SURVIVAL FACTORS GROUP FACTUAL REPORT

(12 Pages)

National Transportation Safety Board
Office of Highway Safety
Washington, DC 20594

Survival Factors Group Factual Report

A. ACCIDENT

NTSB # HWY-07-MH-024

Date and Time:	August 1, 2007 at 6:05 p.m.
Description:	Interstate 35W Bridge collapse
Location:	Interstate Highway 35W Bridge over the Mississippi River, Minneapolis, Hennepin County, MN.
Fatalities:	13
Injuries:	145

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C. ACCIDENT SUMMARY

About 6:05 p.m. (CDT), on Wednesday, August 1, 2007, the 35W Interstate Highway Bridge over the Mississippi River, in Minneapolis, Minnesota experienced a catastrophic failure in the main span of the deck truss portion of the 1907-foot-long bridge. As a result, approximately 1,000 feet of the deck truss collapsed with about 456 feet of the main span falling into the river. An assessment of the gusset plates within the deck truss revealed that the connections at U10, U10 prime, L11 and L11 prime were under-designed. The bridge was comprised of eight traffic lanes, with four lanes in each direction. At the time of the collapse, a roadway construction project was underway that resulted in the closure of two northbound and two southbound traffic lanes causing traffic queues on the bridge. A total of 111 vehicles were documented as being on the portion of the bridge that collapsed. Of these, 17 vehicles were recovered from the water. As a result of the bridge collapse, 13 people died and 145 people were injured.

D. DETAILS OF THE INVESTIGATION

The Survival Factors Group investigation focused on exterior of the 111 vehicles that were documented as being on the bridge structure at the time of the collapse. Additional examinations were made of the interior damage to the only school bus involved in the incident. Also, issues regarding injury mechanisms, emergency response and the unified command structure were examined as well. Additional information regarding survival issues was obtained through interviews with school bus passengers, injured vehicle occupants, and several first responders.

1. INVOLVED VEHICLES

A total of 111 vehicles were identified and documented as being involved in the bridge collapse. Of these, six had trailers attached to them, and there was one additional freestanding trailer that was part of an on going construction project. Twenty-five of the 111 vehicles were related to the on-going construction project, and were identified as construction equipment or as vehicles belonging to construction workers. One of the involved vehicles was a 2003 Bluebird conventional style school bus that was occupied by sixty-three student passengers and a driver.

During the documentation process, it was determined that 94 vehicles remained on the I-35W Bridge and the 17 vehicles were found in the river adjacent to the I-35W Bridge. Inspections of these vehicles were conducted consisting of exterior photography, as well as verification of Vehicle Identification Numbers, and

owner registration information. Refer to Survival Factors Attachment 1 for detailed vehicle information.

1.1 2003 Bluebird School Bus

The 2003 Bluebird conventional style school bus was on the south end of the bridge in the right hand southbound lane when the bridge collapsed. The bus came to rest against the concrete bridge rail.

A detailed inspection was completed on the 2003 Bluebird school bus on Monday August 13, 2007. Exterior damage to the bus was minor with damage to the right front corner and right side. With the exception of one of the windows on the passenger loading door, all the windows remained intact.

The interior inspection of the school bus revealed that the primary area of damage was to several of the wooden seat bottoms under the cushions in 2R, 3R, 5L, 6R, and 10R[1]. The seat bottoms consisted of ½ inch plywood sheets under the seat cushion and they were observed to be cracked and deformed with the plywood sheet under 3R being completely broken through. The forward seat cushion frame member in 12L was bent slightly downward.

The interior inspection revealed that the school bus was equipped with a lap and shoulder belt for the driver's seat and lap belts were installed for the three seat positions in the first row on both sides. An inspection was conducted to determine whether these seat belts were in use at the time of the bridge collapse.

The interior of the 2003 Bluebird school bus was equipped with two Transpec roof hatches between rows 3-4 and 9-10. In addition, to the roof hatches, the vehicle was equipped with four emergency window exits on each side of the bus in rows 3, 6, 9, and 12 and a rear mounted emergency rear door.

Based on interviews with the school bus occupants, all the occupants exited the bus out the rear emergency exit door.

The 2003 Bluebird school bus was equipped with a locked container, capable of storing a Silent Witness video system. An inspection of the locked container revealed that there was no video cassette tape in the recorder.

[1] 2R, 3R, 5L, 6R, and 10R indicate the row number followed by which side of the bus the seat was located on, Left or Right

1.2 Seating Chart

Minneapolis, Minnesota
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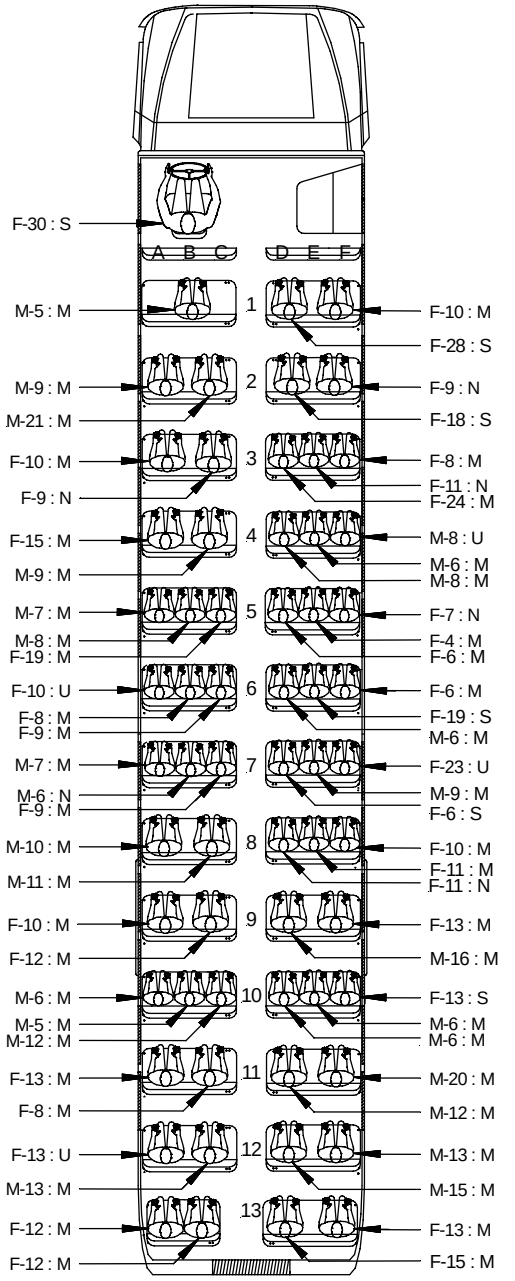
ICAO* INJURY LEGEND
N = None M = Minor S = Serious F = Fatal U = Unknown
F = FEMALE M = MALE # = AGE *International Civil Aviation Organization
SAMPLE INJURY LEVEL AGE GENDER F - 14 : Minor Source: NTSB



U - Unknown due to no interview or medical records available

2. MEDICAL AND PATHOLOGICAL INFORMATION

Safety Board investigators documented the fatal injuries incurred by the thirteen collapse victims. Medical records for the injured that were treated at area hospitals or clinics were processed and documented. All injury descriptions are based on information provided by the Hennepin County Medical Examiner and treating hospitals (See list of Hospitals on following page).

According to autopsy records four of the thirteen victims died from drowning. One victim died as a result of what the Medical Examiner described as, "mechanical and positional asphyxia". The remaining eight victims died as a result of blunt force injuries. Four of the eight victims that died of blunt force injuries, died while on the bridge. Three of the victims were still in their vehicles while the fourth died after exiting her vehicle and being struck by a falling overhead sign.

Based on a review of medical records, seventeen of the thirty-four seriously injured victims sustained compression fractures or burst fractures to the lumbar and thoracic spine. Twelve of the seventeen victims with spinal fractures were identified as being associated to occupants of sport utility vehicles (SUV's) or pick-up trucks.

INJURY ICAO[2] CODES[3]

INJURIES	TOTAL
FATAL	13
SERIOUS	34 Documented
MINOR	111 (70 Documented)
NONE OR UNKNOWN	32
TOTAL	190

2.1 HOSPITAL INFORMATION

Four victims of the bridge collapse were pronounced dead at the scene. Three of them were transported to the Hennepin County morgue, while the fourth victim was extricated the following day from his vehicle then transported to the morgue. A fifth victim that sustained blunt force trauma was transported from the scene and subsequently died from trauma induced cardiac arrest in the hospital emergency room. The remaining eight victims were recovered from their vehicles in the water in the weeks following the collapse with the last one being recovered

[2] International Civil Aviation Organization

[3] 49 CFR 830.2 defines a fatal injury as: any injury that results in death within 30 days of the accident. A serious injury as: an injury which requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; results in a fracture of any bone (except simple fractures of the fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second or third degree burns, or any burns affecting more than 5 percent of the body surface.

August 20, 2007. Autopsies were conducted on all thirteen fatalities as they were recovered. Based on medical records obtained, 145 persons were transported or treated at 12 area Hospitals, Medical Centers, and Clinics. The facilities and Medical Examiner were:

Hennepin County Medical Center	Abbott-Northwestern Hospital
Fairview Hospital at the University of Minnesota campus	Fairview-Oxboro Medical Clinic and Urgent Care
Children's Hospital of Minneapolis	St. John's Hospital
Methodist Hospital	Fairview Ridges Hospital
North Memorial Medical Center	St. Joseph's Hospital
Unity Hospital	Andrew M. Baker, Chief Hennepin County Medical Examiner
Woodwinds Hospital	

3. EMERGENCY RESPONSE

Minnesota State Patrol dispatchers were notified of the accident by a cellular caller through the 911 system at 6:05 p.m. After verifying the collapse using the MN/DOT freeway camera system, they contacted the Minneapolis 9-1-1 dispatch, which is a combined emergency dispatch center for the Minneapolis Fire and Police departments. The first call from Minneapolis 9-1-1 dispatch went out at 6:07 p.m. At 6:08 p.m. Minneapolis 9-1-1 dispatch made a distress call over the Interstate Radio System requesting all available emergency assistance respond to the I-35W Bridge at the Mississippi river due to the bridge collapsing. Initial reports stated that the entire span of I-35W over the Mississippi had collapsed while full of bumper-to-bumper traffic and a full construction crew. At 6:10 p.m. the first Minneapolis Police Department (MPD) unit arrived on scene. At 6:11 p.m. the first of nineteen engine units from the Minneapolis Fire Department (MFD) arrived at the accident. The first Hennepin County Sheriff's Office (HCSO) personnel arrived on the river at 6:14 p.m. to begin conducting the search and rescue of numerous passengers reportedly trapped in their vehicles in the Mississippi River. The Hennepin County Medical Center also initiated their Disaster Plan which involved calling in additional medical personnel, notifying other local hospitals, and dispatching all available ambulances to the scene.

At approximately 6:10 p.m. a Unified Command Post was established in the parking lot of the Red Cross building, which was located on the south side of the river, only several 100 feet above the river and just west of the area of the collapse.

The HCSO established the Sheriff's River Incident Command at 6:25 p.m. near the University of Minnesota River flats area along the north bank of the river. This location had historically been used as a base for water rescue operations and was the facility near the scene of the collapse having adequate boat ramps,. Twelve other Public Safety agencies immediately responded with twenty-eight watercraft to assist with river rescue operations within the first hour of the collapse.

At 7:27 p.m. the IC for the MFD conferred with the HCSO River Operations IC and mutually decided to change the water operations from rescue mode to recovery mode[4] as all victims located within the bridge collapse area had been rescued.

A copy of the Brief Field Incident Reports created by the Minneapolis Fire Department has been compiled and this information is included within this report.

Agencies that responded to assist

Cottage Grove Police Department	Forest Lake Police Department
Crystal Police Department	Fridley Police Department
Dakota County Sheriff's Office	Glencoe Police Department
Eagan Police Department	Glenwood City, WI Police Department
Eden Prairie Police Department	Goodhue County Sheriff's Office
Scott County Sheriff's Office	Hopkins Fire Department
Edina Police Department	Hopkins Police Department
Minneapolis Fire Department	Hutchinson Police Department
Minneapolis Police Department	Lakeville Police Department
Shakopee Police Department	Lino Lakes MN. Correctional Facility
Bayport Police Department Reserve	Maple Grove Police Department & CSOs
Hennepin County Sheriff's Office	McLeod County Sheriff's Office
Sherburne City Police Department	Medicine Lake Fire Department
Minnesota State Patrol	Medina Police Department Reserves
Apple Valley Police Department	Minnestrista Police Department
Bloomington Police Department	Minnetonka Fire Department
St. Louis Park Police Department & Reserve	Minnetonka Police Department
Ramsey County Sheriff's Office	Moose Lake MCF
Sherburne County Sheriff's Office	Moundsview Police Department
St. Paul Fire Department	New Brighton Police Department
St. Paul Police Department	New Hope Police Department
Metro Transit	Northfield Police Department
Brooklyn Center Police Department	Oak Park MN. Correctional Facility
Steele County Sheriff's Office	Oakdale Police Department
Brooklyn Park Police Department	Orono Police Department
Belle Plain Police Department	Owattana Police Department
Blaine Police Department	Plymouth Police Department
Burnsville Police Department	Prior Lake Police Department
Carver County Sheriff's Office	Ramsey County Sheriff's Office
Centennial Lakes Police Department	Red Wing Police Department
Chaska Police Department	Richfield Police Department

[4] Once the IC determined that sufficient rescue efforts had been made and the potential to locate survivors no longer existed, the operation was changed to recovery of victims.

Columbia Heights Police Department	Rosemont Police Department
Coon Rapids Police Department	Roseville Police Department
Anoka County Sheriff's Office	Rush City Police Department
Elk River Police Department	St. Louis Park Fire Department
St. Anthony Police Department	Stillwater MN. Correctional Facility
St. Croix County Sheriff's Office	White Bear Lake Police Department
South St. Paul Police Department	Wright County Sheriff's Office
Washington County Sheriff's Office	Wayzata Police Department
Minnesota Department of Transportation	

Federal Agencies that responded to the scene

Alcohol Tobacco and Firearms	National Oceanic and Atmospheric Administration
Army Corp of engineers	Secret Service
Dept. of Homeland Security	U.S. Coast Guard
Federal Bureau of Investigation Underwater Search and Evidence Recovery Team	U.S. Customs
Federal Emergency Management Agency	U.S. Marines Corps
Federal Highway Administration	U.S. Navy, Naval Sea Systems Command (NAVSEA)
Occupational Safety and Health Administration	National Transportation Safety Board
U. S. Department of Transportation	

Minneapolis and Hennepin County use the unified Command system. The type of response required for the incident determines who will serve as the Incident Commander (IC). In this incident the Assistant Fire Chief of the Minneapolis Fire Department was the IC and the lead agency responsible for overall operations as well as for issues related to the structural collapse of the bridge. The MPD was responsible for the scene investigation (Landside Operations) and scene security, the HCSO was responsible for river rescue and recovery[5] (Waterside operations), and the Hennepin County Medical Center Ambulance was in charge of the EMS Operations.

On August 2, 2007 the Coast Guard established a temporary security zone on the Mississippi River from the Upper St. Anthony Falls Lock/Dam at mile marker 853.8 to the Lower St. Anthony Falls Lock/Dam at mile marker 847.6[6] restricting access through this portion of the river to emergency vessels only. On September 6,

[5] By Minnesota State statute (MSS 86B801), the Sheriff of each county is responsible to ensure bodies are recovered from any waterway within their respective counties.
[6] The bridge collapse was directly downstream from the Lower St. Anthony Falls Lock/Dam.

2007 access was increased to allow limited commercial barge traffic. The Mississippi River was completely opened up for all river traffic on October 6, 2007.

Approximately 25 hours after the incident began; the Minneapolis Fire Department handed over Incident Command to the Minneapolis Police Department since the area had been declared a crime scene. The HCSO continued to be responsible for coordinating public safety dive teams searching the area around the collapse area and using side sonar to attempt to locate vehicles and victims reported missing through Monday August 6, 2007.

On Saturday August 4, 2007 the HCSO accepted the help of the FBI Underwater Search and Evidence Recovery Team (USERT) and the United States Navy "NAVSEA" Mobile Diving and Salvage Teams. On August 5, 2007, the FBI USERT team arrived and started river recovery operations. On August 6, 2007, Navy "NAVSEA" Mobile Diving and Salvage Teams arrived and along with the FBI USERT teams assisted the HCSO who continued to coordinate all water recovery operations until the last victim was removed.

3.1 HENNEPIN COUNTY/MINNEAPOLIS OFFICE of EMERGENCY PREPAREDNESS

The city of Minneapolis and Hennepin County have Emergency Operations Plans (EOP) that use an integrated approach to prepare for handling all emergencies called the Minnesota Incident Management System (MnIMS). The state of Minnesota developed the Minnesota Incident Management System (MnIMS) based on the National Incident Management System (NIMS) for handling emergencies. The NIMS is the nation's first standardized approach to incident management and response unifies federal, state, territorial, tribal and local lines of government into one coordinated effort. This integrated system establishes uniform response processes, protocols and procedures for all emergency responders.

The structure of the MnIMS can be established and expanded depending on the changing conditions of the incident. The MnIMS allows agencies to communicate using common technology, to share goals and tactical objectives, and to understand the roles and responsibilities of others. The MnIMS is a formalized system that lends consistency to the way agencies function in an incident.

The Minneapolis Office of Emergency Preparedness (OEP) has in place mutual aid agreements with other local municipalities, unincorporated areas, and political subdivisions of the state for reciprocal emergency preparedness aid and assistance in an emergency too great to be dealt with unassisted. These arrangements are consistent with the state emergency plan.

The Hennepin County Medical Center (HCMC) is the primary county agency for medical response to include health and medical care. HCMC assisted in the overall emergency response with coordination of emergency medical care and

treatment activities in the I-35W bridge collapse with the Minneapolis Fire Department IC. HCMC utilized those services and facilities of public, private or volunteer health and medical agencies necessary to render appropriate health and medical support for the disaster.

The Minneapolis Emergency Operations Center (EOC) was opened at 6:20 p.m. in order to assist in coordinating the handling of Operations, Planning, Finance and Logistics for Incident Command. Representatives from most agencies involved, city department heads, and their ranking officers participated in the EOC activities. EOC participants adhered to NIMS and MnNIMS standards. The EOC was manned 24-hours a day for the first four days following the collapse and 12 hours a day until the final victim was recovered on August 20, 2007.

On August 23, 2007 the Minneapolis and Hennepin County EOC's conducted a Debriefing/After Action Report with all the responding State, City, and County agencies following the I-35 Bridge Collapse on August 1, 2007. The results of this meeting revealed the following issues:

- The notification system could be improved by updating the agency contact list
- Dispatchers were overwhelmed with the amount of calls coming in showing the need for a mass communication system
- EOC space was inadequate and noisy and suggestions to use the city's 311 facility be considered in the future
- There was no way to find out what equipment was available within the city for use. An electronic inventory system needs to be set-up to capture this information so that it can be accessible from the EOC
- Equipment issues such as the need for extra cell phone batteries, network printers, electrical and data ports, and TV monitors, and head phones to control noise
- EOC needs to set-up an official website to provide accurate updates and other incident related information
- Better communication within departments to provide updates and directions for employees who report to work the next day
- Need to better manage information to families such as a master list, status, locations, and death information

According to the report, the overall response was considered a success based on relationships, open communication, planning, training and equipment. Additionally, the report stated that as a whole, they would benefit from the lessons learned and would be able to build upon the strengths and correct the minor issues discussed in the report.

4.0 INTERVIEWS

Interviews were conducted with a majority of the vehicle drivers, passengers, and the construction workers present on the bridge at the time of the collapse. Additional, interviews were conducted with 42 of the 64 occupants of the school bus. Overall, the interviews were conducted cooperatively by personnel from various responding agencies and were coordinated through the NTSB Survival Factors and Witness Group Chairmen. Those statements obtained directly by the Survival Group Chairman are included in Survival Factors Attachment #2 of this report.

Ronald A. Kaminski

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Survival Factors Group, Chairman