

Committee Findings and Recommendations

Department of Transportation Project Delivery Process: RBA Pilot Project Study 2010

Approved December 16, 2010

Legislative Program Review
& Investigations Committee

Introduction

DOT PROJECT DELIVERY: RBA PILOT PROJECT STUDY 2010

In June 2010, the program review committee authorized its second pilot study using Results-Based Accountability (RBA) principles – an assessment of project delivery implementation by the state Department of Transportation (DOT). The study had two main purposes: further testing of RBA as a tool for legislative oversight work; and using the RBA approach to find to ways expedite and improve the department’s delivery of transportation system improvements from initiation of design through completion.

The RBA evaluation method requires analysis of performance at two levels of accountability: program, which focuses on outcomes for customers; and population, which focuses on broad, community quality of life results. Applying this approach to DOT project delivery proved challenging. Transportation project delivery is a multi-phase process, carried out across all six department bureaus for many different types of improvements. Rather than a discrete program, it is a major function that contributes to a wide range of population-level results desired from the state’s transportation system.

Given this complexity, it was not possible to capture all aspects of DOT project delivery performance within the study timeframe. The program review staff was able to use RBA principles to develop an accountability framework for transportation project delivery that links effective performance of this process with the state’s high level transportation system goals. The framework also: a) clearly articulates the desired population results to which DOT project delivery contributes; and b) establishes key indicators for tracking progress that the major partners, including the state transportation department, together are making the toward those results.

Further refinement of this RBA framework, and more and better indicator data, are needed. However, the program review committee believes the framework can serve as a starting place for guiding better performance management at DOT and more data-driven policy and resource allocation decisions at the legislature.

At the program performance level, PRI staff analysis of DOT project delivery centered on design and construction activities carried out by the Bureau of Engineering and Construction (BEC). While the bulk of the bureau’s project delivery work involves the highway system (roads and bridges, both state and local), it also oversees a number of public transportation and aviation bureau capital construction projects.

Design and construction work carried out by other bureaus (e.g., rail electrification upgrades), or any improvements accomplished through capital acquisitions (e.g., new equipment like rail cars, buses), were not examined as part of this assessment. PRI committee findings and recommendations about construction project delivery practices, in most instances, are generalizable to capital improvements implemented by any bureau.

PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010: STAFF FINDINGS AND RECOMMENDATIONS

Historically, as PRI staff analysis presented later shows, the majority of the department's construction projects have not met original schedules or stayed within original budgets. The department is well aware of its performance problems and has been taking positive steps to begin to find solutions. In recent years, DOT has instituted many management reforms, often in response to critical outside reviews, that have improved its accountability and transparency. The department seems to have adopted most best practices used by other state agencies recognized as leaders in timely, cost-effective transportation project delivery.

However, changes in structure, policies, and procedures to try to increase project delivery efficiency and effectiveness were continual during the PRI study. DOT's project delivery process, and the management systems needed to monitor how well it is being implemented, are still evolving. It is too early to tell completely what impact changes made to date are having on the department's project delivery results.

The committee's RBA-based performance assessment, however, did reveal several overarching areas of concern for DOT project delivery success. These include: effective control of project initiation; still-developing quality assurance functions; inefficient coordination of environmental matters; and the inability to use alternative contracting. Further, high-level project management information systems are inadequate.

In general, top managers responsible for transportation project delivery lack the performance data needed to determine what is working well, what is not, and how best to make improvements. Project management during the design phase is particularly weak, yet timely, high quality project documents and accurate estimates are the foundation for successful construction completion.

PRI committee recommendations for addressing these challenges, in a number of cases, are focused on low and no cost ways to support and expand current positive initiatives within the department. The goals of all the proposed improvements are to expedite delivery of needed transportation improvements while increasing cost-effectiveness and maintaining safety and quality. In addition, committee recommendations are intended to strengthen overall performance management capacity and accountability within DOT.

Report Organization

This report contains two main parts. The first part presents an RBA framework for DOT project delivery, and summarizes, in a report card format, the committee's assessment of progress on achieving the population-level results wanted from the state transportation system. An RBA program report card that evaluates the department's construction project delivery performance is provided in the second part. Both report cards use the following symbols:

- + Indicates a positive trend
- Indicates negative trend
- ↔ Indicates little or no change over time or mixed results
- ? Progress cannot be determined at present

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Framework and population-level results. An RBA framework is intended to place major state programs and services within the larger context of the broad, statewide goals to which they contribute. As developed for program review committee purposes, an RBA accountability framework outlines in one page:

- the desired quality of life results, in the form of a population-level results statement, to which a system, agency, or program makes a significant contribution;
- the key population-level indicators for tracking the state’s progress toward those results;
- all the partners that share responsibility for achieving the results statement;
- the main statewide strategies and major state agency roles and programs established to achieve the results statement; and
- the key measures for assessing the performance of contributing major programs, in terms of end results (outcomes) for the clients they serve.

The framework developed by committee staff for this study, which can be used to guide further data collection and analysis about results, is presented next (see page 5). A key to the acronyms is included in the framework is provided at the end of this introduction.

This one-page RBA framework is followed by a report card based on current key indicator data. (More details on each indicator are provided in Appendix A.) Progress being made is briefly described, and several committee proposals for improving accountability at the population level are presented.

Program report card performance assessment. The purpose of an RBA program performance report card is to provide a concise, data-driven assessment of the effectiveness of a major program, function, agency, or system. The main components of an RBA-based assessment of program-level performance are:

- output and outcome performance data, presented in charts, with trends and baselines identified ,when possible;
- analysis of the reasons for current performance (i.e., what is called the “story behind the data”); and
- discussion of what can be done, particularly in low or no cost ways, to improve performance in measurable ways (i.e., actions to “turn the curve”).

The program review committee report card on DOT project delivery performance is divided into three sections (beginning on page 10). The first section provides brief background information about the department and its project delivery process as context for the discussion of performance trends.

The second section summarizes, in a report card chart, agency performance on four key measures of the successful transportation project delivery (as identified at the bottom of the study’s RBA framework). A discussion of overarching issues related to DOT project delivery

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

performance, and PRI committee recommendations for addressing them, follows that report card performance summary.

The third section of the program report card highlights information developed by PRI to begin to assess DOT project delivery based on each of the three main RBA program performance questions:

- How Much Did We Do? (i.e., outputs in terms of quantity);
- How Well Did We Do It? (i.e., outputs in terms of quality); and
- Is Anyone Better Off? (i.e., outcomes in terms of results for customers).

Specific findings about process efficiency and effectiveness, and corrective actions proposed by the committee, are included in the discussions of the story behind the data and actions to turn the curve related to each of these questions.

Acronyms Used in RBA Framework for DOT Project Delivery	
• RPOs	Regional Planning Organizations
<i>State Agencies</i>	
• DAS	Dept. of Administrative Services
• DEP	Dept. of Environmental Protection
• DECD	Dept. of Economic and Community Development
• DMV	Dept. of Motor Vehicles
• DPS	Dept. of Public Safety
• OPM	Office of Policy and Management
• SHPO	State Historic Preservation Office
<i>Federal Agencies</i>	
• FAA	Federal Aviation Administration
• FHWA	Federal Highway Administration
• FRA	Federal Rail Administration
• FTA	Federal Transit Administration
• NHTSA	National Highway Traffic Safety Administration
• U.S. ACE	U.S. Army Corps of Engineers
• U.S. EPA	U.S. Environmental Protection Agency
• U.S. FWA	U.S. Fish and Wildlife Administration
<i>Advisory Groups</i>	
• TSB	Transportation Strategy Board
• BBD	Bradley (International Airport) Board of Directors
• BICAB	Bradley International Community Advisory Board
• SIMFT	Statewide Incident Management Task Force
• CPTC	Connecticut Public Transportation Commission
• CRCC	Connecticut Rail Commuter Council
• CMC	Connecticut Maritime Commission

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

RESULTS BASED ACCOUNTABILITY FRAMEWORK: DOT PROJECT DELIVERY

POPULATION LEVEL ACCOUNTABILITY

QUALITY OF LIFE RESULTS STATEMENT:

“Connecticut’s transportation system is maintained in a state of good repair and allows for safe, efficient movement of people and goods, livable communities, and sustainable growth.”

RESULTS STATEMENT INDICATORS OF PROGRESS (POPULATION LEVEL)

Indicator 1: Safety <i>Highway Fatality Rate</i>	Indicator 2: Efficiency <i>Road Congestion</i>	Indicator 3: State of Good Repair <i>Infrastructure Condition</i>	Indicator 4: Environmental Quality <i>Reduced Air Pollution</i>	Indicator 5 Economic Vitality <i>Jobs Created</i>
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PARTNERS CONTRIBUTING TO RESULTS STATEMENT

Connecticut General Assembly Congress Other States in Region RPOs and Municipalities (Local Officials) Transit Operators Advisory Groups (TSB, BBD, BICAB, SIMTF, CPTC, CRCC, CMC)	Governor State Agencies: DOT; DAS; DEP; DECD; DMV; DPS; OPM; SHPO Federal Agencies: US ACE; US DOT (FAA, FHWA, FRA, FTA, NHTSA); US EPA; US FWA Agency Employees (and Unions)	Construction Industry Design/Engineering Industry Business Community Airlines and Rail Providers Freight Providers and Users Port Operators and Users Traveling Public
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MAIN STATE STRATEGIES FOR ACHIEVING RESULTS STATEMENT

Establish and Enforce Safety Standards	Preserve Existing Infrastructure & Capacity	Maximize Operating Efficiency	Reduce Congestion/ Increase Choices & Connections	Follow Sustainable Practices & Increase Livability	Promote Public Participation & Accountability
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AGENCY AND PROGRAM LEVEL ACCOUNTABILITY

DOT’S CONTRIBUTION TO DESIRED RESULT: MAIN ROLES AND RELATED MAJOR PROGRAMS

Reduce injuries, fatalities, safety risks	Plan and manage resources to meet public needs, achieve goals	Implement system preservation/capacity improvement programs (all modes)	Operate or oversee facilities/services that move people and goods	Ensure public accountability and transparency
<ul style="list-style-type: none"> - National design standards for highways, bridges, rail, airport safety - Injury/fatality data & research to inform safety efforts - Eliminate hazards, snow and ice removal - Airport & port security - Various targeted efforts such as: <ul style="list-style-type: none"> o work zone safety o seat belt use o impaired/distracted driving o rail crossings o motorcycle safety o local enforcement support 	<ul style="list-style-type: none"> - Inventory, track, evaluate system conditions - Master/long-range plans, STIP, SIP, other statewide planning efforts - Context Sensitive Solution practices - Environmental assessments, mitigations/ accommodations - Asset management/life cycle costing ▪ Constrained capital planning (5-yr. capital plan) 	<ul style="list-style-type: none"> - Inspect current infrastructure - Conduct preventative maintenance, routine repairs (e.g., paving, upgrades) - Deliver capital improvements (e.g., major rehabilitation, renewal, new or expanded capacity) <ul style="list-style-type: none"> o Design/preliminary engineering o Construction administration project management ▪ Hire outside resources for as needed (vendors, contractors, design/other consultants ▪ Acquire property, equipment ▪ Research/test materials, equipment, techniques 	<ul style="list-style-type: none"> - State and municipal airports - Ports/ferries - Rail system - Bus system - Taxi services - Ridesharing program - Bikeways/walkways - Highway/bridge operations (e.g., snow/ice removal, mowing, signs, motorist assistance) 	<ul style="list-style-type: none"> - Agencywide quality assurance/control (QA/QC) efforts - Communication and outreach <ul style="list-style-type: none"> o Public participation process o Stakeholders meetings - Publications (plans, reports, website) - Information technology - Centralized business processes (e.g., contracting, budgeting, funding, accounting, and fiscal reporting)

KEY PROGRAM PERFORMANCE MEASURES:

**DOT PROJECT DELIVERY: IMPLEMENTATION PHASE FOR SYSTEM IMPROVEMENTS
(from project design through completion)**

- | | |
|--|--|
| <ul style="list-style-type: none"> • On schedule • In compliance with relevant standards and requirements (e.g., work quality, environmental, financial) | <ul style="list-style-type: none"> • On budget • Intended project benefits achieved (e.g., improved safety, increased mobility, reduced pollution, sustainable growth) |
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**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

RESULTS STATEMENT PERFORMANCE:		
POPULATION LEVEL ACCOUNTABILITY SUMMARY		
<i>“Connecticut’s transportation system is maintained in a state of good repair and allows for safe, efficient movement of people and goods, livable communities, and sustainable growth.”</i>		
HOW ARE WE DOING?		
<i>Key Indicators</i>	<i>Progress</i>	<i>Most Current Data</i>
1. People travel safely: <i>Deaths due to highway accidents minimized</i>	+	<ul style="list-style-type: none"> Annual highway fatality rate in Connecticut consistently below the national average – 0.83 per 100 million vehicle miles traveled vs. 1.25 nationwide in 2008 Connecticut’s highway fatality rate under the state target (1.00 or less) every year from 2004 through 2008 Using a three-year moving average, which better reflects changes over time in a small number, Connecticut’s highway fatality rate dropped from 0.93 in 2006 to 0.91 in 2008
2. People and goods move efficiently: <i>Highway system travel at or below capacity</i>	↔	<ul style="list-style-type: none"> Congestion on state roads, in terms of the percent of miles approaching or above capacity, remained at about 15% from 2003 to 2009
3. The transportation infrastructure is maintained in a state of good repair: <i>All components of the system in good condition</i>	↔	<ul style="list-style-type: none"> Gradual improvement in the percentage of Connecticut’s national highway system roads (interstates and major state routes) with good ride quality, up from 37% in 2005 to 44% in 2009 (positive) Small decline in percentage of state highway bridges in good condition and slight increase in portion rated poor between 2007 and 2009; given aging infrastructure, number of poor bridges on increase since 1998 (negative) Reliability of state rail service varies with rail vehicle age – three types of vehicles achieving targets for distance between mechanical failures as of 2010 while two types below; reliability dramatically improves with phase-in of fleet replacement program (positive) Reliability of state bus service in terms of miles between road calls declined below target in recent years (FYs 09 and 10) as average age of bus fleet increased (negative) At least 90% of pavement at all state airports rated good or excellent as of January 2010; overall pavement condition goal of 100% good or excellent met at Bradley and three of six general aviation airports (positive)
4. Environmental quality is protected: <i>Air pollution is reduced</i>	?	<ul style="list-style-type: none"> Data related to greenhouse gas emissions from transportation still in development, in accordance with national methodologies, by DOT
5. Economic growth is promoted: <i>New jobs are created</i>	?	<ul style="list-style-type: none"> Only job creation data compiled now is total number of jobs created or sustained as the result of transportation projects funded through federal economic stimulus (ARRA) –16,158 between June 2009 and July 2010

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- *The key indicators and related data for assessing progress in achieving transportation system population-level results were selected with the assistance of DOT policy and planning bureau staff and input from agency top managers. Data for all but the environmental quality indicator currently are collected to some extent by the department as part of its existing performance measurement system.*
- *It is important to note these primary indicators correspond to national performance standards for state transportation agencies that are being developed by the American Association of State Highway and Transportation Officials (AASHTO) and the U.S. Department of Transportation.*
- *Appendix A presents copies of the agency's latest quarterly performance reports related to the indicators for: safety, efficiency, the condition of major components of the transportation system (highways, bridges, rail service, bus service, and airports), and economic growth in terms of jobs created from transportation projects receiving federal stimulus funding.*

THE STORY BEHIND THE DATA

As indicated above, how well the state is doing in achieving the quality of life results desired for its transportation system is unclear. Connecticut continues to make improvements in the area of safety, at least in terms of highway travel. However, there appears to be little progress in system efficiency, as measured by road congestion, and the state of repair of the current infrastructure is mixed. Trends in environmental quality related to the transportation system, as indicated by reductions in air pollution, cannot be determined at this time. The full impact of transportation system investments on the state's economy also is not known.

Existing key indicator data, for the most part, are too limited to draw many conclusions about systemwide performance and progress. The many shortcomings of current transportation system indicators and corresponding data sources were first noted in the staff interim report.

Each primary indicator reflects only selected aspects of results desired from a high quality, efficient, and effective state transportation system. Two of the three indicators for which there are data just relate state highway systems. Further, it is difficult to capture results for a multimodal transportation network because no composite indices exist for any of the indicators. Finally, much of the indicator information is lagging, sometimes by as much as two years.

Despite the many data limitations, the key indicator areas included in the framework represent high-level performance information state transportation agencies currently produce and consistently report for federal funding purposes. They also are the basis for work on national performance standards for state transportation agencies being carried out by the American Association of State Highway and Transportation Officials (AASHTO) in partnership with the U.S. Department of Transportation. The limitations of current indicators are well recognized by AASHTO and the federal government. Research to refine and develop better primary measures is ongoing at the national and state level. There also are plans to develop many second and third tier measures to provide supplemental information about transportation system performance in all areas and at many levels.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

The indicators included in the RBA Framework for this study are a good start at establishing high level comparative accountability measures. They are needed to begin to understand the overall outcomes from the significant state resources allocated to achieving the results statement. PRI staff did not develop any estimate of all state funding resources applied to achieving this results statement; however, expenditures just of the Connecticut Department of Transportation since FY 04 have totaled over \$1 billion per year.

It is important to keep in mind that much of what drives the key indicators are influences beyond the control of DOT or any single state agency. Further, while DOT has a leadership role concerning the safety, efficiency, and condition of the state's transportation network, other state agencies have the primary role for matters concerning the environment (Department of Environmental Protection) and economic development (Department of Community and Economic Development).

In recent years, DOT has undertaken a number of management efforts to make better progress toward state transportation system goals. As discussed in more detail in the next section, the department adopted a constrained five-year capital plan last year aimed at taking a more strategic approach to investing state resources for improving all components of the system. Strategies for preserving current infrastructure and enhancing system efficiency, while ensuring safety and quality, are addressed in the statutorily required DOT biennial master plan, the long-term state transportation plan prepared for the federal government, and the various federally required annual transportation improvement plans.

The department, in cooperation with other agencies, engages in several other planning efforts focused on specific indicator areas. For example, DOT, with the Departments of Public Safety and Motor Vehicles, develops the federally required state highway safety improvement plan each year. The department also works with the Department of Environmental Protection to prepare the state implementation plan for meeting national air quality standards required by the federal environmental agency.

In addition to these DOT efforts, under state law, the Transportation Strategy Board (TSB) is responsible for developing, recommending, and periodically revising a transportation strategy for the entire state system. The board's strategy must include specific tactics and approaches for: stimulating sustainable economic growth; enhancing the quality of life of state residents; easing mobility of people and goods; improving access and connectivity; adequately maintaining infrastructure and equipment; and enforcing safety and security. It also must include the board's projection of required capital investments and operating costs, and recommended funding sources, for implementing the strategy. TSB is in the process of developing its latest revised strategy. For the first time, it is being prepared with the help of DOT planning bureau staff.

Taken together, the various planning efforts of the department and the board outline what the state is doing to meet its transportation goals and what can be done better. However, none of the present planning documents or processes have produced a comprehensive long term strategy for achieving the desired results statement. Further, there is no ongoing, systematic way to track progress. Having multiple plans with divergent purposes for the state transportation system dilutes accountability.

WHAT WILL IT TAKE TO DO BETTER?

DOT has demonstrated a new commitment to performance measurement and management for results. There also has been positive development toward stronger integration of strategic and operational responsibilities in the latest Transportation Strategy Board planning process. However, program review committee believes additional steps are needed to facilitate and promote population-level accountability.

The following recommendations are intended to focus responsibility for, and clarify the desired results of, the state transportation system. In addition, they should help state policymakers and agency managers better determine where additional or modified efforts are needed to make progress in achieving transportation system outcomes for all Connecticut residents. PRI recommends:

- **Amend existing statutory language to replace the department's current master plan requirement with an annual transportation system progress reporting process based on Results-Based Accountability principles. Each year, by January 15th, the Department of Transportation shall submit to the legislature, and publish on its website, an RBA framework that includes the quality of life results statement for the state transportation system and an assessment of progress toward those results based on key indicators.**
- **The framework, results statement, indicators, and annual progress reports should be prepared jointly with the Transportation Strategy Board, with input from major partners and stakeholder groups.**
- **As part of an RBA data development agenda, DOT, in consultation with its partners, should review the adequacy of current indicators and related data resources for assessing progress toward desired results for the state transportation system. Together, they should determine whether there may be more appropriate alternatives for primary indicators and what additional secondary indicators are needed to provide greater public accountability. Preference should be given to indicators that are compatible with the national performance measures.**

RBA PROGRAM PERFORMANCE ASSESSMENT:

DOT PROJECT DELIVERY REPORT CARD

Program Background

- Delivery of state transportation system capital improvement projects involves both project development and project implementation. This performance assessment, in accordance with the study scope, focuses on the *implementation* phase of DOT project delivery, from the point formal design begins through completion of the improvement.
- Department of Transportation project delivery implementation is aimed at carrying out capital improvements to the state system of transportation:
 - on time;
 - within budget; and
 - in compliance with appropriate standards and requirements.Efficient and effective project delivery also helps achieve the safety, mobility, environmental, economic, and other public benefits desired from an implemented improvement sooner and more fully.
- Four separate bureaus have direct roles in administering the wide array of highway, bridge, public transit, aviation, and maritime improvement projects delivered by DOT: Engineering and Construction, Highway Operations, Public Transit, and Aviation and Ports. The Bureaus of Finance and Administration, as well as Policy and Planning, provide critical support functions for effective project delivery implementation, such as budgeting, accounting, contracting, and performance measurement.
- Four federal agencies – Federal Highway Administration, Federal Transit Administration, Federal Rail Administration and Federal Aviation Administration – have significant roles in Connecticut’s transportation project delivery implementation.
- The state’s 15 Regional Planning Organizations and 169 municipalities also are main DOT partners in implementing state transportation system improvement projects.
- DOT’s structure and overall process for delivering capital construction projects, was described in the staff interim report presented to the committee in October 2010. The main steps are:
 - project initiation, which includes scoping and selection of outside professional services, if determined necessary;
 - design development (i.e., preliminary engineering, preliminary and final design);
 - bid and contract award; and
 - construction, which includes contract administration, inspection and testing, project management, and close-out.
- The Bureau of Engineering and Construction is responsible for delivering all highway system and most other types of DOT capital construction projects. Information presented in the following report card is based on committee staff analysis of that bureau’s project delivery performance.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

**DOT PROJECT DELIVERY
PROGRAM LEVEL ACCOUNTABILITY SUMMARY**

Contributes to the Quality of Life Results Statement:

Connecticut's transportation system is maintained in a state of good repair and allows for safe, efficient movement of people and goods, livable communities, and sustainable growth.

Main Contribution: helps to preserve current transportation infrastructure, improve system capacity, and increase mobility options in compliance with work quality, environmental, financial, and other relevant standards. While DOT project delivery is more a major state agency function than a program, it makes a significant contribution toward achieving the results desired for the state's transportation system. Completing capital improvements on time and within budget, without sacrificing safety or quality, is crucial to safe, efficient, and effective movement of people and goods throughout the state.

KEY MEASURES *	PROGRESS	CURRENT DATA
1. Projects are delivered on schedule.	↔	<ul style="list-style-type: none"> • Performance data that reflect time for both the design and construction phases of project delivery are not readily available through current agency information systems • PRI staff analysis of a database created for this study on projects completed over the past 10 years shows: <ul style="list-style-type: none"> ○ Total time to complete project design and construction averaged 5.3 years, with the design phase accounting for 61% of the full process ○ Overall, 37% of all completed projects met their scheduled construction completion times; in comparison, the average for 15 other states during 2001-2005 was 53% ○ The median time over schedule for construction completion was 144 days • Initial data for a new on-time measure for DOT construction projects (excluding design phase) was issued in October 2010; 45% of 29 total contracts completed during 2nd Quarter 2010 met their original contract schedules for construction completion
2. Projects are delivered within budget.	↔	<ul style="list-style-type: none"> • Performance data that reflect total costs of both the design and construction phases of delivering a project are not readily available through current agency information systems. • PRI staff analysis of a database created for this study on projects completed over the past 10 years shows:

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

		<ul style="list-style-type: none"> ○ Original construction budgets (award amount not including any contingency) were exceeded for the majority of completed projects (74%), with an average cost overrun of 23% ○ Construction budgets including a 10% contingency amount, were exceeded for 42% of completed projects; the median overrun was 21% ○ The portion of completed projects exceeding 110% of their original construction budget each year decreased between 2001 and 2010 <ul style="list-style-type: none"> ● Initial data for a new within-budget measure for construction projects (excluding design phase) was issued in October 2010: 69% of 29 total completed during 2nd Quarter 2010 met their original contract budgets for construction, when defined as the awarded value plus 10% contingency
<p>3. Projects are delivered in compliance with relevant standards and best practice</p>	<p>?</p>	<ul style="list-style-type: none"> ● Information about financial status, work quality, and compliance with labor laws, safety standards, and environmental requirements tracked for individual DOT construction projects ● Quantitative measures and aggregated data about quality assurance performance for delivered projects not in place at this time
<p>4. Project benefits are delivered in a timely, cost-effective way</p>	<p>?</p>	<ul style="list-style-type: none"> ● Comprehensive data on the size, scope, and costs of DOT project delivery lacking ● Final outcome data based on intended end results from specific improvements (e.g., fewer accidents, faster travel times, greater access, reduced pollution, new jobs) studied for only a small number of completed projects ● Customer satisfaction with delivered projects not measured
<p><i>* More detail regarding each key performance measure is provided in the later sections of this report card that address the three main RBA program accountability questions: How much did we do? How well did we do it? Is anyone better off?</i></p> <p><i>Quality assurance performance, however, was identified by program review committee as one of five overarching issues for DOT project delivery. Committee findings and recommendations regarding these issues are presented below.</i></p>		

Overarching Project Delivery Issues: Committee Findings and Recommended Actions

Project delivery performance by the state Department of Transportation is difficult to assess at present. As the above report card indicates, the quantitative data needed to address RBA questions about the outputs, efficiency, and outcomes of the department's project delivery process are limited, rarely centrally collected, and sometimes not available. DOT is not unique in this regard; good quality efficiency and effectiveness information is lacking for most state programs and agencies.

A further complication is DOT project delivery is not a discrete agency program with a single, cohesive management structure. As discussed in the October 2010 staff interim report, it is a complex, multi-phase process. Major aspects of project delivery are carried out by different units and offices located within all four operating bureaus and both administrative support bureaus of the department.

Given this structure, project delivery results tend to be tracked on a project by project basis and monitored by phase of delivery. Most current performance data about project delivery is reported by implementation status (e.g., initiation/authorization, design, construction, contract award, or close-out), and mainly for federal funding purposes. Extensive information about each project that DOT plans and implements is collected throughout the delivery process but little is aggregated. Efforts to measure and report about the department's overall project delivery performance in terms of time, cost, and quality are just beginning within the department.

Best practices. Based on PRI staff interviews with agency managers, federal officials, and contractor and consultant associations – plus review of DOT manuals and other written documents – it appears the department has adopted many project delivery best practices identified in a recent AASHTO study.¹

For example, PRI staff observed progress and status meetings, attended by project design and construction staff and top managers, that are held regularly to discuss project schedule and budget performance. Reasons for cost and time overruns during construction are tracked for individual projects and analyzed using project management software. As discussed later, constructability reviews and value engineering, which help identify ways to reduce costs and expedite delivery, are carried out by agency quality assurance staff for selected projects. The Office of Quality Assurance (OQA) also provides support to design staff to improve estimating accuracy. In some cases, DOT has used financial incentives for early project completion by contractors.

Department efforts to expedite projects, contain cost overruns, and ensure quality with these best practices and other tools are described in the following performance measure discussions. The extent that project delivery best practices are being used in all bureaus or how

¹ AASHTO, *Comparing State DOTs' Construction Project Cost and Schedule Performance: 28 Best Practices from Nine States*, May 2007.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

well they are being implemented, however, could not be determined during this RBA assessment.

PRI identified several overarching challenges to successful DOT project delivery that need greater attention. Specific areas of concern, described more fully below, are: controlling project initiation; inadequate project management information; evolving quality assurance functions; the inability to use creative contracting approaches; and inefficient coordination of environmental matters. Current department efforts to address these challenges and PRI committee proposals for additional improvements also are discussed.

In general, these are problem areas recognized by current department leadership. They also reflect, to some degree, recurring themes cited in prior state and federal studies of the agency such as: the 2008 report of the Governor's Commission on Reform of the Connecticut Department of Transportation (the Critelli Commission); the 2007 independent consultant audit of operational failures for the I-84 construction project (the Hill report) that led to formation of the commission; and two recent reviews conducted by FHWA, one concerning preconstruction cost estimating (2002) and another concerning construction cost overruns (2004).

Major agency changes. It is important to note several broad initiatives the Department of Transportation has undertaken in recent years, primarily in response to the reforms called for by Critelli Commission and FHWA recommendations, have strengthened accountability for project delivery results. Chief among these agencywide changes are:

- clarifying the agency mission, vision, values, and priorities, as well as establishing a five-point strategic action plan in the last state transportation master plan (January 2009);
- centralizing financial functions, including all project payment processing and accounting, within the Bureau of Finance and Administration;
- establishing engineering and construction as a separate bureau focused on project delivery implementation;
- combining, expanding, and elevating quality assurance functions in a new office within the engineering and construction bureau; and
- instituting a performance measurement system.

Performance measures. The agency's current performance measurement system was established about two years ago. The purpose was to support better management decision-making based on data and linked to newly developed strategic goals and objectives. At present, DOT performance measurement efforts are led by the strategic planning division of the Bureau of Policy and Planning, and staffed by a four-person unit. Training and support have been provided to managers in all bureaus to assist them in creating and using relevant quantitative measures to assess their most important activities.

Since the agency published its first performance metrics report, "On The Move," in January 2009, progress reports have been issued each quarter and posted on the agency website. The performance measures unit continues to refine current measures and add new ones, in

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

consultation with managers throughout the agency. Based on conversations with planning bureau staff and heads of other bureaus, performance measurement seems well accepted by most department staff and valued by top managers.

The department also has begun to actively participate in the Appropriations Committee RBA process. For the first time, DOT has prepared program report cards using the committee's standard template and addressing two major public transportation programs, the statewide bus system and the Connecticut commuter rail system. Both will be used in the upcoming budget process.

Asset management. The department is shifting to another recognized best practice, using transportation asset management for investment decisions. Asset management, as described in a December 2008 report the Connecticut Academy of Science and Engineering (CASE) prepared for the department, is a strategic and systematic process for resource allocation based on well-defined objectives, performance measures, and quality data.²

Under this approach, management decisions about acquisition, construction, repair, and preservation of assets are made from a systems and life-cycle cost perspective rather than a class-specific, worst-first philosophy. According to DOT, the goal of asset management is to make investments that reflect optimal performance of the whole transportation infrastructure compared to the resources required to operate and maintain it.

The CASE report found states that are leaders in the use of transportation asset management are seeing steady improvement in the condition of assets and more coherent, cost-effective allocation of resources. Connecticut DOT has been using an asset management approach with success for its roadway pavement and bridge maintenance system programs in recent years.

Sustaining improvement. With its many new best management practices and recent restructuring, DOT is moving in a positive direction for more successful project delivery. Much of the progress made to date is related to the agency's current commitment to performance measurement and establishment of a strategic, deliverable capital plan. A recent national report attributed the success of states considered models of effective project delivery practice, such as Washington, Virginia, Missouri, and Florida, to a combination of strong project delivery management and robust performance measurement systems.³

Strong performance measurement – in combination with strategic asset management and effective quality assurance – is the basis for ensuring DOT delivers projects on time, on budget, and in compliance with all relevant standards. A focus on results is also needed to position the department to respond to new requirements for federal funding. Much federal public transportation funding now is provided through competitive grants and FHWA funding is

² CASE, *Applying Transportation Asset Management in Connecticut*, December 2008.

³ Scan Management, Scan Team 07-01 report supported by the National Cooperative Highway Research Program, (NCHRP Project 20-68A), *Best Practices in Project Delivery Management*, October 2009.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

expected to be more performance-based in the future. While reauthorization of federal transportation aid legislation is still pending in Congress, it is clear states will be required to demonstrate they can deliver projects efficiently and effectively to maximize the funding they receive.

Upcoming changes in agency leadership, ongoing state budget constraints, and another large wave of retirements could pose challenges to sustaining strong performance measurement efforts. One way other states' transportation agencies have institutionalized performance measurement is to establish a forum for regular review of performance measure results by senior management including the chief executive officer. To ensure progress toward data-driven management of the state transportation system continues and becomes embedded in DOT, the program review committee recommends:

DOT create a performance measurement results steering committee comprised of top managers representing each bureau. It should meet quarterly with performance measures staff and the commissioner to review and discuss current results data, identify successes and problem areas, and direct actions to improve outcomes.

The committee believes the RBA approach offers another way to focus agency management on results and strategies for achieving them from a system perspective. Much of what the department is doing now to measure and manage performance is consistent with RBA principles. For example, its current quarterly performance measure reports, in essence, are program report cards. Similarly, efforts by DOT and other state transportation agencies to address national performance standards and their broad, population-level indicators of progress, parallel the quality of life results accountability aspect of Results Based Accountability.

The department plans further development of its performance measurement system with more and better data about project delivery and other agency results. A stronger connection between performance, funding decisions, and strategic goals also is intended. This is the same purpose of the RBA process carried out by the Appropriations Committee. The committee believes the department's current RBA and performance measurement efforts could be combined to reduce duplication of effort and promote a better partnership with the legislature. The PRI committee recommends:

the department incorporate RBA as a primary tool for promoting performance measurement and management for results throughout the agency.

Project Initiation

One of the department's most important steps toward improved project delivery was the creation of a fiscally constrained five-year capital plan in January 2010. For the first time, DOT prepared a capital improvement program that prioritizes project implementation based on available resources and asset management principles.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

In its constrained capital plan, the department: outlines anticipated total funding for 2010 to 2014; identifies ongoing projects with committed funding that must be completed; and recommends the small balance of uncommitted funding be applied to what it believes are the state's most critical highway system preservation and public transit projects over the next five years. The plan also includes the agency's extensive list of needed preservation and modernization projects that cannot be funded within the next five years, as well as another list of major long-term initiatives currently without any identified funding sources.

By developing a fiscally realistic program of capital improvements, the department addressed a major obstacle to successful project delivery: past overprogramming. Up until this time, transportation projects often have been authorized to begin design without full consideration of the resources needed to support them through final delivery. As a result, more projects have been initiated than can be funded and completed within reasonable timeframes. The constrained five-year plan establishes a more manageable and deliverable capital program for the agency.

The current plan is a first step in the department's effort to control project initiation. Proposed initiatives traditionally have come from many internal and external sources with differing priorities, including the managers of each bureau, the agency's planning office and the regional planning groups it works with, safety and traffic research, and municipal and state officials. At present, DOT has no formal process or standard criteria for determining which proposed improvements to the state transportation system should be implemented and when.

The agency's lack of a consistent approach to defining, approving, and designing projects has been an ongoing concern of FHWA and DOT leadership. According to both federal and state agency staff, this contributes to extended completion times, inefficient use of staffing resources, and unmet public expectations because too many non priority or undeliverable projects are initiated.

New process. During this study, the department began a project to create a central clearinghouse for project initiation and scoping. The head of the Bureau of Engineering and Construction is leading this effort, with the help of quality assurance office staff and in consultation with other top agency managers.

According to department staff, project initiation will be a joint effort of the financial, engineering, and planning bureaus in the future. The goal is to better coordinate projects with cash flow and allocate resources, both staff and funding, according to state priorities for the transportation system.

Written guidelines will be established to define roles, procedures, and policies for selecting and scheduling all DOT capital improvement projects. By establishing a formal initiation process, the department expects to better control the flow of new projects to match available funding and ultimately improve project delivery performance.

Under current plans for the new process, all proposed projects would go on a central "Needs List." Every project on the list would be required to have a detailed total budget and financial plan covering all phases of its implementation. Summaries of each project outlining

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

costs, the nature of the improvement, and possible funding sources also would be prepared. Engineering staff would have primary responsibility for developing the total budget and scope information for the projects on the needs list.

On an annual basis, the commissioner, with other top managers, would identify priority projects from the needs list to be initiated as new work. Criteria for and techniques to assist in prioritizing projects on the needs list would be developed by the planning bureau staff responsible for performance measurement and asset management. Using the required total project budget data, the finance bureau also would analyze all priority projects from the needs list and make recommendations for final selection based on the agency's overall financial resources and budgetary goals.

Major changes to its design development approval process also are under consideration by DOT. In conjunction with a federal initiative to improve completion times and contain costs, the department is examining adoption of a two-step process for project initiation. Projects could be authorized to begin design but additional approval to proceed would be required once plans reach the 30 percent phase. At this point in design for most projects, the impact of rights-of-way and environmental issues are more clearly known and there is a better sense of the cost commitment required for completion. If a project seems too costly or a better investment is possible, DOT can decide not to proceed with further design.

PRI believes the new project initiation process and alternative approach to design development are major steps in the right direction for better project delivery results. Improving project initiation and design development will result in a capital program that can be more effectively managed and measured. Prioritizing projects with broad strategic objectives in mind also should promote a more programmatic, cross-bureau approach to investment decisions. The PRI committee recommends

the department continue developing the centralized project initiation process and have it in place through a formal department policy statement by July 1, 2011. This process should be used to maintain and regularly update the agency's five-year capital planning document.

Project Management Information

Best practice research demonstrates successful project delivery requires dogged attention to schedule, budget, and quality, from design through final completion. Current automated systems at DOT do not support strong project management and oversight throughout the entire delivery process for its transportation system improvements.

Information systems within DOT for managing design development are especially weak. Effective coordination between the preconstruction and construction phases also is impeded by the agency's lack of up-to-date project management tools and technology.

Current systems. At present, the data needed to track a project's progress from initiation through completion are not integrated. Information about the size, scope, purpose, and

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

implementation status of projects is maintained in a number of different automated systems. In addition, a variety of databases for specific tasks involved in project delivery (e.g., contractor claim processing, execution of contracts and agreements, and environmental permitting) that supplement these existing systems have been created by various managers throughout the department. Some aspects of the project delivery process still are not captured by any computerized system (e.g., timeframes for consultant selection).

Most funding and general descriptive information for active DOT projects is centralized in CORE-CT, a computerized financial/administrative information system used by all state agencies. However, detailed information related to the design or construction status of a project must be extracted from at least three other electronic sources. These include:

- the agency's federal obligation plan, a database maintained by the finance bureau that includes funding and work schedule information for active capital projects receiving federal aid;
- the design staff's engineers job log, an in-house software program that can provide certain scheduling information related to design milestones and submittals and more descriptive information about projects in design; and
- SiteManager, a commercial (AASHTO) software product used by the DOT construction office, to track time, cost, and work quality information for projects it administers.

Currently, there is no software program like SiteManager to systematically track the timeliness or costs of the design process. A former DOT mainframe system used for project accounting for federal funding purposes served as the primary tool for tracking implementation of projects during the design phase. That system was retired when the department completed the transition of all financial processes and data to the CORE-CT system in 2008.

Originally, it was thought CORE-CT could perform the design phase monitoring function, but that has not proved feasible. Despite the department's ongoing efforts to customize it for a variety of transportation project reporting purposes, CORE-CT cannot be used to manage construction projects during preconstruction.

The agency's current preconstruction process involves many steps that can take significant amounts of time to complete. According to the department staff, just designing a typical project of average complexity to the point of final plans can take one to two years. Rights-of-way activities, if needed, may take up to a year and environmental issues can add at least six to nine months to the preconstruction phase. The Bureau of Finance and Administration reports, at best, it takes six to nine months to completely process an agreement for outside professional services. This is from the time permission to hire a consultant is received from the commissioner, through the selection and negotiation processes, to the point all external approvals of an executed contract are complete.

At present, there is no systematic way to track a project through the preconstruction process to determine if delays are occurring and how the department should address them to expedite delivery. In addition, the department's current software program for preparing

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

estimates, as well as the existing data warehouse for supporting item price estimation, bid monitoring and evaluation, and vendor and market analysis, are outdated and underutilized.

In general, the department has devoted more attention and resources to managing projects while they are in construction than during the design phase. This is understandable given the significant costs and direct public impact of transportation construction projects. DOT estimates design accounts for about nine percent, on average, of total construction project costs.

An efficient and effective design process, however, is the foundation for successful delivery of a completed project. The longer the time between design completion and the start of construction, the less reliable preconstruction estimates of construction costs and completion times become. Outdated or inaccurate estimates are poor guides for controlling construction budgets and schedules.

A disconnect between DOT design and construction processes for projects completed over the past ten years is evident. PRI staff analysis presented in the following section shows there has been little relationship between original budgets and schedules set during project design and the actual costs and times to complete projects. The department, partly in response to FHWA concerns, is working to improve the accuracy of its project cost and time estimates and better control the design phase of project delivery.

New information system. Many of DOT's project management deficiencies should be addressed by implementation of a new integrated information system for the preconstruction and construction phases of delivery. Planning for this new system, with the help of an AASHTO consultant, began in 2008. First, an analysis was conducted of: all existing systems and software products; selected reports they generate; and current workflow and information exchange among DOT units with project delivery roles.

Through a Request-for-Information process, it was determined the best approach would be to upgrade and expand current products with "Trns*Port AASHTOware Suite," a comprehensive automated project management system in use by many state transportation agencies. Implementation of system upgrades and new components was expected to begin during 2009. Due to state budget constraints, the department was directed to postpone the project.

At this time, the department is authorized to proceed and is updating the project's scope. The current plan is to start phasing in the new system over an 18-month period beginning at the end of 2010 or in early 2011.

According to the department, the new system will consolidate planning, estimating, preconstruction engineering and design, contract letting, and construction support processes for all capital improvement projects. It will eliminate a number of manual processes as well as permit automated project management of all types of projects, whether state or federally funded, during every part of the preconstruction and construction phases of project delivery.

Two important additional benefits of the new system are:

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- significantly improved quality and consistency of project estimates prepared either by consultants or in-house staff; and
- utilization of electronic bidding.

The department estimated that anticipated savings produced by the new system, primarily from improvement to the bidding function, outweigh system implementation costs (\$1.5 million) by a 4:1 ratio.

States that are strong project delivery performers have project management systems that integrate performance information from every phase of project delivery and support effective oversight of design and construction. They also set targets and monitor times for completing each critical component of the preconstruction and construction process. Several state transportation agencies set goals for getting projects through design and ready for bid, as well as for completing construction once a contract is awarded.

Implementation of the integrated project management information system is essential to improving DOT project delivery performance. Once in place, it will allow the agency to track all the critical milestones of project delivery so it can more quickly identify and address problems that may cause delays, increase costs, or compromise quality. It also will provide much-needed support for better project planning, scoping, and estimating. The PRI committee recommends:

implementing the new integrated project management system as scheduled be a top priority of agency leadership. Also, the department should ensure the new system will be able to track all major steps of the preconstruction process, including: consultant hiring; agreement execution; rights-of-way and utility relocation milestones; and timeframes for environmental reviews and permitting.

Quality Assurance

A strong quality assurance function is central to successful project delivery. Quality assurance is commonly defined as systematic examination or verification that policies and procedures for controlling project quality are implemented effectively.⁴

Over the past two years, DOT has taken many steps to strengthen its quality assurance effort. Most significantly, it created a high level Office of Quality Assurance within the Bureau of Engineering and Construction, currently staffed by 36 positions. While its role, responsibilities, and resources are still evolving, the quality assurance office appears to be positioned to become an effective support for better project delivery results.

The office carries out a number of well-accepted quality assurance and continuous quality improvement activities. Specifically, it is responsible for constructability reviews, value engineering, and checking the quality of all plans, specifications and estimates prior to bidding.

⁴ Based on quality assurance and quality control guidance documents published by FHWA, AASHTO, and the Construction Management Association of America.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

The office also conducts analysis of all bids and provides support for project development, helping design staff with project scoping and estimating. As noted earlier, it has a central role in developing the agency's new project initiation process.

One division of the office is focused on supporting the application of engineering and construction technology to the agency's project delivery process. To date, it has established electronic design standards and supports for computer-aided engineering and construction applications. Progress is being made toward fully digital design deliverables and intermediate submissions (e.g., preliminary and final designs, specifications, as-built plans), which should greatly enhance the efficiency of the design process. The technical division also is overseeing implementation of the department's new integrated project management system, an essential tool for better project delivery as discussed above.

Process reviews. The committee believes one of the most valuable functions of the quality assurance office is performing process reviews. Office staff can be assigned to take an objective and systematic look at of any aspect of the project delivery process to identify ways to improve efficiency and effectiveness. Analysis and better documentation of all processes essential to project delivery has been directed by FHWA. Process mapping of all core agency activities for streamlining and improved accountability also was a central recommendation of the Critelli Commission and one the program review committee endorses.

At this time, no staff are dedicated to the office's process review function. Efforts are occurring on an ad hoc basis by some of the office managers in addition to their other duties. For example, an OQA staff person who works on scoping, estimating, and bid analysis support also is examining the design process and preparing a guide for design development. This process review should make a significant contribution to better management of the time, costs, and quality of design phase of construction projects. It will also produce the documentation the design phase of the process that FHWA is seeking.

Lessons learned. The quality assurance office is using the results of its constructability reviews and information gathered through change order analysis and post-construction reports to identify lessons learned about practices that promote success and ways to correct and overcome delivery problems. A database of lessons learned is being developed and will be accessible to all staff on the agency website in a few months. It will be regularly updated, more complete, and easier to use than the running list that is currently available.

The office's constructability staff receive and review the post construction report forms that are prepared for every completed projects. These forms provide the project field staff's: 1) assessment of contractor compliance and workmanship during construction; and 2) perspectives on any major issues that impeded delivery and ways they were addressed. OQA staff try to use the forms as the basis of a feedback loop between construction and design. When design errors or omissions, unclear specifications or plans, or poor communication seem reasons for project failures, quality assurance staff try to facilitate discussions between design and construction staff to find ways to address similar matters in the future.

The quality assurance office is supportive of expanding opportunities for sharing lessons learned and using the results to improve project delivery. It notes, however, that staffing for this

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

purpose is limited at present. PRI believes the office should apply its resources to one new type of lessons-learned activity based on a successful FHWA practice.

As part of the FHWA process review of the DOT construction cost overruns completed in 2004, the study committee conducting the review asked each district to pick five recently completed projects of different sizes that were representative of typical issues encountered during the normal construction process. The committee then selected three from each district for more in-depth review. Project personnel representing each district met as a group with the committee to make brief presentations about each project and have discussions about problems and common themes. The group then had a brainstorming session to identify major concerns that were considered to be main drivers of cost overruns. Possible strategies for addressing them also were discussed and a list of recommended corrective actions was developed.

The committee believes this approach to lessons learned would be a valuable exercise for the quality assurance office to conduct at least on an annual basis. The process could be used to focus on different aspects of project delivery that the quality assurance office or others in the department have found to be problem areas, such as effectively addressing environmental matters, or highlight successful innovative practices, like the project management team approach used for the department's current "megaproject", the I-95 New Haven Harbor Crossing Corridor Improvement ("Q Corridor") program.

Lessons-learned meetings could include invited members of the public, for at least a portion of the group discussion, to get customer feedback about project delivery success. They could even be used to evaluate, at least informally, benefits produced by the completed projects. The program review committee recommends:

the quality assurance office organize and sponsor a lessons learned event to evaluate project delivery success for a sample of completed projects at least annually.

Performance measures. Data needed to assess the impact of quality assurance office functions, such as accuracy of design estimates and cost-savings from constructability reviews and value engineering, are just beginning to be compiled and reviewed. Beyond lessons learned, information about the level of work quality or compliance with environmental and other standards during the construction process is not regularly compiled and reviewed.

Some potential sources of project quality data have yet to be tapped. For example, contractor and consultant evaluations containing ratings of their project delivery performance are prepared at the completion of every project. Contractor performance ratings were recently added to the SiteManager database of active construction projects maintained by the Construction Office. However, neither the contractor nor consultant performance evaluations are systematically used as measures of completed project quality.

Although stronger coordination is planned, quality assurance efforts are not yet well integrated with the agency's performance measurement system. This is partly because both the quality assurance office and the performance measures unit are relatively new and still

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

developing their organization and operations. A good connection between the two, however, is needed to promote effective continuous quality improvement and better accountability for project delivery results. At minimum, the program review committee recommends:

the quality assurance office work with the performance measures unit to develop quantitative measures of compliance and quality for projects the department delivers. As a first step, quality assurance and performance measurement staff should compile, review, and summarize the results of evaluations of contractor and consultant performance to share with top agency managers.

Creative Contracting Authority

Design-build and other innovative alternatives to traditional design-bid-build contracting have become widely accepted tools for expediting delivery of transportation projects. Design-build, as well as cost-plus-time bidding (A+B), lane rental, and warranty clauses, are contracting methods endorsed by FHWA. Creative contracting alternatives like design-build are recommended as ways to make good projects better, in a recent AASHTO publication on successful project delivery.⁵

All but three other states currently use design-build contracting in some form for their transportation construction projects. At present, DOT does not have statutory authority to use design-build or any other types of creative contracting to carry out its capital projects.

Under the design-build method, the design and construction phases of a project are combined into one contract and awarded on either a low-bid or best-value basis. With a single contracting process, procurement time is reduced. Responsibility for cost efficiencies and construction risks rests with the contractor rather than the state agency. With the contract price fixed and typically schedule-driven, creativity and a cooperative working relationship between the designer and contractor is encouraged. There are potential cost savings from innovations fostered by the team environment and from reduced construction claims and litigation.

The benefits of the design-build approach are well documented by national and other state studies. A 2006 federal report showed design-build project delivery, compared with design-bid-build: reduced overall duration by 14 percent, lowered total costs by 3 percent, and maintained the same level of quality.⁶ Cost-savings, however, varied by type, size, and complexity, indicating the importance of having a good methodology for deciding when to use design-build.

A June 2010 report prepared for the department by the Connecticut Academy of Science and Engineering evaluated the design-build method potential benefits for DOT project delivery.⁷

⁵ AASHTO, *Smart Solutions: 50 Ways America Just Got Better: Highlighting America's Transportation Awards*, 2009.

⁶ FHWA, *Final Report: Design-Build Effectiveness Study -- As Required by TEA-21 Section 1307(f)*, January 2006.

⁷ CASE, *The Design-Build Contracting Methodology for Transportation Projects: A Review of Practice and Evaluation for Connecticut Applications*, June 2010.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

The evaluation found design-build offered the following primary advantages: shortened project delivery times; greater price assurance (e.g., reduced change orders); and the potential for innovative design. The main disadvantages were high costs for proposer bid preparations and, if best value rather than low bid is used, a subjective contract award process. In addition, environmental permitting could be a significant challenge with simultaneous design and construction activity.

CASE concluded, however, that the department should be able to use design-build contracting. It was noted design-build is not suitable for all projects and a careful selection process would need to be developed to ensure effectiveness. Department staff, as well as state contractors and design firms, would need training in alternative contracting techniques. Resources dedicated to proper oversight and support of design build projects also would be required.

The committee believes the ability to use creative contracting methods offers opportunities for significant savings in the time and costs of DOT project delivery. Over the past several years, the department has requested but not received legislative approval for statutory changes to its contracting authority. As noted in the CASE report, the main obstacle to giving the department authority for alternative contracting methods has been the legislature's lack of confidence in the agency's ability to properly implement them.

Phasing in authority for design-build and other approaches could be a way to address legislative concerns. In discussions with PRI staff, the department management indicated the best approach for implementing creative contracting at DOT would be to start with using design-build with on a pilot basis. Given current resources and DOT staff's lack of experience with alternatives like design-build, the agency would most likely use an outside expert to manage the pilot project and provide training to department The PRI committee recommends:

legislation be enacted to permit the department to use design-build and other alternative contracting approaches on pilot basis. Prior to project initiation, the department shall submit a project, and the criteria used to select it as a pilot for design-build or other alternative contracting method, to the legislature's Transportation Committee for review and approval. DOT also shall evaluate the delivery success of the pilot project in terms of timeliness, cost, and quality, and report the results to the Transportation Committee within three months of project completion.

Environmental Matters

Research indicates the following components can add significant time to transportation project delivery: environmental review and permitting processes, rights-of-way acquisition, and utility relocation. Committee staff focused its efforts on examining the environmental process, which is a key component of project delivery. Transportation projects are subject to two environmental processes before construction: review to determine the level of environmental documentation necessary before project design can begin, and environmental permitting prior to construction.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Environmental reviews. The department’s Office of Environmental Planning (OEP), within the Bureau of Policy and Planning, is responsible for reviewing proposed transportation projects to determine their potential impact on the environment. OEP has five full-time staff responsible for conducting environmental reviews, and uses consultants when necessary for either limitations due to workload or help with more technical reviews.

As discussed in the committee staff’s interim report, environmental reviews establish the level of documentation necessary to determine the anticipated environmental impact based on the initial scope of the project. The results of environmental reviews are classified according to three levels:

- categorical exclusion: no significant environmental impact;
- environmental assessment needed: initial environmental impact cannot be determined without additional assessment, resulting in either a finding of no significant impact or initiation of a detailed environmental study; or
- full-scale environmental study needed: required according to the Connecticut Environmental Policy Act (CEPA) or the National Environmental Policy Act (NEPA).⁸

Information obtained from DOT on the number of environmental reviews conducted and the number of projects by environmental review classification, is shown in Table 1. As the table indicates, 650 (98%) of the 663 environmental reviews conducted by OEP between FYs 2005-09 resulted in categorical exclusions – meaning the project, as currently planned, would have no significant impact on the environment. Less than 3 percent of all DOT proposed projects reviewed by OEP were classified as needing a full environmental review under CEPA or NEPA, meaning very few proposed projects require extensive environmental study.

Table 1. DOT Environmental Reviews: 2005-09.						
	2005	2006	2007	2008	2009	Totals
Env. Reviews Requested	73	119	133	107	234	666
Env. Reviews Completed	73	116	133	107	234	663
Categorical Exclusions	70	112	128	106	234	650
Environmental Assessments	0	1	3	1	0	5
Full-Scale Environmental Review: EIE (CEPA)	3	4	3	3	0	13
Full-Scale Environmental Review: EIS (NEPA)	1	1	1	0	0	3

Source of data: DOT Office of Environmental Planning

⁸ Projects requiring a full-scale environmental review and receiving federal aid must follow the requirements under NEPA, while state-funded projects follow the CEPA requirements. The results of any NEPA review satisfy the CEPA requirements. Outcomes for environmental reviews conducted for projects solely funded with state funds result either in a categorical exclusion or an environmental impact evaluation.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Upon classifying the project, DOT (or private consultant) conducts the appropriate level of environmental review. Committee staff received DOT data regarding the overall time necessary for OEP to complete environmental reviews. Information from the department, however, is approximate completion times. Overall, environmental reviews averaged:

- Categorical Exclusions: 8 weeks
- Environmental Assessments: 78 weeks (1.5 years)
- Environmental Impact Evaluations (CEPA): 78 weeks (1.5 years)
- Environmental Impact Statements (NEPA): 156-260 weeks (3-5 years)

Environmental permits. Transportation projects may require one or several environmental permits issued through the Department of Environmental Protection (DEP), U.S. Army Corps of Engineers (ACE), or the State Historic Preservation Office. The bulk of the permitting process for transportation projects occurs within DEP's Inland Water Resources Division and the Office of Long Island Sound Programs.

The DOT Office of Environmental Planning located within the Bureau of Policy and Planning is the department's central clearinghouse for transportation project permit applications. Although the actual information contained in permit applications comes from state or consultant design engineers, depending on who has lead responsibility for project design, OEP is responsible for determining whether environmental permits are necessary and coordinating the permit applications with DEP.

There has been discussion within DOT as to where OEP's function best fits within the department's organization. Some believe environmental planning should be within the Bureau of Engineering and Construction to ensure full access to and coordination with the design and construction functions located in that bureau. Others in the department believe the function should be at arms-length from project design and construction, and is best located in the planning bureau, as it is currently.

A formal policy statement issued by the department last month states OEP is within the Bureau of Policy and Planning, and will have primary jurisdiction in preparing and administering DEP and ACE permit applications for all transportation projects throughout the project delivery process. The policy also states protection of the environment is of paramount concern during all phases of department activity, and all pertinent offices within the department must coordinate early and often with OEP when environmental issues are involved.

The program review committee believes this policy is an important tool for coordinating and better managing environmental matters within DOT's project delivery process. The policy clarifies all activities involving environmental issues must be coordinated with, and processed through, OEP. The policy further sharpens the focus of OEP, making the office clearly accountable for providing guidance and assistance to the department on all environmental issues and responding to environmental submissions in a timely manner.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Permit timeliness. Data from DEP were reviewed to determine the overall time necessary to process permit applications. While analysis is necessary to fully capture the many factors influencing the length of time it takes to make permit decisions, the information below provides basic DEP time frames for processing permits for DOT projects.

Table 2 below shows for calendar years 2008-10, DEP issued an average of 48 permits for DOT transportation projects. The average time to issue a permit over the three years was 278 days. The average amount of time to issue permits has steadily decreased from 439 days in 2008 to 177 days in 2010 – almost a 60% decrease in processing time.

Table 2. Environmental Permit Processing Times for DOT Projects Calendar Years 2008-10				
	2008	2009	2010*	3-year Avg.
Number of transportation project permits issued	44	54	45	48
Average time to process transportation project permits	439 days	231 days	177 days	282 days
<p>*As of 12/8/10 Note: The Inland Water Resources Division and the Long Island Sound Program within DEP receive funds from DOT for staff to process transportation project permits for their respective areas. The data used in the table is a combination of both DEP programs. Source of data: DEP</p>				

There has been significant work recently in the state to examine and improve the environmental permitting processes across agencies in Connecticut. The results of these efforts, however, need time for full implementation before determining if the desired outcomes have been achieved.

For example, the governor issued Executive Order 39 this past February creating a Permitting Task Force. The task force was primarily charged with examining processes for issuing environmental permits and developing recommendations to streamline, simplify (including permit repeal), and shorten approval time frames. An additional goal of the review was to reduce unnecessary burdens, costs, and inefficiencies in the permitting process while maintaining appropriate public health, safety, and welfare, and the orderly conduct of business. The task force issued its report in April 2010, which included the key recommendation of creating a timetable for DEP to complete the initial permit processing phase (i.e., sufficiency review) in 60 days and the second review phase (i.e., technical review) within 180 days.

The 2010 legislature passed legislation requiring DEP to conduct an analysis of its permit processing performance, and ways to streamline the process.⁹ The department issued its report in September 2010 identifying ways to make the DEP permitting process more efficient. At the same time, DEP has been undergoing an internal review since 2008 using LEAN, a structured

⁹ See P.A. 10-158

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

approach to identify and correct inefficiencies, streamline duplicative procedures, and make the overall permitting process more time efficient and less costly.

Another way the two agencies have tried to expedite environmental permit processing is through additional staff within DEP funded by DOT. Information about funds exchanged for this purpose since 2006, shows DOT has transferred almost \$2 million to DEP to augment permitting for transportation projects. A relatively informal agreement between the two agencies existed until early 2008, when a formal Memorandum of Understanding (MOU) was created. The MOU sets out specific criteria as to an annual amount forwarded to DEP by DOT, conditions for how the funding should be used, and reporting requirements indicating how the funds have been used. At present, DOT is to provide DEP an annual budget transfer of \$400,000. The funds currently pay for six full time staff within DEP to expedite the permit process for DOT projects. It is committee's understanding the funds transferred to DEP come from state bond allocations.

Although the current arrangement between the two departments seems to fulfill the needs of each, it is not clear to the committee exactly what DOT is getting in return for the funds provided DEP or how the arrangement has increased the overall efficiency of the project delivery process. The MOU calls for DEP to submit a quarterly report to DOT, beginning with the first quarter of 2009, concerning work performed in the prior quarter. Each report is to include names of the DEP staff who worked on DOT projects, the amount of time spent on DOT projects, and the general nature of the work performed. To date, two summary reports were submitted to DOT in May 2010 showing permit information (e.g., date application received, date permit issued) for FYs 09-10. Although the departments agreed on the format of the two reports, the information submitted does not fully meet the requirements of the MOU. The program review committee recommends:

DOT and DEP re-evaluate the requirements of the current memorandum of understanding regarding support for permit staff to ensure they include realistic reporting requirements of how the funding is used, how it makes the transportation project permit processing function more efficient, and what benefits DOT (and the state) receives from its funding of DEP positions. Any revisions to the MOU should occur by October 1, 2011.

Interagency coordination. The practice for transportation projects is to have project design be roughly 90 percent complete before DOT submits permit applications to DEP for its review. DOT maintains if DEP requires changes to a project's design for environmental purposes, time and expense are added to the design process because projects are almost fully designed by the time environmental permit applications are submitted to DEP. DEP's position is that it is difficult to determine if projects meet permit requirements without project design near full completion.

The committee understands the positions of both departments. Although past attempts between the two agencies have been made to ensure coordination during the project design and environmental permitting processes, it seems those efforts have been inconsistent. For example, the departments used to hold monthly permit update meetings, but committee staff has been told

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

such meetings have not occurred within the past six months. In addition, meetings involving the two departments during project design also have been inconsistent.

On the surface, these issues do not indicate a total lack of coordination between DOT and DEP, yet consistent and timely interaction between the two agencies is vital for an efficient and effective project delivery process. Moreover, there seems to be a disconnect between the departments because their underlying goals appear to work at cross-purposes. It is clear additional coordination is necessary to ensure the most efficient and effective process for delivering transportation projects while protecting the environment to the greatest degree possible. The PRI committee recommends:

The commissioners of DOT and DEP establish an interagency workgroup to meet and discuss ways to fully achieve a balance between expediting transportation project delivery and ensuring proper protection of the environment. Issues to be discussed within the workgroup should include maximizing environmental permitting coordination and streamlining, involving DEP in the transportation project design phase as early as reasonable, examining alternative mitigation strategies, assessing the implementation of creative contracting methods, including design-build, and identifying ways to fully attain and maintain efficient and effective communication. The workgroup should be established by July 1, 2011. Relevant information from the workgroup, including agendas and meeting minutes, should be posted on each agency's website.

It also is clear DOT does not track its overall performance regarding environmental activities within the overall transportation project delivery process. There is little analysis as to how efficient the department is at processing environmental review documents or permit applications, how effective design engineers are at developing environmental permit applications, or the length of time it takes to process permit applications within DOT. Implementation of the new project management system discussed earlier could be an important part of measuring performance for environment-related activities. As currently designed, however, the new system is not anticipated to track any environment-related information, including permit processing times. PRI recommends:

The Office of Environmental Planning begin to fully track its performance for processing environmental review documents and permit applications for transportation projects. The office should determine its main performance measures and frequently gauge its performance against those measures. The results should become part of the department's overall performance measurement system. The department also should determine whether its new automated project management system could contain information to better track and measure environment-related activities within the transportation project delivery process.

I. How Much Did We Do?

At present, the size and scope of the DOT project delivery workload is difficult to determine as project data are maintained in a number of different systems for financial and other purposes. The best available data about active DOT projects are for those authorized to receive federal funding. Information about completed projects is only centralized at this time for capital improvements carried out by the agency's Bureau of Engineering and Construction.

In summary, PRI found:

- The number and size of active projects and projects delivered by DOT can vary greatly from year to year. Based on best available data, in recent years:
 - The department's annual workload of all active federally authorized highway and public transportation improvements averaged 285 projects, with a total annual value (not including any federal stimulus funding) about \$560 million on average (FFYs 06 – 09).
 - On average, the agency's Bureau of Engineering and Construction delivered around 63 construction projects per year, with total final construction costs per year ranging from about \$100 million to more than \$740 million (FYs 05-09).
- The bulk of projects the department delivers involve federal funding and are subject to federal planning, design, construction, and procurement requirements.
- Staff resources for project delivery include department employees and outside professional services; the capacity and cost of DOT staff responsible for project delivery is not known.

A. Project Delivery Workload

Performance Measure 1) Active Projects

- As described in the staff interim report, the best information on active transportation improvement projects only reflects those authorized to receive federal funding. From FFY 06 through 10:
 - The total number of active federally authorized projects ranged from a low of 205 in FFY 08 to a high of 340 FFY 07. (See Interim Report, Measure 1, p.38.)
 - Total funding (federal monies combined with state matching amounts) for active federally authorized projects ranged from a low of \$428 million in FFY08, to a high of just over \$902 million in FFY09. (See Interim Report, Measure 2, p. 39.)
- In FFY 09, the majority of the 287 active federally authorized projects (76%) were highway, bridge,

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

public transit, or aviation improvement projects in some phase of design or construction. The rest (24%) were other types of capital improvements, such as new equipment purchases for public transportation systems. (See Interim Report, Measure 3, p.39.)

Performance Measure 2) Projects Delivered

- The number of construction projects delivered by the department varies widely year to year, with a high of 87 (FY 08) and a low of 41 (FY 06 - complete year data) in recent years.

DOT Construction Projects Delivered: FY 05 – FY 10						
	FY 05	FY 06	FY 07	F 08	FY 09	FY 10*
Number	58	41	60	87	71	34
Total Cost (in millions)*	\$139.577	\$100.249	\$254.385	\$741.114	\$243.265	\$ 74.948

*Total construction cost based on final voucher data; FY 10 data partial through June 1.

Source: PRI staff analysis of DOT completed project data

Story Behind the Data:

At this time, there is no single source of active or completed project information that combines funding and delivery status information for all capital improvements DOT oversees. The best data on the department’s active project delivery work are for federally funded projects, based on federal authorization and obligation reports prepared through the CORE-CT system. It was not possible, within the study timeframe, for the department to develop similar information about projects solely funded with state monies or state funding provided for municipal transportation improvement projects. Some limited information PRI staff developed regarding the number and size of municipal construction projects overseen by DOT is provided in the following section.

For delivered projects, the best existing information is data concerning federally authorized completed construction projects (i.e., those with federal and state matching funds or federal with local matching funds and state oversight) that were carried out by the agency’s Bureau of Engineering and Construction. Again, comparable information for projects funded just with state money could not be prepared in time for this study.

Complete information on how much the department is doing in terms of numbers, size, and types of projects delivered is a necessary first step to understanding the relationship between output levels and available resources.

Actions to Turn the Curve:

DOT recognizes the many limitations of its data about project delivery. As noted earlier, the agency is in the process of implementing a comprehensive project management system for its construction projects. That system will help better identify the agency’s construction project delivery workload at each stage of the implementation process, from design through completion and close-out. In addition, the new capital project

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

initiation process DOT is considering adopting would centralize information about all agency improvement projects proposed and undertaken by any bureau or funding source each year. In the future, it could be used to capture the entire scope of projects the department is responsible for delivering. The program review committee recommends:

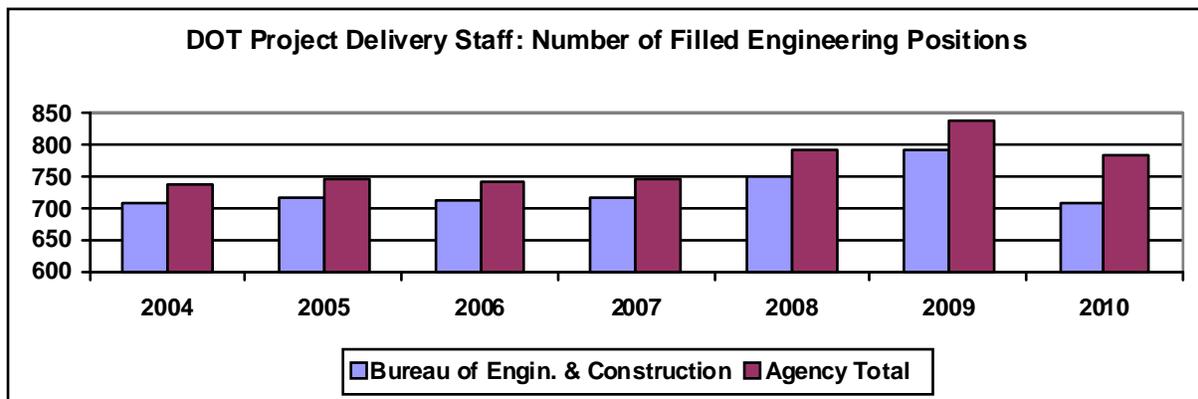
the department, as part of its effort to establish a centralized new project initiation process, develop and maintain a database that can identify and monitor the agency's complete project delivery workload.

B. Project Delivery Staffing

Performance Measure 1) Internal Project Delivery Staffing

A broad measure of internal staff resources allocated to DOT project delivery that could be developed within the timeframe of this study is the number of filled engineering positions with responsibility for transportation improvement projects (e.g., planning, design, or implementation through construction or other means) over time.

Data provided by the agency's human resources staff on the total numbers of filled engineering positions (all classifications) that are coded to DOT projects within each bureau and agencywide each year (as of January 1) from 2004 through 2010 are summarized in the following chart.



Story Behind the Data:

Since 2004, the number of filled engineering positions agencywide grew 6 percent, from 736 to 782. The increase, however, occurred in bureaus other than the Bureau of Engineering and Construction, where the bulk of project delivery responsibilities for DOT capital improvement projects are carried out.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

BEC started with 709 filled positions in 2004, a number that reflects the impact of the 2003/2004 state employee layoffs and early retirement programs. Its total then grew to a peak of 791 in 2009. In 2010, total filled engineering positions for the bureau dropped back to 710, mainly as a result of retirements triggered by the 2009 state incentive program. Thus, current BEC professional staffing capacity for project delivery is unchanged from the low level experienced six years ago.

Past retirement incentives also have had an impact on supply of mid-level staff who have been with the department for five to 10 years. This amount of experience is considered necessary for carrying out design and construction administration functions independently or to begin supervising others. As of November 2010, almost 22 percent of the department's current engineering staff had less than 10 years of experience with DOT; only 4 percent have between five and 10 years of experience.

Further, a significant portion of the agency's experienced engineering workforce is eligible for retirement now and in the coming few years. At present, 108 (14%) of the 778 DOT engineers with project delivery duties are over age 55 and have at least 10 years of DOT employment; 223 (29%) are over age 50 with a minimum of 10 years of departmental experience.

Constrained project delivery staffing capacity combined with impending retirements is a major concern of DOT management and FHWA. As part of its annual strategic planning process, the FHWA Connecticut Division completes a risk assessment of the department's implementation of the federal-aid highway program. This process, carried out with DOT input, helps identify and prioritize potential problem areas. Adequate staffing to ensure efficient and effective delivery of federally funded improvements ranked fifth of the top ten risks incorporated in the current FHWA strategic plan for Connecticut.

It is unclear, however, what levels and types of staff are needed to carry out project delivery in an efficient and cost-effective manner. This issue was recognized by the Critelli Commission and a talent assessment of all DOT staff was recommended, but no such study has occurred to date.

Determining the department's current and future capacity is complicated by personnel changes made under recent contracts negotiated with agency engineering unions. These include: an expanded employee work week (from 35 to 40 hours); revised engineering classifications and related pay increases; and a new requirement for supervisory level positions (i.e., professional engineering licensure). In addition, in-house employee time and costs allocated to project delivery are not tracked by the department at this time. Without further information, the adequacy of current and projected resource levels cannot be assessed.

Actions to Turn the Curve:

The agency's human resources unit has been analyzing trends in age and years of service among department employees as part of a succession planning effort. To prepare for impending retirements, managers have been directed to review and update documentation related to standard operating procedures for critical positions likely to be vacated by retiring employees. Training and guidance on ways to promote continuity of operations also are being provided for department managers at all levels.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

A comprehensive assessment of current staff capacity and analysis of the types of skills and numbers of employees the department needs to carry out project delivery and other major responsibilities effectively has not been undertaken. Until this information is developed, the department cannot determine if present resources are sufficient or additional staffing is justified to ensure timely, cost-effective delivery of improvements to the state transportation systems. PRI recommends:

the transportation department seek the assistance of the Connecticut Academy of Science and Engineering in preparing a talent assessment of its existing staff capacity and projecting its future staffing needs for capital improvement project delivery implementation. The results of this assessment should be completed by July 1, 2012, and shared with the legislature’s Appropriations and Transportation Committees.

Further, the department should establish a mechanism to track the direct and indirect costs of the design, construction inspection and administration, and project management services its employees provide on a per project basis. Measures of project delivery workload, such as project dollar value per employee, also should be developed and used to monitor trends in internal staff capacity.

Performance Measure 2) Consultant Services for Project Delivery

The extent that DOT uses outside consultants for project delivery is broadly measured by data on agreements executed for professional services related to capital improvement projects. As indicated in the table below, DOT has engaged outside professional services for various project delivery tasks (e.g., planning, design, construction inspection, project management, or auditing) at annual total fees ranging from just under \$100 million to nearly \$170 million over the last five years.

Outside Professional Services Agreements for DOT Project Delivery by Type: FY 06 – FY 10					
	FY 06	FY 07	FY 08	FY 09	FY 10
Agreements	37	29	44	35	23
Supplemental Agreements	62	51	58	36	40
Extra works	134	157	187	192	195
On-calls	111	106	113	108	96
Subconsultants	117	121	140	109	146
Total Items	461	464	542	480	500
Total Fees (Amount Negotiated)	\$99,178,559	\$148,150,172	\$169,426,549	\$168,056,805	\$125,431,427
Source: DOT Bureau of Finance and Administration					

Story Behind the Data:

Like all state transportation departments, DOT uses a variety of outside professional services to supplement its internal project delivery capacity and obtain specialized skills its employees do not possess. In addition, contracting out design, inspection, and project management tasks can help manage short-term

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

fluctuations in workload. As the table indicates, the amount the department spends on consultant services related to project delivery, more than \$100 million a year, is substantial.

Additional information and study is needed to determine if the department's current use of consultant services is cost-effective. According to a recent GAO report, the existing research on the costs of contracting out compared to using in-house staff is inconclusive. GAO found methodological issues and other limitations prevented any reliable findings about whether consultants are more or less expensive public employees for highway projects over the long term.¹⁰

The primary problem in such comparisons is establishing an appropriate overhead rate for in-house work. As GAO noted, most state transportation department's accounting systems cannot accurately capture all relevant direct and indirect costs and apportion them to individual projects or functional units. The life-cycle costs of public employee pensions and other benefits also are difficult to quantify. A complete cost-benefit analysis additionally should consider any differences in quality or time-savings between work done in-house and by consultants.

The committee understands fully quantifying all costs and benefits associated with public employees has been difficult for state governments historically. However, until DOT develops a method for identifying all internal staff costs, it will not be possible to determine whether agency resources are being used efficiently.

Actions to Turn the Curve:

The state Contracting Standards Review Board, in accordance with its enabling legislation, recently asked DOT to conduct a cost-benefit analysis of its bridge safety evaluation program. The intent of the analysis is to determine whether it is more cost-effective to inspect bridges using state or private inspectors. DOT requested the board allow it to complete the analysis in three steps, with the first two tasks completed before the end of 2010 and the third task done by March 2011. The board ultimately adopted a resolution calling for the bridge inspection analysis with work segmented into the components and timeframe identified by DOT.

The methodology DOT identifies in its analysis of the bridge inspection program could next be applied to determining costs associated with designing transportation projects with in-house design staff and comparing that with costs of consultant designers. Such a cost-benefit analysis could identify ways to use the department's limited resources for improving the state transportation system more effectively. To determine and apply the most cost effective methods for designing DOT projects, the program review committee recommends:

the Department of Transportation conduct an analysis of transportation project design costs that compares the costs associated with work done by department employees to costs of using private design firms. The analysis should be conducted and completed by July 1, 2012, with a report of the results forwarded to the legislature's Transportation and Appropriations committees on or before that date.

¹⁰ GAO, *Federal Aid Highways: Increased Reliance on Contractors Can Pose Oversight Challenges for Federal and State Officials* (GAO-08-198), January 2008.

II. How Well Did We Do It?

As noted earlier, aggregated data on the overall performance of DOT project delivery is lacking. The department just initiated quarterly reporting on two core project delivery performance measures – on time and on budget – for its completed construction projects. Otherwise, little information has been compiled and reported about how well the department implements the project delivery process, particularly for the design phase.

The PRI committee looked at historical trends in project delivery performance using information about DOT projects completed (i.e., final voucher dates) over the past ten years. As described below, the database used was developed for committee staff by the department. PRI staff analysis focused on two key project delivery measures: schedule and cost. Results are summarized in the following committee findings:

On Time

- The time required to complete the transportation project delivery process – from initiation of project design through construction – increased between 2001 and 2010.
- The time to complete the full project delivery process averaged 1,918 days (5.3 years) for projects completed over the period. The project design component accounted for the largest portion of time within the overall project delivery process, averaging 1,195 days, or 61% of the full project delivery process.
- Project construction completion times determined as part of the project design process are consistently underestimated: 37% of projects were completed on-schedule. The average for 15 other states was 53% between 2001-05.
- Projects exceeded their original construction dates by an average of 223 days (median was 144 days).
- The percent of projects completed beyond their original schedules was higher for state projects than municipal projects, 68% and 44% respectively.
- The highest percentage of projects not completed within their original schedules was for those with the highest original costs (>\$20 million). Conversely, the lowest percentage of projects not completed on time was those with in the lowest original cost range (<\$5 million).
- Projects exceeding their original completion dates with original costs over \$20 million were completed an average of 852 days beyond their deadlines. This average is almost five times that of projects not completed on schedule in the “less than \$5 million” range, which averaged 174 days.

On Budget

- The percent of projects incurring cost overruns of more than 10% decreased 49% for projects completed between 2001-10.
- Just under three-fourths of projects incurred some degree of cost overrun when compared to original construction budgets; the average cost overrun for projects over budget was 23%.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- Of the projects completed *below* their original budgets, the average amount under budget was 8% and the median amount was 5%.
- Construction for 42% of projects was completed over original budgets by more than 10%. The average cost overrun for the projects over 110% of their original budgets was 37% and the median was 21%.
- The percent of projects incurring cost overruns of >10% was essentially the same whether the state or a municipality delivered the project: 42% and 41% respectively.

Completed project database. To examine Connecticut's performance for delivering projects on-time and on-budget, committee staff used data ConnDOT recently submitted as part of an AASHTO initiative. AASHTO's Standing Committee on Quality is establishing a database of specific data elements from states' transportation projects. The initiative is a nationwide effort to collect and analyze transportation project information for states' performance delivering projects on-time and on-budget. The initiative's intended objective is to provide states with centralized information, allowing them to learn from each others' experiences and helping them establish and apply common performance measures on transportation priorities. The database will include information for transportation projects completed between January 2001 through June 2010.¹¹ To date, 36 states are participating, including Connecticut, although the results of the analysis have not been published.

Committee staff analyzed project delivery information for 793 projects delivered between 2001-10. The data sent by DOT to AASHTO only included information for the construction phase of the project delivery process and not for the preconstruction part, specifically project design and project bid/award. The department assembled preconstruction data for the projects as best it could from various sources, since no comprehensive project management system exists. In some cases, complete information is not available for various projects, which is noted in the analysis when applicable.

DOT has just begun publishing two new performance measures for project delivery timeliness and cost effectiveness. The new measures are based on a recent point-in-time and do not include the department's past experience with completing construction contracts on budget or on schedule. Performance prior to that time frame is not part of the baseline used within the measures.

The department has discussed with committee staff its preference for using current data from which to base its future performance for delivering projects on time and on budget, rather than incorporating past performance as part of developing a baseline or performance standard. The committee believes examining historic performance helps provide a broader, more meaningful baseline from which to compare and measure the department's performance at delivering projects on time and within budget. PRI also recognizes the difficulty in determining and analyzing all the factors contributing to project cost effectiveness and completion times without a more complete review of individual projects. For this reason, the analysis below serves as but one proxy of the overall timeliness and cost performance of the transportation project delivery process.

¹¹ The completion date used in the database is "final voucher date" for projects. The final voucher date is the date assigned when projects are closed out for financial and administrative purposes, and not the date a project becomes available for public use. Projects are considered "substantially complete" – open for public use –before their final voucher dates.

A. Projects Are Completed On Schedule

On-schedule performance typically focuses on the construction phase of project delivery – whether projects, once started in construction, are finished on schedule. The scope of this study, however, calls for a review of the project delivery process from initiation of project design through construction. As such, on-schedule performance of the preconstruction and construction phases is reviewed.

The information presented below analyzes the following key milestones within the preconstruction phase: project initiation through the completion of project design; project advertising through construction contract award; and award through the notice to proceed sent to contractors to begin construction. Information is also presented for the construction phase and the department's overall performance for completing construction projects within schedule.

Although the project data supplied by DOT is based on projects' final voucher dates between 2001-2010, such dates are not the most applicable to use within the scope of this study when measuring whether project construction is completed on schedule. Instead, the analysis below uses projects' "substantial completion dates" to indicate project completion. The department classifies projects as substantially complete when they are safe for public use following semi-final inspection, although additional work is necessary to fully satisfy contract terms and administrative requirements for federal reimbursement.

A factor making analysis of project completion challenging is the winter shutdown period for project construction, which runs from December through March. Within the analysis for the overall timeliness of the full project delivery process, construction phase was defined as from the notice to proceed date to the substantial completion date, which does not account for winter shutdown periods. The analysis specific to the performance of the construction phase of the project delivery process accounts for winter shutdown periods.

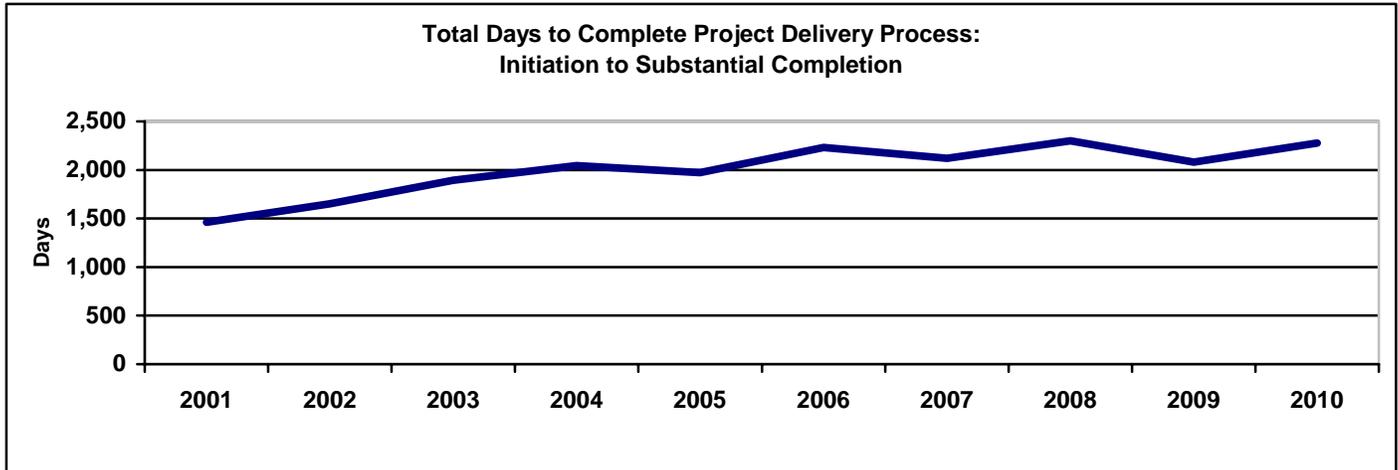
Performance Measure 1: Project Delivery Over Time

Project data were reviewed to determine the aggregate length of time it takes to complete the project delivery process - from project initiation to when projects are deemed substantially complete. The figure below illustrates the average number days by year to complete transportation projects. Completion times for construction contracts are specified by the number of calendar days necessary to complete the contracts, which is why the time frames in the figures below are indicated in days.

- Overall, the trend to complete the transportation project delivery process has been increasing. Process completion times steadily increased between 2001 and 2004, with alternating increases and decreases between 2005-09, only to increase again for projects in 2010. The full reasons behind the steady increase in project delivery times are unclear without more in-depth analyses. Efforts to control time overruns clearly are needed.
- The average time to complete the full project delivery process for the time period analyzed was 1,918 days (5.3 years); the median time was 1,797 days (4.9 years).

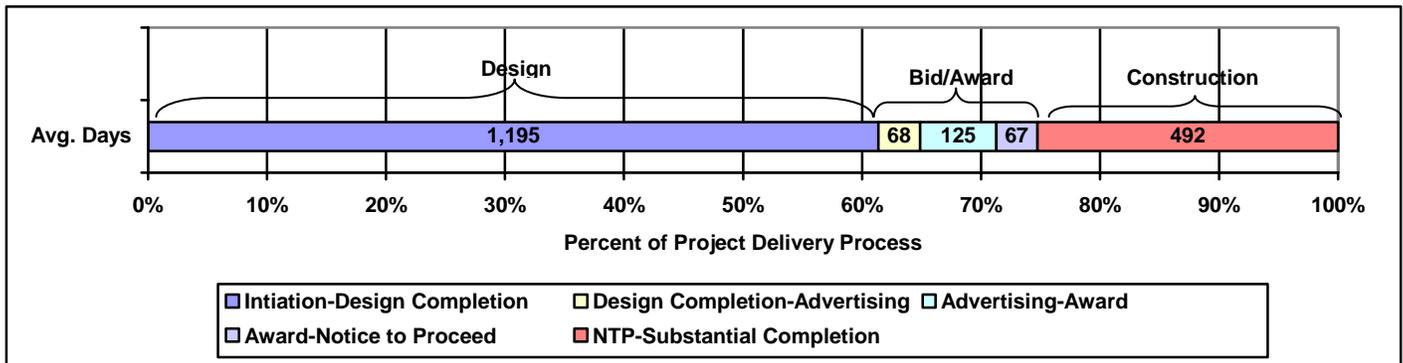
**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- Project delivery completion times ranged from an average low of 1,461 days (4.0 years) in 2001, to 2,301 days (6.3 years) in 2008.



Performance Measure 2: Project Delivery Completion Time by Phase

The figure below shows the amount of time it takes to complete key milestones of the project delivery process. The time frames for the individual parts of the process shown in the graph differ slightly from the overall average time to complete the full process shown above because not all the projects had complete information when each phase of the process was examined individually. (As noted above, the time frame for the construction phase is from the notice to proceed date to the substantial completion date, which does not account for winter shutdown periods.)



- Project design accounted for the largest portion of time within the overall project delivery process, averaging 1,195 days or 61% of the overall time to deliver projects.
- The construction phase accounted for 25% of the processing time, averaging 492 days. (Accounting for winter shutdown: the average number of “calendar days used” for the construction phase is over one year - 409.).
- The administrative processes to advertise, bid, and award projects, and issue notices to contractors

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

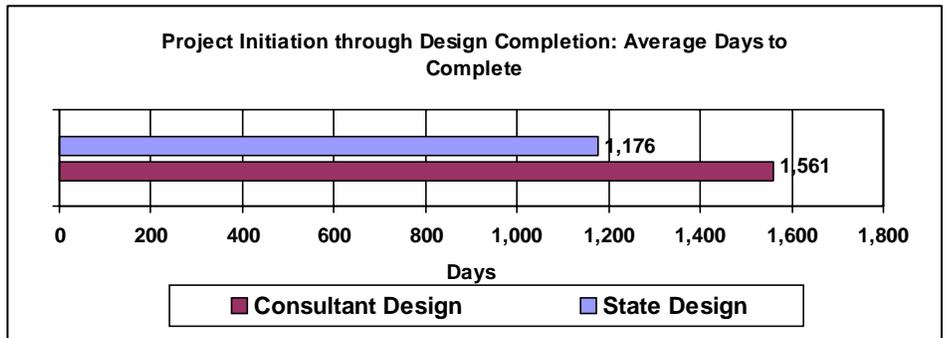
to proceed with work, accounted for the least amount of time within the process, averaging 260 days, or 13% of the overall time.

Performance Measure 3: Project Design by State or Consultant

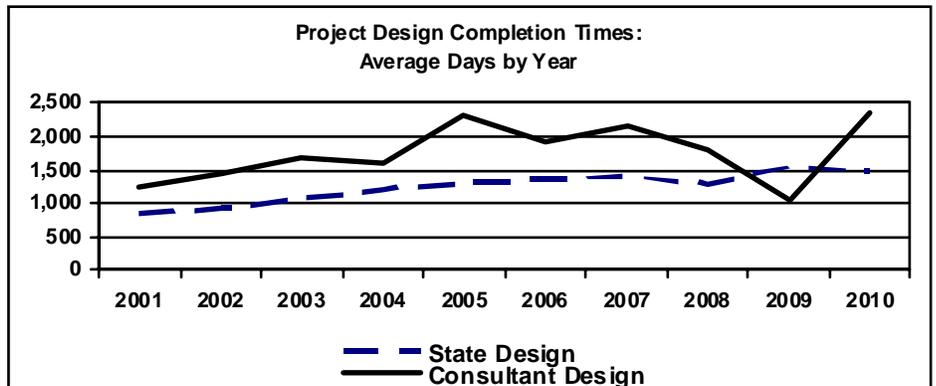
DOT uses state and consultant engineers to design projects. The department notes consultants are used for various reasons, particularly when demand for project design work and/or the overall level of expertise needed for specific project designs, exceeds the design staff resources available within the department.

At times, single projects will be designed by a combination of state and consultant design engineers, making comparative analysis between the two difficult. When applicable, project data were analyzed to determine the time the design phase took to complete for projects designed by state engineers or consultant engineers. Caution must be applied when interpreting the data because the analysis does not include an evaluation of the types of projects designed or the relative size or complexity of the projects designed, which likely affect design completion times.

The adjacent figure provides a basic analysis of the length of time to complete the design phase of the project delivery process by type of designer. Projects designed by state engineers averaged 1,176 days to complete, and projects designed by consultants were completed in an average of 1,561 days.



The flanking figure illustrates the average design completion times by state engineers have steadily increased since 2001, but overall have remained lower than completion times by consultants for all years except 2009. The average completion times for design consultants fluctuated over the period analyzed. Again, the graph shows aggregate results; additional analysis is required to more fully understand the reasons behind the differences.



Performance Measure 4: Projects Constructed On Schedule

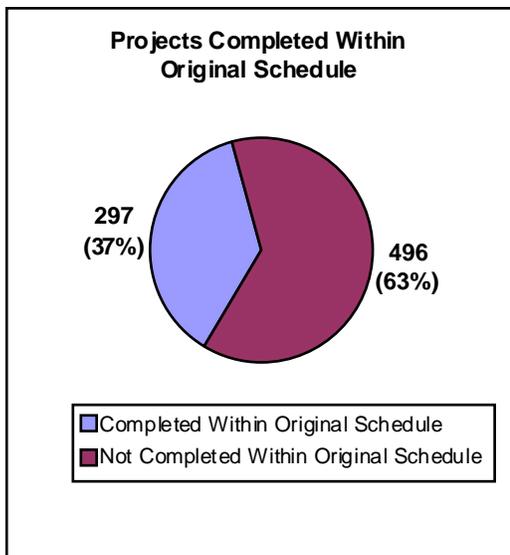
Project completion typically equates to the time it takes to complete the construction phase and whether projects are constructed within the schedules established in construction contracts. An added challenge in analyzing performance of the construction phase of the project delivery process is how to account for the winter

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

shutdown policy used by the department.

The data received from the department for project construction contains information for: 1) original deadlines; 2) time extensions granted to account for unforeseen or changed conditions, delays in utility work, design changes, or weather conditions; and 3) the actual calendar days used to complete projects, which incorporates winter shutdown periods. The analysis below is based on the data provided by DOT and focuses on: 1) the percent of projects constructed on schedule; 2) construction timeliness based on project size; and 3) timeliness of state and municipal projects.

The project database was reviewed to determine if projects were completed within the original schedule dates set out in construction contracts. The figure below illustrates the number and percentage of projects completed on schedule or not on schedule according to their original contract deadlines.

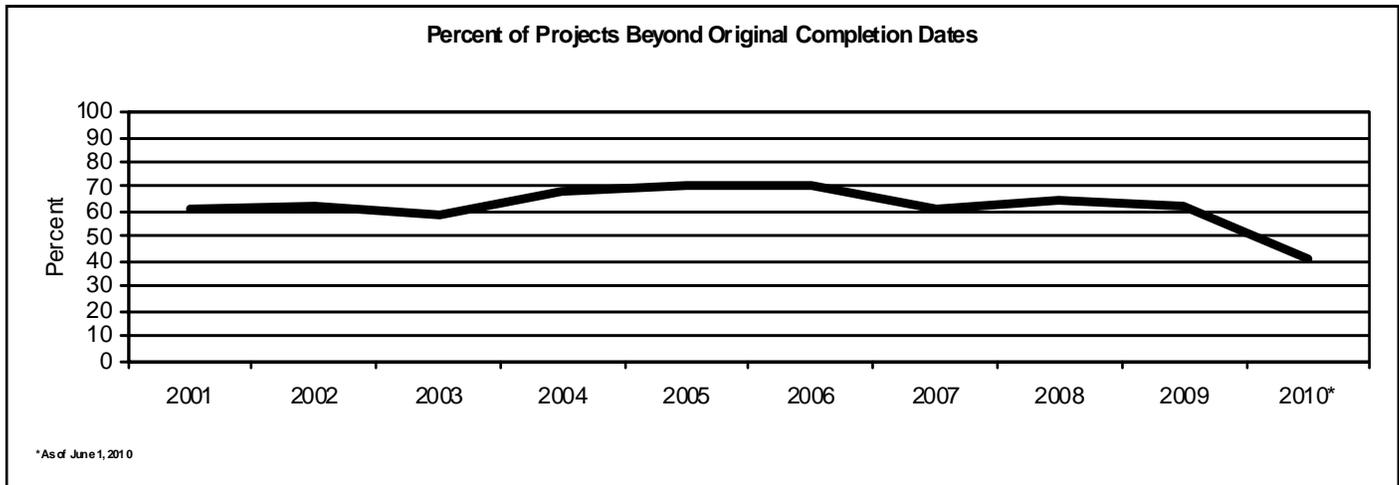


- Of all the projects, 37% were completed within the original schedules specified in their construction contracts, while 63% were not.
- The average length of time projects exceeded their original completion dates was 223 days; the median time was 144 days.
- Of the 297 projects completed within their original schedules, 221 (74%) were completed in less time than the original completion dates specified in the contracts – an average of 40 days before their original deadlines.
- All 496 projects exceeding original completion dates were granted extra time for completion; only 15 of the projects exceeded the extra time allowed.

Project information was analyzed to identify trends in the percent of projects not completed within their original schedule. The figure below shows the results for the projects exceeding their original completion deadlines.

- The trend in the percent of projects delivered after their original completion dates has fluctuated somewhat over the period analyzed, with a noticeable decline in 2010. Overall, the percent of projects not completed on time remained relatively constant between 60-70%; conversely, roughly one-third of projects were delivered on time in any given year (except 2010). At minimum this indicates the project construction completion times determined as part of the project design process are consistently underestimated.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**



Projects were analyzed to examine the relationship between completion times and original project cost. Projects were classified according to three budget levels: over \$20 million; \$5 million to \$20 million; and less than \$5 million, as indicated in the table below.

Original Cost	Total Projects	Projects Completed Beyond Original Schedule	Average Days Past Orig Date	Median Days Past Original Date
Over \$20 million	24	21 (88%)	852	566
Between \$5 million and \$20 million	72	49 (69%)	371	317
Less than \$5 million	697	426 (61%)	174	120

- The analysis clearly shows the highest percentage of projects not completed within their original schedules was for projects with the highest original costs (>\$20 million). Conversely, the lowest percentage of projects not completed on time was those with in the lowest original cost range (<\$5 million).
- Projects exceeding their original completion dates with original costs over \$20 million were completed an average of 852 days beyond their deadlines. This is almost five times that of projects not completed on schedule in the “less than \$5 million” range, which averaged 174 days.

The DOT project information identifies municipal projects receiving federal funding and overseen by the state. The information was analyzed to compare the level of time overruns for projects delivered by municipalities and the state, as shown in the table. (Again, additional analysis is necessary to fully understand the reasons behind these differences.)

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Level	Total Projects	Projects Completed Beyond Original Schedule	Average Days Past Original Date	Median Days Past Original Date
State	617	418 (68%)	239	160
Municipal	176	78 (44%)	134	82

- The percent of projects completed beyond their original schedules was higher for state projects than municipal projects, 68% and 44% respectively.
- The average number of days overdue was 78% higher for state projects (239 days) than municipal projects (134 days). At the same time, the average cost for state projects was \$4 million and \$765,000 for municipal projects.

Story Behind the Data: On-Time

- DOT does not have an automated project management system to adequately track projects through the design phase of the project delivery process. As a result, the department does not have aggregate information to base its overall performance of designing projects in accordance with established time standards. The department's ability to measure the project delivery process against specific standards also is limited because few performance standards exist for determining overall process timeliness or effectiveness. (Information about the few standards that are in place is provided later.)
- Project-specific data for major milestones within the design process were not available for the length of time to select design consultants, completion times for the preliminary engineering and preliminary design components, or the time necessary to complete the rights of way process. As such, the parts of the design process taking the longest time to complete or where areas for streamlining may be found, were not identified.
- Errors or omissions in project design can impact the overall ability to construct projects on a timely basis. The link between construction timeliness and preconstruction performance, however, is inadequate to determine what affect design errors/omissions have on construction timeliness. The department acknowledges more focus is needed in this area and is taking efforts to make improvements.
- A full analysis of consultant agreements to determine whether design consultants deliver their work in accordance with specific schedules included in the agreements was not conducted within this study due to time constraints. Thus, consultants' overall performance in meeting any established time frames within agreements is unclear.
- FHWA recently conducted a process review of the department's consultant selection process for projects using federal funds. The purpose of the review was to see if the process was in compliance with applicable federal laws and regulations. FHWA made several recommendations for improvement, but mostly found the department's process operated in conformance with federal requirements.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- A high percentage of transportation projects are granted extensions beyond the original completion deadlines specified in construction contracts. If time equals money, then the mere extension of a construction project is costing more than originally estimated. This fact makes the overall accuracy of the department's project design function to determine how long project completion will take that much more critical to an efficient project delivery process.
- The results of a 2007 AASHTO study show, for 15 states, an average of 53% of transportation projects were completed on or before their original schedule for 2001-05.¹² This compares to 37% of projects in Connecticut completed on or before their original schedules (for the time period of 2001-10).

Actions to Turn the Curve

Although efforts are needed by the department to decrease the overall number of projects not completed according to their original schedules contained in contracts and better estimate during the design phase how long projects should reasonably take, including building in time for unforeseen circumstances, the department is implementing specific efforts to help minimize projects not completed on time. Key initiatives currently implemented (or under consideration) to ensure projects are delivered on schedule and to make certain the results are transparent are outlined below.

- DOT just developed a performance measure for completing construction projects within schedule, and is beginning to report quarterly progress on the agency website as of October 2010. The department's first quarterly report shows:
 - 45% of the 29 total projects completed during the second calendar quarter of 2010 were completed on time (this is somewhat better than the 10-year average of 37% discussed above.)
 - The reasons cited for project time overruns are:
 - Changed Conditions: 25%
 - Utility Delay: 23%
 - Extra Work: 19%
 - Design Change: 14%
 - Third Party: 11%
 - Weather: 7%
 - Permits: 2%
- Missing from the department's new performance measure is the overall length of project delays and how much time the specific reasons for time extensions add to overall project delays.
- The department is currently considering developing another performance measure around project delivery. Specifically, the department's five-year capital plan would be used to determine which projects the department would deliver (i.e., put to bid) in a given year. The department's performance as to which projects were actually delivered would then be matched against which projects its capital plan said would be delivered.

¹² *Comparing State DOTs' Construction Project Cost and Schedule Performance*, American Association of State Highway Transportation Officials, May 2007.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- The department’s quality assurance office has begun working with project design engineers to help ensure the overall efficiency and effectiveness of the designers’ efforts to adequately estimate the completion times for projects. The office is also in the process of mapping the numerous steps associated with the project design function, which should provide the department with a work-flow schematic of the full project design process. This work is dovetailing OQA’s effort on developing a “design development guide” to ensure all the steps of the various design milestones are fully documented.
- In response to concerns raised by FHWA, the Bureau of Finance and Administration has undertaken a series of efforts to improve administrative efficiency in processing contracts and agreements related to DOT projects. These include aggressive monitoring of all processing times, regular interagency meetings to improve communication about reasons for delays and how to address them, better interagency communication (e.g., memoranda of understanding with the Office of Attorney General about contract reviews), and development of standardized legal documents, such as a master agreement with utilities and ARRA project construction contracts. The bureau also has drafted a master agreement to use with municipalities for project delivery, now under review by the attorney general’s office, and is working on a template for consulting engineering contracts.
- Additional project delivery process performance measures reported by DOT indicate success in these streamlining efforts. Specifically, between July 2008 and the second quarter (April-June) of 2010:
 - recent efforts by the department have been able to almost triple the percent of construction contracts awarded within 60 days of bid opening – from 30% to 86%; and
 - the percent of agreements (all types) executed in under 60 days increased from 28% to 47%.

To improve on-time performance, the program review committee recommends the following actions:

- **The Department of Transportation should continue to examine ways to streamline the time it takes to complete major milestones within the project delivery process. Once the agency's new integrated project management system is fully operational, targets for completing each major step of the design process should be set and monitored by the engineering bureau, with the assistance of the performance measures unit. Attention should be paid to: 1) the degree to which design consultants and staff engineers meet established deadlines for designing projects; 2) the process used by project designers to estimate the amount of time necessary for project completion to ensure such estimates are realistic; and 3) the advertising and contract bidding processes.**
- **The department should continue to fully focus on the link between project design and time extensions to project construction due to design errors or omissions, with the specific goal of increasing the department’s performance for completing projects in accordance with their original schedules.**

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- **DOT should set a yearly performance goal for delivering transportation projects within schedule for construction purposes, rather than continuing to use its recently-established standard of “maximizing percent of construction contracts completed on time.” The department’s performance toward achieving the new goal should be part of its current initiative to measure project completion performance. The goal should be realistic and re-evaluated at least annually.**
- **The department should add the following components to its current measure for on-time project delivery performance: 1) the aggregate times projects are taking to complete beyond their original deadlines; and 2) the aggregate amount of time each reason for scheduling extensions (as identified in the department’s current measure) adds to the overall time for completing projects.**
- **The department should begin benchmarking its performance for delivering transportation projects on schedule with the performance of other states for comparative purposes. DOT should identify best practices used by states with better project completion performance, and determine whether to implement such practices within its project delivery process.**
- **DOT should include on its website a “watch list” of all projects approaching time overruns for the design and construction components of the project delivery process.**

B. Projects Are Completed Within Budget

The following analysis uses two primary methods to determine whether projects are delivered within budget. Using the same data base of 793 transportation projects with final voucher dates between 2001-2010, a comparison was first made between a project’s original cost (i.e., contractor’s bid amount) and the project’s final construction cost – this is referred in the analysis below as the strict measure of on-budget performance. If the comparison showed either a zero or negative difference from the original cost, the project incurred no cost overrun and was completed within its original budget. Conversely, if the final project cost was more than the original budget, the project incurred a cost overrun, which happens through change orders made to the project.

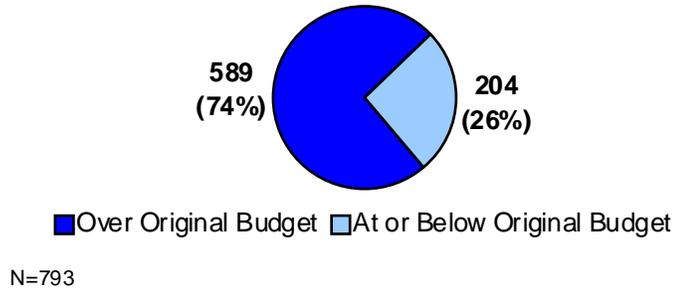
Second, according to general industry practice, a contingency may be added to the original contract amount before a project is considered over budget (DOT uses a ten percent contingency, which is a common standard). The contingency is to cover unanticipated overruns, which may occur because of unknown issues encountered during project construction not predicted during the project design phase. Incorporating the ten percent contingency into the analysis of on-budget performance is referred to below as the lenient measure.

Performance Measure 1: On-Budget Performance (Strict Measure)

Information from the database was examined to determine if the projects were completed within their original budgets. The figure illustrates the number and percentage of projects experiencing cost overruns using the strict measure that any project with final costs over its original contract amount incurred a cost overrun.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

DOT Projects: On-Budget Performance

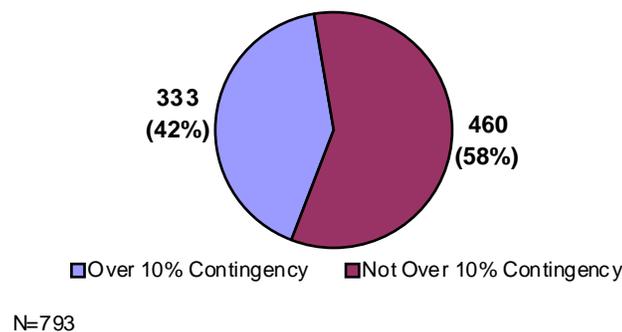


- 589 projects (74%) incurred some degree of cost overrun when original construction budgets were compared against costs.
- The average cost overrun for projects over budget was 23% and the median was 12%.
- Another 204 projects (26%) did not incur any cost overruns – meaning they either met or were below their original budgets. Of those projects completed *below* budget, the average amount under budget was 8% and the median amount was 5%.

Performance Measure 2: On-Budget Performance (Lenient Measure)

As noted above, Connecticut builds a 10% contingency into its transportation project budgets. The contingency is intended to help offset costs associated with project construction not anticipated as part of original project design. According to DOT’s construction manual, the reasons why projects may go over budget are unforeseen condition, change in project scope, contract revision, quantity adjustment, or other adjustment.

**DOT Projects: On Budget Performance
(Based on 10% Contingency)**

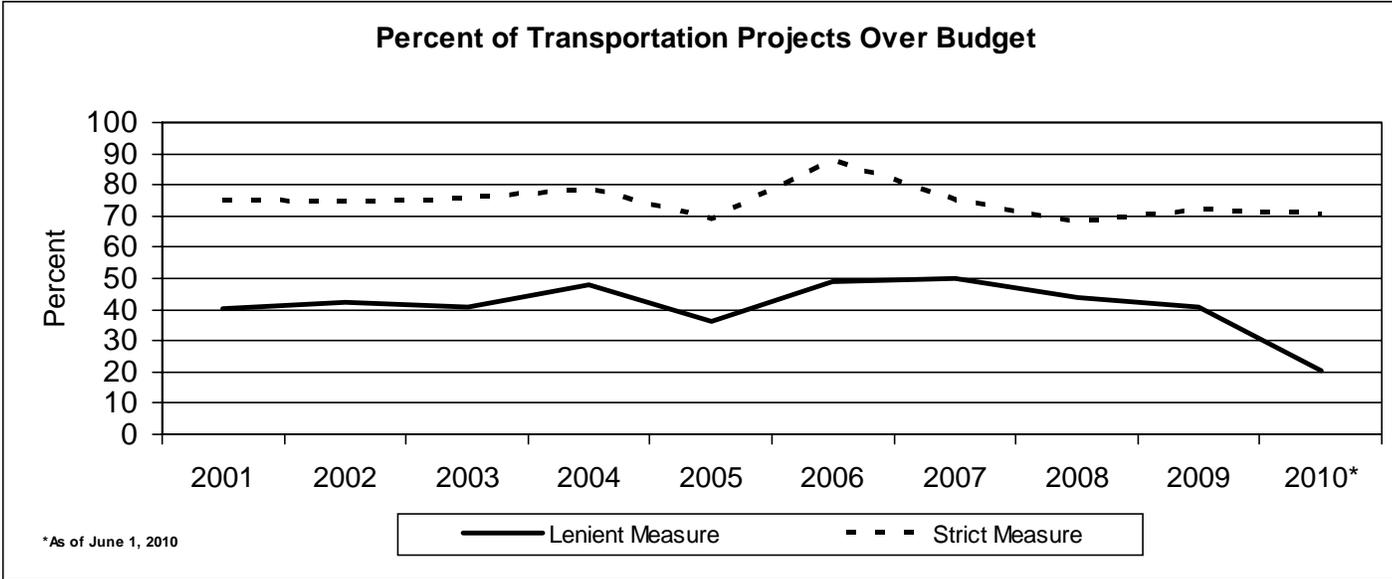


- 333 projects (42%) were over their original budgets by more than 10%.
- The average cost overrun for the 333 projects over budget was 37% and the median was 21%.
- 460 (58%) projects were completed within 110% of their original project budgets. The amount *under* budget was very small (0.6% average and 1.1% median).

Performance Measure 3: Trend in Projects Over Budget

Project information was analyzed to identify trends in the percent of projects incurring any cost overruns using both the strict and lenient measures. The committee believes the results shown in the figure provide a truer picture of project budget overruns over time when both measures are compared. Overall, the trend in projects incurring cost overruns for both measures is mixed for the period analyzed. However, using the lenient measure, the percent of projects experiencing cost overruns over 10% has substantially decreased since 2007.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**



- On average, 42% of projects over the period incurred cost overruns of more than 10% of their original costs and the percent of projects incurring cost overruns of more than 10%, decreased 49% overall, with the sharpest decline occurring in 2010.
- The highest percentage of projects with cost overruns of more than 10% of their original cost occurred in 2007 (50%), and the lowest percent occurred in 2010 (21%).
- Each year, roughly one-third more projects are over budget when applying the strict measure.

Performance Measure 4: Projects Over Budget by Project Size

The original budgets of transportation projects were analyzed to identify the variation in cost overruns based on project size. Projects were classified according to three budget levels: over \$20 million; \$5 million to 20 million; and less than \$5 million. This analysis represents projects with final costs more than ten percent over their original contract amounts (i.e., lenient measure).

Original Project Budget	Total Projects	Projects with final costs over 10% of original budget	Average % Overrun (w/ 10% contingency)	Median % Overrun (w/ 10% contingency)
Over \$20 million	24	17 (71%)	25%	19%
Between \$5 million and \$20 million	72	46 (64%)	28%	21%
Less than \$5 million	697	270 (39%)	39%	21%

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- A greater percentage of the largest transportation projects were delivered over budget accounting for the 10% contingency. Seventy-one percent of projects with original costs exceeding \$20 million were over budget, compared to 64% of projects with original costs between \$5 million to \$20 million, and 39% with costs of less than \$5 million.
- On average, the cost overrun percentage was highest for projects with original budgets under \$5 million (39%) followed by projects between \$5 million to \$20 million (28%), and then projects over \$20 million (25%), although there was little difference in the median cost overrun (19-21%). This signifies that from a percentage standpoint, design estimates were closer to projects' original budgets as project size increased.

Performance Measure 5: Project Budget Performance by State or Local Project

The transportation project data base identifies municipal projects receiving federal funding overseen by the state. DOT has a stewardship agreement with FHWA to oversee such municipal projects to ensure the funding is appropriately used and projects meet federal standards. The information was analyzed to compare the level of cost overruns for projects delivered by the state or municipalities.

Project Category	Total Projects	Projects with final costs over 10% of original value	Average % Overrun (w/ 10% contingency)	Median % Overrun (w/ 10% contingency)
State	617	260 (42%)	35%	19%
Municipal	176	73 (41%)	43%	22%

- The results show the percent of projects incurring cost overruns was almost the same whether the state or a municipality delivered the project. Overall, 42% of state projects had final construction costs over ten percent of their original budgets, while 41% of municipal projects had cost overruns of more than 10%.
- The average percent overrun for municipal projects was slightly higher than that of state projects, 43% and 35% respectively. The median percent overrun for the two entities was closer, with 22% for municipal projects and 19% for state projects.

Performance Measure 6: Cost of Project Budget Overruns

In addition to analyzing budget performance for the volume of transportation projects delivered, the overall costs associated with budget overruns for projects were examined. The analysis differentiates cost overruns based on the strict and lenient measures.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

<u>Strict Measure</u> (cost overrun with no contingency)			
Original Project Cost	Total Original Project Costs	Total Project Overrun Amounts	Overrun as % of Original Cost
Over \$20 million	\$999,391,323	\$198,271,173	19%
Between \$5 million and \$20 million	\$665,804,104	\$153,267,055	23%
Less than \$5 million	\$674,696,355	\$140,095,194	21%
Totals	\$2,339,891,782	\$491,633,416	21%

- In total, cost overruns exceeded original project costs by \$491.6 million (21%) for the period examined.

<u>Lenient Measure</u> (cost overrun over 110% of original budget)			
Original Project Cost	Total Original Project Costs	Total Project Overrun Amount	Overrun as % of Original Project Cost
Over \$20 million	\$766,216,783	\$186,593,876	24%
Between \$5 million and \$20 million	\$485,041,980	\$142,679,093	29%
Less than \$5 million	\$387,764,420	\$125,101,591	32%
Totals	\$1,639,023,182	\$454,374,560	28%

- When accounting for the 10% contingency, the total cost overruns totaled \$454.3 million, or 28% of the total original value for such projects.

Performance Measure 7: Construction Claims

Another factor leading to construction cost overruns for transportation projects is claims brought against the department by contractors for a variety of reasons, including errors and/or omissions in project design plans. The claims information presented in the table below is provided for general descriptive purposes only, since it is difficult to fully analyze claims based on the limited information obtained by committee staff.

- The number of claims was not large. Of the 345 contracts awarded between 2005-10, 13 claims have been filed against the department, or an average of under 4% for all the contracts.
- The total amount of the claims was \$12.8 million, with final settlements of \$3.4 million, or just over 26% of the original claims amount.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Year Contract Awarded	Total Amount Bid	Projects	Claims	% w/ Claims	Total Amount Claimed	Total Amount Settled	Settled/Claimed Amount
2005	\$271,249,045	45	4	9%	\$7,226,853	\$1,769,808	24%
2006	\$229,882,885	67	3	5%	\$2,517,991	\$1,520,000	60%
2007	\$341,342,126	42	3	7%	\$1,407,541	\$0	0%
2008	\$649,933,486	73	2	3%	\$922,373	\$85,185	9%
2009	\$933,581,289	69	1	1%	\$715,250	\$0	0%
2010	\$194,852,723	49	0	0%	\$0	\$0	0%

Notes: 1) “Year” represents the year a construction contract was awarded; 2) “# of claims” represents the number of claims received on those contracts awarded in that year, not when the claim was received (example: 3 claims were received in 2010 for contracts awarded in 2005, 2008, and 2009); and 3) “settled amount” is subject to change because the department may not have settled all the claims indicated.

Story Behind the Data: On-Budget

- Project costs for individual transportation projects are examined within the department by project teams and as part of broader monthly project status meetings involving upper management. The department, however, has not routinely analyzed its entire project delivery system from a macro perspective to determine the level of cost overruns for transportation projects in comparison with projects’ original budgets inclusive of design and construction. Data availability on project cost also varies by bureau, type of project, and funding source.
- Cost information, particularly when trying to isolate full project costs associated with state-designed projects, could not be identified, making it difficult to determine how much the in-house design function accounts of the project delivery process. As a result, overall performance information for how well the department does delivering projects within budget is not known for the complete project delivery process.
- The department has several systems in place to oversee project management and track project budgets. SiteManager and CORE-CT are two of the central automated systems used by DOT to track project progress and budgets.
 - SiteManager is an automated construction management reporting tool consisting of several integrated forms and reports to track projects in construction. Project records are maintained in a central database and accessible by the entire department; records hold important information for measuring performance. This system, however, automates only part of the project delivery process; additional automation of the project design component of the project delivery process is necessary. DOT is currently close to implementing such a system, which should allow it to fully capture relevant performance data applicable to project design.
 - Core-CT is the state’s centralized financial management system. Within DOT, the system is used to track project costs on an individual basis for accounting and payment purposes, and has been fully operational for roughly two years. Additional work is necessary to ensure the system captures complete project financial information useful for measuring project performance.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- A recent joint effort between FHWA and DOT to examine cost overruns occurred in 2004.¹³ The effort appropriately points out cost overruns “have a dramatic affect on the Department’s ability to fund and schedule transportation improvement projects.” Several key findings of the study include: 1) Connecticut faces a significant issue with respect to construction cost overruns; 2) depending on project cost, overruns for larger projects (over \$5 million) range between 20-40%; 3) projects of similar scope and complexity in the region experience cost overrun of generally 10%; and 4) eliminating all cost overruns may be unrealistic given the level of complexity of large transportation improvement projects. The committee developed numerous recommendations, many of which the department has/is implementing including the creation of a Quality Assurance/Quality Control unit responsible for ensuring quality design plans and specifications are developed, which should help lessen cost overruns experienced during construction.
- Engineers in the department’s Office of Quality Assurance develop their own project cost estimates. The office then compares its estimates with those of the lowest bids submitted by contractors. The table shows between FY05 and FY08, the OQA engineers’ project estimates were lower than the low bid totals by a range of 1.2% to 7.2%. This trend changed in FYs09 and 10, when engineers’ estimates exceeded the total of contractors’ low bid amounts – undoubtedly a sign of the overall economic conditions experienced the last two years and the challenge the department faces in predicting contractors’ bids in a difficult market. In addition, it is unclear as to the differences, if any, between the project cost estimates developed by OQA, and the estimates developed by the design engineers, because the information currently is not tracked.

Fiscal Year	# of Contracts	Total Engineers’ Estimates	Total Low Bid Amounts	Percent Low Bids Were Above/Below Engineers’ Est.
2005	46	\$212,631,411	\$223,826,249	5.26%
2006	56	\$213,425,354	\$228,817,622	7.21%
2007	64	\$448,002,649	\$453,524,034	1.23%
2008	64	\$515,027,817	\$532,638,179	3.41%
2009	70	\$948,027,074	\$918,727,952	-3.09%
2010	59	\$437,385,526	\$292,428,198	-33.14%
Averages	60	\$462,416,639	\$441,660,372	-3.18

- The department’s quality assurance office is examining contingency rates used by other states and how Connecticut compares with those states. As part of that review, an analysis will be conducted to determine whether different contingencies should be applied based on project cost and type (PRI endorses such an analysis by the department). It is unclear at this time when the results will be completed.

¹³ Construction Cost Overruns: Process Review, Federal Highway Administration/Connecticut Department of Transportation, June 2004.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- When compared to the results of a review conducted by AASHTO in 2007, Connecticut's performance for delivering projects within budget fared less favorably than the performance of 20 other states included in the review.¹⁴ The AASHTO analysis showed an average of 46% of projects were completed between 2001-05 at or below their original budgets, and 81% completed within 110% of original budgets. Projects completed in Connecticut based on the analysis presented above shows 26% of the projects were completed at or below their original budgets, and 58% of the projects were completed within 110% of original budgets.
- Available on-budget performance information from Massachusetts provides some additional context to Connecticut's performance¹⁵ (although the committee cautions making direct comparisons without additional analysis). Massachusetts' performance for completing highway projects within original budget was 32 percent (FY06), 35 percent (FY07), and 20 percent (FY08). This performance is somewhat better than Connecticut's. Massachusetts defines on-budget as projects completed without the need for additional funds beyond the contract bid amount, which is the same as Connecticut's strict measure for on-budget performance.
- As noted earlier in the report, not having the authority for creative contracting may hinder the department from finding additional ways to deliver projects in more cost effective ways. Earlier committee recommendation to broaden the department's ability to use creative contracting methods is intended to allow DOT to deliver certain projects more in line with original budgets and avoid cost overruns.

Actions to Turn the Curve

The DOT project delivery process, in particular its ability to deliver projects within budget, is not administered in isolation of the department attempting to make improvements. Although the committee believes efforts are needed by the department to collect and analyze additional information related to on-budget performance, the department has put forth efforts to help ensure projects are delivered in a cost effective manner and to track the department's performance. PRI recognizes many of these efforts have recently been implemented and will need time before their success can be determined. Outlined below, are the key initiatives implemented within the department (or under consideration) to ensure projects are delivered within budget and to make certain the results are transparent.

- During the course of this study, DOT published an on-budget performance measure for construction projects and is beginning to report quarterly progress on the agency website as of October 2010. The department's first quarterly report shows the following:
 - 69% of 29 total projects completed during the second calendar quarter of 2010 met their original contract budgets (defined as the awarded value plus 10% contingency).

¹⁴ See: *Comparing State DOTs' Construction Project Cost and Schedule Performance*, American Association of State Highway Transportation Officials, May 2007.

¹⁵ See: MassDOT Scorecard Archive, Massachusetts Department of Transportation-Highway Division.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- The reasons cited for cost overruns are:
 - Quantity adjustments: 53%
 - Unforeseen conditions: 19%
 - Contract revisions: 16%
 - Other adjustments: 8%
 - Changes in project scope: 3%
- Although capturing on-budget information is a positive step toward assessing overall project delivery performance, the department is reluctant at this time to establish a formal standard for its on-budget performance. As a result, the only goal is to improve from the previous quarter; information could be added to measure on-budget performance, including actual cost data, to broaden the measure and make it more meaningful.
- DOT conducts “constructability reviews” for its projects based on AASHTO best practice guidelines. A constructability review, as defined by AASHTO, “is a process that utilizes construction personnel with extensive construction knowledge early in the design stages of projects to ensure that the projects are buildable, while also being cost-effective, biddable and maintainable.”¹⁶ The reviews are conducted by engineers within the department’s Office of Quality Assurance-Constructability Review Unit or on-call consultants with experience in conducting such reviews for complex projects (for the largest projects, construction industry personnel will be used for reviews.) The unit participates in all phases of development and construction of projects, from project scoping and initiation through construction. Engineers examine project designs with the intention of reducing construction costs which may lead to budget overruns, reducing delays and time extensions, reducing change orders due to design-related issues, improving contractor productivity, improving communication between project construction and design, and improving the quality of contract documents resulting in bids. DOT notes it is now conducting constructability reviews sooner in the project design phase to take advantage of any cost saving measures as early as feasible.
- A practice required by federal regulation as a way to help projects from incurring cost overruns is value engineering. Value engineering is a process conducted during project design that systematically reviews certain projects using a multi-discipline approach to identify potential cost savings for highway projects estimated to cost \$25 million or more and bridge projects with estimated costs of \$20 million or more. Additional objectives of the value engineering include: maintaining project function and scope; minimizing life cycle costs; and encouraging innovation. Value engineering may be applied to other projects as DOT deems necessary.
 - The value engineering program has been centralized within the department’s recently-established Office of Quality Assurance. The office has developed formal guidelines to administer the program. The office is now responsible for tracking proposed and/or implemented value engineering recommendations and projected and realized cost savings from applying value engineering, with the goal of leading to more effective project designs and cost effective projects.

16 Constructability Review Best Practices Guide, AASHTO Subcommittee on Construction, August 2000.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- The department has a process in place for districts to first notify the department's Office of Construction-Claims Unit via a specific form when any potential problems occur that may be caused by design errors, omissions, or oversights. The form is required when a construction issue is anticipated to increase the cost of a project by the lesser of five percent or \$100,000, or is deemed a significant issue by the Assistant District Engineer.
- Although the current process does not incorporate and/or report a comparative analysis of design estimates with final cost amounts, the department's quality assurance office is beginning to analyze and compare design estimates with bid amounts and final construction costs. The results of the analysis should help the department identify the degree to which construction estimates determined in the design phase are aligned with bid amounts and final construction costs. As described earlier, the department is close to implementing a new automated project management system which will allow it to capture design-related cost estimate data.
- AASHTO is putting together a new multi-state database which will include information about states' performance for delivering project within budget. The results should provide DOT with project delivery performance information from other states the department can then use to gauge its performance with other states.
- In the past, Connecticut's transportation department has not had a formal fiscally-constrained plan for developing and delivering transportation projects. At times, projects have been designed that the department could not realistically deliver within existing resources. This has changed with the department's recent five-year capital plan. The plan's purpose is to identify only those priority projects the department has the intention of delivering over a certain time horizon and within available resources. PRI believes such a plan will undoubtedly enhance the department's project delivery process.
- Several projects (e.g., the "Q Corridor" mega-project) are incorporating unique management methodologies not previously used in Connecticut to help ensure projects are completed within established budgets. The department is monitoring the relative success of such practices.

Based on the above analysis and findings, the program review committee makes the following recommendations intended to enhance the department's on-budget performance within the transportation project delivery process:

- **The Department of Transportation should begin analyzing its project delivery process with the goal of developing a system through which the department can fully determine the project costs associated with each major milestone of the project delivery process. The system should allow DOT to identify the level to which projects are completed within established budgets for each milestone. The results should be reported as part of the department's performance measure for delivering projects on-budget.**

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

- **The department should establish a goal of having the lowest responsible bid amount be no greater than the design engineer’s estimate. Progress toward achieving such goal should be measured at least annually.**
- **DOT should set a yearly goal of delivering transportation projects within budget for construction purposes, rather than continue using its recently-established standard of “maximizing percent of construction contracts completed on-budget.” The department’s performance toward achieving the goal should be part of its current initiative to measure on-budget performance. The goal should be realistic and re-evaluated at least yearly.**
- **The department should add the following components to its current measure for on-budget performance: 1) the total dollar amount of construction cost overruns; and 2) the amount each reason for cost overruns (as identified in the department’s current measure) adds to overall project costs.**
- **DOT should sharpen its focus for analyzing project design cost estimates with bid amounts and final project costs to link the cost estimating process with overall project construction costs. The results should be included in the department’s performance measures as an indicator of estimating accuracy for transportation projects, and for use to continually improve the project estimating function.**
- **The department should continue researching whether it should set different contingency standards for projects based on project cost and/or type of project. Any changes to the current contingency level should continue to move the project delivery process toward delivering projects within original budgets.**
- **The department should include on its website a “watch list” of all projects approaching cost overruns (including applicable contingencies).**
- **The department should begin analyzing its performance on delivering transportation projects within budget with the performance of other states for comparative purposes. The results also should be used in helping develop appropriate benchmarks and standards for delivering cost effective projects.**

III. Is Anyone Better Off?

Successful project delivery is an important factor in whether the public receives the benefits expected from an implemented transportation system improvement in a timely, cost-effective manner. Delays, cost overruns, poor quality control and other delivery problems also can diminish expected positive impact of completed projects, such as safer travel reduced congestion, increased mobility, stronger economic growth, or better environmental quality. At the same time, a project can be delivered efficiently and effectively, but desired improvements still may not be realized. This could be due many factors outside project delivery, including changed conditions or problems with initial plans (e.g., the wrong approach for achieving the desired improvement was selected).

In summary, the PRI committee found:

- Overall timeliness of project delivery is just beginning to be tracked and reported by DOT.
- Cost-effectiveness cannot be determined; complete costs of projects from design through final delivery and data on project end results are not easily available.
- Customer satisfaction with DOT project delivery performance is not measured in any comprehensive way.

A. Project delivery is timely and cost-effective.

Performance Measure 1) Project benefits achieved on time or sooner than scheduled

- As discussed earlier in this report, the full time to deliver transportation system improvements from initiation to final completion is not tracked and routinely reported.

Performance Measure 2) Project implementation is cost-effective

- To determine cost effectiveness, it is necessary to know what it costs to deliver projects, examine the costs of project alternatives, and be able to quantify the end results of projects delivered. The data and other resources necessary for such analysis are not available.

Story Behind the Data

DOT is not unique in lacking the information needed to determine cost effectiveness. State agencies rarely have complete cost information or quantitative outcome data regarding their major programs and functions.

One of the goals of the state CORE-CT accounting system is to improve agency financial reporting in ways that permit better identification of all costs associated with agency programs and services. The transportation department's ongoing efforts to customize CORE-CT reporting should produce better cost data

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

about the DOT project delivery process in the future. Implementation of the agency's new project management information system, and previous committee recommendations requiring DOT to analyze its internal and outside staffing resources, also will help.

The department collects and analyzes information about many aspects of the safety, efficiency, and condition of the state transportation system. For example, data about traffic safety, as required by the federal government, is gathered, analyzed, and reported by the department. Each year a small number of projects undertaken with the goal of improved safety are selected for in-depth evaluation of accident and other safety data, pre and post project completion.

DOT also maintains extensive databases about the use of state highway and public transportation systems as well as air quality conditions, primarily for federal reporting purposes. Periodically, agency staff use these data to analyze trends in a variety of outcomes, such as traffic congestion, bus and rail ridership, and tons of greenhouse gas emissions, following implementation of significant improvement projects.

Outcome data for individual completed projects, however, are not examined systematically by the department. This is due to several factors. One is the long implementation timeframe of most transportation projects. It is challenging, and sometimes expensive, to collect data that compares conditions before and after a multi-year project is delivered. Also, it takes significant resources to gather and analyze outcome data. Few state agencies, including DOT, have sufficient internal capacity to meet all their research needs. The use of external resources for research projects also has been curtailed significantly by ongoing state budget constraints.

Finally, there are no good tools for measuring some of the results expected from transportation projects. The only generally accepted method of assessing the economic impact of transportation system improvements is limited to job creation. A standard way of measuring environmental impact, which will just address air quality, is still in development by state and federal transportation organizations. The need for considerably more research in both these areas is well recognized.

Customer satisfaction. There is one relatively simple way to measure transportation project delivery results: ask for feedback from stakeholders. Research on transportation agencies with effective strategic performance management shows they focus on measuring and addressing customer satisfaction.¹⁷

In a number of states, transportation agencies use surveys, focus groups, and sometimes even public opinion polls to gauge customer satisfaction. Stakeholders are asked to assess agency performance overall, and within major areas like project delivery. These state agencies use input from their customers to: help target resources to outcomes the public values and considers most important; improve relationships with stakeholders; and build transportation agency credibility. Several also have established performance measures and targets related to customer satisfaction.

DOT is viewed by federal agencies and many stakeholder groups as having a strong public participation program for planning. It is considered a leader in a recognized best practice for successful community planning called Context Sensitive Solutions (CSS). In contrast, feedback from the public, outside contractors and consultant, municipal/regional officials about project delivery or other aspects of agency performance is not regularly gathered or formally reviewed.

The department's written vision and values emphasize customer service and performance that exceeds

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

customer expectations. At this time, however, DOT has no formal mechanism for assessing overall customer satisfaction and none of the agency's current performance measures address customer satisfaction.

Actions to Turn the Curve

The department has established some ways to obtain stakeholder feedback on a limited basis. At present, periodic surveys of rail service user satisfaction are conducted by the public transportation bureau. The bureau has used the results to target resources for rail system improvements. Also, the Bureau of Finance and Administration recently created an on-line survey for obtaining comments from outside contractors about its payment procedures.

DOT planning bureau personnel hold regular meetings with the state's regional planning groups throughout the year. Engineering and construction bureau staff have joint meetings with construction industry representatives, generally on a quarterly basis. Both efforts are used to obtain stakeholder feedback about a variety of issues including how well the agency is delivering projects and other aspects of DOT performance. The department also uses its website "contact us" feature as a way residents to provide comments about any problems or concerns they have related to the state transportation system.

In keeping with best management practices, the department should better coordinate its current efforts to obtain customer feedback. It also needs to elevate the importance of customer satisfaction for performance measurement. PRI recommends:

the DOT performance measures unit identify existing sources of customer feedback information throughout the agency and become a repository for all data related to customer satisfaction. Unit staff also should help managers in each bureau develop low-cost ways, such as focus groups and on-line surveys, to regularly obtain and use input from stakeholders to assess project delivery and other critical performance areas.

In addition, the department should establish and report on measures of customer satisfaction as part of the ongoing development of its performance measurement system.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

APPENDIX A

RBA FRAMEWORK: QUALITY OF LIFE RESULTS STATEMENT PROGRESS INDICATORS

The RBA Framework developed for the program review committee study of DOT project delivery includes five key indicators of overall progress on broad state transportation system results. The department, as part of its own performance measurement system, currently collects, analyzes, and reports on data related to four of these five key indicators. Copies of the agency's latest quarterly progress reports that address the framework indicators of safety, efficiency, state of good repair, and economic vitality are attached. As noted below, the available indicator information is provided in eight separate DOT performance measure reports. Data corresponding to an environmental quality indicator are still in development by the agency.

DOT planning bureau staff is working to coordinate its methodology with nascent national standards for environmental performance. A final decision by AASHTO and federal transportation agencies about the initial national standard, which is expected to be based on current federal practice for quantifying greenhouse gas emissions from transit sources, is pending.

<p><u>Indicator 1: Safety</u> <i>Rate of Annual Highway Fatalities</i> SOURCE: DOT 2010 Q1 PERFORMANCE MEASURE REPORT (October 2010), Measure SS 1-01</p>
<p><u>Indicator 2: Efficiency</u> <i>Percent of Road Network Over Capacity (Congestion)</i> SOURCE: DOT 2010 Q1 PERFORMANCE MEASURE REPORT (October 2010), Measure QL 4-02,</p>
<p><u>Indicator 3: State of Good Repair</u> <i>Condition of Infrastructure Components</i> SOURCE: DOT 2010 Q1 PERFORMANCE MEASURE REPORT (October 2010): Percent of state roads with good quality ride, Measure PR 2-01 Percent of state bridges in good condition, Measure PR 2-03 Reliability of state rail cars (mean distance between failures), Measure PR 2-04 Reliability of state buses (mean distance between road calls), Measure PR 2-05 Percent of state airport pavement rated good or excellent, Measure PR 2-07</p>
<p><u>Indicator 4: Environmental Quality</u> <i>Green House Gas Emissions Related to Transportation System</i> SOURCE: NOT AVAILABLE (currently under development by DOT Policy and Planning Bureau)</p>
<p><u>Indicator 5: Economic Vitality</u> <i>Jobs Created Through Transportation System Investments</i> SOURCE: DOT 2010 Q1 PERFORMANCE MEASURE REPORT (October 2010), Measure AT 5-06</p>



Performance Measures



Objective:
Safety and Security

Program:
Highway Safety

Measure:

Rate of Annual Highway Fatalities

Report Date:

October 1, 2010

Data Frequency: Annual

Current Reported Value: 0.83 fatalities per 100 million vehicle miles traveled (VMT)
7.5 fatalities per 100,000 population

Performance Target Value: Less than or equal to 1.0 per 100 Million Vehicle Miles Traveled (VMT)
Less than or equal to 7.7 per 100,000 Population

Source: Bureau of Policy and Planning
Mr. Joseph Cristalli



Note: Initial fatality counts published by NHTSA are preliminary as of April 30th for the previous calendar year. Final counts are published one year later, for the same calendar year. (For example, calendar year 2008 data are published initially in April 2009, and finalized in mid 2010.) The latest data set used for this posting, covers the time period from 1/1/2008 through 12/31/2008.

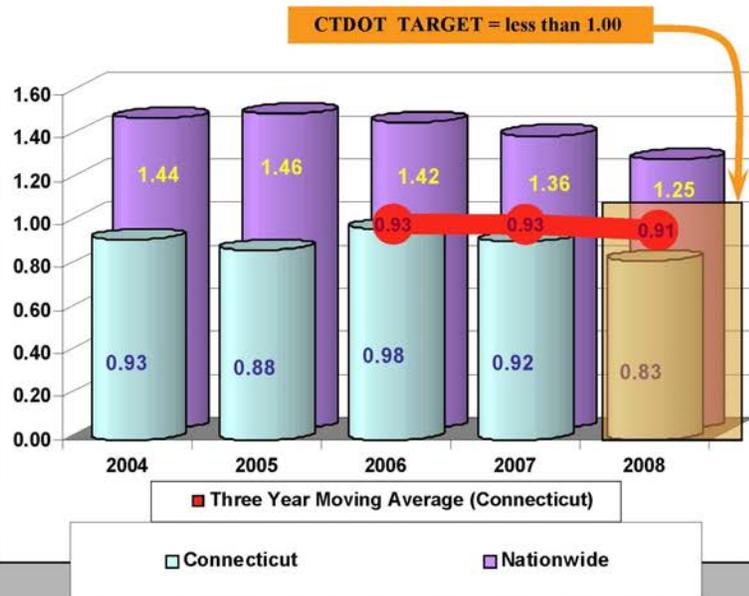
Purpose/Description of measure:

This measure tracks the fatality rate on Connecticut's roadways. By tracking fatality rates, the Department is able to gather information necessary to develop effective programs that ensure the safety and security of the traveling public.

Discussion of trend:

In 2008, Connecticut's fatality rate was 0.83 fatalities per 100 million vehicle miles traveled compared with the national figure of 1.25* fatalities (see Figure 1).
(continued)

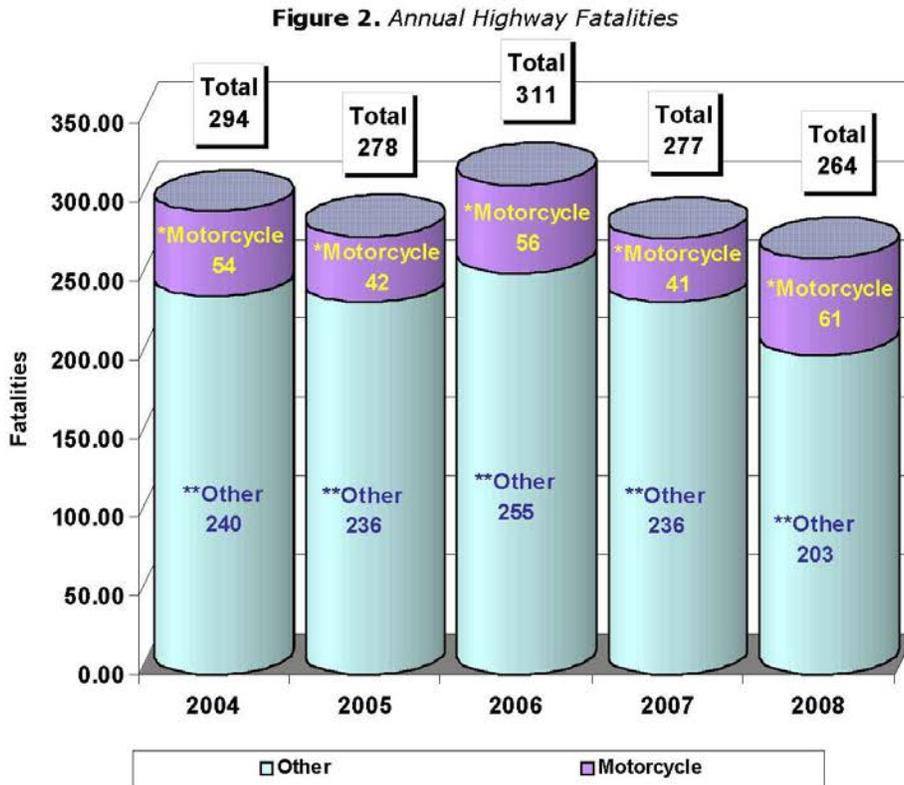
Figure 1. Fatalities Per 100 Million Vehicle Miles Traveled



*From NHTSA Traffic Safety Facts CT 2004-2008, FARS 2004-2007 Final and FARS 2008 Annual Report File. (http://www-nrd.nhtsa.dot.gov/departments/nrd-30/nca/STSI/9_CT/2008/9_CT_2008.htm)

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Rate of Annual Highway Fatalities



* Includes: Operator and Passenger
 ** Includes: Driver, Passenger, Pedestrian, Bicyclist

Discussion of trend (continued):

In 2008, there were 248 fatal motor vehicle crashes in which 264 persons were killed. This 264 figure includes operators, passengers, motorcycle operators, pedestrians and cyclists. In 2008, a total of 61 motorcycle operators and passengers were killed on Connecticut roadways, representing 23.1 percent of the state's total traffic fatalities. Based on 94,441 registered motorcycles, the fatality rate per 10,000 registered vehicles was 6.0, a substantial increase from the 2007 rate of 4.8 per 10,000. Preliminary data indicates that this trend will not continue in 2009.



Performance Measures



Objective:

Program:

Quality of Life

Congestion Management

Measure:

Percent of Road Network with Traffic Volumes Greater than Capacity

Report Date:

October 1, 2010

Data Frequency: Annual

Current Reported Value: 8.80% miles over Capacity

Performance Target Value: Reduce Congestion Throughout the State

Source: Bureau of Policy and Planning
Mr. Michael Connors



Note: Data for this measure becomes available for reporting annually in September for the previous Calendar Year. The latest data set used for this posting covers the time period from 1/1/2009 through 12/31/2009.

Purpose/Description of measure:

This measure tracks the congestion on Connecticut state roadways. Highway congestion is caused when traffic demand approaches or exceeds the available capacity of the highway system. Traffic demands vary significantly, depending on the season of the year, the day of the week, and even the time of day. Congestion can also be measured in a number of ways – level of service, speed, travel time, and delay are commonly used measures. CTDOT is continuously in the process of looking at new ways to monitor and alleviate congestion. Travelers, however, have indicated that more important than the severity or magnitude of congestion is the reliability of the trip travel time. People in a large metropolitan area may accept that a 20 mile freeway trip takes 40 minutes during the peak period, so long as this predicted travel time is reliable and is not 25 minutes one day and two hours the next. The state is in the process of looking at new ways to monitor congestion management.

Discussion of trend:

Demand for highway travel continues to grow. Construction of new highway capacity to accommodate this growth in travel has not kept pace and is not likely to in the near future. Between 1980 and 1999, route miles of highways increased 1.5 percent, while vehicle miles of travel increased 76 percent.

Figure 1. Percent of Miles Approaching or Above Capacity



2010 Data not available until September 2011



Performance Measures



Objective:
Preservation

Program:
Road Condition

Measure:

Percent of Roads with Good Ride Quality

Report Date:

October 1, 2010

Data Frequency: Annual

Current Reported Value: 44% of NHS roads with Good Ride Quality

Performance Target Value: Increase the percentage of roads with Good Ride Quality

Source: Bureau of Engineering and Construction
Mr. Edgardo Block, P.E.



Note: Data for this measure becomes available for reporting annually in June for the previous Calendar Year. The latest data set used for this posting covers the time period from 1/1/2009 through 12/31/2009.

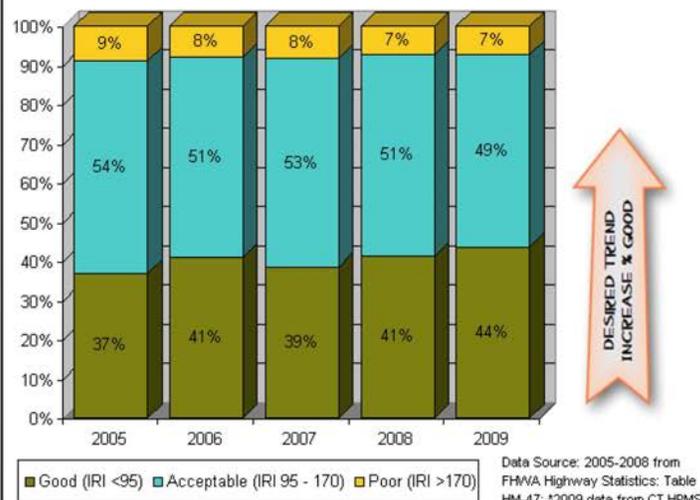
Purpose/Description of measure:

This measure tracks the roughness (complement of smoothness) of pavements on Connecticut's state-maintained roads. The general public's perception of a good road is one that provides a smooth ride. Roughness is an important pavement characteristic because it affects not only ride quality but also vehicle delay costs, fuel consumption and both vehicle and roadway maintenance costs. The Department uses a worldwide standard for measuring pavement smoothness called the International Roughness Index, or IRI.

This index provides a consistent and comparable measure of pavement in terms of the number of vertical bump inches per mile driven. IRI is reported as inches per mile. The lower the IRI number, the smoother the ride. The Federal Highway Administration (FHWA) requires that all states measure and submit IRI data annually for the National Highway System (NHS). The NHS includes interstate and other routes identified as having strategic defense characteristics, as well as routes providing access to major ports, airports, public transportation and intermodal facilities.

(continued)

Figure 1. Ride Quality on National Highway System (NHS)
Roads in Connecticut for 2005 - 2009



**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Percent of Roads with Good Ride Quality

(cont.) Discussion of trend:

Figure 1 on the previous page shows that ride quality on Connecticut's NHS routes has gradually been improving. The percentage of NHS Routes rated good has increased from 37 percent in 2005 to 44 percent in 2009, while the percentage of roads rated poor has decreased slightly to 7 percent over the same period. The goal is to continue to increase the percent of roads in good condition by implementing pavement preservation principles and fully utilizing CTDOT's Pavement Management System. Figure 2 (Right) compares the ride quality on Connecticut's NHS routes with the other New England states and New York for the year 2008.

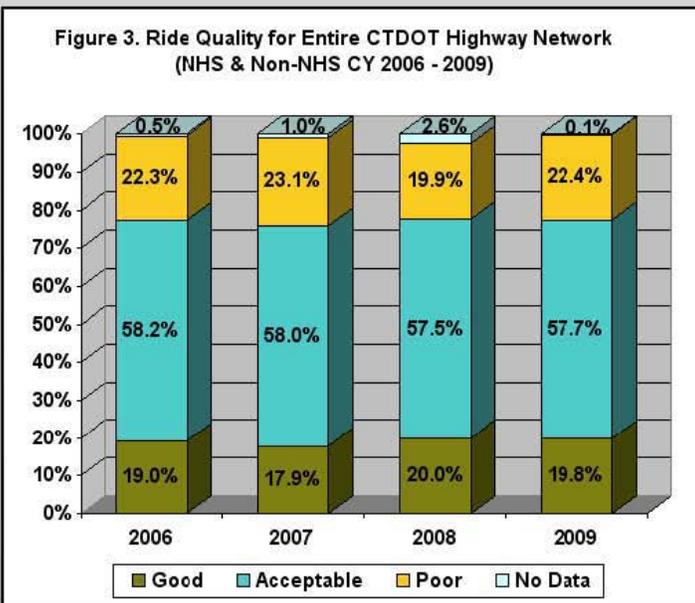
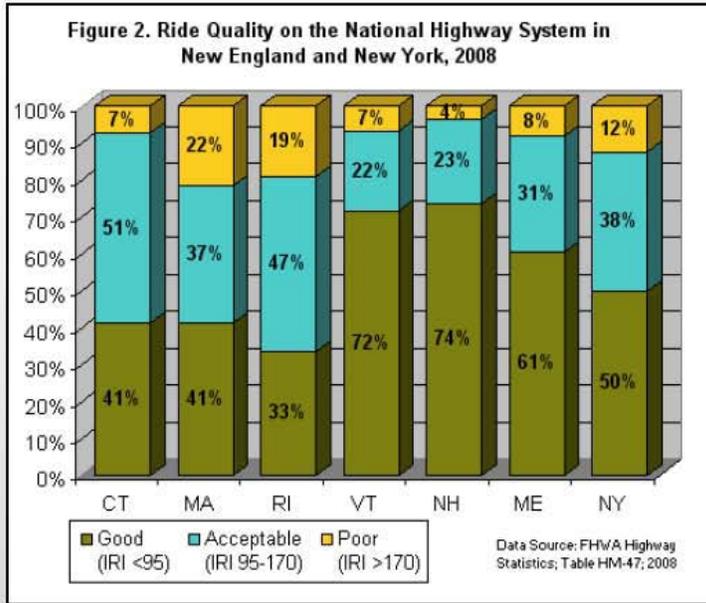


Figure 3 (Left) shows the ride quality of Connecticut's entire state maintained roadway network (approx. 3,744 miles) for calendar years 2006 through 2009. The entire roadway network includes both NHS and non-NHS roadways that are the maintenance responsibility of the Connecticut DOT. As shown in this graph, when the non-NHS roadways are factored in, the percent of the roads with good ride quality is reduced significantly.

NOTE: The ride quality for the entire network was not reported in previous quarters.



Performance Measures



Objective:
Preservation

Program:
Bridge Condition

Measure:
Percent of CTDOT Roadway Bridges in Good Condition

Report Date:
July 1, 2010

Current Reported Value: 34% of bridges in good condition

Performance Target Value: Increase percentage of bridges in good condition

Source: Bureau of Engineering and Construction
Mr. Robert Zaffetti, P.E.

Data Frequency: Annual



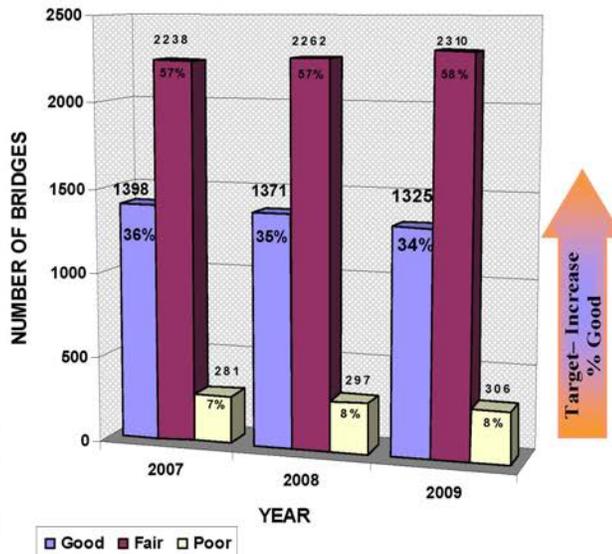
Note: Data for this measure becomes available for reporting annually in July for the previous Calendar Year. The latest data set used for this posting covers the time period from 1/1/2009 through 12/31/2009.

Purpose/Description of measure:

This measure tracks the condition of roadway bridges maintained by the Connecticut Department of Transportation (CTDOT). The Department is directly responsible for almost 4,000 bridges, including all Connecticut National Bridge Inventory (NBI), Connecticut Non-NBI, Adopted and Orphan bridges. The Department also inspects and maintains several special structures (i.e. Tunnel and Pedestrian Bridges) which are not included in this measure. Almost 1,300 additional bridges owned by Connecticut's Municipalities or the Connecticut Department of Environmental Protection or located on Private Property are inspected by CTDOT but are not considered in this measure since they are not maintained by CTDOT.

(Continued)

Figure 1. ROADWAY BRIDGES MAINTAINED BY CTDOT (Good - Fair - Poor)

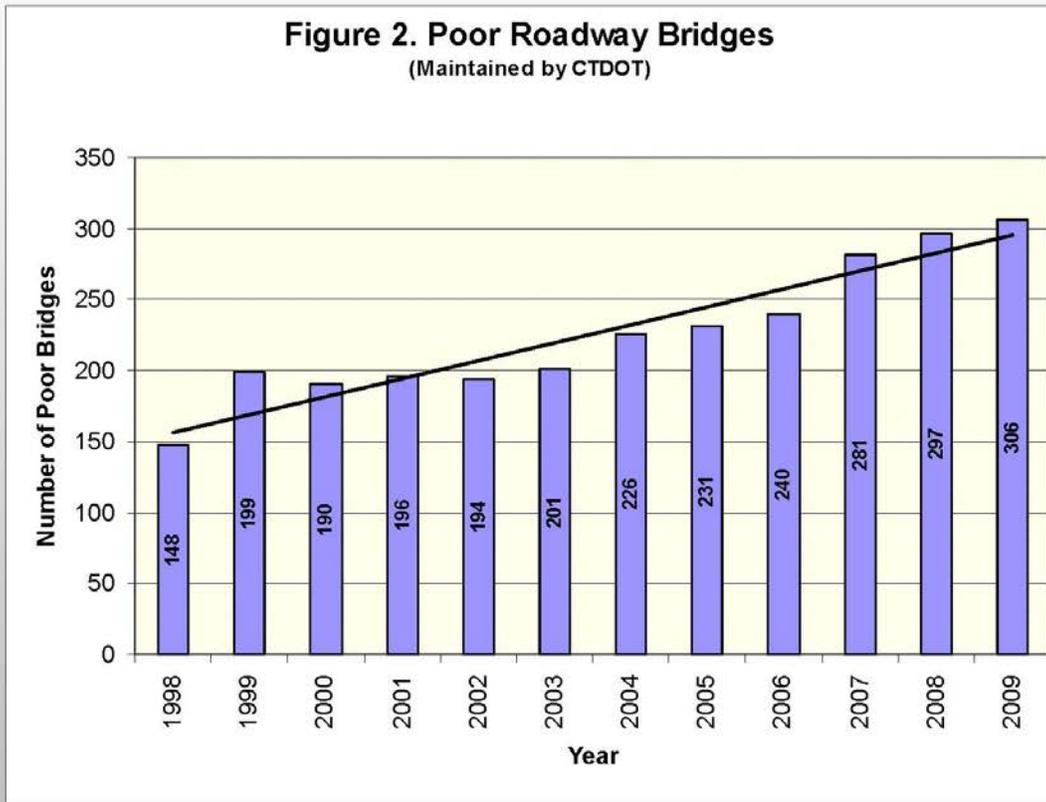


Note: Roadway Bridges Maintained by CTDOT include State NBI, State Non-NBI, Adopted, and Orphan.

Percent of CTDOT Roadway Bridges in Good Condition

Purpose/Description of measure: (Continued)

The condition of all bridge decks, superstructures and substructures are rated on a scale from 0 (failed condition) to 9 (excellent condition). The lowest rating becomes the bridge's overall rating. Whenever the condition rating of a bridge falls into the "Poor" category (4), the Department further reviews its condition, assesses the inspection frequency, adds the structure to the Bridge Program List and initiates a project to address the needs.



Discussion of trend:

Figure 1 shows that the percent of bridges in good condition declined by one percent from 2008 to 2009. As indicated in figure 2, the number of bridges rated "Poor" has been increasing since 1998 due in part to the aging infrastructure. The Department has recently allocated additional resources into bridge maintenance projects to reverse CTDOT's trend and align the Department with national trends of yearly increases in the number of bridges rated "Good".



Performance Measures



Objective:
Preservation

Program:
Rail Condition

Measure:
**Mean Distance Between Failures
(Rail)**

Report Date:
October 1, 2010

Data Frequency: Quarterly

Current Reported Value: Locomotive — 27,970 mi (2010 Q2)
Coach — 371,192 mi (2010 Q2)
M2 EMU — 122,919 mi (2010 Q2)
M4 EMU — 40,337 mi (2010 Q2)
M6 EMU — 92,905 mi (2010 Q2)

Performance Target Value: Locomotive — 35,000 mi
Coach — 260,000 mi
M2 EMU — 80,000 mi
M4 EMU — 65,000 mi
M6 EMU — 60,000 mi

Source: Bureau of Public Transportation — Mr. Eugene Colonese



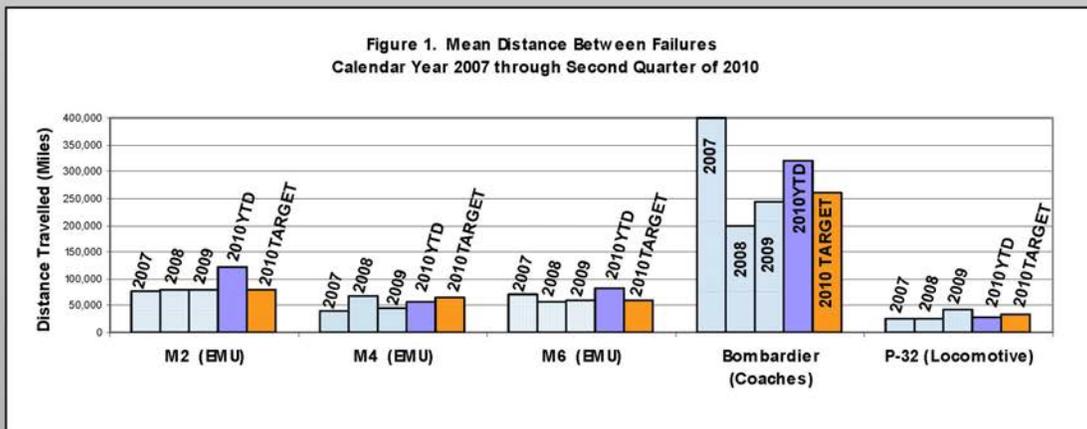
Note: Data for this measure becomes available monthly. The data set used for this posting covers the 2010 calendar year second quarter (4/1/2010 through 6/30/2010).

Purpose/Description of measure:

This measure tracks the reliability of MetroNorth train service on the New Haven Line. Mean Distance between Failures (MDBF) is an industry standard for measuring the reliability of a rail car fleet. It is calculated by dividing the total miles operated by the total number of confirmed primary failures, by car or locomotive fleet. A confirmed primary failure is defined as a failure of any duration for mechanical cause that occurs to a revenue train that is reported late at its final terminal by more than 5 minutes and 59 seconds. Generally speaking, the greater the MDBF, the better the on-time performance of train service.

Discussion of trend:

Figure 1 shows a graphic of MDBF for five types of rail vehicles for 2007 through the second quarter of 2010. The same information is presented in tabular form in Figure 2. In 2001, the Department began an M2 Electric Multiple Unit (EMU) Critical System Replacement (CSR) program, which has dramatically improved the MDBF for the M2 fleet. In 2004, the MDBF for M2 cars was just under 50,000 miles. For 2009, the MDBF for M2 rail cars averaged over 80,000 miles. (cont.)



**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**

Mean Distance Between Failures (Rail)

The 2010 target for the MDBF for M2s was raised to 80,000 miles (from 73,000 miles in 2009) to reflect the increases in recent measured performance. On the other hand, the targets for the M4s, M6s and Bombardiers were reduced in response to the aging condition of these fleet vehicles. As can be noted from Figures 1 and 2, all vehicles with the exception of the locomotives and M4s exceeded the 2010 targets during the second quarter. Three hundred new M8 model EMUs will replace and complement the existing EMUs in the coming years. CTDOT took delivery of the first model M8s during late 2009. These first arrivals are being rigorously tested before being placed into service. It is hoped to have the first 22 of the M8s in passenger revenue service by the end of 2010.

**Figure 2. Table of Mean Distance (Miles) Between Failures
for Locomotives, Coaches and EMUs
(2007 through 2010)**

Equipment Type	2007	2008	2009	2010 YTD	2010 Target Value
Locomotives					
P-32 (Genesis Dual Mode)	25,590	25,188	41,831	28,777	35,000
Coaches					
Bombardier	400,405	199,493	244,120	320,763	260,000
EMUs					
M2	76,892	79,887	80,837	122,941	80,000
M4	39,773	67,924	45,505	55,649	65,000
M6	70,680	56,976	59,393	80,949	60,000



Performance Measures



Objective:
Preservation

Program:
Transit Condition

Measure:

**Average Miles Between Road Calls
(Bus)**

Report Date:

October 1, 2010

Data Frequency: Quarterly

Current Reported Value: 4,008 Mi.—SFY 2010 Q4 (CY 2010 Q2)
4,371 Mi.—SFY 2010 (July 1, '09-Jun 30, '10)

Performance Target Value: 5,000 — Miles Between Road Calls

Source: Bureau of Public Transportation
Mr. Michael Sanders



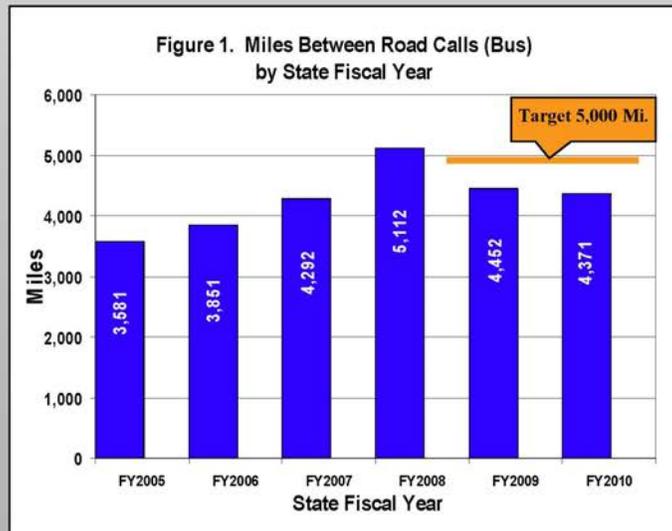
Note: Data for this measure becomes available for reporting quarterly based on state fiscal year (July 1 through June 30). The latest data set used for this posting covers the time period from April 1, 2010 through June 30, 2010, which is quarter 4 of State Fiscal Year (SFY) 2010.

Purpose/Description of measure:

This measure tracks the reliability of CTTransit bus service. Miles between road calls is the industry standard performance metric used nationally by bus operators to measure availability and reliability of equipment. Road calls are traditionally counted when a bus misses one of its scheduled trips. In any given year, the number of road calls can be affected by the age of the fleet, the occurrence of fleet-wide defects on a certain model or model year of buses, the weather, and other factors.

Discussion of trend:

During the second quarter of calendar year 2010, the miles between road calls for CTTransit buses in the Hartford, New Haven and Stamford Divisions (CTTransit's largest operating divisions) averaged 4,008. Figure 1 shows the trend for state fiscal years (SFY) 2005 through 2010, for these same groups of buses. The decline since FY2008 is due primarily to the increased average age of the bus fleet. This trend should begin to reverse as older buses are replaced and supplemented with new ones, which are being purchased with federal stimulus funds.



2.05

Revised: 11/01/2010

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**



Performance Measures



Objective:
Preservation

Program:
Airport Condition

Measure:
Percent of Airport Pavement Rated Good or Excellent

Report Date:
January 1, 2010

Data Frequency: Annual

Current Reported Value: *General Aviation Airports—90% Good or Excellent
Bradley International Airport—100% Good or Excellent*

Performance Target Value: *100% Good or Excellent*

Source: *Bureau of Aviation and Ports*

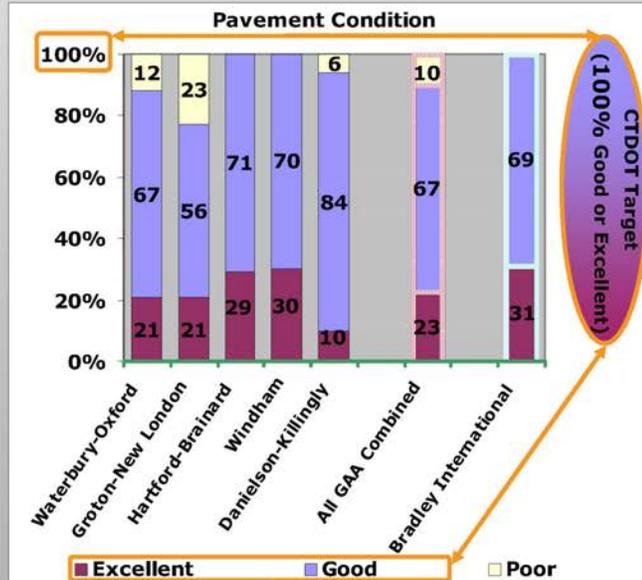


Note: Data for this measure becomes available for reporting annually in December for the current Calendar Year. The latest data set used for this posting covers the time period from 1/1/2009 through 12/31/2009.

Purpose/Description of measure:

This measure tracks the overall pavement condition of CTDOT's Airports. For all the General Aviation Airports (GAA) combined (total pavement area 897,000 square yards (SY)), 90 percent of the pavement is rated as good or excellent. For Bradley International Airport (total pavement area 1,378,167 SY), 100 percent of the pavement is rated good or excellent. A detailed breakup is provided below.

- Waterbury-Oxford Airport (213,000 SY)**
12% poor 67% good 21% excellent
Good or Excellent=88%
- Groton-New London Airport (267,000 SY)**
23% poor 56% good 21% excellent
Good or Excellent=77%
- Hartford Brainard Airport (209,000 SY)**
0% poor 71% good 29% excellent
Good or Excellent=100%
- Windham Airport (151,000 SY)**
0% poor 70% good 30% excellent
Good or Excellent=100%
- Danielson-Killingly Airport (57,000 SY)**
6% poor 84% good 10% excellent
Good or Excellent=94%
- All General Aviation Airports (combined)**
10% poor 67% good 23% excellent
Good or Excellent=90%
- Bradley International Airport (1,378,167 SY)**
0% poor 69% good 31% excellent
Good or Excellent=100%



Discussion of trend:

The goal of the Bureau of Aviation and Ports is to bring the percentage of the good and excellent pavements at the General Aviation Airports to 100%. The percentage of the pavement ranked poor has been steadily decreasing in the recent years, going down to 10% this year, and is now limited to lightly used aprons in most cases under lease to private operators.

**PRI RESULTS-BASED ACCOUNTABILITY PROJECT 2010:
STAFF FINDINGS AND RECOMMENDATIONS**



Performance Measures



Objective:

Accountability & Transparency

Program:

Economic Revival

Measure:



Number of Jobs Created/Sustained

Report Date:

October 1, 2010

Data Frequency: Quarterly

Current Reported Value: 16,158 Jobs Created/Sustained

Performance Target Value: Increase Jobs Created/Sustained

Source: Office of Commissioner
Mr. Philip Scarozzo



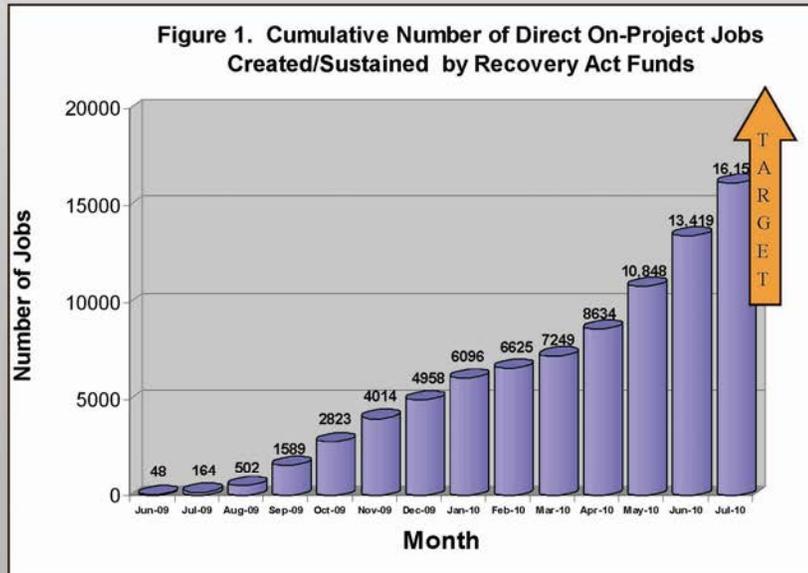
Note: Data for this measure becomes available monthly. The data set used for this posting covers the time period from June 1, 2009 through July 31, 2010.

Purpose/Description of measure:

This measure tracks the number of jobs created and/or sustained in Connecticut on transportation projects as a direct result of the American Reinvestment and Recovery Act (ARRA) 2009. This measure includes jobs created/sustained with ARRA dollars spent on highways, bridges, transit, rail, and enhancements on CTDOT and Regional Planning Agency projects. This listing is for direct jobs only, and does not include indirect jobs created as a result of material manufacturing and delivery to projects, or jobs that may be created in the local economy as a result of ARRA project employed workers. The statistics for number of jobs created/sustained are supplied by the contractors who employ the workers on active projects. Additional information on CTDOT Recovery projects can be accessed on the website at www.ct.gov/dot by clicking on the CTRecovery icon.

Discussion of trend:

As of July 31, 2010 16,158 jobs have been created or sustained in Connecticut on ARRA funded projects. This also represents 539,831 total job hours created or sustained at a payroll of \$21,085,922 for the job hours created/sustained with Recovery Act funds. The numbers reported in Figure 1 have not been converted to Full-Time Equivalent positions.



5.06

Revised: 9/14/2010