TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Motor Coach Crash Mexican Hat, Utah

January 6, 2008

CASE STUDIES WORKSHOP & WEBINAR

John Leonard
Utah Department of Transportation

August 26, 2009

Seaside, OR

T3 Webinars are brought to you by the ITS Professional Capacity Building Program ITS PCB) at the U.S. Department of Transportation's (USDOT) ITS Joint Program Office, Research and Innovative Technology Administration (RITA)

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Crash Location

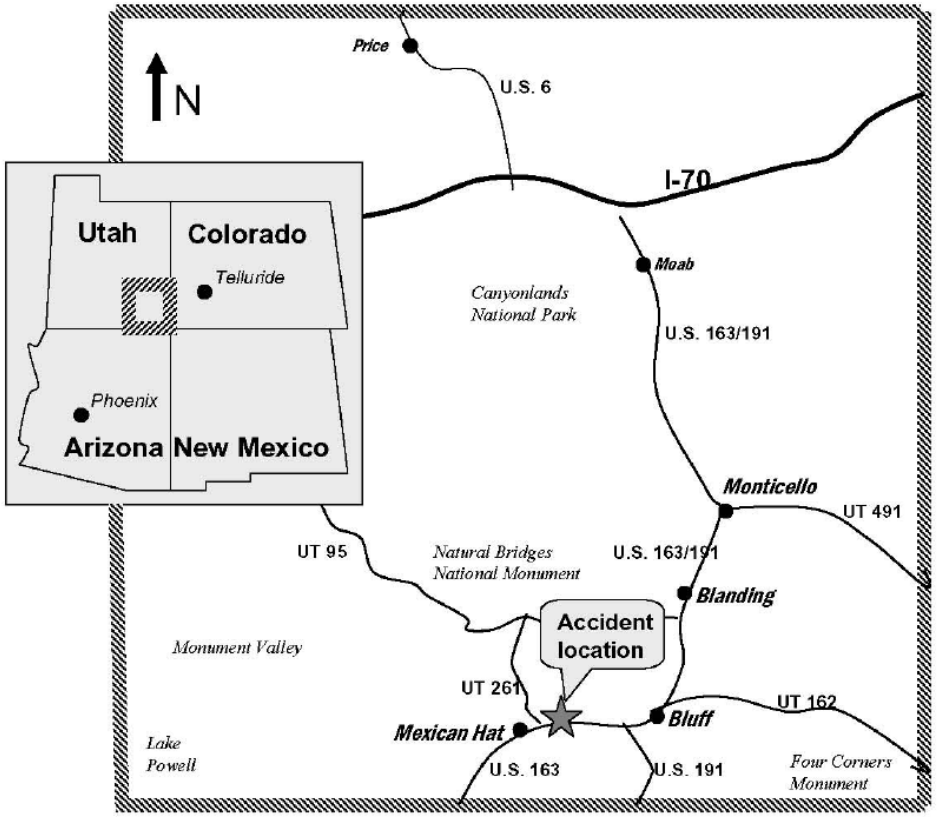


Figure 1. Accident motorcoach's route.

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Charter Details

- Trip originated in Phoenix, Arizona, January 3, 2008
- Consisted of 17 motorcoachs
- Ski trip excursion to Telluride, Colorado
- Scheduled to return January 6, 2008

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Route Diversion

- Colorado State Route 145 is the normal route used from Telluride to Phoenix
- The motor coaches were diverted to an alternate route that included US Routes 191/163 in Utah, due to the closure of Colorado State Route 145 because of snow.

Trip Details

- The alternate route was 70 miles longer than the originally planned route.
- The return trip was 556 miles in snowy weather.
  - The trip began with snow chains installed on the motor coach

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

January 6, 2008

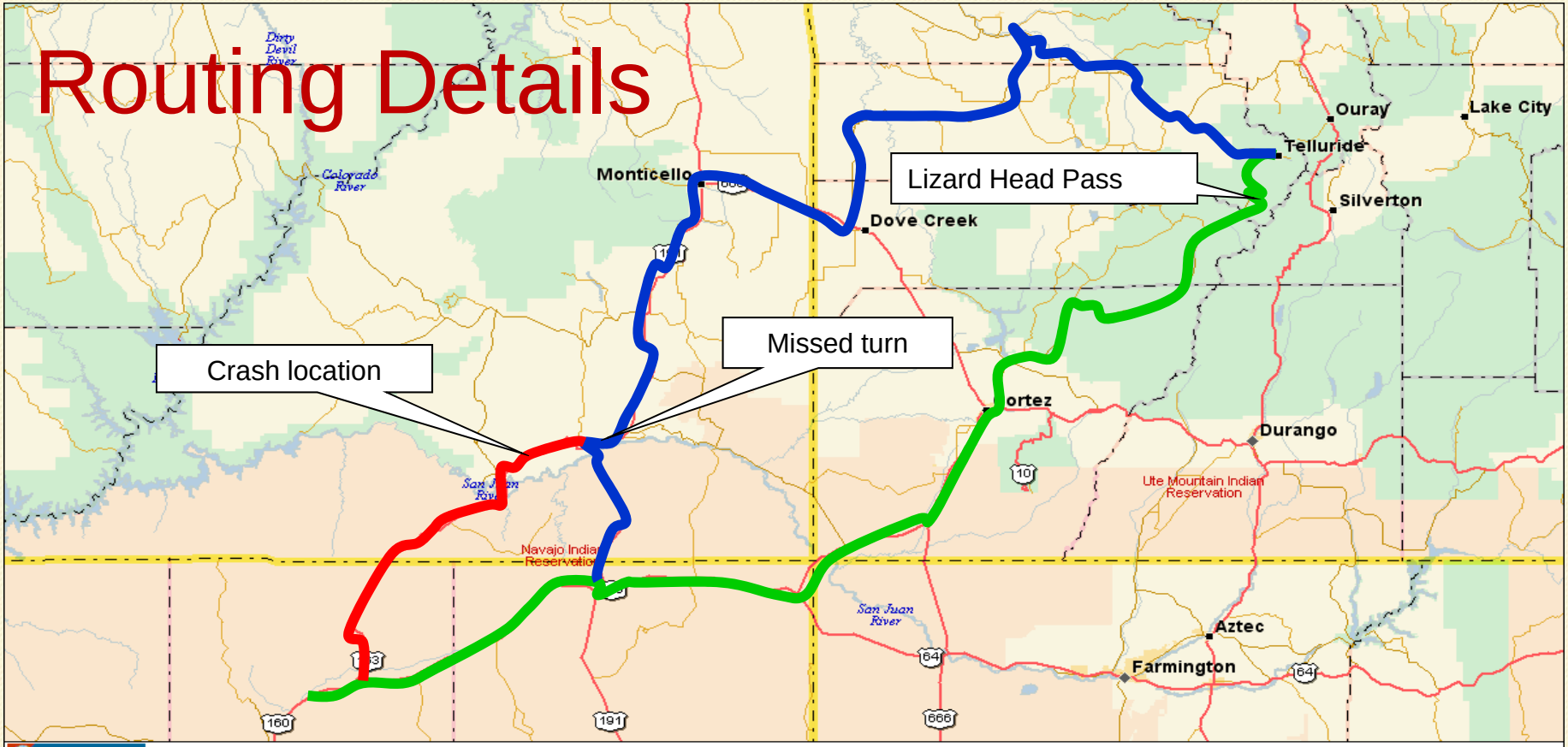
- Departed Telluride, Colorado, at 3:15 p.m.
- Tire chains were removed outside of Telluride
- Driver missed turn to stay on US-191
- Continued straight on U.S. Route 163
- Crash occurred at 8:02 p.m.

TSAG

TRANSPORTATION SAFETY ADVANCEMENT GROUP

Promoting Technology for Public Safety

Routing Details



Source: NTSB

Weather

- According to the National Weather Service (NWS) automated observation system located at the Blanding Municipal Airport (KBDG), approximately 30 miles northeast of the accident site, the temperature at 7:50 p.m. was 30 degrees. The sky was overcast and the dew point was 28 degrees.
- It snowed later that night

Weather

- Utah Highway Patrol Troopers that responded to the scene indicated that the pavement was dry at the time of the accident.
- Two hours after the crash, UDOT vehicle mounted instruments showed a road surface temperature of 37 degrees F with an air temperature of 41 degrees F.

Light Conditions

- Sunset was 5:14 p.m.
- The moon was a waning crescent
  - 3 percent of the moon was visible.
- There was no highway lighting

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Road Characteristics

- 4 miles north of the crash area the highway begins a gradual descent
- For 6,400 feet preceding the curve where the crash occurred, the highway averages a 4% downgrade
- Prior to the curve where the crash occurred is a 1,200 foot-long, 5.6% downgrade

Road Characteristics

- The crash occurred on a 1,641 foot left curve with a spiral transition and a 1,432 foot radius (4-degree) curve.
- The curve has a 6 percent super elevation.
- A curve warning sign is posted approximately 750 feet in advance of the curve.

Road Characteristics

- The highway design plans show a 60 mph design speed.
  - Posted speed is 65 MPH
- Previously, ball-bank indicator tests were performed at the posted speed, and the results indicated that an advisory speed did not need to be posted for the curve

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Traffic Characteristics

- Classified as a secondary rural arterial
- Traffic counts showed the Average Daily Traffic (ADT) was 610 vehicles per day

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Crash History

- Crash records for 2002-2006 showed that 10 other crashes occurred between mileposts 28-32.
  - Crash was at milepost 29
  - Four were property damage only
  - Six crashes involved injury.
- One occurred near the crash scene.
  - There were no other fatal crashes.
- One involved a truck
- There were no other bus crashes.

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

4 Miles prior to Crash Site

HWY. Photo #01 - View of beginning of 4-mile-long downgrade on U.S. Highway 163 at milepost # 33

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

3 Miles prior to Crash Site

Hwy. Photo #2 - View of US163 at MP# 32 looking southwest

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

2 Miles prior to Crash Site

Hwy. Photo #3 - View of US 163 at MP# 31 (Notice steepness of grade)

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

1 Mile prior to Crash Site

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Curve prior to Crash Site--- 5.6% Down Grade

HWY. Photo #5 - View of 5.6 percent downgrade on approach to accident curve (Note the curve warning sign)

Source: NTSB

Crash Site

Hwy. Photo #10 - Continued view of curve with sign for "Valley of the Gods" in the background where the foreslope changes to rising terrain

Source: NTSB

Crash Site

Hwy. Photo #11 - View of guardrail 61 feet from the end where the rear of the motorcoach came into contact with the rail.

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

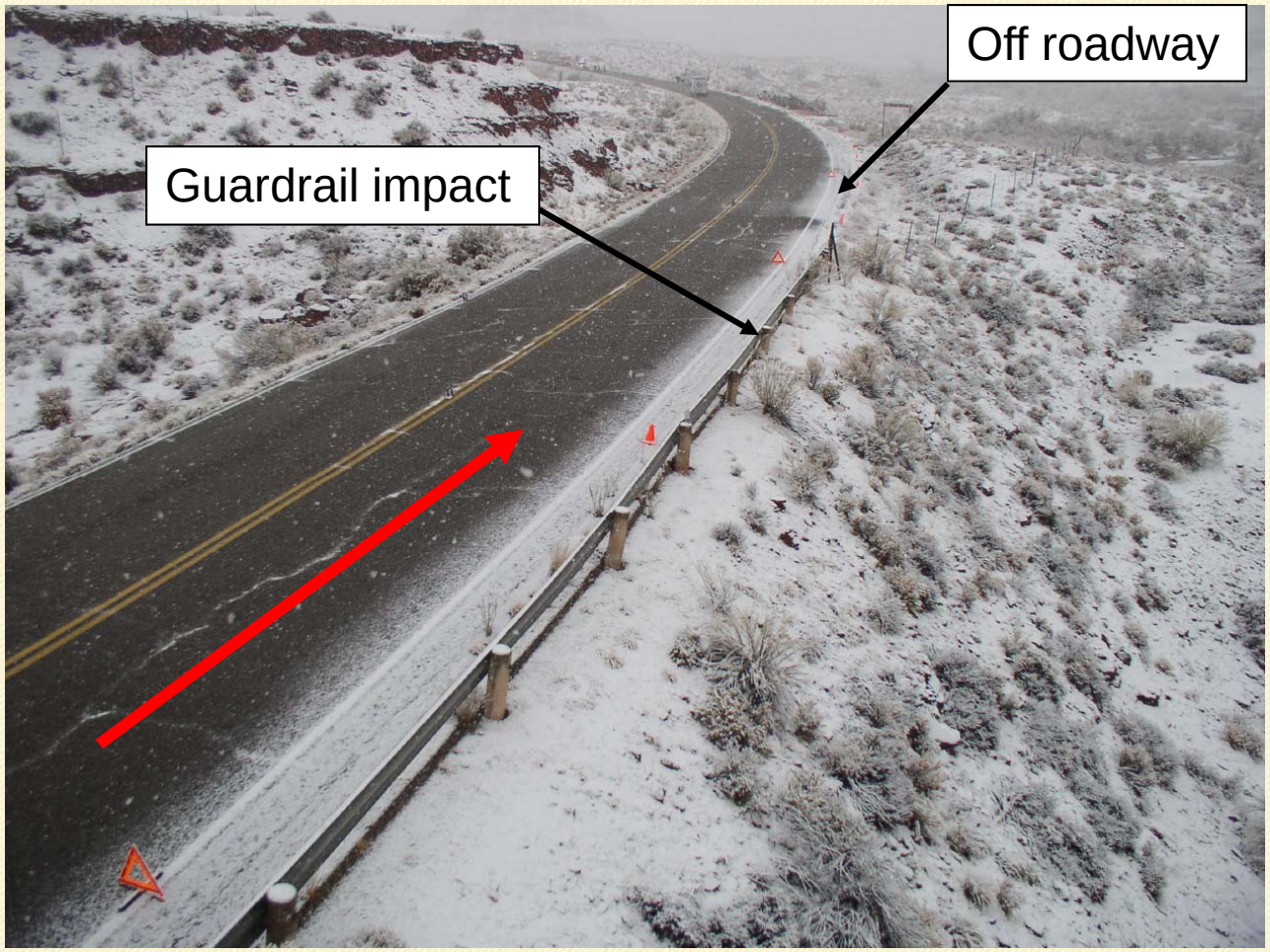
Crash Site

Hwy. Photo #17 - Note the furrowing of the motorcoaches' left front tire as it curves back toward the white painted edge line.

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

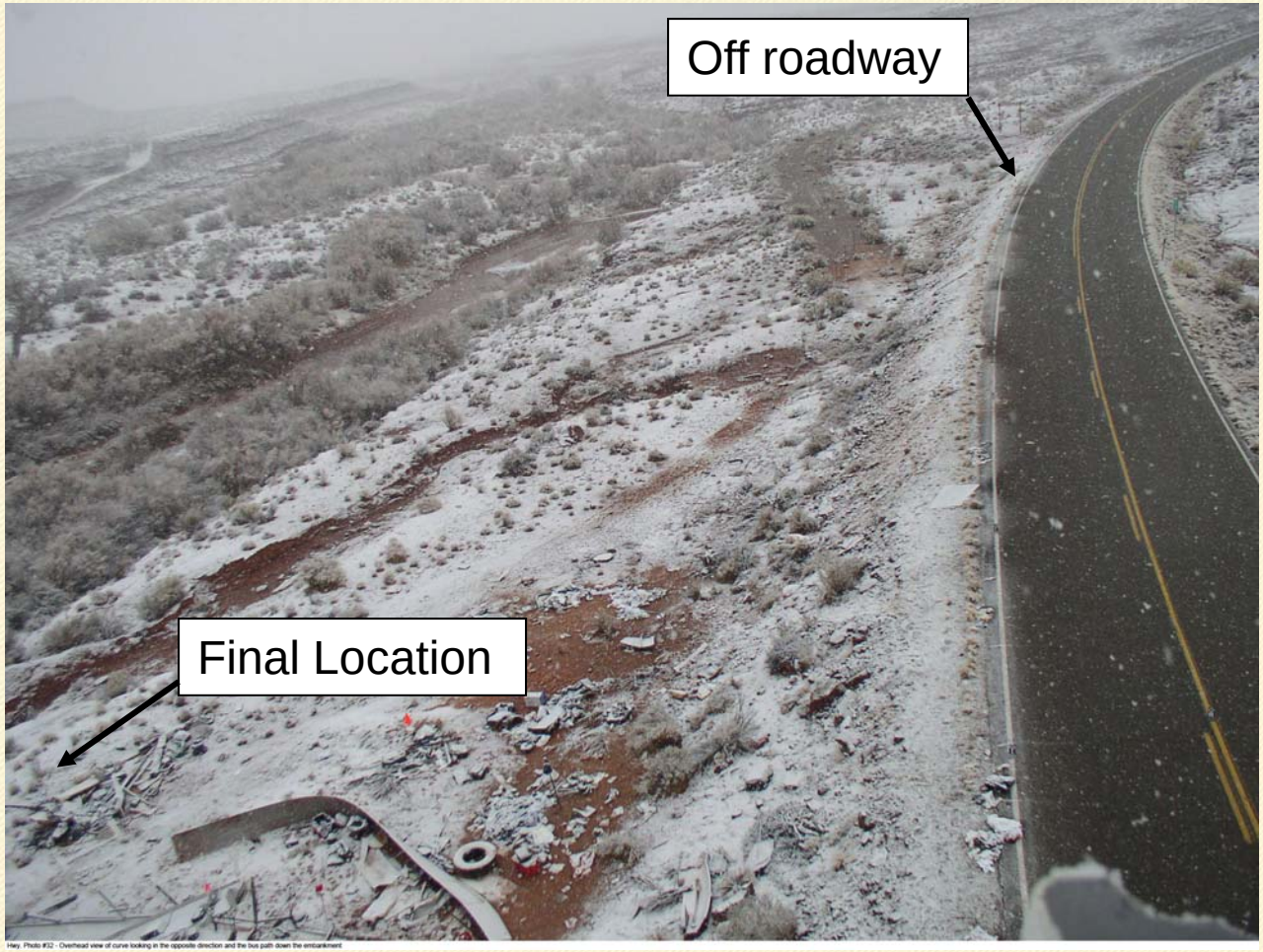
Crash Site



Source:Utah Highway Patrol

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Looking back at Crash Site



Source:Utah Highway Patrol

General Driver Information

- Valid license, many years of experience
- 71 years old with valid medical certificate
- Obstructive sleep apnea (OSA) in personal medical records
- Reported head congestion in the 3 days prior to trip

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

General Driver Information

- 7,000+ foot altitude change
  - Consistent with altitude sickness
- Congestion interfered with use of CPAP device while in Telluride
- Sleep quality poor

Driver Trip Information

- Awoke 6:45 a.m., began trip at 3:15 p.m.
- Stopped to remove chains from bus
- Interviewed passengers said prior to the crash:
  - Drifted onto shoulder
  - Erratic steering caused objects to slide around in coach
  - Passengers expressed concerned about speed

Video Camera

- Motorcoach equipped with a video recording device
  - Forward-facing view
  - Rear interior view
- 10 Seconds of video stored prior to and after the a triggering event

Video Camera

- Forward-facing view of the motorcoach as it approached curve was recorded
  - Motorcoach moves right of center line

Vehicle Speed

- NTSB staff developed a video analysis program
  - UDOT supplied engineering survey of highway reference points
  - The reference points were correlated to time of video image

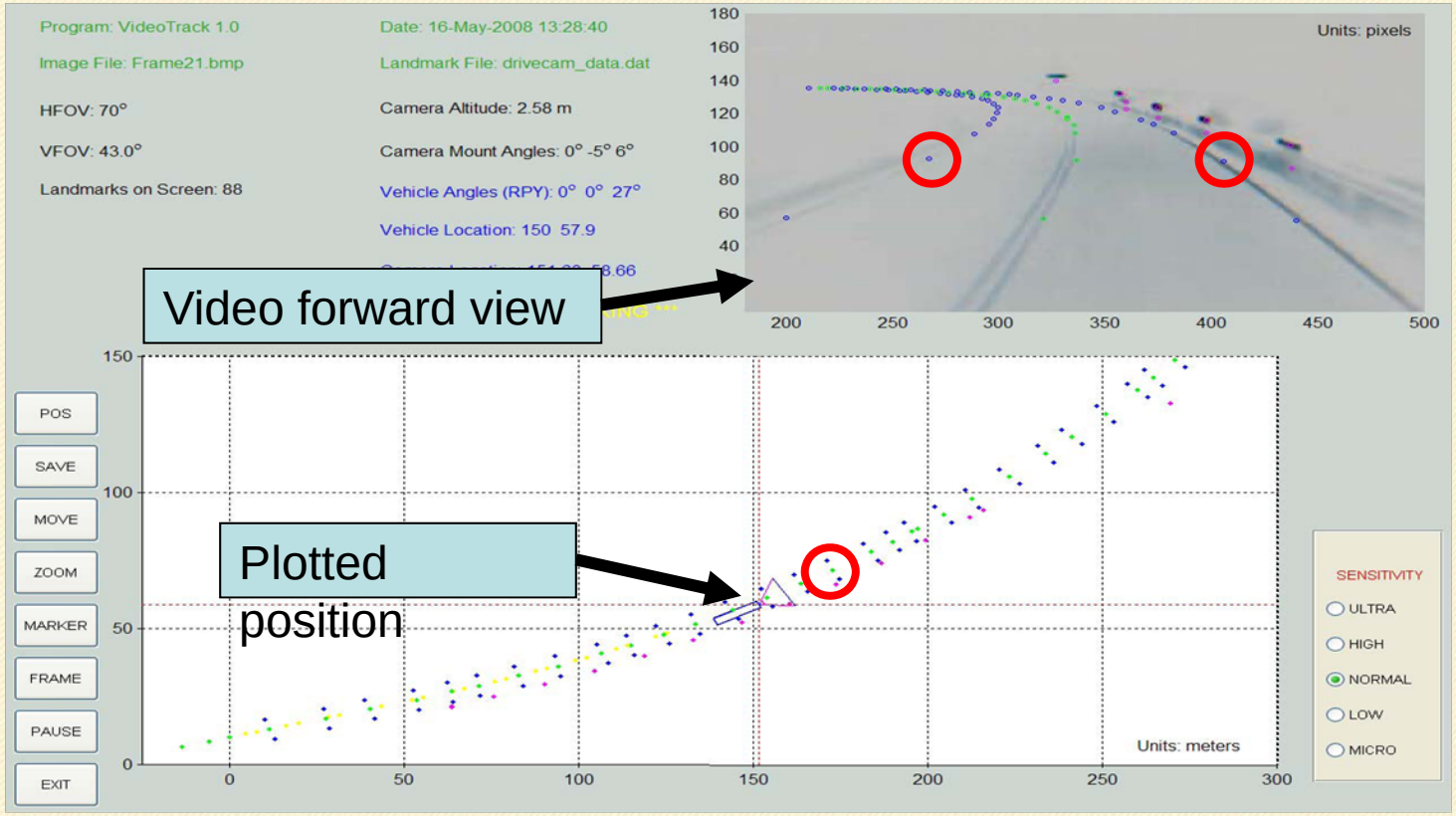
TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Forward Looking Video

Source: NTSB

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Vehicle Speed



Source: NTSB

TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Vehicle Speed Factors

- Vehicle Dynamics Study
- Acceleration Study
- Critical speed of curve
- Gear ratio considerations
- ECM operation and data

Vehicle Speed

- Speed 4 seconds prior to crash determined to be 88–92 mph

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

NTSB Crash Animation

Mexican Hat, Utah
January 6, 2008
8:02 PM

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

UDOT Response

- In Urban area, UDOT Traffic Operations Center is co-located with UHP Dispatch
  - Information is shared immediately
  - Appropriate response is implemented and communication is ongoing
- Monitoring of incident is facilitated through CCTV and traffic sensors

UDOT Response

- In Rural Areas, information is forwarded from local dispatches to local Maintenance Stations and to central TOC
  - Coordination is at local level
    - Use of wireless phones
    - In vehicle communications (radio)
    - TOC is monitor, information provider, and support only
- No on-site monitoring through advanced electronics

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

UDOT Response

- At 8:50 PM, San Juan County Sheriff Office called the Bluff Station Supervisor at home requesting a grader. Information from dispatcher was sketchy. The Supervisor envisioned debris on the road and told SJSO dispatcher it was impractical to send grader and said he would instead send two plows/sanders for debris removal and just in case there was snow or slick roads.
- At 10:30 PM, Plows arrived on scene with plow operators reporting foggy conditions and road at crash site damp from rain. The air/road surface temperature instrument mounted in one of the trucks showed a road surface temp of 37 degrees F. with air temp of 41 degrees F. There was no debris on road and no deicing chemical application was needed.

UDOT Response

- Traffic Control was provided for on-site responders
  - Highway elements were not damaged, and did not require immediate response for repair
  - Short term incident
  - Crash off-highway

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

UDOT Response

- Returned in days following crash
  - General site cleanup
  - Repair of delineators
  - Repair of field fence
- Assisted in on-going investigation

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

UDOT Process

- The TOC process is mostly to collect information, verify, and notify individuals of the incident
  - Use tools, including:
    - Text Paging
    - CMS signs
    - Website Updates
    - Other communications as necessary

UDOT Process

- Can deploy portable Changeable Message Signs, Highway Advisory Radios, and traffic control device trailers that can be used to support additional traffic control for detours/closures
  - For incidents that are longer term

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Questions?

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

NTSB Conclusions
Lessons Learned

NTSB Conclusions

- The Safety Board concluded that the weather at the time of the crash was not a factor in the motorcoach’s departure from the roadway.
- The Safety Board concluded that the
- mechanical condition of the motorcoach was not a factor in this crash.

NTSB Conclusions

- The Safety Board concluded that the design and condition of the highway were not factors in this crash.
  - the posted speed was appropriate for the curve
  - the signage was correct, and;
  - additional roadside barriers were not warranted.

NTSB Conclusions

- The probable cause of this crash was the driver's diminished alertness due to inadequate sleep resulting from a combination of:
  - head congestion
  - problems acclimating to high altitude, and;
  - his sporadic use of his continuous positive airway pressure sleeping device during the accident trip.
- The driver's state of fatigue affected his awareness of his vehicle's excessive speed and lane position on a downhill mountain grade of a rural secondary road.

NTSB Conclusions

- Contributing to the accident's severity was the lack of an adequate motorcoach occupant protection system
  - Primarily due to the National Highway Traffic Safety Administration's delay in developing and promulgating standards to enhance the protection of motorcoach passengers.

TSAG
TRANSPORTATION SAFETY ADVANCEMENT GROUP
Promoting Technology for Public Safety

Questions?