



Project Management Process Improvement for MassDOT

A Major Qualifying Project Report

Submitted to the Faculty of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

In Management Engineering, Civil Engineering Concentration

By

Thales Henrique Rodrigues Oliveira

Date: April 26th, 2012

Approved:

Professor Helen Vassallo, Major Advisor

Table of Contents

Table of Contents	2
Acknowledgements.....	4
Abstract	5
Executive Summary	6
Chapter 1: Introduction and Problem Statement.....	8
Chapter 2: Materials & Methods.....	10
Chapter 3: Results	12
Chapter 4: Discussion	13
MassDOT Overview	13
Current Process.....	14
Assessment for Designers and Contractors	23
Project Management Software	29
Discussion of Results	35
Areas for Improvement Found During Overview	36
Potentials of an Enterprise Project Management Software	37
Tools Available with Software.....	40
Comparison of Online Project Management Software.....	40
Solution	44
Chapter 5: Conclusions and Recommendations	49
Table of Figures	51
Table of Appendices	52
Appendix 1– Current Record of Design Evaluation Form	54
Appendix 2– MassDOT Highway Division CAD Standards (E-12-001).....	56
Appendix 3– MassDOT Utility Reimbursement Policy (E-11-008)	58
Appendix 4– Proposed Utility Relocation Durations within MassDOT Construction Contracts (E-11-006).....	62
Appendix 5– Right-of-Way Policy for Utility Relocations within MassDOT Projects (E-11-005)	64
Appendix 6– Electronic Utility Plan Submissions (E-11-003).....	65

Appendix 7– 2010 Construction Standard Details (E-10-07).....	68
Appendix 8– Design Consultant Performance Evaluations (E-10-005).....	70
Appendix 9– Contractor Performance Reports (E-10-002).....	73
Appendix 9A- Contractor Project Evaluation Form.....	74
Appendix 9B- Subcontractor Project Evaluation Form.....	76
Appendix 9C- Contractor Performance Report Rating Guidelines.....	78
Appendix 9D- Subcontractor Performance Report Rating Guidelines.....	82
Appendix 10– Project Development and Design Standards and Guidelines (P-10-001).....	86
Appendix 11 – Detailed Comparison in a Matrix of 5 EPMS.....	88
Appendix 12 – Email Communication with Krste Gjoneski from Seavus Project Viewer.....	90
Appendix 13 – Email Communication with Harish Kulkarni from Celoxis.....	95
Appendix 14 – Email Communication with Nels Draper from AtTask.....	97
Appendix 15 – Email Communications with Cynthia West from Project Insight.....	98
Appendix 16 – Email Communication with William Betts.....	105
Appendix 17- MassDOT’s 2006 Project Development & Design Guide Book.....	107
Appendix 18- MassDOT’s 2006 Project Development & Design Guide Book.....	108
Appendix 19- City/Town 110% Agreement.....	109
Appendix 20- Project Insight - Gold Training and Implementation Package.....	113
References.....	117

Acknowledgements

The author is sincerely thankful for the contributions made by the following people:

- Professor Helen Vassallo, for the life lessons, guidance, and for taking time out of her schedule to be the author's advisor,
- Projects Engineer, Ann Sullivan and Projects Development Engineer, Arthur Frost from MassDOT's District 3 located in Worcester, for their support and for allowing the author to pursue a project with MassDOT,
- Thomas Emerick, Michael Splaine, Steve Risotti, and Joseph Frawley from MassDOT's District 3, for answering the author's many questions throughout the project,
- Richard Masse and John Donoghue from MassDOT's District 2, for sharing information on their internal forms of assessment on contractors and subcontractors,
- ProjectInfo Program Coordinator, Capital Programming Unit, and employee of the Federal Aid and Programming Office, William (Bill) Betts, for disclosing information on the EMS Dream project,
- Vice President of Project Insight, Cynthia West, for communicating several times with the author to provide an accurate cost estimate,
- Account Executive of AtTask Inc., Nels Draper, for providing a price proposal for AtTask Enterprise Software as a Service(SaaS),
- Account Manager of Seavus Group, Krste (Kris) Gjoneski, for providing cost estimates for the Enterprise Unlimited License of Seavus Project Viewer,
- Account Manager of Celoxis Technologies, Harish Kulkarni, for providing a cost estimate of Celoxis software.

The author would also like to thank all other software companies who provided cost estimates and information on their products, as well as government agencies for sharing online information and research findings on transportation.

Abstract

Although the Massachusetts Department of Transportation (MassDOT) has made improvements to its on-time and on-budget performances, there is still significant area for improvement as 49% of projects in 2010 went over budget and 38% of the projects in 2010 were not completed on time¹. The purpose of this project was to analyze the entire project management process of MassDOT and provide a feasible recommendation to improve certain areas of the process. Based on the research conducted for this project, the overall project management process can be improved with the successful implementation of an online enterprise project management software (EPMS). The recommended EPMS is Project Insight Enterprise SaaS with a total initial annual cost of \$81,960 dollars for 1000 users with different levels of clearance, which includes account set up and implementation on the same day, as well as one week of training for MassDOT staff².

Executive Summary

The Massachusetts Department of Transportation (MassDOT) has made significant improvements to its project management process, but must address particular areas to continue its progress. After the merging of several agencies in 2009, improved communication among agencies resulted in visible improvements to on-time and on-budget performance³. The Federal Highway Division along with MassDOT, both aspire to improve the entire process of transportation projects, from identification of a problem to how the problem is resolved, through different programs, as well as increased communication and education among interest parties. Although data does indicate that noteworthy progress has been recorded since the merging, the remaining room for improvement can be filled with the implementation of an enterprise project management software.

MassDOT still has significant room for improvement on managing budget and time constraints for their projects. According to the Highway Division ScoreCard, published January of 2011 with data from 2010, 49% of projects went over budget and 38% of highway projects were not completed on time¹. The reason for this data cannot be attributed to a single cause, but a combination of problematic areas involving different entities and steps in the process. Detailed analysis of statistical data over the history of the transportation industry in MA is difficult to acquire as most records have not been kept, and some data compilation such as of the ScoreCard, has only recently started as of 2006. Strong changes by the government, including the merger in 2009, as well as overseeing authorities, different programs, and different methods of construction have been able to greatly improve time and cost savings; however, there is still room for improvement.

The goal of this Major Qualifying Project (MQP) was to examine the project management process on the project development of transportation projects within MassDOT to provide feasible recommendations that could potentially improve the process. This goal was accomplished by providing an overview of the process, from the moment a problem reached the agency's attention, to the legal process of deciding whether it will be worked on, to procurement, design, bidding, and conclusion of the construction. Following the overview of the current process, the author provided a discussion of the results and the potential that an online enterprise project management software could have on improving the process. The investigation analyzed the viability of using a software by analyzing different types of software and comparing five software, along with the project management tools provided by each. The feasibility of the proposed recommendation was further analyzed through the use of a financial analysis and cost benefit analysis, and a SWOT analysis.

Through the analysis and discussion presented in this research, an online project management software in the form of a Software as a Service (SaaS, which means it is hosted on the servers of the software company) has a promising future to improve the project management process of MassDOT. However, care must be taken to ensure proper communication between Project Insight (chosen software) and MassDOT IT personnel for proper implementation and future maintenance of the product. The proposed software will not further strain the IT staff, will not require software to be installed on MassDOT computers, and will be securely provided and hosted on the servers of Project Insight. The research findings indicate that Project Insight has the potential to provide further improvements to on time and on budget performances and should be considered to improve the project management process of MassDOT.

Chapter 1: Introduction and Problem Statement

After the economic downturn in 2008, a number of budgetary constraints were imposed on government organizations, from the United States Department of Transportation at the top, to the Federal Highway Administration, to the decreasing amount of funds available to each state's transportation departments⁴. Along with decreasing budgets came increasing political pressure and constant pressure from constituents to significantly improve the quality of transportation with reduced amounts of money and in less time. However, due to the complex nature of transportation projects and the numbers of different interest parties involved, on time and on budget cannot always easily be accomplished.

In efforts to increase efficiency, collaboration, communication, and save money, the Massachusetts Department of Transportation (MassDOT) was officially formed on November 1, 2009 with the merging of several state agencies⁵. These organizations included the Massachusetts Turnpike Authority, MassHighway, the Massachusetts Registry of Motor Vehicles, as well as the Massachusetts Aeronautics Commission, including all of the executives from the Executive Office of Transportation. Although significant improvements have been made, there is still room for improvement with 49% of Highway Projects going over-budget and 38% of Highway Projects completed late, based on a report published March of 2011 using 2010 data¹.

The purpose of this project was to analyze the project management process of transportation projects at MassDOT in order to pinpoint areas of interest and provide viable recommendations that could potentially improve the process. This was accomplished by analyzing the current process, including performance assessments through the life cycle of a

project (including designers and builders), and the current technology used to manage projects. Through the use of research, interviews, and analysis of the current process, the author was able to provide a feasible recommendation in the form of an online enterprise project management software, which has the potential to improve on-time and on-budget performances of transportation projects at MassDOT.

The investigation includes an overview of the current process, an in-depth comparison of five chosen software and their capabilities, along with a financial and cost benefit analysis, and recommendation for a successful implementation of the chosen online enterprise project management software, Project Insight Enterprise SaaS. This document also discusses the tools available with the chosen software and how the potential positive benefits of implementing the solution could possibly improve communication, collaboration, and everyday project management activities at MassDOT and outweigh the benefits attained from the current project management tools.

Chapter 2: Materials & Methods

In order to analyze the project management processes of transportation projects at MassDOT and provide a viable recommendation, a comprehensive analysis of the process and of potential recommendations was carried out. The successful completion of the project relied on the acquisition of sufficient reliable background information and data to allow the author to provide a viable recommendation, which was accomplished through:

- Interviews with MassDOT Employees in the area of project development, project design and review, project management, and information technology
 - Projects Engineer, Ann Sullivan and Projects Development Engineer, Arthur Frost from MassDOT's District 3 located in Worcester
 - Thomas Emerick, Michael Splaine, Steve Risotti, and Joseph Frawley from MassDOT's District 3
 - Richard Masse and John Donogue from MassDOT's District 2
 - ProjectInfo Program Coordinator, Capital Programming Unit, and employee of the Federal Aid and Programming Office, William (Bill) Betts
- Literature review of project management materials and MassDOT documents
- Scholarly and government publications by
 - Transportation Research Board (TRB)
 - U.S. Department of Transportation – Federal Highway Administration
 - American Association of State Highway and Transportation Officials (AASHTO)
 - National Cooperative Highway Research Program (NCHRP)
 - Massachusetts Department of Transportation (MassDOT)
- Interview with online enterprise project management software companies

- Vice President of Project Insight, Cynthia West
- Account Executive of AtTask Inc., Nels Draper
- Account Manager of Seavus Group, Krste (Kris) Gjoneski
- Account Manager of Celoxis Technologies, Harish Kulkarni
- Software companies Clarizen, Tenrox, EPM Live, Easyprojects.net, Genius Project for Web

With the information acquired through the methods mentioned above, a financial and cost benefit analysis enables the reader to see the potentials of the recommended solution to improve on time and on budget performances of the project management process at MassDOT. A SWOT (strengths, weaknesses, opportunities, and threats matrix) analysis was also used to evaluate the use of an online enterprise project management software and present the reader with a non-mathematical evaluation of the proposed recommendation and potentials of the solution.

Chapter 3: Results

The results of this research pinpointed areas of improvement and determined that the most feasible recommendation that has the potential to address certain problems of the process is the implementation of an online project management software, named Project Insight Enterprise SaaS. The reasoning behind this decision was based on the following:

- Hosted on the servers of the chosen software company, Project Insight, instead of MassDOT servers².
 - Software as a Service (SaaS is hosted software on the servers of the software company)
 - Operations and maintenance is the responsibility of the software company.
- Plans to establish an on-site software by Oracle in 2009 were estimated to cost \$8 million dollars for 4000 users, or \$2 million per 1000 user⁶
- MassDOT spent \$450 per year for the Federal Fiscal Year (FFY) of 2008 and of 2009 on ProjectInfo development and maintenance alone⁶Error! Bookmark not defined.
- The proposed solution with Project Insight Enterprise SaaS would cost \$81,960 dollars⁷
 - Includes 1000 users with five different levels of clearance for one year contract
 - Includes account set up and implementation on the same day
 - One week of training for MassDOT staff
 - Project management tools capable of facilitating daily project management activities at a reasonable cost

An overview of the project management process and an in-depth discussion of the results are discussed in Chapter 4.

Chapter 4: Discussion

This chapter was structured in a manner that provides an overview of the project development and management process for transportation projects in MassDOT in the first half of the chapter and a discussion of the results in the second half of the chapter. The second half of this chapter includes a discussion of the results, which contains the supporting evidence that allowed the author to identify a feasible recommendation and the reasoning behind the recommendation.

MassDOT Overview

The overview provides the necessary background information that enabled the author to provide viable recommendations that could potentially improve future project management operations at MassDOT. The first part of the overview includes the current process, assessment for designers and builders, and project management software. The discussion for the current process section contains information about the steps used in the project development of a project and different methods used to complete projects. Government organizations, programs, and changes that have occurred within MassDOT are also discussed. The need for an internal method of assessment for designers and builders to be available within MassDOT became clear after analyzing the project development cycle of the current process and is also discussed under the overview. The third section of the overview examines different project management software, and the possibility to consolidate bidding, estimating, and other access software under one online project management software.

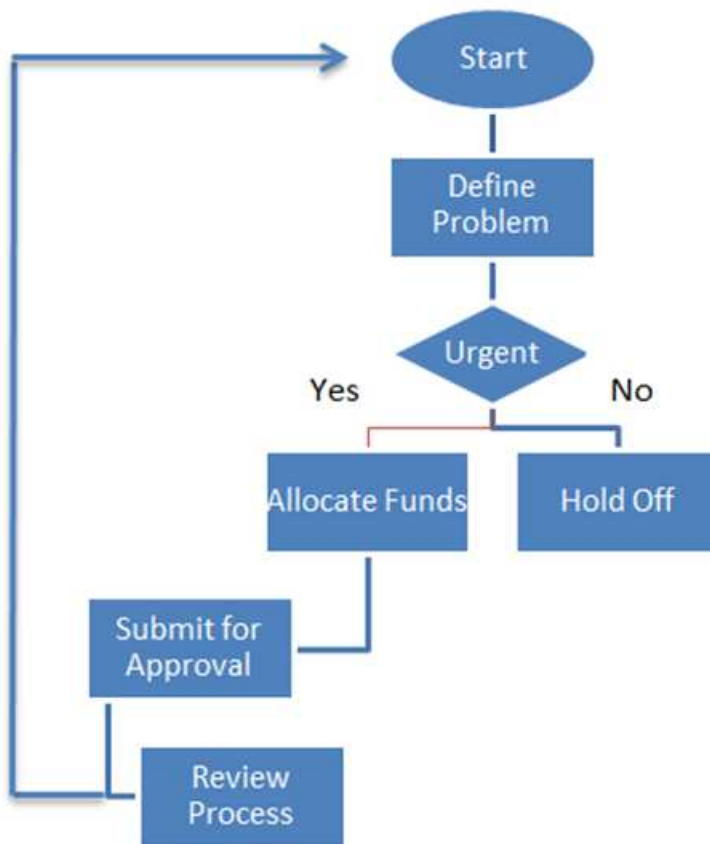
Current Process

The current Project Management Process for the Massachusetts Department of Transportation (MassDOT) is described in detail in the Massachusetts Department of Transportation Highway's 2006 Project Development & Design Guide Book⁸. The purpose of the guidebook is to ensure that designers and employees of MassDOT are aware of the standardized guidelines. In 2003, the Executive Office of Transportation wanted to develop more detailed evaluation criteria to fairly and consistently evaluate transportation projects. The "project evaluation criteria" are then used by transportation agencies and different Metropolitan Planning Organizations (MPOs) to assess projects from the planning process through several milestones to evaluate the projects' potential and funding needs. The Design Guidebook additionally addresses the Project Development Process⁹ and the steps a transportation project must go through; from the moment a transportation problem is identified, to deciding whether it will be worked on, to design, right-of-way, and environmental reviews, the bidding process, and finally construction.

MassDOT Design Guidebook

The process begins with the Project Need Form (PNF) which clarifies the need for the project, or the opportunity to improve a problematic area. The MassHighway District Review Committee and Metropolitan Planning Organization must then determine whether the project requires further examination to verify the problem, whether the project will be rejected, or if the project should proceed to the planning stage. To facilitate future phases of the process, the Design Guide Book states that constituents are identified and public outreach is initiated before the MassHighway District Review Committee and Metropolitan Planning Organization staff reaches a decision. The process occurs in this manner to allow proper project review and preliminary consideration for funding.

Figure 1A- Decision Making Flowchart on Project Management Process of MassDOT⁸



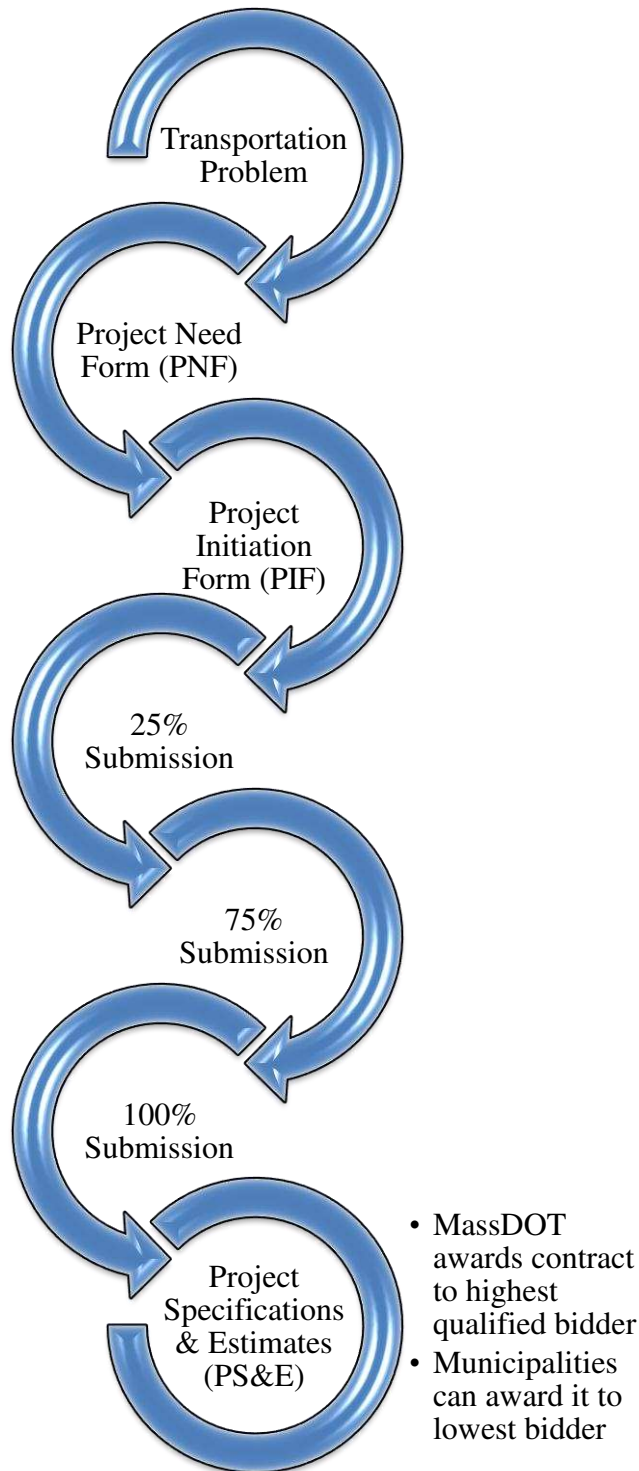
Different types of projects require different levels of project planning and documentation and also require different types of funding. An improvement, expansion, or complete reconstruction of an Interchange, requires a Project Need Form (PNF), as well as a detailed full alternative analysis, functional design reports, traffic related data, and corridor studies, along with public input. If the Project Need Form receives public approval, completes the project planning effort, and also receives approval from the Project Review Committee (PRC) and the Metropolitan Planning Organization (MPO), it will proceed to the Project Initiation Form (PIF). This is done so that the MPO and PRC can oversee and ensure that the potential project provides

a positive impact to the district (Figure 1A), prior to allocating considerable time, money, and resources to the project¹⁰.

Following the Project Need Form (PNF) and Planning step, comes the third step, the Project Initiation Form (PIF). This step involves review of the PIF and TEC forms by the PRC, which then sends comments and documents to the MPO for their preliminary review. After the MPO reviews the TEC and PIF, a funding category, a potential Transportation Improvement Project (TIP) year, and a Project TEC Score is assigned. The project, at this point can be dismissed or moved forward with subsequent review by the MPO. The following steps will involve a Project Management Plan to assign design, right-of-way, and environmental responsibilities.

The following steps of the current project management process are composed of the 25%, 75%, and 100% Plans (Figure 1B), Specifications and Estimates (PS&E) stages. These stages and previous stages are composed of a project development programming effort, which involve different agencies, departments, personnel, and public involvement. These stages focus heavily on documentation of Environmental Studies and Permits, Right-of-Way plans, and design submissions by private design firms to be reviewed by MassDOT employees. Once a project has been approved by all parties involved, it will move to the procurement stage, where it is posted on the web for bidders to review. The Project Development & Design Guidebook states that “Bids received by MassHighway are opened and reviewed, and will be awarded to the most qualified bidder.”

Figure 2B- Chart of the Project Management Process at MassDOT⁸



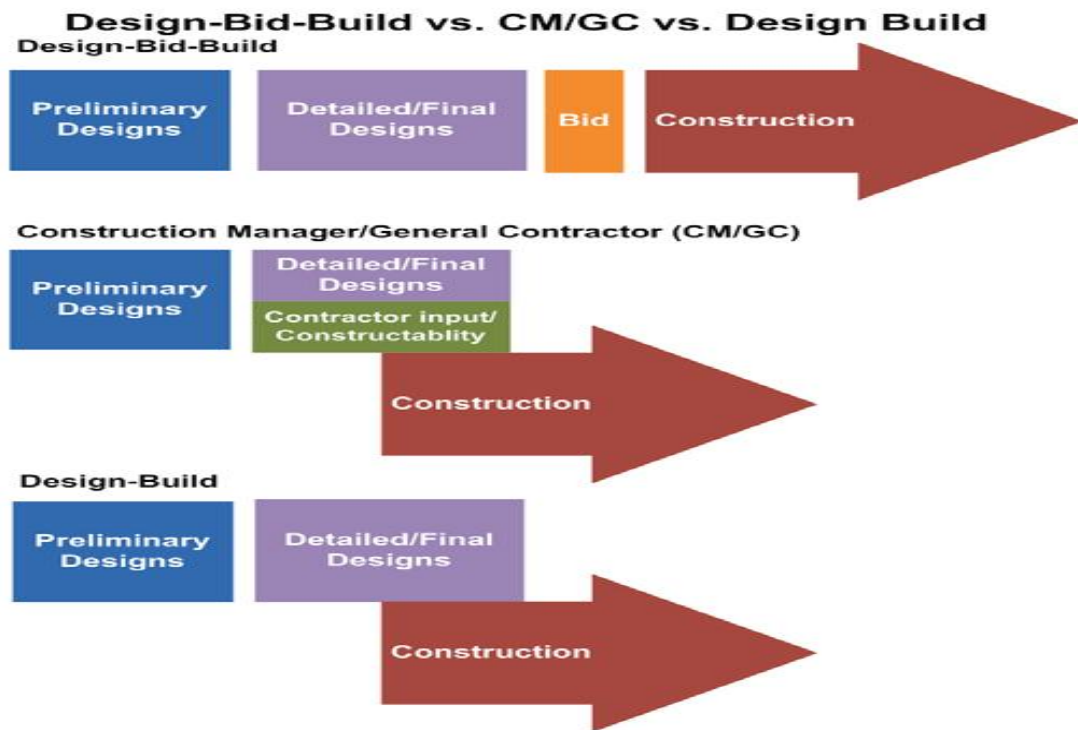
Different Methods of Project Delivery

A good source of information on different methods of accomplishing transportation projects while significantly improving the overall process is the “Every Day Counts” program by the USDOT- Federal Highway Administration (FHWA)¹¹. One of the topics this program covers is shortening project delivery through Accelerated Project Delivery Methods (APMD), which the FHWA is confident that DOTs around the country could deliver transportation projects to the public in half the time of current methods¹². The proposed APMD methods, which include Construction Manager/General Contractor (CM/GC) and Design-Build, significantly reduce the life cycle of a project compared to the

Design-Bid-Build method (Figure 3). The life cycle is reduced as construction efforts begin earlier with CM/GC and Design-Build methods compared to Design-Bid-Build. By eliminating

the need of different companies to accomplish design, bidding, and construction, APMD methods of delivery reduce the possibility of problems with the constructability of designs, multiple exchanges of designs, conflicts between parties involved, and results in a faster, cheaper, and safer project, as the employees who perform design and construction are from the same company.

Figure 3-Accelerated Project Delivery Methods¹²



Further evidence of the benefits of APMD methods can be seen from an additional research from the FHWA, which contains more detailed comparisons between Project Delivery Initiatives. The current process, Design-Bid-Build, carries a significant amount of risk for the owner, while minimal risk for contractors, as contractors and designers can blame each other for design errors and delays. Design-Build has little risk for the owner, but significant risk for the contractor, as the contractor is responsible for both design and construction, under a single

contract. Construction Management/General Contracting and Design-Build methods of project delivery are shown by FHWA's "Every Day Counts" program to reduce and evenly distribute the overall total risk of a project by assigning design and construction responsibility to one company¹¹.

Procedural Changes Indicated Positive Consequences

MassDOT has been showing a pattern of increased performance on all aspects of the process for its transportation projects, as can be seen by the MassDOT Highway Division ScoreCards¹. However, there is still significant area for improvement as 49% of projects in 2010 went over budget (Figure 3) and 38% of the projects in 2010 (Figure 4) were not completed on time. In 2006, 29% of all highway projects were under/on-budget (Figure 3), but in 2010, that number improved to 51%. Another impressive trend visible (Figure 4) is an improvement from 18% of highway projects completed early/on-time in 2006 to 62% in 2010. According to the March 2011 ScoreCard, MassDOT's goal was to reach a percentage of completed projects of 80%, beginning on the Federal Fiscal Year (FFY) of 2011. However, this status cannot be confirmed as ScoreCards beyond March of 2011 have not been found online or within the organization.

Figure 4-MassDOT Highway Division ScoreCard (03/11)¹

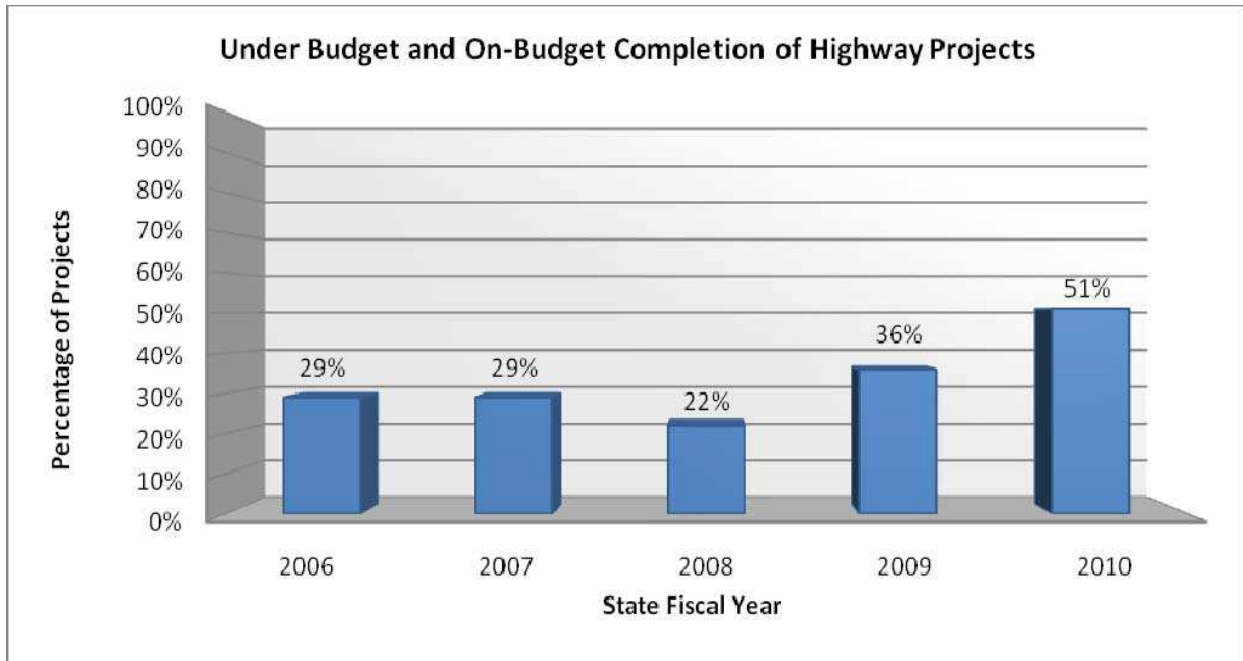
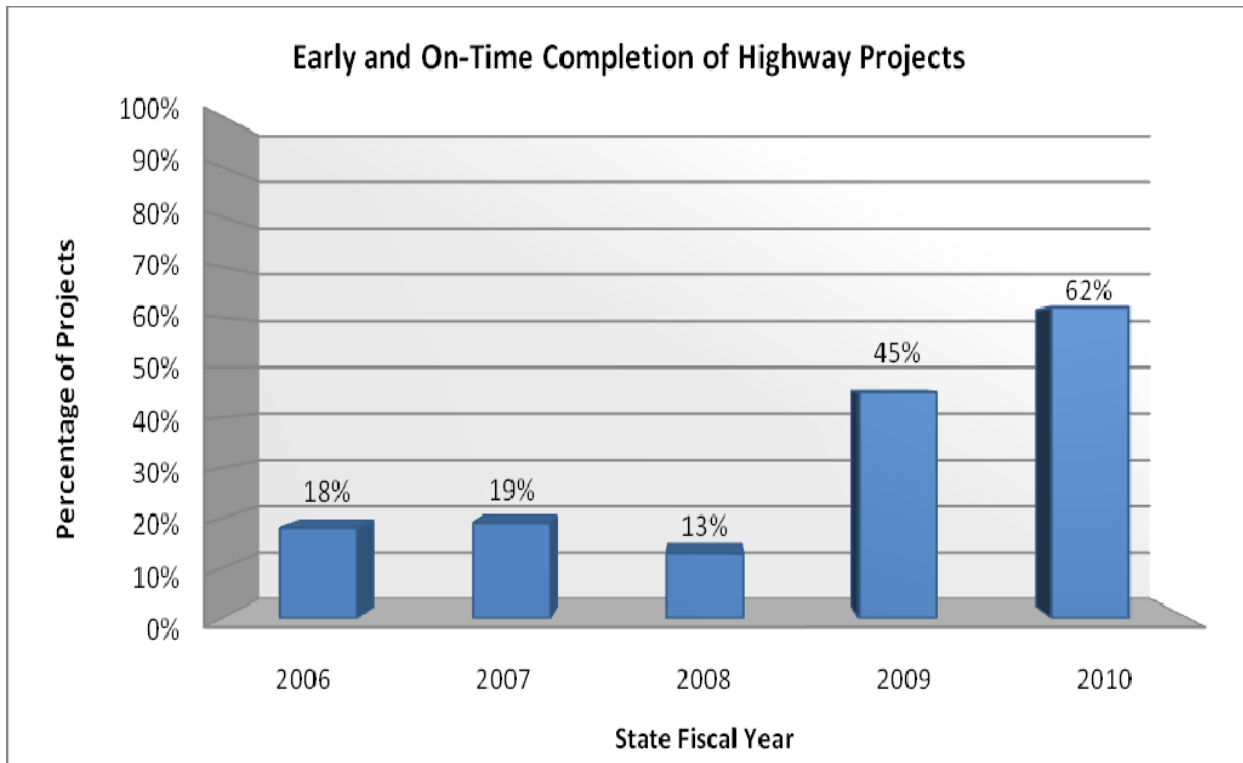
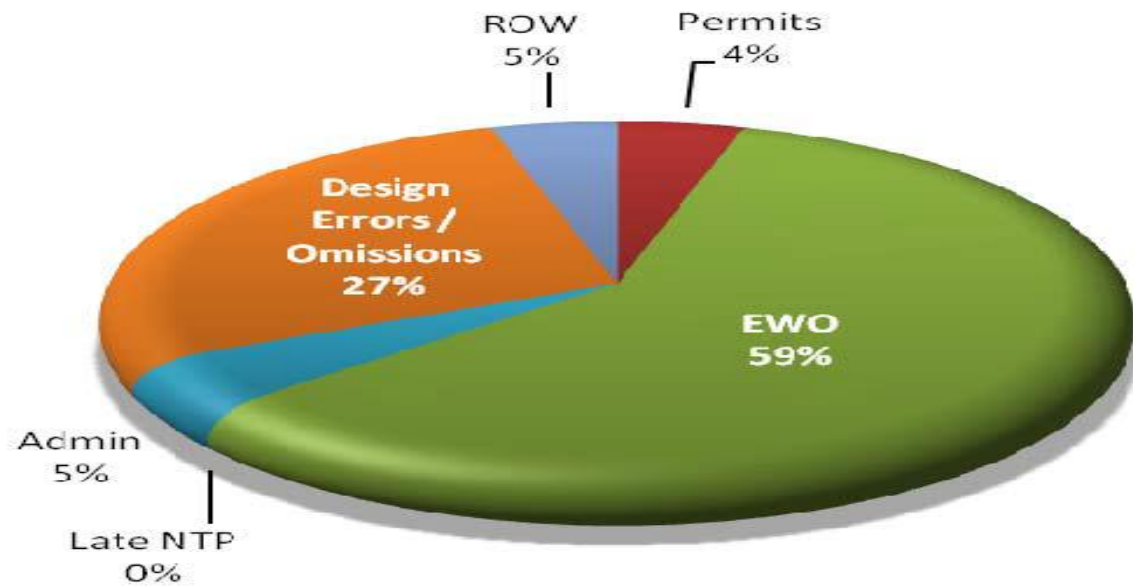


Figure 5- MassDOT Highway Division ScoreCard (03/11)¹



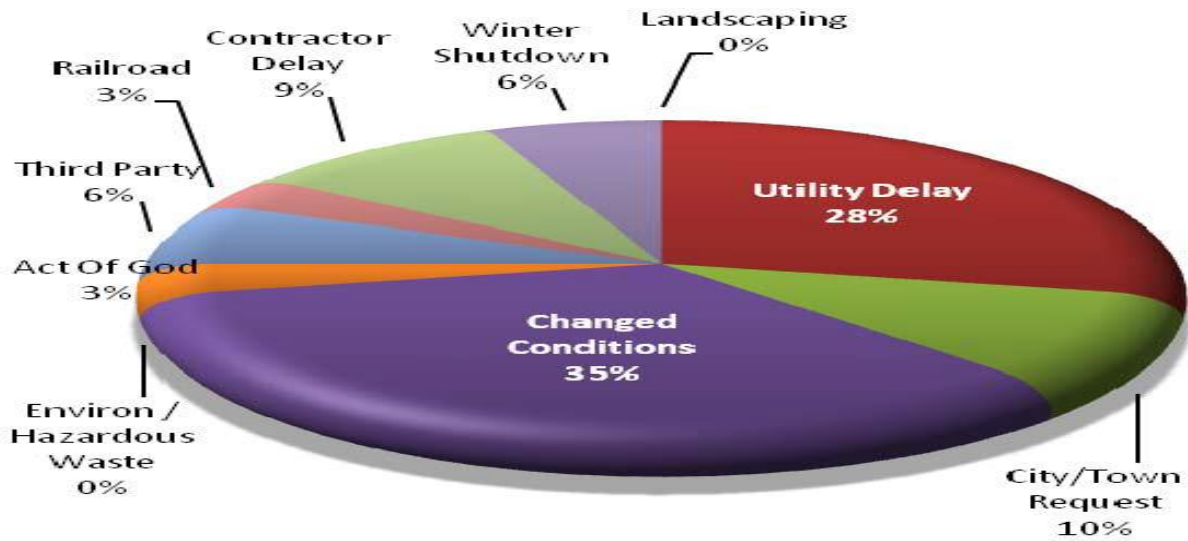
The cause of projects going over budget and not being completed on time can be the result of internal or external causes. Internal causes for the federal fiscal year of 2010 (Figure 5), resulted mainly from Extra Work Orders (EWO) with 59%, which are additional items of work not included in the contract for the construction contractor, followed by Design Errors/Omissions with 27%.

Figure 6-MassDOT Highway Division ScoreCard (03/11) ¹



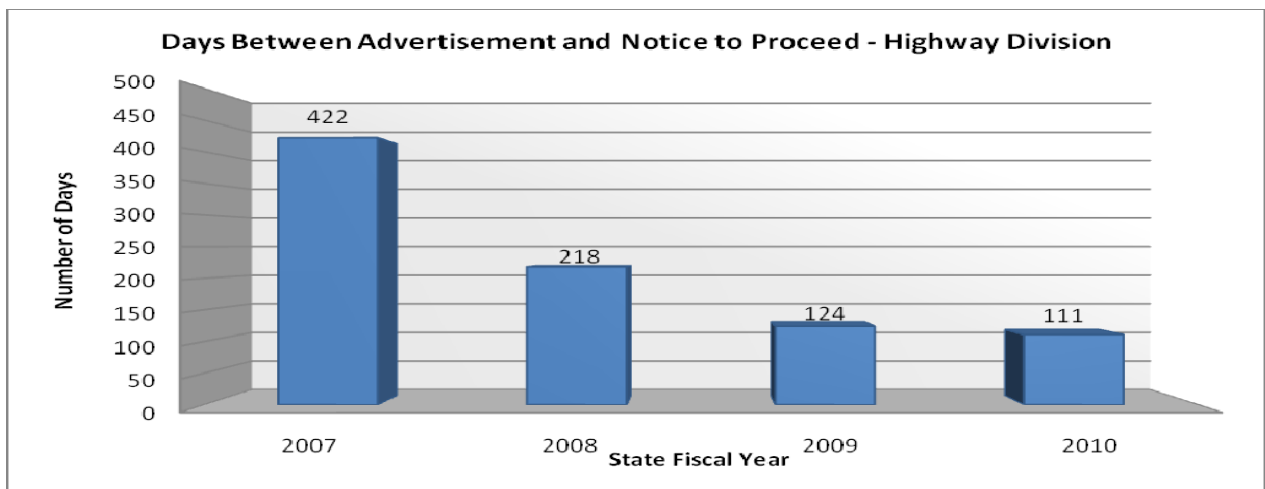
External causes (Figure 6), resulted mainly from Changed Conditions with 35%, that are mainly associated with subsurface issues; followed by utility delays with 28%; and finally with city/town request with 10% of external time extension causes. Consultant procurement was reduced from 8.7 months in 2006 to 6.2 months in 2010. Further statistical evidence that MassDOT greatly improved its process were the reduced “Days Between Advertisement and Notice to Proceed-Highway Division” from 422 days in 2007 to 111 days in 2010 (Figure 7). As previously mentioned, this is a result of the several procedural changes that reduced the life cycle of a transportation project.

Figure 7-MassDOT Highway Division ScoreCard (03/11) ¹



These and other significant improvements related to MassDOT transportation projects can be attributed to MassDOT’s procedure enhancements established in 2008. The process was greatly enhanced due to increased communication between MassDOT and contractors, increased enforcement of schedule deadlines, as well as firmer internal controls and design reviews of projects. Even with the tremendous increase of financial responsibility for MassDOT, the jump from 362.7 million dollars advertised in 2006 to 1.039 billion dollars advertised in 2010¹, the data shows significant reduction in the overall length of a project’s life cycle.

Figure 8-MassDOT Highway Division ScoreCard (03/11) ¹



It is paramount to establish specific, detailed, and legally enforced procurement, design, and construction guidelines. Based on the ScoreCard Data analyzed under the “Current Process” section of this chapter, significant improvements have been made towards reducing costs and the amount of time for an entire project, while constructing, renovating, and expanding the transportation system with safety in mind¹.

Assessment for Designers and Contractors

The last official step of the Project Development Process is Step #8- Process Assessment. This step is located in chapter 2 (page 68) of the Project Development & Design Guide Book⁸, as an optional ‘informal process’. As of the summer of 2011, plans were under way to establish a formal planning, design, procurement, and construction assessment to be internally available for districts. According to information acquired during the month of February 2012, plans were still under way to establish and implement a formal assessment method for designers and builders. Municipalities can award contracts to the lowest bidders, while MassDOT awards contracts to the highest qualified company. However, both methods face problems, as not even the highest qualified companies are always guaranteed to provide the high quality designs expected, which results in several drawings and reviews.

Performance and Accountability

MassDOT’s legal Design Guidebook lacks a standardized method in which construction management is monitored. This is extremely important, as part of Step VII: Construction (Appendix 17- MassDOT’s 2006 Project Development & Design Guide Book) can result in delays and significant additional costs due to Extra Work Orders (EWOs) during the construction phase of a project, which results in the largest percentage of external causes of delays. As a result, the absence of a formal and detailed description of Construction Monitoring also hinders

the ability of the state to properly accomplish Step VIII (Appendix 18- MassDOT’s 2006 Project Development & Design Guide Book), which addresses the entire Project Assessment in one page, from identification of an infrastructure issue, to constituent involvement, procurement, design, bidding, and construction assessment. However, as can be noted from the writing, this “informal process” is not usually accomplished, and very rarely documented.

A very difficult area to address in the current project management process is performance and accountability⁷. Designers can place a tremendous strain on MassDOT employees by submitting documents for review only a few weeks before the Federal Fiscal Year (FFY) deadline. Based on a discussion during an interview with District 3’s Projects Engineer, Ann Sullivan, during the month of February 2012¹⁶, there is a need of Key Performance Indicators (KPIs) to align project and societal goals on Public-Private Partnerships (PPPs). A report entitled “Key Performance Indicators in Public-Private Partnerships – A State-of-the-Practice Report” published in March of 2011 by the Federal Highway Administration along with other organizations, provided evidence to suggest that KPIs can be used for PPPs, as well as conventionally bid projects¹³. That report researched eight case studies in five countries and had a comprehensive literature review that supports the use of Key Performance Indicators in Public-Private Partnerships.

Inspector General Report

A report entitled “Designing and Constructing Public Facilities – Legal Requirements Recommended Practices Sources of Assistance” published on October 1, 2011 by the Inspector General of Massachusetts, explains the legal procedures that apply to public design and construction projects. The document addresses both building construction under Massachusetts General Law (MGL) Chapter 149, as well as public works construction under (MGL) Chapter

30, section 39M. It also reports on legal aspects of procurement, design, alternative project delivery methods in chapter 9, construction, and legal forms for different types of projects¹⁴.

In the report by the Inspector General (p 114), there is a description of “Evaluating Contractor and Subcontractor Performance on Building Contracts Estimated to Cost More than \$100,000”. The report describes the role of ‘the clerk of works’, who is a representative for the government at the project site (p 9). In Appendix 9– Contractor Performance Reports (E-10-002) ‘the clerk of works’ is referred to as the ‘Resident Engineer’. The responsibilities involve observation, monitoring, and record keeping of all aspects related to the construction site. Excellent record-keeping is essential for smooth everyday operation of the construction site and for legal purposes. The role of record keeping for a project should be accomplished by an individual, with significant construction experience, who is typically a full time employee MassDOT Project Manager. The document also states (p 10), that M.G.L. Chapter 149, Section 44J(9) does not legalize the advertisement of contracts for designer’s services if cost estimates are older than one year¹⁴.

Current Contractor Performance Assessment Forms in Place

In efforts to improve construction management and monitoring, on April 20, 2010, an Engineering Directive which can be found in Appendix 9– Contractor Performance Reports (E-10-002) went into effect to evaluate both contractors and subcontractors. These evaluations must be submitted to the Construction Engineer of the district where the construction takes place, after 50% of the construction has occurred and at the finalized 100% stage of construction. The previous version of general contractor evaluations had four categories, while the current contractor evaluation contains nine categories.

The signature of contractors and subcontractors gives them an opportunity to acknowledge the evaluations, as these are used by the Prequalification Committee in future projects, to determine contractor bidding limitations as a result of previous performances¹⁵. Final reports are then used to determine contractors and subcontractors for construction contracts with MassDOT for future projects. Detailed evaluations and constant thorough record keeping are paramount to ensure legal compliance by the state and to have legal documentation in case legal action arises. Once the “Contractor Performance Reports” are finished and signed by the responsible District Highway Director, with a passing ($\geq 80\%$) or failing grade, the report then proceeds to the Deputy Chief Engineer for Construction, who is located in the Boston office.

Massachusetts General Law

The lack of a standardized design evaluation shared within a particular district or with other districts, hinders the ability of MassDOT to have documented past records of performance. This presents an issue as Part D of Section 38 of MGL, Part 1, Title II, Ch. 7 writes “(d) An agency shall evaluate the firms submitting statements of qualifications, taking into account qualifications, letters of interest and technical proposals, and the agency may consider, but shall not be limited to considering, ability of professional personnel, *past record and experience, performance data on file...*”, as well as an issue with Part E which marks “(e)(1) An agency shall select architects, engineers and related professional firms on the basis of qualifications for the type of professional services required, and on technical proposals, if submitted.” By having standardized and legally established evaluation criteria, all districts around the state could benefit from the information when searching for designers¹⁴.

Massachusetts General Laws, Part 1, Title II, Chapter 7 Executive Office for Administration and Finance, Section 38 P – “Evaluation and selection of architectural,

engineering and related professional services firms for public works projects; prequalification; publication of notice on official agency website or professional services bulletin” reports the legal steps of procuring design contracts for public works project. This law is also described on page 29 of the Designing and Constructing Public Facilities by the Inspector General, where it discusses how MassDOT (along with the MBTA and MassPort) must abide by M.G.L. C. 7, Section 38P to procure contracts for professional, architectural, or engineering services¹⁴.

Part b of Section 38 P states “(b) For those agencies that prequalify architectural, engineering and related services, the agency shall require firms engaged in the lawful practice of their profession to submit a statement of qualifications and performance data every 2 years to the agency pursuant to the terms and schedule as determined by the agency. Agencies that prequalify shall have the option of selecting firms from their prequalified list of firms based on the agency policies and without further publically advertising the selection.” This law is in place to ensure that a designer is selected through qualifications, record of performance, and price, according to MassDOT standards, and not by the lowest price¹⁴.

Standardized Design Evaluations for Internal Purposes

A standardized design evaluation for internal purposes can be found in Appendix 1– Current Record of Design Evaluation Form and includes the District Director’s comments about the design. According to an Engineering Directive put into effect August 12, 2010 which can be found in Appendix 8– Design Consultant Performance Evaluations (E-10-005), Project Managers are responsible for keeping record of completed Consultant Performance Evaluation forms. However, Project Managers are not the personnel who hire consultants; therefore the evaluation forms should be kept by project managers for legal and record keeping purposes, but

should mainly be readily available for MassDOT employees who are responsible for picking consultants.

The Projects Engineer from the District 3 of MassDOT (D3), Ann Sullivan, located in Worcester, MA, believes it is very difficult to fit projects under certain criteria and specific slots, as all projects are different¹⁶. However, the author believes that although all projects and designers are different, projects of certain magnitudes could potentially be ranged by cost ranges and types. Once this is accomplished, enforcement of schedules, design standards and guidelines (Appendix 10– Project Development and Design Standards and Guidelines (P-10-001)), allowed number of errors, Extra Work Orders (EWO), and additional costs can be moderated. If the need arises for consultants to be financially held responsible, documentation of the unmet legal milestones would protect the government. As of February, 2012, D3 evaluates consultants simply by giving them a number (Appendix 8– Design Consultant Performance Evaluations (E-10-005)); however, District 2 is the only district which currently has an internal form of assessment in place to evaluate consultants on defined criteria and come up with a rating¹⁶, which can be seen in Appendix 1– Current Record of Design Evaluation Form^{17,18}.

The Projects Engineer at D3 also believes in having a program similar to a “better business bureau” to include the work performed by designers¹⁶. Problems and additional costs during design and eventually construction could be documented to maintain a record in compliance with Massachusetts General Laws, described in previous sections, and could also be seen by municipalities when searching for procurement services. According to a document entitled City/Town 110% Agreement (Appendix 19- City/Town 110% Agreement) acquired through communication with District 3’s Project Engineer, when municipalities hire consultants, a legal agreement is made in which it is stated that if the chosen consultant’s fee exceeds an

amount over ten percent of the contractual agreed cost, the municipality becomes responsible. Currently (March 2012), MassDOT has to constantly remind and encourage consultants to comply with milestones signed on the procurement contract and following legal documents. The milestones are established four to five years before a project and can be updated on ProjectInfo by the parties involved, to reflect changes and to allow sufficient time in case action is required. However, one of the topics discussed was the lack of repercussions towards designers, since MassDOT rarely takes legal action in the case of proving that extra work items should have been documented during design, as it is legally tedious and time consuming for the state to address¹⁶.

To summarize, the legal writings on an assessment method for public work projects are complex to locate and understand. An overall assessment of the entire process of transportation projects, from identification of a project, procurement, design, methods of construction, bidding, and construction performance is paramount to improve the performance of the process. The Inspector General reports that a form of assessment is required, while the legal MassDOT Design Guidebook presents an “informal process”, whereas the Massachusetts General Law requires past data on performance to legally judge a contractor’s ability to perform the project. The potential solution for this and other problems mentioned in this chapter can be accomplished through the use of a document database, which could be used to store assessment forms on designers and contractors that could be easily accessed by decision makers when awarding a transportation contract.

Project Management Software

The discussion in this section focuses on providing the detailed information on several potential solutions related to improving technology at MassDOT. This subdivision contains research by US Department of Transportation (USDOT), Federal Highway Administration

(FHWA), Transportation Research Board (TRB), and MassDOT, on areas such as Intelligent Transportation System (ITS), Every Day Counts Program (EDC), along with other researched ways of improving the transportation system with project management software. MassDOT uses more than 13 applications to deal with highway design and construction efforts, depending on the task at hand¹⁹. Comm-PASS, for example, is used by construction contractors to review bid opportunities, while Bid Express is used by construction companies to make secure internet bids²⁰. There is also different software for pay estimates and for certified payroll. This section strives to compile all relevant data to clearly recommend a feasible action plan supported by interviews, along with research conducted by professors, universities, private, as well as state and federal government agencies, to provide a single technology platform for MassDOT.

Intelligent Transportation System

The United States Department of Transportation Research (U.S. DOT) and Innovative Technology Administration oversee the Joint Program Office in charge of the Intelligent Transportation System (ITS) research. ITS allows for the expansion of capacity and reduction in congestion without requiring significant changes to what is currently in place or major amounts of construction. The Traffic Engineer for District 3 of MassDOT, Joseph Frawley, described how each region of the state has an ITS network in place to guide the sharing of information among different agencies²¹. For example, before MassDOT merged, ITS was used to help share information between MassHighway and the Turnpike agency, but it can also be used by local communities, police, and fire departments. Examples of ITS systems include transit signal priority, which uses the same technology as emergency vehicles. An agreement is made between MassDOT and a city or town to prioritize buses during certain times to reduce congestion. ITS have a wide range of subcategories and can be as simple as having a camera with certain

abilities, such as tilt and zoom, in the place of still cameras. Modern signal controllers are more advanced and allow MassDOT to better control potential traffic congestions.

Mr. Frawley believes that one of the areas that should be addressed to improve the process is the improvement of communication technologies. Mr. Frawley mentioned that most of the signals from traffic boxes are connected by dial up, which only allows for the acquisition of basic data such as the current times for the traffic controller (assuming the device works), which makes the acquisition of data from the devices slow and difficult²¹. Given that most ITS applications use fiber optics; it is a matter of placing these new communication systems in place. To accomplish this and to promote an upgrade throughout the district, state, or even high traffic areas of District 3 such as Route 9 and Route 20, it would be necessary to conduct research on the different types of communication systems such as fiber optics, cable modems, wireless, etc. There are several software packages made by signal control manufactures to run interconnected systems that use real time traffic data for congestion management.

During the research, a good source of information regarding additional readings, potential project management software, and additional sites for reference, was a document published in March of 2009 by the National Cooperative Highway Research Program (NCHRP) entitled “Guidance for Transportation Project Management”²². This research was sponsored by the American Association of State Highway and Transportation Officials (AASHTO), in collaboration with the Federal Highway Administration. Published by the Highway Research Division of the Transportation Research Board (TRB), the research was accomplished through extensive analysis of current practices (including interviews, nationwide surveys, and literature review), identification of proven successful project management practices, and a compilation of data. The ultimate goal of the research was to improve project delivery on time and on budget

performances and optimize the resources at hand, while meeting challenges faced by state department of transportation agencies (DOTs). One of the topics discussed and supported in the document is the use of project management software to facilitate project management operations within departments of transportation.

Every Day Counts Program (EDC)

As can be seen from Federal Highway Administration's (FHWA) Every Day Counts Program (EDC), there are still significant areas for improvement¹¹. The program seeks to improve communication among parties involved in transportation projects, by shortening the project delivery period through research and implementation of innovative ideas, while protecting the environment and safety of roadways. The FHWA Administrator, Victor Mendez, hopes to accomplish these goals by organizing the program around three areas: 1) reducing the carbon footprint of the agency and making it greener, 2) shortening project delivery, and 3) accelerating technology and innovation deployment. An example of the accelerating technology part of the EDC program is the use of the Adaptive System Control. This technology is more reactive to live traffic data allowing for flexible traffic lighting to mitigate congestion efforts, instead of using traffic data for rigid timing of traffic lights from several years earlier¹¹.

Federal Highway's Every Day Counts program recognizes the need for making improvements to the current process, in efforts to shorten the project delivery period. A project's life cycle was discussed on the first section of this chapter, "Current Process", which explained the several steps required during the life time of a project. During the 2012 State of the Union Address, President Obama stated that our transportation system "...too often it's inefficient, outdated, and remote. We need to consolidate federal bureaucracy so our government is leaner, quicker, and more responsive to the need of the American people!" The EDC program attempts

to have a better scope of work, setting stricter standards and schedules, reducing the risks of additional costs and the life cycle of a project¹¹.

ProjectInfo Software

Current project management application, ProjectInfo, provides reporting to approximately half of the projects with limited information as a result of few project management tools available with the software¹⁶. Attempts have been made to add additional applications to ProjectInfo, such as Kronos and a Construction Management System (CMS) late 2010, but without success^{Error! Bookmark not defined.}. Kronos was an attempt to establish an electronic paperless payroll system, and CMS was an attempt to consolidate 13 applications used with the Highway's design and construction process¹⁹. The CMS proposed in 2010 was supposed to act as repository for all project data and contract documents, in efforts to support the process from design, bidding, advertisement, and closeout; however, the reasons why it was unsuccessful are currently unknown⁶.

In the same year of 2010, there was a successful attempt to add an application to ProjectInfo called "The Contract Advertising and Planning Estimate (CAPE)", which provided more accurate estimating and budget allocation by having fields to capture non-reportable data¹⁹. The application allowed ProjectInfo to provide an improved visual of the cost and enabled better funding for Transportation Improvement Projects (TIP) and Construction Management funding. Although ProjectInfo acts as a repository of information related to a project, it lacks efficiency, mobility, and available tools to facilitate the project management process. According to current project managers, the main project management tools used to manage, keep track, schedule, estimate, and coordinate events related to a transportation project are Microsoft Word and Excel documents.

Mr. Frawley also believes that another area for improvement is “The need to allow ProjectInfo Software (MassDOT’s current Project Management Software) to be used with private development projects”, as well as public projects²¹. There is a need to allow ProjectInfo to be used for Public Projects (which have MassDOT as the owner) and Private Development Projects (which can be the construction of a mall, large business establishment, etc.). There are legal differences between the projects, but MassDOT must review both types of projects to ensure legal compliance²⁰. Through the use of ProjectInfo or a different type of software as a repository, both types of projects could be tracked electronically, potentially increasing the turnover rate of reviews for private development projects.

Along with the “Guidance for Transportation Project Management” research accomplished by the Transportation Research Board (TRB), another research document by TRB, entitled “Measuring Performance among State DOTs: Sharing Good Practices” supports the idea of a project management software²³. With a series of reports, the research attempted to address important changes to promote increased performance and provide consistency for measurement and reporting on performance, including: ITS systems, Construction Project Cost and Schedules, Safety, and Operations Performance, and National System Performance Data Collection and Analysis. TRB has recognized the need to promote further research to improve the transportation system, and has established the Strategic Highway Research Program 2 (SHRP 2). This program looks at the transportation system as part of a larger system, and researches ways to improve operations and communications among these systems, and in turn improve highway development. TRB and FHWA recognize that there has been a lack of communication among interested parties related to transportation infrastructure in the past (as was visible in the trends

of the “Current Process”), and SHRP 2 program seeks to improve communication among the systems involved in highway development²⁴.

Project EMS Dream – Attempt in 2009 to establish EPMS

In 2009, there was an effort by the MassDOT IT department to establish an enterprise project management software, entitled “Project EMS Dream”, which attempted to improve project management operations with an on premise solution⁶. On premise solutions entails that the software would be hosted and maintained on the servers of the company using the software (SaaS means hosted and maintained on the servers of the software company). However, the on premise software was estimated to cost \$8 million dollars for 4000 users, which also included the Department of Conservation and Recreation (DCR), Massachusetts Transportation Authority (MTA), and other departments that composed the newly formed MassDOT in 2009. Research conducted by the Capital Programming Unit and Federal Aid and Programming Office until 2009, to provide the supporting evidence for the “Project EMS Dream” included the 2009 Internal Electronic Design Submission Survey and the 2009 Nationwide Electronic Design Survey. Both of these surveys examined the proper use of ProjectInfo, tools used for project management (Word and Excel), and whether employees would be willing to move to an electronic form of design review to reduce paper usage (answer was no)⁶. Although the research and surveys indicate that MassDOT has an advanced process system compared to the rest of the country, the room for improvement cannot be ignored.

Discussion of Results

Once the overview of MassDOT was provided, the author was able to provide a feasible recommendation in the form of an enterprise project management software (EPMS), as it was mentioned in researches performed by the Transportation Research Board (TRB) and Federal

Highway Administration (FHWA). Other organizations that provided research indicating the potential benefits of an EPMS were the American Association of State Highway and Transportation Officials (AASHTO), the National Cooperative Highway Research Program (NCHRP), and the Massachusetts Department of Transportation (MassDOT). Although there has been research by government organizations on the potential benefits of an EPMS system since 1997²⁵, the fear is that the full cost and time savings potential of this capability has not been discovered as it has not been fully explored by state DOTs. TRB also explains in a research entitled “A Guidebook for Sustainability Performance Measurement for Transportation Agencies” that most Department of Transportations are not improving as expected by FHWA, although millions of dollars are spent on an yearly basis to conduct research, publish, and provide information of DOT employees on how to improve the transportation system²⁶.

Areas for Improvement Found During Overview

There were a few areas for improvement discovered while attempting to identify potential areas to improve the project management process of MassDOT. These issues included a lack of one common designer assessment form used for internal purposes throughout all districts, and one location for the storage of these assessments^{16,17, 18}. The need of one integrated information technology platform to improve communication among interest parties in MassDOT to potentially reduce delays and additional costs was also another potential area for improvement^{6Error! Bookmark not defined.,12,22,23}. The current project management application, rojectInfo, provides reporting to approximately half of the projects with limited information as a result of few project management tools available with the software and an inefficient paper based process that results in the loss of time and money¹⁶. Another area for improvement includes

expanding ProjectInfo to be used as a repository to both public and private projects that MassDOT must review²¹.

The concept of on time and on budget is a difficult concept to fulfill in large transportation infrastructure projects involving several different interest parties, while MassDOT operates with limited funds and personnel. The task to keep projects on track is further complicated, as according to current project managers, the main project management tools used to manage, keep track, schedule, estimate, and coordinate events related to a transportation project are Microsoft Word and Excel documents.

Potentials of an Enterprise Project Management Software

Enterprise project management software has the potential to facilitate everyday activities of MassDOT employees, including field supervisors, projects engineers and managers, IT staff, as well as chief administrative employees, through the use of many tools available with the software. These tools could possibly facilitate the ability of managers to oversee, influence, and efficiently control all aspects of projects throughout the life cycle of projects. This would, in turn, allow upper level management to focus on keeping projects on track instead of having to handle resources, timesheets, supplies and materials, along with many other items that could be tracked electronically with the software. The tools available with enterprise project management software complement current procedures by facilitating communication, project tracking and scheduling, estimating, reporting, and the coordination of responsibilities.

The project management tools available with the software have the potential to facilitate everyday operations in MassDOT by enabling project managers to focus on keeping projects on track. TRB has also provided research that with the use of project management software, open

government efforts to facilitate communication among different government agencies provides significant varying levels of improving to cost and time savings²⁷, as was discussed under the “Current Process” section of this chapter. By using project management software to facilitate risk management, data management, project resourcing, scheduling, funding needs, and communication along the way, many sources point to the potential benefits of an EPMS^{28,29,30}.

Several criteria were essential for an online project management software to be considered as a potential option to facilitate the process. A reliable and recognized source of software comparisons for this section was the 2012 Best Online Project Management Comparisons review provided by the TopTenReviews website. Due to certain capabilities, such as the option for the software to be made available on an enterprise level, cost, and additional features, the options were narrowed down to two out of the dozens of online project management software in the market.

States that have successfully implemented Enterprise Project Management platforms include: Washington State DOT, Florida State DOT, California DOT, New York DOT, Utah DOT, and North Carolina. California Department of Transportation (Caltrans) implemented a software entitled Project Resourcing and Scheduling Management software to assist with project management activities. The Division of Project Management in California not only reviews projects (as in MA), but also constantly implements new tools in its process to improve the transportation project management process. North Carolina DOT, is an example of a combined legislative, IT, and employee effort with a successful secured implementation of a maintained enterprise project management software since 2004³¹.

From the information acquired from the overview, the author discusses in this section how MassDOT could potentially attain improvements to the delivery of projects with less time

and money through an online enterprise project management software. This section also attempts to determine the viability of recommending a software based on the data acquired, through the use a strengths, weaknesses, opportunities, and threats (SWOT) matrix was also necessary to visualize certain aspects about the feasibility of the software, which could not be seen from data.

Figure 9-SWOT Analysis of an SaaS Enterprise Project Management Software^{7,22,23,24,31}

Strengths	Weaknesses
<ul style="list-style-type: none"> • Hosted off site by software company • Reduces strain on MassDOT IT staff • Project Management Tools • Collaboration & Communication Tools • Increase efficiency to improve on time and on budget performance • Document Management • Resourcing, Projects & Programs Management Tools • Uniform and standardized rules and forms throughout the state • Funding and Human Resource availability for Planning of Activities • Current time tracking of projects • One platform with different levels of security for projects, reviews, bridge, maintenance, construction management • Nothing to install on MassDOT computers • Secure access to one’s account from any internet-connected computer 	<ul style="list-style-type: none"> • Implementation difficulties • Expansion problems could result in significant additional costs without proper pre-evaluation • Small number of IT personnel per district (D3 has two IT staff members) could prevent quick implementation and expansion • Integration of rules/standards/laws, along with people, and technology provides room for issues • For proper planning, implementation and future successful use of EPMS, the Executive Office would have to quickly establish a new department with users in charge of managing different sections, such as HR, Fiscal, Administration, IT, and Highway Project Management
Opportunities	Threats
<ul style="list-style-type: none"> • Integration with Department of Conservation (DCR) and Massachusetts Transportation Association (MTA) • Complete Project Development Process according to Chapter 2 of PDDG • Accomplish process of a project with less money, time, and resources • Improve Budgeting and Cost tracking • Continuous Project Process Improvement • Retain institutional knowledge electronically 	<ul style="list-style-type: none"> • Business needs could change if an EMPS is not quickly and successfully implemented • Potential for delays and additional costs if MassDOT IT does not quickly and efficiently communicate requirements and software needs • Lack of information on current MassDOT and other government organizations’ software could prevent quick implementation (even SaaS) • User refusal to change to new software

<ul style="list-style-type: none"> • Comment and Review System • Reduce the use of resources 	<ul style="list-style-type: none"> • Slower than calculated implementation time
--	--

Tools Available with Software

This section provides a discussion on project management tools (PMTs) that could potentially improve MassDOT’s project management process, while understanding that MassDOT must operate under constant economic, political, and legal pressure. In addition to offering a discussion on different project management tools that could be implemented, this subdivision describes the potential benefits of implementing PMTs for all interest parties involved in a project. These tools could be used to facilitate project management activities throughout the project development life cycle, from the identification of a problem, to planning, design, and construction.

This section focuses on discussing project management tools and strategies that could increase efficiency and success rates related to transportation projects. These tools provide efficient ways to address complex and often time consuming areas of a project (Appendix 15), such as project management processes, administration, organization, and the many systems that must work in sync. While researching several enterprise project management software, the author attempted to narrow down to a few potential pieces of software by keeping a few criteria in mind. To deliver projects on time and on budget these software needed to have customizable security and permission settings, team collaboration, communication, and synchronization abilities, as well be user friendly and have customer support ready to assist MassDOT with the product, all at a reasonable price.

Comparison of Online Project Management Software

After analyzing the benefits that could potentially be achieved with project management software by private and government organizations, the author compared online project

management software (Appendix 11) to be able to recommend a solution that could potentially resolve most of the problems mentioned in this research. The solution needed to be easy to implement and use, contain several tools that would facilitate communication and collaboration, have the capability to properly and efficiently manage resources, and also have several features to accomplish project management successfully. The number of users per account, cost per individual or annual license fee was also very important due to the budget constraints of MassDOT, as well as available help and support. The ultimate goal of this subsection is to analyze and discuss online project management software to be able to provide potential recommendations to improve the project management process with transportation projects at MassDOT.

Several software company were analyzed during the research, including Genius Project for Web, Project Insight, Project Server Hosting, EPM Live, Tenrox Enterprise Project Management, VCSONline.com, AtTask, and Celoxis. Another potential online project management software researched, named Easyprojects.Net is currently used by COX communication, GoodYear, Toshiba, Lockheed Martin, Staples, and Symantec. It also contains efficient ways to manage projects, improve team collaboration, generate custom fields, lists, and reports, as well as track hours and manage employee workload through timesheets. By establishing different filters and giving specific clearance to different personnel, such as client, executives, team members, and project managers, this software also ensures proper distribution of information to the correct parties involved in a project.

	AtTask	Celoxis	Project Insight	Clarizen	Project Office.net (Seavus Project Viewer)
Contact	Nels Draper	Harish KulKarni	Cynthia West		Krste Gjoneski
Number	1-866-441-0001	1-855-CELOXIS	949-476-6499	1-866-502-9813	770-261-1394
Link	link	link	link	link	link
Price for Enterprise	\$ 130,450	\$ 152,500	\$ 67,560	\$ 599,400	\$ 19,900

Collaboration						
General Collaboration		✓	✓	✓	✓	✓
Centralized Collaboration		✓	✓	✓	✓	✓
Issue Tracking		✓	✓	✓	✓	✓
Forums		✓	✓	✓	✓	✗
MS Project Integration		✓	✓	✓	✓	✓
Desktop Application		✓	✗	✓	✓	✓
RSS Feed		✗	✓	✓	✗	✓

Resource Management						
Resource Details		✓	✓	✓	✓	✓
Import Resources		✓	✓	✓	✓	✓
Email Addresses		✓	✓	✓	✓	✓
Capacity Planner		✓	✓	✓	✓	✗
Resource Notes		✓	✓	✓	✓	✓
Costs		✓	✓	✓	✓	✓
Timesheets		✓	✓	✓	✓	✓
Skill Sets		✓	✓	✓	✓	✗
Groups		✓	✓	✓	✓	✓
Materials/Supplies		✓	✓	✓	✓	✗
Check In/Check Out		✓	✓	✓	✗	✗

Project Management

Task Management		✓	✓	✓	✓	✓
Task Feedback		✓	✓	✓	✓	✗
Scheduling		✓	✓	✓	✓	✓
Calendars		✓	✓	✓	✓	✓
Time Lines		✓	✓	✓	✓	✗
Events		✓	✓	✓	✓	✓
Gantt Charts		✓	✓	✓	✓	✓
Reporting		✓	✓	✓	✓	✓
Statistics		✓	✓	✓	✓	✓
Work Load		✓	✓	✓	✓	✗
Financials		✓	✓	✓	✓	✓
Document Management		✓	✓	✓	✓	✓
Budgeting		✓	✓	✓	✓	✗
Critical Path Method		✓	✓	✓	✓	✗
Project Templates		✓	✓	✓	✓	✓
Scope		✓	✓	✓	✓	✗
Milestones		✓	✓	✓	✓	✓
Automatic Notifications		✓	✓	✓	✓	✓
Privacy Settings		✓	✓	✓	✓	✓
Custom		✓	✓	✓	✓	✓
Baseline		✓	✓	✓	✓	✗
Risk/Benefit Analyzer		✓	✓	✓	✓	✗
Interactive Gantt Charts		✓	✗	✓	✓	✗
Recurring Tasks		✓	✓	✓	✓	✗

Help/Support						
Support		✓	✓	✓	✓	✓
FAQs		✓	✓	✓	✓	✓
Online Video Demo		✓	✓	✓	✓	✓
Online Chat		✓	✗	✓	✓	✗

These software contain a number of tools that can be used to keep a project on time and on budget. To reduce the project life cycle, increased collaboration and communication through current time information is essential for the successful completion of a project. This can be accomplished through team calendars and timelines, individual tasks and responsibilities, issue tracking, and live news feed. These tools have the capability to allow upper level management to focus on keeping projects on track instead of having to handle resources, timesheets, supplies and materials, while ensuring that all employees have a balanced level of responsibility. Project management tools facilitate budgeting, reporting, scheduling, management of tasks, and ensure timely completion of milestones, while always maintaining constant communications with all parties involved. Security settings on the SaaS application also provide settings for individual and group privacy settings.

Given that the shared drive is currently used by MassDOT employees, with security and restriction standards already in place dependent on current position, no significant changes to network infrastructure will be needed with a SaaS solution. As the capabilities of the software were described, there is an opportunity to save time and money with an online enterprise project management software distributed as SaaS, such as Project Insight Enterprise SaaS. This means that this option will not add further strain to the information technology department of MassDOT, as the software will be hosted by the servers of the software company.

Solution

After learning that an enterprise project management software would have the potential to improve on time and on budget performance and researching several different types of software, the author has chosen to recommend Project Insight Enterprise SaaS. Given the never ending

need to cut budgets, improve efficiency, while increasing safety and reducing the strain on the current transportation systems, the project management tools available with this software could have the ability to facilitate everyday activities at MassDOT. The author was able to determine the viability of recommending a software based on the data acquired, through the use of financial calculations, payback period, implementation time and learning curve of the software, along with a benefit-cost analysis. Project Insight has an initial annual cost of \$81, 960 dollars, including training, and an annual contract cost of \$67, 560 with a wide range of project management tools with the potential to facilitate daily project management tasks.

Some of the tools available with Project Insight Enterprise SaaS Software include:

- Collaboration Tools
 - Import from Microsoft Project, Project Templates, Scorecard reporting
 - General & Centralized Collaboration
 - Issue tracking
 - News Feed & Desktop Application
- Resource Management Tools
 - Groups that can be divided by security filters and skillsets
 - Materials & Supplies
 - Check In & Check Out for Timesheets
- Project Management Tools
 - Workflow & Approvals
 - Budgeting and Costing
 - Time/Expense Tracking
 - Advanced Accounting tools

- Reports
- Scope & Milestones
- Customizable tools
- Task Feedback and Management
- Automatic Notifications
- Risk/Benefit Analyzer
- Interactive Gantt Charts

Project Insight Enterprise software in the form of Software as a Service (SaaS) will allow for a smooth implementation at MassDOT. SaaS will not require installation on MassDOT computers and will also be up and running on the same day the software is purchased, with the potential to be easily expanded to other agencies of MassDOT, including the RMV, DCR, and MassPort. However, care must be taken to properly train project managers, administrators, and information technology employees on the wide arrange of project management tools provided by the software. The training package (Appendix 20- Project Insight - Gold Training and Implementation Package), which is included in the first annual contract cost of \$81,960, includes a one week, on-site training on implementation, process improvement, resource allocation, budgeting, scheduling, and time tracking, as well as security and access rights training³². Training is very important to ensure that the employees understand the product to facilitate successful implementation of the software, reduce the learning curve and number of internal questions to MassDOT IT personnel.

In comparison to the Project EMS Dream attempt of 2009 with an on premise software at an initial estimate of \$8 million dollars for 4000 users⁶, or \$2 million dollars for 1000 users, Project Insight Enterprise SaaS Software has a promising future at an initial estimated cost of

\$81, 960 dollars per 1000 users⁷. Although it is complicated to estimate and demonstrate accountability for expenditures in transportation projects³³, one way is to use the benefit-cost analysis (BCA) process. Given that for public agencies, BCA is essentially a measure of Return on Investment (ROI), this project estimates the benefits and costs to society on the investments made on transportation projects, in this case the implementation of a software. The implementation of Project Insight Enterprise SaaS Software is considered economically feasible, as the estimated future benefits of implementing the software exceed the discounted life-cycle cost of \$67, 560 from the second year onward. According to the research provided by the author, the potential benefits of improving on time and on budget performance to the project management process of MassDOT outweigh the annual cost to the Massachusetts Department of Transportation.

The Net Present Value (NPV), or Present Worth (PW) of the recommended solution was estimated to be in the millions. Taking into account that $NPV = \text{Benefits} - \text{Costs}$, the author made certain assumptions about the components of the benefits and cost variables of the equation. Benefits may potentially include increased efficiency and reduced use of resources, including the use of paper, traveling by MassDOT employees, and time spent generating, searching for, and filing reports. Costs could potentially include training of MassDOT employees with the new software, traveling expenses by the software company from California to Boston to provide training, as well as projects affected by the reduced number of employees who will be in training. With the estimated NPV of the implementation of the software, the author found evidence to support that it would in fact increase the number of jobs and not reduce it, as the increased efficiency would allow funds to be directed to other problematic areas of the

transportation system, in turn providing more jobs. With the NPV value of the recommended solution being in the millions, the author strongly suggests further research on the system.

Chapter 5: Conclusions and Recommendations

After a majority of the potential areas for improvement were identified through interviews and research, and an investigation was carried out to narrow down potential solutions, the author recommends the general online project management software system, Project Insight Enterprise SaaS. Although there are the options of using Microsoft Word and Excel for project management functions, or even using more advanced methods, such as enterprise project management software hosted on the servers of MassDOT, a software as a service solution (SaaS) outweighs the benefits of other options. If Project Insight Enterprise SaaS can be successfully implemented, along with the guidelines outlined above, it is likely to improve on time and on budget performances, as has been witnessed by the progress of other states.

The proposed recommendation has a promising future with the first year cost at \$81,960, which includes a one week “Gold Training Package” by employees of the software company, and an annual cost of \$67,560 dollars thereafter. The proposed recommendation provides unique advantages included in their project management tools at a reasonable cost compared to more than twenty other companies analyzed. This research and following recommendations were meant to complement and facilitate enforcement of laws and regulations regarding transportation projects, not change them, by having one technology platform for MassDOT. The tools and resources available with the software will have the potential and capability to improve efficiency of the process by placing several tools under one technology platform for MassDOT employees (whether in the area of construction, planning, designing, legislating, etc), enabling decision making based on communicated and collaborated present time information.

If the software can successfully be implemented in less than one day as planned and be expanded to the other departments and agencies, while being attentive to the weaknesses and threats mentioned in the discussion, it is likely to improve on time and on budget performance with the wide range of project management tools available with the software. However, as analyzed in the discussion of this software, prices vary per license, as well as the learning curve, and also the number of users a certificate allows. Continuing education of employees involved in the area of project management will also be very important to maintain an efficient and successful project development team.

In conclusion, after pinpointing particular areas of interest in the project management process of MassDOT, the general online project management software, Project Insight Enterprise SaaS Software has several project management tools, which will have the potential to improve on time and on budget performances. Even with limited research and data to date on the topic, supporting evidence from improvements accomplished by other states, along with research by the Transportation Research Authority (TRB), Federal Highway Administration (FHWA), and other agencies, this technology will be successful in MassDOT. It is the author's opinion that the implementation of Project Insight Enterprise SaaS Software is worth pursuing further to potentially improve the project management process of MassDOT.

Table of Figures

Figure 1A- Decision Making Flowchart on Project Management Process of MassDOT⁸ 15

Figure 1B- Chart of the Project Management Process at MassDOT⁸ 17

Figure 2-Accelerated Project Delivery Methods¹² 18

Figure 3-MassDOT Highway Division ScoreCard (03/11)¹ 20

Figure 4- MassDOT Highway Division ScoreCard (03/11) ¹ 20

Figure 5-MassDOT Highway Division ScoreCard (03/11) ¹ 21

Figure 6-MassDOT Highway Division ScoreCard (03/11) ¹ 22

Figure 7-MassDOT Highway Division ScoreCard (03/11) ¹ 22

Figure 8-SWOT Analysis of an SaaS Enterprise Project Management Software^{7,22,23,24,31} 39

Table of Appendices

- Appendix 1– Current Record of Design Evaluation Form**
- Appendix 2– MassDOT Highway Division CAD Standards (E-12-001)**
- Appendix 3– MassDOT Utility Reimbursement Policy (E-11-008)**
- Appendix 4– Proposed Utility Relocation Durations within MassDOT Construction Contracts (E-11-006)**
- Appendix 5– Right-of-Way Policy for Utility Relocations within MassDOT Projects (E-11-005)**
- Appendix 6– Electronic Utility Plan Submissions (E-11-003)Appendix 7– 2010 Construction Standard Details (E-10-07)**
- Appendix 7– 2010 Construction Standard Details (E-10-07)**
- Appendix 8– Design Consultant Performance Evaluations (E-10-005)**
- Appendix 9– Contractor Performance Reports (E-10-002)**
 - Appendix 9A- Contractor Project Evaluation Form**
 - Appendix 9B- Subcontractor Project Evaluation Form**
 - Appendix 9C- Contractor Performance Report Rating Guidelines**
 - Appendix 9D- Subcontractor Performance Report Rating Guidelines**
- Appendix 10– Project Development and Design Standards and Guidelines (P-10-001)**
- Appendix 11 – Detailed Comparison in a Matrix of 5 EPMS**
- Appendix 12 – Email Communication with Krste Gjoneski from Seavus Project Viewer**
- Appendix 13 – Email Communication with Harish Kulkarni from Celoxis**
- Appendix 14 – Email Communication with Nels Draper from AtTask**
- Appendix 15 – Email Communications with Cynthia West from Project Insight**
- Appendix 16 – Email Communication with William Betts**
- Appendix 17- MassDOT’s 2006 Project Development & Design Guide Book**

Appendix 18- MassDOT's 2006 Project Development & Design Guide Book

Appendix 19- City/Town 110% Agreement

Appendix 20- Project Insight - Gold Training and Implementation Package

Appendix 1– Current Record of Design Evaluation Form



RECORD OF DESIGN

Consultant - Name: _____ Date: _____
 Department Engineers – P.S. & E. by _____ District No: _____ Boston Office: _____

PROJECT INFORMATION

Project File #: _____

Project: _____
 Contract #: _____ Federal Aid #: _____
 Bid Price: _____ Funds: State: _____ Federal Aid: _____
 Interstate: _____ Primary: _____ Secondary: _____ Other: _____
 Contract Completion Date: _____ Extensions: _____
 Construction Started: _____ Completed: _____
 Project Type: _____
 Bridges: _____

DISTRICT HIGHWAY DIRECTOR’S COMMENTS ON DESIGN

	N/A	YES	NO
1. Were Drawings substantially complete?	_____	_____	_____
2. Preliminary Bridge calcs. furnished?	_____	_____	_____
3. Intent of Design Details clear?	_____	_____	_____
4. Intent of Special Provisions clear?	_____	_____	_____
5. Were Preliminary Quantities accurate?	_____	_____	_____
6. Were any delays due to design errors?	_____	*	_____
7. Were there discrepancies in Contract Drawings?	_____	Minor _____ Serious* _____	_____
8. Were there discrepancies in the Proposal?	_____	Minor _____ Serious* _____	_____
9. Were all necessary items of work included?	_____	_____	*
10. Did consultant provide corrections?	_____	_____	*
11. Was additional allotment required? How much additional allotment?	_____	_____	_____
* 12. How many Claims or EWO’s were necessary due to errors or omissions?	# _____	_____	_____
13. How much money is involved?	_____	_____	_____
* 14. How many <i>sizeable</i> ¹ overruns due to miscalculations?	# _____	_____	_____
* 15. How many <i>sizeable</i> ¹ underruns due to miscalculations?	# _____	_____	_____
16. How much money is involved?	_____	_____	_____
17. Overall Evaluation of Designer:	Good _____	Fair _____	Poor _____

*Use reverse side for explanations or comments on these items with number references.

1. *Sizeable* is greater than, or equal to 25% of Estimated Quantity.

_____ Resident Engineer _____ District Construction Engineer _____ District Highway Director

cc: Boston Construction (4 for distribution), Highway Engineering, A&E Board, Construction Engineer
CSD-688 Rev. 7/97

EXPLANATION OF REFERENCED * ITEMS BY NUMBER

OTHER COMMENTS

KEEP A COPY OF THIS RECORD OF DESIGN IN THE PROJECT FILE.

Appendix 2– MassDOT Highway Division CAD Standards (E-12-001)



Number:	E-12-001
Date:	01/06/2012

ENGINEERING DIRECTIVE

Thomas Broderick (signature on original)

CHIEF ENGINEER

MassDOT Highway Division CAD Standards

The Purpose of this Engineering Directive is to formally issue the *MassDOT Highway Division CAD Standards* for use on all MassDOT Highway Division projects beginning after December 31, 2011. These standards include MassDOT's migration from using Autodesk Land Development Desktop software to using AutoCAD Civil 3D software.

New Projects

All projects initiated after December 31, 2011 shall be created with and conform to the *MassDOT Highway Division CAD Standards*.

All projects initiated after December 31, 2011 shall be created in AutoCAD Civil 3D.

Active Projects

Projects already initiated prior to January 1, 2012 in Autodesk Land Development Desktop may continue to be advanced with this software. However, MassDOT recommends that projects that have not reached the 25% design submission stage as of January 1, 2012 be converted to and completed with AutoCAD Civil 3D. All costs associated with this conversion shall be borne solely by the project proponent (the entity responsible for funding the design phase services).

Appendix 3– MassDOT Utility Reimbursement Policy (E-11-008)



Number:	E-11-008
Date:	12/08/2011

ENGINEERING DIRECTIVE

Tom Broderick (signature on original)

CHIEF ENGINEER

MassDOT Utility Reimbursement Policy

General

This Engineering Directive defines the MassDOT Utility Reimbursement Policy for all projects advertised after September 30, 2012.

MassDOT shall reimburse utility owners for necessary relocations of their facilities within MassDOT projects. Private utility owners shall be reimbursed through an incentive-based policy, and municipal utility owners shall be fully reimbursed.

The following criteria shall apply to all MassDOT Highway Division construction projects. This includes Federal-Aid (FA) projects and Non-Federal-Aid (NFA) projects.

Reimbursement Policy

Privately-owned Utilities

- MassDOT shall reimburse the owners of privately-owned utilities 50% of the actual costs incurred for necessary relocation of their facilities on an incentive/schedule basis, except as noted below.
- MassDOT may, on a case-by-case basis, vary the reimbursement percentage for incentive-based relocation of privately-owned utilities. In these cases, MassDOT shall provide written notification of the reimbursement percentage to the utility owner prior to execution of the Utility Relocation Force Account Agreement for the relevant work.
- For privately-owned utilities holding ownership fee to property or occupancy easement rights, including Railroads, MassDOT shall reimburse the owners of these utilities 100% of the actual costs incurred for necessary relocation of their facilities.

POST _____ DO NOT POST X

Municipally-owned Utilities

MassDOT shall reimburse the owners of municipally-owned utilities 100% of the actual costs incurred for necessary relocation of their facilities.

Relocations/Adjustments of Private Underground Utility Service Connections

- Typically, underground utility service connections to private customers are owned by the customers. As a result, according to the utility owners, if a customer-owned underground utility service connection needs to be relocated or adjusted, the utility owner is not responsible for this work.
- Therefore, MassDOT will assume all costs for relocating or adjusting private underground utility service connections that are necessitated by the Department's construction and maintenance projects. These costs may be incorporated within the Utility Force Account Agreement, construction contract items, or a combination of both, as determined by MassDOT.

Adjustments to Structures

- Adjustments to gate boxes, manholes, and any other structures necessitated by a proposed project are not considered utility relocations and are not eligible for reimbursement under this policy. For municipally-owned utilities, this work should normally be completed by MassDOT's construction contractor using construction contract bid items. For privately-owned utilities, this work should normally be completed by the utility owner with their own work forces.

Utility Relocation Force Account Agreements

- Prior to the project's advertising date, the utility owner shall provide MassDOT with the following items for review and approval:
 - A utility relocation scope of work
 - Estimated cost for the utility relocation work
 - Time duration schedule for the utility relocation work
- All schedules shall be based on actual time durations for the proposed work regardless of available resources due to normal work load.
- Prior to the start of project construction, a Force Account Agreement shall be drafted and executed between MassDOT and the utility owner containing the above information and stipulations.
- For privately-owned utilities (except those eligible for full reimbursement under this Policy) the Force Account Agreement shall be incentive-based. If the utility owner completes their relocation work within the approved schedule, as determined by MassDOT, MassDOT will reimburse the owner for 50% (or other partial amount) of the actual costs incurred for the relocation, including costs for temporary (if necessary) and permanent relocations. If MassDOT determines that the utility owner failed to complete their relocation work within the approved schedule, MassDOT will not reimburse the owner for any costs incurred.

- Upon completion of the utility relocation, if the MassDOT Resident Engineer determines that the utility owner has completed the work within the approved schedule, the District shall submit a memo to the MassDOT Utility Engineer requesting payment be made to the utility owner in accordance with the Force Account Agreement.

Reimbursement Procedures

- The MassDOT Resident Engineer is responsible for coordinating all utility relocations in conformance with the construction contract schedule. The Resident Engineer is also responsible for negotiating any amendments to the construction schedule and utility relocation schedule.

Full Reimbursement Agreements

- For Force Account Agreements that entitle the utility owner to full reimbursement for relocation of their facilities, the District may authorize periodic payments to the utility owner as elements of the work are completed. For each periodic payment, the District shall prepare and forward a memo to the MassDOT Utilities Engineer with a recommendation for payment to the utility owner for the actual costs incurred during the payment period. The Utilities Engineer is responsible for executing any necessary agreement amendments between MassDOT and the utility owner for the actual reimbursement costs incurred.

Incentive-based Agreements

- For incentive-based Force Account Agreements that entitle the utility owner to 50% (or other partial amount) reimbursement for relocation of their facilities, the District may authorize payment to the utility owner after all work is completed within the approved schedule. After the District determines that the utility owner has completed the work within the noted duration and in compliance with the Force Account Agreement, the District shall forward a memo to the MassDOT Utilities Engineer with a recommendation for payment of 50% (or other percentage as included in the Agreement) of the actual total costs incurred. The Utilities Engineer is responsible for executing an agreement amendment between MassDOT and the utility owner for the actual reimbursement costs.
- The District shall retain full determination authority on whether a utility owner has met their schedule and for the percentage to be reimbursed, if any.
- Special consideration for delays caused by events such as major storms will be taken into consideration on a case-by-case basis but may not be an excuse for not meeting the time duration submitted.
- The District reserves the right to reject any time duration estimate submitted that is deemed excessive and unsubstantiated.

Design-Build Projects

- The MassDOT Utility Reimbursement Policy applies to Design-Build projects.

- Design-Build contracts shall be drafted to hold the Design-Build Contractor responsible for all of the project's time durations and schedules.

Municipal Water and Sewer

- The design engineer is responsible for designing all water and sewer utility relocations, and for including necessary payment items for these relocations in the MassDOT construction contract.

Utility Betterments

- MassDOT shall only reimburse utility owners for in-kind relocations. Utility facility betterments are not reimbursable. Examples of betterments are relocating aerial facilities to underground facilities and increasing facility capacity.
- If the utility owner wishes to relocate in the form of a betterment, MassDOT will only reimburse the owner for the equivalent cost of relocating equal facilities, per the terms of the Force Account Agreement.
- To help determine the amount of reimbursement, the utility owner must provide MassDOT with separate cost estimates of in-kind relocations and betterment relocations. Any costs over the in-kind/equal facility relocation shall be borne by the utility owner.
- Betterments of municipal water and sewer facilities may be paid for by the municipality via Non-Participating Agreements.

Appendix 4– Proposed Utility Relocation Durations within MassDOT Construction Contracts (E-11-006)



Number:	E-11-006
Date:	10-07-2011

ENGINEERING DIRECTIVE

Tom Broderick (signature on original)

CHIEF ENGINEER

Proposed Utility Relocation Durations within MassDOT Construction Contracts

Effective immediately, MassDOT shall include the time required to perform all necessary utility relocation work associated with a construction project in the proposed contract duration for all new construction contracts. The Area Construction Engineers in the Boston HQ office are responsible for calculating the proposed contract duration for all construction contracts. In order for these contract durations to include the time required to perform all necessary associated utility relocation work, the MassDOT Project Manager shall acquire all of the information regarding the duration of utility work, utility relocation sequencing and relationships between proposed utility work and other proposed construction work prior to requesting the construction contract duration.

Prior to the project's advertising, each utility owner will submit to the State Utility Engineer a scope of work, an estimate budget of costs, and the estimated durations for the phases of work needed to be done to complete the utility relocations. The State Utility Engineer shall review the information and file for future force accounts to be executed soon after the project's advertising date. This information will also be forwarded to the MassDOT Project Manager and the District Utility/Constructability Engineer. The District Utility/Constructability Engineer shall compile the information and complete a MassDOT Project Utility Coordination Form for each project. This form shall be rendered complete when all of the utility relocation scopes, budgets and duration schedules have been entered into the form.

Therefore, the Construction Contract Duration Request procedure is as follows:

1. The Project Manager (PM) shall request the District Utility/Constructability Engineer (DUCE) to forward a completed Project Utility Coordination (PUC) Form to the PM. This form shall include the durations of the utility relocations, the sequence of the utility relocations, and an estimated timeframe of when the relocations should begin and end in relation to the proposed construction contract phasing. If at the time of the PM's request for the PUC Form, a utility owner has not yet supplied the information, the DUCE may estimate the time duration for the work associated with that utility. These estimated time durations shall be properly noted within the form. If/when the utility owner

does provide the duration information the DUCE shall resubmit the form to the PM so that the most accurate information is included within the construction contract and the estimated construction contract duration. If any utility owners have not provided information prior to the project's bid opening, the estimated durations shall remain within the PUC Form.

2. Upon receipt of the PUC Form, the PM will include this information within the Construction Contract Duration Request to the Construction Engineer. The Area Construction Engineer shall use this information within the calculations when deriving the overall construction contract duration.

3. The PM shall also forward the PUC Form to the project designer. The designer shall include it in the Division I "Work Schedule" section of the construction contract.*

Including this information in the construction contract documents will give proper notice to contractors that are bidding on the project of what is expected in time, scope and coordination between the contractor, MassDOT and the utility owners.

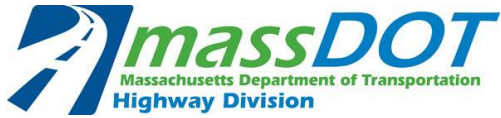
* NOTE: Division I language to precede the utility work schedule information shall state:

The utility schedule and sequence information provided in the Project Utility Coordination Form is the best available information at the time of the bid and has been considered in setting the contract duration. The information is provided for the contractors' use in developing their bids. If the contractor submits a schedule in accordance with Section 8.02 that varies from the one assumed in the Project Utility Coordination Form the contractor must coordinate the proposal with the Engineer and the Utility companies to develop a mutually agreed upon schedule prior to the start of construction.

A time extension will be granted for a utility delay only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form or agreed upon by all parties in the baseline schedule and the delay impacts the critical path.

Inclusion of the Project Utility Coordination information shall not be construed as changing or superseding any other provision of the contract. Utility delays, as provided by Section 5.05, are non-compensable delays. The sole remedy for utility delay is a time extension under Section 8.10.

Appendix 5– Right-of-Way Policy for Utility Relocations within MassDOT Projects (E-11-005)



Number:	E-11-005
Date:	10-07-2011

ENGINEERING DIRECTIVE

Tom Broderick (signature on original)

CHIEF ENGINEER

Right-of-Way Policy for Utility Relocations within MassDOT Projects

Effective for all projects advertised after September 30, 2012, for which MassDOT is responsible for securing the necessary Right-of-Way (ROW), MassDOT shall acquire all necessary ROW for the accommodation, removal and relocation of utilities. This policy is adopted in accordance with M.G.L. c. 6C, §§ 3(21) & 19, 23 C.F.R. § 645 *et seq* (for federal-aid projects), and the American Association of State Highway and Transportation Officials Standing Committee on Highways Strategic Plan Strategy 4-4, dated January 6, 2004. The purpose of this policy is to help prevent delays of highway and bridge projects due to utility conflicts.

This policy requires MassDOT to prepare and secure any necessary layout alterations and plans for accommodating, removing or relocating utilities and utility facilities authorized by law to locate within the highway ROW. Utilities and utility facilities include but are not limited to wires, pipes, poles and conduits, whether above or below ground, which require relocation due to the proposed construction project, on a permanent or temporary basis. Sufficient property rights shall also be acquired to accommodate any ongoing maintenance obligations by the utility owner on the facility.

The designer and the utility owners shall determine the locations and amounts of property takings or easements required at the 75% design stage. This shall give MassDOT sufficient time to coordinate with the affected property owners prior to project advertisement.

If a utility owner decides to change the location of the accommodated or relocated facilities after the project is advertised, and if this change results in additional ROW requirements, the utility owner may be responsible for the associated costs incurred.

MassDOT also recommends that all municipalities, to the extent permissible, adopt this policy for transportation improvement projects for which they are responsible for securing the necessary ROW, as it reduces costs and project impacts associated with related construction delays.

Appendix 6– Electronic Utility Plan Submissions (E-11-003)



Number:	E-11-003
Date:	8-4-2011

ENGINEERING DIRECTIVE

Tom Broderick (signature on original)

ACTING CHIEF ENGINEER

Electronic Utility Plan Submissions

This Directive supersedes Engineering Directive E-10-003, “Electronic Utility Plan Submissions”, dated May 5, 2010. Effective immediately, Utility Plan submissions required during the project design phase shall be made in accordance with the following guidelines:

Transmittal of Materials

- For the purpose of this Directive, “Utility Plans” shall be electronic documents in both AutoCAD format (current version used by MassDOT) and Portable Document Format (PDF) saved on compact disks (CDs).

- o PDF files shall include all sheets/drawings included in the design submission, which may include the title sheet, typical sections, bridge plans (if applicable), cross-sections, etc.

- o AutoCAD files do not have to contain every sheet/drawing included in the design submission. However, they should contain all sheets/drawings involving utilities, such as utility relocation plans, utility section drawings and bridge plans that show utility relocations or fittings.

- Designers shall submit Utility Plans saved on CDs as specified later in this Directive to the MassDOT Project Manager, at each design submission phase. The Project Manager will forward the submitted items to the Utility Engineer, who will distribute the CDs to the involved Utility Companies.

If a Utility Company (or Railroad Company) needs printed sheets, they shall request the sheets through the Utility Engineer or the MassDOT Project Manager. The Designer shall forward the requested paper sheets either directly to the Utility/Railroad, or through the Project Manager to be forwarded to the Utility/Railroad.

Utility/Railroad Companies shall return mark-ups to the Utility Engineer in either AutoCAD format or PDF saved on CDs. Utility/Railroad Companies may submit paper mark-ups in lieu of electronic documents. See the requirements below for direction on the manner in which Utility Companies are to provide their electronic information. **Utility Companies shall not alter the Designer’s file.**

General Requirements

AutoCAD drawing files shall contain existing and/or proposed utilities, with each utility having its own layer name by the type of utility (for example: ExistElect.)

Designers shall use the following color guide for representation of utilities in AutoCAD drawing files and in PDF files. The color guide is consistent with DIG SAFE's color code for marking underground utility lines. This information shall be included on the drawings as part of a legend.

Utility Line Color

Electric Red

Gas-Oil-Steam Brown

Communication/CATV Orange

Potable Water Blue

Sewer Green

Drainage Traditional Grayscale

Utility/Railroad Companies shall use the guidelines above when returning or providing AutoCAD drawings with updated/modified existing utility information or recommendations for proposed utility alignments. Proposed utility alignments shall be shown using a heavier line weight (or thickness) than existing.

Although AutoCAD drawing files are to be provided to the Utility/Railroad Companies for their information and review, the Utility/Railroad Companies shall not make any alterations to the Designer's files. Utility/Railroad Companies shall create new drawing layers using the respective utility colors to show proposed facilities and/or make changes to existing facilities. If existing utility/railroad information is to be edited, the Utility/Railroad Company should copy the existing information in the Designer's respective layer to a new layer and make all edits in this new layer. Names of new layers should include the utility name. (For example: the current "ExistElect" layer should be duplicated and renamed "NSTAR-ExistElect.")

Drawing files submitted to the Utility Engineer should be accompanied by an outline of all changes and new layers created.

Submissions

The following guide shall be used to determine the number of CDs to be submitted:

Electric: 2 CDs

Telephone: 1 CD

Gas: 1 CD

Cable TV: 1 CD

Fire Alarm: 1 CD

Sewer*: 1 CD

Water*: 1 CD (except MWRA: 1 paper set)

DPW/Municipal Highway Department*: 1 CD for each city/town

Railroad: 1 CD (except MBTA: 2 CDs)
RCN, AT&T, MCI, Sprint, Qwest, Fibertech,

- Lighttower, Nstar Communications, AboveNet,
or other long distance utility: 1 CD
 - Tennessee Gas, Buckeye Pipeline, Mobil Gas,
or other long distance gas pipeline: 1 CD
- * Some Cities/Towns may have the same office review these plans. Therefore, each department may not require an individual CD. The Designer should determine if each department's review and subsequent plans submittal is applicable.*

Each CD shall have the following information printed on it:

MassDOT Logo
City/Town
Project Description
Project File Number
Design Phase Submission
Date of Submission
For bridge projects, indicate if the CD contains highway plans, bridge plans, or both

Some Utility Companies may require a set of prints instead of CDs. Requests for plan sets shall be directed to the MassDOT Highway Division Utility Engineer, Ten Park Plaza, Room 6340, Boston, MA 02116.

One full paper set of plans (24" x 36") shall be submitted for the District Utility/Constructability Engineer (DUCE.) This set shall contain every sheet/drawing included in the design submission, including cross-sections and bridge plans (if applicable.) All utilities (existing and proposed) shall be shown in the color format contained in the General Requirements portion of this Directive.

In accordance with current MassDOT policy, all Utility Plan submissions should have a list of the names of the actual Utility Companies to which the CDs are to be forwarded to. For a current list of Utility Company contacts, refer to MassDOT's website.

Appendix 7– 2010 Construction Standard Details (E-10-07)



Number:	E-10-07
Date:	9-8-2010

ENGINEERING DIRECTIVE

Frank Tramontozzi (signature on original)

CHIEF ENGINEER

2010 Construction Standard Details

The purpose of this Engineering Directive is to formally issue the *MassDOT Highway Division 2010 Construction Standard Details* for use on MassDOT Highway Division projects.

The *2010 Construction Standard Details* shall be referenced in the plans and other contract documents of all MassDOT Highway Division projects advertised after September 30, 2010, regardless of the system of measurement used in the contract documents. The drawings in the *2010 Construction Standard Details* are in English units. For projects advertised in Metric units, designers and contractors shall make “hard” English/Metric conversions to adhere to the *2010 Construction Standard Details*. Persons with questions regarding proper unit conversions or with any elements of the drawings should consult the Highway Design Engineer for clarification.

The *2010 Construction Standard Details* supersedes and replaces the following publications, except as noted:

1977 Department of Public Works Construction Standards

*1996 Metric Edition MassHighway Construction and Traffic Standard Details**

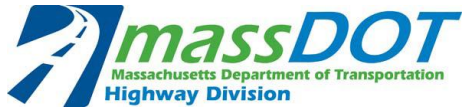
2003 MassHighway Metric/English Supplemental Drawings

* The *2010 Construction Standard Details* does not contain traffic drawings; therefore, the Traffic Standard Details portion of the 1996 publication listed above (i.e. the “TR” drawing series) is not superseded and is still in effect until it is updated or replaced.

The *2010 Construction Standard Details* also contains drawings that supersede other drawings issued through Engineering Directives since April 2003. These Engineering Directives are:

Number	Date	Title	Comments
E-04-003	4/16/04	Detectable Warning Panels	Drawings previously superseded by E-04-007. Guidance text still valid.
E-04-004	4/16/04	Revised Construction Drawings	Superseded in full.
E-04-005	4/16/04	Cantilever Retaining Walls	Drawings superseded. Guidance text still valid.
E-04-006	12/3/04	New Construction Drawings for Installation of Rumble Strips	Superseded in full.
E-04-007	12/16/04	Detectable Warning Panels – Revised	Drawings superseded. Guidance text still valid.
E-05-002	3/2/05	New Construction Drawings for Guardrail Buried in Back-Slope	Drawings superseded. Guidance text still valid.
E-09-003	6/18/09	Hook Lock Grates for Catch Basins	Drawings superseded. Guidance text still valid.

Appendix 8– Design Consultant Performance Evaluations (E-10-005)



Number:	E-10-05
Date:	8-12-2010

ENGINEERING DIRECTIVE

Frank Tramontozzi (signature on original)

CHIEF ENGINEER

Design Consultant Performance Evaluations

The purpose of this Engineering Directive is to establish a formal procedure for evaluating the performance of consultant engineering firms during the design phase of projects advanced by the MassDOT Highway Division. This procedure is effective immediately and replaces all previous procedures used by the MassDOT Highway Division to evaluate the performance of design consultants.

This procedure applies to design services completed directly under MassDOT contracts and to design services completed under contracts administered by municipalities or other outside entities. This procedure does not apply to non-design architect and engineering services, such as bridge inspection, bridge rating, materials inspection, planning and survey.

All Project Managers shall complete a Consultant Evaluation Workbook (MS Excel format) for every prime consultant design assignment and for each subconsultant design assignment with a fee in excess of \$50,000. Project Managers are responsible for entering all information into the Workbook, including scores provided by Reviewing Sections throughout the design phase. Reviewing Sections are responsible for providing evaluation scores to the Project Manager as part of their design reviews at each design submission stage.

The Workbook contains a two-page Performance Evaluation Form which shall be completed/generated either immediately following project bid opening or at the conclusion of the contract, whichever comes first. The Performance Evaluation Forms shall be signed by the Project Manager and forwarded to the design consultant for review and signature. Typically, a Principal-in-Charge shall review, sign and return the Performance Evaluation Form for the design consultant. The Director/Section Head of the unit responsible for the design consultant assignment shall review and sign all completed Performance Evaluation Forms and shall then forward each completed form to the Architects and Engineers Review Board for review.

Project Managers shall retain copies of completed Performance Evaluations as part of the project file for each design assignment.

The Consultant Evaluation Workbook and Performance Evaluation Form shall not be altered by individuals, but may be updated periodically by MassDOT. These materials shall be made available to Project Managers through e-mail, shared electronic work spaces, or other similar method.

Attachment: Performance Evaluation Form

**PERFORMANCE EVALUATION
ARCHITECT-ENGINEER PROFESSIONAL SERVICES CONSULTANT**

Name & Address of Consultant		Project No	
		Project Description	
Type of Services		Complexity of Project	

Contract Data

Contract No		NTP Date		Maximum Obligation	
Contract Assignment		Completion Date		Amount Paid	
Method of Payment		Percent of Work Complete			
Description and Costs of Sub-Contracts (if any)					

Project Manager Evaluation

Responsiveness to comments		Efficient Use of Workhours	
Involvement of Key Personnel in Engineering Services		Ability to work within budget amount or fee	
Manner in which Work was Organized and Accomplished		Overall Design Schedule Adherence	
Clearness & Completeness of Presentation		Local Office Staffing and Equipment	
Evidence of Ingenuity and Experience in Design		Capability for doing more complex work	
Performance at Public Hearings and Other Meetings		Preparation of Invoices and Other Billing Material	
		Project Manager Evaluation	

Reasons for Delays (if any)

--

Project Manager Comments

--

Overall Evaluation

(See Page 2 for Reviewing Section Scores)

0	1	2	3	4	5	6	7	8	9	10
Unacceptable			Below Average			Average		Above Average		Exceptional

Submitted by: _____

Title: _____
Section: _____

Evaluation Date _____

PERFORMANCE EVALUATION	EVALUATION DATE:
ARCHITECT-ENGINEER PROFESSIONAL SERVICES CONSULTANT	

Consultant:	Contract No:	Project No:
-------------	--------------	-------------

DISTRICT ROADWAY REVIEWS:

25%	
75%	
100%	

ABP CONTROLS:

Design Schedules	
Construction Time Determination Study	
Construction Estimating	
Planning Considerations	

BRIDGE REVIEWS:

Type Study/Sketch Plans		35%
Final Design		35%
Specs & Estimate		30%

OTHER REVIEWS:

AAB/ADA	
Bike/Ped	
Landscape	

BOSTON TRAFFIC REVIEWS:

25%	
75%	
100%	

ROW:

Preliminary ROW Plans	
Layout Plans and Instruments	

ENVIRONMENTAL REVIEWS:

25%/Early Env Coordination	
MEPA/NEPA	
Wetlands/Water Quality	
Cultural Resources	
Hazardous Materials	

PROJECT MANAGER:

OVERALL QUALITY OF DESIGN:

	Distr.	Bridge	Envir.	Traffic	ROW	Other	Proj. Mgr. Controls	
Evaluation:								
Weight:								
Weighted Score:								<i>Weighted Score</i>

CONSULTANT COMMENTS - Additional comments may be submitted separately.

Reviewed by PIC*: _____ Title: _____ Date: _____

Approved by: _____ Title: MassDOT - Highway Division Date: _____

This form is to be submitted by the Section Head to the Secretary of the Architects & Engineers Review Board at completion of work (not including construction stage) or at any other time when such a report may be pertinent.

Appendix 9– Contractor Performance Reports (E-10-002)



Number:	E-10-002
Date:	4-20-2010

ENGINEERING DIRECTIVE

Frank Tramontozzi (signature on original)

CHIEF ENGINEER

Contractor Performance Reports

The purpose of this Engineering Directive is to implement new Contractor Performance Reports for both general contractors and subcontractors. Effective immediately, these reports shall be used for the evaluation of all general contractors and their subcontractors on all current and future MassDOT Highway Division construction contracts. These reports replace any similar reports previously used for this purpose.

Separate reports have been developed specifically for rating general contractors and subcontractors. The categories used to evaluate performance have been expanded from four to nine for general contractors, and there are eight categories in the subcontractor report. This will allow Resident Engineers to rate the overall performance levels of general contractors and subcontractors in a broader range of areas associated with performance and contract compliance. In an effort to standardize the ratings submitted by Resident Engineers, guidelines have been established for assigning ratings for each category and for each type of report.

The new forms also include signature blocks for the general contractor as well as for the subcontractors. This is provided to allow contractors the opportunity to acknowledge that they reviewed the report. If a contractor or subcontractor refuses to sign a form, the Resident Engineer should note that in the appropriate signature block.

Completion of these forms is very important because the rating scores will be used as part of a revised process by the Prequalification Committee to determine the bidding limits for each contractor.

At a minimum, the performance reports shall be submitted to the District Construction Engineer after 50% (interim) of the work is completed and at 100% (final) completion of all work. In addition, these forms shall also be used at any interim point in the project to identify problems with either the general contractor or any of the subcontractors.

After sign-off by the District Highway Director, all performance reports shall be submitted to the Deputy Chief Engineer for Construction in the Boston headquarters. This includes reports with either passing or failing ratings. A passing rating is considered to be any rating equal or greater than 80%.

Attachments: Contractor Project Evaluation Form
Subcontractor Project Evaluation Form
Contractor Performance Report Rating Guidelines

Subcontractor Performance Report Rating Guidelines



Final Report

Interim Report

Appendix 9A- Contractor Project Evaluation Form

Date: _____

City/Town: _____ Contractor: _____

Project: _____ Address: _____

F.A. No. _____ Contract Number: _____

Bid Price: _____ Notice to Proceed: _____

Funds: State _____ Fed Aid _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Contractor's Superintendent: _____

Division: (indicates class of work) Highway: _____ Bridge: _____ Maintenance: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1=
5. Subcontractors Performance								x 1=
6. Field Supervision/ Superintendent								x 1=
7. Contract Compliance								x 0.5=
8. Equipment								x 0.5=
9. Payment of Accounts								x 0.5=
(use back for additional comments)							Overall Rating:	

(Give explanation of items 1 through 9 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

District Construction Engineer's Signature/Date

Resident Engineer's Signature/Date

Contractor's Signature Acknowledging Report/Date

Contractor Requests Meeting with the District: Yes No

Contractor's Comments: _____

Appendix 9B- Subcontractor Project Evaluation Form

Date: _____

City/Town: _____ Subcontractor: _____

Project: _____ Address: _____

F.A. No. _____ Contract Number: _____ Subcontract Amount: _____

Prime Contractor _____ Current Contract Completion Date: _____

Date Work Started: _____ Date Work Completed*: _____

Subcontractor's Superintendent: _____

Type of Work Performed by Subcontractor: _____

*If work was NOT completed within specified time (including extensions) give reasons on following page.

	Excellent 10	Very Good 9	Average 8	7	Fair 6	5	Poor 4	% Rating
1. Workmanship								x 2=
2. Safety								x 2=
3. Schedule								x 1.5=
4. Home Office Support								x 1.5=
5. Field Supervision/ Superintendent								x 1=
6. Contract Compliance								x 1=
7. Equipment								x 0.5=
8. Payment of Accounts								x 0.5=
(use back for additional comments)								Overall Rating:

(Give explanation of items 1 through 8 on the following page in numerical order if overall rating is below 80%. Use additional sheets if necessary.)

District Construction Engineer's Signature/Date

Resident Engineer's Signature/Date

Contractor Signature Acknowledging Report/Date

Subcontractor Signature Acknowledging Report/Date

Subcontractor Requests Meeting with the District: Yes No

Subcontractor's Comments: _____

Appendix 9C- Contractor Performance Report Rating Guidelines

When rating the overall performance of a contractor, whether it is an interim evaluation or the final evaluation, the Resident Engineer shall use the following guidelines in determining the rating in each category. Guidelines have been developed to give overall guidance for ratings of 10, 8 and 4. Other numerical ratings may also be used if the description of the performance falls between the upper and lower ratings (10 and 4). Detailed descriptions of the contractor’s performance shall accurately describe the factual basis of the reasons for the rating and shall not include personal or subjective comments.

1. **WORKMANSHIP:** Refers to the quality of the work product produced as defined by Construction Specifications, Plans and Industry Standards where applicable.

Workmanship		
<u>10</u>	<u>8</u>	<u>4</u>
Full compliance with the contract specifications and plans	General conformance with the contract specifications and plans	Substantial deviations from the contract plans and specifications
Requires minimal oversight by the Resident engineer	Requires occasional oversight by the resident engineer	Requires constant oversight by the resident Engineer
Work performed does not require rework to correct deficiencies	Occasional cosmetic defects	Repeated, substantive corrective actions required on work performed

2. **SAFETY:** Refers to proper compliance with all federal, state and local regulations, including, but not limited to, MUTCD compliant traffic management plan, OSHA, Department of Occupational Safety regulations and overall project housekeeping guidelines.

Safety		
<u>10</u>	<u>8</u>	<u>4</u>
Full OSHA compliance	General OSHA compliance	Disregard for OSHA requirements
Full compliance with TMPs	General compliance with TMPs	Frequent failure to follow TMPs
Active safety program such as: regular toolbox meetings, safety manager on site, excellent housekeeping, full fall protection	Adequate housekeeping	Poor housekeeping
Worker injuries rare	Periodic safety meetings	Inadequate or no fall protection
Workers fully engaged in safety issues	Periodic site inspections by corporate safety officer	Frequent worker injuries
	Occasional worker injuries	Workers are unable to speak up about safety issues.
	Workers generally aware of safety issues	

Contractor Performance Report Rating Guidelines

3. **SCHEDULE:** Maintains work progress in accordance with approved schedule of operations and all subsequent approved modifications.

Schedule*		
*Schedule impacts outside Contractor's control are not to be considered failure to control the schedule.		
<u>10</u>	<u>8</u>	<u>4</u>
Full use of schedule to manage construction progress	General adherence to work plan	Routine failure to complete work as planned
Prompt re-submittal of schedules as required or requested.	General attention to schedule as an important part of the contract	General lack of urgency in completing work
Full adherence to stated plan for prosecuting work	Reasonable response to schedule submittal requirements/requests	Failure to submit required/requested schedules

4. **HOME OFFICE SUPPORT:** Refers to all aspects of Project Management including, but not limited to support for field operation needed to prosecute work, scheduling, timely submission of shop drawings/plans, erection/demolition procedures, material acquisition schedules and extra work order proposals.

Home Office Support		
<u>10</u>	<u>8</u>	<u>4</u>
Full support from home office	General support from home office	Lack of support from home office
Timely, accurate submissions	Generally on time and accurate submittals	Late, incomplete submittals
Materials always available when required by field	Materials available when needed	Materials unavailable when needed by field

5. **SUBCONTRACTORS' PERFORMANCE:** Subcontractors used are competent and knowledgeable with sufficient resources to produce high quality work.

Subcontractor's Performance		
<u>10</u>	<u>8</u>	<u>4</u>
Subs exhibit excellent performance as defined for other categories	Subs exhibit average performance as defined for other categories	Subs exhibit poor performance as defined for other categories

Contractor Performance Report Rating Guidelines

6. **FIELD SUPERVISION/SUPERINTENDENT:** Must demonstrate knowledge of construction and contract documents necessary to complete the work as specified. The superintendent must also cooperate fully with Department personnel and all other interested parties so that work progresses as scheduled. The superintendent must be authorized to make decisions in the field that are binding upon the Contractor. In addition, the superintendent must demonstrate effective supervision and staffing of labor force, effective scheduling of subcontractors and proper prosecution of work.

Field Supervision/Superintendent		
<u>10</u>	<u>8</u>	<u>4</u>
Demonstrates full knowledge of contract requirements	Reasonable knowledge of contract requirements	Does not demonstrate working knowledge of contract requirements
Fully cooperates with all reasonable requests	Generally cooperates with reasonable requests	Refuses to cooperate with reasonable requests
Effectively manages workforce	Generally capable of managing workforce	Unable to properly manage workforce
Fully authorized and capable of making jobsite decisions	Able to make jobsite decisions	Unable to make jobsite decisions

7. **CONTRACT COMPLIANCE:** Submittal of all documents required by the contract, but not directly needed for doing construction, such as payroll affidavits, EEO reports, trainees, manpower projections and material certifications.

Contract Compliance		
<u>10</u>	<u>8</u>	<u>4</u>
Fully compliant with Division I contract requirements,	General overall compliance with contract paperwork	Non-compliant with contract paperwork
Material certifications received with material deliveries	EEO, material certifications and certified payrolls generally received as required	Certified payrolls late Incomplete, late submissions of material certifications
Certified payrolls received with estimates		

Contractor Performance Report Rating Guidelines

8. **EQUIPMENT:** Refers to all equipment, machinery and operators used on the project. Equipment must be suitable and readily available, when needed, for all phases of the project. Equipment operators must demonstrate proficiency and skill in the operation of said equipment.

Equipment		
<u>10</u>	<u>8</u>	<u>4</u>
Equipment always available when needed	Equipment usually available when needed	Equipment frequently unavailable
Equipment well maintained	Equipment reasonably well maintained	Equipment poorly maintained
Operators highly skilled and show proficiency in operation of equipment	Operators show proficiency in operation of equipment	Operators lack proficiency in operation of equipment

9. **PAYMENT OF ACCOUNTS:** Refers to the timely payment of undisputed invoices submitted by the subcontractors, material suppliers and police.

Payment of Accounts*		
*Funding/payment issues outside the contractor's control are not to be considered evidence of non-payment or late payment.		
<u>10</u>	<u>8</u>	<u>4</u>
No evidence of non-payment of subcontractors and suppliers	Occasional evidence of non-payment or late payment; i.e. sub mobilization or material deliveries delayed pending payment. No impact to project schedule. Holding of payment for legitimate contractual reasons is not to be considered "non-payment".	Repeated delays to the work due to deliveries or sub mobilizations delayed for non-payment Subcontractors lost for non-payment POs cancelled for non-payment

Appendix 9D- Subcontractor Performance Report Rating Guidelines

When rating the overall performance of a subcontractor, whether it is an interim evaluation or the final evaluation, the Resident Engineer shall use the following guidelines in determining the rating in each category. Guidelines have been developed to give overall guidance for ratings of 10, 8 and 4. Other numerical ratings may also be used if the description of the performance falls between the upper and lower ratings (10 and 4). Detailed descriptions of the subcontractor’s performance shall accurately describe the factual basis of the reasons for the rating and shall not include personal or subjective comments.

1. **WORKMANSHIP:** Refers to the quality of the work product produced as defined by Construction Specifications, Plans and Industry Standards where applicable.

Workmanship		
<u>10</u>	<u>8</u>	<u>4</u>
Full compliance with the contract specifications and plans	General conformance with the contract specifications and plans	Substantial deviations from the contract plans and specifications
Requires minimal oversight by the Resident engineer	Requires occasional oversight by the resident engineer	Requires constant oversight by the resident Engineer
Work performed does not require rework to correct deficiencies	Occasional cosmetic defects	Repeated, substantive corrective actions required on work performed

2. **SAFETY:** Refers to proper compliance with all federal state and local regulations, including, but not limited to, MUTCD compliant traffic management plan, OSHA, Department of Occupational Safety regulations and overall project housekeeping guidelines.

Safety		
<u>10</u>	<u>8</u>	<u>4</u>
Full OSHA compliance	General OSHA compliance	Disregard for OSHA requirements
Full compliance with TMPs	General compliance with TMPs	Frequent failure to follow TMPs
Active safety program such as: regular toolbox meetings, safety manager on site, excellent housekeeping, full fall protection	Adequate housekeeping	Poor housekeeping
Worker injuries rare	Periodic safety meetings	Inadequate or no fall protection
Workers fully engaged in safety issues	Periodic site inspections by corporate safety officer	Frequent worker injuries
	Occasional worker injuries	Workers are unable to speak up about safety issues
	Workers generally aware of safety issues	

Subcontractor Performance Report Rating Guidelines

3. **SCHEDULE:** Maintains work progress in accordance with approved schedule of operations and all subsequent approved modifications.

Schedule*		
*Schedule impacts outside Contractor's control are not to be considered failure to control the schedule.		
<u>10</u>	<u>8</u>	<u>4</u>
Full use of schedule to manage construction progress	General adherence to work plan	Routine failure to complete work as planned
Prompt re-submittal of schedules as required or requested	General attention to schedule as an important part of the contract	General lack of urgency in completing work
Full adherence to stated plan for prosecuting work	Reasonable response to schedule submittal requirements/requests	Failure to submit required/requested schedules

4. **HOME OFFICE SUPPORT:** Refers to all aspects of Project Management including, but not limited to support for field operation needed to prosecute work, scheduling, timely submission of shop drawings/plans, erection/demolition procedures, material acquisition schedules and extra work order proposals.

Home Office Support		
<u>10</u>	<u>8</u>	<u>4</u>
Full support from home office	General support from home office	Lack of support from home office
Timely, accurate submissions	Generally on time and accurate submittals	Late, incomplete submittals
Materials always available when required by field	Materials available when needed	Materials unavailable when needed by field

Subcontractor Performance Report Rating Guidelines

5. **FIELD SUPERVISION/SUPERINTENDENT:** Must demonstrate knowledge of construction and contract documents necessary to complete the work as specified. The superintendent must also cooperate fully with Department personnel and all other interested parties so that work progresses as scheduled. The superintendent must be authorized to make decisions in the field that are binding upon the Contractor. In addition, the superintendent must demonstrate effective supervision and staffing of labor force, effective scheduling of subcontractors and proper prosecution of work.

Field Supervision/Superintendent		
<u>10</u>	<u>8</u>	<u>4</u>
Demonstrates full knowledge of contract requirements	Reasonable knowledge of contract requirements	Does not demonstrate working knowledge of contract requirements
Fully cooperates with all reasonable requests	Generally cooperates with reasonable requests	Refuses to cooperate with reasonable requests
Effectively manages workforce	Generally capable of managing workforce	Unable to properly manage workforce
Fully authorized and capable of making jobsite decisions	Able to make jobsite decisions	Unable to make jobsite decisions

6. **CONTRACT COMPLIANCE:** Submittal of all documents required by the contract, but not directly needed for doing construction, such as payroll affidavits, EEO reports, trainees, manpower projections and material certifications.

Contract Compliance		
<u>10</u>	<u>8</u>	<u>4</u>
Fully compliant with Division I contract requirements	General overall compliance with contract paperwork	Non-compliant with contract paperwork
Material certifications received with material deliveries	EEO, material certifications and certified payrolls generally received as required	Certified payrolls late
Certified payrolls received with estimates		Incomplete, late submissions of material certifications

Subcontractor Performance Report Rating Guidelines

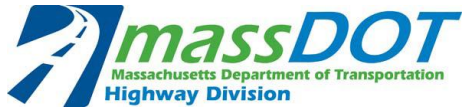
7. **EQUIPMENT:** Refers to all equipment, machinery and operators used on the project. Equipment must be suitable and readily available, when needed, for all phases of the project. Equipment operators must demonstrate proficiency and skill in the operation of said equipment.

Equipment		
<u>10</u>	<u>8</u>	<u>4</u>
Equipment always available when needed	Equipment usually available when needed	Equipment frequently unavailable
Equipment well maintained	Equipment reasonably well maintained	Equipment poorly maintained
Operators highly skilled and show proficiency in operation of equipment	Operators show proficiency in operation of equipment	Operators lack proficiency in operation of equipment

8. **PAYMENT OF ACCOUNTS:** Refers to the timely payment of undisputed invoices submitted by the subcontractors, material suppliers and police.

Payment of Accounts*		
<small>*Funding/payment issues outside the contractor's control are not to be considered evidence of non-payment or late payment.</small>		
<u>10</u>	<u>8</u>	<u>4</u>
No evidence of non-payment of subcontractors and suppliers	Occasional evidence of non-payment or late payment; i.e. sub mobilization or material deliveries delayed pending payment. No impact to project schedule. Holding of payment for legitimate contractual reasons is not to be considered "non-payment".	Repeated delays to the work due to deliveries or sub mobilizations delayed for non-payment Subcontractors lost for non-payment Pos cancelled for non-payment

Appendix 10– Project Development and Design Standards and Guidelines (P-10-001)



Number:	P-10-001
Date:	05-17-2010

Policy Directive

Luisa Paiewonsky (signature on original)

CHIEF ENGINEER

Project Development and Design Standards and Guidelines

The purpose of this Policy Directive is to identify the project development and design standards and guidelines of the Massachusetts Department of Transportation, Highway Division.

All projects to be developed or constructed by the Massachusetts Department of Transportation, Highway Division, shall be advanced in accordance with all applicable federal, state and local laws and regulations and with the standards and guidelines identified in this Policy Directive.

1. The latest edition, including revisions, amendments and supplements, of the following publications:

- MassHighway Project Development and Design Guide
- Department of Conservation and Recreation Historic Parkway Preservation Treatment Guidelines (for parkways only)
- MassHighway Bridge Manual
- MassHighway Survey Manual
- MassHighway Right of Way Manual
- MassHighway Construction and Traffic Standard Details
- MassHighway Standard Specifications for Highways and Bridges
- MassHighway Storm Water Handbook for Highways and Bridges
- MassHighway Building Better Bicycling Manual
- MassHighway Standard Traffic Management Plans
- Central Artery/Tunnel Project Design Criteria and Standard Drawings (for design consistency on Central Artery/Tunnel locations only)
- MassHighway Standard Drawings for Traffic Signals and Highway Lighting
- Massachusetts Amendments to the Manual on Uniform Traffic Control Devices and the Standard Municipal Traffic Code
- Massachusetts State Building Code
- National Fire Protection Agency 502 Manual

2. Current versions of the following relevant policies, procedures and directives:

- MassHighway Engineering Directives
- MassHighway Policy Directives
- MassDOT Highway Division Engineering Directives
- MassDOT Highway Division Policy Directives

3. Standards, guidelines, circulars, policies, and procedures of the following organizations:

- Federal Highway Administration
- American Association of State Highway and Transportation Officials
- Transportation Research Board
- United States Access Board
- Massachusetts Architectural Access Board
- American Nursery and Landscape Association
- American Railway Engineering and Maintenance-of-Way Association
- ASTM International

Appendix 11 – Detailed Comparison in a Matrix of 5 EPMS

	AtTask	Celoxis	Project Insight	Clarizen	Project Office.net (Seavus Project Viewer)
Contact	Nels Draper	Harish KulKarni	Cynthia West		Krste Gjoneski
Number	1-866-441-0001	1-855-CELOXIS	949-476-6499	1-866-502-9813	770-261-1394
Link	link	link	link	link	link
Price for Enterprise	\$ 130,450	\$ 152,500	\$81,960	\$ 599,400	\$ 19,900

Collaboration						
General Collaboration		✓	✓	✓	✓	✓
Centralized Collaboration		✓	✓	✓	✓	✓
Issue Tracking		✓	✓	✓	✓	✓
Forums		✓	✓	✓	✓	✗
MS Project Integration		✓	✓	✓	✓	✓
Desktop Application		✓	✗	✓	✓	✓
RSS Feed		✗	✓	✓	✗	✓

Resource Management						
Resource Details		✓	✓	✓	✓	✓
Import Resources		✓	✓	✓	✓	✓
Email Addresses		✓	✓	✓	✓	✓
Capacity Planner		✓	✓	✓	✓	✗
Resource Notes		✓	✓	✓	✓	✓
Costs		✓	✓	✓	✓	✓
Timesheets		✓	✓	✓	✓	✓
Skill Sets		✓	✓	✓	✓	✗
Groups		✓	✓	✓	✓	✓
Materials/Supplies		✓	✓	✓	✓	✗
Check In/Check Out		✓	✓	✓	✗	✗

Project Management						
Task Management		✓	✓	✓	✓	✓
Task Feedback		✓	✓	✓	✓	✗
Scheduling		✓	✓	✓	✓	✓
Calendars		✓	✓	✓	✓	✓
Time Lines		✓	✓	✓	✓	✗
Events		✓	✓	✓	✓	✓
Gantt Charts		✓	✓	✓	✓	✓
Reporting		✓	✓	✓	✓	✓
Statistics		✓	✓	✓	✓	✓
Work Load		✓	✓	✓	✓	✗
Financials		✓	✓	✓	✓	✓
Document Management		✓	✓	✓	✓	✓
Budgeting		✓	✓	✓	✓	✗
Critical Path Method		✓	✓	✓	✓	✗
Project Templates		✓	✓	✓	✓	✓
Scope		✓	✓	✓	✓	✗
Milestones		✓	✓	✓	✓	✓
Automatic Notifications		✓	✓	✓	✓	✓
Privacy Settings		✓	✓	✓	✓	✓
Custom		✓	✓	✓	✓	✓
Baseline		✓	✓	✓	✓	✗
Risk/Benefit Analyzer		✓	✓	✓	✓	✗
Interactive Gantt Charts		✓	✗	✓	✓	✗
Recurring Tasks		✓	✓	✓	✓	✗

Help/Support						
Support		✓	✓	✓	✓	✓
FAQs		✓	✓	✓	✓	✓
Online Video Demo		✓	✓	✓	✓	✓
Online Chat		✓	✗	✓	✓	✗

Appendix 12 – Email Communication with Krste Gjoneski from Seavus Project Viewer

From: Krste Gjoneski [<mailto:Krste.Gjoneski@seavus.com>]

Sent: Friday, April 06, 2012 3:20 AM

To: Oliveira, Thales Rodrigues

Subject: RE: SPV Quote - Enterprise License

Hello Thales,

I appreciate the provided information about your company interest in our product and I hope that you will find Seavus Project Viewer as a most suitable solution for your needs and environment.

Please note that many customers choose Seavus Project Viewer for 2 primary reasons:

They are able to see 100% of the views as found in Microsoft Project - reducing or eliminating any functionality issues or concerns from your user community when switching them from MSP to Seavus Project Viewer,

A similar user interface to Microsoft Project® - reducing user training to minimum and increases user acceptance

You may find below the detailed information about our Enterprise licensing model follow by the pricing:

Enterprise License Key Installation:

The enterprise license is the same as Company in the configuration setup, but is with unlimited number of user.

Many Global Enterprises want the ability to make our viewer part of a 'standard build' and just deploy it to all desktops. This solves two basic challenges faced by most large organizations; it eliminates the hassles of managing license compliance on individual machines and it eliminates the challenges of determining who within the organization might need a viewer.

The Enterprise License Key provides for unlimited deployment to all divisions, subsidiaries and wholly-owned entities around the world.

IT departments can deploy this license type in a variety of ways supported by the MSI framework or by using advanced enterprise deployment tools from Microsoft, Wise, Novell, Citrix or others. In essence, this installation allows the IT department to deploy the application to a network location for a single point of installation, to use advanced tools for a non-attended - push installation to thousands of workstations, or to manage versions of the application in a structured and secure way.

Advantages:

Eliminates license management concerns; offers deployment as part of a standard desktop 'build', offers a well understood, standardized setup giving a consistent supported desktop environment for all users.

Streamlines deployment of new upgrades and releases; provides centrally, rather than mixed versions in use across the organization resulting in less help-desk/support maintenance issues

Software maintenance is capped no matter how many licenses deployed globally

Very cost effective from the standpoint of the total number of desktops deployed

Please fine the extended company trial version below and during the installation make sure that you check the TU box, so you can check our additional feature called Task Update that allows the users to update the work completed.

http://dl.seavus.com/spv/b6933/SPV_TRIAL_COMP_6_9_0_6933.zip

Your price for Enterprise Unlimited license of Seavus Project Viewer with yearly software maintenance included is \$19,900.00 USD.

*Software Maintenance Agreement includes releases of all new versions, service packs, and unlimited free e-mail and phone support for that year (02.00 to 18.00 EST every working day). We usually have 4 or more releases per year.

Please keep me updated about the presentation feedback, look forward to your response.

Regards,

Kris Gjoneski

Account Manager
Seavus Products
mail to: kg@seavus.com

Seavus Group

Phone: +46 (0) 40-300 940
Fax: +46 (0) 40-300 941
US Phone: +1.770.261.1394
US Toll free phone: 1.888.573.2887
Web: www.seavus.com

“Turning technology into business value.”

From: Oliveira, Thales Rodrigues [thalesoliveira@WPI.EDU]
Sent: Friday, April 06, 2012 9:05 AM
To: Krste Gjoneski
Subject: RE: SPV Quote - Enterprise License

As the initial email mentions, 1000 employees-SPV licenses (if I understand SPV correctly), no currently installed MS Project licenses, and Seavus is not the only viewer we are looking into, we have received estimates and offers from other companies such as AtTask, Tenrox, Celoxis, Project Insight, etc.

-----Original Message-----

From: Krste Gjoneski [mailto:Krste.Gjoneski@seavus.com]
Sent: Friday, April 06, 2012 2:53 AM
To: Oliveira, Thales Rodrigues
Subject: RE: SPV Quote - Enterprise License

Hi Thales,

Thanks for the prompt reply, I am out of the office but I'll do my best to provide you with the requested pricing.

Please let me know: how many MS Project licenses you have installed in the moment, what is the total n# of employees, the approximate n# of SPV licenses potentially needed and is it Seavus the only viewer that you are looking in?

Regards,

Kris Gjoneski

Account Manager
Seavus Products
mail to: kg@seavus.com

Seavus Group

Phone: +46 (0) 40-300 940
Fax: +46 (0) 40-300 941
US Phone: +1.770.261.1394
US Toll free phone: 1.888.573.2887
Web: www.seavus.com

"Turning technology into business value."

From: Oliveira, Thales Rodrigues [thalesoliveira@WPI.EDU]
Sent: Friday, April 06, 2012 8:37 AM
To: Krste Gjoneski
Subject: RE: SPV Quote - Enterprise License

Kris,

I will have a presentation Monday about several companies and understand that due to the late request for a quote and our schedules not coinciding, if Seavus cannot be included until a later date. Thanks.

Respectfully,
Thales Oliveira

-----Original Message-----

From: Krste Gjoneski [mailto:Krste.Gjoneski@seavus.com]
Sent: Friday, April 06, 2012 2:30 AM
To: Oliveira, Thales Rodrigues
Subject: RE: SPV Quote - Enterprise License

Hello Thales,

This is Kris with the sales department of Seavus Products, I am contacting you regarding your interest of Enterprise pricing for Seavus Project Viewer.

I've tried to reach you over the phone but without success. Please note that due to the Easter Holidays i will be out of the office until Tuesday.

I wanted to have a quick word with you in order I provide you with the most appropriate price, I hope that this can wait until I get back to work.

Regards,

Kris Gjoneski

Account Manager
Seavus Products
mail to: kg@seavus.com

Seavus Group

Phone: +46 (0) 40-300 940
Fax: +46 (0) 40-300 941
US Phone: +1.770.261.1394
US Toll free phone: 1.888.573.2887
Web: www.seavus.com

"Turning technology into business value."

From: customercenter@seavusprojectviewer.com [customercenter@seavusprojectviewer.com]
Sent: Friday, April 06, 2012 2:32 AM
To: productsales
Subject: SPV Quote - Enterprise License

FIRST NAME: Thales
LAST NAME: Oliveira
COMPANY:
PHONE: 5084068782
EMAIL: thalesoliveira@wpi.edu

STATE: Massachusetts

COUNTRY: United States

NUMBER OF EMPLOYEES: 251-1000

MESSAGE: I was wondering if I could receive a quote from Seavus ProjectViewer in the SaaS form, for 1000 employees, broken down into 5% administrators, 15% project managers, 50% project engineers, and 30% general. Please, let me know at your earliest convenience.

Appendix 13 – Email Communication with Harish Kulkarni from Celoxis

From: Harish Kulkarni <sales@celoxis.com>
Sent: Thu 4/5/2012 6:50 AM
To: Oliveira, Thales Rodrigues
Subject: RE: Celoxis: Details as per your request.

Hello Oliveria,

Thank you for your interest in Celoxis. For your requirement of 1000 users using the system, you would need an unlimited user license.

An unlimited user license (on-premise) will cost US\$ 29,995 for 1 computing instance. For more details please refer [here](#).

To help you with your evaluation, here are some highlights of Celoxis.

- You can keep track of all your projects, documents, collaborate with your project team & have entire communication **through one single system**.
- You get **real time status of the project & tasks** based on the updates done by the team.
- Get vital info that helps project manager to **stay on top and in full control** (Estimated Cost, Actual cost, Projected Cost, Planned Finish, Projected Finish, Hours to complete etc)
- Can save all your project related documents / files in a central repository within Celoxis. You can track changes and maintain version with **version control** in Celoxis.
- You can **share documents from within Celoxis**, saves you of emailing
- Can collaborate with the team with **online discussions**
- In addition to the pre-configured reports you can prepare **customized reports** and even include your custom fields.
- Can share these reports to your team as well as client. **Less emailing.**
- **No limitation to custom fields** in Celoxis
- **Customizable & Separate dashboards** for each participant
- Access Celoxis from your iPhone, Blackberry, Android, Symbian, Windows Mobile etc.
- **Open Access**
- **Work-flow process** to implement & manage any of your sequential business process.
- **Project Portfolio Management**
- **Role based security** to have control as to what a user can see and access.

Hope this helps! Let me know if you require more details on any of the above.

To get a quick overview, you may also join a webinar here <http://www.celoxis.com/webinar.php>
Please let me know more on your requirements and I can help you choose the right tool. Would a quick phone call work?

Best Regards,

-- Harish

Harish Kulkarni | Account Manager - Sales
Celoxis Technologies
Office: +91-20-25533223
Mobile: +91-904-998-6811
Email: harish.kulkarni@celoxis.com
<http://celoxis.com>

On 4/4/2012 10:02 PM, Oliveira, Thales Rodrigues wrote:

Good afternoon,

I'm extremely interested in finding out how much it would cost to implement Celoxis in an organization with 1000 employees, with 20% administrators (5%) and project managers (15%), 50% members, and 30% general. Please email me back at your earliest convenience.

Respectfully,

Thales Oliveira

Appendix 14 – Email Communication with Nels Draper from AtTask

From: Nels Draper <nels.draper@attask.com>
Sent: Wed 4/4/2012 5:02 PM
To: Oliveira, Thales Rodrigues
Subject: AtTask Pricing Proposal

Hi Thales,

Thanks for your time on the phone today. Per our conversation, I have attached a pricing proposal to this message.

Please let me know if you have any questions. I look forward to our next conversation.

All the best,

Nels

Nels Draper, AtTask Inc
Account Executive
desk: 801-477-9900
mobile: 801-349-9039
nels.draper@attask.com

AtTask | WHERE WORK LIVES™

Appendix 15 – Email Communications with Cynthia West from Project Insight

From: Cynthia West
Sent: Tuesday, April 17, 2012 10:52 AM
To: 'Oliveira, Thales Rodrigues'
Subject: Project Insight - Q&A
Hi Thales,

Here's the summary from our call today:

Further discussion on requirements and questions:

How would a user be classified if the user cannot initiate, but can maintain by making changes and adding material to the project once initiated (not simply view it, as is the case with Team Member Roles)? A 'project scheduler' is a role that allows a person to add tasks, assign resources to a project, but not initiate the project itself. That is a team member role. Anyone, creating the initial project whether from a template, an MSP import or from scratch would be considered a power user.

Some of the administrators were wondering about the maximum amount of data storage Project Insight is capable of handling through your servers?

We do not cap customers on storage. You may store as many files as you wish. The data native to Project Insight, such as projects, tasks, users does not count, only files are added up as storage. You are given a 20MB allocation per team member, so if you have 1000 active users, then your team allocation is 20GB. If you need more, it's \$1/GB/month.

They were also wondering details about how secured the data could be shared online between employees located in different locations of the state with different levels of clearance?

The data is quite secure. We use a blend of 3 types of permissions. This is a detailed subject and we can discuss more tomorrow or with the appropriate people on your team. In the meantime, a lot of the details are covered in this video:

<http://www.projectinsight.net/community/learn/article/permissions.aspx?ReturnUrl=/community/learn/articles/videolist.aspx%3Fid%3D6cd58c07-42fa-45ce-8b2a-58f2e4a49b05>

Depending on this answer, the number of power users range from 131 to 483 out of a 1000.

The initial number of power users (the wording I used with you were Project Executive (5%) and Project Managers (15%)) I had given you was 20% of the 1000, or 200 power users. I happened to see that in the calculations you provided me, use 5 power users.

You are correct that my first summary to you had 5 power users, that was before our discussion of the percentage of users. I updated our pricing in a second email to you. I will re-forward that to you. It did account for the 200 power users.

Please, let me know the classification and revised cost estimate for 131 and 483 power users (depending on the answer to the question) out of a 1000 users.

Do you need the 131 power know that I have clarified the project scheduler role? Let me know.

Please look for my email on the pricing in a second.

Best,

Cynthia

From: Cynthia West
Sent: Monday, April 16, 2012 9:59 AM
To: 'Oliveira, Thales Rodrigues'
Subject: Project Insight - Q&A

Hi Thales,

I can make the call tomorrow at 7:30am my time. Allow me to outline some of the talking points here, then we can follow up in more detail tomorrow:

Further discussion on requirements and questions:

How would a user be classified if the user cannot initiate, but can maintain by making changes and adding material to the project once initiated (not simply view it, as is the case with Team Member Roles)?

A 'project scheduler' is a role that allows a person to add tasks, assign resources to a project, but not initiate the project itself. That is a team member role. Anyone, creating the initial project whether from a template, an MSP import or from scratch would be considered a power user.

Some of the administrators were wondering about the maximum amount of data storage Project Insight is capable of handling through your servers?

We do not cap customers on storage. You may store as many files as you wish. The data native to Project Insight, such as projects, tasks, users does not count, only files are added up as storage. You are given a 20MB allocation per team member, so if you have 1000 active users, then your team allocation is 20GB. If you need more, it's \$1/GB/month.

They were also wondering details about how secured the data could be shared online between employees located in different locations of the state with different levels of clearance?

The data is quite secure. We use a blend of 3 types of permissions. This is a detailed subject and we can discuss more tomorrow or with the appropriate people on your team. In the meantime, a lot of the details are covered in this video:

<http://www.projectinsight.net/community/learn/article/permissions.aspx?ReturnUrl=/community/learn/articles/videolist.aspx%3Fid%3D6cd58c07-42fa-45ce-8b2a-58f2e4a49b05>

Depending on this answer, the number of power users range from 131 to 483 out of a 1000.

The initial number of power users (the wording I used with you were Project Executive (5%) and Project Managers (15%)) I had given you was 20% of the 1000, or 200 power users. I happened to see that in the calculations you provided me, use 5 power users.

You are correct that my first summary to you had 5 power users, that was before our discussion of the percentage of users. I updated our pricing in a second email to you. I will re-forward that to you. It did account for the 200 power users.

Please, let me know the classification and revised cost estimate for 131 and 483 power users (depending on the answer to the question) out of a 1000 users.

Do you need the 131 power know that I have clarified the project scheduler role? Let me know.

Please look for my email on the pricing in a second.

Best,
Cynthia

From: Cynthia West <cynthia.west@projectinsight.com>
Sent: Wednesday 04/04/2012
To: Oliveira, Thales Rodrigues
Subject: Project Insight – summary of investment based on number of users

Hi Thales,

I'm glad I caught you on the phone today. It sounds like things are moving forward rather rapidly, as you stated. This government agency sees the value of moving to an enterprise platform for project management. You gave your presentation last Friday and it went well.

Please find below a summary of our discussion:

DEFINITION OF USERS for GOVERNMENT AGENCY

Total number of team members = 1000

Breakdown as follows:

Administrators

These are people who can change ad dates, add funding and budgeting numbers. There are 5% of these on the team, so 50. These are power users.

Proponents

These are people who can add projects, edit and assign tasks. 15% of the 1000 or 150. These are power users.

Maintenance

These are team member level people who can update tasks, but not add projects. These are 50% of the team or 500. These are team member level users in Project Insight.

General

View only users that cannot create or edit anything. There are 30% of the total 1000 or 300. These are team member level users in Project Insight.

For your reference here is the link to the difference between a power user and a team member:

[Definition of a Team Member](#)

Investment

Project Insight Enterprise SaaS

200 power users

800 team members

TOTAL LICENSE - \$67,560/year

We highly recommend Gold Training and Implementation package to start with. This includes 6 days of onsite training and business process consulting. The complete agenda is here:

[Gold Training Package](#)

\$14,400 if performed onsite (plus travel and expenses)

NEXT STEPS

You said you will try to call me before April 6th if you have news, otherwise we'll huddle up again on 4/16 at 11:30 am ET.

From: Cynthia West <cynthia.west@projectinsight.com>

Sent: Fri 3/23/2012 12:00 PM

To: Oliveira, Thales Rodrigues

Subject: Project Insight – Follow Up

Dear Thales,

I appreciate your time going over your project management needs today. You mentioned that you are working with a government agency to improve their project management processes. We discussed your current situation, challenges and requirements. I will summarize my understanding here. Please feel free to add, subtract or modify what I have written below. Then when we go to present our software, I will know what to focus on.

Current Situation

At present, the agency is using Excel for financials and Word for their project reviews and note taking aspects of their project management. You mentioned that the challenges you are experiencing include:

- These applications are single user and not centralized
- They are all decentralized, which does not facilitate communication
- Communication gets overlooked as people want to reduce the time it takes to formalize it
- Things get misunderstood among the government agency and consultants

Requirements

We reviewed your initial requirements and they are listed below. Please review the list as this will drive our customized presentation to you and your team.

- SaaS
- MSP import
- Centralizing projects
- Mobile applet

We ran out of time on this one. I would like to discuss their requirements in a bit more detail when it makes sense.

Timeline

You said that you would ideally like to decide upon a solution as soon as possible. You believe it will be fewer than 6 months. You will be presenting your case to administrators next week and narrowing down the tools that they will evaluate.

Pricing

We discussed pricing and Project Insight Enterprise SaaS is:

- 5 power users, 995 team members = \$48,540/year.
- There is a one year commitment
- You will want to budget for some training as well. The web training is \$1400/day and the onsite is \$2400/day plus travel and expenses. Here is some more information on training:

[Benefits of Training](#)

[Gold Training Package](#)

\$8400 if performed via web training

\$14,400 if performed onsite (plus travel and expenses)

For your reference, here is the definition of a team member v power user:

<http://www.projectinsight.net/community/learn/article/definition-of-a-team-member-in-project-insight.aspx>

Next Steps

You said that you would reach back out to me next week with a more precise number of team v power users.

Best wishes,

Cynthia

Cynthia West

Vice President, Project Insight

+1 949.476.6499

Cynthia.West@projectinsight.com

www.projectinsight.net



Project Insight Project & Portfolio Management Software

Initiate Project Intelligence®

***This email and any files transmitted with it are confidential and contain privileged or copyrighted information. Please do not distribute information.

Appendix 16 – Email Communication with William Betts

From: Betts, William T (DOT) william.t.betts@state.ma.us
Sent: Fri 4/6/2012 8:36 AM
To: Oliveira, Thales Rodrigues
Subject: RE: Thales Oliveira- MQP Worcester Polytechnic Institute - District 3 MassDOT

Thales,

Documents:

1. The EMS Dream is what was submitted to the Secretary.
2. The EMS Dream Overview is what I used in meetings with the Secretary and others to try and sell the concept of an EMS.
3. Oracle PM Module Evaluation. The Turnpike used Oracle. An IT contractor provided a quick analysis of how we could integrate Oracle with ProjectInfo and this is what he came up with. I wouldn't cite him directly. This is the only documentation I have on why we are staying with our in-house solutions. We have also reviewed McLaren's Enterprise Engineer, IBM's FileNet P8 Repository, and ProLog.
4. The PDT Portal Scope Statement was submitted but never advanced. It is envisioned to be developed in the next iteration of ProjectInfo, which is currently in the scoping process.
5. I conducted the 2009 Internal Electronic Design Submission Survey.
6. I conducted the 2009 Nationwide Electronic Design Survey as well. It indicates that we are pretty advanced in our systems compared to the rest of the country.

Employee access

Aside from the numbers below – every Highway Division employee with a PC log-in has the ability to view anything in ProjectInfo and post documents to the ProjectInfo Repository via the Windows File Explorer function. Only employees with one of the permissions listed below can manipulate ProjectInfo data and post documents through ProjectInfo itself using Internet Explorer.

TIP Editor – edits project information relating to how a project is programmed on the 4 year Statewide Transportation Improvement Plan	3
TIP admin – approves the TIP information	1
PRC admin – full access to every non-technical aspect of ProjectInfo.	4
Proponent – can initiate projects	123
Project maintenance – cannot initiate, but can maintain projects once initiated	352

Other info:

1. We have online bidding software already.

2. DOT started and then stopped the implementation of Kronos, and electronic timesheet software application, due to unforeseen labor issues. There is no schedule for resuming this project which was hoped to enable resource scheduling for project management.
3. MassDOT does have a vision and an ongoing project for integrating our many construction applications into one enterprise Contract Management System. Long-term, ProjectInfo is also being tied into this system. Much of this has to do with the provision of IT resources from the Accelerated Bridge Program. However, it is very slow going and not fully articulated in any sort of professional level documentation.

Hope this helps. Feel free to call me if I can help you sort through anything else.

Bill Betts

Capital Programming Unit

Federal Aid and Programming Office

Massachusetts Department of Transportation

10 Park Plaza | Suite 5532 | Boston MA 02116 | Office (617) 973-7155

e-mail william.t.betts@state.ma.us | web www.mass.gov/massdot

Appendix 17- MassDOT's 2006 Project Development & Design Guide Book

2006 EDITION



2.7 Step VII: Construction

After a construction contract is awarded, the proponent and the contractor will need to develop a construction management plan. The permitting agencies, local authorities, and affected members of the general public need to be informed of the plan. These entities should also be notified as changes in construction areas and activities occur throughout the project.

2.7.1 Public Participation During Construction

Before construction activities begin, the proponent and construction manager must determine the appropriate type of public notification and participation needed. Different projects result in different types of disruption to transportation and other nearby activities. For simple projects, including resurfacing, a minimal degree of public participation may be needed. For these types of projects, the proponent should, at a minimum, notify abutters of the impending construction activity.

For complex projects, the proponent may need to schedule a construction management plan meeting with abutters and other project participants (local boards, interest groups, business associations, etc.). At this meeting, the proponent can describe the types of construction activity needed, construction phasing, and durations. Issues and concerns associated with the construction period can be identified and adjustments made to the construction management program to minimize community impacts as a result.

2.7.2 Construction Management and Monitoring

Careful management and monitoring of construction activities is necessary for most projects to ensure that quality standards are maintained, environmental commitments honored, and community expectations are met.

Appendix 18- MassDOT's 2006 Project Development & Design Guide Book



2006 EDITION

2.8 Step VIII: Project Assessment

Project Assessment can be used as a tool to further improve the project development and delivery processes. Although completion of this process will depend upon the proponent, three important pieces of information can be gathered through this brief, informal process. These include:

- Constituent input into project development process:
 - Were the proponent's expectations for guidance, review, and feedback met?
 - Was the project timeline reasonable?
 - Was the public outreach program for the project appropriate and effective?
 - Were community concerns about the project addressed and community comments incorporated into the planning and design processes?
 - Were appropriate design controls selected for determining the design outcome?
 - Was the project construction effectively managed so that community impacts were minimized?
- Constituent review of the project design elements
 - Was the project need addressed?
 - Is the resulting project consistent with its context?
 - What specific design elements are judged to be successful and recommended for future projects?
 - What specific design elements are judged to be unsuccessful and should be reconsidered, and why?
- Follow-up of Punch List items
 - Are there project elements that still need to be completed?
 - Has the project resulted in any situations requiring follow-up or adjustment to meet the original or newly-created project needs?

Appendix 19- City/Town 110% Agreement

CITY/TOWN 110% AGREEMENT

Agreement By and Between
The Massachusetts Department of Transportation
And The
City/Town of _____

Agreement Number _____

Agreement made this ___ day of _____, 2010 by and between the Massachusetts Department of Transportation, established pursuant to Chapter 6C of the General Laws, having its principal place of business in the State Transportation Building at 10 Park Plaza, Boston Massachusetts 02116 (hereinafter referred to as the “Department”) and the City/Town of _____, (hereinafter referred to as the “City/Town”).

WHEREAS, the City/Town desires the Department to perform roadway reconstruction on _____, (hereinafter referred to as the “Project”), and where the said roadway is under the jurisdiction of the City/Town of _____, in the County of _____, in said Commonwealth, and

WHEREAS, in accordance with Chapter 81 of the General Laws, the Department may at its discretion and subject to appropriation by the Legislature expend monies to improve and upgrade local roads under local jurisdiction, and

WHEREAS, the City/Town shall be responsible for any and all design required for the Project, including construction phase services, and where if the City/Town does not complete engineering plans in a timely manner, funding for the Project may be reallocated, to other projects scheduled within the same TIP, and

WHEREAS, the Department shall advertise, construct, and have construction oversight of the Project in accordance with the contract documents supplied by the City/Town, and

WHEREAS, the Department shall be responsible for the actual bid prices and quantities for the contract items (defined as Participating in the Designer’s Project Construction Estimate), and made a part of the Agreement, labeled “Exhibit A”, and

WHEREAS, the Department shall participate in the payment of said bid items up to, but not exceeding the 10% overruns of the estimated quantities shown on “Exhibit A”, and the City/Town shall be responsible for payment of the remaining balance of said item overruns, and

WHEREAS, any and all construction cost increases that arise out of design errors and/or omissions by the City/Town's consulting engineer shall be considered Non-Participating Work and the City/Town shall be responsible for payment of said Non-Participating Work, and

WHEREAS, any and all construction cost increases, resulting from requests by the City/Town, that result in (1) extra work, (2) changed conditions, (3) item overruns, and (4) traffic control assigned by the Department, shall be considered Non-Participating Work and the City/Town shall be responsible for payment of said Non-Participating Work, and

WHEREAS, an estimate of the Non-Participating Work shall be attached and made part of the Agreement, labeled "Exhibit B", and

WHEREAS, the parties hereto have reached an agreement as to the apportionment of work necessary for the construction of the Project, including the expenses thereof.

NOW, THEREFORE, in consideration thereof, the Department and the City/Town hereby agree each with the other, as follows:

DIVISION OF WORK

The City/Town has procured the services of the consulting firm of _____, to develop the construction plans of the Project.

The City/Town has provided by its own Design Consulting Engineers a complete set of plans, specifications, and estimates for the Project which shall be advertised and awarded by the Department, and where the Department shall provide construction oversight of said Project.

All work to be done by the City/Town's Consulting Engineer, shall be in accordance with the Department's Standard Specifications for Highways and Bridges, and the Department's Highway Design Manual, as amended, 521 C.M.R. Rules and Regulations of the Architectural Access Board ("AAB") and American's with Disabilities Act ("ADA") any and all State or Federal regulations, and/or to the satisfaction of the Department's Chief Engineer. Any additional costs arising from the Project's design being out of compliance with said regulations and policies, shall be borne by the City/Town as Non-Participating Work.

Any and all approvals made by the Department during the Project's design review shall not relieve the City/Town's responsibilities for design errors and omissions as specified under this Agreement.

The City/Town shall obtain all applicable permits and/or clearances required by local, state and federal agencies, unless otherwise directed by the Department. The City/Town shall also be responsible for obtaining all easements, property rights, interests and/or right of way appraisals needed for the construction of the Project, unless otherwise directed by the Department.

The City/Town's representative shall be available, with the authority to approve, or disapprove, the Non-Participating Work (due to additional work requested by the City/Town, or a direct result of a design error or omission), as determined by the Department.

DIVISION OF EXPENSE

The Department shall participate in the construction cost of the Project up to, but not exceeding 10% over the cost for the bid items of work. Payment of the remaining balance of work overruns shall be the responsibility of the City/Town.

Extra work, changed conditions, traffic control, item overruns, costs as a result of design errors or omissions, or requests of the City/Town that cause increases in the Project's construction costs shall be considered Non-Participating Work and shall be funded by the Town.

The City/Town will be responsible for all Non-Participating Work identified in Exhibit B, and the following costs relate to all the above Non-Participating Work that shall also be funded by the City/Town:

1. Extra work orders initiated at the request of the City/Town or its duly authorized representative.
2. Claims for "changed conditions" as defined by M.G.L. c. 30, § 39N arising out of the Non-Participating Work. The Department shall promptly notify the Town upon receipt of such claims.
3. Interest charges on contractor payments levied pursuant to M.G.L. c. 30, § 39G.
4. In the event that the City/Town is responsible for additional costs under this Agreement, the City/Town may elect to reduce the Scope of this Project.

Payments to be made by the City/Town are to be made directly to the Department's Contractor at such times and in such amounts as specified in written orders from the Department to the City/Town.

The Governor, or his designee, the Secretary of Administration and Finance, and the State Auditor or his designee shall have the right at reasonable times and upon reasonable notice to examine the books, records and other compilations of data of the City/Town which pertain to the performance of the provisions and requirements of this Agreement.

FUTURE MAINTENANCE

The City/Town's representative shall be made available to attend the Department's final inspection of the Project. When all punch list items identified as part of the final inspection are addressed to the satisfaction of the Department, the Department shall notify the Town in writing that the Project has been completed. Upon such date of notification, the City/Town shall be

responsible hereafter for the maintenance and preservation of the Project including any additional work items undertaken with this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.

APPROVED

**MASACHUSETTS
DEPARTMENT OF TRANSPORTATION**

LUISA PAIEWONSKY
HIGHWAY ADMINISTRATOR

CITY/TOWN OF _____

(Signature)

(Name-Printed)

(Title)

Appendix 20- Project Insight - Gold Training and Implementation Package

Gold Training and Implementation Package

The gold package is designed for larger project teams with potential adoption challenges. The more numerous the team, the more important it is to have a planned roll out and a controlled implementation. Many times, project teams may need a bit of help either defining their business process or refining an existing process. Our business process consultants can help you with this effort. The deliverable of these sessions is a 'QuickStart Guide' which represents our recommendations specific for how your team should utilize the [project software](#).

We recommend that the project team watch as many free recorded sessions prior to onsite training as possible.

If your implementation follows these criteria, then it may be right for you:

- Your organization needs help refining your business process around the solution.
- The Project Insight implementation timeline is urgent.
- You anticipate some cultural adoption challenges.
- You expect detailed [resource allocation](#), [time tracking](#) and possibly budget tracking.
- You have multiple teams that need different security and access rights.
- You plan to add team members following the initial implementation who will receive minimal training. For easy adoption, the software should be completely set up and ready to use.

48 total personal hours

Day One

- 4 hours analyzing your business needs to identify the best practices for achieving your goals
- 2 hours defining your objectives and the deliverables for the implementation
- 2 hours mapping out the organization's implementation

Day Two

- 4 hours modeling the global settings to fit your business processes
- 4 hours meeting with the team to refine a [project template](#)
- For multiple teams and/or [project templates](#), you will want one session per team.

Day Three

- 6 hours our business process consultant writes up the first draft of the best practices QuickStart Guides for your organization
- 2 hours designated for email and dialogue back and forth refining the documentation
- Many times, this day is conducted offsite and a second trip is made to conduct the actual [product training](#) based on the QuickStart Guides

Day Four

- 3 hours application administrators only (permissions and communications)
- 3 hours application administrators with project managers (budgeting considerations)
- 2 hours project managers only

Day Five

- 3 hours application administrators and project managers to revisit configuration and set up time tracking data.
- 3 hours project managers
- 1.5 hours team members

Day Six

- Review all decisions and questions since initial training
- 3 hours application administrators
- 4 hours project managers
- 1 hour team members

Agenda

Preparation

Decide which 2-3 people will be your Project Insight administrators. Then, ask those individuals to watch two recorded videos before attending the first training session:

[Systems Administration](#)

[Configuration Options](#)

[Permissions](#)

Homework

Make a list of the terminology that will go in each global settings function. For example, for project types, make a list of the types of projects you would like to report on. If you are not certain, you may need to conduct a meeting to determine what should go into the global settings.

Session One

Systems Administration

3 hours of training

Attendees: Application administrators

Configuration Options

3 hours of training

Attendees: Application administrators

Permissions

2 hours of training

Attendees: Application administrators

Homework

Enter in all of your global settings, configure the software and set up permissions in the administration section of Project Insight.

Preparation

Decide who the project managers or schedulers will be to attend the session. Ask them to watch these two recorded videos before the training session:

[Project Scheduling I](#)

[Project Scheduling II](#)

Homework

Review any existing project processes in their current format. You may need to meet with the team to determine if the tasks are complete and the information is accurate.

Session Two

Project Scheduling I

2 hours of training

Attendees: Application administrators, project managers

Project Scheduling II

4 hours of training

Attendees: Application administrators, project managers

Homework

Create your first project templates using one of the three methods covered in the training.

Preparation

Determine who will attend the [resource management](#) and budgeting training. Ask those individuals to watch these recorded videos before the training session:

[Resource Management](#)

[Project Budgeting and Costing](#)

[Portfolio and Project Reports](#)

Session Three

Resource Management

2 hours of training

Attendees: Project managers, resource managers

Project Budgeting and Costing

3 hours of training

Attendees: Project managers, resource managers, executives

Portfolio and Project Reports

2 hours of training

Attendees: Project managers, executives

Homework

Link tasks to resource types in project templates, input any budgets into project templates, if applicable. Set up reports, save and share them with executives.

Preparation

Determine who will attend the team member training. Ask them to watch this recorded video before this training session:

Team Member Overview

Session Four

Team Member Overview

1 hour of training per team

Attendees: Application administrators, project managers, team members

Session Five

Review decisions and questions since initial training, hours to be broken down as needed.

For a complete description of each training session, [click here](#).

Categories: [Getting Started](#)

URL: <http://www.projectinsight.net/community/learn/article/gold-training-and-implementation-package.aspx>

References

- ¹ MassDOT Highway Division ScoreCard (03/11) [Internet]Boston: MassDOT Highway Division; c2011 [cited 2012 02/23]. Available from: <http://www.mhd.state.ma.us/downloads/ScoreCard/ScoreCard0311.pdf>.
- ² West, Cynthia. Personal Communication (04/04/2012).
- ³ MassDOT Highway Division ScoreCard Archive [Internet]Boston: MassDOT Highway Division; c2011 [cited 2012 02/23]. Available from: http://www.mhd.state.ma.us/default.asp?pgid=content/sc_archive/sc_index&sid=about.
- ⁴ USDOT 2013 Budget Summary [Internet]: USDOT; c2012 [cited 2012 03/18]. Available from: <http://www.dot.gov/about.html#perfbudgplan>.
- ⁵ MassDOT.state.ma.us. Highway Home Page. *MassDOT News and Events-Forming of MassDOT*. (09/05/2011). < <http://www.massdot.state.ma.us/highway/Main.aspx>>.
- ⁶ Betts, William. Personal Communication. (04/06/2012).
- ⁷ West, Cynthia. Personal Communication (04/17/2012).
- ⁸ Massachusetts Department of Transportation (MassDOT). *Massachusetts Department of Transportation Highway's 2006 Project Development & Design Guidebook*. Boston: Massachusetts Department of Transportation; 2006.
- ⁹ Project Development Process - MassDOT Planning [Internet] [cited 2012 4/17/2012]. Available from: <http://www.massdot.state.ma.us/planning/Main/PlanningProcess/ProjectDevelopmentProcess.aspx>.
- ¹⁰ Project Review Committee [Internet] [cited 2012 4/7/2012]. Available from: <http://www.mhd.state.ma.us/default.asp?pgid=content/projectReview&sid=about>.
- ¹¹ FHWA's EDC Project Delivery Initiatives Every Day Counts (EDC) Program [Internet]: Federal Highway Administration; c2012 [cited 2012 2/9/2012]. Available from: <http://www.fhwa.dot.gov/everydaycounts/index.cfm>.

¹² Accelerated Project Delivery Methods [Internet]: Federal Highway Administration; c2011 [cited 2012 02/23]. Available from:

www.fhwa.dot.gov/everydaycounts/projects/methods/intro.cfm.

¹³ Key Performance Indicators in Public-Private Partnerships: A State-of-the-Practice Report - Transport Research International Documentation - TRID [Internet] [cited 2012 4/7/2012]. Available from: <http://trid.trb.org/view/2011/M/1104304>.

¹⁴ Inspector General, Gregory W. Sullivan. *Designing and Constructing Public Facilities – Legal Requirements Recommended Practices Sources of Assistance*. Commonwealth of Massachusetts Office of the Inspector General. Published October 1, 2011. [cited 2012 4/1/2012].

¹⁵ Standing Committee on Finance & Audit - Boards & Committees - MassDOT [Internet] [cited 2012 4/7/2012]. Available from:

<http://www.massdot.state.ma.us/BoardsCommittees/StandingCommitteeonFinanceAudit.aspx>.

¹⁶ Sullivan, Ann. Personal Communication. (02/09/2012).

¹⁷ Donoghue, John. Personal Communication. (03/05/2012).

¹⁸ Masse, Richard. Personal Communication. (03/06/2012).

¹⁹ 90 Day Legislative Reports [Internet] [cited 2012 4/16/2012]. Available from:

<http://www.massdot.state.ma.us/InformationCenter/90DayLegislativeReports.aspx>.

²⁰ Risotti, Steve. Personal Communication. (02/27/2012).

²¹ Frawley, Joseph. Personal Communication. (02/09/2012).

²² Guidance for Transportation Project Management [Internet]: Transportation Research Board; c2011 [cited 2012 03/18]. Available from:

<http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=655>.

²³ Measuring Performance among State DOTs: Sharing Good Practices [Internet] [cited 2012 4/7/2012]. Available from:

<http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=543>.

²⁴ Framework for SHRP 2 Transportation Decision Making (Capacity) Research | Pages | Strategic Highway Research Program 2 (SHRP 2) [Internet] [cited 2012 4/7/2012]. Available from:

[http://www.trb.org/strategichighwayresearchprogram2shrp2/pages/framework_for_shrp_2_transportation_decision_making_\(capacity\)_research_463.aspx](http://www.trb.org/strategichighwayresearchprogram2shrp2/pages/framework_for_shrp_2_transportation_decision_making_(capacity)_research_463.aspx).

²⁵ Forbes DE. *Project Management Information Systems*. Transportation Research Board (TRB); 2000 2000. Report nr Project 20-5 FY 1997 Topic 29-04.

-
- ²⁶ *A Guidebook for Sustainability Performance Measurement for Transportation Agencies* | Blurbs | Publications [Internet] [cited 2012 4/7/2012]. Available from: <http://www.trb.org/Publications/Blurbs/166313.aspx>.
- ²⁷ Open Government Initiative [Internet]: USDOT; c2012 [cited 2012 03/18]. Available from: <http://www.dot.gov/open/>.
- ²⁸ *Uses of Risk Management and Data Management to Support Target-Setting for Performance-Based Resource Allocation by Transportation Agencies* | Blurbs | Publications [Internet] [cited 2012 4/7/2012]. Available from: <http://www.trb.org/Publications/Blurbs/166250.aspx>.
- ²⁹ *Managing Risks in the Project Pipeline: Minimizing the Impacts of Highway Funding Uncertainties* - Transport Research International Documentation - TRID [Internet] [cited 2012 4/7/2012]. Available from: <http://trid.trb.org/view/2011/C/1092727>.
- ³⁰ *Project Resourcing & Schedule Management System* [Internet]: Transportation Research Board of the National Academies; c2005 [cited 2011 12/02]. Available from: <http://www.dot.ca.gov/hq/projmgmt/prsm.htm>.
- ³¹ North Carolina Enterprise Project Management Office [Internet] [cited 2012 4/17/2012]. Available from: <http://www.epmo.scio.nc.gov/>.
- ³² Gold Training and Implementation Package | Project Insight Project Management Software Knowledgebase [Internet] [cited 2012 4/16/2012]. Available from: <http://www.projectinsight.net/community/learn/article/gold-training-and-implementation-package.aspx>.
- ³³ Coley, Nathaniel. "Spotlight on Benefit-Cost Analysis". *Federal Highway Administration (FHWA)*. Publication Number: FHWA-HRT-12-003. (Volume 75 – No. 5). March/April 2012. [Internet] [cited 2012 4/17/2012]. Available from: <http://www.fhwa.dot.gov/publications/publicroads/12marapr/05.cfm>