October 6, 2004

To: Emil Frankel, Assistant Secretary for Transportation Policy, U.S. Department of Transportation, Washington, DC

From: Thomas Horan, Executive Director and Associate Professor, School of Information Science, Claremont Graduate University

Re: Recommendations for Federal ITS Program

Introduction

At your request, I have reviewed the federal ITS program. This review focused on the process ("the how") by which federal ITS program initiatives are being designed and implemented. The review featured discussions with Management Council members as well with a select number of federal ITS managers and national experts. (See Appendix for a listing of interviews.) While the short timeframe of the assignment meant that I could not interview all involved parties, I do believe that my interviews, discussions and attendance at recent Strategic Planning Group and Management Council meetings provide sufficient grounds to make recommendations for your consideration.

It is important to say at the outset that I was impressed with the direction that the ITS program has taken in terms of defining and undertaking a diverse set of initiatives. My recommendations should be viewed as building on this momentum. In the spirit of brevity I focus on these recommendations below, with the rationale for each embedded in the discussion. The two recommendations I offer address both the process by which each individual initiative is undertaken, as well as the more general process for encouraging system-wide innovation through ITS and related information technologies.

Recommendation No 1: Implement Criteria of Success (COS) for the Nine Initiatives

Each of the nine ITS initiatives is promising in terms of its potential to affect the mobility, safety and productivity of the transportation system. With regard to the process, a common approach taken by the initiatives is a "waterfall" process whereby background research is performed, followed by architectural development, then prototype design, with subsequent field operation testing and then deployment. While this approach is logical and justifiable, it does carry with it some risk in terms of not rapidly demonstrating value, gaining stakeholder support, linking with external developments, and otherwise innovating for deployment. This risk was noted in various ways by

Management Council members, who expressed an underlying concern that the processes may be "too timid". In presentations and discussions, ITS program managers noted that they are mitigating this risk by becoming more concurrent in their processes. But I think more systematic attention is warranted.

The thrust of this recommendation is to elevate the "go/no go" decision point in each initiative to be become a more full-fledged review along several criteria, criteria that represent management as well as technical concerns. Such criteria are consistent with the initial criteria used by the Management Council in approving the initiatives. I have identified four "Criteria of Success" that could be applied to each initiative. These measures are as follows:

- **Criteria 1: Evidence on Problem-ITS Match.** There is a continuing need in ITS to understand and demonstrate the connection between the problem being addressed and the contribution of ITS to that problem. While the initiatives provide initial rationale for undertaking the initiative, it is incumbent upon each initiative to continue to marshal evidence in support (or relative to) the problem-ITS match. (Moreover, establishment of this review criterion would provide an opportunity to engage the research community in a manner that is not currently occurring.)

- **Criteria 2: Acceptable Architecture.** A common activity in each initiative is that the DOT is taking a leadership role (though the initiative) to define a broad framework and more technical architecture for the candidate system. Therefore, it is a reasonable expectation that the initiative will lead, assist or otherwise identify an architectural solution, and that there be acceptance of this proposed solution by the appropriate stakeholder groups. Moreover, a mid-course review point would allow for a reconsideration (or iteration) of the initial architecture based on expert and field reactions. Of particular interest would be the implications of the architecture on the business model for candidate ITS systems, in terms of allocation of roles, responsibilities and costs.

- **Criteria 3: Stakeholder Acceptance.** It is generally acknowledged that stakeholder support is critical to each initiative's success and most if not all initiatives have some means for engaging stakeholder communities. Creating a criterion for assessing this support would ensure attention to this process. An important element of this criterion would be devising a means whereby the key stakeholder groups input could be made available in a relatively independent fashion to the Management Council. (Also, there appears to be a need to develop tools and processes for soliciting this feedback within (and across) the initiatives.)

- **Criteria 4: Field Evidence of Initiative Impacts.** While criteria 1 focuses on evidence relating to the general ITS-problem fit, this criteria addresses specific, deployment related field experience with the proposed or promising solutions. This can include DOT sponsored field operational tests undertaken as part of the initiative. Significantly, it can also include the innovative testing that may occur

outside of the program either domestically or internationally. With this broader focus, the initiatives would be encouraged to solicit evidence that may be accruing outside of the "official program" *at the earliest possible date*. It is recognized that attention will be needed to avoid an over-reliance on present day solutions rather that pursuing evidence for "not-quite-off the self" solutions.

Implementation Scenario: The implementation of these criteria would be as follows. First, the (four) criteria would be refined based on input from Management Council and the Strategic Planning Group. Once refined, each of the initiative roadmaps would be revised as appropriate to include activities (including new efforts) relative to these criteria. A summary "dashboard" of the initiative relative to these criteria would then be devised. An early version would be completion of a matrix such as contained in figure 1; this could then be developed into a dynamic monitoring information system for both the initiative managers and the Management Council.

It is expected that by making these criteria explicit at the outset, both management and staff will have a common set of criteria for judging the success of the initiatives. If, in some cases, the initiatives meet the performance objectives earlier than expected, then new initiatives can be undertaken. If internal or external market changes affect the ability to achieve the objectives, then mid-course corrections can be made. Similarly, if technical or stakeholder problems thwart the progress of the initiative, then the review point would provide a useful decision point to terminate the initiative. Such an approach is loosely based on management ideas of Robert Kaplan and colleagues for creating a "balanced scorecard" for tracking performance along a number of dimensions (see Kaplan and Norton, 2001).[1]

Recommendation 2: Launch Crosscutting Systems Innovation Initiative

Each of the nine initiatives (as well as several more that are under development) focus on specific ITS applications. This problem-based approach provides a valuable and needed focus across a diverse set of application areas. Yet, a critical feature of the ITS program is its ability to integrate systems in a manner that aids the performance of the current transportation system while simultaneously facilitating a fundamental transformation of that system. For discussion purposes, this transformation can be envisioned as creating an *information-rich* surface transportation system, where ITS provides critical information for users and managers of the system in a variety of formats and across a wide range of transportation uses (see also Zimmerman and Horan, 2004).

Organizational theorists Chris Argyris and Donald Schon distinguish between "single-loop" and "double-loop" learning. Single loop learning is operationally oriented and attends to tactical progress. In many ways the ITS initiatives are geared for single-loop learning, whereas many of the issues raised by Management Council members are

[1] The Balanced Scorecard advocates measures for classified scorecard metrics in for areas: financial, customer, internal, and learning and growth. See Kaplan and Norton (2001), Chapter 5 for adaptation to governmental settings. Additional Information can be found at: http://www.balancedscorecard.org

concerned with double-loop learning.[2] Double-loop learning is more strategic and addresses underlying tenants of an enterprise. A common observation expressed among Management Council members was the need to create an organized process that promotes a leadership role by DOT in using ITS to grapple with fundamental system issues—that is, to engage in double-loop learning (see figure 2).

This interest in the strategic applications of ITS took many forms, encompassing both "big picture" issues about the program focus and impacts as well as "process" concerns about how to involve a broad set of perspectives. I have integrated these various ideas into an overall (second) recommendation, calling for a cross-cutting **Systems Innovation Initiative** that would have the following activities.

- **Technology Scans (ITS-Problem COS)**. There is a continuing need to perform technology scans on industry developments and potential impacts on ITS and transportation systems. The major concern here is being sufficiently aware of technological developments so as to benefit from major trends as well as to avoid being blindsided by developments outside of the program. Consequently, this element of the program would commission technology scans that cross-cut ITS applications. (Two examples would be nano-technology and security-detection developments.)

- **Enterprise Transformation Showcases (Architecture COS).** The individual initiative architectures need to be assessed in terms of how they cumulatively affect enterprise architectures of implementing parties, particularly local departments of transportation and transit properties. In this context enterprise architecture refers to the agency information uses for managing transportation systems in a real time, customer-driven fashion. Activities in this program element include investigations and case studies on how ITS initiatives and related developments are assisting the surface transportation industry in developing high-quality, real-time transportation management and safety use, including provision of timely data to planning, operating, and end-user segments.

- **System Innovation Partnerships (Stakeholder COS).** The initial concept for the Advisory Panel was to provide access to high-level leaders in industry as a reality check for emerging ITS solutions and developments. There is also a need to develop a working group of experts that can be tapped to understand industry developments and partnership opportunities that cut across initiatives. Moreover, insight into major systems innovation is quite likely to come from a diverse array of industry inputs---telecommunications, automotive, information technology, as well as researchers and observers found in university, think tanks, and research organizations. This element would solicit expert input and innovative partnerships, such as in new infrastructure systems (e.g., wireless developments), local/regional institutional innovations (e.g., new state metro or state initiatives),

[2] The "single"-loop refers to feedback on a specific tactics ; the "double" refers to feedback to a strategy that then has a consequent impact of tactics.

and global applications (e.g. border system developments). The key to this program element is that latitude would be given to the potential partners in defining the nature of their proposed partnership and/or input, rather than working this into the specific dimensions of the individual initiatives.

- **Major System Impact Research and Analysis (Demonstrable Impact COS).** There are some nascent examples of collaboration for creating a new generation of system tools. The Next Generation Simulation Community (NGSIM) is a noteworthy example of research collaboration for new tool development. And the ITS program has a rich history of evaluations of individual projects and initiatives. Still, the case remains to be made on major systems impacts by ITS, and therefore priority should be given to developing and implementing innovative partnerships to create demonstrable system impacts. The TRANSCOM operation represents an established initiative of this type, and the integrated corridor initiative carries forth these ideas. Regional undertakings, such as the California Innovative Corridors Initiative, perhaps represent a next-generation model of such an initiative.[3] This element would leverage off such local innovations with the specific intent to demonstrating systems impacts in terms of productivity, travel reduction, and/or safety.

Implementation Scenario: The Systems Innovation Initiative (SII) would be run as a DOT-initiative similar to other initiatives, though there is a need to broad participation both within and outside the DOT. A SII-leader would be identified and would work with a planning team to refine the objectives, projects, and resources needed to undertake the initiative. Ideally, the planning team would include representation from some of the individual initiatives, as well as from related entities such as evaluation, architecture, and outreach. The planning could be expeditious (i.e. completed by end of calendar 2004), with a Broad Area Announcement (BAA) to be undertaken in early 2005. The BAA would solicit partnerships in areas such technology scans, DOT enterprise architecture and organizational showcases, targeted impact assessments, and global developments. A select number of systems innovation partnerships could be established in FY 2006, and like the other initiatives, this initiative would be subject to a mid-course review based on an adaptation of the four criteria laid out in the first recommendation, with special attention to the strategic implications of initiative activities and findings.

Closing Observations

The Management Council and Strategic Planning Group represent a unique intermodal forum for ensuring that the ITS program connects with major transportation policy issues and concerns. While the recent ITS initiatives activity has been crucial in reforming the program, there is a need to institutionalize the gains the proceed in a manner that addresses management level (vis a vis technical level) concerns. The first recommendation attends to this need. However, there is also a profound interest in elevating the discussion to address the strategic directions of the program, including the

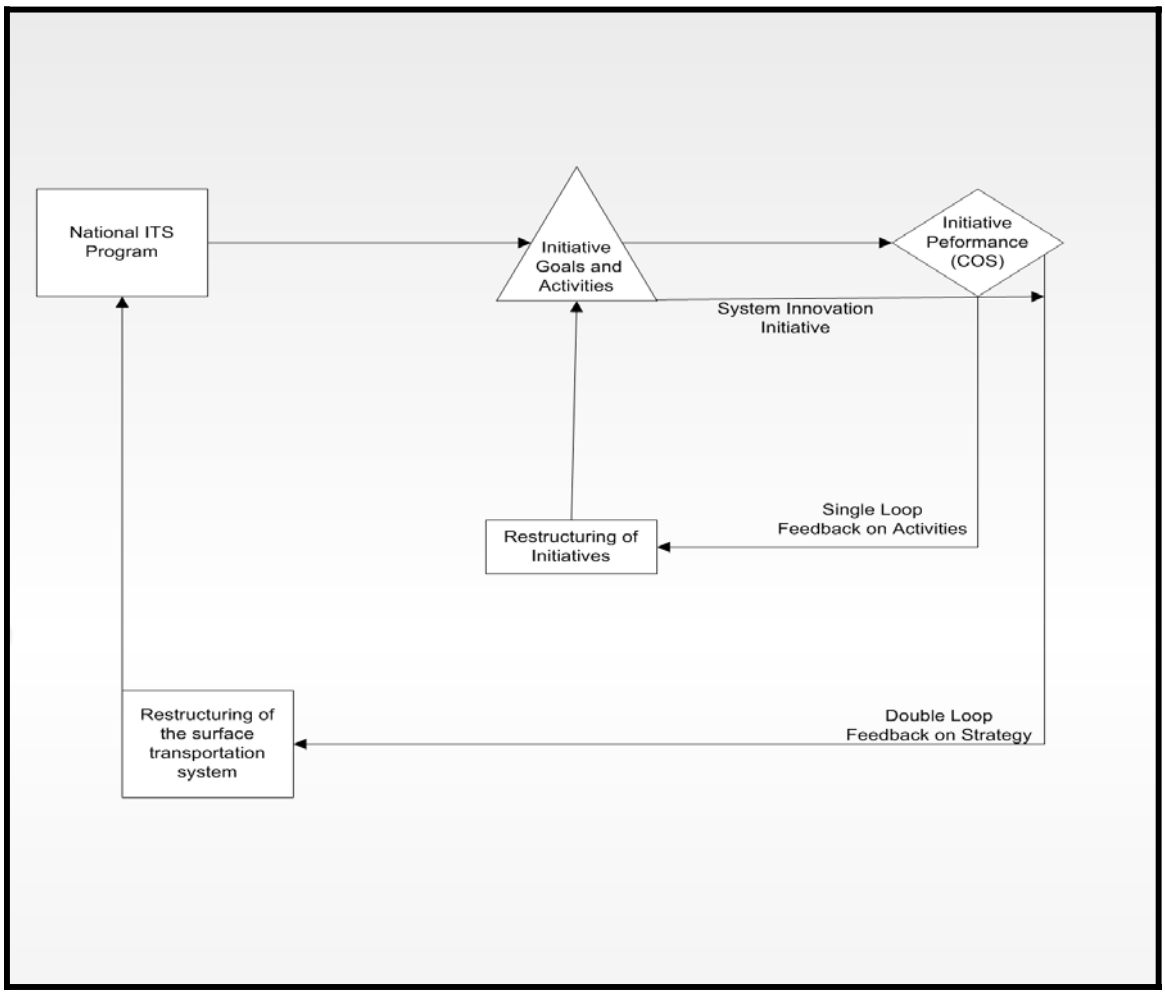
potential of ITS to be an agent of change in creating an information-rich transportation system. The second recommendation attends to this need.

In closing, while the short timeframe of this review has meant that I have undoubtedly overlooked several noteworthy features of the ITS program, I hope these two recommendations provide the Management Council and Strategic Planning Group with useful possibilities for action.

Table 1: Scorecard Matrix for ITS Initiatives

ITS Initiatives	*Criteria of Success (COS)*			
	1- Problem	**2-Architecture**	**3-Acceptance**	**4- Deployment**
	Is there a problem-ITS match?	Is there an acceptable architecture?	Is there acceptance among key stakeholders?	Is there demonstrable evidence of success
ITS Initiative 1	Process: Results: Decisions:			
ITS Initiative 2		Process: Results: Decisions:		
ITS Initiative 3			Process: Results: Decisions:	
ITS Initiative 4				Process: Results: Decisions:

Figure 1: Single Versus Double-Loop Feedback in ITS



APPENDIX

Experts Consulted:

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Lappin, J., Program Manager, Volpe National Transportation Center/RSPA

Marchessault, T., Senior Analyst, Office of the Secretary of Transportation

Paniati, J., Associate Administrator, Federal Highway Administration/JPO

Peters, M., Administrator, Federal Highway Administration

Runge, J., Administrator, National Transportation Safety Administration

Sandberg, A., Administrator, Federal Motor Carrier Safety Administration

Shane, J., Under Secretary, Office of the Secretary of Transportation

Schagrin, M. Program Manager, Federal Highway Administration/JPO

Shaheen, S., Program Manager, University of California/ Berkeley

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Tinklenberg, E.,Consultant, Federal Highway Administration/JPO

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