FHWA Fundamental R&D on Nationally Significant Issues

Research and Technology Coordinating Committee

May 19, 2020

Outline

- Context and background about federally-funded highway RD&T and fundamental research;
- *Some* of the nationally significant issues in highway transportation FHWA RD&T programs could address;
- Process for how fundamental research could be identified to address these issues;
- Asks how to think through trade-offs between fundamental and regular FHWA RD&T assuming a fixed budget for RD&T in the future.

Framing Questions

- Where can FHWA RD&T programs make the most difference in
    - Addressing nationally significant issues facing the country?
    - Filling important gaps other RD&T programs don’t address, specifically, for this discussion, through fundamental research?

Context

- Authorized highway-related RD&T programs across FHWA, ITS-JPO, SP&R, and UTC programs approaches $600 million annually
- $217 mm (37%) is controlled by FHWA.
- About $6 million is allocated for the Exploratory Advanced Research (EAR) program, though there is some fundamental research in other FHWA RD&T programs.
- Fundamental research defies easy definition, but it's a little more applied than basic research and considerably less focused on *developing and delivering* specific applications and innovations than the vast bulk of FHWA's RD&T.

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States | Counties

From May 14, 2020 to May 14, 2020

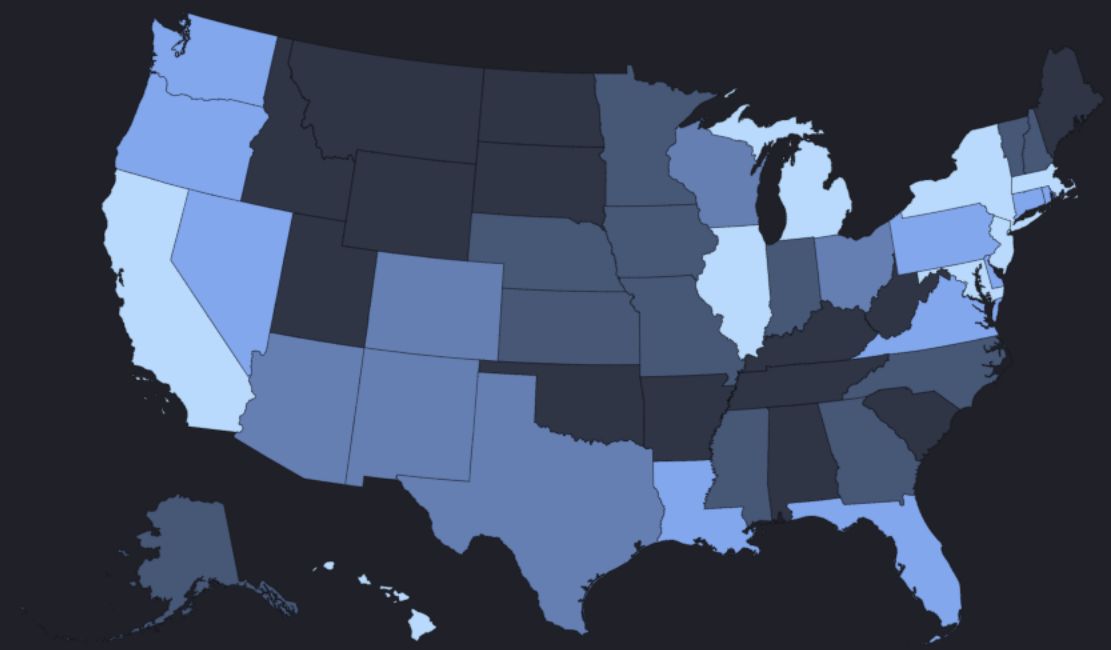
Select metrics: Mobility and Social Distancing | COVID and Health | Economic Impact | Vulnerable Population

Search for a state

State	Social distancing index	% staying home	Imported COVID cases	% change in consumption	COVID death rate
Alabama	20	18%	739	1.7%	1.71%
Alaska	27	23%	1	3.3%	1.13%
Arizona	33	24%	270	-4.4%	2.08%
Arkansas	20	19%	374	3.5%	1.03%
California	43	29%	247	-11.4%	1.74%
Colorado	33	25%	232	-3%	2.18%
Connecticut	40	27%	2,773	-4.8%	3.81%
Delaware	38	26%	1,070	-5%	1.49%
District of Columbia	65	47%	1,933	-18.7%	2.19%
Florida	39	25%	480	-10.4%	1.81%
Georgia	30	22%	841	-1.9%	1.95%
Hawaii	53	26%	0	-11.4%	1.15%
Idaho	24	22%	171	1.7%	1.29%
Illinois	44	31%	2,007	-10.4%	1.87%

Zoom to All states | Show Social distancing index | Show National Statistics

Showing data for May 14, 2020



Social distancing index

16 | 25.6 | 31 | 35.4 | 40.6+

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Role of EAR Program

- Exploratory work "with data provider partners such as mobile phone companies to determine if accurate and reliable origin-destination (OD) products could be developed from mobile device location data." https://www.fhwa.dot.gov/publications/research/ear/20012/20012.pdf
- Data sources and computational algorithms for imputing missing data validated based on a variety of independent datasets and peer reviewed by an external expert panel.
- Two lessons: (a) value of exploratory research (b) serendipity regarding the specific innovation.

Some Nationally Significant Issues

- Highway role in economic prosperity
- Intercity and interstate movement of goods and people in the most efficient, safe, and sustainable ways
- A multi-trillion dollar highway system asset that requires significant re-investment
- Asset Management/System Performance
- Resilience
- Culture of innovation

Highway role in economic prosperity

- What infrastructure investments (capacity, operations, rehabilitation) will yield the greatest economic return to society?
  - Mega-cities and mega-regions are viewed as increasingly important sources of innovation and economic prosperity
    - How do highways affect the economic performance of mega-cities and regions? How well are these highways performing? What is the role of other modes and how well are they performing?
    - How can increased automation affect these roles and outcomes in the most beneficial ways for society?
  - Rural highways are essential for movement of agricultural and bulk products
    - How do depopulating rural states pay for upkeep of their highways?
  - Efficient movement of freight underlies national productivity
    - How can public policy affect the split of freight across modes for the most efficient, safe, and sustainable outcomes?

Intercity and interstate movement of goods and people in the most efficient, safe, and sustainable ways

- What are optimal user fees for cars, trucks, and other highway users?
- How can we achieve the most efficient traffic operations for cars and trucks?
- How can FHWA RD&T (a) monitor changes in personal and freight highway transportation as the economy, trade, and technology evolve and (b) influence these changes to benefit society?

A multi-trillion dollar highway system asset that requires significant re-investment

- How should the nation pay for it (user fees, general taxes) and build political support for increased revenues?
- How can FHWA RD&T define what the federal role and funding share should be?
- How can FHWA RD&T define the most appropriate split of user fees between cars and trucks and when non-highway modes are better alternatives than highways and then influence these outcomes?

Asset Management/System Performance

- What are the most cost-effective materials and designs for new facilities, rehabilitation, and maintenance? How can FHWA foster development of the best predictive models to answer these questions?
- What is the best guidance and support FHWA can provide the states and MPOs in moving to the performance-based federal-aid system required by Congress?

Resilience

- How can FHWA best help highway owners understand asset and system vulnerability and how it is changing (temperatures, wind, waves, storms)?
- How can FHWA best contribute to developing risk-based guidance on design, standards, operations?

Culture of Innovation

- What information, incentives, and support can FHWA provide to states and local governments to implement the state-of-the-art in highway funding, taxing, asset management, safety, etc.?
- How can FHWA RD&T define and reduce barriers to private sector innovation in highway system operation, preservation, and performance?

Fundamental R&D in Highway Transportation

- Policy makers and research managers can define the most important questions RD&T should be addressing (as we try to do above)
- Researchers, however, are the best ones to define promising ways to address these questions through fundamental research.
  - Most highway R&D community oriented around and focused on highly applied R&D, so which researchers to turn to and how?
  - How does FHWA RD&T grow a cadre of highway-oriented researchers willing and able to define and conduct fundamental highway research (perhaps in collaboration with the UTC and SP&R programs)?
  - How can FHWA build upon the best fundamental research being done in the highway R&T community across all federally funded highway RD&T programs?

Trade Offs between fundamental and applied RD&T

- Most of FHWA's RD&T is being done with state DOTs and other asset owners and customers as partners who are seeking specific applications to solve today's problems.
- Assuming a fixed budget what criteria do R&D managers and policy makers use to make trade-offs between investing in fundamental and applied R&D?
- How can the RTCC help FHWA R&D managers think through this problem?