

**HIGHWAY FACTORS GROUP
FACTUAL REPORT OF INVESTIGATION**

(7 Pages)



**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C. 20594**

HIGHWAY GROUP FACTUAL

A. ACCIDENT

Date and Time: May 9, 2005 about 8:19 a.m. (CDT)
Description: School Bus Struck Two Passenger Vehicles
Location: State Highway 291 and State Highway 152
Liberty, Clay County, MO
Vehicle #1: 2000 Thomas 84-Passenger School Bus
Vehicle #2: 2003 Lincoln LS
Vehicle #3: 2001 GMC Pick-up Truck
Motor Carrier #1: Liberty School District
Owner Vehicle #2: Private Person
Owner Vehicle #3: Private Person

Fatalities: 02
Injuries: 49

NTSB #: HWY-05-MH-027

B. HIGHWAY GROUP

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C. ACCIDENT SUMMARY

On Monday, May 9, 2005 at about 8:19 a.m. a 2000 Thomas 84-passenger school bus, driven by a 45-year-old female with 53 elementary school aged children on-board, was traveling southbound on State Highway 291 on a descending grade approaching the intersection with state Highway 152. The speed limit was 45 miles per hour dropping to 40 miles per hour on the descending grade to the intersection. The driver reported losing braking ability on the bus and began to swerve between lanes trying to avoid a collision with other southbound vehicles on Highway 291. The bus eventually left the roadway and onto the right shoulder and struck a light pole. The bus continued south through a "right turn only" lane crossed the westbound lanes on Highway 152 and entered the eastbound lanes. A 2003 Lincoln LS, driven by a 49-year-old male was stopped in the left lane of Highway 152 and a 2001 GMC pick-up truck driven by a 53-year-old male was stopped in the right lane of Highway 152 adjacent to the Lincoln. The school bus struck the Lincoln on the driver's door, pushing it into the GMC. The three vehicles moved in a southerly direction together into a drainage ditch on the southwest corner of the intersection.

The collision resulted in fatal injuries to the driver's of the Lincoln and GMC. Forty eight children and the bus driver received injuries ranging from minor to critical.

The weather was clear and the roadway was dry.

The driver of a fourth vehicle (a 2003 Dodge van) came into the police department at 6:30 p.m. that night to report minor damage to her vehicle from a falling light pole as a result of the collision.

D. DETAILS OF THE INVESTIGATION

This report addresses the physical geometry of the roadway and traffic engineering data from the City of Liberty, MO.

1. INTERSECTION OF MO ROUTE 152 AND MO ROUTE 291

1.1 GENERAL TRAFFIC ENGINEERING INFORMATION

Missouri Routes 152 and 261 are principle arterial roadways intersecting in the City of Liberty, Missouri. The State route number for Missouri 152 ends at the intersection. The roadway becomes a City roadway and is named West Kansas Drive to the east. The intersection is located in a heavily developed commercial area on the west side of the metro Kansas City. Just west of the intersection Missouri Route 152 intersects I-35 in a diamond interchange. Farther to the west it intersects I-435. The terrain is rolling hills.

The posted speed limit on Route 261 is 45 MPH on the southbound approach to the accident intersection. Additionally, a speed limit sign denoting a reduction to 40 MPH is located adjacent to the area of the crest vertical curve, about 1,200 feet north from the intersection.

Both roadways are four lane facilities with exclusive left and right turn lanes at intersections and “two-way-left-turn lanes” between intersections. The pavement material is bituminous asphaltic concrete. Pavement markings are retro-reflective thermo-plastic.

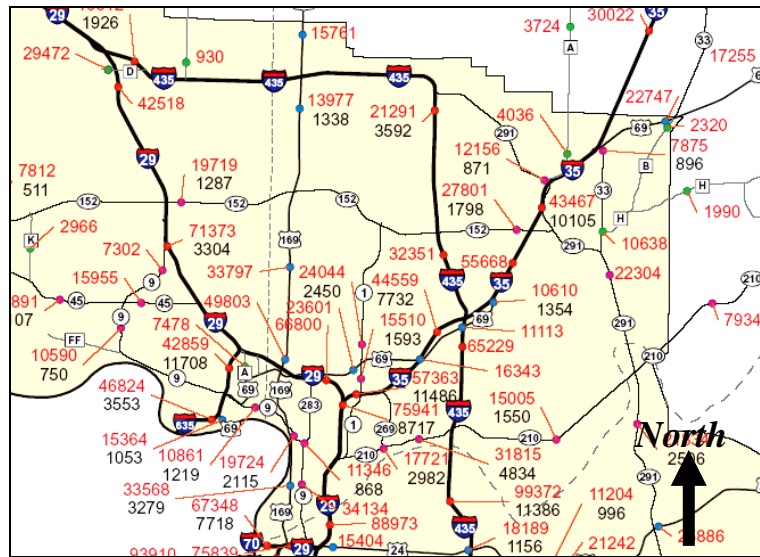


Figure 1
Accident Intersection and MDOT Area Map with Traffic Volumes¹

The Missouri Department of Transportation’s (MDOT) most recent (2002) traffic volume information near the accident intersection was:

- M Route 152 west of the accident intersection – 27,801 Vehicles per day,
- M Route 152 east of the accident intersection – 10,638 Vehicles per day,
- M Route 291 north of the accident intersection – 10,105 Vehicles per day,
- M Route 291 south of the accident intersection – 22,304 Vehicles per day.

1.2 TRAFFIC SIGNAL INFORMATION

The intersection of Missouri Routes 291 and 152 is controlled by a six phase² fully actuated traffic signal. The “controller” for the individual signals is a digital micro-processor. The signal controller senses traffic presence and movement by use of induction loops of wire embedded in the approach pavement of each roadway approach. Each phase has its own set of sensing loops.

¹ MDOT web site

² Each separate traffic movement controlled by the signal is called a “phase”.

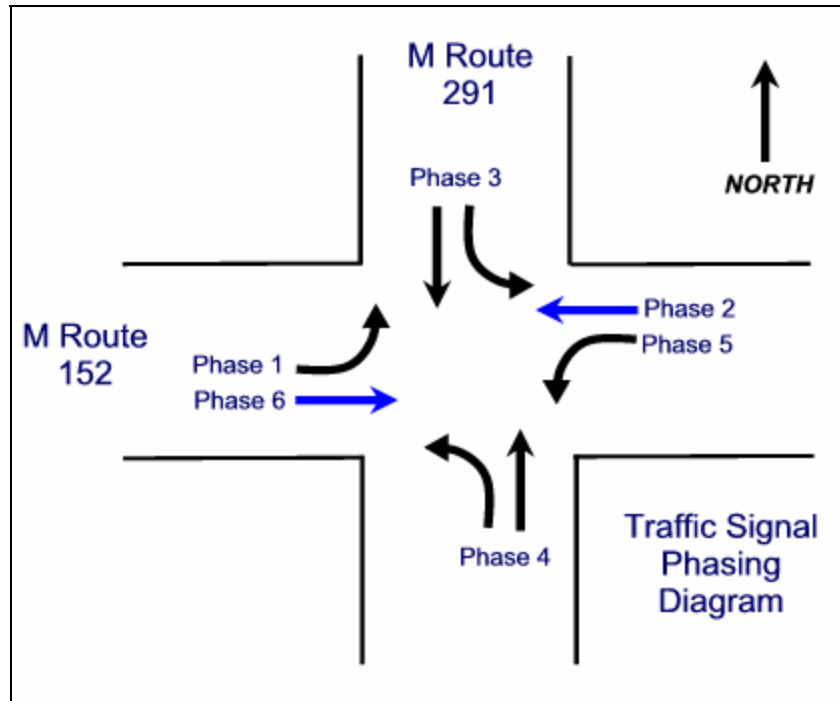


Figure 2
Traffic Signal Phasing Diagram

If there is no traffic detected by the sensors for a phase, the traffic signal controller will skip that phase because it is unnecessary. Two non-conflicting phases may time concurrently. Figure 2 shows the phasing of the signal at Missouri 152 and 291. Phases 3 and 4 control traffic north and south bound on Missouri 291. Traffic never flows on Missouri 291 in opposite directions through the intersection. Phases 3 and 4 can time independently. However, on Missouri 152 the left turn phases (numbers 6 and 5) can move simultaneously, independently or be skipped if no traffic is present to turn left.

1.3 TRAFFIC SIGNAL SERVICE RECORDS

MDOT supplied a “Traffic Signal Service History” form for the accident intersection’s traffic signal equipment. This record begins 12/16/1999 and ends the day of the accident with the notation “Operated signals for PD (Police Department) for accident.” This entry was made by MDOT technicians and means that they aided with traffic control during the accident aftermath by manually controlling the signal from the controller cabinet.

There were 29 entries on the form in the six years covered by the form. Almost all were routine malfunctions common to traffic signal maintenance and operations. Two recent entries involved traffic engineering changes to the signal operation.

- 12/3/04 “Added some all-red time for the NB phases.” In an NTSB interview with the MDOT engineer, it was learned that this additional all-red time was added to phase 3 which is southbound M 291. The MDOT “Phase Basic Timing Data” form for the intersection shows an all-red time for M 291 southbound of 2.5 seconds.
- 5/4/05 “Changed phase 3 to phase 4 and phase 4 to phase 3.” The MDOT engineer stated this change was to allow northbound M291 traffic turning left to synchronize with a green signal at South Forest Avenue which is the next signal on M152 to the west.

The information also shows that the accident intersection traffic signal is not a part of a coordinated signal system on M 152 or M 291. It operates independently based on traffic sensed by its control equipment.

1.4 TRAFFIC ACCIDENT DATA

MDOT supplied traffic accident data for the accident intersection for Jan. 1, 2000 through May 1, 2005. The data sheets show the following information in tabular form:

- Travelway
- Direction of travel
- Mile Log
- Accident Classification (rear end, right angle, etc.)
- Date
- Severity Rating (Property Damage Only, Minor Injury, etc.)
- Light Condition
- Road Surface Condition
- Weather Condition

These data show a total of 204 accidents occurring in or near the accident intersection in four years and five months. The traffic count data shows a total of about 900,000 vehicles entering the intersection per year or about 4,000,000 vehicles entering the intersection during the time the 204 accidents were recorded.

1.5 FIELD OBSERVATIONS OF THE ACCIDENT INTERSECTION

The southbound approach of M 291 is tangent but has a crest vertical curve about 1,200 feet north of the accident intersection. There were several dual wheel skid marks in both lanes southbound in the area of the crest. At other intersections these sorts of tire marks have been evidence of heavy vehicles approaching the crest of the vertical curve and initiating heavy braking to avoid the stopped queues ahead. This is the same approach on which MDOT recently added additional all-red time to the accident signal.

Observation of the asphaltic concrete pavement surface on the southbound approach to the intersection of M152 indicated that the surface would exhibit acceptable frictional factors.

1.6 M291/ M152 PLAN AND PROFILE DESIGN DRAWINGS

MDOT provided plan and profile drawings of the intersection and its approaches. From these drawings and site observations it was determined that the southbound sight distance on the approach of M291 to M152 was at least 1000 feet.

The design drawings complied with guidelines in the American Association of State Highway and Transportation Officials (AASHTO) design guides.

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