

RIDOT Project Development Analysis

DRAFT Final
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ument has not be approved nor accepted by the Rhode Island Department of Transportation. All findings are subject to review, amendment or change.

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Summary

This report examines some key project-development processes and staffing levels of the Rhode Island Department of Transportation against four peer groups. It also reviewed the RIDOT materials testing functions against peer states.

This report recommends that the Rhode Island Department of Transportation alter its management practices and structures to adopt the project-development best practices used by its peers in Vermont, New Hampshire, Maine and elsewhere. These improvements are needed if RIDOT hopes to reliably deliver a more ambitious construction program. The report also finds that the level of materials testing and staffing does not appear excessive and is comparable to peer states. Materials testing personnel may be understaffed for peak construction periods or if the construction program grows considerably above historic levels.

Among the recommendations are:

First, the report recommends that RIDOT develop an emphatic policy that it will identify a fiscally constrained two year list of projects for the State Transportation Improvement Program and then measure and manage to ensure the projects are delivered on time.

Second, RIDOT should conduct monthly project-tracking meetings in which a broad cross-section of the department staff reviews activities necessary to deliver the entire two-year program on time. These meetings should be inclusive of all disciplines that could identify problems and help resolve them to keep projects on track. These meetings should be given high priority, be chaired by a high-profile executive and be documented to ensure they are effective. The meetings should not focus only on projects scheduled for bid in the next three months but rather address the entire two-year program to ensure it is consistently delivered.

Third, the department should “clean house” in the Project Management Portal (PMP) and insist that projects that are not actively under development be removed and that active projects be updated with realistic schedules and budgets. The PMP currently does not serve an effective department-wide function of informing multiple participants of realistic schedules and budgets. This is an interim step pending a larger effort to develop a more effective project-tracking system discussed below.

Fourth, project-development staff should be organized in cross-disciplinary teams of engineers, planners, resource agency liaisons, utility specialists and right-of-way staff. Each team should be given responsibility for a number of projects and be expected to identify key milestones and activities and work cooperatively to ensure projects are let to bid on schedule. These teams could be given programmatic or geographic focus for greater efficiency. The teams could be divided into ones focusing on bridge preservation projects, bridge replacement/rehabilitation projects, urban paving and street-scape projects, traffic/operations projects and so forth. Or they could be divided geographically.

Fifth, high-profile monthly progress meetings with resource agencies should be instituted to address all permits and approvals needed for the upcoming two-year program. Resource agency approval will be critical to the increased bridge, pavement and drainage-maintenance activities. Four organizations were reviewed for this analysis. All rely on regular coordination meetings and standardized programmatic agreements with resource agencies to improve project-development reliability.

Sixth, RIDOT should identify a programming unit that plans, programs and scopes ALL projects. This unit should be integrated into the asset management group but have significant input from all the engineering disciplines. This unit would serve as the “funnel” through which suggested projects are sorted, realistic scopes identified, schedules and budgets set. No change to cost, scope or schedule should be approved without coordination with this unit that serves as the “traffic cop” for keeping the STIP fiscally constrained, realistic and addressing the MAP-21 performance requirements. This unit should operate cooperatively with other divisions to ensure that subject matter experts from structures, safety/traffic, roadway and maintenance have input into project-selection priorities and project scopes. However, this unit would function as the “keeper of the STIP” to ensure that project scopes, schedules, and budgets do not churn without coordination and approval by senior management.

Seventh, staff should complete scoping reports for complex projects before they enter design. For bridge projects, this scoping report would include development of a rehabilitation or replacement recommendation, assessment of the utility, right-of-way and environmental complexity, initial public involvement and estimated budget and schedule. For new structures it also would include a type, size and estimate (TS&E). For roadway projects, the scoping study would determine line, grade, typical section, construction and right of way limits and importantly community involvement regarding project scope elements such as streetscapes and sidewalks. Complex projects would be programmed initially in the STIP only for this planning phase. As the planning phase and scoping report is completed and project scope, cost and complexity are clarified, then the project would be programmed for final development and construction. Projects in this planning phase would be “in the bull pen” waiting matriculation into the financially constrained STIP. From that point, their milestones, scope and costs would be closely tracked through to their construction. Simple projects such as bridge preservation or pavement marking projects would skip the planning report phase and proceed from programming to project development.

Eighth, RIDOT should conduct in-depth benchmarking with staff at the Vermont Agency of Transportation, the New Hampshire Department of Transportation and the Maine Department of Transportation to further refine the staff-comparison information in this analysis. A district within the Ohio Department of Transportation also may provide promising insights as it is similar in size to RIDOT. This benchmarking is recommended because these organizations face similar challenges to RIDOT but all have attained 80 percent or better achievement of project-development milestones for several years, in some cases for nearly two decades. Comparing project-development staff levels with RIDOT and these agencies is complex because of significant differences in how RIDOT staffs and pursues its projects compared to these other agencies. Conclusions are that:

- It appears that RIDOT is understaffed in the areas of structures and environmental coordination compared to the four benchmark organizations.
- RIDOT’s consultant expenditures appear to be significantly higher than peer states’. As a percentage of the construction program, RIDOT’s consultant expenditures for 2010 to 2014 averaged 30.4 percent of the construction program. This is two to three times higher as a percentage than the benchmark organizations. (See Table 1) Even with this higher level of expenditure, RIDOT has less reliable project development schedules than its peers. While RIDOT staff levels appear to be low, staffing recommendations are clouded by the much higher level of consultant resources RIDOT uses.
- Head-to-head comparison of RIDOT project-development staffing to peer organizations is also muddled by RIDOT’s unique practice of not having dedicated project managers who focus solely on developing projects. RIDOT instead co-mingles duties so that staff may be assigned to man-

age some projects but they also issue truck size and weight permits, process access-permits, meet with property owners and handle legislative enquiries. This practice is not seen in the benchmark agencies. While some variables such as overall program size or consultant assistance can be isolated for comparison to other agencies, it is unclear how much time these other duties demand of RIDOT staff.

- RIDOT staff work 35 hour weeks which reduces their per person hours by 13 percent compared to the peer states.

Ninth, it is the recommendation of this report that RIDOT segregate duties and appoint project-development staff to manage development of specific projects with clear expectations for achieving project-development milestones. Non-project-development duties such as issuing permits should be assigned to individuals without project-management responsibilities. However, it is not clear how many staff are needed for these non-project-management duties.

Tenth, this report recommends creating a small “strike force” to handle emergencies. Staff report that emergency projects, particularly bridge ones, arise frequently and churn their priorities. Having a dedicated team whose job it is to handle emergencies could buffer other project-development staff to focus on delivering the planned program.

Eleventh, RIDOT should begin replacing the Project Management Portal. It is wholly unsuited for managing a complex, modern transportation program.

Table 1 A comparison of selected metrics

	Peer State Comparisons				
	RI	NH	VT	Maine	Ohio D7
Average Construction Program	\$150,004,996	\$192,918,154	\$243,096,381	\$283,780,000	\$160,869,536
\$ Consultants/ \$ of Construction	30.44%	12%	5.0%	3.6%	4.8%
Output per project development staff	\$2,205,956	\$1,929,182	\$3,716,796	Not Avail.	\$3,497,164

Table 1 compares some key metrics from RIDOT to New Hampshire, Vermont, Maine and one district at the Ohio departments of transportation. The three states have comparable construction programs to Rhode Island, as does the one Ohio district. The Ohio District includes Dayton and its surrounding counties which collectively have a population and highway network comparable to Rhode Island’s.

Rhode Island has the highest expenditures on consultants per size of construction program of any of the peers. In fact, it’s more than 2.5 times larger proportionally than the next comparable peer. Also, it has the second lowest average production per engineering staff.

These data come from disparate sources. Vermont’s expenditures come from its DOT budgets. New Hampshire’s come from data produced from its purchasing computer system. Maine’s comes from published construction reports and data provided by the department. Ohio’s data come from internal Ohio DOT figures. Rhode Island consultant expenditures come from a report generated by the finance department on engineering contracts. Staff levels come from a review of personnel levels and construction volume comes from analyzing data from the Turino construction management firm. Such disparate data sources were needed because none of the states were tracking these costs in this way.

Background

The analysis of RIDOT's project-development process is prompted by the challenge of delivering a larger construction program when additional revenues are secured. The department recognizes the need for increased investments, particularly in its bridge program. These increases will require a larger construction program with reliable project-development processes.

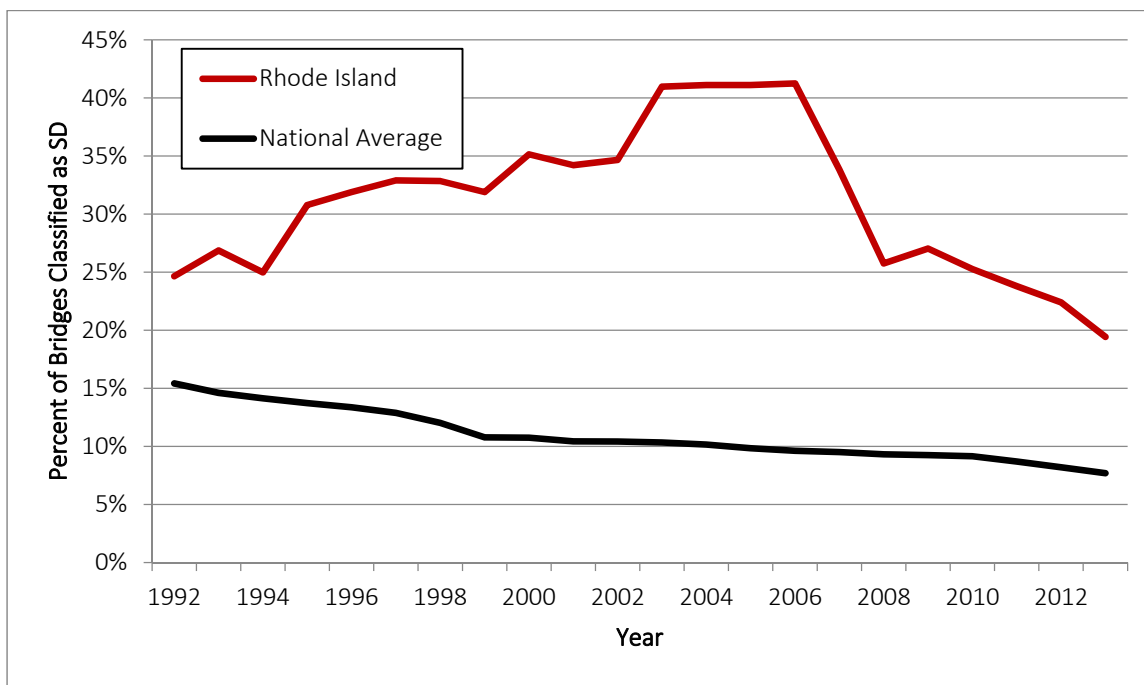


Figure 1 Trends in Rhode Island and U.S. bridge conditions

Figure 1 illustrates the category of bridge structural deficiency conditions compared to national averages. On a percentage basis, Rhode Island consistently ranks near the bottom nationally in bridge conditions. As seen in Figure 1, however, Rhode Island has made very substantial improvement and cut the percentage of its structurally deficient bridges by half in the past decade. Much of this improvement is the result of many large bridge projects that replaced hundreds of thousands of square feet of bridges with new structures. The department consistently spends more on structures than the Federal Highway Administration allocates to RIDOT in bridge funds and it has in recent years adopted a bridge preservation approach to further improve long-term conditions.

However, RIDOT faces a new challenge of delivering an increased number of bridge projects if it is to continue reducing bridge deficiencies. Even more importantly, sustaining the good bridge conditions once achieved will require delivering an increased number of bridge preservation projects. Although each bridge preservation project may be less complex than a bridge-replacement project, each one requires a set of plans, utility and right-of-way coordination, maintenance of traffic plans and possibly environmental permits and community coordination. RIDOT has averaged about 13 bridge projects per year let to construction between 2009 and 2013 according to data retrieved from the Torino Group consulting firm that manages RIDOT construction project tracking.

Although the next decade's bridge program is still under development, it is certain to increase in size. As significant as the number projects will be the importance of the timing of the bridge projects. Many will

be preservation projects scoped to improve a “fair” bridge before it deteriorates into the “poor” category. If the treatments are delayed to the point that the bridge has already deteriorated, the treatment may not be appropriate, would waste money and not adequately repair the bridge. If RIDOT cannot increase the delivery of its bridge projects and ensure they are delivered at the right time in the bridge lifecycle, it will not be able to achieve and sustain new Federal requirements that no more than 10 percent of bridges on the National Highway System (NHS) can be structurally deficient. RIDOT also will experience an overall decline in bridge conditions.

RIDOT faces a similar challenge with its pavements. Overall pavement conditions have declined when measured across the entire network as seen in Figure 4. RIDOT logically has prioritized its limited pavement dollars on the highest-volume routes and has kept its Interstate Highway System and limited access route pavements in good condition. However, conditions on the lower functional class routes have declined because of a lack of adequate budgets to keep the entire network in good condition. As seen in Figure 2, the overall network conditions have declined.

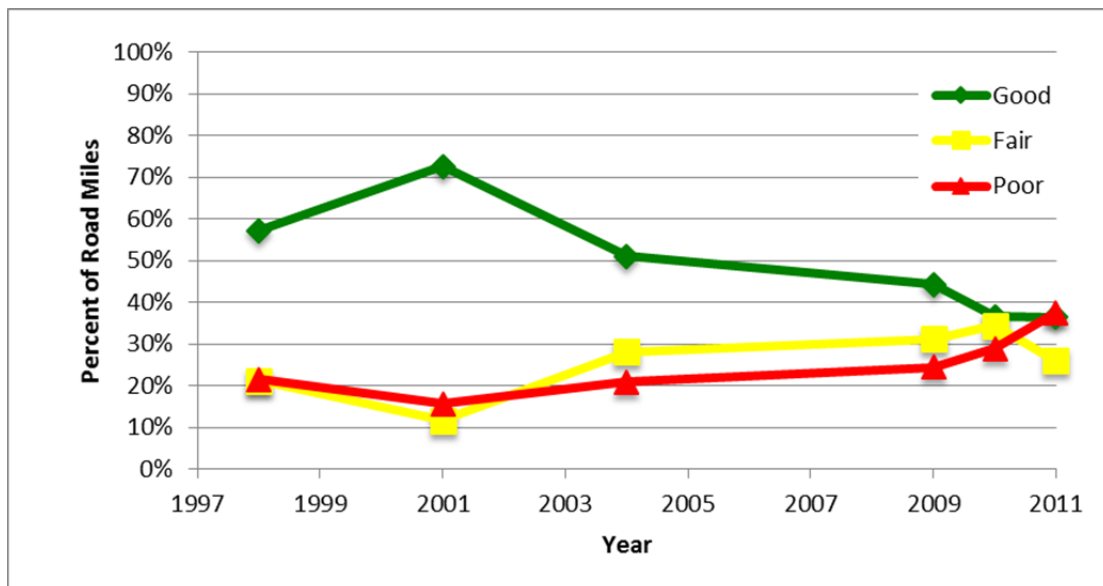


Figure 2 Pavement conditions from 1997 to 2011

As with the larger bridge program, if RIDOT were to receive enough funding to achieve its pavement targets it would require a significant increase in the level of effort to deliver the projects. As seen in Figure 3, the optimum pavement scenario represents a significant expansion of the pavement program compared to recent years. The blue bars represent the size of the roadway projects let to bid by RIDOT between 2009 and 2013. They ranged in total cost per year for all roadway projects from \$66 million to \$40 million for a five-year average of \$47 million. With the Article 21 funds, the pavement program grows to a 10-year average of \$69 million. If all needed funding were provided, the annual program would increase to an average of \$104 million or a more than doubling of recent program size. As with the bridge program, this would require a significant increase in projects to be designed, permitted, coordinated with the municipalities and neighborhoods and then let to bid. More project engineers and inspectors would be required. Because many of these additional projects would be on the urban routes, they would require curbs, sidewalks, ADA coordination, drainage permitting and utility relocations. The degree of project management and coordination would increase substantially.

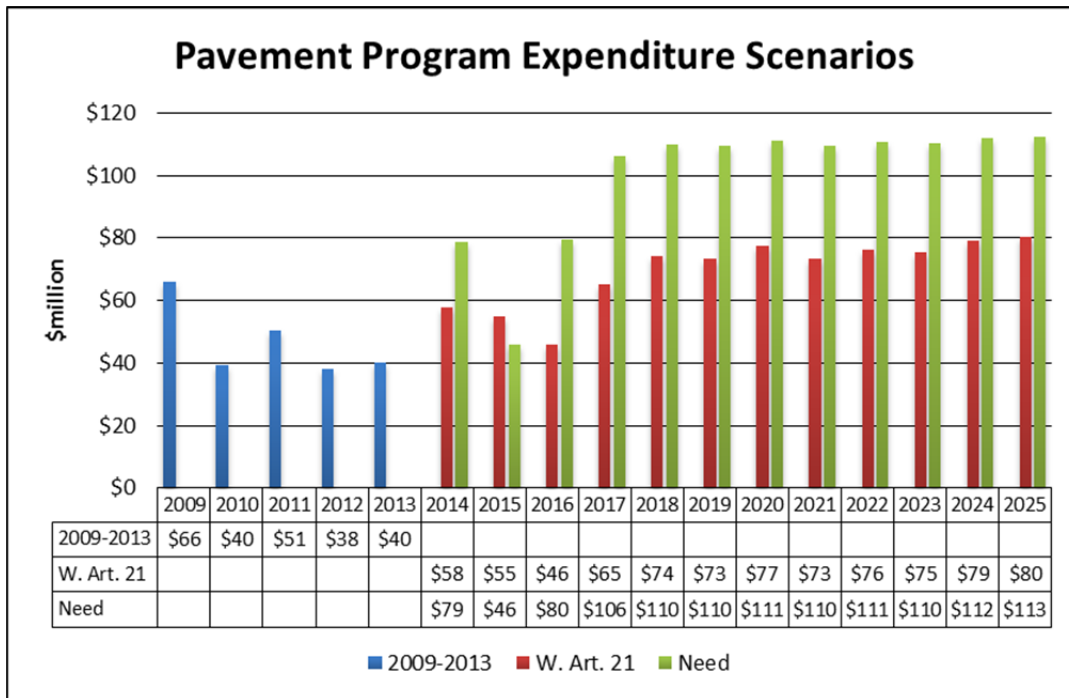


Figure 3 Projected increase in RIDOT pavement program under optimal pavement budgets.

Both the bridge and pavement programs anticipate a large, steady and sustained level of project delivery. This reflects the asset management philosophy behind both programs. In a performance-based asset management organization, asset-investment needs would be predicted years in advance. A calibrated mix of preservation, maintenance, rehabilitation and replacement projects would be planned years in advance to sustain highway assets for a reasonable lifecycle cost. Treatments would be delivered at the right time in an asset's lifecycle. When assets are still relatively sound, preservation and maintenance are emphasized. When the assets reach a point that preservation is no longer effective, rehabilitation is planned. When assets are beyond economical repair, they are scheduled for replacement and left to deteriorate and no further investment is made until the asset is replaced. Such a calibrated strategy can save substantially over the life of the asset.

Therefore, asset management cannot be effective without the timely delivery of projects and maintenance at the right points in the asset lifecycle. The steady, reliable delivery of projects anticipated in the Better Bridge and Reliable Roads projects can be contrast to the history of project delivery from 2009 to 2014 seen in Figure 4.

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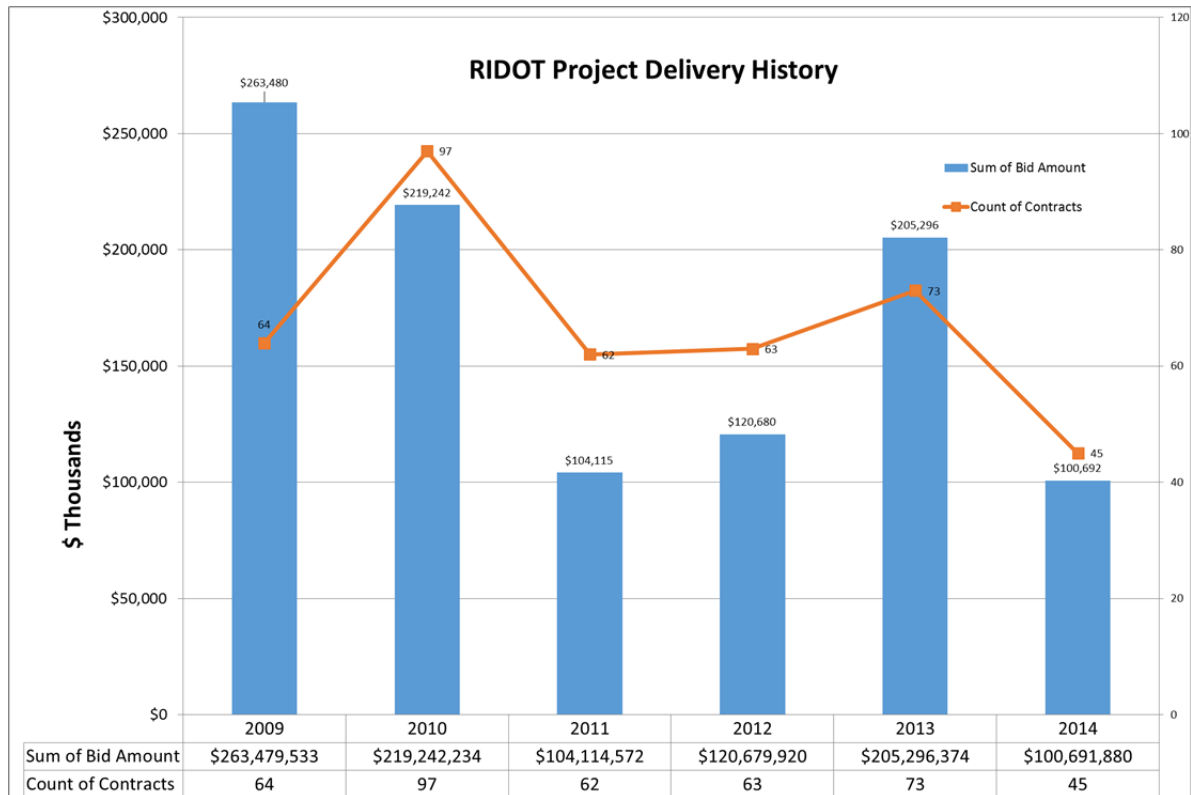


Figure 4 History of projects let to bid 2009 to 2014.

The size of the construction program varied from \$263 million to \$100 million and the number of projects varied from 97 to 45. The variability is caused by erratic funding. Increases occurred in 2009 because of the American Reinvestment and Recovery Act (ARRA) then funds fell sharply as Federal appropriations became uncertain and subject to short-term authorizations. Commendably, RIDOT project-development staff geared up and used all of the Federal funds provided by ARRA and used all regular FHWA appropriations. The staff is understandably proud of their ability to use the ARRA funds with such short timelines. Several staff members noted that RIDOT has lapsed no State or Federal funds because of inability to deliver enough projects.

However, staff also describe the delivery of the ARRA program as requiring unsustainable, heroic efforts. They expressed surprise that they were able to deliver the large program. More than 40 staff members were interviewed and many expressed the opinion that they could not sustain the increased level of project delivery that ARRA represented with current processes. Many also expressed doubt that current project-development processes could deliver the size of program anticipated by the former Better Bridge and Reliable Roads efforts. Notably, RIDOT has no “shelf.” That is projects that have been designed, permitted and are ready to bid if additional funds become available. A “shelf” of projects is common in agencies with reliable project-development processes. RIDOT practices “just in time” project development because its project-development process is geared toward emergencies and developing only projects that can be funded with certainty in the fiscal year.

Comparisons to Vermont, New Hampshire, Maine and Ohio

The departments of transportation in Vermont, New Hampshire and Maine participate in a tri-state performance management consortium. They benchmark performance against one another and publish common performance measures. All three states focus upon reliable project-development and consider the reliable development and delivery of projects as a core mission and an important corporate value. Their agencies publish a year in advance a schedule of construction projects to be let to bid each month of the following fiscal year. They then track the delivery of that program and measure their performance. State executives have invested their credibility in reliable project delivery and expressed the following sentiment in their Tri-State Performance Measures Report. ¹

“As agencies of state government, the most important asset we can build and maintain is the trust of the people we serve. Trust in our agencies not only makes projects go easier, it makes legislative and executive funding decisions a more straightforward process. When the public and our partners in industry believe in our ability to deliver on promises, they become stronger advocates for our agencies’ goals, plans, and budgets.

That trust is built by consistently doing three simple things: say what we intend to do, do it, and when necessary, clearly explain why something wasn’t done. In the realm of capital project development, it begins and ends with schedules, budgets, and the quality of our final products.”

Each agency follows a similar process. It produces a list of projects to be constructed in the following fiscal year and then measures performance against the number of those projects let to bid and the total dollar amount of the program. Monthly internal progress meetings are held to track the delivery.

Monthly external coordination meetings are held with resource agencies and other stakeholders essential to the permitting, right-of-way and utility coordination process.

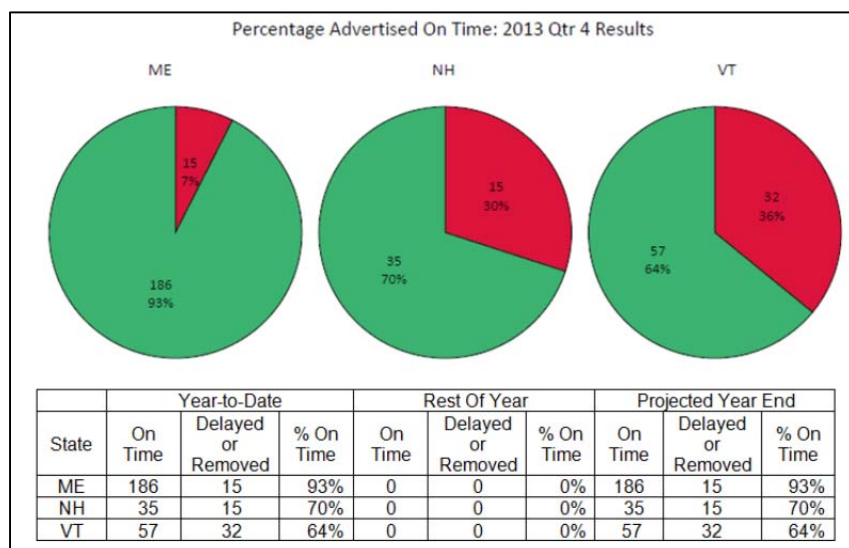


Figure 5 Project delivery record of three peer states.

the additional emergency projects. RIDOT was also affected by Super Storm Sandy which affected its program. As seen in Figure 6, the agencies delivered the large majority of the value of their published capital programs.

As seen in Figure 5, the 2013 results ranged from 93 percent on time delivery for the Maine DOT to a low of 64 percent for Vermont. However, Vermont was still affected by the aftermath of Hurricane Irene which affected planned schedules. As it responded to emergencies, its regularly scheduled projects were delayed. However, its end-of-year total program was

107 percent of its original planned program because of

**Total Construction Value Delivered: 2013 Qtr 3 Results
(All Dollars in Millions)**

State	Advertised to Date	Remainder of Calendar Year	Projected for Year	Construction Value of CAP	Percent of CAP
ME	\$ 222.27	\$0	\$222.27	\$224.94	99%
NH	\$ 165.01	\$0	\$165.01	\$175.60	94%
VT	\$207.79	\$0	\$207.79	\$193.43	107%

Figure 6 Value of capital programs delivered com

The following section will summarize some of the major strategies used by these three agencies. Also staffing levels and consultant volumes will be compared.

Selected Vermont Agency of Transportation Practices

The Vermont Agency of Transportation (VTTrans) published the following statement of principles for its Project Development Division managers.

- We will meet or exceed the goal of 80% of projects being advertised on time in calendar year 2013 according to the Tri State Measure. We will do the same for other key milestones such as Clearances for NEPA, Utilities, and ROW.
- No excuses, and zero tolerance for finger pointing. We focus on solutions.
- If we fail, WE ALL FAIL.
- The Director's Office will work closely with everyone involved to include holding Monthly Production Meetings on the first Monday of each month with key stakeholders
- Everyone will communicate well. This includes listening.
- Section Heads are expected to solve communication break downs between Sections. Director's Office is the last resort.
- Innovation developed collaboratively is to be exercised when populating dates for Artemis project delivery milestones.
- The 80% Goal is not a reason for expecting and setting unrealistic project delivery milestone dates.
- We have not failed if some projects are not advertised on time. The 20% is for unexpected changes in a project schedule.
- These performance expectations are key to our success and will be included in your individual performance evaluations.

The VTTrans publishes a detailed project list each year for the following year. The SFY 2016 program can be viewed at <http://vtrans.vermont.gov/about-us/capital-programs/fy2016> . The overall program includes detailed listing of planned projects in the area of paving, interstate bridges, state highway bridges, roadway, safety and traffic operations, park and ride lots, bicycle and pedestrian facilities, and transportation alternative and multi-modal projects. Internally, the agency produces more detailed multi-year lists with milestones for complex projects, such as Interstate Highway System Bridges. Its Interstate bridge development list includes 28 projects scheduled for bid through 2019. Each is assigned to one of nine different project managers. Budget amounts for preliminary engineering, right-of-way and construction are specified for each of the six years. The total amount expected for construction ranges from \$59 million to \$18 million for each of the six years. Project-development milestones are tracked to ensure that the department keeps the projects on schedule, or adjusts them as budget or project-

development needs dictate. As the projects become more than 90 percent developed, they are added to the annual list of projects to be let to bid the following fiscal year.

VTrans also has an ambitious accelerated bridge program that includes 62 projects. The goal for each is to move from programming to construction in two years. Most of the bridges are small, deficient structures needing replacement and lacking complex permitting requirements. The program uses expedited project development tactics as well as relies on pre-fabricated bridge elements and full roadway closures to expedite development and construction. A team of nine staff manage the program. Two civil engineers manage consultant designed projects. A team of four civil engineers and two technicians manage the in-house developed accelerated bridge projects. The staff are overseen by a civil engineer manager who reports to the structures engineer.

The VTrans' accelerated bridge program succeeds in part because of a strong agency commitment to it and to substantial advanced scoping in the planning stage to identify critical problems. The following chart taken from the National Highway Institute risk management course illustrates the logic behind the VTrans scoping. Figure 7 is an adaptation by NHI of concepts from the Project Management Institute's Body of Knowledge. Both emphasize that the number of risks to a project's cost, scope and schedule are greatest at the beginning of a project when many of its details are unknown. However, the impact of those risks are lessened because the project manager has time to address them. Concurrently, a few risks late in the project schedule create much greater impacts to the budget, scope, schedule or quality of a project.

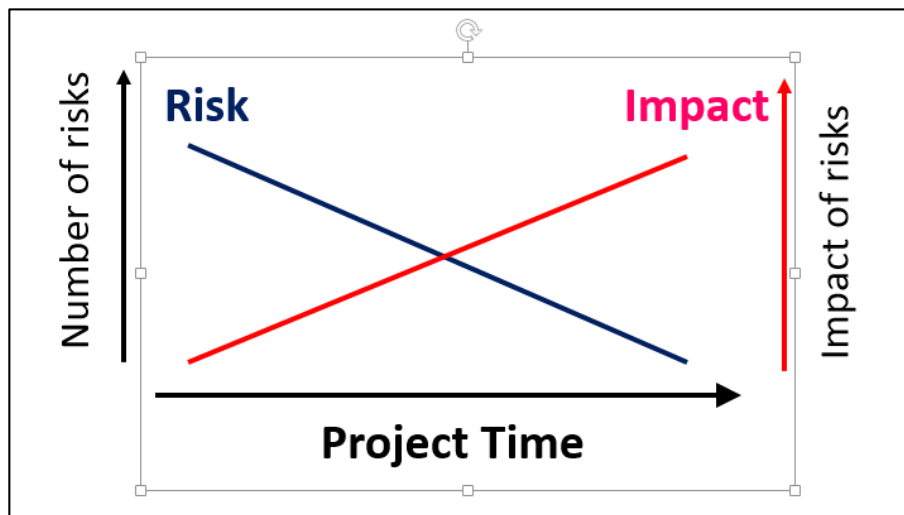


Figure 7 Risks identified early in a project have fewer impacts on project schedules than do those identified late in project development.

VTrans spends six months to a year developing a scoping document for each of the accelerated bridge projects. It also has sometimes conducted risk analysis early in the project to identify key risks. The scoping document involves field reviews of the structure and its surrounding environment to identify key issues that will affect maintenance of traffic, utility coordination, right-of-way acquisition and permitting. The scoping process

also involves developing alternative structure and construction options which are coordinated with the community and the resource agencies. The scoping report summarizes the issues surrounding the project, the results of the community consultation, an expected budget and other issues critical to the timely delivery of the project. The scoping process reduces the risks to the remaining project schedule because fewer unknowns are likely to arise later in the project-development process.

The scoping report performs several important functions. It documents the community involvement and resource agency coordination results. It also demonstrates the agency has considered reasonable alter-

natives and selected one that balances engineering considerations, cost, community input and resource-agency requirements. The scoping report also supports reliable project delivery by clarifying the design and project-development issues that will need to be addressed once the project is programmed for design and construction. Once the scoping report is completed and the project assigned to design, then the tracking of its project-development milestones begins. The agency has more knowledge and more confidence with which to identify project-development milestones and has reasonable assurance that it can meet them. Finally, the scoping process involves all the pertinent units within the Agency of Transportation. This internal involvement allows key units such as traffic, safety, right-of-way and utility groups to understand their role in meeting the schedule and budget. Also, the inclusion of the construction team allows constructability issues to be identified early in the project.

The focus on project delivery is inherent in the name of VTrans units. One of the largest divisions is the Project Delivery Bureau. It has four units within it, Highway Safety and Design Unit, Environment and Hydraulics, Right of Way, Utilities and Survey, and Structures. Each of those sub-units focuses heavily on both in-house design and managing consultants. Although the precise breakdown of in-house to construction design was not available, the general numbers indicate VTrans relies much more on in-house design than does RIDOT. Table 2 includes selected comparative data.

Table 2 Selected comparative data for VTrans.

VTrans					
	Construction Contract Amount	Number of Contracts	Production Per Engineering Staff	Consulting Contract Volume	\$Consultants/\$ Construction
2011	\$266,393,323		\$3,551,911	\$10,884,314	4.1%
2012	\$244,063,266		\$3,254,177	\$9,748,451	4.0%
2013	\$283,663,706		\$3,782,183	\$13,430,164	4.7%
2014	\$294,021,891		\$3,920,292	\$17,485,405	5.9%
2015	\$305,656,430		\$4,075,419	\$17,957,885	5.9%
Total	\$1,393,798,616			\$69,506,219	5.0%
5 Year Ave.	\$278,759,723		\$3,716,796	\$13,901,243.80	5.0%
Project Development Highway		25			
Project Development Bridge		38			
Project Development Environ.		12			
Total		75			

VTrans has produced an average six-year program of \$278 million compared to RIDOT's \$150 million from 2010 through 2014. VTrans produced its program with 75 engineers, technicians and a few support staff and an average of \$13.9 million annually in consultant support. The total production value per staff member for VTrans averaged \$3.716 million for six years while for RIDOT it averaged \$2.205 million.

Several factors are noticeable. VTrans relied much less on consultants, averaging about \$30 million less per year than RIDOT. Also, VTrans has a larger environmental staff with 12 personnel compared to RIDOT's 7. Also, not seen in these figures is that VTrans appears to have a larger number of engineers and technicians devoted to bridge development projects. Its Project Delivery Bureau Structures

Table 3 Selected comparative data for RIDOT

RIDOT					
	Construction Contract Amount	Number of Contracts	Production per engineering staff*	Consulting Contract Volume	\$Consultants/\$ Construction
2010	\$219,242,234	97	\$3,224,151	\$43,177,179	19.7%
2011	\$104,114,572	62	\$1,531,097	\$39,935,907	38.4%
2012	\$120,679,920	63	\$1,774,705	\$51,000,160	42.3%
2013	\$205,296,374	73	\$3,019,064	\$46,671,998	22.7%
2014	\$100,691,880	45	\$1,480,763	\$47,490,350	47.2%
Total	\$750,024,980	340	\$2,205,956	\$228,275,594	30.4%
Five year average	\$150,004,996	68	\$2,205,956	\$45,655,119	30.4%
RIDOT Engineering Staff		61			
RIDOT Environmental Staff		7			
Total staff for this analysis*		68			

has 15 personnel in the Project Development Team, nine civil engineers, five technicians and one manager. Those personnel are in addition to the nine in the Accelerated Bridge Program. In addition, another six – five engineers and one technician form the design/build consultant team. Six positions additionally are dedicated to project initiative and innovation. In total at VTrans there are 38 personnel devoted to bridge-development projects. These personnel only tangentially deal with outside issues such as truck permits. They are involved in community meetings but only during the project-development stage. RIDOT has about 30 personnel in its structures department. They manage all bridge functions including inspections, permits, Federal reporting and project management. At VTrans, in addition to the 38 personnel in the Project Development Bureau Structures there are another 11 in the Bureau of Asset Management Performance who handle bridge inspections and Federal reporting. **So in total, VTrans has about 49 personnel dedicated to bridges compared to RIDOT with about 30.**

For comparison, according to 2013 National Bridge Inventory Data, VTrans has 2727 structures over 20 feet totaling 9.5 million square feet compared to 757 RIDOT bridges totaling 8.3 million square feet.

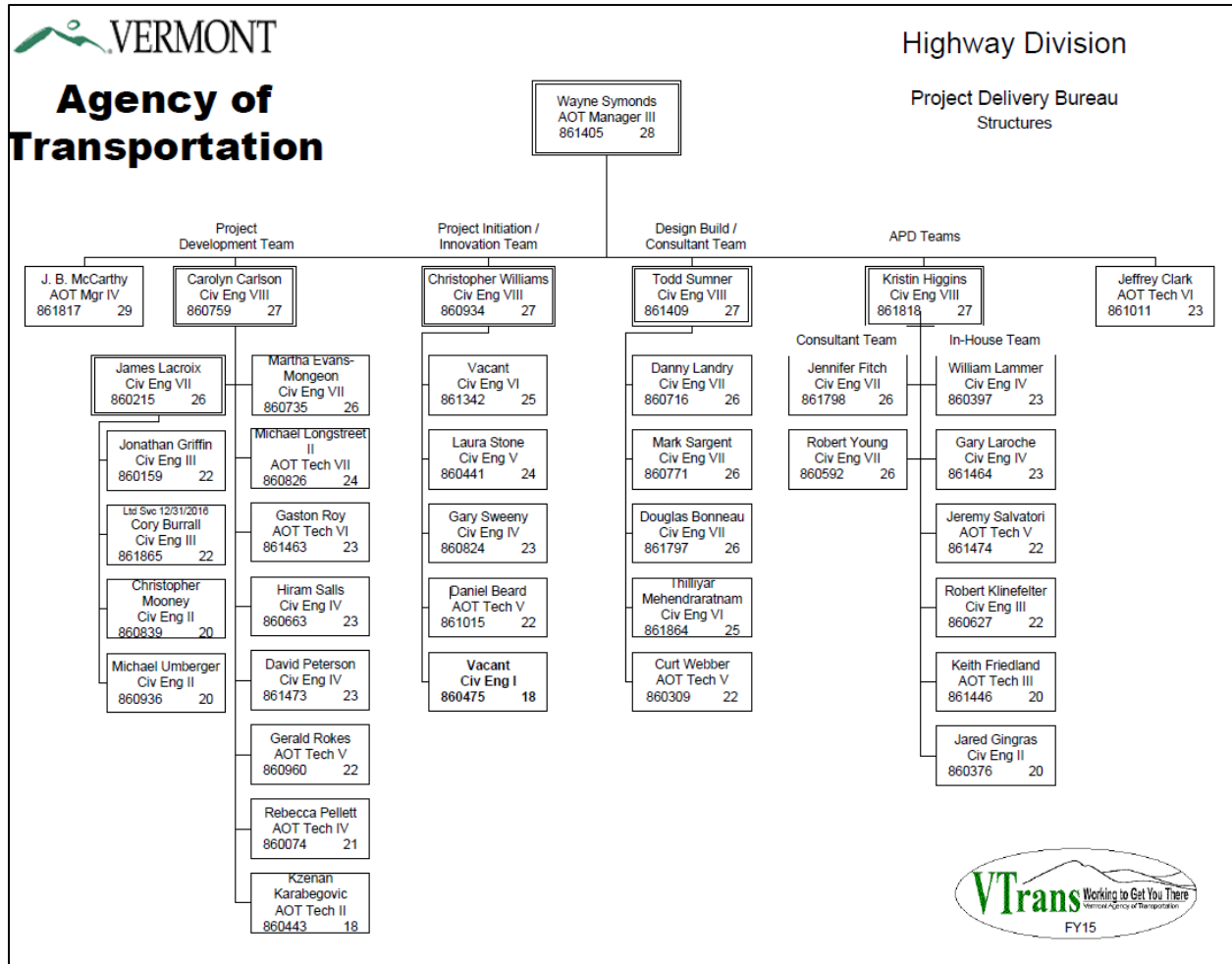


Figure 8 VTrans table of organization for Project Delivery Bureau Structures.

Comparative data for RIDOT are in Table 3. The data for construction contracts volume and number come from Torino. The consulting volumes come from a special report generated by the RIDOT finance and contracts office. Of particular note are the 68 RIDOT personnel assumed to be devoted to project management shown in Table 4. They include the green engineering and environmental staff. **The 22 blue engineering positions are not included in the analysis of the per capita project-delivery volume assuming they are managers.** Those in the blue category are assumed to be in management and not assumed to be available to assist with project delivery.

As can be seen by comparing Table 2 to Table 3, RIDOT has slightly fewer staff than VTrans, produces a smaller program but has much higher consultant expenditures.

RIDOT Project Development Report

Table 4 RIDOT staff included in this analysis are shown in the Green table. Those in Blue are excluded as being in management and not working on project development. The Blue table staff are shown here only to illustrate that all engineering staff were accounted for, and which of those were included in the analysis.

Engineering Management		
CHIEF ENGINEER (DOT) 00149A 1.0		1
DEPUTY CHIEF ENGINEER (DOT) 00145A 2.0 280,262 2.0 280,262		1
MANAGING ENGINEER (DOT) 00141A 6.0 697,223 6.0 697,223		3
ASSOCIATE CHIEF ENGINEER (DOT) 00143A 2.0 221,530 2.0 221,530		1
CHIEF CIVIL ENGINEER (BRIDGE DESIGN) 00138A 1.0 103,615 1.0 103,615		1
CHIEF CIVIL ENGINEER (ROAD DESIGN) 00138A 2.0 204,029 2.0 204,029		2
CHIEF CIVIL ENGINEER (TRAFFIC DESIGN) 00138A 1.0 99,046 1.0 102,080		2
CHIEF CIVIL ENGINEER (TRANSPORTATION 00138A 2.0 188,851 2.0 188,851		2
MANAGER OF SURVEY OPERATIONS (DOT) 00135A 1.0 91,145 1.0 92,233		1
SUPERVISING CIVIL ENGINEER (BRIDGE DESIGN) 02835A 2.0 170,994 2.0 170,994		1
CHIEF REAL ESTATE SPECIALIST (DOT) 00032A 1.0 83,248 1.0 83,248		1
SUPERVISING HISTORIC PRESERVATION 00031A 1.0 82,317 1.0 82,317		1
REAL ESTATE APPRAISER III 00032A 1.0 81,040 1.0 81,040		1
PROGRAMMING SERVICES OFFICER 00131A 2.0 153,185 2.0 153,185		2
PRINCIPAL CHEMIST 00029A 1.0 74,724 1.0 74,724		1
SUPERVISOR, CONSTRUCTION RECORDS 00030A 1.0 74,587 1.0 76,512		1
Subtotal Management		22
Engineering Production Staff		
PRINCIPAL CIVIL ENGINEER (DESIGN) 00033A 13.0 1,099,128 13.0 1,099,128		13
SENIOR CIVIL ENGINEER (DESIGN) 00031A 18.0 1,270,065 18.0 1,275,816		18
CIVIL ENGINEER 00027A 1 22.0 1,210,053 22.0 1,224,564		22
SENIOR LANDSCAPE ARCHITECT 00026A 1.0 53,977 1.0 53,977		1
SENIOR REAL ESTATE SPECIALIST (DOT) 00026A 8 3.0 172,265 3.0 172,686		3
CIVIL ENGINEERING ASSOCIATE 00025A 4.0 214,979 4.0 214,951		3
ASSISTANT ADMINISTRATIVE OFFICER 00121A 1.0 44,398 1.0 44,398		1
Subtotal Engineering Production Staff		61
Total Engineering Staff		83
Environmental and Resource Agency Staff		
SUPERVISING HISTORIC PRESERVATION 00031A 1.0 82,317 1.0 82,317		1
PRINCIPAL HISTORIC PRESERVATION SPECIALIST 00028A 1.0 70,079 1.0 70,079		1
ENGINEERING TECHNICIAN IV (NATURAL 00027A 1.0 67,605 1.0 67,605		1
SENIOR ENVIRONMENTAL SCIENTIST 00030A 2.0 124,650 2.0 129,088		2
ENVIRONMENTAL SCIENTIST 00026A 1.0 56,676 1.0 56,676		1
PRINCIPAL ENVIRONMENTAL SCIENTIST 02832A 1.0 76,719 1.0 76,719		1
Subtotal Environmental and Resource Agency		7
Total Personnel Assumed Engaged in Project Development		68

Selected New Hampshire Department of Transportation Practices

The New Hampshire Department of Transportation manages 2,155 state bridges totaling 10,385,500 square feet in deck area. It also manages 4608 centerline miles of highway. As in Vermont, the New Hampshire Department of Transportation publishes an annual list of projects up to two years in advance and closely tracks their delivery. The 2015-2016 advertising schedule can be viewed at <http://www.nh.gov/dot/org/projectdevelopment/planning/documents/AdYr1.pdf>

Table 5 NHDOT staffing levels

New Hampshire DOT Project Development Staff	
Project Management	
Chief	1
Project Managers	7
Administrative	3
Final Design	8
Preliminary Design	8
Plan Prep	2
CADD Support	4
Consultant Design	8
Design Services	1
Design Services Utilities	12
Survey	3
Records	3
Roadside	2
Bridge Administration	3
Design/Engineering Engineers	16
Bridge Design Techs	3
Environmental Project Management	9
Environmental Program Management	7
Total	100

The department averaged \$192 million in construction projects let to bid between 2011 and 2014. It produced that program with about 100 staff with about 84 of those in the Division of Project Development and 16 in the Bureau of Environment. An additional 32 personnel are in the field including surveyors. Seven senior project managers serve beneath the Project Management Chief. They are augmented by five in-house design teams with six people each. Another team of eight addresses consultant reviews. The environmental staff consist of two teams. Nine persons focus on environmental issues relating to project management and another seven focus on program management. The program management staff includes specialist in cultural resources, air and noise, water quality, wetlands and contamination. Table 5 includes a summary of the NH project-development staff. NHDOT's staffing differs from RIDOT because the 100 staff include 12 utility services designers not included in the RIDOT engineering staff numbers.

New Hampshire DOT relies much more on in-house design than does RIDOT. Sixteen in-house bridge design engineers produce plans and are assisted by three in-house design techs. The total bridge team includes 33 people, including the designers and technicians mentioned and 12 people in the Existing Bridge unit that includes three engineers and nine bridge inspectors. The in-house team in 2014 designed nine bridge rehabilitation projects worth \$16.8 million and five bridge preservation ones worth \$4.6 million. They also reviewed plans worth \$10.4 million designed by consultants. They also administered 29 consultant contracts for tasks such as design, complex inspections and load ratings, underwater inspections, quality assurance of steel fabrication, and paint inspection. It reported \$9.92 million in bridge consultant services in 2014.

The bridge team also inspected 1,551 state bridges and 1,145 municipal bridges for a total of 2,696 inspections. They also reviewed 1,290 truck permits.

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The Bureau of Highway Design reports that for 2014, its eight member Preliminary Design team worked on 25 projects in addition to reviewing Traffic Impact Studies. The 25 projects for which it produced pre-

liminary development plans will total \$51 million in construction value. That team also reviewed 10 consultant projects in various stages that will total \$420 million in construction value. The team also designed two task order resurfacing projects and reviewed 24 development proposals.

The eight person Final Design section developed and advertised 13 pavement and preservation projects and oversaw development of 12 safety projects worth \$12.7 million. The Consultant Design Section oversaw development of a total of 28 Federal-aid projects worth \$75.1 million, six State projects worth \$6.4 million and 1 emergency project for \$2 million.

NHDOT executives estimate that by dollar volume about half of their construction program is produced by consultants, however, their staff produce in-house more of the smaller, less-complex projects. They focus heavily on project-management activities. For instance, a long-running Interstate 93 expansion project is mid-way through a 10-year program. A senior project manager and two staff have been assigned for several years full time to that project.

The NHDOT executives say that delivering projects on time is an important agency priority. They say it has substantially increased their credibility with the public, legislators and with the contracting industry. The agency received a revenue increase last year which was in part attributed to confidence that the agency could invest the proceeds quickly into highway improvement projects.

Agency officials said in 2014, 57 percent of their projects were let to bid within 30 days of the advertised date, less than 33 percent were up to 90 days late and 10 percent were more than 90 days delayed. They said their schedules in 2014 were hampered by the uncertain Federal appropriations.

They said the original impetus for focusing on project delivery came as a result of the need to improve public perception of their agency. The reliable project delivery has been appreciated by the public and contracting industry that can better prepare bids knowing two years in advance which projects are expected. The agency also keeps a “shelf” of projects. The 2015 shelf consists of \$23 million in projects and the 2016 shelf is expected to be \$53 million. The shelf allows for rapid addition of projects if revenue exceeds expectations.

NHDOT staff emphasize monthly coordination meetings with resource agencies and utilities. They said right-of-way and utility delays used to be a constant source of complaint. They increased their coordination with resource agencies, the right-of-way staff and the utilities so that those complaints are much less common. The agency has standing monthly meetings with the cultural resource and natural resource review agencies. They also publish minutes of their review meetings to enable everyone, including outside stakeholders, to be able to keep abreast of project issues. Detailed minutes of individual projects are documented and published.

<http://www.nh.gov/dot/org/projectdevelopment/environment/units/project-management/nracrmeetings.htm>

As seen in Table 6, the New Hampshire staff over a four-year period produced on a per capita basis a lower dollar volume of projects than did the RIDOT staff. But the amount of consultant billings in New Hampshire appear to be about one third of the amount of Rhode Island’s. New Hampshire executives say they rely upon consultants for complex projects and for specialty areas such as safety studies, safety design projects, and roadway safety audits. Staff produce plans for many routine projects in-house.

Table 6 NH DOT program size, staffing levels and consultant volume.

New Hampshire				
	Construction Contract Amount	Production Per Engineering Staff	Consulting Contract Volume	\$Consultants/\$ Construction
2011	\$226,299,314	\$2,262,993	\$22,938,723	10%
2012	\$205,879,639	\$2,058,796	\$13,748,678	7%
2013	\$165,010,000	\$1,650,100	\$29,840,113	18%
2014	\$174,483,663	\$1,744,837	\$22,219,924	13%
Four Year Average	\$192,918,154	\$1,929,182	\$22,186,860	12%
NH Project Develop Bureau Staff		84		
NH Environmental Staff		16		
Total staff for this analysis		100		

As does Vermont, the New Hampshire DOT also tracks internally the completion of milestones for complex, multi-year projects that are not yet mature enough to be advertised in the two-year program. It uses its ARTEMIS project-tracking system and its monthly review meetings to keep abreast of these multi-year projects.

Selected Maine Department of Transportation Practices

The Maine Department of Transportation has produced an average annual construction program of \$283 million while achieving an approximate 80 percent on-time delivery rate. Its executives say that an 80 percent delivery rate is reasonable because one that is higher may force staff to cut corners or take other undesirable steps just to achieve the delivery target. Allowing up to 20 percent of projects to be delayed allows for a reasonable accommodation of inevitable project delays. However, the executives and staff say they are very focused on their 80 percent target. Staff have been known to print off charts of their performance and post them in offices to keep everyone focused upon the target of reliable project delivery.

The Maine DOT was the original model for the project delivery effort that was later emulated by Vermont and New Hampshire. It publishes a Maine DOT Work Plan <http://maine.gov/mdot/projects/workplan/> that spells out overall capital program goals for the upcoming three years and lists the individual projects expected to go to construction each year. Maps and lists are published by county. Figure 9 illustrates the bridge project history and target included in the current Work Plan.

The Maine DOT takes a similar approach to that used in Vermont and New Hampshire. One of its four major bureaus is the Bureau of Project Development. The bureau is organized into teams that are led by project managers and include right-of-way and utility staff. They coordinate closely with the environmental sections that also work in teams. The teams are assigned projects and are expected to deliver them. Monthly progress meetings are held internally as well as monthly progress meetings with the resource agencies. Maine officials say they are on a first-name basis with the environmental agency staff because of their frequent meeting and close coordination.

The Maine officials say they began their emphasis on project delivery several years ago to counteract skepticism that the agency could reliably deliver a large program. They said they have found that the ability to reliably deliver a program lays the foundation for additional revenue.

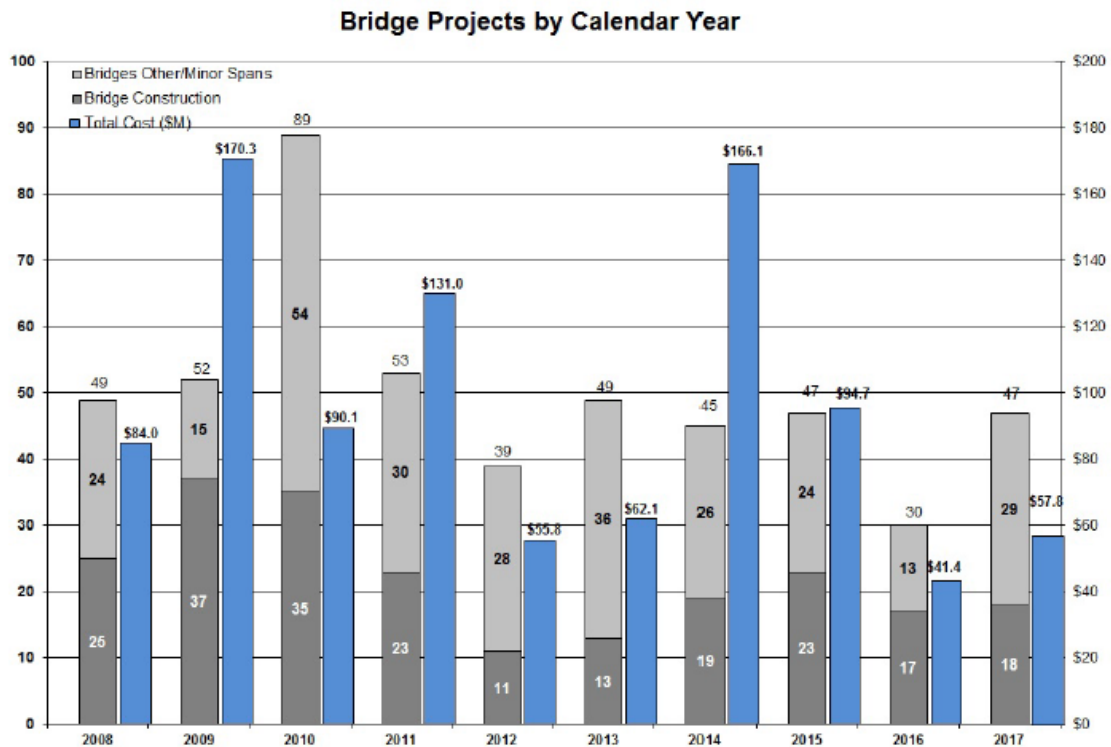


Figure 9 Past and forecasted Maine DOT bridge programs.

Like with Vermont's bridge scoping process, the Maine DOT emphasizes thorough project planning before committing a project to construction. Many complex projects are funded in the STIP only for preliminary engineering (PE) and stay in the PE phase until there is clarity about the project scope and impact. For a bridge project, the agency may determine the type, size and estimate from the preliminary planning phase and began coordination with the resource agencies. The project will not be committed to a construction year until the agency believes the scope is clear. **The Maine production staff focuses on production and is not expected to juggle other duties, such as handling permits.**

Details of employee levels were not available because the Maine organization is different than Rhode Island's and tables of organization were not provided to allow function-by-function comparisons. Overall about 350 people are in Maine's Project Development Division. Included in that division are construction, right of way, utilities, survey, aerial photography, contracts and specifications, testing and geotech, multi-modal programs as well as highway and bridge programs. Some years ago, Maine integrated right-of-way and utilities into the project development arm. In comparison, for the RIDOT analysis, functions such as construction, right of way, utilities, survey, materials testing and others were excluded.

The comparison of the Maine DOT to RIDOT is muddled by the different size of the two departments and the different ways in which the divisions are organized. However, superficially it appears that Rhode Island has about 320 personnel in the comparable divisions that comprise Maine's project-development

division that has 350. As mentioned earlier, RIDOT staff are expected to work only 35 hours weekly, versus 40 which affects any per-capita comparisons.

Maine DOT did provide consultant contract amounts and hours by consultants and in-house staff to produce project plans seen in Tables 7 and 8. According to their figures, consultant costs averaged only 3.6 percent of the total construction cost over the past six years. Although consultants are a relatively small part of the program, they have become a larger part of the total hours compared to the in-house staff as seen in Table 7.

Table 7 Comparative contract amounts and consultant costs

Maine DOT				
	Construction Contract Amount	Production per engineering staff	Consulting Contract Volume	\$Consultants/\$ Construction
2009	\$371,520,000		\$8,000,000	2.2%
2010	\$286,580,000		\$5,800,000	2.0%
2011	\$296,590,000		\$6,900,000	2.3%
2012	\$220,720,000		\$11,000,000	5.0%
2013	\$236,170,000		\$15,000,000	6.4%
2014	\$291,100,000		\$14,200,000	4.9%
Total	\$1,702,680,000		\$60,900,000	3.6%
Six year average	\$283,780,000		\$10,150,000	3.6%

Table 8 Consultant hours and costs by year.

Cal. Year	Consultant Hrs	Internal Staff Hours	Consultant Hrs Pct
2004	114,602	77,617	60%
2005	43,713	75,373	37%
2006	43,984	77,200	36%
2007	32,288	67,924	32%
2008	65,019	73,453	47%
2009	79,569	73,347	52%
2010	57,836	67,377	46%
2011	68,816	49,134	58%
2012	109,961	55,846	66%
2013	149,839	55,207	73%
2014	141,724	56,594	71%

Cal. Year	Consultant Services	Internal Staff	Consult. Pct
2004	\$11.5	\$3.1	79%
2005	\$4.4	\$3.0	59%
2006	\$4.4	\$3.1	59%
2007	\$3.2	\$2.7	54%
2008	\$6.5	\$2.9	69%
2009	\$8.0	\$2.9	73%
2010	\$5.8	\$2.7	68%
2011	\$6.9	\$2.0	78%
2012	\$11.0	\$2.2	83%
2013	\$15.0	\$2.2	87%
2014	\$14.2	\$2.3	86%

Ohio Department of Transportation District 7

A brief comparison will be made to the Ohio Department of Transportation District 7. It is of the approximate size of Rhode Island. ODOT's district 7 includes Dayton, Ohio, and the very busy Interstate 75 with daily total volumes of up to 112,000 vehicles with trucks exceeding 16,000 per average day. The district

has a population of about 972,000 compared to the 1.055 million in Rhode Island. As seen in table 8, the district has produced an annual average program of about \$161 million over the past six years

Table 9 Ohio District 7 comparative production, staff and consultant numbers.

Ohio District 7				
	Contract	\$ Product/Staff	Consulting	% Consultant
	Amounts			Cost of Program
2009	\$115,903,000	\$2,519,630	\$8,242,979	7.1%
2010	\$234,985,000	\$5,108,370	\$10,102,898	4.3%
2011	\$106,205,581	\$2,308,817	\$4,127,656	3.9%
2012	\$85,488,661	\$1,858,449	\$5,025,990	5.9%
2013	\$214,170,233	\$4,655,875	\$12,736,157	5.9%
2014	\$208,464,738	\$4,531,842	\$6,091,262	2.9%
Total	\$965,217,213		\$46,326,942	4.8%
Average	\$160,869,536	\$3,497,164		
Project Development Staff	46			

with 46 staff and an average consultant percentage of 4.8 percent of the value of construction. These staff numbers are understated because for very complex projects the staff would receive assistance from ODOT central official specialists in the environmental or specialty review area. However, because the district would only let to bid one or two very complex projects per year such assistance would be a small part of the district's overall effort. The Ohio DOT relies heavily upon project tracking, frequent coordination meetings and reliance on programmatic agreements to expedite approval of small projects. The district has had a project-delivery rate consistently above 90 percent measured against the month in which projects were scheduled to bid.

Recommendations for Rhode Island

The examples from Vermont, New Hampshire and Maine illustrate that relatively small Northeastern states have developed reliable project-delivery processes. While those states with relatively small programs have achieved reliable project delivery rates so have larger states such as Ohio and Florida that have produced programs in excess of \$2 billion while achieving very high rates of project delivery. The recommendations for RIDOT are based on a synthesis of the practices of these states and basic practices recommended by the Project Management Institute.

First, the report recommends that RIDOT develop an emphatic policy that it will identify a fiscally constrained two year list of projects for the State Transportation Improvement Program and then measure and manage to ensure the projects are delivered on time. The first step taken by the other states when they began to emphasize reliable project development was to adopt a policy and communicate emphatically that reliable project development was a priority. Reliable project delivery provides a department credibility with communities, legislators and the construction industry. Experience shows that reliable project development is a skill that can be learned by an organization. Once ingrained, it becomes like "muscle memory" and is routine to the dozens or hundreds of staff and consultants responsible for meeting the milestones. Reliable project delivery did not come immediately in any agency. Officials in each of the agencies said it took several years of focus but now has become routine.

This report recommends that RIDOT compare its current STIP with a realistic assessment of projects that are under development. With the large amounts spent on consultants, there is likely to be many projects under development that are well advanced in design. The department should identify a realistic two-year list of projects and, after careful review, publish them as a biennial work plan similar to that done in Vermont, New Hampshire, Maine, Ohio, Florida and other states. The published two-year Work Plan then becomes the target against which the subsequent steps are taken.

Presently, RIDOT cannot say what its project-delivery rate is. This is because it lacks a baseline of what projects it wants to construct and when. The Work Plan derived from an updated STIP will provide that baseline.

Second, RIDOT should conduct monthly project-tracking meetings in which a broad cross-section of the department staff reviews activities necessary to deliver the two-year program on time. These meetings should be inclusive of all disciplines that could identify problems and help resolve them to keep projects on track. These meetings should be given high priority, be chaired by a high-profile executive and be documented to ensure they are effective. It is important to review all projects in the two-year STIP and not only those scheduled for bid in the next quarter as is done currently. Also, the meetings should document changes in schedule, scope and cost to ensure accountability and to ensure the Work Plan is up to date.

Common in all the agencies studied are monthly, high-profile project-review meetings. These need to be inclusive with project managers, environmental staff, right-of-way staff, utility specialists and construction staff. It would greatly assist this effort to have staff dedicated to organizing and documenting the results of these meetings. The agenda would focus upon the two-year program and the status of each project and what is needed to keep it on schedule. Experience states that early meetings may be chaotic, disorganized and sometimes argumentative. At first, data regarding project cost, schedule and scope will be unreliable. Each meeting will reveal another set of obstacles or more poor data that will cause the schedule to churn. However, experience also shows that over time, the true status of projects is clarified and gradually the teams develop more accurate summaries of project status. To emphasize the importance of these meetings, they should be chaired by a high-level executive. Agendas should be formalized, minutes taken and follow-up action documented.

Third, the department should “clean house” in the Project Management Portal and insist that projects that are not actively under development be removed and that active projects be updated with realistic schedules and budgets. The PMP currently does not serve an effective department-wide function of informing multiple participants of realistic schedules and budgets. For project tracking and coordination across work units to be effective, everyone needs to literally be on the same page. Interviews with RIDOT staff revealed that the PMP is not viewed as reliable. Because the system is not used department-wide, much of its data is inaccurate. Access to it is limited to some staff and the production of ad hoc reports of projects' status is not possible. The monthly progress meetings and the tracking of project schedules will not be effective until a common database of projects with accurate costs, scopes and schedules is available. Presently, many staff keep their own spreadsheets and lists of project status, most of which are not shared. RIDOT will not be able to effectively track the status of hundreds of projects under development for the next few years if its project database is not accurate and credible. Closely related to the first two steps, is the need to update the status of all the projects in the PMP and to remove ones that are not actively under development.

This is an interim step pending a larger effort to develop a more effective project-tracking system discussed below.

Fourth, project-development staff should be organized in cross-disciplinary teams of engineers, planners, resource agency liaisons, utility specialists and right-of-way staff. This organization could be done by changing the table of organization or through a “matrixed” structure. In a matrix structure, personnel may still report to different supervisors but are expected to work “horizontally” on dedicated teams. An example could be the formation of three bridge teams each with two to three engineers, an environmental specialist, a utility specialist and a right-of-way specialist. Each team would be assigned a number of projects, say five per year for the next four years. Three such teams would appear to be adequate for the size of the bridge program RIDOT expects to deliver for the next five years. The formation of teams and the assignment of project-delivery duties to them assigns “owners” to each project and provides each team with the multi-disciplinary set of skills needed to deliver the projects. The perspectives of the different disciplines also keeps the teams focused on all the different types of risks and issues that must be addressed. As an executive of the Maine DOT said, “We don’t have a lot of silos around here.” He viewed the matrix approach as essential for identifying the many different types of problems that can affect projects particularly in the environmental, utility and rights-of-way areas. It is common for DOT staff to say that “the engineering is easy” meaning that design problems seldom are the cause of project delays. Instead, the external factors of utility relocations, environmental permits and right-of-way are the most common cause of delay and cost increases. The formation of teams acknowledges upfront that the path to success lies in addressing all the disciplines that are needed to ensure reliable achievement of project delivery.

Each team should be given responsibility for a number of projects and be expected to identify key milestones and activities and work cooperatively to ensure projects are let to bid on schedule. These teams could be given programmatic or geographic focus for greater efficiency. The teams could be divided into ones focusing on bridge preservation projects, bridge replacement/rehabilitation projects, urban paving and street-scape projects, traffic/operations projects and so forth. Or they could be divided geographically. Vermont “batches” its bridges geographically to create efficiency in field reviews. Staff can travel to one region and conduct multiple reviews. The formation of teams and the assignment of them to types of projects or to regions of the state can create experience and efficiencies essential to success.

Fifth, high-profile monthly progress meetings with resource agencies should be instituted. Resource agency approval will be critical to the increased bridge, pavement and drainage-maintenance activities. Four organizations were reviewed for this analysis. All rely on regular coordination meetings and standardized programmatic agreements with resource agencies to improve project-development reliability.

RIDOT currently coordinates with the resource agencies on a regular basis. This recommendation calls for a marginal increase in the level of effort and stature to the coordination. Having high-level RIDOT officials meeting regularly with high-level resource agency personnel to address issues is essential to a partnering approach. In the four agencies studied, none sought a confrontational relationship with the resource agencies. To the contrary, they viewed the resource agencies as critical stakeholders who hold the key to their success. In interviews with RIDOT, those who were closest to the resource agencies expressed the greatest doubt about RIDOT’s ability to deliver a larger construction program because of resource agency issues.

Sixth, RIDOT should form a unit in the asset management division that plans, programs and scopes ALL projects. RIDOT staff repeatedly describe project scopes and schedules changing without coordina-

tion with other parties. Several said it was difficult to even determine the current scope of a project without personally contacting the project manager. Scope issues included elements such as pavement markings, signage and traffic control devices being added to project scopes while those same elements were in design in other projects. Communities requesting additional amenities were frequently cited as issues that drive up project cost and delay delivery. A lack of internal coordination left other units unclear of project work limits and unable to coordinate schedules of projects occurring in close proximity.

A centralized project scoping unit is needed that approves, documents and monitors project scopes. This unit should be based in an asset management division but have significant input from all the engineering disciplines. Linking the programming function to an asset management division can increase the data-driven approach to selecting projects. Project selection should be driven by asset conditions and they should be scoped to achieve the asset-condition targets.

This unit would serve as the “funnel” through which suggested projects are sorted, realistic scopes identified, schedules and budgets set. No change to cost, scope or schedule should be approved without coordination with this unit that serves as the “traffic cop” for keeping the STIP fiscally constrained and realistic. This unit should operate cooperatively with other divisions to ensure that subject matter experts from structures, safety/traffic, roadway and maintenance have input into project-selection priorities and project scopes. However, this unit would function as the “keeper of the STIP” to ensure that project scopes, schedules, and budgets do not churn without coordination and approval by senior management. The reports generated by this unit could inform all units about the elements within projects, their expected schedules and their budget. Major changes should not be made unless agreed to by the scoping group and then the changes documented to inform all other parties. A work unit of four to five people is anticipated for this group. They would be primarily coordinators and facilitators who serve as gatekeepers to projects that enter the project-development process.

Seventh, planning staff should complete scoping reports for complex projects before they enter design. Common in Maine, Vermont and Ohio is a longer, more formal preliminary development phase that clarifies project scopes before the projects are approved for final design. A major reason for reliable completion of project milestones is a lack of surprises. When projects enter design without extensive coordination the chance of surprises, delays and additional costs increase. Ohio has a formal and stratified preliminary development phase with more complexity for major projects and a more perfunctory preliminary development phase for less complex ones. Maine programs projects only for preliminary engineering until it is confident of the project scope, budget and environmental permitting requirements. Only then, are they scheduled for final design. The Vermont scoping reports bring the resource agencies, community and internal department units into agreement before final design begins.

A common complaint about relying on preliminary scoping reports is that some issues such as quantities of cuts and fills or right-of-way takes are not known until late in the design process. Although true, agencies such as Ohio, Vermont and Maine reduce the impact of delays by more constant coordination with the resource agencies and other stakeholders throughout the design process.

For bridge projects, this scoping report would include development of a rehabilitation or replacement recommendation, assessment of the utility, right-of-way and environmental complexity, initial public involvement and estimated budget and schedule. For new structures it also would include a type, size and estimate (TS&E). For roadway projects, the scoping study would determine line, grade, typical section, construction and right of limits and importantly community involvement regarding project scope elements such as streetscapes and sidewalks. Complex projects would be programmed initially in the

STIP only for this planning phase. As the planning phase and scoping report is completed and project scope, cost and complexity are clarified, then the project would be programmed for final development and construction. Projects in this planning phase would be “in the bull pen” waiting matriculation into the financially constrained STIP. From that point, their milestones, scope and costs would be closely tracked through to their construction. Simple projects such as bridge preservation or pavement marking projects would skip the planning report phase and proceed from programming to project development.

Eighth, RIDOT should conduct in-depth benchmarking with staff at the Vermont Agency of Transportation, the New Hampshire Department of Transportation and the Maine Department of Transportation to further refine the staff-comparison information in this analysis. A comparable district within the Ohio Department of Transportation also may provide promising insights because it is similar in size to RIDOT. This benchmarking is recommended because these four organizations face similar challenges to RIDOT but all have attained 80 percent or better achievement of project-development milestones for several years, in some cases for nearly two decades.

Initially it appears that RIDOT may be understaffed in the bridge and environmental areas. In the environmental area it has only 50 percent of the staff of Maine or New Hampshire. It appears to have eight to ten fewer bridge staff than the other states, **although those states have many more structures but not substantially more bridge area.**

However, the large size of the RIDOT consultant program makes head-to-head staff comparisons difficult. Unless the other agencies’ published numbers are wrong, it appears they spend far less on consultants than does RIDOT, although their staffs are not commensurately larger. New Hampshire’s project-development staff is 33 percent larger than RIDOT’s but RIDOT’s consultant billings are 300 percent larger proportionally than New Hampshire’s.

Further complicating RIDOT’s comparison to peers is its co-mingling of duties. It appears that no one at RIDOT is a pure project manager. They manage projects when they can around other duties such as handling access permits, truck size and weight permits or responding to public enquiries. Although difficult to quantify, this diversion from project management must lead to distractions and inefficiencies. A key first step is for RIDOT to determine how many personnel are needed for those non-project tasks and determine if those tasks can be staffed with current personnel, leaving the others to focus upon managing projects. Also, the department must determine if the “jack of all trades” interests of staff serve the best interest of the department.

This report recommends that RIDOT staff speak directly and at length with their counterparts in Vermont, New Hampshire, Maine and possibly Ohio. These apparent differences in the size of the consultant programs, productivity per staff, internal management processes and size of key staffs such as for environmental permitting should be understood in more detail. Also, the lessons learned from the other states will carry more weight if learned from peers rather than from a consultant’s report.

Ninth, it is the recommendation of this report that RIDOT segregate duties and appoint project-development staff to manage development of specific projects with clear expectations for achieving project-development milestones. Non-project-development duties such as issuing permits should be assigned to individuals without project-management responsibilities. To be frank, RIDOT has among the worst bridge conditions in the country. It is hard to identify a higher and better use of engineering talent than to deliver a shelf of bridge projects and have them ready for any financial windfall that may arise. Bridge emergencies plague the department’s project-development schedule. Having plans ready for the

structures that are in the worst condition can head off unexpected emergencies and demonstrate that the department is ready to deliver if additional money is provided.

Tenth, this report recommends creating a small “strike force” to handle emergencies. Staff report that emergency projects, particularly bridge ones, arise frequently and churn their priorities. Having a dedicated team whose job it is to handle emergencies could buffer other project-development staff to focus on delivering the planned program. A lack of staffing has prevented this long-recommended unit from being formed.

Eleventh, RIDOT should start development of a new project management system. The PMP is wholly inadequate for managing a complex, modern transportation program. A new management system should be developed to parallel the project-management process RIDOT identifies. The form of the system should follow the function that RIDOT wants for its project development process. For simple projects, RIDOT may want only a handful of project milestones. For more complex projects, it will want additional milestones. And for major projects, it will need many milestones reflecting the complexity of the projects. The management system should parallel these project-development rules and provide the data and reports to allow the department to aggregate the totality of its program and how it is tracking while allowing a manager to drill down to each milestone on each project. The program should be geo-located and tied to a data warehouse. This functionally would allow it to be linked to legacy databases and systems and allow the system to map projects and display project information spatially.

Managing the thousands of milestones that will be needed for reliable delivery of a \$200 million annual construction program will require accurate, consistent data. Such data are not now produced by the PMP.

Project Development Conclusion

RIDOT needs better project-management processes and probably up to 20 additional staff in the areas of structures, environmental permitting and project management. However, having additional staff while retaining the large volume of consultant billings would put RIDOT’s total project-development costs well above its peers. RIDOT should embark on a series of benchmarking meetings with its peers and understand how it can emulate their project-development successes while also assessing its need for such large consultant billings.

Comparative Analysis of the Rhode Island DOT Materials Staffing Levels

Summary and Conclusion

Senior management at the Rhode Island Department of Transportation (RIDOT) requested that an analysis be conducted of the staffing levels of the materials unit and compared to those of selected peer states. A comparison was conducted but no definitive conclusion could be reached because of the differences in how other states staff materials testing units and use consultant services. Superficially, RIDOT is more heavily staffed in the materials division than are peer states. However, the peer states rely more heavily on consultants and construction staff for some testing functions, which RIDOT does not. RIDOT's materials division also includes research, product evaluation and pavement preservation, which are handled by other divisions in other states. The other states also rely on contractor-certified testing, something the Federal Highway Administration (FHWA) will not allow in Rhode Island. Although the other states' expenditures on consultants are not easily obtained, it appears that when all costs are considered RIDOT's inspection costs probably are not higher than the peer states'.

Analysis

When narrowly defined, RIDOT may or may not have more personnel in the "materials" area than peer states based on a per dollar of construction basis. It has 53 staff in the materials area compared to 30 for the Vermont Agency for Transportation and 25 for the New Hampshire DOT. However, in New Hampshire and Vermont field testing and precast/prestress testing is performed by construction staff who are not included in their materials staffing numbers. Also, those states have much larger geotechnical staffs who perform some functions conducted by the RIDOT materials staff.

Also, the other states regularly augment staff with consultants during peak summer construction periods which RIDOT does not do. The other states could not produce a cost estimate of their consultant usage because those costs are embedded within contractors' bids and other spending categories that could not be readily summarized. However, a Vermont testing official estimated that his staff are augmented with 30 consultants in the summer construction season. Vermont could not produce accurate costs for inspection services because they are spread between consultant costs, and some costs imbedded in contractors' bids.

In RIDOT also, some testing and acceptance functions such as concrete field testing that are done by the "construction" units in other states are performed by "materials" staff in RIDOT. To make an accurate comparison a much more in-depth task-by-task comparison would be needed to make a complete "apples to apples" comparison.

Staff in the RIDOT materials division perform some tasks such as geotechnical assistance, research, product evaluation and pavement preservation activities that are handled by other units in the other states. Because of RIDOT's small size, it lacks the number of divisions, such as a soils and geotechnical division, and a Pavement Preservation division, which are common in other states. Those duties are included in the RIDOT materials staff functions and are co-mingled with their materials duties.

RIDOT does not use contractor test results for acceptance like some other states based upon insistence from the Federal Highway Administration and RIDOT's own policies. The approach is based on experience that the state's contractors need close oversight to ensure compliance with specifications and materials standards. Some of these functions that RIDOT performs that other states do not include:

- RIDOT has an inspector in every asphalt and concrete plant for each production run when the plants are producing materials for RIDOT while other states may visit plants only on a random, weekly basis.
- Other states sometimes rely on consultants to inspect asphalt and concrete plans, which RIDOT does not allow.
- RIDOT staff also perform detailed plan reviews related not only to materials but construction and specification writing, which in other states may be conducted by specialists in the design section. Again, because of its small size, RIDOT materials specialists provide comments on pavement designs and other issues that in larger states are handled by design specialists
- RIDOT does not accept contractor test results, which are accepted in some states.
- The relatively small size of RIDOT and its construction program creates proportionately higher overhead for fixed costs, such as operating a laboratory.
- The relatively small RIDOT projects do not create economies of scale for inspection and testing. Each small project needs testing which creates higher per-project testing costs. In states with more large projects, the per-dollar cost of testing can be lower.

Every state reviewed has different sampling rates, which complicates testing comparisons. RIDOT tests 1 of every 600 tons of asphalt or per production run, New Hampshire one of every 750 tons and Ohio one of every 500 tons. There are hundreds of materials sampling and testing procedures and each would need to be compared to make a thorough comparison. However, the RIDOT testing rates are not much different, and are in fact lower, than in some states.

The Table 10 highlights the major comparisons between RIDOT and the peer states.

Table 10 Selected comparative data regarding materials testing.

	5 Year Average Program	Material Staff	Geotech Staff	Consultant Use	Inspect Plants	Use of Contractor Tests
Rhode Island	\$150,004,996	53*	0	Very Low	Continuous	None
Vermont	\$243,096,381	30	13	High	Continuous	High
New Hampshire	\$192,918,154	27	26	High	Continuous	Low
Maine	\$283,780,000	36	25**	Low	Spot Checks	Low
Ohio District 7	\$160,869,536	18	2	Moderate	Spot Checks	High
ODOT	\$1,773,960,372	135	18	High	Spot Checks	High
* Does not Include 22 Vacancies						
** Approximate						

Another significant difference is that Vermont does not test materials with its staff on fast-tracked design/build projects which removes tens of millions of dollars of bridge projects from more in-depth testing requirements. Vermont uses contractor-supplied test results for acceptance, which is less labor intensive, for design/build projects. Also, many of the design/build projects use pre-cast components, which are tested at the plant and which lower testing requirements. RIDOT does not use design/build frequently.

New Hampshire has a smaller staff but tests such as asphalt density core tests that are done by RIDOT staff are done by contractors in New Hampshire and sent to independent laboratories for certification. In addition New Hampshire DOT uses construction staff for ready-mix concrete and other testing on-site. The New Hampshire DOT also has three standing on-call contracts for other testing support such as testing of pre-cast products which are cast out of state. RIDOT staff believe the consultant inspection of pre-cast testing to be inadequate. It was the subject of a FHWA inquiry when a precast item in another state was supposed to have reinforcing steel, but did not. New Hampshire also has a separate geotechnical unit of 26 people, while Rhode Island has one person in the design section and one in materials who provide geotechnical advice as needed. The New Hampshire materials staff don't conduct plan reviews which they do in Rhode Island. The New Hampshire staff said they would be reluctant to compare their overall level of effort for testing against Rhode Island's because of the differences in how the two states rely on consultant assistance.

The Ohio DOT has substantially lower staffing levels but it relies heavily upon contractor-supplied testing. Ohio also has a flexible inspection and testing staff. Highway technicians can be trained in inspection and will flex over to inspection and testing when construction programs are high. When the construction program in a district or county is light, they will flex back to maintenance activities or plowing snow. Such practices are not permitted under RIDOT's labor agreements.

A significant consideration in the RIDOT approach to testing is the Federal Highway Administration's insistence that the state not relax inspection and testing processes. Staff and FHWA have anecdotal examples of contractors providing substandard materials on RIDOT projects when inspectors were not present or were untrained, and on non-RIDOT projects when inspection was not provided. FHWA and RIDOT materials division have reduced testing frequencies in many areas in recent years and believe that testing personnel are understaffed due to the number of projects and plants that need to be covered. FHWA and RIDOT report that during the busy construction season, materials staff must cover several projects simultaneously and it is convinced that contractors will cut corners if inspectors are not present. The FHWA Rhode Island Division does not support a move toward using contractor test results for acceptance.

RIDOT staff contend their testing and acceptance processes result in longer-lasting pavements. They cite the 15+-year life of high-volume routes' surface courses and more than 25+ year life for low-volume roadways as evidence that the higher standards save money by providing longer service lives for materials, especially for pavements.

Conclusion

Although exact comparisons are difficult because of the differences in how states staff and test materials, it does **not** appear that RIDOT's overall level of effort on testing is excessive or the materials division overstaffed. During peak construction periods the testing personnel may be understaffed and unable to serve all projects to the extent desired by FHWA. This may be particularly true for pavement projects and geotechnical applications.

Although RIDOT does not allow contractor test results for acceptance as some states do, the RIDOT position is strongly endorsed by FHWA, whose staff say they will not allow it in Rhode Island. FHWA believes it has seen contractors attempt to use substandard materials and will not support a shift to contractor acceptance testing. A shift to contractor acceptance testing is not intended to be used to reduce state staffing per FHWA detailed in the document, "Optimal Procedures for Quality Assurance Specifications."

RIDOT relies on staff to test nearly all materials while other states rely more heavily on consultants. The consultant costs for the other states could not be isolated and were often embedded in contractors' prices. RIDOT materials staff insist consultant costs are 20 percent higher than staff costs, and that consultant quality is weak in the materials testing area.

RIDOT's small size also causes its materials staff to conduct some activities that are performed in other division in peer states. These functions include plan review, geotechnical consultation, specification writing and management of a pavement preservation program. Although exact "apples to apples" comparisons were not possible without the peer states expending considerable effort to isolate all testing costs, it does not appear that RIDOT's testing processes are excessive.

Also, unlike the project-development process, for materials testing there are clear national protocols which are accepted by FHWA and AASHTO. RIDOT follows those nationally recognized procedures and its testing frequencies do not appear to exceed them.

¹ Tri-State Performance Measures Report accessed at http://vtransengineering.vermont.gov/sites/aot_program_development/files/documents/publications/2013%20Tri-State%20Report.pdf p. 3