# Bridge Street and State Street Intersections Safety Study

Safety Study
Prepared for: City of Struthers
September 2022

Prepared By: Environmental Design Group

*The community impact people.*

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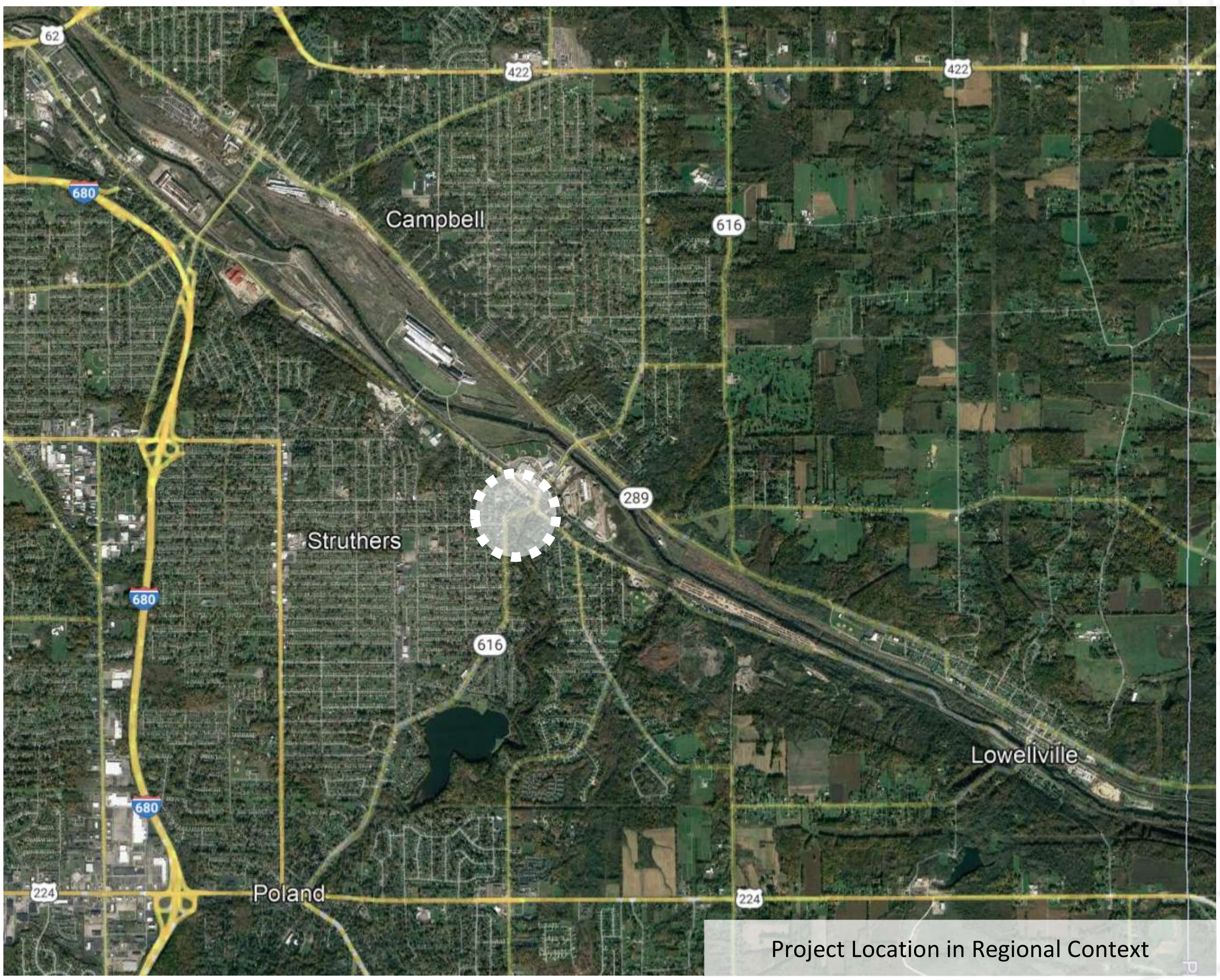
City of Struthers, Ohio
Mahoning County
Intersection: Bridge Street and Lowellville Road, Bridge Street and State Street, and Bridge Street and Terrace Street
Study Completion Date: September 2022
Consultant: Environmental Design Group


# LOCATION MAP



## II. PPURPOSE AND NEED

The City of Struthers has identified a need to examine the downtown State Street and South Bridge Street in terms of pedestrian, bicyclist, and motor vehicular safety. This report articulates the study as performed through review and analysis of crash history, existing conditions, probable causes of crashes, potential solutions, recommendations for safety improvement countermeasures, and a cost estimate associated with those recommendations. The intention is to provide a detailed and multi-faceted plan to improve the safety of residents and travelers in the downtown Struthers area.

## III. EXISTING CONDITIONS

### A. Background

The downtown area of the City of Struthers consists of four main intersections and one railroad crossing. The roadway intersections are Lowellville Road (minor arterial) and South Bridge Street (principal arterial), South Bridge Street and State Street (minor arterial), Main Street (local road) and South Bridge Street, and South Bridge Street and Liberty Street (local road). The Norfolk Southern Railroad crosses South Bridge Street approximately 125 feet north of the State Street centerline and approximately 145 feet south of the Main Street centerline.

The Ohio State Bike Route 70 follows State Street to South Bridge Street northward. See Figure 1.

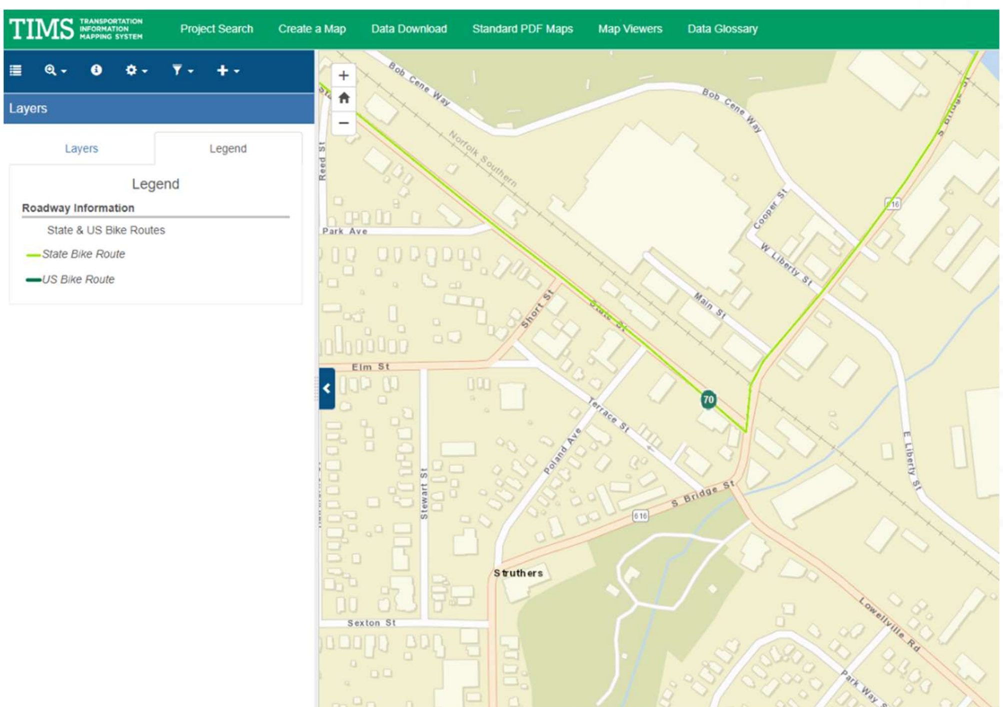



*Figure 1 - ODOT TIMS map of State Bike Route in downtown Struthers.*

Various traffic controls exist throughout the area, including level crossing signals at the railroad (for both vehicular traffic and pedestrian traffic), two traffic signals, and two stop-controlled intersections. See Figure 5 for a diagram showing these traffic controls. The posted speed limit throughout the subject area is 25mph.

The Active Transportation Need in the area reaches level 4 out of 4, as illustrated in Figure 2. The Active Transportation Demand in the area reaches level 3 out of 4, as illustrated in Figure 3.

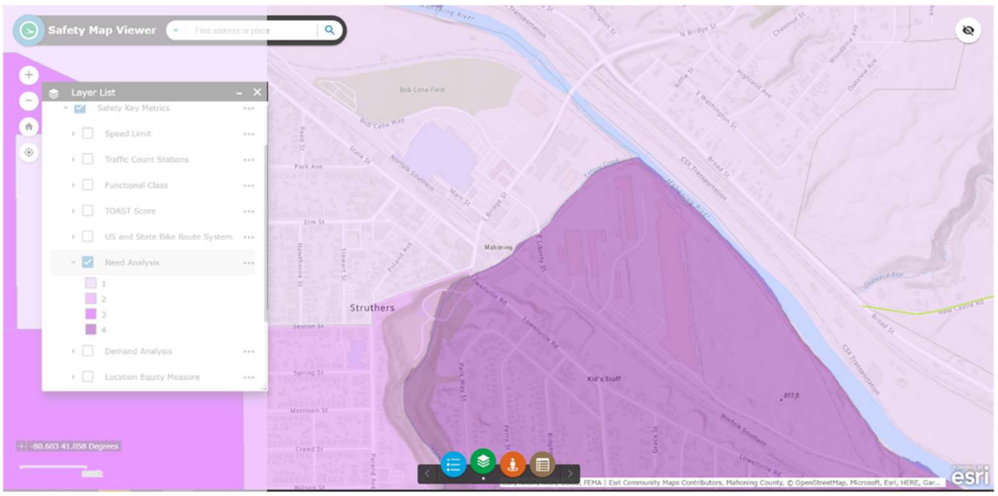



*Figure 2 - Active Transportation Need as illustrated in the ODOT Safety Viewer.*

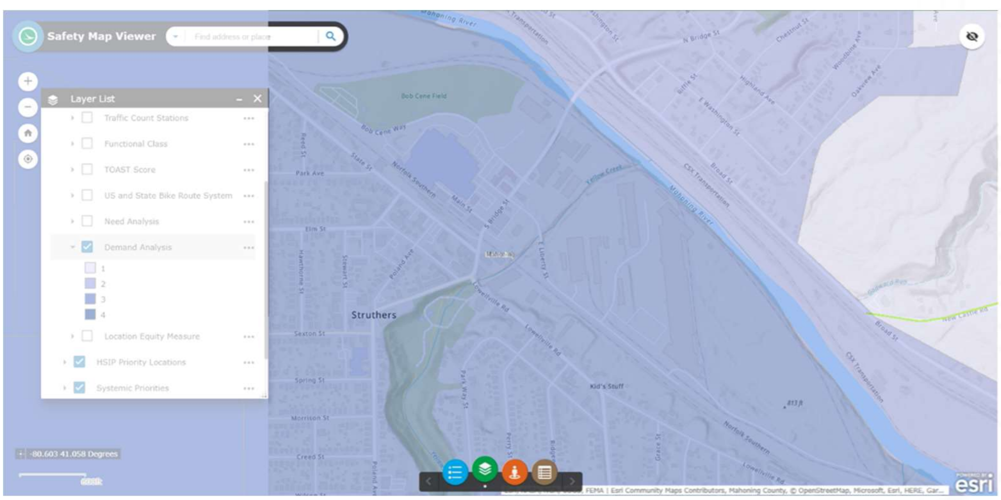



*Figure 3 - Active Transportation Demand as illustrated in the ODOT Safety Viewer.*

## B. Conditions Diagram

Environmental Design Group staff traveled to the intersection for a field review of existing conditions on July 11, 2022. The investigation followed the GORE (Geometry, Operations, Roadway Users/Human Factors, and Environment) Model as described in the ODOT Regional Road Safety Audit Implementation Guide. The time envelope was 2:00pm – 6:00pm and weather conditions were dry and sunny. The field-gathered

information is supplemented with other sources of information from the City of Struthers, ODOT, and Google Earth imaging. The observations and current conditions are described below as visually articulated in
Figure 4. The existing traffic control is depicted in Figure 5. Full sheets are in Appendix A.

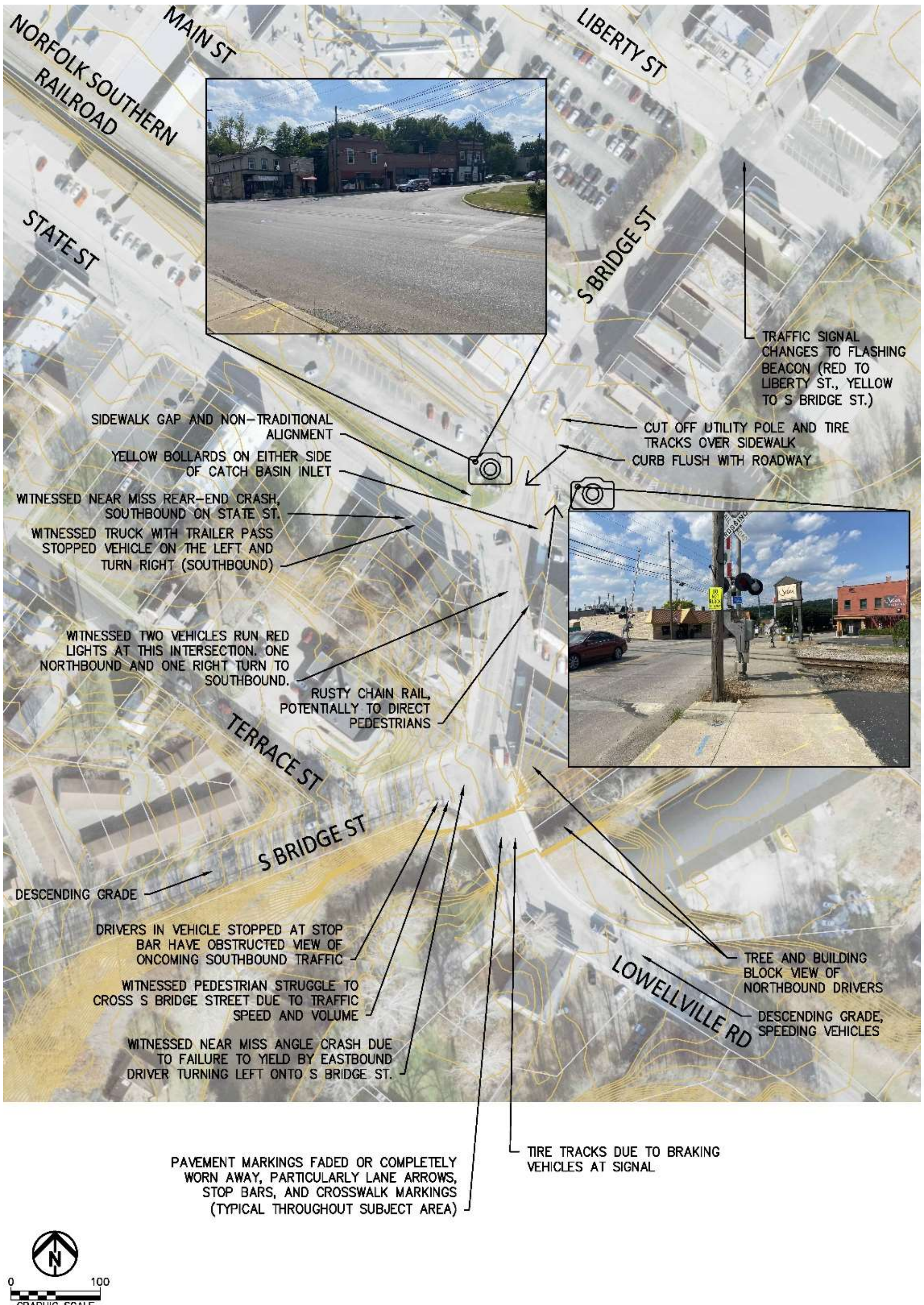


*Figure 4 – Existing conditions within the study area.*

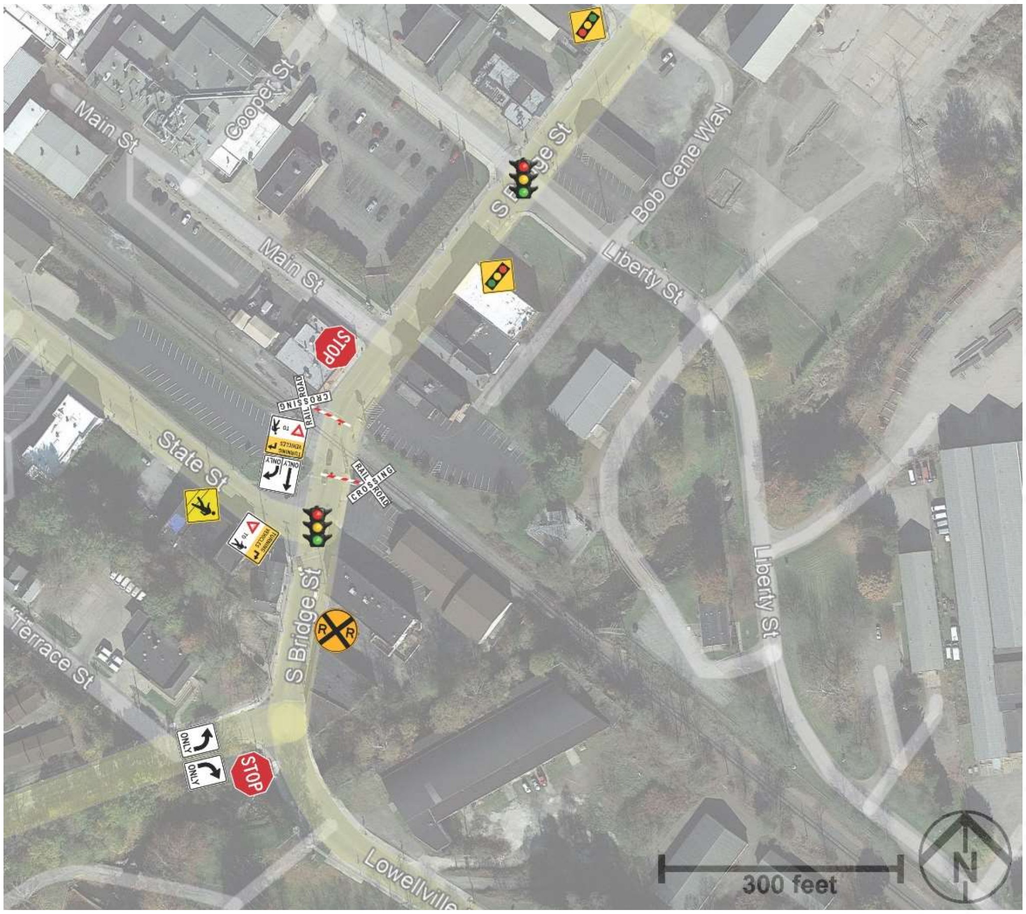



*Figure 5 - Existing signage and traffic control within the study area.*

## C. Physical Condition

See below for site visit GORE Model findings on the physical conditions, along with a detailed discussion.

1. Geometry

   *Roadway elements such as curves, gradients, sight distance, and clear zones.*

   The roadway and sidewalk dimensions vary throughout the subject area and are articulated in Figure 6 and Figure 7. The two curves on South Bridge Street have approximated radii of 149 feet and 213 feet. The lane widths vary throughout the area from 10 feet to 20 feet. Similarly, the width of the sidewalk varies from 5 feet to 10 feet. In some cases, the wide exterior lanes are assumed to include street parking, although minimal street parking was observed during the site review. The curb returns at the intersections of State Street and South Bridge Street with South Bridge Street are relatively large, with approximate 40- to 55-foot radii. Other curb returns at Main Street and Liberty Street have radii near 10 or 25 feet, as is common for urban areas.


*Figure 6 - Facility dimensions, the southern portion of South Bridge Street.*

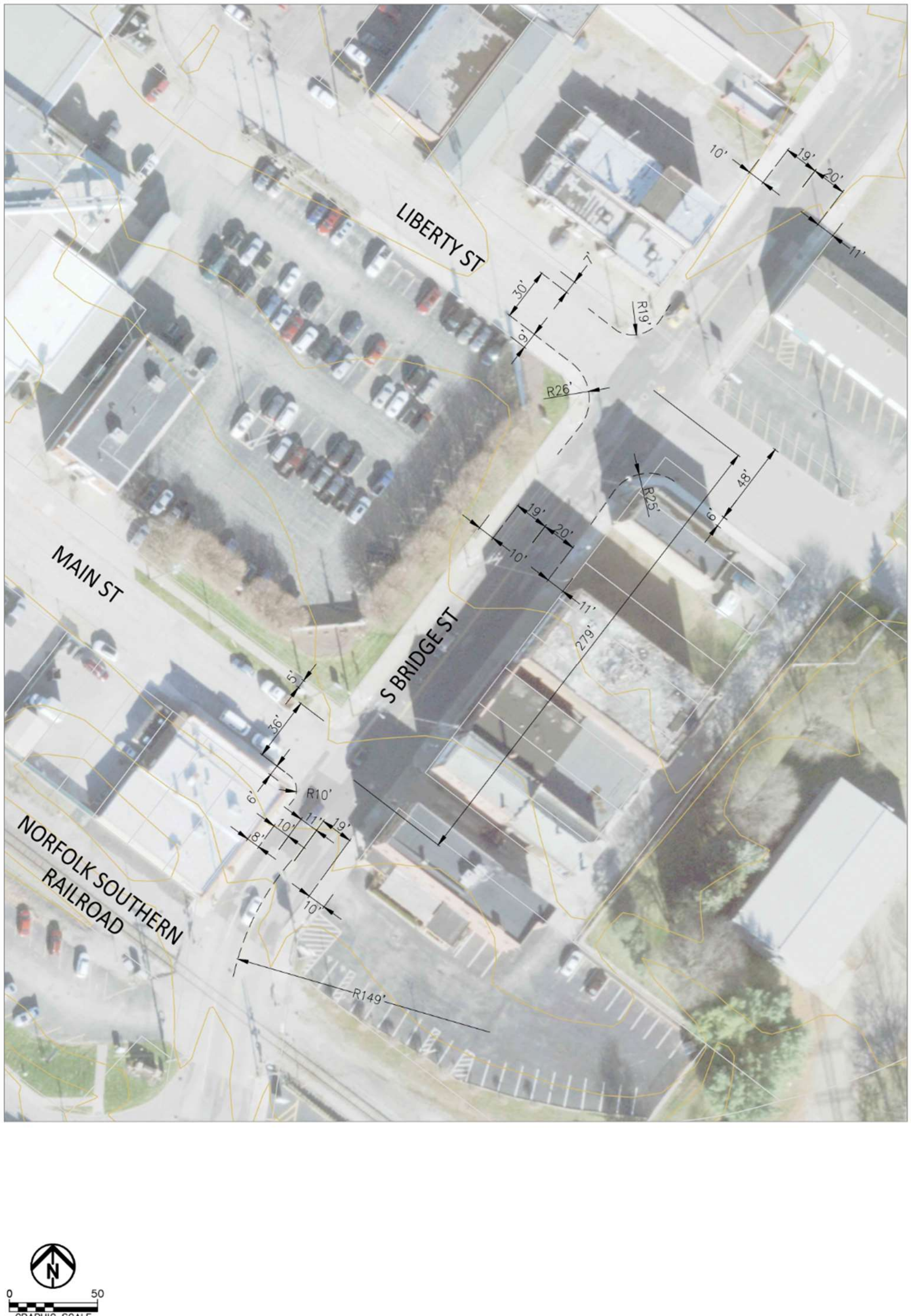



*Figure 7 - Facility dimensions, the northern portion of South Bridge Street.*

The intersections of Liberty Street and Main Street with South Bridge Street are unskewed. The intersection of State Street with South Bridge Street is skewed approximately 29 degrees. The Norfolk Southern Railroad crossing occurs on South Bridge Street between Main Street and State Street on a similar 29-degree skew. South Bridge Street intersects Lowellville Road on the west side of the curved section. The intersections are spaced to create approximately 215- to 280-foot city blocks.

South Bridge Street slopes down eastward to Lowellville Road at approximately 9%, based on GIS contours. Lowellville Road slopes down northward to South Bridge Street at approximately 3.5%. South Bridge Street continues to slope down northward at approximately 2% through the remainder of the subject area. State Street slopes down eastward towards South Bridge Street. Liberty Street and Main Street are relatively flat. On the whole, the subject area is somewhat concave, with the low point at Liberty Street.

Existing Conditions sheets utilizing GIS contours are in Appendix A.

There are some sight challenges and obstructions within the corridor, mainly in the southern portion. The view of northbound drivers on Lowellville Road is blocked due to the alignment curved towards the northeast, with a large tree and the building at 190 South Bridge Street located inside the curve. Due to the angled approach, trees, earth, and buildings, drivers stopped in the left turn lane on South Bridge Street at Lowellville Road must move nearly 40 feet beyond the stop bar to see oncoming traffic from the left. Drivers in the right turn lane must also move beyond the stop bar for a clear view of oncoming traffic from the left. Similarly, eastbound drivers on State Street must move beyond the stop bar for a clear view of oncoming traffic from the right.

As is typical in an urban setting, many elements are located within the clear zones, including utilities, buildings, street furniture, and community signage.

2. Operations

   *How the road is utilized and how effective current operational practices are at preventing or mitigating crashes.*

   The existing traffic control and safety improvement countermeasures at this location include advisory signage, a flashing beacon (the signal at Liberty Street and South Bridge Street functions as a flashing beacon at certain parts of the day), and a pedestrian railroad crossing device.

   Advisory Signage: W3-3 Signal Ahead on South Bridge Street (northbound and southbound at Liberty Street), W11-A2 Pedestrian Crossing on State Street at the South Bridge Street intersection, and R10-15 Turning Vehicles Yield to Pedestrians on all approaches at the South Bridge Street intersection. The southbound W3-3 sign is visible on Google street view from September 2021, but all other signs are not and are presumed to have been installed within the last nine months.

   Speed limit signs showing the 25mph posted speed are located outside the project area.

Observationally, the speeds exhibited by vehicles on South Bridge Street and Lowellville Road approaching the subject area appear in the 35-45mph range, with slowing occurring at intersections and interaction with other traffic. Tire skid marks on the asphalt show higher-than-appropriate speeds are used on the left turn from South Bridge Street onto South Bridge Street.

Many of the pavement markings such as arrows and perhaps crosswalk lines were faded or no longer present. There are several locations where lane assignment signs would have been expected, but none were posted.

During the afternoon site visit, several near-miss crashes and law-averse driving habits were witnessed.

At the intersection of State Street and South Bridge Street:

- An eastbound driver on State Street stopped abruptly to avoid a rear end crash with a parked vehicle.
- An eastbound driver of a truck and trailer passed on the left of a vehicle stopped at the signal and turned right onto South Bridge Street in front of said stopped vehicle.
- An eastbound driver on State Street proceeded through the red light on a right turn without slowing or stopping first.
- A northbound driver ran the red light on South Bridge Street.

At the intersection of South Bridge Street and Lowellville Road:

- A driver eastbound on South Bridge Street turned left onto South Bridge Street without a sufficient gap in northbound traffic, causing the northbound driver to slow abruptly as crash avoidance.

Discussion with a local police officer revealed that many drivers fail to recognize and obey the traffic signal at Liberty Street and South Bridge Street. The signal was installed within the last three years and the at-fault drivers in crashes often state that they forgot the signal was present. The police officer also noted that he regularly tracks vehicle speeds at 35-45mph on South Bridge Street southbound into the study area.

Pedestrians and cyclists were observed navigating the corridor. Pedestrians struggled to find appropriate, safe gaps in traffic to cross both the South Bridge Street – Lowellville Road intersection and the State Street – South Bridge Street intersection. A cyclist was observed swerving between lanes and making a left turn from Lowellville Road onto South Bridge Street westbound with a minimal gap in southbound traffic.

South Bridge Street traffic was stopped at several points during the site visit while trains passed on the Norfolk Southern rail. One train was timed, with the roadway closing at 5:17pm and reopening at 5:22pm. During that time, traffic queued for long distances northbound and southbound on South

Bridge Street at the crossing, as well as eastbound on South Bridge Street at Lowellville Road. The last vehicle in the queue waiting at the stop-controlled South Bridge Street - Lowellville Road intersection did not proceed through the intersection until 5:25pm.

3. Roadway Users/Human Factors
   *The various modes present along the roadway and the potential conflicts that may exist.*

   The site visit occurred on a sunny day in July, which generally welcomes the presence of pedestrians, cyclists, and motorcycles. Several motorcycle operators were observed navigating the study area during the visit. One cyclist was observed riding in the traffic lane on Lowellville Road. Several pedestrians were observed using the sidewalks. Given the proximity of Yellow Creek Park, it is assumed that pedestrian activity is regular throughout the area.

   A post office is located at the northwest corner of South Bridge Street and Lowellville Road, drawing traffic from patrons to trucks and tractor trailers for delivery.

   Industrial buildings located north of Main Street and west of South Bridge Street suggest a heavy component of truck deliveries and also higher traffic at times of shift change.

   Trains are regularly crossing throughout the day, requiring temporary road closures and queueing.

   There are restaurants, shops, and retail businesses within the study area which regularly draw customer traffic during business and evening hours.

   The major conflicts anticipated in this area are pedestrians at crossings with vehicular traffic, cyclists along the streets (without bicycle infrastructure), large trucks with smaller vehicles as the trucks navigate tight curves and turns, and all motor vehicles at the intersections.

4. Environment
   *Performance of a roadway under various environmental conditions such as differing weather patterns and lighting scenarios.*

   With descending grades towards South Bridge Street from State Street and South Bridge Street, snowy and icy conditions may contribute to errant vehicles, particularly at the intersections.

   Drainage issues were not noticeable during the site visit and are not expected as the longitudinal grade and cross slopes on South Bridge Street appear to be 2% or more.

Street lighting is present, although there appears to be a gap in the area surrounding the State Street – South Bridge Street intersection. It is expected that the signals are more noticeable at night and in dark conditions.

5. Field Observations

   *Other gathered information not covered in the GORE model.*

   In general, there is quite a bit of street furniture and overhanging items such as wires, mast arms, signage, large utility poles, etc. These items tend to build up over time and often become a distraction to drivers, if not complete blockages to oncoming traffic.

   The owners of Struthers Nutrition at 2 State Street provided insight into the daily operations of the area, stating that many drivers simply do not stop at stop signs or red lights. The police officer mentioned that while on-street parking is not illegal, many choose not to park on the street, particularly during high volume traffic hours, as space (width-wise) is limited and parked vehicles are often hit.

   A utility pole has been cut off near the base at the inside of the curve, on the east side of South Bridge Street and just north of the railroad tracks. Several tire tracks show frequent instances of vehicles driving over this corner.

   Two yellow bollards have been installed at a catch basin inlet on the east side near 158 South Bridge Street. These may have been a response to wide left turns from vehicles on State Street or possibly to redirect traffic to the drive on the north side of the bollards.

   While sidewalk is available in most portions of the study area, some locations are incomplete, degraded, or non-existent. At the northwest corner of the State Street – South Bridge Street intersection, the sidewalk is discontinuous and placed around the brick-base, electronic City of Struthers sign. The sidewalk on the east side of Lowellville Road, South Bridge Street, is badly worn and cracked with earth and grass significantly overtaking the edge. There are curb ramps at some crossings but not all, and very few crosswalk markings on the pavement. A person using a wheelchair on the west side of South Bridge Street would be unable to cross without additional navigation on the roadway before reaching a location with a low enough curb to reach the sidewalk on the east side. At State Street and South Bridge Street, an old, rusted chain rail appears to be installed to direct pedestrians toward a driveway on the east side.

   The railing on the Lowellville Road bridge over Yellow Creek does not meet the current ODOT minimum dimensions for pedestrian facilities. According to the ODOT Multimodal Design Guide section 4.7, if the primary purpose of the railing is to separate users from a drop-off, the minimum height should be 42 inches above the walk surface. Currently, the top of rail is 36 inches above the walk surface.

The house at property 173 South Bridge Street has been removed in recent months. The driveway remains.

It appears there may have been some work with replacing electric utility poles and light posts in recent months.

See Figure 8 through Figure 23 of this document for intersection views and photos.

*Figure 8 – Property at 173 South Bridge Street with house removed.*

*Figure 9 – Evident recent work with light poles.*


*Figure 10 - Evident recent work with utility poles.*

*Figure 11 - Rusty chain rail directing pedestrians to driveway north of rail.*

*Figure 12 - Yellow bollards at catch basin inlet.*

*Figure 13 - Curb flush with the roadway at the inside of the curve, east side of South Bridge Street, north of the railroad.*

*Figure 14 - Inside of curve, east side of South Bridge Street with cut-off pole and tire marks over the edge.*

*Figure 15 - Pedestal without a pole, normally covered by an orange cone.*


*Figure 16 - R10-15 pedestrian crossing signage.*


*Figure 17 - Faded crosswalk markings.*


*Figure 18 - View of South Bridge Street intersection from State Street eastbound.*


*Figure 19 - View of Liberty Street intersection from South Bridge Street northbound.*

*Figure 20 - View of Lowellville Road southbound at South Bridge Street. Example of wide lanes.*


*Figure 21 - Rail crossing with pedestrian and vehicular protection.*

*Figure 22 - Large curb return at State Street.*


*Figure 23 - Insufficient pedestrian facility south of South Bridge Street, east side of Lowellville Road.*

# IV. CRASH DATA AND ANALYSIS

## A. Available Traffic Data

Turning count movements and volume analyses for this safety study were sourced from StreetLight Data. All data, unless otherwise noted, is captured for the period of May 31, 2021 (Memorial Day) through September 6, 2021 (Labor Day). This period was chosen because of the increased number of drivers due to non-inclement weather and school being out of session. Figure 24 shows turn count movements for the intersections that were analyzed as part of this study.

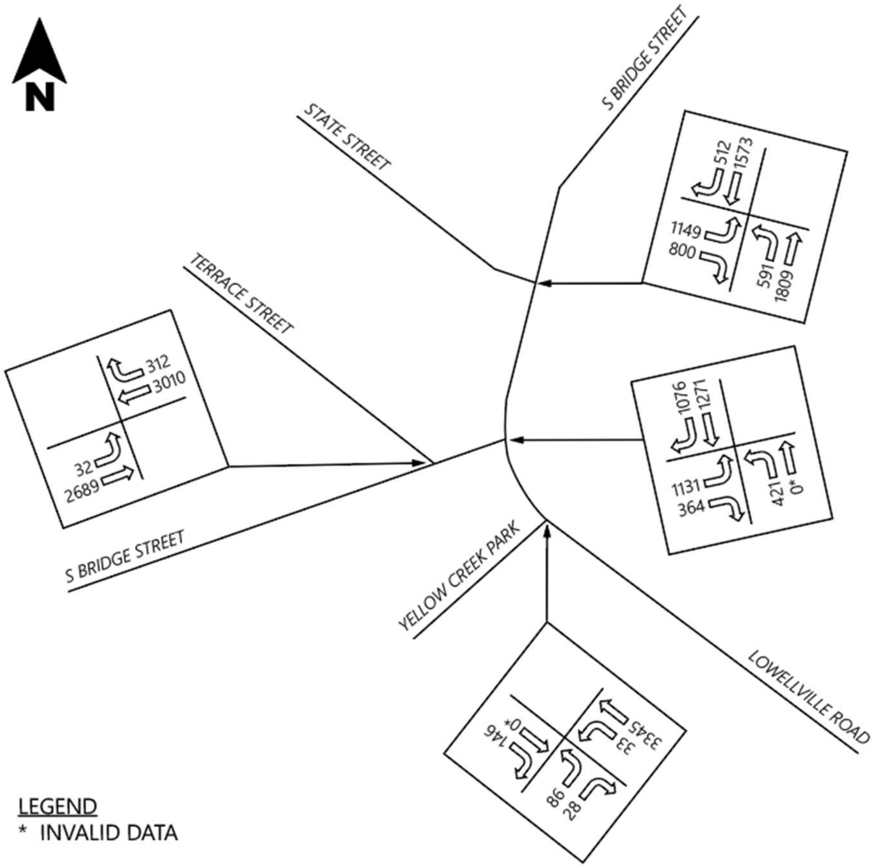



*Figure 24 – All-day turning movement counts for summer (5/31/2021 – 9/6/2021)*

Turning count movements were performed for the intersection of Yellow Creek Park with Lowellville Road during winter/spring, summer, and fall of 2021. Summer (Memorial Day through Labor Day) saw the largest volume of travel into and out of Yellow Creek Park, likely due to favorable weather and school being out of session. The drive into Yellow Creek Park (westbound) had the highest volume of traffic between 5:00pm and 6:00pm. The highest volume of traffic northbound on Lowellville Road was between 4:00pm and 5:00pm, and the highest volume of traffic on Lowellville Road southbound was between 5:00pm and 6:00pm. The winter/spring period (1/1/2021 – 4/1/2021) saw the lowest traffic volume traveling into/out of the park, likely due to Ohio's winter weather conditions discouraging people from using the park. Note that StreetLight did not register through-traffic traveling southbound onto Lowellville Road.

The intersection of Bridge Street and Terrace Street was also analyzed using StreetLight. The turning movement count analysis for Terrace Street shows a total of 344 vehicles turning onto the one-way road. The traffic analysis of Bridge Street eastbound shows a volume peak between 5:00pm and 6:00pm. The peak for westbound traffic is between 7:00pm and 8:00pm.

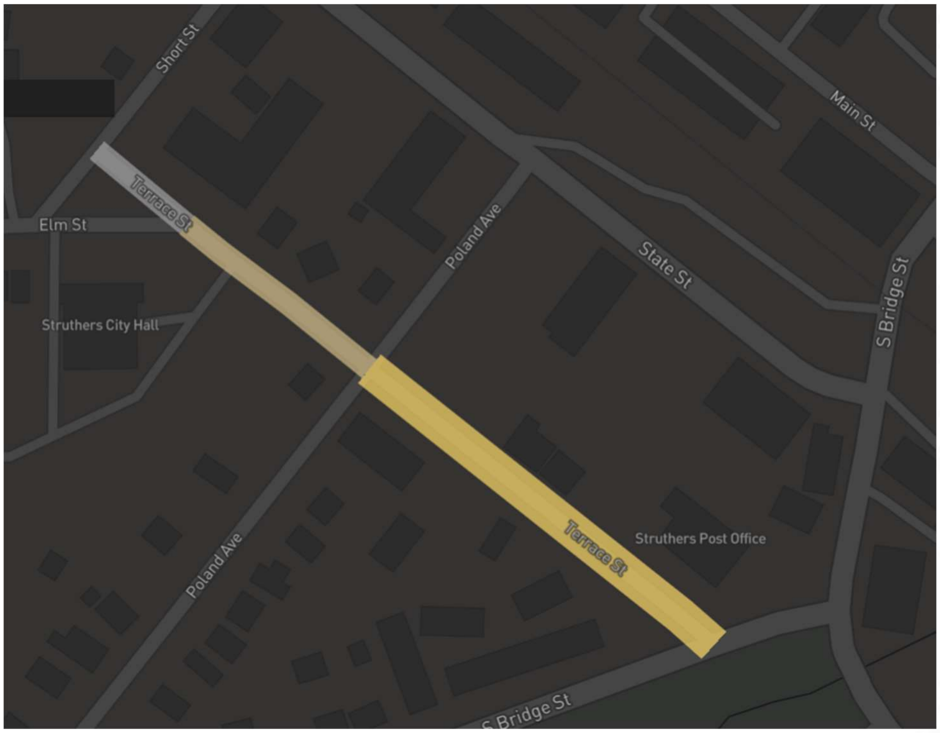


*Figure 25 – Terrace Street 2019 AADT, with gold being higher AADT and gray being lower AADT*

The turn count movement data for the intersection of Bridge Street and Lowellville Road shows a high number of vehicles traveling on Bridge Street turning left or right to stay on Bridge Street. These movements are also two of the highest turn counts in the study area, confirming that Bridge Street is used as a thoroughfare in this area. The highest volume of traffic eastbound and southbound on Bridge Street occurs from 5:00pm to 6:00pm, and the highest volume of traffic northbound on Lowellville Road occurs between 4:00pm and 5:00pm.

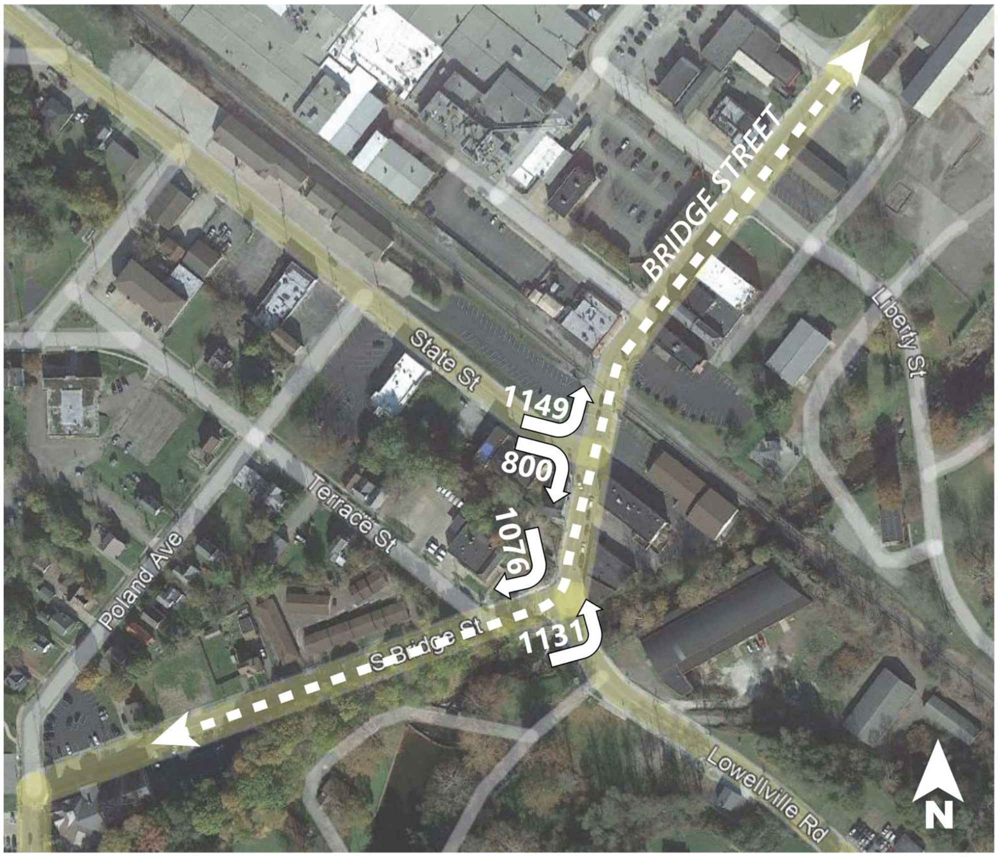


*Figure 26 – Bridge Street as a thoroughfare based on high turning movement counts.*

The turn count movement data for the intersection of Bridge Street and State Street indicates a large number of vehicles turning left from State Street onto Bridge Street, furthering the confirmation that Bridge Street is the main thoroughfare of this area. The highest volume of traffic northbound on Bridge Street and eastbound on State Street occurs from 5:00pm to 6:00pm, and on southbound Bridge Street the highest volume occurs between 4:00pm and 5:00pm.

StreetLight Data processes anonymized location records from smartphones and navigation devices in connected cars and trucks. ODOT typically considers StreetLight Data reliable. Per the StreetlightData.com website,

*"Every month, we ingest, index, and process vast amounts of location data from connected devices and the Internet of Things, then add context from numerous other sources like parcel data and digital road network data – to develop a view into North America's vast network of roads, bike lanes, and sidewalks. Next, our proprietary data processing engine, Route Science®, algorithmically transforms the inputs into contextualized, aggregated, and normalized travel patterns. We validate them using 1,000s of traffic counters and embedded sensors – and enrich them further using your own data sources, like transit ticketing or shared mobility data. Route Science® then normalizes and aggregates the data into analytics, delivering unique insights into how vehicles, bicycles, pedestrians, and bus and rail passengers move on virtually every road and Census Block."*

## B. Crash Data Summaries

The study area consists of four main intersections, which will be reviewed separately at the end of this section. As the intersections are close in proximity, there are benefits to studying the area as a whole as well. This is an urban area with a typically higher traffic volume and therefore the crash history from the previous three years (2019 – 2021) may be considered. Traffic crashes that have been reported to the Ohio Department of Public Safety are obtained from the ODOT TIMS webpage.

Each crash from the data set is reviewed with particular attention to critical elements of the crash such as type of crashes, locations, contributing factors, driver actions and reactions, and severity of injuries. Some crashes are removed from the data set as they occurred outside project limits, are animal related, or contain other reasons rendering the crash non-applicable. Any necessary corrections are made to the crash data before further processing.

Once the refined collection of crash data is modified, the ODOT Crash Analysis Module (CAM) tool is used to organize the crash data into tables and charts. Information is tabulated in various categories based on significant crash characteristics such as the previously noted critical elements as well as the date, time of day, weather conditions, road conditions, and other relevant aspects. The complete crash information tables are provided in Appendix B of this report.

From 2019 through 2021, a total of 22 crashes were reported throughout the studied area. The most common type of crash reported during this period was the rear end crash, which accounted for 10 crashes, or 45%. The second most common type of crash reported was the angle crash, which accounted for four crashes, or 18%. The fixed object crash occurred three times, or 14%, followed by two left turn crashes, or 9%. Other types of crashes – right turn, backing, head on – occurred once each, or 5%. See Figure 27.

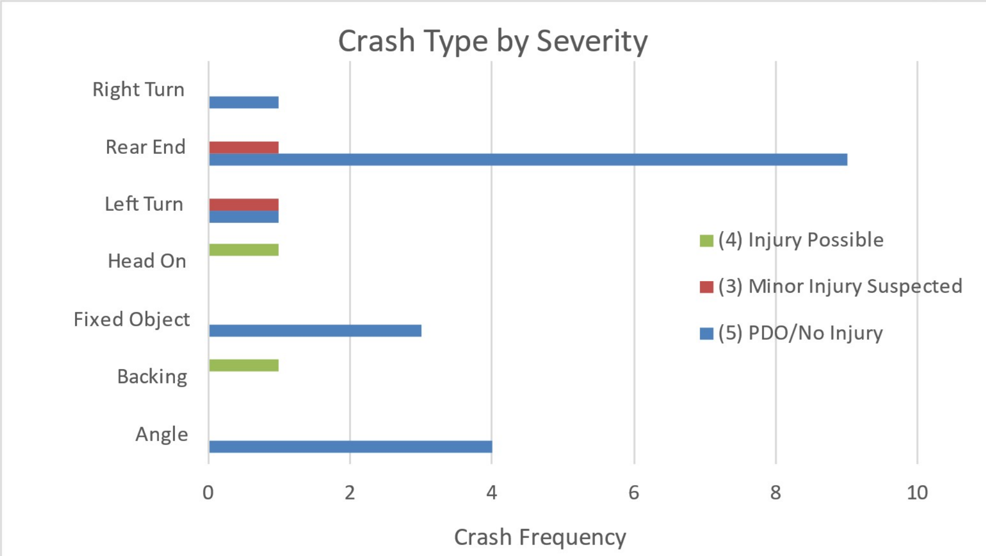



*Figure 27 – Crash type by severity for study years 2019 – 2021 at Bridge Street and State Street.*

In the three-year accident analysis period, the study area experienced zero fatalities or serious/ incapacitating injuries, four non-severe or minor injuries, and 18 cases of property damage only. See Table 1.

*Table 1 – Crash quantities by injury level for study years 2019 – 2021 at Bridge Street and State Street.*

| **Total Crashes** | **Injury Level** | | | |
|---|---|---|---|---|
| **Crash Type** | **(3) Minor Injury Suspected** | **(4) Injury Possible** | **(5) PDO/No Injury** | **Grand Total** |
| Rear End | 1 | 0 | 9 | 10 |
| Angle | 0 | 0 | 4 | 4 |
| Fixed Object | 0 | 0 | 3 | 3 |
| Left Turn | 1 | 0 | 1 | 2 |
| Right Turn | 0 | 0 | 1 | 1 |
| Backing | 0 | 1 | 0 | 1 |
| Head On | 0 | 1 | 0 | 1 |
| **Grand Total** | 2 | 2 | 18 | 22 |

The most frequent contributing factor noted in the crash data was Following Too Closely / Assured Clear Distance Ahead, which was cited in 10, or 45%, of the identified 22 crashes. The second most frequent contributing factor was Failure to Yield (six crashes, 27%). The remaining contributing factors – Improper Turn, Drove off Road, Left of Center, Improper Passing, Improper Backing, and Swerving to Avoid – each occurred once, or 5% each.

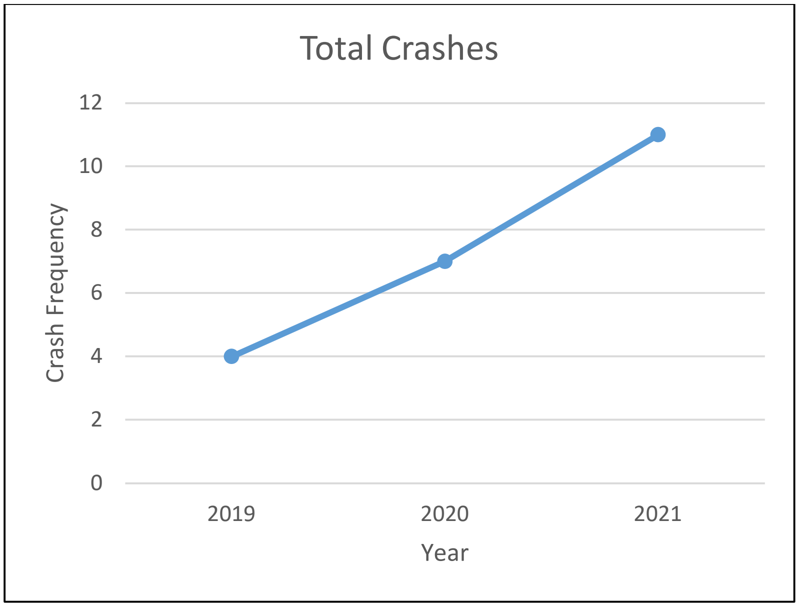



*Figure 28 - Total crashes for study years 2019 – 2021 at Bridge Street and State Street.*

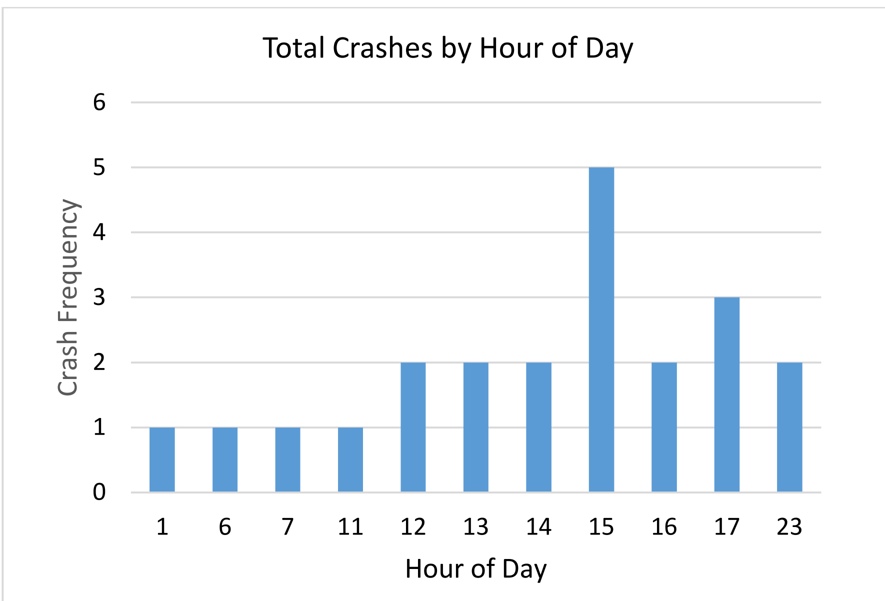



*Figure 29 - Total crashes by hour of day for study years 2019 – 2021 at Bridge Street and State Street.*

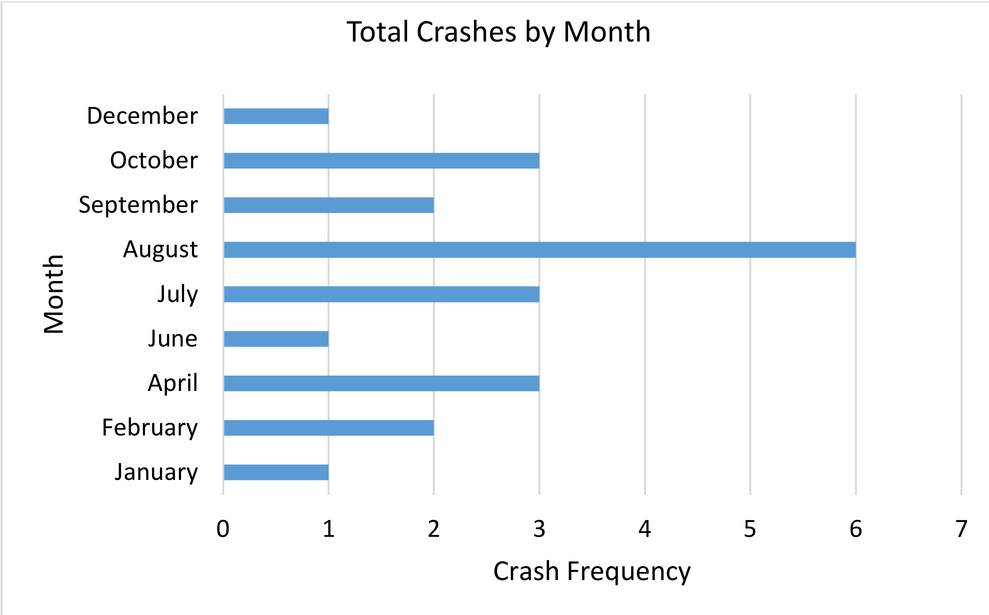



*Figure 30 - Total crashes by month for study years 2019 – 2021 at Bridge Street and State Street.*

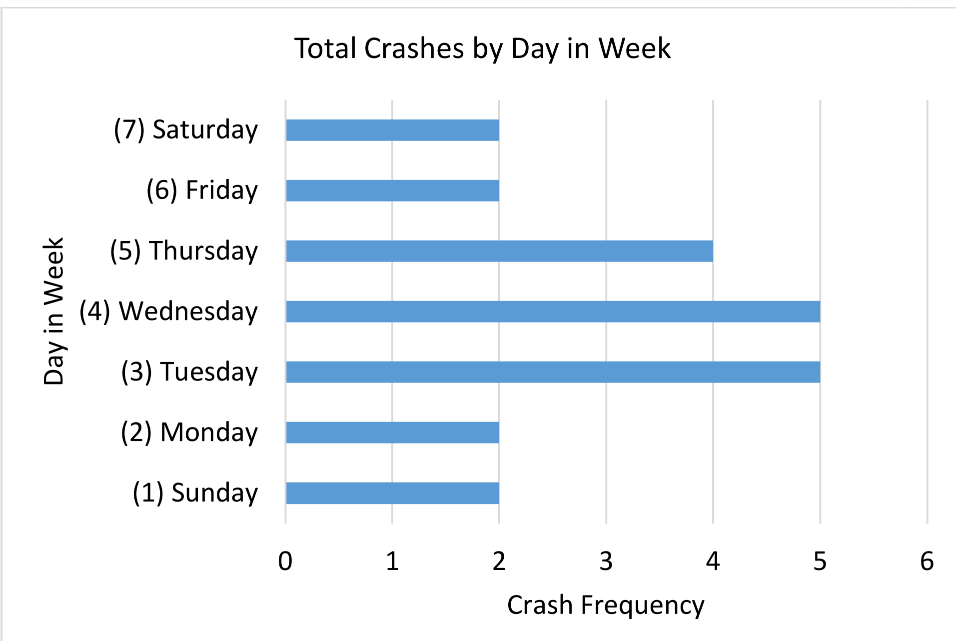



*Figure 31 - Total crashes by day of week for study years 2019 – 2021at Bridge Street and State Street.*

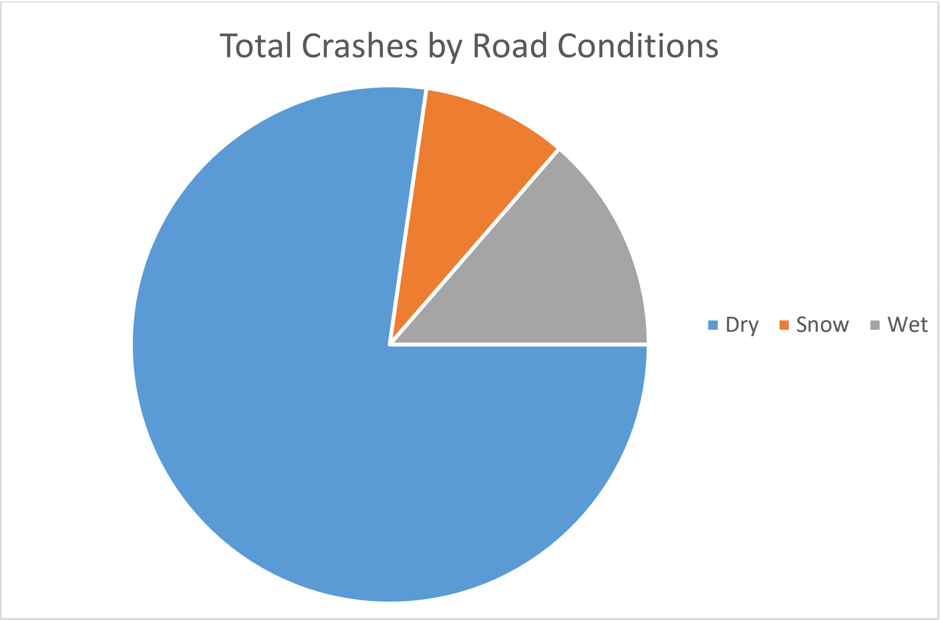



*Figure 32 - Total crashes by road condition for study years 2019 – 202 at Bridge Street and State Street.*

The crashes were aggregated in the following elements of the study area:

- Six crashes (27%) occurred at the intersection of South Bridge Street and Liberty Street and all were rear end crashes due to Following Too Closely / Assured Clear Distance Ahead.
- Six crashes (27%) occurred at the intersection of South Bridge Street and Lowellville Road and five were angle crashes due to Failure to Yield. One was a backing crash due to Improper Backing.
- Four crashes (18%) occurred at the intersection of South Bridge Street and State Street. Two were rear end crashes due to Following Too Closely / Assured Clear Distance Ahead, one was a sideswipe-passing crash due to Improper Passing, and one was a fixed object crash due to Improper Turn.
- Two crashes (9%) occurred at the intersection of South Bridge Street and Main Street and both were rear end crashes due to Following Too Closely / Assured Clear Distance Ahead.
- Of the remaining four crashes, two (9%) occurred on State Street northwest of the intersection with South Bridge Street and two (9%) occurred on South Bridge Street between State Street and Main Street.

Other applicable data gleaned from the crash reports:

- The number of crashes in the area increased with each year; four in 2019, seven in 2020, and 11 in 2021.
- Two crashes (9%) were reported as a Hit-Skip, and therefore the at-fault driver characteristics and actions are unknown.
- Zero crashes were reported in relation to drugs or alcohol.

- Eight crashes (36%) were reported to have involved a distracted driver.
- There were six crashes (27%) involving a Young Driver and in two of those crashes, the Young Driver was at fault.
- There were eight crashes (36%) involving an Older Driver and in five of those crashes, the Older Driver was at fault.
- The heaviest concentration of crashes occurred during the 3pm hour (5 crashes, or 23%), followed by the 5pm hour (3 crashes, or 14%). The other hours of the day saw two, one, or no crashes.
- Tuesday and Wednesday each experienced five crashes, or 23% each.
- The month with the highest number of crashes was August (6 crashes, or 27%), followed by April, July, and October (3 crashes each, or 14% each).
- Most of the crashes (17 crashes, or 77%) occurred on dry road conditions, while three occurred on wet roads (14%), and two on snowy roads (9%).
- Four crashes (18%) occurred not at an intersection. At intersections, 10 crashes (45%) occurred at intersections with signalized traffic control and eight crashes (36%) occurred at intersections with one- or two-way stop controls.
- One crash (5%) involved the operator of a motorcycle.

## C. Crash Diagram

The Collision Diagram can be found in Figure 33 and in Appendix C.


*Figure 33 – Crash Diagram for study years 2017 – 2021.*

## D. Crash Graphs and Tables

Crash graphs and tables from the ODOT CAM tool are in Appendix B. The most relevant graphs pertaining to the analysis discussion are included in Figure 27 - Figure 32 in a previous section of this report.

## E. Probable Causes and Identification of Potential Countermeasures

The downtown Struthers area has several factors and characteristics that lead to crashes. A review of crash reports, a field investigation, discussions with police, and other researchers point to the following probable causes for various crashes throughout the State Street and Bridge Street area:

1. Poor visibility and anticipation of the signal at Bridge Street and Liberty Street,
2. Excess congestion and waiting, which is exacerbated by frequent train passings, and
3. Too narrow lanes when parking is in use, too wide lanes when parking is not in use.

These are not the only probable causes, but likely the most prominent. The discussion below illustrates these probable causes and the safety improvement countermeasures that could be implemented as potential solutions.

**Poor visibility and anticipation of the signal at Bridge Street and Liberty Street.**
The signal at Bridge Street and Liberty Street has been in place for only five years. Previously, Bridge Street was not stop-controlled. Residents, employees, and other people that have driven this area for longer than five years may fail to recognize or remember that the intersection is now signalized. In fact, a police officer confirmed that many of the drivers cited for Ran Red Light stated that they forgot about the signal or did not notice the red light. Drivers do not anticipate the potential need to stop.

The signal is not always on a red-green phase cycle. During the field review, it was noted that the signal switched to a flashing beacon style operation, with Bridge Street traffic receiving the yellow and Liberty Street with the red. This setting favors the north/south traffic on Bridge Street which is significantly higher than that of Liberty Street, however, it causes drivers to not expect a stop at the intersection. This results in more Ran Red Light actions and also increases the likelihood of Rear End crashes as drivers are “surprised” by the direction to stop. Drivers do not anticipate the potential need to stop.

The visibility of the signal is less than desirable. There is only one signal serving the entire intersection, hanging in the center. The signal head is small and not especially noticeable against the background when northbound or southbound. The W3-3 “signal ahead” signage is placed only 160 feet ahead of the stop northbound and 185 feet ahead of the stop southbound, which does not provide enough time and space for a driver to perceive, make a decision, and react. The signs are also set on the outside edge of the driver’s cone of vision due to the wide lanes. See Figure 35 for a representation of the poor visibility of the signal and advisory signage.

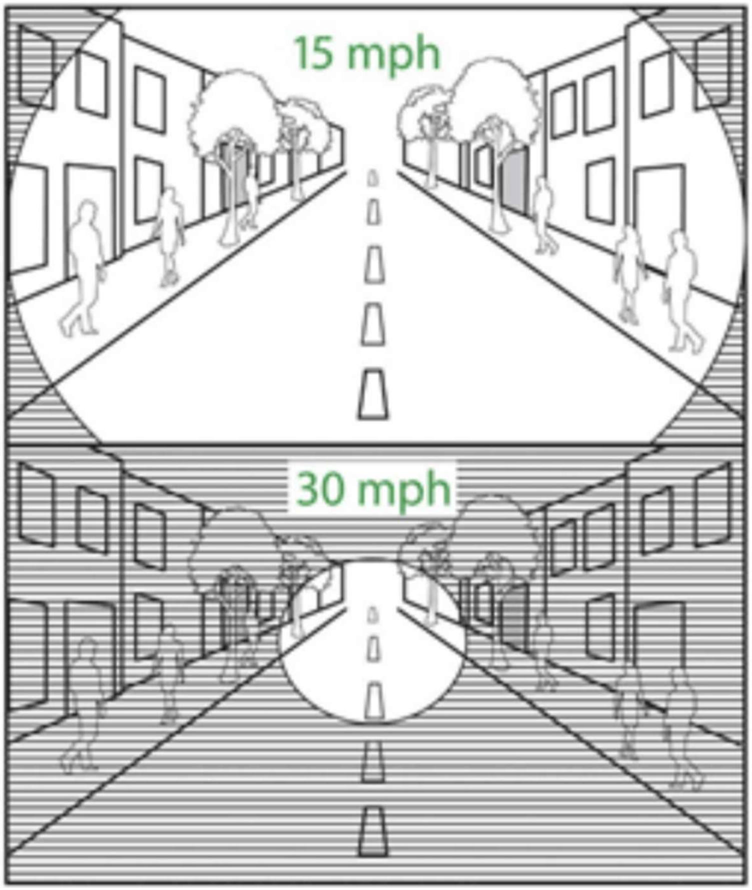


*Figure 34 - Field of vision based on the speed of motorist (source: Walkable City Rules)*


*Figure 35 – Poor visibility northbound on S. Bridge Street.*

Safety improvement countermeasures that lead to better signal visibility and anticipation are:

- Provide two signal heads for the approach lane, such that at least one is directly over the lane of travel,
- Install 12” signal heads instead of the 8” signal heads currently in place,
- Include signal back plates for increased visibility,
- Install W3-3 “signal ahead” signage farther ahead of the intersection to provide ample time to react,
- Consider placing the signage overhead, while not blocking view of the signal, to improve perception of the sign,
- Move the curbs in to reduce the width of the lane and bring the signage within the cone of vision,
- Maintain the signal on green/red phasing and install detectors on Liberty Street approaches to favor north-south travel while providing opportunities for east-west travel when needed, and
- Install pedestrian crosswalks for improved intersection visibility and pedestrian signals and pushbuttons to maintain pedestrian mobility through the intersection.

**Excess congestion and waiting, which is exacerbated by frequent train passings.** In the downtown Struthers area, many roadways converge to a central setting, with a portion of Bridge Street serving as a thoroughfare. This places the intersections especially close to one another, with little room for storage between. The signals on Bridge Street at State Street and Liberty Street do not appear coordinated, which results in a disjointed traffic system. During the evening peak hour, the stop-controlled Bridge Street at Lowellville Road develops long queues on Bridge Street eastbound with minimal gaps for that traffic to proceed onto Bridge Street/Lowellville Road or for drivers northbound on Lowellville Road to turn left onto Bridge Street.

The Norfolk Southern rail crossing Bridge Street at the center of town often causes long queues and delays throughout the area. Queues develop on Bridge Street eastbound at the Lowellville Road intersection and also on State Street eastbound at the Bridge Street intersection. When the train has passed and the roadway is opened, some drivers must wait several minutes before they can proceed through the intersection which they were approaching.

This type of congestion and repeated waiting times while navigating downtown can lead to impatience and frustration among drivers, which in turn, often leads to discourteous, risky, and dangerous driving behavior. Running red lights, entering traffic with insufficient gaps, and other aggressive actions are typical outcomes. As discussed in the existing conditions, this behavior was witnessed several times in a single afternoon.

While slower driving in a populated area is advantageous and encouraged for the safety of pedestrians, cyclists, and other drivers, this should be accomplished through traffic calming rather than excessive waiting at traffic signals. Safety improvement countermeasures that reduce excessive congestion and waiting yet maintain a lower exhibited speed through the area are:

- Install a traffic signal at Bridge Street and Lowellville Road to enable drivers on Bridge Street to navigate the intersection on a green phase rather than waiting for rare gaps during peak hours,
- Coordinate the existing and proposed traffic signals to encourage positive progress through the downtown area at the posted 25 mph speed limit,
- Coordinate the signals with the train crossing such that the impact of the closures are minimized and the queues are dissolved faster,
- Install traffic calming measures such as:
  - more pedestrian infrastructure (i.e., crosswalks, islands, wider sidewalks, increased pedestrian mobility),
  - improving safety for cyclists with bike lanes,
  - improving sign placements for greater perception,
  - raised intersections for greater driver attention, and
  - mini-roundabouts, such as at Bridge Street and Liberty Street.

Estimated traffic counts show a signal warrant is met at the intersection of Bridge Street and Lowellville Road. Certified traffic turning movement counts would be required to perform an official warrant for design. See the estimated traffic signal warrant in Appendix D.

**Too narrow lanes when parking is in use, too wide lanes when parking is not in use.**

In several areas, the lanes appear very wide, because most on-street parking is not realized or not used. Locals, police, and crash reports indicate that the space allotted for on-street parking is too narrow and therefore not often used. This width combined with congestion, close intersections, and curved/skewed roadways creates a difficult navigation for drivers. Anecdotal evidence states that crashes with parked vehicles are frequent when the parking is used.

The resulting wide lanes can trigger unsafe driving behavior such as passing other vehicles within the same lane and driving faster. This leads to greater opportunities for frustrated drivers to attempt to reduce their waiting times. In a paper titled Narrower Lanes, Safer Streets, presented at the 2015 Canadian Institute of Traffic Engineers annual conference, author Dewan Masud Karim provides evidence that wider lanes increase risk on city streets. Karim conducted a wide-ranging review of existing research as well as an examination of crash databases in two cities, which focused on 190 randomly selected intersections in Tokyo and 70 in Toronto. Karim found that collision rates rise as lane widths exceed about 10.5 feet.

Roads with the widest lanes — 12 feet or wider — were associated with greater crash rates and higher impact speeds. Karim also found that crash rates rise as lanes become narrower than about 10 feet, though this does not take impact speeds and crash severity into account. He concluded that there is a sweet spot for lane widths on city streets, between about 10 and 10.5 feet.

The National Association of City Transportation Officials (NACTO) recommends “Lanes greater than 11 feet should not be used as they may cause unintended speeding and assume valuable right of way at the expense of other modes. This includes the use of wide outside lanes for bicyclist accommodation. Wide outside lanes are not an effective means of accommodating bicyclists in urban areas. Travel lane widths of 10 feet generally provide adequate safety in urban settings while discouraging speeding. Cities may choose to use 11-foot lanes on designated truck and bus routes (one 11-foot lane per direction) or adjacent to lanes in the opposing direction.”

Safety improvement countermeasures that can reduce parked car conflicts and also reduce the negative safety implications of overly wide lanes are:

- Remove on-street parking which is rarely used due to the narrow widths and install a wider sidewalk, bike lanes, or other means to reduce the perceived lane width, and
- Provide off-street parking on City-owned parcels within the downtown district.

Other factors contributing to an unsafe feeling and experience in the downtown area are the high differential in speeds exhibited and difficulties for pedestrians and cyclists.

Some vehicles exhibit the posted 25 mph speed limit, some proceed slower during times of congestion, and some exhibit speeds higher than the posted speed limit. While this is not uncommon, to a certain degree, the differential in the downtown Struthers area may be greater than typical due to the mostly downhill approaches (which tends to cause higher speeds entering the downtown area), the higher degree of frustration leading to drivers “making up time” with higher speeds, and the effects of the perceived wider lanes. Studies show that a higher variance of vehicle speeds in traffic flow increases the risk of crashes.

Downtown is difficult to navigate for roadway users of active transportation modes. Insufficient pedestrian crossings, low visibility of pedestrians, and no bike facilities can make it difficult for these users to travel safely. To navigate the area, pedestrians and cyclists may be more likely to perform unsafe actions – pedestrians crossing outside of crosswalks, cyclists passing through red lights, cyclists weaving between slower or stopped vehicles, etc. Increasing the ease, safety, and mobility of active transportation modes throughout the downtown area will likely improve safety for these users and those operating motorized vehicles.

Countermeasures focused on traffic calming and increasing the mobility of all modes of traffic, previously identified in this section, are expected to ameliorate the speed variance and difficulties in mobility.

# V. RECOMMENDATIONS AND PRIORITIZATION

## A. Countermeasure Recommendations and Implementation Plan

Overall, downtown navigation may be confusing and stressful to all operators. Signals are not well seen, buildings block drivers' view of their surroundings and potential vehicular conflicts, wait times feel frequent and excessive, parking that may exist but is not well spaced, a greater speed differential among drivers, and pedestrian and cyclist mobility is challenged and feels unsafe, and cyclists and pedestrians moving wherever they can maneuver. The following recommended safety improvements are expected to address the probable causes of crashes in the downtown area and prevent potential conflicts between operators of motor vehicles, cyclists, and pedestrians.

Traffic Signals:

- Remove the singular signals at State Street and Liberty Street and replace with new, 12" signal heads with back plates. Install two signal heads per approach. Use ODOT standard mast arms and remove excess wiring.
- Install a traffic signal in a similar fashion to the replaced signals at State Street and Liberty Street at the intersection of Bridge Street and Lowellville Road. Estimated turning movement counts from Streetlight Data indicate Traffic Signal Warrant 1 based on 8-hour traffic volumes is met.
- Cut and clear tree limbs blocking sight of the Bridge Street and Lowellville Road intersection on the eastbound and northbound approaches to increase/improve signal visibility.
- Interconnect the signals at the three intersections. Include a phase similar to preemption to accommodate and resume traffic movement appropriately after a train crossing.
- Remove the flashing beacon phase of the signal(s). Install detectors at the minor approaches to better facilitate traffic for all approaches.
- Optimize the signal phasing at all signals.
- Install advisory signage such as W3-3 "Signal Ahead" at OMUTCD recommended distances in advance of the intersections.
- Install lane assignment signage (R3-5L, R3-8) and Left Turn Yield on Green (R10-12) signage on approaches and overhead.

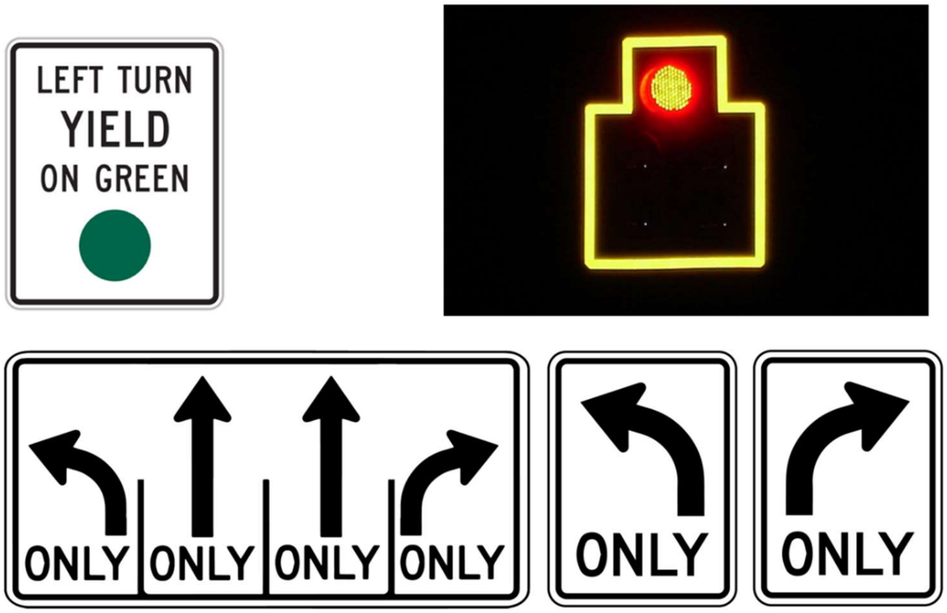



*Figure 36 – Examples of signage and signal heads for improved visibility at the intersection.*

Parking:

- Remove on-street parking in the downtown area along Bridge Street and within 200 feet of the signalized intersections.
- Install bike lanes with buffers in the areas formerly considered possible on-street parking. Extend the bike lanes beyond the downtown area as far as feasible.
- Install a city-owned parking lot at parcels 38-005-0-027.00-0, -028.00-0, and -029.00-0.

Pedestrian Improvements:

- Install a road diet for traffic calming and providing pedestrian/bicycle facilities.
- Install crosswalk markings at all crosswalks.
- Install pedestrian signals and accessible pushbuttons at signalized intersections.
- Install curb ramps where curb ramps do not exist or do not meet current Americans with Disabilities Act codes.
- Install sidewalks in areas of sidewalk gaps.
- Install a traffic island at State Street and Bridge Street to control turning movements and provide pedestrian refuge.

## B. Proposed Conditions Diagram

A Conceptual Plan for the countermeasures recommended above can be found in Appendix E.

The conceptual-level estimated cost to design and construct the recommended countermeasures is approximately $1,650,744, assuming construction in 2024 with high inflation factors. See Appendix F for the detailed cost estimate.