

2.0 TRAFFIC AND ACCIDENT DATA

2.1 Traffic Analysis

2.1.1 Existing Conditions

The existing US 60 roadway between Florence Junction and the Town of Superior can generally be described as a two-lane rural highway that traverses rolling to mountainous terrain. The project limits begin at Milepost (MP) 211.7, just west of the junction of SR 79 and US 60 at Florence Junction and continues east to MP 226.8 at the junction of SR 177 and US 60 in Superior.

The existing speed limits on US 60 are as follows:

- 55 mph from MP 211.78 to MP 212.96 (SR 79 Intersection)
- 65 mph from MP 212.96 to MP 225.06 (Raised from 55 mph on 06/22/98)
- 50 mph from MP 225.06 to MP 225.60
- 45 mph from MP 225.60 to MP 226.80 (Town of Superior)

The horizontal and vertical alignments are close to meeting the AASHTO criteria for the posted design speed of 65 mph. (see the AASHTO Controlling Design Criteria Report, summarized in Section 3.0.) Existing paved shoulders are generally adequate except in the climbing lane and left turn lane sections where they are only 2 feet wide.

2.1.2 Traffic Data

The average daily traffic (ADT), peak hour factors (K), directional splits (D), and truck (T) percentages for the years 1993 to 1998 and the design year of 2025 were provided by the Transportation Planning Division, (ADOT). The traffic volume information is based on traffic loop counters located at MP 212.6, MP 224.5 and MP 226.20. The K, D and T factors were assumed to be the same for both the existing traffic volumes and the design year 2025 traffic volumes. The traffic volumes and characteristics within the corridor are summarized in Table 2-1.

**Table 2-1
US 60 TRAFFIC VOLUMES BY MILEPOST AND YEAR**

<i>Begin Milepost</i>	<i>End Milepost</i>	<i>1998 ADT</i>	<i>2025 ADT</i>	<i>K, D, & T Factors (%)*</i>
212.6	224.5	9000	16000	14, 51, 15
224.5	226.2	8100	15000	14, 51, 15
226.2	226.9	9400	17000	14, 51, 15

* Typical for all years.

Within the project limits, there are 13 intersections along US 60. The information for these intersections such as milepost, lane geometry, and intersection configuration is summarized in Table 2-2. All of the intersections are unsignalized with stop control on the side streets. SR 79 and SR 177 intersect US 60 with grade-separated traffic interchanges. These recent improvements provide fully directional ramps to provide turn bays and access in every direction.

**Table 2-2
INTERSECTIONS**

Milepost Location	Left or Right	Intersecting Roadway Description	Existing Auxiliary Lanes		
			Left Turn Lanes on US 60	Right Turn Lanes on US 60	Left / Right Turn Lanes on Minor Street
211.96	Left	El Camino Viejo	Y	N	N
212.24	Underpass	State Route 79	N	Y	Y
214.25	Left	Queen Valley Road	Y	Y	N
215.84	Right	Mineral Mountain Rd.	N	N	N
217.00	Right	Dromedary Peak Road	N	N	N
222.41	Left	Hewitt Station Road	N	N	N
223.09	Right	Boyce Thompson Southwestern Arboretum Entrance	Y	Y	N
225.08	Left	Silver King Road	N	N	N
225.20	Right	County Landfill Entrance	Y	N	N
225.61	Right	Mary Drive	Y	N	N
225.80	Left	Main Street	Y	N	Y
226.35	Left & Right	Western Avenue	Y	N	N
226.42	Left & Right	Belmont Avenue	Y	N	N
226.53	Left & Right	Church Avenue & Kiser Street	Y	N	N
226.62	Overpass	Stone Avenue	Y	N	N
226.8	Underpass	State Route 177	N	Y	N

2.1.3 Level of Service Analysis (Existing Highway Conditions, prior to construction of SR 79 TI)

The method used for describing and determining capacity and traffic operating conditions in this study is as outlined in the Highway Research Board *Highway Capacity Manual* (HCM) (Special Report 209) and has been expressed in terms of levels of service (LOS). The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists. A LOS definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Six levels of service are used to define operating conditions, designated by the letters A through F. LOS A represents the best operating conditions while LOS F represents the worst, with traffic demand exceeding highway capacity. The goal for the US 60 is to provide a design year LOS B or better for rural areas of the study and LOS C or better for urban and urban fringe sections.

US 60 Level of Service Analysis

Traffic operations on two-lane, two-way highways are directly affected by passing capabilities. As the volume of oncoming traffic in the opposing lane increases, the opportunity to pass slower vehicles is reduced, resulting in lower operating speeds and a reduced level of service. Limited opportunities for passing due to restricted stopping and passing sight distance have a similar effect. Thus, one of the many input requirements to calculate the level of service using the HCM is to know the percentage of “no passing” zones located within a particular segment of the highway.

Another factor that greatly influences the two-lane, two way highway capacity is the type of terrain. The HCM classifies all terrain into level, rolling or mountainous categories. Level terrain allows trucks to operate at the same speed as passenger cars (generally short grades of no more than 2 percent). Truck speed is substantially reduced in rolling terrain but does not typically result in operations with crawl speeds. Mountainous terrain effects trucks such that they tend to operate at crawl speeds for significant distances or at frequent intervals.

Capacity on two-lane highways is also affected by the presence of trucks, recreational vehicles (RVs), and extended vertical grades. Trucks and RVs have a detrimental effect since they are larger and slower than passenger cars. Their impact is further aggravated by extended grades, which hinder speed, sight distance, and passing capability. As cars queue behind slower moving vehicles,

opportunities to pass become increasingly limited, resulting in long delays.

Under ideal conditions, a two-lane, two-way highway can carry 2,800 passenger car equivalents (pce) per hour in both directions. To achieve this capacity, the roadway conditions must include a 60 mph or greater design speed, 12-foot lanes and 8-foot shoulders, no “no passing” zones, a 50/50 directional split, no turning vehicles and level terrain.

When existing conditions do not meet the ideal conditions, the level of service is reduced accordingly. The factors that reduce the ideal level of service for US 60 include 15% trucks, 2% recreational vehicles assumed, 56/44 directional splits, numerous “no passing” zones, rolling and mountainous terrain, and 1 to 8 feet of usable shoulder. Applying these adjustment factors reduces the existing hourly level of service for both directions. To obtain the level of service, the average daily traffic shown in Table 1-1 was converted to the design hour volume using the K factors. The Level of Service analysis was performed using the Highway Capacity Manual procedures.

Based on the foregoing, the level of service expected on the existing roadway was computed for both the current year traffic level (2000) and the projected traffic level in the design year 2025. The two-lane highway portion of the Highway Capacity Software was used to compute the level of service. The climbing lanes on US 60 were analyzed using multilane highways portion of the Highway Capacity Software. The input requirements and the results for the level of service analysis are shown in Table 2-3.

The data in Table 2-3 was obtained from ADOT’s Transportation Planning Division. The data was divided into roadway sections based on the location of current in-field traffic counters. During the current (2002) year, a level of service F or E was obtained for all highway sections within the US 60 corridor, except for a level of service A in Section 1. During the design (2025) year, a level of service F was obtained for all the highway sections within the US 60 corridor, except for a level of service B in Section 1.

SR 79 Intersection Level of Service Analysis

The capacity of the Florence Junction SR 79 intersection was analyzed in 1999 using the Highway Capacity Manual’s unsignalized level of service method. 1998 P.M. Peak hour turning movement volumes were determined at the intersection. The geometry of the intersection, with over 175-feet of separation between the EB and WB lanes of US 60, lead to evaluation of the existing intersection as two separate unsignalized intersections. The south intersection is comprised of the US 60 eastbound roadway and the north and south legs of SR 79. The north intersection consists of the US 60 westbound roadway and SR 79 northbound traffic forming a “T” intersection. The intersections were found to operate at LOS A for the 1998 p.m. peak hour volumes. The

**Table 2-3
LEVEL OF SERVICE SUMMARY—EXISTING ROADWAY**

	Milepost Limits			
	Section 1 212.1-212.96	Section 2 212.96-217.34	Section 3 217.34-225.0	Section 4 225.0-226.8
Average Daily Traffic				
Study Year – 1998	9,000	9,000	8,100	9,400
Current Year - 2002	11,800	11,800	10,800	8,900
Design Year – 2025	16,000	16,000	15,000	17,000
Traffic Factors				
Design Hour Factor (K)	14	14	14	14
Directional Factor (D)	51	51	51	51
Percentage of Trucks (T)	15	15	15	15
Percentage of RVs (RV)	2	2	2	2
Percentage of No Passing	100	48	78	100
Peak Hour Factor (PHF)	0.95	0.95	0.95	0.95
Design Hour Volumes				
1998	1,260	1,260	1,130	1,320
2002	1,620	1,650	1,650	1,250
2025	2,240	2,240	2,100	2,380
Design Speed	65	65	60	50
Terrain	Rolling	Rolling	Mountainous	Rolling
Typical Section	4-Lane	2-Lane	2-Lane	3-Lane.
LOS, Study Year 1998	A	E	E	E
LOS, Current Year 2002	A	F	F	E
LOS, Design Year 2016	B	F	F	F

1998 peak hour volumes and an annual growth factor of 2% were used to obtain design year 2025 peak hour volumes. A LOS analysis was then completed for the 2025 design year peak hour. LOS C and F were obtained for the south and north intersections, respectively.

2.1.4 Level of Service Analysis (Proposed Roadway Improvements)

Current traffic situation on US 60 is such that significant improvements to the roadway are warranted. Several enhancements to the existing roadway were considered that would improve the LOS, as follows:

- Widen the existing shoulders in the climbing lane sections.
- Adjustment of the vertical and horizontal alignment to increase passing sight distances.
- Improve passing opportunities by adding additional passing/ truck climbing lanes.
- Widen the roadway to four lanes.
- Provide grade-separated interchanges at major intersections, such as Florence Junction-SR 79 and at Queen Valley Road. Both of these intersections are within the access controlled limits.

A roadway that is constructed with structurally adequate paved shoulders can be used to assist in dispersal and breakup of platoons. Slower moving vehicles may temporarily use the shoulder to permit faster vehicles to pass, returning to the travel lane when passing maneuvers have been completed. An analysis was completed to verify the highway capacity improvements with the shoulder widths being 8 feet and improving the passing opportunities to 80% of the available distance. The LOS for the improved two-lane roadway only changed from LOS E to LOS D for the year 1998 traffic volumes and LOS F did not change for the design year 2025 traffic volumes. The results are shown in Table 2-4.

**Table 2-4
LEVEL OF SERVICE SUMMARY
IMPROVED ROADWAY**

	Milepost Limits		
	MP 212.65 to MP 217.34	MP 217.34 to MP 225.00	MP 225.00 to MP 226.8
LOS StudyYear 1998 2-lane Improved Section *	E	E	E
LOS CurrentYear 2002 2-lane Improved Section *	F	F	E
LOS Design Year 2025 2-lane Improved Section *	F	F	F
LOS Design Year 2025 4-lane Divided Section	B	B	B**

* Improved Section with 80% passing zones
 ** 5-Lane Urban Section

Climbing lanes are a spot improvement, applied mostly on steep, sustained grades, which cause heavy vehicles to travel at slow speeds. This reduces capacity, creates platoons, and increases delay. Criteria outlined in the Highway Capacity Manual (TRB Report No. 209) to warrant truck-climbing lanes include:

1. Upgrade traffic flow rate exceeds 200 vph.
2. Upgrade truck flow rate exceeds 20 vph.
3. One of the following conditions exist:
 - a) Level of Service E or F exists on the grade.
 - b) A reduction of two or more levels of service is experienced when moving from the approach segment to the grade.
 - c) A 10-mph or greater speed reduction is experienced for a typical heavy truck.

The first two criteria are met based on the current and design year projections. The results of the existing highway capacity analyses as outlined in Table 2-3 indicate that Criteria 3a warrant is met within all the study segments. Criterion 3b and 3c was not analyzed since a separate analysis of approximately 58 existing vertical curves requires

considerable effort and the justification was already achieved through Criterion 3a.

In the last six years two separate passing/truck climbing lane projects have been completed near Gonzales Pass within the study limits. These projects installed an eastbound passing lane from MP 217.5 to 218.46 and a westbound climbing lane from MP 218.89 to MP 220.00. The existing climbing lanes were analyzed for capacity using the current year traffic volumes. A level of service A was obtained for the direction with the climbing lane and a level of service E was obtained for the direction opposite to the climbing lane direction. The existing and any proposed climbing lanes will alleviate some of the delays caused by trucks and, will also improve passing opportunities. Reconstruction and flattening of the many vertical curves will also improve passing sight distances along the corridor. However, as noted earlier, even with passing opportunities increased to 80%, a LOS B will not be achieved. Therefore widening of the roadway to four lanes becomes the prudent alternative.

An analysis of widening the existing US 60 to a four-lane highway was conducted. LOS B was obtained for all the rural highway study segments for the design year 2025 traffic. The results are shown in Table 2-4. The segment through the City of Superior was analyzed for a five lane urban section with two through lanes in each direction and a two way left turn lane. Level of Service A in one direction and LOS B in the opposing direction were obtained for the design year (2025) traffic volumes.

2.1.5 Recommendation

This study recommends that US 60 be widened to four lanes (two lanes in each direction) for the entire length of highway between Florence Junction and the western city limits of Superior. The section within the city limits of Superior is recommended to be a five lane urban section. Several issues were considered in arriving at this conclusion:

- The traffic projections used with the study are based on historical data, which does not consider the added traffic resulting from an improved facility. The model also does not consider an accelerated growth rate that may result within the Superior and Globe areas as new developments are being proposed in these towns for persons that want to leave the congestion that is being experienced in the Phoenix metropolitan area. Any significant increase in the design year ADT would further validate the requirement for four lanes throughout to achieve a LOS of B. For example, the traffic

projections were based on 2% growth in 1999/2000. The Transportation Research Board (TRB) is now recommending that a 5% growth factor be used for estimating purposes.

- A four-lane divided facility is a safer roadway than one that necessitates passing opportunities using opposing lanes.
- A five lane urban facility is required through the City of Superior to provide safe and improved access to various businesses and streets.
- The existing two-lane highway can be improved with the addition of passing / truck climbing lanes and adjustments to the vertical and horizontal alignments. However, the improved two-lane highway will still operate well below the desired LOS B for the design year.

It is also recommended that a divided roadway be used versus an undivided roadway. The divided roadway separates opposing traffic for increased safety, offers the opportunity to control turning traffic (median crossovers) for increased safety, operational efficiency, provide better access control, minimizes visual impacts through earthwork balance and a better fit to the land form, and is more appropriate for the rural mountainous area.

2.2 Accident Analysis

2.2.1 Analysis

This analysis includes accident data for the period between December 1998 and November 2003, in the study limits of US 60 between MP 212.0 to MP 227.0. The data was provided by the Accident Records Branch of the Traffic Engineering Section, Arizona Department of Transportation.

Figure 2-1 shows the number of accidents by milepost location. Average accident rates by milepost location are depicted on Figure 2-2. The average accident rate for the US 60 corridor from MP 212.0 to 226.85 is calculated to be 0.93 accidents per million vehicle miles of travel per year. This can be compared to an accident rate for a typical two-lane rural highway in Arizona of 0.79 accidents per million vehicle miles of travel per year.

Similar to the traffic analysis section of this report, the corridor was separated into four different study segments for accident analysis based on significant variations in the geometry, topography, and accessibility. The total number of accidents and the accident rate in each study segment are shown in Table 2-5. Accident rates were calculated by milepost based on the number of reported accidents within each mile section and the historical traffic volumes at that location. As indicated in Table 2-5, study segment 1 (Florence Junction) experienced an

accident rate higher than the Arizona average for a similar facility. Figure 2-2 illustrates that there are several locations where the accident rate is above the State average for a similar kind of facility. These locations include the Florence Junction intersection of SR 79, Queen Valley Road intersection, Gonzales Pass area, Boyce Thompson Southwestern Arboretum entrance road and intersections with local Superior streets and access points.

A total of 237 accidents were reported within study limits over a period of five years from December 1, 1998 to November 30, 2003. The number of Property Damage Only (PDO), injury and fatal accidents reported were 121, 108 and 8 respectively. The percentage of PDO, injury and fatal accidents to the total number of accidents reported were 51%, 46% and 3% respectively. The lighting conditions may have influenced the accidents since 78 (33%) of the total accidents occurred during dark and dawn/dusk light conditions. The pavement conditions were not reported to be a factor for the accidents. The physical condition of the driver may be one of the influencing factors with 30 (13%) of the total accidents involving sleepy/ intoxicated drivers. The majority of the accidents listed hitting fixed objects (53), angle accidents (49) and rear end (23) as the accident type. The percentage of the hit fixed objects, angle and rear end accidents as compared to the total number of accidents reported were 22%, 21% and 10% respectively.

Figure 2-2 shows that the accident rates on US 60 at Mileposts 212, 214, 215, 217, 218, 219, and 223 exceeded the Arizona average for a similar facility. Table 2-6 shows the accident history information where accident rates exceeded the Arizona Average.

2.2.2 Conclusions

The average accident rate on US 60 from Florence Junction to Superior is just above the Arizona average for a similar facility, however several locations continue to be significantly above this rate even with the construction of local roadway improvement projects. Without improvements, these locations will likely experience an increase in accidents as traffic volumes increase. Accordingly, it is recommended that the route be reconstructed to a four lane divided highway to not only improve the capacity and LOS but to also significantly improve safety and reduce the occurrence of accidents.

A separate Access Management Plan (TRACS No. 060 PN 199) has been prepared for the US 60 corridor from Apache Junction to the TNF

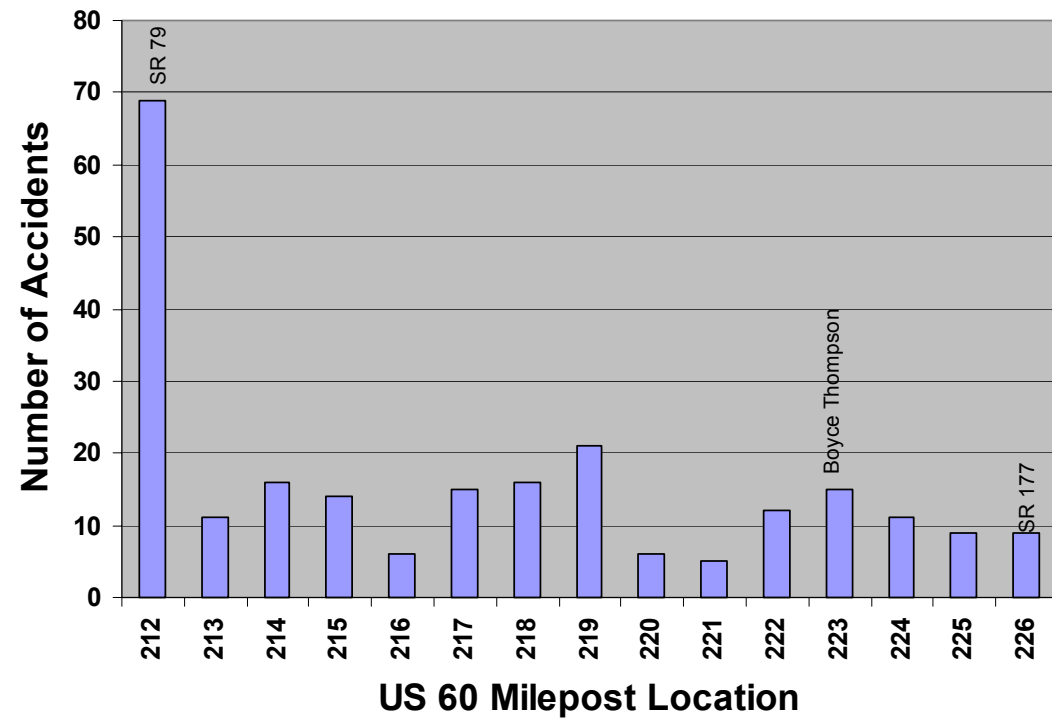
**Table 2-5
US 60 ACCIDENT HISTORY**

Section	Begin Milepost	End Milepost	Distance (miles)	Terrain	Total Number of Accidents	Accident Rate *
1 Florence Junction	212.05	212.65	0.65	Rolling	66	5.05
2 Florence Junction to TNF West Boundary	212.65	217.34	4.69	Rolling	57	0.71
3 TNF West Boundary to West City Limits	217.34	225.00	7.66	Mount.	96	0.74
4 West City Limits to SR 177	225.00	226.85	1.85	Rolling	18	0.59

* Number of Accidents per Million Vehicle Miles of Travel per Year

Boundary. To maintain access control per the management plan, and to reduce the occurrence of accidents at two particularly high accident areas identified and shown on Figure 2-2 as the Florence Junction intersection with SR 79 and the Queen Valley intersection, grade separated interchanges are recommended for both of these locations.

**Figure 2-1
NUMBER OF ACCIDENTS BY MILEPOST LOCATION
1998-2003**



**Figure 2-2
ACCIDENT RATE BY MILEPOST LOCATION
1998-2003**

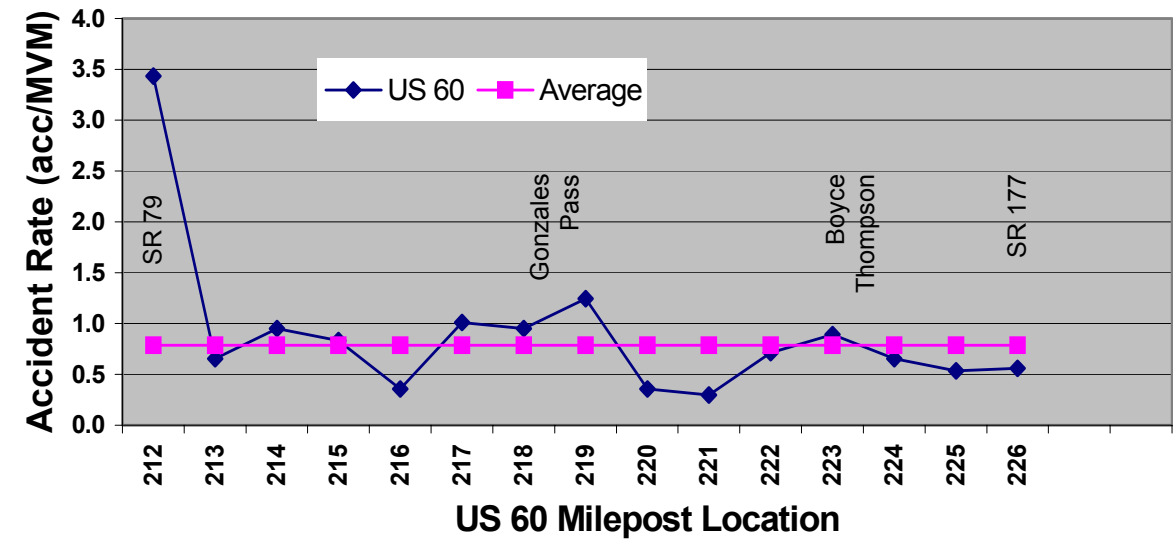


Table 2-6. ACCIDENT HISTORY INFORMATION

**LOCATIONS WHERE ACCIDENT RATES EXCEEDED ARIZONA AVERAGE
1998 - 2003**

LOCATION	TOTAL NO. ACCIDENTS	INJURY ACCIDENTS	FATAL ACCIDENTS	DAY/ NIGHT	COLLISIONS W/ OTHER VEHICLES					SINGLE VEHICLE COLLISIONS			PRIMARY CAUSES REPORTED & COMMENTS
					TOTAL COLLISIONS W/ OTHER VEHICLE	ANGLE	REAR-END	SIDE-SWIPE (SAME)	HEAD-ON	TOTAL SINGLE COLL.	FIXED OBJECT	HIT ANIMAL	
MP 212-213	69	43	3	57 / 12	54	46	3	1	0	15	6	2	Angle collision (46) and hitting fixed object (6) were the most common accident types. Failure to yield the right-of-way, ran stop sign, and speed too fast for conditions were most reported. Fifty-two accidents occurred at the intersection of US 60/SR 79. The 69 accidents involved a total of 95 injuries. Three fatalities and eight injuries occurred in three fatal angle type intersection collisions.
MP 214-215	16	6	0	9 / 7	3	0	0	1	0	13	7	3	Hitting fixed object (7) and wild animal (3) were the most common accident types. Speed too fast for conditions was most reported. Drinking was involved in two accidents.
MP 215-216	14	5	0	10 / 4	5	0	1	2	1	9	4	1	Hitting fixed object (4) and sideswipes-same direction (2) were the most common accident types. Speed too fast for conditions was most reported.
MP 217-218	17	7	1	9 / 8	9	0	4	2	1	8	3	2	Rear-end (4) and hitting fixed object (3) were the most common accident types. Speed too fast for conditions and following too closely were most reported. Drinking was involved in three accidents. Three fatalities and one injury occurred in the single head-on collision.
MP 218-219	16	4	0	8 / 8	6	0	1	4	0	10	5	1	Hitting fixed object (5) and sideswipes-same direction (4) were the most common accident types. Speed too fast for conditions and unsafe passing were most reported.
MP 219-220	21	13	1	15 / 6	11	0	3	4	1	10	7	0	Hitting fixed object (7) and sideswipes-same direction (4) were the most common accident types. Speed too fast for conditions was most reported. Drinking was involved in five accidents. One fatality and three injuries occurred in the single head-on collision.
MP 223-224	15	6	1	7 / 8	4	0	0	2	1	11	5	1	Hitting fixed object (5) was the most common accident type. Speed too fast for conditions was most reported. Drinking was involved in four accidents and sleepy-fatigued drivers in three accidents. One fatality and one injury occurred in the single head-on collision.