

Replacing MDT's Oudated Bridge Management System

Deployment of the Advitam Scanprint system

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Project Background



Project Background

- MDT has approximately 6000 structures in the system
- MDT Inspects all publicly owned non-Federal bridges in Montana
- 5 districts report to the central office

Project Background

- At the end of 2014, MDT formally began a search for a new Bridge Information Management System
- Replacement of the existing system needed to meet 4 main goals:
 - Be a Customizable-off-the-Shelf (COTS) system
 - Meet the immediate need to collect bridge data in compliance with MAP-21 and FHWA Requirements
 - Interface with and dynamically exchange information with external data sources
 - Meet the agency goal of increasing robustness and efficiency

Project Background

- In addition to the primary requirements, MDT wanted a system that could:
 - Incorporate MDT-specific inspection items on top of NBI and NBE data
 - Enable work and data collection on mobile devices
 - Provide a management function for repairs suggested by the inspectors
 - Allow the ability to edit reports and create new reports without complicated processes

Project Background

- In June 2015, Advitam was selected through an RFP process
- The system went live in late December, 2016
- The system manages all bridge inspection and inventory data for MDT
- We are currently working on an RFP for a system to integrate with the data available in the Structure Management System (SMS) that will allow us additional Asset Management Capabilities

Project Background

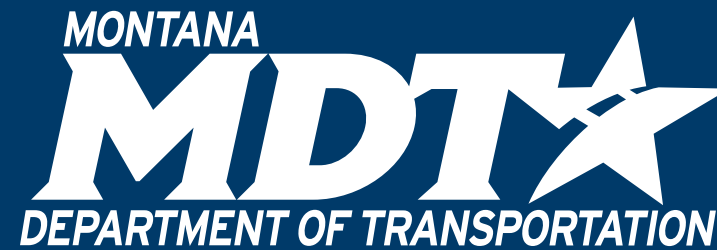
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Project Approach



Project Approach

- The teams:



Project Approach

- MDT's RFP required the contractor to use the Agile method of project development.
- Agile vs Waterfall
- Somewhat difficult with RFP, but we managed to make it work

Project Approach

- Phase 1 – Project Kickoff

Inputs	<ul style="list-style-type: none">• Executed Contract• Client contact information
Deliverables	<ul style="list-style-type: none">• Refined schedule• Final project team organization• Points of contact• Final project implementation plan

Project Approach

- Phase 2 – System Customization and Delivery

Inputs	<ul style="list-style-type: none">• MDT's existing data• MDT user profiles• MDT workflow processes – user stories• Naming Schema for data dictionary• Feedback from MDT personnel
Deliverables	<ul style="list-style-type: none">• Progress reports• Sprint deliverables• Test plans• Weekly project call• Monthly sprint demonstrations• Documentation Updates

Project Approach

- Phase 3 – User Training and User Assistance

Inputs	<ul style="list-style-type: none">• Training groups• Training submittal requirements• MDT review and comments on training documents
Deliverables	<ul style="list-style-type: none">• Training Sessions• Training documents• User Manuals

Project Approach

- Phase 4 – System Support and Maintenance

Inputs	<ul style="list-style-type: none">• Requests from Inspectors• Requests from MDT Headquarters Personnel
Deliverables	<ul style="list-style-type: none">• On-site and remote support from Advitam• Ticketing system with status tracking including resolution• Online help sessions as needed

Project Timeline

- Kickoff Meeting: June 30, 2015
- Shut-down of old system: December 9, 2015
- User training: Week of December 7, 2015
- Go-Live date: December 17, 2015
- Signed off into Service and Maintenance Agreement: December 5, 2016
- Time from Kickoff to Go-Live = approx. 5.5 months
- Time from Kickoff to S&M = approx. 1 year

Final Result



Final Result

- Software package that:
 - Contains inventory data for all non-federal public bridges in Montana
 - Contains all inspection data – including historical data for all bridges inspected by MDT
 - Allows tracking and prioritization of bridge reactive maintenance work (replaced an old spreadsheet)
 - Contains bridge-related correspondence
 - Holds plan sets, photos, videos, and other electronic files
 - Provides reporting for bridge inspections, critical findings and their status, scour critical bridges, and other important issues

Final Result

- Mobile app that allows data collection in the field
- Tracking of inspection QC/QA process
- Ability to add new attributes whenever needed
- Customizable in almost everything

Final Result – Inventory Data

- One click to access data
- Fully electronic bridge file

Picture	Name (or ID)	HDT Structure ID	Type	Feature Intersected	Location	HDT Inspection District	Owner	Next Inspection Date	Facility Carried by Structure	Structure Condition
	00000000007019	07019	Bridge	OTTER CREEK	7M SE MELVILLE	05 - BILLINGS	02 - 02 County Hwy Agency	Nov 10, 2017	GLASTON RD	Good
	00000000007020	07020	Bridge	STEVENS CREEK	105 - 4 M SSE NOXON	01 - MISSOULA	02 - 02 County Hwy Agency	May 19, 2017	STEVENS RIDGE TR	Good
	00000000007022	07022	Bridge	ARMINGTON COULEE	128 - 2M E ARMINGTON	03 - GREAT FALLS	02 - 02 County Hwy Agency	Jul 06, 2017	WILLIAM CREEK RD	Not Applicable
	00000000007023	07023	Bridge	WILLOW CREEK	160 - 6M NW AUGUSTA	03 - GREAT FALLS	02 - 02 County Hwy Agency	Oct 05, 2017	SUN CANYON RD	Good
	00000000007027	07027	Bridge	DUCK CREEK	8.3M N WEST YELLOWSTONE	02 - BUTTE	01 - 01 State Highway Agency	Jul 22, 2017	GALLATIN RD	Not Applicable
	00000000007028	07028	Bridge	BIRCH CREEK	3M W APEX	02 - BUTTE	02 - 02 County Hwy Agency	Nov 30, 2017	BIRCH CREEK RD	Good
	00000000007029	07029	Bridge	ASHLEY CREEK	5M W KALISPELL	01 - MISSOULA	02 - 02 County Hwy Agency	Feb 25, 2018	WHALEBONE DR	Not Applicable
	00000000007031	07031	Bridge	ODELL CREEK	29M E MONIDA	02 - BUTTE	02 - 02 County Hwy Agency	Jun 28, 2018	S VALLEY RD S-509	Good

Selected asset : 07019 - 00000000007019 - Location: 7M SE MELVILLE - Feature Intersected: OTTER CREEK - Owner: 02 - Facility Carried by Structure: GLASTON Displaying 1-50 of 5046 items | Page 1 of 101 | Page size | 50

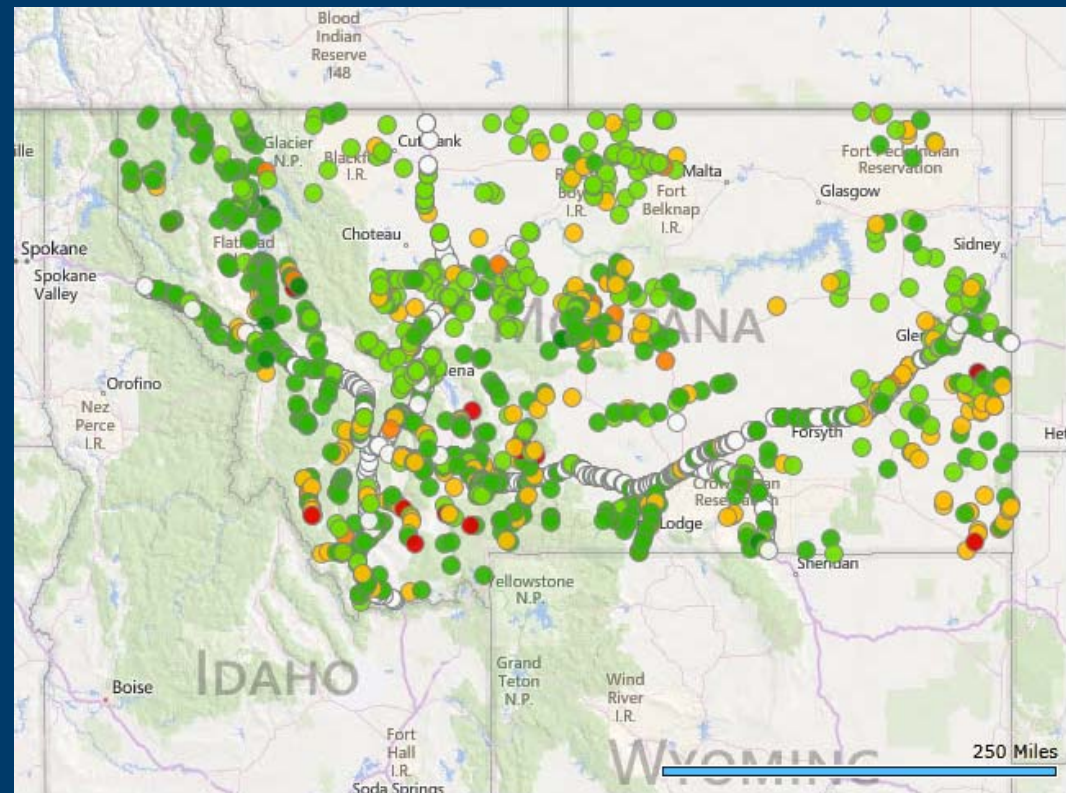
Location | Attributes | Components | Repairs | Inspection masters | Inspections | Documents | Photos | *AssetPosts

Type: Bridge
Name (or ID): 00000000007019
HDT Structure ID: 07019
Latitude: 46.00525



Final Result – Inventory Data


- Different types of assets can be handled for MDT:
 - Bridges
 - Culverts
 - Tunnels
 - Signs
 - Lights
 - Walls
 - ...
- Very useful GIS capabilities



Final Result – Inventory Data

- Documents

Selected asset : 01214 - I00015236+02121 • Location: 2M N CRAIG • Feature Intersected: SEP MISSOURI RVR-CO RD • Owner: 01 • Facility Carried by Str

Picture	Name (or ID)	MDT Structure ID	Type	Feature Intersected	Location	MDT Inspection District	Own
	I00015236+02121	01214	Bridge	SEP MISSOURI RVR-CO RD	2M N CRAIG	03 • GREAT FALLS	01 •

Location | Attributes | Components | Repairs | Inspection masters | Inspections | Documents | Photos | *AssetPosts


+ New | Edit | Show details | Delete | Download | Edit all | Group by: Don't group

Type	Name (or ID)	Download	Date	Include in Inspection Report	Comments
Plans	01214	Download	8/9/2016	<input type="checkbox"/>	original as-built plans. does not include rehab plans.
Plans	01214 rehab plans 1993	Download	8/31/2016	<input type="checkbox"/>	Rehab plans 1993
Inspection Sketches	Cracked Welds	Download	7/18/2016	<input type="checkbox"/>	Photos from 7-15 on cracked welds.
FC Inspection Plan	I00015236+02121	Download	5/13/2016	<input type="checkbox"/>	
Shop Drawings	Steel Shop Drawings	Download	9/7/2016	<input type="checkbox"/>	Shop Drawings for steel girders and associated superstructure elements

Final Result – Inventory Data

- Components for inspections

Selected asset : 01214 - I00015236+02121 • Location: 2M N CRAIG • Feature Intersected: SEP MISSOURI RVR-CO RD • Owner: 01 • Facility Carried by Structure: I 15 • MDT Inspection District: 03 • Next Inspectic *Displaying 1 items* Page size 50

Picture	Name (or ID)	MDT Structure ID	Type	Feature Intersected	Location	MDT Inspection District	Owner	Next Inspection Date	Facility Carried by Structure	Structure Condition
	I00015236+02121	01214	Bridge	SEP MISSOURI RVR-CO RD	2M N CRAIG	03 • GREAT FALLS	01 • 01 State Highway Agency	Jul 15, 2016	I 15	Good

Location | Attributes | Components | Repairs | Inspection masters | Inspections | Documents | Photos | *AssetPosts

Tree View | Drawings | Inspection drawings | Map

Components + New | Delete | Copy | Copy

Components

- Reinforced Concrete Deck (SF) 12
- Reinforced Concrete Deck (SF) 12
 - Steel Girder|Beam (LF) 107
 - Steel Protective Coating (SF) 515
- Steel Stringer (LF) 113
 - Steel Protective Coating (SF) 515
- Steel Floor Beam (LF) 152
- Reinforced Concrete Column (EA) 205
- Reinforced Concrete Submerged Pile Cap/Footing 890
- Reinforced Concrete Pile (EA) 227
- Reinforced Concrete Pier Cap (LF) 234
- Pourable Joint (LF) 301
- Compression Joint (LF) 302
- Movable Bearing (roller, sliding, etc.) (EA) 311
- Fixed Bearing (EA) 313

Properties Edit

Archived

Type: FHWA National Bridge Inventory Bridge Elements > Superstructure > Steel Girder|

Name (or ID): Steel Girder|Beam (LF)

Number: 107

Position: 36

Parent:

Comments: AutomatedAdvitamScriptMap21

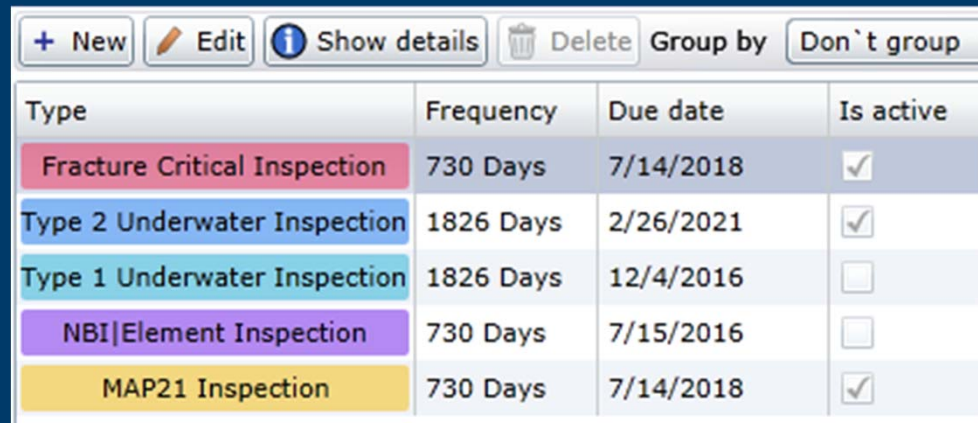
Attributes

Filter | Edit | Backup Data | View history

Attribute	Value - V
(MDT075) Structure Unit Type	0M • first main span
Comments: AutomatedAdvitamScriptMap21	
(Num) Quantity	1142
(SCALE) Units	Length • feet
(EnvTyps) Environment Conditions	2 • Low

Final Result – Inspection Data

- Ability to define inspection types



Type	Frequency	Due date	Is active
Fracture Critical Inspection	730 Days	7/14/2018	<input checked="" type="checkbox"/>
Type 2 Underwater Inspection	1826 Days	2/26/2021	<input checked="" type="checkbox"/>
Type 1 Underwater Inspection	1826 Days	12/4/2016	<input type="checkbox"/>
NBI Element Inspection	730 Days	7/15/2016	<input type="checkbox"/>
MAP21 Inspection	730 Days	7/14/2018	<input checked="" type="checkbox"/>

Final Result – Inspection Data

- Scheduling

Status: To define | Type: All types | From: 4/1/2017 To: 4/30/2017 | Display mode: Daily | Only equipments |

Inspection Type	Asset	Start Date	End Date
MAP21 Inspection	I00015086+03271	2017-04-21	2017-04-22
MAP21 Inspection	I00015086+03272	2017-04-20	2017-04-21
MAP21 Inspection	I00015086+03272	2017-04-23	2017-04-24
MAP21 Inspection	I00015086+03272	2017-04-24	2017-04-25
MAP21 Inspection	I00015086+03272	2017-04-25	2017-04-26
MAP21 Inspection	I00015086+03272	2017-04-26	2017-04-27
MAP21 Inspection	I00015086+03272	2017-04-27	2017-04-28
MAP21 Inspection	I00015086+03272	2017-04-28	2017-04-29
MAP21 Inspection	I00015086+03272	2017-04-29	2017-04-30
MAP21 Inspection	I00015270+04311	2017-04-05	2017-04-06
MAP21 Inspection	I00015270+04312	2017-04-05	2017-04-06

Group by: Date | Asset

Inspection type	Asset
4/6/2017	
MAP21 Inspection	01247 - I00015270+04312

Team: | Date: |

Inspections: MAP21 Inspection on 01246 - I00015270+04311 on April 2017 - Team: Billings |

244 inspection(s) displayed |

Final Result – Inspection Data

- Inspection Info

Properties

Type **MAP21 Inspection**

Status Final

Team Great Falls

Team leader Charles Pecos

From 7/14/2016

To 7/14/2016

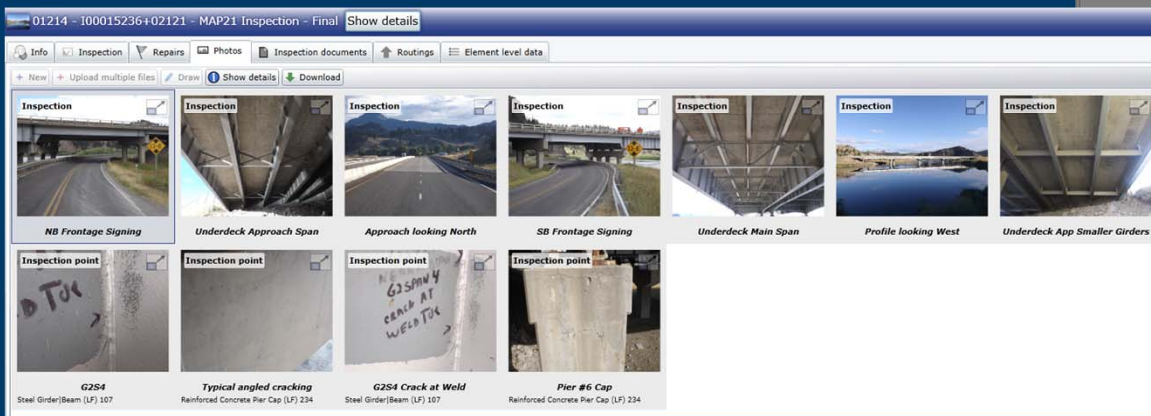
Reviewed by William Lay

Inspection activities				
User	Begin	End	Activity	Comments
Charles Pecos	Jul 14, 2016 07:00 AM	Jul 14, 2016 16:00 PM	On-site	

Inspection weather				
Begin	End	Weather	Temperature	Comments
Jul 14, 2016 07:00 AM	Jul 14, 2016 16:00 PM	Sunny	70	Clouds in the morning with sunshine and a light wind after noon.

Final Result – Inspection Data

- Photos



Final Result – Inspection Data

- Photos
 - Draw: edit a photo



Final Result – Inspection Data

- Documents

The screenshot displays a software interface for managing inspection data. At the top, a header bar shows the project name "01214 - I00015236+02121 - Fracture Critical Inspection - Final" and a "Show details" button. Below the header is a navigation bar with tabs for "Info", "Inspection", "Repairs", "Photos", "Inspection documents", and "Routings". A secondary toolbar contains buttons for "+ New", "Edit", "Show details", "Delete", "Download", and a "Group by" dropdown menu set to "Don't group". The main area features a table with the following data:

Name (or ID)	Type	Comments
I00015236+0.2121 NB	Xxx	Fracture Critical Inspection Plan and Findings

Final Result – Inspection Data

- Inspection Routings

Asset	Info	Type	Status	Date sent	Sender	Recipient	Date received	Comments
01673 - I00090380+00001	Inspection Element Level Inspection March 24, 2017	Inspection	Final	3/3/2017	Jim Miars	Jim Miars		
01673 - I00090380+00001	Inspection Element Level Inspection March 24, 2017	Inspection	Ready for Final	3/2/2017	Kim Mathiason	Jim Miars		
01673 - I00090380+00001	Inspection Element Level Inspection March 24, 2017	Inspection	QC Review On-going	3/2/2017	Jim Miars	Kim Mathiason		
01673 - I00090380+00001	Inspection Element Level Inspection March 24, 2017	Inspection	Inspection On-going	3/2/2017	Jim Miars	Jim Miars		
01673 - I00090380+00001	Inspection Element Level Inspection March 24, 2017	Inspection	Inspection Planned	2/27/2017	Jim Miars	Jim Miars		

Final Result – Inspection Data

- Element Level Inspection

P00001142+02631 - NBI/Element Inspection Map 21 - Xxx [Show details](#)

Info Inspection **Flags** Photos Documents Activities Routings Element level data

Filter: Not filtered

Number	Name	Unit	Quantity	Quantity calculated	Condition State 1	Condition State 2	Condition State 3
12_3_1	Concrete Deck - Bare	Scale	501	0			
1080	Delamination/Spall/Patched Area	Scale		0			
1090	Exposed Rebar	Scale		0			
1120	Efflorescence/Rust Staining	Scale		0			
1130	Cracking (RC and Other)	Scale		92	12	20	60
1190	Abrasion/Wear (PSC/RC)	Scale		0			
1900	Distortion	Scale		0			
4000	Settlement	Scale		0			

Selected item: Concrete Deck - Bare 12_3_1: Help

Element #:	Condition State 1: GOOD	Condition State 2: FAIR	Condition State 3: POOR	Condition State 4: SEVER
12 - Reinforced Concrete Deck (SF)				
Description: All reinforced concrete bridge decks regardless of the wearing surface or protection systems used.	That portion of the element that has either no deterioration or the deterioration is insignificant to the management of the element, meaning that portion of the element has no condition based preventive maintenance needs or repairs. Areas of an element that have received long lasting structural repairs that	That portion of the element that has minor deficiencies that signifies a progression of the deterioration process. This portion of the element may need condition based preventive maintenance. Areas of the element that have received structural repairs that improve the element, but the repair is not	That portion of the element that has advanced deterioration requiring repair. The summation of the quantity of the element in poor or worse condition determines the need for repairs, rehabilitation, or replacement activities.	That portion of the element that warrants a review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Classification: NBE - National Bridge Element				
Units of Measurement: sq.ft.				

Save and Close

Final Result – Inspection Data

- Element Level Inspection

01214 - I00015236+02121 - MAP21 Inspection - Final [Show details](#)

Info Inspection Repairs Photos Inspection documents Routings Element level data


Display mode Percentage Quantity

Number	Name (or ID)	Unit	Quantity	Quantity Calculated	Percentage Calculated	Condition State 1	Condition State 2	Condition State 3	Condition State 4
3210	Delamination/Patched Area/Pothole (Wearing Surfaces)	Area • sq feet	18417	125	0.68		0.54	0.14	
3220	Crack (Wearing Surface)	Area • sq feet	18417	1500	8.14		8.14		
3230	Effectiveness (Wearing Surface)	Area • sq feet	18417	0	0				
7000	Damage	Area • sq feet	18417	0	0				
107	Steel Girder Beam (LF)					95	5		
1000	Corrosion	Length • feet	1142	30	2.63		2.63		
1010	Cracking	Length • feet	1142	26	2.28		2.28		
1020	Connection	Length • feet	1142	0	0				
1900	Distortion	Length • feet	1142	0	0				
4000	Settlement	Length • feet	1142	0	0				
7000	Damage	Length • feet	1142	0	0				
515	Steel Girder Beam (LF) > Steel Protective Coating (SF)					83	15	1	1
3410	Chalking (Steel Protective Coatings)	Area • sq feet	23982	3500	14.59		14.59		
3420	Peeling/Bubbling/Cracking (Steel Protective Coatings)	Area • sq feet	23982	0	0				
3430	Oxide Film Degradation/Color/Texture Adherence (Steel Protective Coatings)	Area • sq feet	23982	0	0				


Selected Item: Steel Girder|Beam (LF) 107 > 1010 Cracking : Condition State 2

Comments Photos Values history Repairs

+ New + Upload multiple files Draw Show details Download



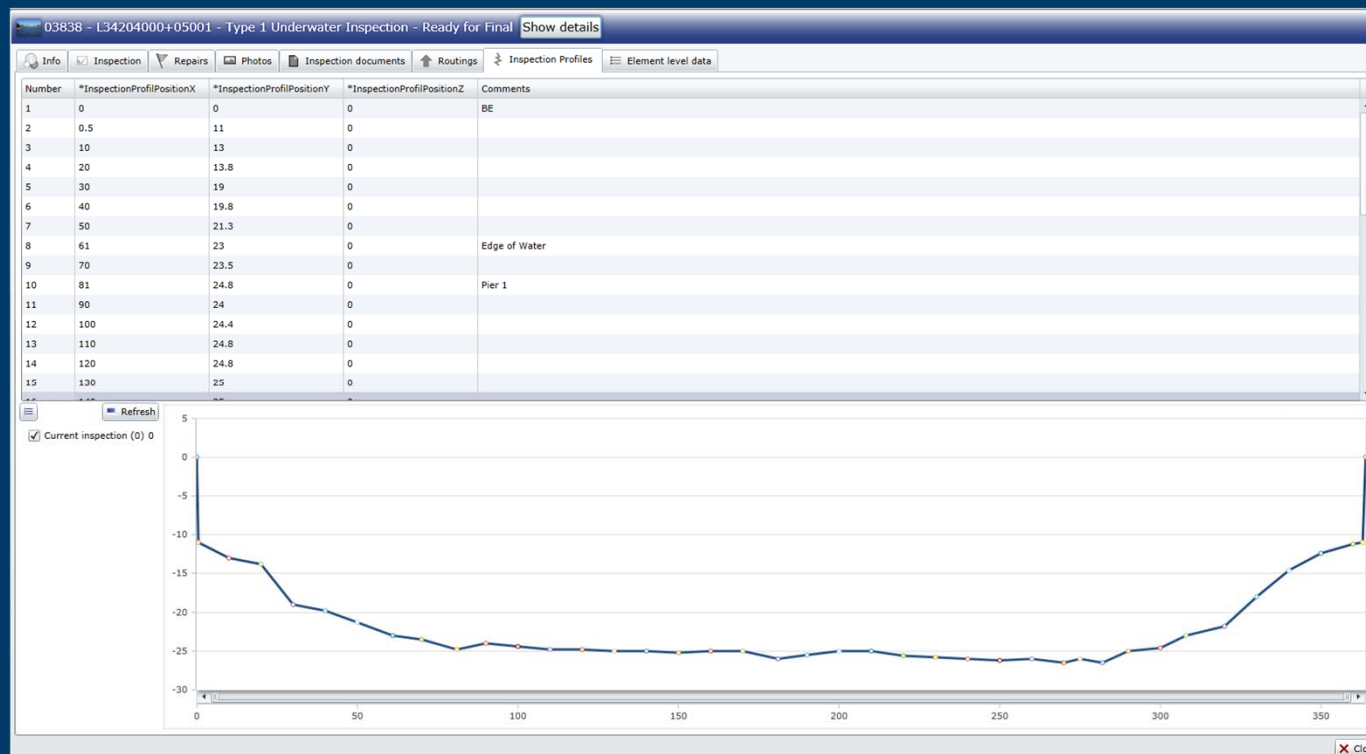
G2S4
Steel Girder|Beam (LF) 107



G2S4 Crack at Weld
Steel Girder|Beam (LF) 107

Final Result – Inspection Data

- Stream Cross-Sections



Final Result – Inspection Data

- Using tablets in the field
 - Reduces risk of errors inherent in paper in the field and data entry in the office
 - Saves time in the office to allow more time in the field inspecting bridges



Final Result – Repair and Maintenance

- The data and information collected in the field can be used to support MDT follow-up activities, such as repairs and maintenance
- These activities can be tracked and followed in the system

Number	Asset name	MDT Structure ID	Type	Repair status	Priority	Date	Component:	Comments
2015-0120	I00015038+07801	01025	Reactive Bridge Maintenance	Work completed	H - High	10/27/2015		Bridge rail was impacted and at least 2 steel posts are...
2016-0050	I00015086+03271	01075	Reactive Bridge Maintenance	Work completed	H - High	1/1/2016		Train Derailed below the bridge, impacting one of the...
2015-0115	I00015155+00551	01139	Reactive Bridge Maintenance	Report complete	H - High	9/15/2015		Water is running down behind the backwall at the...
2015-0119	I00090455+03082	01768	Reactive Bridge Maintenance	Report complete	H - High	10/9/2015		Single impact damage to a single beam at a previou...
2016-0049	I00094052+01481	01920	Reactive Bridge Maintenance	Work completed	H - High	1/1/2016		Failed Fel-span joint was removed and new header...
2016-0051	L01302054+05001	02197	IMMEDIATE REVIEW ITEM	Work completed	CP - Critical priority	12/23/2015		Bridge closure recommended on 12-23-15 due to...
2015-0084	L07006000+06001	02445	Repair suggestion	Open	H - High	9/15/2015		Cut down the trees that are under the bridge and...
2016-0027	L07008000+01001	02446	Repair suggestion	Open	H - High	11/9/2015		Repair crushing girder in Span 1 at Abutment 1.
2016-0028	L07008000+01001	02446	Repair suggestion	Open	H - High	11/9/2015		Repair/replace markers at the bridge corners.
2016-0025	L07011004+04001	02448	Repair suggestion	Open	H - High	11/9/2015		Install markers on the corners of the bridge. Markers...
2016-0026	L07019004+03001	02450	Repair suggestion	Open	H - High	11/9/2015		Patch the deck where the asphalt surfacing is missing...
2016-0024	L07022000+09001	02453	Repair suggestion	Open	H - High	11/9/2015		Install markers on the bridge corners.
2016-0023	L07022000+09001	02453	Repair suggestion	Open	H - High	11/9/2015		Clean trash from around the fencing tied to the bridge...
2016-0041	L07063002+05001	02459	Repair suggestion	Open	H - High	11/25/2015		Repair the cap of Bent 7 on its' Left as starting to crush.
2016-0002	L07418000+02001	02511	Repair suggestion	Open	L - Low	10/7/2015		Trim the willow trees away from the sides and under...
2016-0019	L07427001+08001	02514	Repair suggestion	Open	H - High	11/9/2015		Install the back-to-back markers on the NW corner of...

Final Result – User Feedback/Comments

- Bridge Inspectors had some difficulty getting used to the new system
- The public, design engineers, consultants, and those not used to the old system are loving the new one
- More intuitive – easier to navigate
- Inspectors love multiple photo upload capabilities and drawing ability (no more struggling with Microsoft Paint)
- Conversion back to English units
- Allows better description and quantification of material defects (attach comments, photos, etc)

Final Result – User Feedback/Comments

- Ability to attach and access plans and other inspection documents is very convenient
- Capability of remote access helpful when traveling for inspection (no more worries about forgetting a file in the office)
- HQ loves the ability to track the inspection through its process – planned, inspection ongoing, QC, QA, and Final.
- We need different tablets. The small screen on our current ones is causing problems.

Final Result – Lessons Learned

- Give yourself more time! Our aggressive schedule was difficult.
- Make sure your employees are able to devote the needed time to the project.
- If you have someone who is familiar with bridge data and the bridge inspection process, and also familiar with the location of the data in your current database – make that person part of the transition team!
- Include a database administrator on your team.
- Give yourself plenty of time to write the RFP.

Next Steps



Next Steps

- We are working on an RFP for a COTS solution that will use the inspection data in our database and perform Asset Management type analyses.
- We continue to expand SMS as additional needs come to light.
- We will continue uploading as-built plans until all of them are available in SMS.
- Hopefully, we will have new tablets soon!

Questions?

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- amjackson@mt.gov

