Improving Transportation Safety Through Accident Investigation

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The NTSB is an independent federal agency charged to:

Determine the probable cause of transportation accidents,

Make recommendations to prevent their recurrence,
The NTSB is responsible for investigating:

• All U.S. civil aviation accidents.
• Selected Highway accidents.
• Major Railroad accidents.
• Major Pipeline accidents.
• Major marine accidents.
• Transportation accidents involving the release of hazardous materials.
The Party System

• Federal Regulatory Agencies (FAA, FHWA, NHTSA, FRA, USCG)
• State/Local Regulatory and Enforcement Agencies.
• Operator/Carrier
• Vehicle Manufacturer
• Operator Union
Investigative Groups

• Led by NTSB specialist
• Party representatives who are technically qualified
• Develop the factual evidence in the investigation.
• Analysis performed by NTSB staff.
Scope of the Accident

- 111 vehicles on bridge when it collapsed
- 145 people transported to 12 area hospitals
- 13 victims fatalities
- NTSB on-scene Aug 1 – Nov 9.
Parties to the Investigation

• Federal Highway Administration
• Minnesota Department of Transportation (+ Tech Support)
• Jacobs Engineering
• Progressive Contractors Inc.
• (Support from 93 other agencies)
Investigative Groups

• Highway Factors & Bridge Construction
• Bridge Design
• Witness
• Survival / Emergency Response
• Mapping / Evidence Collection
• Video and Photogrammetry Analysis
• Structural Investigation
• Computer Modeling
• Transportation Disaster Assistance
Video Evidence

Pre-Collapse

North

South
Video Evidence

Collapse Video - Frame #1

North

South

L11W
Video Evidence

Collapse Video - Frame #11

North

South
Fracture and Deformation

U10W

U10E

North

Upper chord

Lower chords

Upper chord
Initial Tension Fracture U10 West

L9/U10W

Up

North
Loads at Time of Accident

Orange and red shading: exceeds yield stress

Stress

Yield stress
Allowable

Tension diagonal
Compression diagonal
Probable Cause

... The inadequate load capacity of the U10 gusset plates, due to a design error by the bridge design firm ...

Contributing to the design error was the failure of the design firm’s quality control procedures and inadequate design review by Federal and State transportation officials.

Also contributing was the generally accepted practice of not giving proper attention to gusset plates in inspections and load ratings of steel truss bridges.
Safety Recommendations

• Four recommendations to FHWA (including an emergency recommendation issued early in the investigation)

• Six recommendations to AASHTO
Collision of Metrolink Train 111 with Union Pacific Train LOF 65-12
Chatsworth, CA

September 12, 2008
Parties to the Investigation

- Federal Railroad Administration
- California Public Utilities Commission
- Los Angeles Fire and Rescue
- Los Angeles Police Department
- Metrolink
- Connex
- Mass Electric Construction Company
- Union Pacific Railroad (UP)
- United Transportation Union
- Brotherhood of Locomotive Engineers & Trainmen
- Bombardier Inc. (Passenger Car manufacturer)
Investigative Groups

- Mechanical
- Track
- **Signals**
- Rail Operations
- Survival Factors
- **Human Performance**
- Crashworthiness
- **Recorders**

(Also supported by Transportation Disaster Assistance Group)
Safety Issues

- Cell phone use by train crews
- Lack of a positive train control system on the Metrolink rail system.
  - Performance of the signal system.
Metrolink Engineer's Text Messages

On-Duty Off-Duty On-Duty

Sent

Received

06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00

Number of Characters

0 50 100 150 200

On Duty

Off Duty

On Duty
Signal Aspects from CP Bernson to CP Davis
Probable Cause

... the failure of the Metrolink engineer to respond to the red signal because he was ... text messaging ...

Contributing was the lack of a positive train control system ...
Recommendations

• Two to the FRA

(The U.S. Congress acted to require Positive Train Control in response to this accident)
Motorcoach Overturn
Mexican Hat, Utah

January 6, 2008
Parties to the Investigation

- Utah Highway Patrol
- Utah Department of Transportation
- Federal Motor Carrier Safety Administration
- Motor Coach Industries
- Busco, Inc. (dba Arrow Stage Lines)
- San Juan County, Utah
Investigative Groups

- Survival Factors
- Motor Carriers
- Human Performance
- Vehicle Factors / Vehicle Performance
- Highway Factors
- Vehicle Recorders
- Biomechanics & Medical
- Material Failure Analysis

- Transportation Disaster Assistance
Safety Issues

- Driver fatigue and excessive speed
- Hours-of-service violations and motor carrier trip planning
- Motorcoach occupant protection
- Emergency medical notification and response with regard to large buses traveling on rural roads
DriveCam II System

• Forward view
• Audio
• Forward/lateral acceleration
• Interior view
  – No hands, steering wheel
  – 20 seconds (10 before crash)
Vehicle Speed
Emergency Response - Ejections

- Not ejected
- Ejected
Probable Cause

. . . Driver’s diminished alertness due to inadequate sleep . . excessive speed on downhill mountain grade . .

Contributing to severity was the lack of . . . motorcoach occupant protection . .
Safety Recommendations

• To the Federal Interagency Committee on EMS
• To Utah Bureau of EMS
• To Federal Highway Admin.
• To AASHTO
• To American Bus Association & Arrow Stage Lines
Colgan Air Flight 3407
Clarence Center, NY

February 12, 2009

Board Meeting DCA09MA027
Parties to the Investigation

- Federal Aviation Administration
- Colgan Air, Inc.
- Air Line Pilots Association
- National Air Traffic Controllers Association
- United Steelworkers Union (Flight Attendants)
Investigative Groups

- Operations
- Air Traffic Control
- Meteorology
- Aircraft Structures
- Aircraft Systems
- Flight Recorders (FDR & CVR)
- Aircraft Performance
- Human Performance
- Maintenance Records
Accredited Representatives

• Transportation Safety Board – Canada
  – Transport Canada
  – Bombardier
  – Pratt & Whitney Canada
• Air Accidents Investigation Branch – United Kingdom
  – Dowty Propellers
History of Flight

- Snow and light-to-moderate icing expected en route.
- Captain set reference speeds switch for icing conditions.
- Speed slowed, triggering stick shaker and stick pusher.
- Pilot fought stick pusher – airplane stalled and crashed.
HOT-2: gear’s down.
HOT-1: flaps fifteen before landing checklist.
HOT-2: uhhh.
Cues of Slowing Airspeed

- Airspeed information on primary flight displays
- Pilots must ensure airspeed remains above low-speed cue
Probable Cause

• Captain’s inappropriate response to . . stick shaker . . led to aerodynamic stall . . .

• Contributing:
  – Failure to monitor air speed . .
  – Failure to adhere to sterile cockpit rules . .
Recommendations

• 25 recommendations to the FAA
• Reiterated 3 additional recommendations previously made to the FAA
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