



Virginia Center *for* Transportation
INNOVATION
& **RESEARCH**

We bring innovation to transportation.

Naturalistic Data: Opportunities for State DOT Research Programs

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VDOT Mission

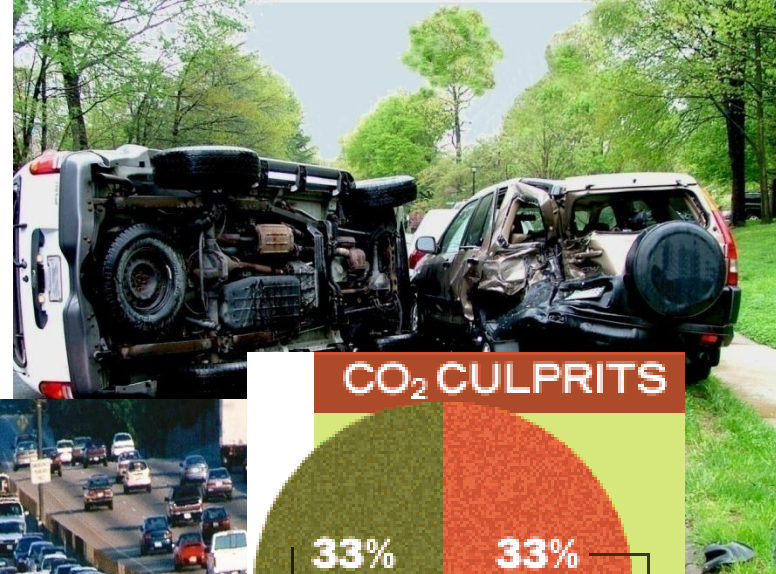
- VDOT's mission is to plan, deliver, operate and maintain a transportation system that is safe, enables easy movement of people and goods, enhances the economy and improves our quality of life



Safety and Mobility Issues

Safety

- 33,963 deaths/year (2009)
- 5,800,000 crashes/year
- **Leading cause of death for ages 4 to 34**



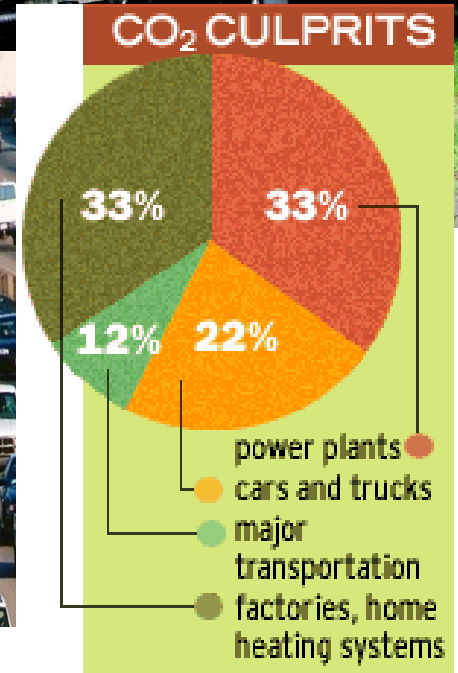
Mobility

- 4.2 billion hours of travel delay
- \$78 billion cost of urban congestion



Environment

- 2.9 billion gallons of wasted fuel



**Slide adapted from USDOT*



How does Naturalistic Data change our approach?

- Problem identification and definition
- Analysis methods
- Solution generation





Police Crash Report

Revised Report

CRASH		City of _____		Local Case Number _____	
Crash Date	MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	<input type="radio"/> City of	<input type="radio"/> Town of

DRIVER INFORMATION

<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>
Driver's Action P1	Driver Vision Obscured P3	Type of Driver Distractions P4	Drinking P5
<ul style="list-style-type: none"> 1. No Improper Action 2. Exceeded Speed Limit 3. Exceeded Safe Speed But Not Speed Limit 4. Overtaking On Hill 5. Overtaking On Curve 6. Overtaking at Intersection 7. Improper Passing of School Bus 8. Cutting In 9. Other Improper Passing 10. Wrong Side of Road - Not Overtaking 11. Did Not Have Right-of-Way 12. Following Too Close 13. Fail to Signal or Improper Signal 14. Improper Turn - Wide Right Turn 15. Improper Turn - Cut Corner on Left Turn 16. Improper Turn From Wrong Lane 17. Other Improper Turn 18. Improper Backing 19. Improper Start From Parked Position 20. Disregarded Officer or Flagger 21. Disregarded Traffic Signal 22. Disregarded Stop or Yield Sign 23. Driver Distraction 24. Fail to Stop at Through Highway - No Sign 25. Drive Through Work Zone 26. Fail to Set Out Flares or Flags 27. Fail to Dim Headlights 28. Driving Without Lights 29. Improper Parking Location 30. Avoiding Pedestrian 31. Avoiding Other Vehicle 32. Avoiding Animal 33. Crowded Off Highway 34. Hit and Run 35. Car Ran Away - No Driver 36. Blinded by Headlights 37. Other 38. Avoiding Object in Roadway 39. Eluding Police 40. Fail to Maintain Proper Control 41. Improper Passing 42. Improper or Unsafe Lane Change 43. Over Correction 	<ul style="list-style-type: none"> 1. Not Obscured 2. Rain, Snow, etc. on Windshield 3. Windshield Otherwise Obscured 4. Vision Obscured by Load on Vehicle 5. Trees, Crops, etc. 6. Building 7. Embankment 8. Sign or Signboard 9. Hillcrest 10. Parked Vehicle(s) 11. Moving Vehicle(s) 12. Sun or Headlight Glare 13. Other 14. Blind Spot 15. Smoke/Dust 16. Stopped Vehicle(s) 	<ul style="list-style-type: none"> 1. Looking at Roadside Incident 2. Driver Fatigue 3. Looking at Scenery 4. Passengers 5. Radio/CD, etc. 6. Cell Phone 7. Eyes Not on Road 8. Daydreaming 9. Eating/Drinking 10. Adjusting Vehicle Controls 11. Other 12. Navigation Device 	<ul style="list-style-type: none"> 1. Had Not Been Drinking 2. Drinking - Obviously Drunk 3. Drinking - Ability Impaired 4. Drinking - Ability Not Impaired 5. Drinking - Not Known Whether Impaired 6. Unknown
Condition of Driver Contributing to the Crash P2	Method of Alcohol Determination (by police) P6	Drug Use P7	
<ul style="list-style-type: none"> 1. No Defects 2. Eyesight Defective 3. Hearing Defective 4. Other Body Defects 5. Illness 6. Fatigued 7. Apparently Asleep 8. Other 9. Unknown 	<ul style="list-style-type: none"> 1. Blood 2. Breath 3. Refused 4. No Test 	<ul style="list-style-type: none"> 1. Yes 2. No 3. Unknown 	

VEHICLE INFORMATION

<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>	<input type="radio"/> <input type="radio"/>
Vehicle Maneuver V1	Vehicle Damage V4	Vehicle Condition V5	Skidding Tire/Mark V2
<ul style="list-style-type: none"> 1. Going Straight Ahead 2. Making Right Turn 3. Making Left Turn 4. Making U-Turn 5. Slowing or Stopping 6. Merging Into Traffic Lane 7. Starting From Parked Position 8. Stopped in Traffic Lane 9. Ran Off Road - Right 10. Ran Off Road - Left 11. Parked 12. Backing 13. Passing 14. Changing Lanes 15. Other 16. Entering Street From Parking Lot 	<ul style="list-style-type: none"> 1. Unknown 2. No damage 3. Overturned 4. Motor 5. Undercarriage 6. Totalled 7. Fire 8. Other 	<ul style="list-style-type: none"> 1. No Defects 2. Lights Defective 3. Brakes Defective 4. Steering Defective 5. Puncture/Blowout 6. Worn or Slick Tires 7. Motor Trouble 8. Chains In Use 9. Other 10. Vehicle Altered 11. Mirrors Defective 12. Power Train Defective 13. Suspension Defective 14. Windows/Windshield Defective 15. Wipers Defective 16. Wheels Defective 17. Exhaust System 	<ul style="list-style-type: none"> 1. Before Application of Brakes 2. After Application of Brakes 3. Before and After Application of Brakes 4. No Visible Skid Mark/Tire Mark
Vehicle Body Type V3	Special Function Motor Vehicle V6	EMV in service V7	Truck Cover V8
<ul style="list-style-type: none"> 1. Passenger car 2. Truck - Pick-up/Passenger Truck 3. Van 4. Truck - Single Unit Truck (2-Axles) 7. Motor Home, Recreational Vehicle 8. Special Vehicle - Oversized Vehicle/Earthmover/Road Equipment 9. Bicycle 10. Moped 11. Motorcycle 12. Emergency Vehicle (Regardless of Vehicle Type) 13. Bus - School Bus 14. Bus - City Transit Bus/Privately Owned Church Bus 15. Bus - Commercial Bus 16. Other (Scooter, Go-cart, Hearse, Bookmobile, Golf Cart, etc.) 18. Special Vehicle - Farm Machinery 19. Special Vehicle - ATV 21. Special Vehicle - Low-Speed Vehicle 22. Truck - Sport Utility Vehicle (SUV) 23. Truck - Single Unit Truck (3 Axles or More) 25. Truck - Truck Tractor (Bobtail-No Trailer) 	<ul style="list-style-type: none"> 1. No Special Function 2. Taxi 3. School Bus (Public or Private) 4. Transit Bus 5. Intercity Bus 6. Charter Bus 7. Other Bus 8. Military 9. Police 10. Ambulance 11. Fire Truck 12. Tow Truck 13. Maintenance 14. Unknown 	<ul style="list-style-type: none"> 1. Yes 2. No 	<ul style="list-style-type: none"> 1. Yes 2. No



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CRASH INFORMATION

Location of First Harmful Event in Relation to Roadway C1	Traffic Control Type C5	Roadway Description C9	Intersection Type C12
<ul style="list-style-type: none"> 1. On Roadway 2. Shoulder 3. Median 4. Roadside 5. Gore 6. Separator 7. In Parking Lane or Zone 8. Off Roadway, Location Unknown 9. Outside Right-of-Way 	<ul style="list-style-type: none"> 1. No Traffic Control 2. Officer or Flagger 3. Traffic Signal 4. Stop Sign 5. Slow or Warning Sign 6. Traffic Lanes Marked 7. In Parking Lanes 8. Yield Sign 9. One Way Road or Street 10. Railroad Crossing With Markings and Signs 11. Railroad Crossing With Signals 12. Railroad Crossing With Gate and Signals 13. Other 14. Pedestrian Crosswalk 15. Reduced Speed - School Zone 16. Reduced Speed - Work Zone 17. Highway Safety Corridor 	<ul style="list-style-type: none"> 1. Two-Way, Not Divided 2. Two-Way, Divided, Unprotected Median 3. Two-Way, Divided, Positive Median Barrier 4. One-Way, Not Divided 5. Unknown 	<ul style="list-style-type: none"> 1. Not at Intersection 2. Two Approaches 3. Three Approaches 4. Four Approaches 5. Five-Point, or more 6. Roundabout
Weather Condition C2	Roadway Defects C10	Work Zone Related C13	Work Zone Workers Present C14
<ul style="list-style-type: none"> 1. No Adverse Condition (Clear/Cloudy) 3. Fog 4. Mist 5. Rain 6. Snow 7. Sleet/Hail 8. Smoke/Dust 10. Blowing Sand, Soil, Dirt, or Snow 11. Severe Crosswinds 	<ul style="list-style-type: none"> 1. No Defects 2. Holes, Ruts, Bumps 3. Soft or Low Shoulder 4. Under Repair 5. Loose Material 6. Restricted Width 7. Slick Pavement 8. Roadway Obstructed 9. Other 10. Edge Pavement Drop Off 	<ul style="list-style-type: none"> 1. Yes 2. No 	<ul style="list-style-type: none"> 1. With Law Enforcement 2. With No Law Enforcement 3. No Workers Present
Light Conditions C3	Roadway Alignment C6	Work Zone Location C15	Work Zone Type C16
<ul style="list-style-type: none"> 1. Dawn 2. Daylight 3. Dusk 4. Darkness - Road Lighted 5. Darkness - Road Not Lighted 6. Darkness - Unknown Road Lighting 7. Unknown 	<ul style="list-style-type: none"> 1. Straight - Level 2. Curve - Level 3. Grade - Straight 4. Grade - Curve 5. Hillcrest - Straight 6. Hillcrest - Curve 7. Dip - Straight 8. Dip - Curve 9. Other 10. On/Off Ramp 	<ul style="list-style-type: none"> 1. Advance Warning Area 2. Transition Area 3. Activity Area 4. Termination Area 	<ul style="list-style-type: none"> 1. Lane Closure 2. Lane Shift/Crossover 3. Work on Shoulder or Median 4. Intermittent or Moving Work 5. Other
Mechanical Device C4	Roadway Surface Condition C7	Relation to Roadway C11	School Zone C17
<ul style="list-style-type: none"> 1. Yes - Working 2. Yes - Working and Obscured 3. Yes - Not Working 4. Yes - Not Working and Obscured 5. Yes - Missing 6. No Traffic Control Device Present 	<ul style="list-style-type: none"> 1. Dry 2. Wet 3. Snowy 4. Icy 5. Muddy 6. Oil/Other Fluids 7. Other 8. Natural Debris 9. Water (Standing, Moving) 10. Slush 11. Sand, Dirt, Gravel 	<ul style="list-style-type: none"> 1. Main-Line Roadway 2. Acceleration/Deceleration Lanes 3. Gore Area (Between Ramp and Highway Edgelines) 4. Collector/Distributor Road 5. On Entrance/Exit Ramp 6. Intersection at end of Ramp 7. Other location not listed above within an interchange area (median, shoulder and roadside) 	<ul style="list-style-type: none"> 1. Yes 2. Yes - With School Activity 3. No
Truck Cover V8	Roadway Surface Type C8	Intersection Area C11	Intersection Area C18
<ul style="list-style-type: none"> 1. Yes 2. No 	<ul style="list-style-type: none"> 1. Concrete 2. Blacktop, Asphalt, Bituminous 3. Brick or Block 4. Slag, Gravel, Stone 5. Dirt 6. Other 	<ul style="list-style-type: none"> 8. Non-Intersection 9. Within Intersection 10. Intersection-Related - Within 150' 11. Intersection-Related - Outside 150' 	<ul style="list-style-type: none"> 1. Rear End 2. Angle 3. Head On 4. Sideswipe - Same Direction 5. Sideswipe - Opposite Direction 6. Fixed Object in Road 7. Train 8. Non-Collision 9. Fixed Object - Off Road 10. Deer 11. Other Animal 12. Pedestrian 13. Bicyclist 14. Motorcyclist 15. Backed Into 16. Other

Naturalistic Data will benefit...

- Traffic simulation modeling
- Motorcycle safety
- Driver training and licensing policies
- Localized traffic operations



- Naturalistic data provides a host of possibilities for applied research that will lead directly to improvements in safety and mobility.



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