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**James M. Jeffords Center's
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Infrastructure Maintenance

It is generally accepted that a well-maintained infrastructure is an essential part of the commercial economy and private commuter experience. Increasing trends in road traffic, especially increasing freight shipments, emphasize the importance of healthy road systems.¹ Constrained by budget shortfalls that are plaguing the nation,² many states are looking for cost efficient and innovative ideas in order to more efficiently maintain their current infrastructure. These strategies include increased public sector involvement, initiating preventative maintenance strategies, and developing new techniques and technologies for maintaining infrastructure. Vermont is no exception to these chronic budget shortfalls and need for innovation, facing a projected \$180 million shortfall in 2012.³ This is roughly equal to the entire amount spent by VTrans on maintenance activities in 2010: \$180 million.⁴

Public Private Partnerships

The U.S. Department of Transportation (DOT) defines a Public Private Partnership (PPP) as, “a contractual agreement formed between public and private sector partners, which allows more private sector participation than is traditional. The agreements usually involve a government agency contracting with a private company to renovate, construct, operate, maintain, and/or manage a facility or system.”⁵ Twenty-nine states currently have legislation allowing PPPs to play a role in the handling of state infrastructures, represented in Figure 1.⁶ (Although Vermont has no public-private partnership enabling legislation, it does have public private partnerships

¹ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” National Conference of State Legislatures, October 2010, accessed November 29, 2011, <http://www.ncsl.org/documents/transportation/PPPTOOLKIT.pdf>, p. 1.

² David Combs, “State Budget Gaps: How Does Your State Rank?” Stateline.org, March 15, 2011, accessed November 29, 2011, <http://www.stateline.org/live/ViewPage.action?siteNodeId=136&languageId=1&contentId=15158>.

³ David Combs, “State Budget Gaps: How Does Your State Rank?”

⁴ Vermont Agency of Transportation, “VTrans 2011 Factbook,” p.16.

⁵ United States Department of Transportation, “Report to Congress on Public-Private Partnerships,” December 2004, accessed September 17, 2011, <http://www.fhwa.dot.gov/reports/pppdec2004/pppdec2004.pdf>, p. 18.

⁶ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p. 1.

for its railroad network.⁷) The goal of these partnerships is efficient project completion at a reduced cost to the public. Potential risks also exist, though these risks may be mitigated by due diligence in crafting PPP enabling legislation as well as carefully considering whether to utilize the private sector for an infrastructure related project.⁸

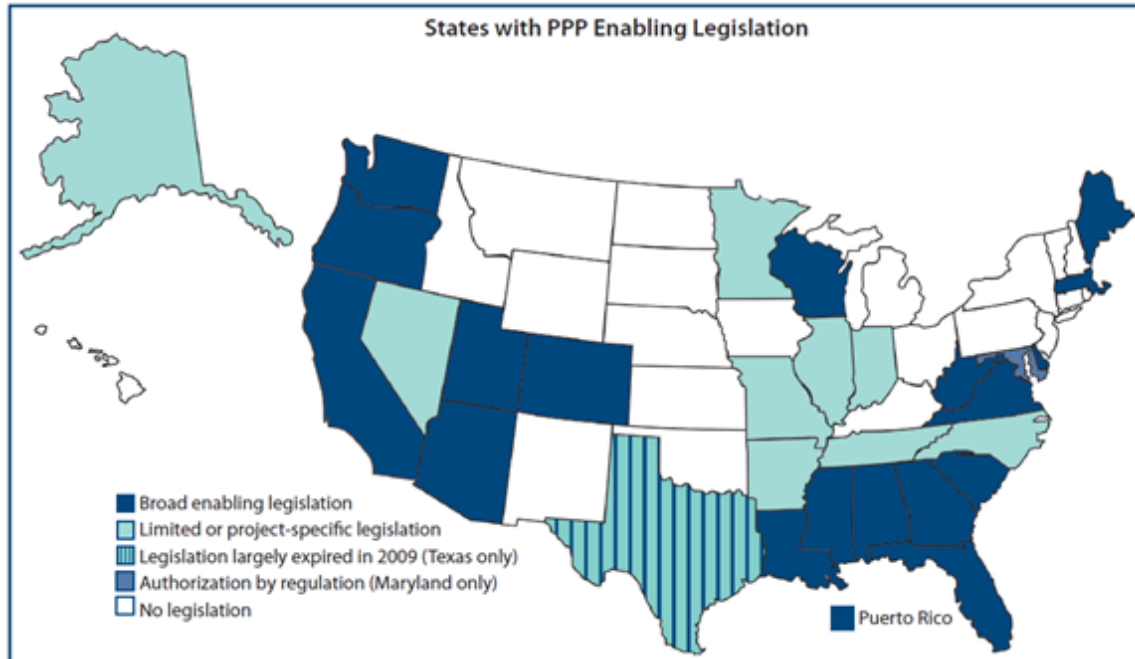


Figure 1: States with Legislation enabling Public Private Partnerships.⁹

Source: Jaime Rall, et al., 2010, “Public Private Partnerships for Transportation: A Toolkit for Legislators,” National Conference of State Legislators, accessed November 29, 2011, p. 15.

Not all PPPs are created equal. Roles assumed by the private sector in a PPP can include designing, building, operating, maintaining, or financing a facility and limited-term ownership.¹⁰ A state’s individual goals dictate which types of PPPs may be beneficial to implement.¹¹ Thus ‘Operate and Maintain’ (O&M) or ‘Brownfield Concession’ PPPs would be an option for a state interested in maintenance alternatives, as these heavily involve the private sector in

⁷ About half of Vermont’s railroad network is owned by the state (like a highway), but managed and maintained by a private railroad company under a lease agreement with the state. The other half of the railroad network, although privately owned, has been the beneficiary of public funds (mostly Federal, but managed by the state -- although the construction itself has been managed by the railroad.) Source: email correspondence with Christopher Parker, Executive Director of the Vermont Rail Action Network, December 28, 2011 and the Vermont Agency of Transportation, “Vermont State Rail and Policy Plan,” <http://railroads.vermont.gov/railpolicyplan.htm>, accessed December 28, 2011.

⁸ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p. 1.

⁹ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p. 15.

¹⁰ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p.5.

⁸ Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p. 31.

maintenance activities. An overview of several different types of PPPs is demonstrated in Table 1.

Table 1: Different Types of Public Private Partnerships and the Needs They Fulfill.¹²

Private Sector Risks and Responsibilities under Different Project Delivery Models													
Project Delivery Models	Functional Responsibilities and Project Risks												
	Planning	Environmental Clearance	Land Acquisition	Finance	Preliminary Design	Final Design	Construction	Construction Inspection	Maintenance	Operations	Long-Term Preservation ^b	Traffic Revenue	Asset Ownership
Traditional Design-Bid-Build (DBB) (not a PPP)						•	•						
Design-Build (DB)						•	•	•					
Design-Build with Warranty						•	•	•			•		
Operate and Maintain (O&M)									•	•			
Construction Management at Risk (CM at Risk)					•	•	•	•					
Design-Build-Operate-Maintain (DBOM)				•		•	•	•	•	•		•	
Design-Build-Finance-Operate (DBFO)				•		•	•	•	•	•		•	
Brownfield Concession				•					•	•	•	•	
Greenfield Concession				•		•	•	•	•	•	•	•	
Build-Transfer-Operate (BTO)				•	•	•	•	•	•	•	•	•	
Build-Own-Operate-Transfer (BOOT)	•	•	•	•	•	•	•	•	•	•	•	•	•
Build-Own-Operate (BOO) (not a PPP)	•	•	•	•	•	•	•	•	•	•	•	•	•
Asset Sale (not a PPP)				•					•	•	•	•	•

Source: Jaime Rall, et al., 2010, “Public Private Partnerships for Transportation: A Toolkit for Legislators,” National Conference of State Legislators, accessed November 29, 2011, p. 5. Massachusetts

These marriages between the public and private sector are not always beneficial to the state. Specifically, capital costs are inherently higher due to tax breaks given to publically funded projects that are not available to those carried out by the private sector.¹³ Ideally they will save the government money on infrastructure related projects; however, this is not always possible. Without specific attention to policymaking, and oversight of the project itself, the

¹² Jaime Rall, et al., “Public Private Partnerships for Transportation: A Toolkit for Legislators,” p. 5.

¹³ Office of Inspector General, “Financial Analysis of Transportation Related Public Private Partnerships,” Federal Highway Administration, July 28, 2011, accessed September 17, 2011, <http://www.oig.dot.gov/sites/dot/files/PPP%20Final%20Report%207-28-2011%20508%20PDF.pdf>, pp. 6-8.

implementation of such projects becomes a risky gamble for the state. In summary, strategic planning and development is necessary in order to effectively implement PPP's; however, they are not on their own likely to fill the infrastructure budget gap.¹⁴

Legislation enabling the use of PPPs in Massachusetts was passed in 2009. Massachusetts previously had significant problems in its attempts to outsource highway maintenance to the private sector, citing both cost and quality of work as problems.¹⁵ What distinguishes this failure from the contemporary private sector reprisal is the scope of the legislation. The previous legislation which enabled the state to outsource its maintenance operations was found to be politically motivated and lacking oversight.¹⁶ In contrast the 2009 bill is more stringent in its oversight of PPPs – incorporating an oversight commission, competitive procurement standards, and approval from the Department of Transportation Board of Directors.¹⁷ Massachusetts' experience highlights the need for competent legislation and oversight as a prerequisite to successful private sector involvement.

Louisiana

The Louisiana Department of Transportation and Development (DOTD) outsources many of its highway maintenance activities to the private sector citing "statutory and political limits placed on their staff size, operating budget, and project costs," as justification for this decision.¹⁸ Outsourced activities include pavement stripping and surface repair among others. DOTD has noted that the quality of work performed through these contracts has improved as oversight has increased with each successive cycle.¹⁹

Preventative Maintenance Strategies

U.S. DOT defines preventative maintenance as "a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system."²⁰ Preventative maintenance includes both cyclical (actions performed on a determined interval

¹⁴ Office of Inspector General, "Financial Analysis of Transportation Related Public Private Partnerships," p. 9.

¹⁵ Ryan J. Dlesk and Lansford C. Bell, "Outsourcing Verses In-House Highway Maintenance: Cost Comparison and Decision Factors," Clemson University Department of Civil Engineering, April 2006, accessed September 17, 2011, <http://www.clemson.edu/t3s/scdot/pdf/projects/SCDOT%20OUTS%20FINAL%20REPORT.pdf>, p. 10.

¹⁶ Washington State Department of Transportation, "Review of Highway Maintenance Outsourcing," January 2004, accessed September 17, 2011, <http://www.wsdot.wa.gov/NR/rdonlyres/6100788C-F371-4654-90DD-89F8FD0FFF1B/0/HwyMaintenanceOutsource.pdf>.

¹⁷ Nicholas Farber, "2009 State PPP Legislation," National Conference of State Legislatures, accessed September 17, 2011, <http://www.ncsl.org/documents/transportation/NFarber0709.pdf>, p. 8.

¹⁸ Ryan J. Dlesk and Lansford C. Bell, "Outsourcing Verses In-House Highway Maintenance: Cost Comparison and Decision Factors," p. 17.

¹⁹ Ryan J. Dlesk and Lansford C. Bell, "Outsourcing Verses In-House Highway Maintenance: Cost Comparison and Decision Factors," p. 9.

²⁰ Federal Highway Administration, "Bridge Preservation Guide," U.S. Department of Transportation, August 2011, accessed, September 27, 2011, <http://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf>, p. 6.

basis), and condition based activities that are identified as necessary by the bridge inspection process.²¹ The most desirable strategy, according to the U.S. DOT, is strategic maintenance performed early in the structures life-cycle.²² A highly cited infrastructure publication by W.R De sitter entitled "The Law of Fives" argues that one dollar spent in the 1st phase of a bridges life (design and construction) is as effective as five dollars spent in the second phase (pre-corrosion) and as effective as 125 dollars spent in the final phase (general corrosion).²³

A study done by the Pioneer Institute studied the cost effectiveness of preventative bridge maintenance compared to repair and rehabilitation later in a bridges life. They assert "for any asset, it is expected that there is a 40 percent drop in quality over 75 percent of its lifetime, followed by a more precipitous drop in the final quarter of the asset's life."²⁴ The institute explains, "[t]reating maintenance as a discretionary expense, combined with a diffusion of responsibility and outright inability to monitor asset condition, results in a massive and growing maintenance backlog."²⁵ Several states have implemented annual funds or legislation to address this issue.

Idaho

When the Idaho Transportation Department (ITD) was facing an annual budget shortfall surpassing \$200 million in 2008, the legislature commissioned its office of performance evaluation to conduct a thorough review of ITD revenues and expenses. Along with being underfunded, the report found that ITD was lacking a cohesive strategic vision and coordinated long-term infrastructure management plan. The report recommended that the state drop its "worst-first" approach to pavement and bridge preservation and instead adopt a "preservation-first" approach that would save the state six to 10 times the amount spent on maintenance within 10 years... although these efforts are in the early stages, Idaho already is seeing positive movement.²⁶

New Hampshire

According to the New Hampshire's Department of Transportation (NHDOT), consistent maintenance is essential to maintain a cost effective pavement surface program. This usually entails resurfacing frequently used roads at least every eight to ten years. New Hampshire's State Legislature has made resurfacing a priority by increasing their Betterment Program

²¹ Federal Highway Administration, "Bridge Preservation Guide," p. 9.

²² Federal Highway Administration, "Bridge Preservation Guide," p. 6.

²³ D.J. Vanier, "Asset Management 101: A Primer," National Research Council Canada, 2000, accessed November 9, 2011, <http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc44300.pdf>, p. 6.

²⁴ David Westerling and Steve Poftak, "Our Legacy of Neglect-The Longfellow Bridge and the Cost of Deferred Maintenance," p. 13.

²⁵ David Westerling and Steve Poftak "Our Legacy of Neglect-The Longfellow Bridge and the Cost of Deferred Maintenance," p. 18.

²⁶ PEW Center on the States "Measuring Transportation Investments: The Road to Results," The Rockefeller Foundation, May 2010, accessed November 2011, http://www.pewcenteronthestates.org/uploadedFiles/Measuring_Transportation_Investments.pdf, p.61-62.

funding and raising the budget for resurfacing from \$12 million to \$18 million per year, allowing \$1 million per year for each of the six maintenance districts to go towards much needed resurfacing of secondary roads.²⁷

New Techniques

California

The California Department of Transportation (Caltrans) recently implemented a cost effective system to repave dozens of roadways. This system entails paving a thin, relatively cheap layer of asphalt over existing roadways. It is estimated that this will extend the life of these roads by over a decade as well as freeing funds for other projects. With the additional savings of \$34.5 million, Caltrans was able to replace a total of 4,345 concrete slabs on interstate highways.²⁸ The result of this new technique is a major contributor to the near-record amount of Caltrans activity going on, reaching nearly \$11 billion statewide.²⁹ This activity includes segments of nearly every local freeway and some interstates being resurfaced, totaling 276 paving projects this fiscal year.³⁰

Wyoming

In Wyoming, a statewide computer system has begun helping with infrastructure maintenance by showing areas or sections of roadways and the costs to maintain or reconstruct them. The goal of this computer system is to eventually aid decision makers in targeting infrastructure projects and areas of greatest need and providing the implications and costs it will take to fix them. This data once required phone calls and running reports, now the computer system will gather all the necessary information in a single electronic location.³¹

New Hampshire

New Hampshire's Department of Transportation (NHDOT) is also currently incorporating new techniques and technologies in order to better maintain its infrastructure. These include using thicker overlays, paving fabrics and reinforcements, micro-surfacing treatments, and chip seals into their road surface maintenance programs. In addition, NHDOT is introducing crack sealing into their road maintenance programs based on studies that show that crack sealing can extend

²⁷ American Society of Civil Engineers, "New Hampshire's Infrastructure Report Card," June 15, 2011, accessed September 2011, http://www.asce.org/uploadedFiles/Infrastructure_-_New/2011%20NH%20RC.pdf, p. 2.

²⁸ Gary Richards, "Caltrans goes on a repaving binge," MercuryNews.com, accessed October 2011, http://www.mercurynews.com/bay-area-news/ci_18808365?nclck_check=1&forced=true.

²⁹ Gary Richards, "Caltrans goes on a repaving binge."

³⁰ Gary Richards, "Caltrans goes on a repaving binge."

³¹ The PEW Center on the States "Measuring Transportation Investments: The Road to Results," accessed November 2011, http://www.pewcenteronthestates.org/uploadedFiles/Measuring_Transportation_Investments.pdf, p.59.

the surface life of pavement by two years.³²

Conclusion

Infrastructure maintenance is a multifaceted issue, which has been addressed by many states in a multitude of ways, all to varying degrees of success. Depending on the state's transportation needs and capabilities, different programs can be more desirable and/or efficient. Public Private Partnerships have shown to lessen the financial burden for states to maintain their infrastructure, but must be implemented respective to the financial desirability of the states assets. Preventative maintenance has shown data of its cost effectiveness over time and is currently prioritized in several states. The implementation of new technologies and techniques also help to reduce cost and increase efficiency, especially though the provision of information. Indeed, states have a variety of options which can be used in order to efficiently, and cost effectively maintain a healthy infrastructure.

This report was prepared by Jordan White, Avory Resca, Kamran Rosen in response to a request from the House Transportation Committee under the supervision of graduate student Kate Fournier and Professor Anthony Gierzynski on November 29, 2011.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Anthony Gierzynski. The material contained in the report does not reflect the official policy of the University of Vermont.

³² American Society of Civil Engineers, "New Hampshire's Infrastructure Report Card," p.6.