Financing Sustainability and Resiliency of Transportation Infrastructure in an Era of Fiscal Constraint

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Abstract

In this short paper, I review several solutions in order to provide technical assistance to U.S. State officials in implementing new financing approaches for surface transportation projects. The general idea is to educate transportation officials on project funding and finance options, project planning and delivery, and life-cycle asset management. I examine a strategic plan and attempt to identify specific goals of such technical assistance.

Keywords – Transportation system, Investment gaps, Education.
Introduction

This paper is focused on the U.S. transportation sector’s urgent needs of new and innovative financing approaches to address the growing challenges of the sector. Key facilities, such as the U.S. Interstate Highway system, completed decades ago, are now well past their original design lives, and often suffer from years of deferred maintenance (Winston, 2012). A major challenge is that investment levels have not kept pace with the transportation system’s investment needs (Rouhani et al., 2016a; Beheshtian et al., 2016; Beheshtian et al., 2017). The reason is that available funding is typically used for large capital projects that would consume most if not all available funding and still often fall short of being fully funded (Rouhani, 2012). Traditional mechanisms for funding infrastructure are no longer adequate to meet national and regional needs (NSTIFC, 2009). These problems underscore the importance of finance mechanisms that can bridge investment gaps between available resources and infrastructure needs (Rouhani et al., 2013; Rouhani and Beheshtian, 2013; Rouhani et al., 2014).

The overarching goal of this paper is to provide technical assistance to State officials in implementing new financing approaches for surface transportation projects that can address the above problems. There is a pressing need to educate transportation officials on project funding and finance options (Rouhani and Niemeier, 2011; Rouhani 2016; Rouhani and Gao, 2016), project planning and delivery (Rouhani et al., 2014a; Madani et al., 2014; Rouhani et al., 2015a), and life-cycle asset management (Lin et al., 2009; Rouhani, Daher et al., 2018). This paper reviews cutting edge information on the adoption and deployment of innovative finance and project delivery options, and on the application of alternative revenue options to real-life projects. The goal is to improve how the State DOTs and local transportation officials advance major projects and program initiatives in the sector. This paper also examine awareness of techniques and practices that protect the interests of the public (Rouhani and Zarei, 2014;
Rouhani and Gao, 2014) and the use of analytical tools for decision-making processes in selecting project delivery methods (Rouhani et al., 2018).

**General Framework**

As part of that mission, I try to transfer university-based knowledge into practical application in order to realize broad social benefits of road infrastructure provision. Figure 1 shows an illustrative framework for the general strategic plan. Three major layers provide the basic foundations of the technical assistance: Education and Training, New and Innovative Practices (Research), and Fundamental Knowledge. These three layers provide a general service for all stakeholders in project finance. The bottom layer, Fundamental Knowledge, will provide the common knowledge surrounding the best practices in a variety of inter-connected fields, including public finance (Rouhani et al., 2018), private finance (Reinhardt, W. 2011; Rouhani et al., 2015a), project evaluation (Rouhani et al., 2015b; Rouhani, 2018) and system analysis (Mirchi et al., 2012; Rouhani et al., 2016b), asset management (Rouhani, 2014b), and sustainable transportation (Litman and Burwell, 2006; Anas and Lindsey, 2011; Rouhani, 2013).

The second layer offers insights into new and innovative practices/tools of financing transportation projects such as: (a) INVEST (Infrastructure Voluntary Evaluation Sustainability Tool) as a web-based tool to integrate sustainability into transportation projects, which considers the full lifecycle of projects; (b) Least Cost Planning (LCP) as a process for identifying the most cost-effective mix (both direct and indirect costs) of demand and supply options (Rouhani and Beheshtian, 2013) to meet transportation goals; (c) Housing +Transportation (H+T) Affordability Index to assess the percentage of affordable metropolitan areas (Isalou, et al., 2014); (d) innovations in travel demand models developed by metropolitan planning organizations (MPOs) for urban traffic analysis (Rouhani, 2018); (d) tools that can address the economic impact...
analysis and cost benefit analysis (CBA) needs of competitive programs like Transportation Infrastructure Generating Economic Recovery (TIGER) (Rouhani et al., 2016b).

As the last layer, we should provide the required insights into new and innovative practices in interdisciplinary project finance research that require the sustained contribution of researchers from multiple disciplines. State departments should develop experimental and theoretical tools and techniques necessary for further advances, which will be pursued through three main research tracks: public finance, public private partnerships, and long-term strategies for transportation investments, as well as several smaller exploratory research themes known as

Figure 1 Strategic plan.
research Seeds (Bel and Foote, 2009). Three other activities complete the overall mission: industrial outreach and knowledge transfer; analysis of institutional capacity/capability issues of different organizations; envisioning the potential advantages and disadvantages of partnering with the private sector.

To complement the strategic plan, we should identify specific goals of such technical assistance:

1. Provide a comprehensive understanding of the benefits and costs of various financing approaches (Rouhani et al., 2016b);
2. Advance knowledge and the state of practice about financing techniques and tools that complement traditional highway financing methods (Rouhani et al., 2018);
3. Communicate and consult effectively with State DOTs, public agencies, policy makers, and stakeholders at large, in order to advance awareness of States DOTs;
4. Offer professional training and outreach services to public officials; and
5. Transfer knowledge to industry and other sectors by promoting extensive collaborations.

**Educational Program**
The support system needs to focus on the four core elements of learning: Knowledge, Actions, Beliefs and Networks. The education program would be led by industry and university experts, including faculty, practitioners, executives or other leaders in their industries that would create a compelling educator group (Figure 2).
The education component should be organized to execute the following tasks:

An illustrative list of research programs/topics that could be offered is shown in Table 1.
Table 1 List of topics

<table>
<thead>
<tr>
<th>1) Public Finance (Taxation, Bonds, Loans)</th>
<th>6) Financial and Legal Structures</th>
<th>11) Working with Unions – Project Labor Agreements</th>
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</thead>
<tbody>
<tr>
<td>2) Financial Regulations</td>
<td>7) Managing Complex, Cross Functional, Cross Sector P3 Teams</td>
<td>12) Role of Government Agencies under P3’s</td>
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<tr>
<td>3) Role of Government Agencies &amp; PPP’s</td>
<td>8) Innovative Debt Financing Techniques - Securitization</td>
<td>13) Negotiation and Interest Based Bargaining</td>
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<tr>
<td>5) Risk Analysis and Management</td>
<td>10) Life Cycle Analysis – Funding Deferred Maintenance &amp; Renewal</td>
<td>15) Transportation Economics</td>
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</table>

Research Programs
Effective project finance management will depend on informed leadership. The proposed objective is advancement of knowledge regarding best practices in financing and delivery options. To that end, we identified three major research themes, which we refer to as research tracks: public finance, public private partnerships, and long-term strategies (Ortiz et al., 2008). The research component will result in the creation of research reports, journal papers, white papers, and detailed annual guidelines that offer information sharing of best practices in project finance and assist training in the use of tools and decision-making processes to state DOTs. Figure 3 illustrates the general framework of the research programs.
Conclusion

This paper provides an overview of a strategic plan to educate U.S. state officials about new and innovative approaches regarding transportation finance and investment. I develop two key teaching and research frameworks that are in line with my proposed overall strategic plan. I examine the key aspects, however, our existing knowledge and as a result our actions do not guarantee a successful future transportation system for the USA, in specific.

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