction which were identified as part of screening were:

- Approach turn (left turn opposite) crashes at intersections
- Broadside crashes at intersections
- Pedestrian and bicycle crashes at intersections and mid-block
- High-severity, high-speed rear-end collisions

The data-driven recommendations are accompanied by an associated Benefit/Cost (B/C) ratio quantifying the expected cost effectiveness of a proposed improvement at a specific location. The BC ratio consists of selecting a countermeasure with a known crash reduction factor, estimating the cost of construction, and computing a benefit cost (B/C) ratio. B/C represents a ratio of benefits of crash reduction to the cost of construction and maintenance over the life cycle of improvement.

Project benefits were determined by applying established Crash Reduction Factors (CRFs) specific to the proposed improvement to the expected number of severe injury and fatal crashes anticipated over the service life of the improvement in its absence (no-action condition). The expected reduction in crashes resulting from the improvement was then multiplied by current TxDOT standard costs representing societal economic impact from severe and fatal road crashes.

Individual projects' B/C ratio is obtained by dividing the total economic safety benefit by the implementation cost. B/C values greater than one represent a positive societal return on investment. Higher B/C values indicate higher levels of cost-effectiveness.

Exhibit 30, *Table of Project Locations and Recommendations*, represent the potential recommended improvement to address the safety concern at that particular location. The following pages are intended to provide a brief overview of the location, project recommendation, and benefit/cost analysis. Further information can be found in Appendix A, *Corpus Christi MPO-Wide Safety Network Screening*.

PRIORITIZATION

The following project prioritization criteria was developed by the project team with input from Corpus Christi MPO and Safety Task Force members.

Step 1: Benefit/Cost Based Ranking (60 points)

Highest B/C = 60 points.
Lower B/Cs score in order of B/C

Step 2: Underserved Population Score (10 points)

- **10 points** if in or adjacent to a Very High Disadvantaged Population Census Block Group
- **8 points** if in or adjacent to a High Disadvantaged Population Census Block Group
- **5 points** if in or adjacent to a Medium Disadvantaged Population Census Block Group
- **0 points** if in or adjacent to a Low Disadvantaged Population Census Block Group

If multiple levels are adjacent, the highest score will be used.

Step 3: Scope-Joining Opportunity Score (20 points)

Composite Score =
Benefit/Cost Score
+ Disadvantage Population Score
+ Scope-Joining Score
Final Project Ranking Score

Along with the development of this action plan, a project list has been developed to address critical safety needs that is shaped by data, implements proven safety countermeasures with quantifiable crash reduction factors, and considers equity and community input. The initial 20 locations may include multiple projects that would address the nature and magnitude of the safety problem followed by development of countermeasures and benefit/cost analysis of proposed improvements.

Exhibit 30, Table of Project Locations and Recommendations

Location	Project ID	Intersection(s) / Corridor	From Street	To Street	Improvement Recommendation	Cost	Benefit / Cost
1	1.1	Everhart @ Holly	n/a	n/a	Protected-only left turn phasing	$2,000	2294.53
	1.2	Everhart @ Holly	n/a	n/a	Check / update change and clearance intervals	$2,000	1361.73
2	2.1	Staples @ SPID SFR	n/a	n/a	Check / update change and clearance intervals	$2,000	709.45
	2.2	Staples @ SPID SFR	n/a	n/a	Pavement markings, lane control signing	$13,600	6.21
3	3.1	Kostoryz @ SPID SFR	n/a	n/a	Check / update change and clearance intervals	$2,000	652.27
	3.2	Kostoryz @ SPID SFR	n/a	n/a	Pavement markings (extension lines)	$5,600	31.4
	3.3	Kostoryz @ SPID SFR	n/a	n/a	Add signal heads	$10,150	385.58
	3.4	Kostoryz @ SPID SFR	n/a	n/a	Add roadway lighting	$55,000	188.54
4	4.1	Rodd Field @ SPID SFR	n/a	n/a	Check / update change and clearance intervals	$2,000	228.72
	4.2	Rodd Field @ SPID SFR	n/a	n/a	Add signal heads, signing	$7,000	32.67
5	5.1	Holly @ Weber	n/a	n/a	Signal timing update, "no right turn" blankout signs	$21,000	56.76
	5.2	Holly @ Weber	n/a	n/a	Protected-only left turn phasing	$2,000	3570.57
6	6.1	Saratoga @ Cimarron	n/a	n/a	Protected-only left turn phasing	$2,000	2294.53
7	7.1	Ayers @ SPID SFR	n/a	n/a	Check / update change and clearance intervals	$2,000	171.54
	7.2	Ayers @ SPID SFR	n/a	n/a	Add signal heads	$8,500	17.94
8	8.1	Staples @ Yorktown	n/a	n/a	Protected-only left turn phasing, add backplates	$30,000	407.76
	8.2	Staples @ Yorktown	n/a	n/a	Signal timing update	$10,000	21.66
	8.3	Staples @ Yorktown	n/a	n/a	Add roadway lighting	$71,000	56.06

Exhibit 30, Table of Project Locations and Recommendations (cont.)

Location	Project ID	Intersection(s) / Corridor	From Street	To Street	Improvement Recommendation	Cost	Benefit / Cost
9	9.1	Baldwin @ Greenwood	n/a	n/a	Check / update change and clearance intervals	$2,000	114.36
	9.2	Baldwin @ Greenwood	n/a	n/a	Add signal heads	$17,000	8.97
10	10.1	Waldron @ Knickerbocker	n/a	n/a	FYA ped protect, lighting	$50,000	119.95
11	11.1	Leopard @ Callicoatte	n/a	n/a	Protected-only left turn phasing	$18,000	32.19
	11.2	Leopard @ Callicoatte	n/a	n/a	Add reflective backplates	$12,000	38.12
12	12.1	S Padre Island Dr	W Point Rd	Nile Dr	Variable speed limit system	$10,000,000	36.76
13	13.1	US 77 Bus @ FM 70	n/a	n/a	Intersection conflict warning system	$100,000	22.37
	13.2	US 77 Bus @ FM 70	n/a	n/a	Convert to all-way stop	$31,500	436.01
14	14.1	Staples @ Curtis Clark	n/a	n/a	Raised median / turning movement restriction	$100,000	101.05
15	15.1	Weber @ Yorktown	n/a	n/a	Protected-only left turn phasing	$7,000	98.02
16	16.1	Leopard @ Staples	n/a	n/a	LPI, pedestrian countdown signals	$40,000	50.93
17	17.1	McKinzie @ Up River	n/a	n/a	Install traffic signal	$1,000,000	12.57
	17.2	McKinzie @ Up River	n/a	n/a	Raised median / turning movement restriction	$100,000	61.27
18	18.1	Holly Rd	Caroll Ln	Ennis Joslin Rd	Roadway lighting, bike lane signing and markings	$2,024,000	3.35
19	19.1	Staples St	Saratoga Blvd	McArdle Rd	Raised median	$6,000,000	5.99
20	20.1	Santa Fe St	Oleander Ave	Santa Monica Pl	Roadway lighting, bike warning signs	$567,000	2.32
21	21.1	Staples @ McArdle	n/a	n/a	Protected-only left turn phasing, partial signal rebuild	$400,000	1.87

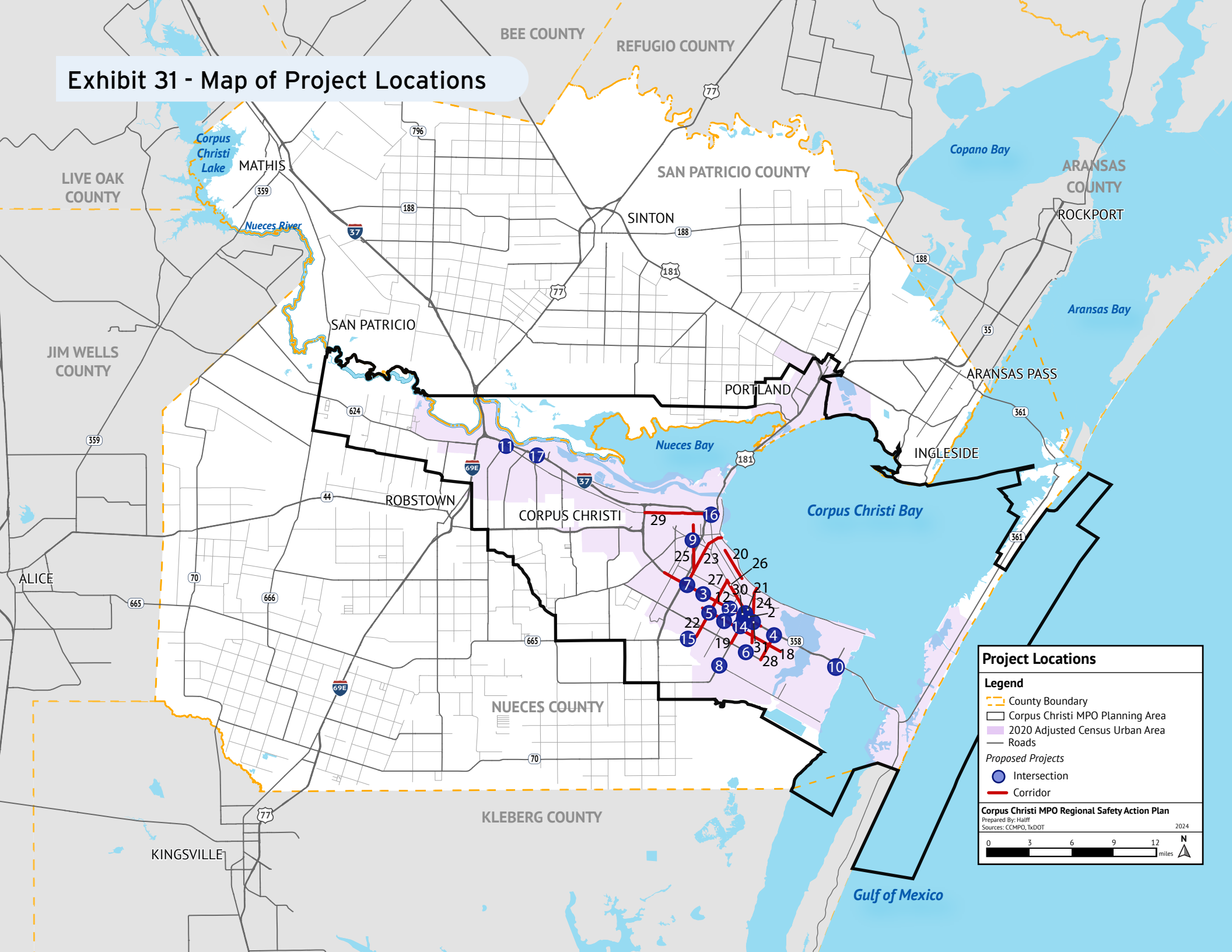
Exhibit 31, Table of Additional Project Locations and Recommendations

Location	Project ID	Intersection (s) / Corridor	From Street	To Street	Improvement Recommendation	Cost	Benefit / Cost
22	22.1	Weber	Bratton Rd	SH 358	Raised median	$2,600,000	13.75
	22.2a	Weber	Caravelle Pkwy	Holly Rd	PHB with median ped refuge	$800,000	4.13
	22.2b	Weber	S of Brushwood Ln	S of Brett St	PHB with median ped refuge	$800,000	9.76
	22.3	Weber	Saratoga Blvd	SPID WB	Ped left protection (FYA mod), Ped countdown signals	$40,000	91.26
	22.4	Weber Rd @ SPID WB	n/a	n/a	Realign crosswalks (right turn ramps)	$60,000	5.36
	22.5	Weber	Yorktown Blvd	SPID	Corridor signal timing	$40,000	8.52
23	23.1a	Ayers	Staples St	Baldwin Blvd	Road Diet	$100,000	25.9
	23.1b	Ayers	Baldwin Blvd	Horne Rd	Road Diet	$150,000	81.24
	23.2	Ayers	Baldwin Blvd	Horne Rd	Lighting improvements	$1,700,000	9.19
	23.3	Ayers	Tarlton St	Roosevelt Dr	Raised median (ped refuge)	$800,000	6.29
	23.4	Ayers	Pearse Dr	S of Horne Rd	Raised median	$600,000	9.32
	23.5a	Ayers	Arlington Dr	Norton St	RRFB (2)	$50,000	53.43
	23.5b	Ayers	S of Horne Rd	S of Cuiper St	RRFB (3)	$100,000	12.68
	23.6	Ayers @ Tarlton, Ayers @ Blevins	n/a	n/a	LPI and Ped countdown signals	$35,000	35.52
24	24.1	Airline	Gaines St	Lum Ave	Minor delineation and signing	$2,500	0
	24.2	Airline	Gollihar Rd	SPID	Lighting (both sides of street)	$54,000	8.28
	24.3	Airline	Kimbrough Dr	Cimarron Blvd	Raised Median	$2,700,000	4.54
	24.4	Airline	Ocean Dr	Alameda St	Road Diet	$250,000	9.59
	24.5a	Airline @ Gollihar Rd	n/a	n/a	LPI, markings, lighting	$45,000	11.92
	24.5b	Airline @ McArdle Rd	n/a	n/a	Ped signal relocation, FYA ped protect	$35,000	14.96
	24.5c	Airline @ Williams Dr	n/a	n/a	FYA ped protect, lighting	$30,000	39.66
	24.5d	Airline @ Holly Rd	n/a	n/a	FYA ped protect, lighting, channelizing islands	$100,000	6.7
25	25.1a	S Port @ Niagara St	n/a	n/a	RRFB	$68,900	98.74
	25.1b	S Port @ Morgan, S Port @ Tarlton, S Port @ Horne	n/a	n/a	FYA ped protect	$4,500	101.7
	25.2	S Port	Agnes St	Ayers St	Lighting (both sides of street)	$385,000	68.79
	25.3	S Port	Agnes St	Ayers St	Raised median	$156,000	8.27
26	26.1	Staples	Weber Rd	McArdle Rd	Raised median	$1,960,000	9.94
	26.2a	Staples @ Weber Rd	n/a	n/a	LPI / Left Turn Ped Protect	$1,500	61.02
	26.2b	Staples @ Mustang Tr	n/a	n/a	Add crosswalk, LPI / Left Turn ped protect	$15,500	118.52

Exhibit 31, Table of Additional Project Locations and Recommendations (cont.)

Location	Project ID	Intersection (s) / Corridor	From Street	To Street	Improvement Recommendation	Cost	Benefit / Cost
27	27.1	Weber	Staples St	SPID	Raised Median	$1,700,000	6.76
	27.2	Weber	Staples St	SPID	Lighting (both sides of street)	$2,000,000	3.79
	27.3	Weber @ Staples, Weber @ Gollihar, Weber @ McArdle	n/a	n/a	FYA ped omit	$2,000	812.03
	27.4	Weber	Gollihar Rd	SPID	Corridor signal timing	$20,000	2.43
28	28.1	Rodd Field	Saratoga Blvd	SPID	Raised median	$1,500,000	13.85
	28.2	Rodd Field	Holly Rd	SPID	Ped signal improvements	$16,200	79.11
29	29.1	Leopard	McBride Ln	Van Cleve Dr	RRFB (2), ped refuge medians	$205,000	95.36
	29.2	Leopard @ McBride, Leopard @ Navigation, Leopard @Westchester	n/a	n/a	Ped signal improvements	$183,000	173.45
	29.3	Leopard	SH 358	Oak Park Ave	Sidewalks	$1,415,020	26.1
	29.4	Leopard @ Old Robstown Rd	n/a	n/a	Crosswalk markings	$5,730	1.77
	29.5	Leopard @ Brownlee Blvd	n/a	n/a	R10-15 signs	$1,000	0
	29.6	Leopard @ Navigation, Leopard @ Westchester, Leopard @ Up River	n/a	n/a	Check change and clearance intervals	$10,000	129.16
	29.7	Leopard	Staples St	Upper Broadway	Road Diet	$225,000	2.13
30	30.1	Staples @ SPID NFR	n/a	n/a	Evaluate clearance/change intervals	$2,000	113.63
	30.2	Staples @ SPID NFR	n/a	n/a	Extension line markings, signal head realignment	$20,000	4.96
	30.3	Staples @ SPID NFR	n/a	n/a	Intersection lighting	$135,000	1.82
	30.4	Staples @ SPID NFR	n/a	n/a	Ped signing improvements	$3,300	109.28
31	31.1	Airline @ SPID SFR	n/a	n/a	Markings: U-turn ramp accel lane, realign FR thru intersection	$50,000	0
	31.2	Airline @ SPID SFR	n/a	n/a	Corridor signal timing	$50,000	20.27
32	32.1	Everhart @ SPID SFR	n/a	n/a	Evaluate clearance/change intervals, coordination	$30,000	30.33
	32.2	Everhart @ SPID SFR	n/a	n/a	Yield signing/marking on U-turn ramp	$1,541	31.59
	32.3	Everhart @ SPID SFR	n/a	n/a	Extension line markings	$5,400	0

Exhibit 31 - Map of Project Locations



1. Everhart Rd at Holly Rd

The intersection of Everhart Road and Holly Road is a 4-leg 4-lane divided signalized urban intersection. This intersection has an Annual Daily Traffic (ADT) count from 2018 of 25,436 on Everhart Road and 18,430 on Holly Road.

Identified Safety Problems

Safety Performance Functions (SPFs) show that the intersection performs at Level of Service of Safety (LOSS) IV from the total crash frequency standpoint, indicating high potential for crash reduction. From the severity standpoint, the intersection performs at the LOSS-III, LOSS-IV boundary level, indicating moderate to high or high potential for crash reduction.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
1-A	Retime FYA for Fully Protected Left Turns by Time of Day	2294.53	86	1-2 yrs
1-B	Review and Revise Yellow and All Red Signal Timing	1361.73	84	1-2 yrs

Recommended Improvements

Approach Turns

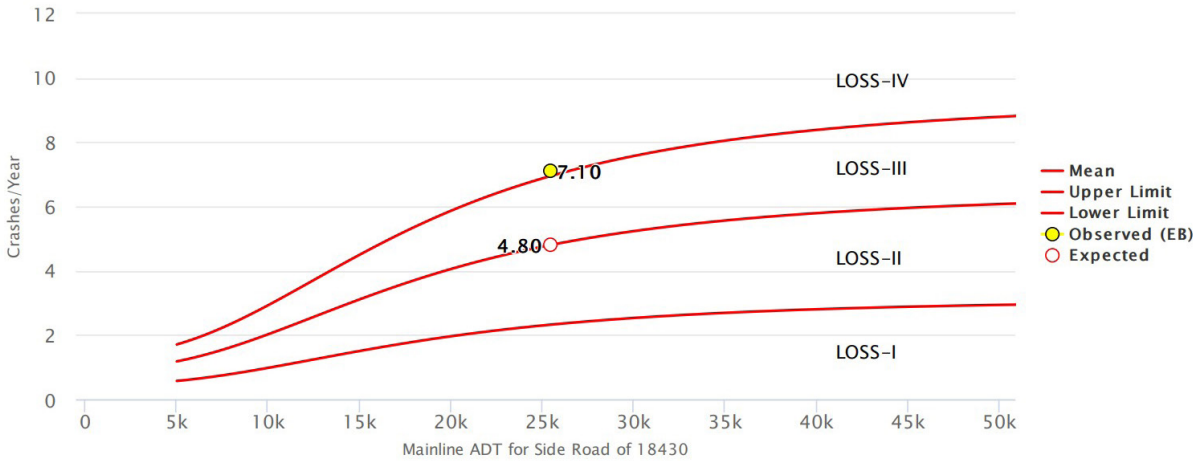
Crash data indicates that approach turn crashes involved drivers turning left from all 4 directions. We recommend that Fully Protected Left Turns should be implemented for both Everhart and Holly.

Broadsides

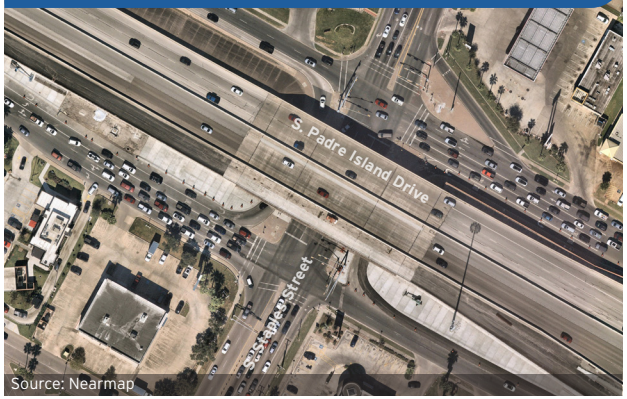
Crash records show at-fault drivers in broadsides from all 4 directions, with westbound most common. In consideration of the incidence of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the National Cooperative Highway Research Program (NCHRP) Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012).

The benefit-cost analysis (B/C) ratio for the implementation of fully protected left turn lanes on both Everhart Road and Holly Road is **2,294.53**, which indicates the measure is expected to be highly cost-effective.

The B/C Analysis for signal timing correction is a ratio of **1,361.73**, which shows the measure is expected to be extremely cost-effective.



2. S. Staples St at SH 358 EB FR



The intersection of S. Staples Street and SH-358 Eastbound Frontage Road/S. Padre Island Drive is a 4-leg 4-lane divided signalized urban intersection. Because this is a frontage road intersection, traffic on SH-358 Eastbound Frontage Road/S. Padre Island Drive is one way. This intersection has an ADT count from 2018 of 37,306 on Staples Street and 8,541 on SH-358 Eastbound Frontage Road.

Identified Safety Problems

Direct diagnostics showed that the intersection displays patterns of Sideswipe Same Direction and Overtaking Turn crashes. Although Broadside crashes were not an identified pattern, they represent about 23% of all injury level crashes accounting for about 27% of all injuries. This indicates that broadside crashes can be high severity when they occur at the intersection. Broadsides at a signalized intersection can be easily susceptible to cost effective correction, as such they will be analyzed with identified crash patterns.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
2-A	Review and Revise Yellow and All Red Signal Timing	709.45	80	1-2 yrs
2-B	Lane Line Extensions and Advance Lane Selection Signs	6.21	30	2-3 yrs

Recommended Improvements

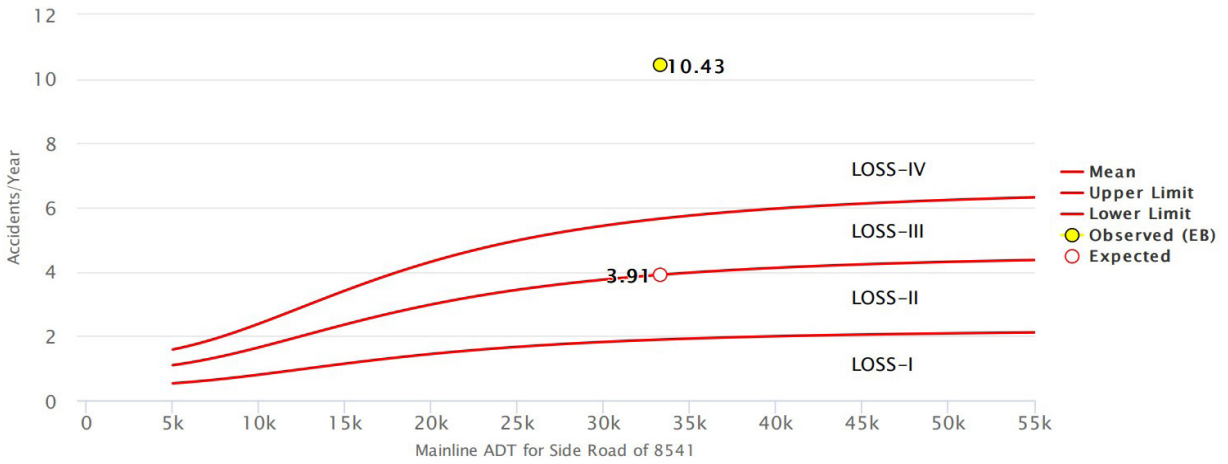
In consideration of the incidents of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the NCHRP Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012). B/C Analysis for signal timing correction is a ratio of **709.45**, which shows the measure is expected to be extremely cost-effective.

To address the pattern of sideswipe same direction and overtaking turn crashes at the intersection, it is recommended that turn lane line extensions through the intersection be reinstated for each of the left turn lanes.

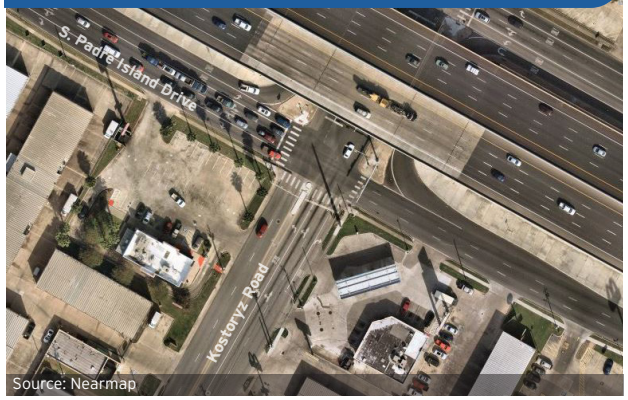
Additionally, it is recommended that turn lane lines be extended through the intersection for the right turn lanes from the SH-358 Eastbound Frontage Road. In conjunction with this, it is recommended that an advance lane selection sign be installed in advance of the intersection on southbound Staples Street.

Finally, to address potential conflicts between westbound U-turning traffic and Eastbound Frontage Road thru traffic, it is recommended that dotted extensions of both eastbound thru lane edge lines should be added, along with a Yield line in between both YIELD signs on the U-turn lane.

Even using a conservative Crash Reduction Factor (CRF) of 10%, the B/C ratio of **6.21** shows the measures are expected to be cost-effective.



3. Kostoryz Rd at SH 358 EB FR



The intersection of Kostoryz Road and SH-358 Eastbound Frontage Road/S. Padre Island Drive is a 4-leg 4-lane divided signalized urban frontage road intersection. Because this is a frontage road intersection, traffic on SH-358 Eastbound Frontage Rd./S. Padre Island Drive is one way. Furthermore, because of the nature of the intersection, left turns from northbound Kostoryz Road are not possible, while available imagery also indicates that right turns on red are permitted from eastbound SH-358 Eastbound Frontage Road/S. Padre Island Drive.

This intersection has an ADT count from 2018 of 20,229 on Kostoryz Road and 7,659 on SH-358 Eastbound Frontage Road.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
3-A	Review and Revise Yellow and All Red Signal Timing	652.27	78	1-2 yrs
3-B	Signal Modifications, Reposition Heads, Additional Signal Head	385.58	74	2-3 yrs
3-C	Intersection Lighting	188.54	68	2-3 yrs
3-D	Lane Line Extensions	31.4	42	2-3 yrs

Identified Safety Problems

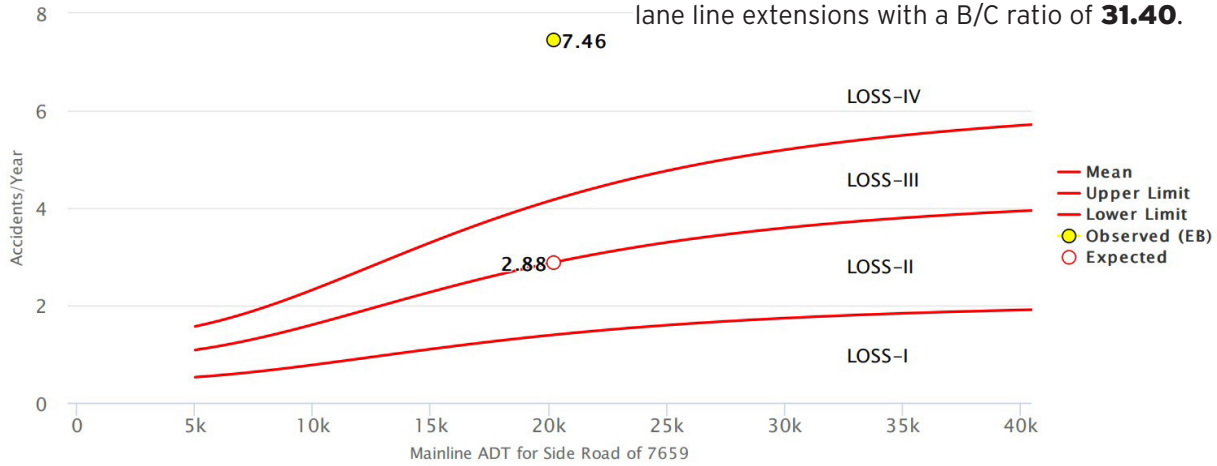
SPFs shows that the intersection performs at LOSS IV from both the total crash frequency standpoint and the crash severity standpoint, indicating high potential for crash reduction.

Crash data indicates that the most common conflicts are seen between eastbound and southbound vehicles. Given the presence of a one-way road without the additional distance provided by adjacent lanes traveling in the opposite direction, or left turns between phasing on the one-way approach, this allows quicker entry to the intersection for eastbound traffic and decreases the distance between eastbound vehicles and conflicting southbound vehicles between phases.

Recommended Improvements

In consideration of the incidents of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the NCHRP Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012).

If a field visit confirms that yellow and all-red timings are not necessarily consistent with NCHRP 731 guidance, as adjusted for one-ways, correcting the intervals is recommended. The benefit-cost analysis for signal timing correction and indicates a B/C ratio of **652.27**. Additional improvements at location include signal modifications with a B/C ratio of **385.58**, intersection lighting with a B/C ratio of **188.54** and lane line extensions with a B/C ratio of **31.40**.



4. Rodd Field Rd at SH 358 EB FR

The intersection of SH-357 (Rodd Field Road) and SH-358 Eastbound Frontage Road (S. Padre Island Drive) is a 4-leg 4-lane divided signalized urban frontage road intersection. Because this is a frontage road intersection, traffic on SH-358 Eastbound Frontage Rd./S. Padre Is. Dr. is one way. This intersection has an ADT count from 2018 of 32,205 on SH-357/Rodd Field Road and 5,122 on SH-358 Eastbound Frontage Road.

Identified Safety Problems

SPFs have not yet been developed for a Texas Urban 4-lane Divided Signalized 4-leg ramp/frontage road intersection facility, so the Texas Urban 4-lane Divided Signalized 4-leg intersection SPF model was used here to serve as the best-fit proxy model. The models show that the intersection performs at LOSS IV from both the total crash frequency standpoint and the crash severity standpoint, indicating high potential for crash reduction.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
4-A	Review and Revise Yellow and All Red Signal Timing	228.72	69	1-2 yrs
4-B	Signal Modifications, Additional Heads and Advance Signs	32.67	43	2-3 yrs

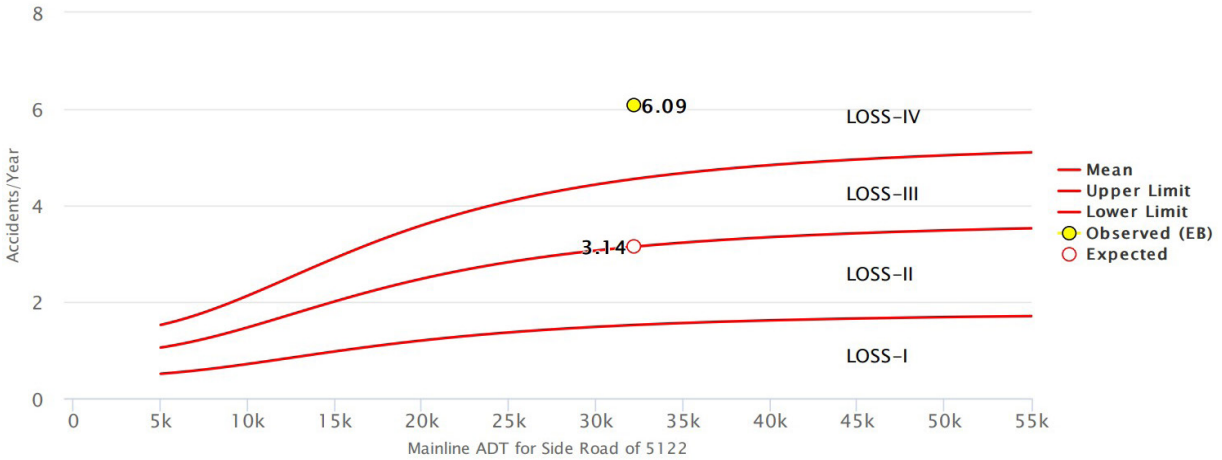
Recommended Improvements

Broadsides

In consideration of the incidents of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the NCHRP Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012).

If a field visit confirms that yellow and all-red timings are not necessarily consistent with NCHRP 731 guidance, as adjusted for one-ways, correcting the intervals is recommended. The B/C analysis for signal timing correction indicates a B/C ratio of **228.72**, which shows the measure is expected to be extremely cost-effective.

In consideration of the pattern of Broadside crashes, especially northbound broadside crashes, we recommend signal modifications including the installation of secondary left side signals on northbound SH-357. Concurrent with this, we also recommend that an advance signal ahead warning sign (Manual on Uniform Traffic Control Devices (MUTCD) W3-3) should be erected on the northbound approach in advance of the intersection. The proposals to address the pattern of northbound Broadside crashes at the intersection, are expected to be cost-effective even assuming a conservative 10% CRF, with a B/C ratio of **32.67**.



5. Weber Rd at Holly Rd

The intersection of Weber Road (FM43) and Holly Road is a 4-leg 4-lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 32,555 on Weber Road and 19,274 on Holly Road.

Identified Safety Problems

SPFs show that the intersection performs at LOSS IV from the total crash frequency standpoint, indicating high potential for crash reduction. From the severity standpoint, the intersection performs at the border of the LOSS-III and LOSS-IV levels, indicating moderate to high potential for crash reduction.

Direct diagnostics showed that the intersection displays patterns of Rear-End and Sideswipe Same Direction crashes. Although Approach Turns were not identified as a pattern by diagnostics, crash history indicates that approach turns at this location have been high severity crashes and lend themselves to be susceptible to correction.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
5-A	Retime FYA for Fully Protected Left Turns by Time of Day	3570.57	68	1-2 yrs
5-B	Restrict Right Turn on Red	56.76	36	2-3 yrs

Recommended Improvements

Rear-Ends and Sideswipe Same Direction

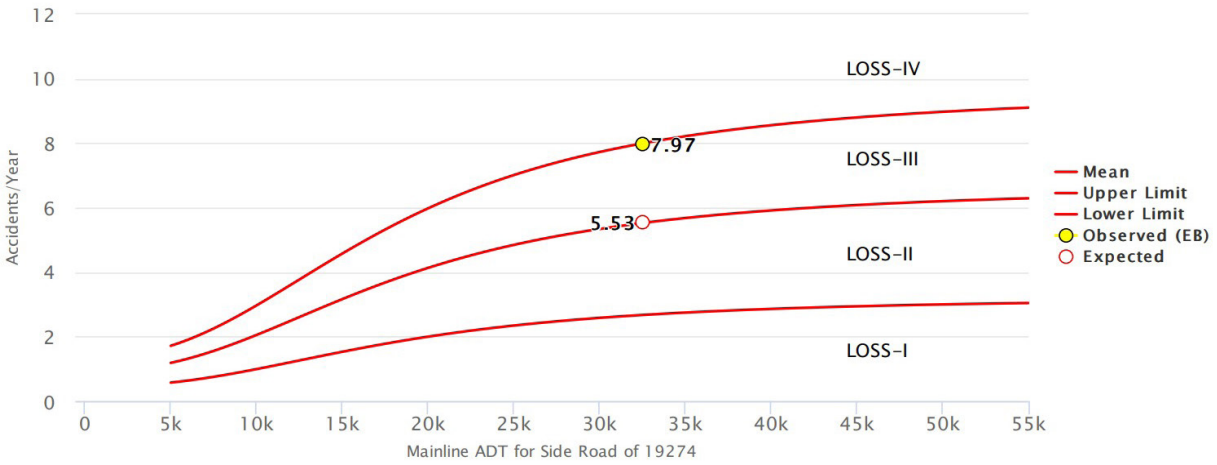
To address both the rear-end and sideswipe same direction crash patterns at the intersection, we recommend that signal re-timing be undertaken in order to improve traffic progression, this may include re-timing of surrounding signals upstream and/or downstream of the intersection, as such a higher cost estimate than usual has been included in the B/C analysis.

In tandem with this measure, we recommend that R3-1 NO RIGHT TURN Blank Out signs be installed in both directions on Holly Road in order to prevent right turns during protected left turn phasing from Holly Road.

The B/C analysis ratio for signal re-timing and installation of NO RIGHT TURN blank out signs is **56.76**, indicating the measures are expected to be cost-effective even with a conservative estimate of a 20% crash reduction factor.

Approach Turns

The implementation of fully protected left turns at Weber Road and Holly Road, at least between 5:00 A.M. and Midnight, using an estimated cost of $2,000 for signal re-timing has a B/C ratio of **3570.57**, which indicates the measure is expected to be extremely cost-effective.



6. Cimarron Blvd at Saratoga Blvd

The intersection of Cimarron Boulevard and Saratoga Boulevard (SH-357) is a 4-leg 4-lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 27,760 on Saratoga Blvd. and 21,367 on Cimarron Blvd. In all directions there are 2 heads for 2 through movement lanes which are centered over the lanes. All directions have a single dedicated left turn lane and a dedicated right turn lane.

Identified Safety Problems

SPFs show that the intersection performs at LOSS IV from the total crash frequency standpoint, indicating high potential for crash reduction. From the severity standpoint, the intersection performs at the high LOSS-III level, indicating moderate to high potential for crash reduction.

Direct diagnostics showed that the intersection displays patterns of Approach Turn crashes, as well as crashes occurring under dark conditions.

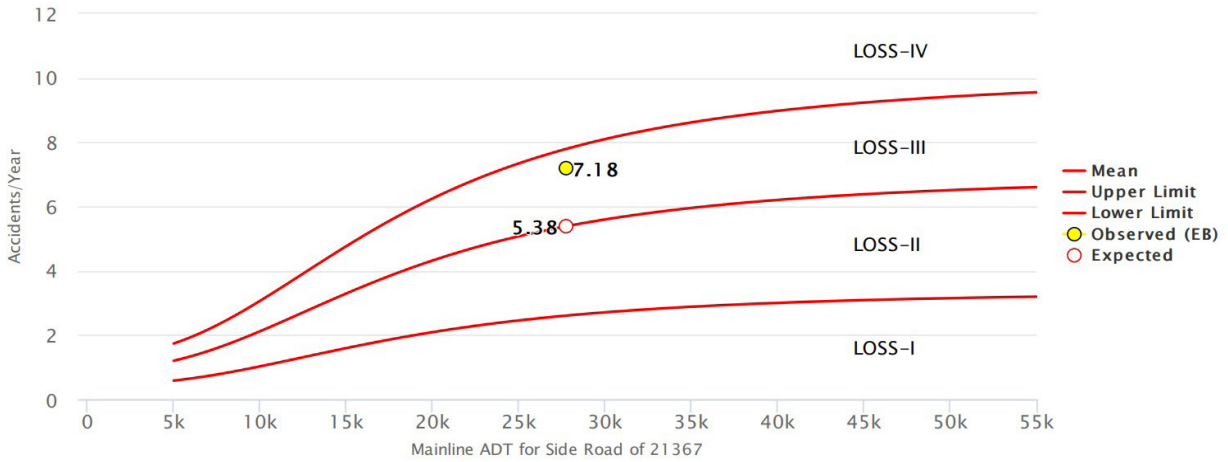
Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
6-A	Retime FYA for Fully Protected Left Turns	2294.53	63	1-2 yrs

Recommended Improvements

Approach Turns

Due to the strong pattern of high-severity approach turn crashes recorded at the intersection, and the reduction in approach turn crashes already seen by implementation of fully protected left turns on Saratoga Blvd, we recommend that Fully Protected Left Turns also be implemented on Cimarron Blvd. Because the signals in place on Cimarron already allow for implementation of left turn on green arrows only, only a change in signal timing would be required.

The B/C analysis for implementation of fully protected left turns on Cimarron Blvd used an estimated cost of $2,000 for signal re-timing. Even using a conservative CRF of 50%, the B/C ratio of this measure is **2294.53**, which indicates the measure is expected to be very cost-effective.



7. Ayers St at SH 358 EB FR

The intersection of BS0286A/Ayers Street and SH-358 Eastbound Frontage Road (S. Padre Island Drive) is a 4-leg 4-lane divided signalized urban frontage road intersection. This intersection has an ADT count from 2018 of 10,575 on Ayers Street and 2,117 on SH-358 Eastbound Frontage Road.

Identified Safety Problems

The models show that the intersection performs at LOSS IV from both the total crash frequency standpoint and the crash severity standpoint, indicating high potential for crash reduction. SPFs have not been developed for this facility type as well as diagnostic models have not been developed for ramp/frontage road intersection facilities. However the best fit proxy model for direct diagnostics showed that the intersection displays a pattern of Sideswipe Same Direction crashes.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
7-A	Review and Revise Yellow and All Red Signal Timing	171.54	63	1-2 yrs
7-B	Modify Signal, Add Secondary Heads	17.94	35	2-3 yrs

Recommended Improvements

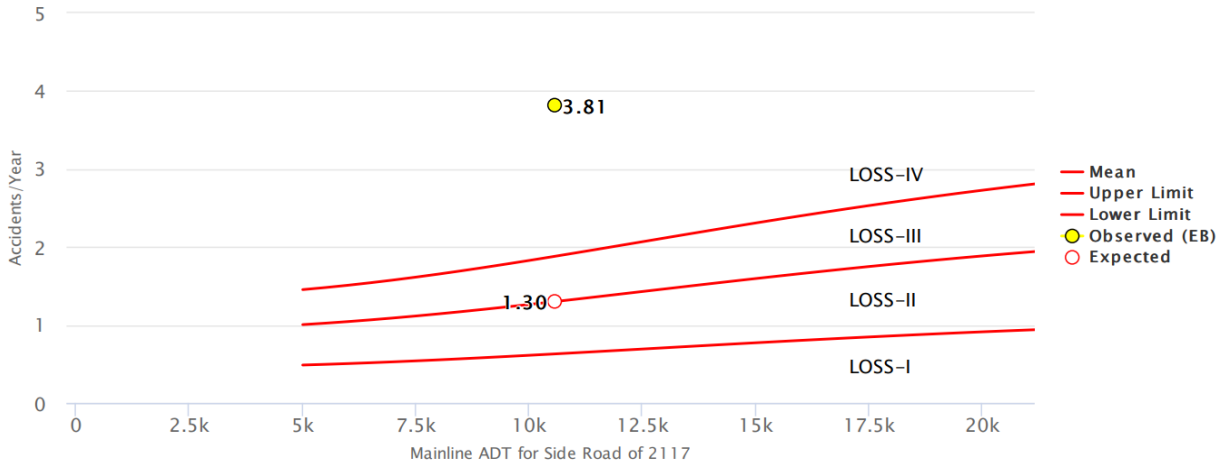
Broadsides

Shorter than recommended intervals are strongly correlated with broadside crashes. In consideration of the incidents of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the NCHRP Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012). The B/C analysis for signal timing correction indicates a B/C ratio of **171.54**, which shows the measure is expected to be extremely cost-effective. In addition, the installation of secondary left and right-side pole-mounted signals on the eastbound SH-358 frontage road with an expected B/C ratio of **17.94**.

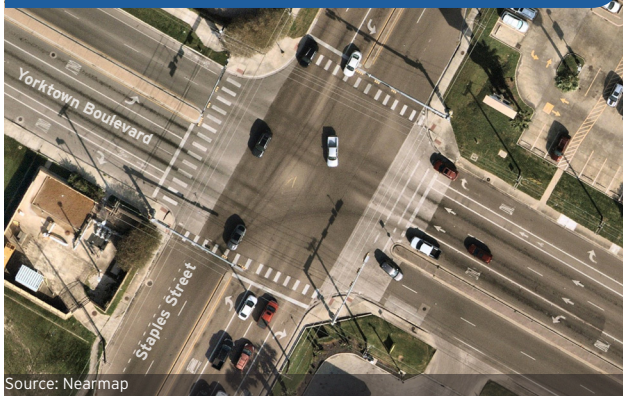
Sideswipe Same Direction

In cases with double left turns and a high proportion of sideswipe same direction crashes related to turning movements, we would typically recommend that turn lane line extensions be painted on the pavement. However, in this case extension lines are already present for southbound and eastbound left turn lanes where double left turns are possible. In this regard, the only recommendation at this time would be to ensure that the striping is well maintained.

It would be recommended that yield lines be reinstated for the northbound right turn lane from Ayers Street. It would be recommended that yield lines also be painted on the pavement adjacent to the YIELD sign for the east side U-turn lane. In this regard the measures discussed above are not expected to be cost-effective and so they are not recommended.



8. Staples St at Yorktown Blvd



Source: Nearmap

The intersection of S. Staples Street (FM2444) and Yorktown Boulevard is a 4-leg 4-lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 19,934 on Staples St. and 12,537 on Yorktown Blvd.

Identified Safety Problems

SPF show that the intersection performs at LOSS IV for both total crash frequency and crash severity, indicating high potential for crash reduction at this location. Direct diagnostics unsurprisingly showed that the intersection displays patterns of Rear-End and Approach Turn crashes, as well as crashes occurring under dark conditions. There is currently no intersection lighting visible at the intersection.

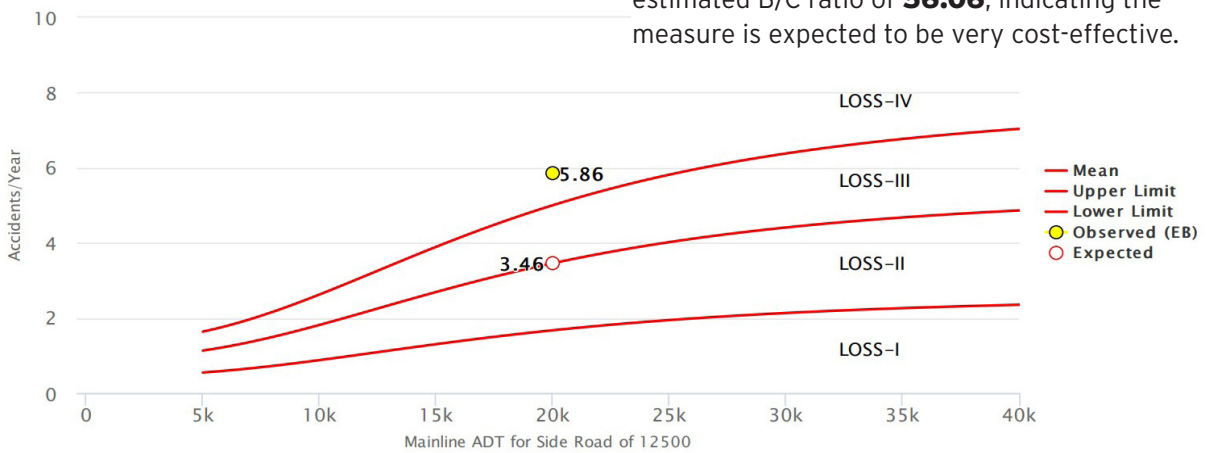
Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
8-A	Modify Signal for Fully Protected Left Turns and Add Backplates	407.46	48	2-3 yrs
8-B	Intersection Lighting	56.06	26	1-2 yrs
8-C	Retime Signal for Improved Coordination	21.66	12	1-2 yrs

Recommended Improvements

Approach Turns

In consideration of the pattern of approach turn crashes at the intersection, we recommend that signals on all approaches be modified to provide fully protected left turn movements. Additionally, existing signals for northbound and southbound traffic on Staples Street do not have reflective backplates, we recommend that new signal heads have reflective backplates.

The proposal to provide fully protected left turns on all approaches, along with backplates on Staples Street, is expected to be extremely cost-effective, with a B/C ratio of **407.46**. For more information regarding the benefit-cost analysis.



Rear-Ends

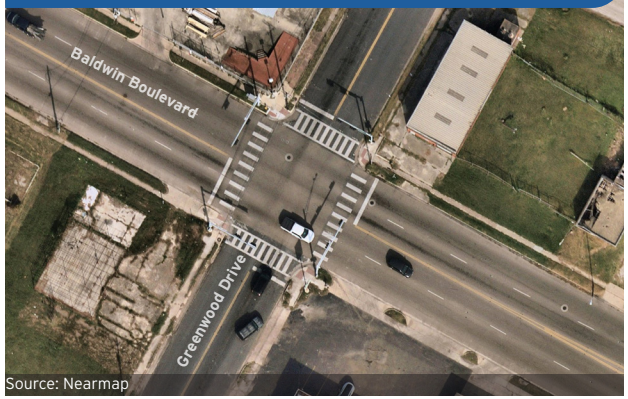
The proposal to improve progression through signal re-timing on all approaches is expected to be very cost-effective, with a B/C ratio of **21.66**. The cost of the measure includes an estimate for re-timing and coordination of additional signals in the vicinity, which may be required.

Crashes in Dark Conditions

Although there is a presence of overhead power lines at the intersection, it is recommended that intersection luminaries be provided. The presence of overhead power lines on all four approaches may require a solution with custom street lighting design and/or right-of-way acquisition.

Provision of intersection lighting results in an estimated B/C ratio of **56.06**, indicating the measure is expected to be very cost-effective.

9. Baldwin Blvd at Greenwood Dr



The intersection of Baldwin Boulevard and Greenwood Drive is a 4-leg 4-lane undivided signalized urban intersection. There are 2 thru lanes in each direction on the major street, Baldwin Blvd., and 1 thru lane in each direction on the minor street, Greenwood Dr. This intersection has an ADT count from 2018 of 15,404 on Baldwin Blvd. and 6,177 on Greenwood Dr.

Identified Safety Problems

SPFs show that the intersection performs at LOSS IV from both the total crash frequency standpoint and the crash severity standpoint, indicating high potential for crash reduction.

Diagnostic models have not been developed for Texas urban 4-lane Un-Divided Signalized 4-leg intersections, however the best fit proxy model for direct diagnostics, the Texas Urban 4-lane Divided Signalized 4-leg Intersection model, was utilized. The diagnostics showed that the intersection displays a pattern of Broadside crashes.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
9-A	Review and Revise Yellow and All Red Signal Timing	114.36	47	1-2 yrs
9-B	Modify Signals, Add Secondary Signal Heads	8.97	9	2-3 yrs

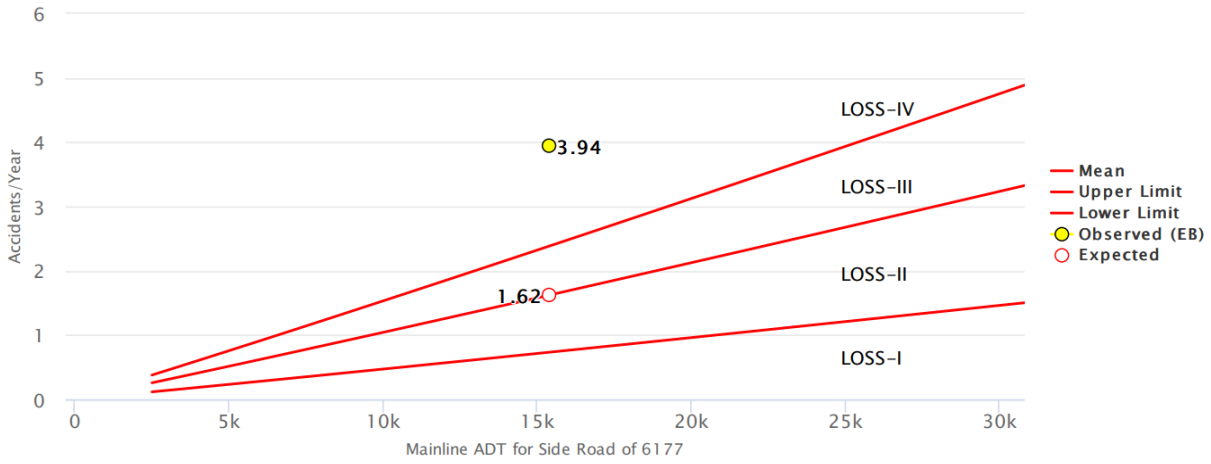
Recommended Improvements

Broadsides

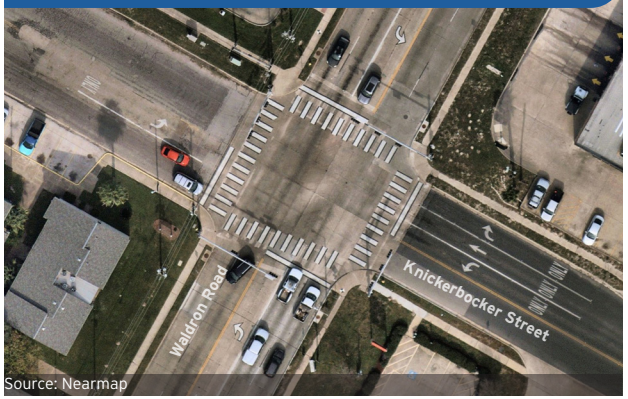
Shorter than recommended intervals are strongly correlated with broadside crashes. In consideration of the incidents of high severity Broadside crashes, we recommend that yellow (Change) plus all-red (Clearance) timings be reviewed in the field and checked for conformance with values recommended in the NCHRP Report 731 Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections (2012).

If a field visit confirms that yellow and all-red timings are not necessarily consistent with NCHRP 731 guidance, correcting the intervals is recommended. The B/C ratio for signal timing correction is **114.36**, which shows the measure is expected to be extremely cost-effective.

Crash data suggests that there is a tendency for vehicles involved in Broadside crashes at the intersection to disregard the traffic signals. While backplates have been added in recent years, we recommend that additionally secondary pole mounted signal heads be installed in all directions to further increase the conspicuity of signals. The addition of secondary signals heads at the intersection is expected to be cost-effective even assuming a conservative 10% CRF, with a B/C ratio of **8.97**.



10. Waldron Rd at Knickerbocker St



The intersection of Waldron Road and Knickerbocker Street is a 4-leg 4-lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 16,618 on Waldron Road and 3,013 on Knickerbocker Street.

Identified Safety Problems

SPF show that the intersection performs at about the average, LOSS II/III boundary, from the total crash frequency standpoint, indicating moderate potential for crash reduction. They also show that it performs in the LOSS-III category from the crash severity standpoint. This indicates moderate to high potential for crash reduction.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
10-A	Signal Retiming and Intersection Lighting	119.95	41	2-3 yrs

Recommended Improvements

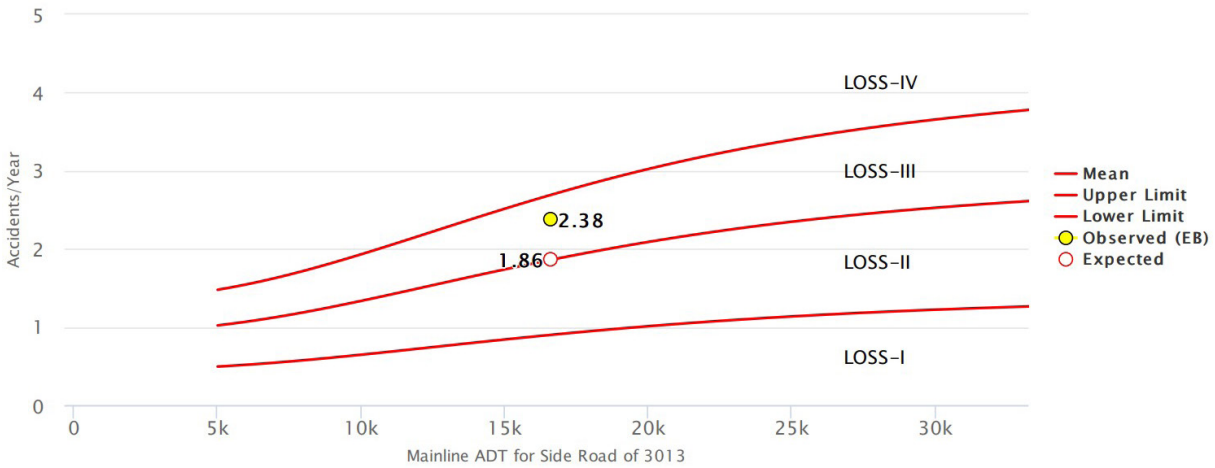
Pedestrian and Bicycle Crashes

If not currently in place, it is recommended that fully protected left turns be implemented between the hours of 7 P.M. and 10 P.M. in order to avoid conflicts between turning vehicles and vulnerable road users.

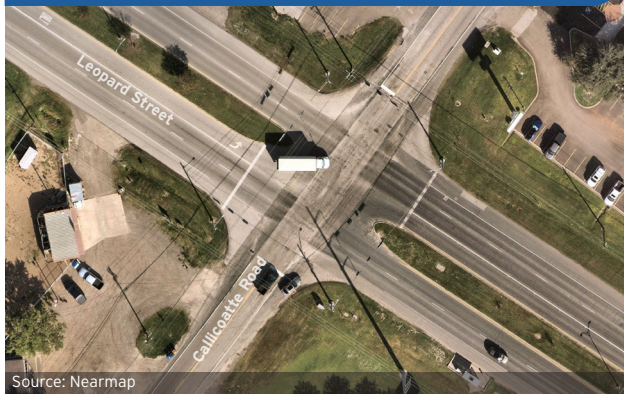
We recommend that timing be adjusted in order to ensure that pedestrian push buttons are more responsive to calls in the hours between 7 P.M. and 10 P.M. – perhaps including leading pedestrian intervals.

A B/C analysis was performed for re-timing of signals to provide fully protected left turns, more responsive pedestrian calls between the hours of 7 P.M. and 10 P.M. and leading pedestrian intervals, as well as the installation of intersection and under mast-arm lighting at the intersection. In the case of under mast-arm lighting, the cost of the measure has been accounted for, however no additional benefit has been included as the measure has not been studied to determine a CRF.

The estimated B/C ratio of **119.95**, indicates that the measures are expected to be very cost-effective.



11. Callicoatte Rd at Leopard St



The intersection of FM1694/Callicoatte Road and SS0407/Leopard Street is a 4-leg 4- lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 14,420 on Leopard Street and 6,284 on Callicoatte Road.

Identified Safety Problems

SPF shows that the intersection performs at LOSS IV from the total crash frequency standpoint, indicating high potential for crash reduction. The intersection performs at the LOSS-III level from the crash severity standpoint, indicating moderate to high potential for crash reduction.

Direct diagnostics showed that the intersection displays a pattern of Approach Turn crashes.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
11-A	Add Signal Backplates	38.12	40	1-2 yrs
11-B	Modify Signal for Fully Protected Left Turns by Time of Day	32.19	36	1-2 yrs

Recommended Improvements

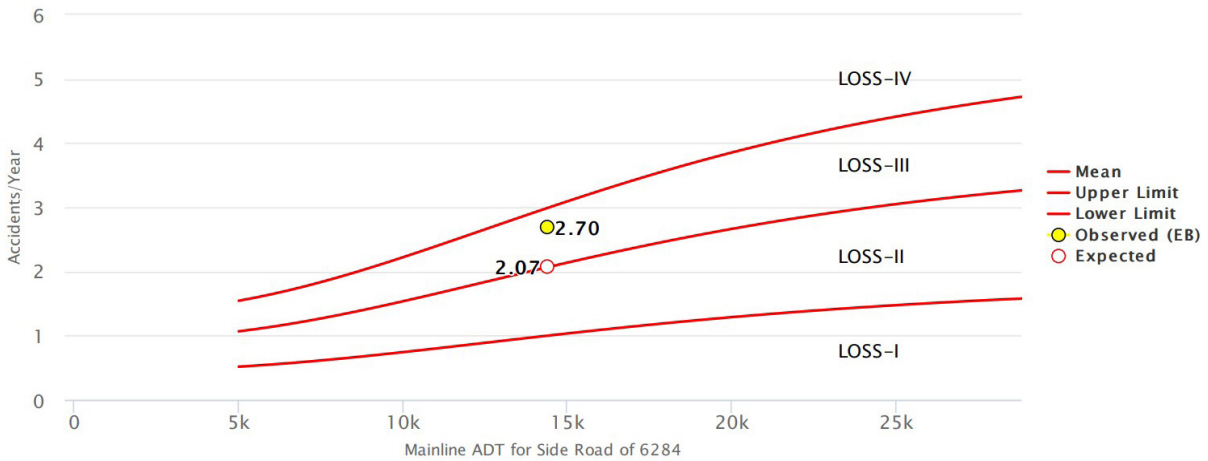
Approach Turns

To address the pattern of high severity approach turn crashes at the intersection, we recommend that signals be reconExhibitd for traffic on Leopard Street to provide Fully-Protected left turn between 8 A.M. and 9 P.M.

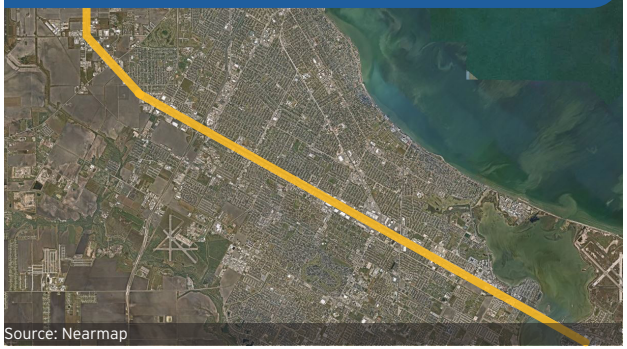
The proposal to provide fully protected left turns by time of day on Leopard Street is expected to be extremely cost-effective, with a B/C ratio of **32.19**.

It is also recommended that backplates be installed on all signal heads at the intersection for the overall safety of the intersection.

The measure is expected to be cost-effective, with a B/C ratio of **38.12**.



12. SH 358
South Padre Island Dr


Source: Nearmap

The SH-358/S. Padre Island Drive corridor between MP 0.000 (I-37 interchange) and MP 15.755 (NAS Drive) is classified as an urban 6-lane divided freeway facility on flat or rolling terrain, with 12' lanes. This facility has an average ADT count of 91,168. The included distance is approximately 15.75 miles. The corridor has a continuous median concrete barrier separating eastbound and westbound traffic. Inside and outside shoulders are present and are approximately 6 to 10 feet wide. The speed limit is 65 mph westbound, and 65 mph eastbound, except for a section between MP 4.75 and MP 11.20, approximately, where it is 60 mph eastbound.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
12-A	Variable Speed Limit System	17.67	38	3-5 yrs

Identified Safety Problems

SPF analysis of the safety performance of SH-358, MP 0.000 – 15.755. From both the frequency and severity standpoint the corridor performs in the LOSS-I and II categories for approximately just under 50% of its limits, reflecting low to moderate potential for crash reduction.

However, between MP 4.5 and MP 10.9 both the frequency and severity of crashes jump into the LOSS-IV category, representing high potential for crash reduction. There is also a localized departure into LOSS-IV from both the frequency and severity standpoint between MP 11.6 and MP 13.2, and again between MP 14.6 and 15.2.

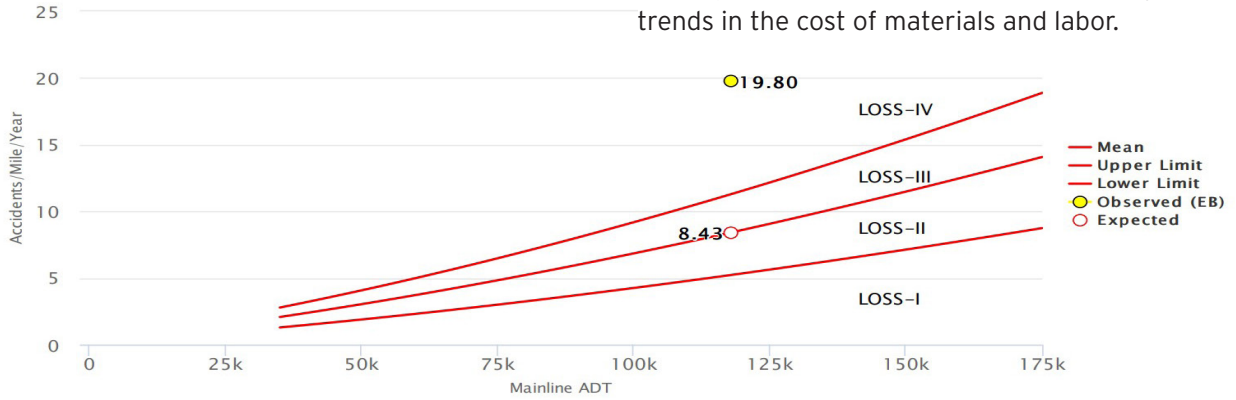
Therefore, the highest LOSS in terms of both total crash frequency and crash severity is seen between the western side of the interchange with SH-286 and the eastern side of the interchange with Airline Road.

Recommended Improvements

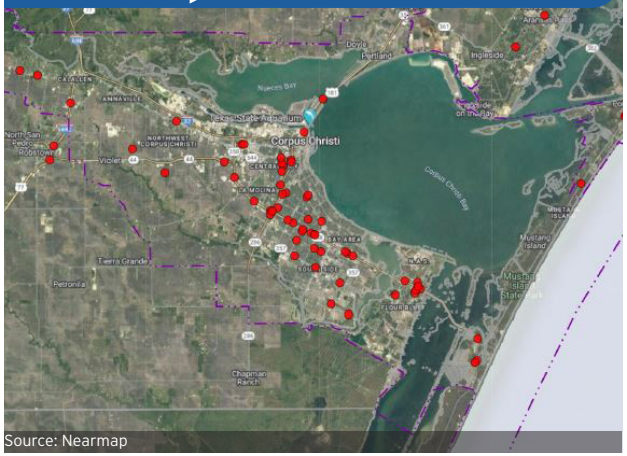
In general, addressing high-speed, high-density operations by deploying a Variable Speed Limit (VSL) system along the corridor could ameliorate the patterns of rear-end, multi-vehicle, sideswipe same direction crashes, as well as fixed object crashes due to run-off-the-road incidents.

A preliminary B/C analysis was performed for implementation of a VSL system on SH-358 MP 4.5 to MP 11.0 using Vision Zero Suite software. The cost of the system was conservatively estimated at $1.5M per mile on this divided facility, to include any fiber connectivity, radar sensors and/or weather detection equipment that might be required and rounded upwards.

The B/C ratio is expected to be **36.76**. The results show that the measure is expected to be highly cost-effective. The Corpus Christi MPO is advised to develop a more detailed estimate reflecting current trends in the cost of materials and labor.



13. System-wide Pedestrian Improvements



The network screening process for the Corpus Christi metropolitan area revealed that when Fatal crashes only are considered across the network, Pedestrian involved crashes were the second most common crash type, representing a substantial 26% of fatal crashes.

Most crashes involving vulnerable road users within the Corpus Christi MPO study area occurred at non-intersection locations i.e. segments. This pattern is suggestive of pedestrian crashes involving mid-block crossings by pedestrians.

Identified Safety Problems

It is noteworthy that in all but one case for this sample of crashes, all crashes occurred under dark conditions. Flashing beacons and the accompanying retroreflective warning signage would in this regard increase the conspicuity of pedestrians at nighttime.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
13-A	Mid-block Crosswalks with Beacons	48.42	35	3-5 yrs

Recommended Improvements

Fatal Pedestrian Mid-Block Crashes

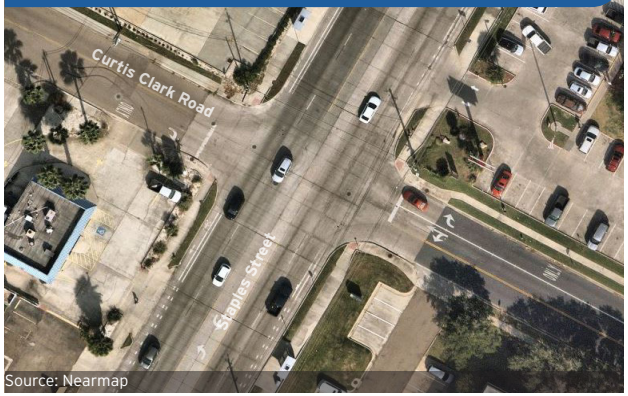
In order to address what appears to be a systemic pattern of fatal crashes involving mid-block crossings by pedestrians, the systemic deployment of pedestrian Rectangular Rapid Flashing Beacons (RRFBs) is recommended as a countermeasure.

A B/C analysis was performed on the systemic rollout of RRFBs at the identified locations. The analysis includes consideration for the installation of crosswalk markings, as well as the provision of ADA compliant curb ramps at each location. Due to the apparent trend for these crashes to occur during dark or poorly lit conditions, we recommend that crosswalk illumination be included as part of any RRFB installations, for example, such as the "Safewalk Crosswalk Illuminator" as available from TAPCO.

Using the FHWA CRF of 47%, the B/C analysis for systemic provision of RRFBs with crosswalk illumination, pavement markings and curb ramps, resulted in an estimated B/C ratio of **48.42**, which indicates the measure is expected to be cost-effective.

This brief analysis shows that a systemic countermeasure such as RRFBs has the potential to be both extremely cost effective and effective at improving safety. We have not recommended this countermeasure for state highways or major arterials, but application on a systemic level across targeted mid-block locations on city streets within Corpus Christi MPO has the potential to provide a cost-effective crash reduction and safety improvement for vulnerable road users.

14. Staples St at Curtis Clark Dr



The intersection of Curtis Clark Drive and S. Staples Street is a 4-leg 4-lane divided unsignalized urban intersection. This intersection has an ADT count from 2018 of 37,306 on Staples Street, while counts are not available for Curtis Clark Drive, they are estimated to be 500.

Identified Safety Problems

SPFs show that the intersection performs at LOSS IIV from both the total crash frequency standpoint, and the crash severity standpoint, indicating high potential for crash reduction.

A direct diagnostic model is not available currently for a 4-lane unsignalized divided 4-leg intersection, however, with broadside crashes accounting for close to 50% of all crashes, and with such an elevation of high severity broadsides, this strongly suggests broadside crashes are a pattern at this location.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
14-A	Minor Road Movement Restrictions (Right In, Right Out)	101.05	34	2-3 yrs

Recommended Improvements

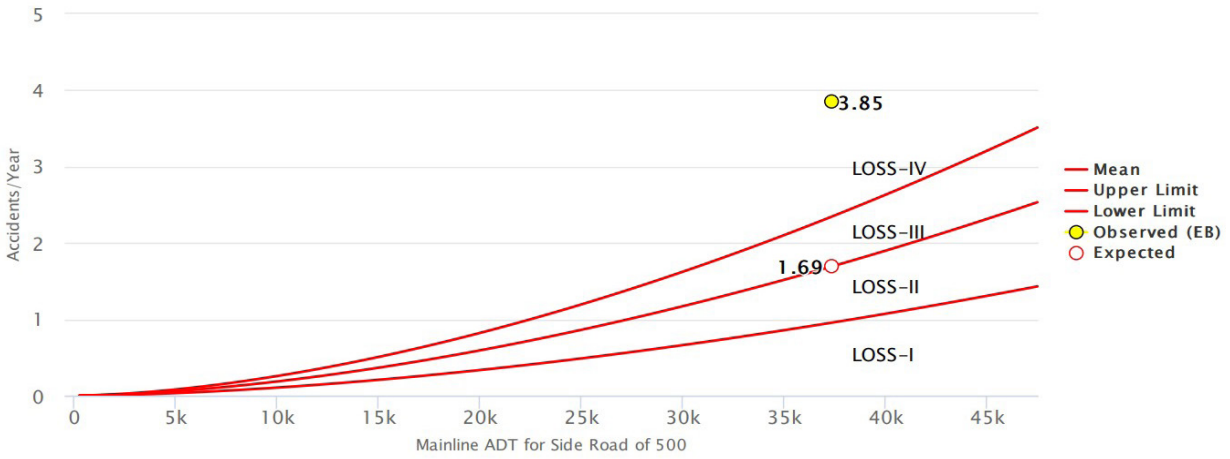
Broadsides

To address recurrent high-severity broadside crashes at the intersection, one solution in these circumstances would be to signalize the intersection, however, given the ADT volumes at this intersection, MUTCD traffic signal warrants are unlikely to be met.

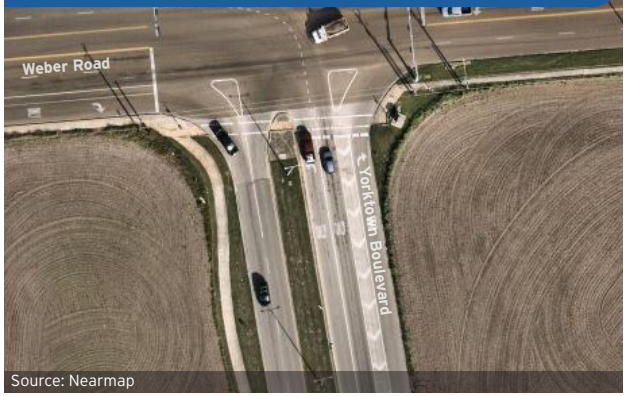
Another solution would be the installation of a raised median on Staples Street which would impose access restrictions preventing through and left turn movements from Curtis Clark Drive, as well as left turn movements from Staples Street.

Movements would essentially be restricted to RI-RO for both streets.
Providing a raised median to implement access control along Staples Street would provide a more robust and appropriate mitigation measure.

The B/C analysis of a raised median on Staples Street to imposed RI-RO only movements for Curtis Clark Drive shows an estimated B/C ratio of **101.5**, which indicates the measure is expected to be cost-effective.



15. Weber Rd at Yorktown Blvd



The intersection of FM0043/Weber Road and Yorktown Boulevard is a 3-leg 4-lane divided signalized rural intersection. This intersection has an ADT count from 2018 of 15,076 on Yorktown Blvd. and 14,015 on FM0043/Weber Road.

Identified Safety Problems

The SPFs demonstrate the models to be a good fit and to show that the intersection performs at LOSS IV from both the total crash frequency standpoint, and the crash severity standpoint, indicating high potential for crash reduction. As was the case for safety performance functions, direct diagnostics have not at this time been developed for Texas Rural 4-lane Divided Signalized 3-leg Intersections, however a proxy model using the equivalent Texas Urban model was used to identify potential patterns. The intersection displays a pattern of approach turn crashes, as well as fixed objects crashes, crashes occurring under dark-lighted conditions and crashes which resulted in off-left lane departures.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
15-A	Modify Signal for Fully Protected Left Turns by Time of Day	98.02	32	1-2 yrs

Recommended Improvements

Approach Turns

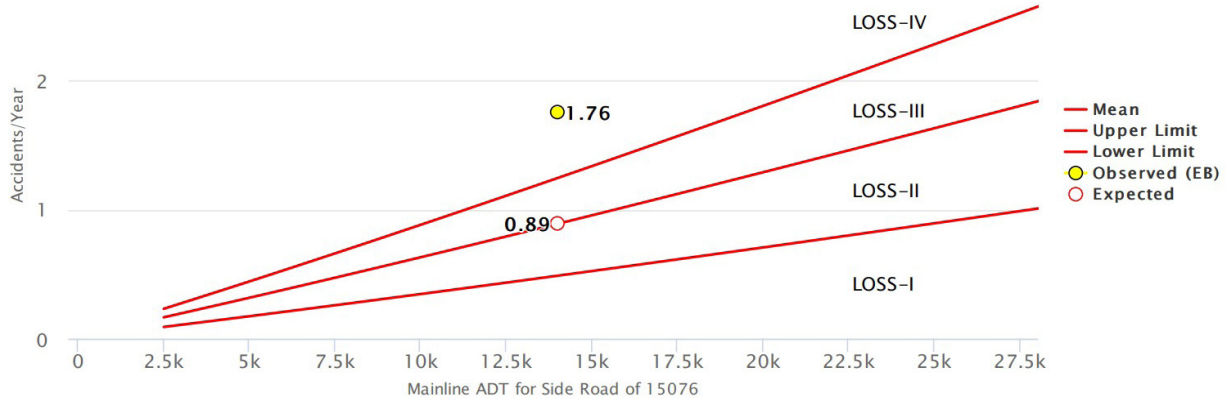
Due to the strong pattern of high-severity approach turn crashes recorded at the intersection, which appear to be occurring predominantly in dark conditions, we recommend that Fully Protected Left Turns be implemented on Weber Road at least between the hours of 4 P.M. and 11 P.M. Because the signals in place on Weber Road already allow for implementation of a protected left turn on green arrow only, only a change in signal timing and replacement of the circular red with a red left arrow for the left turn lane on westbound Weber Road would be required.

The B/C analysis for implementation of fully protected left turns on Weber Road by time of day (4 P.M. to 11 P.M.), using an estimated cost of $7,000 for signal re-timing and signal head replacement shows a B/C ratio of **98.02**, which indicates the measure is expected to be very cost-effective.

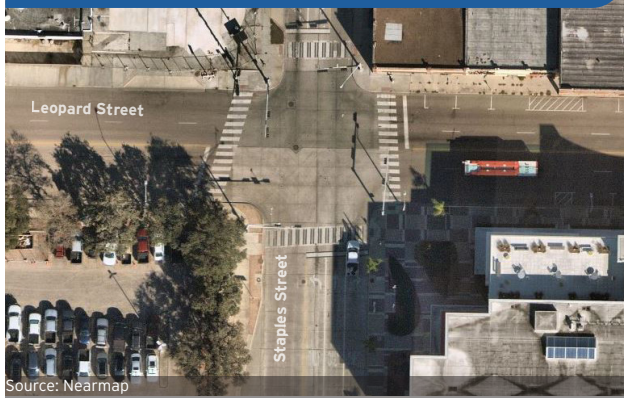
Dark-Lighted/Fixed Object/Off-Left

To address the pattern of fixed-object and off road left crashes occurring under dark conditions at the intersection, we initially recommend that the present lighting be checked in the field for adequate luminosity, and any deficiencies be rectified as a first measure. We also also recommend that street lighting be installed on Weber Road to enhance visibility of approaching eastbound traffic for westbound left turning vehicles in dark conditions. Centerline rumble strips should be installed on the Weber Road approaches and that reflective yellow paint be placed at least on the pedestrian portion of the curb of the central median at the intersection on Yorktown Blvd.

However, because all crashes were at the Property Damage Only (PDO) and Level-C injury level, none of these crashes were severe enough to be considered under TxDOT Highway Safety Improvement Program Safety Index calculation rules, which would result in a B/C ratio of zero. As such, a B/C analysis has not been made.



16. Leopard St at Staples St



The intersection of SS0407/Leopard Street and Staples Street is a 4-leg 4-lane undivided signalized urban intersection. This intersection has an ADT count from 2018 of 8,476 on SS0407/Leopard St. and 6,049 on Staples St.

Identified Safety Problems

SPFs show that the intersection perform LOSS III and LOSS IV, from the total crash frequency standpoint, indicating moderate to high potential for crash reduction. SPF functions also show that it performs in the LOSS-IV category from the crash severity standpoint, indicating high potential for crash reduction.

Direct diagnostics did not display any pattern of crashes; however, we always assess crashes involving vulnerable road users, (pedestrians and cyclists), and typically 3 or more injury crashes involving vulnerable road users over a 5-year period is considered a pattern (rate of 0.6 per year).

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
16-A	Signal Retiming for Fully Protected Left Turns, Countdown Pedestrian Heads, Backplates	50.93	32	1-2 yrs

At this location 5 pedestrian and bicycle-involved crashes at the injury level over a 6-year period (rate of 0.83) is indicative of a pattern of Pedestrian and Bicycle-involved crashes. Crashes involving vulnerable road users at the intersection account for 50% of all injury level crashes at the intersection, indicating they are high-severity crashes.

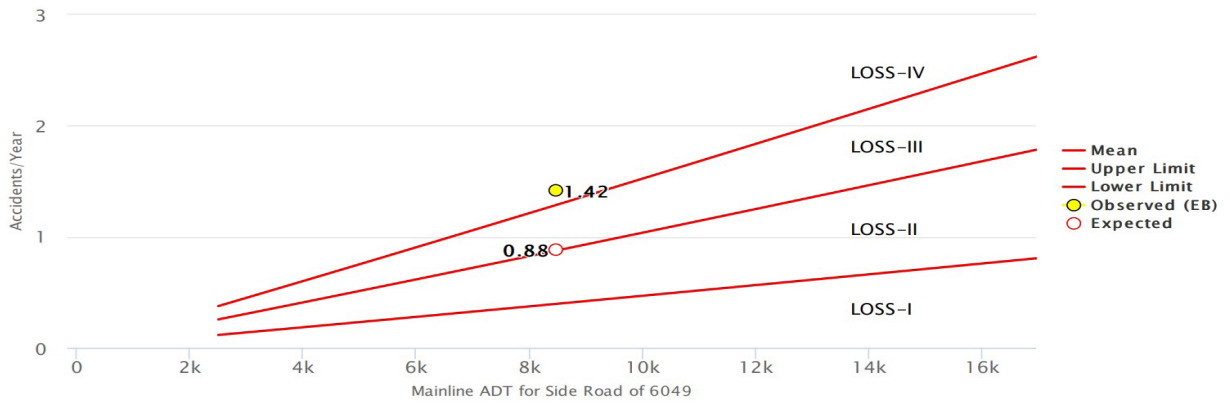
Recommended Improvements

Pedestrian and Bicycle Crashes

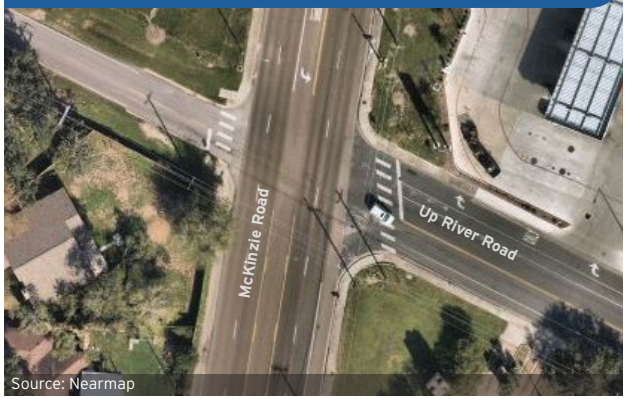
In order to address the pattern of crashes involving vulnerable road users (pedestrian/bicycle-involved crashes) at the intersection and to address the overall safety of the intersection, it is recommended that pedestrian countdown timers be installed as part of the pedestrian control on the western pedestrian crossing.

It is also recommended that re-timing take place so that pedestrian signal calls are more responsive between 12 P.M. and 8 P.M., including leading pedestrian intervals. Additionally, it is recommended that the westbound and southbound Permissive Only left turn signals be replaced with 5-section Protected/Permissive signals, this is recommended in conjunction with re-timing of all signals to provide Fully Protected Left Turns by time of day (12 P.M. to 8 P.M.). At the same time, it is recommended that backplates be included on all signal heads at the intersection.

Using a conservative CRF of 15%, the implementation of pedestrian countdown timers, Fully Protected Left Turns by time of day on all approaches to include re-timing of signals and leading pedestrian intervals, and provision of backplates at the intersection results in a B/C ratio of **50.93**, which indicates that the measures are expected to be very cost-effective.



17. McKinzie Rd at Up River Rd



The intersection of FM3386 (McKinzie Road) and Up River Road is a 4-leg 4-lane divided un-signalized urban intersection. This intersection has an ADT count from 2018 of 13,639 on FM3386/ McKinzie Rd. and 2,385 on Up River Road.

Identified Safety Problems

SPFs show that the intersection performs at LOSS IV from both the total crash frequency standpoint and the crash severity standpoint, indicating high potential for crash reduction. Crash frequency at the intersection is almost 3.5 times the expected average, with crash severity at over 2.8 times the expected average.

Direct diagnostics have not been developed for a Texas urban 4-lane divided unsignalized 4-leg intersection. However, with broadside crashes representing over 77% of all crashes at the intersection, this is highly indicative of a strong broadside pattern at the intersection.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
17-A	Minor Road Movement Restrictions (Right In, Right Out)	61.27	30	2-3 yrs
17-B	Signalize Intersection	12.57	6	2-3 yrs

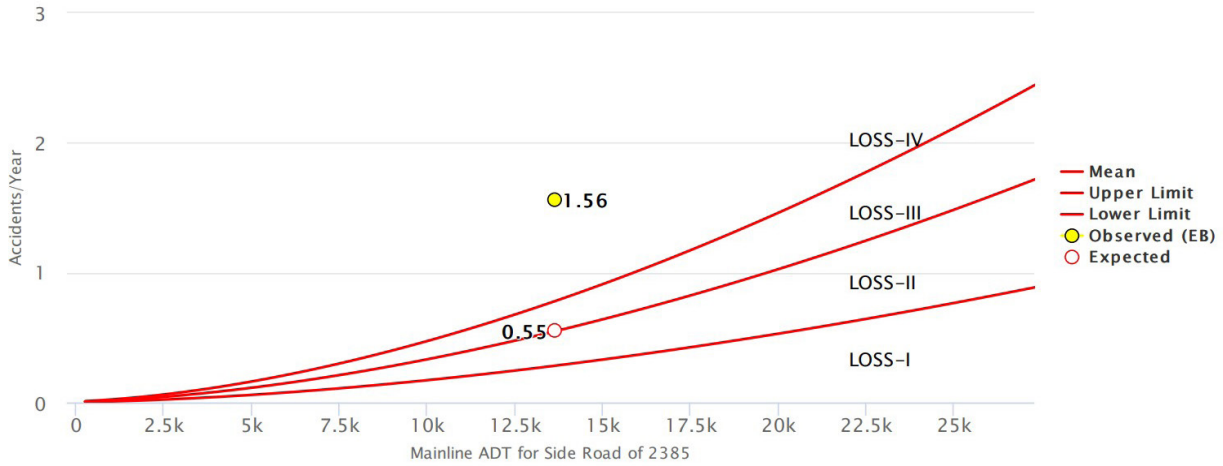
Recommended Improvements

Broadsides

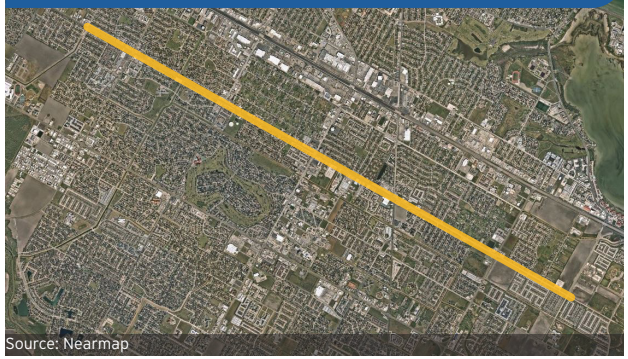
To address the recurrence of high severity broadside crashes at the intersection, one option would be to signalize the intersection if signal warrants are met. This option would require signal interconnection and coordination with the signalized ramp intersection at I-37 approximately 250 ft to the north. Should warrants be met, the B/C analysis for signalizing the intersection shows an expected B/C ratio of **12.57** with spending up to $1,000,000 on signalization (higher than typical, to allow for interconnection and coordination with nearby signals), which indicates the measure is expected to be cost-effective.

Most broadside crashes appear to involve at-fault vehicles from eastbound and westbound Up River Road. If signal warrants are not met, or if signalization is otherwise not desired, another solution to address the pattern is to implement access control by way of a raised concrete median on McKinzie Road which allows only RI-RO movements from and to Up River Road. This would require the elimination of the southbound left turns from McKinzie Road, as well as the erection of ONE WAY (MUTCD R6-1) signs in the median facing Up River Road east and west, and the erection of NO LEFT TURN (MUTCD R3-2) signs below the current STOP signs in both directions on Up River Road.

The B/C analysis for implementation of access control at the intersection of McKinzie Rd. and Up River Rd. by way of a raised median on McKinzie Rd. shows an estimated B/C of **61.27**, which indicates the countermeasure is expected to be very cost-effective.



18. Holly Rd (Carrol Ln to Ennis Joslin Rd)


Source: Nearmap

Over the 6-year study period there were 5 severe bicycle involved crashes along Holly Road between Carroll Lane and Ennis Joslin Road. This included 2 Fatal crashes and 3 Injury crashes.

There are dedicated bike lanes in place on Holly Road between Ayers Street and Rodd Field Road in both directions. Between these streets Holly Road is a 4-lane facility with a central Two-Way-Left-Turn-lane (TWLTL). East of Rodd Field Road however, it becomes a 2-lane facility with a central TWLTL.

Identified Safety Problems

The existing bike lanes are narrow, particularly on the south side of Holly Rd. (eastbound). There is street lighting present on Holly Road in both directions. However, due to the presence of high-tension power lines on the south side of Holly Rd. (eastbound), street lighting is not as frequent as it is on the north side of Holly Rd.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
18-A	Improved Street Lighting, Signing and Markings for Bicycle Lanes	3.35	10	1-3 yrs

Additionally, east of Airline Road, there is an increased presence of power lines on both sides of Holly Road which coincides with an increased scarcity of street lighting.

Recommended Improvements

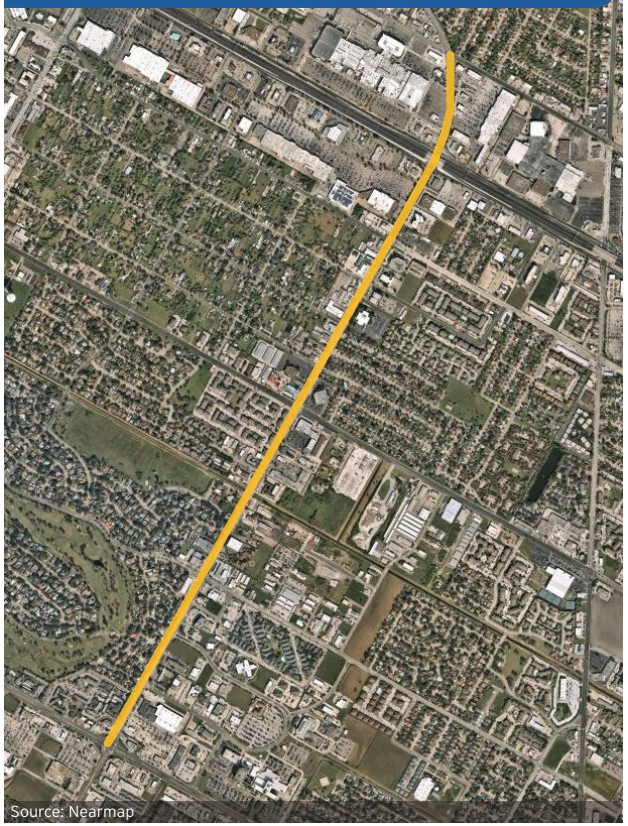
It is recommended that maintenance restriping of bike lane lines and markings be performed on a regular basis to maintain conspicuity. In addition to this we recommend that additional bike lane symbol pavement markings be painted in both directions on Holly Road to increase conspicuity and awareness of the presence of the bike lanes, as there are some locations along Holly Road where it may not be obvious as to whether the white lines delineate a shoulder or a bike lane.

In conjunction with this it is recommended that additional bike lane warning signs (MUTCD W11-1) be installed in both directions along Holly Road. Concurrently, it is recommended that signage (MUTCD R3-17, R3-17aP and R3-17bP) be installed at Ayers Street and Rodd Field Road to indicate the beginning and end of the bike lane corridor. Further to the above recommendations it is recommended that Corpus Christi MPO increase the frequency of street lighting on the south side of Holly Road between Ayers Street and Airline Road and on both sides of Holly Road east of Airline Road.

The B/C analysis included increased street lighting on the south side of Holly Road between Ayers Street and Airline Road and provision of street lighting on Holly Road between Airline Road and Ennis Joslin Road, the provision of increased frequency of bicycle warning signs and pavement bike lane symbols, as well as the installation of signage indicating the beginning and end of the bike lane corridor near Ayers Street and Rodd Field Road.

The analysis shows an estimated B/C ratio of **3.35** using a conservative 20% CRF applied to both bicycle-involved crashes and crashes occurring under dark conditions. This indicates the measures are expected to be cost-effective.

19. Staples St (Saratoga Blvd to McArdle Rd)



Staples Street from Saratoga to McArdle is an Urban, 4-Lane Divided Arterial carrying about 37,130 AADT over a distance of about 2 miles. Route 260668, section B01911, Mile Marker 5.88-7.875.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
19-A	Access Control - Raised Median	5.99	8	3-5 yrs

Identified Safety Problems

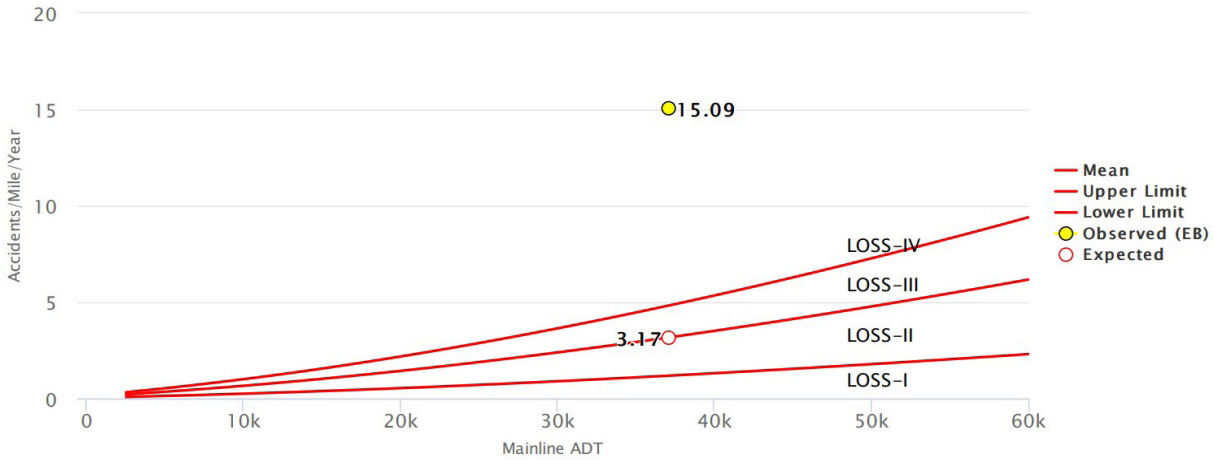
SPFs show that the corridor performs at LOSS IV from the total crash frequency standpoint (Exhibit 2), indicating high potential for crash reduction. In fact, the crash experience is 6.28 times the expected mean for the volume carried.

From the severity standpoint, the intersection performs at the LOSS-IV level, indicating high potential for crash reduction, with observed performance of 4.76 times the mean or expected performance.

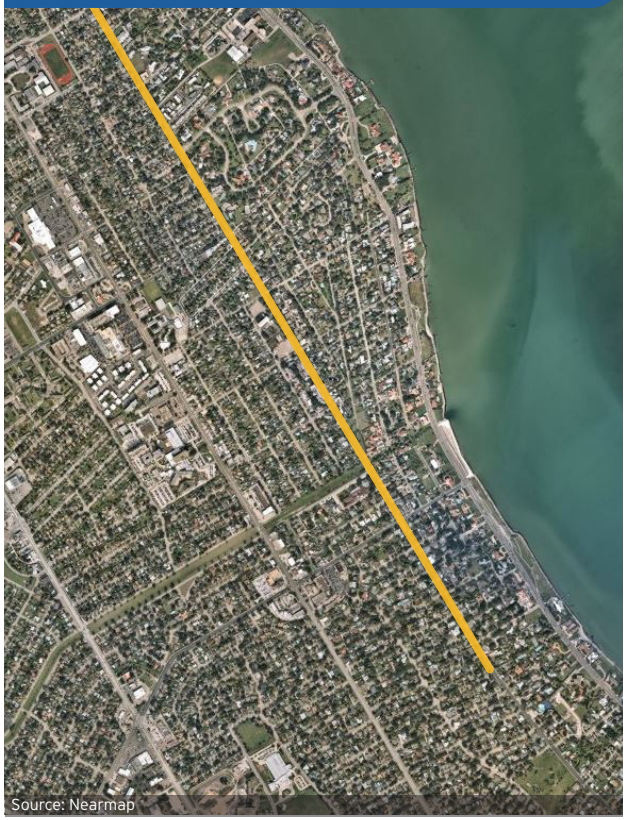
The corridor displays patterns of Rear End, Sideswipe Same Direction and Approach Turn collisions.

Recommended Improvements

Using a more conservative assumption of 50% crash reduction at all severity levels and a generous $6,000,000 estimated cost for 2 miles of access consolidation and raised center median construction, assuming that some right of way may need to be acquired, the B/C ratio is **5.99**, indicating that the measure is expected to be cost-effective.



20. Santa Fe St (Oleander Ave to Santa Monica Place)


Source: Nearmap

Over the 6-year study period there were 5 severe bicycle crashes along Santa Fe Street between Oleander Avenue and Santa Monica Place. All recorded crashes were at the Injury level. Two out of the five crashes involved hit and run incidents. Contributing factors to the crashes were recorded as: failure to control speed; changing lanes when unsafe; and swerving/veering.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
20-A	Street Lighting and Signs for Bicycles	2.32	5	1-2 yrs

Santa Fe Street is a 4-lane undivided facility from Oleander Ave. to Doddridge Street, and a 2-lane facility with a central TWLT lane south of Doddridge St. There are no dedicated bike lanes in place on Santa Fe Street between Oleander Ave. and Santa Monica Pl.

With crashes recorded between 10 P.M. and 9 A.M. and at least 3 of 5 confirmed as in dark conditions, it appears that lighting and visibility are contributing factors to bicycle involved crashes along this segment. Weather and road conditions were not a factor in crashes.

Identified Safety Problems

There are no shoulders on Santa Fe St., no street lighting, and there are power lines along the northern side (northwest direction) of the street. It is possible that these combined factors are contributing to bicycle involved crashes on this segment of Santa Fe Street.

Additionally, imagery indicates that Santa Fe St. accommodates a bus route.
It is possible that a stopped bus in dark conditions could conceal a nighttime cyclist on the roadway edge from motorists.

There is a single "BICYCLES SHARING ROADWAY" warning sign (MUTCD W11-1) in the northbound direction near Brawner Parkway, and none at all in southbound direction. There is a single intersection luminaire present at each of the signalized intersections along the segment (Texan Trail and Doddridge Street), but no street lighting along the route.

Recommended Improvements

To address what appears to be a pattern of mid-block nighttime bicycle involved crashes on Santa Fe Street between Oleander Ave. and Santa Monica Pl., we recommend that additional "BICYCLES SHARING ROADWAY" warning signs be installed on Santa Fe St. in both directions approximately every half-mile. In conjunction with this, it is recommended that street lighting be installed on the southern side of Santa Fe St.

Using a conservative combined CRF of 20% in the B/C analysis indicates an estimated B/C ratio of **2.32**. This suggests that the proposed countermeasures are expected to be cost-effective.

21. Staples St at McArdle Rd

The intersection of S. Staples Street and McArdle Road is a 4-leg 4-lane divided signalized urban intersection. This intersection has an ADT count from 2018 of 24,763 on Staples St. and 12,425 on McArdle Road.

Identified Safety Problems

SPF shows that the intersection performs at LOSS IV from the total crash frequency standpoint, indicating high potential for crash reduction. The intersection performs at the LOSS-III level from the crash severity standpoint, indicating moderate to high potential for crash reduction.

Direct diagnostics showed that the intersection displays patterns of Sideswipe Same Direction, Off-in-Median crashes and crashes with Traffic Signal Poles. Approach turn crashes account for half of all injuries at the intersection, and are susceptible to cost-effective correction.

Project ID	Improvement Recommendation	Benefit/Cost	Ranking Score (out of 90)	Timeframe
21-A	Modify Signal for Fully Protected Left Turns by Time of Day	1.87	5	1-2 yrs

Recommended Improvements

Approach Turns

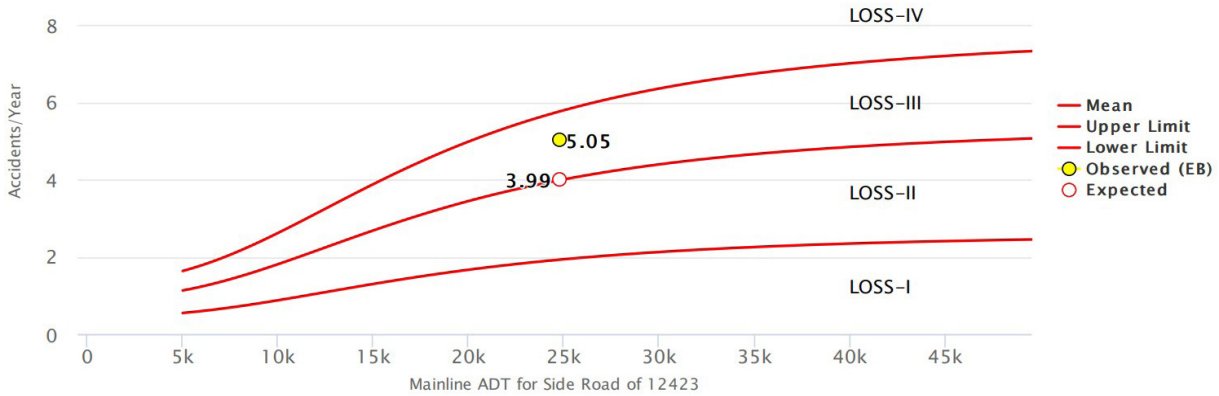
In consideration of the high severity approach turn crashes at the intersection, we recommend that signals on all approaches be modified to provide fully protected left turn movements between 6 A.M. and 10 P.M. Concurrent with this it is recommended that longer mast arms be installed for north and southbound traffic on Staples Street so that left turn signal heads can be accommodated overhead, better meeting driver expectancy for signal location in Corpus Christi and reducing the potential for vehicles to collide with the center median mounted signals.

We recommend that backplates be installed on all signals. Regulatory signs should also be changed. The proposed improvements to address approach turn crashes is expected to be cost-effective, with a B/C ratio of **1.87**.

Sideswipe Same Direction

With regard to the pattern of sideswipe same direction crashes we would typically recommend that advance street names signs (MUTCD D3-2) be installed on all approaches here, facilitating timely deceleration and lane changes for drivers in preparation for turns. However, because crashes at the PDO level are not considered as part of B/C analysis under TxDOT Highway Safety Improvement Program Safety Index calculation rules, a zero B/C ratio would result.

Similarly, to address the pattern of off-in-median crashes and crashes with traffic signal poles, as well as the pattern of sideswipe same direction crashes, we would typically recommend that all lane lines, including left turn lane lines, be extended through the intersection as dotted extensions. However, as outlined previously, because all crashes are at the PDO level a zero B/C ratio would result, and this treatment is not recommended at this time.



POLICIES AND PROGRAMS

The FHWA proven safety countermeasures can serve as a powerful tool in identifying which implementable solutions may be appropriate based on known crash characteristics. Countermeasures can be implemented to achieve safety benefits and build public support for continued project implementation.

In this section, a review of existing safety-related policies, plans, and guidelines currently held by Corpus Christi MPO member communities was prepared during the planning process. This review was conducted to measure the level to which area communities are already addressing safety through their policies and programs.

Complete Streets

Complete Streets are streets designed and operated to enable safe mobility for all users. This includes people of all ages and abilities, regardless of whether they are travelling as drivers, pedestrians, bicyclists, or public transportation riders. The concept of Complete Streets is planning, designing, operating, and maintaining roadways to prioritize safety, comfort, and access for all users. Complete Streets allow road users, such as older adults, people living with disabilities, people who walk and bike for transportation, and people who do not have access to a car, to safely navigate their community. Complete Streets make it easy to cross the street, walk to schools, bicycle to work, and move actively with assistive devices. They help buses to run on time and make it safe for people to walk or move actively to and from transit hubs.

Traffic Calming

Traffic Calming is a set of design interventions that are implemented to slow or divert traffic on a roadway to make it safer for all users. Countermeasures may include speed humps, traffic circles, signs, lighting, pavement markings, curb bulb-outs, and others. These strategies are often quick and inexpensive to install.

Parking

Minimum parking requirements limit a city's ability to create dense, pedestrian friendly areas. Through addressing parking requirements in city code, communities can proactively encourage developers to build and dedicate space for people, rather than cars.

Corpus Christi has established a residential traffic calming ordinance, enabling the addition of traffic calming measures at the request of residents. The City has added procedures for grading the need for traffic calming on a street and will cover up to 100% of the cost for the countermeasures, depending on how the project scores.
(Code of Ordinances, Ch. 53, Article IV., Division 2)

Access Management

Access points are essential elements of any roadway network as they represent the start and end points of any trip. Access points can range from large, complex intersections to simple, unpaved field entrances. These access points are often areas of conflict and require special consideration when designed.

Safe Routes to Schools

Safe Routes to Schools is a program that promotes and encourages walking and bicycling to school through infrastructure improvements, enforcement, safety education, and incentives. The programs are often a partnership between the City, school district, and parent groups. Exhibit 32, *Map of School Locations*, represents opportunities for safety countermeasures along roadways adjacent to schools in the Corpus Christi MPO study area.

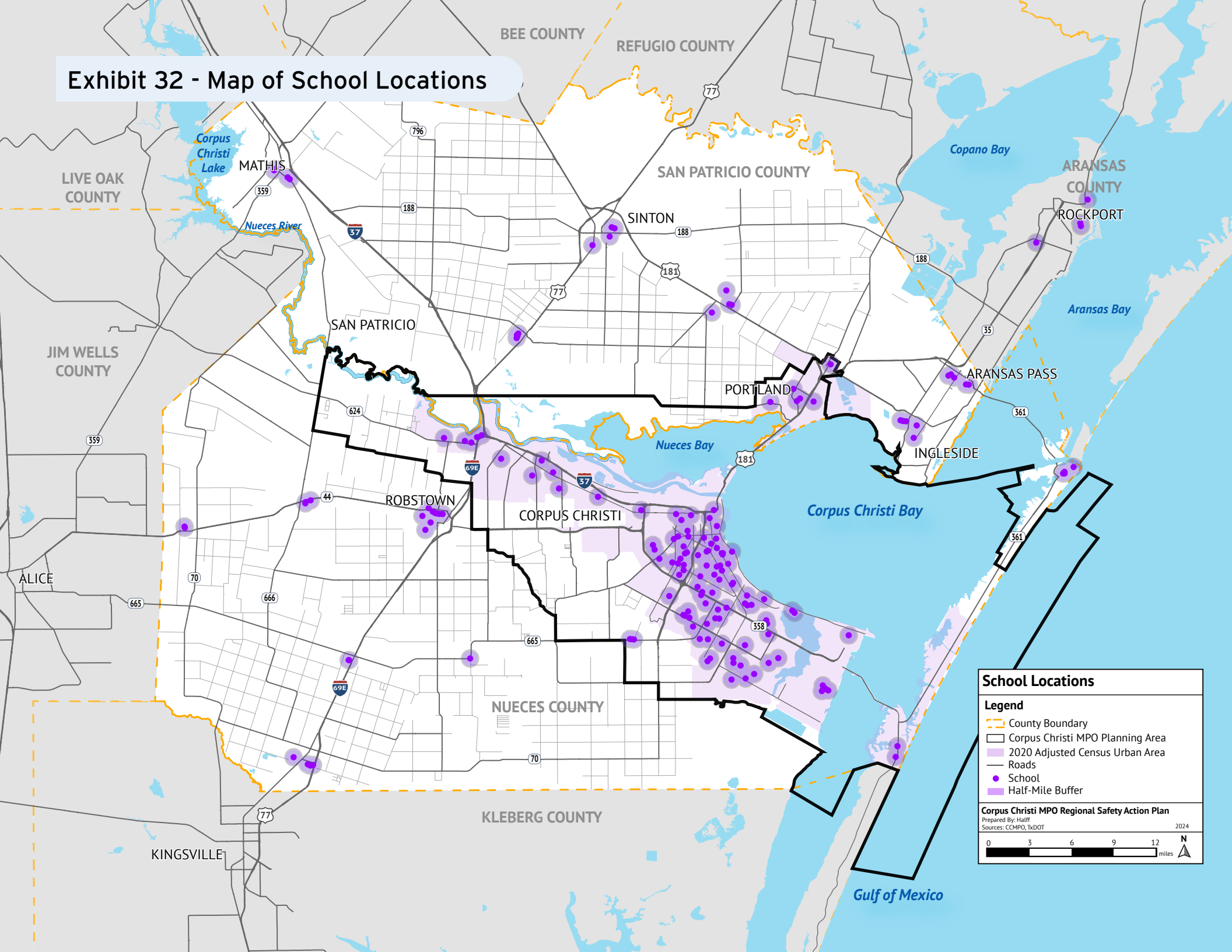
Slow Streets

Slow Streets are safe, comfortable, low-vehicle-traffic routes that prioritize active transportation. These shared streets are thoughtfully designed and implemented on residential streets to provide safe, comfortable alternative to driving. They are open to all forms of transportation but encourage traveling at a safe speed (typically under 15 mph) to allow people of all ages and abilities to safely use the roadway.

Walk. Bike. Safe. Texas

Walk. Bike. Safe. Texas aims to address pedestrian and bicyclist safety through an outreach and educational campaign for all road users. The organization's goal is to increase awareness of pedestrian and bicyclist vulnerability, educate individuals on traffic laws, and motivate all users to replace reckless behaviors with safe behaviors. Walk. Bike. Safe. has a variety of educational materials for all roadway users and municipalities.

Exhibit 32 - Map of School Locations



EXISTING CODES AND ORDINANCES

Exhibit 33, *Table of Local Policies and Programs*, provides a high-level review of local codes and ordinances for jurisdictions in the Corpus Christi MPO planning area. This evaluation was based on the information available to the project and should be viewed as a starting point for where to focus attention with regard to code and ordinance amendments to promote road safety. Some issues, such as speed limits and crosswalk markings, were not included due to the limited presence of local policy.

These policies and programs have proven to reduce crashes and improve safety outcomes for people using the roadway. Through implementing roadway design standards, updating policies, and executing safety programs, communities can preemptively reduce operating speeds and improve the safety of their residents.

The Corpus Christi MPO will continue encouraging participation from member communities to better follow regional best practices and align their policies and design with other nearby jurisdictions. Improving regional traffic safety will be a collaborative effort from all parties. While the Corpus Christi MPO can provide leadership and some level of funding, it is the local communities that will do most of the work. In order for this plan to succeed, the Corpus Christi MPO will have to gain the support of local jurisdictions to implement and update these policies and programs.

No Right Turn on Red signage at Brownlee Blvd and Morgan Ave

No Right on Red

A permissible "Right Turn on Red" was introduced in the 1970s as a fuel savings measure and has had detrimental effects on bicyclists and pedestrians. While the law requires motorists to come to a full stop and yield to cross traffic before proceeding, many motorists do not comply with the regulations, increasing crash risk and severity. Prohibiting right turns on red is a simple, low cost safety measure to improve intersection safety for all roadway users. Part-time Right Turn on Red prohibitions during the busiest times of the day may be sufficient to address the problem. Right Turn on Red prohibition signage can be placed at intersections with high concentration of pedestrian- or bicyclist-involved crashes.

Exhibit 33, Table of Local Policies and Programs

Jurisdiction	Population (2022)	Bicycle / Pedestrian Plan	Bicycle / pedestrian Defined in Code	Vision Zero	Design Standards (Lane Width)	Design Standards (Sidewalk)	Design Standards (Intersection)	Traffic Calming	Parking	Access Management / Driveways	Safe Routes to Schools	Slow Streets
Corpus Christi	317,804	X	X	X	X	X	X	X	X	X		
Portland	20,130		X		X	X	X		X	X		
Port Aransas	3,072		X		X	X	X		X	X		
Aransas Pass	8,720		X		X	X	X		X	X		
Ingleside	9,713				X		X			X		
Sinton	5,505				X		X			X		
Nueces County	353,245				X		X			X		
San Patricio County	68,942				X		X			X		

PROGRESS EVALUATION

To better understand the effectiveness of the identified projects and strategies, the following performance measures should be used to evaluate progress towards the goal of a reduction in serious injury and fatal crashes. According to Map-21, Performance Measures, and Performance-Based Funding, performance measures are defined as "data about the use, condition, and impact of the transportation system, reported for illustrative purposed to demonstrate progress made toward established targets." Performance measures can be tracked at two scales, the effort and output of a project or strategy or the results of the project or strategy.

As part of an effective Regional Safety Action Plan, methods to measure progress over time as well as reporting on progress should be made public and accessible. The Federal Highway Administration established five highway safety performance measures to carry out the Highway Safety Improvement Program:

- number of fatalities and serious injuries.
- rate of fatalities and serious injuries per 100 million vehicle miles traveled.
- non-motorized fatalities and serious injuries.

Corpus Christi MPO should also monitor performance measures related to each emphasis area including speed involved crashes, distracted driving related crashes, unrestrained crashes, and impaired driving crashes. In addition to this tracking effort, Corpus Christi MPO should continue to update its Crash Data Dashboard for ease of use by other entities and the public.

In addition to the Crash Data Dashboard, Corpus Christi MPO should produce a Safety Action Report that highlights the progress made toward the goal of reduction in serious injury and fatal crashes. This report will include information on implementation efforts, ongoing projects and related programs as well as a review of national, statewide, regional, and local policies that may affect progression. A good example of policies that may affect progression include revision of local roadway design standards or equivalent Manual on Uniform Traffic Control Devices (MUTCD) updates and best practice guidance from entities like National Association of City and Transportation Officials (NACTO). While some of the content may overlap, this is intended to be developed and maintained separately from the Performance Measure Report.

It will be important for Corpus Christi MPO to work with local entities such as City of Corpus Christi, City or Portland, TxDOT, and Nueces and San Patricio counties to make certain proven safety countermeasures are implemented as part of roadway and intersection construction projects. Through coordination with these entities, Corpus Christi MPO can also track projects and mileage of infrastructure improvements that address safety concerns. Additional performance measures that can be tracked relative to various emphasis areas include the educational and outreach components of the Regional Safety Action Plan.

Awareness of proven safety countermeasures and ways in which the community and residents can contribute to a safe road system should be highlighted and tracked. Corpus Christi should utilize the Joint Safety Task Force Committee to provide continual updates related to safety programs and initiatives and encourage involvement by all local entities in these efforts.

While performance targets have not been identified, they should be consistent with Corpus Christi MPO performance measure targets. Corpus Christi MPO should update this plan in coordination with MTP and TIP updates. The Corpus Christi MPO Crash Data Dashboard along with utilization of software programs like Vision Zero Suite should be coordinated with local entities to provide analytical tools to address safety concerns and provide the appropriate safety countermeasure. This will not only make certain that crash locations that are susceptible to correction are being addressed but also the greatest benefit is being achieved through cost effective measures.

Enforcement Results

March 2024 marked one year since the launch of the Harbor Bridge Task Force. The project team with Texas Department of Public Safety (DPS), TxDOT, and Texas Alcoholic and Beverage Commission (TABC) launched to help curb the number of injuries, crashes, and deaths due to wrong way drivers. In just one year, the ask force conducted nearly 35,000 traffic stops on U.S. 181 with 453 narcotics arrests and 329 DWI's. In addition, there were nearly 3,400 speeding citations issued along with 489 seatbelt citations While there still continues to be incidents along this corridor, enforcement has helped minimize the affects and impacts on key emphasis areas identified through this planning effort. It will be important for Corpus Christi MPO to continue to work with partner agencies on enforcement and education campaigns to increase awareness and reduce fatal and serious injury crashes.

CORPUS CHRISTI MPO

METROPOLITAN PLANNING ORGANIZATION

REGIONAL SAFETY ACTION PLAN

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