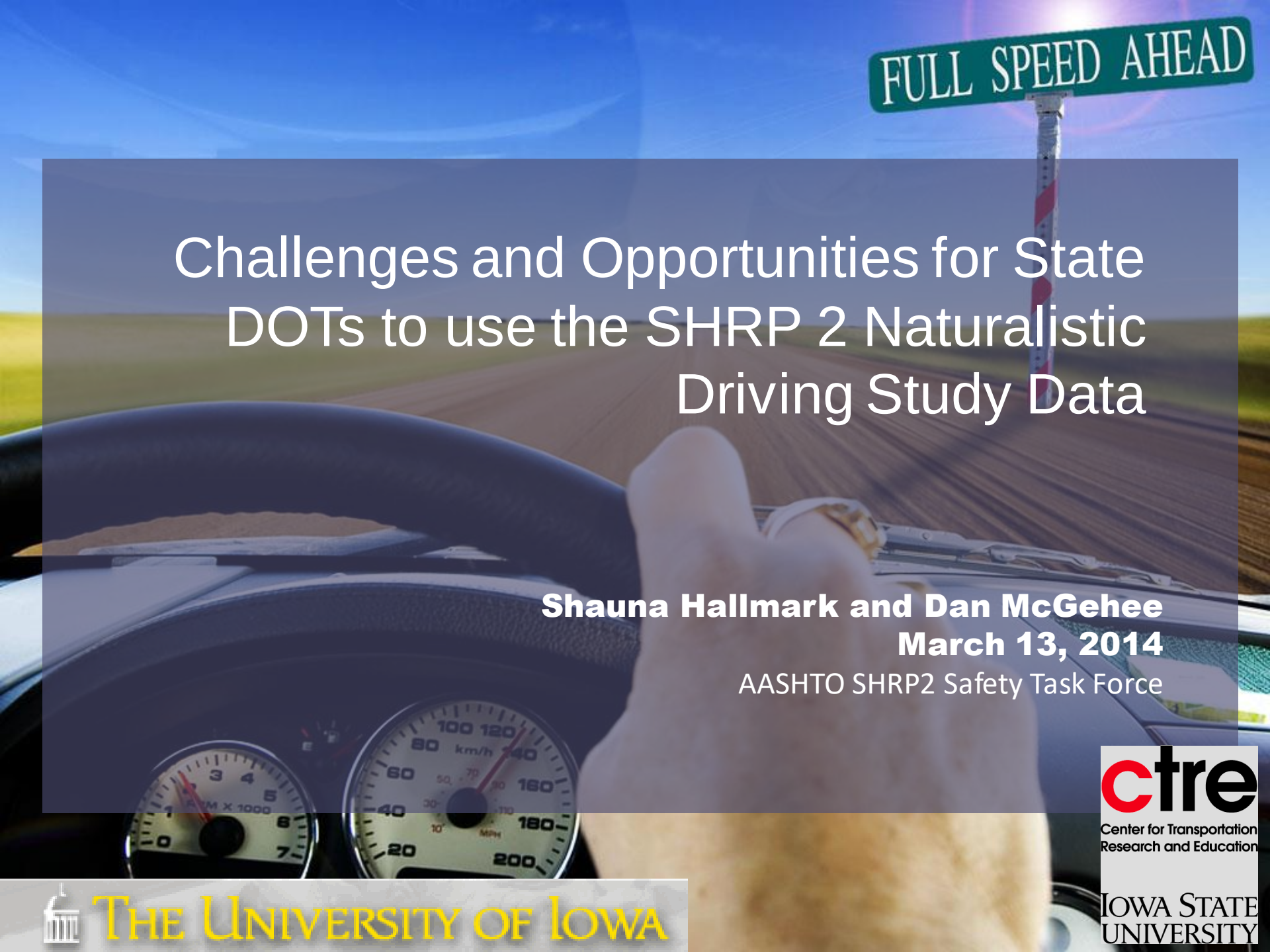

Challenges and Opportunities for State DOTs to use the SHRP 2 Naturalistic Driving Study Data

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SHRP 2 S08d: Rural Curves

- Assess the relationship between driver behavior and characteristics, roadway factors, environmental factors, and likelihood of lane departures using NDS and roadway data
  - Develop models to quantify the relationship between driver behavior and the roadway environment
  - Focus on curves on rural 2-lane paved roadways

SHRP 2 S08d – Research Questions

- Define curve area of influence
  - When do drivers begin reacting to the curve (implications for sign placement, sight distance)
- Define relationship between driver distraction, other driver, roadway, and environmental characteristics and risk of lane departure
  - Impact of countermeasures
  - Impact of specific roadway features (i.e. radius)
  - Impact of distraction/driver characteristics

SHRP 2 S08d – Rationale for Selection of Topic/Methodologies

- SHRP 2 S02 identified rationale for selection of research questions using SHRP 2 NDS data
- Does it matter to stakeholders?
  - State DOTs
  - Lane departure crashes ~ 50% fatal crashes
  - Curves have 3 x crash rate, of significant interest to state/local agencies

SHRP 2 S08d – Rationale for Selection of Topic/Methodologies

- Are NDS data the right data (i.e. would simulation, crash data, etc. be better)
  - Crash data does not have information about what drivers are doing before lane departure event, no information about what is happening when all goes well, simulation is limited– no real driver response)

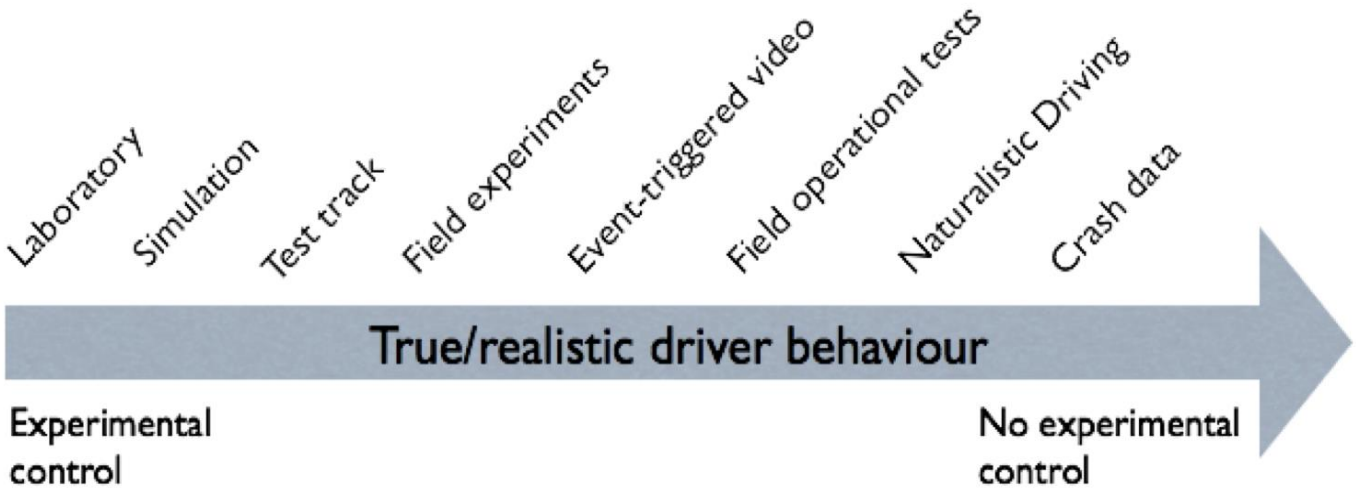


Image source: SHRP 2 S02

SHRP 2 S08d – Rationale for Selection of Topic/Methodologies

- Can the data support the research question (evolving as we learn more about the data)
  - ISU team reviewed sample data set (variables likely to be available, accuracy, frequency)
  - Adjusted expectations as new information became available

Data sources: ESRI, Florida DOT

SHRP 2 S08d – Rationale for Selection of Topic/Methodologies

- Is the research question structured so the results help stakeholders?
  - Tried to structure so results reflected what DOTs/local agencies expect (odds ratio rather than complicated statistical equations - as appropriate)
- Structured team to have varied expertise
  - Roadway data
  - Traffic engineering
  - Human factors
  - NDS data
  - GIS expertise

- Time and resources needed to address topic
  - i.e. calculated how long to manually reduce driver face video
  - Weighed sample size against practicality of reducing data

Big Picture Challenges/Lessons Learned

- Ability to obtain IRB with home institution and data sharing agreement with VTTI
  - Takes much longer than expected
  - Start early
- Ability to securely store potentially identifying information (GPS traces, forward video, etc.)
  - Needed to have IT people trained in IRB, how to back up datasets
- Experience with large datasets
  - Data quality issues
  - Managing large data
  - Manual versus automated data reduction
  - Noise (uninformed analyses may have erroneous results)
    - Statistical model to pick out driver upstream response point in some cases indicated a point far beyond curve sight distance

Big Picture Challenges/Lessons Learned

- Understanding of diverse datasets
  - roadway data (potentially multiple datasets)
  - human factors (multiple data streams)
  - Sufficient understanding of GIS/spatial analyses to understand linking roadway/NDS data
  - Formed team with diverse talents
  - took time to understand data, data collection methods
  - Worked with VTTI/CTRE as needed to ask questions, understand data, budgeted time for these efforts

Data Request Challenges

- Identification of appropriate research questions
  - Can the research question be supported by the data?
  - Level of manual data reduction necessary to extract needed data
  - If processes are automated, needs quality assurance protocols
- Current understanding of how NDS/roadway data were linked
  - Data not linked in manner typically understood by roadway researchers (multiple GPS points linked to one segment rather than GPS points linked to corresponding segments),
  - Not clear if data be queried to extract a particular roadway of interest (e.g. rural 2-lane paved curves with radius < 2000 ft.) without additional manipulation
  - Need to consider how to target particular roadway type

Data Request Challenges

- Significant resources to run queries
  - Need to set appropriate filters
    - Tried to understand data first
    - Worked with VTTI to decide how to set filters (iterative process)
  - Need to understand what data variables are available (accuracy, noise, consistency)
    - Reviewed sample dataset
    - Requested small dataset first (adapted research question as necessary)
    - Reviewed data dictionaries
    - Reviewed how variables were collected

Example of Challenges/Resolution

- Steering wheel position less available than expected for S08
  - Used to establish reaction point
  - Altered methodology for research question
  - May give indication of drowsy driving (not able to target drowsy drivers in data request)
- Difficulty in determing when sensors are working to set filters
  - Reviewed initial data
  - Fine-tuned query for final dataset
  - Issues may be resolved as VTTI provides more info on sensor availability/accuracy
- Need to confirm availability/accuracy of desired output based on research needs

Early implementation

- Select topics likely to be successful in early stages until:
  - Body of researchers have expertise
  - Better estimates for costs for data extraction/reduction are available
  - Challenges/limitations of dataset are better understood

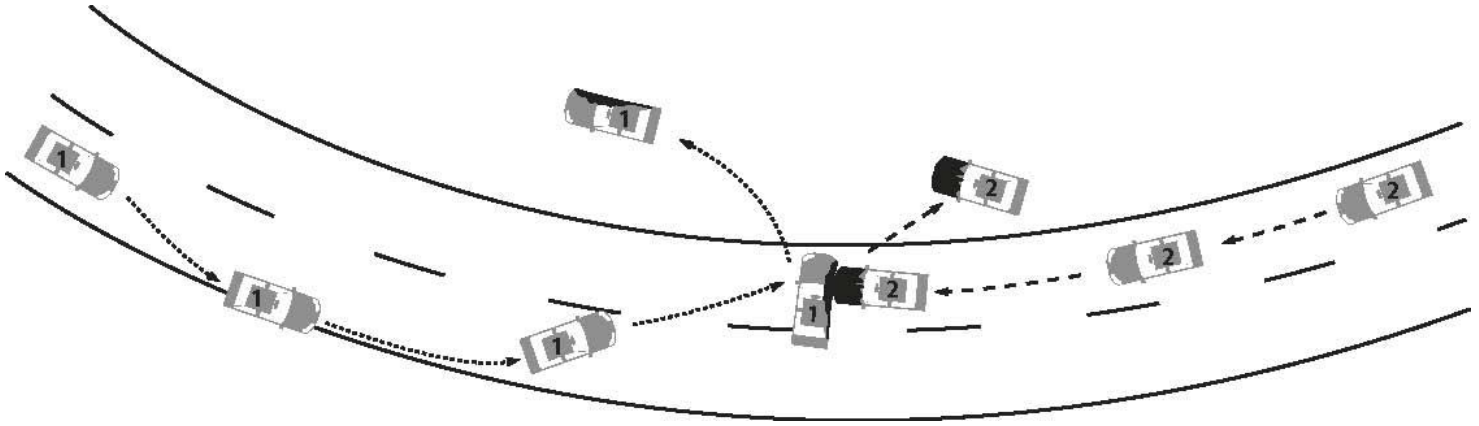
Early Implementation Topics

Typology of Crash/Near-crashes in the SHRP 2 Naturalistic Driving Study Data

- Will be difficult in short term to determine what can be conducted within specific/time resources
- Review of safety critical events will provide insight into where resources could be best expended
- SHRP 2/VVTI plans to reduce variables for crash/near-crash
  - 20 seconds before/10 seconds after
  - ~ 700 crashes
  - ~ 7000 near-crashes

Typology of Crash/Near-crashes in the SHRP 2 Naturalistic Driving Study Data

- Summarize crash/near-crash event files (already prepared by VTTI)
  - Crash type
  - Roadway types
  - Driver factors
  - Environmental factor
- Summarize recommendations for types of analyzes that be conducted most efficiently in short-term



Evaluating Rural Intersection Safety Risk

- Rural intersections account for 30% of rural crashes
- Safety issues of rural intersections not well understood
- Research objective is to evaluate relationship between roadway, driver, and environmental characteristics and rural intersection crash risk
- Phase I: funded by Iowa DOT
  - Around 50 intersections
  - Evaluation of data
  - Proof of concept
- Phase II
  - Pooled fund or implementation project
  - 500 intersections

Image source: FHWA

Evaluation of Driver Seat Belt Compliance

- Use trip level summary
- Summarize factors associated with seat belt compliance/non-compliance
  - Trip characteristics
    - Time of day
    - Vehicle type
    - Month
    - Day of week
    - Trip duration
  - Driver characteristics
    - Risky behavior (number of violations, crashes)
    - Medical condition
    - Gender
    - Age
    - Education level
- Initial analysis conducted for Iowa DOT

Image source: FHWA

Other early implementation ideas

- Turning movements at signalized intersections
  - Intersection conflicts serious concern particularly for older drivers
  - Reasonably easy to identify intersections
  - MRI study shows some early results for intersection study