An Overview of Transportation RD: Priorities for Reauthorization:
Response to Questions for the Record

Elizabeth Deakin
Professor of City and Regional Planning, University of California, Berkeley
Former Director (March 1, 1999- Feb. 28, 2009), UC Transportation Center
March 2009

Questions Submitted y Subcommittee Chairman David Wu

1) Arms -Length Evaluations

Arms-length evaluations of research are important for credibility and can help target research dollars on the most cost-effective and creative topics. Independent evaluators can be asked to point out strengths and weaknesses in the research design, comment on the reasonableness of proposed expenditures, evaluate the qualifications of the researchers and their track records, estimate the contribution that the research is likely to make, and identify whether the proposed research is innovative or duplicates other past or ongoing research.

In the research community, peer review is the norm. Journals and some university transportation centers use either double-blind or confidential reviews and the reviewers are selected both for their subject area knowledge and for their ability to provide a dispassionate evaluation. In the most rigorously organized peer reviews, research collaborators, former students and former professors, and anyone with a close professional or financial interest in the outcome are disqualified from participating in a review.

Peer reviews are not perfect – for one thing, reviewers often know or can surmise the authors and vice versa, despite the removal of identifiers, and big names and big institutions may sometimes be given deference that the proposal might not actually deserve. Despite these flaws, most researchers agree that outside peer review is the best way we have devised for obtaining independent evaluations of research proposals and products and reducing biases in the evaluations.

On the other hand, there is also a desire research to be relevant to users, especially short-term, applied research that is expected to lead directly to a deployable product. For this reason reviews by outside researchers are often complemented by reviews or project oversight by practitioners, industrial partners, and others with a direct interest in the outcome. Such reviews and oversight are especially helpful in raising practical questions about the utility of a product, the size of the market for it, competing products and their pros and cons, etc.

In addition to peer review and end-user reviews, strategies for obtaining evaluations that can be of value in guiding research programs include:

- Using independent expert panels to generate research topics, review research proposals, oversee research as it proceeds, and review products. (This can be the same panel or different panels at each step.)

- Public agency and industry advisory committees, who can bring user and researcher viewpoints into the evaluation process while maintaining some intellectual distance. Independence of the reviewers can be built into this process. For example, some state DOTs enlist representatives of other state DOTs and universities outside the state to evaluate their research programs and major projects. Because panel members are not competing for the grants, they are more likely to be dispassionate than local reviewers might be.

NSF uses independent expert reviewers, and NAS committees evaluating research and research needs are typically independent expert panels. NCHRP and TCRP use stakeholder review panels to select and review projects. USDOT also uses these methods for some of its programs, but also does many reviews internally, in some cases because there's a lack of resources to bring in outside reviewers. Many states have research advisory committees, but for projects rely on internal staff review and (sometimes) project advisory committees composed of likely end users. The University Transportation Centers program calls for peer review of research proposals and products but does not provide much guidance on what qualifies as peer review.

Congress could mandate independent reviews by peers and end users for all major research programs (as well as for field tests, demonstration projects, and other major projects) and provide funding for such reviews as part of program costs.

2) Strategic Outcome -Based Transportation Plans – Best Practices from Other Countries

Transportation research would benefit from a mixed portfolio including some long term, basic research whose application is uncertain as well as more applied research and development - some of which may nevertheless be years from application, and some of which could be implemented in the short term and therefore should be coordinated with transportation plans and programs in order to move R&D results into implementation. Partnerships for implementation should extend not only to federal and state transportation agencies but also to the many other federal, state and local agencies, businesses and industries that have roles in implementation of transportation projects or products or are users of transportation products.

A study currently underway with funding from the Volvo Educational and Research Foundation, involving researchers from Leeds University in the UK as well as from UC Berkeley, is examining the problem of moving research from studies to actual use by investigating how innovative cities and regions learn about innovations. Preliminary findings are that loose networks of professional acquaintances are a principal way for information on innovations to be transmitted among end users, and that professional meetings and short articles in publications are more valuable to professionals than are journals. Further, meetings that cross disciplinary boundaries are more effective in transmitting new ideas than are specialty conferences, which are better at developing expertise than at spreading new ideas. Researchers use both formal journals and their own networks to learn about new ideas and to share them. The work suggests that an important way to speed up knowledge transfer is to encourage participation in professional activities, especially ones that can attract participation from multiple disciplines and specialties.

In a related study just getting underway, UC Berkeley researchers are looking at ways that transportation, urban development, and environmental agencies and foundations select and evaluate research and disseminate research findings. While the study is just getting underway, we have

identified several good examples that could be adopted by US transportation agencies. For example, Sweden uses international panels of experts to help evaluate its research agendas, assess research progress, and advise on action items.

A second study reviewing transportation policies in Canada, the UK, and Sweden, conducted by the Center for Global Metropolitan Studies at UC Berkeley, offer examples of best practices in prioritizing projects, including research projects. The general approach is as follows:

1) **Adopt national goals and objectives, along with performance measures which track accomplishments.** Typical goals for transportation are improved access, efficient movement, economic growth, environmental quality, and social inclusion. For each goal, specific performance measures are identified and agencies must measure and report their achievements.
2) **Require horizontal and vertical policy integration:** National transport policies are required to be coordinated with policies for other infrastructure, housing and urban development (both urban redevelopment and new town programs,) economic development, and the environment. In addition, local and regional policies are expected to be consistent with national policies**.** Inter-departmental and inter-governmental coordination mechanisms including joint committees and jointly funded programs have been established to help achieve this integration. In some countries policy integration is also being accomplished in part through institutional restructuring: Canada's and Sweden's national transport authorities lie within broader ministries, the Ministry of Transport, Infrastructure and Communities in Canada (created in 2006) and the Ministry of Enterprise, Energy and Communications in Sweden. The UK Department for Transport (DfT) is a stand-alone ministry but transport plans must align with the umbrella land use (spatial) plans at the local, regional and national level and local transport plans are reviewed by the DfT for adherence to the spatial plans and the DfT Smarter Choices campaign to lower carbon emissions.
3) **Align project selection criteria to national goals.** Project selection criteria are required to reflect the national goals, objectives, and performance measures.
4) **Provide information and incentives for government at all levels as well as citizens and businesses to support and help meet the goals.** Funding programs, tax policies, and pricing strategies have been revised to focus on achievement of national goals and objectives. Programs have been funded to encourage citizens and businesses to reduce their carbon emissions, for example. In the UK, nationally sponsored marketing programs are also underway to let people know what they can do to reduce emissions.
5) **Provide funding and create room for experimentation with innovative strategies**. For example, both **t**he UK and Sweden have used pricing to manage congestion in their largest cities, London and Stockholm; in the Swedish case this experiment was led by the national government.
6) **Encourage public-private partnerships.** Canada recently established and funded an Office of Public Private Partnerships as a component of the $33B multi-year Infrastructure Plan.

While these steps are largely aimed at aligning investment programs and projects with national goals, research agendas have been developed to help achieve the national goals and are being funded. In the US, such research agendas have sometimes been developed (e.g., the Transportation environmental research program requested by Congress) but there has been less consistency in connecting research expenditures to either the research agendas or to national policy directives.

3) Criteria for UTC Selection

RITA currently requires that University Transportation Centers report on their products in research, education, human resources, and tech transfer. The specific criteria are:

1) the number of projects selected for funding
2) the amount budgeted for those projects
3) the number of research reports published
4) the number of research reports presented at academic/professional meetings
5) the number of transportation courses offered
6) the number of students participating in transportation research projects
7) the number of transportation degree programs offered
8) the numbers of students enrolled in those programs,
9) the number of transportation-related masters and PhD degrees awarded
10) the number of seminars, symposia, and other activities conducted for transportation professionals and
11) the number of professionals participating in those events.

In addition, RITA requires centers to demonstrate the capacity to manage the grant effectively, both in terms of business services and in terms of a Principal Investigator who can provide appropriate intellectual leadership.

These are straightforward performance criteria that can be used to evaluate the productivity of the transportation centers or the capacity of prospective centers to perform well. The 11 criteria focus on inputs and outputs and hence are useful in measuring productivity. They are easily and objectively measured. Even so, the meaning of the numbers – what value to place on a high or low result – still requires interpretation.

In addition, university transportation centers could be evaluated based on **outcomes or accomplishments resulting from these activities**, including:

1) extent to which research results have opened up new research directions, led to new fields of study, and/or led to new or substantially improved practices. including systematic interdisciplinary approaches addressing emerging issues in science, technology and multi-agency, multi-jurisdictional, and/or public-private partnerships to improve implementation of research results
2) percent of graduates in last five or 10 years who are practicing in the field of transportation; number who have risen to leadership positions in the transportation field
3) extent to which professional practice has changed in notable ways as a result of technical assistance and tech transfer activities.

These latter criteria are harder to measure and are more subject to interpretation. However, they are the sorts of criteria often used to evaluate quality and outcome changes. Independent peer review panels are a common way to implement evaluations using such criteria.

Nascent groups would be placed at a disadvantage compared to long-established centers of excellence if the focus is primarily on accomplishments and resources already in place, and so it may be useful to have separate criteria for new centers, such as the following:

1) a minimum of three regular / permanent (tenured or tenure-track) faculty members whose teaching and research is primarily in the field of transportation (or a university commitment to hire such faculty members during the first two years of the grant
2) a university commitment to offer at least one degree program with a formal, university-approved specialization in transportation
3) transportation research funding of at least 20% of the amount of the grant on average over the past three years or a commitment of matching funds of at least 20% of the amount of the grant for the period of the grant
4) evidence of current or proposed collaboration (extant and planned) of major state, regional and/or local transportation agencies and private sector organizations with an interest in transportation, as evidenced by letters of support and commitments for matching funds.

These criteria would also be useful in sizing grants to nstitutional capacity.

Responses to Questions Submitted by Subcommittee Ranking Member Adrian Smith

1) Restoring Trust in Technology Assessments

Trust in technology assessments, and more generally in assessments of the likely impacts of prospective investments, depends in large part on how accurate past assessments have been. Many studies have found that benefits have been overestimated and costs underestimated; the pattern of error is not random. Technology assessments, travel demand forecasts and cost estimates for new transportation investments (roads, tunnels, bridges, rail projects) have been the subject of considerable study in recent years, and scholars such as Bent Flyvbjerg and Daniel Kahneman (among many others) have examined why forecasts and other prospective assessments are inaccurate. Kaheman has identified psychological factors leading to "optimism bias" whereas Flyvbjerg believes that there is considerable "strategic misrepresentation." Other factors including unforeseen changes or instabilities in factor prices (e.g., fuel price fluctuations) also have affected the accuracy of forecasts, of course, but these factors have been found to be insufficient to explain the gap between forecasts and results.

Strategies that have been recommended for overcoming these problems include:

- Use of independent peer review committees as evaluators. For example, both US and EU universities call upon outside panels of experts to review university programs. Some transport programs in the EU also use peer reviews of this sort to take an independent look at the justification for proposed projects. While peer reviews are not perfect – especially if peers are drawn from a "club" of associates – awareness of their limitations has led to improvements in the design of peer review teams, often by including international experts, experts drawn from industry, and experts from a variety of disciplines as part of the assessment team: people with a bit more distance from the individuals and agencies being reviewed.
- Scenario testing is a method that acknowledges uncertainties in key factors that could shape future markets and opportunities. Scenario testing has been used in the US by several states and Metropolitan Planning Organizations to assess alternative urban development and transportation investment packages and has been used by corporations such as Shell to investigate energy futures as a function of, among other things, public attitudes toward energy conservation and the environment. The development of the scenarios is typically done with multidisciplinary expert panels, and in public settings, with public involvement.
- The UK Department of Transport has adopted a cost estimation procedure, reference class forecasting, that accounts for "optimism bias uplift" by adjusting costs upward and/or demand forecasts downward, based on past experience with similar projects. It is most easily applied when there are in fact similar projects, and is not as easy to apply to unique projects or new ideas that have not been examined before.
- Focus groups are used to test consumer responses to new products and options in relatively quick, inexpensive ways.
- Other market research techniques that can help assess technologies include stated preference surveys and consumer panels that participate in repeated surveys and/or focus groups over a period of time, sometimes several years.
- Demonstration projects and field tests are ways to further test markets but also to investigate implementation barriers and opportunities. Demonstrations and field tests often can be improved by including a wide range of stakeholders in the design (so that all the factors that

- Markets can offer a test of technology readiness, risks and opportunities: is there a business plan for implementation and are private investors interested in the opportunities presented?

2) Strategy for Transportation for the 21st Century

I see several reasons for a new, comprehensive plan for the US transportation system that is multimodal.

First, we need to find an effective way to pay for the transportation system. The highway trust fund is depleted, and changes in vehicle and fuel technologies seem likely to make the gas tax increasingly problematic. How to pay for both urban/metro and rural highways needs to be considered in terms of emerging energy futures and technology options. In metropolitan areas, how to pay for transit services also needs to be part of the discussion. New technologies can make paying for transportation fast, efficient, convenient, private, and flexible, and multimodal applications could be made available.

Second, we need to pay more attention to freight movements, which are critical to the economy but also have high impact on the nation's transport systems. Truck and rail freight systems must link to each other and to ports and airports more effectively. Better strategies are needed to manage the heavy and often concentrated traffic impacts that result from international trade through major ports. Freight movements are inextricably linked to security concerns and technology applications and better planning and management could yield major improvements. A plan to pay for freight improvements equitably is also needed.

Third, there are promising opportunities to reduce costs and improve performance by implementing new technologies for applications ranging from data collection to user fee collection to improved safety and security, but these options need evaluation in the context of ongoing investment programs and in comparison to more conventional approaches.

Fourth, we might be able to have better, cheaper, faster transportation services for both passengers and freight if we coordinate across modes better. For example, it's increasingly important to discuss whether we should be investing in truckways, moving more freight to rail, or finding new truck-rail combinations for freight movements. Opportunities for better service at lower cost could result if we plan for and coordinate urban transit, conventional passenger rail, and (in some cases) high speed rail with air travel modes; rail could not only serve as an airport access mode but could simultaneously serve a substitute for some short-haul air trips (as is happening in the Boston-Washington corridor), and a commute option in some markets.

MPOs currently prepare transportation plans that cover highways and transit, and increasingly address freight within their boundaries. Some states also have been developing strategic plans covering these critical topics. It would be timely to evaluate the performance of MPOs under the new responsibilities given them since ISTEA , to review state transport policy, planning, and investment strategies over the same period, and to look at how well states and MPOs are coordinating investments and evaluating

projects. Such a critical review and assessment could be done in one to two years if mandated by Congress, and could provide valuable information on best practices and needed changes in practices. The resulting information would be extremely valuable in shaping a new strategic plan for USDOT and the nation, and might offer new ideas on how to restructure categorical grants, create incentives for cost-effective and high benefit investments, and make better use of new technologies in transportation.