



SHRP 2

Strategic Highway Research Program

Accelerating solutions for highway safety and performance



Charles Fay Sr. Program Officer
NATMEC June 23, 2010 Seattle, WA

Counter - measure ?



TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Issue: Highway Safety

- Approx. 40,000 fatalities/ year in U.S. alone
- That's equivalent to med-size jet/ day crashes
- Leading cause of death for ages 3-33*
- Over 2 million injuries/ year

- SHRP 2 Safety Program Goal: Greatly increased knowledge of driver behavior - proposed countermeasures based on the findings

- Naturalistic Driving Study – Unprecedented scope/scale
- First to develop complementary roadway database

- One of a kind database=decades

Content

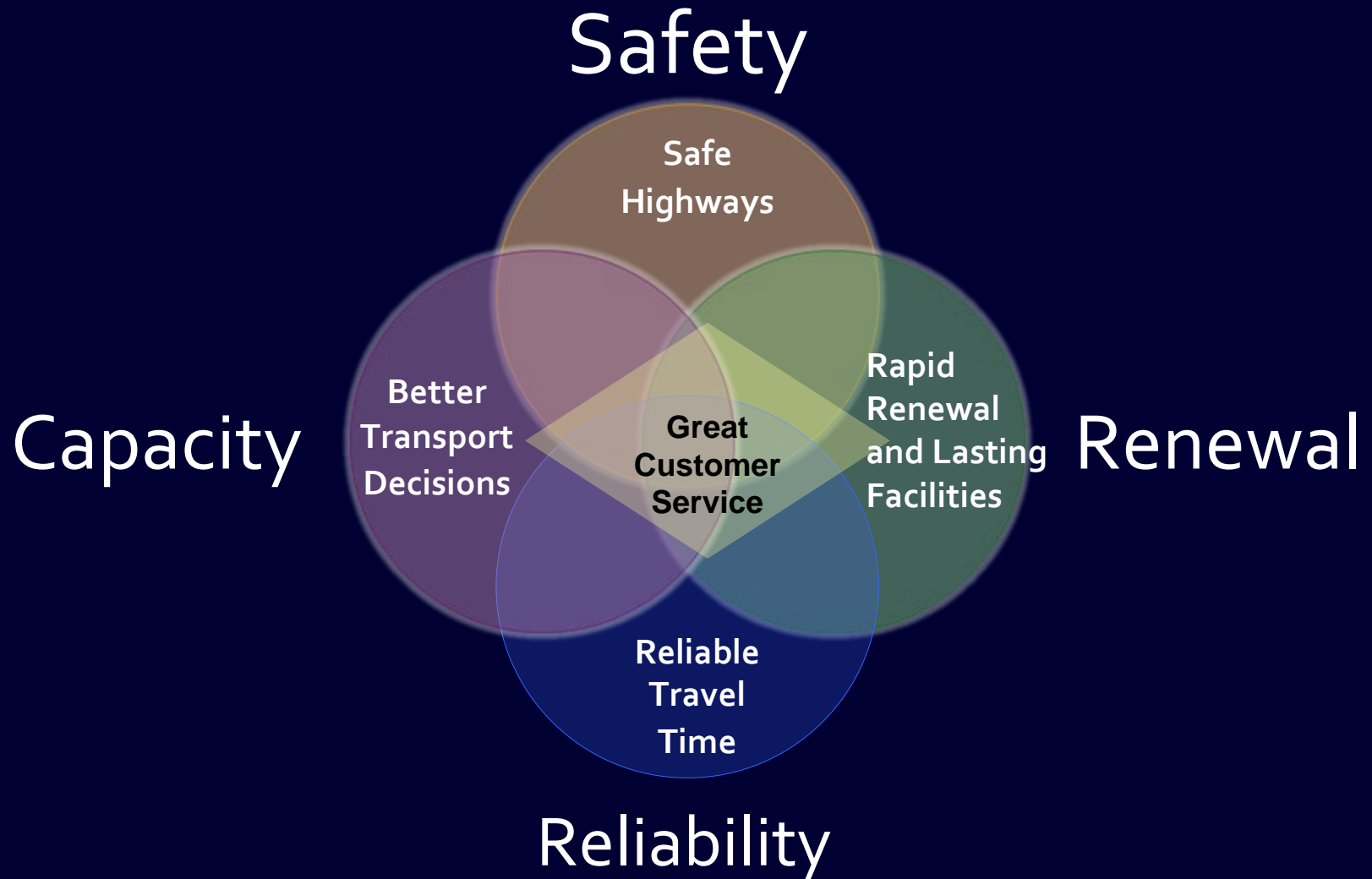
- **Overview SHRP 2**
- **SHRP 2 Naturalistic Driving Study**
- **SHRP 2 Roadway Information Projects & brief intro - complementary data, including traffic data**
- **Bill Hyman - more detail on complementary data**



Overview SHRP 2

- Authorized by Congress \$170 million; 7year
- Targeted, short-term program of strategic highway research
- Administered by TRB under MOU with FHWA and AASHTO
- Integrates multiple disciplines to address critical needs in 4 areas

Four Focus Areas





SHRP 2 Capacity Research

Integrate mobility, economic, environmental, and community needs into the planning and design of new highway capacity



SHRP 2 Renewal Research

Get in, Get out, Stay out



SHRP 2 Reliability Research

**Achieve reliable travel times by
reducing the causes of delay**

SHRP 2 Governance

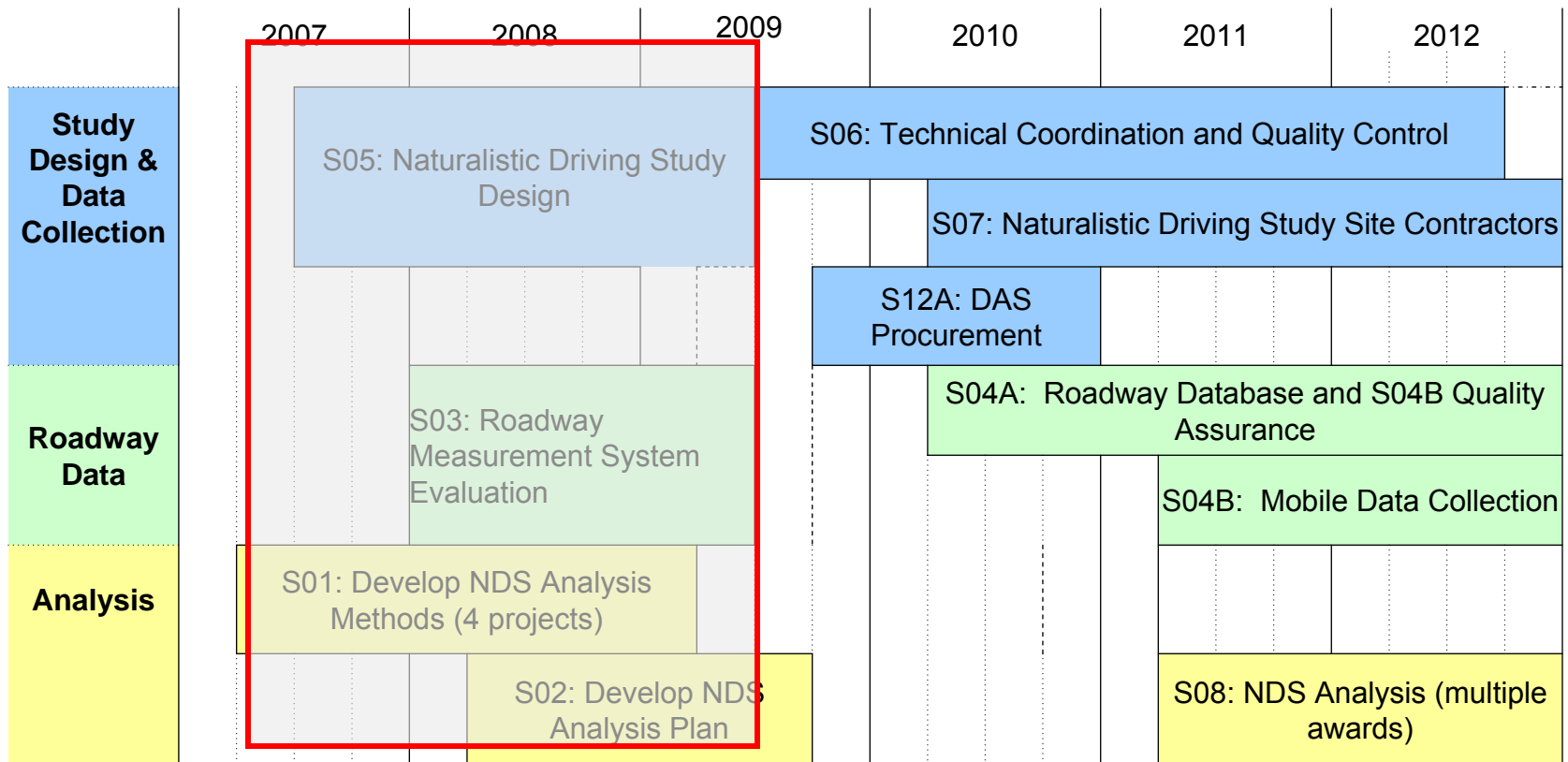
- **Oversight Committee**
 - Overall program responsibility
- **Technical Coordinating Committees**
 - One for each strategic focus area
 - Work plan development, research monitoring
- **Expert Task Groups**
 - One for each group of related contracts
 - RFP preparation, proposal review
 - Assist TCC with review of deliverables
- **In total to date: 40+ committees, 400+ members**

SHRP 2
Safety Research Program
Naturalistic Driving Study



SHRP 2 Safety Project Timeline

SHRP 2 Safety Research Program (Dated-Dec 2009)
Not shown: Site Based Projects (S09 and S10)



SHRP 2 Naturalistic Driving Study (NDS)

- Strategic focus on the driver
- Variety of sensors to collect better data:
 - Objective pre-crash data- what was that car doing in my bedroom?
 - More accurate crash data
 - Near crash/incident data
 - “Exposure” data (normal driving/ baseline)
- Determine relative crash risk for different factors
- Develop crash surrogates

SHRP 2 NDS

- \$48 million (planning, design, equipment, data collection, management, QA/QC, some analysis)
- ~ 2000 instrumentation packages (DAS) operating over 2 years
- ~ 3100 participants
- 6 sites
- Passenger cars, vans, SUVs, pick ups

Participants & Assessment

- Men and Women
- 6 **age groups:
 - Teen (16-20)**
 - Younger Older Driver (51-65)
 - Young Adult (21-35)
 - Middle Older Driver (66-75)
 - Middle Adult (36-50)
 - Older Older Driver (76+)**
- Some 1-year, some 2-year
- Recruitment:
 - Primary: random listed sample (centralized)
 - Secondary: targeted (at sites)

Driver Assessment (testing-vision, cognitive, psych, physical, health questionnaire, etc...)

SHRP 2 NDS Study Sites



Seattle, WA
Bloomington, IN
Raleigh-Durham, NC
Tampa Bay, FL
Central PA
Erie County, NY

How the sites were chosen

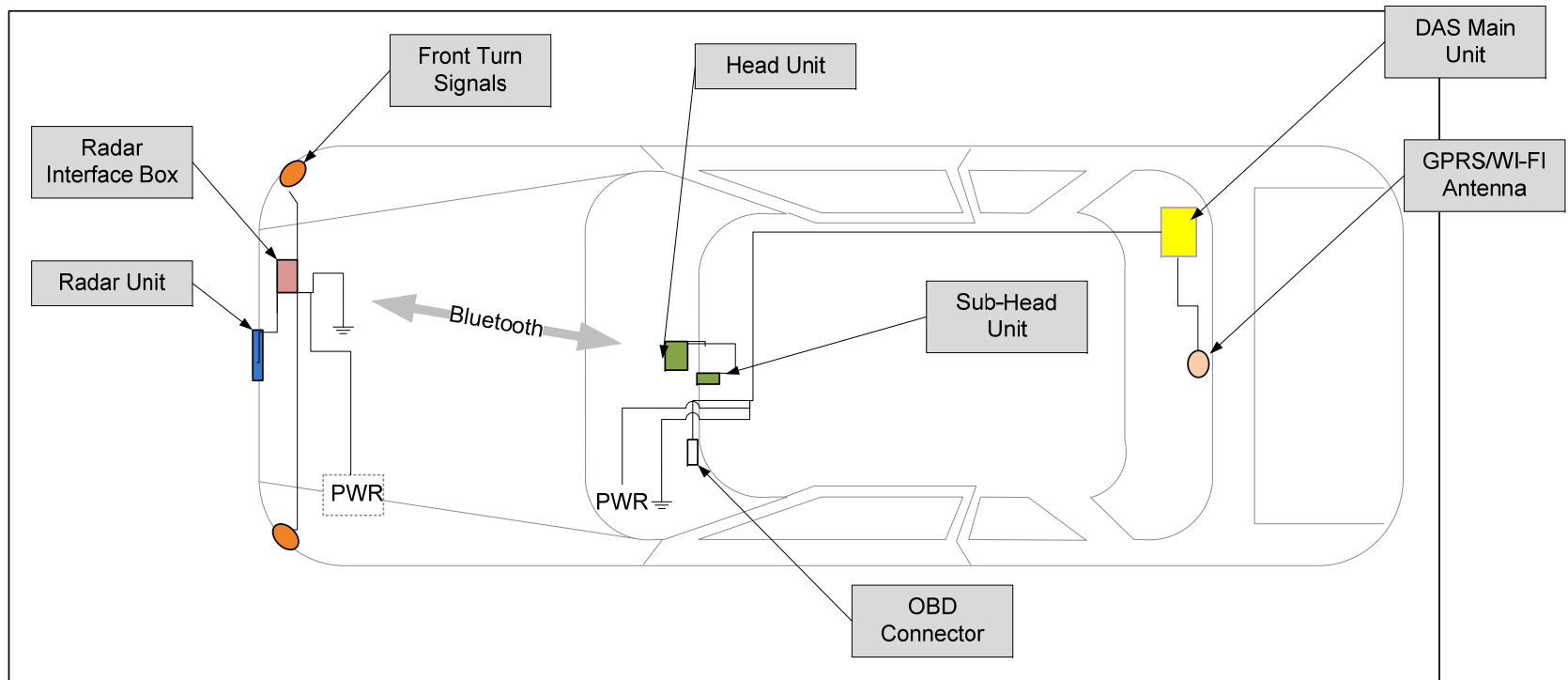
- July and September 2008: Requests for Qualifications
 - Contractor qualifications AND proposed site
 - 19 responses; 11 deemed qualified
- March 2009: Request for Proposals:
 - Pre-bid meeting for all qualified proposers
 - 9 proposals received
- May-June 2009 proposal review and contractor selection process

Contractors, IRBs: data collection

- **1**: recruitment of drivers for all sites
- **6**: at sites to install equipment and interact with drivers
- **1**: for overall coordination, quality assurance, and maintain database
- **2 or more** to collect roadway data, quality assurance, create spatial database
- **8**: IRBs – includes NAS

Data Acquisition System (DAS)

One system to fit ALL participant vehicles



DAS Head Unit



Camera Views



DAS

- Multiple Videos
 - Algorithm: Head Pose Monitor
 - Algorithm: Lane Tracker
 - Algorithm: Driver ID
- Accelerometer Data (3 axis)
- Rate Sensors (3 axis)
- GPS
 - Latitude, Longitude, Elevation, Time, Velocity
- Forward Radar
 - X and Y positions
 - X and Y velocities
- Cell Phone
 - ACN, health checks, location notification
 - Health checks, remote upgrades
- Illuminance sensor
- Passive alcohol sensor
- Incident push button
- Video
- Audio (only on incident push button)
- Turn signals/ wipers
- Vehicle network data
 - Accelerator
 - Brake pedal activation
 - ABS
 - Gear position
 - Steering wheel angle
 - Speed
 - Horn
 - Seat Belt Information
 - Airbag deployment
 - Many more variables...

Data

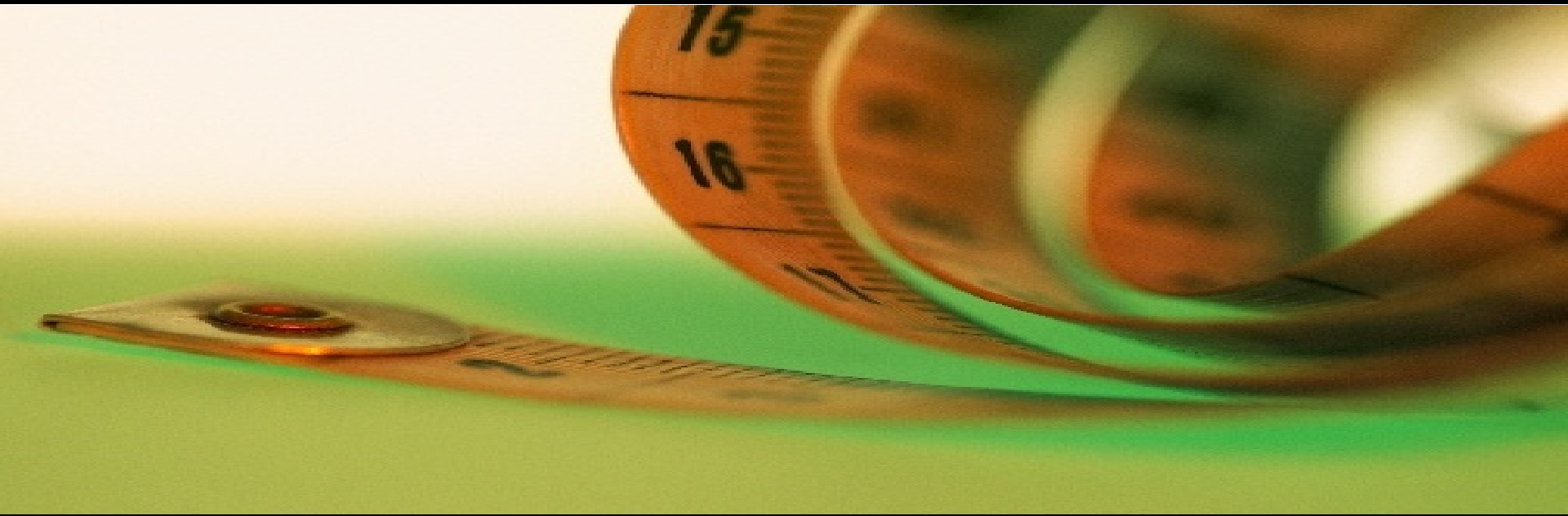
- Not triggered – rather continuous recording- why?
- Compressed, saved sensor data (~ 1 petabyte)
- 1 petabyte = 1000 terabytes
- Large volume of roadway data – in addition to 1 petabyte from DAS
- Strict database security measures to assure participant privacy (GPS, video); sensitive roadway data

Use of NDS data

- Applications to date:
 - Inattention: ban on hand-held devices by teens
 - Drowsiness: policies, regulations for commercial drivers
 - Vehicle: evaluation of crash warning algorithms
 - Education: feedback to teens and parents
- Potential: (first study to include road data)
 - Roadway design, roadside hardware, ITS
 - Vehicle design
 - Planning, highway operations, fuel efficiency, environmental effects
 - Minds of the future.... Many more

Project (s) So₃/So₄

- Roadway Measurement System Evaluation
- Acquisition of Roadway Information



SHRP 2 Roadway Information Projects:

- **So3: Roadway Measurement System Evaluation**
Completed
- **So4A: Roadway Information Database Developer, Technical Coordination, Quality Assurance for Mobile Data Collection**
Executed- 5/2010
- **So4B: Mobile Data Collection**
RFP &Q anticipated late summer 2010

Project S03 SHRP 2 Rodeo

Project S03 (Roadway Measurement Evaluation) aka SHRP 2 Rodeo

- Objective: to prequalify vendors and determine what can be collected to meet our needs
- 10 vendors participated (9/16 - 9/20/2008)
- S03 contracting team: ARA, CSI, KCI

Rodeo participants

- Data Transfer Solutions
- Enterprise Info Solutions
- Fugro/Roadware
- Geospan
- Mandli Communications
- Michael Baker
- Pathways Services
- Sanborn
- Teleatlas
- Yotta
- FHWA DHMS**



http://www.edats.com/services/asset_management/MAC_Vehicle.aspx

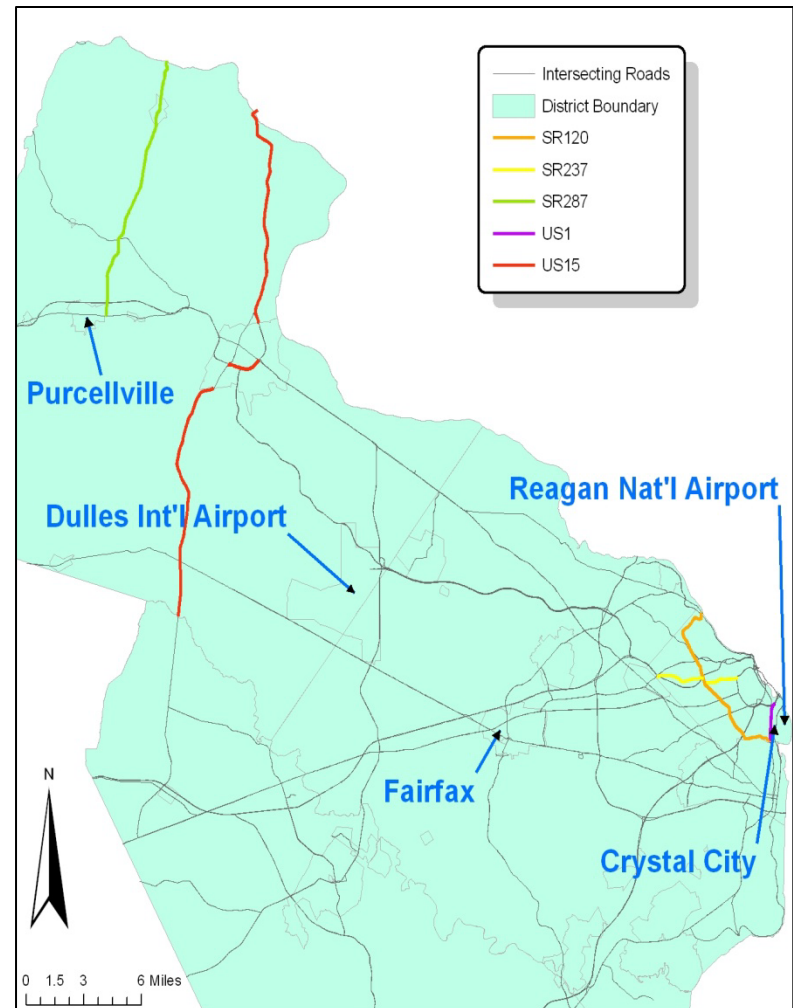


Mobile LiDAR

<http://www.mandli.com/mobileLidar.html>

Rodeo Location

- Northern Virginia
- Two Survey Loops
 - Arlington area, ~ 11 miles each direction
 - Leesburg area, ~ 41 miles each direction
 - 3 passes each direction



Rodeo test site criteria

Physical Characteristics

- Terrain
- Urban/ rural
- Cover
- Roadway type

Data elements of interest:

- 25 roadway features with a total of 113 attributes, or data elements
- ex. Lane=feature; width is attribute

Features include: (no particular order)

- Barrier systems
- Pavement markings
- Roadside obstacles
- Signs
- Rumble strips
- Street lighting
- Grade
- Curvature
- Cross slope
- Pavement condition (3)
- Intersections (6)
- Driveways
- Lanes
- Median
- Shoulder
- Ramps
- RR crossing
- On-street parking
- Sidewalks

Within the two rodeo loops were:

Six 2500-ft test sections contained data elements

- Manually surveyed (<1 cm vert; <2 cm horiz.)

Vendors provided these locations after data collection

Calibration Verification Sites established for GPS, DMI and IRI (if measured) – approx. half didn't normally calibrate before collecting data – Sign of things to come?

9AM-3PM data collection window

Data requested

2 types of data sets requested: Initial and Final

- Initial data set to evaluate consistency in collection over the entire rodeo course (e.g., GPS)
 - ~ 260 miles
- Final data set to evaluate ability to collect specific data elements within 2500 ft test sections
 - ✓ Positional Accuracy/ Precision (3 reps)
 - ✓ Identification: e.g., sign type

Evaluation results:

- GPS consistency – basically good for all sites (urban/rural, canopy, highway) sub 30 cm
- No vendors provided all the data elements
- Hardly any provided geometric data, though indicated... Assumed automated; but results indicate need of QA/QC
- Overall vendors were inconsistent in following procedures and data delivery requirements
 - resulting in data not evaluated

So3 Evaluation results:

- Taken together the vendors provided most of the data elements (88/113) - so they can be collected to varying degree of accuracy/precision; with refinement should be able to provide within desired spec. with sufficient QC/QA
- Additional data process will give some indication if valid assumption
- In general with the systems evaluated (photo/video-log) Accuracy diminishes as you move further away from the vehicle
- Industry claim of sub-meter- achievable for objects close to the vehicle (within shoulder), but begin to get poor beyond shoulder

What now: Additional Data Request

- Additional data request - emphasis on lane departure
- Not necessarily only data needs for So₄ projects, but will serve as pre-qualification to bid on Project So₄B
- Technologies used in rodeo not necessarily technologies used today, and not in 2011 when So₄B will start collecting data
- Whatever technologies planning to propose to use on So₄B- those are the technologies to collect these additional data

Data element	Desired	Vendors** rodeo results (best of...)
Curve radius	25 feet (7.62 m)	+/- 5-10% **
Cross-slope**	0.1%	No (0.2%)
Grade	0.5%	Yes
Lane width	0.328 feet (0.1 m)	Yes
Shoulder width	0.5 feet (0.152 m)	Yes
Signs/objects	~ 3 feet/sub-meter	Yes
Sign type	All, but emphasis on speed limit, warning	Not conclusive; assumed possible

Additional data Q&A

May 5, 2010

So₄A contractor and SHRP 2 meeting with vendors before data submission including follow-up Q&A

WE WANTED TO BE CRYSTAL CLEAR W/ SPECS

- Data due to So₄A contractor June 15, 2010
- **Prequalification to bid on So₄B**-if data not received exactly as specified- cannot be evaluated and out of competition.
- Results late July 2010

Acquisition of Roadway Information:

- **So4A: Roadway Information Database Developer, Technical Coordination, Quality Assurance for Mobile Data Collection**
 - \$1 million
 - RFP 9/4/09 released; due 10/15/09
 - 12 proposals received
 - **Iowa State Univ.-prime, CSI-sub, V.Norohna, P.Jovanis**
- **So4B: Mobile Data Collection (subject to change)**
 - \$3.5 million
 - Expected RFP & Q release Aug/ Sept 2010; est. start date 4/15/11
 - Pre-qualification to bid (Additional Analysis)

Project So₄A

User needs, **data discovery**, data collection plan

Early tasks for So₄A to determine:

- User needs/ data and analysis requirements, incl. min GIS functionality
- What relevant roadway data are available for each site that meet specifications /**initial look at complementary data , incl traffic data**
- Determine capabilities of mobile data collectors (So₄B)
- Determine data elements and sources of data (newly collected under So₄B or from other sources); provide plan to collect/ acquire data

Project So₄A (cont.)

Develop GIS to support analyses of the NDS

- Design, build & manage GIS (duration of SHRP 2)
- Multiple data sets - disparate specs, including referencing systems
- Can/ should the data within each site be merged?
- Can/ should the data across sites be merged?
- Support SHRP 2 analyses projects



Project So₄A: Quality Assurance of the Mobile Data Collection Project (So₄B)

- Communication plan btw So₄A contractor and So₄B contractor(s)
- Data collection plan for So₄B
- Quality assurance plan & execution of QA for data delivered by So₄B contractor(s)
- Data collection field manual/ calibration sites

Complementary Data for Roadway Database

- Traffic data – more detailed “exposure” data-allowing for better crash analysis and relationship btw congestion & safety
- Weather information
- Work zone information
- Incident information
- Special events
- Traffic control information
- Safety programs(e.g. click-it/ticket)
- Bill’s presentation will focus more on some of these data types

FAQs about the SHRP 2 NDS



Frequently Asked Questions about the SHRP 2 Naturalistic Driving Study

What is SHRP 2?

In 2005, the United States Congress created the second Strategic Highway Research Program (SHRP 2) to address the challenges of moving people and goods efficiently and safely on the nation's highways. SHRP 2 is administered by the Transportation Research Board of The National Academies, under a Memorandum of Understanding with the Federal Highway Administration (U.S. Department of Transportation) and the American Association of State Highway and Transportation Officials.

SHRP 2 is a targeted, short-term research program carried out through competitively awarded contracts to qualified researchers in the academic, private, and public sectors. SHRP 2 addresses four strategic focus areas: the role of human behavior in highway safety, rapid renewal of aging highway infrastructure; congestion reduction through improved travel time reliability, and transportation planning that better integrates community, economic, and environmental considerations into new highway capacity. Additional information about SHRP 2 can be found on the program's Web site at www.trb.org/shrp2.

What is a "naturalistic" driving study?

A naturalistic driving study investigates ordinary driving under real-world conditions in order to make the driving experience safer. In the SHRP 2 study, 3000 volunteer drivers will agree to have their cars fitted with cameras, radar, and other sensors to capture data as they go about their usual driving tasks.

Experience with earlier naturalistic driving studies demonstrates that drivers quickly forget the presence of cameras and sensors, which are as inconspicuous as possible. This allows researchers to study driving behavior that is as close to "natural" as possible: thus a "naturalistic driving study." This kind of study is needed because driver behavior contributes to more than 90 % of crashes and is the primary factor in more than 60 % of crashes.

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http://onlinepubs.trb.org/onlinepubs/shrp2/NDS_FAQs.pdf

www.trb.org/shrp2

Thank you

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