

A graphic of a road intersection with a vertical road and a horizontal road crossing at the center. The roads are grey with yellow dashed lines. The background is light pink.

Road Safety Audit

**SR 306 (Reynolds Road)
and
US 20 (Mentor Avenue)
Intersection
City of Mentor, Ohio**

May 2009

**Prepared By
Northeast Ohio Areawide
Coordinating Agency
1299 Superior Avenue
Cleveland Ohio 44114**



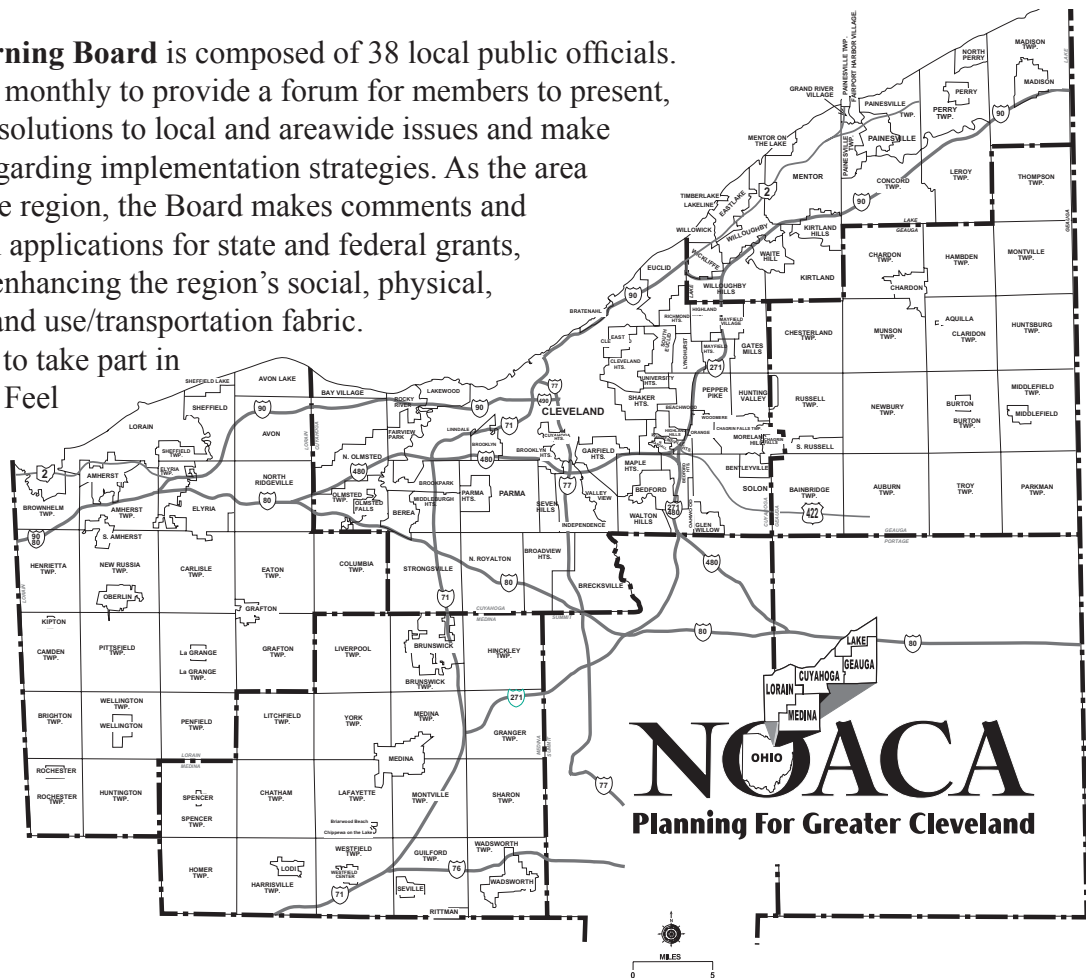
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- Perform continuous water quality, transportation-related air quality and other environmental planning functions.
- Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.
- Conduct transportation and environmental planning and related demographic, economic and land use research.
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- At NOACA Governing Board direction, provide transportation and environmental planning assistance to the 172 units of local, general purpose government.

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**Road Safety Audit
SR306 (Reynolds Road) and US20 (Mentor Avenue)
City of Mentor, Ohio**

May, 2009

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Executive Summary

This Road Safety Audit (RSA) for the intersection of SR306 and US20 in Mentor, Ohio is one of thirteen safety audits conducted in the Northeast Ohio Areawide Coordinating Agency's (NOACA) region as part of NOACA's Safety Studies program for Fiscal Year 2009. The thirteen RSA locations chosen for examination were the highest ranked among a group of high crash locations identified by NOACA through analysis of crash data in the region.

Road safety audits are conducted by independent, ad-hoc audit teams formed for the purpose of examining hazardous or high crash locations. The auditors attempt to identify deficiencies, hazardous conditions, or ill-functioning apparatus and to identify opportunities for improvements; particularly low cost, short term safety improvements. The audit team for this RSA consisted of technical personnel from NOACA, the City of Mentor, the City of Cleveland, and the Federal Highway Administration.

The recommendations in this report include not only low cost, short term remedial actions but also high cost, intermediate and long range improvements. When these suggested remedial actions or suggested improvements are implemented, they will improve the level of safety at this intersection. The main suggested improvements for this intersection are summarized below:

- Examine all points of access (ingress and egress) to and from all the businesses near or around the intersection and modify or redesign them to permit safer entry and exit maneuvers. Encourage or institute by design Right-in/Right-out entry and exit at all driveways. This could be created by providing clear signage and markings, including arrows and painted islands on these driveways to minimize potential traffic movement conflicts. The driveways of the Shell gas station fronting Mentor Avenue should be consolidated. Move the driveway closest to the corner of the intersection a little farther east, open a curb cut for it, and close the existing one. Narrow the driveway for the car wash building and restrict it to right turn only;
- Develop, in cooperation with adjoining property owners, and implement an access management plan for the area surrounding the intersection. The goal of the plan would be to reduce the number of access points to minimize potential traffic movement conflicts;
- Re-examine the curvatures of all corner curbs, particularly the southwest corner in front of Long John Silvers restaurant, and the layouts of the driveways serving the businesses adjoining the intersection. Provide better turning radii to enable smoother turning maneuvers and easier entering and exiting through these driveways;

- Redesign the intersection to reduce the scale of its expanse and remove the island structure that forms the westbound channelized right turn lane on the eastern leg of the intersection to pave the way for providing better lane marking, better visibility, and improved signal timing and phasing;
- Clean or pressure wash the roadway pavement and sidewalks from debris, and repair the surfaces of both pavement and sidewalks to provide for a smoother ride, safer conditions, more pleasant pedestrian experience, and a more aesthetically pleasing environment;
- Reduce clutter, especially that created by the presence of a plethora of advertising signs, overgrown shrubs, and ill kept landscaping;
- Delete the permissive left turn movement and place it within a protected phase for the movement of traffic from US20 eastbound onto SR306 northbound. The present permissive left turn movement contributes to the occurrence of rear-end collisions in the channelized right turn lane on the westbound approach of the eastern leg of the intersection. Right turning traffic that has the right of way in the channelized right turn lane is forced to yield to de facto northbound traffic that is turning left onto SR306 northbound from US20 eastbound during the permissive left turn phase. It was found that these conflicting movements also cause right-turn collisions between traffic turning right from the channelized right turn lane to go north on SR306 and northbound traffic from US20 eastbound turning left onto SR306 during that permissive left turn phase;
- Re-align the North-South legs of the intersection (SR306: Reynolds and Broadmoor), and widen the southern leg (Broadmoor) to 4 lanes from US20 to SR84 (Johnnycake) when possible or at the earliest possible opportunity when time comes for major reconstruction;
- Either prohibit right turn on red from the driveway of the Shopping Plaza fronting SR306, for lack of adequate visibility of oncoming southbound traffic on SR306, or lower the embankment near the bridge abutment. Offset the stop lines of the turn lanes by setting back the stop line of the left turn lane to provide a clear distance to enable drivers of right turning vehicles to see and better judge the approach speed of oncoming southbound traffic on the main road;
- Remove all objects and shrubberies present in any quadrant obstructing the line of sight;
- Remove the auxiliary signal head over the single southbound through lane of the southern leg of SR306 (Broadmoor) to eliminate potential confusion, as the primary signal heads over the northern leg of SR306 (Reynolds) are sufficient;
- Separate and stagger the stop bar for the northbound left-turn bay on the southern leg of SR306 (Broadmoor) by setting it back to provide more room for eastbound left turning traffic from US20 and right turning westbound traffic on US20, particularly truck traffic; and

- Educate the owners of adjoining and adjacent businesses about the magnitude of the current crash problem at this location and invite them to work with the City of Mentor on developing better alternatives to mitigate the current crash problem;
- Examine the current phasing and timing plans, and redesign the plans to incorporate the suggested changes in traffic movement patterns, prohibitions, and priorities.

RSA Background Information

A Road Safety Audit is a formal examination of a roadway or intersection performed by an independent, unbiased road safety audit (RSA) team made of professionals with wide ranging experiences. The team visits the road or intersection to be audited and evaluates existing conditions relative to user safety to identify possible deficiencies and any hazardous factors or conditions to determine the possible causes or contributing factors of crashes. The RSA team takes into consideration the safety of all road users, searches for opportunities for safety improvements, evaluates such opportunities, and writes a report that describes the safety issues the team has uncovered, publishes its findings, conclusions, and recommendations, and presents the report to the project owner.

The audit for this intersection is part of the Northeast Ohio Areawide Coordinating Agency's (NOACA) safety studies program for fiscal year 2009 to assist the Ohio Department of Transportation (ODOT), District 12 office, fulfill work requirements concerning roadway improvements to increase or improve safety.

The NOACA road safety audit program for FY 2009 includes thirteen RSAs conducted for select locations throughout the NOACA region. These select locations ranked highest in a listing of high crash locations enumerated based on crash data analysis NOACA performed for each county in the NOACA region. The methodology NOACA used to rank the intersections is described in **Appendix B**. Other high crash locations in the listing that have been studied by ODOT or NOACA, or for which improvements have been suggested or implemented, have been precluded from consideration for auditing.

The steps for a road safety audit, taken from the Federal Highway Administration (FHWA) Road Safety Audit Guidelines, are as follows:

1. Identify the project or the road-in-service to be audited;
2. Assemble an RSA team;
3. Conduct pre-audit meeting(s) among the RSA team and with the project owner or officials having jurisdiction over or interest in the location identified;
4. Conduct field observations under various operating conditions;
5. Perform audit analysis;
6. Present audit findings, conclusions, and recommendations to the project owner or design team;
7. Invite the project owner or design team to prepare a formal response to the audit; and
8. Encourage the project owner or design team to seek funding to make the recommended improvements or incorporate them in the project plans as or when appropriate.

Intersection Layout, Description, and Average Daily Traffic (ADT)

The following aerial photograph shows the intersection of SR306 and US20, and the prevailing surrounding environment.

SR306 is a principal north-south arterial that commences at its intersection with SR283 (Lakeshore Boulevard) and traverses the City of Mentor southward, crosses two freeways, namely SR2 to the north and I-90 to the south, and has full interchanges with them. It lies on flat terrain, with some horizontal curvatures, on the south side of the intersection, and on a slope terrain (incline grade/vertical curvature) on the north side of the intersection. US20, on the other hand, is a vital principal east-west arterial, sandwiched between the two freeways, and traverses the entire City of Mentor. It lies on flat terrain (level grade) on both sides of the intersection. It is listed on the National Highway System.

The existing geometry of the intersection consists of the following:

1. The eastbound approach (US20 eastbound) consists of one exclusive left turn lane and two through lanes with a shared right turn;
2. The westbound approach (US20 westbound) consists of one exclusive left turn lane, two exclusive through lanes, and one exclusive channelized right turn lane;
3. The northbound approach (SR306 northbound) consists of one exclusive left turn lane, and two through lanes with a shared right turn;
4. The southbound approach consists of two exclusive left turn lanes, one through lane, and one exclusive right turn lane.

The intersection is within the vicinity of high activity commercial establishments. There is a shopping plaza, Points East, located in the north-west quadrant of the intersection, anchored by major retailers. Smaller, yet active, retail shops occupy the northeast quadrant of the intersection. The southeast quadrant is occupied by a Shell gas station with a car wash service building in the rear, and the southwest quadrant is occupied by Long John Silver restaurant.

All commercial establishments have multiple driveways fronting all legs of the intersection. There is a large shopping center in the northwest quadrant of the intersection, served by two traffic signal controlled driveways, one of which fronts the northern leg of SR306. A smaller retail shopping plaza is situated on the northeast quadrant of the intersection with large curb cuts fronting both SR306 and US20. The area is lively and heavily travelled with average daily traffic of about 33,000 vehicles per day (VPD) on SR306 north of US20 and about 16,000 vehicles per day (VPD) on SR306 south of US20. Average daily traffic on the eastern leg of US20 is about 22,000 vehicles per day (VPD) and about 18,000 vehicles per day (VPD) on the western leg of US20.



Crash Analysis (Three-Year Crash Data for Years 2005-2007)

Crash data for the most recent 3-year period were examined to form a general view of the nature and magnitude of the crash problem at this intersection. Records show that there were 147 crashes during the three-year period between 2005 and 2007. It is evident from the following bar charts that the predominant type of crash among the various types of crashes is the rear end collision. Although the volume of traffic at this intersection is typical of that in an urban area, this type of crash signifies that there may be a high number of abrupt stops or slowdowns unpredictable to drivers of trailing vehicles. This would cause trailing vehicles to collide with vehicles in front of them. This is substantiated by the fact that drivers were cited for following too closely as a contributing factor in many accidents. A large number of these sudden stops or slowdowns occur mainly in the westbound channelized right turn lane. These sudden stops or slowdowns are due to unexpected or unpredictable events at or near the junction of the channelized lane with the mainline northbound side of SR306. This compels drivers to make split-second decisions to stop or slow down abruptly without being able to give adequate advanced notice of intent to trailing traffic. Four distinct events were observed that appear to explain what compels drivers in the westbound channelized right turn lane to stop or slow down abruptly. They are:

1. Permissive eastbound left turning traffic (that is traffic turning left, during a permissive green interval, from the US20 eastbound approach onto SR306 northbound);
2. Pedestrians unseen well in advance of approaching right turning vehicles due to the presence of tall shrubs;
3. Conflicting indications of the pole-mounted traffic signals when the solid red light for stop and the green right of way arrow are simultaneously lit; and
4. Northbound vehicles in the right lane after negotiating the hump and large expanse of the intersection coming from SR306 south of US20.

Crashes appear to be higher between the hours of 10:00 am and 7:00 pm with the highest being during the afternoon/evening period, particularly peak hour 4:00-5:00 pm. This correlates with the increase in activity and traffic volumes in and around the intersection after the opening hours of the shopping plaza, and the heavy traffic movement southbound during the evening peak hour to access I-90 and SR 2 Freeway. Traffic traversing that intersection may also be associated with shopping trips to and from the Great Lakes Mall.

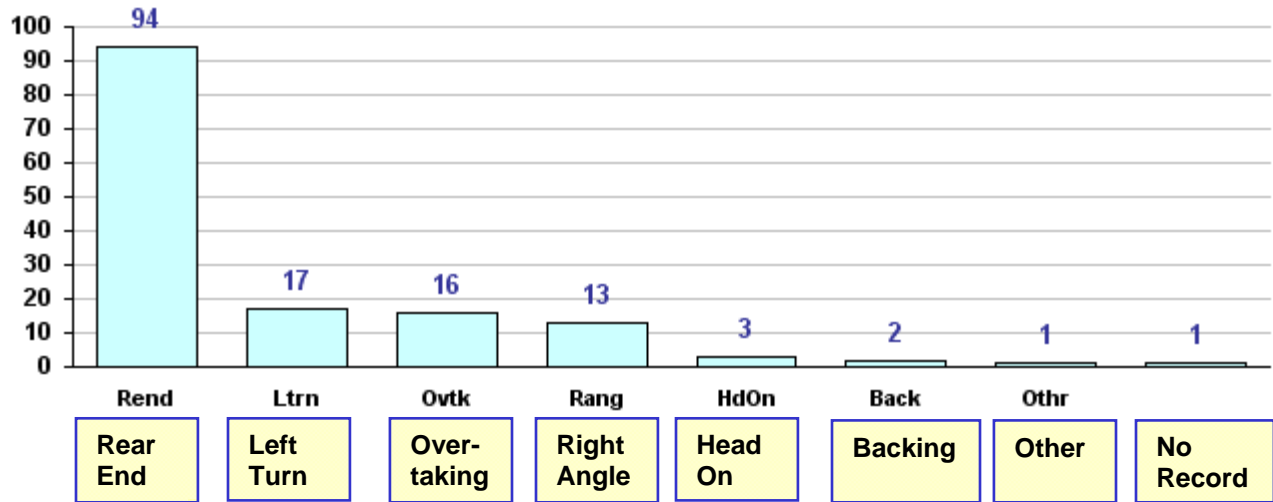
Although most crashes occurred during daylight, there is a significant number that occurred during the dark period. While the causes of crashes during daylight were investigated by the audit team, there was reason to believe that visibility issues and lighting conditions during the dark period cannot be ignored or ruled out as areas of concern related to the crash problem.

Most crashes also occurred on dry pavement conditions (about 77%). This indicates that road surface condition, often associated with sliding or hydroplaning, is not a primary contributing factor.

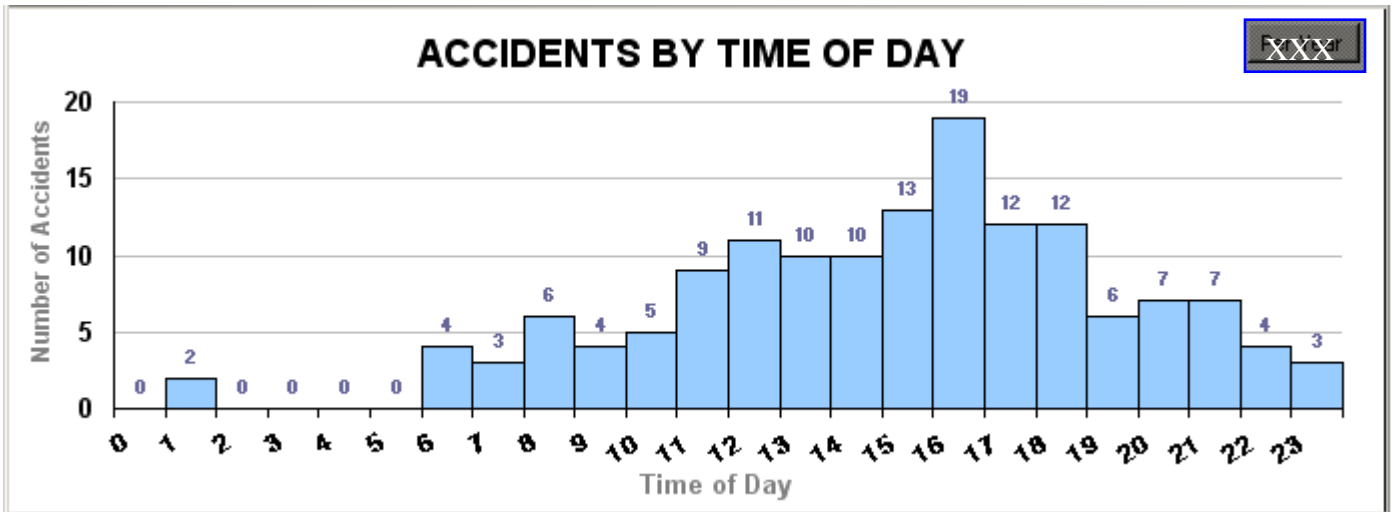
While the majority of crashes are property damage only, 20% of the total number of crashes in the 3-year period of 2005-2007 resulted in injuries. Crash severity, therefore, is a significant concern.

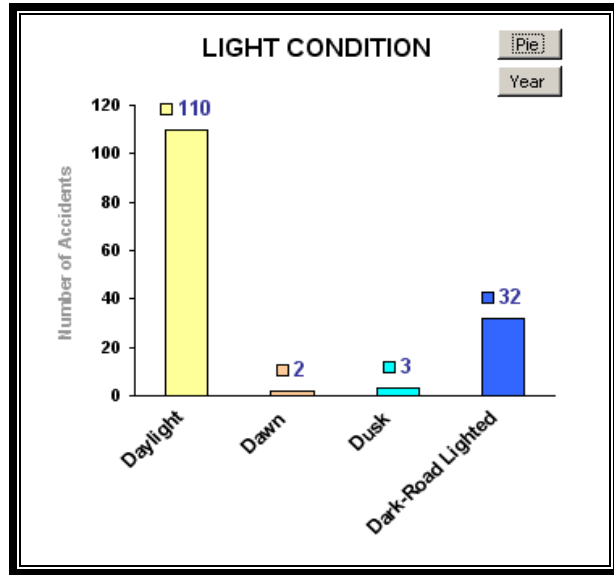
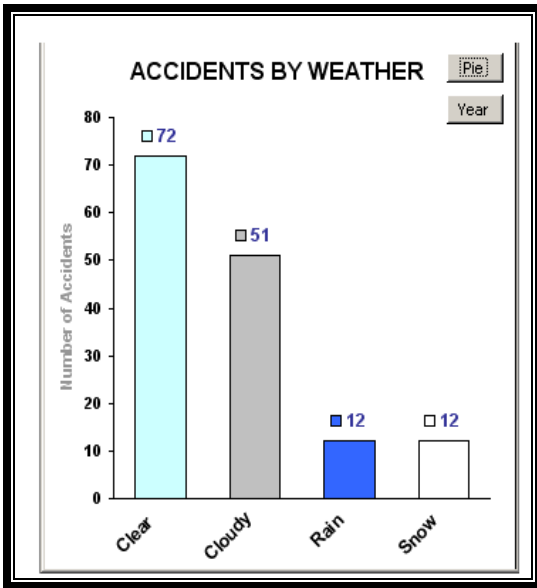
It is, therefore, reasonable to conclude that overall intersection operation, geometry, and traffic control devices are primary elements to be focused on to determine the causes of these crashes.

NUMBER OF ACCIDENTS BY TYPE



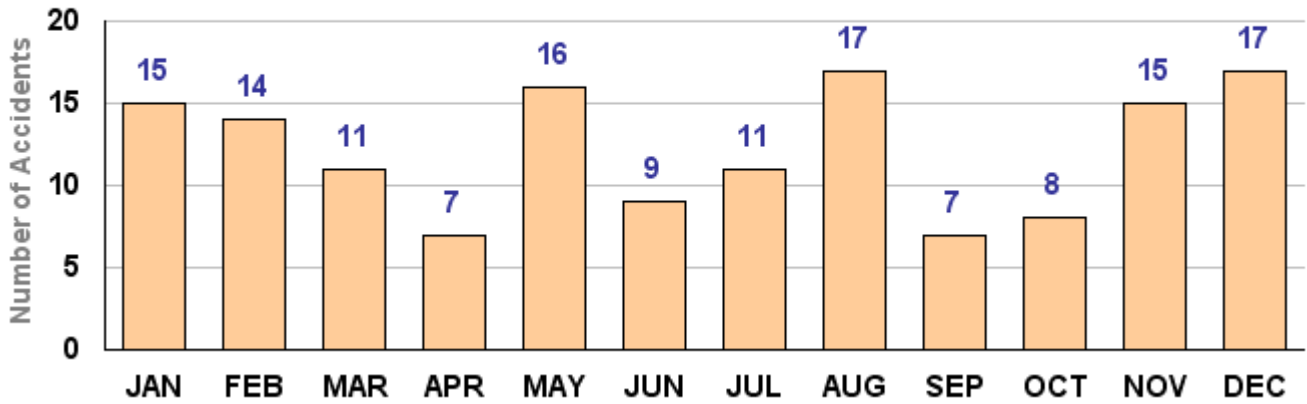
ACCIDENTS BY TIME OF DAY





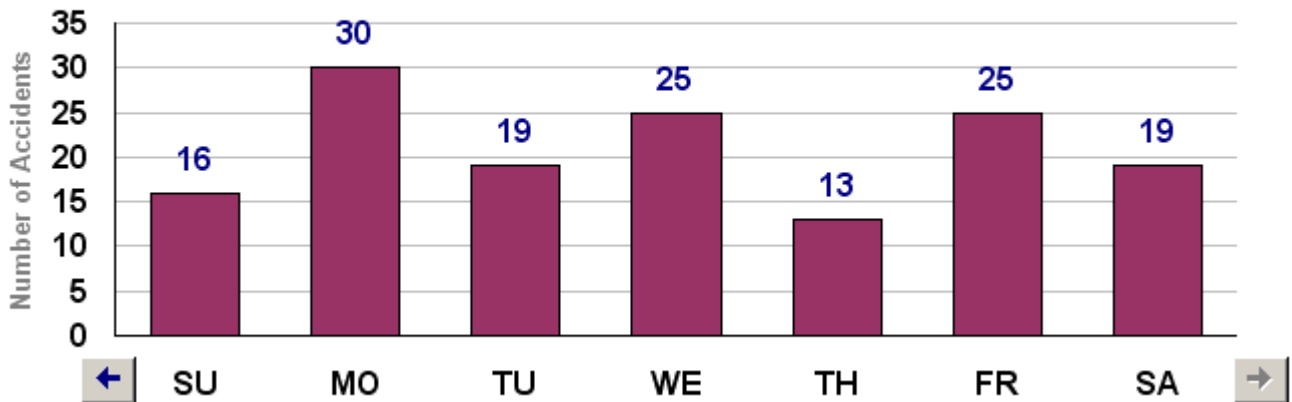
ACCIDENTS BY MONTH

XXXXX



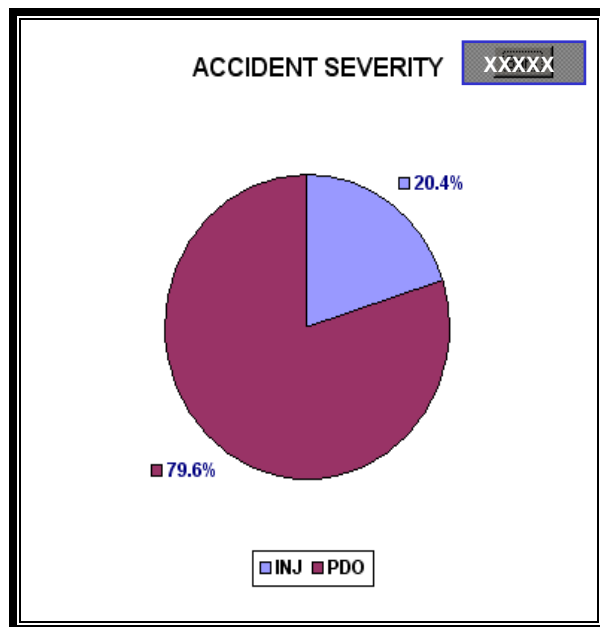
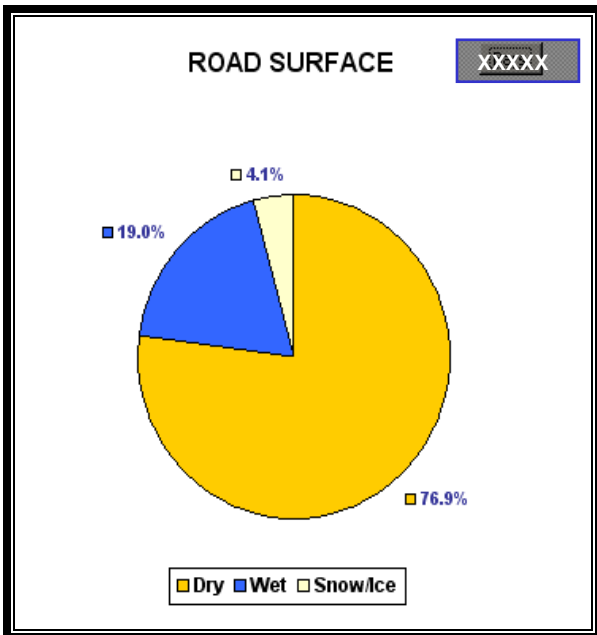
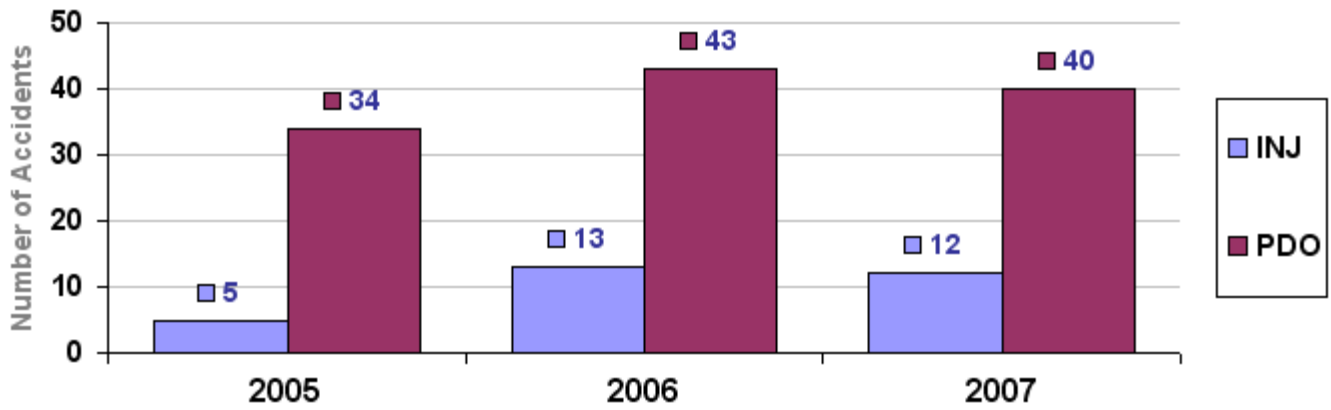
ACCIDENTS BY DAY OF WEEK

XXXXX

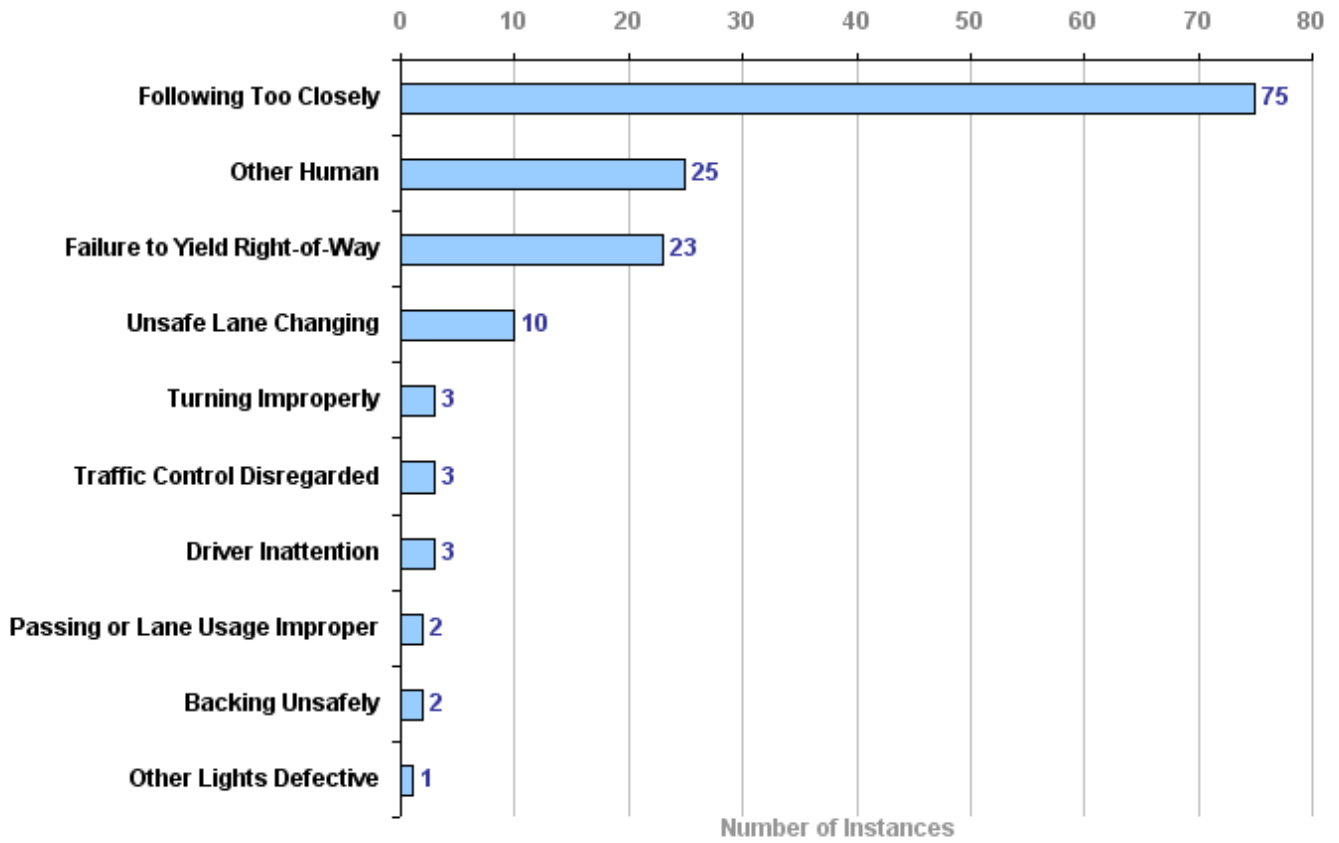


SEVERITY DISTRIBUTION BY YEAR

XXXXXX



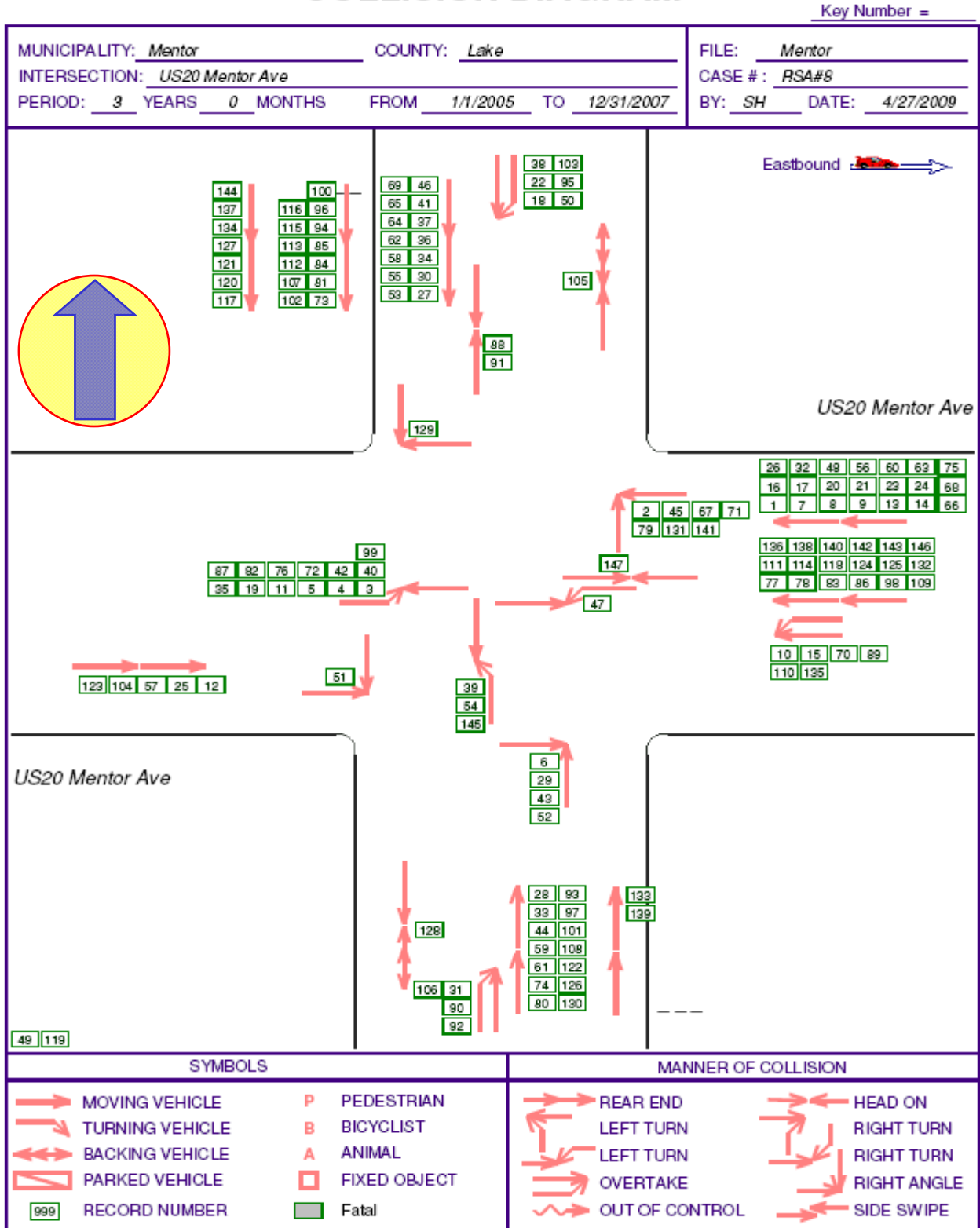
ACCIDENT CONTRIBUTING FACTORS



Collision Diagram

This collision diagram depicts the type, frequency, and relative location of the crashes that occurred in the most recent 3-year period of the crash data (Year 2005-2007). It is intended to aid the reader to understand, by viewing, the nature of the crash problems at this intersection.

COLLISION DIAGRAM



HSA Software 3.0

Pre-Audit Meeting

A pre-audit meeting of the audit team was held on March 18, 2009 at the City Hall of the City of Mentor. An aerial photo of the intersection and surrounding area was presented to the audit team to discuss their views, experiences, and knowledge of the location. The team discussed at length the various characteristics of the intersection and the prevailing conditions. The audit team also reviewed the crash data for the 3-year period between years 2005-2007 and available Average Daily Traffic (ADT) data to assess the level of activities in and around the intersection. The Audit Team adjourned the pre-audit meeting and reconvened in the field for real time observations and discussions.

The Audit

The audit team conducted an on-site Road Safety Audit (RSA) for the intersection of SR306 and US20 in Mentor, Ohio on March 18, 2009. The team spent considerable time on site making observations, recording notes, and compiling an inventory of prevailing conditions and physical characteristics of the intersection and surrounding area. These observations are summarized below and corroborated with photographs to illustrate the descriptions:

- Southbound traffic on the southern leg of SR306 (Broadmoor) south of US20 experiences congestion. Southbound traffic backs up to US20 causing other southbound traffic released through other signal phases to get stuck within the intersection, preventing or delaying other traffic movements to pass through. The following photos show the congestion on SR306 south of US20, and how eastbound traffic turning left onto southbound SR306 gets stuck within the intersection while the green interval is available for the eastbound/westbound traffic movements on US20.



Westbound traffic on US20, turning left onto SR306 southbound during the green interval of the exclusive left turn phase, slows down due to congestion downstream on SR306 southbound



Residual westbound traffic on US20 turning left onto SR306 southbound trapped within the intersection during the green interval for east-west traffic movements due to congestion on the southern leg of SR306

- SR306 south of US20 is too narrow, especially for truck traffic, leaving little lateral distance between moving traffic and the sidewalk, as seen in the photo below. The sidewalk is also cracked and soiled.
- Standing or slow draining water on the apron or near the curb, probably due to inadequate sloping, contributes to further narrowing of the lane as drivers tend to shift to the left to avoid it. A drop in temperature will turn this standing water into a sheet of ice producing hazardous icy road conditions. Drainage catch basins are available, as seen in the photo below.

Road is narrow. Sidewalk is cracked, narrow, and soiled



Congestion on narrow, single-lane south-bound SR306 (Broadmoor) south of US20, looking south

Standing water avoided by drivers



Northbound SR306, south of US20, looking south

Storm water catch basin



- Lane guide markings to help traffic remain in its pre-designated paths are absent, which causes traffic to tend to encroach upon each other or get too close to the path of adjacent moving vehicles. This might explain some of the overtaking collisions.



Southbound approach of SR306 showing the double left-turn lanes. A new pavement has recently been laid. Lane guide markings need to be placed.



Absent are lane guide markings within the intersection to guide the double left turning movements from the SR306 southbound approach to US20 eastbound

- A post without a traffic regulating sign. A heavily soiled sidewalk, not conducive to safe or pleasant pedestrian experience



This sign post is without a sign and should either be removed or affixed with a needed sign.



Water and debris in front of the Shell gas station flows onto sidewalk and street.

- Four distinct events were observed that appear to compel drivers in the westbound channelized right turn lane to stop or slow down abruptly. They are:

1. Permissive eastbound left turning traffic (that is traffic turning left onto SR306 northbound from the US20 eastbound approach during a permissive green interval) conflicting with the right of way of traffic in the channelized right turn lane when it is turning right onto SR306 northbound from the US20 westbound approach. Permissive left turns from US20 eastbound onto SR306 northbound are allowed simultaneously with protected right turn movements from US20 westbound onto SR306 northbound. This causes a serious potential hazard due to conflicting traffic movements. This explains the causes of many rear end collisions as traffic in the channelized right turn lane is often forced to make abrupt stops or slowdowns to yield to the oncoming traffic from the permissive left turn movements that, by de facto, override the right of way of the traffic in the channelized lane and assumes de facto right of way. The two photos below provide real time clarification of conditions;
2. Pedestrians are often unseen well in advance of approaching right turning vehicles due to the presence of overgrown, tall shrubs. Although the pedestrian signal can be controlled by pedestrians, right turning traffic advances beyond the faded stop line in this lane, which is also too far from the main road, to make right turns on red;
3. The conflicting indications of the pole-mounted traffic signals when the solid red light and the green arrow are simultaneously lit; and
4. Aborted right-turn-on-red attempts when a northbound vehicle appears in the through lane after it has negotiated the hump and large expanse of the intersection coming from either the leg of the intersection south of US20 or from the US20 eastbound approach turning left on a permissive green interval.



Faded Stop Line



Stop Line is faded, and placed too far from edge of intersection with the main road

- The pole-mounted traffic signals are intended to control traffic in the channelized right turn lane, but needlessly operate in tandem with the traffic signals mounted on the mast that are intended to control the through and left turn lanes. This causes potential conflicts for traffic movements and confusion to drivers in the channelized right turn lane, especially when conflicting signal indications appear. The following photographs and their captions provide clarifications of real time conditions.



The pole-mounted signals, intended for the channelized right-turn lane, and the mast-mounted signals, intended for the through and left-turn lanes, operate in tandem causing the production of conflicting signal indications, shown in the photos below.



The pole-mounted signals, intended for the channelized right-turn lane, and the mast-mounted signals, intended for the through and left-turn lanes, operate in tandem causing the production of conflicting signal indications, shown in the photos below.



The pole-mounted signals, intended for the channelized right-turn lane, and the mast-mounted signals, intended for the through and left-turn lanes, operate in tandem causing the production of conflicting signal indications as shown in the photo. The signal heads mounted on the pole on the right of the road across the one shown in the photo display the same indications, hence the confusion.



The pole-mounted signals, intended for the channelized right-turn lane, and the mast-mounted signals, intended for the through and left-turn lanes, operate in tandem causing the production of conflicting signal indications as shown in the photo. The signal heads mounted on the pole on the right of the road across the one shown in the photo display the same indications, hence the confusion.

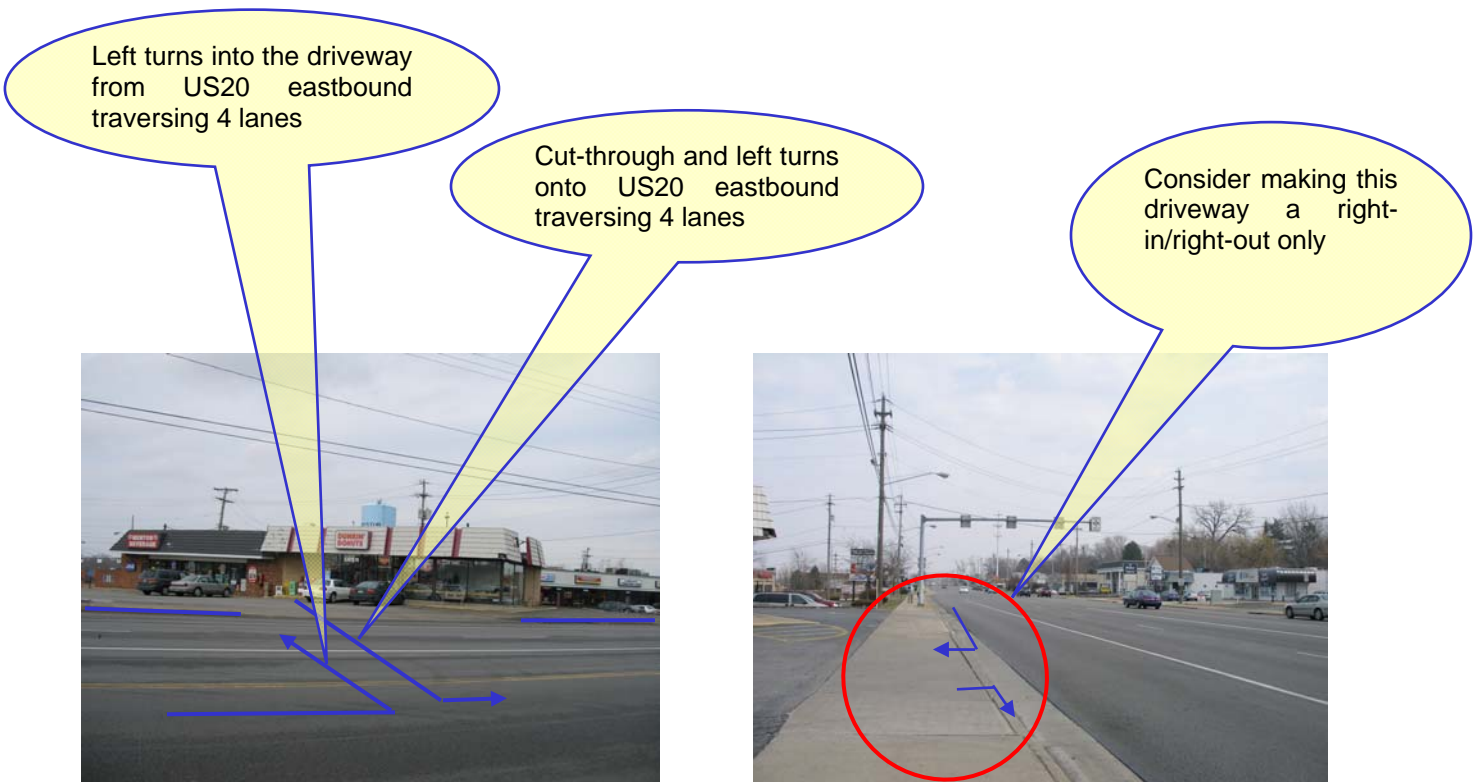


The pole-mounted traffic signal heads are intended to control traffic in the channelized right turn lane on the US20 westbound approach. They, however, operate in tandem with the signals mounted on the mast, which causes some confusion to drivers.



The pole-mounted traffic signal heads on the pole to the left, within the island, is intended to control traffic in the channelized lane as evidenced by its placement and location far to the right of the edge of the roadway for through traffic.

- The driveway to the retail shops in the northeast quadrant of the intersection, fronting US20 (Mentor Avenue), is sometimes used as a cut-through by violators who enter the forefront of the shops from the SR306 southbound approach through its driveway fronting northbound SR306, and exit it by turning left onto US20 eastbound. Furthermore, eastbound traffic on US20 often attempts to enter the driveway, crossing four lanes of roadway or traffic, especially during heavy traffic movements. Consider making this driveway to serve right-in/right-out only traffic movements to discourage cut-through behavior and to prevent disruption to the flow of westbound traffic on US20 when vehicles attempt to enter it by turning left from the US20 eastbound through lanes.



- This shopping plaza driveway, fronting SR306, should be addressed based on the illustrations in the following photographs. Either prohibiting right turns on red or setting back the stop line for the left turn bay should help address the problem of the line of sight.

Driver line of sight in this vehicle is obstructed by the presence of vehicles to its left waiting in the left turn bay.



Vehicle blocks line of sight of driver in vehicle on right



Set back stop bar for this left turn bay to overcome problem of line of sight for vehicles in the right turn bay



Retaining wall and embankment are irremovable obstacles to line of sight



When traffic exiting the driveway of the shopping plaza on SR306 awaits the green interval, the line of vision of those who intend to turn right on red is blocked by vehicles in the left turn lane protruding beyond the stop line.



The left turn prohibition sign, affixed on the traffic signal mast overhead, is sometimes violated. Prohibition of left turns into the shopping plaza during the noon-7pm period should be maintained and enforced.

- Pedestrian crossing signs, signals, push buttons, and crosswalks are adequately and appropriately available. They are well placed and function well.



- The boulder and the raised landscape timber in the island are fixed objects that are neither necessary nor aesthetically pleasing and pose a hazard.

Raised landscape timber: an unnecessary fixed object and unsightly

Boulder: an unnecessary fixed object, unsightly



- Lane markings, stop line delineation, arrows, and center line markings are faded.



Faded/worn out lane and stop bar markings



Faded/worn out lane and stop bar markings



Faded/worn out lane, stop bar, and cross walk markings



Faded/worn out lane markings and lane assignment arrows

- Surface conditions are less than desirable. Cracked pavement and sidewalks, debris on pavement and sidewalks, and broken curbs were noticed.



Debris and cracked concrete sidewalks and aprons



Cracks in pavement



- Hesitations, perhaps due to a sense of uncertainty, were observed as drivers negotiate the right turn movement onto SR306 northbound from the US20 eastbound approach.

Vehicles in the channelized right turn lane past the pole-mounted signal heads



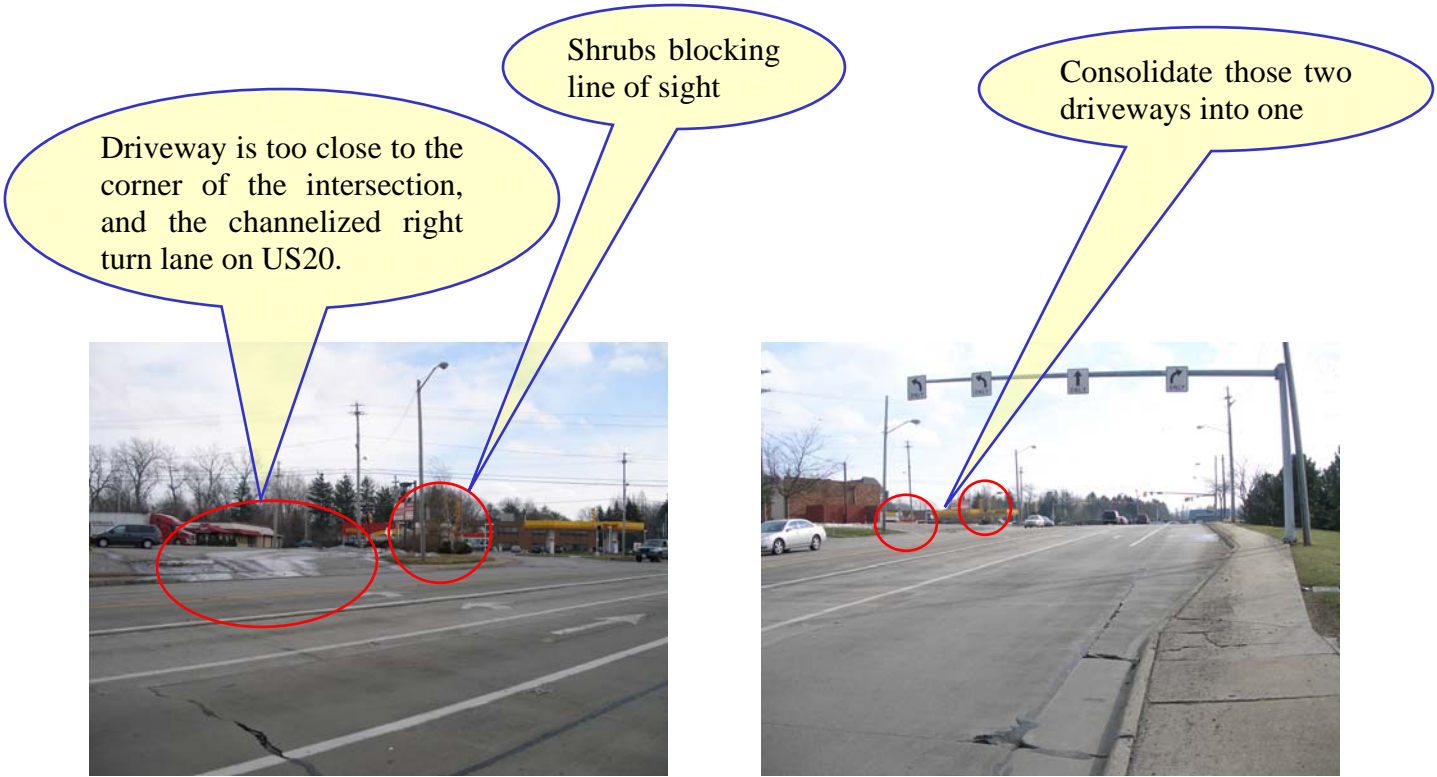
Signal indications on the pole-mounted signal heads, intended to control traffic in the channelized right turn lane, display conflicting indications



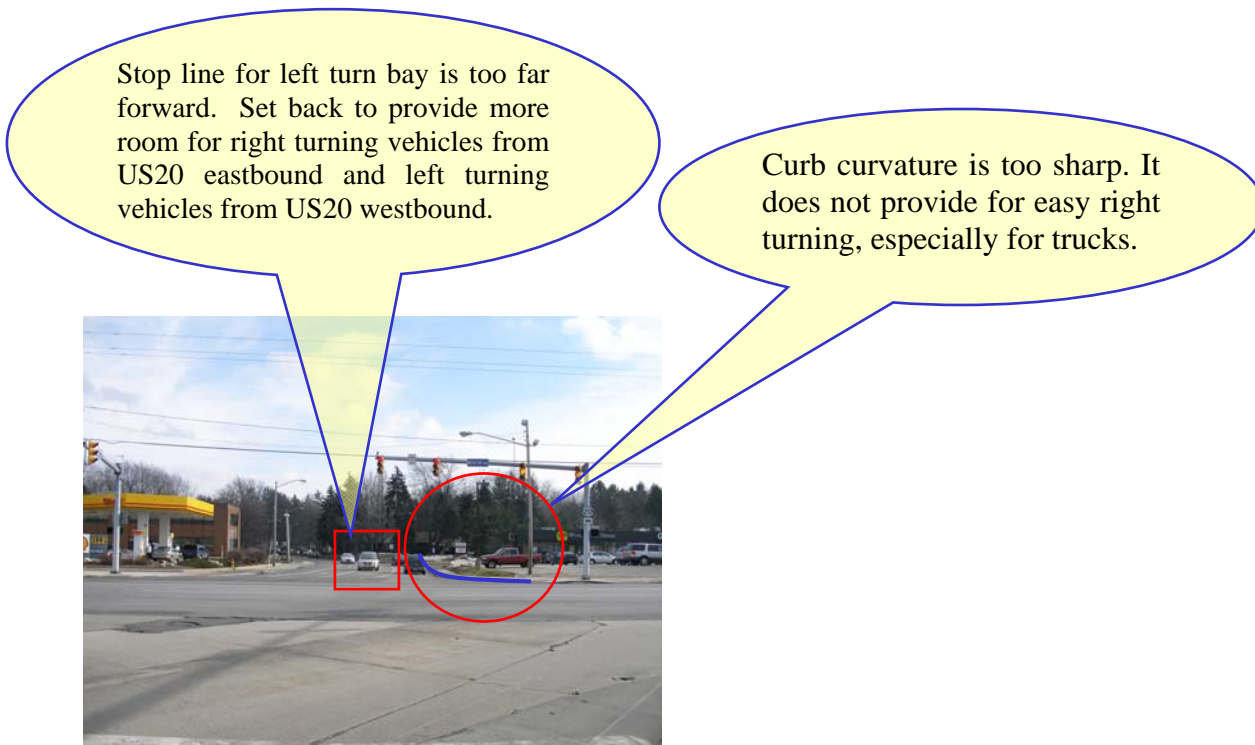
Traffic in the channelized right turn lane turns right onto SR306 northbound from the US20 westbound approach either when the traffic signal indicates right of way or when drivers turn right-on-red.

To some drivers it could be obvious but to others it sends a conflicting message, which causes second thinking and hesitation. Traffic control indications must be clear and intuitive. Obviously, in this case it is not.

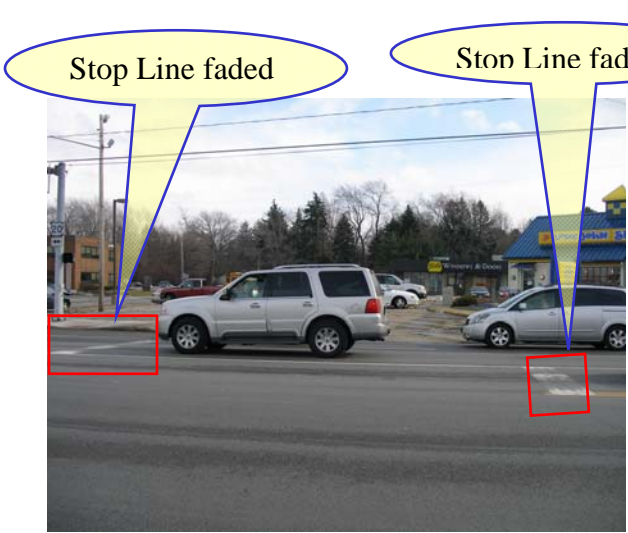
- There are two driveways for the shops in this shopping strip. They can be consolidated and replaced with one driveway to be located farther away from the corner of the intersection.



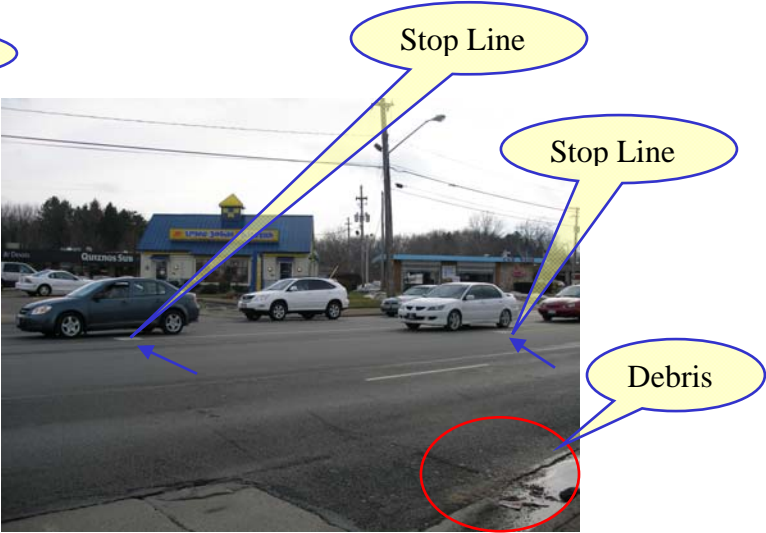
- The stop line for the left turn bay on the northbound approach of SR306 should be offset or staggered from the stop line for the through bay to provide room for southbound left and right turning traffic from US20. The curb curvature on the southwest quadrant should be increased.



- Stop lines are offset appropriately here. Marking, however, is faded.

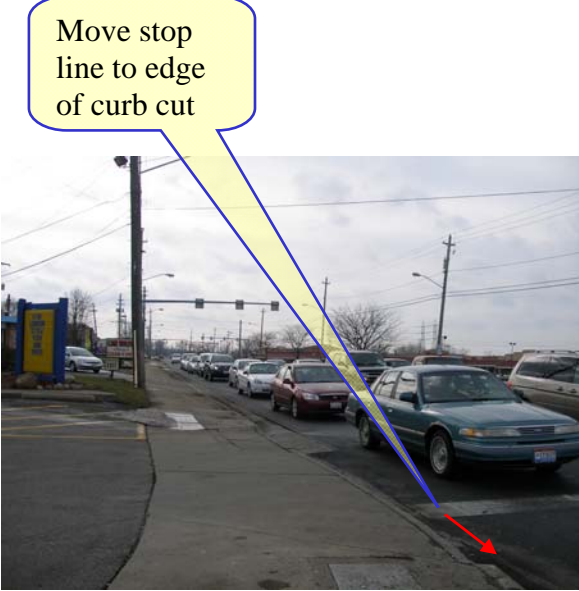


US20 eastbound, stop line markings, faded



US20 eastbound, stop line markings, faded

- Reposition stop lines as illustrated in the photos below. The driveways for the Long John Silvers restaurant should be made into Right-In/Right-Out access only.



- The overall area of the intersection projects a very large expanse. It could be scaled down through redesign to provide for better traffic movements and shorter clearance time where traffic can traverse the intersection quicker.



- Consolidate the driveways for the Shell gas station fronting US20. Move the driveway closest to the corner of the intersection a little farther east. Open a curb cut for it and close the existing one. Narrow the driveway for the car wash building and restrict it to right turn only, either at all times or at least during peak periods.



Reconfigure the openings and location of the driveways relative to the orientation and position of the gas pumps, and the proximity to the intersection.

Area wasted. It cannot be used for parking because the space is needed for the movement of entering and exiting traffic.



Proposed restricted Right only

Resize and realign the driveway of the car wash facility and restrict it to right turn only at least during peak periods.

Proposed new curb



Overall view of the Shell gas station driveways and curbs along US20



Misalignment of vehicle exit and entry points into gas station due to the misalignment of driveways with the positions and orientation of the gas pumps.



- Signage to I-90 is inconspicuous and small. It is placed on the mast pole on the far right of the roadway, but potential users need to see it well in advance and expect to find it placed overhead as traffic bound for I-90 will be or should be advised in advance to be in the left lane. Using guide signs specified in the Ohio Manual of Traffic Control Devices (OMUTCD) would be helpful to Mall shoppers and visitors who may not be familiar with area.

Place the I-90 information sign overhead on mast.



Sign pointing to I-90 is placed too far to the right and may not always be seen by drivers, especially when trucks or tall vehicles occupy the channelized right turn lane.



- Hazardous location for pedestrian crossing due to shrubs, island location, and lane configuration. Visibility should be afforded to pedestrians and drivers to afford all the opportunity to ensure that their actions would be safe.

Pedestrians standing here to cross cannot see or be seen well in advance of oncoming traffic in the channelized right turn lane because of the shrubs.



Drivers in this lane cannot see pedestrians standing behind the shrubs.



When pedestrians stand here, behind the shrubs, to cross, drivers of oncoming traffic in the channelized right turn lane cannot see them in advance.

- Lane assignment signs and signal overheads are adequate for all lanes on the southbound approach of SR306. The southbound approach, however, is very wide as it consists of 4 lanes (2 left turn lanes, one through, and one exclusive right turn). Overhead lane assignment signs are available and helpful but lack directional signs to I-90.

This auxiliary signal head, intended to augment another one for the single southbound through lane of the SR306 leg south of US20 is not needed, as it might mislead drivers to think there are two through lanes.



Lane assignment sign is located too far to the right and far beyond where needed to be seen by drivers.



Post-audit Meeting

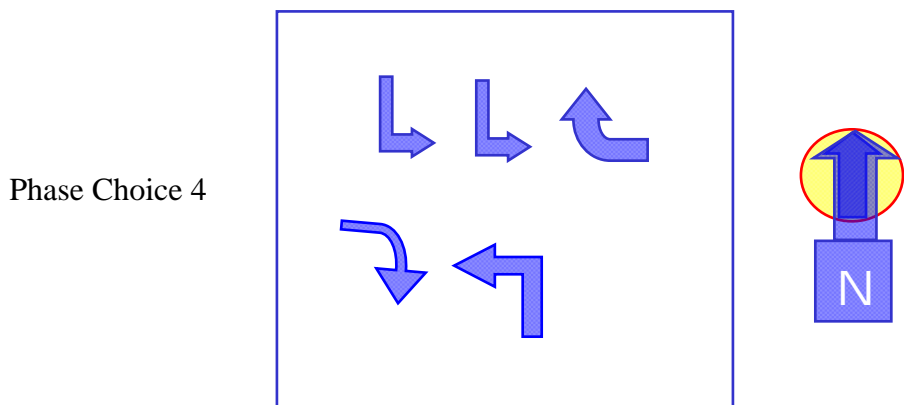
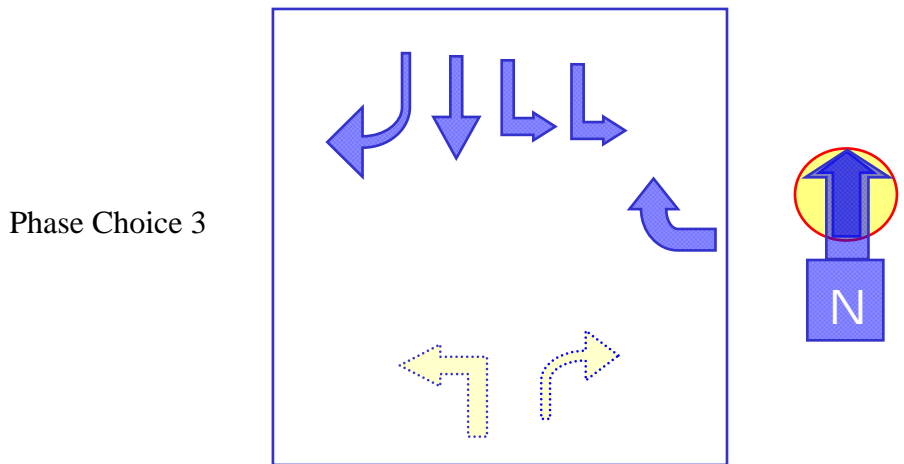
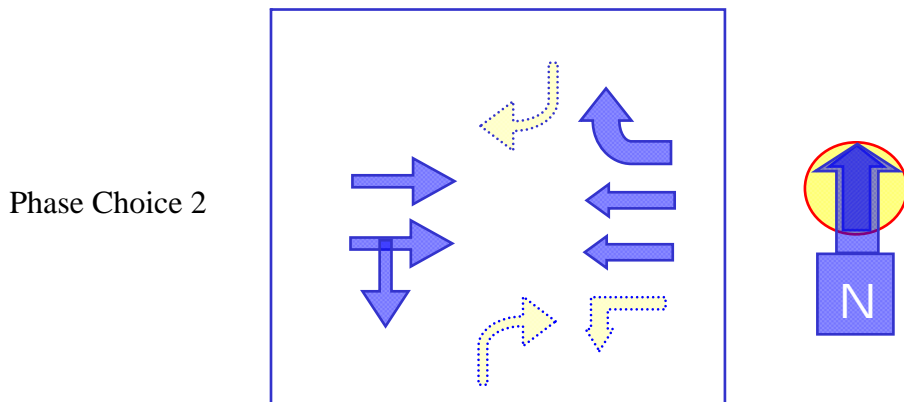
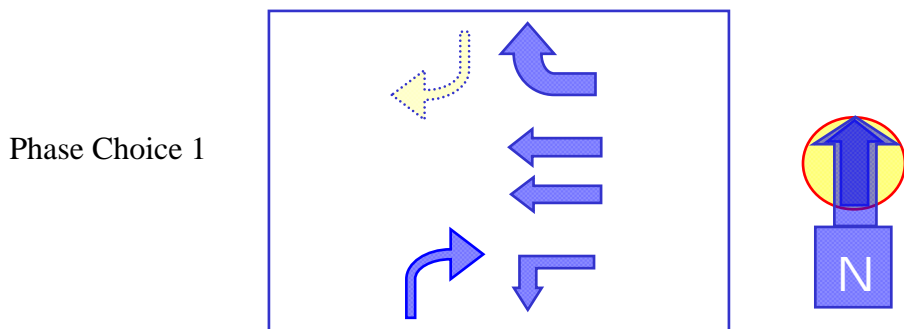
A post-audit meeting was convened at the office of the City Engineer of the City of Mentor to share and discuss the team's observations, opinions, impressions, findings, and possible remedial measures or actions. Caucuses were also held on site to discuss initial observations made by the members of the audit team to help formulate a collective opinion or view of the prevailing conditions and site characteristics that appear to contribute to the crash problem at this intersection. The audit team consolidated and summarized their field observations, articulated below, upon which the team based its findings, conclusions, and recommendations presented in this report.

Findings and Recommendations

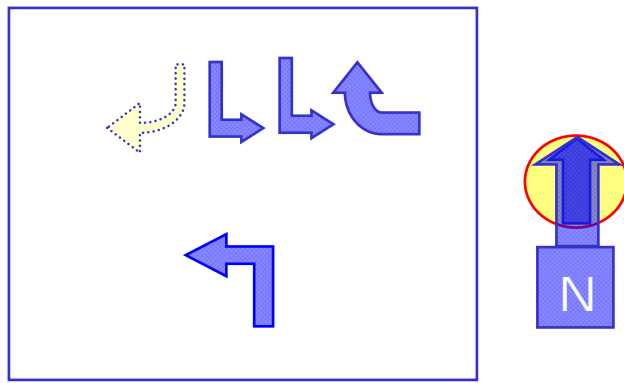
- Lane markings and assignments on all legs of the intersection are appropriately placed and allocated, but have faded and are in need of restoration.
- The area around the SR306/US20 intersection is heavily travelled and is active with various commercial offerings and the proximity of the Great Lakes Mall. The commercial establishments, particularly those near the intersection, are served with multiple access points too close to the intersection that increase the potential for traffic conflicts. Access management, therefore, should be employed and evaluated for a better circulation of traffic in and around the intersection. Driveways fronting US20 serving the Shell gas station situated in the southeast corner of the intersection should be consolidated and the one closest to the corner relocated farther from it. The driveway serving the car wash building should be narrowed and restricted to allow right turn only. The Shell gas station driveway fronting the southern leg of SR306 should be restricted to right-in/right-out only traffic movements. Southbound traffic on SR306 that attempts to enter this driveway by turning left onto it disrupts the continuous movement of southbound traffic and interrupts the flow of the heavy northbound traffic and often causes backups well into the SR306/US20 intersection. Traffic exiting this driveway that turns left disrupts the flow of both the northbound and southbound traffic on SR306. The nature of the traffic movement conflicts created from using this driveway in ways other than right-in/right-out can result in rear end and angle collisions.
- There are no bus stops at or near this intersection.
- Lateral clearance is a matter that often times is overlooked. Clutter, and objects situated too closely to the curbs affect the perception of safety. Larger vehicles or drivers that shy away from being too close to adjacent curbside fixtures tend to move away and distance their vehicles from such objects or fixtures, thereby driving closer to the lane divider markings. This movement, sub-conscious as it may be, leaves little room for vehicles in the inner or adjacent lanes to move freely. Therefore, the slightest reaction to a real or perceived need for avoidance causes or increases the potential for opposite direction or passing/overtaking sideswipe collisions. An inventory and a review of existing objects and fixtures located near the curbs should be made, and a plan of action should be established to remove those that are not necessary or to set back those that are too close as far away from the curbs as possible in order to increase the area of lateral clearance.

- SR306 intersects US20 at both obtuse and acute angles, making the curvature of the curbs at the corners of the intersection either too expansive or too sharp. Furthermore, the northern leg of SR306 is misaligned with the southern leg of SR306, which also winds and meanders with narrow lanes south of its intersection with US20. Reconstruction of the roadway in the future should take into consideration the need not only to widen these lanes but also to increase the capacity of the southern leg of SR306 between US20 and SR84 to 4 lanes to make it consistent with the other segments of SR306.
- Left turn bays' stop lines on the northbound and southbound approaches of SR306 are a little too close to the intersection. Set these stop bars back a little farther from the intersection and offset them, by placing them prior to the stop bars for the through lanes, to provide more clearance for larger or longer vehicles to negotiate left turn movements from US20 onto SR306 northbound, and right turning vehicles to negotiate right turns maneuvers from US20 eastbound onto SR306 southbound. Furthermore, vehicles in the exclusive right turn bay on the northbound approach of SR306 will be afforded a better view of oncoming traffic from US20 westbound to enable them to make safe turns on red.
- Clear or remove shrubberies and other obstructions within the lateral clearance areas and within space of all corners of the intersection. All shrubs, walls, signs, and landscaping features should be kept at or below 36" high.
- Check all clearance intervals, particularly the all red, and ascertain adequacy in light of the large expanse of the intersection.
- The multiple pole-mounted signal heads on the two poles controlling the right turn channelized lane should be reduced to three heads and according to or consistent with the requirements of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). The operation of those signal heads should also be independent from the operation of the signal heads that control the through and left turn movements on US20. Alternately, the succeeding recommendation is another viable alternative to the treatment of this signal or the solution to the traffic movement conflicts concerning the channelized right turn lane.

- Right-Turn-On-Red for traffic in the channelized right turn lane must be prohibited. Traffic in this lane can have many opportunities to move within a protected phase. These opportunities can be made available in any one or more of the following possible phase scenarios:

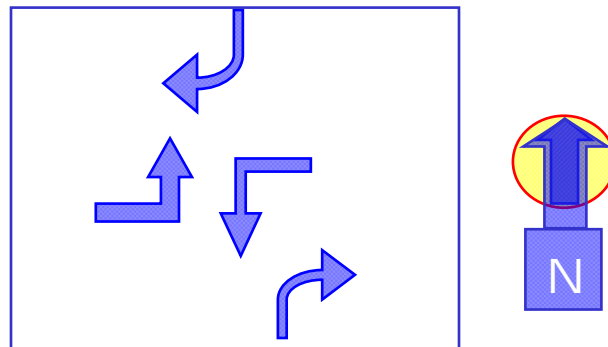


Phase Choice 5

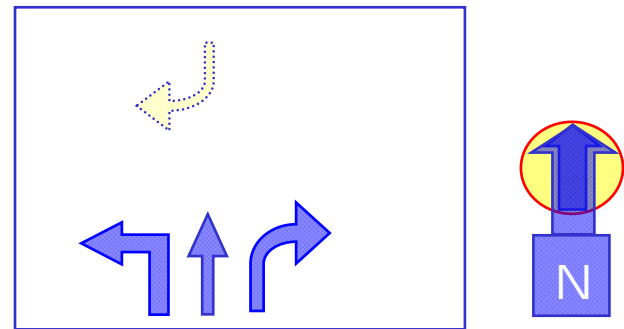


- Primary eastbound and westbound left turn movements from US20 onto northbound and southbound SR306 should be accommodated in protected phases only. Permissive eastbound left turn movements must be eliminated or prohibited and replaced with allowing them only during a protected left turn phase. These left turn movements can be accommodated in any one or more of the following possible phase scenarios:

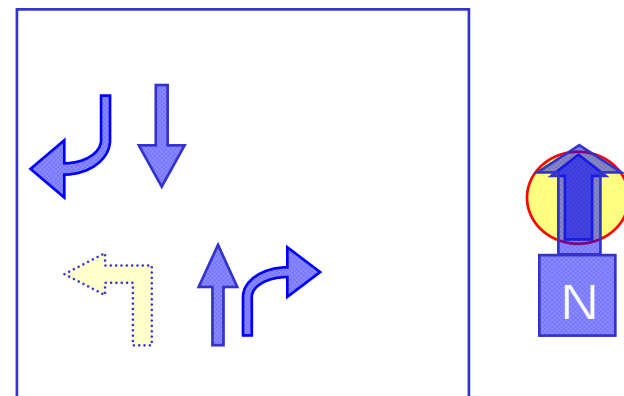
Phase Choice 6



Phase Choice 7



Phase Choice 8



Conclusion

The above findings and recommendations are sent to the City of Mentor Traffic and City Engineers for their review and consideration to make the necessary improvements or modifications as deemed appropriate. They are asked to comment on all the findings, recommendations, and suggestions.

The City of Mentor may use this report as basis to request safety funding from the Federal Highway Administration through the Ohio Department of Transportation (ODOT) to address some or all of the findings, recommendations, and suggestions presented in this report.

Appendix A: Glossary

Backplate: A thin metal or plastic plate, affixed behind the traffic signal head or beacon, that extends outward from and parallel to the signal face on all sides of the signal housing to shield the sun glare and to provide a background for improved visibility of the signal indications.

Capacity: Traffic carrying ability of a facility over a range of defined operational conditions. Capacity analysis provides tools to assess facilities and to plan and design improved facilities.

Clearance Interval: The yellow plus all-red interval that occurs between the phases of a traffic signal to provide for clearance of the intersection before conflicting movements are released.

Crash Reduction Factor: The percentage of crash reduction expected after implementing recommended countermeasures.

Detector: A device that detects the presence of a vehicle and actuates the demand for a green signal.

Green Time: The duration of the green indication for a given movement at a signalized intersection.

Island: Area between traffic lanes used for the control of vehicular movements or for pedestrian refuge. Within an intersection area, a median or an outer separation shall be an island. An island may be designated by pavement markings, channelizing devices, curbs, pavement edges, or other devices.

Pedestrian Crossing Countdown Signal: Displays flashing numbers that count down the time remaining until the end of the flashing “DON’T WALK” (FDW) interval.

Queue: The length of vehicular traffic accumulating in a traffic storage bay (left, right, or through lanes) awaiting the start of the green interval to begin moving.

Signal Phasing: The way in which the right of way is allocated among conflicting traffic movements that seek to use the same space.

Truncated Domes: Detectable warning system aids the visually impaired, which comply with the detectable warnings on the walking surfaces section of the Americans with Disabilities Act.

Appendix B: Methodology for ranking high crash locations

Crash locations are ranked according to one of four criteria:

1. Frequency of crashes

Rank 1 means that the location has the highest number of crashes or crash frequency.

2. Equivalent Property Damage Only (EPDO) Index:

This index is based on a formula where crashes of all severities are converted to the equivalent of property damage only crashes. ODOT uses this formula in their crash analysis. It is similar to NOACA's severity index. The formula is:

EPDO Index = (No. of fatal crashes X 90.14) + (No. of injury crashes X 5.50) + (No. of property damage only crashes) + (No. of crashes of unknown severity)

Rank 1 means that the location has the highest EPDO.

3. Crash Rate (Crashes per million entering vehicles):

CR = (No. of crashes X 1,000,000) / (No. of data years X 365 days X approach volume)

Rank 1 means that the location has the highest crash rate.

4. Composite Ranking:

Composite Ranking = Rank based on Frequency + Rank based on EPDO + Rank based on Crash Rate.

Rank 1 means that the location has the highest Composite Ranking.

Appendix C: Improvement Cost and Term Length Range Categories

Cost Category	Cost Range
Low Cost	Less than \$100,000
Medium Cost	\$100,000-\$5,000,000
High Cost	Greater than \$5,000,000

Time Range Category	Time Range
Low Range	One year or less
Medium Range	One year -5 years
High Range	More than 5 years

Example of Iterations:

