Urban Street Symposium 5
Closing Session

Performance-Based Analysis of Geometric Design of Highways and Streets

Research Progress and Opportunities

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Research Progress and "Opportunities"

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USS5 Design-Related Themes

Complete streets/design for all users

Space constraints, fiscal constraints

Safety

Importance of non-transportation outcomes (e.g., economic development, healthy communities, social interaction)

Flexibility to adapt to specific context

Characteristics of Performance-Based Analysis

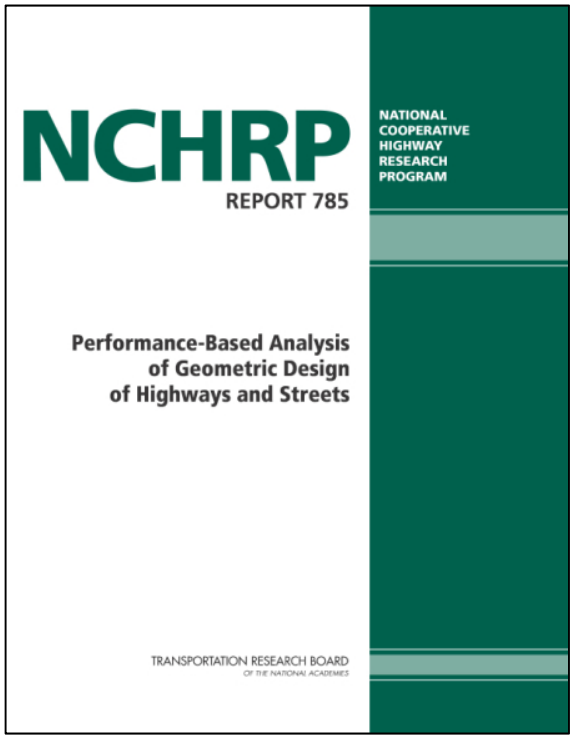
Objective outcomes of alternative design decisions are quantified/ predicted and used to inform decisions

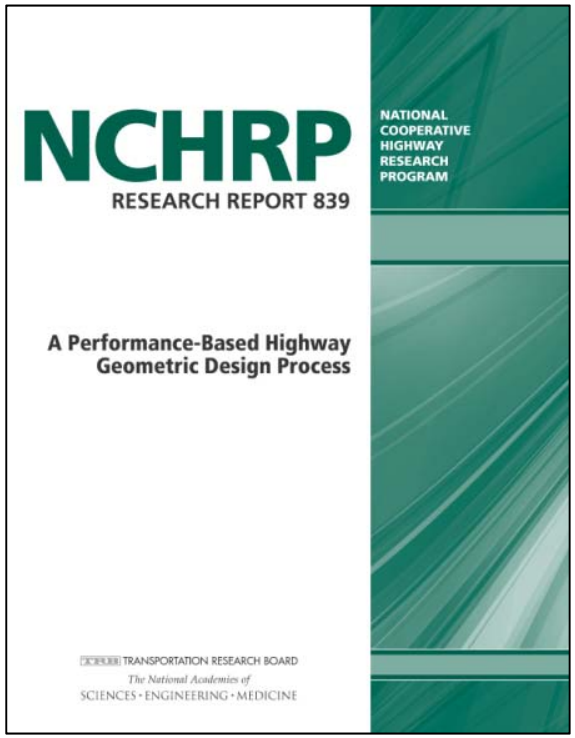
Level of analysis detail is consistent with project development stage

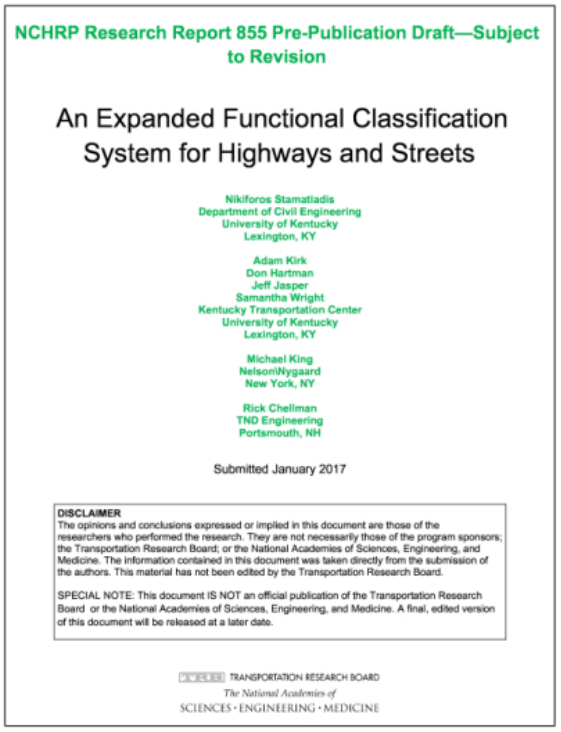
Performance measures are linked to broader intended project outcomes and societal goals

Requires knowledge of direct and indirect impacts of design on performance

Recent Design “Process” Research







Offer new/revised ways for designers to think about…

Context

Context / Roadway	Rural	Rural Town	Suburban	Urban	Urban Core
Principal Arterial	H speed H mobility-L access	L/M speed M mobility-H access	M/H speed M mobility-H access	L/M speed M mobility-M access	L speed M mobility-M access
	LC: L separation; NC: M separation; CC: H separation	LC: L separation; NC, CC: M separation	LC: L separation; NC: M separation; CC: H separation	LC: L separation; NC: M/H separation; CC: H separation	LC: L separation; NC, CC: M separation
	P1: *; P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P1: *; P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P3: Wide; P4: Enhanced
Minor Arterial	H speed H mobility-M access	L/M speed M mobility-H access	M speed M mobility-M access	L/M speed M mobility-M/H access	L speed M mobility-M/H access
	LC: L separation; NC: M separation; CC: H separation	LC: L separation; NC, CC: M separation	LC: L separation; NC: M separation; CC: H separation	LC: L separation; NC, CC: M separation	LC: L separation; NC, CC: M separation
	P1, P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P1: *; P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P3: Wide; P4: Enhanced
Collector	M speed M mobility-M access	L speed M mobility-H access	M speed M mobility-H access	L speed M mobility-H access	L speed M mobility-H access
	LC: L separation; NC, CC: M separation	LC, NC: L separation; CC: M separation	LC: L separation; NC, CC: M separation	LC: L separation; NC, CC: M separation	LC, NC: L separation; CC: M separation
	P1, P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P1: *; P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P3: Wide; P4: Enhanced
Local	M speed M mobility-M access	L speed M mobility-H access	L speed L mobility-H access	L speed L mobility-H access	L speed L mobility-H access
	LC, NC, CC: L separation	LC, NC, CC: L separation	LC, NC, CC: L separation	LC, NC, CC: L separation	LC, NC, CC: L separation
	P1, P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P1: *; P2: Min; P3, P4: Wide	P2: Min; P3: Wide; P4: Enhanced	P3: Wide; P4: Enhanced

Speed, Mobility, Accessibility, and Separation levels -- H: High; M: Medium; L: Low

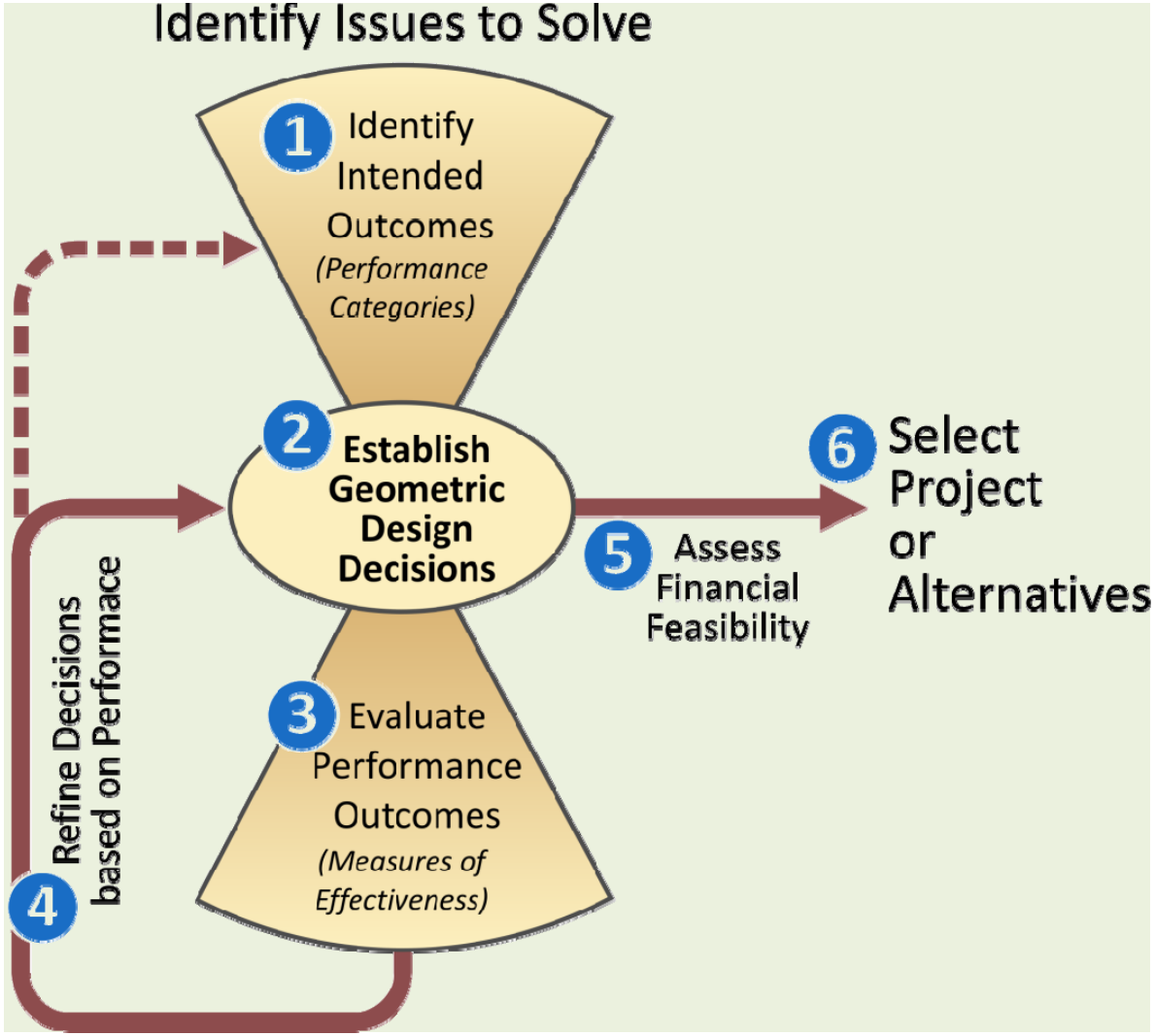
Bicycle Connectors -- LC: Local; NC: Neighborhood; CC: Citywide

Pedestrian Traffic Levels -- P1: rare/occasional; P2: low; P3: medium; P4: high

Pedestrian Facility Width -- *: site-specific considerations; Min: minimum; Wide: greater than minimum; Enhanced: wide for large congregating pedestrian groups. Pedestrian facility separation should be considered in conjunction with driver target speeds.

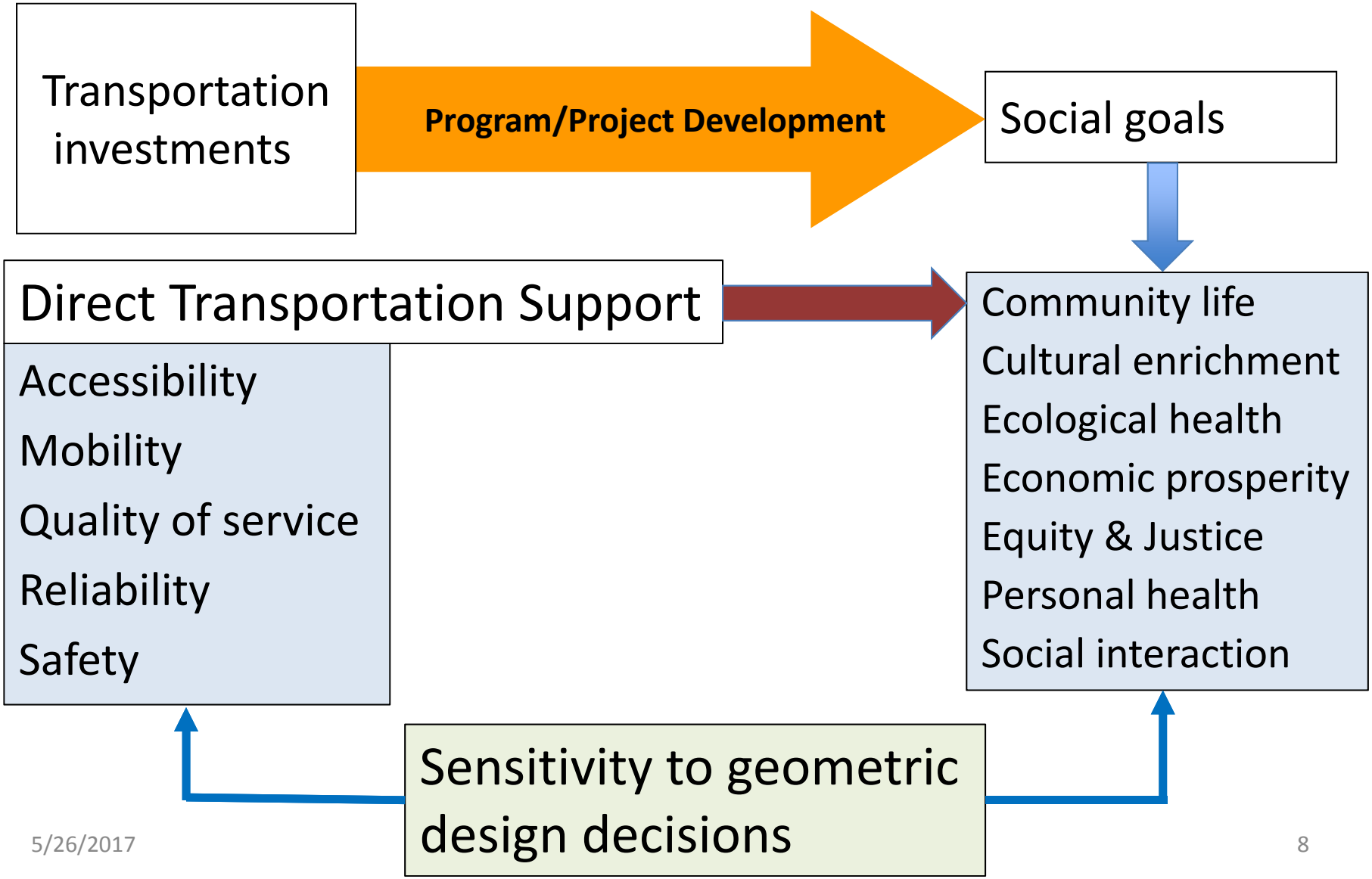
From Stamatiadis et al., Pre-publication draft of NCHRP Report 855

Design Decision-Making



From Ray et al., NCHRP Report 785

Geometric Design Performance



Hauer (2005) – The Road Ahead

HSM Highway Safety Manual AASHTO

The Rational Sty

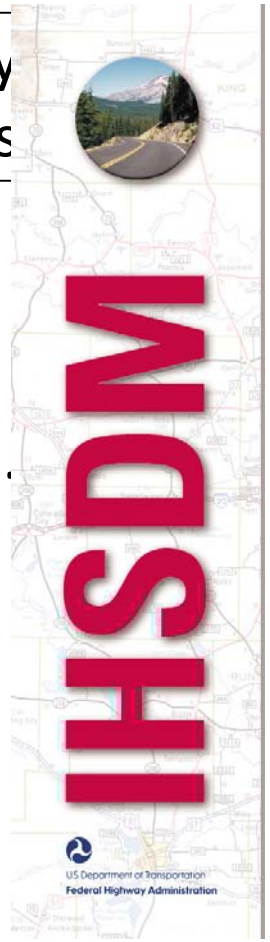
lys

CMF CRASH MODIFICATION FACTORS CLEARINGHOUSE

matic to a more rational style

hungry for factual knowledge.

SaA AASHTOWare Safety Analyst AASHTO

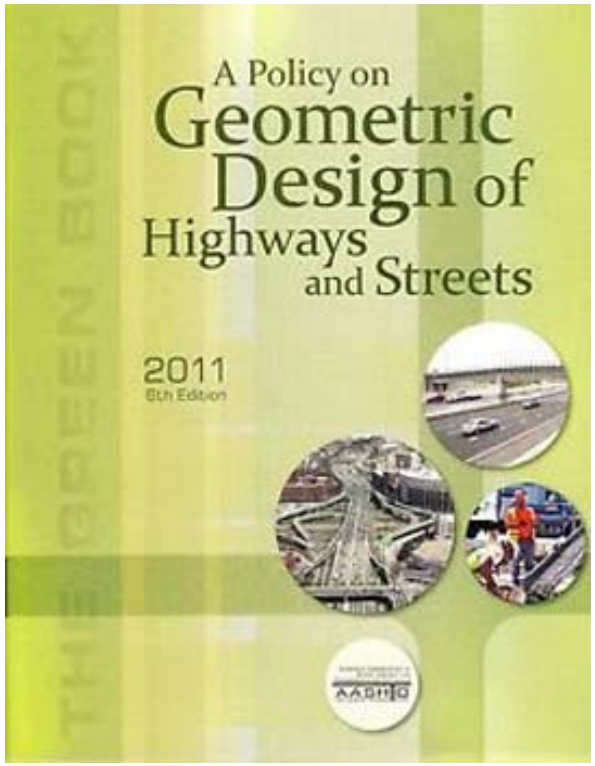


With Safety defined as…

The number of crashes, or crash consequences, by and severity, expected to occur on the entity during a specified period

NCHRP 20-07/Task 394 [Active]
Development of Performance-Based Geometric Design Content for the Next Edition of the AASHTO Green Book

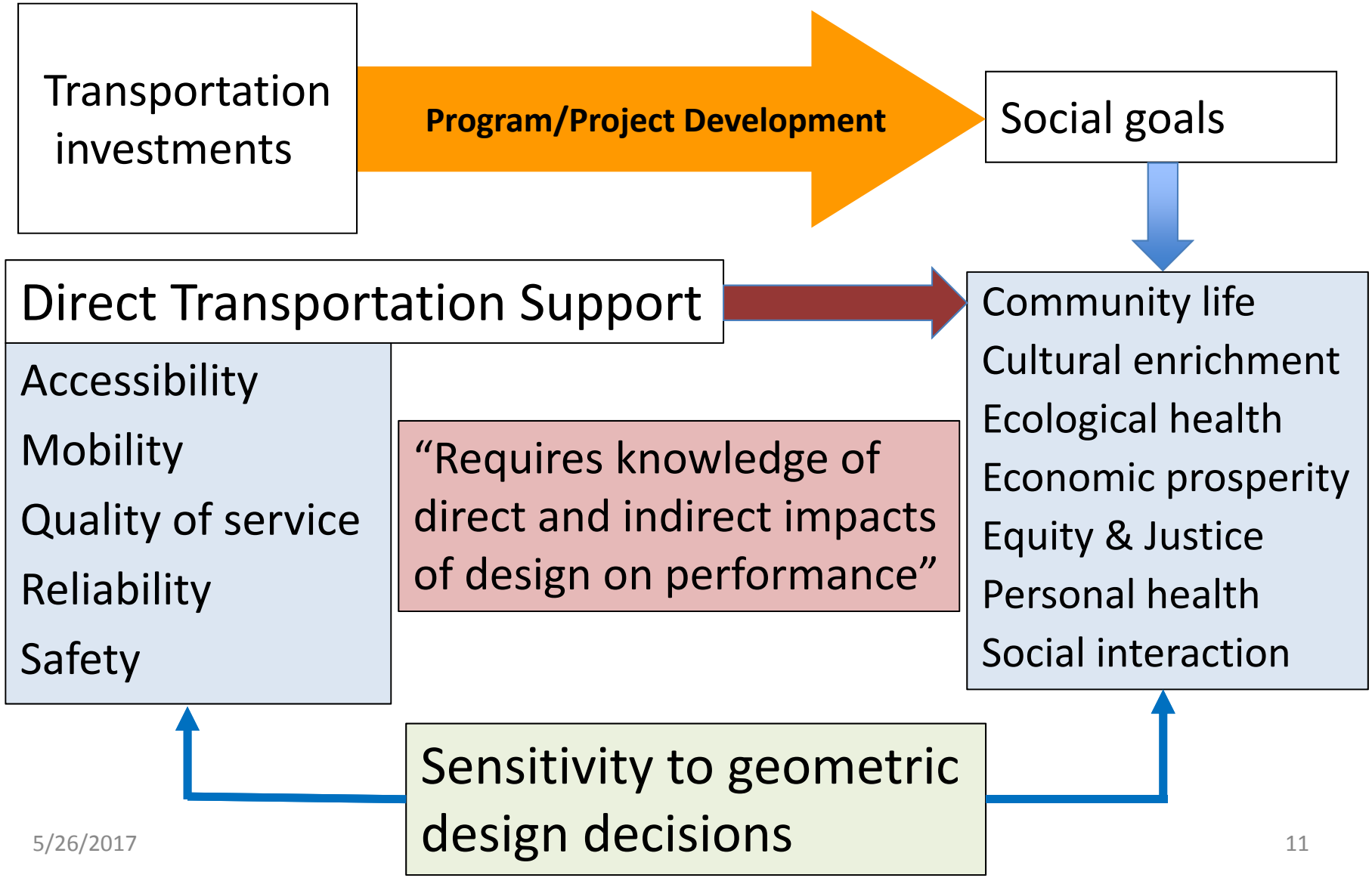
http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4093



provide recommended content changes for the AASHTO Green Book based on the AASHTO *Highway Safety Manual*; NCHRP Report Number 785; and other relevant research

primary content change should be an introduction to and overview of the concept of performance-based design

“Opportunity” 1: Knowledge Generation and Management



"Opportunity" 1: Knowledge Generation and Management

Illustrative example from Ray et al., NCHRP Report 785

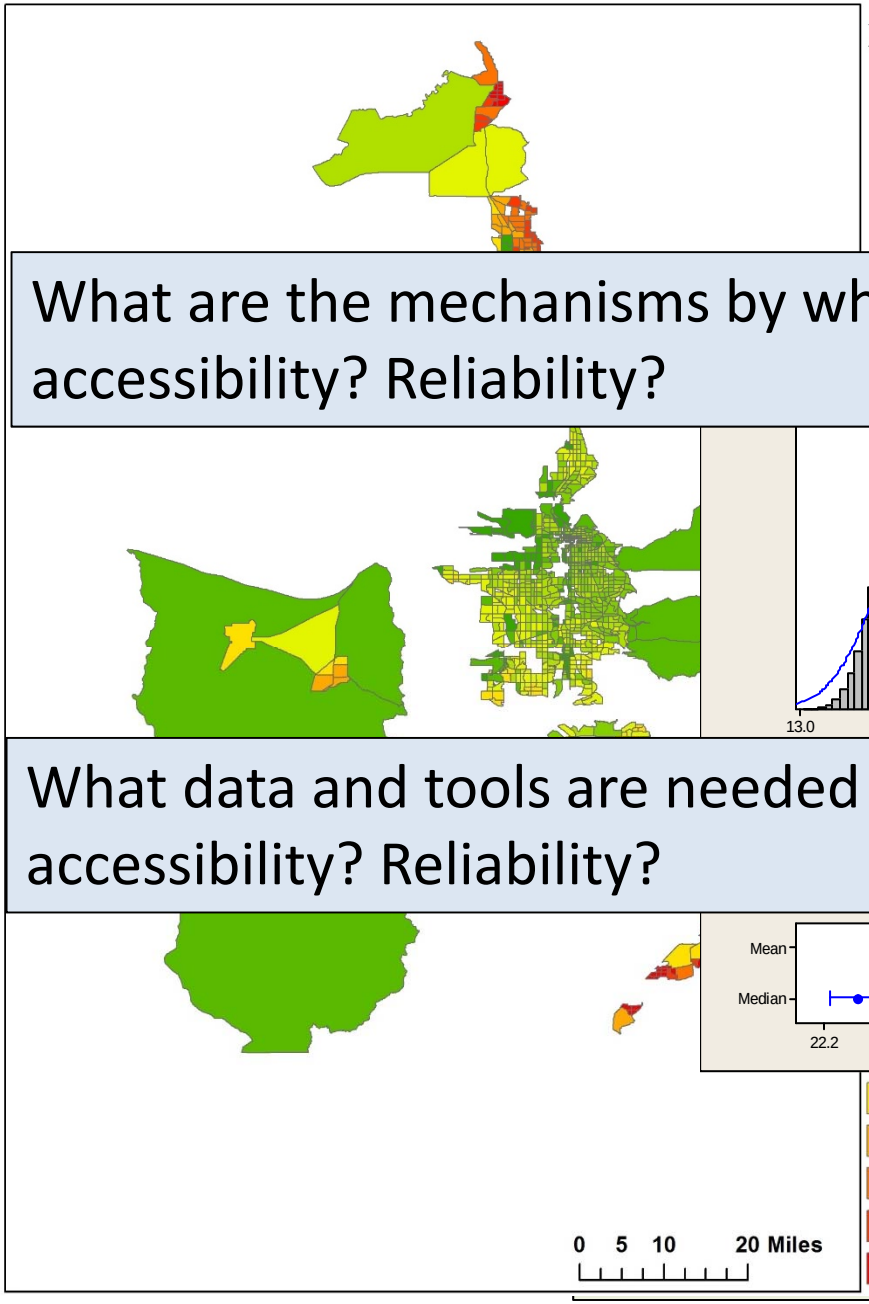
Intersection Geometric Elements/Characteristics	Accessibility	Mobility	Quality of Service	Reliability	Safety
Int… fe…	●◊	●*	●*	□x	●*
Au… tra…					
Bicycle accommodation facilities	●	●	●	□x	●x
Curve tapers and radii	●x	●x	●x	□x	●x
Design vehicle accommodations	□x	□x	□x	□x	□x
Intersection sight distance	●x	●x	●x	□x	●x
Lane widths	●x	●x	●x	□x	●x
Median opening configuration	●◊	●◊	●◊	□x	●x
Number and types of lanes	●◊	●*	●*	□x	●*
Pa… su…					
Si… (in… ADT)					
Shoulder width and composition	●x	●x	●x	□x	●x
Traffic islands	●x	●x	●x	□x	●x
Horizontal alignment of approaches	●x	●x	●x	□x	●*
Vertical alignment of approaches	●◊	●*	●*	□x	●*

● = direct effect
□ = indirect effect
-- = no effect
* = relationship can be directly estimated by existing performance prediction tools
◊ = relationship can be indirectly estimated using more than one existing tool
x = relationship cannot be estimated by existing tools

How to we manage and prioritize data and information to make performance-based analysis practical and cost-effective?

What do we do when need for information on "performance effects" outpaces its availability?

cessibility & Reliability



What are the mechanisms by which design decisions impact accessibility? Reliability?

What data and tools are needed for designers to analyze accessibility? Reliability?

y to geometric
ecisions

“Opportunity” 3: Addressing the Complexity of Safety Performance

Example SPFs - Urban 4-leg Signalized Intersections

What do the next generations of safety models need to look like to more fully address urban street design alternatives?

$$N_{bimv} = \exp(a + b \times \ln(AADT_{maj}) + c \times \ln(AADT_{\min}))$$

Does model development have to be driven by statistical regression models? Can we build on experience and individual projects in a quantitative/objective way?

$$N_{bike} = (N_{bimv} + N_{bisv}) \times f_{bikei}$$

Questions/Comments?

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