NATIONAL TRANSPORTATION SAFETY BOARD

OFFICE OF HIGHWAY SAFETY

WASHINGTON, D.C.

HIGHWAY GROUP CHAIRMAN FACTUAL REPORT

PHOENIX, ARIZONA - HWY21MH008

A. CRASH INFORMATION & CRASH SUMMARY

Refer to the *Crash Information and Crash Summary Report* in the docket for this investigation.

B. HIGHWAY FACTORS GROUP

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C. DETAILS OF THE HIGHWAY FACTORS INVESTIGATION

The Highway Factors Group obtained information related to the design, maintenance, and operation of the highway environment to establish a foundation for evaluating whether the condition, design, or operation of the highway facility contributed to or caused the crash. Information was obtained from the Arizona Department of Transportation (ADOT) that provides a general description of the crash location; highway information including geometric design, traffic metrics, and crash history. Focus areas included looking at temporary traffic control through incident management areas, and messages on permanent Dynamic Message Sign (DMS) installations. .

1. General Information

The crash occurred on Wednesday June 9, 2021 at 10:07 p.m. (MST) on eastbound Arizona State Route Loop 202 (SR Loop 202), approximately 193 feet east of mile marker 4.[1] The GPS coordinates for this location are 33.45580299 degrees north latitude and 111.974451degrees west longitude, and the highway station number is approximately 50+40.2. See **Figure 1** below for an

[1] SR Loop 202 is also referred to as Red Mountain Freeway.
[2] Highway station numbers give dimensional information and are located on highway design plans.

overhead Google image view of the accident location. The yellow marker on the right shows the location where the police established a temporary traffic control zone through an incident area near exit 6, and the yellow marker on the left at exit 4 shows where the crash occurred.

Figure 1.- Google Earth overhead view of crash location. The right yellow marker depicts where a temporary traffic control zone (TTCZ) began near exit 6, and the left yellow marker is the crash location at exit 4.

In the crash area, SR Loop 202 is a freeway with the east and westbound lanes divided by a concrete median barrier. SR Loop 202 was constructed in 1990 as a 55-mile-long partial beltway around southern and east Phoenix metro area. It traverses through Phoenix, Tempe, Mesa, Chandler and Gilbert, Arizona. The eastbound lanes are composed of a High Occupancy Vehicle (HOV) lane and four through lanes. The exit lane for exit 4 ended approximately 200 feet before the crash location. The westbound roadway has an HOV lane and three through lanes. The police convention for numbering the lanes is 1-4 with #1 lane being the left-hand lane adjacent to the HOV lane and #4 being the right-hand lane. See **Figure 2** depicting the travel lanes.

Figure 2. View of the eastbound lanes on the left and westbound lanes on the right in the image with the impact area and tanker positions annotated.

On the eastbound side of SR Loop 202, the traffic lanes were 12-foot-wide with a 10-foot-wide median shoulder and 10-foot-wide right-hand shoulder and 2-foot-wide concrete drainage inlet that also serves as a shoulder. The width of the cross-section from the concrete median barrier to the concrete barrier on the right-hand shoulder was 82.5-feet. The right-hand shoulder was delineated from the traffic lanes with a solid white pavement stripe and the median shoulder was delineated from the HOV lane by a solid yellow pavement stripe. The HOV lane was delineated from the through traffic lanes by an 8-inch-wide solid white pavement stripe. The through traffic lanes were delineated by 4-inch-wide dashed 10-foot-long white pavement lines spaced at 30-foot gaps. A raised bi-directional, reflective pavement marker was installed in the center of each gap between dashed lines. The marker reflected white light to drivers driving in the correct direction and reflected red light to wrong-way drivers. There were no alert grooves or rumble strips installed on the road shoulders.

2. Traffic Metrics

As determined by the Arizona Department of Transportation (ADOT) in 2020, the annual average daily traffic for both westbound and eastbound directions of travel on SR-202 near the crash location was 104,271 vehicles; 90% were passenger vehicles.[3] The heavy truck and single unit truck ADT in 2020 was approximately 6,989 trucks per day or 16 percent of the total ADT.

[3]The annual average daily traffic in 2018 for eastbound and westbound directions of travel on SR-202 in this same location was 157,230 vehicles, 93 % of which were passenger vehicles. See Highway Attachment Traffic Metrics and 2018 AADT State Routes for more detailed traffic information.

The speed limit was posted at 65 mph. ADOT provided the NTSB with volume and speed information for each travel lane. On June 9, 2021, the average speed of traffic from 10 p.m. until 10:07 p.m. near the detector station at Mile Marker 4.739 was 9.9 mph.[4] This location is approximately 0.7 miles forward or east of the crash location. The crash occurred at 10:07 p.m.

The traffic volume on SR Loop 202 eastbound near mile marker 4 between 8:00 p.m. and 10:00 p.m. was 4,833 vehicles in all five lanes of traffic. Between 9 and 10 p.m. the volume was 1,917 vehicles.

Between 8:00 p.m. and 9 p.m., the average speed for all lanes of traffic at this location was 66.1 mph. Between 9:00 p.m. and 10 p.m., the average speed for all lanes of traffic was 26.1 mph, and had dropped to below 10 mph by 9:49 p.m.

3. Crash History

ADOT records showed that for the travel lanes in the 4-mile-long area on SR Loop 202 from mile marker 2 through 6, approximately 1,501 motor vehicle crashes occurred between 2016 and 2020 with 682 of the crashes occurring in the eastbound lanes. Two fatal rear-end crashes involving heavy trucks occurred during this time-period.[5] Overall, twenty-four of the crashes from 2016 through 2020 involved heavy trucks.

4. Roadway Geometry

The crash occurred on a straight or tangent section of roadway forward of a crest vertical curve and located in between two horizontal curves.[6] The tangent section that preceded the crash location was approximately 1,320-feet long. The tangent section continued for another 200-feet after the impact area and then transitioned into a right-hand horizontal curve. A right-hand curve began 200-feet after the impact area. This curve had a radius of 2,083.48-feet and was 2,645.7 feet long.[7]

5. Highway Signage

There was one highway sign applicable to the crash-involved truck driver's navigational route in addition to the overhead permanent Dynamic Message Sign (DMS) board installations at mile marker 1.75 and mile marker 4.1. An advance exit sign for the Priest Drive exit 6 was located 1.5 miles in advance of the Priest Drive exit and approximately 1,642-feet from the impact area. See **Figure 3** below.

[4] Research in Texas work zones show that when traffic queue speeds drop to 35 mph or below stop and go traffic may result. "Brydia, Robert, "Facilitating Deployment of Highly Portable End of Queue Warning Systems on I-35 Reconstruction Project," Texas A&M University Transportation Institute, 2008

[5] See Highway Attachment ADOT Crash History for SR-202.

[6] See Highway Attachment Highway Design Plans for detailed geometry information.

[7] See Crash Scene Diagram in Accident Reconstruction Group Chairman's Report for geometry details.

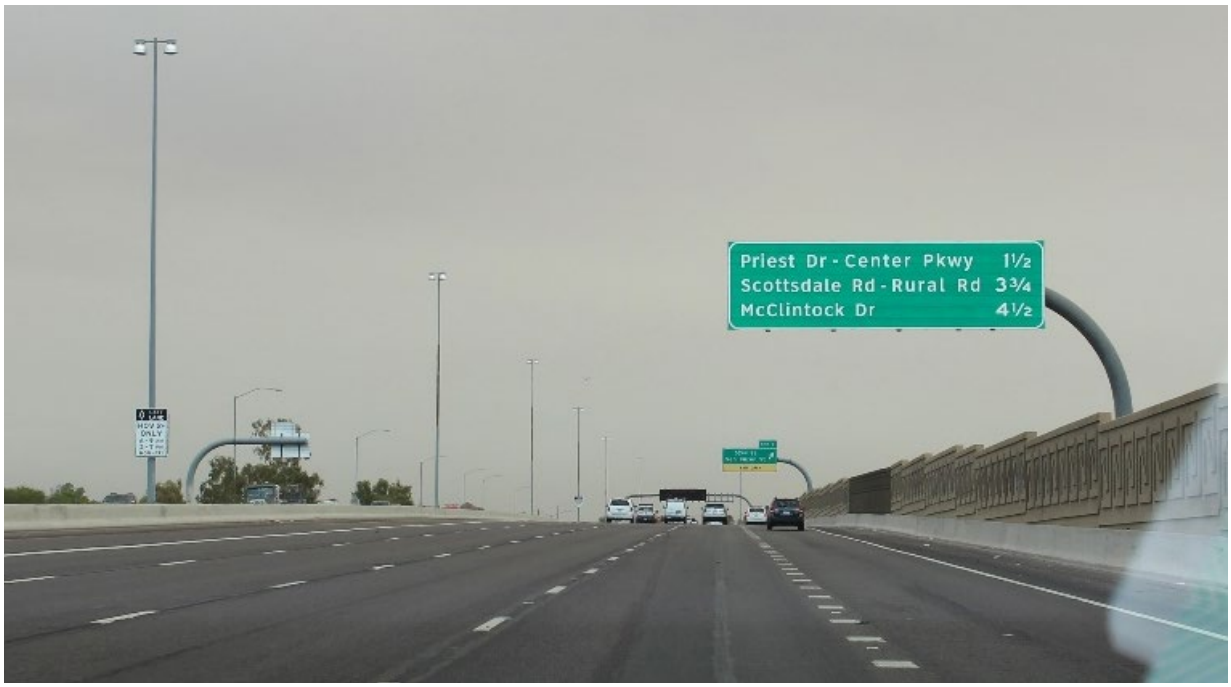

Figure 3. View of advance exit sign for Priest Drive located at Station number 33+98 or approximately 1,642-feet from the crash location. The exit only lane for exit 4 is located on the right in the photograph and the overhead DMS near the impact area is visible in the center of the photograph.

The ADOT has adopted the Federal *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD) 2009 Edition. Guidance and standards are in MUTCD section 2L. This section contains requirements and recommendations for character size, spacing, colors, design characteristics, brightness, message composition, and applications. In general, permanent Changeable Message Signs (CMS) electronic displays (also referred to as dynamic message signs or DMS) must be visible from at least 0.50-mile on 55-mph or greater speed zoned roadways and be legible for a minimum of 600-feet.[8] On high-speed (55-mph or greater roadways) the character size shall be 18-inches. ADOT indicated their DMS character size was 18-inches as required. The sign structural supports spaced 90-feet apart allowed the over-head electronic DMS signs to cover the entire 5-lane-wide road and the sign display was 31-feet wide and positioned 18.5 feet above the traffic lanes.

6. Highway Safety Lighting

High-pressure sodium vapor lights were installed approximately 60-feet above the concrete median barrier at 200-foot intervals. A still image from the forward-facing video recording (from the DriveCam video equipment on the crash-involved truck-tractor) showing the crash location

[8] The MUTCD uses the term Changeable Message Sign (CMS). In this report DMS and CMS have the same meaning and DMS is used. See Highway Attachment DMS Specifications for Dimensions of DMS signs for more detailed dimensions.

documented that the roadway was well illuminated.[9] See **Figure 4** below showing highway safety lights.

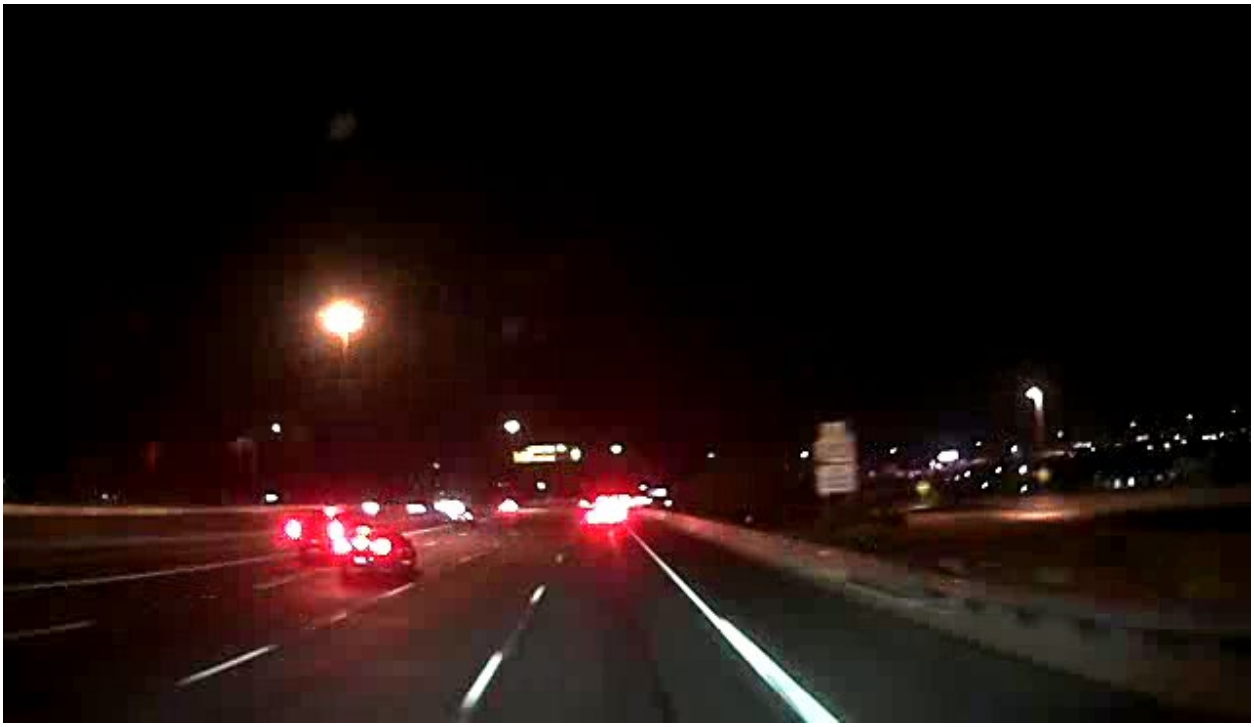

Figure 4. View of highway safety lighting approximately 200-feet west of the impact area. Source: Lytx DriveCam forward-facing in-cab video still image from truck-tractor.

7. Concrete Median Barrier Information

In this crash the truck-tractor tanker semitrailer combination unit struck the traffic queue in the right lane, veered left, and struck the concrete median barrier. The tanker semi-trailer separated from the truck-tractor and rolled the barrier onto the westbound lanes. The concrete median barrier was rated as a NCHRP-350 Test Level 4 (TL-4) barrier. A TL-4 barrier is considered for general use on high-speed freeways with and average mix of passenger vehicles and truck traffic. The crash test for TL-4 barriers is intended to provide resistance in most real-world crashes where typical impact scenarios do not exceed the practical worst-case scenarios of a 15-degree impact angle at 50-mph with a 19,700-pound single unit truck (SUT).[10] In lesser impact speeds and angles which account for most barrier impacts the TL-4 has been found to provide adequate resistance even to heavier truck tractor semitrailer combinations which are tested at the TL-5 level. In a TL-5 test an 80,000-pound truck tractor van semi-trailer is used to impact the barrier at 50-mph and 15-degrees. Additionally, a TL-6 test is available which used the same

[9] See Highway Attachment Highway Safety Lighting Plans and Signing Plans and video screen shots for more detailed information.
[10] See National Cooperative Highway Research Program Report 350 (NCHRP-350, Test Level 4 Report Transportation Research Board (TRB) 1993.

speeds and encroachment angle but uses a truck tractor tanker semi-trailer as the test vehicle. The TL-6 barrier is 96-inches tall.

In both the TL-4 and TL-5 crash tests the test vehicle is not allowed to roll over the back side of the barrier. In this crash the tanker combination unit impacted the barrier at an approximate encroachment angle of approximately 26-degrees, which exceeds the performance envelope found in the crash test (15-degrees).[11] A TL-6 barrier would be required to safely re-direct a fully loaded tanker semitrailer at 15-degrees encroachment traveling at 50-mph.

8. June 9, 2021, Pre-Crash Roadway Closure Due to Criminal Event

8.1 Pre-Crash Incident that Resulted in SR-202 Eastbound Lane Closures

Prior to the 10:07 p.m. multi-vehicle crash, a shooting incident was reported to the Arizona Department of Public Safety (AZDPS) Operations Communications (OpsComm) a 7:58 p.m. The AZDPS OpsComm received a telephone call reporting shots fired near milepost 5 at a passenger car traveling eastbound on SR-202. The caller was the operator of the vehicle that was struck and had pulled off on the eastbound shoulder of SR-202 at Priest Drive/Center Parkway (mile marker 6).[12]

AZDPS Highway Patrol Division (HPD) Troopers and an AZDPS HPD Sergeant (Sgt) were dispatched to the scene. Two AZDPS Trooper arrive first, then the Sgt arrived after 8:18 p.m. and then requested an additional seven AZDPS Troopers to respond to the scene. In total, 12 AZDPS Troopers were assigned to the incident. At 8:58 p.m., the Sgt announced to the ADOT Traffic Operations Center (TOC) that he was Incident Command (named Priest Command). He then began coordinating for traffic to be re-routed off at Priest Drive and the eastbound lanes of SR-202 to be closed for a search for perishable evidence (shell casing). To provide advance warning of the road closure, AZDPS units coordinated with the ADOT TOC to activate two permanent DMS board installations on SR-202 eastbound at mile marker 1.75 and mile marker 4.1.[13] AZDPS Troopers then used flares, traffic cones, and marked police vehicles to set up a travel lane taper in advance of the closed section of five eastbound lanes of SR-202 to guide roadway traffic to the Priest Drive exit ramp.[14]

The TOC was advised again at 9:04 p.m. of the lane closure and evidence search; lane closure was officially initiated at 9:16 p.m. The search starting point was at the location where the victim vehicle had pulled over (SR-202 at Center Parkway). The search was conducted in a westbound direction in the eastbound lanes to the closure of the lanes. At approximately 9:47 p.m., a shell casing was recovered "approximately 30-feet east, from the beginning of the gore-point to

[11] See Technical Accident Reconstruction Factual Report for impact to barrier angles.
[12] Highway Attachment AZDPS Incident Report I21031298.
[13] TOC CAD records indicated the AZDPS notified them at 8:58 p.m. of the Incident Command under the AZDPS Sgt (named Priest Command). AZDPS incident records and TOC reports indicate the road was fully closed at 9:16 p.m. and the road closure was terminated at 10:00 p.m.) See Highway Attachment Statements from Traffic Operations Center (TOC) personnel.
[14] See Highway Attachment Statements from Traffic Operations Center (TOC) personnel.

the Priest Road exit, from eastbound SR-202".[15] At 10 p.m., 44-minutes after the roadway closure was initiated, all lanes were re-opened.

8.2 Arizona Department of Transportation (ADOT) Traffic Operations Center

The ADOT Traffic Operations Center (TOC) is the central point of traffic information for various law enforcement agencies and the motoring public "to reduce congestion and secondary incidents through traffic management."[16] One of the goals for the TOC is to "initiate and document ADOT response to unplanned incidents." The TOC operates approximately 352 Closed Circuit TV's (CCTV's) traffic cameras.[17] ADOT has approximately 291 permanent DMS board installations.[18]

Per the ADOT TOC Guidelines and Procedures manual, the purpose of the DMS boards are to provide drivers with information about traffic, roadway conditions, Amber Alerts, and public service announcements. Dynamic Travel Times (DTT) are automatically activated between 5:00 a.m. and 11:00 p.m. Monday through Friday and 7:00 a.m. through 9:00 p.m. on Saturday and Sunday.[19] The DMS boards are controlled using Cameleon Client Software (Cameleon) what allows for multiple messages to be displayed at various priority levels, as well as allowing two-panel message displays.

TOC operators activate or deactivate DMS boards either as a scheduled request or in response to an unplanned incident. Per the TOC manual, once ADOT personnel, or DPS troopers, advise they are on scene at an incident, and establish a traffic control plan, an Operator at the TOC will gather the information listed below.[20]

1. Name of ADOT Incident Commander (IC)
2. Contact phone number for the ADOT IC
3. The exact milepost to milepost range of the closure
4. The detour route or plan (examples: "traffic detoured onto right shoulder", or a street-by-street detour list)
5. A brief update about the incident that includes an estimate for re-opening (examples: "Cleanup operations are underway for 500 gallons of fuel that has leaked out of the tanker truck." Or "This will be an extended closure as DPS conducts a criminal investigation for the 2-vehicle fatal crash.")

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[15] Highway Attachment AZDPS Incident Report I21031298.
[16] See Highway Attachment Traffic Operations Center Guidelines and Procedures Excerpts.
[17] Traffic Management | ADOT (azdot.gov) or (https://azdot.gov/business/transportation-systems-management-and-operations/traffic-management (accessed 1/27/2023).
[18] Per ADOT Manual, "ADOT has been actively developing freeway travel time estimates since 2008 to be displayed on DMS boards visible to the largest number of freeway weekday commuters on the most heavily traveled freeway corridors" and
[19] Operators "have the capability to activate or extend the travel times in event of heavy traffic outside the established rush hours."
[20] To standardize documentation of ADOT's incident management response and event reporting, TOC Operators enter the incident into the Motorola/Spillman Flex CAD system.

On June 9, 2021, prior to 8:58 p.m. initiation of Incident Command for the lane closure to search for evidence, the DMS boards were displaying DTT messages alternated with an informational message urging people to get vaccinated for COVID. Upon request by the Incident Command, the dispatcher/operator activated the DMS boards at mile marker 1.75 (DMS050 at 24th Street) at 9:06 p.m. and mile marker 4.1 (DMS051at 52nd Street) at 9:09 p.m. The displayed message read:[21]

LAW ENFORCEMENT
AT PRIEST
EXPECT TO STOP

The traffic incident message was in a (dual-panel) two-page format that alternated every two seconds with DTT. At 9:35 p.m., the message was inadvertently blanked at by TOC personnel then put back up at 9:47 p.m. According to a statement from the 2nd shift supervisor at TOC, there was a communication issue between the HPTOC AZDPS Troopers in the TOC and the AZDPS Troopers on-scene and dispatch. The ADOT Public Information Officer (PIO) in the TOC had observed on CCTV that the roadway was still closed, and law enforcement remained in the traffic lanes and the message was re-displayed at 9:47 p.m. The TOC shift supervisor ordered the message to remain up until CCTV cameras showed law enforcement was no longer occupying the roadway.[22] The message was then blanked from the two permanent DMS boards at 10:08 p.m. TOC CCTV verified that all lanes were open, and traffic was moving.

At the time of the shooting incident, present at the TOC was the assigned supervisor for the 2nd shift, 2 Dispatchers, ADOT PIO, and two Highway Patrol TOC DPS (HPTOC/DPS) Troopers. Post-crash, one dispatcher provided a written statement that about 9:00 p.m. she overheard that AZDPS was planning to stop traffic on SR-202 near Center Parkway in the eastbound lanes. This dispatcher stated one of the HPTOC/DPS Troopers stated AZDPS did not believe they were going to have the freeway closed for an extended amount of time".[23] The dispatcher did observe the Troopers on the CCTV in the SR-202 mainlines and that they had flares out and were using marked AZDPS HPD vehicles to block the HOV lane and 4 other lanes.

A TOC Incident Response Unit (IRU) had completed a traffic assignment and heading home, traveling east on SR-202 when he came upon slowed traffic about a mile from the location where the AZDPS had shut down the lanes.[24] He remained in the traffic up to the location where the road was closed (exiting at Priest Road exit). He observed the AZDPS had established a short taper across all lanes of traffic and re-routed traffic onto the Priest Drive exit. He did not recall the length of the taper, only that it appeared short. His IRU vehicle had been equipped with traffic cones and flashing lights but not a portable dynamic (or changeable) message board. He approached an

[21] See Highway Attachment TOC Documentation on DMS Boards.
[22] See Highway Attachment Traffic Operations Center (TOC) personnel statements for details of the TOC operation of this incident.
[23] See Highway Attachment Traffic Operations Center (TOC) personnel statements for details of the TOC operation of this incident.
[24] TOC Control Room Operator (Operator) is responsible for dispatching the Incident Response Unit members. The ADOT Incident Response Unit (IRU) is comprised of 2 shifts that patrol the Central District ADOT road Monday through Friday from 5:00 a.m. to 8:00 p.m. and remain on call outside of these hours. They are the first point of contact to respond to requests for traffic control, infrastructure damage or debris removal.

AZDPS Trooper, inquired if they needed assistance and they answered they did not need assistance. He recalled traffic was moving slow but not stopping as he departed SR-202 at Priest Road exit.[25]

The Dispatch Supervisor on-duty (2nd shift ended at 10:00 p.m. on June 9) at the time of the shooting incident reported that there was a "temporary break/closure" (east of 52nd street and west of Van Buren exit on SR-202 eastbound). The Supervisor stated he observed several AZDPS Troopers walking on foot on the mainline with flashlights (see **Figure 5** between the two red lines). Figure 6 is a screenshot taken from live CCTV video on the same CCTV camera but on June 15th, 2021, not June 9, 2021. Traffic was stopped near the red line on the right of the photo near the Priest Road exit. (The photo was a screenshot of a CCTV live feed from the night of June 15, 2021, to illustrate the CCTV view the Dispatch Supervisor is referring to.) The Dispatch Supervisor stated that the view of the CCTV at about 10:05 p.m. showed the AZDPS units had cleared the scene, the road was open, and traffic was flowing. Once the Dispatch Supervisor was logged into the CAD and Cameleon software, he released the DMS board related to the traffic incident. According to the Dispatch Supervisor's statement, traffic was flowing at Priest Drive when he observed the CCTV about 10:05 p.m.

Figure 5. CCTV screen shot from the Traffic Operations Center showing location of AZDPS units searching for evidence. Screen shot is from June 15, 2021, and for illustrative purposes only. Source: ADOT TOC.

Upon AZDPS report of a vehicle fire event at 52nd Street exit (the 4-fatal milk tank-truck crash) he assessed the scene via CCTV, activated DMS at 10:12 p.m., and created a CAD event at

[25] He arrived home about 10:00 p.m. after traveling 25 miles from the location where he departed SR-202 at Priest Drive. See Highway Attachment Statement from Off-Duty Incident Response Unit.

10:15 p.m. Additional TOC reports state that the TOC dispatched an IRU, SR-202 east- and westbound was closed at State Route 143 and SR-202 eastbound 44th Street ramp, westbound 52nd Street and Priest Drive ramps were closed. By 10:44 p.m. the roadway closure was expected to be at least 10 hours. A private entity was contacted for barricades and ADOT HAZMAT dispatched to respond for milk truck load of milk went into roadway drain.[26] The DMS boards showed the following messages related to the closure of SR-202 for the 4-fatal crash:

10:13 p.m.	VEHICLE FIRE AT 52nd ST ROAD BLOCKED (alternated with DTT message)
10:31 p.m.	ROAD CLOSED AT 52nd St / Use ALT ROUTE (alternated with DTT message)
10:37 p.m.	ROAD CLOSED AT 52nd ST / USE ALT ROUTE (DTT message removed)
11:15 p.m.	ROAD CLOSED SR-143 – 52ND ST USE ALT ROUTE

The ADOT TOC reported to NTSB investigators that the message on the DMS installations for the lane closures for the evidence search was classified as a level 4 message.[27] The CAD system shows the message priority level for the vehicle fire and road blocked was also classified as a level 4. Then it was re-classified as a Level 1 by 10:37 p.m. and the alternating message was removed.

There are 10 separate priority levels, with a Level 1 as highest priority. The importance of the message dictates at what level of the message will be sent. Per the ADOT Manual:

- High Priority Level encompasses levels one through three and overwrites the travel times:

  1. Automated Wrong Way messages.
  2. Active unplanned closures of ADOT roads.
  3. Active planned closures of ADOT roads.

- Low Priority Level encompasses levels four through ten and alternates messages with travel times:

  4. Active unplanned lane restrictions, or ramp closures (crashes, debris, etc.).
  5. Active planned lane restrictions, or ramp closures (construction, roadway maintenance).
  6. Sweeper activity messages, Amber Alerts, Blue Alerts, and Silver Alerts.
  7. Event Messages.
  8. Pre-warning construction messages.
  9. High pollution advisories, public service announcements.
  10. Travel Time.

- Dual Panel Display: Operators should utilize a dual panel message for any incident/situation in which motorists would benefit from additional information.

According to the ADOT manual, DMS signs are "activated by operators in response to unplanned incidents such as blocking crashes, lane restrictions, traffic management, weather, and Amber Alerts." Active traffic management means that DMS may include "advising motorists of alternate

[26] See Highway Attachment Traffic Operations Center (TOC) personnel statements for details of the TOC operation of this incident.
[27] See Highway Attachment Traffic Operations Center Guidelines and Procedures Excerpts.

routes, traffic congestion, clearing crashes, or warning of hazardous non-blocking incidents impacting traffic." The ADOT manual states that:

> In accordance with the Federal HighwayAdministration's (FHWA) Manual on Uniform Traffic Control Devices (MUTCD), only traffic, operational, regulatory, warning, and guidance information may be displayed on dynamic message signs (DMS). This includes messages for incident management, route diversion, adverse weather warnings, lane/ramp/roadway control, travel times, and destination guidance.
>
> Other applications include safety related messages such as emergency homeland security messages as well as Amber Alert, Silver Alert, and Blue Alert messages.
>
> Dynamic message signs (DMS) shall not be used for any non-transportation or non-safety related purpose such as advertisement or to support a private entity.

On June 10, 2021, the message on the DMS board located at the crash location reverted to the dual-panel format with the DTT and informational message regarding vaccinations for COVID-19. See **Figure 6** and **Figure 7** below.

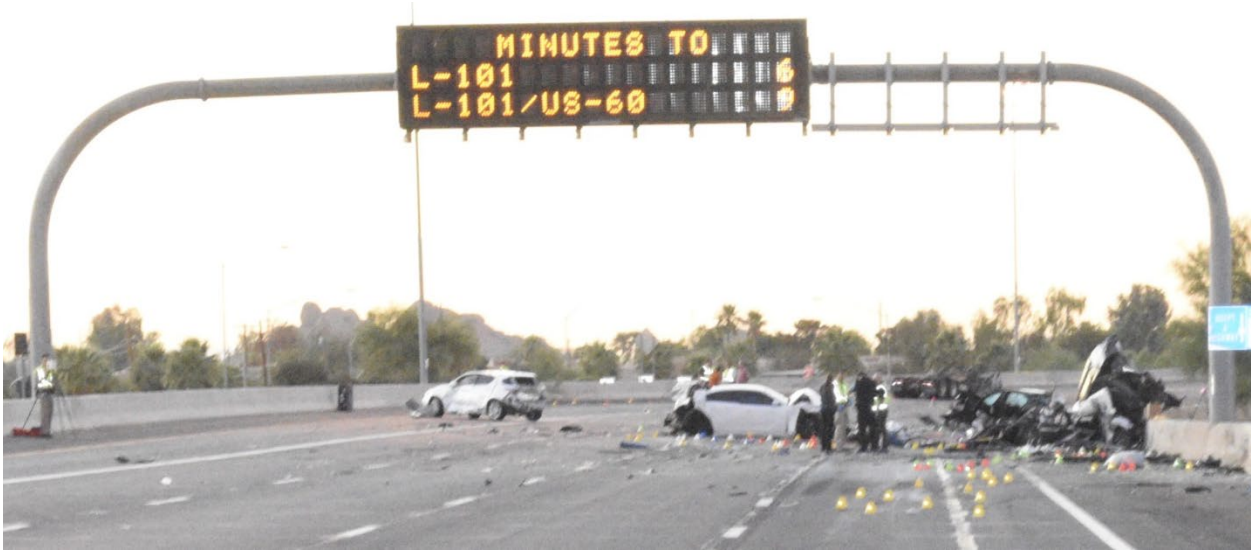


Figure 6. View of permanent DMS board with DTT message at the crash location.

Figure 7. View of permanent DMS board with COVID-19 message at the crash location.

Post-crash, NTSB inquired with ADOT on the classification of the road closure as a Priority Level 4. ADOT responded on October 8, 2021, and August 24, 2022 the following: "Our record indicates the dispatcher took the documented action, warned drivers of the location and situation in accordance with information as identified throughout the event."

On January 4, 2021, the FHWA issued an official interpretation on how Changeable Message Signs (CMS/DMS) may be used.[28] The issuance was in response to questions States had on using unconventional language on DMS and on addressing public input. The memorandum was intended to clarify the provisions of the MUTCD and "assist States and local agencies in ensuring that their traffic control devices willpromote the safe and efficient utilization of the highways." Specific to the principal uses of CMS are Real-Time and Travel Time Message. The memorandum states:

> These uses (below) are consistent with the uses of traffic control devices in general throughout the rest of the MUTCD and, with two special exceptions, are related to traffic control. The public has now developed a confidence in the operational capabilities of CMS and has come to primarily expect that information relevant to travel conditions will be displayed on them in the event of unexpected conditions.
>
> - Real-Time Traffic Control Messages
>
> The original intent of CMS was to provide information about traffic and travel conditions in real time. Whether for non-recurring congestion, incidents, work zones, or similar conditions, CMS are mainly used for the purpose of informing the traveling public of unexpected or atypical travel conditions. Accordingly, uses other than relevant real-time

[28] See Official Ruling No. 2(09)-174 (I) - Uses of and Nonstandard Syntax on Changeable Message Signs - FHWA Office of Operations (dot.gov).

traffic control messages should be selective and confined to periods during which traffic exposed to those messages will not be likely to habituate to seeing non-relevant messages on the signs.

- Travel Time Messages

  Travel time messages are a valuable resource to travelers during periods of congestion when travel time might vary considerably. To be effective, the travel time should have some point of reference, most often a distance, over which that time applies so that the traveler can gauge the level of congestion and extent of any delay. Either a distance or a reference-location-based exit number[29] appropriately provides this context. Ideally, comparative travel times for alternative routes to a common destination will provide the most direct message and help to balance traffic volumes among the two routes.

Per FHWA interpretation, DMS should, like any other traffic control device meet the five following principles of traffic control devices:

- Fulfill a need. (Signs fulfill a need by providing regulatory, warning, or guidance information to the road user at the point that information is needed to ensure safe and efficient operation. The primary purpose of CMS is to provide relevant information on changing highway traffic conditions. To meet this need, these signs are most often located in advance of major junctions, before areas prone to incidents or adverse road-weather conditions, and in areas of recurring congestion on facilities with higher volumes and speeds where driver workload demands are high.)
- Command attention. (By their nature of displaying an illuminated message and, often, by their placement to take advantage of long viewing distances and in an overhead position, electronic CMS tend to capture the attention of the road user.)
- Convey a clear, simple meaning. (Clear and simple messages are easy to read and comprehend with only short glances away from the roadway, resulting in minimal visual and cognitive distraction from the driving task.)
- Command respect from road users (Respect for CMS is gained through the posting of information that is relevant to all road users at the location and time it is displayed.
- Give adequate time for proper response.

The NTSB also inquired as to the use of a COVID-19 message on the ADOT DMS boards and was provided documents as to the ADOT guidance[30] for Covid-19 DMS messages:

- The President: Continuation of National Emergency statement, February 24, 2021
- FHWA's Covid-19 Information & Resources April 1, 2021
- ADOT Communication: Message boards encourage stopping the spread of Covid-19, March 25, 2020

[29] See MUTCD § 2E.31.
[30] See Highway Attachment ADOT Guidance for DMS messaging.

Per the ADOT March 25, 2020, communication, motorists would see messages on DMS signs displayed indefinitely on ADOT's 291 overhead DMS boards statewide "encouraging them to stop the spread of COVID-19." The Presidential Declaration of the Continuation of the National Emergency published in the *Federal Register* on February 24, 2021, stated "in accordance with section 202(d) of the National Emergencies Act (50United States Code 1622(d(), the President would continue the national emergency declared in Proclamation 9994 concerning the COVID-19 pandemic. On April 1, 2021, the FHWA provided information on their website that the FHWA was providing communication to States and local highway agencies through FHWA Division Offices regarding their authority to use CMS (DMS) boards for messages concerning COVID-19 during the Presidentially declared national emergency.[31]

9. Traffic Incident Management

9.1 AZDPS Highway Operations Manual

AZDPS HPD Highway Operations Manual ("intended to guide and facilitate timely and appropriate decisions and actions related to critical HPD field operations"[32]) all AZDPS HPD Troopers are trained in the National Traffic Incident Management (TIM) procedures. As described by the HPD manual, TIM Responder Training "provides guidance and tools to allow troopers to make the best decisions to mitigate traffic incidents and restore traffic in a safe, expedient manner." TIM training:

> consists of a planned and coordinated multidisciplinary process to detect, respond to, and clear traffic incidents so traffic flow may be restored as safely andquickly as possible.
>
> Effective TIM reduces the duration and impact of traffic incidents and improves the safety of motorists, crash victims, and emergency responders. The overarching purpose of TIM is the safety of responders, those involved in incidents and those approaching and passing incidents.

The manual also explains that "movement of traffic must be balanced with the absolute need for safety and the integrity of incident investigation activities." According to TIM, clearance and termination of incidents safely and quickly includes the need to protect tow operators while they finish vehicle removal, and all personnel and equipment are removed from the roadway. The AZDPS manual states the following:

> When parking at scenes, troopers shall position a patrol vehicle at a point visible prior to the scene with the rear-facing emergency lights activated in order to protect such things as people, property, or a crime scene. To prevent injury in the event of a collision, the patrol vehicle parked prior to the scene should be unoccupied as much as practical. Troopers should consider parking additional patrol/support vehicles forward of the scene to offer them a level of protection from a collision.

[31] See https://www.fhwa.dot.gov/coronavirus/ last update on April 1, 2021 (accessed 1/27/2023).
[32] See Highway Attachment AZDPS Highway Patrol Division Highway Operation Manual for more information.

For the pre-crash roadway closure in response to the reported shooting and search for evidence, AZDPS blocked the lanes with tapered cones, flares, and police cars with emergency flashing lights. TIM guidance for safe first responder vehicle position, "lanes may be blocked by utilizing linear and multilane blocks." The TIM also states that "the accepted national standard is the affected lane pus one additional lane". At the time of the search, all lanes were blocked as the location of the evidence in the lanes of traffic was unknown. The closure was coordinated by the AZDPS HPD Incident Command with the TOC, the TOC provided advance warning to motorists through the deployment of messages on the DMS installation boards in advance of the blocked lanes. Traffic was diverted onto a ramp to limit the congestion from the closure. Once the closure was terminated and communicated by Incident Command to the TOC, the TOC used CCTV cameras to view the roadway and verify law enforcement were no longer in the roadway before removing the warning messages from the DMS.

Per the AZDPS HPD Operations Manual, for Highway Closures:

Length of Tapers

- Troopers should consider the length of tapers when setting up emergency lane closures. The length of tapers in emergency lane closures will vary based on geographical factors to include: urban freeways, rural freeways, reduced visibility and any other factors which may cause a trooper to adjust the length of a taper.

- A general rule in an urban setting is to space cones or flares approximately 40 feet apart; which is approximately the distance from one skip line, if present, to the next. In rural settings, troopers may consider placing cones or flares no further apart in feet than the speed limit; for example, 35 mph = 35 feet apart, 45 mph = 45 feet apart, 55 mph = 55 feet apart and so forth.

- More detailed information regarding tapers is available in the *Manual on Uniform Traffic Control Devices* and Federal Highway Administration National Traffic Incident Management training.

Secondary Units

- Secondary units arriving at the scene must immediately provide for adequate traffic control, including a proper taper. With anticipated closures lasting 30 minutes or more, assistance from the ADOT ALERT should be requested. Troopers should request that all appropriate DMS be activated.

Full Roadway Closures

- A full roadway closure may require special routing of traffic through surface streets. Local jurisdictions must be notified of such rerouting as soon as possible. If local law enforcement units are not available, troopers should be assigned to traffic control at highway intersections to help accommodate the increased traffic congestion. Troopers must coordinate any closures with the TOC and, if warranted, implement the Incident Command System (ICS).

9.2 Federal Guidance on Control of Traffic through Incident Management Areas

ADOT has adopted the Federal *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD) 2009 Edition. In Chapter 6I, the MUTCD provides guidance for the control of traffic through incident management areas. A traffic incident is defined as an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic. Traffic incidents can be divided into the three following general classes of duration, each of which has unique traffic control characteristics and needs:

1. Major- expected duration of more than two hours,
2. Intermediate – expected duration of 30 minutes to 2 hours, and
3. Minor – expected duration under 30 minutes.

Per MUTCD, "Responders arriving at an incident should estimate the magnitude of the traffic incident, the expected time duration of the incident, and the expected vehicle queue length, and then should set up the appropriate temporary traffic controls for these estimates."

Intermediate Traffic Incidents. According to the MUTCD:

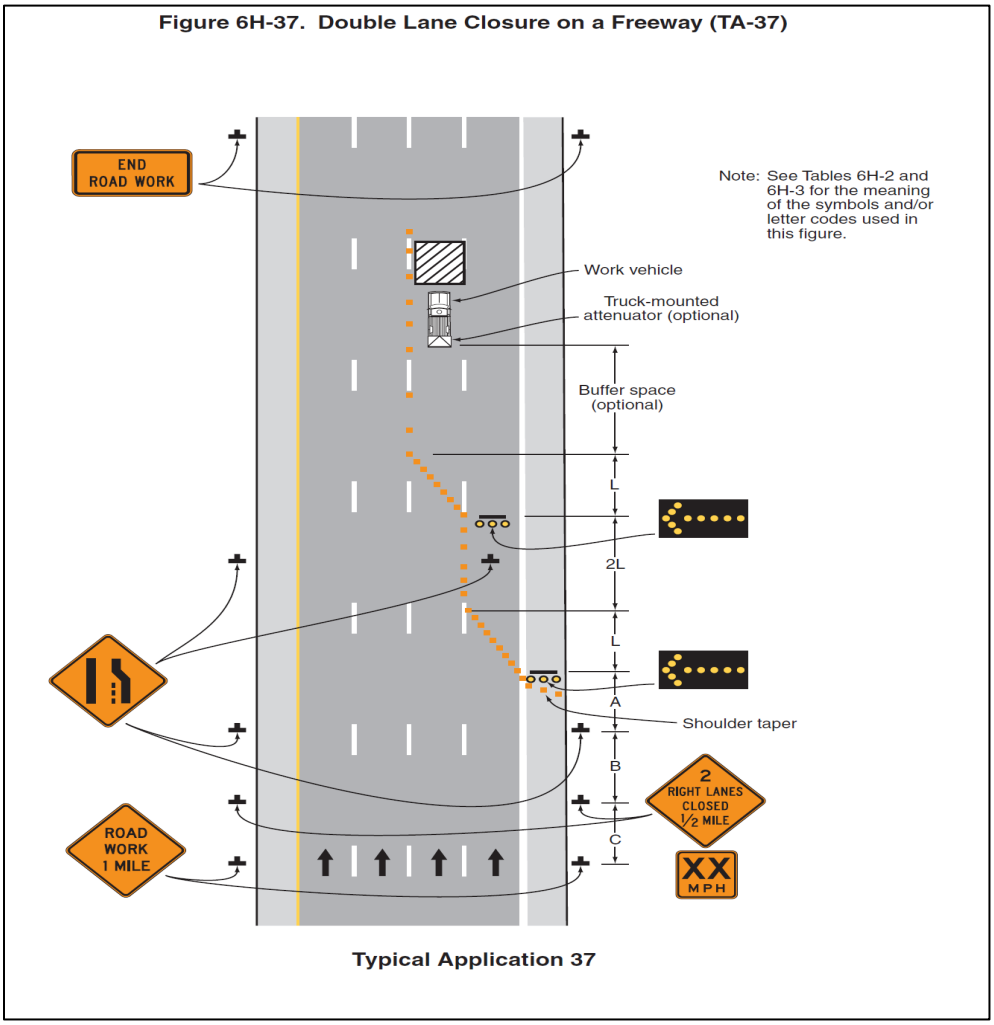
> Intermediate traffic incidents typically affect travel lanes for a time-period of 30 minutes to two hours, and usually require traffic control on the scene to divert road users past the blockage. Full roadway closures might be needed for short periods during traffic incident clearance to allow traffic incident responders to accomplish their tasks.
>
> Other support information provided by the MUTCD include the following:
>
> -The establishment, maintenance, and prompt removal of lane diversions can be effectively managed by interagency planning that includes highway and public safety agencies.

Guidance:

> All traffic control devices needed to set up Temporary Traffic Control (TTC) at a traffic incident should be available so that they can be readily deployed for intermediate traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert traffic approaching the queue and to encourage early diversion to an appropriate alternative route.
>
> Attention should be paid to the upstream end of the traffic queue such that warning is given to road users approaching the back of the queue.
>
> When light sticks or flares are used to establish the initial traffic control at incident scenes, channelizing devices (See Section 6F.63 MUTCD) should be installed as soon thereafter as practical. Section 6F.63 standards indicate designs shall be crashworthy and shall be as shown in MUTCD Figure 6F-7, page 605 MUTCD.

Tapered Lane Closure Guidance. For the shooting incident and evidence search, AZDPS closed all five freeway lanes to provide protection while they accomplished the necessary search for

perishable evidence. The closest typical application in the MUTCD is for a double lane closure on a freeway (TA-37). See **Figure 8** MUTCD TA 37 below.



Report Figure 8. MUTCD TA-37.

Table 6H-4 in the MUTCD provides the formulas for determining taper length as follows:

- Where: L=taper length in feet
- W= width of offset or lane width in feet
- S = posted speed limit
- L=WS or 12-feet x 65 mph = 780-feet

Using the formula provided in figure 8 shows that a 780-foot taper would be required for each 12-foot-wide lane in the posted 65-mph speed zone and a 1,560-foot buffer space between each lane closed would be required to be compliant with MUTCD guidance. The longitudinal distance required to taper 5 lanes would be approximately 10,140-feet or approximately 1.92 miles. And this would require 156 cones spaced at 65-foot intervals.

Minor Traffic Incidents. Section 6I.04 of the MUTCD provides the following support and guidance information for providing temporary traffic control through minor incident areas. It states:

> Minor traffic incidents are typically disabled vehicles and minor crashes that result in lane closures of less than 30 minutes. On-scene responders are typically law enforcement and towing companies, and occasionally highway agency service patrol vehicles. Diversion of traffic into other lanes is often not needed or is needed only briefly. It is generally not possible or practical to set up a lane closure with traffic control devices for a minor traffic incident. Traffic control is the responsibility of on-scene responders. When a minor traffic incident blocks a travel lane, it should be removed from that lane to the shoulder as quickly as possible."

E. Docket Material

The following attachments and photographs are available in the public docket.

ATTACHMENTS

Highway Attachment Traffic Metrics and 2018 AADT State Routes.
Highway Attachment Crash History.
Highway Attachment Highway Design Plans.
Highway Attachment DMS Specifications for Dimensions of DMS signs.
Highway Attachment Safety Lighting Plans and Signing Plans.
Highway Attachment AZDPS Incident Report I21031298.
Highway Attachment Statements from Traffic Operations Center (TOC) Personnel.
Highway Attachment: Traffic Operations Center Guidelines and Procedures Excerpts.
Highway Attachment TOC Documentation on DMS Boards.
Highway Attachment Statement of Off-duty Incident Response Unit.
Highway Attachment ADOT Guidance for DMS Messaging.
Highway Attachment AZDPS Highway Patrol Division Highway Operation Manual.

PHOTOGRAPHS

Highway Attachment (10) Highway Photographs

END OF REPORT

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