Human Factors in Roadway Design and Operations

Kate Hunter-Zaworski, Ph.D., P.E.
Civil and Construction Engineering
Oregon State University
Corvallis, OR

Three doctors to dispense with your human factors ailments

• Dr Katharine Hunter-Zaworski
• Dr David Hurwitz
• Dr Robert Layton
**Impetus for Workshop**

- Identify need for Human Factors workshop that addresses particular issues that are relevant to Oregon
- OSU workshop provides updated materials that are compliant with standard practice in Oregon and US
- NCHRP Report 600, provides a background, but is currently being updated

**Traffic engineering is defined as;**

...that branch of engineering which applies technology, science and human factors to the planning, design, operations and management of roads, streets, bikeways, highways... and abutting lands.”
Human Factors

“is an applied scientific discipline that enhances (and applies) the relationship between devices and systems, and the people who are meant to use them.”

References for the Course

- The references and impetus for this course are:
  - MUTCD
  - TDC Handbook
  - Green Book
  - Research results
  - NCHRP Report 600, Human Factors Guidelines for Road Systems, TRB
  - Other references
The NCHRP Report 600

• Provides:
  – Specific actionable design principles
  – Supported by operational decisions
  – Review of key research and analysis

NCHRP Report 600 and Standards

• NCHRP Report 600 is a set of guidelines with human factors applications to supplement the standards:
  – AASHTO Policy on Geometric Design (the Green Book)
  – State standards, ODOT Design Manual

• Operations/Control:
  – Manual on Uniform Traffic Control Devices
  – ODOT, Supplement to MUTCD
Guidelines vs Standards

- There are some parts of the guidelines that do not match the standards.
  - For example, *Speed Selection on Horizontal Curves* in NCHRP 600 is based on a paper from New Zealand
  - Also, Passing Sight Distance is based on the old AASHTO Policy method

- Introduction and overview of Guidelines
- “Guideline” itself
- Rating of guideline; empirical data or expert judgement
- Figure, table or graphic to augment the text
• Discussion
  – Summarize materials behind guideline choice
• Design issues
  – Special design consideration
• Cross reference
  – Reference to other guidelines
• Reference
  – Reference from the literature

**Course Objectives**

• To provide background data, analysis methods, research results and current research on application of human factors knowledge to the design, operations and control of streets and highway.
• Comprehensively, not limited to the *NCHRP Report 600, Human Factors Guidelines*
Caution

• There will be redundancy in information, slides and photos. Hopefully this will help weave a comprehensive understanding of human factors applications to traffic engineering

Who is the primary decision maker in use of highway transportation system?

• Road user?
• Highway designer and traffic engineer?
  – Many primary decisions are made before road user sees the highway
    • Horizontal alignment – curvature, width
    • Vertical alignment – vertical curvature, sight distance
    • Traffic control – type, location, visibility, speed control
Highway Systems have Three Major Components

- Roadway
- Traffic Control
- Road User

Traffic Engineers can't be Expected to

- Solve all design problems
- Control extremely complex conditions
- Deal with all numerous, severe conflicts
- Traffic control devices regulate, control, warn and guide motorists

*Note: The more traffic control devices present, potentially the poorer the design*
Conflicts Result From

- Mix of various road users
  - Cars, trucks, busses, motorcycles, pedestrians, bikes, motorcycles, and equestrians
- Numerous vehicles
- Varying paths
  - Turns, directions, lane changes, stops
- Various speeds
- Mix of user purposes, familiarity

Highway System Failure Measured By

- 32,675 fatalities (2014)
- 3 million injuries
- 6 million police reported crashes
  - 2 million unreported crashes
System Failures Attributed to Error by

- Users
  - Drivers, pedestrians, cyclists, motorcyclists, buses, trucks
- Roadway design
- Traffic control
- Combination of all above

- Design and operations solutions must be jointly developed by designers and traffic engineers
  - With comprehensive understanding of human factors principles
Highway Designers Must

• Meet traveler demands
• Provide road users knowledge how to behave safely on roadway design
• Know impact of design decisions on traffic control needs