



**NTSB** National Transportation Safety Board

## A Review of the Evidence Investigators Use in Determining Operator Fatigue

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" We're not sure yet, but we think he may have been asleep at the wheel."

## Challenges in Investigating Operator Fatigue

- On-scene evidence is fleeting
- Available evidence varies greatly
- No “blood test” for fatigue
- First responders may lack awareness of fatigue



## Goals

- What **indicators** do investigators use to determine that operator fatigue caused an accident?
- What **sources of evidence** are used to find fatigue indicators?



## Method

- Reviewed NTSB major accidents after 1990 with fatigue as probable cause or contributing factor
- Coded **fatigue indicators** listed in “Analysis” section
- Recorded **evidence sources** for each fatigue indicator



## Fatigue Indicators

- Recent work/rest history
- General work/rest history
- Time on task/time awake
- Appearance/behavior
- Organizational factors
- Task factors
- Circadian factors
- History of fatigue
- Medical issues
- Performance errors
- Self report



## Evidence Sources

- Time of day
- Operator self-report
- Interviews with others
- Records
- Data/voice/video recordings
- Wreckage/reconstruction
- Medical tests



## Tallahassee, FL July 26, 2002



## Tallahassee, FL July 26, 2002

### Fatigue Indicators

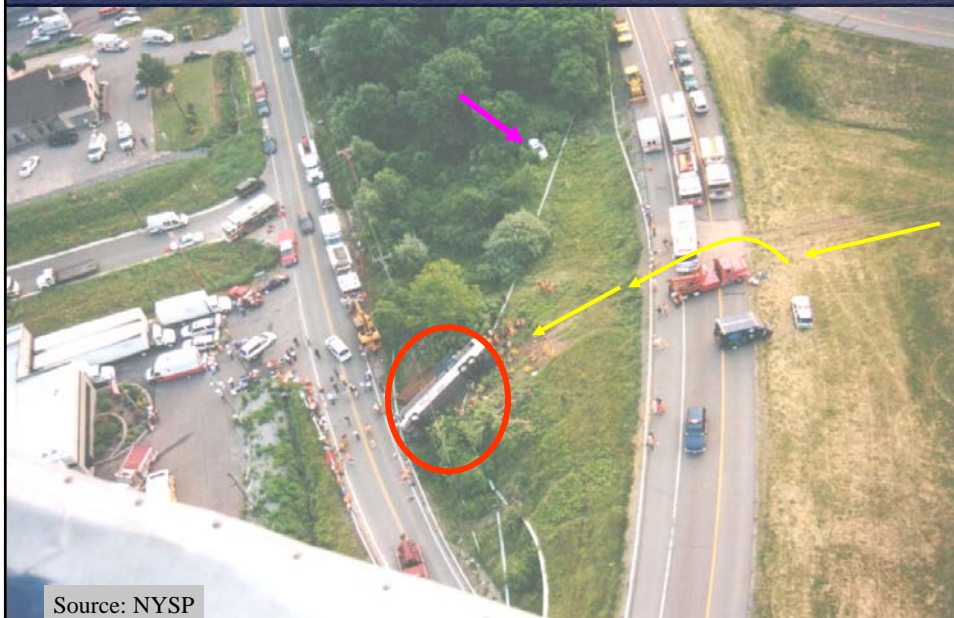
- Circadian factors
- Crew's recent sleep history
- Performance errors
- "Appeared tired"

### Evidence Sources

- Time of day
- Crew interviews
- Work schedule
- Black box recordings
- Interviews with friends/family



## Victor, NY June 23, 2002



## Victor, NY June 23, 2002

### Fatigue Indicators

- Driver had very little sleep in days preceding accident
- No tire marks on pavement
- Appeared sleepy
- Driving erratically

### Evidence Sources

- Driver self-report
- Hotel interviews
- Casino video
- Wreckage/reconstruction
- Passenger interviews



## Clarkston, MI November 15, 2001



## Clarkston, MI November 15, 2001

### Fatigue Indicators

- No braking in response to signal or during 2 minutes prior to accident
- History of falling asleep while working
- Obstructive sleep apnea
- Highly variable work schedule

### Evidence Sources

- Data recorder
- Coworker interviews
- Medical records
- Work schedule records

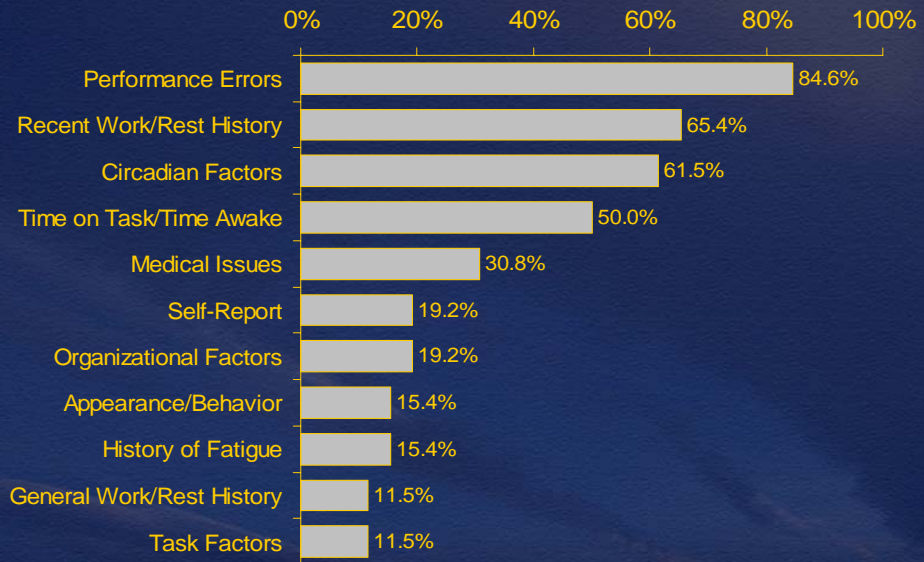


## Results

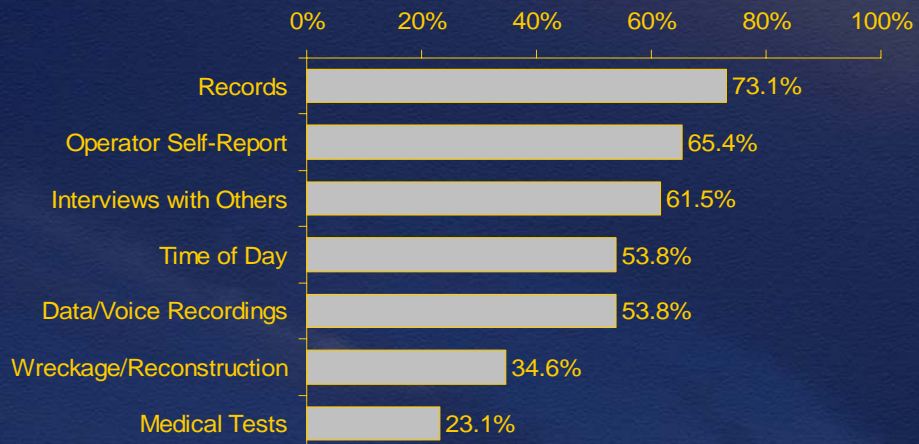
- 26 major accident reports over 13-year period
- Accidents represented all modes
- Average indicators: 5.2
- Average evidence sources: 4.6



## Fatigue Indicators



## Evidence Sources



## Discussion

- No investigation relied on a single indicator to conclude operator fatigue
- Nearly every accident included *predisposing factor* and *manifestation* of fatigue



## Making a Fatigue Determination

### *Predisposing Factors*

Used to establish that the operator was in a fatigued state at the time of the accident

### *Manifestations*

Were the actions that led to the accident consistent with fatigue/sleep?



		Fatigue Indicators										
		Predisposing Factors							Manifestations			
		Recent Work/Rest History	General Work/Rest History	Time on Task/Time Awake	Circadian Factors	Medical Issues	Organizational Factors	History of Fatigue	Task Factors	Performance Errors	Self-Report	Appearance/Behavior
Evidence Sources	Records	x	x		x	x	x	x				
	Operator Self-Report	x	x	x	x	x	x	x		x		
	Interviews with Others	x	x	x		x	x	x	x	x	x	
	Time of Day			x	x							
	Data/Voice Recordings									x	x	x
	Wreckage/Reconstruction									x		
	Medical Tests					x		x				

