Integration of Safety into the Design Process

Timothy E. Barnett, P.E., PTOE
State Safety Operations Engineer
“IF YOU THINK GOOD DESIGN IS EXPENSIVE, YOU SHOULD LOOK AT THE COST OF BAD DESIGN”

DR. RALF SPETH, CEO JAGUAR
Fatal Collisions in Alabama

- Head On: 30%
- Sideswipe: 14%
- Angle: 12%
- Other: 3%
- Rear End: 1%
- RwD: 40%
You're in a box on wheels hurtling along several times faster than evolution could possibly have prepared you to go.

Next 5 miles
Crash Contributing Factors

VEHICLE: 13%

DRIVER: 93%

ROADWAY: 34%

Treat, 1979;
Graphic Credit: Thomas Neuman
Active Failures and Latent Failures

Critical Decision

Critical Event

Critical Reason

Associated Factors

Crash
Most design engineers believe a design value published in a manual is there primarily for safety reasons, and that any deviation from that value will result in significant degradation in safety.
Rigid design standards in many cases have evolved to serve three purposes:

• Efficiency in design,
• As a quality control measure,
• Efficiency in construction.
“The direct application of established design criteria or standards (i.e., nominal safety) is no assurance that a certain quality of design (i.e., substantive safety) will be achieved—indicating that such criteria are not sufficient in themselves.”

Jack E. Leisch
“Dynamic Design for Safety”
ITE 1972
Nominal versus Substantive Safety

Examined in reference to compliance with standards, warrants, guidelines and sanctioned design procedures.

The expected or actual crash frequency and severity for a highway or roadway.
Nominal Safety is Absolute
Substantive Safety is a Continuum
AASHTO Policy

AASHTO has emphasized that the Policy on Geometric Design is a flexible document.

Indeed, a close reading of it reveals that there is significant flexibility in both technical content and recommended usage.
Focus on Standards

The focus on rigid standards has been translated in the minds of designers to a belief that standards equals safety, and that no compromises can be accepted.

This view holds even with design values that clearly are not related to substantive safety.
• For the most part, we have focused on the importance of nominal safety, and
• Many designers have been taught that adherence to nominal safety directly translates into substantive safety performance.
Traffic volume is the chief determinant of relative risk.

The length of highway over which the exception occurs strongly influences relative risk.

The design element or feature in question (lane width, shoulder width, superelevation, curvature, grade) will have differing expected sensitivities based on the type of facility.
Planning Level Tools

- Statewide Strategic Highway Safety Plan
- ALSAFE
Project Level Tools

- Roadway Improvement Safety Evaluation (RISE)
- Vision Zero Suite
- Interactive Highway Safety Design Methodology (IHSDM)
Design

Existing Conditions

Alternative 1

Alternative 2

Alternative 3
Design Countermeasures to Address Safety

- Intersection Design
- Roadway Departures
Older Driver and Pedestrian Safety Issue

High speeds.
Low visibility of pedestrians.
A real head turner.

Slower vehicle speeds.
Good visibility of pedestrians.
Rural Intersections
Directional Crossovers

Curb Entire Divider

Curb Along Radius and Storage Lane

8' Shoulder

5' R

10' Opening**

100' Min.

(150' Desir.)

5' R

5' R
Alternative Intersection/Interchange Design
Median Barriers
Centerline Rumble Stripes
Cross Centerline Crash
Edge Lines
THANK YOU
For your contribution to saving lives