PCS- Sign Off Page for Phase 2 - Business Requirements

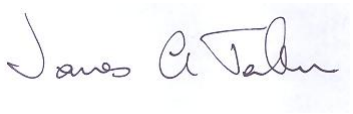
Project Name: 0093-0164

Date: 05/29/09

Attached Forms	Check Mark if Attached	Comments
Functional Requirements Document	**X**	
Project Plan	**X**	
Solutions Options Paper (FileNet vs. ProjectWise)	**X**	
Risk Assessment	**X**	
Cost Benefit Analysis	**X**	
Engineering Business Requirements	**X**	
FHWA Approved Research Report	**X**	
Proof of Concept Evaluation	**X**	
Options Paper (CTDOT Hosting vs. Vendor Hosting)	**X**	

Approval to Proceed to Phase III: Design

Executive Sponsor: James Fallon
Signature:



Office Phone Number: (860)594-2975

Agency Technology Manager: Jose Romero
Signature:

Jose Romero

Digitally signed by Jose Romero
DN: cn=Jose Romero, o=DOT - Office of Information Systems, ou, email=jose.romero@po.state.ct.us, c=US
Date: 2009.06.12 09:50:54 -04'00'

Office Phone Number: (860)594-3512

Agency Business Manager: William Pratt
Signature:

Office Phone Number: (860)594-3320

State of Connecticut

(CTDOT/Bureau of Engineering and Highway Operations)

Functional Requirements Document

(Engineering Content management system - ECMS)

Federal SPR (Research) project 0093-0164

(6/5/08)

Executive Sponsor	Mike Lonergan
Business Manager	William Pratt
IT Manager	Charles Dew

Required Form IV-5
Distributed 12.20.07

Project Summary

The overall objective is to develop a digital design environment to utilize and evaluate electronic data systems to improve the efficiency and effectiveness of ConnDOT's project-delivery workflow by streamlining and improving workflow in the design process. This development project will be geared to reduce the time needed to access plan archives; to provide for the submission and review of engineering documents and drawings; and to benchmark current paper workflow processes and the newly installed digital design environment (encompassing electronic document generation, management, signatures, project advertisement and support services). The result will be to demonstrate the cost-effectiveness of a secure, efficient, standardized project design platform that helps reduce project costs, decreases project development times, and provides both accountability and storage for project documents.

Part 1. "As Is" analysis of current system: *document existing work flow and data flow. Include work flow and data flow diagrams as necessary.*

A. Current Process:

Currently, the Connecticut Department of Transportation (ConnDOT) does not have a clear mechanism in place to store and obtain electronic Computer Aided Design (CAD) data and general project data (correspondence and other data) that have been paid for under professional consulting services. Electronic data from large corridor projects have been lost and data are typically not conforming to standards because deliverables are only on paper. Past CAD policies did not address the standardization and delivery of electronic data. Consulting services handles a majority of project designs for ConnDOT. Today's advances in digital technologies offer many opportunities to improve the long-established process used within ConnDOT. Examples of present conditions and issues follow:

- Professional consulting services develop the majority of contracts developed by ConnDOT. In the past, ConnDOT never stressed the importance of standardizing CAD designs, and organizing the electronic data for both internal design and consultant services together. Furthermore, there has never been a cost effective delivery process to obtain the electronic data that the State of Connecticut and Federal Government pays for. Advances in operational efficiency and project delivery are not possible without improvements in these areas;

- The reproduction of engineering drawings and documents is one of ConnDOT's most costly workflow processes. This is required for both design review and delivery of engineering drawings and documents for contractors to prepare project bid proposals. To improve this process and reduce reproduction costs, ConnDOT needs to begin developing the necessary applications that will allow in-house engineers and consultant engineers to deliver a common (standardized) design package (plans, specs and estimates) in electronic format;

- Mylar contract drawings, manually-signed, are not indestructible and can be modified. Mylars can be edited, copied and scanned, and the ConnDOT Mylar

storage area is not under high security. Electronic document technologies (PDF) are available that can foster a more secure environment for contract drawing usage; and

- Digital signatures (currently piloted) are required to accomplish the above and there is a need to reduce operational costs and to improve quality, by providing documents in intelligent (searchable) PDF format throughout the entire design development process. Digital signatures will enable compliance with both Governor Rell's Executive Order #3 and Federal ADA Laws since the documents would be generated from their source applications rather than from scanning processes.

- The existing design development process is heavily dependent on paper. Typically, design submittals (Preliminary Design, Semi-Final, Final etc) require 18 sets of paper plans and corresponding design reports. Furthermore, at times project data and critical correspondence are lost and/or not taken into consideration as a project progresses from design through construction.

- Electronic data for projects are currently stored in "Silos of Data", i.e. multiple discipline divided network drives or on user's local machines. This process leads to a loss of project data confluence and inefficiency throughout the entire project development process and into construction. ConnDOT's Engineering Application's Section has started to migrate to a project container environment using existing network server infrastructure; however, a more robust engineering content management system and network infrastructure is needed.

- There is a need at ConnDOT to keep all project related data together for all disciplines throughout the entire project lifecycle using an integrated engineering content-management system that enables project teams, their information and their tools to work together as one.

A. Current Roles and Responsibilities (Hyperlinks provided to existing CTDOT Webpages):

a. Project Planning

i. *Intermodal and Environmental*

b. *Infrastructure Design Production and Support*

i. *State Design*
   1. *Project Development*
   2. *Highway Design*
   3. *Facilities Design*
   4. *Structure Design*

ii. *Traffic Engineering*

iii. *Consultant Design*

iv. *Design Services*
   1. *Soils and Foundations*
   2. *Contract Development*

3. *Hydraulics and Drainage*
4. *Utilities*
5. *Bridge Safety*
6. *Environmental*

v. *Environmental Planning*

vi. *Engineering Applications*

c. Infrastructure Construction

i. *Construction Main Office*

ii. *Construction District Offices*

1. *District 1*
2. *District 2*
3. *District 3*
4. *District 4*

d. *Office of Information System (Support Function for Both Engineering and Construction)*

1. *OIS Business Systems*
2. *OIS Eng. Support*
3. *OIS PC Support*

B. Current Functions: *The following link provides information as to the existing cursory processes in the project development process:*

Existing Process Flow Chart.

Part 2. "To Be" analysis of current system: *document all desired procedures, roles and responsibilities, and functions. Refer to the SDM manual for additional information.*

A. Required operational functions:

- Usability - *The Department's Engineering Applications Business Unit has developed an Engineering Business Requirements document that details the intended usability and workflow "by" Engineering Discipline. A link to that document can be found here:*
  - *Engineering Business Requirements*
- Audit trail - *Detailed audit trail functions are described in the Engineer Business Requirements Document.*
  - *Engineering Business Requirements - Page 19*
- Reliability - *The proposed ECMS must be 100% reliable, since it associated with the design and development of Transportation Infrastructure Improvements. If the system is down, employee productivity is down. The proposed system does not pose any health and safety issues if it goes down and no revenues will be lost.*
- Recoverability - *In the event that the system (database and application) goes down, the system must be up and running in a minimum of two hours after a failure is detected. Preferably, a system design should consider a back-up that will initiate immediately upon system failure notification. If the process site (hardware, data, and onsite backup) is destroyed, the application must be restored within one business day.*
- System availability - *The system must be in operation 7 days a week 24 hours a day.*
- Fault tolerance - *It would be desirable if users can still work locally on documents if the system goes down.*
- Performance –
  - *Response time for queries: Should be within 10 seconds.*
  - *Maximum file size uploads time: should be 1 minute for DOT internal, and 30 minutes for external web access.*
  - *Expected volume of data (See Table 1 Below):*
  - *Expected volume of user activity: Refer to the Engineering Business Requirements - Appendix D*

Table 1

Engineering Content Management System - Preliminary Capacity Analysis

Potential Active Data (100 Projects Per Year Full Production) **Prelim. Calculation:**
1,000 Documents Per Project – Max. Ten Years 1,000,000 10 Gigs Per Project Avg. X 100 Projs. X 10 years **10,000 Gigabytes = 10 Terabytes (Can be phased in, since full production of 100 projects/year will not occur until approx. 3 years after the production implementation)**

Potential Legacy Data - 600,000 Construction Plans **Prelim. Calculation:**
100years x 100 Projects Per Year = 10,000 Potential PDF Project Files (documents) 500kb per sheet scanned X 600,000 = 300,000,000kb **300,000,000kb = .3 Terabytes** **Expansion = .3 Terabytes**

Potential Bridge Safety Data - 6000 Bridges **Prelim. Calculation:**
50 documents per bridge X 6000 = 300,000 potential documents. 300,000 documents X 20mb per file = 6,000,000mb **6,000,000mb = .005 Terabytes** **Expansion = .005 Terabytes**

Potential Traffic Intersection Data - 5000 Intersections **Prelim. Calculation:**
100 documents per intersection X 5000 = 500,000 potential documents 500,000 documents X 5mb per file = 2,500,0000mb **2,500,000mb = .002 Terabytes** **Expansion = .002 Terabytes**

Preliminary Estimate Total : 11 Terabytes

- Capacity – *See Table 1 above.*
- Data retention – *Data must be retained for the life of the infrastructure being constructed specifically for the future uses for maintaining infrastructure. A safe assumption would be for a minimum of 40 years. For those projects that do not get constructed and have gone through a planning stage, a minimum of 15 years of data retention would be acceptable.*
- Work flow – *Detailed workflow and procedural documentation can be found at www.ct.gov/dot/digitaldesign . In the future, the DDE Manual (http://www.ct.gov/dot/lib/dot/documents/deng/CTDOT_DDE_Guide.pdf) will be revised to include more specific uses of the ECMS. Workflow is*

also presented in the following charts:

- *Proposed Process and Flow Chart*

- Americans with Disabilities – *Not applicable at this time. The proposed system interfaces will be ADA compliant for both internal and external customers. PDF Engineering Drawings (not presented to the public) are difficult to make ADA Accessible.*

- Security –*DOIT's proposal to have CTDOT's external customers use RSA FOB Keys will not work. The following documents outline the discussion and justification for an alternative solution:*

  - *Engineering Business Requirements – Page 6 (Design Submissions and Review)*

  - *Engineering Business Requirements – Appendix F*

B. Required data functions:

- Data currency - *The proposed Engineering Content Management System must be able to access data of various dates and ages. Data is kept current by end-users updating the database (with files) and is workflow and production dependent. The proposed system's integration with existing department databases must operate in a way that automatically updates attribute data based on changes to the existing databases. (i.e. If the CORE project costing system is updated, the ECMS must have the ability to automatically "read in" the imported data updates). This is a one way scenario. We do not expect to the ECMS to update other existing Department databases. Please refer to the Engineering Business Requirements – Page 11 for a detailed description of the desired systems integration.*

- Data flow – *Please refer to the following link for information regarding the proposed data flow.*

  - *Proposed Process and Flow Chart*

- Interfaces to external system
  - Inbound
    - *Possible Bid Management Information Data – CTDOT Bid Data.*
    - *Contract Assembler – Used to assemble individual construction specifications into a complete word document.*
    - *Bentley IPlot – Used plot MicroStation CAD files to Paper or PDF format.*

- *Bentley MicroStation – CTDOT's Standard Design Software Package.*
- *Bentley InRoads – CTDOT's Standard Roadway Design Software*
- *Adobe Acrobat – Standard Application for dealing with PDF's in the Architectural, Engineering and Construction Field. Also used to apply digital signatures to Engineering Drawings*
- *MicroSoft Office – Standard authoring application.*
- *Bentley STAAD – Structural Analysis Software*
- *Trafficware - Syncro Traffic Analysis – Standard Software for Traffic Analysis*
- *Bentley – StormCAD – Drainage analysis software*
- *Bentley - Storm and Sanitary – Drainage analysis software.*
- *Future AutoCAD*

o Outbound

- *Direct Cost Accounting System.*
  - *Refer to Engineering Business Requirements – Page 4*

- Security Data Perspective – *The data proposed to be kept in the ECMS is not applicable to HIPAA requirements. CTDOT is aware that certain engineering data sets will be deemed "highly sensitive" in nature and will need to be treated in a sensitive process. Some examples of highly sensitive documents involve Airport engineering plans/drawings, or other major vertical infrastructure. CTDOT intends to plan and document these scenarios, and implement the necessary solutions. (i.e. encryption at the document level during publishing or alternative authentication ECMS solutions). Future electronic data security will be more controlled and adaptable than existing processes.*

C. Desired Roles and Responsibilities:

- *Refer to the following link for the Business Units Roles and Responsibilities:*
  - *Engineering Business Requirements – Appendix B*
  - *Project Team Wheel*

D. Desired Procedures/workflow:

- *Detailed workflow and procedural documentation can be found at www.ct.gov/dot/digitaldesign . In the future, the DDE Manual (http://www.ct.gov/dot/lib/dot/documents/deng/CTDOT_DDE_Guide.pdf) will be revised to include more specific uses of the ECMS. Workflow is also*

presented in the following charts:

- *Proposed Process and Flow Chart*

E. Acceptance Requirements – *Engineering Applications will accept the system based on performance and operation of the deployed development system. FHWA needs to evaluate the system based on delivered documentation regarding benchmarks of existing vs. proposed processes.*

F. Documentation required: *Detailed workflow and procedural documentation can be found at www.ct.gov/dot/digitaldesign . In the future, the DDE Manual (http://www.ct.gov/dot/lib/dot/documents/deng/CTDOT_DDE_Guide.pdf) will be revised to include more specific uses of the ECMS. Workflow is also presented in the following charts:*

- *Proposed Process and Flow Chart*

Part 3. Security: *Examples of items to consider in determining security requirements:*

- *Secure access to the facility housing the hardware/software through use of (but not limited to), individual assigned keycards, security personnel, physically locked and secure buildings/rooms.*
- *Role-based access to the software. No user may access the system that is not directly involved in construction based projects within the State of CT, Department of Transportation. Authorized users include, but not limited to Engineers within DOT, those offices that submit work pertinent to applicable projects, outside consultants assigned to work on specific projects, contractors awarded specific contracts, internal/external auditors, Federal Highway Administration.*
- *Controlled access by data type. Project jobs assigned to outside consultants can be updated and viewed by them only for designated role based folders to be controlled by System Administrators. Department Personnel can view outside Consultants work. Outside consultants may not view/update projects developed by Department. Contractors awarded a project may only view data they are authorized to see within the awarded contract. Non Freedom of Information type data may only be entered/viewed by specific personnel within Contract Development unit.*
- *Controlled access by system function, e.g. system administrator functions. Various area's of the Department/outside Consultants/Awarded contractors will not be allowed to access various portions of system, depending on job requirements. Copying and printing of documents will be controlled, based on individual role types. System administrator functions will allow for configuration of user*

access/initial password. Users will then be allowed to change their own password for additional security. Internal/external auditors will have access to inquire on all aspects of projects. Federal Highway Administration users will have ability to access the system (role based) and inquire on specific federally funded full oversight projects.

Part 4. Requirements Traceability Matrix: *Desirable for larger, complex projects. Traceability should provide the following:*

- *Not applicable at this time.*

High Level -
Project Plan - ECMS - 0093-0164/SPR_2253

ID	Task Name	Duration	Start	Finish	% Comp.	Resource Names
1	**TASK 1 - ECMS - Proof of Concept (POC)**	**395 days?**	**Wed 12/5/07**	**Tue 6/9/09**	**86%**	
2	**Subtask 1A - DOIT SDM Business Issues Phase Deliverables**	**85.88 days**	**Wed 3/5/08**	**Wed 7/2/08**	**100%**	
9	**Subtask 1B - DOIT Business Requirements Phase Deliverables**	**395 days?**	**Wed 12/5/07**	**Tue 6/9/09**	**86%**	
10	Project Team Wheel	0.88 days	Thu 6/5/08	Thu 6/5/08	100%	Bergeron Eric S.
11	Functional Requirements Document	12.25 days	Thu 6/5/08	Mon 6/23/08	100%	Bergeron Eric S.,William Pratt
12	Solutions Options Paper	0.88 days	Tue 6/24/08	Tue 6/24/08	100%	Bergeron Eric S.,William Pratt
13	Cost Benefit Analysis	0.88 days	Wed 6/25/08	Wed 6/25/08	100%	Bergeron Eric S.
14	FHWA Approved Research Report	4.38 days	Tue 6/24/08	Mon 6/30/08	100%	Bergeron Eric S.
15	Engineering Business Requirements Document	12.25 days	Thu 6/5/08	Mon 6/23/08	100%	Bergeron Eric S.
16	Risk Assessment Document	1.75 days	Wed 6/25/08	Thu 6/26/08	100%	Bergeron Eric S.,William Pratt
17	Milestone - IBM FileNet Evaluation - Proof of Concept	54.47 days	Thu 3/6/08	Thu 7/31/08	100%	William Pratt,Bergeron Eric S.
18	**POC (DOT) - Technical Requirments, POC System Implementation, Training, and Piloting.**	**394.88 days?**	**Wed 12/5/07**	**Tue 6/9/09**	**85%**	
70	Proof of Concept Evaluation Form	13 days	Thu 2/5/09	Mon 6/1/09	85%	Bergeron Eric S.
71	Options Paper - DOT Hosting/Vendor Hosting	1 day	Fri 5/29/09	Fri 5/29/09	100%	Bergeron Eric S.
72	PSC Sign-Off Document	1 day	Tue 6/9/09	Tue 6/9/09	50%	Charlie Dew,Pratt William S.
73	**TASK 1A - FHWA/SPR Project Reporting**	**717.88 days?**	**Tue 9/30/08**	**Thu 6/30/11**	**23%**	**Eng. Apps.**
87	**TASK 1B - TIP/STIP**	**236 days**	**Wed 12/19/07**	**Thu 11/13/08**	**100%**	**Eng. Apps.**
93	**TASK 2 - Engineering Content Development (Specs) Apps. and Integration**	**113 days**	**Tue 4/21/09**	**Thu 9/24/09**	**0%**	
112	**TASK 3 - ECMS Design Phase**	**110 days?**	**Wed 6/10/09**	**Tue 11/10/09**	**0%**	
204	**TASK 4 - ECMS Construction Phase**	**84 days?**	**Wed 11/11/09**	**Mon 3/8/10**	**0%**	
335	**TASK 5 - Testing Phase**	**17 days?**	**Tue 3/9/10**	**Wed 3/31/10**	**0%**	
364	**TASK 6 - Implementation Phase**	**5 days?**	**Wed 3/31/10**	**Wed 4/7/10**	**0%**	
378	Milestone - Complete Digital Advertising of Contract Bid Documents	1 day	Thu 5/13/10	Thu 5/13/10	0%	

Solutions Options Paper

Describe Solutions

PROJECT NAME:	DATE:
Federal Research Project 0092-0164 / SPR - 2253	06 - 20 - 08
ISSUE TO BE RESOLVED:	**EVALUATION CRITERIA USED TO ASSESS THE PROBLEM:**
ProjectWise vs. FileNet	Testing, Piloting and Research

Leverage Existing IT Solutions – Buy Existing System – Build in House / Possible External Resources.

RECOMMENDATION - OPTION NO>1 – Implementation of Bentley ProjectWise – Engineering Content Management System

OPTION 1	OPTION 2	OPTION 3
Description: **Implementation of Bentley ProjectWise – Engineering Content Management System**	**Description:** **Implementation of IBM – FileNet Data Management System**	**Description:** **Continued use of the X:CTDOT_Projects on MS Explorer**
Pro's: 1. CTDOT has a Master Agreement in place for all Bentley Software. 2. ProjectWise Software Costs are included CTDOT's existing Enterprise License Subscription, which includes the software costs for all Bentley Infrastructure Design Applications. 3. Offers direct database integration with all Bentley CAD Applications currently in use at the Department of Transportation. (See Functional Specifications). 4. CTDOT has already begun piloting ProjectWise and has an	**Pro's:** 1. DOIT has a Master Agreement in place for IBM-FileNet and has set the State Data Management System Standard to IBM FileNet. .	**Pro's:** 1. Already in Production 2. Users are already familiar with Windows Explorer

Solutions Options Paper

Describe Solutions

existing approved DOIT Project Profile in place. Significant Business Partner Development has occurred. 5. Federal Research Funding will be in place shortly with the sole purpose of evaluating/benchmarking CTDOT's traditional paper based processes vs. new processes using ProjectWise to accept digital submissions. 6. ProjectWise has Web and Geospatial Functionality 7. ProjectWise has a connector built for FileNet Interoperability. See Bentley Website and **Appendix C**		
Con's: 1. New IT Infrastructure Dependant. 2. Web and Security issues have hampered the desired business function of the system. 3. PW may have to be customized to accommodate the Direct Cost Accounting System.	**Con's:** 1. New IT Infrastructure Dependant 2. See Appendix A – Cost Comparison – NPV cost analysis shows ProjectWise as the most economical solution for CTDOT and the State of Connecticut. 3. See Appendix B – CTDOT EA – Response to IBM's Responses- A CTDOT FileNet/Sword System evaluation showed that the solution does not offer a complete "out-of-the-box" integration between	**Con's:** 1. Network outages and performance issues cause production delays. 2. No web portal 3. CAD data processing cannot occur on a users local machines in order to streamline engineering data processing and production. 4. Non-Oracle based. 5. Existing server capacity and condition are non-conducive to long term development of further Engineering Applications and Data

Solutions Options Paper

Describe Solutions

	Bentley CAD products currently deployed at CTDOT. 4. See Appendix C – Michigan DOT FileNet vs. ProjectWise Comparison– Refer to Michigan DOT's email correspondence regarding FileNet and ProjectWise.	Storage. (i.e. construction plan archives) 6. Non-preferred to an Active Directory Environment. (Archive Projects)
Cost/Benefit (high level): **See B/C Analysis on Website**	**Cost/Benefit (high level): See Adove**	**Cost/Benefit (high level):**

Solutions Options Paper

Describe Solutions

Appendix A – Cost Comparison

Appendix A - Bentley ProjectWise vs. IBM FileNet

Bentley	Year 1	Year 2	Year 3
ProjectWise Base Lisc. (Site Lisc. Included as a part of DOT Bentley ELS)*	$ 20,000.00	$ 20,000.00	$ 20,000.00
Installation	$ 35,000.00	$ -	$ -
Training (EA provides PW Training)	$ 25,000.00	$ 25,000.00	$ 25,000.00
Annual Support (Site Lisc. Included as a part of DOT Bentley ELS)	$ -	$ -	$ -
Discount Factor (5-Year)End of Year Payment (Nominal Rate)**	$ 0.95	$ 0.90	$ 0.85
Present Value	$ 23,652.50	$ 22,377.50	$ 21,170.00
Net Present Value	**$ 67,200.00**		

IBM	Year 1	Year 2	Year 3
FileNET Base Lisc.	$ 699,000.00	$ -	$ -
Installation	$ 100,000.00	$ -	$ -
Training	$ 30,000.00	$ -	$ -
Annual Support	$ -	$ 100,000.00	$ 100,000.00
Sword			
Base Product	$ 170,000.00		
Maint.	$ 35,000.00	$ 35,000.00	$ 35,000.00
Professional Services	$ 181,000.00	$ 50,000.00	$ 50,000.00
	$ 1,215,000.00	$ 185,000.00	$ 185,000.00
Discount Factor (5-Year)End of Year Payment (Nominal Rate)**	$ 0.95	$ 0.90	$ 0.85
Present Value	$ 1,149,511.50	$ 165,593.50	$ 156,658.00
Net Present Value	**$ 1,471,763.00**		

* For cost analysis purposes, CTDOT existing ELS Contract with Bentley ($250,000) has been divided by the number of software packages currently in use to derive at: $20,000

- MicroStation
- InRoads
- Haested
- STAAD
- Rebar
- ProjectWise
- Bentley Map
- OnSite
- Iplot
- DeCartes
- IRAS
- StormCAD
- LEAP

** From Federal Defense Procurement Sources on preparing NPV Analysis
http://www.acq.osd.mil/dpap/cpf/docs/contract_pricing_finance_guide/vol2_ch9.pdf

Solutions Options Paper

Describe Solutions

Required Form IV-9
Distributed 12.20.07

Solutions Options Paper
Describe Solutions

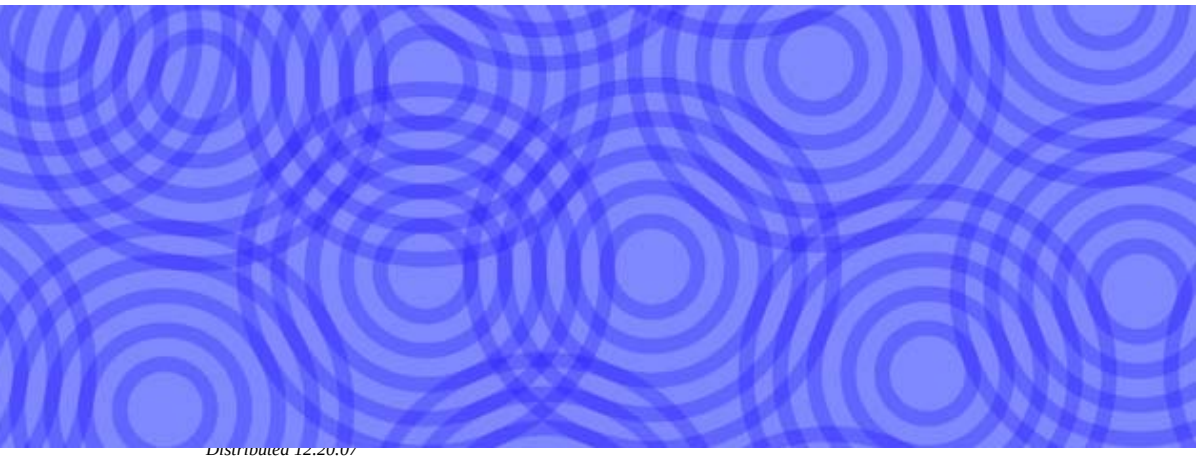
Appendix B – CTDOT EA – Response to IBM's Responses

State of CT DOT

Response Document

Donald Lussier
IBM Software Sales Specialist
Enterprise Content Management
6 Lantern Lane
Cumberland, RI 02864
Business 401-334-9727
Cell 401-617-7431

May 29, 2009



Distributed 12.20.07

Table of Contents

1. Responses to Questions

Question #	Question	Answer
	Specification	
1	*Is Sword Fusion interoperable with Bentley InRoads and IPlot Software? If so, how is it interoperable?*	Sword Fusion has been designed to be interoperable with other applications that integrate into the MicroStation environment. InRoads supports its own proprietary Explorer user interface outside of MicroStation. Fusion could store the InRoads file types in the database (or combination of files as complex documents). The user will interact with Fusion to retrieve/save the relevant files and then interact with InRoads using this data. The user would create IPlot plot sets and manage them through Sword Fusion – the plot set can then be launched. For closer level of integration Sword Fusion can be customized to add new commands to directly link with IPlot.
2	*How does Sword Fusion work for end-users starting the process of referencing CAD files directly from the FileNet System?*	When the parent drawing is added to the FileNet database through Sword Fusion the system locates the references and attempts to automatically resolve them with existing drawings in the database. If an automatic reference cannot be made, the system will prompt the user to handle the unresolved reference – this involves either selecting another drawing in the database as the required reference or selecting the references drawing and adding it to the database as a new drawing. We can also work with you on strategies and tools for batch indexing existing drawings (that may already be stored in FileNet or be stored in a file system). The requirements of each customer are usually slightly different in this area so we provides professional services to understand your requirements and amend our scripts / tools as appropriate.
3	*Does IBM/FileNet/Sword offer a pdf engineering drawing commenting solution capable of server shared review*	The AutoVue tool offers a collaborative review environment (requires on-line internet access) so that multiple users can simultaneously redline and comment on pdf engineering drawing.

Comment [b1]: Ends Users cannot be reliant on SET files. PW Plot Organizer offers direct integration and flexibility to PW when users would have to create a plot sets from scratch.

Comment [b2]: This does not appear to be direct integration. PW offers direct integration with File References. In other words in PW end-users can reference files directly from the database. From this response, it appears Sword Fusion would be a reference healing tool.

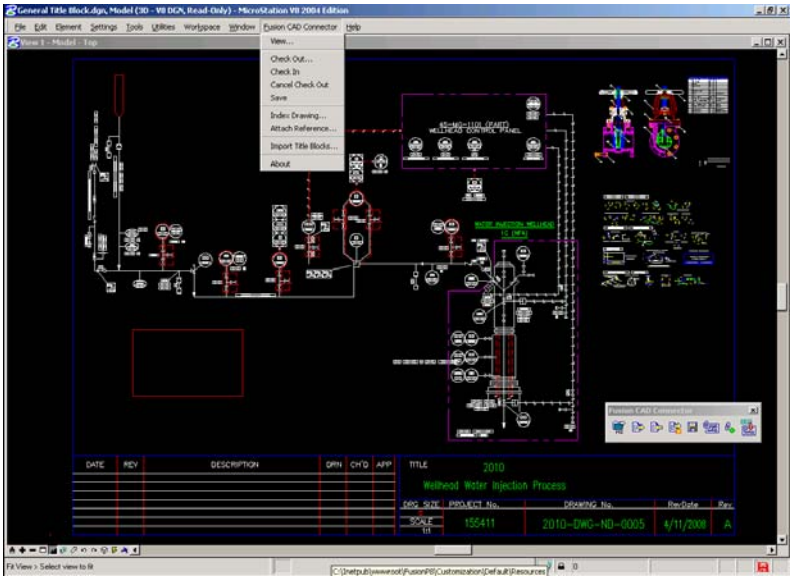
Question #	Question	Answer
	processes (similar to Adobe Acrobat 8.0 functionality?) and the ability to associate multiple drawing mark-ups with 1 comment?	

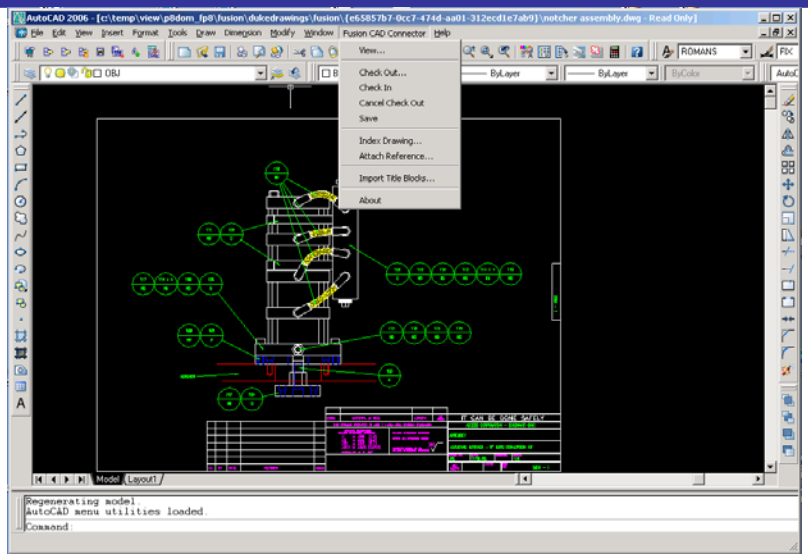
Question #	Question	Answer
	Specification	
4	*Can we write custom plugins for Filnet and Fusion?*	Sword Fusion allows the customer to configure and customize the user interface and store the results in a "theme".
5	*When a file is opened for editing does it make a copy to the local workstation?*	When a document is viewed in the Fusion web client it is not copied to the local workstation. If a document is check out then he document is copied to the local workstation so it can be edited in the native application. The actual destination directory can be configured so that either user can select location or you can set a default location which could be on a shared network drive.
6	*Does FileNet have logins local to FileNet only not to the Windows domain?*	FileNet leverages Active Directory for logins so FileNet does not its own Login Id's.
7	*Where would Microstation configuration files kept (in FileNet or outside of FileNet)?*	The MicroStation configuration files could be grouped together into a Fusion complex document and then stored in the FileNet database. We would recommend they are retained on the local workstation but can be easily retrieved and restored from FileNet database when a new workstation is being configured.
8	*What are the capabilities of Sword Fusion to keep up with frequent updates of versions of Bentley*	We have designed our integration to use well defined Bentley interfaces that are typically supported across multiple versions of the software. This reduces our effort and timeline to ensure support for new releases.

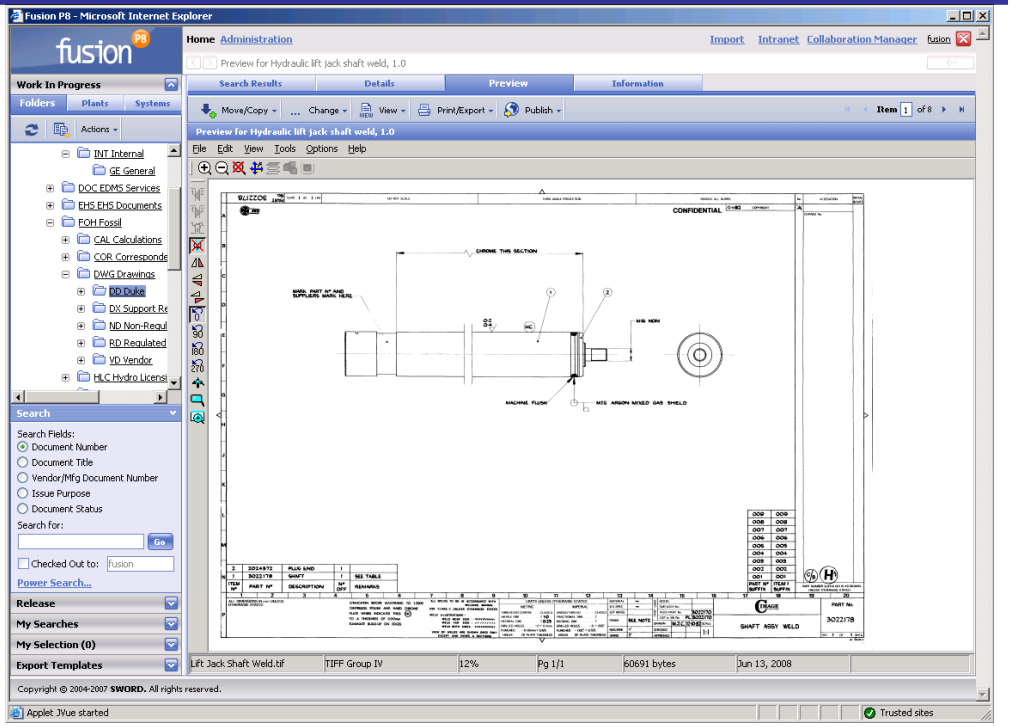
Comment [b3]: How do user preferences and configurations see the complex document.

Comment [b4]: Storing configurations on a local machine would make it extremely difficult for the Department to manage enterprise CAD Standards. PW Managed Workspaces would offerto link Department Standards.

Question #	Question	Answer
	Software including MicroStation and InRoads?	

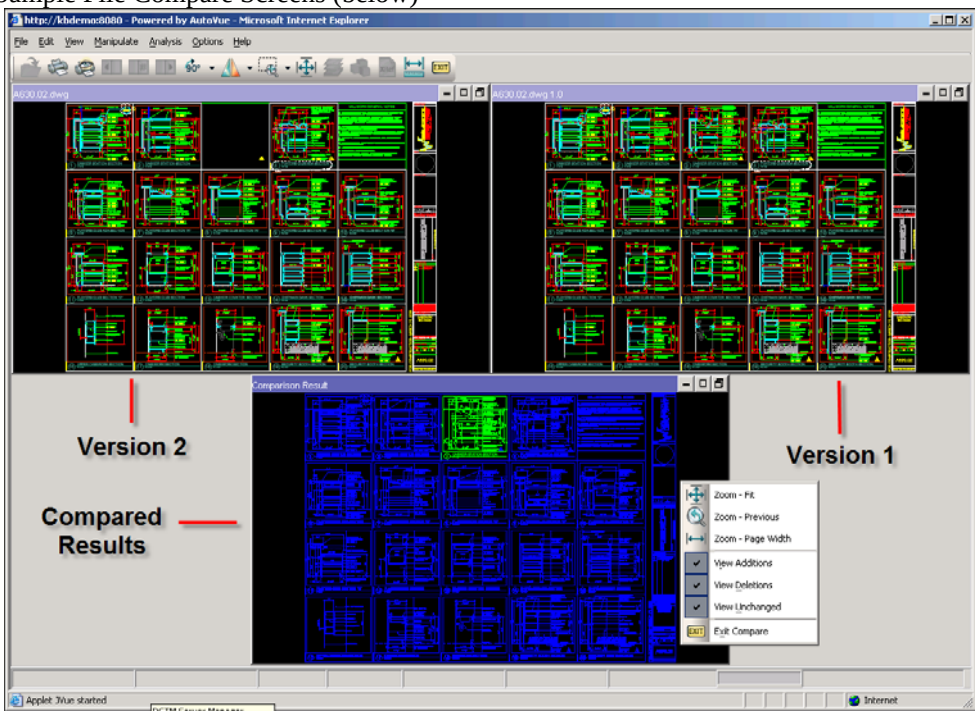
Question #	Question	Answer
	General Application Functions and Integration	
9	*The proposed system shall provide desktop application integration such that all file access functions are hooked to the Content Management System. This should include (but not be limited to) File> New, Open, and Save As. This should include Microsoft Office, Bentley MicroStation, IRAS/B, and Descartes, and Autodesk AutoCAD.*	The proposed system integrates with AutoCAD, MicroStation and Microsoft Office. Sample MicroStation CAD Connector  Sample AutoCAD CAD Connector (below)

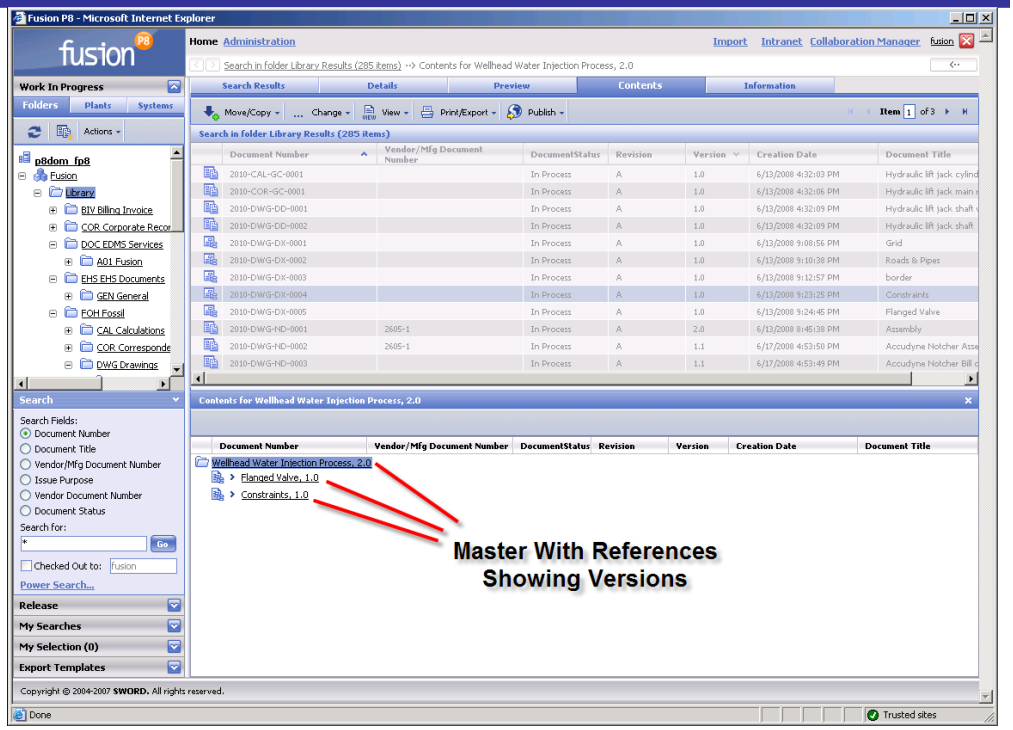
Question #	Question	Answer
		
10	*The proposed system shall provide support for Multiple Document Interface, where applicable. This should include (but not be limited to) Microsoft Office, Adobe PDF and AutoCAD applications.*	The proposed system supports the ability to open multiple documents into the application where this is supported by the integration tools provided by the application itself. Sample CAD File Viewing in Fusion (below)

Question #	Question	Answer
		
11	*In addition to the aforementioned integration, the proposed system shall provide attribute exchange for MicroStation, AutoCAD, and Microsoft Office document types. More specifically, the system shall provide the ability for attributes in the content*	The proposed system supports the exchange of metadata to/from the MicroStation and AutoCAD title blocks.

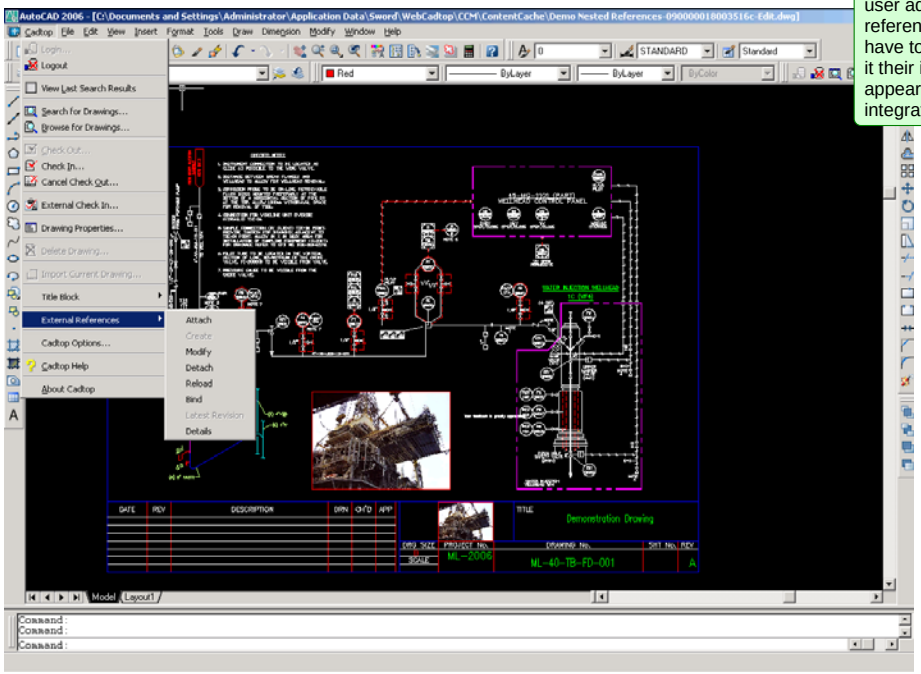
Question #	Question	Answer
	management system to populate intelligent title blocks within CAD format documents, and custom fields within Office format documents.	
12	*The proposed system should provide the capacity to specify both an edit, a redline, and a view application for each file type.*	The proposed system supports a native (edit) and view rendition of each document. We do not recommend a specific redline rendition because the redlines are managed themselves as objects in the FileNet database.
13	*The proposed system shall provide support for multiple versions of desktop applications. More specifically, the system should support multiple versions of MicroStation and AutoCAD, and provide a mechanism to distinguish between different versions of the*	The proposed system will support integration with multiple versions of desktop applications. Specific minimum version levels are required for integration (Microsoft Office 2003, AutoCAD 2006, MicroStation 8) but documents generated by older versions of the applications can be viewed and redlined.

Question #	Question	Answer
	same file type. For example, the system should be able to correctly launch AutoCAD 2004 to edit a DWG file of that vintage, and AutoCAD 2007 to edit a DWG file of that vintage.	
14	*The system must be capable of the centralized creation and storage of electronic plan and specification packages throughout the entire contract development process (addendums and construction orders). The said electronic plan and spec packages are then enabled for possible transmition to DAS Web Portal (or other) in accordance*	Sword Fusion logical documents support the creation of plan and specification packages. The Logical document is a container for other documents that are stored in the database. The contents of a logical document can be published to SharePoint web sites and then extracts the structure and documents for access via a web portal. Specific customization may be required to interface with DAS Web Portal.

Question #	Question	Answer
	with the above law.	
15	*System shall provide ability for document comparisons between files with detailed specific output.*	The proposed system allows multiple documents to be retrieved in a single operation and then they can be used in any application to perform comparisons. Sample File Compare Screens (below) 
16	*System shall provide ability for racking of versions and all their related files, as they existed when that version was created*	The proposed system is able to track the version of all parent and references documents. The references can be assigned as static or dynamic. Static references mean that the parent drawing will always reference a specific version of a references drawing even though later versions may exist in the database. Sample Reference Version Tracking Information Screen, Master Showing References and their Specific Versions. (below)

Question #	Question	Answer
	. *For example, version 4 of a master file may currently be related to version 3 of one of its reference files. However, when the master file was at version 2, the reference file may have been at version*	

Question #	Question	Answer
	CAD Application Integration	
17	*In addition to the general integration items, the proposed system shall provide CAD reference file support for Bentley's MicroStation, and Autodesk's AutoCAD. MicroStation versions supported should include MicroStation/J, V8 2004 Edition, and V8 XM Edition). AutoCAD versions supported should include AutoCAD 2000, 2002, 2004, 2005, and 2007.*	The proposed system provides CAD reference file support for viewing for all application versions listed above. CAD reference file support through direct integration is supported from AutoCAD 2006 and MicroStation V8.
18	*Reference file support should be broken down into the following specific functions, and itemized as supported or not, for both MicroStation and AutoCAD:* • *Attach/Detach Reference – should allow user to access*	Sword Fusion supports the ability to attach and detach references.

Question #	Question	Answer
	content management repository, or optionally access local storage	Sample CAD Integration Menu Showing Attach/Detach Commands (below) 
19	*Attach/Detach Reference should provide for immediate or delayed update of content management database, such that reference attachment changes are automatically recorded to the content management*	If a user changes a reference (replaces instance, updates version) through Sword Fusion integration this will be reflected immediately.

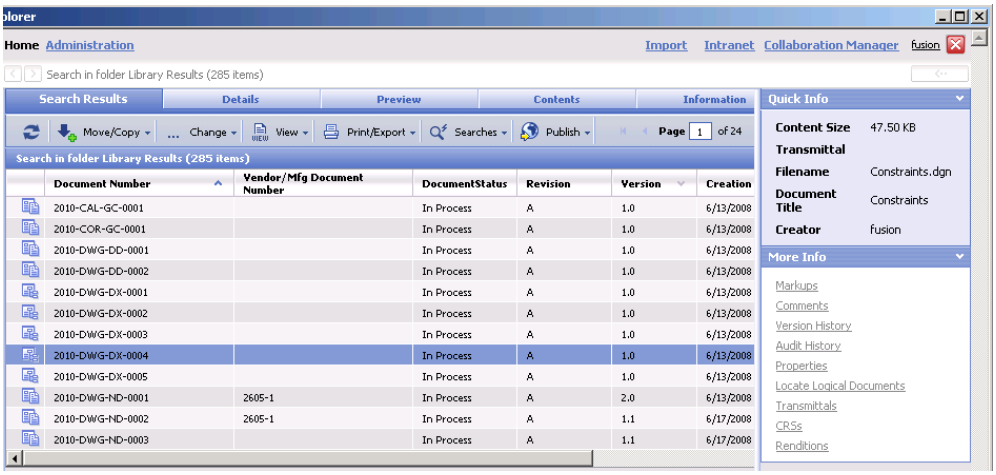
Comment [b5]: No screen shots from MicroStation.. How would a end-user adjust level symbology etc. of reference files? Seems like I would have to go into the database and set it their individually. There does not appear to be direct database integration?

Question #	Question	Answer
	system	
20	*Attach/Detach Reference should support both Raster and Vector reference attachments*	Attach and detach is supported with both raster and vector references.
21	*Local Caching – The proposed system should support the concept of local caching such that performance is enhanced, and network transfers are minimized when working on compound document sets.*	Even though the master copy of the referenced drawings is stored in the FileNet database local copies can be retained on the users workstation (drawing border templates) to save the requirement for retrieval across the network when the parent drawing is opened.
22	*Reference Deletes – The proposed system should warn the user if they are attempting to delete a file that has been referenced to another file*	The system supports a generic user alert mechanism to provide a warning for many conditions – deleting a document referenced elsewhere is just one condition.
23	*Reference Moves – The proposed system should automatically heal broken linkages as a result of moving a previously referenced file to a different folder.*	The parent drawing and its references are now stored in the FileNet database and hence this condition should no longer be applicable.

Comment [b6]: How is it supported directly in the database?

Comment [b7]: There appears to be no automation with reference "copy outs".

Question #	Question	Answer
24	*Reference Renames - The proposed system should automatically heal broken linkages as a result of renaming a previously referenced file.*	The parent drawing and its references are now stored in the FileNet database and hence this condition should no longer be applicable.

Question #	Question	Answer
25	*Nested References – The proposed system should support the concept of nested reference files. More specifically, if file B references file C, should file B be attached to file A, then the user viewing/editing file A should see files B, and C.*	The proposed system will retrieve references from referenced documents (nested references) when the parent document is retrieved.
26	*Real-time notifications – The proposed system should support the concept of notifications such that the user is made aware when one of the files referenced in the active session has been modified by another user.*	The Fusion web client supports the "Quick Info" area to provide immediate notification on items such as the checkout status of a document. When a user selects a document they will immediately see this status. Sample Quick Info Pane 
27	*CAD Workspace support – The proposed system*	The workspace / profile creates a number of data files to represent the configuration information for the project / user. These data files can be organized as a complex document and stored in the database.

Question #	Question	Answer
	shall provide the ability to associate a MicroStation Workspace, or AutoCAD profile with a given file, or folder. Subsequent edit sessions for the file should then be forced to activate the specified workspace • *In addition, Workspace /Profile support should feature inheritance such that the Workspace can be assigned at any level in the folder structure, and will inherit to all files/folders below it in the folder tree.*	
28	*CAD Workspace management – The proposed system shall provide the*	The various elements of the workspace can be stored as a complex document and managed in the FileNet database. The complex document can then be retrieved by the user to download allow the workspace constituent files to their workstation.

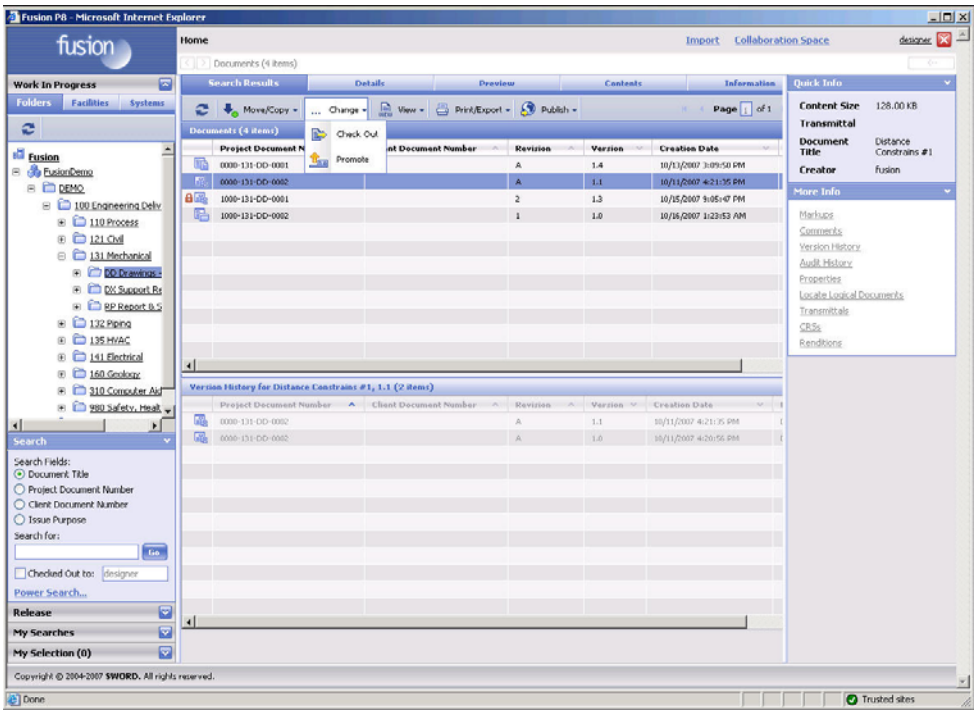
Comment [b8]: It is not feasible for CTDOT end-users to remember to download workspaces on an as needed basis

Question #	Question	Answer
	capability to store designated workspace files (cell/block libraries, font resource files, linetype resource files, etc.) within the content management system. Required workspace files shall then be automatically downloaded to the client workstation when needed, based upon the workspace being assigned to a file or folder.	
29	*InRoads Preferences – The proposed system must be capable of reading and writing Bentley InRoads preference files for the successful development, delivery and completion of High Value Data (Digital Terrain Models (.dtm) and coordinated geometry files (.alg).*	The Digital Terrain Models and Coordinated Geometry Files can be stored in the FileNet database.
30	*Shall provide tracking abilities to view and*	The proposed system allows multiple versions of documents to the stored in the database and the Fusion web client allows the user to list all versions of a document. The user is able to view one or more versions of a document.

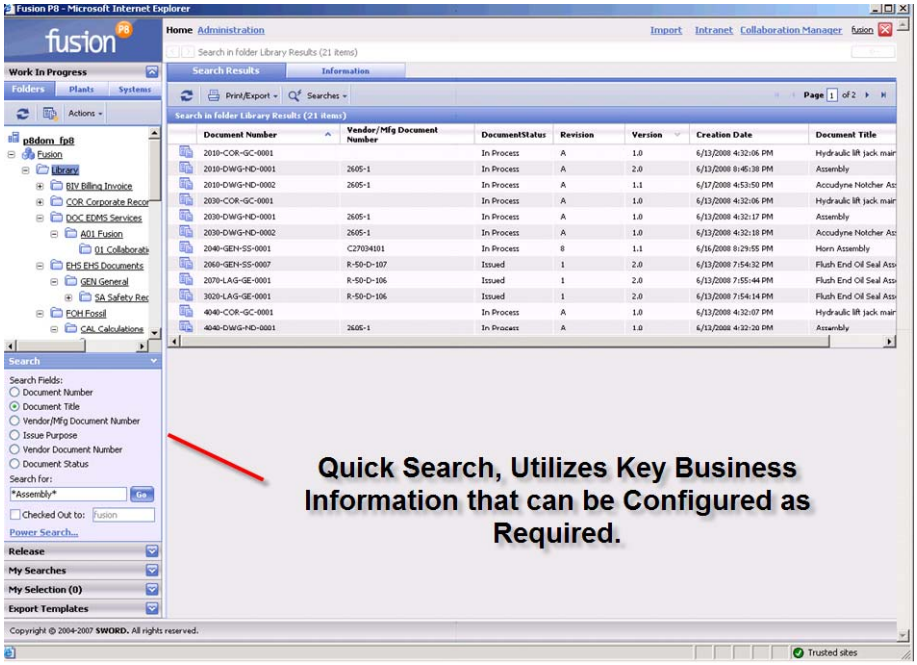
Comment [b9]: It does not appear to offer direct integration to the database, similar to what PW offers with all other Bentley Products. Its one thing to store the files, its another layer of integration to be able to configure them inside the database like PW offers.

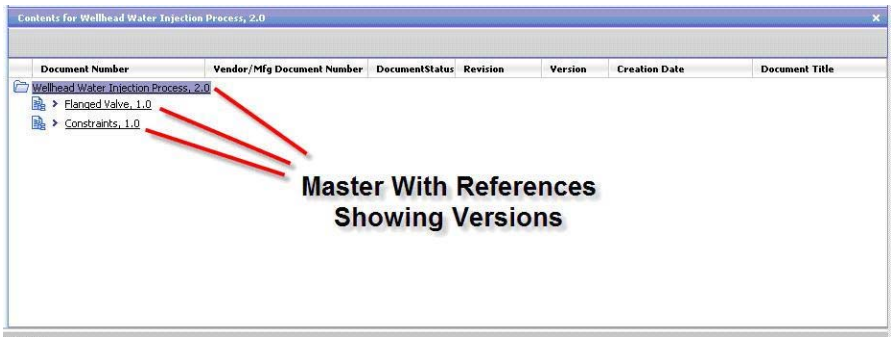
Question #	Question	Answer
	monitor changes through viewing various versions in succession.	

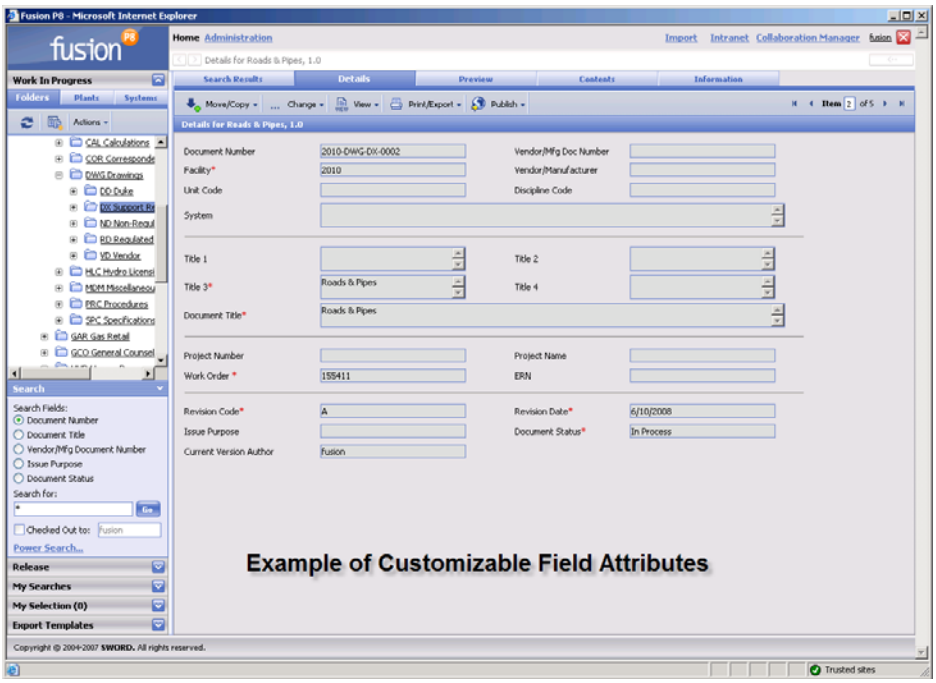
Sample Version Screen Showing Master File and Versions (below)



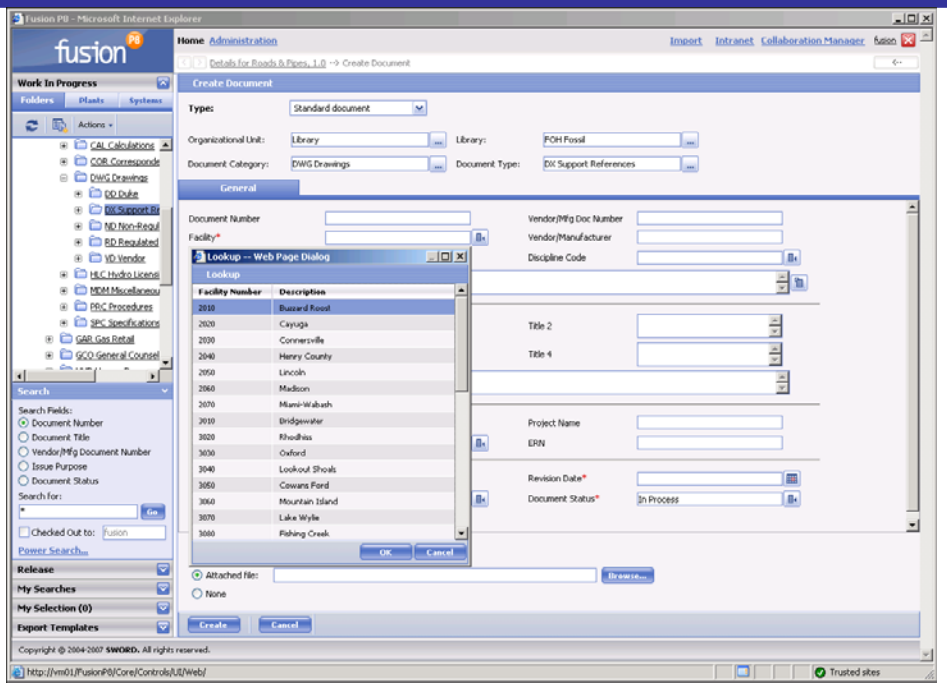
Question #	Question	Answer
	Legacy Data	
31	*The proposed system shall provide a means of bulk-loading legacy documents into the content management repository. Bulk import methods should support (but not be limited to) the following functions:* • *Support import of individual files, or entire folder structures in a single operation*	The Sword Fusion Import tool supports the bulk indexing of individual files or groups of documents.
32	*Import of simple files, or import of files with associated metadata (in either a delimited text file, or Excel spreadsheet)*	The Import tool allows the customer to create different import templates to support mapping of metadata from the supplied input file containing metadata to fields associated with target document classes in the FileNet database.
33	*Support of CAD documents including pre-existing raster and vector reference attachments. In the event of pre-existing reference file relationships, the system should provide a batch-mode reference discovery tool.*	The proposed system is able to automatically resolve references when the reference drawing is already stored in the Fusion database. If the reference is not already stored in the database, this requires manual intervention as part of the indexing process.

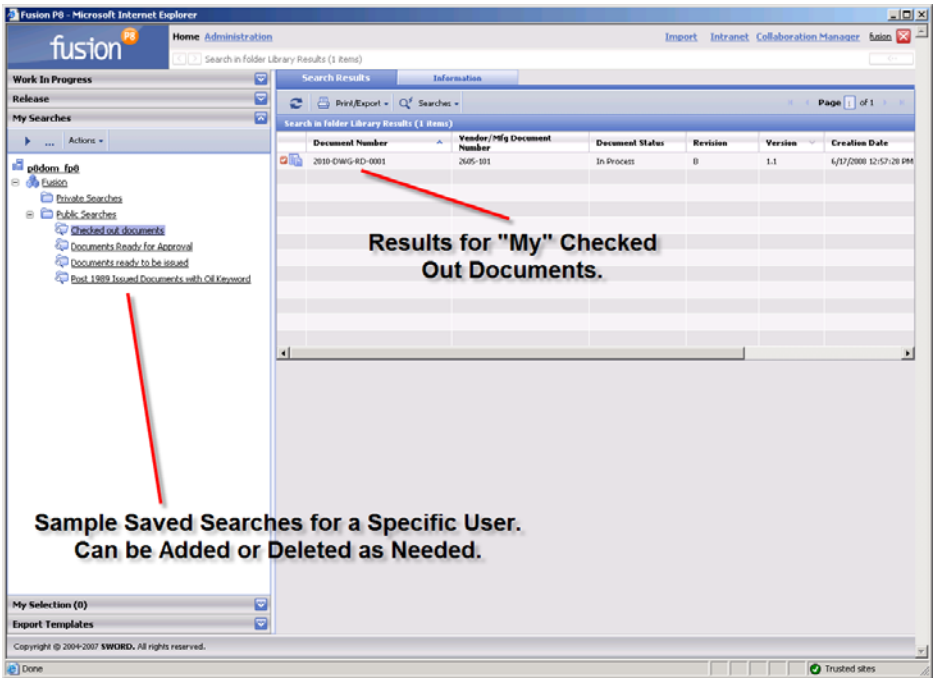
Question #	Question	Answer
	Indexing/Searching	
34	*The proposed system shall provide an easy means of viewing all files checked out to a given user.*	Sword Fusion allows the user to perform a quick search to identify documents that are checked out to a specific user. Sample Quick Search Screen 
35	*The proposed system shall provide an easy means of determining the list of files attached as reference to the file in question (forward look-up)*	The “More Info” panel in Sword Fusion supports an option to allow user to list documents referenced by the parent document.
36	*The proposed system shall provide an easy means of determining the list of files that are referencing the file*	The “More Info” panel in Sword Fusion supports an option to allow user to list documents referenced by the parent document.

Question #	Question	Answer
	in question (reverse look-up)	Sample Forward and Reverse Reference Review (below) 
37	*The proposed system shall be capable of performing full text searches on Microsoft Office document types, Bentley MicroStation documents, and Autodesk AutoCAD documents.*	The proposed system is able to perform full text searches on Microsoft Office, AutoCAD and MicroStation document types.
38	*Where applicable, the proposed system shall display "thumbnail" views of documents to aid in the search process. This shall include (but not be limited to) MicroStation, and AutoCAD document types.*	Sword Fusion allows the user to preview the contents of a document when searching for documents. This supports AutoCAD and MicroStation document types.

Question #	Question	Answer
39	*The proposed system shall provide the capacity for folder or "project" level attributes that can be inherited at the document level.*	When adding new documents to the database the system is able to dynamically create the folder structure based upon the document attributes.
40	*The proposed system shall provide the capacity for custom document attributes, to be defined by the System Administrator*	The proposed system support customer defined document classes with each class supporting custom document attributes. Sample Attributes, can be defined by the System Administrator 
41	*The proposed system shall provide the*	Default values can be configured.

Question #	Question	Answer
	capacity to further define custom attributes by: • *Providing default values based on system attributes, or administrator defined values.*	
42	*Limiting users to a defined list of choices*	Lookup drop down lists can be configured
43	*Forcing formatting options (such as upper case)*	Formatting such as lower/upper case can be configured via the user interface forms.
44	*Determining the value list for an attribute based on the value chosen for another attribute*	When using lookup lists, the value from one list can be used to determine the list of values in another list. Sample Pre-Defined Attribute Selection, Not Limited to Single Fields

Question #	Question	Answer
		
45	*The proposed system shall provide the capacity to automatically index documents based on their Windows/Operating System level file properties.*	The proposed system is able to support this type of indexing behavior but configuration will be required to ensure it works in the Connecticut DOT environment.
45	*The proposed system should provide the capacity to save searches, and execute them again with minimal effort on the user's part*	Sword Fusion allows the user to create saved searches and then simply click on the search for it to be executed.

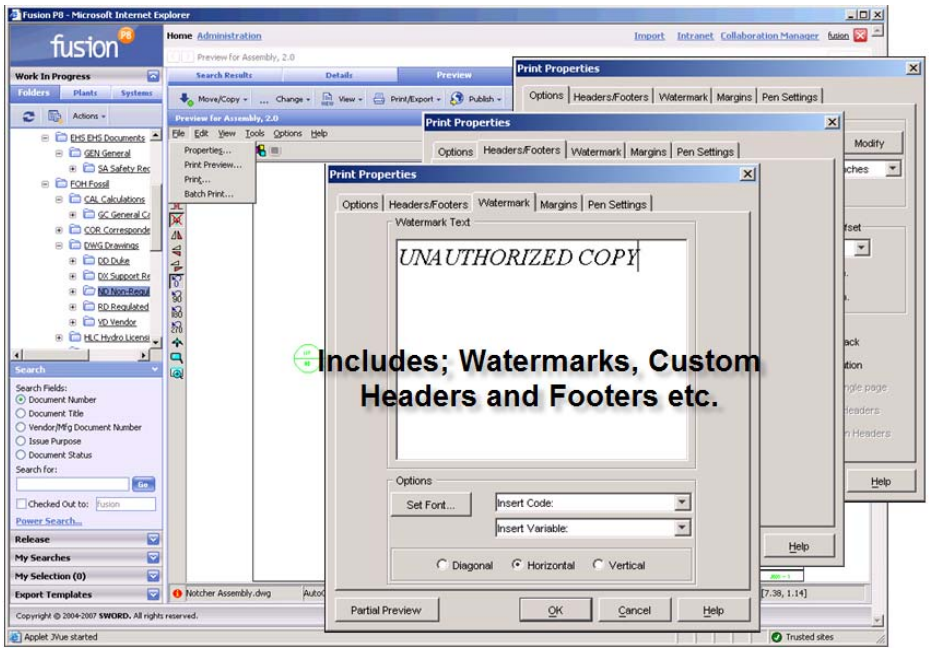
Question #	Question	Answer
46	*The proposed system should provide the capacity for both global (visible to all), and personal saved searches.*	The permissions of a saved search may be configured to determine their accessibility. Sample Saved Searches 
47	*The proposed system should provide the capability to generate indexes based on CAD file content. More specifically, features on a drawing or map should be indexed against the file, and available for subsequent search operations. As an example, one might*	The proposed system is able to reference metadata within the CAD drawing content in order to generate index values when indexing into the FileNet database. Also full text retrieval based upon textual content of the CAD drawing will allow users to locate the drawing based upon its contents.

Question #	Question	Answer
	need to know on which drawing(s) a particular transformer appears.	

Question #	Question	Answer
	Geospatial Referencing / Indexing	
48	*In addition to traditional document indexing, the proposed system shall provide support for Geospatial referencing/indexing. More specifically, the system should provide the capacity to display documents on a map view, in addition to the traditional file list view.* • *Geospatial Map views – The proposed system shall provide the capacity to configure a background map on which to display coordinate aware documents. Coordinate aware documents should be displayed as polygons, or alternately as pushpins* • *Non-geospatial documents – For display of documents that are not*	The proposed system would support the storage of coordinate locations as part of the metadata. The proposed system does not support a map view with documents being displayed based upon their geospatial position on the map. The proposed system does not support finding a document based upon its geospatial position (i.e. find all document within a mile of this geospatial position). We would propose to work with Connecticut DOT on these requirements and see if they can be added as customizations within this project but are added to the next release of the Sword Fusion product (subject to product management approval).

Question #	Question	Answer
	coordinate system aware (typically Office documents), the proposed solution should provide a means of adding geospatial reference information in order to properly display the document on the map view. • *Coordinate Systems – In support of the map view, the proposed system should provide support for those coordinate systems in common use throughout North America. In addition, the solution should be able to transform documents between coordinate systems on the fly in order to properly display on various*	

Question #	Question	Answer
	background maps. • *Geospatial Searches – In addition to traditional metadata-based searches, the proposed system should provide the capacity to search for documents based on their geospatial location.* • *Map View Re-symbolization – When documents are displayed as polygons on the map view, the system should provide the capacity to re-symbolize the polygons (change the color) based on other metadata.*	

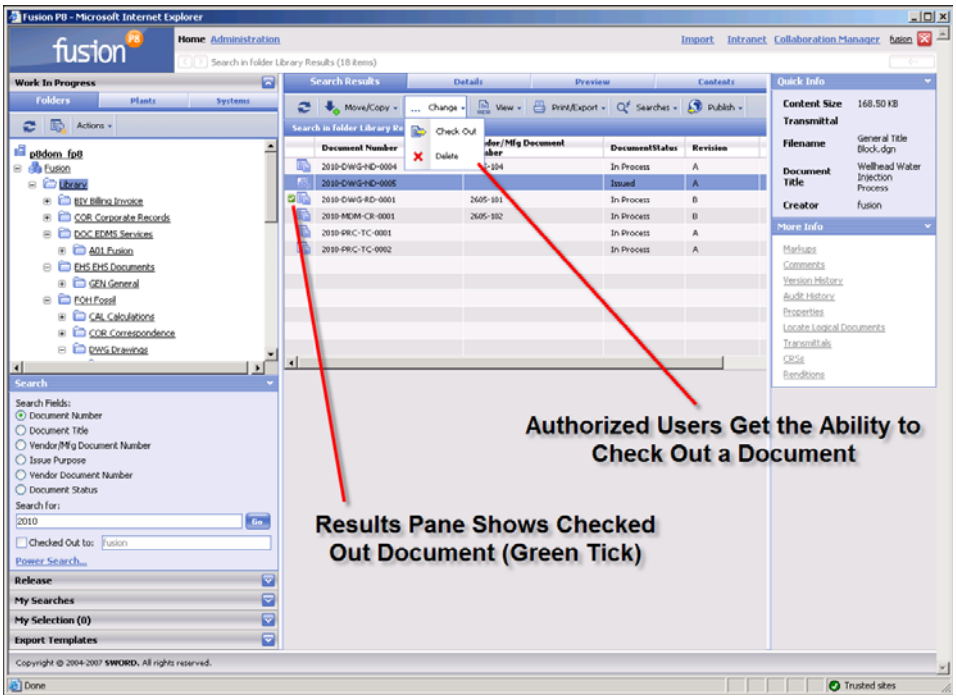
Question #	Question	Answer
	Batch Plotting / Automation	
49	*The proposed system should support batch printing of engineering drawings/maps. Batch printing support should include (but not be limited to) the following functions:* • *The proposed system shall provide integration with the MicroStation batch plotting engine for output to paper drawings, or PDF files.*	The proposed system will be configured to support integration with InterPlot for batch printing. Sample Internal Batch Printing Screen 
50	*The proposed system shall provide integration with the Bentley Digital InterPlot*	The resultant output files and control files from InterPlot can be stored in the database. The proposed system will be configured to support integration with InterPlot for batch printing.

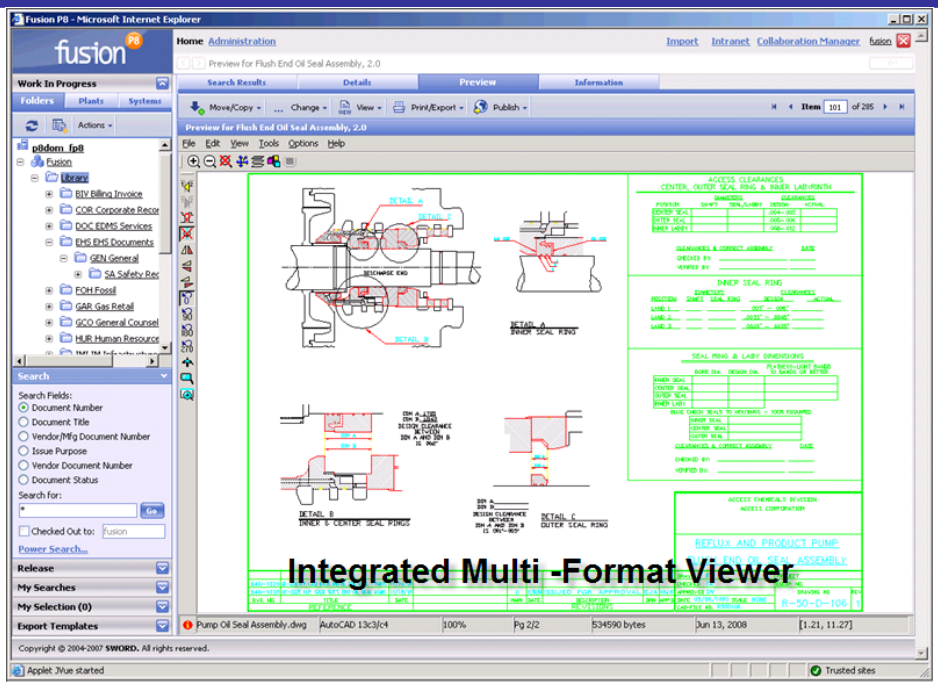
Question #	Question	Answer
	production plotting solution for output to paper drawings, or output to PDF files. InterPlot integration should include support for InterPlot Organizer, Design Scripts, Settings files, and color tables.	
51	*The proposed system should support automated plotting processes based on document, or project milestones. More specifically, the system should support automatic generation of paper drawings, or PDF files at specified workflow events. PDF files created at project milestones should be tagged with*	The automatic generation of paper drawings or PDF files based upon specific document lifecycle events can be supported but will require Connecticut DOT specific configuration. The automatic tagging with metadata from CAD document will also require specific configuration.

Question #	Question	Answer
	metadata from the original native format CAD document.	

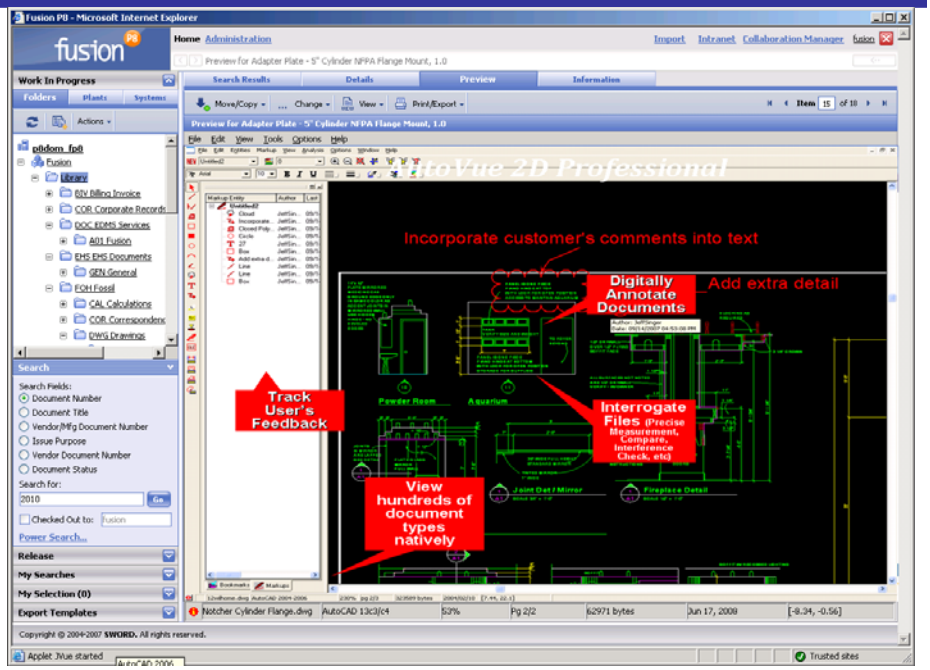
Question #	Question	Answer
	Web Access	
52	*The proposed system shall provide the capacity to access the content management repository from a Web browser, for only those projects they have been granted access for. Web access shall include (but not be limited to) the following functions:* • *New Documents – The proposed system shall provide the capacity for web users to create/upload new documents*	Sword Fusion allows users to add new documents to the database.
53	*View/Edit Document metadata – The proposed*	Sword Fusion allows user to view and edit standard / customer defined metadata associated with documents.

Question #	Question	Answer
	system shall provide the capacity to view and/or edit document metadata, both standard and that defined by the user organization	
54	*Searches – The proposed system shall provide the capacity for web users to execute interactively defined searches, as well as previously saved searches. This should include metadata based searches, as well as full text searches, and component-based searches and provide results for only the data they are authorized to view.*	Sword Fusion allows user to perform Quick, Power and full text searches. The results of the searches will take into account the access control rules that have been configured and will limit the documents listed in the search results.

Question #	Question	Answer
55	*Document check out/in – The proposed system shall provide the capacity for web users to check out/in simple (non-compound) documents.*	Sword Fusion allows users to check out and check in documents. Sample Checked Out Documents Screen (below) 
56	*CAD Viewing – The proposed system shall provide the capacity for users to view CAD document types (DGN and DWG files) without having installed viewing technology.*	Sword Fusion allows users to view CAD drawings without requiring the drawing files to be downloaded to their workstation. The viewer allows the user to zoom and pan around the drawing without loss of resolution. The user can display multiple versions of the same drawing. Sample CAD View Screen (below)

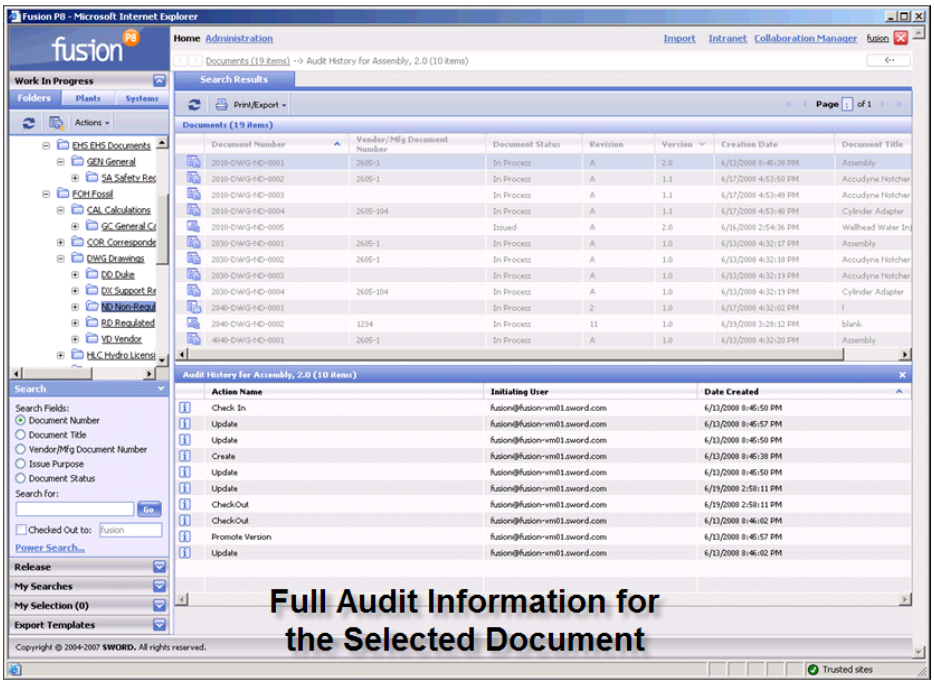
Question #	Question	Answer
	Further, the viewing technology should provide the capacity to zoon in/out without loss of resolution. Lastly, the viewing technology should provide the capability to display multiple versions of the same drawing and highlight changes between versions.	

Question #	Question	Answer
	Redlining/Commenting	
57	*In support of the engineering review process, the proposed system shall provide commenting tools for common engineering drawing/map formats. Redlining functionality shall include (but not be limited to) the following:* • *Non-intrusive commenting for MicroStation DGN and AutoCAD DWG format files. Non-intrusive commenting involves integrating with redline applications that create new files in which to store user comments.*	The proposed system allows redlines to be created for MicroStation and AutoCAD drawings. The redlines created do change the drawings in any manner – they are stored as separate objects in the FileNet database.
58	*The proposed system should support non-intrusive commenting via an installed/integrated desktop application (thick-client approach), as well as from a web browser (thin-client approach).*	The redline tool is supported from the Sword Fusion web client. Sample Redlining Tool Screen (below)

Question #	Question	Answer
		

Question #	Question	Answer
	Integration with Existing Systems	
59	*The system should be capable of integrating with the existing systems:* *a. CORE Project Costing* *b. SYS – Bridge Safety Report Database* *c. Traffic Signal Intersection Database* *d. Possible Legacy PCMS Data* *e. Financial Obligation Plan – Database* *f. AASHTO Trns*Port*	The proposed system has very flexible integration tools that can support different types of integration dependant on the requirements for each existing system. In many cases the ability to create a Uniform Resource Locator (URL) that makes reference to document(s) in the database can provide a simple method to integrate and this can be accomplished by Connecticut DOT IT personnel.

Question #	Question	Answer
	Security/Auditing/Backup's and Recovery	
60	*The proposed system shall provide security on an individual basis through "roll" definition. Users will be set up to be able to read and/or write to only those files required for them to process their work, both at the discipline level and individual projects.*	The security rules are established and configured in FileNet content management infrastructure and not through the Fusion application layer. The FileNet security can be configured at the user or role level in order to control access to specific documents.
61	*Further breakdown of security shall be required during the electronic workflow routing. Based on status of document and type, the security of the document automatically changes. Security must allow either specific users access or groups to read/write/print or deny access based on status.*	The FileNet system supports different workflow lifecycle stages of a document and this can also be used to determine the security access for documents in the database.
62	*System will allow individual files to be password locked as well as specific folders where necessary to help prevent unauthorized access.*	The proposed system does not support assigning passwords against specific documents and / or folders. The system allows the customer to assign security permissions against specific documents and folder to control access to the information.
63	*Password for such security of files and folders must be able to be assigned and administered at discipline level with ability for system security administrators to delete password should it be forgotten.*	The proposed system does not support assigning passwords against specific documents and / or folders. The system allows the customer to assign security permissions against specific documents and folder to control access to the information.

Question #	Question	Answer
64	*Audits must be created when user 'checks out' and 'checks in' document. Showing on audit should be (but not limited to) date and time stamp, user name, if document was changed and computer number (IP address?).*	The proposed system creates an audit log when documents are checked out and checked in. The system retains information about the user id, date / time and the identity of the document. Sample On-Line Auditing Screen 
65	*For files that have sensitive data, audits must also be written when document is read and/or printed. In these instances, an*	The system is also able to record audit entries for documents when retrieved and printed.

Question #	Question	Answer
	export to local drive is not permitted.	
66	*Reporting capabilities on audit stored information by (but not limited to) user name and date parameters.*	The customer is able to create reports based upon audit information that is stored in the database and logs.
67	*System must have automated daily backup capabilities as well as ones that can be administered on demand. This includes both full system back up or individual folders/files.*	The system has been designed to integrate with the Connecticut DOT existing backup and recovery tools and processes. The underlying database managed by the system is stored in a relational database and on standard file systems and hence will be applicable to existing backup / recovery tools.
68	*Recovery also should allow full system recovery as well as individual folders/files and allow choice on*	The system has been designed to integrate with the Connecticut DOT existing backup and recovery tools and processes.

Question #	Question	Answer
	version of files.	

Question #	Question	Answer
69	*System shall provide mechanism for electronic routing of document or group of documents. When a document(s) is completed at one stage, its status changes. Automatic notification of individual or project can be set up as well as having document(s) sent to a specified folder, based on state.*	The proposed system supports the management of the lifecycle status of documents throughout their entire lifecycle. The system can be configured to automatically send emails when documents migrate from one life cycle stage to another. The email notifications can be used to route documents throughout their lifecycle to different people in the organization. The proposed system also has an optional module called Fusion Collaboration Manager (FCM) that supports the automated review and approval of documents (or packages of documents). This module leverages SharePoint to allow Connecticut to optionally open up document centric processes with their contractors and vendors.

2. Cost Structure

To assist in the cost estimate development, the below tables offer ballpark user #'s and location information assuming a full production system was in place.

DOT Main Office – High Band Width – (Sword Fusion Needed)

	Actual	*Projected Concurrent*
End User Count	*1000*	*460*

District Offices (5) – Low Band Width (Sword Fusion Needed)

	Actual	*Projected Concurrent*
End User Count	*320*	*140*

Research Lab – High Band Width (Sword Fusion Needed)

	Actual	*Projected Concurrent*
End User Count	*60*	*20*

Engineering Records – Low Band Width

	Actual	*Projected Concurrent*
End User Count	*10*	*2*

Const. Trailers – Low Band Width – Various Locations

	ProjectedActual	*Projected Concurrent*
End User Count	*60*	*10*

Consultant Engineers – Low Band Width – Various Locations (Sword Fusion Needed)

	Projected Actual	*Projected Concurrent*
End User Count	*250*	*30*

IBM - FileNet Pricing

IBM ECM software, license users based on Authorized Users. For 1,700 users, the list price for the software and 12 months of support is $699,750. This would include all your environments, development, test, production and high availability along with toolkits for the API's.

This software is priced at list for discussion and budgetary purposes. Discounts can be applied once we determine the interest level, time of purchase and quantity of purchase.

The installation of these products will range from $50K - $100K depending on the number of environments you request to be installed.

Education for Administrators and Developers will range in the $30K area and again depends on the number of Administrators and Developers you want to train.

SWORD Pricing

Software

Total users requiring Sword Fusion – 1630

The Fusion web client license is for the Fusion application. The Fusion CAD Connector is just for the users that want Fusion integrated directly into their CAD application – this is typically a small subset of total users. We have assumed 100 users will require Fusion CAD Connector. The pricing also includes licensing for the document viewing / redline tool – we have provided pricing for Brava Enterprise based upon a 1 hour concurrent pricing model (i.e. after one user finishes using the tool the next user needs to wait an hour before that license is returned to the pool).

Mfg	Type	Part #	Item	Qty	Disc	Unit Cost	Total Cost	Maint. Cost
Sword	License	FUWC-R	Fusion User Registered License	1630	80%	$ 120	$ 195,600	–
Sword	Maint	FUWC-R-M	Fusion User Maintenance	1630	80%	$ 24	–	$ 39,120
Sword	License	FUCC-R	Fusion CAD Connector Registered License	100	30%	$ 350	$ 35,000	–
Sword	Maint	FUCC-R-M	Fusion CAD Connector Maintenance	100	30%	$ 70	–	$ 7,000
Sword	License	FUBV-1H	Brava Enterprise – 1 Hour Concurrent License	200	30%	$ 315	$ 63,000	–
Sword	Maint	FUBV-1H-M	Brava Enterprise Maintenance	200	30%	$ 63	–	$ 12,600
						Sub-Total	$293,600	$58,720

Professional Services

We have quoted below for standard Fusion installation (assuming FileNet P8 already installed). We have estimated standard Fusion configuration (i.e. different document classes, forms, etc.) based upon as assumption of 5 document classes. We then made an estimate based upon the questions that require some level of customization for the end solution. We have included some services for Fusion P8 admin and Fusion P8 train the trainer Training courses.

Mfg	Type	Part #	Item	Qty (hrs)	Disc	Unit Cost	Total Cost
Sword	Services		Fusion P8 Installation (QA & Prod. Environments)	100	25%	$ 150	$ 15,000
Sword	Services		Fusion P8 base configuration (5 document classes)	240	25%	$ 150	$ 36,000
Sword	Services		Customization Services (Batch Indexing, InterPlot interface, Indexing Windows properties, geospatial referencing, lifecycle triggered email notifications, Integration 6 IT systems using URL mechanism)	640	25%	$ 120	$ 76,800
Sword	Services		Fusion P8 Admin and User (train the trainer) training	120	25%	$ 150	$18,000
Sword	Services		Project Management (Initial project schedule, mgt plan, 1 day per week over 20 elapsed weeks)	200	25%	$ 180	$ 36,000
						Sub-Total	$181,800

Appendix C – Michigan DOT FileNet vs. ProjectWise Comparison

EMAIL Correspondence from Michigan DOT

Eric,

Long story that I will try to make short. They set Filenet as our enterprise standard. We were able to prove that it did not work for CAD. About that time they announced that PWise worked with FileNet. We were then able to get PWise. PWise semi-automatically exports information to FileNet. It did not work the other direction. We had the interface from PWise to FileNet set up and operational. Since then FileNet has fizzled out. Due to our enterprise agreement we have unlimited use of PWise where FileNet we had to buy licenses to use it. PWise does not encrypt documents like FileNet does so we were able to develop internal applications that use the PWise back end database. This makes it cheap and quick to get things accomplished. Tried this with FileNet but with encryption you had to use their software for everything and support was not the greatest. As a result we are getting request to use PWise for Fleet and Human Resource applications. So far we have resisted because we do not have the resources to support more applications.

Attached is a report we did a while back. Hope this answers some of your questions. Feel free to call for more information.

Daniel J. Belcher, P.E., P.S.
MDOT - Design Division
Engineering Support Services
517.335.2182
belcherd@michigan.gov

>>> "Bergeron, Eric S." <Eric.Bergeron@po.state.ct.us> 4/22/2008 12:59PM >>>
Hi Dan,

Eric from CTDOT here. I did a google search and noticed Michigan DOT may be
using Filenet in addition to PW in some areas.. We are hitting a little bit
of a cross-roads here between our IT Global Agency (DOIT) pushing IBM-Filenet, yet we are on Master Agreement with Bentley for ProjectWise.
Does Michigan use PW on an Enterprise level or mainly just for Engineering
Data?. Did your PW implementation run into any of these issues? We are
just trying to justify why we need PW instead of Filenet..

Thanks for your help,
Eric

EDMS Project - Software Testing
FileNET Panagon, Green Pasture G5, Bentley ProjectWise
E V A L U A T I O N R E P O R T

Methodology:

The EDMS project plan included a series of tasks for preparation and testing of selected software. These tasks began with development of performance factors, or criteria, during the business and technical requirements analysis portion of the project. From these performance factors, test scripts were developed. Once the software had been selected, it was installed, configured, and formal training sessions held. A 3-phase testing method used comprised of: 1) configuration testing, 2) structured testing (vendor demonstrations of their software on MDOT's system), and 3) ad hoc, or user, testing.

Software tested:

FileNET Panagon -	Content Services for repository, document sharing, and document management
	eProcess and eForms for workflow
	Web Services for web access
Green Pasture -	G5 for CAD file management
Bentley -	ProjectWise for CAD file management

Ad hoc testing took place during May, 2002, and was conducted by the following:

Design Division:	Real Estate Division:	OIM:
Don Reed	Teresa Vanis	Sue Shulick
Harold Hovey	Gary Rittenburg	Tom Franklin
Stephanie Doherty	Forest Kraus	Cowen Mwakanandi
Steve Driver		Dave Hundt
		Julie Gee
FHWA:	Transportation Planning:	
Don Bullock	Paul McAllister	
Vershun Tolliver	Tom Hanf	

Software Recommendation:

FileNET Panagon - Content Services, eProcess, eForms and Web Services
Bentley ProjectWise - CAD file management

The Bentley product was selected for it's ease of use, simplified bulk loading capability, integration with email (GroupWise), ease of user and administrative interface, and error free performance.

Test Results:

Configuration Testing:

Database - All three products, FileNET Panagon, Green Pasture G5, and Bentley ProjectWise, were verified compatible with Oracle. The capability for reading from and writing to an existing Oracle database will be tested during the Environmental Review workflow pilot.

eMail (GroupWise) - Both FileNET Panagon and Bentley ProjectWise worked with the GroupWise mail system for user notification on various tasks and document transitioning. However, we were unable to drag and drop email from GroupWise into the FileNET repository. In order to save an email to the repository it was necessary to first save it to the desktop and then to the repository. Although Green Pasture claimed to be integrated with GroupWise, they were unable to connect G5 to GroupWise for testing.

Servers and Network - Basic server setup and configuration was standard and issue-free. Once installed and configured, all three applications have pretty much been stable and performed as advertised. Several different configurations were tested and almost all issues encountered were resolved by working hand in hand with the appropriate technical personnel.

Distributed file storage, user ID synchronization and authentication, scanning of paper documents to digital, back file conversion, and volume/load testing will be performed during the Environmental Review workflow pilot.

FileNET Panagon with G5 and ProjectWise: *tested by Design Division*

Note: Factors #2 was removed from testing as requirements for this project.

PERFORMANCE FACTOR	SCORE for G5	SCORE for PW	COMMENTS
Design #1 - ability to import CAD engineering drawing files and meta data (system indexing, e.g. date created and who created it)	☒ Pass – ☐ Fail	☒ Pass + ☐ Fail	Score is based on ease of use.
Design #3 - ability to set up engineering drawing file folders and states, e.g. draft, preliminary, final	☒ Pass – ☐ Fail	☒ Pass + ☐ Fail	Score is based on ease of use.
Design #4 - ability to add participants and documents to a project (user and document security)	☒ Pass – ☐ Fail	☒ Pass + ☐ Fail	Score is based on ease of use & intuitiveness of the software.
Design #5 - robustness of Library Services applicable to MicroStation files, e.g. ability to store and access engineering drawing reference, view, check in, check out, version, restrict security	☒ Pass – ☐ Fail	☒ Pass + ☐ Fail	Score is based on ease of use (crash/relogin) & friendliness of the GUI
Design #6 - ability to customize look and, e.g. display based on filters or security	☒ Pass – ☐ Fail	☒ Pass ☐ Fail	Score is based on ease of use (GUI).
Design #7 - ability to access project files and meta data without Panagon with G5 or PW mediation, e.g. emergency procedures if system is down	☐ Pass ☒ Fail	☒ Pass ☐ Fail	G5 file names are encrypted; PW are not.
Design #8 - miscellaneous factors derived from previous user experience, e.g. plot groups of drawings. Note: Integration with IPlot is critical to this project.	☐ Pass ☒ Fail	☒ Pass ☐ Fail	G5 does not work with MDOT plotting software IPlot).
Design #9 - create and utilize distributed file storage areas Note: To be tested during development.	☐ Pass ☐ Fail	☐ Pass ☐ Fail	

FileNET Panagon: *tested by Real Estate Division*

Note: It was hard to view attachments at the bottom of the screen (on workflow form) without changing Desktop properties and it was sometimes hard to open the eform signature box in the workflow. System was too slow (too much lag time). Factors #3, #10, #11, #12, #13, #15, and #16 were removed from testing as requirements for this project.

PERFORMANCE FACTOR	SCORE	COMMENTS
Real Estate #1 - ease of scanning and indexing relevant paper documents Note: To be tested during development phase of Environmental Review workflow	☐ Pass ☐ Fail	
Real Estate #2 - read and write data to a Real Estate database, e.g. ReSale Note: To be tested during development phase of Environmental Review workflow	☐ Pass ☐ Fail	
Real Estate #4 - ease of designing and developing process workflow definitions	☒ Pass ☐ Fail	
Real Estate #5 - ease of adding an ad hoc participant to a process workflow	☒ Pass ☐ Fail	
Real Estate #6 - ease of tracking progress of a process workflow instance	☒ Pass ☐ Fail	
Real Estate #7 - engineering drawing creation collaboration from remote site, e.g. markup Note: CAD file management tool will come with viewer for non-CAD users to view engineering drawings and the drawings will also be stored in a format viewable by the IDM viewer. Also, markup will be available.	☐ Pass ☒ Fail	Able to search and find drawing (.dgn file) but unable to view using IDM viewer.
Real Estate #8 - mechanism for associating documents to one another in a named "document folder"	☒ Pass ☐ Fail	
Real Estate #9 - mechanism for setting and enforcing security on documents and folders	☒ Pass ☐ Fail	
Real Estate #14 - mechanism for designing and using electronic forms, e.g. with workflow	☒ Pass ☐ Fail	

FileNET Panagon: tested by Transportation Planning - Environmental

PERFORMANCE FACTOR	SCORE	COMMENTS
Environmental #1 - ease of designing and developing process workflow definitions	☒ Pass ☐ Fail	
Environmental #2 - ease of launching a process workflow	☒ Pass ☐ Fail	
Environmental #3 - ease of tracking the execution of a process workflow, e.g. adhering to deadlines, as well as ability to attach and organize documents in various file formats	☒ Pass ☐ Fail	
Environmental #4 - ease of tracking progress of a process workflow instance	☒ Pass ☐ Fail	
Environmental #5 - ease of distributing process workflow based on identified criteria, as well as affixing authorization, e.g. passworded signatures and dates	☒ Pass ☐ Fail	

FileNET Panagon: *tested by Federal Highway Administration*

Note: Factors #8 and #10 were removed from testing as requirements for this project.

PERFORMANCE FACTOR		SCORE	COMMENTS
Cross Functional #1 -	ease of adding, deleting, and modifying users from an existing MDOT directory information base, (synchronize and authenticate) Note: To be tested during development prior to production.	☐ Pass ☐ Fail	
Cross Functional #2 -	ease of adding participants to a process workflow	☒ Pass ☐ Fail	
Cross Functional #3 -	ease of assigning tasks to participants	☒ Pass ☐ Fail	
Cross Functional #4 -	ease of importing existing desktop documents into FileNET repository	☒ Pass ☐ Fail	
Cross Functional #5 -	ease of importing meta data (document indexing) into FileNET repository	☒ Pass ☐ Fail	
Cross Functional #6 -	interface to functions in standard MDOT desktop productivity tools, e.g. add to repository, set security, version, checkin, checkout, markup	☒ Pass ☐ Fail	
Cross Functional #7-	interface to existing electronic mail software environment (GroupWise) (add document, revision, version, create user profile, checkin and checkout, markup, set security)	☐ Pass ☒ Fail	Unable to save documents directly to repository from GroupWise. Had to copy to desktop and then add to repository.
Cross Functional #9 -	ease of capturing images and entering meta data for the back file of paper documents	☐ Pass ☐ Fail	See Design #1 and #2
Cross Functional #11 -	ease of designing and developing process workflow definitions	☒ Pass ☐ Fail	
Cross Functional #12 -	ease of launching a process workflow	☐ Pass ☐ Fail	See Environmental #2
Cross Functional #13 -	ease of tracking progress of a process workflow instance	☒ Pass ☐ Fail	
Cross Functional #14 -	ability to create and update a simple and complex search or query	☒ Pass ☐ Fail	

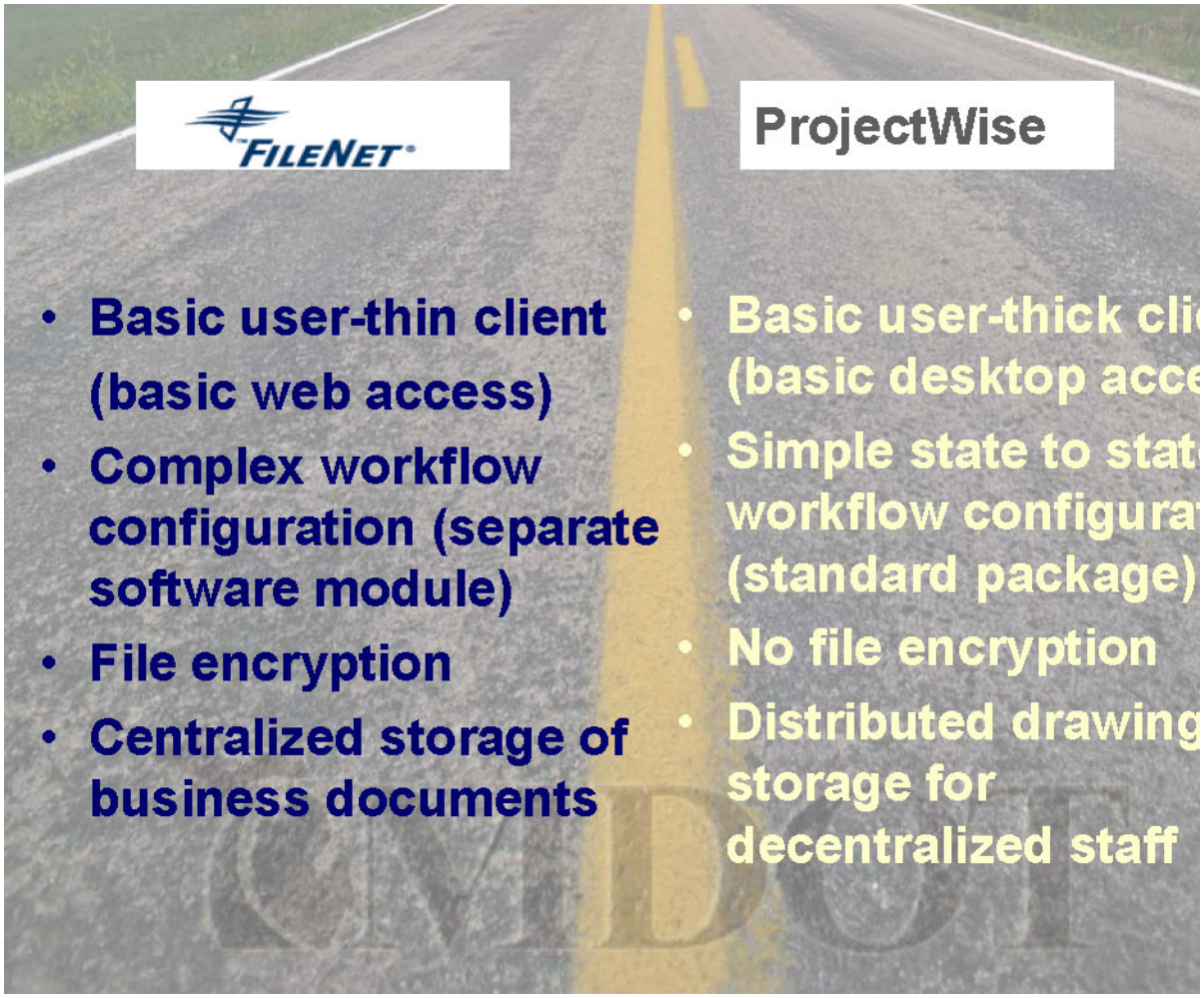
Cross Functional #15 -	ability to create complex project spaces (documents, folders, workflow, security, queries)	☒ Pass ☐ Fail	
Cross Functional #16 -	ability to handle large volumes documents and transactions Note: To be tested during development prior to production.	☐ Pass ☐ Fail	.

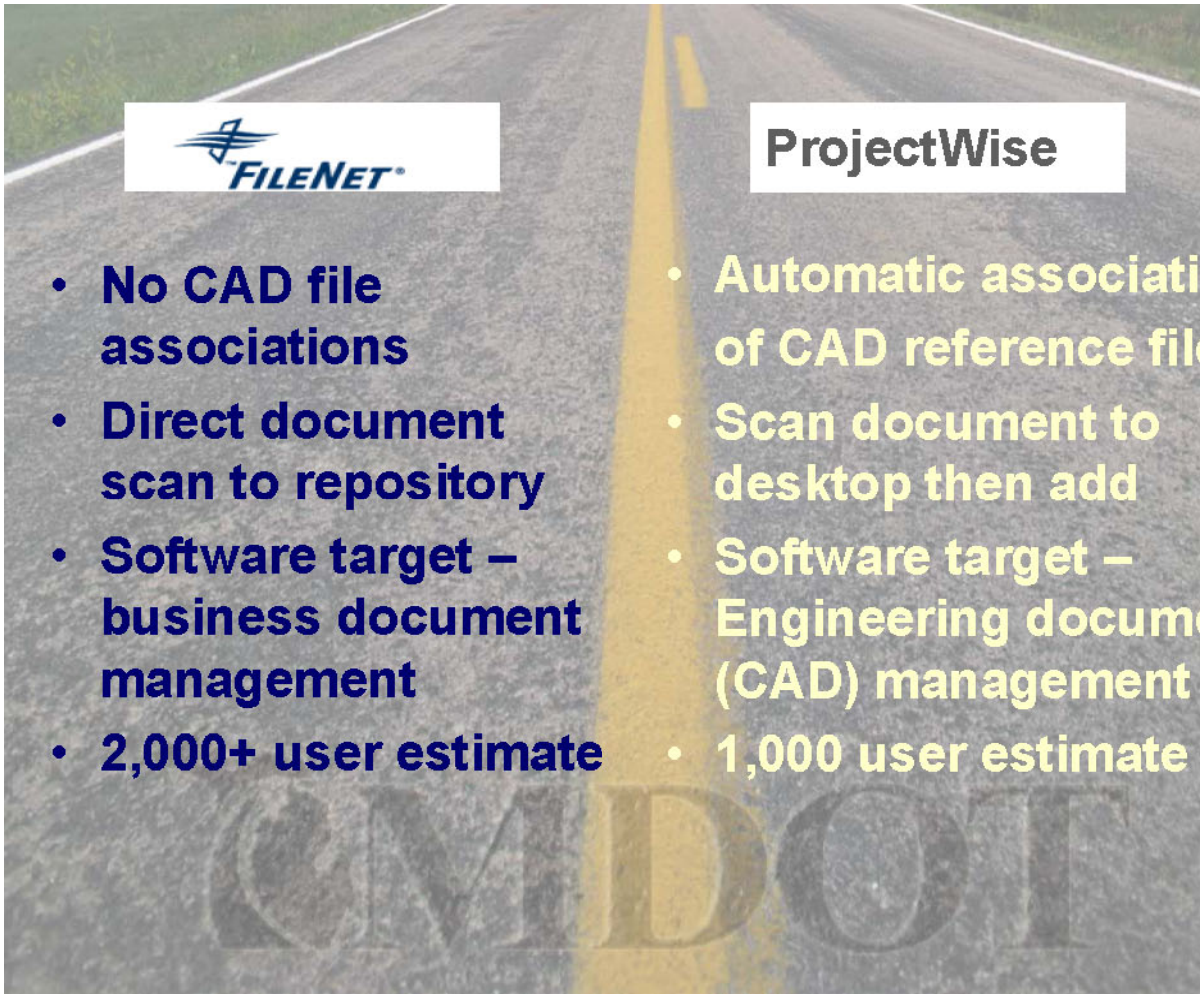
Correspondence Management Factors were not tested. However, these factors map to factors that were tested, such as designing, processing, and tracking workflow, scanning and indexing, assigning participants, document creation collaboration (through workflow), setting up and running searches or queries. OCR scanning and keyword searching will be tested during design and development of the Environmental Review process workflow.

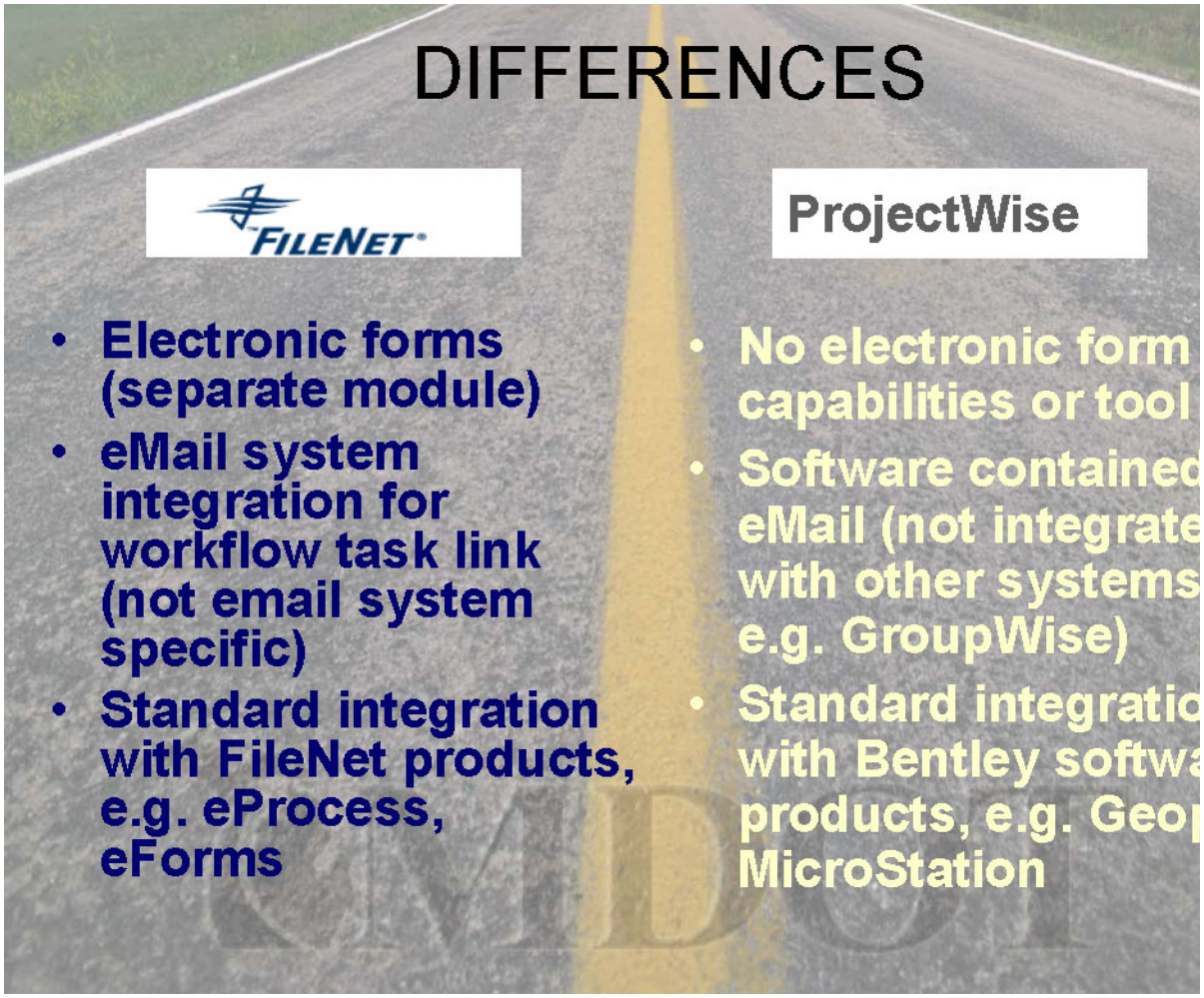
Web Information Portal Factors will not be tested until software is located that can provide the required functionality.

PROJECTWISE and FILENET

- Document storage repository
- Repository security
- Version control
- Document sharing
- Document search and retrieval
- Document life cycle management
- Document sharing with external partners
- Web enabled access
- Thick client (desktop loaded software)
- Thin client (Internet Explorer accessible)


FILENET
ProjectWise
• Basic user-thin client (basic web access)
• Complex workflow configuration (separate software module)
• File encryption
• Centralized storage of business documents
• Basic user-thick cli (basic desktop acce
• Simple state to stat workflow configura (standard package)
• No file encryption
• Distributed drawing storage for decentralized staff
CVIDOT


FileNet
ProjectWise
• No CAD file associations
• Direct document scan to repository
• Software target – business document management
• 2,000+ user estimate
• Automatic associati
of CAD reference fil
• Scan document to desktop then add
• Software target – Engineering docum
(CAD) management
• 1,000 user estimate
CMDOT


DIFFERENCES
FileNet
ProjectWise
• Electronic forms (separate module)
• eMail system integration for workflow task link (not email system specific)
• Standard integration with FileNet products, e.g. eProcess, eForms
• No electronic form capabilities or tool
• Software contained eMail (not integrate with other systems e.g. GroupWise)
• Standard integratio with Bentley softwa products, e.g. Geop MicroStation

Project Risk Assessment

Project Title:	Digital Design Environment Development
Executive Sponsor:	Mike Lonergan
Project Manager(Tech/Bus.):	John Molina / Eric Bergeron
Project Co/Ctr Number:	0093-0164 - SPR_2253
Content Period (Month/Year):	8-Jun
Date Report Submitted to PSCS:	
Current Project Phase:	Business Requirements
Date of Last Presentation to Area IS Steering Committee:	

RISK CATEGORIES	RISK	Impact On Project	Risk Level	MITIGATION STRATEGY
		Schedule, Cost and Scope	Risk Level	
Organizational Risks	Interaction - with internal and external group	Schedule and Scope	Very High	Better DOIT Coordination
	Dependence - on other projects	Schedule	Low	
	Interfaces - to other systems	Schedule, Cost and Scope	Medium	Bentley - OIS Training for PW SQL / Bentley Customization Required to Batch Upload a Database Listing
	Decision making body	Schedule, Cost and Scope	Very High	Selection of 1 individual, that can make high level decisions and recommendations quickly
	Project Executive Sponsor commitment	Schedule, Cost and Scope	Low	
	Resources availability	Schedule, Cost and Scope	Very High	Consultant Services will need to be pursued in combination with State Resources
	Expertise (quality, quantity, availability, continuity of SME's)	Schedule, Cost and Scope	High	Identify application knowledge gaps. Strive to get Project Team Members adequate Training in applications.
	Team location		Low	
	Training available (for users of the system being developed)	Schedule an d Cost	High	A clear Training Program Needs to be Developed with a combination of classroom based with web based.
	Project Manager/Leader Experience		Low	
	Developer experience with same type of project		Low	
	Team experience - with methodology used	Schedule and Cost	High	SDM is new to CTDOT, and it appears it could impact project acceleration.
	Team experience - with development tools used	Schedule and Cost	Medium	Vendor assistance for Team Admin Training
	Other -			
Project Oriented Risks	Project Objectives - clearly defined and well understood		Low	
	Training available for team members in technology, methodology and development tools		Low	
	Size of the project		High	Strive to continually explore cost and time saving measures (i.e. DOIT Hosting/Subscription)
	Platforms - required for development	Schedule and Cost	High	Accelerate Procurement using FHWA QBS for the use of specialized CAD Consultant Services
	Other -			
Resource Risks	Project Initiation resource		Low	
	Project Analysis and Planning resource		Low	
	Project Execution and Control resource	Schedule and Cost	Very High	Selection of 1 individual, that can make high level decisions and recommendations quickly
	Resources availability for design	Schedule, Cost and Scope	Very High	Vendor assistance required
	Resources availability for testing		Low	
	Resource availability for implementation	Schedule, Cost and Scope	Very High	Vendor assistance required
	Other -			

Project Risk Assessment

RISK CATEGORIES	RISK	Impact On Project	Risk Level	MITIGATION STRATEGY
		Schedule, Cost and Scope	Risk Level	
Environmental Risks	Environmental availability	Schedule, Cost and Scope	Very High	Accelerate DOIT Development Environment
	Environment for Analysis/Design/Construction	Schedule, Cost and Scope	Very High	Accelerate DOIT Development Environment
	Environment for Testing	Schedule, Cost and Scope	Very High	Accelerate DOIT Development Environment
	Environment for Acceptance	Schedule, Cost and Scope	Very High	Accelerate DOIT Development Environment
	Production/Implementation environment	Schedule, Cost and Scope	Very High	Accelerate DOIT Production Environment
	Developer experience with the environment	Schedule, Cost and Scope	High	Accelerate DOT and Vendor familiarity with DOIT's Environment and Protocol
	Stability of the environment	Schedule, Cost and Scope	High	Accelerate DOT and Vendor familiarity with DOIT's Environment and Protocol
	Equipment availability	Schedule, Cost and Scope	High	Accelerate DOT and Vendor familiarity with DOIT's Environment and Protocol
	Tools availability	Schedule, Cost and Scope	High	Accelerate DOT and Vendor familiarity with DOIT's Environment and Protocol
	Platform previously used and installed		Low	
	Other -			
Product Technology Risks	The technology (internal to the product/service)		Medium	
	The technology (relative to ultimate replacement)	Schedule	High	Establish a Protocol for System Replacement (Steps necessary to transition to an alternative System)
	Developer experience with the technology		Low	
	Distributed Database solution		Low	
	Distributed Process Solution		Low	
	Multimedia Data	Schedule	High	
	Unstructured Data Manipulation		Low	
	Transaction/Interaction Complexity	Schedule	High	A clear Training Program (Worfflow Based) Needs to be Developed with a combination of classroom based with web basec
	Other -			
Product Constraint Risks	Size - magnitude of the project		Low	
	Timing - ability to response to a timing requirement	Schedule and Cost	High	Vendor implementation planning
	Capacity - ability to handle volume		Low	
	Quality - required perfection		Low	
	Synchronization - with other entities		Low	
	Expandability - requirement to be able to grow		Low	
	Flexibility - ability to accommodate many options		Medium	
	Security - need for controls	Schedule, Cost and Scope	Very High	Work on a Resolution with DOIT on a web based app. secuirty solution
	Other -			
Project Constraints Risks	Mandated milestone date	Schedule	Very High	Revise the Project Plan and Establish a Critical Path for Milestones
	Mandated milestone date	Schedule	Very High	Revise the Project Plan and Establish a Critical Path for Milestones
	Mandated number of people	Schedule	Very High	Establish proper planning to allocate project team members and pilot training
	Mandated type of people		Low	
	Mandated budget	Schedule and Cost	Very High	Continually strive to update equipment lists and project budjets as more accurate information becomes availible.
	Other -			
OTHER RISK FACTORS				

***Note**: This is just a sample checklist, project managers will need to add other risk items (in "Other" fields) to log all the related risks for the project.*

System Life Cycle Cost Profile									
DDE Development - Engineering Content Management System	Years 1 - 5		Constant Dollars or Current Dollars						
Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
Site and Facility									
Hardware Lease/Purchase	$950,000.00		$250,000.00						$1,200,000.00
Hardware Maintenance				$31,500.00	$31,500.00				$63,000.00
Shipping									$0.00
Installation									$0.00
Software Purchase									$0.00
Software Maintenance & Upgrade	$527,832.00	$295,682.00	$320,682.00	$295,682.00	$320,682.00				$1,760,560.00
System Testing									$0.00
Conversion									$0.00
Studies									$0.00
Procurement									$0.00
Database Preparation									$0.00
Personnel									$0.00
Travel									$0.00
Training									$0.00
Overhead									$0.00
Consulting.	$108,000.00	$825,000.00	$925,000.00	$75,000.00	$75,000.00				$2,008,000.00
More….									$0.00
									$0.00
Total Projected Costs	$1,585,832.00	$1,120,682.00	$1,495,682.00	$402,182.00	$427,182.00				$5,031,560.00
Discount Factor (5-Year) End of Year Payment (Nominal Rate)	0.9461	0.8951	0.8468	0.8011	0.7579				
Total Present Value Costs	$1,500,355.66	$1,003,122.46	$1,266,543.52	$322,188.00	$323,761.24				$4,415,970.87

System Life Cycle Benefit Analysis Profile

Engineering Content Management System - Assuming Full Production	Equation Description		Years 2009 - 2013			Constant Dollars or Current Dollars				
Benefits Category	Equation Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
Hard Dollar Revenues		0	0							
Reimbursements		0	0							
Cost Reduction										
*General Improvement in Project Delivery**	(35hrs/wk)(8weekssavings)=140 hrs/month(4 Engineers) = 560 hrs./month ($60/hr) (150 projects/yr)	0.00	0.00	10,080,000.00	10,382,400.00	10,693,872.00	0.00	0.00	0.00	42,170,960.16
Reduction of Printing Costs (CE and State Des) (ProjectWise)	Total Printing Costs [$123,500/year] [25% reduction yr. 1] and [50% Red yr 2] and [75%red in yr 3]	0.00	0.00	30,875.00	61,750.00	92,625.00	0.00	0.00	0.00	185,250.00
Reduction of Printing Costs (Contract Admin.) (Webportal, or Digital Plan Room, or CD ROM)	Total Printing Costs [$331,000/year] [25% reduction yr. 1] and [50% red yr 2] and [75%red in yr 3]	0.00	0.00	82,750.00	165,500.00	248,250.00	0.00	0.00	0.00	496,500.00
*Digital Design Review (Time Savings on Design Review (Acrobat Review)***	(20 Engs Reviewing Projs)(3 hours saved/proj.)($60/hr)(150 projs./yr)	0.00	0.00	540,000.00	556,000.00	572,886.00	0.00	0.00	0.00	1,668,886.00
Digital Plan Archive System (Time Savings obtaining Digital Archives Engineers)	[150 projects per year/5 Engineers Researching/5hrs time savings per Eng./$60.00 per hour]	0.00	0.00	0.00	225,000.00	231,750.00	0.00	0.00	0.00	456,750.00
Digital Plan Archive System (Time Savings obtaining Digital Archives ROW/Surveys)	[150 projects per year/5 Surveyors or ROW people/3hrs time savings per Eng./$60.00 per hour]	0.00	0.00	0.00	135,000.00	139,050.00	0.00	0.00	0.00	274,050.00
							Benefits are expected to continue from yr 6 and beyond			
Soft Dollar Cost Avoidance										
Other (specify)										
Total Projected Benefits		$0.00	$0.00	$10,733,625.00	$11,525,650.00	$11,978,433.00	$0.00	$0.00	$0.00	$45,252,396.16
Discount Factor (5-Year) End of Year Payment (Nominal Rate)		0.9461	0.8951	0.8468	0.8011	0.7579	0	0	0	
Total Present Value Benefits		$0.00	$0.00	$9,089,233.65	$9,233,198.22	$9,078,454.37	$0.00	$0.00	$0.00	$27,400,886.24

* Overall we anticipate a signficant reduction in "turn-around time" for projects by providing proper software applications, data organization, technology and training for Engineers.
At this time, we are assuming that out of the 150 projects delivered per year, project delivery could be reduced by 2 Months (8 weeks) since production will be improved.
Assuming typically 2 Supervisory Level Engineers (Project Managers) and Two Lower Level Engineer's are responsible for delivering projects via CE Design or State Design,

** Typically during Design Review, there are representatives from multiple discipline reviewing plans. On Average, there
are approximately 15 engineers plus their Supervisors reviewing Design Submittals (Say 20 Supervisor's and Engineers).
Using automated Engineering Review Tools allows Engineers/Supervisors to comment directly on PDF or Electronic Plan sets.
On Average Eng. Applications has estimated that each engineer could save 3 hours per project using automated tools
20 (Engineers/Supervisors)/3 hours per project/$60.00 per hour BFO/150 projects per year.. = $540,000 per year

System Life Cycle Cost-Benefit Analysis Profile									
☐ Status Quo or ☒ Alternative - ECMS		Years 2009 -2013			☐ Constant Dollars or ☐ Current Dollars				
Cost Profile	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
Total Projected Costs	$1,585,832.00	$1,120,682.00	$1,495,682.00	$402,182.00	$427,182.00	$0.00	$0.00	$0.00	$5,031,560.00
Total Present Value Costs	$1,500,355.66	$1,003,122.46	$1,266,543.52	$322,188.00	$323,761.24	$0.00	$0.00	$0.00	$4,415,970.87
Benefits Profile	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
Total Projected Benefits	$0.00	$0.00	$10,733,625.00	$11,525,650.00	$11,978,433.00	$0.00	$0.00	$0.00	$45,252,396.16
Total Present Value Benefits	$0.00	$0.00	$9,089,233.65	$9,233,198.22	$9,078,454.37	$0.00	$0.00	$0.00	$27,400,886.24
Cumulative Cost-Benefits Profile	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
Cumulative Total Projected Benefits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cumulative Total Present Value Benefits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Qualitative Benefits	Related System Objectives					Measure of Effectiveness			
Better project communication						**FHWA Research Report Requirements:**			
Better data organization						Benchmarking - Pilot Projects "Existing Processes"			
Better project quality						vs. New Processes of Digital Submissions			
More efficient access to FOI requests									
Enabling of other Technologies									
- Use of 3D models in the field									
- Use of geospatial attributes to automatically show project limits									
Improvements to employee morale									
Better contracting data organization									
Telecommuting enabling									

Comparison of Alternatives					
Description	**Status Quo**	**Implement the ECMS - Alt. 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
QUANTITATIVE FACTORS					
Total Present Value Benefits	**0**	**$27,400,886.24**	**n/a**	**n/a**	**n/a**
Less Total Present Value Costs	**0**	**$4,415,970.87**	**n/a**	**n/a**	**n/a**
Net Benefit (Cost)	**0**	**$22,984,915.37**	**n/a**	**n/a**	**n/a**
Benefit/Cost Ratio	**0**	**6**	**n/a**	**n/a**	**n/a**
QUALITATIVE BENEFITS					
Description					
Better project communication					
Better data organization					
Better project quality					
More efficient access to FOI requests					
Enabling of other Technologies					
- Use of 3D models in the field					
- Use of geospatial attributes to automatically show project limits					
Improvements to employee morale					
Better contracting data organization					
Telecommuting enabling					

ENGINEERING  APPLICATIONS

Engineering Business Requirements
For an
Engineering Content Management System (ECMS)
(Project 0093-0164)

6/20/08

Table of Contents

Executive Summary

The purpose of this document is to clearly describe the scope and needs of the engineering business related to the proposed Engineering Content Management System (ECMS) and Digital Design Environment Development in the scope of Federally Funded SPR Project 0093-0164. Appendix A - Functional Specifications for an Engineering Content Management System (ECMS), outlines the detailed system requirements that need to be met. Additionally, we hope that this document can further assist the Office of Information Systems (OIS) better develop OIS staffing roles and requirements. The intent of the document is not to serve as a formal DOIT System Development Methodology (SDM) material, but rather to supplement the development of those documents.

The goal of the project is to transform the Bureau of Engineering and Highway Operations, streamlining and organizing project development and delivery. It is understood, an ECMS (In full Production) can potentially enable numerous other enterprise wide data applications. At this time the focus is solely on engineering content as it pertains to the development and the delivery of capital improvement projects for the Bureau. These projects require Computer Aided Design applications, the development of high value data (3D CAD files, digital terrain models, drainage databases and quantity databases), special provisions (specifications) and legacy data. Expansion into other application uses should only be considered after a production system is in place, successfully piloted and adequately staffed.

For the proposed project and piloting, Engineering Applications (EA) is requesting OIS to assume technology partner responsibilities and be the lead with the following priorities:

1. Direct Cost Accounting System Technical Conversion and Transition to ProjectWise
2. Development of the existing and proposed technical IT infrastructure and architecture schematic for both the development and production system.
3. Gaining system architecture schematic, security, approval through DOIT.
    a. Guidance in the development and submittal of required DOIT SDM documentation in consideration that this may be a federal sponsored research project.
4. System hardware cost estimate development
5. System hardware specification development
6. System hardware installation and maintenance
7. Oracle System Integration and Testing
8. Application deployment (including Oracle 10g or higher) and testing for both the development and production system
    a. Automated Application Deployment (i.e. script logic)
9. Guidance and Technical Assistance with ProjectWise Security Model Development
10. ProjectWise Data Back-Up and Recovery

EA responsibilities, which have been documented in Appendix B Engineering Applications Roles in Project 0093-0164/SPR 2253 – ProjectWise Phase 1 and 2 and the DDE Development, includes engineering end-user representation, system workflow documentation, testing, application usage support and training etc. Although further discussion is needed; EA's role assumes the majority of the business partner functions as prescribed in DOIT's recommended IT Project Team: (DOIT Recommended IT Project Team Composition)

Appendix C – Definition of Key Terms, provides an overview of key terms used throughout the document.

Direct Cost Accounting System Transition to ProjectWise

A critical part of the scope of the project is to successfully continue and/or transition the Direct Cost Accounting System to usage in ProjectWise, so that system maintenance costs can be reimbursed from federally funded projects.

General Overview – CTDOT Projects Datasource

Project 0093-0164 will focus on piloting several active construction projects (To be determined) and developing the construction plan archive system, which would contain scanned imagery with associated metadata of the archived mylars located at the Engineering Records Center. See Figure 1 below:

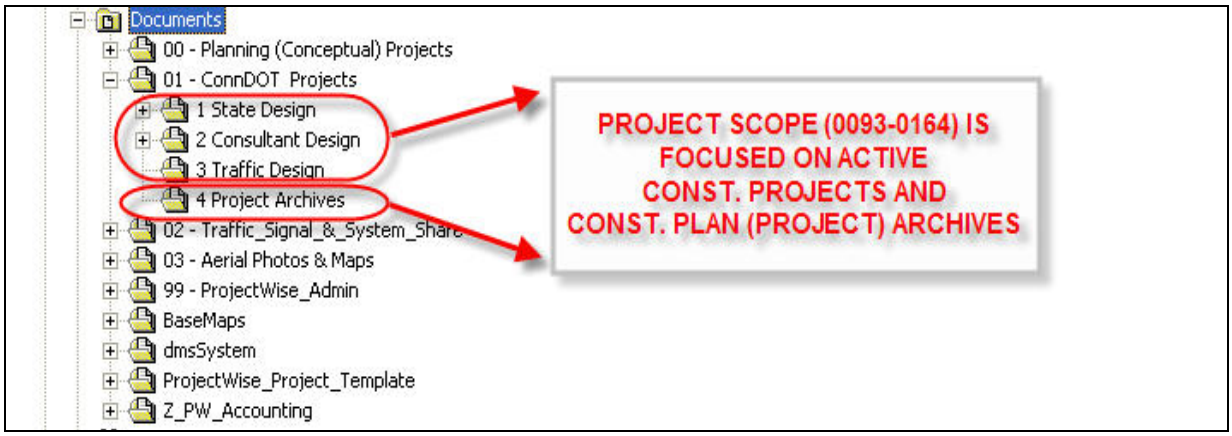


Figure 1

Project Template Overview

The primary engineering business is based on CTDOT's Standard Project Template (Figure 2). This template will be used with every project for both in-house engineering production and external engineering production. This project template is already in production on CTDOT_Projects on SH3DGS18 and is being used for Pilot Project 0092-0619 and 0107-0158 in the ProjectWise Development System. Potential end-user numbers can be done by observing the windows network groups set-up on CTDOT_Projects on SH3DGS18.

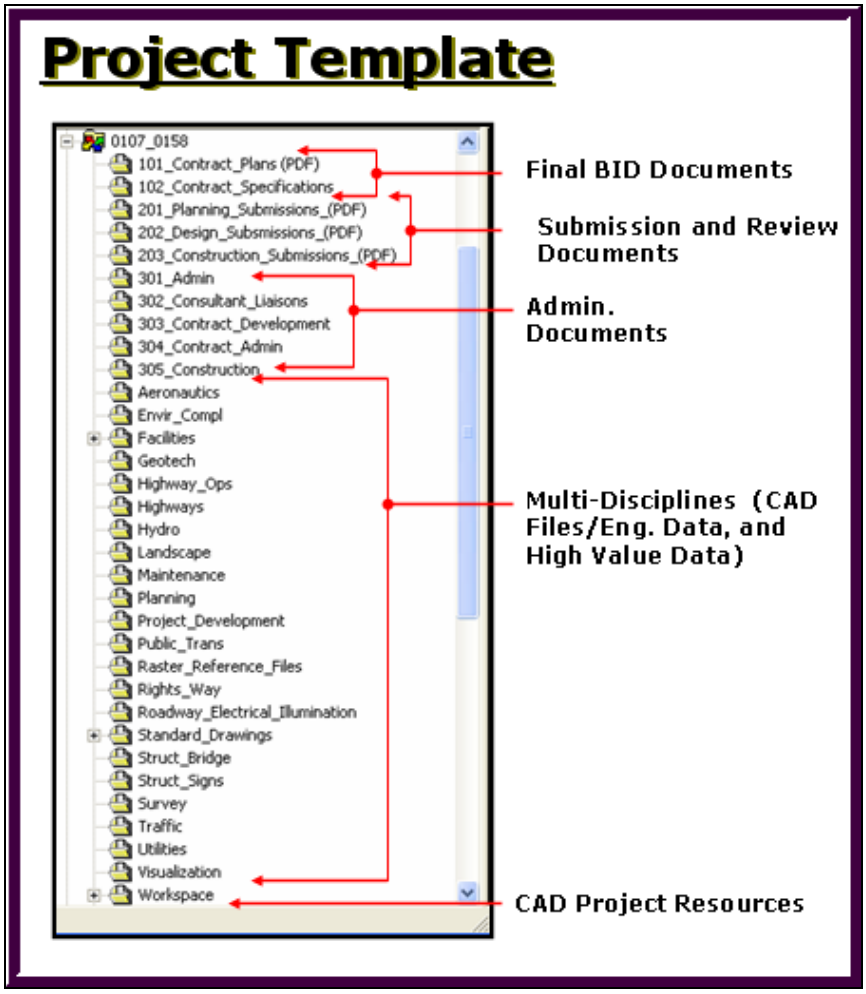


Figure 2

Final Bid Documents - Business and Security Requirements

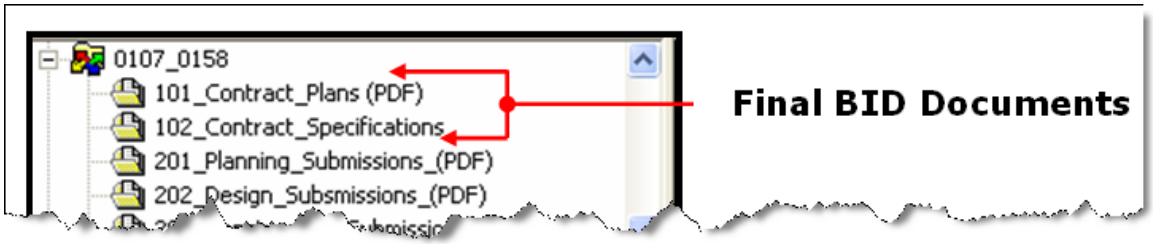


Figure 3

The primary purpose of the folders in Figure 3 above is to store the Department's Final Contract Plans (Drawings) and Specifications in PDF format. These folders and documents will be "read only" to internal DOT employees who have ProjectWise. External Contractors and Consultants will not have access to these folders until it has been determined that a contract has been successfully awarded to a contractor. For the future, "Outside Access Requests" application procedures will need to be established at the appropriate time proper system architecture is place.

Engineering data in these storage areas will require only uploads "check-ins" by Engineering Applications (EA), Contract Development, or Contract Admin staff. For the piloting, Engineering Applications Staff will be handling all the engineering data management. At the same time, Engineering Applications will provide all training (classroom based, hands-on, and support based).

The future goal is for Engineering Records staff to download (export) copies of the PDF files and either burn the data to a DVD and/or print the engineering plan sets. Testing has occurred with the existing ProjectWise Development System at the Engineering Records Center. It was determined the network connections would need to be upgraded to reach the desired download speeds. OIS Network Staff is currently working on ordering a new wireless connection to continue testing. OIS Eng. Support is also evaluating a development scenario in which file caching servers could be placed at Pascone Place (and other Offices) with the purpose of having the documents ready for quick download. Bentley Systems should be consulted with these two scenarios with the development of a revised network/system schematic for both the development and production system. At this time, EA Staff is carrying DVD's to Engineering Records for set-up and reproduction. A solution to better this is required.

Appendix D – Existing Network Infrastructure and User Functions by Location, outlines the potential concurrent end-users and functions (upload/downloads) file sizes per location assuming ProjectWise is full production. This is a joint document developed by OIS Network and EA.

EA is involved with the development of very detailed digital signature and submission procedures for engineering data. A link to the Draft Document can be found here: Draft Digital Submission Procedures. This document covers the addendum and construction order process. Digital Signatures is not part of the scope of this project.

Appendix H – Preliminary Security Model
outlines the ProjectWise Security Model under development.

Design Submission and Review – Business and Security Requirements

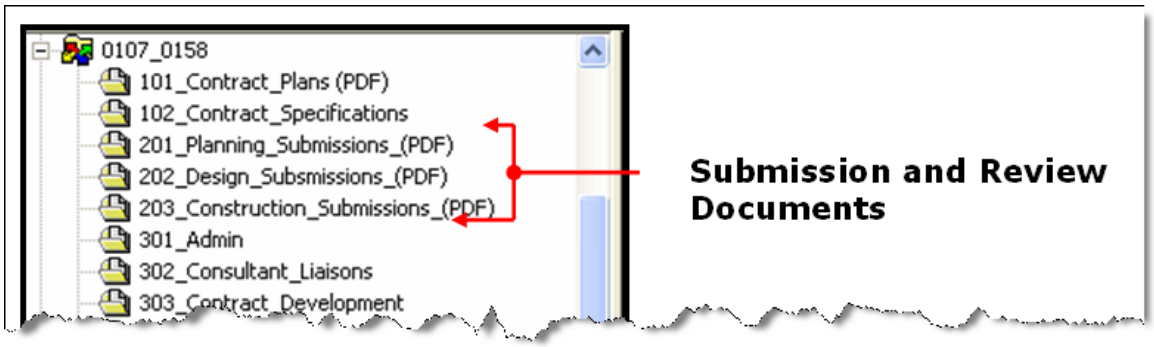


Figure 4

Design Submissions:

The three folders denoted in Figure 4 above represent the majority of benefits associated with increasing productivity, quality and collaboration during project design submissions and reviews. The primary purpose of the above folders is to facilitate the transmission (uploading) of electronic design submissions for external CTDOT business partners (i.e. Consultant Engineers and Contractors) involved in the project development and construction process (future shop and working drawing process). Alternatively internal DOT staff will also use the folder for the receipt of the data, and for transmission of internal design submissions. At this time, EA is only considering the design submission process as a part of the scope of this project. Future development will consider both planning and construction submissions.

The primary access point for the external business partners would be via ProjectWise's Web Explorer Lite (WEL). External business partners will only have access to the above denoted folders during the preliminary design phases. The type of documents they will be submitting to those folders will generally be Microsoft Word (Special Provisions), Excel (Eng. Calcs), MicroStation (Design Files), and Adobe PDF (Design Submissions).

The existing development system uses DOIT's VPN FOB keys. Both EA, OIS and DOIT have had numerous meetings regarding the FOB key issue. The present VPN FOB key solution will not fulfill Engineering Business Requirements. The reasons why it will not work have been documented in Appendix F – DOT/Bentley response to DOIT's Security Concerns Letter. While EA is opposed to the VPN FOB key solution, EA is not opposed to alternative two factor authentication solutions or single factor authentication solutions (Core-CT). Suggested solutions to remediate the disagreements between DOT and DOIT are the following:

1. Develop a single factor authentication solution and architecture acceptable to DOIT and DOT.
2. RFI/RFP alternative two factor authentication solutions that do not require a VPN FOB keys.
3. Prepare a rebuttal to DOIT's Commissioner Letter, have DOIT revise the letter for the Commissioner to sign off on.

Submission Reviews:

Engineering's future intent is for internal engineers to apply Adobe Acrobat's Shared Review application using an email link not an email attachment to the ProjectWise storage location of the design submission. Engineering Applications has piloted the solution under Project 0107-0158 and 0092-0619. An internal server share has been set-up to facilitate Adobe Design Reviews.

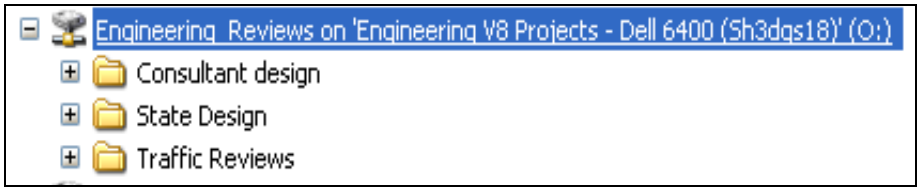


Figure 5

Early feedback from District 4 has revealed an approximate 50% time savings in design review time. In their opinion, every design review should be done in this fashion. While the results are promising, customization of both ProjectWise and Adobe Acrobat will likely be required and has been identified on the project plan as a possible RFP item. The following bullets outline a list of potential future application development/customization needed for both ProjectWise and Adobe Acrobat:

- Acrobat relies primarily on a windows environment. The following are Acrobat bugs and desired features have been identified with the software:
    - Two comment tools (text box and call-out tool) do not work with Engineering's Approval workflow. Adobe is aware of this; however, the proposal of a version 10 release is unacceptable.
    - Provide comment summary functionality in Adobe Reader 8.0.
    - Provide better formatting options and layout for comment summary reports in Acrobat 8.0.

- Provide the ability to batch comparison analysis of multiple separate files or PDF Packages.
- Provide the ability to initiate a shared review of a PDF Package and/or a multiple page PDF document.

- The following are ProjectWise desired features:
  - ProjectWise I-desktop integration with Acrobat similar to MS Office Products.
  - Direct integration between a ProjectWise data folder and Adobe Acrobat's Shared Review Functionality to mimic what EA has already started on.

Project Administration – Business and Security Requirement

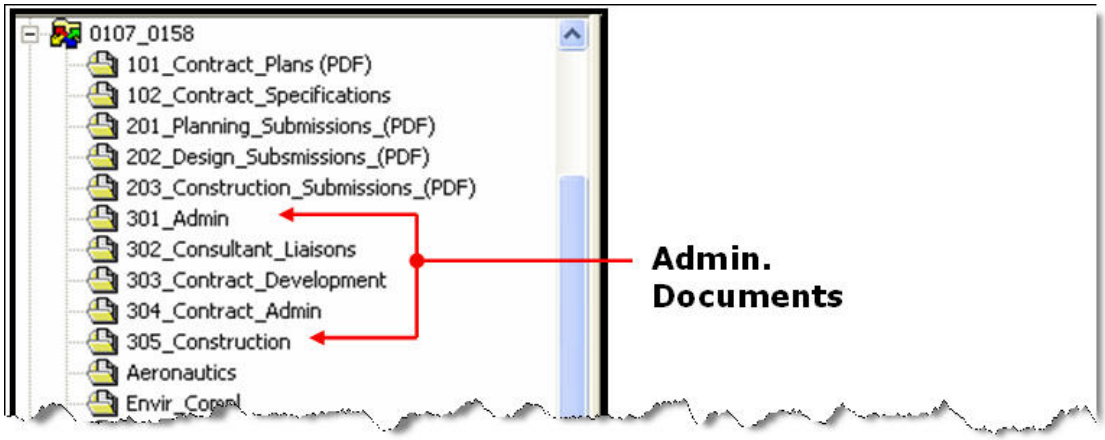


Figure 6

The purpose of the Administration folders outlined in Figure 6 above is for the storage of general project related source documents (i.e. MS Word, MS Excel etc) that relate to a project. Since digital signatures have not progressed to the use on general documents, the functions of these folders will have not have high importance.

Both the Contract Development folder and the Contract Admin folder will be used for reviews and changing the statuses (security) of final contract documents as they move from stage to stage. ProjectWise "State Change" functionality needs to be evaluated to determine if it will work in their desired workflow. At this time, the Contract Development folder (security model) can only be seen by their designated security group and administrators.

During the piloting of Project 0092-0619, Contract Development provided the Federal Highway Administration a DVD disk of the Final Contract Plans (PDF)(close to 1000 sheets), Specifications (PDF), and Estimates. While the solution was successful, Engineering Applications position is that a future solution would allow FHWA to access the data in a specific folder in ProjectWise. A "State Change" in ProjectWise would have triggered an automated email to them, that the data was ready. Current ProjectWise network infrastructure does not allow for this.

Engineering Disciplines CAD and High Value Data – Business and Security Requirements.

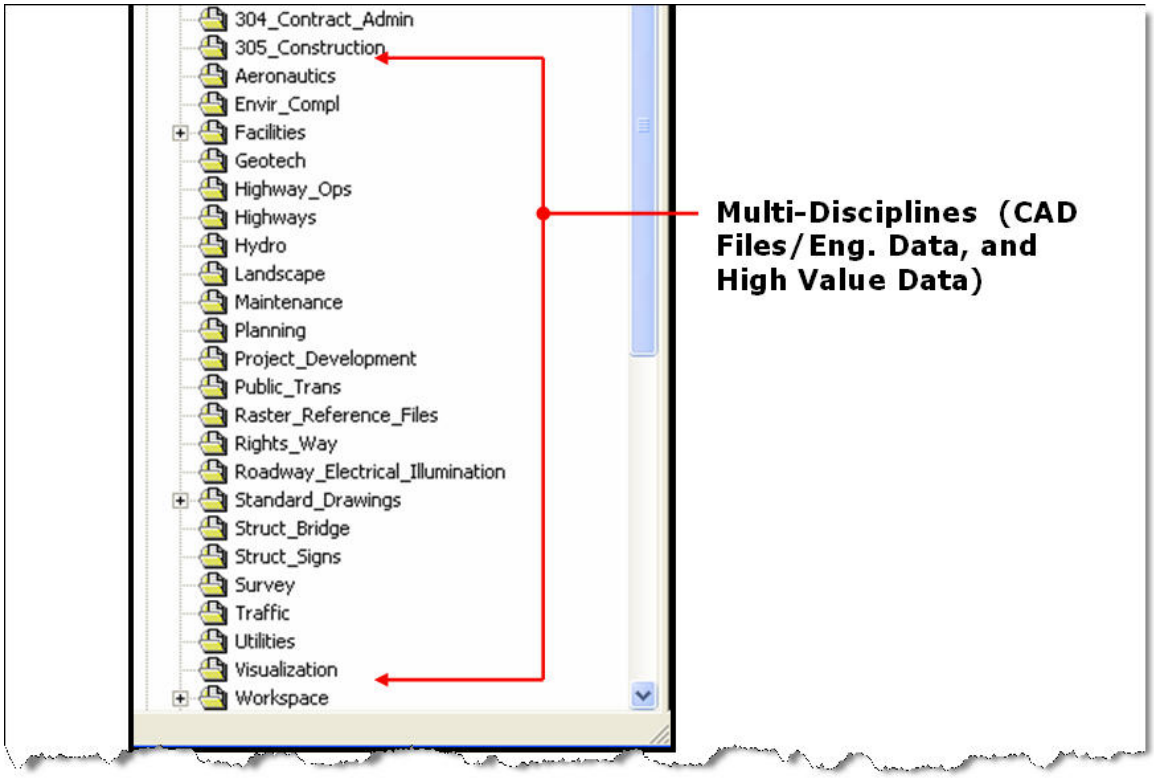


Figure 7

The folder structures outlined in Figure 7 provides Engineering and Design Disciplines a storage area for their electronic 3D Design models, Contract Sheet models, additional high value data production and storage of project correspondence and specifications. These folders contain mainly .MicroStation, InRoads, Microsoft Word and Excel, Raster Imagery, and PDF files. File naming conventions for these folders has been standardized on for CAD files, while design submissions and project correspondence is a "Work-in-Progress" (WIP). The Digital Design Environment Guide (http://www.ct.gov/dot/lib/dot/documents/deng/CTDOT_DDE_Guide.pdf) provides listings of both standard and WIP naming conventions.

It is these project folders that are the foundation for CTDOT's project storage standard. The files within these folders require the Engineering Content Management System (ECMS) to function in a manner that allows integration with the design applications. This integration and functionality are documented in Appendix A - Functional Specifications for an Engineering Content Management System (ECMS) . This integration with CTDOT's foundation CAD software Microstation, Survey and Roadway design software InRoads and Microsoft Office Applications allows Engineering to automate and enhance production of engineering contract designs and documents.

It should be noted that while in-house project design is currently utilizing these folders during production on CTDOT_Projects on SH3DGS18. Conversely without ProjectWise, CTDOT has no clear way of obtaining CAD or High Value data that was paid for by Consultant Engineers. Transmission of a DVD or CD containing CAD or High Value data is not a desirable solution since it is not efficient and there are no guarantees that project data confluence remains intact.

The lack of data makes it virtually impossible for the Department to be able to take advantage of 3D high value data that can potentially be used for inspecting construction projects and difficult to

maintain infrastructure. ProjectWise will serve as the vehicle for the department to begin to preserve and utilize CAD and High Value Data.

Security for these folders is read/write access per discipline. The security model currently used on SH3DGS18 will be carried over to ProjectWise. The proposed security model is outlined in Appendix H – Preliminary Security Model

.

CAD Resources – Business and Security Requirements

Figure 8

CAD Resources are critical in the development of project designs since they contain all the necessary fonts, linestyles, and custom working units as projects are designed. This data needs to be kept with the project before and after completion in order to maintain project data confluence.

Again, integration of the ECMS is required so that the design applications can be configured to locate this data within the ECMS.

Security to this folder is set to read-only for all disciplines with exception to certain sub folders that have read/write privileges for plotting output.

Project Location and Construction Staging Representation using ProjectWise Geospatial

Every project location survey or design typically contains graphical location information in MicroStation format. Additionally, every project has attribute information that is associated with its phase (i.e. planning, design, or in-construction). Within the application, ProjectWise has the ability to both present the survey location shape and color code the status information (phase) on a Connecticut geospatial interface (See Figure 9 below).

ProjectWise also has the ability (via the Oracle Spatial Connector) to export the graphical coordinate information of the shape directly into the Oracle database. The short term goal of the project is to be able to port this information easily to the web for further research, testing and presentation to management. The testing and research can be done with either ESRI or Bentley Geospatial Products as long as the necessary workflows and information gets automatically sent to the Oracle Spatial database correctly.

The longer term goal is to be able to provide this information to the general public for viewing a projects status and information. In addition, the Office of Engineering and FHWA have indicated they want the ability to view simultaneously Project and Construction Staging Limits (CAD information) simultaneously, with "real time" accident history.

For the scope of the project, System Architecture will need to be developed for the development and production system, which takes into consideration hardware for Bentley and Oracle's necessary Geospatial Applications. Consideration should also be given to ESRI's necessary hardware requirements to facilitate interoperability.

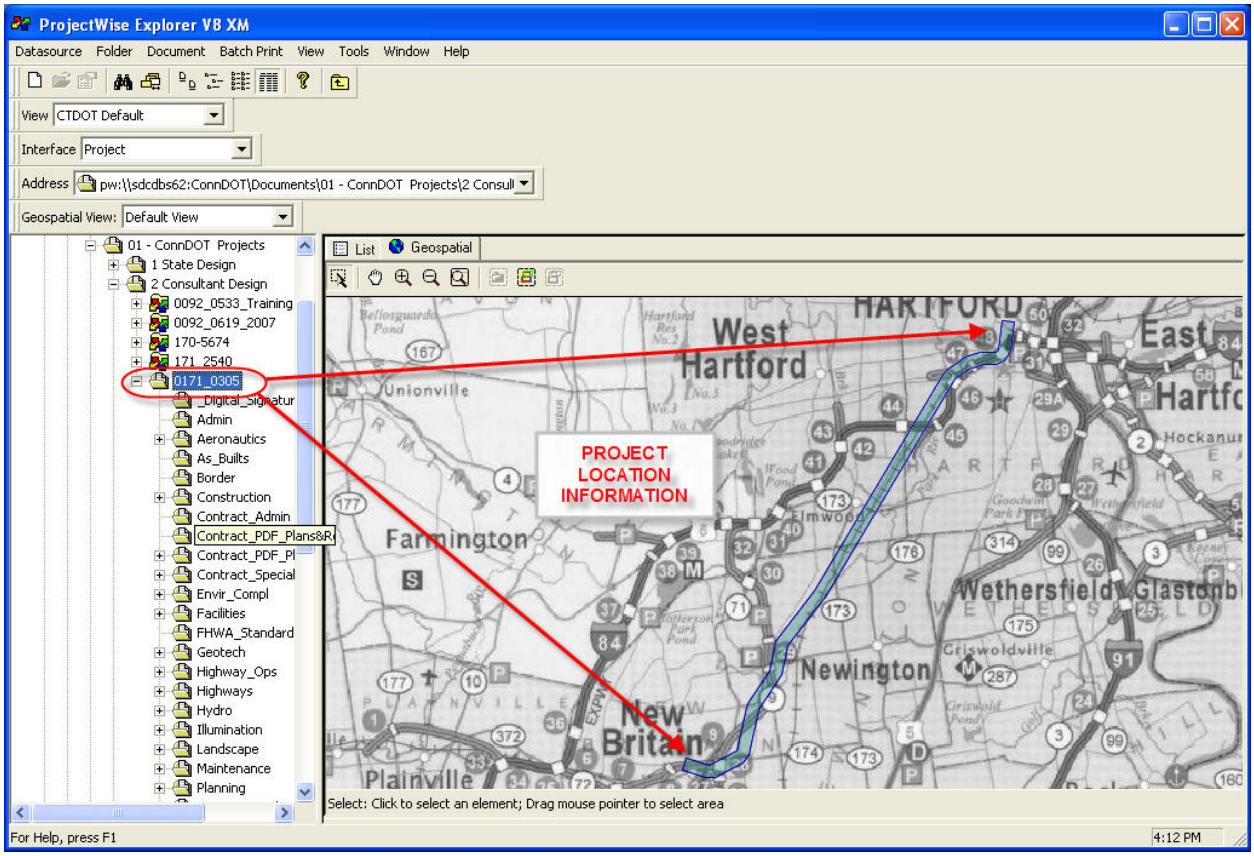


Figure 9

Project and Infrastructure Attributes – Integrating ProjectWise Attribute Fields with existing Department Databases

ProjectWise has the ability to integrate with existing Microsoft and Oracle databases. Rather than having engineers enter redundant information about projects, EA would rather integrate the attribute fields so they are reading information from existing department databases or systems. Figure 10 below depicts a screen shot of ProjectWise Attribute fields.

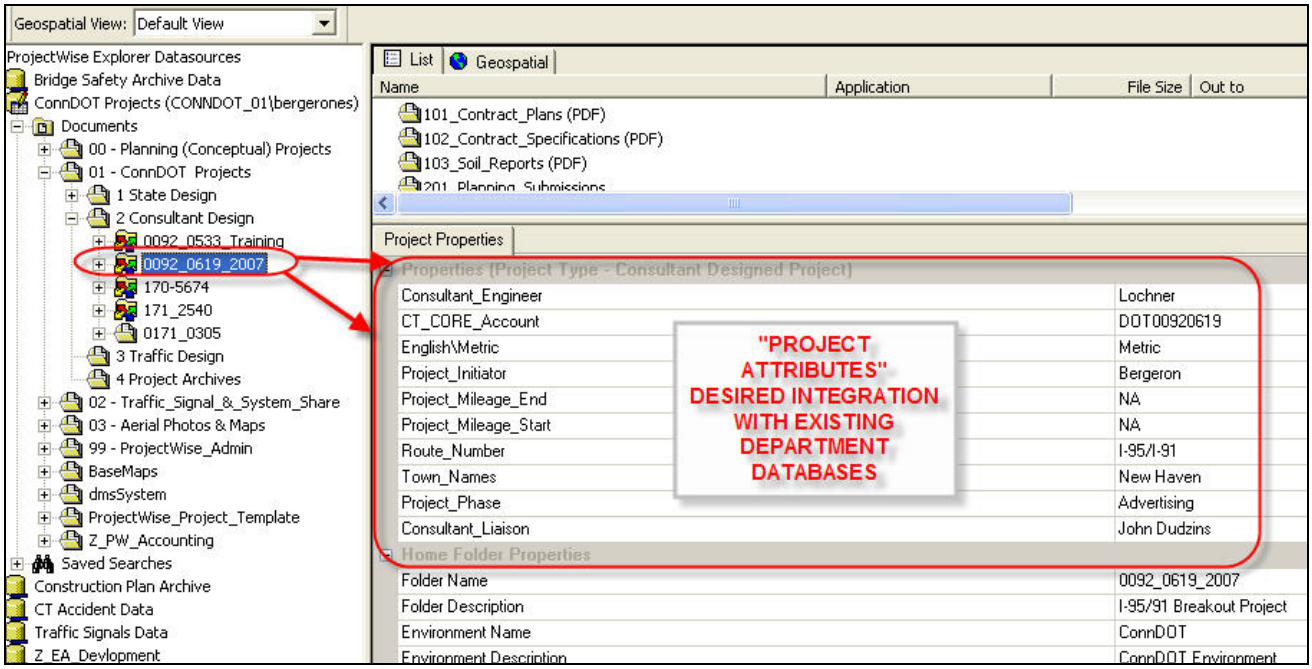


Figure 10

EA with OIS would develop a schema which will define the desired attributes and integration per ProjectWise Environment. OIS would pursue the technical integration. For the active projects environment, the concept is to integrate with all or some of the following existing databases:

1. CORE Project Costing – (Intermediate Table)
2. Fin. Man. Obligation Plan – (Assuming Oracle Conversion)
3. Possible Roadway Network Database
4. Joblog
5. PCMS remnants

The following other ProjectWise data sources need to be developed and tested with the existing database integration:

1. Bridge Safety - SYS Information System. Bridge Safety would like to begin utilizing ProjectWise for data storage.
2. Traffic Signal Intersection Database
3. Existing Dbase Construction Plan Archive Database
4. Possible IRM Database

Legacy Data (Construction Plan Archive System)

A significant component of the project scope is scanning a sample set of the approximate 600,000 Mylar construction plans located at the Engineering Records Center and uploading them into ProjectWise. EA will develop an Implementation Plan and handle the data storage and security structure in ProjectWise. It is desired to perform the scanning and attribute data entry outside of ProjectWise using Adobe Acrobat or other application capable of creating a multi-page pdf and assigning specific metadata to the file. The pdf files would then be uploaded into ProjectWise and the associated metadata would need to be automatically imported (copied) into the ProjectWise Oracle database.

Kentucky DOT performed a similar project using ProjectWise System as the ECMS for the scanned archives. Information can be provided regarding Kentucky's ProjectWise Implementation.

A vendor (via an RFP) will be needed to perform the scanning in a desired timeframe. Existing Engineering Records staff will need to have a role in the project. At this time, their roles in the project will need to be identified in the implementation plan.

Bridge Safety and Traffic Signal Intersection Data

The ECMS also needs to accommodate active and historical bridge safety inspection reports (PDF) and traffic signal design CAD, analysis and documents. Both data sets should also be able to integrate with their respective existing informational databases (SIS for Bridge Safety Data and the Traffic Signal Log). In both cases it will be desired to bulk load all the approx. 4,000 traffic signals folders and approx. 6,000 bridge folder and attribute information in one process. Figure 11 and Figure 12 below provides screen shots of the desired integration of both datasets.

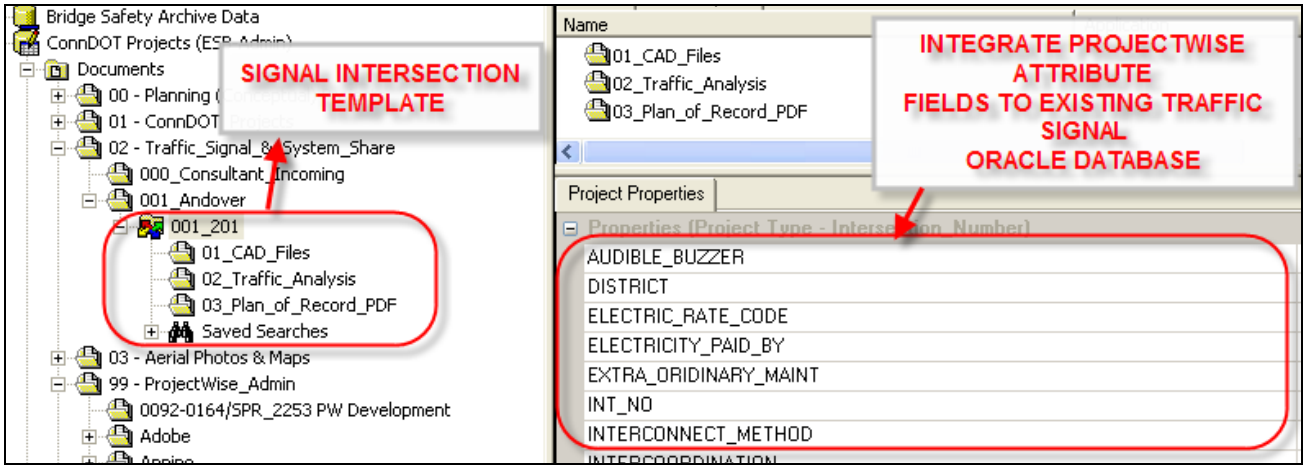


Figure 11

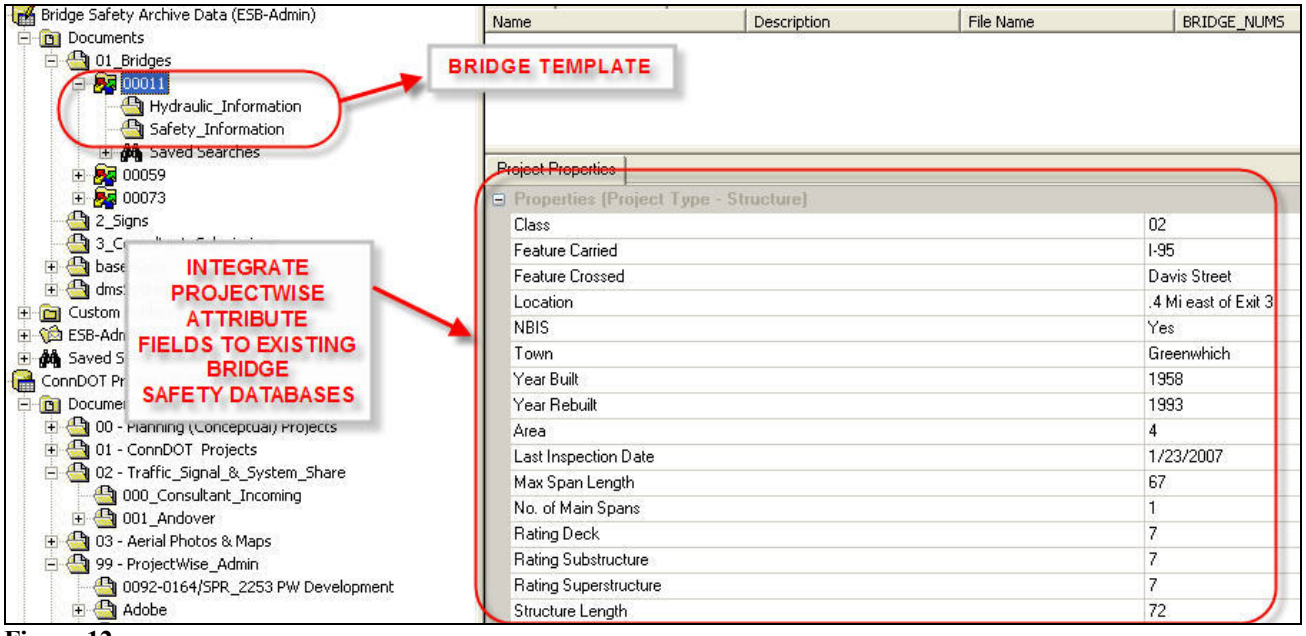


Figure 12

Quality Assurance, Control and additional Architectural, Engineering, and Construction (AEC) Applications for the Digital Design Environment

EA has identified areas of needed application development associated with CAD production, quality assurance, and efficiency. These proposed applications may need to consider soliciting an RFP from

third party Task Based Consultants. Below is a list of possible applications that need additional development:

1. Digital Design Environment Installer – More efficiency and assistance is needed configuring remote computers to CTDOT CAD Standards.
2. AutoCAD DDE Environment Development – EA would like to begin entertaining the submission of AutoCAD files that are capable of working in the Digital Design Environment.
3. CAD File Quality Assurance and Control Applications – Numerous DOT's have developed or purchased quality control applications associated the checking the integrity of CAD submission.
4. More efficient PDF Batch Plotting - Similar to how ProjectWise functions, an application is desired which will provide an end-users an option to export project CAD files to a users local machine to take advantages of more efficient local computer power publishing.
5. MicroStation based applications that are capable of streamlining the placement features (via cells or specialized line styles) and providing the ability to harvest quantities using Bentley Inc's InRoads and Quantity Manager or other application.
6. Adobe Acrobat and ProjectWise customization as identified in the Design Submission and Review – Business and Security Requirements above.
7. MicroStation XM workspace and configuration development for the DDE.

Appendix A - Functional Specifications for an Engineering Content Management System (ECMS)

The Bureau of Engineering and Highways has identified the need to provide an Engineering Content Management System (ECMS) for all engineering electronic data, including application integration. The system should be adaptable to reach outside of engineering to warehouse project planning and construction data also.

In order to accomplish this, any system will require the following (but not limited to):

General Application Functions and Integration

- The proposed system shall provide desktop application integration such that all file access functions are hooked to the Content Management System. This should include (but not be limited to) File> New, Open, and Save As. This should include Microsoft Office, Bentley MicroStation, IRAS/B, and Descartes, and Autodesk AutoCAD.
- The proposed system shall provide support for Multiple Document Interface, where applicable. This should include (but not be limited to) Microsoft Office, Adobe PDF and AutoCAD applications.
- In addition to the aforementioned integration, the proposed system shall provide attribute exchange for MicroStation, AutoCAD, and Microsoft Office document types. More specifically, the system shall provide the ability for attributes in the content management system to populate intelligent title blocks within CAD format documents, and custom fields within Office format documents.
- The proposed system should provide the capacity to specify both an edit, a redline, and a view application for each file type.
- The proposed system shall provide support for multiple versions of desktop applications. More specifically, the system should support multiple versions of MicroStation and AutoCAD, and provide a mechanism to distinguish between different versions of the same file type. For example, the system should be able to correctly launch AutoCAD 2004 to edit a DWG file of that vintage, and AutoCAD 2007 to edit a DWG file of that vintage.
- The system must be capable of the centralized creation and storage of electronic plan and specification packages throughout the entire contract development process (addendums and construction orders). The said electronic plan and spec packages are then enabled for possible transmition to DAS Web Portal (or other) in accordance with the above law.
- System shall provide ability for document comparisons between files with detailed specific output.
- System shall provide ability for tracking of versions and all their related files, as they existed when that version was created. For example, version 4 of a master file may currently be related to version 3 of one of its reference files. However, when the master file was at version 2, the reference file may have been at version

CAD Application Integration

- In addition to the general integration items, the proposed system shall provide CAD reference file support for Bentley's MicroStation, and Autodesk's AutoCAD. MicroStation versions supported should include MicroStation/J, V8

2004 Edition, and V8 XM Edition). AutoCAD versions supported should include AutoCAD 2000, 2002, 2004, 2005, and 2007.

- Reference file support should be broken down into the following specific functions, and itemized as supported or not, for both MicroStation and AutoCAD:
    - Attach/Detach Reference – should allow user to access content management repository, or optionally access local storage
    - Attach/Detach Reference should provide for immediate or delayed update of content management database, such that reference attachment changes are automatically recorded to the content management system
    - Attach/Detach Reference should support both Raster and Vector reference attachments
    - Local Caching – The proposed system should support the concept of local caching such that performance is enhanced, and network transfers are minimized when working on compound document sets.
    - Reference Deletes – The proposed system should warn the user if they are attempting to delete a file that has been referenced to another file
    - Reference Moves – The proposed system should automatically heal broken linkages as a result of moving a previously referenced file to a different folder.
    - Reference Renames - The proposed system should automatically heal broken linkages as a result of renaming a previously referenced file.
    - Nested References – The proposed system should support the concept of nested reference files. More specifically, if file B references file C, should file B be attached to file A, then the user viewing/editing file A should see files B, and C.
    - Real-time notifications – The proposed system should support the concept of notifications such that the user is made aware when one of the files referenced in the active session has been modified by another user.

- CAD Workspace support – The proposed system shall provide the ability to associate a MicroStation Workspace, or AutoCAD profile with a given file, or folder. Subsequent edit sessions for the file should then be forced to activate the specified workspace
    - In addition, Workspace/Profile support should feature inheritance such that the Workspace can be assigned at any level in the folder structure, and will inherit to all files/folders below it in the folder tree.
- CAD Workspace management – The proposed system shall provide the capability to store designated workspace files (cell/block libraries, font resource files, linetype resource files, etc.) within the content management system. Required workspace files shall then be automatically downloaded to the client workstation when needed, based upon the workspace being assigned to a file or folder.
- InRoads Preferences – The proposed system must be capable of reading and writing Bentley InRoads preference files for the successful development, delivery and completion of High Value Data (Digital Terrain Models (.dtm) and coordinated geometry files (.alg).
- Shall provide tracking abilities to view and monitor changes through viewing various versions in succession.

Legacy Data

- The proposed system shall provide a means of bulk-loading legacy documents into the content management repository. Bulk import methods should support (but not be limited to) the following functions:
    - Support import of individual files, or entire folder structures in a single operation
    - Import of simple files, or import of files with associated metadata (in either a delimited text file, or Excel spreadsheet)
    - Support of CAD documents including pre-existing raster and vector reference attachments. In the event of pre-existing reference file relationships, the system should provide a batch-mode reference discovery tool.

Indexing/Searching

- The proposed system shall provide an easy means of viewing all files checked out to a given user.
- The proposed system shall provide an easy means of determining the list of files attached as reference to the file in question (forward look-up)
- The proposed system shall provide an easy means of determining the list of files that are referencing the file in question (reverse look-up)
- The proposed system shall be capable of performing full text searches on Microsoft Office document types, Bentley MicroStation documents, and Autodesk AutoCAD documents.
- Where applicable, the proposed system shall display "thumbnail" views of documents to aid in the search process. This shall include (but not be limited to) MicroStation, and AutoCAD document types.
- The proposed system shall provide the capacity for folder or "project" level attributes that can be inherited at the document level.
- The proposed system shall provide the capacity for custom document attributes, to be defined by the System Administrator
- The proposed system shall provide the capacity to further define custom attributes by:
    - Providing default values based on system attributes, or administrator defined values.
    - Limiting users to a defined list of choices
    - Forcing formatting options (such as upper case)
    - Determining the value list for an attribute based on the value chosen for another attribute
- The proposed system shall provide the capacity to automatically index documents based on their Windows/Operating System level file properties.
- The proposed system should provide the capacity to save searches, and execute them again with minimal effort on the user's part
- The proposed system should provide the capacity for both global (visible to all), and personal saved searches.
- The proposed system should provide the capability to generate indexes based on CAD file content. More specifically, features on a drawing or map should be indexed against the file, and available for subsequent search operations. As an

example, one might need to know on which drawing(s) a particular transformer appears.

Geospatial Referencing / Indexing

- In addition to traditional document indexing, the proposed system shall provide support for Geospatial referencing/indexing. More specifically, the system should provide the capacity to display documents on a map view, in addition to the traditional file list view.
    - Geospatial Map views – The proposed system shall provide the capacity to configure a background map on which to display coordinate aware documents. Coordinate aware documents should be displayed as polygons, or alternately as pushpins
    - Non-geospatial documents – For display of documents that are not coordinate system aware (typically Office documents), the proposed solution should provide a means of adding geospatial reference information in order to properly display the document on the map view.
    - Coordinate Systems – In support of the map view, the proposed system should provide support for those coordinate systems in common use throughout North America. In addition, the solution should be able to transform documents between coordinate systems on the fly in order to properly display on various background maps.
    - Geospatial Searches – In addition to traditional metadata-based searches, the proposed system should provide the capacity to search for documents based on their geospatial location.
    - Map View Re-symbolization – When documents are displayed as polygons on the map view, the system should provide the capacity to re-symbolize the polygons (change the color) based on other metadata.

Batch Plotting / Automation

- The proposed system should support batch printing of engineering drawings/maps. Batch printing support should include (but not be limited to) the following functions:
    - The proposed system shall provide integration with the MicroStation batch plotting engine for output to paper drawings, or PDF files.
    - The proposed system shall provide integration with the Bentley Digital InterPlot production plotting solution for output to paper drawings, or output to PDF files. InterPlot integration should include support for InterPlot Organizer, Design Scripts, Settings files, and color tables.
    - The proposed system should support automated plotting processes based on document, or project milestones. More specifically, the system should support automatic generation of paper drawings, or PDF files at specified workflow events. PDF files created at project milestones should be tagged with metadata from the original native format CAD document.

Web Access

- The proposed system shall provide the capacity to access the content management repository from a Web browser, for only those projects they have been granted access for. Web access shall include (but not be limited to) the following functions:

- New Documents – The proposed system shall provide the capacity for web users to create/upload new documents
- View/Edit Document metadata – The proposed system shall provide the capacity to view and/or edit document metadata, both standard and that defined by the user organization
- Searches – The proposed system shall provide the capacity for web users to execute interactively defined searches, as well as previously saved searches. This should include metadata based searches, as well as full text searches, and component-based searches and provide results for only the data they are authorized to view.
- Document check out/in – The proposed system shall provide the capacity for web users to check out/in simple (non-compound) documents.
- CAD Viewing – The proposed system shall provide the capacity for users to view CAD document types (DGN and DWG files) without having installed viewing technology. Further, the viewing technology should provide the capacity to zoon in/out without loss of resolution. Lastly, the viewing technology should provide the capability to display multiple versions of the same drawing and highlight changes between versions.

Redlining/Commenting

- In support of the engineering review process, the proposed system shall provide commenting tools for common engineering drawing/map formats. Redlining functionality shall include (but not be limited to) the following:
  - Non-intrusive commenting for MicroStation DGN and AutoCAD DWG format files. Non-intrusive commenting involves integrating with redline applications that create new files in which to store user comments.
  - The proposed system should support non-intrusive commenting via an installed/integrated desktop application (thick-client approach), as well as from a web browser (thin-client approach).

Integration with Existing Systems

- The system should be capable of integrating with the existing systems:
  a. CORE Project Costing
  b. SYS – Bridge Safety Report Database
  c. Traffic Signal Intersection Database
  d. Possible Legacy PCMS Data
  e. Financial Obligation Plan – Database
  f. AASHTO Trns*Port

Security/Auditing/Backup's and Recovery

- The proposed system shall provide security on an individual basis through "roll" definition. Users will be set up to be able to read and/or write to only those files required for them to process their work, both at the discipline level and individual projects.
- Further breakdown of security shall be required during the electronic workflow routing. Based on status of document and type, the security of the document automatically changes. Security must allow either specific users access or groups to read/write/print or deny access based on status.
- System will allow individual files to be password locked as well as specific folders where necessary to help prevent unauthorized access.

- Password for such security of files and folders must be able to be assigned and administered at discipline level with ability for system security administrators to delete password should it be forgotten.
- Audits must be created when user ‘checks out’ and ‘checks in’ document. Showing on audit should be (but not limited to) date and time stamp, user name, if document was changed and computer number (IP address?).
- For files that have sensitive data, audits must also be written when document is read and/or printed. In these instances, an export to local drive is not permitted.
- Reporting capabilities on audit stored information by (but not limited to) user name and date parameters.
- System must have automated daily backup capabilities as well as ones that can be administered on demand. This includes both full system back up or individual folders/files.
- Recovery also should allow full system recovery as well as individual folders/files and allow choice on version of files.
- System shall provide mechanism for electronic routing of document or group of documents. When a document(s) is completed at one stage, its status changes. Automatic notification of individual or project can be set up as well as having document(s) sent to a specified folder, based on state.

Appendix B Engineering Applications Roles in Project 0093-0164/SPR 2253 – ProjectWise Phase 1 and 2 and the DDE Development

Business Project Manager - Eric Bergeron
Assistant Project Manager – Tony Servidone

Responsibilities / Functions:

- Expert Knowledge of "Engineering" Business functions and the associated development and delivery of Capital Improvement Infrastructure Projects using AEC Applications (ProjectWise, MicroStation, Adobe Acrobat, InRoads, On-Site).
- Serves as Power User of AEC Applications (ProjectWise, MicroStation, Adobe Acrobat, InRoads, On-Site).
- All procurement development and purchasing associated with specialized Engineering Applications related to Computer Aided Design (CAD), plotting and the further development of the DDE and possible scanning services associated with Engineering Records Center. See project deliverable schedule.
- Completion of the Final SPR Work Plan and all associated Reports that need to be transmitted to FHWA for final authorization/approval of funding.
- Responsible for the development of a "shareable" project schedule and assuring that critical dates are being met and documenting why dates are not being met.
- Responsible for coordinating bi-weekly project team meetings and monthly – Supervising Engineer / DOIT Manager meetings.
- Act as a Liaison to FHWA for the Development Project Funding Approval and to report as the success of deliverables via SPR Reporting Procedures.
- Coordinate all Hardware / Software / Equipment / Purchase approval through OIS - Research - FHWA.
    - Reviews recommended project purchases by others.
- Coordinating all Engineering Application Software Interoperability with ProjectWise.
- Testing and approving all ProjectWise functionality with Engineering Applications.
- Represent OOE and the OOC End Users in the Development and Implementation of ProjectWise.
- End User Training and Work Flow Development for related Engineering Applications.
- Serves as a technical lead contact for Bentley Systems Inc. for the implementation of ProjectWise.
    - Responsible for developing scopes of work and deadlines for any required work Bentley is to perform.
- Developing scopes of work and deadlines for any work required by consulting services related to Engineering Applications.
- Responsible for Web Content Development and Publishing associated with the DDE, ProjectWise workflows, and application procedures.

- Specifying required ProjectWise Environments and Attributes for possible Oracle Systems Integration.
- Coordinating a bi-monthly PW and PDF Development Working Group (focused on Engineering Data Management) composed of stakeholders from Planning, Engineering, Construction, Contract Dev. and Admin.
- Coordinate the development of documentation regarding CDS (Digital Signature) piloting results, digital signatures and electronic submission guides, policy and procedural development.
- Provide feedback on PW Engineering User Security Models.
- ProjectWise Plotting Workflows.
- ProjectWise SPR Reporting and the development and submittal of quarterly SPR project reporting to FHWA.
- The development of an Implementation, Procedural and Quality Control Plan for scanning the Engineering Records Center (Pascone Place).
- As needed, may delegate tasks and responsibilities to others within Engineering Applications.

ProjectWise Administrator – Julie Annino

- ProjectWise Account Set-up.
- ProjectWise Project Container initiation requests and application procedures.
- To provide feedback, direction and offer knowledge as to the development of ProjectWise Geospatial.
- End User Training and Work Flow Development for related Engineering Applications.
- ProjectWise End-User Install Coordination.
- Consultant Engineering application procedures.
- To coordinate and provide end-user Training.

ProjectWise and MicroStation Configuration Lead – John Rinaldi

- Research optimal configuration settings for ProjectWise and MicroStation.
- Implement optimal configuration settings for ProjectWise and MicroStation.
- Plotting Configuration Expert.
- ProjectWise Environment Configuration Development
- Engineering Records Center quality control procedure development and plotting configuration expert.
- ProjectWise and MicroStation Support

ProjectWise InRoads and Bentley OnSite Development Team – Elaine Richard
Assistant: Gregory Sardinskas

- Lead in Bentley InRoad's migration/interoperability with ProjectWise.
- Lead in Bentley OnSite Development with ProjectWise and migration of InRoads 3D models (High Value Data) to the Office of Construction.
- Lead in developing naming convention standards for engineering data

ProjectWise Direct Cost Accounting System Transition and Integration – Kathleen Zimmerman

- Lead in coordinating the transition of the Direct Cost Accounting System to ProjectWise's Audit Tracking or other alternative.
- Coordinate Bentley Services on the above.

ProjectWise CAD Standards Development and BIM Development – Bruce Bourgoin

- Lead in providing end-user training for ProjectWise and MicroStation.
- Lead in CAD standards development for structural and facilities design and the research into using BIM for Facilities Design.

Appendix C – Definition of Key Terms

1. **Architectural, Engineering, and Construction (AEC)** - Generally used as term to describe the field of developing and constructing capital improvements.

2. **Computer Aided Design (CAD)** - The applications, hardware, tools used in the Engineering, Architectural, and Construction field to develop oversee and maintain capital improvement projects.

3. **Digital Design Environment (DDE)** - A system of files and folders that configures a client computer to CTDOT's CAD Standards. The Digital Design Environment (DDE) is also an environment that allows the creation, modification, and exchange of high-value electronic engineering data. The information contained in CTDOT's DDE was developed for use with CTDOT's foundation CAD platform MicroStation from Bentley Systems Inc.

4. **High Value Data** - A term that is becoming more important within many state DOT's is "High Value Data (HVD)". HVD is electronic data that is a byproduct of the design process. HVD includes digital terrain models (DTM's), alignments (ALG's) and others. These files can be used during the construction phase of the project for digital terrain queries and optional GPS driven earth moving equipment. More importantly, these files can also be used in the life cycle maintenance of a designed transportation facility. Coming full circle, these files can be used for any rehabilitation or modification of the existing project in the future. Previously, CTDOT has only supplied the paper contract drawings and specifications to the Contractor and Construction Inspectors. With CTDOT's project container electronic file storage approach, this data is now in place and searchable for future queries. HVD can be used in a Management Information System (MIS) and Geographical Information System (GIS).

5. **Direct Cost Accounting System** – The system used to journal voucher PE Projects for the direct in-house hourly charges to obtain the cost reimbursement of CAD Systems.

Appendix D – Existing Network Infrastructure and User Functions by Location

Main Network Sites	Existing Data Circuit Types	Hosts Per Site	Potential Concurrent Users**	End User Functional Descriptions	User Frequency of Transactions	Desired Transmission Time	Recommended Data Circuit Type for PW	Comments
Contractors	Indeterminable		2 Users Per Site	Frequent Upload of PDF Shop Drawings to the Construction Submissions Folders of the Project template. File download (check-in) of "access granted" Contract Plans and Specs Folder and Construction Plan Archives System. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 15mb** **Maximum Download (check-out/read): 200mb**	2 Transactions Per Day	30min		
Consultant Engineers	Indeterminable		5 Users Per Site	Frequent Upload of PDF Contracts Plans and Specs to the Planning, Design and Construction Sub Folders of the Project template. File download (check-in) of "access granted" Construction Plan Archive System. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200mb** **Maximum Download (check-out/read): 50mb**	2 Transactions Per Day	30min		
Headquarters	20GB Ether to Data Center	964						
Basement - 30			15	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Highway Operations Sub folder of the Project Directory. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	1 Transaction per hour	Max 1 min		
1st Floor - 202			75	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of MicroSoft Office documents (50kb) to PDF Documents (10mb) in size. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 10mb** **Maximum Download (check-out/read): 200mb** (very rare)	20 Transactions Per Day	Max 1 min		
2nd Floor - 215			100	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Aeronatics/Public Trans Folders Sub folder of the Project Template. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	50 Transactions Per Day	Max 1 min		
3rd Floor - 282			170	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files, imagery ext, and PDF Contract Documents and general office documents to varios engineering discipline sub directory folders of the Project Template. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200mb** **Maximum Download (check-out/read): 200mb**	70 Transactions Per Hour	Max 1 min		

4th Floor - 235			100	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files, imagery ext, and PDF Contract Documents and general office documents to varios engineering discipline sub directory folders of the Project Template. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200mb** **Maximum Download (check-out/read): 200mb**	50 Transactions Per Hour	Max 1 min		
DOIT Connection/Internet	OC3 25 Mbytes	0	0					
District 1	1 ADSL Premium & 1 T1	77	30	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	10 Transactions Per Hour	Max 1 min		
District 2	1 ADSL Premium+ & 1 T1	74	30	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	10 Transactions Per Hour	Max 1 min		
District 3	2 T1's	91	30	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	10 Transactions Per Hour	Max 1 min		
District 3A	Site to be determined	Not on line yet	20	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	5 Transactions Per Hour	Max 1 min		

District 4	1 ADSL Premium+ & 1 T1	67	30	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	10 Transactions Per Hour	Max 1 min		
Research Lab	OC3 15 Mbytes	60	20	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of CAD files (200kb) and general office documents (50kb) to Construction Discipline Project Folder. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	5 Transactions Per Hour	Max 1 min		
Pascone Place	1 T1	10	5	Frequent Download (Read) of PDF Contracts Plans (for plotting) and Specs from the Proposed Active Project Subdirectories for Contract Plans and Specs. File upload (check-in) of pdf scans associated with scanning the construction plan archives. **Average file size upload (check-in): 10mb** **Maximum file size upload (check-in): 200mb** **Maximum Download (check-out/read): 200mb**	10 Transactions Per Day	Max 1 min		
FHWA	1 ADSL Premium	To be Determined	20	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of misc. office type files. **Average file size upload (check-in): 2mb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	2 Transactions Per Day	Max 1 min		
Future Trailers (General)			8	Infrequent Download (Read) of PDF Contracts Plans and Specs from the Proposed Active Project Subdirectories and the Const. Plan Archive System. File upload (check-in) of misc. MS Office type files. **Maximum file size upload (check-in): 200kb** **Maximum file size upload (check-in): 200kb** **Maximum Download (check-out/read): 200mb**	2 Transaction Per Day	Max 1 min		
			**Potential Concurrent - Actual Installations could be actual Hosts Per Site					

Appendix H – Preliminary Security Model

CTDOT ProjectWise Project Template / Folders	No Access (Everyone)	Read-Only (Everyone)	Read/Write Eng Discipline (ProjectWise Group)	ProjectWise Group Name
101_Contract_Plans (PDF)		X		
102_Contract_Specifications		X		
201_Planning_Submissions(PDF)		X	Project Manager, Future CE Group	
202_Design_Submissions(PDF)		X	Project Manager, Future CE Group	
203_Construction_Submissions(PDF)		X	Project Manager, Future CE Group	
301_Admin			TBD	
302_Consultant Design			Consultant Design (GDGS_CDS)	GDGS_CDS
303_Contract_Development	X		Contract Development (GDGS_CEST)	GDGS_CEST
304_Contract_Administration	X		Contract Development (GDGS_EST), Contract Administration (GDGS_Contract_Admin)	GDGS_CEST, GDGS_Contract_Admin
305_Construction			TBD	
Aeronautics		X	Aviation & Ports (GDGS_AVN)	GDGS_AVN
Border			TBD	
Envir_Compl			TBD	
Facilities		X	Facilities Design (GDGS_SFC)	GDGS_SFC
Geotech			TBD	
Highway_Ops		X	Traffic Operations (GDGS_TRA_OPS)	GDGS_TRA_OPS
Highways		X	State Highways (GDGS_SHW)	GDGS_SHW
Hydro		X	Hydraulics & Drainage (GDGS_DHD)	GDGS_DHD
Landscape		X	Facilities Design (GDG_SFC)	GDGS_SFC
Maintenance			TBD	
Planning		X	Internmodal Planning (GDGS_IPL)	GDGS_IPL
Project_Development		X	Project Development (GDGS_PJC)	GDGS_PJC
Project_Resources		X	TBD	
Public_Trans		X	Public Transportation (GDGS_PDS)	GDGS_PDS
Rster_Reference_Files			TBD	
Roadway_Electrical_Illumination		X	Illumination (GDGS_ILL)	
Struct_Bridge		X	Structural Bridge (GDGS_SBR)	GDGS_SBR
Struct_Signs		X	Structural Bridge (GDGS_SBR)	GDGS_SBR
Survey		X	Surveys (GDGS_SUR)	GDGS_SUR
Traffic		X	Traffic Engineering (GDGS_Traffic)	GDGS_Traffic
Utilities		X	Utilities (GDGS_UTIL)	GDGS_UTIL
Visualization		X	Engineering Aplications (GDGS_DGS)	GDGS_DGS

Appendix F – DOT/Bentley response to DOIT's Security Concerns Letter

After reviewing DOIT's draft letter of Security Vulnerabilities, DOT agrees with DOIT's security concerns, although feels there are risks that are overstated.

The first statement indicating that DOT is putting "other clients" at risk with our ProjectWise application is misleading. ProjectWise is as much of a risk to other DOIT clients as some other DOT applications, such DOT C-Vision, and CORE-CT. The statement that two factor authentication would limit potential hacker attempts to **only** people with a key fob is also untrue. There have been well known attacks that have successfully penetrated two factor authentication using man in the middle attacks and Trojan horses.

The problem we have is not with two factor authentication, but in the physical key fob that DOIT strongly recommends for access to its managed DMZ. It has been proven that in an e-business environment that physical key fobs are an administration burden. These burdens include lost, broken, and out of sync key fobs. Our office tested multiple key fobs ultimately ending up with unusable fobs, and associated delay with lost key fobs which lead to no means of accessing our application until a replacement is obtained.

ConnDOT is receptive to two factor authentication but only if the technology used doesn't adversely affect our e-business initiatives. Our recommendation for two factor authentication is to use adaptive authentication from RSA that is a server side product that provides two factor authentications without the use of key fobs. Currently there are multiple applications running within state agencies that only employ single factor authentication, using SSL encryption via a third party (i.e. VeriSign), some of these applications include Judicial's E-Docket System, DRS – E-Tax Filing, DOT C-Vision, and CORE-CT. The data handled by these applications include tax information, payroll, and money transfers that are more sensitive and damaging if stolen than ProjectWise data.

Included in the next few paragraphs are responses from both DOT and Bentley Systems Inc. to all the numbered items in the draft letter. We feel that DOIT has not properly assessed.

1. **ProjectWise does not support "strong passwords"**

a. to move to strong passwords, Active Directory would have to be integrated into the solution;

b. DOT is currently working on implementing Active Directory, but we are not aware of the status of that project;

Bentley Response: There are a couple of approaches that can help mitigate this:
1) Domain Accounts: An "Extranet" domain could be established in the DMZ. This would be separate from the internal domain and allow the state to create user accounts for consultants with strong password policies in place. So long as there is a trust between the internal and external domains we can synchronize the accounts into ProjectWise.
2) Native ProjectWise Accounts: ConnDOT can create user accounts for the consultants natively in ProjectWise and establish strong passwords. Bentley can edit the ProjectWise Web Server interface to remove the ability for users to change their passwords (an easy task).

2. **ProjectWise does not limit the types of files which can be uploaded (see 3b below);**

DOT Response:

Yes it is true that ProjectWise currently does not limit the types of files which can be uploaded, but neither does the VPN SSL solution. Since two factor authentication is not completely secure files containing trojans, worms, and viruses could still be uploaded to the ProjectWise system if forced to use VPN SSL

Bentley Response: The firewall could possibly be configured to block certain file extensions from passing in externally.

3. **Without the appropriate level of security (VPN with fob) the application server is exposed to the entire World-wide Web (WWW). This allows any individual or group to attempt to gain access to the ProjectWise servers—literally millions of people from all over the world. If they gain access:**
Bentley Response: The user would need a valid account to gain access to ProjectWise - this can be tracked using Intrusion Detection System (IDS). If using the extranet domain option the accounts can be disabled after a certain number of failed attempts. There is also a way we can track the connections to ProjectWise and record them using "DMSTracing". The DMSTracing utility will not automatically disable accounts after X number of bad attempts.

a. They can upload any files because ProjectWise does not limit by type;
See Response for 2.
b. These files could include those containing false data or, worse, viruses, "Trojans" or other "malware." (While Bentley has indicated that their software would not open such files, they have not shown how they would intercept "self extracting" files to keep them from executing.)
Bentley Response: The ProjectWise server software will write the file to a Windows folder on a server running Antivirus software. ProjectWise software will not prevent the AV software from cleaning or removing an infected file. Transferring the file to the ProjectWise storage area will never execute the file itself. Nothing on the server-side will ever execute the file. The only way possible to execute a file through ProjectWise would be to upload it – have the AV software miss it – have a client perform a copy-out function to their local PC – have the AV software on the local PC miss it and then execute it.

c. In addition, these uploads could change or delete existing files and specifications, access confidential information, or change contact information (e-mail addresses could be redirected without anyone's knowledge).
Bentley Response: We would need to know more specifics on how this would happen. We cannot see a way of doing this without some very advanced script that possibly finds a way to self-execute and then somehow pulls information about user accounts from the database. In the case of domain accounts we do not store the passwords in the database as they get authenticated to the domain in real-time. In the case of native ProjectWise accounts the script would have to perform a crack on the md5 hashed password, which (if successful) would only grant them access to the ProjectWise documents.

d. There appears to be no anti-virus protection to protect the rest of the DOIT network, potentially allowing an intruder to "spoof" a DOT user (use their official e-mail and access rights) to move further into the system.
Bentley Response: Our customers typically run a commercially available Antivirus software package on all servers and desktop systems. Our software is designed to work much like many other Windows client/server offerings by not interfering with those products.

e. ProjectWise server can only restrict access AFTER the validation by the Integration server, after passing through the firewall.
Bentley Response: There are several topics here. First, we have authentication, which is the ability to log into ProjectWise. This requires user accounts to be created by the administrator and specifically added to ProjectWise. After a user is authenticated, their access rights within the system are controlled by the administrator (which folders and documents can be seen). Our Integration Server and Gateway Server (often deployed in DMZ scenarios) can also filter addresses of client connections for allow/disallow).
Summary
We believe the language in the draft letter was extreme and in some cases misleading. We agree to a letter for "Acceptance of Risk", but believe the language should be structured in a way that illustrates the risk in comparison to other existing applications running within the State Agencies.

Development of a Digital Design Environment (DDE) for the Connecticut Department of Transportation

A Project Proposed for Inclusion
in the Connecticut SP&R Work Program

Prepared by:
Engineering Applications and the
Office of Information Systems

March 28, 2008

Proposal Number P-08-1

Connecticut Department of Transportation
Bureau of Engineering and Highway Operations
Division of Research

James M. Sime, P.E.
Manager of Research

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INTRODUCTION AND BACKGROUND

Currently, the Connecticut Department of Transportation (ConnDOT) does not have a clear mechanism in place to store and obtain electronic Computer Aided Design (CAD) data and general project data (correspondence and other data) that have been paid for under professional consulting services. Electronic data from large corridor projects have been lost and data are typically not conforming to standards because deliverables are only on paper. Past CAD policies did not address the standardization and delivery of electronic data. Consulting services handles a majority of project designs for ConnDOT. Today's advances in digital technologies offer many opportunities to improve the long-established process used within ConnDOT. Examples of present conditions and issues follow:

- Professional consulting services develop the majority of contracts developed by ConnDOT. In the past, ConnDOT never stressed the importance of standardizing CAD designs, and organizing the electronic data for both internal design and consultant services together. Furthermore, there has never been a cost effective delivery process to obtain the electronic data that the State of Connecticut and Federal Government pays for. Advances in operational efficiency and project delivery are not possible without improvements in these areas;

- The reproduction of engineering drawings and documents is one of ConnDOT's most costly workflow processes. This is required for both design review and delivery of engineering drawings and documents for contractors to prepare project bid proposals. To improve this process and reduce reproduction costs, ConnDOT needs to begin developing the necessary applications that will allow in-house engineers and consultant engineers to deliver a common (standardized) design package (plans, specs and estimates) in electronic format;

- Mylar contract drawings, manually-signed, are not indestructible and can be modified. Mylars can be edited, copied and scanned, and the ConnDOT Mylar storage area is not under high security. Electronic document technologies (PDF) are available that can foster a more secure environment for contract drawing usage; and

- Digital signatures are required to accomplish the above and there is a need to reduce operational costs and to improve quality, by providing documents in intelligent (searchable) PDF format throughout the entire design development process. Digital signatures will enable compliance with both Governor Rell's Executive Order #3 and Federal ADA Laws since the documents would be generated from their source applications rather than from scanning processes.

- New York State DOT (NYSDOT) has already begun transitioning their design and construction process to be compatible to a new technology often referred to as High Value Data (digital terrain models, and roadway alignment geometry). The uses of High Value Data via GPS-enabled applications (Bentley OnSite) have also streamlined NYSDOT's inspection process by providing more accurate inspections, pay item tracking and reduced contractor disputes. ConnDOT is standardized on Bentley's InRoads™ for civil design, which outputs high value data.

The existing design development process is heavily dependent on paper. Typically, design submittals (Preliminary Design, Semi-Final, Final etc) require 18 sets of paper plans and corresponding design reports. Furthermore, at times project data and critical correspondence are lost and/or not taken into consideration as a project progresses from design through construction.

Electronic data for projects are currently stored in "Silos of Data", i.e. multiple discipline divided network drives or on user's local machines. This process leads to a loss of project data confluence and inefficiency throughout the entire project development process and into construction. ConnDOT's Engineering Application's Section has started to migrate to a project container environment using existing network server infrastructure; however, a more robust engineering content management system and network infrastructure is needed.

There is a need at ConnDOT to keep all project related data together for all disciplines throughout the entire project lifecycle using an integrated engineering content-management system that enables project teams, their information and their tools to work together as one. ProjectWise™ by Bentley Systems has been identified as being a system with the potential to provide these capabilities.

PROBLEM STATEMENT

The present Federal Surface Transportation Act (SAFETEA-LU) and FHWA/ConnDOT Stewardship agreement strives to promote greater oversight and efficiency in the delivery of transportation projects. Furthermore, Governor Rell's Executive Order Number 3, issued December 15, 2004, requires transparency in the state contracting process through establishment of a single location on the internet for all contract and agreement related documents.

At this time, ConnDOT does not have the capabilities of fulfilling the "total" requirements of the Executive Order, which is to provide plans, specs and estimates in a centralized internet portal environment. There is need to address and remediate this situation through the development of an integrated engineering content-management information system with

capabilities that support the needs of project teams in a digital design environment.

OBJECTIVES

The overall objective is to develop a digital design environment to utilize and evaluate electronic data systems to improve the efficiency and effectiveness of ConnDOT's project-delivery workflow by streamlining and improving workflow in the design process. This development project will be geared to reduce the time needed to access plan archives; to provide for the submission and review of engineering documents and drawings; and to benchmark current paper workflow processes and the newly installed digital design environment (encompassing electronic document generation, management, signatures, project advertisement and support services). The result will be to demonstrate the cost-effectiveness of a secure, efficient, standardized project design platform that helps reduce project costs, decreases project development times, and provides both accountability and storage for project documents.

PROJECT GOALS AND MILESTONES

To achieve the project objectives, the following project milestones are anticipated to be required:

- Form a technical committee (TC) that includes ConnDOT engineering and information systems personnel and FHWA;
- Benchmark project workflow parameters using existing methods for small, medium and large projects. Consider benchmarking projects in all modes of transportation{An interim report will be required after necessary piloting has commenced};
- Create a development, production and staging environment of ProjectWise and begin using the system on pilot transportation infrastructure projects. ProjectWise will serve as ConnDOT's primary engineering content management system;
- Acquire and implement necessary hardware and back-up system (equipment) to fully implement ProjectWise;
- Develop a construction plan archive system using ProjectWise;

- Develop a system/application for digital plan sheet management and indexing. This would be a production tool/application that will improve the management/organization of CAD Contract Sheet Files and how they are published to PDF. The proposed application should significantly decrease the amount of time required to generate/modify contract sheet files and publish Portable Document Format (PDF) Contract Sheet Files;

- Develop an Oracle database interoperability plan for compatibility with CORE Project Costing and other department systems;

- Deploy and test the developed application(s) on selected pilot projects involving both consultant engineers and in-house engineers;

- Include future deployment of ProjectWise and other CAD applications in ConnDOT's current software deployment applications;

- Design, purchase and implement an interoperable/scalable Oracle database for ProjectWise and for future interoperability with ESRI, AASHTO or other Oracle based applications;

- Develop the application of PDF Technology in the design environment (Reviewing, Commenting, Collaboration and As-Built Drawing Creation), develop a customized interface specifically designed for ConnDOT's typical design review workflow, and apply the applications on the selected pilot projects. The interface would have to integrate with ProjectWise and with Microsoft Outlook™ and incorporate the functionality of Adobe Acrobat's™ collaboration /commenting features. The goal of the collaboration system is to streamline workflows, retain comments and improve communication in ConnDOT's design review process;

- Continue development of ConnDOT's CAD standards (in-progress) and develop custom applications that can be used by both in-house engineers and consultant engineers. Design custom applications to automatically configure remote clients PC's to ConnDOT's future CAD Standards and serve as a quality control mechanism to assure that the latest CAD standards are reflected in the CAD Design and PDF contract sheets;

- Purchase, install and deploy any necessary equipment and applications so that the processes may be applied to selected pilot projects;

- Develop an implementation plan, and task based scope of work to procure and/or utilize state forces for custom application development and scanning services (on a defined sample set) for digitally archiving the Construction Plans located at the Engineering Records Center - Pascone Place.

- Develop ProjectWise Geospatial and server infrastructure to begin showing project locations and other Department assets geospatially.

BENEFITS

ProjectWise is a product that allows all project team members to work together as one using the most up-to-date and accurate design data. The system will offer the following benefits:

- A Digital Design Environment (DDE) is anticipated to form the foundation for complying with Governor Rell's Executive Order #3. It is anticipated that ConnDOT's complete sets of contract documents will be delivered to an internet portal or other electronic delivery method once project data are organized more efficiently and converted to PDF as intelligent, secure documents in an organized structure. Projectwise is anticipated to meet the requirements for an acceptable DDE for ConnDOT’s use;

- ProjectWise is anticipated to improve contract quality, project data organization, production, delivery and communication of ConnDOT projects for both consultant engineers (CE) and in-house engineers. Once fully implemented, all design submittals are anticipated to be accomplished via a secured network connection rather than the current hand truck of paper. Bentley Systems Inc. is reporting that clients that have successfully implemented ProjectWise have achieved a 185% return on investment;

- ProjectWise is anticipated to be a solution that allows for improved oversight and transparency in the contract development process. The improvements are anticipated to include better access to freedom of information requests and legal inquiries;

- Consultant engineers and in-house engineers are anticipated to have all the tools and instructions necessary to deliver standardized electronic project data;

- A substantial reduction in paper plotting over time is anticipated, although the need for paper plotting will never completely disappear. For design submittals, it is anticipated that during discipline review, plotting will

only be necessary if an engineer has a need to plot specific sheets of a plan set. It is anticipated that the use of the development system on pilot projects, through benchmarking, will quantify savings of paper cost in Engineering and during advertising plan printing (industry claims savings of 50% and 75%, respectively, are possible);

- Conversion of contract documents (plans and special provisions) to PDF are anticipated to enable a future online bidding system and to provide for intelligent documents with searching and measuring capabilities. PDF is anticipated to be an ideal choice because it is an open standard and a software purchase is not required to view PDF documents;

- Digital submission of PDF Plans, design reports and specifications are anticipated to lay the groundwork for a future where automated design reviews reduce the design review time, provide for a multi-discipline review, and provide for a common database repository for review comments. Figure 1 represents a comparison of the existing and proposed timelines for design submittals. Additionally, Appendix D and E outline both the existing and proposed design submission processes.

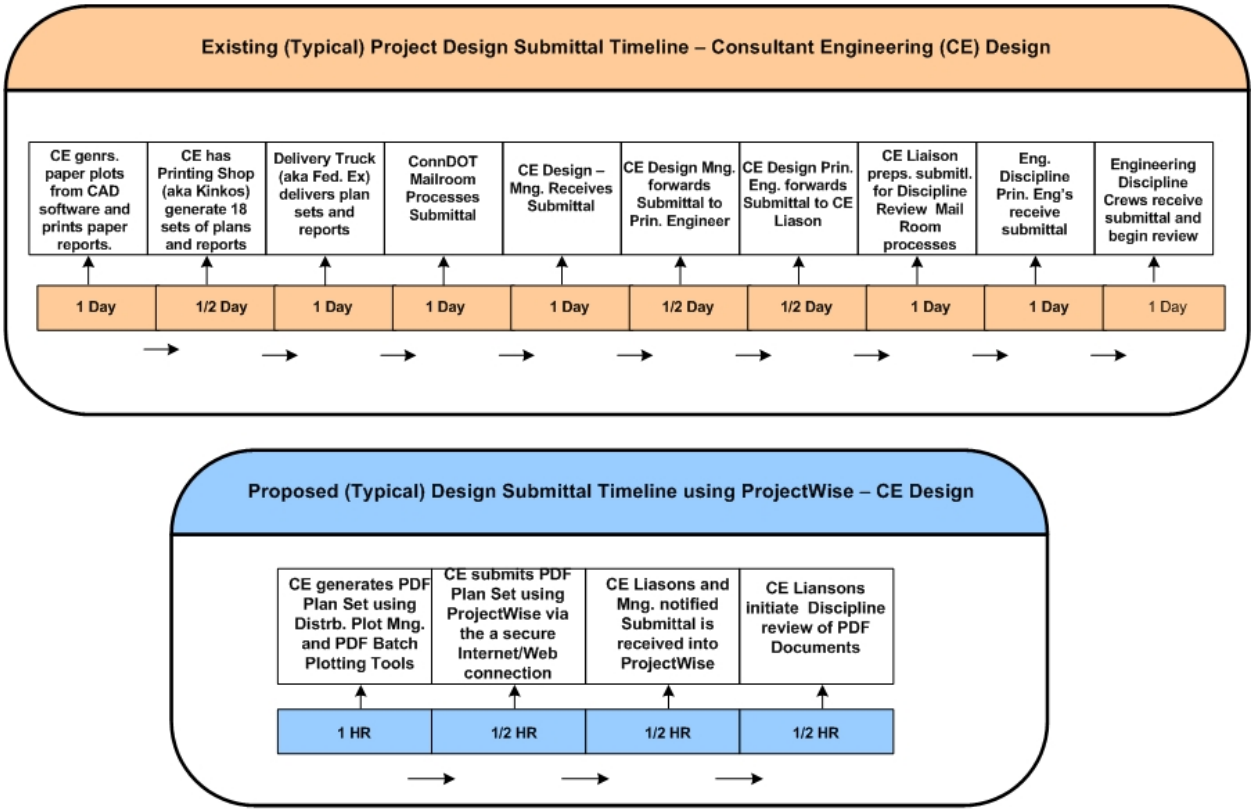


Figure 1 - Typical Project Submission Timelines

- ProjectWise is anticipated to provide GIS functionality at ConnDOT to the extent that project limits can be located

geospatially on a "user friendly" state map interface. This is anticipated to allow managers and engineers to access project data "real-time" in the proper geospatial location, and be interoperable with future GIS applications at ConnDOT;

- Projectwise is anticipated to allow integration of data from GPS-enabled earth-moving and construction equipment in order to save time and money during the construction process. ConnDOT is anticipated to benefit from the development of a protocol for future use of High Value Data as a deliverable; and

- ProjectWise and associated CAD data are anticipated to become a foundation for developing ConnDOT's GIS for infrastructure management.

IMPLEMENTATION

Engineering Applications will lead and coordinate a multi-disciplined technical committee to perform oversight of the development project and to help facilitate decision making and direction on the project. Management from the highest levels of ConnDOT will be periodically briefed regarding the development project. It is anticipated that high level support for the development project will be sought through the issuance and or revision of a Commissioner's Policy Statement(s) requiring all internal and external ConnDOT engineering resources to utilize a standardized digital design and construction environment for all pilot projects.

The Office of Construction has suggested utilizing engineers from District Offices during the development of this project. Additionally, an evaluation plan will be developed that includes benchmarks and clear documentation about the feedback, difficulties and successes of the developed applications and processes that are implemented on pilot projects.

WORK PLAN AND DELIVERABLES

Work plan tasks and deliverables can be found in Appendices B and C.

BUDGET ESTIMATE (EQUIPMENT, SOFTWARE AND STAFFING)

Budget: Refer to Appendix A for the Office of Information System's (OIS) preliminary project cost estimate. It is anticipated that a three year cost will be approximately $3,230,000. At this time, the budget includes additional software, major hardware, and preliminary estimates for consultant services. It is anticipated that Engineering Applications and OIS Engineering Support will charge personnel expenses to the Direct Cost Accounting System (CAD Account), while OIS Business Systems Staff will charge to overhead.

COST ESTIMATE - CONNDOT INVOLVEMENT BY OTHER UNITS

Other Units at ConnDOT are anticipated to be involved. As indicated above, Engineering Applications recommends that a technical committee be formed in the first month of this project, composed of department designees primarily from Engineering and OIS, with ex-officio liaisons from Research and FHWA-CT. The anticipated time required of the technical committee is anticipated to be minimal throughout most of the research project (a few hours every quarter). The majority of development and implementation personnel costs are anticipated to be for the services of both Engineering Applications staff and Office of Information Systems staff.

DDE Implementation and Maintenance Costs For First Five Years
Project Costs by Year for DOT00930164PE

		YR1	YR2	YR3	YR4	YR5	TOTALS
Hardware	Federally Funded	760,000	0	200,000	0	0	960,000
	State Match	190,000	0	50,000	0	0	240,000
	CAD Account	0	0	0	31,500	31,500	63,000
	Hardware Total	**950,000**	**0**	**250,000**	**31,500**	**31,500**	**1,263,000**
Software	Federally Funded	222,266	36,546	56,546	0	0	315,357
	State Match	55,566	9,136	14,136	0	0	78,839
	CAD Account	250,000	250,000	250,000	295,682	320,682	1,366,364
	Software Total	**527,832**	**295,682**	**320,682**	**295,682**	**320,682**	**1,760,560**
Consulting	Federally Funded	26,400	600,000	700,000	0	0	1,326,400
	State Match	6,600	150,000	150,000	0	0	306,600
	CAD Account	75,000	75,000	75,000	75,000	75,000	375,000
	Consulting Total	**108,000**	**825,000**	**925,000**	**75,000**	**75,000**	**2,008,000**
Personnel	Federally Funded	0	0	0	0	0	0
	State Match	0	0	0	0	0	**0**
	PS Dollars	0	0	0	0	0	0
	Personnel Total	**0**	**0**	**0**	**0**	**0**	**0**
Grand Totals		**1,585,832**	**1,120,682**	**1,495,682**	**402,182**	**427,182**	
Project	**Federally Funded**	1,008,666	636,546	956,546	0	0	2,601,757
Project	**State Match**	252,166	159,136	214,136	0	0	625,439
Operating	**CAD Account**	325,000	325,000	325,000	402,182	427,182	1,804,364
PS	**PS Dollars**	0	0	0	0	0	0
	Total	1,585,832	1,120,682	1,495,682	402,182	427,182	5,031,560

Total Federal Project Dollars: $3,227,196.00

Federally Funded	1,008,666	636,546	956,546	0	0	2,601,757
State Match	252,166	159,136	214,136	0	0	625,439
Total	**1,260,832**	**795,682**	**1,170,682**	**0**	**0**	3,227,196

**Resources normally within CAD Account will still charge CAD Account. OIS personnel to remain under PS.

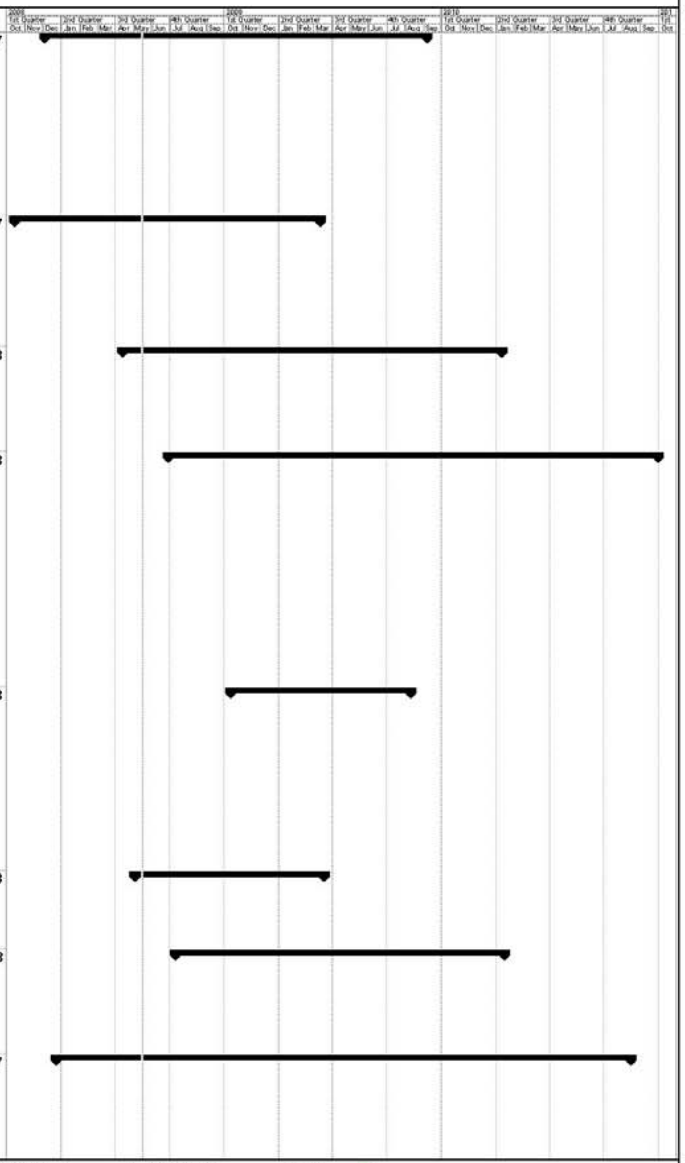
*Federal Participation in Maintenance Costs is not possible. All maintenance costs anticipated to be covered by CAD Account.

APPENDIX B – HIGH LEVEL TASK SCHEDULE

ENGINEERING APPLICATIONS

Project No. 93-H049/SPR-2253
DDE Development

ID	Task Name	Notes	Duration	Start
1	TASK 1 - ProjectWise Engineering Documentment Management System (Development System)	The purpose of this task is to continue the development of the ProjectWise Development System including caching server concept testing, Oracle Systems Integration and performance testing. Additionally, to continue working on Pilot Projects.	524.57 days?	Wed 12/5/07
117	TASK 2 - TIP/STIP - Procurement / Purchasing / Administrative	The purpose of task is for establishing the Project in TIP/STIP, and to facilitate procuring task based Engineering Application Developers	420.71 days?	Mon 10/15/07
132	TASK 3 - ProjectWise Engineering Documentment Management System (Staging and Production System Development)	The major purpose of this task is for the purchasing and set-up of all major ProjectWise Hardware (Servers).	520.76 days?	Mon 4/14/08
140	TASK 4 - Engineering Application Development	The purpose of this task is for the initiation of task based consultants to assist in the development of the Digital Design Environment and the development of specialized CAD Configurations required for the successful delivery of Projects.	674.29 days?	Mon 6/30/08
153	TASK 5 - ProjectWise Archive System Development (Engineering Records Center Scanning)	The purpose of this task is to develop an implementation plan, and task based scope of work to procure and/or utilize state forces for custom app. development and scanning services (on a defined sample set) for digitally archiving the Const. Plans.	247.43 days?	Mon 10/13/08
160	TASK 6 - End User Training and Documentation	The purpose of this task is for the development of end-user training and necessary documentation.	259.86 days	Mon 5/5/08
166	TASK 7 - Staging and Production System Piloting	The purpose of this task is to begin piloting the use of digital submissions, digital signatures, and digital design reviews.	452.14 days?	Fri 7/11/08
209	TASK 8 - Project Reporting and Benchmark Requirements	The purpose of this task is for documenting according to Federal SPR Guidelines all the necessary project statuses, results, and lessons learned.	789.64 days	Mon 12/24/07



Project: workplan_spdr
Date: Thu 6/16/05

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 1

APPENDIX C – TASK DELIVERABLES

TASK 1 - ProjectWise Engineering Documentment Management System (Development System)

Subtask 1A - Project Concept Development
Subtask 1B - Technical Requirements Oracle/PW – Confirmation / Documentation / Testing
Subtask 1C - Staff Requirements/Roles
Subtask 1D - Proof of Concept and Development System Piloting

TASK 2 - Procurement / Purchasing / Administrative

Revise the Draft SP&R Proposal (FHWA and the Division of Research to Review)
Resubmit RPM using NHS funding
TIP/STIP RPA
FHWA Authorization
Finalize Equipment List and Specifications and Phase 1 Framework (FHWA Approval Required)
Purchase ProjectWise and Framework Architecture Equipment/Hardware
RFP Development - Systems Integration Services / AEC App. Development
Receive proposals from Systems Integration Services/ AEC Application Development
Proposer(s) are selected based on a "Qualifications Based Selection Criteria"
Eng. Apps. Develops a "Scope of Work" based on the objective(s) of this report
Selected Proposer(s) estimate cost for the proposed scope of work
Contract Negotiation/Agreement/Authorization Phase
Development of a Multidiscipline Project Team to Facilitate PDF Development
Selection of Pilot Projects is documented and solicited by Engineering Applications

TASK 3 - ProjectWise Engineering Documentment Management System (Staging and Production System Development)

ProjectWise Network Set-Up
ProjectWise Back-Up System Set-Up
ProjectWise Caching Servers Set-Up
Project Wise Integration Server Application Installation/ Configuration
ProjectWise Database Server Set-Up
ProjectWise WebServer Set-Up
ProjectWise Admin Set-up and Workflow Development
Software Deployment System Testing
ProjectWise Explorer/Admin Client Deployment (Script Logic Development)
ProjectWise Plot Organizer Client Deployment (Script Logic Development)
Adobe Acrobat Deployment for Digital Signatures / Comment and Review (Script Logic Development)
Microstation and Inroads XM Deployment (Script Logic Development) (Not Part of Project)

TASK 4 - Engineering Application Development

DDE Installer for Environment
Adobe Acrobat Customization for Design Review
Wireless Tablet Technology Integration and Development for Review of Plans
MicroStation and CAD Systems Configuration Development
Automated CAD Standards Checking Application Development
AutoCAD DDE Workspace Config. for Facilities Design Projects

TASK 5 - ProjectWise Archive System Development (Engineering Records Center Scanning)

Develop Implementation Plan
Develop QA/QC Procedural Plan
Develop System On-Going Maintenance Plan
Possible RFI/RFP Development for Scanning Services
Database Systems Integration with old Dbase Program
System Implementation and Scanning Commences

TASK 6 - End User Training and Documentation

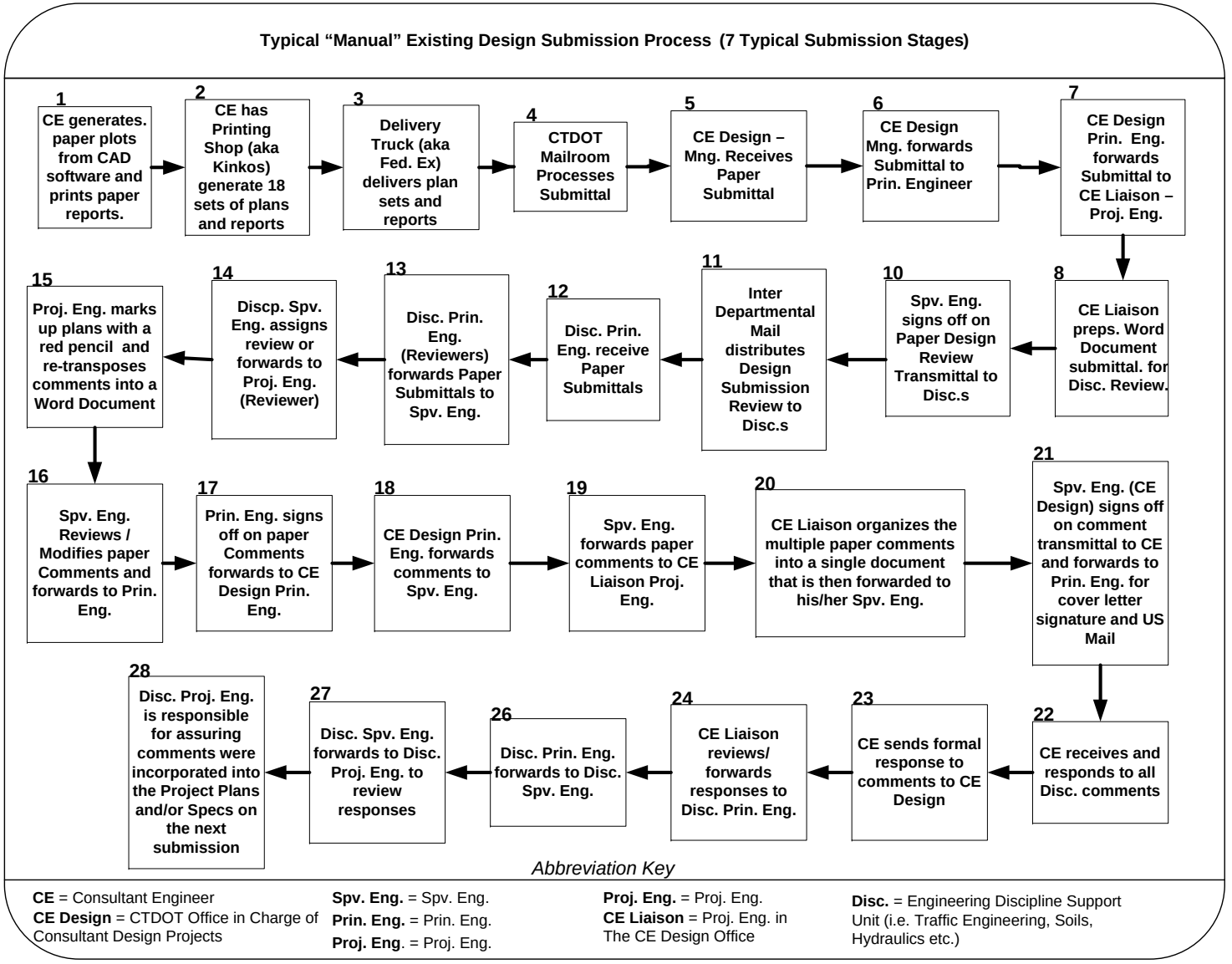
Microstation XM, Inroads XM, and Plot Organizer Training (Not Part of This Project)
Projectwise Explorer Training for all users
Adobe Acrobat/Reader Training for all Projectwise users
Create Web based training videos
New Application Training
Append the DDE Manual
Documentation of script logic software installations

TASK 7 - Staging and Production System Piloting

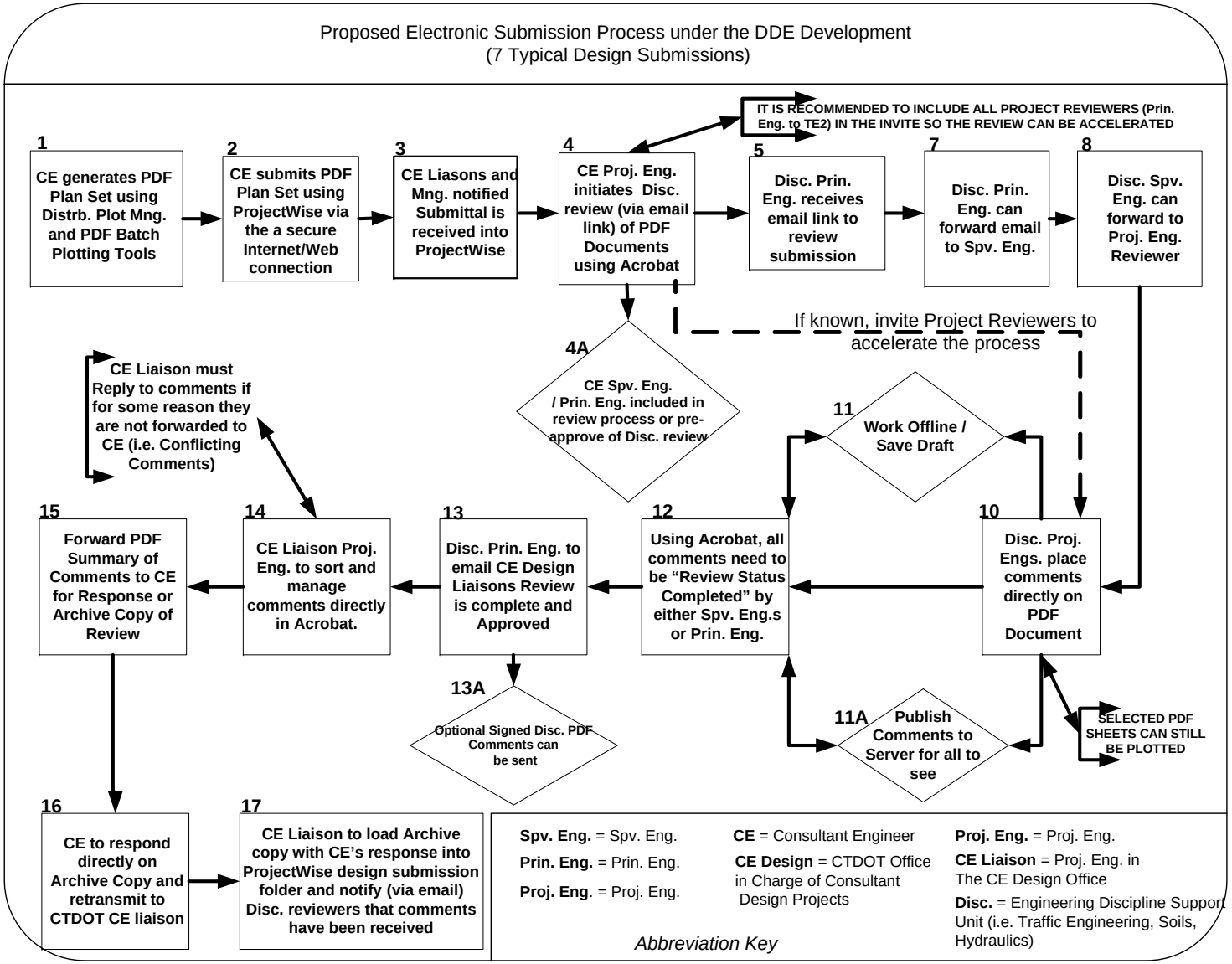
Pilot Project # 6 - Define Goals
Pilot Project # 7 - Define Goals
Pilot Project # 8 - Define Goals
Pilot Project # 9 - Define Goals

TASK 8 - Project Reporting and Benchmark Requirements

Quarter Report #1
Quarter Report #2
Quarter Report #3
Quarter Report #4
Quarter Report #5
Quarter Report #6 - Interim Report (Benchmarking Comparison)
Quarter Report #7
Quarter Report #8
Quarter Report #9
Quarter Report #10
Quarter Report #11
Develop and submit draft final report and executive summary


Typical "Manual" Existing Design Submission Process (7 Typical Submission Stages)
1
CE generates. paper plots from CAD software and prints paper reports.
2
CE has Printing Shop (aka Kinkos) generate 18 sets of plans and reports
3
Delivery Truck (aka Fed. Ex) delivers plan sets and reports
4
CTDOT Mailroom Processes Submittal
5
CE Design – Mng. Receives Paper Submittal
6
CE Design Mng. forwards Submittal to Prin. Engineer
7
CE Design Prin. Eng. forwards Submittal to CE Liaison – Proj. Eng.
8
CE Liaison preps. Word Document submittal. for Disc. Review.
10
Spv. Eng. signs off on Paper Design Review Transmittal to Disc.s
11
Inter Departmental Mail distributes Design Submission Review to Disc.s
12
Disc. Prin. Eng. receive Paper Submittals
13
Disc. Prin. Eng. (Reviewers) forwards Paper Submittals to Spv. Eng.
14
Discp. Spv. Eng. assigns review or forwards to Proj. Eng. (Reviewer)
15
Proj. Eng. marks up plans with a red pencil and re-transposes comments into a Word Document
16
Spv. Eng. Reviews / Modifies paper Comments and forwards to Prin. Eng.
17
Prin. Eng. signs off on paper Comments forwards to CE Design Prin. Eng.
18
CE Design Prin. Eng. forwards comments to Spv. Eng.
19
Spv. Eng. forwards paper comments to CE Liaison Proj. Eng.
20
CE Liaison organizes the multiple paper comments into a single document that is then forwarded to his/her Spv. Eng.
21
Spv. Eng. (CE Design) signs off on comment transmittal to CE and forwards to Prin. Eng. for cover letter signature and US Mail
22
CE receives and responds to all Disc. comments
23
CE sends formal response to comments to CE Design
24
CE Liaison reviews/ forwards responses to Disc. Prin. Eng.
26
Disc. Prin. Eng. forwards to Disc. Spv. Eng.
27
Disc. Spv. Eng. forwards to Disc. Proj. Eng. to review responses
28
Disc. Proj. Eng. is responsible for assuring comments were incorporated into the Project Plans and/or Specs on the next submission
Abbreviation Key
CE = Consultant Engineer
CE Design = CTDOT Office in Charge of Consultant Design Projects
Spv. Eng. = Spv. Eng.
Prin. Eng. = Prin. Eng.
Proj. Eng. = Proj. Eng.
Proj. Eng. = Proj. Eng.
CE Liaison = Proj. Eng. in The CE Design Office
Disc. = Engineering Discipline Support Unit (i.e. Traffic Engineering, Soils, Hydraulics etc.)

APPENDIX E - PROPOSED CONNDOT DDE DESIGN PROCESS



System Development Methodology

Technical Requirements Document

Project Name: ProjectWise V8*i* Pilot Implementation

Project Profile#: 1001001

Agency Name: Department of Transportation

Revision: 1.0

Date: 5/29/2009

Table of Contents

Intent of this Document

This Technical Requirements Document is a template that will capture the technical requirements necessary to support the deployment of business solution in the DOIT environment.

The requirements are listed across 10 categories: Architecture, Network, Server, Database, Desktop, Application Hosting, Security, Directory & Messaging, System Upgrades, and Integration/Interface Requirements.

The Architecture and Infrastructure Migration Requirements section captures any architecture or infrastructure requirements that are not already satisfied in the existing technical environment, but must be addressed as an upgrade to the existing technical environment in order for the solution to work as required.

If changes are proposed and/or required to any of the established baseline project delivery infrastructure once the project is in flight, it must be submitted formally through the DOIT change control process as defined in the project Change Management Process document.

The samples contained in this document are meant to convey the intent of the deliverable content and format.

Please complete the sections that are applicable to your solution – if a section is NOT APPLICABLE – please put N/A in the tables.

Sample data/content contained in this template is NOT REAL. It is only provided to help convey the intent of the deliverable.

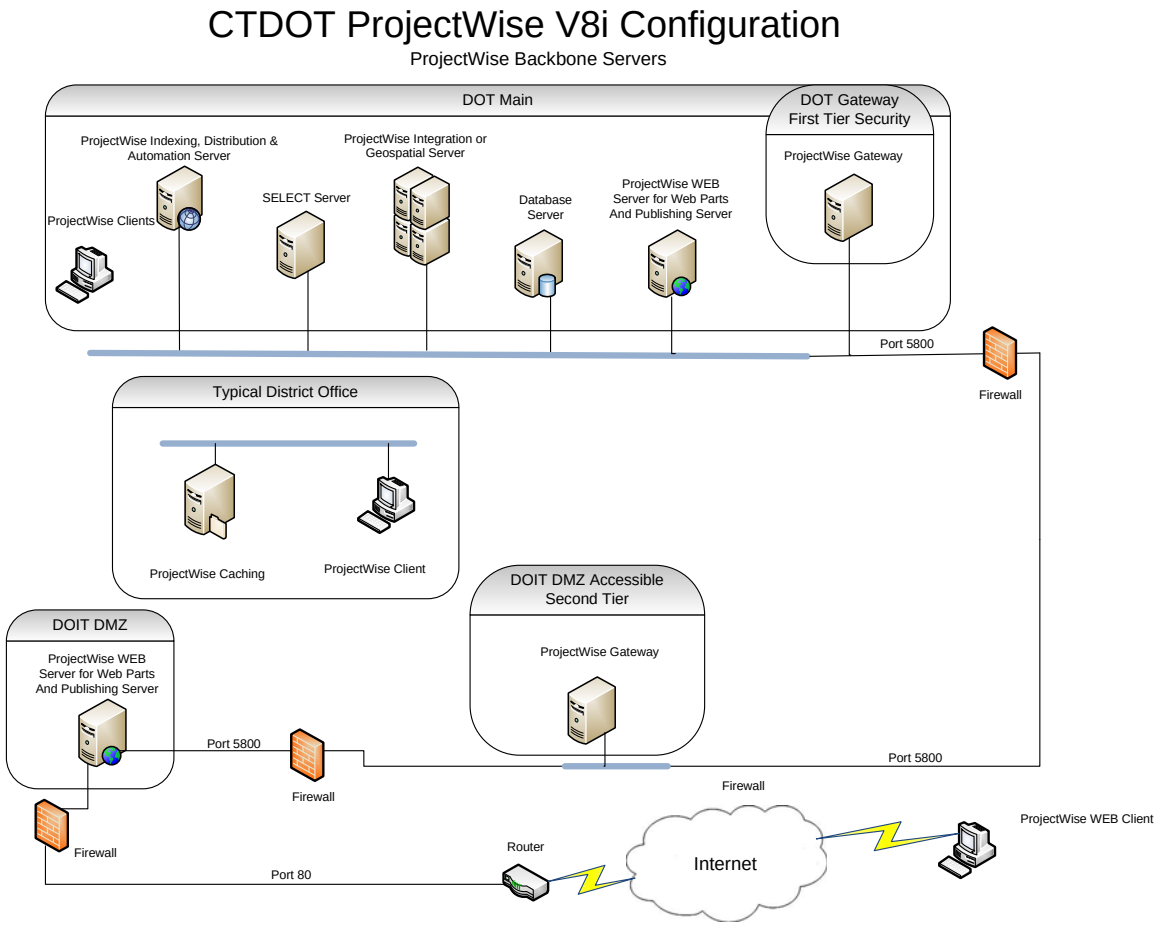
Architecture Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All architecture requirements should be assigned a unique requirement id, with a standard requirement prefix of “ARCH”.

REQMT ID	Mandatory/ Optional	Requirement Description
ARCH1001	Mandatory	Must utilize 3 Tiered Architecture for application to operate in DOIT Application Hosting facilitate (e.g. a provide application networking diagram in this spec after this table). Diagram provided
ARCH1002	Mandatory	Must use Java vx.x or later for all new web application development. Java not required
ARCH1003	Mandatory	1. Describe the system architecture. (e.g., client-server vs timesharing) The architecture is client-server. The ProjectWise Clients communicate directly to the ProjectWise Servers. Only one server (ProjectWise Integration Server) communicates directly with the Oracle Database through ODBC. 2. Describe the network architecture. (e.g., fddi, fast ethernet, switched, etc.) The ProjectWise solution relies only on the underlying TCP/IP network and leverages all existing name resolution techniques (DNS, HOSTS file, etc) for communication between client and server modules. 3. Describe any other applications which might be competing for the re this configuration ProjectWise uses port 5800 to transfer data betweer servers.

B.1 Architecture Diagram

Please provide an architectural diagram of the solution that is defined in this functional requirements document. Please include all servers, networking, and applications in diagram.



Network Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All network requirements should be assigned a unique requirement id, with a standard requirement prefix of “NET”. Please complete this section if applicable to your solution.

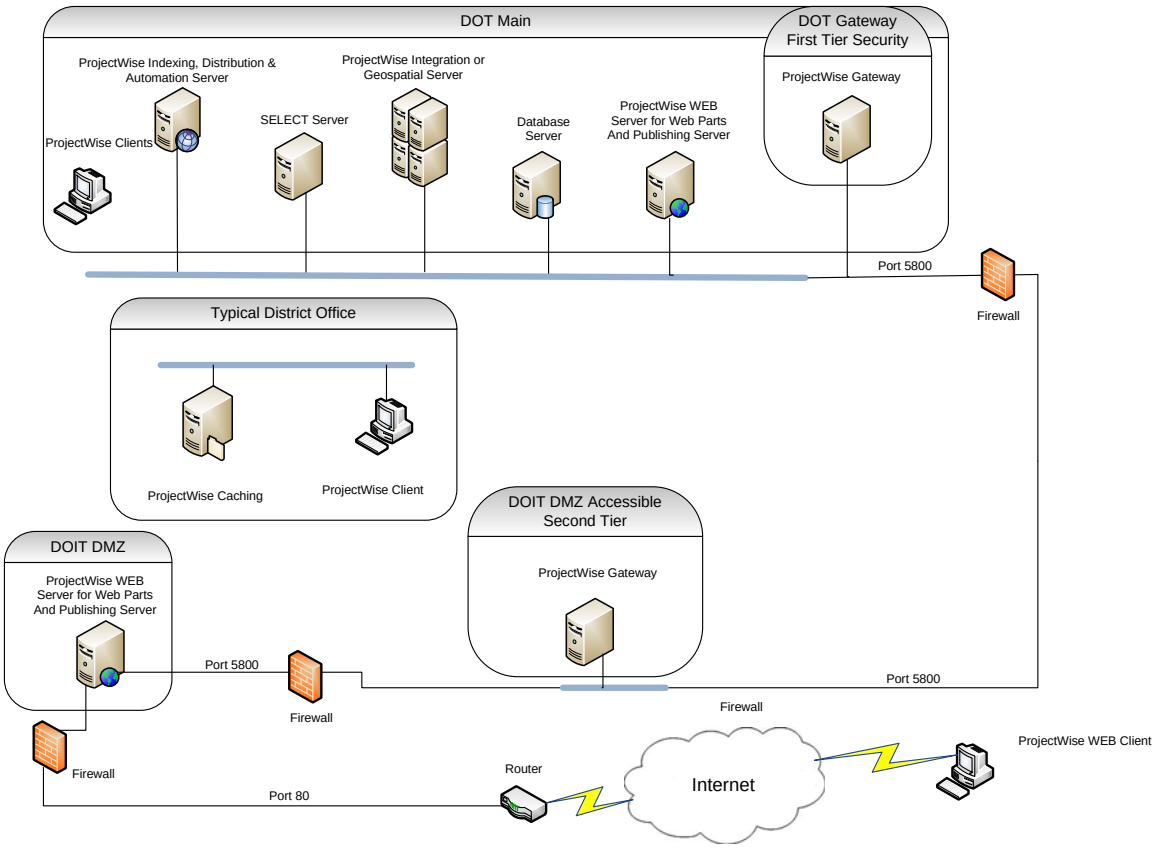
REQMT ID	Mandatory/ Optional	Requirement Description
NET1001	Mandatory	Must define the External Networking Circuits needed for application if applicable (Speed, Bandwidth, Protocol). TCP/IP Port 5800 must be open between all client and server components.
NET1002	Mandatory	Must define the Networking Switches, Routers, VLans needed for application if applicable. N/A.
NET1003	Mandatory	Must define the Internal Networking functions needed for application if applicable. N/A.
NET1004	Mandatory	Do you require a CSS for load balancing? No

C.1 Network Architecture Diagram

Please provide an architectural diagram of the solution that is defined in this functional requirements document. Please include all servers, networking, and applications in diagram.

CTDOT ProjectWise V8i Configuration

ProjectWise Backbone Servers



Server Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All server requirements should be assigned a unique requirement id, with a standard requirement prefix of "SER". Please complete this section if applicable to your solution.

Existing Application Server Requirements

Please tell us about your server requirements for your existing application that you have running. If this is a new application – complete the next section only.

REQMT ID	Mandatory/ Optional	Requirement Description
SER1001	Mandatory	Unix/Mainframe/Wintel Server Requirements - Describe the hardware which is being used. (e.g., model of machine(s), qty. and speed of CPUs, amt. of RAM, Size and number of disks) for the Existing Application. If you are working with a vendor to upgrade this application – If your vendor has specified specific recommendations – please enter them here as requirements.
SER1002	Mandatory	Describe the transaction volumes/ratio for the Existing Application: Transaction load - online(OLTP):batch ratio e.g. 90:10: Peak Volume - OLTP e.g. 5000 transactions / hr: Peak Volume - Batch e.g. 5M records loaded in 3 hours: Reporting load - ad-hoc:canned-query ratio e.g. 80:20: Peak Volume - number of reports / hour:
SER1003	Mandatory	Does the Existing application have known scalability issues? e.g., Some modules process serially and/or issue explicit locking instructions.) No. ProjectWise scales well enough to meet the demands of global implementations serving thousands of users.
SER1004	Mandatory	Any additional information which would affect the server sizing on the Existing Application?
SER1005	Mandatory	Scalability Requirements for the Existing Application: How will the processing requirements grow over time? -If you will be increasing the number of users, please specify the rate and timeframe. (e.g., 15% increase in active concurrent users for each of the next three years.)

SER1006	Mandatory	How many concurrent active users are connected to the Existing Application System?

New Application Server Requirements

Please tell us about your server requirements for your new application that you are looking to bring into DOIT. Please complete this section only if this is a new application.

REQMT ID	Mandatory/ Optional	Requirement Description
SER1001	Mandatory	Unix/Mainframe/Wintel Server Requirements - Describe the hardware which is being used. (e.g., model of machine(s), qty. and speed of CPUs, amt. of RAM, Size and number of disks) for the New Application. If your vendor has specified specific technical recommendations – please enter them here as requirements. Wintel Pentium 3GHz, 4GB RAM, 1GB Free Disk space
SER1002	Mandatory	Describe the transaction volumes/ratio for the New Application: Transaction load - online(OLTP):batch ratio e.g. 90:10: Peak Volume - OLTP e.g. 5000 transactions / hr: Peak Volume - Batch e.g. 5M records loaded in 3 hours: Reporting load - ad-hoc:canned-query ratio e.g. 80:20: Peak Volume - number of reports / hour: N/A
SER1003	Mandatory	Does the New application have known scalability issues? e.g., Some modules process serially and/or issue explicit locking instructions.) No.
SER1004	Mandatory	Any additional information which would affect the server sizing on the New Application? No
SER1005	Mandatory	Scalability Requirements for the New Application: How will the processing requirements grow over time? As more users and more data are added to the system the load on the Database may increase. The one ProjectWise Integration Server will handle approximately 500 concurrent users. -If you will be increasing the number of users, please specify the rate and timeframe. (e.g., 15% increase in active concurrent users for each of the next three years.) We are in a Proof of Concept Phase at this time. Growth is TBD.

SER1006	Mandatory	How many concurrent active users are connected to the New Application system? Currently less than 20

Database Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All database requirements should be assigned a unique requirement id, with a standard requirement prefix of “DATA”. Please complete this section if applicable to your solution.

REQMT ID	Mandatory/ Optional	Requirement Description
DATA1001	Optional	Describe the software versions to be sized. Solaris: ? Oracle: ? SQL: ?

Supported Databases for use with ProjectWise V8i Edition

Oracle®	Oracle®	Oracle®	Microsoft®	Microsoft®
9.2.0.5	10.2.0.3	11.1.0.6 (Enterprise Edition)	SQL Server 2000(SP 4 or later)	SQL Server 2005 SP2 Standard Edition
Oracle ODBC Driver 9.2.0.8 It is recommended to use the Oracle 10.2.0.3 driver whenever possible, even with a Oracle 9i server	Oracle ODBC Driver 10.2.0.3	Oracle ODBC Driver 11.1.0.6	ODBC Driver 2000.85.1022.00 Or ODBC Driver 2000.86.3959.00	ODBC Driver 2000.86.3959.00 Or ODBC Driver 2000.85.1022.00 Or SQL Native Client Database Driver (SNAC9) 2005.90.3042.00

-Which optimizer, if any, is being used? None

-Has Oracle Parallel Query been implemented? No

DATA1002	Mandatory	Describe the RDBMS deployment strategy -Will this be a RAC (Real Application Clusters) deployment? Yes/No No -if RAC, how many nodes? -% available resource capacity desired should 1 node fail? (e.g., 50%, 60%,…,100%) N/A
DATA1003	Mandatory	Describe the logical volume methodology. (e.g., striping (interface factor), mirroring, raid-5 etc.) N/A

DATA1004	Mandatory	Describe what the application is doing e.g. what the transaction does? The application runs SQL queries, inserts new records and updates existing ones. Tables and indexes are only created when the initial software setup is executed and a ProjectWise executable handles that.
DATA1005	Mandatory	Describe the transaction volumes/ratio: Transaction load - online(OLTP):batch ratio e.g. 90:10: We do not use OLTP. (N/A) Peak Volume - OLTP e.g. 5000 transactions / hr: We do not use OLTP. (N/A) Peak Volume - Batch e.g. 5M records loaded in 3 hours: User dependent upon workflows Reporting load - ad-hoc:canned-query ratio e.g. 80:20: (N/A) We do not have delivered reports Peak Volume - number of reports / hour: (N/A) We do not have delivered reports. Peak Volume will be user dependent upon workflows
DATA1006	Mandatory	Is the application primarily update intensive? Updates are part of the user workflows when data is changed but many transactions are based on select statements
DATA1007	Mandatory	Describe the size of the database -gross volume: Varies depending on number of documents, users, configuration, etc. Some are several hundred MB. -number of tables: We deliver 140 depending on the features installed and some additional tables are created to store information related to project and document attributes. Probably no more than 160 tables. -the size of the most frequently accessed tables (rows and volume): This would probably be the document table or the associated environment attribute table. Size will vary depending on the number of documents. Some organizations have over one million records with no performance issues. -the number of indexes per table: Some tables have indexes, some do not, they are created programmatically by the application -the selectivity of each index (i.e., number of rows accessed per each non-value): Handled programmatically by the application -number of compiled database objects: Handled programmatically by

the application

DATA1008	Mandatory	Must utilize the data elements defined within the Enterprise Data Warehouse for all adds/updates to Agency profile data; no fundamental Agency profile data can be replicated in stand-alone databases.

Desktop Requirements

In order to provide for infrastructure planning and implementation, identify all planned volumes, activity rates, connectivity sites, bandwidth requirements, storage requirements, and so on, for all infrastructure sites. All desktop requirements should be assigned a unique requirement id, with a standard requirement prefix of “DESK”. Please complete this section if applicable to your solution.

SAMPLE

REQMT ID	Mandatory/ Optional	Requirement Description
DESK1	Mandatory	Must provide the following desktop/Laptops solutions on the following platform – give CPU, memory, and disk requirements - give total number (each)
DESK2	Mandatory	Must provide CRT l Monitors for all Desktops – give total number.
	Optional	Must provide Flat Panel Monitor for all Desk tops – give total number
DESK3	Mandatory	Must provide the following Operating System on the Desktops – give total number
DESK4	Mandatory	Must provide list of all applications to be loaded on desktops – give total number per application, software version and assignments
DESK5	Mandatory	Must provide proof of software licensing for all software to be loaded on Desktops/Laptops – give copies of certificates
DESK6	Mandatory	Must provide networked printer information – give brand, model, how old, and total number
DESK7	Mandatory	Must provide asset information for desktop, printers, laptops and other peripheral devices to be supported by Desktop Services – give serial number of desktop, laptop, monitor, networked printer with corresponding agency asset tag number.
DESK8	Mandatory	Must provide maintenance coverage for desktops/laptops and networked printers
DESK9	Mandatory	Must provide other peripheral device information (e.g., scanners, personal printers) – give brand, model, how old, total number of each

DESK10	Mandatory	Must provide location information – give main address, telephone, main contact information and total end-users at each site

Application Hosting Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All application hosting requirements should be assigned a unique requirement id, with a standard requirement prefix of “HOST”. Please complete this section if applicable to your solution. N/A

REQMT ID	Mandatory/ Optional	Requirement Description
HOST1001	Mandatory	Must supply UserID and Password for Testing/Troubleshooting basic functions?
HOST1002	Mandatory	Must Supply Test Scripts for Functionalitity Testing & Regression Testing?
HOST1003	Mandatory	Must Supply Test Scripts for Performance Testing?
HOST1004	Mandatory	Do you Support .Net and Java Standards?
HOST1005	Mandatory	Must the Application have a Disaster Recovery Plan – If DOIT Environment fails – what is your expectation for disaster recovery of this application – how quick does the application need to be up for business processing of transactions?
HOST1006	Mandatory	Must the Application have load balancing for handling heavy transaction loading?
HOST1007	Mandatory	Must the servers and databases have high availability for acess?

Security Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All architecture requirements should be assigned a unique requirement id, with a standard requirement prefix of “SAFE”. **These are requirements are Mandatory for any solution**.

REQMT ID	Mandatory/ Optional	Requirement Description
SAFE1001	Mandatory	Must define DNS & Firewall requirements and/or changes - if applicable. No DNS changes required. Port 5800 must be open for bidirectional traffic from the ProjectWise Web Server to the ProjectWise Integration Server and port 443 must be open externally from the ProjectWise Web Server to the Internet for secure web traffic. Including FQDNs, IP addresses, port numbers and directional flow. See diagram
SAFE1002	Mandatory	Must have DOIT Security Team do an application security review during solution architecture/design phase to assess initial compliance and risk associated with the application.
SAFE1003	Mandatory	Must have DOIT Security Team implement a vulnerability Assessment of the application, database, and infrastructure of the solution when the application arrives to be hosted on DOIT Staging environment.
SAFE1004	Mandatory	Must have DOIT Security Team implement a Full Risk Assessment of the application, database, and infrastructure of the solution when the application arrives to be hosted on DOIT Staging environment.
SAFE1005	Mandatory	Must have DOIT Security Do final Assessment of the application, database, and infrastructure of the solution when the application moves to DOIT production environment (especially if there are any significant changes from Staging environment).
SAFE1006	Mandatory	Must have the owner of the data sign off on any mitigated, accepted, or transferred risk associated with the system.

Directory & Messaging Requirements

Identify any architectural requirements that must be met in order for the solution to align with the existing/planned enterprise architecture. All architecture requirements should be assigned a unique requirement id, with a standard requirement prefix of “DIR”. **These are requirements are Mandatory for any solution**.

REQMT ID	Mandatory/ Optional	Requirement Description
DIR1001	Mandatory	Must define Directory & Messaging requirements and/or changes - if applicable. The User Synchronization Service (running on the ProjectWise Integration Server) must be running as a user account with read access to the Active Directory.
DIR1002	Mandatory	Must have MS-Exchange Requirements (number of users, number of sites, size of mail.) N/A
DIR1003	Mandatory	Must have Mail polices – retention time, archive time, etc. N/A
DIR1004	Mandatory	If application sends email notifications must supply date to add to server, ip address, requester name and contact info, server name N/A

System Migration & Upgrade Requirements

Identify hardware and software upgrade requirements that must be addressed in order to meet the architecture and infrastructure requirements described above (in sections A and B). Please complete this section if applicable to your solution.

REQMT ID	Requirement Description	Migration Requirement
ARCH 1	Must utilize Service-Oriented Architecture (SOA) to facilitate routine, re-usable data retrieval, update, and creation (e.g. a common "read table x" service that will be called by multiple modules who would subscribe to such service).	Not Applicable. SOA requirements are satisfied with the existing architecture and infrastructure components.
ARCH 2	Must use Java vx.x or later for all new web application development.	Not Applicable. Java not required.
ARCH 3	Must utilize the data elements defined within the Enterprise Data Warehouse; no fundamental Agency profile data can be replicated in stand-alone databases.	Not Applicable. Data warehouse requirements are satisfied with the existing architecture and infrastructure components.
INFR 1	Must provide failover capability for all production application components and data bases.	Not Applicable. Failover requirements are satisfied with the existing architecture and infrastructure components.
INFR 2	Must provide clustered implementation of application components and databases on the client/server platform	Not Applicable. Clustering requirements are satisfied with the existing architecture and infrastructure components.
INFR 3	Must provide AIX version x.x as the server operating system.	Not Applicable. AIX not required.
INFR 4	Must allocate 200GB of memory on production AIX platform	Not Applicable. AIX not required.

Application/Data Interface Requirements

Identify all of the system-to-system interactions required to support the solution. All interface requirements should be assigned a unique requirement id, with a standard requirement prefix of “INTRF”. Please complete this section if applicable to your solution.

SAMPLE

Reqmt ID	Mandatory/ Optional	From Application	To Application	Interaction
INTRF 1	Mandatory	App 1	Portal	Must provide real-time read only retrieval of App 1 data to Portal app via web service.
INTRF 2	Optional	App 2	Portal	Must provide real-time read only retrieval of App 2 data to Portal app via web service.
INTRF 3	Mandatory	New App	Claim	Must pass new claim data created in New App as update transaction to Claim app via web service.
INTRF 4	Mandatory	Claim	Billing	Must pass Claim cost data from Claim system to Billing system thru existing batch interface.
INTRF 5	Mandatory	Billing	App 3	Must pass new Billing data from Billing system as update transaction to App 3 app via web service.
INTRF 6	Mandatory	Billing	App 4	Must pass new Billing data from Billing system as update transaction to App 4 app via web service.
INTRF 7	Mandatory	Billing	New App	Must pass new Billing data from Billing system as update transaction to New App via web service.

Application User/Transactional Volume Requirements

The Agency development team needs to provide the DOIT team their applications user volumes and transaction volumes for the applications this document supports.

SAMPLE

Maximum Application Users (Worst Case)

Application	Max # Users (2008)	Max # Users (2009)	Max # Users (2010)	Max # Users (2011)
Application #1 (Internal Users)	100	500	2000	10,000
Application #1 (External Users)				

Maximum Concurrent Application Users

Application	Max # Concurrent Users (2008)	Max # Concurrent Users (2009)	Max # Concurrent Users (2010)	Max # Concurrent Users (2011)
Application #1 (Internal Users)	10	50	200	1000
Application #1				

(External Users)

Maximum Applications Transactions

Application	Max # Transactions (2008)	Max # Transactions (2009)	Max # Transactions (2010)	Max # Transactions (2011)
Application #1 (Transactions Inbound)	10	50	200	1000
Application #1 (Transactions Outbound)				

Requirements Signoff

The Agency and DOIT Team signoff on these functional requirements means that you accept these requirements at this time. Any changes to the project scope or additional requirements will require that a formal change be submitted to the DOIT Team.

Agency Signoffs:

Business Owner:

Name:	
Title:	
Date:	
Signature:	

Business Project Manager:

Name:	
Title:	
Date:	
Signature:	

Third-Party Vendor Owner:

Name:	
Title:	
Date:	
Signature:	

DOIT Signoffs:

DOIT Director:

Name:	
Title:	
Date:	
Signature:	

DOIT Project Manager:

Name:
Title:
Date:
Signature:

DOIT Security:

Name:
Title:
Date:
Signature:

DOIT Hosting Manager:

Name:
Title:
Date:
Signature:

Template Change Control

This area is used for document change control purposes only and should be deleted for actual project/program use.

DOCUMENT HISTORY:

File Name:	Technical Requirements Document
Author:	DOIT PMO
Creation Date:	04/14/08
Version:	1. 1.0
Subject Matter Expert	Larry Williford/Keith McHugh
Subject Matter Expert	2.
Subject Matter Expert	
Subject Matter Expert	

Date	3. Version	Revision Author(s)	4. Revision Notes
	5.		
	6.		

System Development Methodology

Proof of Concept Evaluation Form: ECMS – And Associated Digital Submissions of Contract Plans – DOT Hosted Solution

Project Profile #: ECMS - 1001001

Agency: Department of Transportation

POC PRODUCT NAME: ProjectWise/Acrobat		DATE: 05/14/2009	
Proof #	**Proof Description**	**Pass/ Fail**	**Comments**
Initial POC Implementation – Business and Technical Observations			
1	**Technical Resources – Hardware Support and Set-Up - *"Assessment of a Future Production System"***	F	The DOT's Office of Information Systems has expressed concern to the Quality Assurance Office over the lack of resources to implement and support the hardware infrastructure required to fully implement the production system. Additionally, the Department of Transportation does not have the ability to hire staff to maintain the server operations. DOIT Server Application Hosting Staff has also expressed concern in regards to the resource requirements of a full hosting scenario of the ProjectWise System at their headquarters. A DOT system design, implementation and construction would fail to meet the ECMS Project Schedule. Proposed Solution: A vendor hosted solution should be pursued in order to resolve technical resource shortages.
2	**Technical Resources – System Technical/Application Support - *"Assessment of a Future Production System"***	F	Primarily, the Department has a single dedicated application development resource (TA2) focused on the majority of Bentley Products including - ProjectWise, MicroStation, InterPlot Organizer and Adobe Acrobat. This individual is also responsible for all hardware associated with the systems operations. A database lead is also assigned to ProjectWise; however, their time is primarily dedicated to all Department Systems. While the TA2 assigned these responsibilities has performed well, it is felt that he cannot solely handle a Production System efficiently with redundancy. An engineering document management system that could potentially support an approximate $500,000,000 capitol program requires support redundancy. A recent (04-09-09) week long outage of the POC system has exposed the importance of a having a production system that can recover in a timely manner with dedicated resources capable of troubleshooting the system.

			Proposed Solution: In the above scenario, being able to take advantage of the vendors expertise could have allowed a more responsive turnaround time. Allow CTDOT to pursue vendor hosting for the major components of the system. This will alleviate internal resource requirements. Internal resources can then be devoted to software deployment and development.
3	**Technical Resources – Business Side (Training, Application Support and Development) – "Assessment of a Future Production System"**	P	With the ability to deliver contract data digitally, the Department is saving a significant amount of money and the contract development process is becoming more transparent. While the applications have worked well for the Pilot Projects (See Results Below) they have been focused on a small number of select projects using a select few business resource support personnel to facilitate it. See strategy below for suggestions on transitioning business personnel into addressing future support requirements. The success of the business is also heavily reliant on Technical IT Resources. A significant finding is that without IT Staff supporting more efficient software management and deployment more time is required by engineering staff troubleshooting software versions and compatibility issues as they relate to implementing new business processes.
			Proposed Solution: Designation of dedicated project data managers needs to be more specific according to project/discipline or conversely a data management unit should be developed in order to facilitate a full production system. In the short term, existing Quality Assurance employees will be designated as project data managers. The responsibilities of the data managers include the complete coordination of publishing of Digital Submissions and Digital Contract Data and the development of necessary staff training. A clear training program and documentation needs to be developed that is focused on project development using required engineering applications. Consultant Services have been initiated in an effort to begin the development of a Digital Project Development Guide and the required applications that will assist in this endeavor. In the absence of a software distribution mechanism, the Office of Quality Assurance also needs to assess whether the system can be implemented more efficiently with high level users (CAD intensive) using the Thick Client and less advanced users using

			the thin (Web) client. In order to further reduce support requirements during reproductions, it would be an additional benefit if the Department had an alternative website dedicated to hosting contract data during the advertising process. Consultant IT Services will be needed in order to develop required AEC Applications as defined by Quality Assurance.
4	**Application Version Upgrades – Assessment of the Department Technical Staff's Ability to /New Technology Capability**	F	Bentley System Inc. continually upgrades their applications in order to provide more efficiency in terms of application functionality and offerings of new technology. The Department's OIS Staffing can only handle system upgrades at 1.5-2 year intervals. Difficulties are also experienced deploying necessary software version upgrades, since our Eng. OIS Staff does not appear to have necessary direction, priority, technical resources and skills necessary to deploy software efficiently. At times, Eng. OIS Support Staff are not given the required network rights to successfully complete their assignments. Solution: Proceed with the evaluation of a vendor hosted Solution in order to minimize system resource requirements so IT Staff can be more focused on software deployment and development.
5	**IT Infrastructure – Network DOT Main Office**	P	The Department's Main Office network has been performing very well during the POC.
6	**IT Infrastructure – Network DOT Remote Offices**	F	The DOT's major remote offices generally lack adequate bandwidth to facilitate an optimal system solution given the data sizes the engineering business requires. An evaluation of remote location caching servers is on-going, however, the implementation and testing has run into technical difficulties. Bentley has been requested to assist with the completion of this item (if it can be). The Office of Quality Assurance will be initiating a request to OIS for assessment of providing fiber-optic network at District 3 and 3A. The connections to the remote offices are generally inadequate to support the necessary business of the Agency. The network needs to be re-tooled.
7	**Assessment of End-Users Technical Skills and Ability to Work with Digital Engineering Data.**	F	The Office of Quality Assurance – Engineering Applications Section has performed preliminary training for Pilot Project participants. The training has exposed that the level of technical expertise and knowledge about technical engineering applications, basic computer operations, and data management is sorely lacking, particularly by the Contract Development Unit. More specifically, end-users need to better understand basic

			Microsoft Windows and Office Operating functions and the causes and effects of storing data on the network, versus on local drives, proper data management, dealing with digital media and best practices for digital reproductions. A “ground roots” training program needs to be developed and established that is focused on project delivery using the required technical applications.
8	**Internal IT / Vendor Coordination**	F	In general, the overall environment is difficult to coordinate (vendor, internal IT, and DOIT) and needs to be streamlined. During the POC implementation, Bentley Systems Inc. (DOT Vendor) did not get full cooperation with required statement of work items necessary to upgrade servers under the purview of CTDOT Office of Information Systems. Bentley, Quality Assurance Staff and the Office of Information – Business Systems staff has expressed concern over the condition of the server the POC System is on. While there were initial coordination issues on preliminary technical architecture and requirements, DOIT staff cooperated fully with the vendor on the initial planning and set-up of the POC at DOIT.

ProjectWise/Acrobat Software Functionality			
9	**ProjectWise Typical CE Firm (Web Client) Upload/Download Testing**	P	Generally, the initial testing showed as expected results. The common problem found at CE/External firms was they had T1 lines to the web that are shared by multiple users. An interesting result was obtained from Close Jenson and Miller (CJM) had a Business Class Cable Internet Connection (COX) the performance testing was better than average. Further testing of Cable Internet Connections (Comcast) has showed promising results. The Quality Assurance Group is considering the development of a specification for External Partners that will require the procurement of high speed internet connections for specific sized projects based on dollar size and potential file size submissions. (i.e. For Q-Bridge Engineers, Contractors, etc. a spec would be created requiring internet connections of 22MBps down / 5MBps upload) The costs of the service could be billed as direct costs towards the project or corridor project) By requiring a specific PC and connection, the Department can then better recommend virus protection software.)
10	**ProjectWise Typical Construction Trailer (Web Client)**	P	Same as above. The Office of Construction and the Constructions Applications Group is interested in pursuing a specification for Cable Web Connections for field offices.
11	**ProjectWise - Web Functionality**	P	ProjectWise's Web provides basic functionality to facilitate electronic file transfer, which may be able to suffice on the short term, however, the following are items that were identified as desired functionality: - We did notice that the web did not provide the ability to search Project Attributes. This is a feature that should be provided. The feature request was brought up to Bentley during a recent training class. - An additional requested feature allows users to change their own password. Not having this feature causes more administration requirements for staffing. - It would also be beneficial to have basic automated notifications available when users transmit data externally into ProjectWise.
12	**ProjectWise - Project Administration, Set-Up, Attribute Integration**	P	Generally, it is very simple to configure and set-up Projects in ProjectWise. There is significant work that needs to be done that is required to look at integrating Project Attributes to existing Department Databases. During System Design, we plan on

			developing a Statement of Work for Bentley Systems to assist us in integrating ProjectWise to existing Department Databases.
13	**ProjectWise -Security Administration**	P	The ease of applying security to project set-up becomes difficult when applying design security settings to multiple folders at once. It would be desirable to apply security settings to multiple folders at once. This should be a requested feature to Bentley in a future release. A necessary work-around has been developed that takes advantage of project templates for State Design and Consultant Design.
14	**ProjectWise Delta File Transfer**	F	We had initial hopes that the web client would work with delta file transfer. After the system was set-up, we found that it does not work with the web. Since the Business process relies on changing filenames during certain milestones, taking advantage of Delta File Transfer is not feasible at this time for PDF File Transfer. Once CAD Production data can be tested properly, we anticipate delta file transfer can be tested more successfully.
15	**ProjectWise Remote Office - Caching Server Test**	F	Initial tests of the Caching Server crashed the Department's Network located at Engineering Records (T1). OIS is investigating the cause. The Office of Quality Assurance has initiated a request to OIS for upgrading the Department's Network Infrastructure at District 3 and 3A.
16	**ProjectWise General Engineering Data Management - Application**	P	Overall, the performance of ProjectWise allows for very secure and easy to use data management functionality.
17	**ProjectWise Document/Folder Security**	P	Out of the box, ProjectWise does not allow read/only restrictions on a folder/document and allow a user to create a new document. This would be beneficial if it worked this way so that users can create documents, but not alter existing documents. As a work around, Content Managers are required to mark documents as read-only.

18	**Adobe Acrobat CDS - Digital Signature Usage**	P	In June of 2007, the Department was given approval to Pilot the use of Digital Signatures using Adobe's CDS. The overall results of this application have worked very well. Piloting continues, and has actually helped the Department change Engineering Content Management in order to improve business processes. IT Support is minimal since it relies on external subscription services. It would be desirable to have an internal certification lisc. Management application in place, this is a feature current CDS Vendors are considering. (i.e. In the case, a DOT employee leaves or is transferred, the certificate can be transferred to other Department employees).

Pilot Project Observations and Results

19	**<Pilot Project 107-0158> State Design - 70% Design Submission – Digital Final Contract Drawings**		
	1. PDF Plotting 2. Sending the Design Submission on a **(DOT Internal)** collaborative review using Adobe Acrobat.	P	The Project Manager involved in the project was very receptive to trying the new processes. There were some initial difficulties with PDF Plotting that was mainly associated with versions of software (Mainly IPlot Org. and MicroStation). Once the versions were stabilized, the pdf plotting was simple for the project manager. The Project Manager needed to plot the PDF's for the disciplines involved in the project, since training was not provided. Quality Assurance/Engineering Applications provided training for the projects team that was involved in the Adobe Acrobat design review process. A couple of bugs were noted in Acrobat and the biggest challenge was getting the user familiar with new comment approval processes. Once a workflow was established users grasped what needed to be done. Better training and clearer documentation is needed to transition to a production environment. The use of Acrobat and not Reader is a must. Reader limited some users from working efficiently summarizing comments etc. Several users provided positive feedback in the application.
	3. Software Versions	F	OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.

	4. Final Design/Advertising Process a. Digital Signature Process b. Advertising process via DVD vs. Paper Method – Time and Cost Study	F	The Contract Development Unit made numerous comments during final design that resulted in numerous re-plotting and re-signing attempts by the Project Engineer and Managers. Several Contractors complained about not having paper plans available with such a small job. Contract Development sent Eng. Records (Printing Services) the incorrect notification of engineering paper sizes to plot. Contractors were offered paper plots, however, a lack of training and knowledge of how to properly plot PDF's was occurring. A short-term software upgrade was required at Engineering Records. Significant Technical Support was required by Engineering Application staff during the reproductions process. Solution: Contract Development needs to be involved in a design review prior to FDP. Contract Dev. needs to properly inform Eng. Records (Printing Services)of paper sizes. To our knowledge a form field was created on for Eng. Records (Printing Services)Staff to inform them of plan sizes for future projects. In order to further reduce support requirements during reproductions, it would be an additional benefit if the Department had an alternative website dedicated to hosting contract data during the advertising process. Eng. Records (Printing Services)needs to be trained thoroughly in an effort to improve their capabilities in dealing with digital contract data.

20	**<Pilot Project 0092-0619 – I95/91 Breakout> FDP - Consultant Design Submission – Digital Final Contract Drawings**		
	1. Final Design/Advertising Process a. PDF Plotting b. Sending the Design Submission on a **(DOT Internal)** collaborative review using Adobe Acrobat. c. Digital Signature Process d. DCD Review by FHWA e. Advertising process via DVD	F	After some initial support requirements for Bentley's InterPlot Organizer, the Consultant Engineer involved in the project was able to successfully use the software to plot PDF's. One issue the Consultant Engineer Recommended was minimizing the amount of signatures required on Plan Sheets. The Contract Development Unit made numerous comments during final design that resulted in re-plotting and re-signing attempts by the Project Engineer and Managers. Due to this, it was difficult to determine what changes were occurring from the FDP Submission to the DCD Submission. There was no issue reported with the digital signature issuance and usage. Contract Development decided to submit digitally via DVD the DCD approval to the FHWA. While it was a savings in paper, it required significant support from Engineering Applications Staff since Contract Development Staff is not trained sufficiently and does not have sufficient knowledge in dealing with digital contract data. Quality Assurance Engineering Applications provided initial pilot training and support for the Contract Development Unit; however, additional documentation and training will still be required. Significant technical support by Quality Assurance/Engineering Applications Staff to Engineering Records Staff was required during Reproduction of the DVD's issued to Contractors. In general, contractors accepted the method of receiving the data via DVD.

			Solution: A plan for streamlining project plan assembly and creation in PDF format is in progress. It will involve changes to the Department of Consumer Protection Regulations as it would pertain to digital signature usage. Contract Development needs to be involved in a design review prior to FDP. Provide FHWA with proper training in using ProjectWise Web, they could easily access the DCD Data (Plans and Specs) rather than using the DVD Distribution Method. This would significantly reduce technical support. In order to further reduce support requirements during reproductions, it would be an additional benefit if the Department had an alternative website dedicated to hosting contract data during the advertising process. Eng. Records (Printing Services)needs to be trained thoroughly in an effort to improve their capabilities in dealing with digital contract data.
	2. Software Versions	F	Internally at DOT, OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment and inconsistent versions of Acrobat. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.

	3. Potential for Operation Cost Savings and Use of Data by Contractors.	P	As a potential service, significant operational savings can be realized with full production of digital data. In general, contractors accepted the method of receiving the data via DVD. The delivery of electronic data makes it significantly easy for Contractors to communicate more efficiently and distribute plans and specs faster. It seems as though the larger contractors are better prepared to deal with electronic media. Ultimately, the project ended up getting 4 bidders with Walsh Construction being awarded the contract.
	4. Digital Submissions of Construction Order Processes	P	The Consultant Engineer successfully transmitted change order data through ProjectWise. No issues were experienced and the application continues to work fine. In an effort to minimize data management resources in the future Engineering Applications is developing new procedures to streamline the plan production process.
	5. Const. Dist. Access a. Basic File Transfer/Reading of files via the WEL	TBD	This has not been set-up and/or coordinated yet. Training is anticipated to occur soon.
	6. ProjectWise & Primavera Expedition Interoperability	TBD	For the piloting, Quality Assurance/Engineering Applications provided the prime data manager for the Q-Corridor Project access to the ProjectWise Web with the understanding that they need to be aware that the latest and greatest contract plan data is located on the ProjectWise System, and copies could be distributed via Expedition as needed. For the future, there is a definitive need for better collaboration, archival procedures, and linking between both systems via common dashboards and/or synchronized account administration. Without the development of a clear integration plan it will be difficult for the department to progress using both systems.

	<Pilot Project 0092-0532 – Q-Bridge > FDP - Consultant Design Submission – Digital Final Contract Drawings		
21	1. Final Design/Advertising Process a. PDF Plotting b. Digital Submissions c. Digital Signature Process d. DCD Review by FHWA e. Advertising process via DVD	F	After some initial support requirements for Bentley's InterPlot Organizer, the Consultant Engineer involved in the project was able to successfully use the software to plot PDF's. There were no issues reported with the digital signature issuance and usage, however, there was an issue that occurred that that required contract sheet #'s to change throughout the entire plan volume set, thus requiring signers to re-digitally sign a significant amount of sheets. Contract Development decided to submit digitally via DVD the DCD approval to the FHWA. While it was a savings in paper, it required significant support from Engineering Applications Staff since Contract Development Staff is not trained sufficiently and does not have sufficient knowledge in dealing with digital contract data. Significant Technical Support was required by Engineering Application staff during the reproductions process. Quality Assurance Engineering Applications provided initial pilot training and support for the Contract Development Unit; however, additional documentation and training will still be required. Significant technical support by Quality Assurance/Engineering Applications Staff to Engineering Records Staff was required during Reproduction of the DVD's issued to Contractors. In general contractors accepted the method of receiving the data via DVD.

			Solution: A plan for streamlining project plan assembly and creation in PDF format is in progress. It will involve changes to the Department of Consumer Protection Regulations as it would pertain to digital signature usage. Contract Development needs to be involved in a design review prior to FDP. Provide training to FHWA so they can use ProjectWise Web, to access the DCD Data (Plans and Specs) rather than using the DVD Distribution Method. This will significantly reduce technical support. In order to further reduce support requirements during reproductions, it would be an additional benefit if the Department had an alternative website dedicated to hosting contract data during the advertising process. Eng. Records (Printing Services) needs to be trained thoroughly in an effort to improve their capabilities in dealing with digital contract data.
	2. Addendum Process and Use of ProjectWise Web for Design Submissions.	P	The consultant engineers were successfully trained and transmitted significant sized data through the system. Typically Consultant Engineers would transmit the data on PC's that were independent so they would not interrupt normal production or they would transfer data after hours. ProjectWise Web has been instrumental in QA/QC Routines with checking the final project plans prior to them being advertised.
	3. Software Versions	F	Internally at DOT, OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment and inconsistent versions of Acrobat. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.

	4. Potential for Operation Cost Savings and Use of Data by Contractors.	P	As a potential service, significant operational savings are being realized with full production of digital data. In general, contractors accepted the method of receiving the data via DVD. The delivery of electronic data makes it significantly easy for Contractors to communicate more efficiently and distribute plans and specs faster. It seems as thought the larger contractors and better prepared to deal with electronic media. Ultimately, the project ended up getting 4 bidders with Walsh Construction being awarded the contract.
	5. Construction Order Process	TBD	TBD
	6. Const. Dist. Access b. Basic File Transfer/Reading of files via the WEL	TBD	This has not been set-up and/or coordinated yet. Training is anticipated to occur soon.
	7. ProjectWise & Primavera Expedition Interoperability	TBD	For the piloting, Quality Assurance/Engineering Applications provided the prime data manager for the Q-Corridor Project access to the ProjectWise Web with the understanding that they need to be aware that the latest and greatest contract plan data is located on the ProjectWise System, and copies could be distributed via Expedition as needed. For the future, there is a definitive need for better collaboration, archival procedures, and linking between both systems via common dashboards and/or synchronized account administration. Without the development of a clear integration plan it will be difficult for the department to progress using both systems.

	<Pilot Project 0138-0221 – Moses Wheeler Bridge > FDP - Consultant Design Submission –Digital Final Contract Drawings		
22	1. Final Design/Advertising Process a. PDF Plotting b. Digital Signature Process c. DCD Review by FHWA d. Advertising process via DVD	F	After some initial support requirements for Bentley's InterPlot Organizer, the Consultant Engineer involved in the project was able to successfully use the software to plot PDF's. There were numerous issues reported with the digital signature installation and confusion on how to use the signature. The problems seemed to stem from the Consultant Firms IT and Engineering Departments confusion on how to install and set-up the digital signature properly. After some initial by Quality Assurance – Engineering Applications Staff support and GeoTrust/VeriSign support. Contract Development decided to submit digitally via DVD the DCD approval to the FHWA. While it was a savings in paper, it required significant support from Engineering Applications Staff since Contract Development Staff is not trained sufficiently and does not have sufficient knowledge in dealing with digital contract data. One issue occurred in which the project engineer assumed the system would take care automatic DCD approval from FHWA and he was not clear that he needed to reproduce a DVD. The ultimate result was a delay in timely advertising of an addendum and required federal approvals. Quality Assurance Engineering Applications provided initial pilot training and support for the Contract Development Unit; however, additional documentation and training will still be required. See Engineering Business Assessment Above. Significant technical support by Quality Assurance/Engineering Applications Staff to Engineering Records Staff was required during Reproduction of the DVD's issued to Contractors. In general contractors accepted the method of receiving the data via DVD. There were issues plotting pdf's via Reprodesk.

			Solution: A plan for streamlining project plan assembly and creation in PDF format is in progress. It will involve changes to the Department of Consumer Protection Regulations as it would pertain to digital signature usage. Contract Development needs to be involved in a design review prior to FDP and needs significant basic computer training. Provide training to FHWA using ProjectWise Web, so they can easily access the DCD Data (Plans and Specs) rather than using the DVD Distribution Method. This would significantly reduce technical support. Eng. Records (Printing Services) needs to be trained thoroughly in an effort to improve their capabilities in dealing with digital contract data.
	2. Addendum Process and Use of ProjectWise Web for Design Submissions.	TBD	The consultant was trained, but it appears they will require additional training.
	3. Software Versions	F	Internally at DOT, OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment and inconsistent versions of Acrobat. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.
	4. Potential for Operation Cost Savings and Use of Data by Contractors.	P	As a potential service, significant operational savings are being realized with full production of digital data. In general, contractors accepted the method of receiving the data via DVD. The delivery of electronic data makes it significantly easy for Contractors to communicate more efficiently and distribute plans and specs faster. It seems as thought the larger contractors and better prepared to deal with electronic media. Ultimately, the project ended up getting 4 bidders with Walsh Construction being awarded the contract.
	5. Construction Order Process	TBD	TBD
	6. Const. Dist. Access c. Basic File Transfer/Reading of files via the WEL	TBD	TBD

	7. ProjectWise & Primavera Expedition Interoperability	TBD	TBD

23	**<Pilot Project 0301-0106 – >New Haven Rail Yard – CCO Shop> - FDP - Consultant Design Submission – Digital Final Contract Drawings**		
	1. Final Design/Advertising Process a. PDF Plotting b. Digital Signature Process c. Digital Submission Process d. Advertising process via DVD	P	The Consultant Engineer had initially prepared their design plans according to the 2005 digital design environment, and was already familiar with Bentley IPlot Software. This project also incorporated recommendations by the Quality Assurance Engineering Applications to streamline the plan assembly and digital signature processes. Legally, this posed issues since we were required by DOT's legal staff to enforce supplemental agreement language into the Department's Contracts with Consultant Engineers. With the revised procedures it becomes very important for Consumer Protection to incorporate new language similar to what Landscape Architects have been approved for. The Consultant Engineer successfully submitted their FDP Plan Set through ProjectWise Web. This project happened to be the 4th Pilot Project the Engineer from Contract Development was involved with. Significant progress was made by the engineer in better understanding of the system uses. It is apparent the more use by the engineers, the more they become familiar with the system.
	2. Addendum Process and Use of ProjectWise Web for Design Submissions.	TBD	TBD
	3. Software Versions	F	Internally at DOT, OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment and inconsistent versions of Acrobat. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.
	4. Potential for Operation Cost Savings and Use of Data by Contractors.	P	As a potential service, significant operational savings are being realized with full production of digital data. In general, contractors accepted the method of receiving the data via DVD. The delivery of electronic data makes it significantly easy for Contractors to communicate more efficiently and distribute plans and specs faster. It seems as thought the larger contractors and better prepared to deal with electronic media. Ultimately, the project ended up getting 4 bidders with Walsh Construction being awarded the contract.

	5. Construction Order Process	TBD	TBD
	6. Const. Dist. Access d. Basic File Transfer/Reading of files via the WEL	TBD	TBD
	7. ProjectWise & Primavera Expedition Interoperability	TBD	TBD
	<Pilot Project 0150-0126> Washington – Retaining Wall – 30% Preliminary Design Review		
24	1. PDF Plotting 2. Sending the Design Submission on a **(DOT Internal)** collaborative review using Adobe Acrobat.	P	The project engineer did not have any issues assembling and using Bentley IPlot Organizer. The Soils and Foundations Group suggested having the ability to edit or modify each others comments especially within their own group. Out of the Box, Adobe Acrobat does not allow for this, would need to be custom.
	3. Software Versions	F	Internally at DOT, OIS EA Support was unable to script software installation on users PC's thus resulting in inefficient software deployment and inconsistent versions of Acrobat. Solution: OIS EA Support needs to deploy software via scripting and to keep users updated with the latest software versions.

Additional Items			
25	**<Accessing Archive Const. Data>**	P	Since test results showed promising result with dealing with ProjectWise Web Access, it is assumed that Municipalities, Planning Agencies, Engineers, Surveyors and Architects will no issues accessing the system. The issues experienced with searching via the web client are not applicable since a likely archive system will take on individual document attributes rather than project attributes. It is preferred to test this scenario when a production system is in place.
26	**<CAD Production - Development- PW Internal Managed Workspace>*.** 1. Development of a PW Management Workspace Environment 2. Testing of a PW Management Workspace Environment a. Plotting / Publishing i. Local vs. Server b. InRoads Integration * Consultant Help Needed for Management Workspace Integration	TBD	We have been waiting for approval for the use of DOIT Consultant Services to assist in this testing
27	**<CAD Production - Development- PW External Managed Workspace>.** 1. Development of a PW External Managed Workspace Environment 2. Testing of a PW External Managed Workspace Environment a. Plotting / Publishing i. Local vs. Server b. InRoads Integration	TBD	We have been waiting for approval for the use of DOIT Consultant Services to assist in this testing

V8i Version Technical Evaluation Criteria for ProjectWise Proof of Concept			
Technical Point	**Significance**	**Previous Functional Evaluations**	**Pass/Fail**
Athens using .Net vs. TomCat	Allows deployment at DOIT. Previous web server versions used freeware components contrary to DOIT standards. Attempts at using other web presentation layers (i.e. Go Global) failed.	Previous version setup at DOT. Used in-house: performance sufficient, abilities insufficient Demonstrated with DDE in 2006; warm reception. Used by 2 Consulting Firms via VPN fall 2006: VPN connections unreliable, data transfer rates insufficient and variable.	P
Gateway Server – Integration Server complete integration	Older versions of gateway services routed to Integration Server, Database Server and File Caching Server. New version routes all requests through Integration Server, which will pass through and back data requests. Allows deployment of major components at DOT vs. DOIT	N/A	P
Net change capability with file caching servers	Ability to analyze binary layout of files on main file server vs. satellite file server and only transmit delta. For large files, this reduces network load and user lag time.	Testing with District Offices and Engineering Archives facilities with older version yielded 60 – 70 minute download times.	F
No other DOT using Bentley's products has the requirement of using a remote location (DOIT) for internet access	No way to determine from vendor experience impact of network latency across multiple connections / tiers		P

POC PRODUCT NAME: ECMS – Bentley ProjectWise	DATE: 05/14/09

Proof of Concept Summary

Summarize the results and conclusions drawn from the POC testing

1. **CTDOT does not have necessary IT Technical Resources to effectively support and maintain a DOT Hosted system. A vendor hosted solution should be pursued to further evaluate the pros and cons.**

2. **Software versioning, distribution and management methods have not been properly standardized on by DOT's OIS Engineering Applications Support Unit.**

3. **DOT's Remote Offices will need a more robust Network Infrastructure (Increased Broadband Capability). A phased approach considering funding the District 3 and 3A should be considered.**

4. **In order for the engineering business process using an ECMS to be successful, significant training, documentation and support will be required for both Internal and External Design Groups. Suggestions for the development of support structure are outlined above.**

5. **The continued development in the area of digital contract plans submissions and electronic bidding must continue to support the Governor's Executive Directive #3.**

DOIT OPTIONS PAPER

NAME: Connecticut Department of Transportation - ECMS	DATE: 05-29-09
ISSUE TO BE RESOLVED: Allowing CTDOT to proceed to the Design Phase assuming a Vendor Hosted Solution.	**EVALUATION CRITERIA USED TO ASSESS THE PROBLEM:** POC (DOT Hosted Solution) – Evaluation Form Attached.
RECOMMENDATION - OPTION NO> **(2 – Proceed to the Design Phase)**	

OPTION 1	OPTION 2	OPTION 3
Description: **DOT/DOIT (web) Hosted ProjectWise Solution**	**Description:** **Bentley Hosted Solution*** *** Network Arch./Bandwidth Requirements TBD**	**Description:** **Bentley Hosted Solution – File Storage(caching) at DOT*** *** Network Arch./Bandwidth Requirements TBD**
Pro's: • Performance • Data is located at CTDOT	**Pro's:** • System hardware, application, back-up can be supported by the vendor. • Specialized and knowledgeable staffs are available to support the product. • Cost structure and budgeting can be planned easier for long term system maintenance • Versioning cycles more frequent • Project Schedules can be met with a Bentley System design and solution.	**Pro's:** • System hardware, application, back-up can be supported by the vendor. • Cost structure and budgeting can be planned easier for long term system maintenance • Versioning cycles more frequent • Since the vendor makes the software, they are the best to support the system. • Project Schedules can be met with a Bentley system design and solution. • Data is located at Bentley and CTDOT
Con's: • CTDOT IT does not have necessary resources to effectively support and maintain the system. • Desired versioning cycles not obtainable • Two dedicated IT Resources would be required to implement and maintain the system. They have not allocated to OIS (Approval has not been granted to hire) • Project Schedules would be impacted with a DOT System Design and Implementation. • Thick Client Software Distribution is still not	**Con's:** • Performance for dealing with larger files internally • Data is located at Bentley • Thick Client Software Distribution is still not automated at CTDOT • Bandwidth considerations between DOT and DOIT • Bentley uses MS SQL for database software, which could pose challenges with future desired system integration. CTDOT standard	**Con's:** • Performance for dealing with larger files internally • CTDOT IT would have to maintain an additional server. CTDOT IT may not have the necessary resources to effectively support and maintain the system. • Thick Client Software Distribution is still not automated at CTDOT • Bandwidth considerations between DOT and DOIT • Bentley uses MS SQL for database software, which could pose challenges with future desired system

automated at CTDOT	database platform is Oracle. • Security and Admin. Set-Up will not be turn-key transitioning from CTDOT's POC System to a Bentley Hosted Solution.	integration. CTDOT standard database platform is Oracle. • Security and Admin. Set-Up will not be turn-key transitioning from CTDOT's POC System to a Bentley Hosted Solution.
Cost & Benefit $ (if applicable): TBD	**Cost & Benefit $ (if applicable):** TBD	**Cost & Benefit $ (if applicable):** TBD