Electronic Construction Collaboration System— Phase II

**Final Report
June 2010**

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16. Abstract

During the first year of research, work was completed to identify Iowa DOT needs for web-based project management system (WPMS) and evaluate how commercially available solutions could meet these needs. Researchers also worked to pilot test custom developed WPMS solutions on Iowa DOT bridge projects. At the end of the first year of research, a Request for Proposals (RFP) was developed and issued by the Iowa DOT for the selection of a commercial WPMS to pilot test on multiple bridge projects.

During the second year of research, the responses to the RFP issued during the first year of research were evaluated and a solution was selected. The selected solution, Attolist, was customized, tested, and implemented during the fall of 2009. Beginning in the winter of 2010, the solution was implemented on Iowa DOT projects. Researchers worked to assist in the training, implementation, and performance evaluation of the solution. Work will continue beyond the second year of research to implement Attolist on an additional pilot project. During this time, work will be completed to evaluate the impact of WPMS on Iowa DOT bridge projects.

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ELECTRONIC CONSTRUCTION COLLABORATION SYSTEM—PHASE II

Final Report
June 2010

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EXECUTIVE SUMMARY

Bridge construction projects are becoming increasingly complex as the demand for context-sensitive solutions, aesthetic designs, and accelerated bridge construction becomes more prevalent. In addition, the Iowa Department of Transportation (Iowa DOT) is entering a phase of design and construction of large border bridges, such as the I-80 (let 2008 for $56 million) and US 34 bridges over the Missouri River and the I-74 bridge over the Mississippi River.

Compared to typical construction projects, these bridges generate more contractor Requests for Information (RFIs), Value Engineering proposals, Requests for Changes, and shop drawings. Management of these submittals is a significant challenge for resident construction engineers and other Iowa DOT staff. In addition, some submittals require cross-departmental and project consultant reviews. Commercially available software exists for managing submittals and project collaboration teams; in-house solutions may also be possible. Implementation is intended to speed construction submittal review time and reduce incidence of delay.

This report contains information on work completed during the second year of research for this project. During the first year of research, researchers worked to identify what the Iowa DOT's functional needs were for a web-based project management system (WPMS). Simultaneously, researchers worked to evaluate commercially available WPMSs. A comparison of the Iowa DOT's needs and what was commercially available showed that commercially available systems contained the necessary functionality to meet the needs of the Iowa DOT. In addition to this work, custom solutions were developed with basic functionality and implemented on two bridge projects. These solutions aided project participants, but they also exposed the need for a more robust, full-featured solution.

With the functional needs determined and an awareness of how commercially available solutions could meet these needs, researchers worked with the Iowa DOT to develop and issue a Request for Proposals (RFP) to select a commercial solution to pilot test on Iowa DOT bridge projects. The RFP was developed during the first year of research and issued at the end of the first year of research.

At the start of the second year of research, researchers worked with the Iowa DOT to complete the RFP process begun during the first year of research to select a solution to implement on pilot projects. Working through the RFP process, a vendor, Attolist, LLC (Newforma 2014), was selected to provide a WPMS for two Iowa DOT bridge projects. The software was selected in the summer of 2009 and was provided for the Iowa DOT as part of a Software as a Service agreement. This agreement allowed the Iowa DOT to rapidly implement the solution with minimal effort.

After the solution was selected, researchers worked with Attolist and the Iowa DOT to make some minor customizations to the solution, test it, and implement it within the Iowa DOT. Researchers spent the fall of 2009 working on these tasks since the first pilot project was to be let in the winter of 2010.

After the solution was implemented within the Iowa DOT, researchers worked during the winter of 2010 to train project participants on the system. Along with the training, the solution was loaded for the first pilot project in late winter 2010. Researchers worked with project participants to monitor the solution and provided assistance as necessary after the letting.

During the first two months of use on the first pilot project, the solution performed well. Project participants generally found the solution beneficial and saw benefit in its use as a tool to aid in project management. While the solution generally performed well, there were some issues that researchers worked to resolve. The primary issue related to the intuitiveness of the solution. Many users initially struggled to navigate the solution. These users eventually learned to use the solution, but work will be needed in the future to improve training and the intuitiveness of the solution to help provide a better system for users.

To measure the effectiveness of Attolist and the WPMS on Iowa DOT bridge projects, a preproject survey was issued to project participants. Upon completion of the pilot projects, a postproject survey will be issued to project participants and web statistics will be analyzed to evaluate the effect of the WPMS. This work will continue beyond the second year of research along with the implementation of Attolist on the second pilot project during the summer of 2010.

Attolist has, so far, been an improvement over the initial solutions implemented during the first year of research. Attolist has effectively addressed the inability of the initial solutions to fully manage the shop drawing submittal and RFI processes. While there have been some issues following the initial implementation of the Attolist project, participants have generally accepted it well and indicated it has the potential to improve the project management of Iowa DOT bridges.

INTRODUCTION

Problem Statement

Bridge construction projects are becoming increasingly complex as the demand for context-sensitive solutions, aesthetic designs, and accelerated bridge construction becomes more prevalent. In addition, the Iowa Department of Transportation (Iowa DOT) is entering a phase of design and construction of large border bridges, such as the I-80 (let 2008 for $56 million) and US 34 bridges over the Missouri River and the I-74 bridge over the Mississippi River.

Compared to typical construction projects, these bridges generate more contractor Requests for Information (RFIs), Value Engineering proposals, Requests for Changes, and shop drawings. Management of these submittals is a significant challenge for resident construction engineers (RCEs) and other Iowa DOT staff. In addition, some submittals require cross-departmental and project consultant reviews. Commercially available software exists for managing submittals and project collaboration teams; in-house solutions may also be possible. Implementation is intended to speed construction submittal review time, reduce incidence of delay claims, and free up Iowa DOT staff from project management administrative tasks.

Research Objectives

Moving forward from the first year of research, researchers sought to select and implement a commercially available web-based project management system (WPMS) on pilot projects within the Iowa DOT during the second year of research. By selecting a commercially available solution, researchers hoped to address some of the issues that arose with the custom solutions developed and implemented during the first year of research.

Specifically, the goal of implementing a commercial solution was to be able to use a solution that could fully manage the shop drawing submittal and RFI processes. This was something that previous solutions had been unable to effectively do. By using a solution that had been developed and tested extensively in the market place, researchers hoped that the selected solution would be able to more effectively manage project information with minimal customization.

An additional benefit of using a commercial WPMS was related to the timeline required for implementing the solution. With the pilot projects that required the solution having letting dates only six months into the second year of research, it was infeasible to custom develop a solution, test it, and implement it.

Implementation of Solution

At the end of the first year of research, the Iowa DOT, working with researchers, issued a Request for Proposals (RFP) for a WPMS to be used on two bridge pilot projects. During the second year of research, a solution, Attolist, was selected through the RFP process. Upon selection, a contract was drafted for the two bridge pilot projects. Using the remaining time until

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the first pilot project was let, the solution was customized, tested, and implemented within the Iowa DOT.

During the second half of the research period, Attolist was implemented on the first pilot project, the US 6 Broadway Viaduct Project in Council Bluffs. Training was also completed for all project participants, and researchers began to measure the performance of the solution. After the conclusion of the second year of research, the solution will be implemented on the second pilot project, the US 65 Iowa Falls Arch Bridge in Iowa Falls.

SUMMARY OF PREVIOUS RESEARCH

During the first year of this project, researchers began their investigation and implementation of web-based collaboration on bridge construction projects within the Iowa DOT. Researchers initially worked to meet the immediate needs of the Iowa DOT by implementing a solution on the I-80 bridge over the Missouri River and subsequently on a bridge in Jackson County. The primary goal of these solutions was to help project participants manage RFIs and shop drawing submittals through the use of a WPMS. A secondary benefit of these solutions was an improvement in access to contract documents and other project information.

The first implementation of a WMPS occurred on the I-80 bridge over the Missouri River project. Because of the timing, this project was already in progress and an expedient solution was deployed utilizing the Iowa DOT website to improve access to contract documents for project participants. This solution met the immediate needs, but project participants desired a more full-featured solution that allowed collaboration on submittals and RFIs. Following the I-80 project, a second solution was launched for the US 52 over Mill Creek bridge project in Jackson County. For this project, an expanded solution was implemented that was developed in-house by the Iowa DOT. It also used the Iowa DOT website to improve access to contract documents, and it included a File Transfer Protocol (FTP) site to transfer documents and used the "Google Groups" application for managing RFIs (Google Groups n.d.). This solution also performed well, but it was not feasible for future projects because of inefficiencies in transferring information between the three systems. Ultimately, project participants desired a full-featured solution tailored to managing RFIs and submittals.

Concurrently, with the first two pilot projects researchers worked to identify the needs for long-term WPMSs and also evaluated commercial solutions to see if they could meet the Iowa DOT's needs. To investigate the Iowa DOT's functional needs for a WPMS, interviews were conducted with a wide variety of people—Iowa DOT personnel from multiple offices, contractors, consultants, suppliers, other state DOTs and owners, and professionals from other construction sectors. To evaluate the functionality of commercial solutions, a search of the Internet was conducted to identify and initially screen the solutions. Follow-up demonstrations were conducted with a dozen vendors to further evaluate the solution's functionality.

Based on the needs of the Iowa DOT and what was commercially available to meet these needs, researchers felt that a commercially available solution would be a good fit for further pilot testing. Working with the Iowa DOT, an RFP) was drafted and issued for a WPMS solution to

pilot test on two bridge projects. This RFP was issued at the conclusion of the first year of research.

PHASE II PILOT PROJECT

Introduction

The Jackson 108 pilot project was initiated in the fall of 2008 to further test the use of web-based collaboration on Iowa DOT bridge projects. Moving forward from the I-80 bridge pilot project in Council Bluffs, the objective of the Jackson 108 project was to create a web-based collaborative environment for project participants to manage shop drawings, submittals, and RFIs. Using the Iowa DOT's website and the Google Groups application, project participants were able to electronically submit, track, review, and distribute project information (Google Groups n.d.). The Jackson 108 project was completed during the fall of 2009, and the evaluation of the project was completed during the second year of research.

Web-based Collaboration Technology

Two technologies were selected for the Jackson 108 project. For electronic collaboration, the system used a combination of the Iowa DOT website and the Google Groups application. (Google Groups n.d.) Using a combination of both of these sites allowed for a simple way to expand upon the functionality offered during the I-80 pilot project.

The first technology used was a project-specific webpage. A publically accessible webpage for the Jackson 108 bridge was set up on the Iowa DOT website (www.iowadot.gov/jackson108/plans.html). This webpage was used to post the proposal, plans, addendums, special provisions, specifications, plan revisions, vibration monitoring reports, and meeting minutes for the project. The webpage also had a link to upload shop drawings via an FTP site. The drawings that were uploaded to the webpage were manually configured by Iowa DOT employees to appear on the actual project webpage.

To facilitate further collaboration, the "Jackson 108" group was created using the Google Groups application and a link was placed on the Jackson 108 webpage so that the Google Group could be accessed from the home page. The Google Groups application created a password-protected collaborative environment where project participants could upload RFIs for review and exchange ideas on project issues through online discussions. This application was hosted by Google and operated in a manner similar to most message boards on publically accessible web sites. The Google Groups application allowed users to have the option of being notified via e-mail anytime something was posted (Google Groups n.d.).

Project Results

To evaluate the success of the Jackson 108 pilot project, researchers issued a postproject survey. This survey was given to all project participants. It asked them to rank the impact of the project

webpage on various aspects of their project responsibilities. It also asked them to rank the impact of the website on the overall management of the project and how web-based collaboration should be used in the future. A copy of the survey given to project participants is shown in Appendix A.
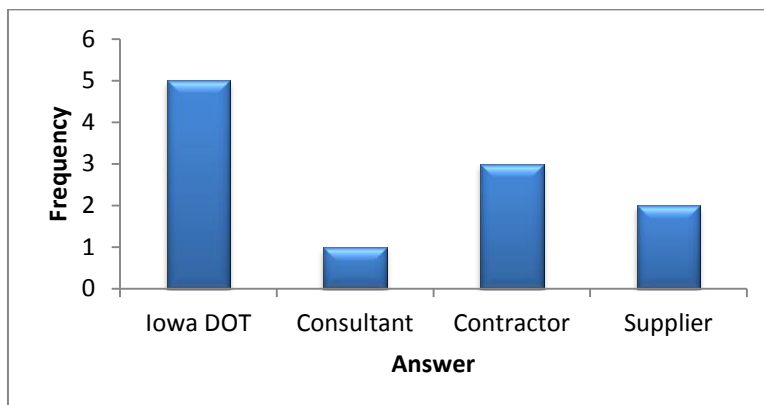
Figure 1. Project role of survey respondents
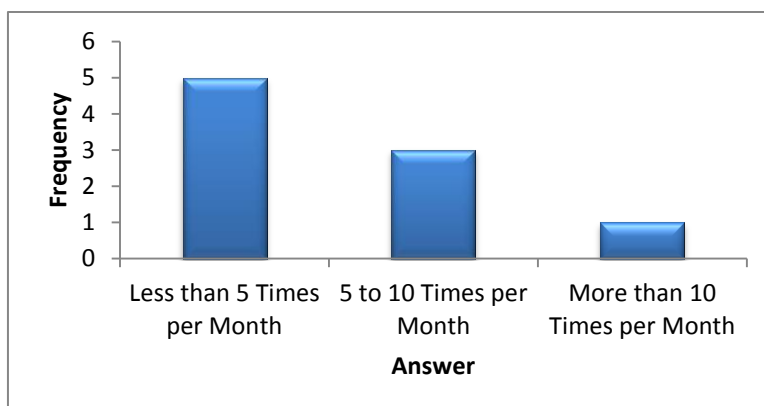
Figure 2. The number of times users accessed the site per month

As shown by the bar charts in Figures 1 and 2, there was a wide distribution of site users and frequency of use. Most of the participants were from the Iowa DOT, and most users only accessed the site a couple of times per month. The average responses to the survey questions are shown in Table 1. Appendix B shows individual graphs for each of the questions shown in Table 1. An analysis that compares averages among questions shows that the site made the most impact by easing the submittal process and making project information more available. Additionally, respondents found the site made the submittal process more transparent and also helped reduce the cost associated with submitting documents. In terms of future directions, users wanted to implement web-based collaboration in the future, but the desire to have increased functionality was not as intense as it was for the previous project. Figure 3 shows survey responses regarding the most appropriate project size for electronic collaboration implementation. Most project participants found the $5 million project size appropriate as a threshold for implementing a WPMS.

Table 1. Survey responses

Question:	Average Response
The project website made the submittal process easier and more efficient for me.	4.27
The project website made the RFI process easier and more efficient for me.	3.91
The project website made relevant project information more easily available.	4.27
The project website increased accountability for project participants.	3.73
The project website increased the transparency of document management.	4.18
The project website decreased the overall cost associated with document management and transmittal of documents.	4.09
The project website decreased the review time of documents.	4.18
The project website simplified my job on this project.	3.73
I would recommend using this project website again on bridge projects.	4.09
I would recommend using a more full-featured project website to assist project participants in the future.	3.73

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree
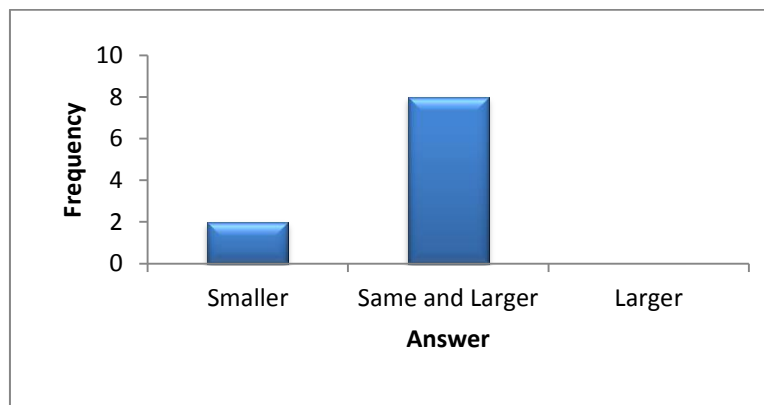
Figure 3. Recommended project size for future implementation

The final portion of the survey included three fill-in-the-blank questions. The first question asked users what they thought worked well on the system. Users responded that the WPMS made it easier to access information, simplified communication, reduced paper usage, decreased response time, and created more transparency in processes. The second question asked users what could be improved on the system. Users said that the e-mail notifications sent to everyone should only be sent to people affected by the information, the FTP site required too much work and needed to be automated, and a feature such as a dashboard to help users track information would be useful. The final question asked what should be changed for future implementations, and the responses showed a desire to implement the improvements sought in the answers to the first question.

Beyond evaluating the project using the postproject survey, the statistics from website usage were also evaluated. As shown in Figure 4, the most-viewed feature on the webpage was the "plans" section; this was followed by the "working drawings" section. Features such as the "vibration monitoring" section were viewed relatively infrequently. Trends shown in the web statistics are largely consistent with those in the survey responses.
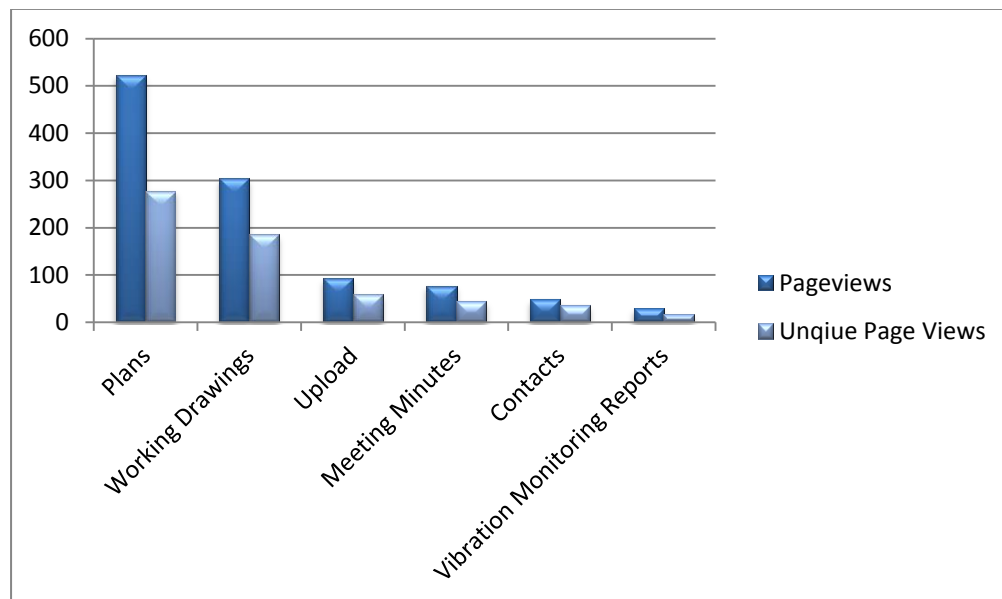
Figure 4. Jackson 108 webpage statistics

Conclusions

For the Jackson 108 bridge, the combination of the Iowa DOT website and Google Groups application served as an expedient way to pilot test a web-based collaborative environment. The two components of this pilot project did not require a large investment of time to develop and allowed the project participants to electronically submit shop drawings. While the collaborative environment created for the Jackson 108 project worked well, there were aspects of the solution that required additional improvement. Some of the issues included having the inability to keep conversations on Google Groups private, the lack of "ball-in-court" or "dashboard" features to allow participants to know who was working on what, and the inability to control which e-mails

participants received from Google Groups. Because of the inability to have private conversations and other issues, not all of the submittals on the project were managed through the Google Groups application (Google Groups n.d.). Another issue with the FTP site was the amount of time Iowa DOT engineers had to spend transferring documents that had been uploaded to the website. The full process of uploading a drawing could take as long as 30 minutes. On large projects with considerable drawings and revisions, this administrative function could become very time consuming. Because of the amount of staff time required to service an FTP site, this approach was not deemed feasible for future projects. Except for the aforementioned issues, the system developed for the Jackson 108 project, while limited in its capabilities, worked well. The limitations of this system, however, would make it impractical for a project where considerably more submittals are processed and more collaboration is required.

PHASE III PILOT PROJECTS

Solution Selection

One of the first tasks completed during the second year of research was the completion of the RFP process initiated during the first year of research. The RFP had been issued during the previous year of research, but all other tasks in the RFP process took place during the second year of research. Table 2 shows the timeline for the selection of the solution using the RFP process. Ultimately, the selected solution would be implemented on two pilot projects, the US 6 Broadway Viaduct Bridge in Council Bluffs and the US 65 Iowa Falls Arch Bridge in Iowa Falls. These two projects would be let in February 2010 and July 2010, respectively. The RFP also indicated the possibility of using the solution on two unnamed additional pilot projects.

Table 2. RFP timeline

RFP to prospective bidders	June 29, 2009
Vendor's final submitted written questions	July 10, 2009
Final DOT reply to vendor questions posted on DOT website	July 17, 2009
Bid opening date	July 22, 2009
Review submitted vendor proposals	July 22–28, 2009
Vendor presentations	August 10 and 12, 2009
Recommended award sent to vendors	August 13, 2009
Protest of award	August 23, 2009
Completion of contract negotiations and execution of the contract	August 25, 2009
Contract begin date	September 1, 2009
Customization, set-up, testing, and acceptance Completed	December 31, 2009

As the RFP process progressed, questions were submitted by prospective vendors regarding the RFP and their proposals. These questions were fielded by the Iowa DOT's procurement office

with technical questions being answered by the Iowa DOT project managers, Jim Nelson and Kim Powell.

Ultimately, 16 vendors submitted proposals. The proposers' solutions ranged from off-the-shelf to custom-developed solutions. Proposals from the 16 proposers were scored by a five-member selection team using a best-value selection process outlined in the RFP. The top three proposals were shortlisted and invited to present their solutions to the selection team. The scoring matrix used by the selection team, and provided in the RFP, is shown in Table 3. Weights for the different categories were not provided to proposers.

Table 3. RFP scoring matrix

Evaluation Criteria
Overall quality of content of submitted proposal information and responsiveness RFP specifications Proposal scope and schedule
Data Security Hosting Site access Auditing Archiving
Functionality Available functions: Mandatory and optional Solution workflow User interface
Vendor Presentation Scoring is based on the vendor's presentation and responses to Iowa DOT questions.
Experience Previous projects Qualification of subcontractors Demonstrated ability to meet deadlines
Cost – See Schedule of Prices

The selection team scored the proposals and shortlisted the three proposals with the highest scores. The following firms were shortlisted: Submittal Exchange (Textura 2014), Attolist (Norforma 2014), and Eadoc (Eadoc 2014). Each firm was invited to present their solution in person at the Iowa DOT or remotely via a web conference. Proposers were given one hour for their presentation and half an hour for questions by the selection team.

To provide proposers with an idea of what the Iowa DOT was most interested in, each of the shortlisted proposers was sent a prompt for their presentation regarding what the Iowa DOT was most interested in seeing. The prompt asked proposers to address the following areas of their solutions:

1. Creating RFIs and submittals
2. Managing user accounts
3. Overall system navigation
4. Workflow functionality
5. System security
6. Training and support
7. Maintenance and updates

Following the presentation, the selection team scored each presentation and added it to the firm's proposal score to obtain the total score. Attolist, the firm with the highest total score, was recommended for the award of the contract. Following the RFP timeline, a contract was executed with Attolist on September 1 to provide a web-based collaboration solution for the two pilot projects. There were no protests of the contract award.

Solution Customization

Shortly following the contract execution, a kick-off meeting was held with Attolist to begin customizing and implementing their solution. Key implementation members met with Attolist at this time to work out a timeline for the customizations and implementation. Progress meetings were subsequently conducted monthly per Attolist's contract to evaluate progress. A timeline was created to complete all customizations to the system by the end of October 2009. This would allow two months to test the customizations and set up the Broadway Viaduct project before it went into use by project participants in January 2010.

As part of Attolist's proposal, a number of customizations to their solution were included to tailor the solution to meet the needs of the Iowa DOT. These customizations fell into three main categories:

1. Adjusting user terminology
2. Adjusting user functionality
3. Allowing access through the Iowa DOT website

The first customization, adjusting user terminology, was completed primarily to ensure that the terminology used within the solution was consistent with the Iowa DOT's current terminology. The primary change this required was the replacement of the term "Architect" within the system with the term "Designer." Previously, Attolist had been used primarily on vertical construction projects; thus the term "Architect" was commonly used throughout the system.

The second customization, adjusting user functionality, was initiated to ensure that the Iowa DOT could most efficiently transfer their current workflows for document management into the system. One part of this customization was the need to change the roles and names of different users within the system. This change again stemmed from the difference between the way the Iowa DOT manages projects and how many vertical projects are managed. First, a user type was created and named for the RCE. The role was customized to allow the RCE to continue current

Iowa DOT workflows, act as the intermediary for all RFIs, and have administrative control over the system. Second, some customizations were required to allow the Iowa DOT to continue to jointly review documents along with a third party consultant. Some changes were needed to ensure that central Iowa DOT engineers would have the ability to review shop drawing submittals.

The final part of adjusting the user functionality required changing user permissions within the system to allow the Iowa DOT to collaborate with consultants on project issues without their discussion being visible to the contractor. By completing this customization, the Iowa DOT could move these discussions away from e-mail and still provide the contractor with a single unified answer for project issues.

The last customization to the Attolist system was to allow for access to the system from the Iowa DOT website. This customization was conducted to create an association between the Attolist solution and the Iowa DOT, since the solution was hosted by Attolist. This was accomplished by creating a webpage on the Iowa DOT website for web-based construction collaboration (http://www.iowadot.gov/bridge/ecpm.html). A log-in page was created at this address that allows system users to log in to Attolist from the Iowa DOT website.

Solution Testing

Upon completion of the customizations, a test project was created within Attolist in order for researchers and the Iowa DOT to test and familiarize themselves with the system. Researchers created multiple virtual users in this test environment to check the navigation of the system, upload documents, and simulate the workflow of documents between the contractor, Iowa DOT engineers, and consultants.

Testing the solution served researchers well because they were able to identify a number of bugs in the customizations that Attolist was able to promptly resolve. By identifying and resolving minor issues in the system prior to releasing the solution for project use, researchers aimed to reduce problems for users and hopefully improve system acceptance among project users.

A secondary benefit from testing the system was that researchers became quite familiar with the system. This allowed them to help examine how to best transfer Iowa DOT processes and workflows into the system. Additionally, based on this familiarity with the system, researchers identified a potential need for user guides to aid project participants in basic functions of the Attolist system.

User Guides

Based on the testing of the Attolist solution, researchers concluded that users would benefit from guides with step-by-step instructions for basic processes within the system. It was anticipated this would be especially beneficial for users who seldom used the system and may not remember their training. Based on this need, researchers created three user guides: one for general system

navigation, one for RFIs, and one for submittals. These user guides are shown in Appendices C, D, and E.

After completion of the user guides, Attolist independently released similar user guides as part of a system upgrade. Some of these user guides covered similar material; however, none of them addressed the specific practices and procedures of the Iowa DOT as the guides developed by the researchers did. The user guides produced by researchers were posted on the Iowa DOT web-based construction collaboration webpage as PDF files.

Solution Implementation

After completion of the site-testing program and approval from the Iowa DOT, the project site was set up for the Broadway Viaduct Project. The Iowa DOT uploaded contract documents and researchers worked to determine workflows and final project procedures. This included setting up groups of project participants for reviewing submittals.

Training

As part of Attolist's contract, three training sessions were included per pilot project. These sessions would be conducted via a web conference and would last approximately half an hour. It was anticipated, based on the user friendliness of the system, that minimal training would be required for users. To ensure that knowledge obtained during training sessions was retained, the goal was to train users within a couple weeks of their need for the system. For this reason, one of the Broadway viaduct training sessions was conducted for the Iowa DOT and the project consultants approximately three weeks before the project letting. A second training session was conducted for the contractor approximately three weeks after the project letting. The third training session was saved in case additional training or a refresher was required. An additional benefit of conducting two training sessions allowed the trainer to target the different user types within the system. Since the contractor user type does not have the same available functionality, training them with functions only available to the Iowa DOT could serve to confuse them. Training for the Iowa Falls Arch Bridge will be conducted during the summer of 2010.

Performance Measurement

Measurement of WPMS performance on the pilot projects will be conducted mostly in two ways. First, pre- and postproject surveys will be conducted to gauge project participants' opinions of the system and its perceived benefit. Second, web statistics will be analyzed to quantify the amount of usage that the system received.

During the second year of research, the only performance measurement conducted was the preproject survey on the Broadway Viaduct Bridge. The preproject survey was distributed to project participants and can be seen in Appendix F. It was distributed to the system users at the training events; a total of 20 responses was received. A review of the users in Attolist shows this provided a 63% response rate. Graphs summarizing the responses to the preproject survey on the

Broadway Viaduct Bridge are shown in Figures 5–11. Figures 5 and 6 give some general information on the project roles of the survey respondents and also how much they expect to use the system.
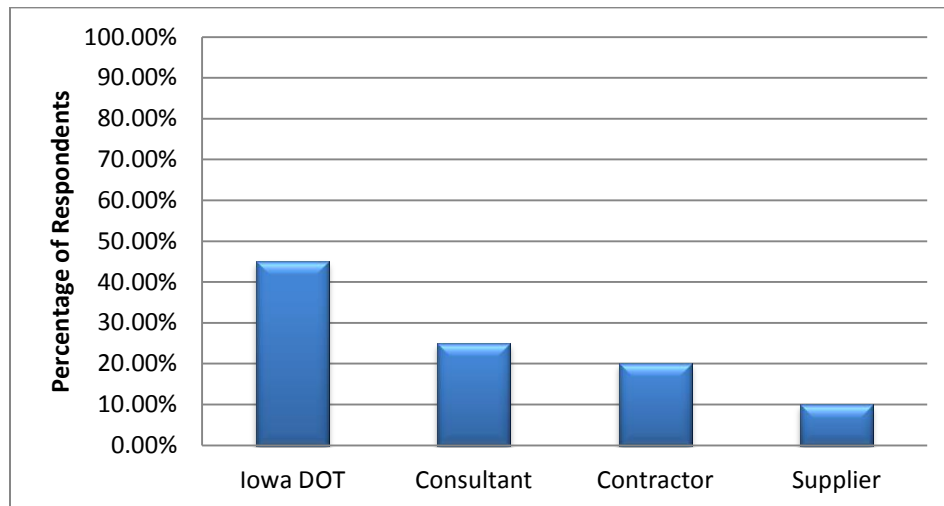
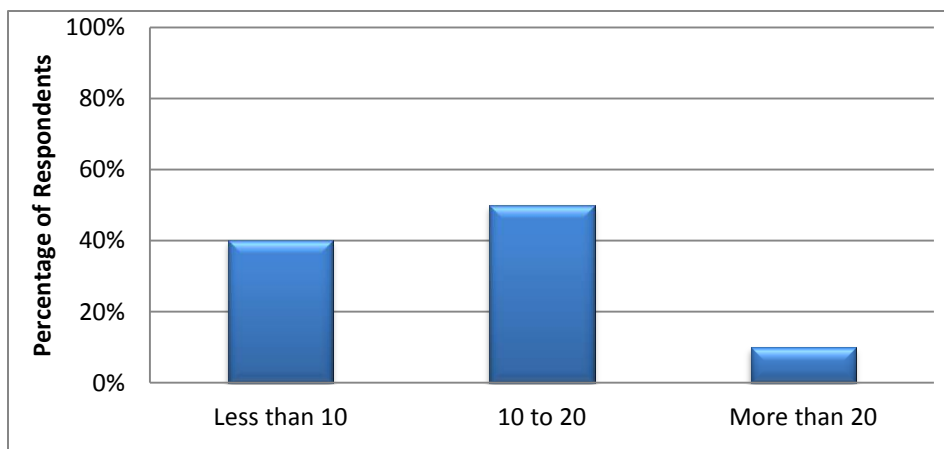

Figure 5. Survey respondent project role

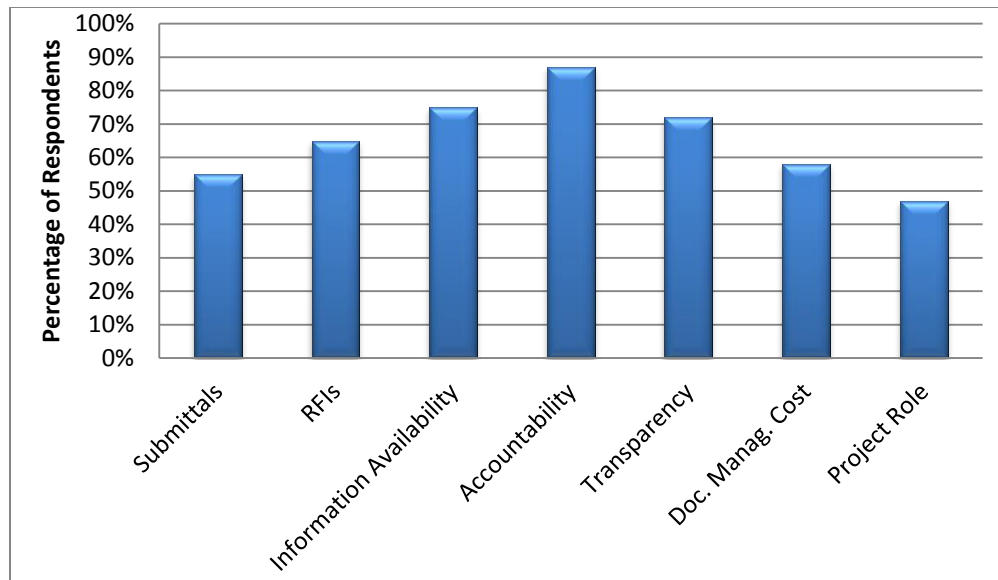**Figure 6. Anticipated system usage per week**

Figure 7. Respondents anticipating a positive impact from the system

Figure 7 summarizes a number of survey questions regarding the effects of the system on the management of the project. In general, most project participants felt that the WPMS would provide benefit in most of the surveyed areas. As shown in the figure, project participants felt that the WPMS could best help in increasing information availability, accountability, and document management transparency. The final column, Project Role, shows that only 45% of the respondents felt that the WPMS would make their job on the project easier. Individual graphs for each of the figures can be seen in Appendix G.
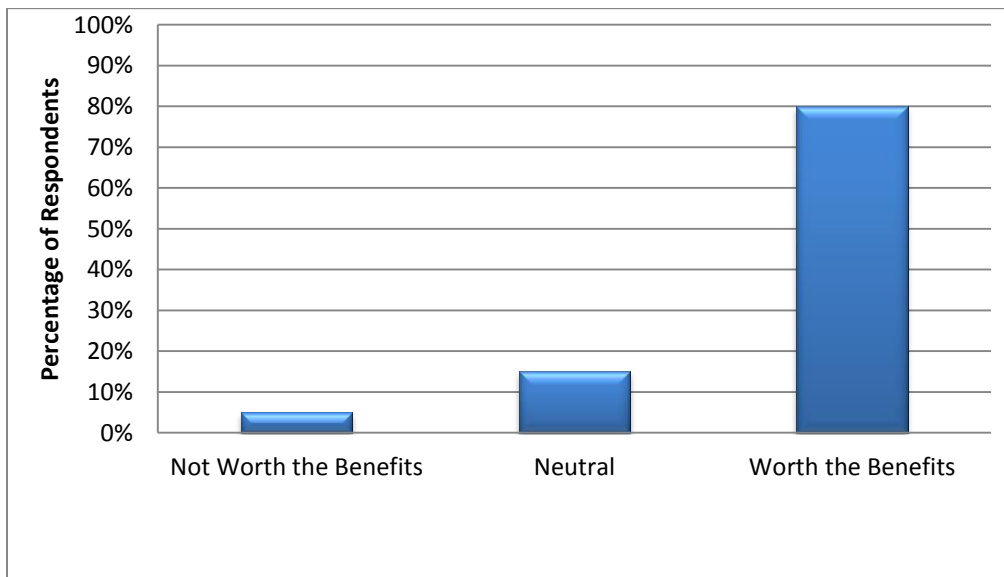

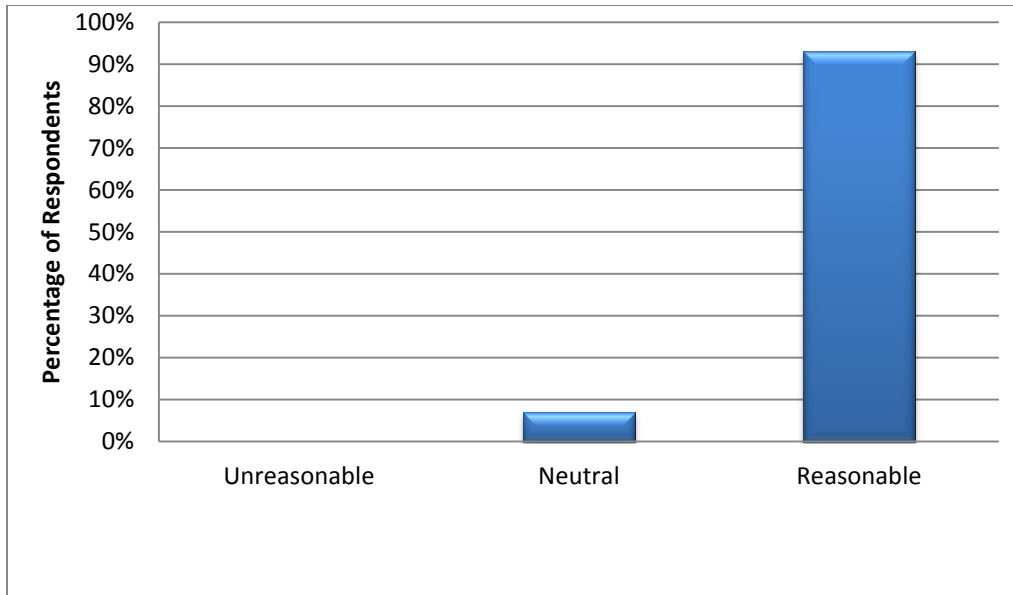**Figure 8. Perceived benefit of learning to use the system**

Figure 9. System technological requirements

Figure 8 shows that users generally felt that the time required to learn to use the system was well worth the benefit the system provided to them. It is surprising that respondents overwhelmingly selected this response when less than half of the respondents answered that they expected that the WPMS would ease their project responsibilities as shown in Figure 7. Figure 9 shows that project participants felt the technological system requirements of Internet access, an Internet browser, and an e-mail account were reasonable.
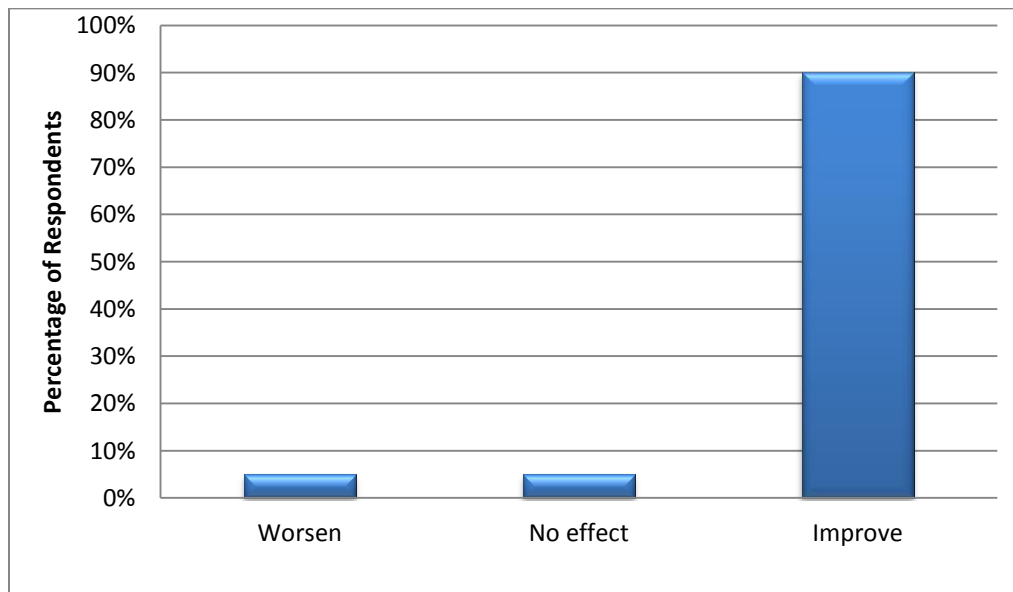

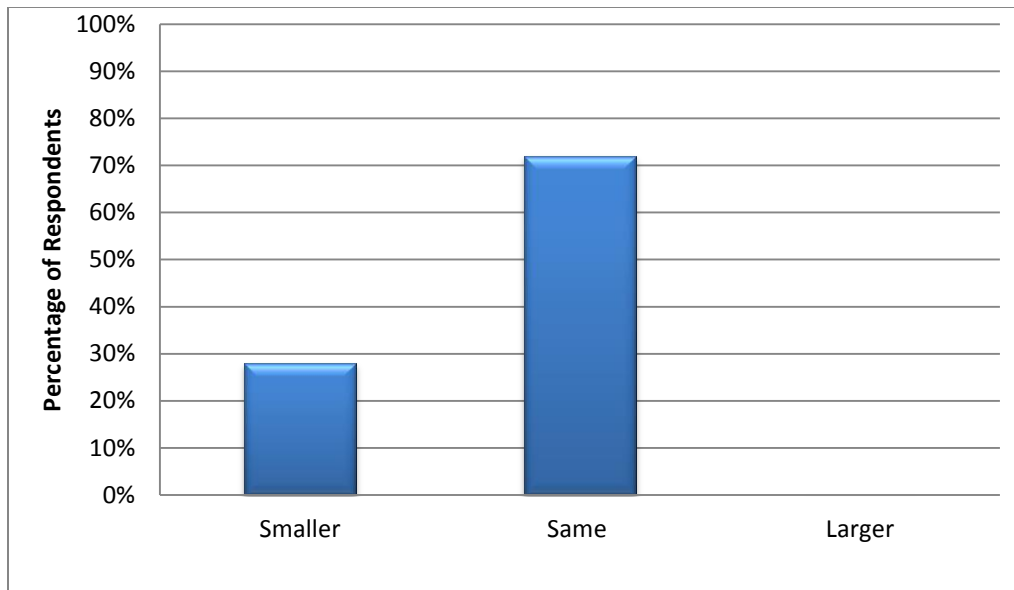**Figure 10. Overall effect on project management**

Figure 11. Project size driving implementation

Figures 10 and 11 show that the project participants thought that the $25 million construction cost of the Broadway Viaduct Bridge was sufficient to make the WPMS worth implementing and that the system had potential to improve the project management of the bridge. With 90% of the respondents indicating the WPMS has the potential to improve project management on Iowa DOT bridge projects, the WPMS appears to have initially been well received on the Broadway Viaduct Project.

In the final part of the preproject survey, respondents were asked open-ended questions regarding what they perceived to be the biggest benefit, concerns, improvements, and expected difficulties with the solution. In general, users felt that the benefits of the system would be better organization and tracking of documents, more rapid flow of information, improved access to information, and increased efficiency. The respondents' biggest concerns were the time required to learn to use the system, getting the full project team to buy into the solution, and the availability of computers with Internet access. For the most part, users felt they would need to interface with the system before they could offer suggestions or concerns specific to its use.

The same preproject survey will be issued prior to the Iowa Falls Arch Bridge pilot project. Additionally, upon completetion of each pilot project a similar postproject survey will be issued to the project participants. An analysis will then be completed between the two projects and also between the pre- and postproject surveys to evaluate the impact of the WPMS.

Special Contract Provision

During the first year of research, a draft special contract provision was created for use of the commercially selected WPMS on pilot projects. Some minor changes were made to this special provision after Attolist was selected as the vendor to provide the WPMS. The special contract provision issued for the Broadway Viaduct Project is shown in Appendix H.

Project Archiving

After both pilot projects are completed, the information stored within Attolist will need to be transferred into the Iowa DOT's in-house archival system. Attolist provides archived information in a combination format of Excel spreadsheets and pdfs. Additionally, by the time the pilot projects are completed, Attolist may have an offline version of their solution that would allow the Iowa DOT to access project information in the same interface used during the project.

To evaluate the archiving options of project information upon completion of the pilot projects, a task force was formed composed of Iowa State researchers and Iowa DOT engineers and information technology specialists. The task force was able to determine that, because of the format of the information provided by Attolist, there will be some manual effort required to transfer this information to the Iowa DOT's internal archiving system. Based on the amount of information created during the two pilot projects and the effort required to automate the archiving process, it was agreed that it did not make sense to automate the archiving process for the two pilot projects. For a future solution encompassing more projects, however, it will be critical to develop a solution that can automate the transfer of information into the Iowa DOT's archives.

Broadway Viaduct Bridge

During the winter of 2010 the first pilot project, the Broadway Viaduct Project, in Council Bluffs was let. After the letting, the selected contractor, Cramer and Associates, began to interface with the system. Prior to the letting of the project, researchers had extensively researched project participant needs and also tested Attolist. To monitor the solution and also to aid in the acceptance and performance of the solution, researchers worked with a variety of project participants after the letting to determine how the system was performing and how it could be improved. This was completed through periodic phone conversations and e-mails.

Speaking with the project participants, most of them felt that during the first two months of using the system they found it beneficial and saw quite a bit of potential for it. There were a number of issues, however, that needed to be resolved. One of the issues was the inability of the Iowa DOT and designer project participants to collaborate on the submittals and how the Iowa DOT's current practices could be most effectively replicated by the Attolist workflow. The second issue that came up was that the system was not as intuitive as the users desired.

The first issue regarding collaboration on submittals was easily resolved. Initially, when multiple opinions were required on a submittal, each project participant was asked to respond to the submittal. This proved to be a rather ineffective procedure because it was very difficult to communicate and compile the individual responses into a unified response. Therefore, an alternative process was developed. For submittals requiring collaboration, a separate messaging thread was created within Attolist where reviewers can discuss the submittal. Once a consensus is reached, a response is then transferred to the submittal and it is returned. While this process is not ideal, because it requires using a separate messaging thread, it has proved an effective way to collaborate on submittals.

The second issue of user friendliness has been a bit more problematic for users. Initially, many users struggled to figure out exactly what they needed to do to submit, view, and review documents within the system. Additionally, many users were unaware of who could view things within the system and who they were sending information to. While most of the frequent users of the system were able to learn how to effectively accomplish things within the system, occasional users are likely to experience some frustration, and users will likely experience the challenge of climbing a learning curve at the start of the second pilot project.

To help make the solution more user friendly, researchers will be evaluating the most effective way to train system users. Additionally, since many WPMSs were originally designed for vertical construction, the default work flows do not necessarily match how the Iowa DOT manages documents. Work by researchers to help better match system workflows with current DOT workflows should also help simplify the interface for users.

Iowa Falls Arch Bridge

The Iowa Falls Arch Bridge will be let in the summer of 2010. Researchers will work with the Iowa DOT to implement improved training and also to complete performance measurements as on the Broadway Viaduct Bridge. This project will use the same central office Iowa DOT engineers; however, the rest of the project participants will be new to the solution.

I-74 MISSISSIPPI BRIDGE

The design for a bridge to replace the I-74 crossing of the Mississippi in Davenport is currently being completed for the Iowa DOT by consultant Alfred Benesch & Company. As an infrastructure critical bridge, this two-span suspension bridge along with its approach ramps has considerable complexity. At this point, funding has yet to be secured for the actual construction of the bridge. The final design being completed is a major undertaking with an approximate cost of $50 million.

Because of the size of the project, participants need a solution for managing information. Hanson Professional Services Inc., a subconsultant to Alfred Benesch, uses ProjectWise for this purpose. ProjectWise, from Bentley Systems (Bentley 2014), has historically been used by design firms internally to manage electronic plans and files. Hanson set up ProjectWise as a password-protected site to facilitate the sharing of documents and the management of design issues. The ProjectWise solution allows all of the users to access the design documents. To ensure users are not simultaneously changing plans, however, users must "check out" documents, locking them away from other users before making changes. The system also manages RFIs and project issues and provides a way to share general project information such as plans and specifications.

Use of this site has allowed the designers in Chicago and Iowa DOT personnel in Ames to access documents and collaborate on design issues. Iowa DOT personnel have found the system beneficial in improving access to documents and also in aiding RFI processing and issue

tracking. They have found the system to be especially beneficial given the size of the project and the amount of information associated with it.

Although the system has worked well, users have not found it entirely intuitive. Some of the default settings for checking out documents have led to unnecessarily locking documents so they cannot be used by other project participants. In addition, Iowa DOT participants report that the RFI process is somewhat convoluted from their point of view and could be more intuitive.

Overall, the use of ProjectWise has proved beneficial for this project and users asserted that it would be beneficial on future projects. One concern for future projects relates to having a consultant select and host the solution. This has worked well during the design phase of the I-74 project; however, in the future such a policy could lead to the selection of different WPMS solutions for each project the Iowa DOT is managing. This could make it difficult for Iowa DOT personnel because they would need to learn to use a different system for each project.

BRIDGE INFORMATION MODELING

As part of the researchers' investigation into a WPMS for the Iowa DOT, researchers examined where the future for WPMS technology may lie. One possibility is an integration of a WPMS with other computer systems through technology such as bridge information modeling (BrIM). Currently, in the vertical construction industry building information modeling is gaining wide popularity. It revolves around the idea of using a single 3D model for a project. This model contains all of the building plans and specifications. Furthermore, this model is maintained for the full life cycle of the building. By doing this, all of the information is retained in a single location, and information and history for specific building components can be easily accessed (Autodesk 2014).

Although this technology is quickly gaining popularity in the vertical construction industry, no equivalent exists that has been specifically designed for the horizontal construction industry. One of the premier software providers to the horizontal engineering and construction industry, Bentley, has developed an idea for BrIM (Figure 12) (Bentley 2014). They have no specific "BrIM" solution currently, however. Ultimately, the development and implementation of a BrIM solution has potential to improve design and construction through improved information sharing. Additionally, BrIM offers a potential for significant improvements in the operational management of bridges during their life cycle by improving the accessibility of information (Cho 2009).
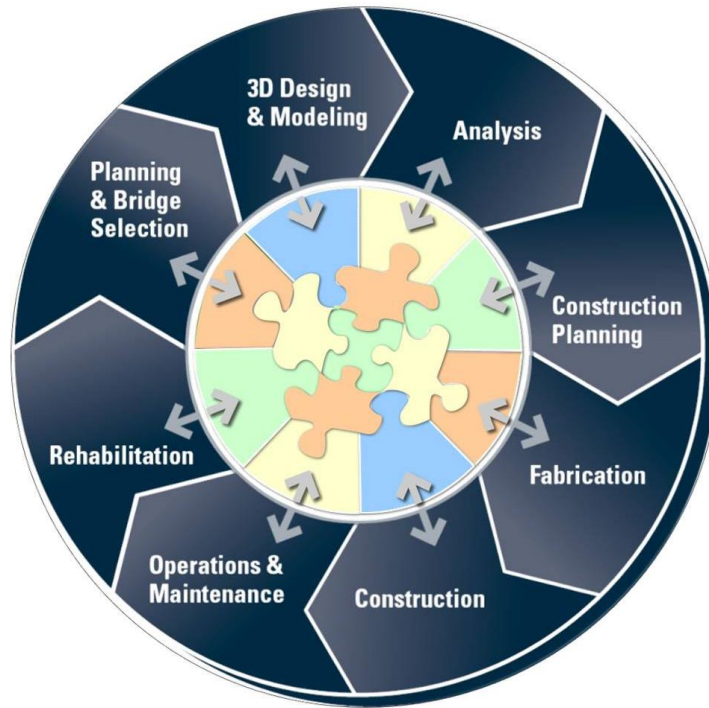
Figure 12. Bridge information modeling concept (Bentley 2014)

Currently, the Iowa DOT does not use any BrIM technology or 3D modeling for bridges. To obtain a better understanding of the level of current implementation of these technologies in Iowa, researchers spoke to the contractors and suppliers that the DOT regularly interfaces with. The goal was not only to find out if these companies used 3D modeling, but also if they would find it beneficial if a 3D model was provided. Speaking with personnel from two contractors that regularly construct bridges for the Iowa DOT, researchers found that neither one uses 3D modeling extensively. One contractor had used 3D modeling on a project but opined that for most projects, the benefits would not justify the added expense. This contractor did concede that this technology could be beneficial on a bridge project with complex geometry. Based on interviews with four suppliers, the results showed that there is a variety of usage levels for 3D modeling. Two suppliers did not use any 3D modeling, one supplier was just starting to use some 3D modeling, and one structural steel supplier was moving toward doing all of its detailing in 3D. Based on these informal interviews, it seems that while 3D may provide some project participants some benefit, in general the response did not indicate that there was an immediate need for 3D modeling on DOT bridge projects. The exception to this may be for bridges that have usual details or complex geometry.

SUMMARY

During the second year of research, work focused on selecting and implementing a commercially available WPMS on multiple Iowa DOT bridge pilot projects. Completing the RFP process that was begun in the first year of research, Attolist LLC was selected to provide a WPMS for two Iowa DOT bridge construction projects. Researchers spent the first half of the research period

customizing and testing the Attolist solution for use on the pilot projects. During the second half of the research period, the solution was implemented on the first pilot project, the US 6 Broadway Viaduct Bridge in Council Bluffs.

Since implementing Attolist on the first pilot project, the solution has performed well. Initial performance measurements using preproject surveys showed that users generally accepted the solution and believed that that it could help improve the management of bridge construction projects. Some issues, however, did arise early in the implementation process. The ability to collaborate on submittals required improvement; however, this was easily resolved by using the existing messaging function within the solution. Additionally, users did not find the system as intuitive as they would have expected. Issues regarding the intuitiveness of the solution were dealt with on a case-by-case basis for the first pilot project. Prior to the start of the second pilot project, researchers should be prepared to adjust training and provide help sheets that will make the system more intuitive for project participants. Furthermore, researchers and developers should investigate workflows for documents within the system and make small changes to ensure they are compatible with Iowa DOT workflows.

Overall, Attolist has proved to be an improvement over the pilot project solutions that were initiated during the first year of research. Attolist has addressed early implementation issues and appears to be meeting the project management needs of the Iowa DOT. Such issues have been minor, and most project participants have anticipated the solution to be beneficial. An Iowa DOT engineer commented that so far on the Broadway Viaduct Project management of submittals and RFIs has required 10% of the effort required by the I-80 bridge project, which served as the impetus for this research project.

FUTURE RESEARCH

Research activities beyond the second year will be targeted to assist in the implementation of Attolist on the Iowa Falls Arch Bridge. Work will need to be completed to evaluate how some of the issues on the Broadway Viaduct Project can be addressed. Finally, work will be completed to continue to evaluate the performance of Attolist on all pilot projects.

Beyond continuing the current work, additional investigations about how web-based collaboration may benefit the Iowa DOT should be completed to evaluate how a WPMS can be used as a tool on smaller bridges, specifically those under $10 million construction budget where a commercial solution may not be economical. Furthermore, it would be beneficial to evaluate how a WPMS could be better incorporated into the full life cycle of a project from bidding to archiving and operation instead of ending electronic collaboration when construction is complete. Consideration should be given to sharing data with existing systems that handle finances, project scheduling, and construction field management. These improvements would encourage continual electronic collaboration throughout the life cycle of a transportation facility.

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APPENDIX A: POST-PROJECT SURVEY

Post-Project Survey
Iowa DOT Jackson 108 Project
US 52 over I.C.E. Railroad and Mill Creek

Please answer the following questions based on your experience with the Iowa DOT's FTP site and Google Groups Application on this project. Your answers are important in helping the Iowa DOT determine how to implementation web-based collaboration solutions in the future. Upon Completion please return this survey to Aaron Zutz, aczutz@iastate.edu.Thank you.

Participant Information:

1. What was your role on this project (please circle):

   Iowa DOT Employee   Consultant   Contractor   Supplier

2. Approximately how many times per month did you interface with either the FTP site or Google Groups site (please circle):

       Less than 5   5 to 10   More than 10

Project Website Experience:
Using similar Iowa DOT bridge projects as a baseline, please respond to the following statements by circling the most appropriate number where:
   1 = Strongly Disagree
   2 = Disagree
   3 = Neutral
   4 = Agree
   5 = Strongly Agree

1. The project website made the submittal process easier and more efficient for me.
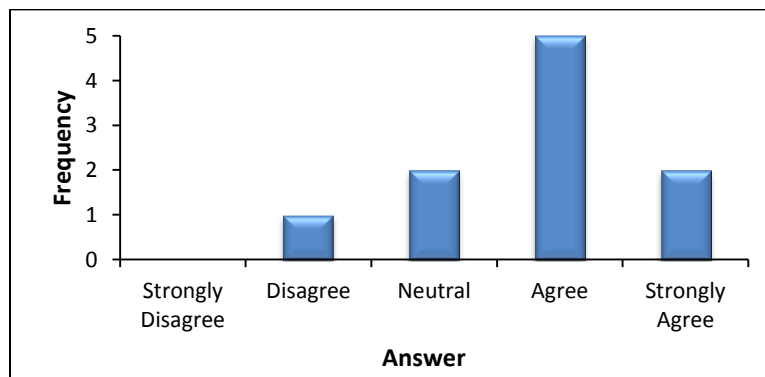
   1   2   3   4   5

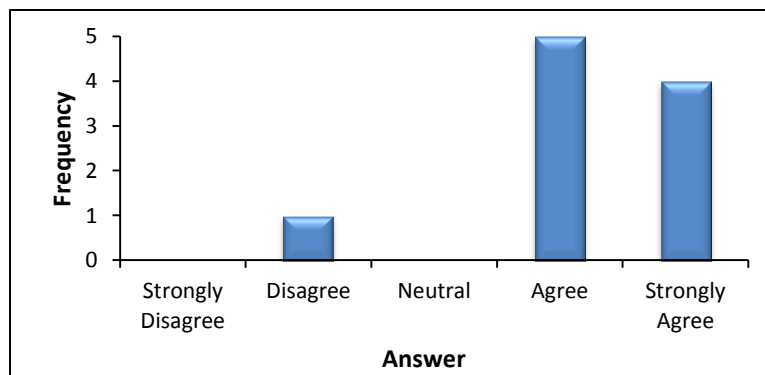2. The project website made the RFI process easier and more efficient for me.

   1   2   3   4   5
3. The project website made relevant project information more easily available.

   1   2   3   4   5
4. The project website increased accountability for project participants.

   1   2   3   4   5

5. The project website increased the transparency of document management.
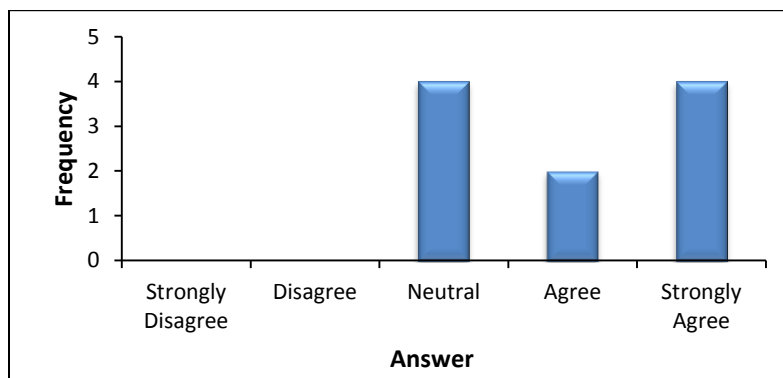
   1   2   3   4   5

6. The project website decreased the overall cost associated with document management and transmittal of documents.
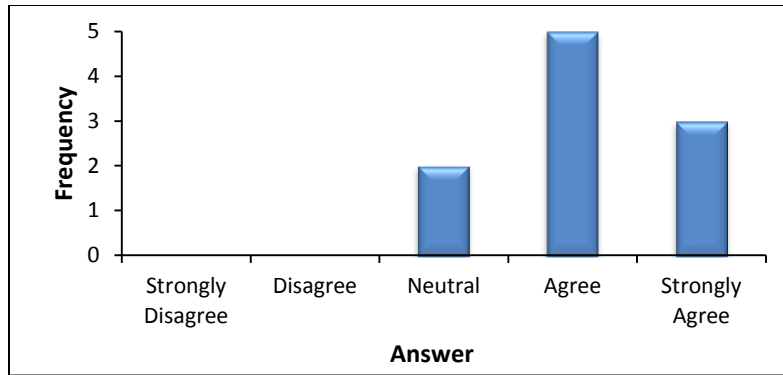
   1   2   3   4   5

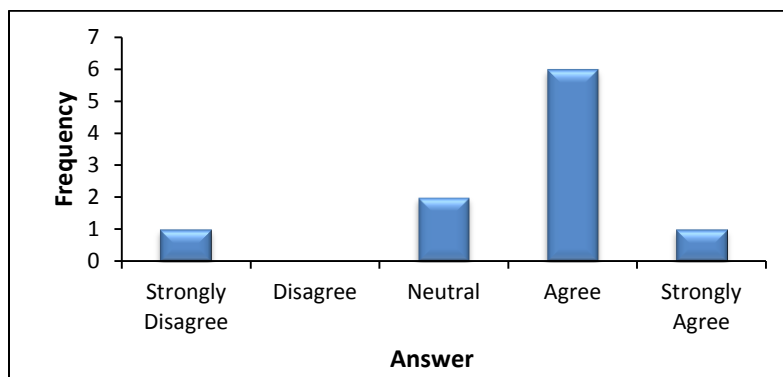7. The project website decreased the review time of documents

   1   2   3   4   5

8. The project website simplified my job on this project.

   1   2   3   4   5

9. I would recommend using this project website again on bridge projects.

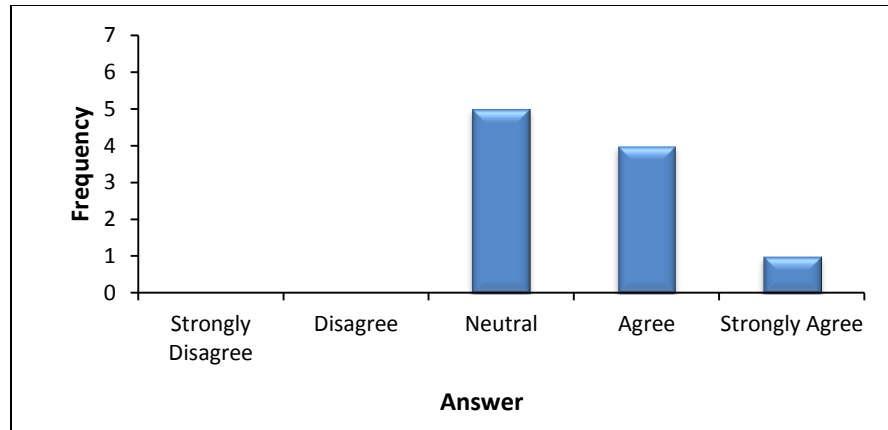   1   2   3   4

10. I would recommend using a more full featured project website to assist project participants in the future.

    1   2   3   4   5

11. I would recommend using a project website to assist project participants on projects that are

    Smaller   Same Size   Larger

<u>Please write in answers to the following questions:</u>
What has worked well with this system?
What could be improved on this system?
For future implementation, what needs to be changed?

APPENDIX B: POST-PROJECT SURVEY RESULTS
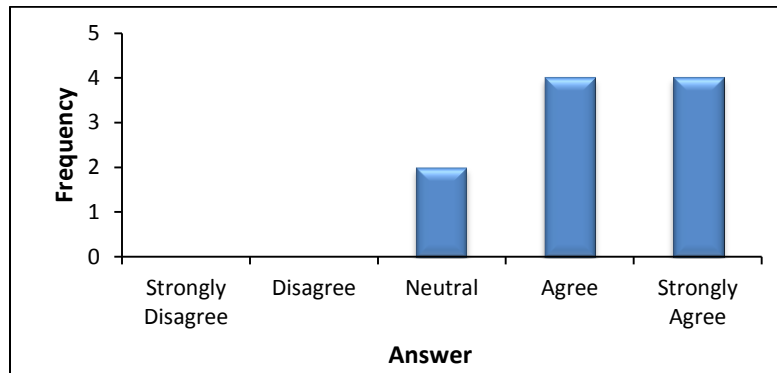
Figure 13. Statement 1: "The project website made the submittal process easier and more efficient for me."

Figure 14. Statement 2: "The project website made the RFI process easier and more efficient for me."

Figure 15. Statement 3: "The project website made the RFI process easier and more efficient for me."
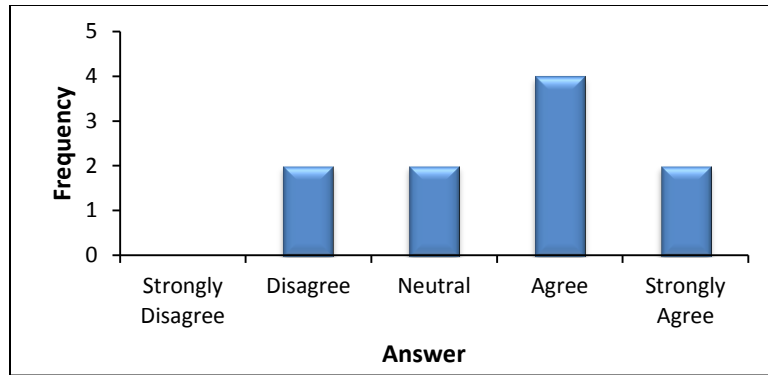
Figure 16. Statement 4: "The project website increased accountability for project participants."
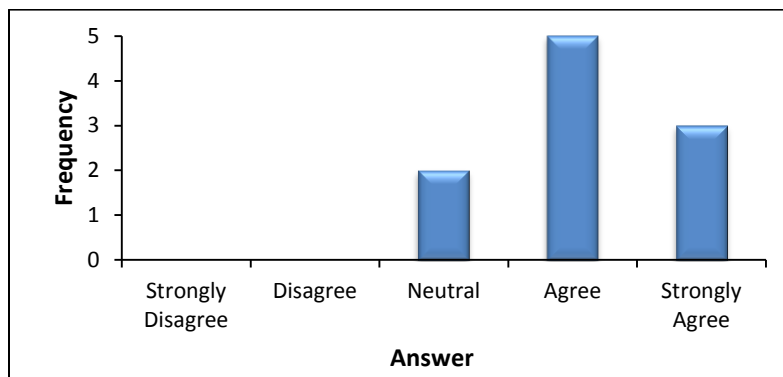
Figure 17. Statement 5: "The project website increased the transparency of document management."

Figure 18. Statement 6: "The project website decreased the overall cost associated with document management and transmittal of documents."

Figure 19. Statement 7: "The project website decreased the review time of documents."

Figure 20. Statement 8: "The project website simplified my job on this project."
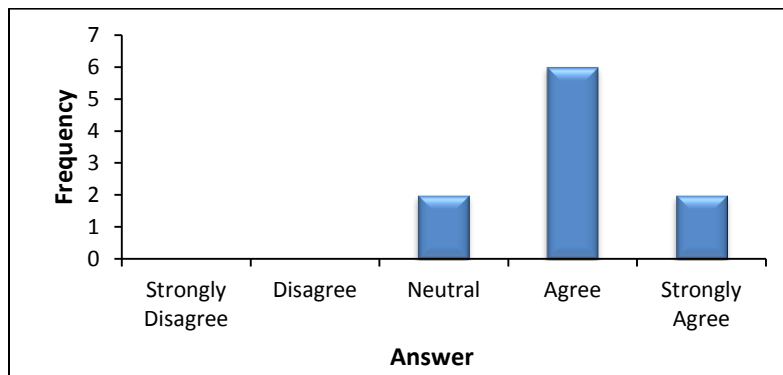
Figure 21. Statement 9: "I would recommend using this project website again on bridge projects."

Figure 22. Statement 10: "I would recommend using a more full-featured project website to assist project participants in the future."

Iowa Department of Transportation:

Attolist Quick Start Guide

Web-based Construction Collaboration for Iowa DOT Bridge Projects

System Navigation

Produced: December 2009

Iowa Department
of Transportation

IOWA STATE
UNIVERSITY

Table of Contents:

Additional help can be found by clicking the "Help" button in Attolist

Attolist Support can emailed at info@attolist.com or throught their website at attolist.com/contact/

General:

Attolist is being pilot tested on select Iowa DOT bridge projects to assist in the management of their construction. The primary role of attolist will be to assist project participants in the management of RFI's and shop drawing submittals. The site will also be used to manage contract documents and meeting minutes. By utlizing Attolist project participants will be able to electronically submit, review, and monitor construction documents.

User Requirements:

The Iowa DOT will providing user accounts for project participants. In order for participants to utilize the Attolist site they will need a computer with internet access and an email account. Use of the site will be contractually ditacted by the Special Contract Provision for Electronic Submittals. Inorder to get an account project participants can contact the Resident Contruction Engineer. The Attolist website can be accessed through the Iowa DOT webpage at:

http://www.iowadot.gov/bridge/ecpm.html

Navigation:

Upon logging into attolist a list of projects that the user is part of will be brought up. Individual project information can be accessed using the three tabs in the upper right hand corner of the screen. These tabs allow the user to access information on Project Management, Document Management, and Construction Administration. On the following pages flow charts are given to show what is contained in each area.

Project Management:

The Project Management tab is not expected to be used extensively. Meeting minutes will be posted on Attolist, however they will be under the Document Management tab. The headings listed in the chart below show up in Attolist in the left side bar. Not all of the categories will necessarily be used.

Project Management

Action Items	Meetings	Milestones	Message Forums
Team Categories	**Meeting Types**	**Project Phase**	**Message Categories**
	Pre-Bid Meetings	Bidding	General Messages
	Pre-Construction Meetings	Construction	Design Team Messages
	Weekly Progress Meetings		Phone Records
			Supplemental Reviews

Document Management:

The primary use of the Document Management tab will be for the contract documents. Developmental specifications and special provisions for the project will be listed under the appropriate headers in the Design Phase section. Construction documents will be listed under the Sheet-Spec Index. Additionally meeting minutes will be posted under Reports in the Construction Phase. The headings listed in the chart below show up in Attolist in the left side bar. Not all of the categories will necessarily be used.

Document Management

Design Phase	Construction Phase	Sheet Index	Spec Index	Shared Folders
Document Logs	**Document Logs**	Same side bar as "Construction Phase"	Same side bar as "Construction Phase"	CAD Files Construction Documents
IDOT References	Change Orders (COs)			Contractor Transfer*
Proposal	Potential Change Orders (PCOs)			Design Team Transfer*
Plans	Proposal Request (PRs)			DOT Team Transfer*
Addendums	Revisions (REVs)			
Special Provisions	Value Engineering (VE)			
Development Specs				* May not be applicable depending on User preferences
	Reports			
	Meeting Minutes			
Sheet-Spec Index	**Sheet-Spec Index**			
Sheet List	Sheet List			
Specifications List	Specifications List			

Construction Administration:

Construction Administration will be used to manage Submittals and RFI's. These documents will be created, reviewed, and stored in Attolist. There are separate quick start guides for both submittals and RFI's. The Iowa DOT will continue to use Field Manager for field reports, so this feature will not be used in Attolist. The headings listed in the chart below show up in Attolist in the left side bar.

Construction Administration

Submittals	RFIs	Field Reports
Submittal Logs	**RFI Logs**	**Field Report Logs**
Substitutions		**Non Conforming Items**
Submittal Schedule		

Iowa Department of Transportation:

Attolist Quick Start Guide

Web-based Construction Collaboration for Iowa DOT Bridge Projects

Requests For Information (RFI)

Produced: December 2009

Iowa Department of Transportation

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IOWA STATE UNIVERSITY

Table of Contents:

Additional help can be found by clicking the "Help" button in Attolist

Attolist Support can emailed at info@attolist.com or throught their website at attolist.com/contact/

Accessing RFIs:

The RFI dashboard can be accessed in Attolist by placing the mouse over the "Construction Administration" Tab in the upper right hand corner of the screen. A drop down menu will appear; the user should click on the "RFIs" option.

The RFI dashboard serves as the homepage for the management of RFIs in Attolist. Users can create new RFIs, review RFIs, forward RFIs, and view RFIs. The dashboard shown in the screenshot below lists the new RFIs with their statuses and also gives statistics on the management of RFIs. Using the buttons on sidebar to the right of the screen users can create and access RFIs.

RFIs can be accessed using the right sidebar and selecting the status of the RFI that the user is trying to access. Stored RFIs will have attachments with comments if applicable. When opening attachments it is important to click the "View Markups" Button. Clicking on the actual file will not show the markups. Individual RFIs will also show the history of the document.

US 6 Broadway Viaduct Bridge Replacement [demo] / RFI # 0014-00

View RFI

Official RFI Number	0014-00
Subcontractor RFI Number	
RFI Title	test 123454
Due Date	12/10/2009
Date Submitted	12/03/2009
Date Returned	12/03/2009
Question	Test
Suggestion	N/A
CSI Division or Drawing Number	N/A
Cost Impact	Not Applicable

Attachments

12/03/2009	Test (Report_9.pdf)	Project Admin (Prime Contractor) - Contractor 1

RFI History

12/03/2009 3:18 PM	Answered	Project Admin (Iowa DOT) - Aaron Zutz
12/03/2009 3:17 PM	Reopened	Project Admin (Iowa DOT) - Aaron Zutz
12/03/2009 3:17 PM	Answered	Project Admin (Iowa DOT) - Aaron Zutz
12/03/2009 3:11 PM	Forwarded	Project Admin (Prime Contractor) - Contractor 1

Answer History

12/03/2009	Project Admin (Iowa DOT) - Aaron Zutz
Test Answer	
(pending)	Project Admin (Prime Contractor) - Contractor 1

References

None

Revision History

12/03/2009	0014-00: test 123454

<u>Creating RFIs:</u>

To create a RFI begin by clicking the "Create new RFI" button on the top of the right side bar. Enter information in the fields of the form using the information below:

1. Official RFI Number: Use default number
2. Revision Number: Use default number
3. RFI Title: Enter appropriate name
4. Due Date: Selection applicable due date*
5. Question: Enter the question in this field
6. Suggestion: Enter in suggested answer if applicable
7. CSI Division or Drawing number: Enter affected Iowa DOT specifications section number
8. Cost Impact: This field is not used
9. Add Attachments: If attachments are necessary type in an appropriate name and select file to upload using the "Browse" button and select the appropriate pdf file to upload

*Note: It is the responsibility of the party submitting RFIs to understand requirements for response timelines.

US 6 Broadway Viaduct Bridge Replacement [demo]

Add A New Submittal

Submittal Number*	[ ] - [ ]
	(Spec Section - Number)
Submittal Title* (Note: 100 characters max)	[ ]
Number of Copies*	N/A - PDF ▾
Date Received/Sent*	12/03/2009
Requested Due Date*	12/24/2009 ▦ mm/dd/yyyy
Submittal Type*	☐ Shop Drawings ☐ Product Data
	☐ Samples ☐ Test Data
	☐ Certifications ☐ Schedules
	☐ Mix Designs ☐ Calculations
	☐ Mock-up ☐ Other
Trade	[▾]
Category	[▾]
Substitution	[▾]
Subcontractor/Manufacturer	[ ]
Contractor Transmittal Number	[ ]

10. References: Use this to link a RFI to other related documents in Attolist
11. Forward RFI: Select team members to send the RFI to. For contractors this will be the Resident Construction Engineer.

References

Construction Phase Docs	LINK	None
Design Phase Docs	LINK	None
Sheets	LINK	None
Specifications	LINK	None
Reports	LINK	None
Submittals	LINK	None
RFIs	LINK	None
Field Reports	LINK	None
Meeting Minutes	LINK	None
Messages	LINK	None

Revision History

None

Forward RFI

Choose Recipient

- ○ Scott Baldermann / attolist
- ○ Chuck Jahren / Iowa State University
- ○ James Nelson / Iowa DOT
- ○ Cherice Ogg / Iowa DOT
- ○ Kim Powell /
- ○ James RCE / Iowa DOT
- ○ Aaron Zutz / Iowa State University

Save Draft   Send

Reviewing RFIs:

When opening a RFI to answer it the user can either "Forward" or "Return" the RFI. For users wishing to forward a RFI, after clicking the "Forward" button they will be taken to a screen where they will be able select who they wish to forward the RFI to and also include any notes in the "Pending Answer" section of the screen. The RFI will be forwarded when the user clicks the "Forward" button. Instructions for reviewing RFIs are on the next page.

US 6 Broadway Viaduct Bridge Replacement [demo] / RFI # 0014-00

View RFI

Official RFI Number	0014-00
Subcontractor RFI Number	
RFI Title	test 123454
Due Date	12/10/2009
Date Submitted	12/03/2009
Date Returned	open
Question	Test
Suggestion	N/A
CSI Division or Drawing Number	N/A
Cost Impact	Not Applicable

Attachments

12/03/2009   Test (Report_9.pdf)   [+ ADD MARKUPS]   Project Admin (Prime Contractor) - Contractor 1

RFI History

12/03/2009 3:11 PM   Forwarded   Project Admin (Prime Contractor) - Contractor 1

Answer History

(pending)   Project Admin (Iowa DOT) - Aaron Zutz

References

None

Revision History

12/03/2009   0014-00: test 123454

[Delete RFI]   [Forward RFI]   [Return RFI]   [Print RFI]   [Edit RFI]

To return a RFI begin by clicking the "Return" button. On the next screen enter information in the fields of the form using the information below:

1. Resident Construction Engineer: Enter answer to RFI in this space

2. Attachments: To markup up the drawing click the "add markups" button. A pop-up window will appear with a pdf of the file. The file should be marked up in this window. The software allows users to insert stamps electronically. This can be done using the "Raster Image" button on the left sidebar. When the mark ups are complete the user should save them using the "Save Markups" button in the upper left hand corner of the screen.

3. Add Attachments: If any additional attachments are necessary type in an appropriate name and select file to upload using the "Browse" button and select the appropriate pdf file to upload

4. References: Use this to link a RFI to other related documents in Attolist

5. Returning the document: Use the "Return" button to send the response to the person who originally submitted the document. Use the "Return with Notifications" to select other teams members to be notified by email of the response.

Return RFI

RFI Number	0013-00
RFI Title	Test 1243
Official Due Date	12/10/2009
Question	Test
Suggestion	N/A
Resident Construction Engineer Answer	

2,000 character limit

CSI division or drawing number	N/A
Return to Project Admin (Prime Contractor)	Contractor 1

Save Draft	Return / Close	Return With Notification

Attachments

None

Add Attachments

Upload file types jpg or pdf. Maximum file size is 50MB per attachment.

Title:		File:		Browse...
Title:		File:		Browse...
Title:		File:		Browse...
Title:		File:		Browse...

Iowa Department of Transportation:

Attolist Quick Start Guide

Web-based Construction Collaboration for Iowa DOT Bridge Projects

Shop Drawing Submittals

Produced: December 2009

Table of Contents:

Additional help can be found by clicking the "Help" button in Attolist

Attolist Support can emailed at info@attolist.com or throught their website at attolist.com/contact/

Accessing Submittals:

The submittal dashboard can be accessed in Attolist by placing the mouse over the "Construction Administration" tab in the upper right hand corner of the screen. A drop down menu will appear; the user should click on the "Submittals" option.

The submittal dashboard serves as the homepage for the management of submittals in Attolist. Users can create new submittals, review submittals, forward submittals, and view submittals. The dashboard shown in the screenshot below lists the open submittals with their statuses and also gives statistics on the management of submittals. Using the buttons on sidebar to the right of the screen users can create and access submittals.

Viewing Submittals:

Submittals can be accessed using the right sidebar and selecting the status of the submittal that the user is trying to access. Stored submittals will have attachments with comments if applicable. When opening attachments it is important to click the "View Markups" Button. Clicking on the actual file will not show the markups. Individual submittals will also show the history of the document.

Creating Submittals:

To create a submittal begin by clicking the create submittal button on the top of the right side bar. Enter information in the fields of the form using the information below:

12. Submittal Number: Enter applicable Iowa DOT specifications section number
13. Submittal Name: Enter appropriate name
14. Number of Copies: Leave as default setting (N/A – PDF)
15. Requested Due Date: Selection applicable due date*
16. Submittal Type: Check most appropriate box
17. Trade Group: Select the Iowa DOT office or document type most appropriate based on the submittal. This will determine who the submittal is sent to for review.
18. Category: If a choice from the drop down menu is applicable select it. This information will be used to supplement the "Submittal Type"
19. Substitution: Select the appropriate option
20. Subcontractor/ Manufacturer: Enter name if applicable
21. Contractor Transmittal Number: This field can be left blank

*Note: It is the responsibility of the party submitting documents to understand requirements for review timelines.

US 6 Broadway Viaduct Bridge Replacement [demo]

Add A New Submittal

Submittal Number*	[____] - [_____] *(Spec Section - Number)*
Submittal Title* *(Note: 100 characters max)*	[_____]
Number of Copies*	N/A - PDF ▾
Date Received/Sent*	12/03/2009
Requested Due Date*	12/24/2009 ▦ mm/dd/yyyy
Submittal Type*	☐ Shop Drawings ☐ Product Data
	☐ Samples ☐ Test Data
	☐ Certifications ☐ Schedules
	☐ Mix Designs ☐ Calculations
	☐ Mock-up ☐ Other
Trade	[_____ ▾]
Category	[_____ ▾]
Substitution	[_____ ▾]
Subcontractor/Manufacturer	[_____]
Contractor Transmittal Number	[_____]

22. References: Use this to link a submittal to other related documents in Attolist
23. Review Comments: This section should be left blank
24. Add Attachment: Type in an appropriate file name and select the file to upload using the "Browse" button locate the appropriate pdf file to upload

References

Construction Phase Docs	LINK	None
Design Phase Docs	LINK	None
Sheets	LINK	None
Specifications	LINK	None
Reports	LINK	None
Submittals	LINK	None
RFIs	LINK	None
Field Reports	LINK	None
Meeting Minutes	LINK	None
Messages	LINK	None

Review Comments

Review comments provided by the design team are hidden from the construction team when the submittal is "open". Review comments provided by the construction team are visible when the submittal is "open" or "returned". Review comments do not appear on transmittals.

Note: 1000 characters max.

Add Attachments

Upload file types jpg or pdf. Maximum file size is 50MB per attachment.

Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...

25. Submittal Schedule: This feature is not used
26. Notifications: Individual People can be selected to receive the submittal. If a trade group has been selected it is unnecessary to select anyone here.
27. To Finish: Click "Send", members of the trade group and/or people under "Notifications" selected will receive email notifications for the submittal.

Submittal Schedule

Link Submittal to Schedule Item. Please disable pop-up blocker for attolist.com

Schedule Items: None

Notify Architect by Email

○ Scott Baldermann attolist

○ Chuck Jahren Iowa State University

○ James Nelson Iowa DOT

○ Cherice Ogg Iowa DOT

○ Kim Powell

○ James RCE Iowa DOT

○ Aaron Zutz Iowa State University

| Save Draft | Send | Cancel |

Reviewing Submittals:

When opening a submittal to review it the reviewer can either "Forward" or "Return" the submittal. For users wishing to forward a submittal, after clicking the "Forward" button they will be taken to a screen where they will be able select who they wish to forward the submittal to and also include any notes in the "Transmittal Notes" section of the screen. The submittal will be forwarded when the user clicks the "Save" button. Instructions for reviewing submittals are on the next page.

US 6 Broadway Viaduct Bridge Replacement [demo]

View Submittal

Submittal

Submittal Number	1234-12
Submittal Title	Test 1243
Submittal Status	Open
Number of Copies Received	N/A - PDF
Date Received	12/03/2009
Submittal Type	Shop Drawings
Link to Submittal Schedule	[none]
Requested Due Date	12/24/2009
Trade	
Category	
Substitution	No
Substitution Accepted	No
Subcontractor/Manufacturer	
Transmittal Number	
Internal Archiving Number	
Submittal Notes	
Review Status	
Reviewed By	
Number of Copies Returned	0

[Edit] [Delete] [Forward] [Return] [Print]

Attachments

12/03/2009	Test (Report_9.pdf)	⊕ ADD MARKUPS	*Project Admin (Prime Contractor) - Contractor 1*

Submittal History

12/03/2009 10:07 AM	Forwarded	*Project Admin (Prime Contractor) - Contractor 1*
12/03/2009 10:07 AM	Added	*Project Admin (Prime Contractor) - Contractor 1*

Transmittal History

	Sent	Returned	Printable
Aaron Zutz / Iowa State University	12/03/2009	Auto-generated	🗎

Review History

12/03/2009	*Prime Contractor - Contractor 1*
(pending)	*Resident Construction Engineer - Aaron Zutz*

References

To return a submittal begin by clicking the "Return" button. On the next screen enter information in the fields of the form using the information below:

6. Review Status: Select one of the four standard Iowa DOT options: "No exceptions taken", "Furnish as Noted", "Revise and Resubmit", or "Rejected"
7. Reviewed By: Enter name of Reviewer
8. Number of Copies Returned: Leave as Default (1)
9. Date of Return: Use default date (Today's Date)
10. Trade Group: Select Iowa DOT office or document type most applicable. This will determine who the returned submittal will go to.
11. Category: If a choice from the drop down menu is applicable select it. This information will be used to supplement the "Submittal Type"
12. Substitution: Select the appropriate option
13. Substitution Accepted: Select the most appropriate option only if this submittal is a substitution
14. Submittal Notes: This section is not used
15. Attachments: To markup up a file click the "add markups" button. A pop-up window will appear with a pdf of the file. The file should be marked up in this window. The software allows users to insert stamps electronically. This can be done using the "Raster Image" button on the left side bar. When the mark ups are complete the user should save them using the "Save Markups" button in the upper left hand corner of the screen.

16. References: Use this to link a submittals to other related documents in Attolist
17. Add Attachments: If any additional attachments are necessary type in an appropriate name and select file to upload using the "Browse" button and select the appropriate pdf file to upload
18. Review Comments: Insert comments here that are not included in the marked up submittal.
19. Returning the document: Use the "Return" button to send the response to the person who originally submitted the document. Use the "Return with Notifications" to select other team members to be notified by email of the response.

_____ Contractor) - Contractor 1

References

Construction Phase Docs	LINK	None
Design Phase Docs	LINK	None
Sheets	LINK	None
Specifications	LINK	None
Reports	LINK	None
Submittals	LINK	None
RFIs	LINK	None
Field Reports	LINK	None
Meeting Minutes	LINK	None
Messages	LINK	None

Add Attachments

Upload file types jpg or pdf. Maximum file size is 50MB per attachment.

Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...
Title:	File:	Browse...

Review History   Hide Comments

| 12/03/2009 | Prime Contractor - Contractor 1 | ☐ |
| (pending) | Resident Construction Engineer - Aaron Zutz | |

Review Comments

Review comments provided by the design team are hidden from the construction team when the submittal is "open". Review comments provided by the construction team are visible when the submittal is "open" or "returned". Review comments do not appear on transmittals.

Note: 1000 characters max.

[Return]   [Return With Notification]   [Cancel]

APPENDIX F: ATTOLIST PRE-PROJECT SURVEY

Attolist Pre-Project Survey
Broadway Viaduct & Iowa Falls Arch Bridge

Please answer the following questions based on your current experience and knowledge of web-based project management and its use by the Iowa DOT. Your answers are important in helping the Iowa DOT measure the benefits of using web-based project management on bridge construction projects. Upon completion please return this survey to Aaron Zutz, aczutz@iastate.edu. Thank you.

Participant Information:

3. What is your role on this project (please circle):

   Iowa DOT Employee   Consultant   Contractor   Supplier

4. Approximately how many times per month do you expect you will need to interface with the web-based project management site?

   Less than 10   10 to 20   More than 20

Project Website Experience:
Based on your knowledge of web-based project management and prior experience with Iowa DOT bridge projects, please respond to the following statements by circling the most appropriate response

12. For my work, I expect web-based project management will make the submittal process_____.

    More Difficult   No Effect   Easier

13. For my work, I expect web-based project management to make the RFI process_____.

    More Difficult   No Effect   Easier

14. For my work, Web-based project management will make relevant project information_____.

    Less Available   No Effect   More Available

15. Utilization of Web-based project management will result in _____ in accountability for project participants.

   A Decrease   No Effect   An Increase

16. Utilization of Web-based project management website will result in _____in the transparency of document management.

   A Decrease   No Effect   An Increase

17. Utilization of Web-based project management will result in _____in the overall cost associated with document management and transmittal of documents.

   A Decrease   No Effect   An Increase

18. Web-based project management will make my job _____.

   Harder   No Effect   Easier

19. Learning to use this web-based project management system will be_____.

   Not Worth the Benefits   Neutral   Worth the Benefits

20. The computer and internet requirements for this system are _____.

   Unreasonable   Neutral   Reasonable

21. Based on my current knowledge and experience web-based project management has the potential to _____ project management on other Iowa DOT bridge projects.

   Worsen   No Effect   Improve

22. I would recommend using web-based project management to assist project participants on projects that are _____ than Broadway Viaduct.

   Smaller   The Same Size   Larger

Please write in answers to the following questions:
What do you expect to be the primary benefits from using web-based project management?

What are your biggest concerns with web-based project management and its use on this project?

Was there anything you want the system to do that it could not do?

What parts of the system did you find or expect to be hard to learn and use?
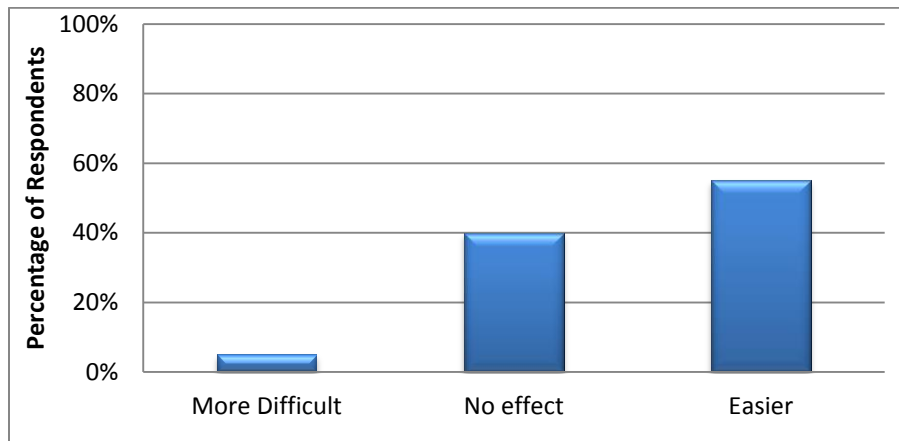
APPENDIX G: PRE-ATTOLIST PROJECT SURVEY RESULTS

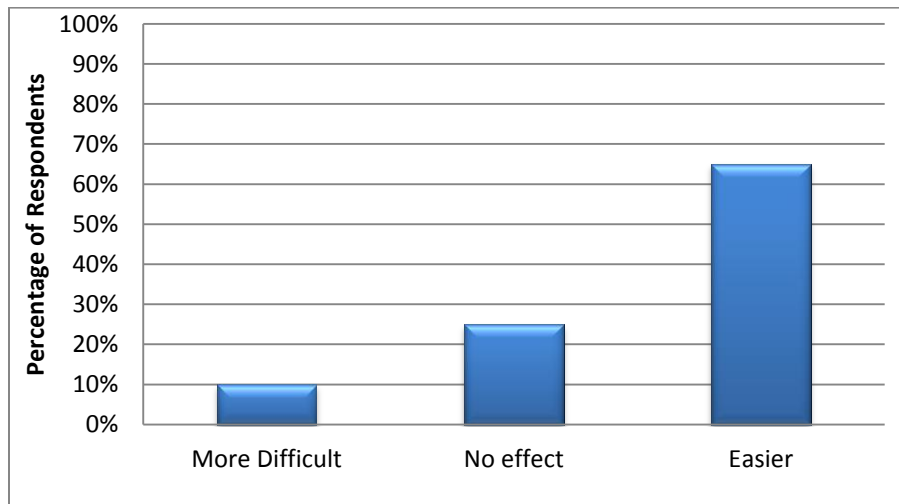

Figure 23. Anticipated submittal process effect

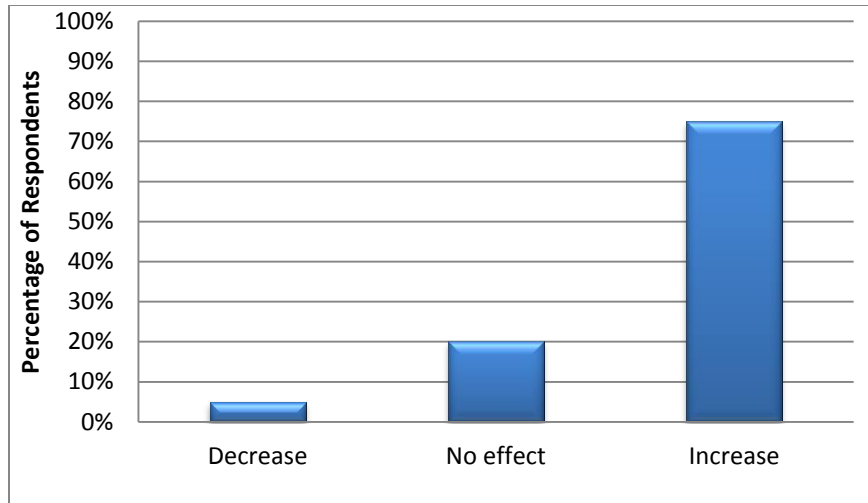**Figure 24. Anticipated RFI process effect**

Figure 25. Anticipated impact on project information availability
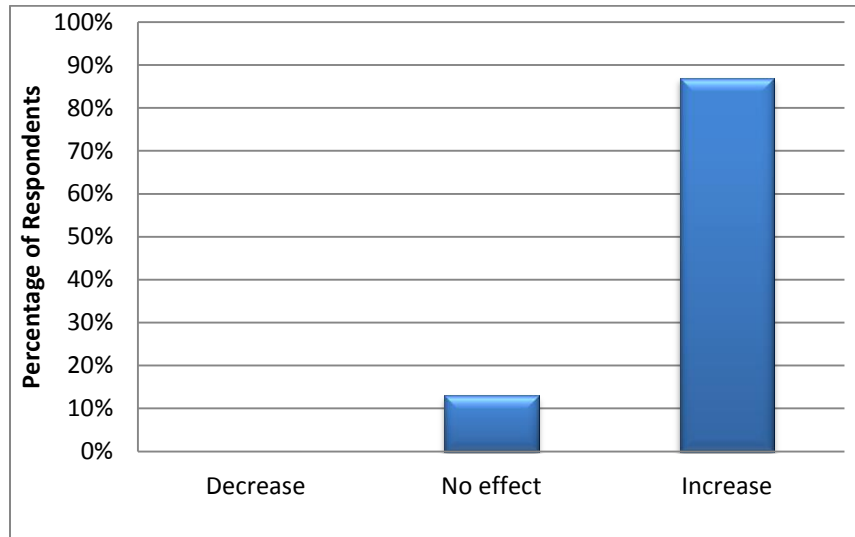

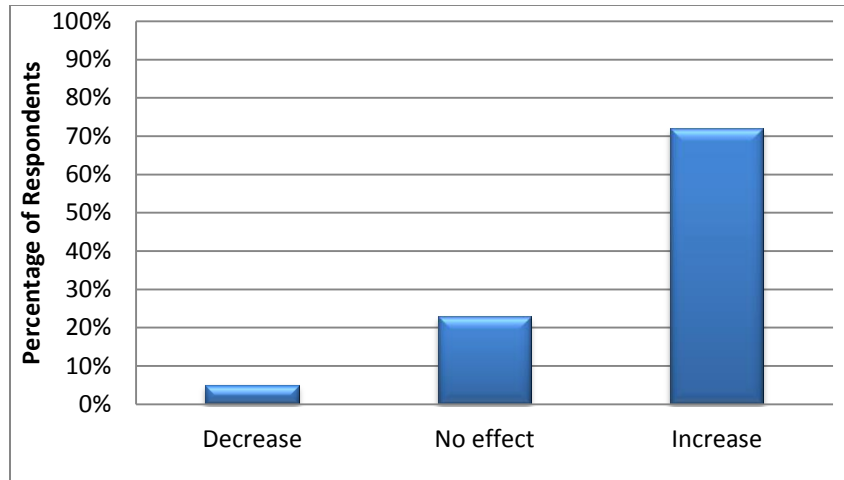**Figure 26. Anticipated impact on accountability**

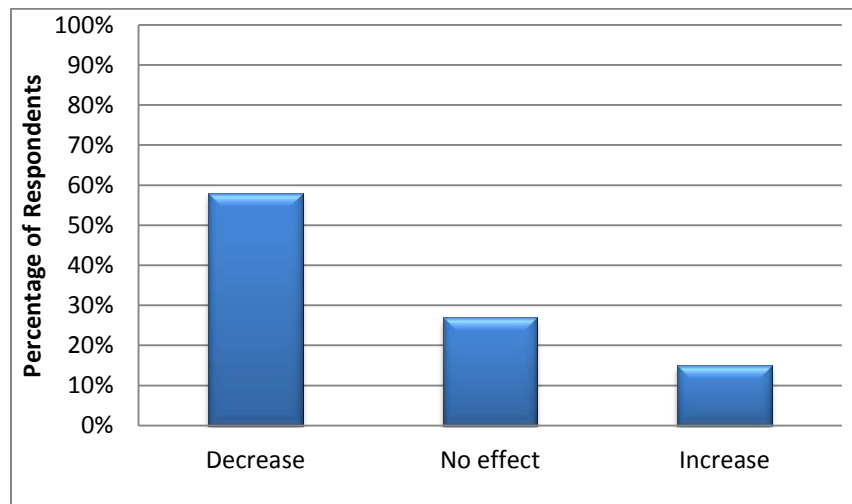**Figure 27. Anticipated impact on document management transparency**

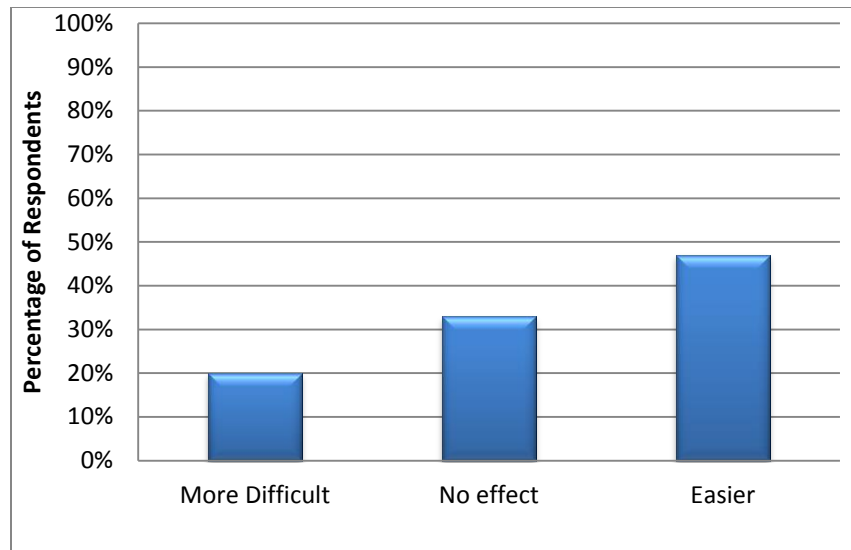**Figure 28. Anticipated impact on document management cost**

Figure 29. Anticipated impact on project role

APPENDIX H: SPECIAL CONTRACT PROVISION ISSUED FOR THE BROADWAY VIADUCT PROJECT

Iowa Department of Transportation

SPECIAL PROVISIONS

FOR

ELECTRONIC SUBMITTALS

Pottawattamie County
BRF-006-1(113)--38-78

Effective Date
February 16, 2010

THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

090037.01 GENERAL.
This special provision covers the submittal of electronic shop drawings, working drawings, all written project correspondence, other submittals as required by the contract documents, and requests for information (RFI).

In order to assist participants in the management of documents and also to improve communication, transparency, accountability, and the review time of the aforementioned documents, a document management website will be used for this project. This website will handle the submission, management, and approval of submittals and RFIs.

The website will require that participants have an internet browser and an email account. For optimum use, a broadband internet connection is recommended. The Iowa DOT will provide and maintain the project website. The Contractors will be responsible for accessing the website to comply with the special provision. It is anticipated that little to no formal training will be required for users. A brief introduction to the website and its primary functions will be conducted at the project preconstruction meeting. Additional information regarding website support, training, and operation will be provided at that time.

090037.02 PURPOSE AND USE.
The primary purpose of the project website is to facilitate the electronic submittal process. Additionally the project website will manage RFIs, contract documents, and meeting minutes. The functionality of the website will allow project participants to upload submittals to the website for review. Review of documents will occur on the website and project participants will be notified of the results of the review via the website or an email from the website. The capabilities of the website will allow participants to track the progress of submittals and view their history until performance of the Contract is complete. Additional functions of the website may be used at the Contracting Authority's discretion.
A website URL will be supplied to the contractor at the preconstruction conference for the electronic submittals. The Contractor may request the URL from the Engineer prior to the preconstruction conference. Shop drawings, working drawings, other submittals as required by the contract documents, and RFIs must be submitted, reviewed, and distributed through this website. Exceptions may be made

on a case by case basis by the Engineer. In the case of an emergency where the timeframe of a review does not allow it to be processed through the project website the creator of the document will be required to retroactively document the submission and approval process on the project website. Participants are expected to interface with the website on a regular basis to ensure they are aware of current information thereon.

Submittals are to be submitted in Adobe Acrobat PDF format sized to print 11 inch x 17 inch or 8.5 inch x 11 inch. It is the responsibility of the party uploading each submittal to ensure that it is legible. A minimum resolution of 300 dpi is recommended. Shop drawings submittals requiring the Engineer's review stamp must contain white space sized 3 inch horizontally by 2.5 inch vertically for the stamp and shall be located in the same spot on each page in a given submittal.

Submittal schedule and review period shall follow Article 1105.03 of the Standard Specifications. Submittals without a defined review period in the Standard Specifications shall be 30 calendar days.

No confidential information shall be placed on the website. All information residing on the website will be the property of the Iowa DOT. The Contracting Authority reserves the right to revoke access to the website for unauthorized or inappropriate use and dissemination of user passwords.

090037.03 METHOD OF MEASUREMENT AND BASIS OF PAYMENT
All costs for complying with this special provision shall be considered incidental to the project. No separate payment will be made.