Coryell County

Transportation Safety Action Plan

April 2024

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Executive Summary

The goal of the Coryell County Transportation Safety Action Plan (TSAP) is to create a safer transportation system for its residents by eliminating fatalities and serious injuries resulting from crashes. This plan identifies the most apparent roadway safety issues throughout Coryell County and provides the framework to address these issues.

The development of this plan was a collaborative effort between Coryell County and a multidisciplinary executive committee. A comprehensive approach was used to analyze the current safety conditions throughout the County to understand the predominant safety issues that are causing fatalities and serious injuries. Through effective engagement with the executive committee and the public, implementation actions and activities were developed to address these issues.

On November 14th, 2023, the Coryell County Judge made the official statement committing to the goal of the TSAP:

Coryell County is committed to a goal of zero roadway fatalities and serious injuries. This can be achieved within 10 years, by January 2034, with the funding and completion of projects outlined in the Safety Action Plan.

Chapter 1: Introduction

Study Area – Coryell County

Coryell County has an area of approximately 1,052 square miles located in Central Texas and has a population of approximately 84,878 residents[1]. The two largest cities in the County are Gatesville and Copperas Cove, with populations of 16,198 and 37,964, respectively. There are approximately 1,373 miles of roadway within Coryell County, of which about 628 miles are maintained by the County. It is important to note that 22% of the County is occupied by the Fort Cavazos military installation. The roads within the installation are maintained by the Department of Defense and not included in this plan.

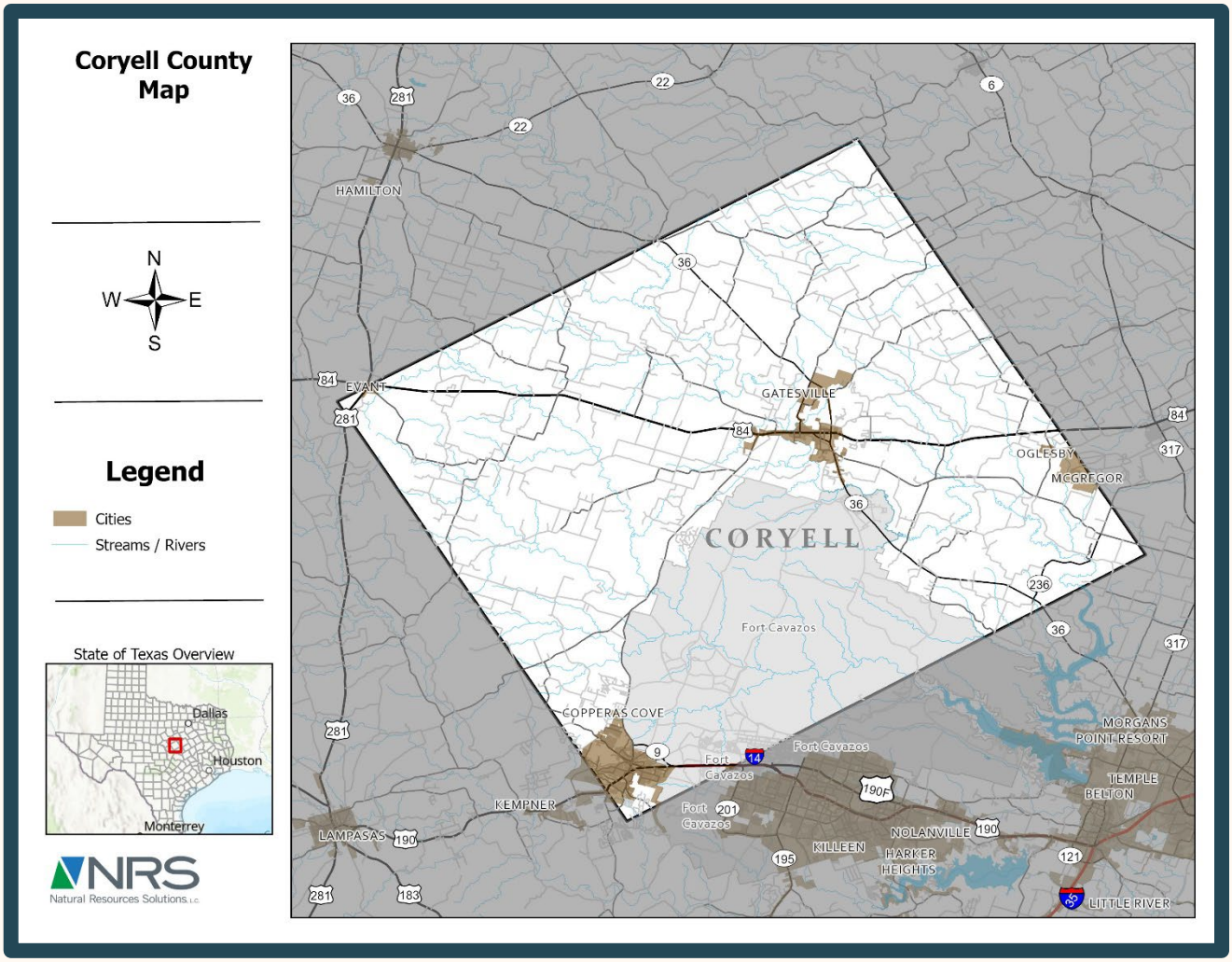


Figure 1. *Map of Coryell County*

[1] U.S. 2023 Census

Background

America's transportation and particularly its roadway system is an integral part of everyday life to many. The safety and efficiency of the roadway system is important because crashes can irreversibly change the course of human lives, touching victims, their families and loved ones, and society as a whole. Death and serious injury are preventable and do not have to be a consequence of using America's roadway system. Federal and state authorities have set a vision and goal to significantly reduce fatalities and serious injuries on our highways, roads, and streets. This is the first step of reaching an ambitious long-term goal of zero roadway fatalities and serious injuries. This TSAP was created with these goals in mind and directly contributes to the U.S. Department of Transportation (USDOT) goal of zero roadway fatalities aiding in the reduction of total transportation-related deaths nationwide.

Federal Traffic Safety Summary

According to data from the Centers for Disease Control and Prevention (CDC) and the National Highway Traffic Safety Administration (NHTSA), motor vehicle crashes consistently rank as one of the top causes of death, particularly among younger age groups. In 2021, 42,939 people died in vehicle crashes and 2.4 million were severely injured. The estimated cost of all traffic crashes totaled $340 billion in 2019[2].

Nationwide, most people killed and injured in traffic crashes were drivers (67%), followed by passengers (24%), pedestrians and cyclists combined were 5% of the total while motorcyclists were 3%. People ages 21 to 24 years old had the highest fatality and injury rate while children five to nine years old had the lowest fatality rate. Children under five had the lowest injury rate.

The National Roadway Safety Strategy (NRSS) is the USDOT's comprehensive approach to significantly reduce fatalities and serious injuries on the Nation's highways, roads, and streets. The NRSS is a USDOT-wide approach to working with stakeholders nationwide to achieve the ambitious long-term goal of reaching zero roadway fatalities and serious injuries.

The NRSS sets a vision for the Nation's roadways, adopting the Safe System Approach principles to guide actions the USDOT will take in pursuit of five core objectives: Safer People, Safer Roads, Safer Vehicles, Safer Speeds, and Post-Crash Care. The NRSS is a collaborative effort between the Secretary of Transportation and the Operating Administrations whose roles and responsibilities include roadway safety. These administrations include:

- Federal Highway Administration (FHWA)
- Federal Motor Carrier Safety Administration (FMCSA)
- Federal Railroad Administration (FRA)

[2] National Center for Statistics and Analysis. (2023, December). Traffic safety facts 2021: A compilation of motor vehicle traffic crash data (Report No. DOT HS 813 527). National Highway Traffic Safety Administration.

- Federal Transit Administration (FTA)
- National Highway Traffic Safety Administration (NHTSA)
- Pipeline and Hazardous Materials Safety Administration (PHMSA)

The passage of the 2021 Infrastructure Investment and Jobs Act (PL 117-58) is an investment in America's transportation network, and supports the funding, program, and policy provisions described in the NRSS safety actions.

Texas Traffic Safety Summary

The Federal Highway Safety Improvement Program (HSIP) is a federally funded state administrated program that requires each state to identify hazardous locations, sections, and elements, including roadside obstacles and unmarked or poorly marked roads, which may constitute a danger to motorists, bicyclists, and pedestrians. The HSIP also requires states to assign priorities for the correction of such locations, sections, and elements and to establish and implement a schedule of projects for their improvement[3]. The HSIP is directed by the Texas Strategic Highway Safety Plan (SHSP), which is Texas' comprehensive plan to reduce fatalities and serious injuries on state and local roadways.

According to SHSP, Texas had 4,056 fatalities and 19,434 suspected serious injuries on Texas roadways in 2021. Texas has not had a day without a death on its roadways since November 7, 2000. The fatal crashes can be attributed to several factors including vehicle safety (tires, brakes, steering, lights, etc.), the roadway (intersections, curves, lighting, etc.) and human behavior (impairment, speeding, distraction, etc.). To significantly reduce or end this streak of deaths on Texas roadways, the current revision of the SHSP has focused on safety with engineering, education, and enforcement efforts and address driver behavior through education and enforcement programs. Further, the state is addressing emergency response and post-crash care[4].

Coryell County Traffic Safety Summary

The Texas Department of Transportation (TxDOT) Crash Records Information System (CRIS) houses a comprehensive traffic crash incident database for Texas. This database was used to query Coryell County crash data from January 1, 2018, to December 31, 2021. The query resulted in 3,656 unique traffic incidents. Each record contained the following fields:

[3] Texas Department of Transportation, Highway Safety Improvement Program Guidelines, Traffic Safety Division. September 2021. https://ftp.dot.state.tx.us/pub/txdot-info/trf/hsip/hsip-guidance.pdf
[4] Texas Department of Transportation, Texas strategic Highway Safety Plan, 2022-2027. https://www.texasshsp.com/wp-content/uploads/2022/08/2022-2027-Texas-SHSP.pdf

- Crash ID – an alphanumeric database key that uniquely identifies individual CRIS records.
- Contributing Factors – a comma-separated list of up to 5 contributing factors as recorded in the original police report. 455 unique combinations of 67 unique individual causes.
- Time stamp – date and time the incident occurred.
- Crash Latitude – the latitude of the incident to 8 decimal places (~1cm)
- Crash Longitude - the longitude of the incident to 8 decimal places (~1cm)
- Weather_ Condition – 9 possible values: (i) Clear, (ii) Cloudy, (iii) Rain, (iv) Sleet/Hail, (v) Snow, (vi) Fog, (vii) Severe Crosswinds, (viii) Other, and (ix) Unknown.
- Crash Severity – Fatality, Suspected Major Injury, Suspected Minor Injury, Not Injured
- Injury Count, and Fatality Count – integer value representing the number of individuals injured or killed, respectively.

With these data sets, an analysis was completed to identify traffic problem areas in support of county-wide traffic safety planning and solution implementation.

Between 2018 and 2021, Coryell County had 36 fatalities and 121 suspected serious injuries on its roadways. A crash density heat map reveals that the incidents are concentrated in the urban areas and along major roadway arteries (Figure 2). About 53% of all incidents in Coryell County occurred in the Copperas Cove area while about 21% were in the Gatesville area. The remaining 26% were spread throughout the rest of the county that is mostly rural and small townships. East Business 190 in Copperas Cove and East Main Street in Gatesville had the highest and second highest number of incidents, respectively. Farm to Market 116 had the highest number of fatalities while East Business 190 and State Highway 36 had the highest number of serious injury incidents. Coryell County's crash statistics are consistent with national trends, which show crash incidents tend to increase with urban areas where more traffic is concentrated. Crash severity and casualty rates tend to be higher in rural areas due to higher traffic speeds.

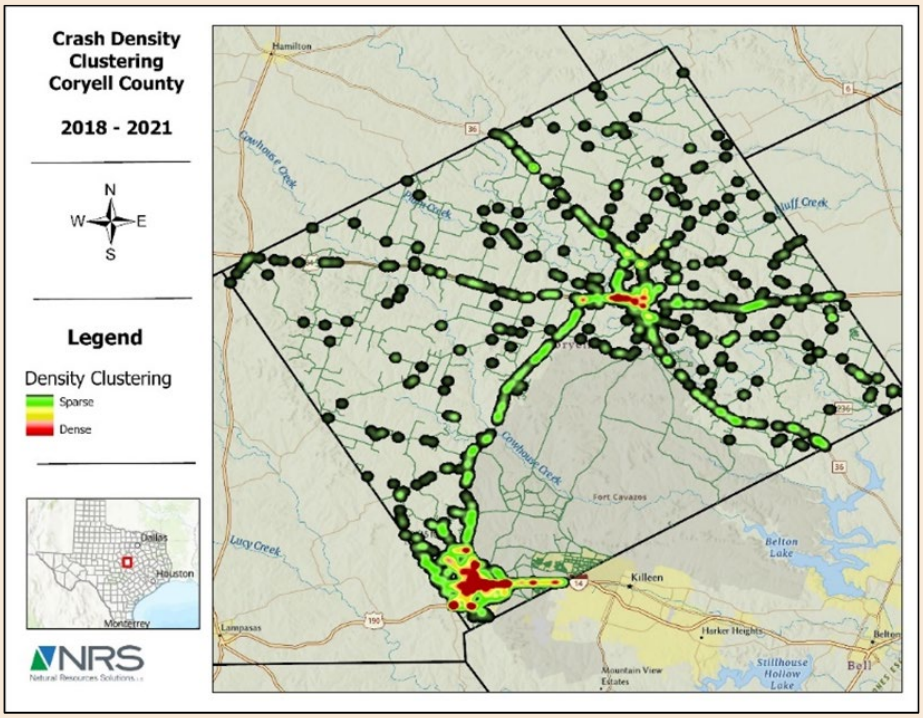


Figure 2. *Crash density clustering in Coryell County between 2018 and 2021*

This is Coryell County's first TSAP. Through stakeholders, subject matter experts and the general public at large, the TSAP will identify transportation safety problem areas and provide safety solutions and implementation actions to address these problems. The goal of zero roadway fatalities and serious injuries is to reduce the number of severe-injury and fatal traffic collisions in Coryell County. Other regional transportation safety planning efforts and studies are underway that are adjacent and connected to Coryell County that will further reduce severe-injury and fatal collisions for area residents. These include:

- Central Texas Roadway Safety Action Plan – Central Texas Council of Governments (CTCOG) & Killeen-Temple Metropolitan Planning Organization (KTMPO)
- Regionally Coordinated Transportation Plan for the Central Texas State Planning Region 23 – CTCOG
- Signalization Study – KTMPO
- Bike Share Feasibility Study -KTMPO
- Future Growth Scenario Report - KTMPO

Chapter 2: Planning Process

Roles of Participants

The development of this plan was a collaborative effort among Coryell County, Natural Resources Solutions, Aegis Creek, various stakeholders, and the public. Descriptions of the involvement of these participants are below.

Coryell County and Natural Resources Solutions

Coryell County contracted with Natural Resources Solutions (NRS) to develop this plan. NRS is a locally owned environmental consulting company with extensive experience in Coryell County. NRS focuses on project planning, grant seeking and submission, environmental permitting (state and federal), data compilation and management, Geographic Information System (GIS) analyses, and regulatory and nonregulatory policy analyses. With the company being local to Gatesville, TX and through previous work with the County, NRS has a clear understanding of County needs, goals, and challenges regarding infrastructure, transportation, and hazard mitigation, and possess expert knowledge on socioeconomic dynamics and geographic features.

Aegis Creek

NRS contracted with Aegis Creek to assist with the analysis of existing transportation safety conditions, a crucial component of plan development. Aegis Creek is owned and operated by CEO and founder Dr. J. Kevin Cammack, Ph.D., M.B.A. Aegis Creek helps to bridge the gap between firms proposing and/or bidding on RFPs, and the goals and objectives of federal and state government. Aegis Creek has experience building custom models from variable data inputs for specific scenario-building in the fields of construction, manufacturing, and finance.

Executive Committee

An executive committee was formed with stakeholders from various jurisdictions of the County. The stakeholders were consulted during the development of the plan to determine the greatest safety needs in their area of Coryell County. Stakeholder input was vital to developing the implementation and action activities discussed in Chapter 4. The executive committee was comprised of the following stakeholders:

- Roger Miller, Coryell County Judge
- Kyle Matthews, Coryell County Commissioner Precinct 1
- Justin Latham, Coryell County Road and Bridge
- Justin Mannix, Coryell County Road and Bridge
- Gary Chumley, Mayor of Gatesville
- Scott Albert, Gatesville City Manager
- Monty Sanders, Coryell City VFD Fire Chief
- Chuck Weeks, Mayor of Evant
- Ronnie Sullins, Oglesby ISD Schoolboard
- Damon Adams, Assistant Superintendent for Copperas Cove ISD
- Michael Haire, Director of Transportation for Copperas Cove ISD

Public

Engaging with the public was an essential component of plan development that allowed for community feedback and representation. Concerns expressed by the community were taken into consideration and incorporated into implementation and action activities. The following section outlines the various outreach methods used to engage the public and increase participation in the development of the plan.

Public Engagement Methods

Website

A website[5] explaining the purpose of the TSAP was launched on January 5th, 2024. The website served as an outreach and educational tool to inform the public about the development of the plan, as well as provide additional resources about TSAPs. The website also provided a link to the Public Survey and stressed the importance of community participation during the plan development process.

Survey

A public survey was developed and deployed to seek public input on transportation safety concerns around the County. The survey consisted of six questions, two of which were open-ended to allow the public to include any opinion they may have regarding transportation safety issues. See Appendix A for survey questions. The survey was conducted from January 5th, 2024, to February 29th, 2024, and 318 responses were received. The survey also included an option to

[5] https://www.coryell-county-sap.com/

place points on a map to indicate where the public had concerns. The map tool was available via a link included in the survey. The public placed 160 points on the map to indicate where they had transportation concerns within Coryell County. Findings from the survey and map are discussed in Chapter 3.

Survey Outreach

Extensive outreach to raise awareness of the public survey was achieved through various methods. The goal was to ensure that as much of the community as possible was surveyed to develop a comprehensive understanding of the greatest safety concerns of the residents of Coryell County.

NRS contacted organizations located in Coryell County with a request to share the survey through their various media pages to further extend the reach of the survey. A graphic was created for organizations to post that included a brief description of the safety action plan as well as a link to the survey. Table 1 contains the list of organizations that were contacted.

Figure 3. *Graphic provided to local organizations*

A postcard advertising the public survey was mailed to 17,971 of the 29,998 residential addresses in Coryell County. The postcard included information about the Safety Action Plan, potential projects that could be included in the plan, a QR code and link to the public survey, and a link to the Safety Action Plan website. The addresses were selected based on the median household income of the mailing route, prioritizing the lowest income routes to help address equity concerns (see Equity Considerations Section). A copy of the postcard is available in Appendix B.

Table 1. *List of organizations contacted.*

Organization Contacted	Platform
Coryell County	Facebook, Website
Coryell Preparedness Hub	Facebook
Coryell Joint Communications Group	Facebook
Texas Department of Public Safety	Facebook
City of Copperas Cove	Facebook, Website
Copperas Cove ISD	Facebook
Copperas Cove Police Department	Facebook
Copperas Cove Chamber of Commerce	Newsletter
Copperas Cove Public Library	Website
Copperas Cove Senior Center	Facebook
Copperas Cove Repeater Association	Facebook
City of Gatesville	Facebook, Website
Gatesville ISD	Facebook
Gatesville Police Department	Facebook
Gatesville Civic Center	Facebook, Website
Gatesville Public Library	Facebook, Website
City of Oglesby	Facebook
Oglesby ISD	Facebook
City of Evant	Facebook, Website
Evant ISD	Facebook
Jonesboro ISD	Facebook
Coffee Saloon	Facebook
Turnersville Community Center	Facebook, Website

Public Meeting

A public meeting was held on April 4th, 2024, at 2pm in the Coryell County Commissioners Courtroom. The purpose of the meeting was to inform the public of the progress of the TSAP and listen to any final feedback. The meeting was advertised in a news story that ran in the Gatesville messenger on March 22nd, 2024, as well as a public notice that was published on the Coryell County website on March 21st, 2024. See Appendix C for the notices and Appendix D for a list of attendees for the public meeting.

Figure 4. *Photo from April 4th public meeting*

Equity Considerations

The National Association of Colleges and Employers (NACE) defines equity as a term that "refers to fairness and justice and is distinguished from equality: Whereas equality means providing the same to all, equity means recognizing that we do not all start from the same place and must acknowledge and make adjustments to imbalances. The process is ongoing, requiring us to identify and overcome intentional and unintentional barriers arising from bias or systemic structures."[6]

Relating to equity, a new Executive Order was enacted on February 16, 2023, titled *Executive Order 14091 - Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government.* The Executive Order strives to advance equity throughout Federal Government funding, programs, and activities. The Executive Order states, "By advancing equity, the Federal Government can support and empower all Americans, including the many communities in America that have been underserved, discriminated against, and adversely affected by persistent poverty and inequality. We can also deliver resources and benefits equitably to the people of the United States and rebuild trust in Government."

The Executive Order also discusses the need to focus on rural areas of the United States. The following passage pulled from the Executive Order demonstrates this:

"Sec. 6. Creating Economic Opportunity in Rural America and Advancing Urban Equitable Development:

a. Agencies shall undertake efforts, to the extent consistent with applicable law, to help rural communities identify and access Federal resources in order to create equitable economic opportunity and advance projects that build community wealth, including by providing or supporting technical assistance; incentivizing the creation of good, high-paying union jobs in rural areas; conducting outreach to and soliciting input from rural community leaders; and contributing new resources and support to interagency programs such as the Rural Partners Network.
b. Agencies shall undertake efforts, to the extent consistent with applicable law, to strengthen urban equitable development policies and practices, such as advancing community wealth building projects; preventing physical and economic displacement as the result of Federal investments; facilitating equitable flows of private capital, including to underserved communities; and incorporating outcome-based metrics focused on urban equitable development in the design and deployment of Federal programs and policies. To support these efforts, the Assistant to the President for Domestic Policy shall issue a policy memorandum on actions agencies can take to advance urban equitable development."

[6] https://www.naceweb.org/about-us/equity-definition

The USDOT has taken action to comply with Executive Order 14091 and has included a Planning Topic dedicated to equity on their public web page which provides links to the DOT's Equity Plans, showing the USDOT's commitment to incorporating equity into their planning efforts. The USDOT noted, "Considering equity early and often through methods such as public participation and data collection and analysis improves the planning process's ability to adequately respond to the needs of the community it serves. It may also improve project delivery by preventing costly and time-consuming delays that could arise from previously unrecognized conflicts as projects move from planning into implementation."[7]

The USDOT updated their existing 2022 Equity Plan to comply with the 2023 Executive Order and made the following statement:

"DOT is committed to pursuing a comprehensive approach to advancing equity for all. The first DOT Equity Action Plan, in response to Executive Order 13985, was finalized in January 2022 as a major milestone for the Department that represented a shift in how the agency exercises its existing authorities and delivers transportation programs. The 2023 update of the DOT Equity Action Plan includes:

- An update on the progress made by DOT on the Equity Action Plan released in 2022.
- Potential barriers that underserved communities may face in accessing and benefiting from the agency's policies, programs, and activities and strategies to address those barriers.
- Information on how DOT has and will continue to meaningfully engage with communities.
- Key actions that DOT will undertake to continue to expand access and opportunity to all communities while focusing on underserved, overburdened, and disadvantaged communities.

The 2023 USDOT Equity Action Plan highlighted actions to be taken by DOT to address disparities, including high transportation insecurity and cost burdens experienced by low-income households and rural communities."[8]

Additionally, the USDOT recognized the importance of the new Climate and Economic Justice Screening Tool (CEJST) recommended for use by Federal Agencies to identify areas with equity concerns. The CEJST is easily accessed, user friendly, and provides information on several parameters including transportation barriers.

The CEJST uses census tracts, which are small, permanent geographic divisions of a county. Tracts are considered disadvantaged when they experience burdens. Most of the burdens are ranked using percentiles that show how much burden each tract experiences when compared to other tracts. Other burdens use a yes/no" designation to indicate rating. Thresholds determine

[7] https://www.planning.dot.gov/planning/topic_transportationequity.aspx
[8] *USDOT Equity Action Plan 2023 Update,* September 2023, Executive Summary

if communities in a tract are overburdened and underserved and therefore disadvantaged. The disadvantaged tracts are highlighted on the CEJST map.

Aside from the CEJST map, the USDOT looks for Areas of Persistent Poverty (APP) and Historically Disadvantaged Communities (HDC) and provides a table and map tool that is broken down by census tracts and identifies these areas. The USDOT also has an Equitable Transportation Community (ETC) that provides information about disadvantages relating to climate and disaster, environmental, health vulnerability, social vulnerability, and transportation insecurity.

To stay in alignment with the USDOT's commitment to equity, this TSAP was developed using the USDOT tools to define and identify disadvantaged areas in Coryell County.

CEJST[9]

According to the CJEST, there are four[10] census tracts in Coryell County that are identified as disadvantaged. Table 2 shows the specific disadvantages the tracts are facing, and Figure 5 shows the locations of the disadvantaged communities in relation to the rest of the County.

[9] https://screeningtool.geoplatform.gov/en/#9.49/31.4283/-97.8073
[10] Five including Ft. Cavasos

Table 2. *Coryell County CEJST disadvantages*

Tract Number	Disadvantage	Percentile
48099010300 (103)	Low Income People in households where income is less than or equal to twice the federal poverty level, not including students enrolled in higher ed	91st
	Climate Change Expected population loss rate - Fatalities and injuries resulting from natural hazards each year	94th
	Climate Change Projected wildfire risk - Projected risk to properties from wildfire from fire fuels, weather, humans, and fire movement in 30 years	92nd
	Transportation Transportation barriers - Average of relative cost and time spent on transportation	93rd
	Workforce Development Unemployment - Number of unemployed people as a part of the labor force	95th
	Workforce Development High school education - Percent of people ages 25 years or older whose high school education is less than a high school diploma	21%
48099010701 (107.01)	Low Income	65th
	Climate Change Projected wildfire risk	97th
48099010601 (106.01)	Low Income	76th
	Climate Change Projected wildfire risk	99th
48099010501 (105.01)	Low Income	87th
	Housing Housing cost - Share of households making less than 80% of the area median family income and spending more than 30% of income on housing	99th

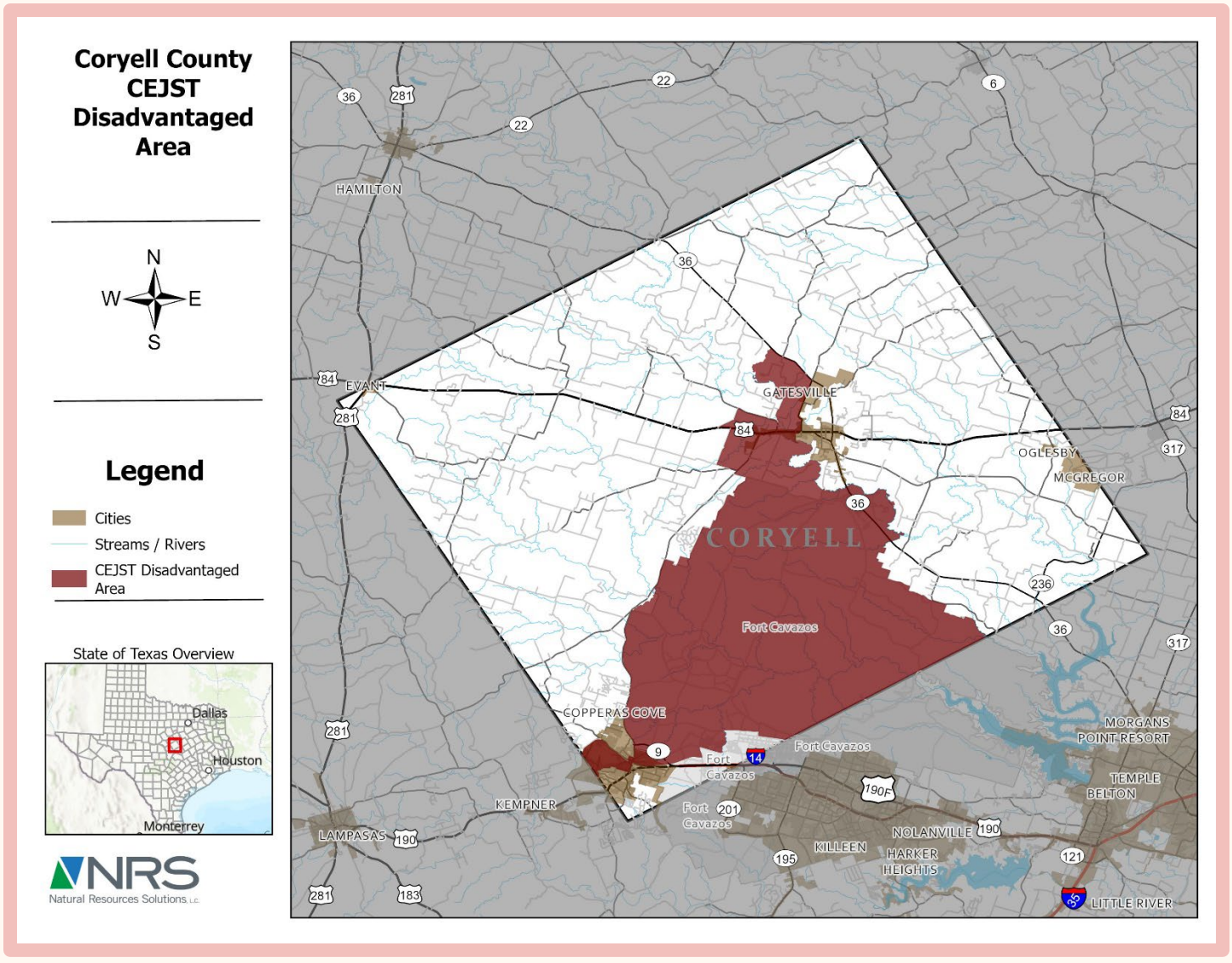


Figure 5. *CJEST disadvantaged areas in Coryell County*

Areas of Persistent Poverty and Historically Disadvantaged Communities

APPs are defined as "Any County that has consistently had greater than or equal to 20 percent of the population living in poverty during the last 30-year period, as measured by the 1990 and 2000 decennial census and the most recent (2021) annual Small Area Income and Poverty Estimates as estimated by the Bureau of the Census." Or "Any Census Tract with a poverty rate of at least 20 percent as measured by the 2014–2018 5-year data series available from the American Community Survey of the Bureau of the Census."[11] HDCs are defined as any census tract identified as disadvantaged in the CEJST. See Table 3 and Figure 6 for APPs and HDCs in Coryell County.

Table 3. *APP's and HDC's in Coryell County*

Census Tract Number	APP	HDC
Census Tract 101.01	No	No
Census Tract 101.02	No	No
Census Tract 102.01	No	No
Census Tract 102.02	No	No
Census Tract 103	No	Yes
Census Tract 104	No	Yes
Census Tract 105.01	Yes	No
Census Tract 105.02	Yes	No
Census Tract 105.03	Not Identified	No
Census Tract 105.04	No	No
Census Tract 106.01	Yes	Yes
Census Tract 106.03	No	No
Census Tract 106.04	No	No
Census Tract 107.01	No	No
Census Tract 107.02	No	No
Census Tract 108.02	No	No
Census Tract 108.03	No	No
Census Tract 108.04	No	Yes
Census Tract 9800	Yes	No

[11] https://datahub.transportation.gov/stories/s/tsyd-k6ij

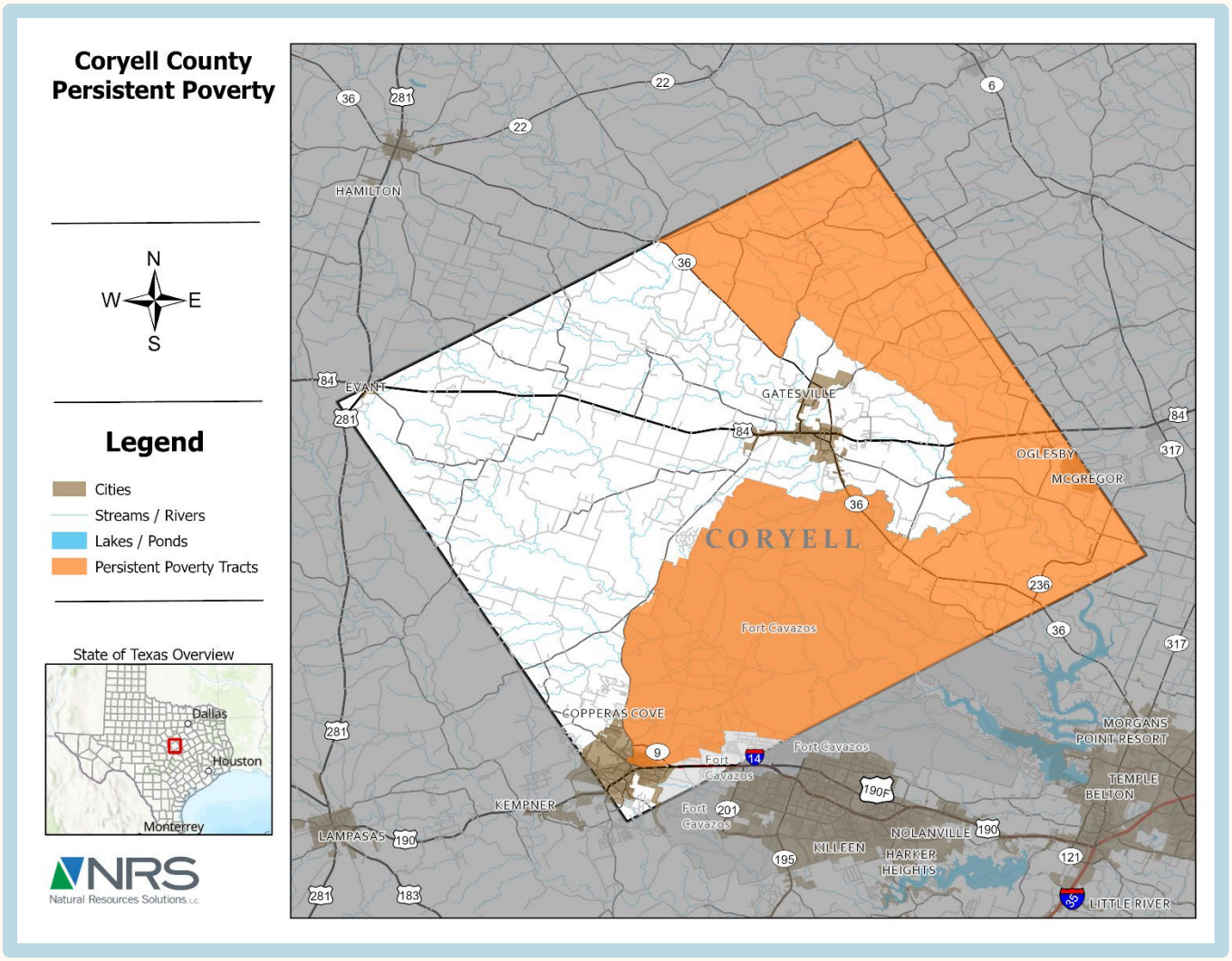


Figure 6. *Areas of persistent poverty map*

USDOT ETC

According to the USDOTs Equitable Transportation Community explorer, Coryell County is in the 69th percentile for transportation insecurity.[12] Census tract 48099010101 (101.01) and tract 48099010102 (101.02) represent the majority of the rural county and are in the 97th and 94th percentile, respectively, for transportation insecurity with the main disadvantages being transportation access and traffic safety. This data is a great representation of the disparity of transportation systems in rural and urban areas.

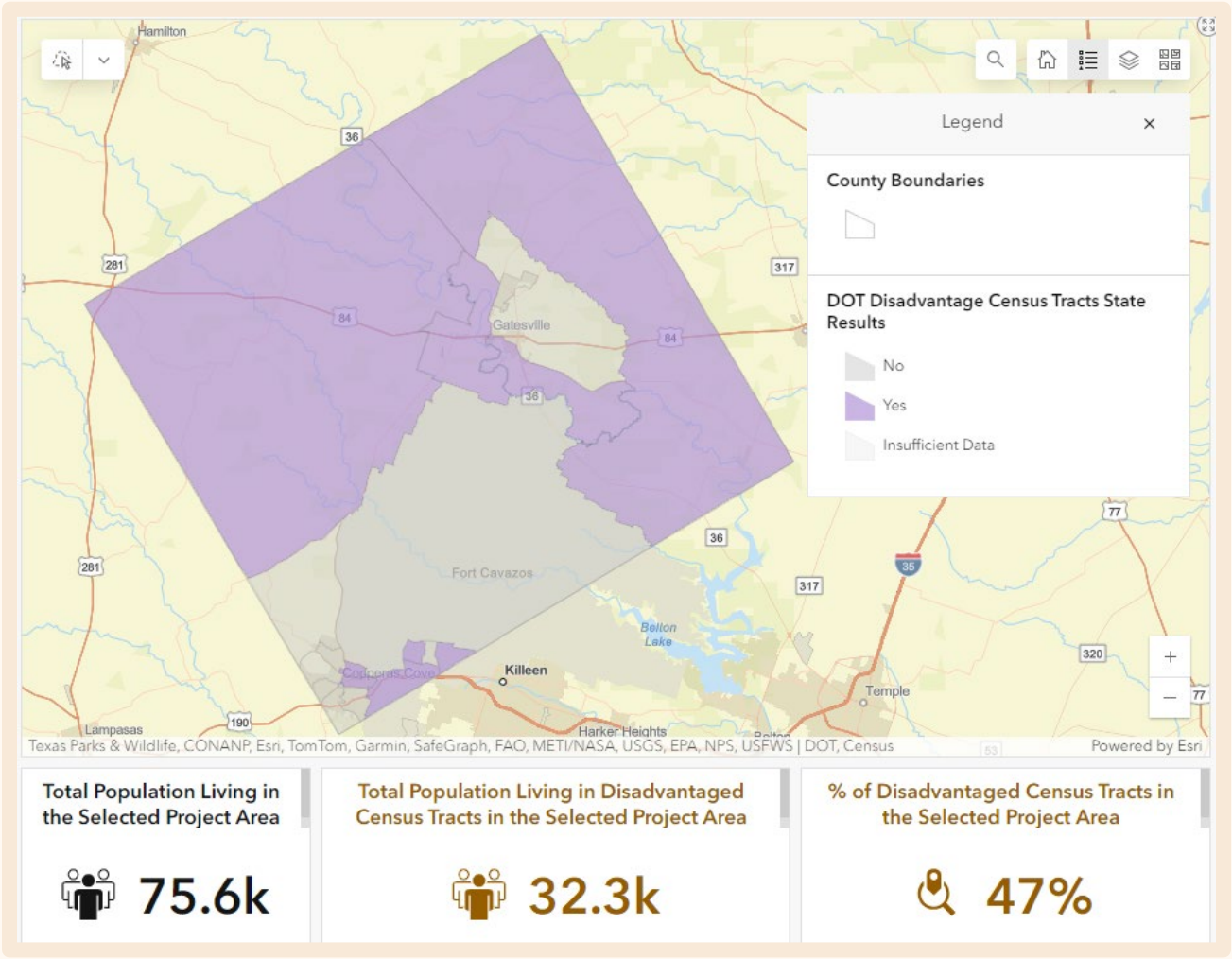


Figure 7. *DOT disadvantage map*

[12]https://experience.arcgis.com/experience/0920984aa80a4362b8778d779b090723/page/ETC-Explorer---State-Results/

Figure 8. *DOT transportation insecurity percentile for Coryell County*

Once the disadvantaged areas around the county were defined, the TSAP was developed with actions specifically taken to ensure representation of concerns from areas identified as tracts with equity concerns. The first action taken was during the public survey outreach. Sending a postcard advertising the public survey to all 29,998 residential addresses in Coryell County was not feasible. Addresses were grouped by United States Postal Service mail routes and prioritized by median household income, with the lowest income routes being prioritized. This ensured that the postcard was reaching areas of the county that are considered disadvantaged due to low income and assured that the residents in these areas had ample opportunity to provide their feedback on transportation safety in the county.

Equity played an important role during project prioritization. This TSAP considers how to improve safety for all people in Coryell County, however areas that were identified in the CEJST, APP, HDC, and ETC as disadvantaged were prioritized. See Chapter 4 for how specific projects were prioritized considering equity. Recognizing, identifying, and addressing transportation safety issues within Coryell County, where equity concerns exist, is a holistic approach to

improve transportation safety county-wide, with a goal to reduce fatalities and serious injuries resulting from car crashes.

In summary, this TSAP used all of the tools currently available to identify areas within Coryell County where equity is a concern, and those areas were then considered and prioritized during the selection of transportation safety projects. As Coryell County grows, the monitoring and maintenance of this TSAP and projects that are implemented from this TSAP will continue to rely on the existing equity identification tools and any newly developed equity tools to ensure that equity considerations are a prominent aspect of the TSAP into the foreseeable future.

Safe System Approach

The Safe System Approach (SSA) was utilized during the development of this TSAP to create a comprehensive plan for creating safer roads. The SSA is a human-centered strategy, designed to consider that people will inevitably make mistakes and therefore road systems should be engineered to anticipate human error in order to prevent fatal and serious injury on roadways. Rooted in Sweden's Vision Zero program, this approach has now been adopted by several countries across Europe, Australia and New Zealand due to its success in significant reductions in fatalities after implementation. Here in the United States, parallel road safety initiatives that have acknowledged the importance of implementing the SSA include Vision Zero, Toward Zero Deaths, and Road to Zero. What makes this strategy so successful is its comprehensive approach comprised of six major principles and five elements, that shift the responsibility of road safety from road users to those who design the transportation system.

Figure 9. *The Safe System Approach*

Safe System Approach Principles

The SSA declares that no death or serious level of injury should be acceptable in a transportation network. To achieve this objective, the SSA is grounded in the following six principles.

> **Death/Serious Injury is Unacceptable** – A SSA emphasizes that no one should by killed or seriously injured when using transportation systems, therefore decisions and designs related to roadways should most importantly, prioritize road safety.

Humans Make Mistakes – The SSA recognizes that even the most compliant and alert road users can inevitably make a mistake that can lead to vehicle collision. With this in mind, the road system should be planned, designed and operated to assume a level of human mistake and prevent death and serious injury when a crash does occur.

Humans are Vulnerable – The human body has a limit in the amount of kinetic energy it can tolerate during a vehicle collision before death or serious injury occurs. The SSA therefore focuses not just on managing speed but managing the kinetic energy delivered to a road user by designing and operating a system that considers the human vulnerability threshold.

Responsibility is Shared – The SSA iterates that to prevent death and serious injury on road transportation systems, all stakeholders must work collaboratively and are responsible in doing their part. Stakeholders include, but are not limited to road users, system managers (including planners, designers, builders, operators, maintainers), law enforcement, emergency responders, and vehicle manufacturers.

Safety is Proactive – A SSA recognizes the importance of using data-driven tools to proactively identify and mitigate risks in design within a roadway system that has led to death or serious injury, and systemically apply countermeasures to all locations within a system that share similar features rather than solely waiting for crashes to occur and reacting afterwards.

Redundancy is Crucial – The SSA requires that all parts of a system be strengthened so that in the event one element fails, other parts of the system will still protect roadway users.

Five Elements of a Safe System

In the SSA, five elements are implemented as a whole, to cohesively provide a safer network of roads and freeways. It is important to remember that no element is sufficient just on its own.

Safe Road Users – Roadway users share the responsibility of creating a safe system by being attentive, adapting to changing conditions, complying with laws, and not driving under the influence. These responsible behaviors are addressed by all users of the system including those who walk, bike, ride transit or travel by other modes, to ensure users reach their destination unharmed.

Safe Vehicles – A key component to a safe system includes the use of vehicles that come with safety features such as autonomous emergency breaking and lane assist to prevent crashes from occurring, as well as seatbelts and airbags to protect occupants in the event of a collision. Additionally, future widespread implementation of vehicle features such as bicycle and pedestrian detection will ensure safety of all roadway users.

Safe Speeds – By designing a transportation system with safe speed features like appropriate road design, speed-limits, safety cameras, education and enforcement, the chance of death and serious injury to humans will be reduced due to lower impact forces, providing additional time for drivers to react and/or stop, and improving visibility to aid in the prevention of collision.

Safe Roads – By adhering to a human-centric framework, providing safe roads requires that design features and safety countermeasures take driver behavior into consideration. Incorporating signs alerting drivers of hazards, traffic signals to mitigate conflict between road users, and strategically placing roundabouts to reduce speed at busy intersections, are all countermeasures that provide safe roadway conditions, preventing death and serious injury from occurring.

Post-Crash Care – While the Post-Crash Care element aims to improve survivability of collisions by expediting emergency response, on-site care, and transportation of injured persons to a hospital, it also encompasses crash reporting and investigation, traffic incident management, and the justice system, resulting in the prevention of secondary crashes of similarly identified areas within the roadway system.

Chapter 3: Analysis of Existing Transportation Safety Conditions

Aegis Creek Safety Analysis

To reduce fatalities and serious injuries and increase overall transportation safety conditions in Coryell County, it is important to understand existing crash trends. Analyzing existing crash trends and safety conditions through a data driven process revealed important information about who was involved in crashes, what factors contributed to the crash, and where the crash occurred. These details identify where the most impact can be made to improve safety conditions. This analysis was crucial to developing the projects described in Chapter 4.

Aegis Creek completed a comprehensive safety analysis to provide a baseline level of crashes across Coryell County. The following summarizes their approach, processes, and findings.

1. Abstract

A spatio-temporal analysis has been conducted aiming to identify road accident hotspots in Coryell County and identify causal components related to roadway designs, driver behavior, and "attractors", over the time period of 2018-2021. The initial hypothesis was that there would be one or two clear hotspots and trends around specific causal factors (such as weather) that would provide opportunities for immediate improvements in traffic safety.

While the overall distribution is smooth and random, clustering analysis suggests that Copperas Cove has roadway design and control issues that are significantly worse than the rest of the county. Geographically, of the top 50 hotspot or "attractor" locations for traffic accidents in Coryell County, 31 of them are located in Copperas Cove, accounting for 73% of the accidents in the top 50 geographically proximate hotspots in Coryell County.

Traffic incidents are also clustered in time. Fatalities were found to be more likely to occur in off-peak hours or during commute hours, and remarkably, the hotspots are not the most dangerous locations, accounting for only a single fatality over the 4 years studied. Rather, fatalities tended to occur near uncontrolled intersections that fall outside of identifiable hotspots. Non-fatal accidents, in contrast, tend to cluster along roadways (and at specific locations in Copperas Cove), and tend to occur primarily during peak commute hours, typically with a single mode around the evening commute (1700 to 1900).

This suggests a two-pronged approach to traffic safety planning; improvement of traffic management and controls near hotspots, particularly in Copperas Cove, and alternate methods such as education campaigns for overall driver awareness throughout the rest of the county.

2. Background and Summary

This project seeks to provide an understanding of traffic safety risks on roadways in Coryell County, Texas following the guidelines of the U.S. Department of Transportation's Federal Highway Administration Rural Safety Action Plan Guidelines [1], using the strategy outlined in Figure 10. The core of any safety planning effort is the data analysis (Steps 2 and 3), thus a robust analytical framework is key to providing workable inputs to Steps 4 and 5. Specifically, by using a spatial analysis as well as a classic count analyses, we hypothesized that specific issues related to roadway design, driver behavior, and "attractors" using the Weisstein definition [2], Coryell County will be able to identify a plan to mitigate traffic safety issues county-wide.

There have been a number of studies to identify correlations between various factors and the prevalence of traffic safety incidents. Once identified, these correlations can then be used as the basis of policy and infrastructure implementations designed to improve safety and lower risk.

Figure 10. *DOT FHA Local Road/Traffic Safety Action Planning Strategy*

Traffic incidents are inevitably tied to spatial locations (road segments and governance regions); traffic is restricted to roadways, and policies are implemented and enforced by various governmental bodies. In most roadway accident studies, crashes are grouped in spatial units that range from intersection or road section level to zip code or county level (e.g. [3],[4],[5], [6],[7]). Our study follows these precedents.

Individual crashes are commonly organized via "Heinrich's Pyramid" (Figure 11) in descending order of severity and impact from "fatalities" (most severe) at the top to "near accidents" at the bottom. As a rough rule of thumb, there is a decrease in frequency of roughly an order of magnitude as one ascends the pyramid. Covariate analysis provides a method to further examine hotspots for potential explanatory variables, or covariates, that can be addressed in policy as part of future traffic safety plans. Generally, covariates typically fall into well understood categories, such as:

- Traffic Speeds and Variance thereof
- Traffic Density as a function of Roadway Design
- The skill mix of drivers

- Traffic Controls and Roadway Design
- Traffic Mix
- Time of Day
- Weather Events

Figure 11. *Heinrich's Pyramid*

3. Data and Data Management

For this analysis, we examined 3,656 unique traffic incidents recorded in the Texas Department of Transportation (TxDOT) Crash Records Information System (CRIS), a state-wide database of crash records populated from police reports by local police departments and sheriff's departments. The CRIS database provides pre-designed queries and limited data pulls to the general public. Representatives of county governments and local law enforcement are allowed to make full database queries. For this study, individual records were pulled by the Coryell County Sheriff's department, providing the opportunity to identify correlations far beyond the publicly available data tables on CRIS. The data set covers the period January 1, 2018, through December 31, 2021.

Detailed Description of the Data

The Coryell County Sheriff pulled a dataset comprising all incidents in Coryell County, regardless of severity, for the four-year period from January 1, 2018, through December 31, 2021. Individual incidents were stripped of personally identifying information (PII) and are identified solely by the unique CRIS database key. Each incident record includes the location in WGS 84 (decimal lat/long pairs) format to 8 decimal places (approximately 1mm precision), a text description consisting of up to five selection from a menu of 78 different causal contributing factors, weather descriptions limited to ten unique values - clear, cloudy, rain, sleet/hail, snow, fog, sever wind, other, and "unknown,", a date/time stamp that records the incident date and time to the second, and a short description of the crash severity with four unique values – not injured, minor injury, serious injury, fatality. For each incident, the coordinates were mapped to the nearest specific address using mygeodata.cloud.

Each individual record consists of the following fields:

- Crash_ID – an alphanumeric database key that uniquely identifies individual CRIS records.
- Contributing_Factors – a comma-separated list of up to 5 contributing factors as recorded in the original police report. 455 unique combinations of 67 unique individual causes.
- Time_stamp – date and time the incident occurred.
- Crash_Latitude – the latitude of the incident to 8 decimal places (~1cm)

- Crash_Longitude - the longitude of the incident to 8 decimal places (~1cm)
- Weather_Condition – 9 possible values: (i) Clear, (ii) Cloudy, (iii) Rain, (iv) Sleet/Hail, (v) Snow, (vi) Fog, (vii) Severe Crosswinds, (viii) Other, and (ix) Unknown.
- Crash_Severity – Fatality, Suspected Major Injury, Suspected Minor Injury, Not Injured
- Injury_Count, and Fatality_Count – integer value representing the number of individuals injured or killed, respectively.

Date/time stamps were deconvoluted to year, month, day, and hour of day. The causal contributing factors menu includes a number of factors that appear to be repetitive, such as "animal in roadway – domestic" and "animal in roadway – wild". The contributing factors menu largely focused on driver behaviors rather than traffic controls or roadway design elements. Given that there are only 36 fatalities in the period examined and 3656 total incidents, 78 different causes make it difficult to make any statistically meaningful inference – as a general rule of thumb, at least ten data points are required to provide a 90% confidence interval, and for each additional correlation, the number of data points required increases by a factor of ~10. Thus, to reduce the complexity of the dataset and provide actionable pointers to causal factors, the menu of causal factors was reduced to ten unique values, specifically: asleep, cellphone, driver inattention, evading police, ill, improper turn, unknown, road rage, speeding, under the influence, and unsafe driving. Each reduced causal factor was ranked according to a presumption of risk as delineated in Table 4. Ranks were assigned inversely according to the degree of perceived risk – for example, if a crash was attributed both to speeding (rank 10) and cellphone usage (rank 5), the primary causal factor was assigned to be cellphone usage.

Table 4. *Reduce casual factor rankings.*

SIMPLE FACTOR	RANK	SIMPLE FACTOR	RANK	SIMPLE FACTOR	RANK
UNDER INFLUENCE	1	CELLPHONE	5	VEHICLE BREAKDOWN	9
ASLEEP	2	EVADING POLICE	6	SPEEDING	10
ROAD RAGE	3	DRIVER INATTENTION	7	IMPROPER TURN	11
ILL	4	UNSAFE DRIVING	8	UNKOWN	12

It is important to note that many of the classic traffic safety data inputs, such as traffic mixes, through-rates, and average speeds per road segment for both count-based and spatio-temporal analysis are not available. Lack of such data are not surprising given the fact that Coryell County is vast – it covers approximately 2,738 square kilometers – and the rural nature of the area limits the availability of resources to track these details. Thus, we have used the following values in Table 5 for exposure by road type (all roads are assumed to be two lanes, except for Interstate Highways which were assumed to be four lanes):

Table 5. *Annual average daily traffic (AADT) and average speed assumptions*

Road Type	Speed Limit (MPH)	Traffic Density (v/hr/lane)
Interstate and Federal Highway	70	1000
State Highway	80	500
FTM	80	200
Residential Road	35	25
Urban Surface Street	35	250
Rural Road	50	25

Data Error and Mitigation

The primary sources of error in the dataset are related to (a) the structure of the data in the CRIS database and the stripping of PII from that data, (b) the rural nature of the county, and (c) a lack of specific information about traffic flows by roadway. Of these, the data structure issues and rural aspects dominate; furthermore (c) may be considered a subset of (b).

As a rural county, Coryell County has a relatively small population spread over a large area. The population density in Coryell County is just 27.6 per square kilometer; by comparison, Houston's population density is between 30,000 and 150,000 per square kilometer. The total population is 83,093 people as of the 2020 census, and the county covers approximately 2,738 square kilometers, of which approximately one fourth is part of Ft. Cavazos, a US military base, and not covered by this study. Unlike more urban areas, where traffic densities are usually well mapped for the purpose of urban planning, there is a (wholly anticipated) paucity of available data on (i) traffic densities, (ii) average speeds, and (iii) the location of controls throughout the county. Thus, for the purpose of this evaluation we have used estimates such as those in Table 5, or, in the case of traffic controls used point searches of publicly available satellite maps.

Locations and Bins

The CRIS database records incident locations as latitudinal and longitudinal coordinates to 9 decimal places. While the specific coordinate system is not given for the dataset, the coordinates are assumed to be in WGS 84 format. The recorded coordinates are overly precise – 9 decimal places is equivalent to a precision of +/- 1 millimeter, or approximately 100x more precise than the best GPS receivers available today – and when analyzed for clustering, it was found that for hotspots, nearly all recorded incidents occurred within a meter or less of each other.

The lack of contextual data on the encoding means that errors could not be quantified, and locations were taken prima facia as accurate to within 10 meters. To identify clusters, records were sorted both latitudinally and longitudinally and the distances between the coordinates of sequential records calculated using the Haversine formula (1), where φ_n is the latitude of point *n*, and λ_n are the longitudes of points n, respectively, and r is radius of the Earth (estimated as 6,371,000 meters).

$$2r \arcsin\left(\sqrt{\sin^2\left(\frac{\varphi_2 - \varphi_1}{2}\right) + \cos\varphi_1 \cdot \cos\varphi_2 \cdot \sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right) \quad (1)$$

Given any two WGS 84 coordinates, (1) provides the distance between them in meters based on the assumption of the Earth as a perfect sphere, and estimate that adds roughly 1% error, or less than half a meter when assuming that hotspots occur within roughly half a city block of a particular traffic control or structural causal factor. A standard city block is about 90 meters, thus for this analysis, clusters comprise all incidents located within 45 meters of each other. Ideally the correct approach to identifying clusters would be to employ a k-nearest-neighbor algorithm that both sorts entries into nearest neighbor groups and also minimizes the total number of clusters. However, we found that simply sorting the entire dataset on either latitude or longitude then calculating the distance to the prior entry in the list independently returned clusters with the same members provided we considered clusters with a population greater than two. In a denser environment with high regularity, e.g. Houston, such an approach would be expected to fail, however, the lack of common road alignment and rural nature of the county appears to mean that hotspots are widely separated both latitudinally and longitudinally. Thus, this simpler approach was used.

There are multiple methods for binning, in addition to the hotspot method above, for example, in a fixed geographic binning method, the county could be divided into ~272,600 boxes 100 meters on a side (10,000 sq m) and incidents then assigned to a particular bin according to the box they appear in. This approach has the drawback of arbitrary borders between bins that may split actual clusters into multiple bins.

Initial analysis was performed by road segment, consisting of a road name and a city; in this binning paradigm, all 3,656 incidents occur on just 547 unique road segments, compared with 602 unique bins using the 100 square meter box method and 2,628 unique bins using the 45-meter nearest neighbor approach.

Time Stamps

For each record, the time stamp was broken into the date (dd/mm) and assigned to an hour of the day (24 values, from 0:00 - 1:00 to 23:00 – 24:00).

Crash Contributing Factors

To allow for statistically significant inference, the Contributing Factors provided by CRIS were reduced to a shorter list of higher-level cause descriptions. As an example, in the CRIS data, there are three different individual causes that refer to cellular phone use while driving; similarly, driving under the influence is broken into three different individual descriptions (one for "alcohol", one for "drug", and one for "medication"), and there are 17 different subsets of "Failure to Yield". This is further exacerbated by the fact that between one and five contributing factors for each record. Each individual contributing factor was designated as being a subset of one of the factors listed in Table 6. To identify the most important crash contributing factor in a

list and identify a primary cause for each record, each individual factor was assigned a priority from 1-11, with a lower priority number indicating greater importance. Thus, if the list of causes for a record reduced to, for example, "Under the Influence" (priority 1) and "Unsafe Driving" (priority 7), the cause used in the analysis was "Under the Influence".

Table 6. *Reduced list of crash contributing factors*

KEY CONTRIBUTING FACTOR	RELATIVE PRIORITY
UNDER INFLUENCE	1
ASLEEP	2
ROAD RAGE	3
ILL	4
CELLPHONE	5
EVADING POLICE	6
DRIVER INATTENTION	7
UNSAFE DRIVING	8
SPEEDING	9
IMPROPER TURN	10
OTHER	11

The spatial distributions of accidents over 2018 to 2021 are shown in Figure 12. As the figure illustrates, the distribution appears to combine a random scatter of incidents with clustering on major traffic arteries and around the two major population centers of Gatesville and Copperas Cove. From this distribution, it is difficult to derive any meaningful conclusions about geographic distribution other than the axiomatic statement that there is likely some correlation between traffic density and the rate of traffic accidents.

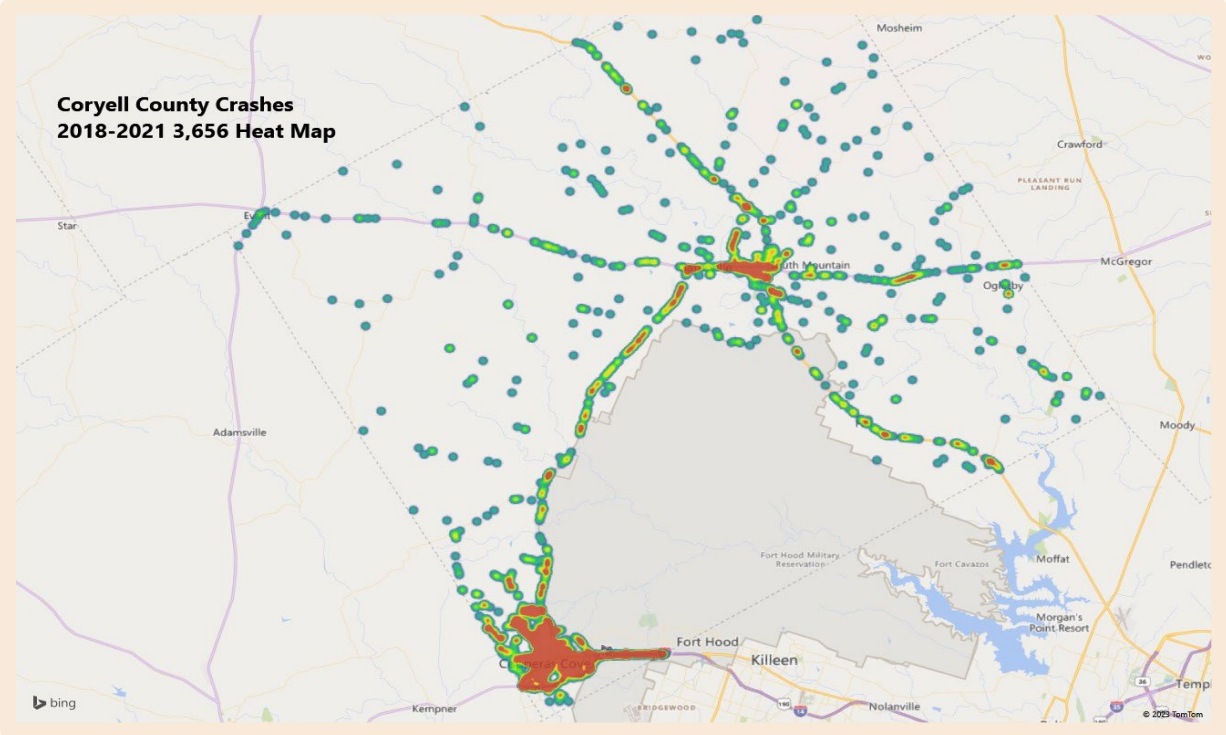


Figure 12. *Geographic heat map scatter plot of all traffic accidents 2018-2021*

When looking only at fatalities (Figure 13), scattering is even more evident, particularly when each data point is examined. Despite the apparent clustering in the map around State and Federal highways, only three fatalities out of 36 are recorded as occurring on these major

thoroughfares. As such it is difficult to draw meaningful conclusions from a simple analysis of the geographic scatter plot of fatalities either.

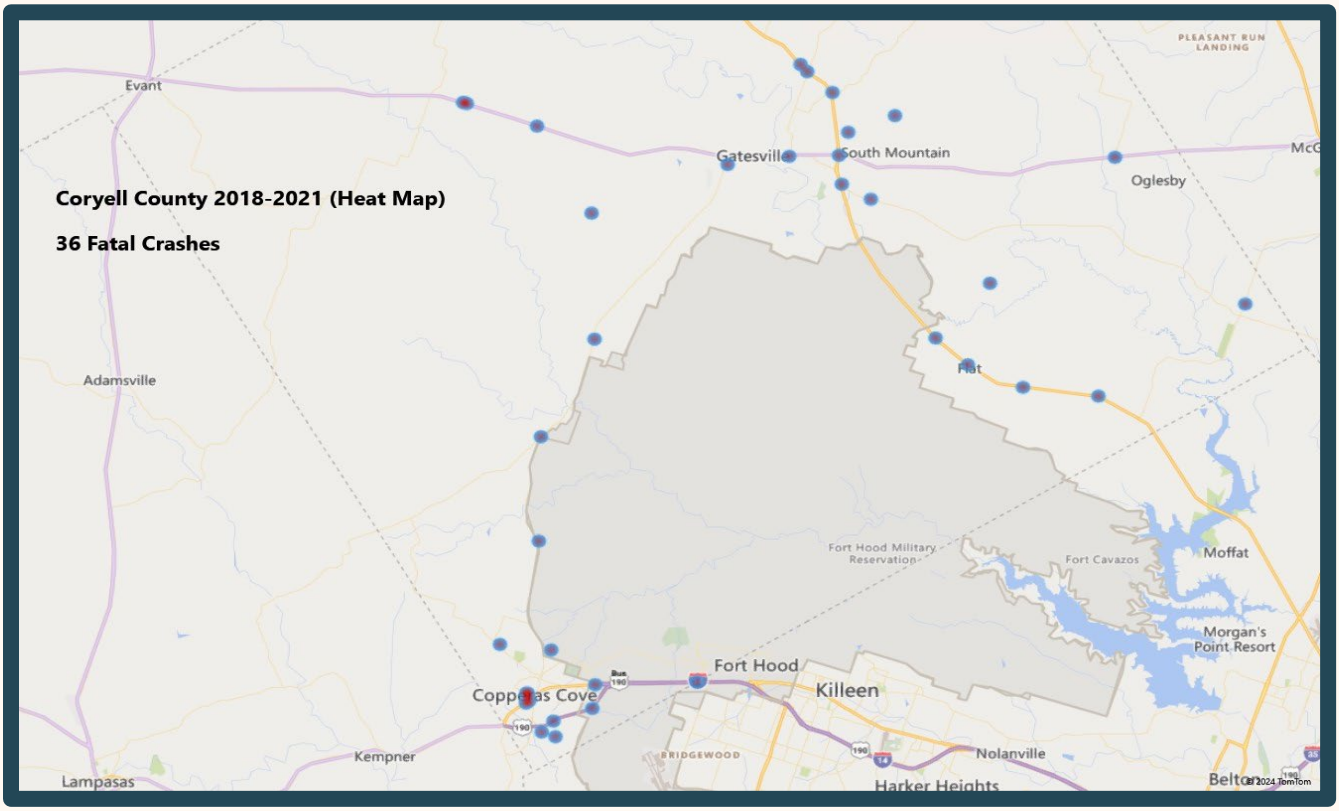


Figure 13. *Geographic heat map scatter plot of fatal traffic accidents 2018-2021*

Figure 14 provides a distribution map of incidents, separated by severity, over the course of a day. As can be seen in the figure, while injury accidents and non-injury accidents all are clearly distributed in a quasi-normal fashion during peak periods with a mode around the evening commute, fatalities appear to invert this trend with two modes, one in the evening commute period and one in the morning commute period, with the bulk of the remaining incidents occurring during off-peak hours. Color differentiation is used in Figure 14 to aid in identifying trends; points that account for less than 3% of the incidents in the population are colored green, points between 3% and 6% are yellow, and any entry accounting for more than 6% of the total population of incidents is red. For fatalities, the median fractional distribution per hour is 2.8%, while all other distributions show a median between 3.8% and 4.0%.

Crash Hour					
00:00 - 00:59	2.8%	2.5%	1.6%	2.2%	2.1%
01:00 - 01:59	5.6%	1.7%	1.6%	1.9%	1.9%
02:00 - 02:59	0.0%	2.5%	1.8%	1.1%	1.3%
03:00 - 03:59	5.6%	0.0%	0.4%	1.1%	1.0%
04:00 - 04:59	0.0%	4.2%	1.6%	1.0%	1.2%
05:00 - 05:59	2.8%	0.8%	1.0%	1.6%	1.5%
06:00 - 06:59	11.1%	2.5%	3.4%	3.9%	3.9%
07:00 - 07:59	11.1%	3.4%	5.7%	5.9%	5.9%
08:00 - 08:59	0.0%	3.4%	3.6%	4.2%	4.0%
09:00 - 09:59	0.0%	4.2%	5.3%	4.0%	4.2%
10:00 - 10:59	2.8%	3.4%	2.6%	4.3%	4.0%
11:00 - 11:59	2.8%	3.4%	5.1%	5.1%	5.1%
12:00 - 12:59	2.8%	1.7%	5.9%	6.6%	6.3%
13:00 - 13:59	2.8%	5.9%	7.3%	5.9%	6.1%
14:00 - 14:59	2.8%	6.8%	5.9%	5.1%	5.3%
15:00 - 15:59	0.0%	5.9%	5.9%	6.6%	6.4%
16:00 - 16:59	8.3%	5.1%	8.3%	8.8%	8.6%
17:00 - 17:59	11.1%	12.7%	7.7%	8.7%	8.8%
18:00 - 18:59	8.3%	7.6%	6.7%	6.4%	6.5%
19:00 - 19:59	5.6%	5.9%	5.1%	4.6%	4.8%
20:00 - 20:59	2.8%	4.2%	3.8%	3.1%	3.3%
21:00 - 21:59	2.8%	4.2%	4.0%	3.2%	3.3%
22:00 - 22:59	5.6%	5.1%	3.2%	2.6%	2.8%
23:00 - 23:59	2.8%	2.5%	2.4%	1.9%	2.0%
	FATAL INJURY	SERIOUS INJURY	MINOR INJURY	NOT INJURED	TOTAL

Figure 14. *Fractional population distribution of fatal, serious-injury, minor-injury, and non-injury incidents by time of day. Peak hours are assumed to be 6AM (0600) to 7PM (1900).*

4. Rates and Probabilities by Severity and Time of Day (County-wide)

Generally, individual crash events satisfy the definition of independent Bernoulli trials – that is each incident is binary (it occurred or did not occur), and incidents are independent – one crash (generally) will not influence the occurrence of another. In the absence of significant changes to the underlying infrastructure and population, the rate of traffic incidents over time is expected to be constant. Thus, we can model the traffic incidents over time as simple Poisson distributions.

Under a Poisson Distribution with a mean number of events λ in a particular time (or space) interval, the probability of k events in the same interval is given by (2):

$$\frac{\lambda^k e^{-\lambda}}{k!} \tag{2}$$

Table 7. *County-wide incidents per year by severity*

Severity	2018	2019	2020	2021	*Average*
Fatal	6	7	12	11	*9*
Severe Injury	38	48	45	59	47.5
Any Injury	184	240	167	258	212.25

Over the period studied (2018-2021), there were a total of 36 fatalities, or an average of nine fatalities per year with six in 2018, seven in 2019, 12 in 2020, and 11 in 2021 (Table 7). As shown in Figure 15, the number of pre-pandemic incidents is somewhat lower than expected although still within a 90% confidence interval of the expected distribution.

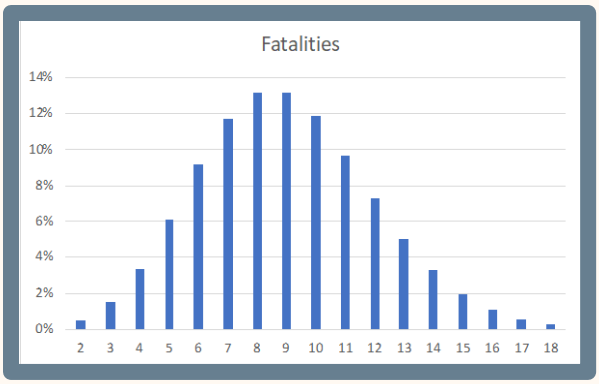


Figure 15. *Poisson distribution of fatalities*

Both severe-injury accidents and the population of all injury-accidents, in contrast, showed a decrease in 2020 relative to both 2019 and 2021, suggesting a negative correlation between traffic density and severity. The only significant outlier was the 2020 total of all injury-incidents (164); based on the existing population of incidents the probability of seeing this small a number of incidents in 2020 was just 0.02%, or just under 0.1% of the likelihood of seeing the mean number of incidents (212).

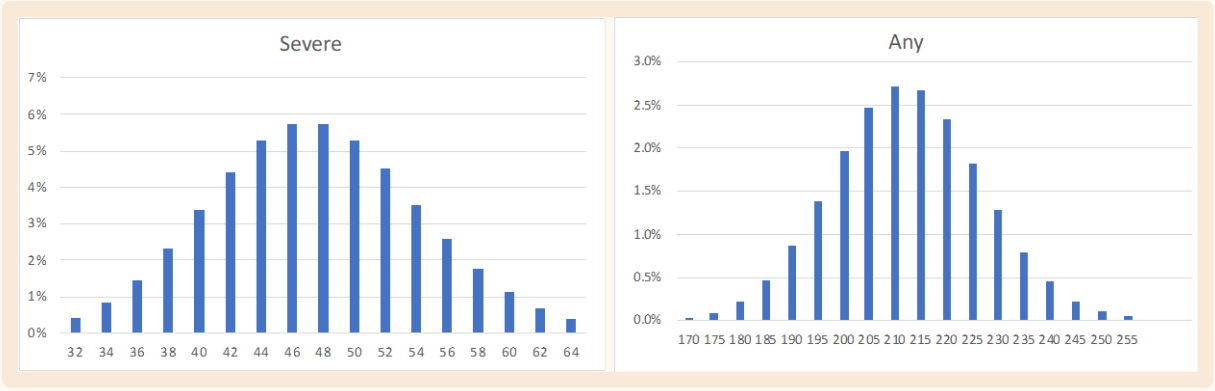


Figure 16. *Poisson distributions of severe-injury (left) and all-injury incidents (right)*

Crash distribution by hour of day is clearly time dependent as the time distribution matrix in Figure 17 illustrates. This matrix lists the probability, based on the hourly mean, that the cumulative number of incidents in a given four-year period will be below the number at the top of the matrix, i.e. zero (0) fatalities, two (2) or fewer combined fatalities or severe injury accidents, and 10 or fewer injury accidents of any severity. The lower the probability, the more likely there are to be spikes in injurious incidents in a given hour in any four-year period. Thus, there is a significant chance (63%) that fatalities will be observed

Crash Hour	P(<1 fatality)	P(<3 severe)	P(≤10 any injury)
00:00 - 00:59	78%	92%	100%
01:00 - 01:59	61%	92%	100%
02:00 - 02:59	100%	96%	100%
03:00 - 03:59	61%	99%	100%
04:00 - 04:59	100%	87%	100%
05:00 - 05:59	78%	99%	100%
06:00 - 06:59	37%	74%	96%
07:00 - 07:59	37%	68%	68%
08:00 - 08:59	100%	92%	97%
09:00 - 09:59	100%	87%	82%
10:00 - 10:59	78%	87%	99%
11:00 - 11:59	78%	87%	84%
12:00 - 12:59	78%	96%	79%
13:00 - 13:59	78%	68%	43%
14:00 - 14:59	78%	61%	61%
15:00 - 15:59	100%	74%	68%
16:00 - 16:59	47%	61%	27%
17:00 - 17:59	37%	15%	14%
18:00 - 18:59	47%	42%	40%
19:00 - 19:59	61%	61%	74%
20:00 - 20:59	78%	81%	95%
21:00 - 21:59	78%	81%	93%
22:00 - 22:59	61%	68%	96%
23:00 - 23:59	78%	92%	100%

Figure 17. *Crash probability matrix by hour and severity.*

during the hours 0600-0700, 0700-0800, and 1700-1800, while severe and minor-injury accidents peak between 1700-1800 hours.

5. Spatial Distribution of Incidents by Severity

All 36 fatal crashes are listed in Table 8, and are binned by "road segment", i.e. roadway name and city. Fatal incidents are exceedingly rare (~1% of all incidents), while 143 serious injury incidents (3.9%) were recorded, along with 639 minor/possible injury incidents (17.5%) and 2,840 non-injury incidents (77.6%).

Fatalities by Roadway

There were only 3 road segments (Table 8) – (i) FTM Rd 116 in Gatesville, (ii) S State Highway 36 in Gatesville, and (iii) Urbanktke Lane in Copperas Cove – where more than one traffic fatality was recorded in CRIS over 2018-2021. The fatalities on Urbanktke Lane appear to be an outlier – despite two separate fatal incidents, no other injury incidents were recorded on Urbanktke Lane and only three non-injury incidents. In comparison, FTM 116 in Gatesville recorded four serious-injury-incidents, eight minor-injury-incidents, and 60 non-injury-incidents and six serious, ten minor, and 39 non-injury incidents were recorded on S. HWY 36. Both FTM 116 and HWY 36 were in the top ten highest-incident-density road segments for all four incident types.

From a fatality perspective, FTM 116, State HWY 36, and Urbanktke Lane are particularly concerning. Given that Adair St. and Adair Ave. are essentially the same road and the traffic density at the prison is expected to be considerably lower than even main surface streets, the two separate fatal incidents on Adair St. and Adair Ave. suggest an outsized safety issue related to the prison.

Table 8. *Fatalities by road segment*

ROAD NAME	CITY	# of FATALITIES
FTM Rd 116	Gatesville	3
S State Highway 36	Gatesville	2
Urbanktke Lane	Copperas Cove	2
County Rd 274	Gatesville	1
Mother Neff Pkwy	McGregor	1
W Highway 84	Gatesville	1
County Rd 321	Gatesville	1
Robert Griffin Iii	Copperas Cove	1
Cedar Ridge Rd	Gatesville	1
US-84	Gatesville	1
County Rd 360	Gatesville	1
Adair St	Gatesville	1
Dryden Ave	Copperas Cove	1
Willow Loop	Kempner	1
E Business 190	Copperas Cove	1
Old Waco Rd	Gatesville	1
E County Rd 178	Purmela	1
S FM-116	Copperas Cove	1
E Leon St	Gatesville	1

ROAD NAME	CITY	# of FATALITIES
Smith Creek Ln	Gatesville	1
FTM Rd 107	Gatesville	1
US-190	Kempner	1
FTM Rd 116	Copperas Cove	1
US-84	Oglesby	1
US-84	Purmela	1
W Business 190	Copperas Cove	1
W Central Texas Expy	Killeen	1
FTM Rd 1783	Gatesville	1
Wagontrain Cir	Copperas Cove	1
FTM Rd 929	Gatesville	1
Adair Ave	Gatesville	1
Georgetown Rd	Copperas Cove	1

Fatalities are highly unlikely on any road segment, but much less likely, as a fraction of all incidents, on high-volume roadways such as Federal and State Highways. Only six of the 36 recorded fatalities occurred on Federal Highways, despite the fact that these highways are all four lanes and presumably have the highest traffic volumes of any road in the county (over 4,000 vehicles per hour using the assumptions in Table 5, above, versus at most 1,000 vehicles per hour on the most traveled Farm-to-Market roads).

Fatalities by Hotspot

As shown in Table 9, 35 of the 37 fatalities were not associated with geographic hotspots. In fact, it appears that the most likely places for a motorist to die in an accident are in areas where there is no measurable rate of incidents at all. Only two of the recorded fatalities occurred in proximity to a hotspot of other incidents – one at 1406 Georgetown Rd in Copperas Cove (total of 26 incidents recorded within 45 meters), and one at 1817 FTM Rd 929 in Gatesville (14 recorded incidents).

As with the road segment analysis, 702 Urbantke Lane is a concerning hotspot for fatalities, though no other injury-incidents are recorded for this location.

Table 9. *Fatalities by hotspot*

FATALITY LOCATIONS	FATALITIES	SERIOUS INJURIES	POSSIBLE/ MINOR INJURIES
512 Cedar Ridge Rd Gatesville TX 76528 (Count 1)	2	0	0
702 Urbanktke Copperas Cove TX 76522 (Count 1)	2	0	0
US-190 Kempner TX 76539 (Count 1)	1	0	1
439 County Rd 274 Gatesville TX 76528 (Count 1)	1	0	0
2730 E Business 190 Copperas Cove TX 76522 (Count 1)	1	0	3
US-84 Purmela TX 76566 (Count 1)	1	1	4
US-84 Oglesby TX 76561 (Count 1)	1	0	2
1002 E Leon St Gatesville TX 76528 (Count 1)	1	0	0
2602 S FM-116 Copperas Cove TX 76522 (Count 1)	1	0	1

FATALITY LOCATIONS	FATALITIES	SERIOUS INJURIES	POSSIBLE/ MINOR INJURIES
1087 Dryden Ave Copperas Cove TX 76522 (Count 1)	1	0	3
3760 FTM Rd 1783 Gatesville TX 76528 (Count 1)	1	0	1
11845 S State Highway 36 Gatesville TX 76528 (Count 1)	1	0	0
547 Robert Griffin Iii Copperas Cove TX 76522 (Count 1)	1	0	0
12120 FTM Rd 116 Gatesville TX 76528 (Count 1)	1	0	1
867 FTM Rd 107 Gatesville TX 76528 (Count 1)	1	0	0
125 E County Rd 178 Purmela TX 76566 (Count 1)	1	0	0
2583 FTM Rd 116 Copperas Cove TX 76522 (Count 1)	1	0	0
125 Smith Creek Ln Gatesville TX 76528 (Count 1)	1	0	0
2703 Willow Loop Kempner TX 76539 (Bin 1) (Count 3)	1	0	0
1255 County Rd 321 Gatesville TX 76528 (Count 1)	1	0	0
320 Old Waco Rd Gatesville TX 76528 (Count 1)	1	0	0
130 FTM Rd 116 Gatesville TX 76528 (Count 1)	1	0	0
411 W Business 190 Copperas Cove TX 76522 (Count 1)	1	0	0
135 County Rd 360 Gatesville TX 76528 (Count 1)	1	0	0
US-84 Gatesville TX 76528 (Count 1)	1	1	7
1406 Georgetown Rd Copperas Cove TX 76522 (Bin 20) (Count 26)	1	1	4
6200 W Central Texas Expy Killeen TX 76549 (Count 1)	1	0	2
6565 Mother Neff Pkwy McGregor TX 76657 (Count 1)	1	1	0
7560 FTM Rd 116 Gatesville TX 76528 (Count 1)	1	1	0
1817 FTM Rd 929 Gatesville TX 76528 (Bin 215) (Count 14)	1	5	5
8501 W Highway 84 Gatesville TX 76528 (Count 1)	1	2	1
202 Wagontrain Cir Copperas Cove TX 76522 (Count 1)	1	0	0
9725 S State Highway 36 Gatesville TX 76528 (Count 1)	1	0	0
2201 Adair Ave Gatesville TX 76528 (Count 1)	1	0	0
2201 Adair St Gatesville TX 76528 (Count 1)	1	0	3
Total	**37**	**12**	**38**
Total Incidents of Like Severity	**37**	**143**	**639**
Fraction of all like incidents	**100%**	**8.4%**	**5.9%**

Injuries By Roadway

Unlike with fatalities, the incidence of serious injuries appears strongly aligned presumed high-traffic, high-speed roadways (Table 10). Other than E. Main Street in Gatesville and County Roads 269 and 317 in Oglesby and Mound, respectively, all serious injury incidents occurred on an Interstate, State Highway, Expressway, or FTM (FM).

Minor injury accidents (Table 11) appear to cluster on surface streets such as Main Street in both Gatesville and Copperas Cove, as well as Ave. D. in Copperas Cove. Finally, it is worth noting that

this trend appears to continue for non-injury incidents, with several of the same surface streets appearing in Table 11 and Table 12.

Table 10. *Top 15 serious-injury incidents by road segment*

ROAD NAME	CITY	# of INCIDENTS
E Business 190	Copperas Cove	8
S State Highway 36	Gatesville	6
E Main St	Gatesville	6
I-14	Killeen	5
FTM Rd 929	Gatesville	5
FTM Rd 116	Gatesville	4
W Central Tx Expy	Killeen	3
FTM Rd 2657	Copperas Cove	3
FTM Rd 2412	Gatesville	3
N State Highway 36	Jonesboro	3
S State Highway 36	Moody	2
W Business 190	Copperas Cove	2
US-190	Copperas Cove	2
County Rd 269	Oglesby	2
County Rd 317	Mound	2

Table 11. *Top 15 minor-injury incidents by road segment*

ROAD NAME	CITY	# of INCIDENTS
E Business 190	Copperas Cove	67
S Main St	Copperas Cove	22
E Main St	Gatesville	20
FTM Rd 2657	Copperas Cove	17
US-84	Gatesville	14
W Business 190	Copperas Cove	11
E Ave D	Copperas Cove	11
W Ave D	Copperas Cove	10
S State Highway 36	Gatesville	10
S FM-116	Copperas Cove	9
State Highway 36th Byp N	Gatesville	9
Dryden Ave	Copperas Cove	9
Lutheran Church Rd	Copperas Cove	9
FTM Rd 116	Gatesville	8
Robertson Ave	Copperas Cove	8
State School Rd	Gatesville	7

Table 12. *Top 19 non-injury incidents by road segment*

ROAD NAME	CITY	# of INCIDENTS
E Business 190	Copperas Cove	354
E Main St	Gatesville	99
W Ave D	Copperas Cove	87
S Main St	Copperas Cove	86
Dryden Ave	Copperas Cove	84
US-84	Gatesville	73
FTM Rd 116	Gatesville	70
I-14	Killeen	69

ROAD NAME	CITY	# of INCIDENTS
FTM Rd 2657	Copperas Cove	51
W Ave B	Copperas Cove	48
Robert Griffin Iii Blvd	Copperas Cove	47
Lutheran Church Rd	Copperas Cove	42
W Business 190	Copperas Cove	39
S State Highway 36	Gatesville	39
Georgetown Rd	Copperas Cove	39
S FM-116	Copperas Cove	37
US-190	Copperas Cove	37
Veterans Ave	Copperas Cove	34
N FM-116	Copperas Cove	31

Injuries By Location

Table 13 provides a rank-ordered list of locations and the number of serious-injury accidents at that location. Locations that include an appended bin number, e.g. (Bin 219) recorded a total number of incidents reflected in the appended "Count" number; so 1817 FTM Rd 929 Gatesville TX 76528 (Bin 215) (Count 14), which shows five serious injuries recorded a total of 14 incidents within 45 meters of that address. Location names without a Bin Number and with a count of one represent a series of incidents along a particular road segment but not otherwise connected by proximity. Thus, the seven serious-injury incidents on I-14 in Killeen, for example, occur along I-14, but all at different locations.

Minor injury accidents tend to either cluster in hotspots or along major roadways, consistent with general assumptions about traffic accidents overall – they tend to occur where the traffic is. Other than the general occurrence along Federal highways (I-14, US-84, and US-190), all minor incidents cluster at specific intersections.

As Table 13 and Table 14 illustrate, there is no meaningful causal correlation between non-fatal crash locations and fatal crash locations.

Given that all incidents are independent of each other, systematic roadway or structural problems should become evident as correlations between fatalities and other incident types in a scatter plot. As there is no hypothetical mechanism to justify nonlinear correlations, a linear least squares fit should provide strong evidence of a such a problem.

A scatter plot of non-fatal injuries versus fatal injuries at each road segment (Figure 18) shows only limited support for any geographic correlation between fatalities and non-fatal crashes. In fact, for the set of all locations the R^2 values (9% for non-injury v/s fatality, 8% for minor-injury v/s fatality, and 11% for serious injury v/s fatality) suggest that while positive correlations can be found, they are more likely spurious than not. This may be an artifact of the paucity of fatalities – fatalities are simply too rate to derive a statistically meaningful correlation; however if this is the case, eliminating locations with no fatalities from the scatter plot (Figure 18, right) would be expected to improve the indicator of statistical significance (R^2), and both the slope of the

linear regression trendlines and the R^2 values drops significantly (from ~ 9% for minor- and non-injury crashes to less than 2%). Further, the residual plot for Figure 18 (left) shows substantially negative residuals for the correlations with minor- and non-injury accidents suggesting that the fit is driven largely by the outliers with large numbers of fatalities.

Table 13. *Serious injuries by location.*

Locations	Fatality	Serious Injuries	Possible/ minor Injuries
I-14 Killeen TX 76544 (Count 1)	0	7	12
1817 FTM Rd 929 Gatesville TX 76528 (Bin 215) (Count 14)	1	5	5
2041 FTM Rd 2657 Copperas Cove TX 76522 (Bin 9) (Count 54)	0	4	11
3018 E Business 190 Copperas Cove TX 76522 (Count 1)	0	3	1
2801 S State Highway 36th Byp Gatesville TX 76528 (Bin 178) (Count 25)	0	3	13
16700 S State Highway 36 Moody TX 76557 (Bin 166) (Count 2)	0	3	0
16301 S State Highway 36 Moody TX 76557 (Count 1)	0	3	2
1418 E Business 190 Copperas Cove TX 76522 (Bin 58) (Count 10)	0	3	2
6251 W Central Tx Expy Killeen TX 76544 (Bin 111) (Count 6)	0	2	1
8501 W Highway 84 Gatesville TX 76528 (Count 1)	1	2	1
9004 FTM Rd 2412 Gatesville TX 76528 (Count 1)	0	2	0
3820 FTM Rd 116 Gatesville TX 76528 (Count 1)	0	2	0
5602 Harman Rd Copperas Cove TX 76522 (Count 1)	0	2	0
401 County Rd 317 Mound TX 76558 (Count 1)	0	2	2
305 E Main St Gatesville TX 76528 (Bin 211) (Count 6)	0	2	0
2623 FTM Rd 1829 Gatesville TX 76528 (Count 1)	0	2	0
351 Lutheran Church Rd Copperas Cove TX 76522 (Bin 154) (Count 15)	0	2	5
2202 FTM Rd 580 Copperas Cove TX 76522 (Count 1)	0	2	0
2360 S FM-116 Copperas Cove TX 76522 (Count 1)	0	2	3
14230 FTM Rd 107 Mc Gregor TX 76657 (Count 1)	0	2	0
1815 St Louis St Gatesville TX 76528 (Count 1)	0	2	1
1114 E Main St Gatesville TX 76528 (Bin 203) (Count 26)	0	2	3
11045 S State Highway 36 Gatesville TX 76528 (Count 1)	0	2	0
11145 S State Highway 36 Gatesville TX 76528 (Count 1)	0	2	0

Table 14. *Minor injury crash locations*

Locations	Fatalities	Serious Injuries	Possible/ minor Injuries
2102 Business 190 Copperas Cove TX 76522 (Bin 70) (Count 36)	0	1	17
2801 S State Highway 36th Byp Gatesville TX 76528 (Bin 178) (Count 25)	0	3	13
2360 S FM-116 Copperas Cove TX 76522 (Bin 5) (Count 31)	0	1	13
I-14 Killeen TX 76544 (Count 1)	0	7	12
2041 FTM Rd 2657 Copperas Cove TX 76522 (Bin 9) (Count 54)	0	4	11
606 E Business 190 Copperas Cove TX 76522 (Bin 39) (Count 30)	0	0	9

Locations	Fatalities	Serious Injuries	Possible/ minor Injuries
1408 Dryden Ave Copperas Cove TX 76522 (Bin 145) (Count 37)	0	1	9
US-84 Gatesville TX 76528 (Bin 192) (Count 19)	0	0	9
117 W Ave D Copperas Cove TX 76522 (Bin 121) (Count 37)	0	1	8
US-84 Gatesville TX 76528 (Count 1)	1	1	7
602 E Business 190 Copperas Cove TX 76522 (Bin 32) (Count 5)	0	0	6
1407 E Business 190 Copperas Cove TX 76522 (Bin 61) (Count 7)	0	0	6
1221 E Business 190 Copperas Cove TX 76522 (Bin 57) (Count 41)	0	1	6
101 W Business 190 Copperas Cove TX 76522 (Bin 24) (Count 17)	0	0	6
US-84 Gatesville TX 76528 (Bin 197) (Count 9)	0	0	6
US-190 Copperas Cove TX 76522 (Count 1)	0	0	6

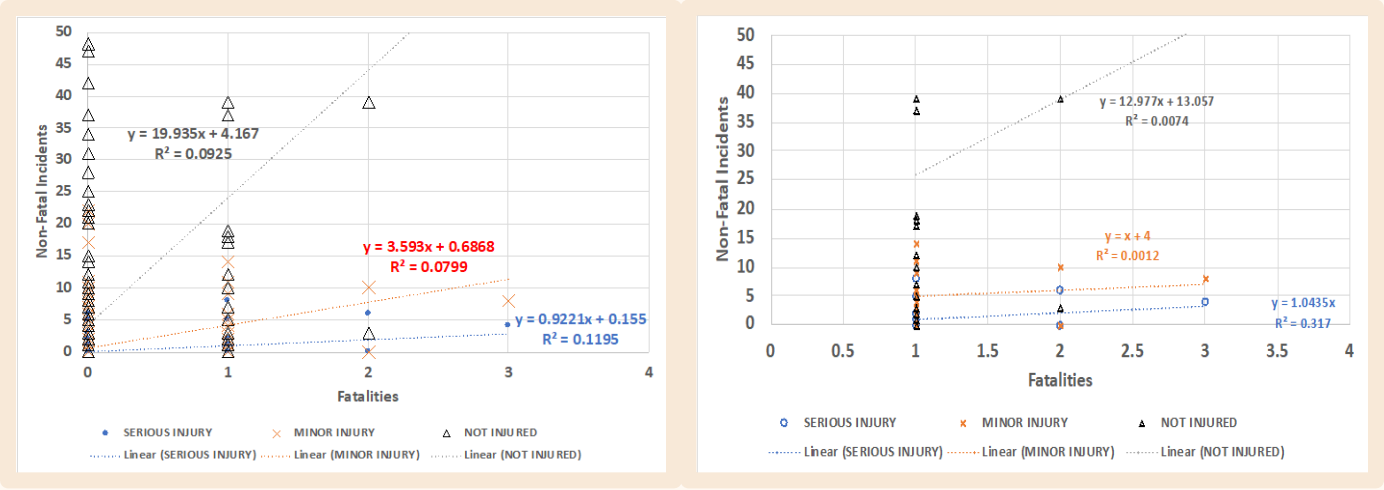
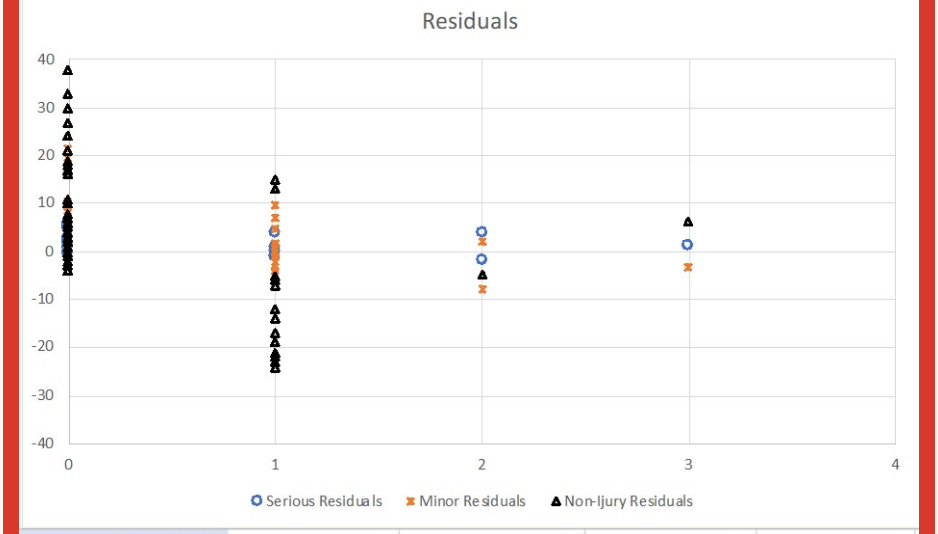


Figure 18. *Scatter plots of non-fatal v/s fatal incidents by location. (Left: all locations, Right: only locations with at least one fatality)*



Average Residual	0	1	2	3
Serious	0.008	-0.506	1.001	1.079
Minor	-0.025	-1.458	-2.873	-3.466
Non	-0.066	-9.138	-23.037	6.028

Figure 19. *Residual plot for the linear regression fit line In Figure 18 (left)*

In contrast to the low statistical significance of the correlation of non-fatal and fatal incidents, there is much stronger correlation between serious injury accidents and minor and non-injury accidents (Figure 20).

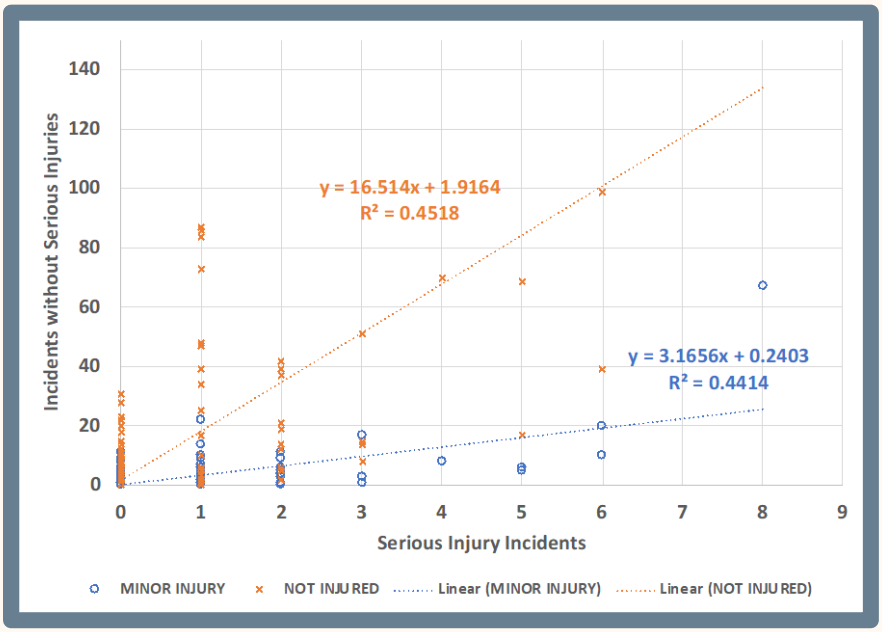


Figure 20. *Scatter plot of non-serious/non-fatal incidents v/s serious injury incidents by location*

6. Incidents by Geography

As shown in Table 15 and highlighted in the heat map in Figure 21, and the pie charts in Figure 22, the bulk (1,934, or just under 53%) of all incidents in Coryell County occurred in Copperas Cove (population 38,986). Gatesville (pop. 16,135) accounted for 20.8%, with the remaining 27% spread throughout the 12 micropolitan areas of Killeen, Oglesby, Kempner, Purmela, Jonesboro, Evant, Moody, McGregor, Fort Cavazos, Valley Mills, Mound, and Clifton.

Despite its low population and distance from the gates of Ft. Cavazos, Gatesville hosted the vast majority of traffic fatalities (19 of 36 recorded fatal incidents, or 53%, occurred in Gatesville) over the four years studied. Gatesville also hosted an outsized portion of the Major/Serious injury accidents (50 of 118, or 42%)

Table 15. *Total incidents by geography and severity*

Statistical Area	Population	TOTAL	Fatalities	Major	Minor	Non-injury
Copperas Cove	38,986	2298	10	39	315	1934
Gatesville	16,135	977	19	50	146	762
Killeen	--	156	1	11	16	128
Oglesby	484	62	1	4	10	47
Kempner	1,146	31	2	1	4	24
Purmela	2,073	31	2	1	3	25
Jonesboro	200	30	0	3	2	25
Evant	1,582	16	0	1	1	14
Moody	1,376	15	0	2	2	11
McGregor	5,321	13	1	2	2	8
Fort Cavazos	--	12	0	1	4	7
Valley Mills	1,229	9	0	0	0	9
Mound	174	5	0	2	0	3
Clifton	3,465	1	0	1	0	0

Overall, drivers in the statistical areas of Oglesby, Kempner, Gatesville, and Purmela were 5-10x more likely to be involved in a fatal traffic accident than drivers in Copperas Cove or McGregor, while the remaining statistical areas did not record any fatalities (Table 15). This does not necessarily extend to overall safety, however. Citizens in the Jonesboro and Oglesby areas were 3x more likely to be involved in a traffic accident than those in either Copperas Cove or Gatesville, and all four of these respective statistical areas have roughly 10x the per capita rate of minor injury accidents as the remaining statistical areas. As a caveat, however, this data is uncorrected for actual traffic flow rates, nor are the populations adjusted for areas that cross county borders. Gatesville sits at the intersection of two major traffic arteries, State Highway 36, and State Highway 84, and is flanked along Hwy-84 by Oglesby to the East and Purmela to the West. And while U.S. Business 190 runs through Copperas Cove, traffic flows may be self-controlled due to commute traffic to and from the gates of Fort Cavasos.

Table 16. *Incident rates per 1000 population by severity and statistical area*

CITY	Fatalities	Major	Minor	Non-injury
Jonesboro	0.000	3.750	2.500	31.250
Evant	0.000	0.158	0.158	2.212
Moody	0.000	0.363	0.363	1.999
Valley Mills	0.000	0.000	0.000	1.831
Mound	0.000	2.874	0.000	4.310
Clifton	0.000	0.072	0.000	0.000
McGregor	0.047	0.094	0.094	0.376
Copperas Cove	0.064	0.250	2.020	12.402
Purmela	0.241	0.121	0.362	3.015
Gatesville	0.294	0.775	2.262	11.807
Kempner	0.436	0.218	0.873	5.236
Oglesby	0.517	2.066	5.165	24.277

The majority of traffic fatalities in the county align with the major traffic arteries; BUS 190, Hwy 84, Hwy 36, and FTM 116 with circumnavigates the west side of Fort Cavasos. Outside of the major arteries, the most dangerous feature appears to be uncontrolled three-way intersections such as driveway entrances. For example, all four of the fatalities not in the immediate proximity of one of the major traffic arteries (red circled items in Figure 21) occurred at driveway entrances or small residential streets connecting to Farm-to-Market roads.

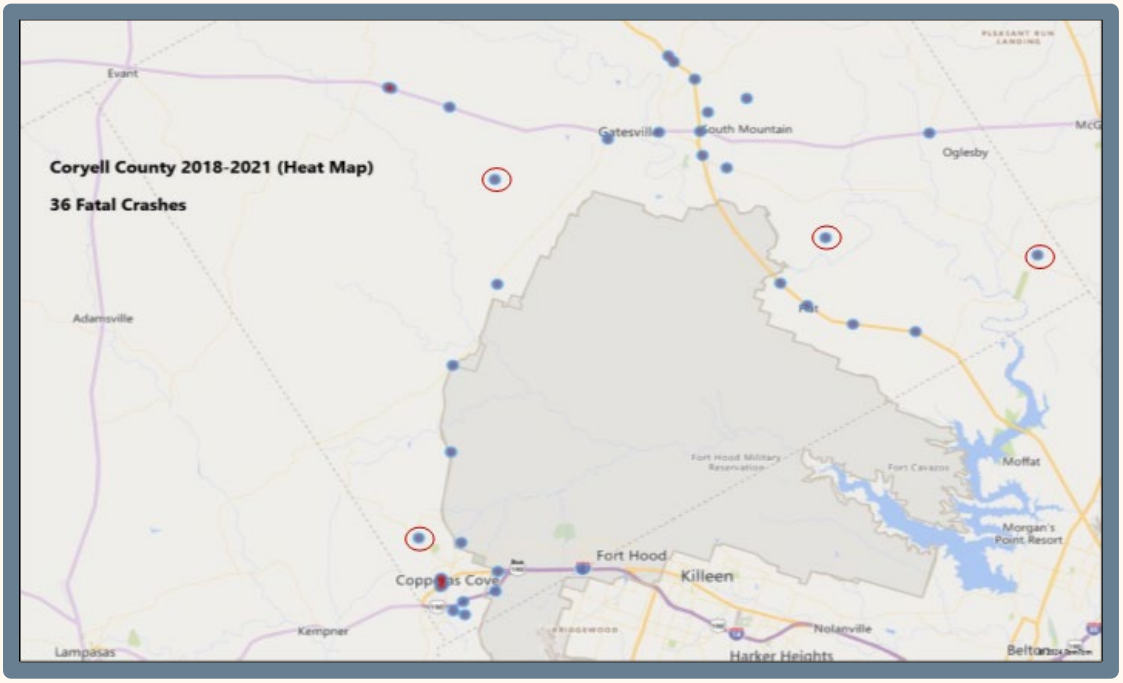


Figure 21. *Off-main-artery fatalities at 3-way intersections*

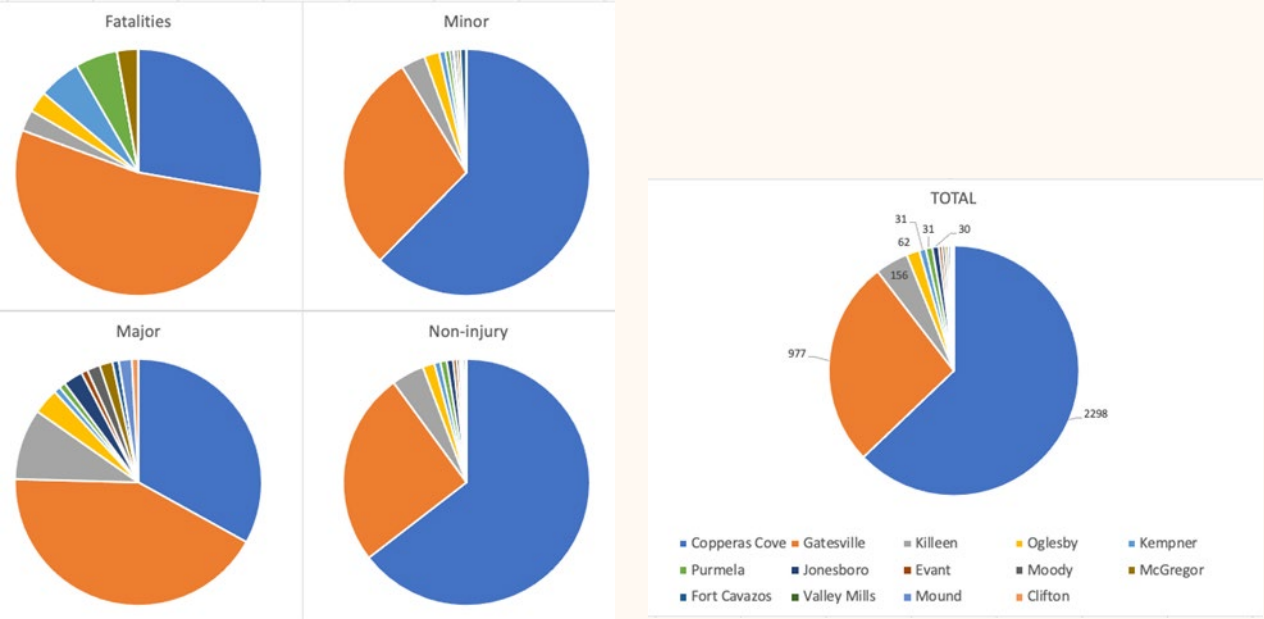


Figure 22. *Incidents by severity and geographic location*

7. Causes and Severity

The primary factors leading to incidents, as recorded by the responding officer varied dramatically depending on the severity of the incident (Tables 11 and 12). While across the board, "Driver Inattention" was the primary factor regardless of severity, "Driving Under the Influence" was the second leading factor in fatalities (nearly 30% of all fatalities involved the influence of drugs, alcohol, or medications). In Table 18, the red cells indicate any primary factor responsible for more than 10% of the incidents of a particular severity, the green cells account for 3% or less of the total in the category, and the yellow cells fall in between.

The most dangerous contributing factor as a fraction of total incidents with that primary cause is cellphone usage – 14% of all incidents where cellphone usage was the primary cause resulted in fatalities. This is followed, respectively, by (i) driving under the influence (4.7% of incidents resulted in a fatality), (ii) sleeping at the wheel (3% of incidents result in a fatality), and (iii) driver inattention (1% of incidents resulted in a fatality.

- Cellphone Usage: 14% chance of fatality (3 of 22 incidents), 5% chance of serious injury (1 of 22)
- DUI: 4.7% chance of fatality (10 of 214 incidents), 9.8% chance of serious injury (21 of 214)
- Sleeping at the wheel: 2.8% chance of fatality (3 of 108), 2.8% chance of serious injury (3 of 108)
- Driver inattention: 1% chance of fatality (15 of 1,439 incidents), 3.5% chance of serious injury (51 of 1,439)

Outside of DUI, Sleeping, Driver inattention, and Cellphone usage, all other recorded causal factors were far more likely to result in incidents with minor or no injuries. Driver inattention, in

addition to being the most common primary factor, was unique in that it accounted for roughly the same fraction of incidents (~40% in every category) regardless of severity (Table 17 and Table 18).

Table 17. *Crash Severity as a function of primary contributing factors. Top Row – totals by severity, rightmost Column – totals by primary contributing factor.*

PRIMARY FACTOR	**36**	**118**	**505**	**2997**	**3656**
Driver Inattention	15	51	238	1135	***1439***
Under Influence	10	21	41	142	***214***
Asleep	3	3	24	78	***108***
Cellphone	3	1	2	16	***22***
Unsafe Driving	2	10	46	387	***445***
Speeding	1	11	69	530	***611***
Unknown	1	15	73	607	***696***
Ill	1	2	6	34	***43***
Improper Turn	0	0	4	50	***54***
Evading Police	0	3	1	5	***9***
Road Rage	0	1	1	13	***15***
	Fatal Injury	Serious Injury	Minor Injury	Not Injured	***TOTAL***
			SEVERITY		

Table 18. *Percentages of accidents of each severity as a function of primary cause.*

Driver Inattention	41.7%	43.2%	47.1%	37.9%	39.4%
Under Influence	27.8%	17.8%	8.1%	4.7%	5.9%
Asleep	8.3%	2.5%	4.8%	2.6%	3.0%
Cellphone	8.3%	0.8%	0.4%	0.5%	0.6%
Unsafe Driving	5.6%	8.5%	9.1%	12.9%	12.2%
Speeding	2.8%	9.3%	13.7%	17.7%	16.7%
Unknown	2.8%	12.7%	14.5%	20.3%	19.0%
Ill	2.8%	1.7%	1.2%	1.1%	1.2%
Improper Turn	0.0%	0.0%	0.8%	1.7%	1.5%
Evading Police	0.0%	2.5%	0.2%	0.2%	0.2%
Road Rage	0.0%	0.8%	0.2%	0.4%	0.4%
	Fatal Injury	Serious Injury	Minor Injury	Not Injured	TOTAL

8. Weather and Severity

While weather data overall was sparse, it appears that weather is not a meaningful contributor to crash severity. The caveat to this analysis is that we lack crucial data required to make a meaningful correlation – specifically dates and times that specific weather events occurred and the areas that were afflicted. Further, without accompanying data on traffic flow rates and traffic speeds, the correlations to weather are at best anecdotal.

As shown in both Table 19 and Table 20, roughly 75% of all recorded incidents occurred when the weather was "clear", and less than 1% of all incidents are related to extreme weather events such as snow, high winds, or hail.

Table 19. *Crash Severity as a function of reported weather conditions. Top Row – totals by severity, Rightmost Column – totals by primary contributing weather factor.*

Weather	**Fatal Injury**	**Serious Injury**	**Minor Injury**	**Not Injured**	***3656***
Cloudy	3	19	87	468	*577*
Clear	27	87	367	2157	*2638*
Rain	5	10	41	291	*347*
Fog	1	1	5	37	*44*
Unknown	0	0	0	17	*17*
Hail	0	1	3	14	*18*
Snow	0	0	1	13	*14*
High Wind	0	0	1	0	*1*
	Fatal Injury	**Serious Injury**	**Minor Injury**	**Not Injured**	***TOTAL***
	SEVERITY				

Table 20. *Crash Severity as a function of reported weather, expressed as a percentage of the total in a severity category*

Cloudy	8.3%	16.1%	17.2%	15.6%	***15.8%***
Clear	75.0%	73.7%	72.7%	72.0%	***72.1%***
Rain	13.9%	8.5%	8.1%	9.7%	***9.5%***
Fog	2.8%	0.8%	1.0%	1.2%	***1.2%***
Unknown	0.0%	0.0%	0.0%	0.6%	***0.5%***
Hail	0.0%	0.8%	0.6%	0.5%	***0.5%***
Snow	0.0%	0.0%	0.2%	0.4%	***0.4%***
High Wind	0.0%	0.0%	0.2%	0.0%	***0.0%***
	Fatal Injury	Serious Injury	Minor Injury	Not Injured	***TOTAL***

9. Time of Day and Severity

Tables 21 and 22 tabulate crash severity by the hour of the day. Perhaps not surprisingly, the most likely times of day for a fatality to occur coincide with commute hours. Roughly 50% of all fatalities occur either between 6AM and 8AM or between 4PM and 7PM, split approximately evenly between morning and evening commute hours. The second-most deadly times are at the end of the dinner hour (10PM – 11PM), around bar closing times (1AM-2AM) and again at 3AM.

In contrast, 5PM-6PM is when most serious injury crashes (nearly 20% of all serious injury incidents) occur. Non-injury and minor injury incidents tend to be evenly distributed over the working day from 6AM to 7PM, with slight bimodality – there are peaks at around noon and again between 4PM and 6PM.

Table 21. *Incidents by severity and time of day*

Crash Hour	Fatalities	Severe Injuries	Minor Injuries	Non-injury	3656
00:00 - 00:59	1	3	8	66	*78*
01:00 - 01:59	2	2	8	56	*68*
02:00 - 02:59	0	3	9	34	*46*
03:00 - 03:59	2	0	2	32	*36*
04:00 - 04:59	0	5	8	31	*44*
05:00 - 05:59	1	1	5	48	*55*
06:00 - 06:59	4	3	17	118	*142*
07:00 - 07:59	4	4	29	178	*215*
08:00 - 08:59	0	4	18	126	*148*
09:00 - 09:59	0	5	27	120	*152*
10:00 - 10:59	1	4	13	130	*148*
11:00 - 11:59	1	4	26	154	*185*
12:00 - 12:59	1	2	30	197	*230*
13:00 - 13:59	1	7	37	177	*222*
14:00 - 14:59	1	8	30	154	*193*
15:00 - 15:59	0	7	30	197	*234*
16:00 - 16:59	3	6	42	263	*314*
17:00 - 17:59	4	15	39	262	*320*
18:00 - 18:59	3	9	34	192	*238*
19:00 - 19:59	2	7	26	139	*174*
20:00 - 20:59	1	5	19	94	*119*
21:00 - 21:59	1	5	20	95	*121*
22:00 - 22:59	2	6	16	78	*102*
23:00 - 23:59	1	3	12	56	*72*
SEVERITY	Fatal Injury	Serious Injury	Minor Injury	Not Injured	*TOTAL*

Table 22. Likelihood of severity by time of day

Crash Hour	Fatalities	Severe Injuries	Minor Injuries	Non-injury	TOTAL
00:00 - 00:59	2.8%	2.5%	1.6%	2.2%	2.1%
01:00 - 01:59	5.6%	1.7%	1.6%	1.9%	1.9%
02:00 - 02:59	0.0%	2.5%	1.8%	1.1%	1.3%
03:00 - 03:59	5.6%	0.0%	0.4%	1.1%	1.0%
04:00 - 04:59	0.0%	4.2%	1.6%	1.0%	1.2%
05:00 - 05:59	2.8%	0.8%	1.0%	1.6%	1.5%
06:00 - 06:59	11.1%	2.5%	3.4%	3.9%	3.9%
07:00 - 07:59	11.1%	3.4%	5.7%	5.9%	5.9%
08:00 - 08:59	0.0%	3.4%	3.6%	4.2%	4.0%
09:00 - 09:59	0.0%	4.2%	5.3%	4.0%	4.2%
10:00 - 10:59	2.8%	3.4%	2.6%	4.3%	4.0%
11:00 - 11:59	2.8%	3.4%	5.1%	5.1%	5.1%
12:00 - 12:59	2.8%	1.7%	5.9%	6.6%	6.3%
13:00 - 13:59	2.8%	5.9%	7.3%	5.9%	6.1%
14:00 - 14:59	2.8%	6.8%	5.9%	5.1%	5.3%
15:00 - 15:59	0.0%	5.9%	5.9%	6.6%	6.4%
16:00 - 16:59	8.3%	5.1%	8.3%	8.8%	8.6%
17:00 - 17:59	11.1%	12.7%	7.7%	8.7%	8.8%
18:00 - 18:59	8.3%	7.6%	6.7%	6.4%	6.5%
19:00 - 19:59	5.6%	5.9%	5.1%	4.6%	4.8%
20:00 - 20:59	2.8%	4.2%	3.8%	3.1%	3.3%
21:00 - 21:59	2.8%	4.2%	4.0%	3.2%	3.3%
22:00 - 22:59	5.6%	5.1%	3.2%	2.6%	2.8%
23:00 - 23:59	2.8%	2.5%	2.4%	1.9%	2.0%
	Fatal Injury	Serious Injury	Minor Injury	Not Injured	Total

10. Contributing Factors by Time of Day

Key: DI == Driver Inattention, S == Speeding, UD == Unsafe Driving, DUI == Under the Influence, A == Asleep, IT == Improper Turn, I == Ill, C = Cellphone Use, RR == Road Rage, EP == Evading Police.

Table 23. *Contributing factors by time of day*

Factor	DI	S	UD	DUI	A	IT	I	C	RR	EP	TOTAL
00:00	1.1%	2.6%	0.9%	8.9%	3.7%	0.0%	2.3%	4.5%	0.0%	0.0%	78
01:00	1.0%	1.0%	0.9%	7.5%	4.6%	0.0%	0.0%	0.0%	0.0%	0.0%	68
02:00	0.6%	0.3%	0.4%	8.9%	5.6%	0.0%	2.3%	0.0%	0.0%	0.0%	46
03:00	0.5%	0.5%	1.1%	5.6%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	36
04:00	0.6%	0.8%	2.2%	3.3%	3.7%	0.0%	2.3%	0.0%	0.0%	11.1%	44
05:00	1.3%	0.3%	2.5%	0.9%	5.6%	0.0%	4.7%	0.0%	0.0%	0.0%	55

Factor	DI	S	UD	DUI	A	IT	I	C	RR	EP	TOTAL
06:00	4.0%	2.5%	4.0%	2.8%	8.3%	1.9%	2.3%	13.6%	0.0%	0.0%	142
07:00	6.7%	6.4%	5.2%	1.4%	9.3%	0.0%	7.0%	0.0%	6.7%	0.0%	215
08:00	4.8%	4.7%	2.7%	0.0%	5.6%	1.9%	7.0%	9.1%	6.7%	0.0%	148
09:00	4.0%	3.9%	5.6%	0.5%	4.6%	7.4%	11.6%	0.0%	6.7%	0.0%	152
10:00	4.6%	3.4%	3.8%	0.9%	6.5%	3.7%	0.0%	0.0%	13.3%	22.2%	148
11:00	5.4%	5.6%	4.3%	2.3%	2.8%	13.0%	11.6%	0.0%	6.7%	0.0%	185
12:00	6.7%	7.4%	7.0%	2.8%	3.7%	1.9%	2.3%	13.6%	0.0%	0.0%	230
13:00	6.6%	8.0%	7.0%	1.4%	3.7%	7.4%	2.3%	0.0%	0.0%	0.0%	222
14:00	5.0%	7.0%	5.2%	1.9%	5.6%	11.1%	4.7%	4.5%	0.0%	0.0%	193
15:00	6.6%	7.4%	7.4%	2.8%	2.8%	9.3%	2.3%	4.5%	0.0%	11.1%	234
16:00	9.5%	10.0%	7.9%	2.8%	4.6%	16.7%	7.0%	18.2%	26.7%	0.0%	314
17:00	11.0%	8.3%	8.8%	2.3%	2.8%	13.0%	14.0%	4.5%	0.0%	11.1%	320
18:00	7.2%	6.2%	5.4%	6.5%	2.8%	1.9%	9.3%	0.0%	20.0%	0.0%	238
19:00	4.3%	4.3%	7.9%	5.1%	3.7%	3.7%	4.7%	4.5%	6.7%	11.1%	174
20:00	1.9%	3.6%	2.5%	7.9%	0.0%	3.7%	0.0%	9.1%	0.0%	11.1%	119
21:00	2.8%	2.0%	2.2%	9.8%	0.9%	1.9%	0.0%	4.5%	0.0%	0.0%	121
22:00	2.4%	2.0%	3.1%	8.9%	3.7%	1.9%	0.0%	0.0%	0.0%	22.2%	102
23:00	1.4%	1.8%	2.0%	4.7%	1.9%	0.0%	2.3%	9.1%	6.7%	0.0%	72
Factor	DI	S	UD	DUI	A	IT	I	C	RR	EP	

11. Geographic Hot Spots

This section has the same caveat as the weather/severity section – without traffic through-rates, traffic density by hour, and average speeds, it is difficult to make strong causal correlations. Incidents were divided geographically by "road segment" and by geographic bins to identify hotspots. A road segment was defined as a particular named road of arbitrary length running through one and only one of the identified statistical areas (e.g. Gatesville or Copperas Cove). If a named road continued through more than one statistical area, the section in each statistical area was considered a unique road segment. Geographic bins were defined as clusters of incidents within occurring within 45 meters of each other and were identified as described above.

Road Segments

Of the 3,656 incidents recorded over the four years from 2018 to 2021 on 547 unique road segments, 2498 (70%) occurred on just 68 of those unique road segments. 430 incidents (12% of all recorded incidents) occurred on E. Business 190 in Copperas Cove. With a total of 125 (3.4%), E. Main St. in Gatesville was the second most common location for traffic incidents.

The 50 road segments with the largest number of incidents are listed in Table 24, with the total number of incidents on the right. These 50 road segments (~10% of the total incident locations) account for 2,303 total incidents (63%).

Table 24. *Top 50 road segments for traffic accidents*

Road Segment	Fatal	Serious	Minor	Non-injury	All
E Business 190, Copperas Cove	1	8	67	354	430
E Main St, Gatesville	0	6	20	99	125
S Main St, Copperas Cove	0	1	22	86	109
W Ave D, Copperas Cove	0	1	10	87	98
Dryden Ave, Copperas Cove	1	1	9	84	95
US-84, Gatesville	1	1	14	73	89
Farm To Market Rd 116, Gatesville	3	4	8	70	85
I-14, Killeen	0	5	6	69	80
Farm To Market Rd 2657, Copperas Cove	0	3	17	51	71
S State Highway 36, Gatesville	2	6	10	39	57
Lutheran Church Rd, Copperas Cove	0	2	9	42	53
Robert Griffin Iii Blvd, Copperas Cove	0	1	5	47	53
W Ave B, Copperas Cove	0	1	4	48	53
W Business 190, Copperas Cove	1	2	11	39	53
S FM-116, Copperas Cove	1	2	9	37	49
Georgetown Rd, Copperas Cove	1	1	6	39	47
US-190, Copperas Cove	0	2	6	37	45
Veterans Ave, Copperas Cove	0	1	3	34	38
N FM-116, Copperas Cove	0	0	6	31	37
E Ave D, Copperas Cove	0	0	11	23	34
Bridge St, Gatesville	0	0	4	28	32
Constitution Dr, Copperas Cove	0	0	4	28	32
Robertson Ave, Copperas Cove	0	0	8	23	31
Joes, Copperas Cove	0	1	3	25	29
Farm To Market Rd 929, Gatesville	1	5	5	17	28
Farm To Market Rd 107, Gatesville	1	2	5	19	27
West Ave E, Copperas Cove	0	0	5	22	27
S State Highway 36th Byp, Gatesville	0	2	3	21	26
Hl, Copperas Cove	0	0	4	20	24
Robert Griffin Iii, Copperas Cove	1	0	4	18	23
US-84, Purmela	1	1	3	17	22
W Central Tx Expy, Killeen	0	3	3	15	21
W Main St, Gatesville	0	2	5	12	19
N State Highway 36, Jonesboro	0	3	1	14	18
State Highway 36th Byp N, Gatesville	0	0	9	9	18
State School Rd, Gatesville	0	1	7	10	18
E Business, Copperas Cove	0	0	2	15	17
US-190, Killeen	0	2	1	14	17
E Highway 84, Gatesville	0	0	2	14	16
Farm To Market Rd 1113, Copperas Cove	0	0	4	12	16

Road Segment	Fatal	Serious	Minor	Non-injury	All
HWY 84, Oglesby	1	0	5	10	16
W Ave C, Copperas Cove	0	0	1	14	15
Adair St, Gatesville	1	1	2	10	14
E Leon St, Gatesville	1	0	1	12	14
Farm To Market Rd 2412, Gatesville	0	3	3	8	14
BUS 190, Copperas Cove	0	0	0	14	14
Oak Springs Rd, Kempner	0	1	3	10	14
W Washington Ave, Copperas Cove	0	1	3	10	14
Martin Luther King Jr, Copperas Cove	0	0	1	12	13
Old Osage Rd, Gatesville	0	0	2	11	13

Proximate (binned) to Unique Intersections

As described above, incidents were grouped according to proximity. A bin, or cluster was defined as any identifiable group of incidents occurring within a 45-meter radius. A detailed analysis of nearest-neighbors indicated that simply sorting the list of records on either latitude or longitude and calculating the distance between nearest neighbors in the list using the Haversine formula resulted in the identification of the same clusters of incidents for all clusters with $n > 3$. The counting method defaults to Road Segment analysis where no two incidents occur within 45 meters of each other on a particular road segment. Table 25 lists only those bins that are distinct geographically proximate clusters.

Unlike the road segment analysis, which suggests that Gatesville is home to the most significant hotspots, the proximate analysis squarely points to Copperas Cove as having the most dangerous specific locations in Coryell County. Of the 759 incidents in the top 50 bins, 555 of them occur in Copperas Cove. All remaining ten statistical areas in Coryell County only account for 204 incidents over 19 locations.

The most significant hotspot is located at 2041 Farm to Market Rd 2657 Copperas Cove TX. This location has 54 total incidents over four years, nearly 32% more than the next largest cluster at 1221 E Business 190 Copperas Cove TX.

Table 25. *Proximate incidents by nearest address*

LOCATION	Fatal	Serious	Minor	ALL
2041 Farm To Market Rd 2657 Copperas Cove TX 76522 (Bin 9) (Count 54)	0	3	10	54
1221 E Business 190 Copperas Cove TX 76522 (Bin 57) (Count 41)	0	1	4	41
117 W Ave D Copperas Cove TX 76522 (Bin 121) (Count 37)	0	1	5	37
1408 Dryden Ave Copperas Cove TX 76522 (Bin 145) (Count 37)	0	1	6	37
2102 Business 190 Copperas Cove TX 76522 (Bin 70) (Count 36)	0	1	6	36
2360 S FM-116 Copperas Cove TX 76522 (Bin 5) (Count 31)	0	1	7	31
606 E Business 190 Copperas Cove TX 76522 (Bin 39) (Count 30)	0	0	6	30
1004 S Main St Copperas Cove TX 76522 (Bin 26) (Count 27)	0	1	2	27

LOCATION	Fatal	Serious	Minor	ALL
1114 E Main St Gatesville TX 76528 (Bin 203) (Count 26)	0	2	3	26
1406 Georgetown Rd Copperas Cove TX 76522 (Bin 20) (Count 26)	1	1	3	26
2801 S State Highway 36th Byp Gatesville TX 76528 (Bin 178) (Count 25)	0	2	7	25
601 S Main St Copperas Cove TX 76522 (Bin 52) (Count 21)	0	0	0	21
US-84 Gatesville TX 76528 (Bin 192) (Count 19)	0	0	6	19
101 W Business 190 Copperas Cove TX 76522 (Bin 24) (Count 17)	0	0	4	17
202 Robert Griffin Iii Blvd Copperas Cove TX 76522 (Bin 93) (Count 17)	0	0	1	17
1212 E Business 190 Copperas Cove TX 76522 (Bin 56) (Count 16)	0	0	2	16
351 Lutheran Church Rd Copperas Cove TX 76522 (Bin 154) (Count 15)	0	2	4	15
1817 Farm To Market Rd 929 Gatesville TX 76528 (Bin 215) (Count 14)	1	4	1	14
1418 E Business 190 Copperas Cove TX 76522 (Bin 60) (Count 13)	0	0	1	13
301 Constitution Dr Copperas Cove TX 76522 (Bin 50) (Count 13)	0	0	0	13
402 W Ave B Copperas Cove TX 76522 (Bin 130) (Count 13)	0	0	1	13
410 State Highway 36th Byp N Gatesville TX 76528 (Bin 213) (Count 12)	0	0	2	12
1114 E Main St Gatesville TX 76528 (Bin 205) (Count 11)	0	0	3	11
US-190 Copperas Cove TX 76522 (Bin 12) (Count 10)	0	0	2	10
1418 E Business 190 Copperas Cove TX 76522 (Bin 58) (Count 10)	0	1	2	10
1450 Parnell St Copperas Cove TX 76522 (Bin 69) (Count 10)	0	0	3	10
1629 W Main St Gatesville TX 76528 (Bin 187) (Count 10)	0	0	3	10
1901 E Main St Gatesville TX 76528 (Bin 199) (Count 10)	0	0	0	10
US-84 Gatesville TX 76528 (Bin 197) (Count 9)	0	0	5	9
107 West Ave E Copperas Cove TX 76522 (Bin 114) (Count 9)	0	0	1	9
311 S Lovers Ln Gatesville TX 76528 (Bin 184) (Count 9)	0	1	0	9
604 E Business 190 Copperas Cove TX 76522 (Bin 36) (Count 9)	0	0	2	9
606 E Business 190 Copperas Cove TX 76522 (Bin 37) (Count 9)	0	0	1	9
612 Mesquite Cir Copperas Cove TX 76522 (Bin 149) (Count 9)	0	0	1	9
I-14 Killeen TX 76544 (Bin 105) (Count 8)	0	0	2	8
1004 S Main St Copperas Cove TX 76522 (Bin 27) (Count 8)	0	0	1	8
1545 E Business 190 Copperas Cove TX 76522 (Bin 65) (Count 8)	0	0	0	8
203 W Washington Ave Copperas Cove TX 76522 (Bin 131) (Count 8)	0	0	0	8
US-190 Killeen TX 76544 (Bin 100) (Count 7)	0	1	1	7
104 S 6th St Gatesville TX 76528 (Bin 209) (Count 7)	0	0	1	7
1407 E Business 190 Copperas Cove TX 76522 (Bin 61) (Count 7)	0	0	3	7
2730 E Business 190 Copperas Cove TX 76522 (Bin 87) (Count 7)	0	0	1	7
718 E Main St Gatesville TX 76528 (Bin 207) (Count 7)	0	0	2	7
906 E Business 190 Copperas Cove TX 76522 (Bin 48) (Count 7)	0	1	1	7
I-14 Killeen TX 76544 (Bin 104) (Count 6)	0	1	1	6
2527 E Main St Gatesville TX 76528 (Bin 196) (Count 6)	0	1	1	6
2529 Bridge St Gatesville TX 76528 (Bin 185) (Count 6)	0	0	2	6
2601 E Main St Gatesville TX 76528 (Bin 195) (Count 6)	0	0	0	6
305 E Main St Gatesville TX 76528 (Bin 211) (Count 6)	0	2	0	6

12. References

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Survey Results Analysis

The public survey was an important part of the TSAP for several reasons. First, it provides valuable insights into specific safety concerns and priorities of the community. By requesting input directly from community residents, stakeholders can better understand the issues in the region, including hazardous road conditions, areas prone to accidents, and perceived risks. Second, a public survey facilitates community engagement and participation in the planning process. It allows residents to voice their opinions, share their experiences, and contribute to the development of solutions. This collaborative approach creates a sense of ownership and accountability among officials, stakeholders, and the public.

On behalf of Coryell County, NRS deployed a survey that targeted the residents and commuters of Coryell County. The survey was designed to identify and assess the transportation safety issues of concern to the public and provide opportunities for additional input. The survey was built and deployed using Survey Planet, an online survey platform that allows user-friendly survey design and both ease of use and confidentiality for respondents. The survey was available from January 5th, 2024, to February 29th, 2024. During that time 318 survey responses were received.

The survey collected basic information about the home and work zip codes of respondents to assess what areas or regions of the county respondents occupied or frequented. The majority of the responses were from the 76522 (Copperas Cove) and 76528 (Gatesville) zip codes. All responses were confidential. Respondents were asked to check off which listed transportation issues were of concern to them. Respondents could select multiple concerns from among:

- Roads conditions are poor (potholes, crumbling shoulder, etc)
- Lack of sidewalks
- Dangerous intersections
- Lack of lane line or faded line
- Lack of streetlights
- Roads are too narrow
- Lack of turn lanes or turn signals where needed
- Insufficient traffic signage or signals where needed
- Lack of crosswalks
- Lack of bike paths or lane
- Poor visibility
- Dangerous sidewalks
- Posted speed too high
- Dangerous turn
- Dangerous crosswalks
- Posted speed too low
- Dangerous low water crossings

- Lack of guard rails or damaged guard rails where needed
- Other

Respondents who selected "Other" were given the option of entering text into an open-ended text box. See Figure 23 and Table 26 for the number of times each response was selected. The subsequent questions followed an adaptive branching structure, based on the concerns that each respondent selected. For each item that the respondent checked off as a concern, the survey deployed a follow-up question asking about the location or locations where the respondent experienced these concerns.

Table 26. *Safety Concerns Selected by Respondents*

	Safety Concerns	Number of Times Selected by Respondents
●	Roads conditions are poor	201
●	Lack of sidewalks	137
●	Dangerous intersections	136
●	Lack of lane line or faded line	95
●	Lack of streetlights	94
●	Roads are too narrow	83
●	Lack of turn lanes or turn signals where needed	82
●	Insufficient traffic signage or signals where needed	81
●	Other	64
●	Lack of crosswalks	63
●	Lack of bike paths or lane	60
●	Poor visibility	53
●	Dangerous sidewalks	52
●	Posted speed too high	47
●	Dangerous turn	46
●	Dangerous crosswalks	40
●	Posted speed too low	26
●	Dangerous low water crossings	25
●	Lack of guard rails or damaged guard rails where needed	23

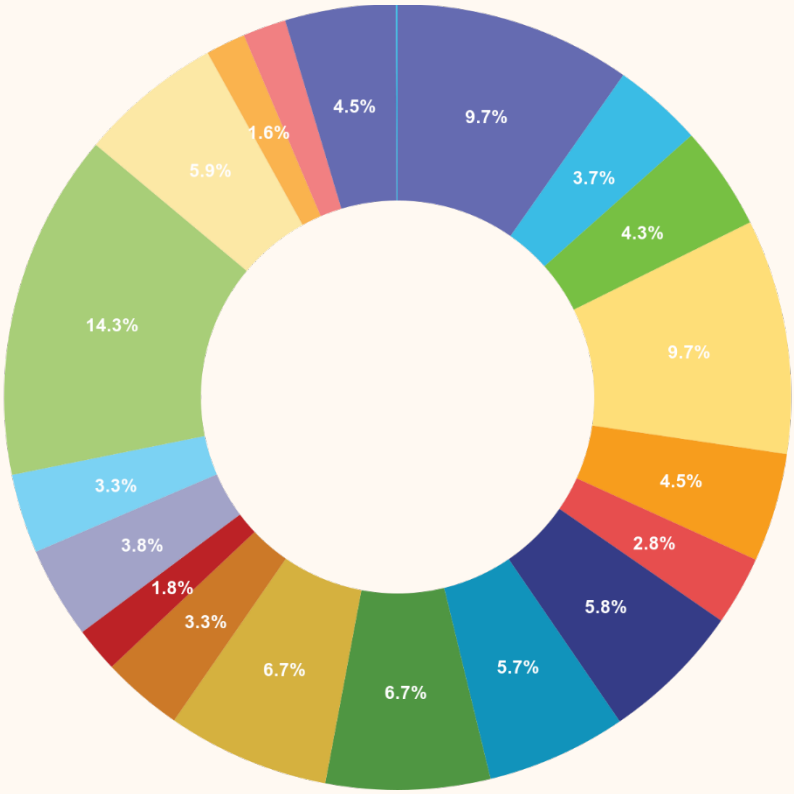


Figure 23. *Donut chart of responses selected by respondents.*

Respondents were given the option to click a link to be directed to a webpage where they were able to place a location point on a map, and/or they could choose to enter location information and other related information into an open-ended text box. There were 160 points placed on the map. See Figure 24. Respondents were given an additional opportunity to enter any other location information they wanted to and were also given another opportunity to provide open-ended text responses to include any other transportation safety concerns or other comments.

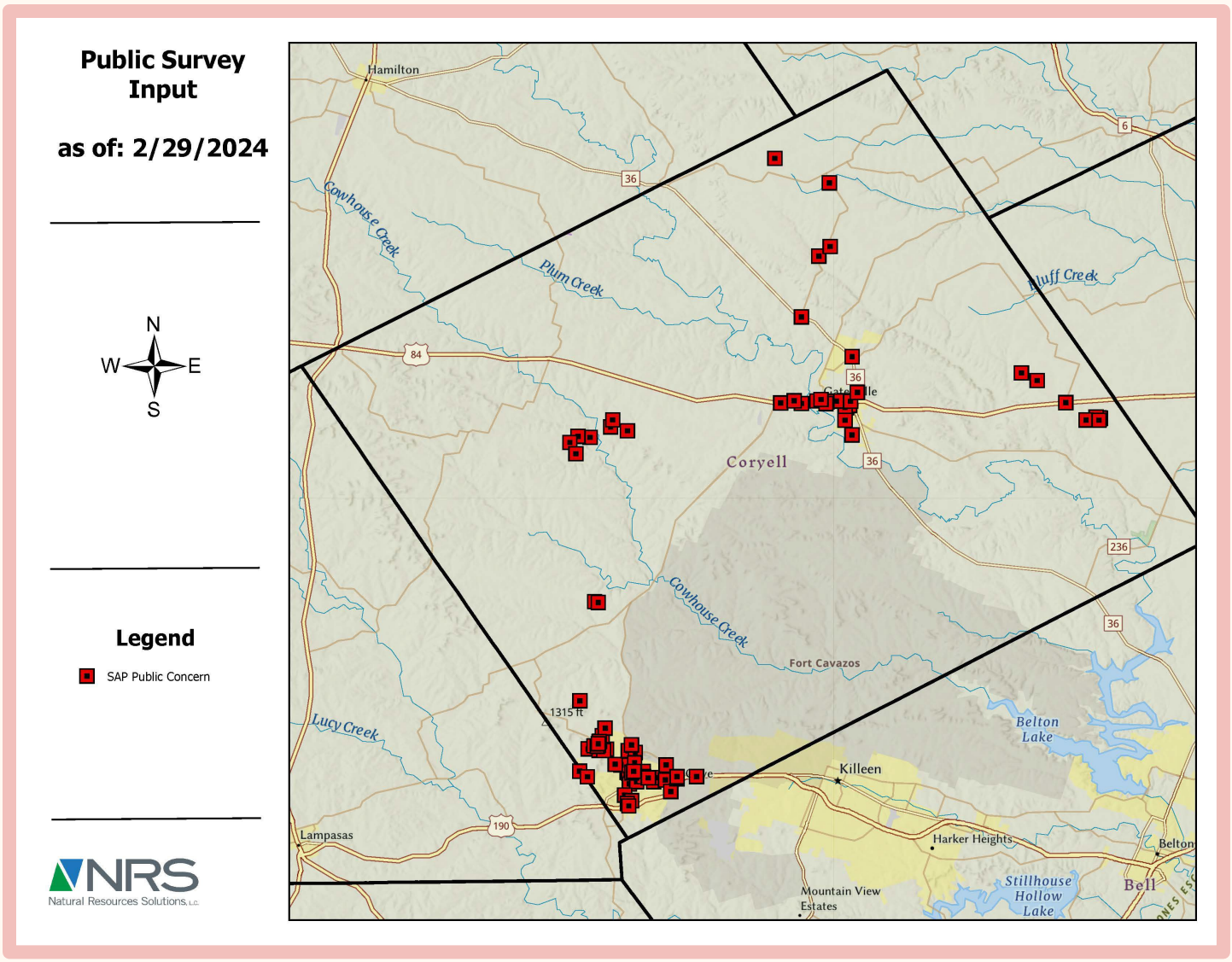


Figure 24. *Points placed on map from public survey.*

The following topics are reoccurring concerns identified by the public survey and are examined further below:

Sidewalks

Of the 318 Coryell County Public Survey Respondents, 189 or 59% indicated that sidewalks were a significant safety concern for Coryell County, the second highest concern behind poor road conditions. The need for sidewalks is further justified by several key factors. First, they are crucial to pedestrian safety by reducing the risks of accidents and collisions with vehicles. Sidewalks provide a designated space for walking, separate from vehicular traffic. Sidewalks promote accessibility for all members of the community, including children, the elderly and people with disabilities. Accessible sidewalks with curb ramps and smooth surfaces ensure that everyone can move around safely and independently, regardless of mobility limitations. Neighborhoods and

communities with sidewalks promote social interaction, facilitate community engagement, encourage outdoor activities, and encourage walking as a mode of transportation and physical activity. Well-designed sidewalks enhance the attractiveness of neighborhoods, increase property values, and stimulate economic activity by encouraging foot traffic to local businesses. Investing in sidewalks not only enhances safety but also fosters healthier, more vibrant, and inclusive communities for all residents.

Crosswalks

An important element of sidewalks are crosswalks. Crosswalks link pedestrian pathways by crossing vehicle roadways. This creates dangerous interactions between drivers and pedestrians. One hundred and three (32%) public survey respondents selected crosswalks as a safety concern. Installing and maintaining visible, updated crosswalks increases visibility for both pedestrians and drivers, improving the overall safety at intersections. Clearly marked crosswalks promote vehicle driver awareness, reduce congestion, and enhance the predictability of driver and pedestrian behavior. Additionally, Crosswalks in conjunction with sidewalks, promote accessibility for individuals with disabilities, the elderly and other vulnerable road users. Highly visible and well-maintained crosswalks are crucial to pedestrian safety, facilitate traffic management and contribute to community engagement and livability for all residents.

Bike Lanes

Bike lanes provide designated areas for cyclists, separating them from motor vehicles. In the Coryell County public survey, bike lanes accounted for 60 of the 318 responses (19%). This concern is especially prevalent in urban areas near neighborhoods, parks and schools. Bike lanes increase safety for cyclists and motorists by reducing collisions and injuries. Additionally, visible bike lanes encourage more people to choose cycling as a mode of transportation. They provide safe routes for individuals who rely on bicycles as their primary means of transportation, including commuters, students, and those who choose not to own a car. By investing in bike infrastructure, cities demonstrate a commitment to fostering a more livable and vibrant community for all residents.

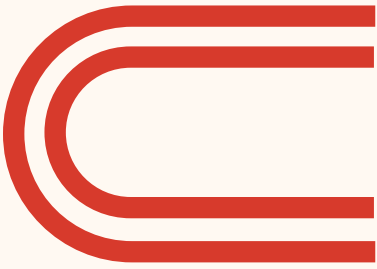
Pavement Markings/ Striping

Coryell County respondents stated that the lack of, or faded roadway lane lines was a significant concern in 95 of the 318 surveys. Visible roadway lines are essential for the safety of the travelling public and traffic management. Its core function is to provide a clear delineation of lanes, pedestrian crossings, and bike lanes. They provide visibility for all users of the road. Properly applied markings guide drivers by indicating lane usage, merging points, intersections and turns. Reflective or high contrast striping materials improve visibility of the road during nighttime or adverse weather conditions. This is especially helpful for delineating the edge of the road to one side and oncoming traffic on the other side of a rural two-way road. Roadway striping is important for a safety action plan as it enhances clarity and visibility, provides guidance and

direction for drivers, and improves nighttime visibility. By investing in well-maintained and properly marked roadways, communities can create safer and more accessible transportation networks for all road users.

The public survey provided insight into the safety concerns of Coryell County residents which contributed to the framework of this TSAP. The open response answers to the public survey questions are available upon request.

An additional source of data that was used during the safety analysis was data collected from emergency services personnel. NRS met with Daniel Lay, EMS Director at Coryell Health, on November 9th, 2023, and have had several follow up calls since to share data and discuss the development of a 911 dispatch system NRS is developing for the County. See the Progress and Transparency Section in Chapter 5 for more information.



Chapter 4: Implementation Actions & Activities

The results of the safety analysis, public survey, and stakeholder input have led to a methodology to create a safer transportation system in Coryell County. By implementing the actions and activities described in this methodology, the County will make strides towards the eventual goal of zero roadway fatalities and serious injuries. The methodology is broken down into achievable components in the following sections.

Each component includes cost estimates that can be generalized into Low, Medium, and High categories with Low = $0 to $250K, Medium = $250K to $1M, and High being >$1M.

It is important to note that if implementation funding is received to carry out these activities, Coryell County would be able to create a transportation safety program, which could include a new coordinator position, created under the County Auditor to oversee the projects, keep records, and coordinate with required subcontractors.

Education & Awareness

As discussed in the pervious chapter, driver inattention (distracted driving) and driving under the influence were the causes of the majority of fatal and serious injury crashes between 2019 and 2021 (see Table 27). With these two categories making up almost 70% of fatal crashes and 61% of serious injury crashes, it is crucial that they are addressed. This issue relates back to the 'Safe Road Users' element of the Safe System Approach where "Roadway users share the responsibility of creating a safe system by being attentive, adapting to changing conditions, complying with laws, and not driving under the influence." Since driver inattention and impaired driving are roadway users' responsibility and are a result of human error, these issues cannot be solved only by correcting the road system. The way to address these crash causes are through increasing driver awareness and implementing educational programs to improve the transportation safety culture of Coryell County.

Table 27. *Causes of fatal and serious injuries between 2018-2021*

Primary Factor	Fatal Injury	Serious Injury
Driver Inattention	15	51
Under Influence	10	21
Asleep	3	3
Cellphone	3	1
Unsafe Driving	2	10
Speeding	1	11
Unknown	1	15
Ill	1	2
Improper Turn	0	0
Evading Police	0	3
Road Rage	0	1

Awareness

A potential remedy to increase driver awareness is to deploy new warning signs along roadways. Some warning signs alert the driver of unexpected conditions that may occur, keeping them aware of their surroundings and allowing them to take precautions. Other warning signs alert drivers of conditions that are occurring so they may proceed safely. Examples of warning signs are listed below:

Weather Warning Signs

- Slippery road
- Bridge may ice in cold weather
- Road may flood
- Flashflood area
- Turn around don't drown
- Flood gauges
- Flashing flood signs

School Zone Warning Signs

- School zone – reduced speed
- Crosswalks
- No texting while driving near school zones
- Bus stop ahead warning
- Never pass a school bus when lights are flashing (either direction)

Other

- Intersection ahead
- Cattle crossing
- Deer crossing
- Truck crossing
- Military area
- Tank crossing
- Hospital (near hospitals)
- Emergency vehicles (near fire stations)
- Share the road (bicycles)

Speed

- Speed radars
- Reduced speed ahead
- Caution lights for reduced speed
- Speed limit signs on rural roads
- Winding road ahead

Pedestrian

- Yield to pedestrians
- Watch for pedestrians
- Stop for pedestrians in crosswalk

Increasing driver awareness will lead to safer drivers and less fatal and serious crashes caused by driver inattention. Installing warning signs is an easy and relatively inexpensive action that could save lives.

Education

Educating the public through traffic safety campaigns will continue to raise awareness around the dangers of driver inattention and driving under the influence. The Texas Department of Transportation (TxDOT) provides an abundance of topics surrounding driver safety that could be

developed into pamphlets, fact sheets, videos, etc. and provided to schools, libraries, community centers, etc. to educate the public about the dangers of driver inattention and driving under the influence. For convenience, hyperlinks to the traffic safety campaigns are available below:

Driver Behavior

- Drive a Safe Speed
- Be Safe. Drive Smart.
- Move Over or Slow Down
- Talk. Text. Crash.
- Work Zone Safety
- #EndTheStreakTX

Pedestrians and Bicyclists

- Back to School
- Bicycle Safety Campaign
- Pedestrian Safety Campaign

Share the Road

- Look Twice for Motorcycles

Driving Under the Influence

- College and Young Adult Impaired Driving
- Faces of Drunk Driving
- Football Season
- Holiday Season
- Labor Day

Seatbelts and Car Seats

- Child Passenger Safety
- Click It or Ticket
- Teen Click It or Ticket

Educating drivers will directly improve the safety culture of Coryell County. If drivers are made aware of the dangers and consequences of distracted and impaired driving, they will take measures to prevent them from occurring.

Enforcement

An important component of education and awareness is enforcement. For the safety practices above to work, drivers must be held accountable by the local law enforcement. Examples of enforcement issuing tickets for speeding or texting while driving, and ensuring school zone laws are being followed such as obeying decreased speed, no passing buses, no cellphone usage etc. To aid in enforcement practices, the National Highway Traffic Safety Administration (NHTSA) has a High Visibility Enforcement (HVE) toolkit on their website. The NHTSA states "HVE is a universal traffic safety approach designed to create deterrence and change unlawful traffic behaviors."

HVE is a combination of high visibility and proactive law enforcement used to target a specific safety issue. It includes a publicity strategy to promote voluntary compliance with the law as well as to educate the public. HVE strategies such as checkpoints and saturation patrols should

include increased publicity and warnings to the public. While forewarning the public may seem counterproductive to catching violators, it actually increases the deterrent effect and prevents violations from occurring.

The HVE concept moves the use of enforcement away from traditional law enforcement tactics. It incorporates enforcement strategies designed to make enforcement efforts obvious to the public and is supported by a coordinated communication strategy and publicity. Ideally, HVE is enhanced through multi-jurisdictional efforts as well as partnerships between people and organizations dedicated to the safety of their community. Additional information on HVE elements such as enforcement, publicity, and visibility practices can be found on the HVE Toolkit Website.

Prioritization

Enforcement should be the first step to implementing education and awareness. Training law enforcement on HVE concepts will have a quick turn around to seeing improvement to safety in the community.

Education and Awareness efforts should be prioritized next and can occur at the same time. While educational programs are being developed, areas should be surveyed to determine where warning signs around the county are needed and appropriate.

Timeframe

Education, awareness, and enforcement should be continuous efforts even after the goal of zero fatalities and serious injuries is achieved. Below is a general timeframe for when each component should be implemented by based on effort needed to plan, develop resources, and deploy campaigns:

Awareness – within 1 year of funding

Education – within 2 years of funding

Enforcement – within 1 year of funding

Cost

Awareness – Medium

Education – Medium

Enforcement – Low

Costs of these components will vary based on scope.

Audits

Coryell County is a rural county with limited resources and a small road and bridge department. Many roadway features such as crosswalks and striping are old or faded and need to be updated with modern safety countermeasures, but the County lacks the funds and manpower to do so. With this in mind, the following audit projects were designed to not only improve safety for roadway users, but to also implement a record keeping system for transportation related projects. A record keeping system to locate, track progress towards improvements, and monitor success of improvements for various roadway safety features will provide the County with information such as where and what the features are and when they were last updated. The record keeping system is described in more detail in the Progress and Transparency Section in Chapter 5.

The audit projects will be split into two phases and are applicable to multiple roadway features as outlined below. For each project, location prioritization was decided based on equity considerations, presence of schools, and rural or urban classification.

See Appendix E for more information on the proposed actions.

Sidewalks

Proposed Action: Walkways/Sidewalks

Phase 1 – Locate & Update

- Locate and record locations of existing sidewalks county-wide by coordinating with county and city officials.
- A subcontractor qualified to assess conditions of existing sidewalks, repair sidewalks, and install new sidewalks would be hired.
- The subcontractor would first assess the condition of the existing sidewalks and determine if repair is needed. Repair is generally needed if there are uneven surfaces, cracking, drainage issues, or excessive vegetation growth.
- Sidewalks in poor condition will be repaired.

Phase 2

- Once existing sidewalks are repaired, locations for new sidewalks are to be selected. Locations include Copperas Cove, Copperas Cove ISD, Gatesville, Gatesville ISD, Oglesby, Oglesby ISD, Evant, Evant ISD, South Mountain, Jonesboro ISD
- Once locations are selected sidewalks will be constructed. Order of completion would be based on prioritization as outlined.

Data Showing Need

- Safety Analysis: 3 pedestrian fatalities, 8 serious injuries
    - Repairing existing and installing new sidewalks will prevent future pedestrian fatalities and encourage residents to walk as a mode of transportation.
- Public Survey
    - 189 or 59% of respondents to the public survey selected dangerous sidewalks or lack of sidewalks as a concern, making it the second most identified safety concern.
- Stakeholder Input
    - No existing sidewalks in Evant
    - Very few sidewalks in Oglesby
    - Schools in all towns need more sidewalks.

Prioritization

Communities should be completed in the following order. Disadvantaged communities[13], school locations, and urban and rural areas are all factors in prioritization.

1. **Gatesville ISD & Gatesville**
    - CJEST – in the 93rd percentile for transportation barriers (census track 103)
    - A Historically Disadvantaged Community
    - USDOT ETC – in the 73rd percentile for transportation insecurity
        - 61st percentile for transportation access
        - 77th percentile for transportation cost burden
        - 68th percentile for traffic safety
    - School – sidewalks are necessary for children to walk safely to and from school.
    - Urban – will serve a larger population that is more likely to walk for transportation.

2. **Copperas Cove & Cove ISD**
    - CJEST – has three disadvantaged census tracts:
        - 107.01 – 97th percentile for wildfire, 65th percentile for low income
        - 106.01 – 99th percentile for wildfire, 76th percentile low income
        - 101.01 – 96th percentile for housing cost, 87th percentile for low income
    - Has a Historically Disadvantaged Community
    - Has three Areas of Persistent Poverty
    - USDOT ETC – overall in the 63rd percentile for transportation insecurity but communities range from the 40th to 80th percentile.
        - 64th percentile for transportation access
        - 66th percentile for transportation cost burden
        - 54th percentile for traffic safety

[13] Over the 65th percentile is considered disadvantaged for CJEST and USDOT ETC

- School – sidewalks are necessary for children to walk safely to and from school.
- Urban – will serve a larger population that is more likely to walk for transportation.

3. **Oglesby & Oglesby ISD**
   - USDOT ETC – in the 97th percentile for transportation insecurity
     - 97th percentile for transportation access
     - 42nd percentile for transportation cost burden
     - 89th percentile for traffic safety
   - School – sidewalks are necessary for children to walk safely to and from school.
   - Rural community – rural communities don't typically have sidewalks.

4. **Evant & Evant ISD**
   - USDOT ETC – in the 94th percentile for transportation insecurity
     - 94th percentile for transportation access
     - 46th percentile for transportation cost burden
     - 97th percentile for traffic safety
   - School – sidewalks are necessary for children to walk safely to and from school.
   - Rural community – rural communities don't typically have sidewalks.

5. **Jonesboro ISD**
   - USDOT ETC – in the 94th percentile for transportation insecurity
     - 94th percentile for transportation access
     - 46th percentile for transportation cost burden
     - 97th percentile for traffic safety
   - School – sidewalks are necessary for children to walk safely to and from school.

6. **South Mountain**
   - USDOT ETC – in the 70th percentile for transportation insecurity
     - 69th percentile for transportation access
     - 64th percentile for transportation cost burden
     - 83rd percentile for traffic safety
   - Rural community – rural communities don't typically have sidewalks.

<u>Timeframe</u>

Within 2 years of funding

<u>Cost</u>

High

Crosswalks

Proposed Action: Crosswalk Visibility Enhancements, Leading Pedestrian Interval (LPI), Pedestrian Hybrid Beacons (PHB), Rectangular Rapid Flashing Beacons (RRFB)

Phase 1 – Locate & Update

- Locate and record locations of existing crosswalks county-wide by coordinating with county and city officials.
- A subcontractor qualified to assess the conditions of existing crosswalks, improve existing crosswalks, and install new crosswalks would be hired.
- The subcontractor would first assess the condition of the existing crosswalks and determine what improvements would be appropriate. Improvements include enhancing signs, lighting, and pavement markings.
- Eligible crosswalks will be updated.

Phase 2

- Once existing crosswalks are improved, locations for new crosswalks are to be selected. Locations include Copperas Cove, Copperas Cove ISD, Gatesville, Gatesville ISD, Oglesby, Oglesby ISD, Evant, Evant ISD, South Mountain, Jonesboro ISD and unincorporated areas.
- New crosswalks should include safety enhancements such as LPI's, PHB's, and RRFB's.
- Once locations are determined, crosswalks will be constructed. Order of completion would be based on prioritization as outlined.

Data Showing Need

- Safety Analysis: 3 pedestrian fatalities, 8 serious injuries
    - Improving existing and installing new crosswalks will prevent future pedestrian fatalities and encourage residents to walk as a mode of transportation.
- Public Survey
    - Of the 318 responses to the public survey, 103 or 32% of respondents identified dangerous crosswalks or lack of crosswalks as a concern.
- Stakeholder Input
    - Crosswalks in Evant need to be updated. They are both on a highspeed road with no caution lights. They would benefit from a PHB or RRFB.
    - No existing crosswalks in Oglesby. Especially needed by schools.
    - Lovers Lane is Gatesville is in poor condition and needs crosswalks near the school.
    - Schools in all towns need more crosswalks.

Prioritization

Communities should be completed in the following order. Disadvantaged communities, school locations, and urban and rural areas are all factors in prioritization.

1. **Evant & Evant ISD**
   - Rural community - due to Evant only needing the two existing crosswalks to be enhanced, this would be a much smaller undertaking than the urban areas in the county and should be prioritized first.
   - USDOT ETC – in the 94th percentile for transportation insecurity
     - 94th percentile for transportation access
     - 46th percentile for transportation cost burden
     - 97th percentile for traffic safety
   - School – crosswalks are necessary for children to walk safely to and from school.

2. **Oglesby & Oglesby ISD**
   - Rural community – Oglesby is a small, rural community that has no existing crosswalks despite the presence of schools. Oglesby should be prioritized over areas that have exiting crosswalks.
     - USDOT ETC – in the 97th percentile for transportation insecurity
       - 97th percentile for transportation access
       - 42nd percentile for transportation cost burden
       - 89th percentile for traffic safety
     - School – crosswalks are necessary for children to walk safely to and from school.

3. **Gatesville ISD & Gatesville**
   - CJEST – in the 93rd percentile for transportation barriers (census track 103)
   - A Historically Disadvantaged Community
   - USDOT ETC – in the 73rd percentile for transportation insecurity
     - 61st percentile for transportation access
     - 77th percentile for transportation cost burden
     - 68th percentile for traffic safety
   - School – crosswalks are necessary for children to walk safely to and from school.
   - Urban – will serve a larger population that is more likely to walk for transportation.

4. **Copperas Cove & Cove ISD**
   - CJEST – has three disadvantaged census tracts:
     - 107.01 – 97th percentile for wildfire, 65th percentile for low income
     - 106.01 – 99th percentile for wildfire, 76th percentile low income
     - 101.01 – 96th percentile for housing cost, 87th percentile for low income
   - Has a Historically Disadvantaged Community
   - Has three Areas of Persistent Poverty

- USDOT ETC – overall in the 63rd percentile for transportation insecurity but communities range from the 40th to 80th percentile.
    - 64th percentile for transportation access
    - 66th percentile for transportation cost burden
    - 54th percentile for traffic safety
- School – crosswalks are necessary for children to walk safely to and from school.
- Urban – will serve a larger population that is more likely to walk for transportation.

5. **Jonesboro ISD**
    - School – crosswalks are necessary for children to walk safely to and from school.
    - USDOT ETC – in the 94th percentile for transportation insecurity
        - 94th percentile for transportation access
        - 46th percentile for transportation cost burden
        - 97th percentile for traffic safety

6. **South Mountain**
    - USDOT ETC – in the 70th percentile for transportation insecurity
        - 69th percentile for transportation access
        - 64th percentile for transportation cost burden
        - 83rd percentile for traffic safety
    - Rural community – rural communities don't typically have crosswalks but still benefit from them.

Timeframe

Within 2 years of funding

Cost

Medium to high depending on how many crosswalks need to be updated, installed, and what safety enhancements are used.

Bike Lanes

Proposed Action: Road/Bicycle Lane Reconfiguration

Phase 1 – Locate & Update

- Locate and record locations of existing bike lanes county-wide by coordinating with county and city officials.
- A subcontractor qualified to assess the conditions of existing bike lanes and install new bike lanes would be hired.
- The subcontractor would first assess the condition of the existing bike lanes and determine if improvements are needed. Improvements include repainting lines and installing flexible delineator posts.
- Eligible existing bike lanes will be improved.

Phase 2

- Once existing bike lanes are improved, locations for new bike lanes are to be selected. Locations include Copperas Cove and Gatesville.
- Once locations are selected bike lanes will be constructed. Order of completion would be based on prioritization as outlined.

Data Showing Need

- Safety Analysis: in the data set analyzed there were 17 crashes involving pedalcyclists, all in Copperas Cove or Gatesville.
    - Installing bike lanes in urban areas will prevent future crashes involving pedalcyclists and encourage residents to bike as a mode of transportation.
- Public Survey
    - The lack of bike lanes and paths was identified by 20% of respondents as a significant concern.
    - Many open responses referenced Copperas Cove & Gatesville while discussing the need for bike lanes.

Prioritization

Communities should be completed in the following order. Disadvantaged communities are the main factors in prioritization. Only urban communities are included in this project due to need. Rural communities typically don't have enough bicycle traffic to justify dedicated lanes. Urban areas will benefit from bike lanes and encourage residents to utilize bicycles as a mode of transportation.

1. **Copperas Cove & Cove ISD**
    - CJEST – has three disadvantaged census tracts:

    - 107.01 – 97th percentile for wildfire, 65th percentile for low income
    - 106.01 – 99th percentile for wildfire, 76th percentile low income
    - 101.01 – 96th percentile for housing cost, 87th percentile for low income
  - Has a Historically Disadvantaged Community
  - Has three Areas of Persistent Poverty
  - USDOT ETC – overall in the 63rd percentile for transportation insecurity but communities range from the 40th to 80th percentile.
    - 64th percentile for transportation access
    - 66th percentile for transportation cost burden
    - 54th percentile for traffic safety
  - Urban – will serve a larger population that is more likely to walk for transportation.
  - Has existing bike lanes. Should be prioritized to expand the existing network.

2. Gatesville ISD & Gatesville

  - CJEST – in the 93rd percentile for transportation barriers (census track 103)
  - A Historically Disadvantaged Community
  - USDOT ETC – in the 73rd percentile for transportation insecurity
    - 61st percentile for transportation access
    - 77th percentile for transportation cost burden
    - 68th percentile for traffic safety
  - Urban – will serve a larger population that is more likely to bike for transportation.

<u>Timeframe</u>

Within 2 years of funding

<u>Cost</u>

Medium

Pavement Markings

Proposed Action: Redo and add pavement lines on County roads with retroreflectivity to lessen roadway departures. There is only one phase for this project because repainting lines and adding new markings can be completed simultaneously.

Phase 1 – Locate & Add

- Coordinate with county and city officials to determine what roads need updated pavement markings.
- A subcontractor qualified to repaint pavement markings as well as add new markings would be hired. New markings should be retroreflective.
- Locations include Copperas Cove, Copperas Cove ISD, Gatesville, Gatesville ISD, Oglesby, Oglesby ISD, Evant, Evant ISD, South Mountain, Jonesboro ISD, unincorporated areas.
- Order of completion would be based on prioritization as outlined.

Data Showing Need

- Safety Analysis: updating and adding pavement markings could potentially decrease driver inattention which is the number one cause of fatal and serious injury crashes. It could also decrease other causes of crashes such as unsafe driving and improper turns.
- Survey
    - Of the 318 responses to the public survey, 95 or 30% of respondents selected lack of line or faded line as a concern.
    - Many respondents noted that lines need to be redone or added 'all over town'.
- Stakeholder Input
    - Copperas Cove noted striping/pavement markings are an issue especially with school buses.

Prioritization

Communities should be completed in the following order. Disadvantaged communities, school locations, and urban and rural areas are all factors in prioritization.

1. **Copperas Cove & Cove ISD**
    - CJEST – has three disadvantaged census tracts:
        - 107.01 – 97th percentile for wildfire, 65th percentile for low income
        - 106.01 – 99th percentile for wildfire, 76th percentile low income
        - 101.01 – 96th percentile for housing cost, 87th percentile for low income
    - Has a Historically Disadvantaged Community
    - Has three Areas of Persistent Poverty
    - USDOT ETC – overall in the 63rd percentile for transportation insecurity but communities range from the 40th to 80th percentile.

    - 64th percentile for transportation access
    - 66th percentile for transportation cost burden
    - 54th percentile for traffic safety
  - Urban – largely populated area. The more people using roads the higher the chances of crashes.
  - Schools – pavement markings will lead to safer streets near schools.

2. **Gatesville ISD & Gatesville**
  - CJEST – in the 93rd percentile for transportation barriers (census track 103)
  - A Historically Disadvantaged Community
  - USDOT ETC – in the 73rd percentile for transportation insecurity
    - 61st percentile for transportation access
    - 77th percentile for transportation cost burden
    - 68th percentile for traffic safety
  - Urban – largely populated area. The more people using roads the higher the chances of crashes.
  - Schools – pavement markings will lead to safer streets near schools.

3. **Oglesby & Oglesby ISD**
  - USDOT ETC – in the 97th percentile for transportation insecurity
    - 97th percentile for transportation access
    - 42nd percentile for transportation cost burden
    - 89th percentile for traffic safety
  - Schools – pavement markings will lead to safer streets near schools.
  - Rural community – pavement markings typically aren't maintained in small rural communities.

4. **Evant & Evant ISD**
  - USDOT ETC – in the 94th percentile for transportation insecurity
    - 94th percentile for transportation access
    - 46th percentile for transportation cost burden
    - 97th percentile for traffic safety
  - Schools – pavement markings will lead to safer streets near schools.
  - Rural community – pavement markings typically aren't maintained in small rural communities.

5. **Jonesboro ISD**
  - USDOT ETC – in the 94th percentile for transportation insecurity
    - 94th percentile for transportation access
    - 46th percentile for transportation cost burden
    - 97th percentile for traffic safety

- Schools – pavement markings will lead to safer streets near schools.

6. **South Mountain**
   - USDOT ETC – in the 70th percentile for transportation insecurity
     - 69th percentile for transportation access
     - 64th percentile for transportation cost burden
     - 83rd percentile for traffic safety
   - Rural community – pavement markings typically aren't maintained in small rural communities.
7. **Unincorporated areas**
   - Remaining country roads and unincorporated communities should be assessed for need of new or updated pavement markings as well.

Timeframe

Within 2 years of funding

Cost

Medium

Dangerous Curves

Proposed Action: Road Curve Delineation, Road Curve Improvements, Rumble Strips, Wider Edge Lines

There is only one phase for this project due to the nature of remedying existing curves.

Phase 1 – Locate & Update

- Coordinate with county and city officials to identify locations of dangerous turns throughout the county.
- A subcontractor qualified to assess roadway dynamics should be hired.
- The subcontractor would determine the best solution for each curve and apply it.
- Potential solutions include adding pavement markings, warning signs, chevron signs, widening shoulders, etc.
- Once solutions are identified the turns will be updated with improvements.

Data Showing Need

- Safety Analysis: making improvements to dangerous turns could potentially decrease driver inattention which is the number one cause of fatal and serious injury crashes. It could also decrease other causes of crashes such as unsafe driving.
- Stakeholder Input
    - County noted a few locations with dangerous curves: County Road 142, Lutheran Church Road, Oak Springs Road to 113 to County Road 3220.

Prioritization

Dangerous curves will likely be in rural areas of the County away from cities and towns making it difficult to prioritize based on disadvantages. Because of this, once turns are identified they should be prioritized based on current danger with the most dangerous improved first. The subcontractor hired to make improvements should be qualified to assess how dangerous the turns identified are.

Timeframe

2 years

Cost

Medium

Flood-Related Safety Projects

Coryell County has experienced devastating floods that have caused substantial damage to the county's roads. The repeated flooding has resulted in the degradation and failure of many roads and low water crossings, posing a significant risk to the safety of Coryell County residents. Floods have caused transportation fatalities, accidents, and road rescues in multiple locations across the County and on several occasions before and after the 2015 and 2016 flood disasters discussed below.

In 2015 and 2016, flood events occurred in Coryell County that triggered two FEMA disaster declarations (DR-4223 and DR-4269) for the County. During this time, the County experienced a considerable number of flood-related emergencies that directly contributed to three fatalities in 2015, as well as several flood rescues occurring in both the 2015 and 2016 floods, all of which were a result of attempting to drive during the flooding.

Updating and repairing/replacing bridges and low water stream crossings with modern safety features mitigates future risk of fatalities and accidents occurring during flood events and contributes to a safer transportation system. These updates include:

- Stream Crossing Signs – 'road may flood', 'flashflood area' 'turn around don't drown', flashing lights warning of dangerous water.
- Stationary Flood Gauges – depth gages installed on roads and crossings to inform drivers on how deep the water is.
- Stream Crossing Structure Reconfiguration – resurfacing eroded lanes, elevating travel surfaces using small bridges, or adding guardrails on elevated structures.

With the help of county officials, a list of 22 crossings that frequently flood were identified for safety improvements. See table 28 for the list of crossings and their proposed actions. See Appendix F for location descriptions of crossings and see Appendix G for maps and locations of the crossings.

Prioritization

Priority order for improving crossings is outlined as follows.

The first crossing that should be improved is the Straws Mill Road crossing (CRXING011) due to the severe degradation of the crossing. (Figure 25). If the Straws Mill crossing becomes unusable it will cause major disruption to transportation access as it is located in a rural area. This crossing is also located in an Area of Persistent Poverty and a Historically Disadvantaged Community.

1. CRXING011

Next, crossings that are considered disadvantaged by three of the four tools[14] used for measurement should be improved.

2. CRXING017
3. CRXING003

There are seven crossings that are considered disadvantaged by two of the four tools used for measurement. These are further prioritized by scope with the lowest cost and shortest timeframes being prioritized first in order to make improvements quickly.

4. CRXING018
5. CRXING015
6. CRXING006
7. CRXING004
8. CRXING007
9. CRXING001
10. CRXING002

The remaining projects are in the top percentiles for having transportation insecurity and are again broken down by scope.

11. CRXING022
12. CRXING021
13. CRXING020
14. CRXING019
15. CRXING016
16. CRXING012
17. CRXING013
18. CRXING014
19. CRXING005
20. CRXING008
21. CRXING009
22. CRXING010

Timeframe

The numbers in the timeframe column of Table 28 are representative to the timeframe of the projects and are categorized below:

- 1 = < 1 year
- 2 = 1-2 years
- 3 = 3+ years

[14] CJEST, APP, HDC, and USDOT ETC from Ch. 2

Cost

Similar to timeframe, the numbers in the cost range column of Table 28 are representative to the timeframe of the projects and are categorized below:

- 1 = $0-$500k
- 2 = $501k-$2M
- 3 = >$2M

Figure 25. *Low water crossing on Straws Mill Road*

Table 28. *List of crossings and proposed actions*

Project Number	Proposed Action(s)	Cost Range	Timeframe	CEJSC Disadvantaged?	Area of Persistent Poverty?	Historically Disadvantaged Community?	Transportation Disadvantage? (ETC)
CRXING001	Signs Flood Guage Guardrails New 40' Bridge	1	2	No	Yes	No	Yes
CRXING002	Signs Flood Guage Guardrails New 100' Bridge	2	2	No	Yes	No	Yes
CRXING003	Signs Flood Guage Guardrails New 60' Bridge	1	2	Yes	Yes	Yes	No
CRXING004	Signs Flood Gauge Guardrails	1	1	No	Yes	No	Yes
CRXING005	Signs Flood Gauge Guardrails	1	1	No	No	No	Yes
CRXING006	Signs Flood Gauge Guardrails	1	1	No	Yes	No	Yes
CRXING007	Signs Flood Guage Guardrails New 60' Bridge	1	1	No	Yes	No	Yes
CRXING008	Signs Flood Guage Guardrails New 60' Bridge	1	2	No	No	No	Yes
CRXING009	Signs Flood Guage Guardrails New 60' Bridge	1	2	No	No	No	Yes
CRXING010	Signs Flood Guage Guardrails New 60' Bridge	1	2	No	No	No	Yes
CRXING011	Signs Flood Gauge	1	1	Yes	Yes	Yes	No

Project Number	Proposed Action(s)	Cost Range	Timeframe	CEJSC Disadvantaged?	Area of Persistent Poverty?	Historically Disadvantaged Community?	Transportation Disadvantage? (ETC)
CRXING012	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING013	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING014	Signs Flood Gauge Guardrails	1	1	No	No	No	Yes
CRXING015	Signs Flood Gauge	1	1	No	Yes	No	Yes
CRXING016	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING017	Signs Flood Guage Guardrails New 60' Bridge	1	2	Yes	No	Yes	Yes
CRXING018	Signs Flood Gauge	1	1	No	Yes	No	Yes
CRXING019	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING020	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING021	Signs Flood Gauge	1	1	No	No	No	Yes
CRXING022	Signs Flood Gauge	1	1	No	No	No	Yes

Chapter 5: Conclusions

Additional Safety Issues

Additional safety issues and concerns were identified through the safety analysis, public survey, and stakeholder input processes we undertook to formulate this TSAP. It is appropriate to document these safety issues in this TSAP even though the remedies (safety improvement projects) may not be appropriate for the County to address through the SS4A funding opportunities. Some of these projects are on state maintained roads and also require more technical expertise than the County has available, therefore TXDOT would be better suited to address many of these issues. The additional safety concerns are summarized below:

FM 116

This road had a total of 176 incidents from 2018-2021. There were 3 fatal, 6 serious injury, 23 minor injury, and 138 no injury crashes. Safety concerns regarding this road include dangerous intersections, water pooling on the road and causing cars to hydroplane, and unsafe speeds. This road would need an engineering study to determine what is causing the drainage issues, how to set safe speeds, and how to improve intersections. There is a considerable amount of growth expected along this road in the next 5-10 years which will result in more traffic. If the issues aren't addressed more fatal and serious injury crashes are to be expected.

HWY 36 & FM 929 Intersection

There have been 16 crashes at this intersection between 2018-2021 with 1 being fatal and 4 resulting in serious injuries. There are currently no stop lights or caution lights at the intersection and the speed limit is 60. There are bends in the road approaching the intersection from either direction on Highway 36, making it difficult to see oncoming traffic.

HWY 36 & Old Osage Road Intersection

Crashes at this intersection are a common occurrence and multiple have resulted in fatalities. This is mainly a result of speeding and limited visibility. A study would need to be completed to determine the best solution for this intersection.

HWY 84 & FM Intersections (near Oglesby)

The Farm to Market Road intersections along Highway 84 are all dangerous intersections. There has been a fatality at the HWY 84 & FM 185 intersection, and it's only a matter of time before another occurs. The speed along Highway 84 is too high, and there are no warning signs or lights for intersections. Multiple improvements along this road need to be made.

Policy and Process Changes

An important aspect of transportation safety action planning is policy and process changes. This involves assessing current County-wide policies, plans, guidelines, or standards to identify opportunities to improve how processes prioritize transportation safety. Existing Coryell County policies, plans, guidelines, and any other current standards were reviewed to identify potential opportunities that would help improve how Coryell County prioritizes transportation safety County-wide. Currently, there are no County documents that are relative to transportation safety. However, Coryell County is the recipient of a 2023 Texas General Land Office Resilient Communities (RCP) grant that Coryell County will utilize to develop, adopt, and implement Building Codes that meet or exceed the standards set forth in the International Residential Code 2012 (IRC 2012). Coryell County will also develop, adopt, and implement a forward-looking, County-wide Land Use Plan and corresponding Zoning Ordinances that will integrate the Coryell County Hazard Mitigation Plan. The Land Use Plan, when complete, will address rapid growth in the County and transportation needs to accommodate the development/growth and influx of new county residents. It will ensure any development of the transportation system will prioritize safety for all road users. Coryell County's goals and objectives for the new Land Use Plan, Zoning Ordinances, and other documents resulting from the RCP project are to establish and maintain alignment across all appropriate plans, to achieve "smart growth", and to create a safer, more prepared community to better serve the growing population.

Progress and Transparency

Coryell County administers and maintains the county roads within the county through their Road and Bridge Department, who coordinates with the cities of Gatesville and Copperas Cove (the two largest population centers of the county). Both the City of Gatesville and Copperas Cove have minor road maintenance capacity. Because funding for safer roads and bridges is not abundant for the county or for the cities within Coryell County, significant improvements beyond basic road maintenance are lacking. With this, road and bridge improvements do not usually include coordination or record keeping. These administrative activities are not a priority when funding is only available for basic road maintenance.

Administrative activities such as overall road and bridge coordination, initial inventory of unsafe road features, and record keeping of activities pertaining to improving those unsafe road features (see Audit Section) is critical to improving safety at a county-wide level and prioritizing future safety-related road improvements included in this TSAP. This information should be kept in a database and include elements such as costs, dates, activities performed, and other relevant information. This system will also be a way to track the progress of this TSAP. As implementation activities are completed, they should be reported and shared with the public to strengthen the safety culture of Coryell County.

Aside from implementation activities being tracked, the effectiveness of the TSAP must be measured. To accomplish this, CRIS data should be reviewed on a yearly basis to determine if fatal and serious injury crashes are decreasing. County officials should meet around April of each year, starting in 2025 (one year since this TSAP's completion) and determine if fatal and serious crashes are decreasing, and how to proceed with the implementation of this Plan. Yearly numbers should be compiled and included in the new record keeping system/database to keep safety information regarding the County centralized.

To help with this effort, Coryell County is expanding their capacity to monitor, collect, store, and retrieve data that relates to emergency management and specifically crash data, road conditions, and reoccurring trouble spots throughout the county. An emergency management record system will enable local Law Enforcement, Emergency Medical Servies and Fire Departments to record events as they occur and later retrieve relevant information as needed. Previously, records were kept in non-digital formats making the data difficult to search after the event. In addition to the CRIS data that is currently available, which tracks crash date, time, and cause, a robust local record management system will incorporate these metrics plus others including response time analysis, more specific casualty and injury data, traffic flow analysis, and trend analysis. By incorporating these new capabilities at the local level throughout all agencies in the county, decision makers will have valuable insight into the impacts of the TSAP. This will allow data driven adjustments and optimizations to be made that will improve the overall effectiveness.

The NHTSA has formed a Rural Traffic Safety Working Group (RTSWG) to aid with the unique challenges rural communities face and to identify and affect ways the agency can increase its focus on activities appropriate to the rural environment. Coryell County should appoint a representative to participate in the RTSWG to learn about resources and methods that will assist the County in applying the Safe System Approach discussed in Chapter 2. The working group meets monthly and includes representation from across the agency, including most regional offices.[15]

Conclusions

As noted, Coryell County is a rural county with limited resources. To meet the commitment of zero fatalities and serious injuries resulting from transportation related crashes by 2034, the County will pursue grant funding to implement the safety measures and actions described in this plan.

[15] Rural Safety | NHTSA

Appendices

Appendix A: Survey Questions

Appendix B: Survey Postcard

Appendix C: Public Meeting Notices

Appendix D: Public Meeting Attendees

Appendix E: Proposed Actions

Appendix F: Locations of Crossings

Appendix G: Maps of Crossings

Appendix A: Survey Questions

Q1. What is your home zip code?

Q2. What is your work zip code?

Q3. About how many miles do you drive in an average week?

- 0-200 miles
- 201-400 miles
- 401-600 miles
- More than 600

Q4. Which of the following modes of transportation do you use in a typical week. Check all that apply.

- Personal car
- Taxi or ride-share (such as Uber or Lyft)
- Motorcycle
- Bus
- Bicycle
- Walking
- Other

Q5. What are your top transportation safety concerns in Coryell County? Select all that apply.

- Lack of sidewalks
- Dangerous sidewalks
- Lack of bike paths or lane
- Dangerous intersections
- Lack of crosswalks
- Dangerous crosswalks
- Lack of turn lanes or turn signals where needed
- Insufficient traffic signage or signals where needed
- Lack of lane line or faded line
- Lack of streetlights
- Posted speed too high

- Posted speed to low
- Poor visibility
- Dangerous turn
- Roads conditions are poor (potholes, crumbling shoulder, etc.)
- Roads are too narrow
- Lack of guard rails or damaged guard rails where needed
- Dangerous low water crossings
- Other

Question branching here based on responses to Q5. Each concern had a follow up formulated this way:

Q6. Where do you feel [safety concern from above] is a concern? You may write in your answer below OR click the following link to identify the location or locations on a map of the county. https://experience.arcgis.com/experience/af4301e84502438c83b87cf934d2d3a1/

Q7. Where do you feel there are other transportation safety concerns? You may write in your answer below OR click the following link to identify the location or locations on a map of the county. https://experience.arcgis.com/experience/af4301e84502438c83b87cf934d2d3a1/

Q8. Do you have any other Coryell County transportation safety concerns that we have not addressed in the survey? Feel free to provide information about any additional concerns below.

Q9. Did you use the link provided to place your transportation concerns on the map?

- No, I did not use the link
- Yes, I did use the link

Appendix B: Survey Postcard

Coryell County Safety Action Plan

www.coryell-county-sap.com

Potential projects for the safety action plan include:

- Traffic sign and signal improvements
- New/improved sidewalks and crosswalks
- Installing bike lanes, turn lanes, and guardrails
- Reduced speed limits, safe school routes, & more!

Tell us what YOU would like to see included by taking the S.A.P. public survey!

SCAN HERE

Survey closes 2/29/24

A transportation Safety Action Plan for Coryell County is currently being developed that will include **projects** that **improve** dangerous roads identified by the public

To take the survey on your device, scan the QR code on the back or visit www.coryell-county-sap.com/community

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Appendix C: Public Meeting Notices

CORYELL COUNTY TEXAS

800 East Main Street, Suite A
Gatesville, Texas 76528
(254) 865 - 5911, ext 301
FAX: (254) 865 - 2040

FILED
AT 9 O'CLOCK A M

MAR 21 2024

Jennifer Deaton
COUNTY CLERK, CORYELL CO., TEXAS

A public meeting regarding the Coryell County transportation Safety Action Plan is scheduled **for 2:00pm on April 4th at the Coryell County Main Street Annex in the Commissioners Courtroom at 801 E. Leon Street, Gatesville, TX 76528.** The Safety Action plan is a comprehensive plan that identifies roadway safety concerns and provides solutions for these concerns. The overall goal of the Safety Action Plan is to reduce fatalities and serious injuries. This public meeting is an opportunity for the public to voice the transportation safety concerns they would like to see addressed in the plan.

THE GATESVILLE MESSENGER

Coryell County to discuss SAP at public meeting April 4

COURTESY PHOTO

Posted Friday, March 22, 2024 11:34 am

Alexandra Meelbusch

Coryell County is currently in the process of developing a Transportation Safety Act Plan to identify and address roadway and transportation safety concerns. The plan will feature projects that are to improve dangerous roads identified by the community.

A public meeting will be held to discuss the Coryell County Safety Action Plan on Thursday, April 4, at 2 p.m. and will be in the Commissioner's Courtroom.

This comprehensive plan will identify many areas of concern to provide a framework to address concerns and reduce injuries and fatalities.

Coryell County is committed to a goal of zero roadway fatalities and serious injuries. This can be achieved within 10 years, by Jan. 2034, with the funding and completion of projects outlined in the safety action plan.

Current potential projects include traffic signal and signal improvements, new and improved sidewalks and crosswalks, the installation of bike lanes, turn lanes, and guardrails, reduced speed limits, and safer school routes.

Funding has been provided by the U.S. Department of Transportation's Safe Streets and Roads for All (SS4A) grant to develop the plan, which they applied for and were awarded last year.

Coryell County was one of 25 SS4A Safety Action Plan (SAP) awards in the State of Texas in 2022.

Since public involvement is essential to the development of an SAP, a survey was conducted from Jan. 5 through Feb. 29 for citizens of Coryell County to complete. With 318 responses to the survey, locals provided 131 points on a map of Coryell County to identify road with safety concerns.

Post cards alerting citizens of Coryell County to the survey were mailed out to 17,000 residential addresses.

For more information, visit https://coryell-county-sap.com.

The Commissioner's Courtroom is located at 800 East Main Street.

Appendix D: Public Meeting Attendees

Coryell County SS4A Public Meeting

SIGN IN SHEET April 4, 2024

1. Justin Latham
2. Gary Chumley
3. [illegible]
4. K. Mathis
5. Ryan Baham
6. Celeste Drake
7. Kaylee Dusang
8. Cathy Long
9. Casey Childers NRS
10. Marie T. Dominguez
11.
12.
13.
14.
15.

Appendix E: Proposed Actions

Focus Area	Proposed Action	Safety Concerns	Considerations	FHWA Benefit Cost Ratio (if available)	FHWA Total Crash Reduction (if available)	FHWA Fatal/ Severe Injury Crash Reduction (if available)	Resources
Speed Management	Appropriate Speed Limits	Excessive speeds, dangerous road conditions, increasing ADT	Pedestrian / bicycle activity, crash history, land use, intersection spacing, driveway density, roadway geometry, traffic volume		Varies with application		Speed Limits
	Variable Speed Limits	Inadequate visibility, congestion, work zones, inclement weather	Effective on urban or rural freeways, often implemented with road weather information systems	9:1 - 40:1	34%	51%	Variable Speed Limits
Roadway Departures	Wider Edge Lines	Inadequate visibility, driver inattention	Low cost, presence of curves, increased rural nighttime traffic	25:1	37%	22%	Wider Edge Lines
	Safety Edge	Inadequate visibility, driver inattention	Low-cost, ideal around rural erodible shoulders	700:1 - 1,500:1	21%	11%	Safety Edge
	Road Curve Delineation	Inadequate visibility, driver inattention, excessive speeds	Use systematic approach to identify problem curves, apply appropriate strategies in advance of curve and /or within curve. These strategies include pavement markings, warning signs / reflective strips on signposts, chevron signs, sequential dynamic chevrons	Varies with application	Varies with application	Varies with application	Road Curve Delineation
	Rumble Strips	Inadequate visibility, driver inattention	Can be edge-line or centerline, low-cost, easy to install during reconstruction and resurfacing projects	>100:1	up to 51%	up to 64%	Rumble Strips
	Road Curve Improvements	Inadequate visibility, driver inattention	Line of sight, road ditch steepness, adding widening shoulders	Varies with application	Varies with application	Varies with application	Road Curve Improvements
	Median Barriers	No separation of users, driver impairment	Can be used on high-speed roads that have a head-on crash risk, can be cable, metal, or concrete		97%		Median Barriers
Road Intersections	Reflective Signal Backplates	Inadequate visibility, driver inattention	Low-cost, standard improvement for signalized intersections		15%		Reflective Signal Backplates
	Reduced Left Turn Conflict Intersection	Excessive vehicular conflict, congestion, no separation of users	This can be used when left turns across traffic is an issue. Install restricted crossing U-turn or median U-turn		Varies with application	Varies with application	Reduced Left Turn Conflict intersection

Focus Area	Proposed Action	Safety Concerns	Considerations	FHWA Benefit Cost Ratio (if available)	FHWA Total Crash Reduction (if available)	FHWA Fatal/ Severe Injury Crash Reduction (if available)	Resources
Pedestrians /Bicycles	Yellow Change Interval	Excessive vehicular conflict, excessive speeds, non-compliance (yield ROW), driver inattention	Yellow too short - drivers cannot stop safely, too long - invites initial red-light running. Consider speed of approaching vehicle, driver perception, intersection geometry.		12%	14%	Yellow Change Interval
	Roundabouts	Excessive vehicular conflict, congestion, excessive speeds	Can be used in urban and rural areas to reduce congestion and transition from high to low-speed areas.		82%		Roundabouts
	Dedicated Turn Lanes	Excessive vehicular conflict, congestion, no separation of users	Improves safety at major road approaches, especially with significant amount of turning traffic.		Varies with application	Varies with application	Dedicated Turn Lanes
	Systematic Safety Countermeasures at Stop-Controlled Intersections	Inadequate visibility, driver inattention, excessive speeds, non-compliance (yield ROW), driver inattention, driver impairment	Includes multiple low-cost countermeasures: intersection warning signs, reflective sheeting on signposts, enhances pavement markings, stop bar, removal of vegetation to improve sight distance	12:1	15%	27%	Systematic Safety Countermeasures at Stop-Controlled Intersections
	Crosswalk Visibility Enhancements	Inadequate visibility, excessive speeds, non-compliance (yield ROW), driver inattention	High-visibility crosswalks at all mid-block pedestrian crossings and in controlled intersections, improved lighting at crosswalks, enhanced signing, and pavement markings.		42%		Crosswalk Visibility Enhancements
	Leading Pedestrian Interval (LPI)	Inadequate visibility, non-compliance (yield ROW), driver inattention	LPI's allow pedestrians to enter the crosswalk at an intersection 3-7 seconds before turning vehicles are given a green light		13%		Leading Pedestrian Interval
	Pedestrian Hybrid Beacons (PHB)	Inadequate visibility, non-compliance (yield ROW), driver inattention	PHB's can be used at higher-speed roadways and uncontrolled intersections. Once activated it signals for drivers to slow, stop, and proceed.		29%	15%	Pedestrian Hybrid Beacons
	Rectangular Rapid Flashing Beacons (RRFB)	Inadequate visibility, non-compliance (yield ROW), driver inattention	RRFB's are flashing lights that accompany pedestrian warning signs and are activated by the pedestrian when crossing		47%		Rectangular Rapid Flashing Beacons

Focus Area	Proposed Action	Safety Concerns	Considerations	FHWA Benefit Cost Ratio (if available)	FHWA Total Crash Reduction (if available)	FHWA Fatal/ Severe Injury Crash Reduction (if available)	Resources
Crosscutting (Multiple Focus Areas)	Road/Bicycle Lane Reconfiguration	Inadequate visibility, excessive vehicular conflict, excessive speeds, driver inattention	One countermeasure involves converting 4 roadway lanes into 3 roadway lanes, and 2 bicycle lanes. Another countermeasure is to reallocate space in the right-of-way through roadway reconfiguration. Countermeasure is dependent on road type. Existing bike lanes can be improved with flexible delineator posts that separate the bike lane from the road.		19-47%		Road/Bicycle Lane Reconfiguration
	Walkways / Sidewalks	No separation of users	It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is a large amount of pedestrian activity		65-89%		Walkways / Sidewalks
	Road Safety Audit	Inadequate visibility, excessive speeds, excessive vehicular conflict, congestion, non-compliance (yield ROW), no separation of users, driver inattention, driver impairment	Audits are performed by a multidisciplinary team, account for all road users and road capabilities, documented in formal report, require formal response from road owner		10-60%		Road Safety Audit
	Pavement Friction Management	Inadequate visibility, excessive speeds, congestion, driver inattention, driver impairment	Should be applied where increased friction demand is needed: horizontal curves, intersection approaches, wet weather crashes, rear-end crashes, crosswalk approaches		20%		Pavement Friction Management
	Lighting	Inadequate visibility, driver inattention, excessive vehicular conflict, congestion, no separation of users	Can be continuous roadway segments or at specific intersections and pedestrian crossings, consider history of crashes at night, traffic volume, presence of crosswalks		28-42%		Lighting

Focus Area	Proposed Action	Safety Concerns	Considerations	FHWA Benefit Cost Ratio (if available)	FHWA Total Crash Reduction (if available)	FHWA Fatal/ Severe Injury Crash Reduction (if available)	Resources
Stream Crossings	Stream Crossing signs	Inadequate visibility, excessive speeds, driver inattention, driver impairment	This can be signs and/or flashing lights warning of a dangerous water				Stream Crossing signs
	Stationary Flood Gauges	driver inattention, driver impairment, driver inattention	A depth gauge may be installed when a roadway frequently floods				Stationary Flood Gauges
	Stream Crossing Structure Reconfiguration	Inadequate visibility, driver inattention, excessive speeds	Includes multiple low-cost countermeasures that improve the accessibility and safety of a roadway stream crossing including, resurfacing eroded lane(s), elevating the travel surface using culverts or small bridges, adding guard rails on elevated structures				Stream Crossing Structure Reconfiguration

Appendix F: Locations of Crossings

Project Number	Location Description (Intersection)
CRXING001	County Road 356
CRXING002	County Road 355
CRXING003	Bald Knob Road Bridge
CRXING004	CR 315, .85 miles from FM107
CRXING005	CR 106, 0.3 miles south of CR102
CRXING006	CR 274, near CR267
CRXING007	Winter Rd/ Coryell Creek
CRXING008	CR 303
CRXING009	CR 101
CRXING010	CR 101
CRXING011	Straws Mill Rd
CRXING012	Table Rock Creek Rd
CRXING013	Greenbriar Rd
CRXING014	CR 162
CRXING015	Prairie View Rd
CRXING016	Arrowood Ln
CRXING017	CR 133
CRXING018	CR 274
CRXING019	Lutheran Church Rd
CRXING020	Greenbriar Rd
CRXING021	CR 197
CRXING022	CR 198

Appendix G: Maps of Crossings

Coryell County Safety Action Plan Stream Crossing Projects

Legend

- Cities
- Streams / Rivers
- Lakes / Ponds
- SAP Crossings

State of Texas Overview

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