National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: February 23, 2004

In reply refer to: H-04-01 through -03

Honorable Mary E. Peters
Administrator
Federal Highway Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

On Saturday, October 13, 2001, about 2:00 p.m. central daylight time, a 2000 Thomas Built Buses, Inc., 78-passenger school bus carrying 27 Seward High School students and 3 adults (excluding the driver) was traveling westbound through a work zone on U.S. Route 6 in Omaha, Nebraska. As the Seward bus entered the work zone lane shift at the approach to the West Papillion Creek Bridge, it encountered a 1986 Motor Coach Industries 52-passenger motorcoach carrying Norfolk High School students traveling eastbound. Although no collision occurred between the Norfolk and Seward buses, the westbound school bus departed the traveled roadway on the right and subsequently struck the W-beam barrier on the approach to the bridge, steered to the left momentarily, and then steered abruptly back to the right, striking the W-beam again and, finally, a three-rail barrier between the guardrail and the concrete bridge railing. The bus passed through the remains of the three-rail barrier, rode up onto the bridge's sidewall, and rolled 270 degrees clockwise as it fell about 49 feet, landing on its left side in a 1-foot-deep creek below the bridge. Three students and one adult sustained fatal injuries. The remaining passengers and the busdriver sustained injuries ranging from serious to minor.[1]

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the Nebraska Department of Roads (NDOR) to recognize and correct the hazardous condition in the work zone created by the irregular geometry of the roadway, the narrow lane widths, and the speed limit. Contributing to the accident was the accident bus driver's inability to maintain the bus within the lane due to the perceived or actual threat of a frontal collision with the approaching eastbound motorcoach and the accident bus driver's unfamiliarity with the accident vehicle. Contributing to the severity of the accident was the failure of the traffic barrier system to redirect the accident vehicle.

Work zone management in the accident vicinity was governed by a "generic" traffic control plan, as was allowed by the 1988 *Manual on Uniform Traffic Control Device*s

[1] For more information, read National Transportation Safety Board, *School Bus Run-Off Bridge Accident, Omaha, Nebraska, October 13, 2001,* Highway Accident Report NTSB/HAR-04/01 (Washington, DC: NTSB, 2004).

(MUTCD).[2] NDOR relied upon its district construction engineer, project manager, and project assistants to ensure that the contractor in charge of the U.S. 6 construction project complied with this generic traffic control plan. However, none of these NDOR employees had specific or general training in traffic engineering. Further, the American Traffic Safety Services Association (ATSSA) training that these employees reportedly received did not include the depth of traffic operations and safety engineering training necessary to manage and make traffic engineering control decisions for a large construction project. NDOR acknowledged that traffic engineering office staff did not monitor traffic accident experience in work zones or periodically inspect work zones beyond the annual inspections required by the Federal Highway Administration (FHWA). The general contractor's project management personnel also had no training in construction work zone safety. The general contractor contracted with a "safety consultant," but this person's duties related to workers' occupational safety, not traffic safety or operations.

As required by the FHWA, NDOR conducted random, statewide work zone traffic control reviews annually. In 1999, a team of FHWA and NDOR engineers traveled approximately 2,000 miles in 4 days to review some 50 Nebraska work zones.[3] Merely traveling 2,000 miles in 4 days would require about 33 hours (at an average driving speed of 60 mph). Assuming 12-hour workdays, with no breaks, would leave only 15 hours to inspect 50 projects, about 18 minutes per project. Such figures call into question the thoroughness of the FHWA-required inspections and the accuracy of the resulting statistics.

A subsequent FHWA-NDOR work zone review on July 26, 2001, rated the work zone on U.S. 6 (West Dodge Road) as "fair" for 2001. The inspection report mentioned only minor signage discrepancies; it failed to mention the following instances of nonconformance with FHWA policy and MUTCD guidelines:

- Two-lane, two-way operation in an area where road users could not see from one end of the operation to the other and the posted speed limit was 45 mph.

- Lack of traffic control training for the individuals apparently responsible for monitoring the safety effectiveness of the traffic control plan.

- Failure to monitor reported traffic accidents in the work zone.

- Failure to document the lack of a buffer space and barriers between the work and traffic space.

- Failure to document the May 15, 2001, damage to the barrier transition on the northeast corner of the West Papillion Creek Bridge caused by an earth-moving truck and the barrier's subsequent inadequate repair.

Traffic control needs and safety hazards in construction work areas can change frequently as a project progresses. A feature that might not have been hazardous one day can become a danger the next day. Properly trained and vigilant construction supervision personnel can correct

[2] MUTCD, 1988 edition, chapter 6 (revision 3-1992).

[3] Study of Work Zone Crashes in Nebraska prepared by FHWA and NDOR, August 1999.

hazardous conditions or request assistance from the State traffic engineering office or from the American Association of State Highway and Transportation Officials. In this instance, construction engineering and supervision personnel with training in traffic engineering and work zone traffic control would probably have recognized that this project did not comply with MUTCD guidelines and other traffic safety guidance. The Safety Board concluded that because inspections of U.S. 6 required and evaluated by the FHWA and executed by NDOR personnel were inadequate, several hazardous conditions either developed, were left uncorrected, or both.

Also key to effective work zone management is monitoring the work area's traffic accident experience so that potential hazards can be corrected. But work zone traffic accident records can be monitored effectively only if reports are acquired in a timely manner, directly from local and State traffic law enforcement agencies. Waiting for the reports to be sent to the State through normal channels can take months, a delay that renders them almost useless for the timely identification of hazards.

Neither the AASHTO,[4] MUTCD, nor FHWA policy documents contain guidance on the maintenance of existing traffic safety features (such as traffic barriers) in construction work zones. Yet these safety features may be even more important in work zones than in the normal operational environment, especially in the narrow, curvy segment of U.S. 6 where the accident occurred, an area requiring relatively "perfect" driving performance, especially by drivers of large, commercial vehicles. Because some States, including Nebraska, require contractors to maintain the roadway facility during construction, the need for guidance or standards to which a facility must be maintained is particularly critical. In this case, the contractor had supposedly repaired the barrier system struck by the earth moving vehicle, but not to any accepted standard of performance. The repair resulted in the W-beam not being secured at its west end, and, therefore, it lacked the strength provided by tension from another structure. This allowed the W-beam to act like a "swinging door" and be pushed aside when it was struck by the school bus.

The approach angle for the Seward school bus to the guardrail was about 6 degrees—40 percent less than the angle at which crash tests are usually conducted. The Seward bus was traveling at a speed of about 40 mph[5] when it struck the barrier. This reduction in speed, from standard crash testing at a speed of 60 mph, represents a decrease in energy by 2.25 times. Given this lower angle of impact and lower speed, the school bus is more likely to have been redirected safely had it struck a barrier that met design and performance guidelines. The Safety Board concluded that had the barrier system struck by the accident bus been repaired to its original design and strength, the bus would probably have been deflected back into its lane and its departure from the bridge avoided. The Safety Board further concluded that NDOR and the contractor failed to adequately maintain the barrier system on the northeast corner of the West Papillion Creek Bridge, as required by the construction contract, and this failure contributed to the severity of the accident.

[4] *Guide for Selecting, Locating and Designing Traffic Barriers,* 1977. The 1977 edition would have been in effect in 1985 and was superseded in 1989.

[5] The bus fell vertically into the creek in about 1.7 seconds; when combined with the vertical velocity due to gravity of about 38 mph, the bus's forward speed was determined to be about 40 mph.

The *Federal-Aid Policy Guide*[6] contains more stringent guidelines for work zone safety and monitoring than does the MUTCD. The *Federal-Aid Policy Guide* requires that "construction zone accidents and accident data *shall* [emphasis added] be analyzed and used to continually correct deficiencies which are found to exist on individual projects…," while the applicable MUTCD guideline states, "When *warranted* [emphasis added], an engineering analysis should be made (in cooperation with law enforcement officials) of all accidents occurring within the temporary traffic control zones."

Highway engineers, States, and contractors use both the *Federal-Aid Policy Guide* and the MUTCD in determining the safe design and operation of highway work zones. However, as demonstrated by this accident, both guides are not always utilized. NDOR representatives did not use the *Federal-Aid Policy Guide* in designing the U.S. 6 work zone. Although the *Federal-Aid Policy Guide* contains a requirement that contractors maintain traffic safety systems during construction, the MUTCD does not. To ensure the safe design and operation of work zones, the MUTCD and *Federal-Aid Policy Guide* must provide consistent advice.

Therefore, the National Transportation Safety Board recommends that the Federal Highway Administration:

> Incorporate into the *Manual for Uniform Traffic Control Devices* the stricter criteria on work zone safety and management contained in the *Federal-Aid Policy Guide, 23 Code of Federal Regulations 630J, Subchapter G-Engineering and Traffic Operations, Part 630-Preconstruction Procedures, Subpart J-Traffic Safety in Highway and Street Work Zones*, to include continuously monitoring traffic accident experience in work zones to detect and correct safety deficiencies existing in individual projects. Further, the traffic accident reports necessary to accomplish this should be obtained monthly, directly from local traffic law enforcement agencies. (H-04-01)
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> Require divisional offices to participate in the States' work zone safety inspections and diligently monitor and evaluate the results of those inspections in conformance with the *Federal-Aid Policy Guide, 23 Code of Federal Regulations 630J, Subchapter G-Engineering and Traffic Operations, Part 630-Preconstruction Procedures, Subpart J-Traffic Safety in Highway and Street Work Zones.* (H-04-02)
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> Include in the *Manual for Uniform Traffic Control Devices* a requirement that, for roadways under construction, traffic safety features (such as barrier systems) be maintained at an equivalent or better level than existed prior to construction. (H-04-03)

[6] U.S. Department of Transportation, Federal Highway Administration, *Federal-Aid Policy Guide*, 23 *Code of Federal Regulations* 630j, Subchapter G—*Engineering and Traffic Operations*, Part 630—*Preconstruction Procedures*, Subpart J—*Traffic Safety in Highway and Street Work Zones*, transmittal 30 (Washington, DC: January 2002).

The Safety Board also issued safety recommendations to the Nebraska Department of Roads, Omaha Fire Department, National Association of State Directors of Pupil Transportation Services, and Thomas Built Buses, Inc.

Please refer to Safety Recommendations H-04-01 through -03 in your reply. If you need additional information, you may call (202) 314-6607.

Chairman ENGLEMAN CONNERS, Vice Chairman ROSENKER, and Members CARMODY, GOGLIA, and HEALING concurred with these recommendations.

Original Signed

By: Ellen Engleman Conners
Chairman