

# The Cost of Truck Crashes: Delay and Environmental Costs

Mike Johnsen, FMCSA, sponsor

Doug Lee, Volpe Center, PI

Garrett Hagemann, Economist

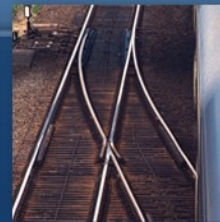
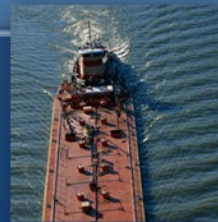
Kent Hymel, Economist

Adam Klauber, Environmental Engr

George Noel, Environmental Engr

David Pace, Economist

Catherine Taylor, Economist



John A. Volpe National Transportation Systems Center  
U.S. Department of Transportation

# Crash Cost Components

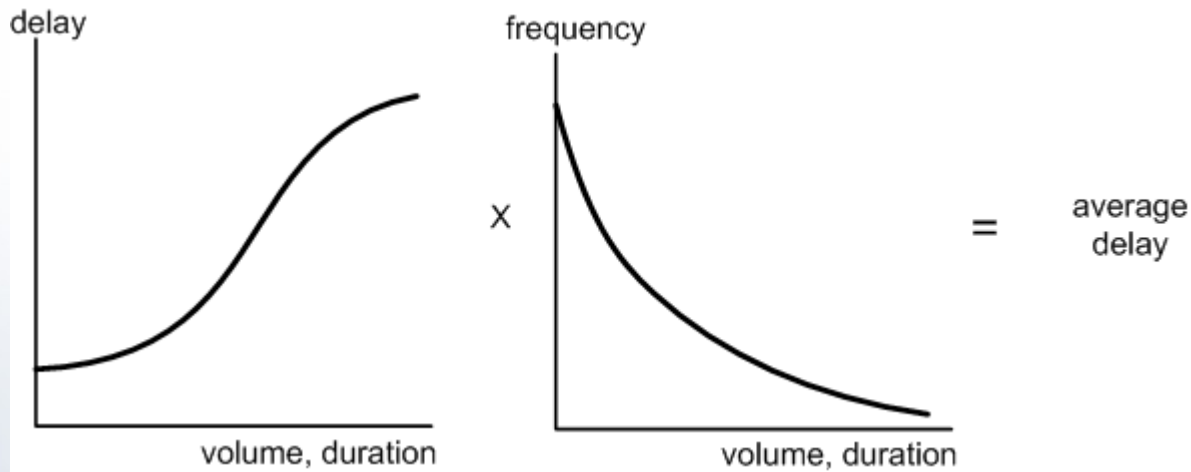
- Fatalities
- Medical Costs
- **Property Damage**
- Emergency Services
- **Delay**
- **Emissions**
- **(Hazardous Materials)**



# Fundamental Delay Equation

$$E(\text{delay}) = \sum_{\text{all crash types}} D_i \times F_i$$

- where  $D_i$  = delay for crash type  $i$

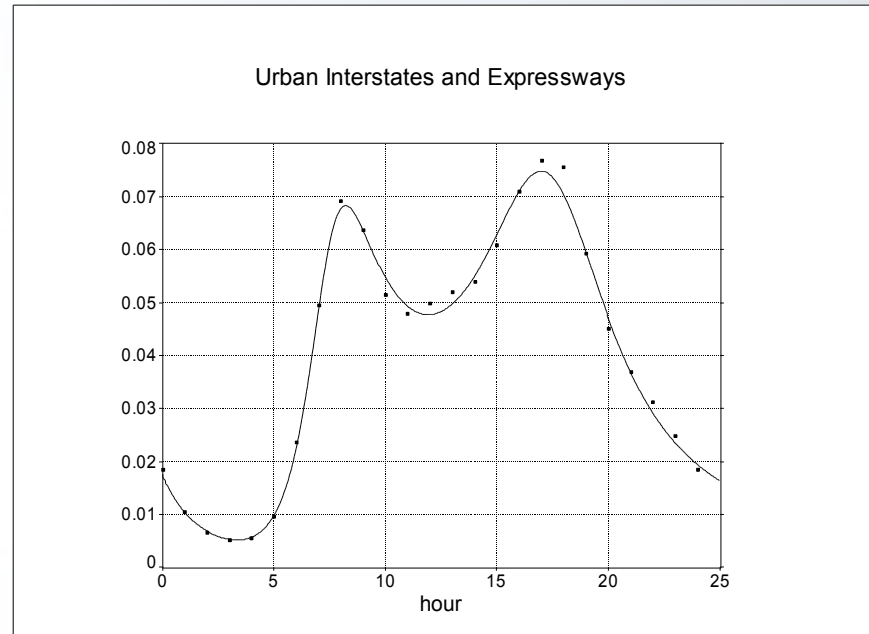


average delay across all volumes is NOT = delay from the average volume



# Delay Factors

- Volume
  - functional class
  - time of day
  - day of week
- Duration
  - severity (fatality, all)



# Delay Components

- Queuing Delay on the facility (microsimulation modeling)
  - capacity
    - closure
  - volume
  - other road type characteristics
  - diversion rules
- Network (diversion) delay (deterministic queueing model)



# Traffic Simulations Overview



- Traffic Simulation runs (TSIS CORSIM tool – version 6.2)
  - Baseline cases (without crashes) Monte Carlo 10 runs each
  - Crash scenarios, Monte Carlo 40 runs each
    - Full closures (15 minutes; 1½ hour; 4 hr) *diversions for longer 2 runs*
    - Partial closures (same durations as full closure)
  - Network configurations
    - Expressway, urban & rural (without surface network)
    - Arterial, urban only (with connected expressway)
    - Other, urban & rural local/collector/minor arterial (with connected expressways)
- Outputs
  - Delay distributions (median value selected)- baseline delay subtracted
  - Animation files (vehicle time-step data) for binary code conversion (parser)



# Field CMV Crash Delay Data

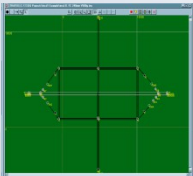
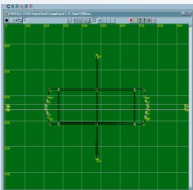
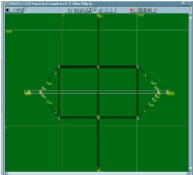
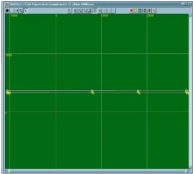
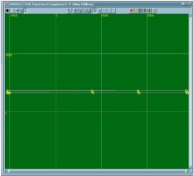
- All States contacted for crash data – Kentucky and Pennsylvania contributed statewide CMV crash closure duration and location data

Attribute	Kentucky	Pennsylvania
Location	Road mile marker	Latitude/longitude
Duration	Discreet value of lane closure	7 range values for incident (e.g. 0-30 min.)
Severity	Fatal, Injury, Property Damage Only (PDO)	Fatal, Injury, PDO
Truck type	No data	Yes
Urban/rural distinction	As defined by Kentucky State Highway Patrol	As defined by PennDOT
Vehicle configuration	4 truck types, 2 bus types	7 truck types, 2 bus types
Other relevant data	Hazmat presence, other involved vehicles	# injuries/fatalities, Hazmat presence





# Traffic Simulation Details



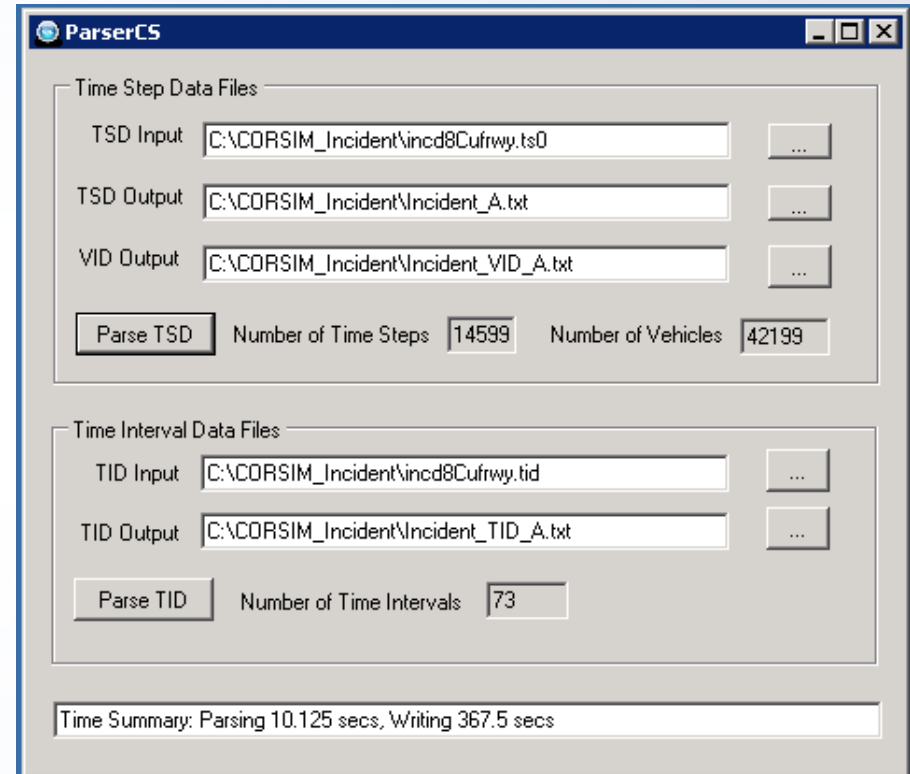
- **Variable ranges**
  - **Volumes**- 50-6,000 vehicles per hour
  - **Lane number range**- 2-6 bi-directional (HPMS data)
  - **Speeds**- 30-65mph (HPMS data)
  - **Fleet composition**- 4-20% trucks (HPMS data)
  - **Link**- 0.25-4 miles (segment length contains all queues)
  - **Node**- various including signalized intersections (e.g. urban arterials)
  - **Non-involved direction traffic**
    - Rubber necking factor for interstates only
- Other (urban and rural) rotating blockage on partial closure





# Parsing of TSIS-CORSIM Binary Files

- Parsing Application Developed to Translate Binary Output
  - Time Step Data Files (TSD) - Individual Vehicle data
- Parse TSIS-CORSIM binary files
  - Utilize for the TRAFVU component for visualizing the simulation
    - Contains second-by-second data
    - Contains aggregated information for each time interval assigned



# Vehicle Emissions Simulation

## Overview

- Emissions Methodology
  - Parsing of TSIS-CORSIM binary files
    - Utilize Parser Application developed by Volpe Center
    - Parser reads CORSIM animation & calculates vehicle specific power (VSP)
    - VSP calculated for each **link** and separated by vehicle type
  - Motor Vehicle Emission Simulator (MOVES) 2010a
    - Parser application creates and output table using MOVES Operating Mode Distribution feature for Project Level Scenario
    - Operating Mode Distribution utilizes drive cycle across each link



incident minus baseline to estimate the emissions impacts



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# Very Preliminary Delay and Emissions Results

Urban Interstates/Expressways

	ALL	Fatal	Injury	PDO
Vehicle Delay (hrs)	1,805	9,292	2,236	1,531
Value of Time	\$ 21,893	\$ 112,715	\$ 27,120	\$ 18,574
Emissions and Fuel Costs	\$ 6,190	\$ 31,871	\$ 7,668	\$ 5,252
Total Cost	\$ 28,083	\$ 144,585	\$ 34,788	\$ 23,825

- Road Type (functional class, urban/rural)
- Fatality
- Truck Type

