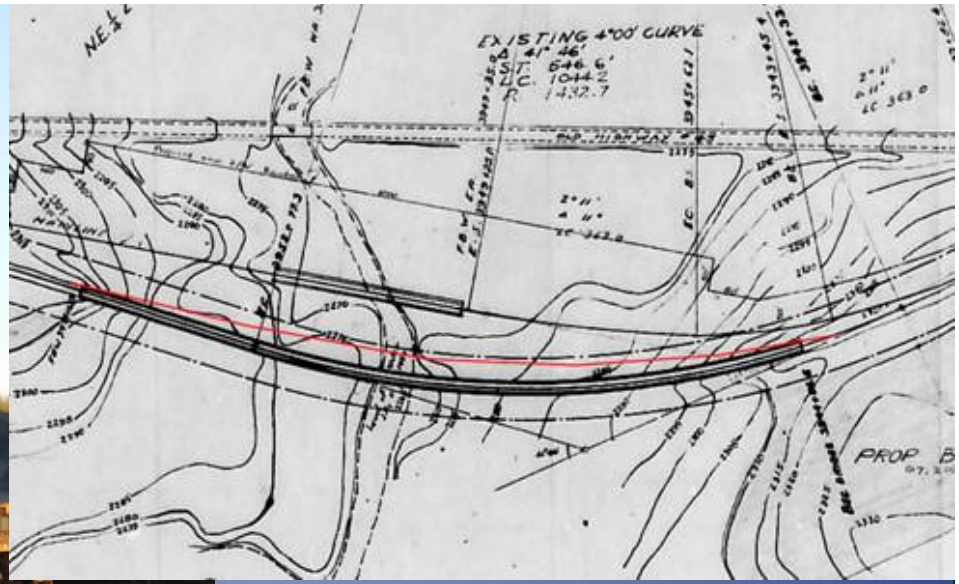
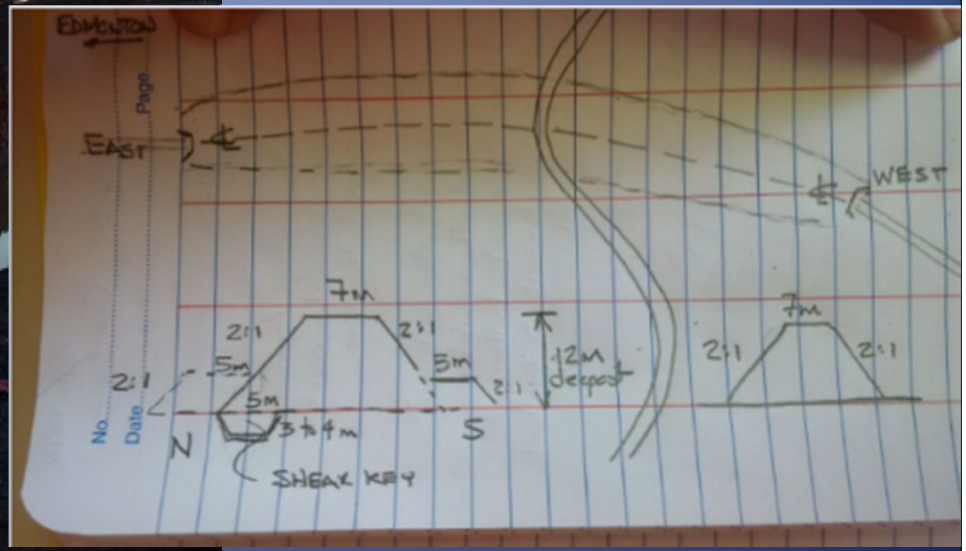

Mi. 88.7 Ruel – Derailment March 7, 2015
Single span 99' TPG destroyed
Causeway March11
Crane set up – March 12
New center pier construction starts March 14
Team photo with 2 replacement spans in position- March 17
First train over the new 2 span bridge – March 18

Site environmental remediation – summer 2015

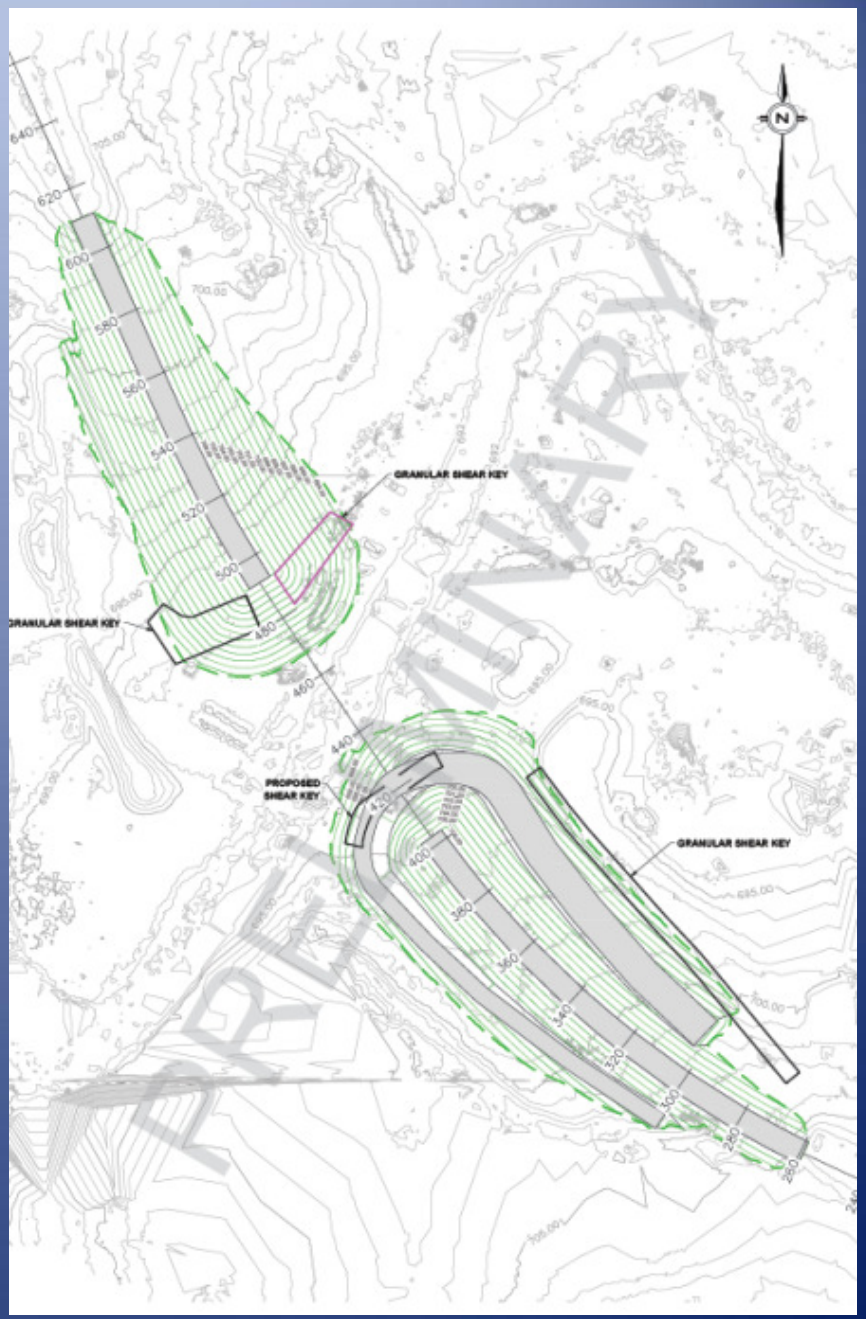

… The Myerthorpe Emergency
Mayerthorpe, Alberta
Mile 74.7 Sangudo Subdivision
Tuesday April 26, 2016

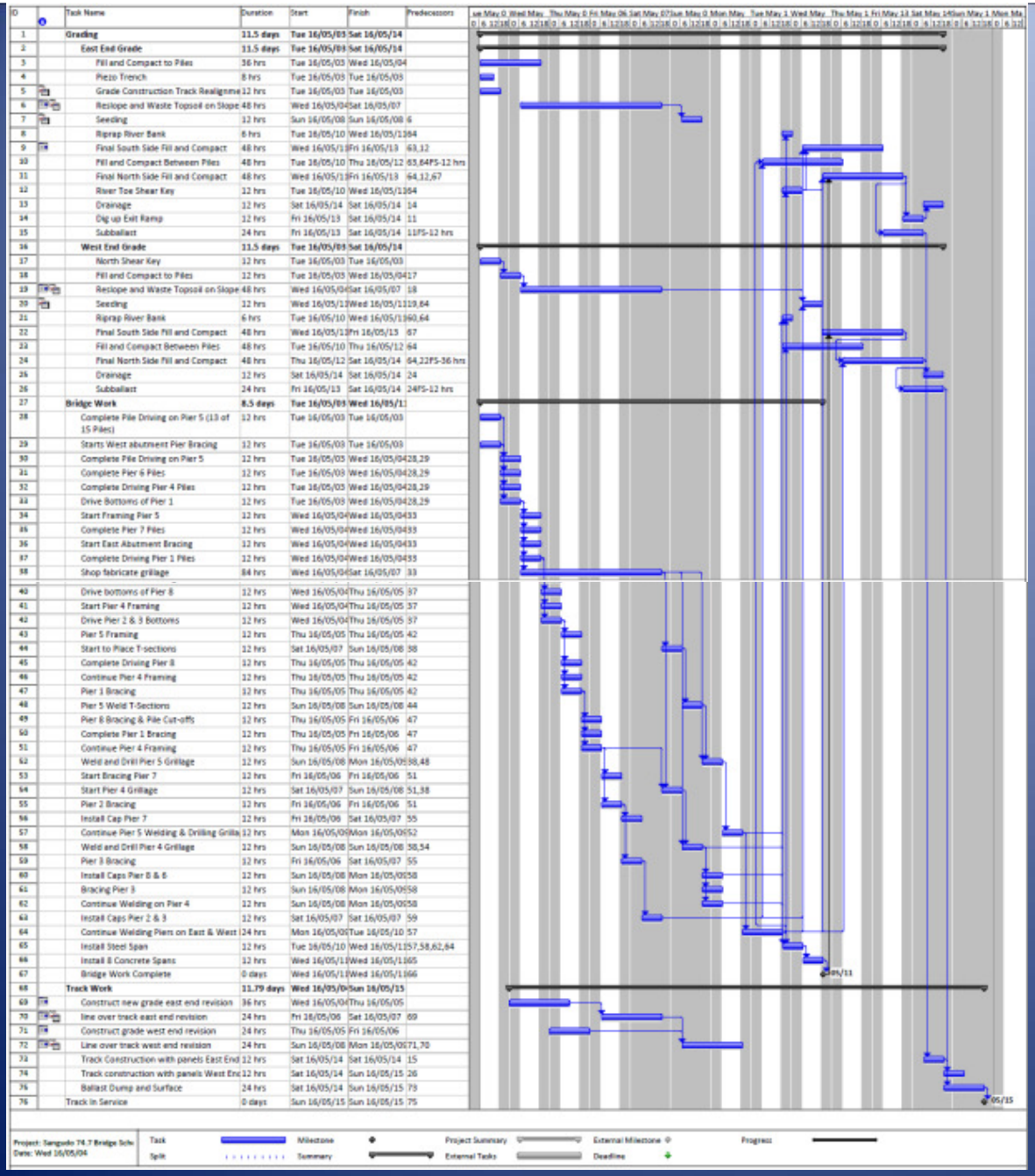
Daybreak April 27th – Reconstruction day 1 – Options Assessment


EXISTING 4°00' CURVE
Δ 41° 46'
S.T. 646.6'
L.C. 1044.2
R 1432.7
PROP


EDMONTON
Page
EAST
WEST
7m
2:1
5m
5m
12M deepest
3 to 4 m
SHEAR KEY
N
S
No.
Date


LEGEND:
CPT
BOREHOLE+INCLINOMETER
BOREHOLE+PIEZOMETER
TEST PITS
GRANULAR SHEAR KEY
PROPOSED SHEAR KEY
120+600
120+500
120+400
120+300
PADDLE RIVER
NOTE:
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN METERS.


GRANULAR SHEAR KEY
GRANULAR SHEAR KEY
PROPOSED SHEAR KEY
GRANULAR SHEAR KEY
PRELIMINARY

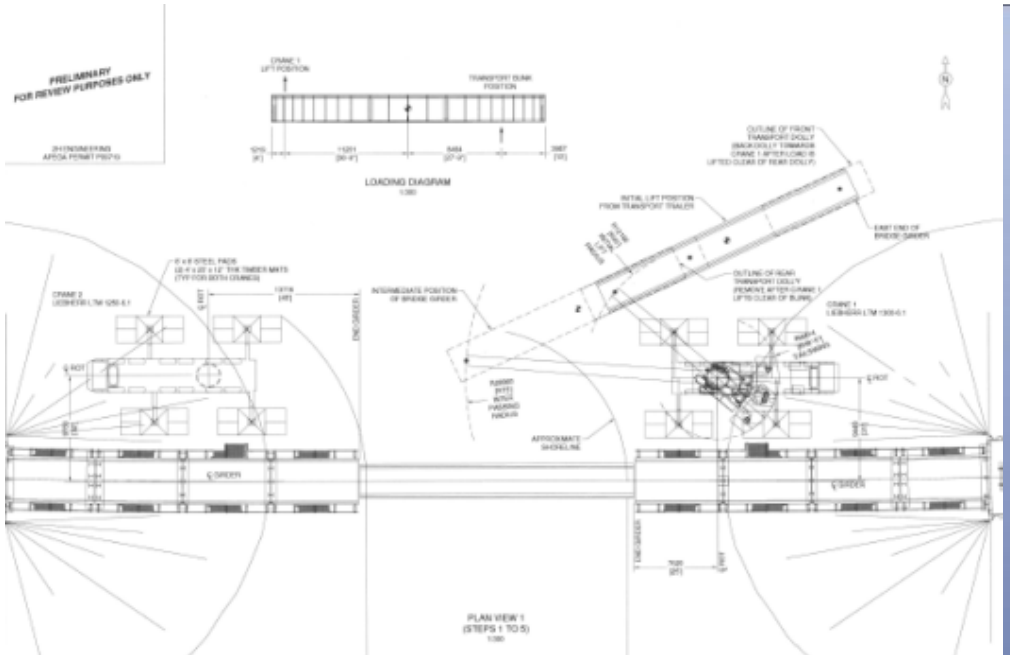


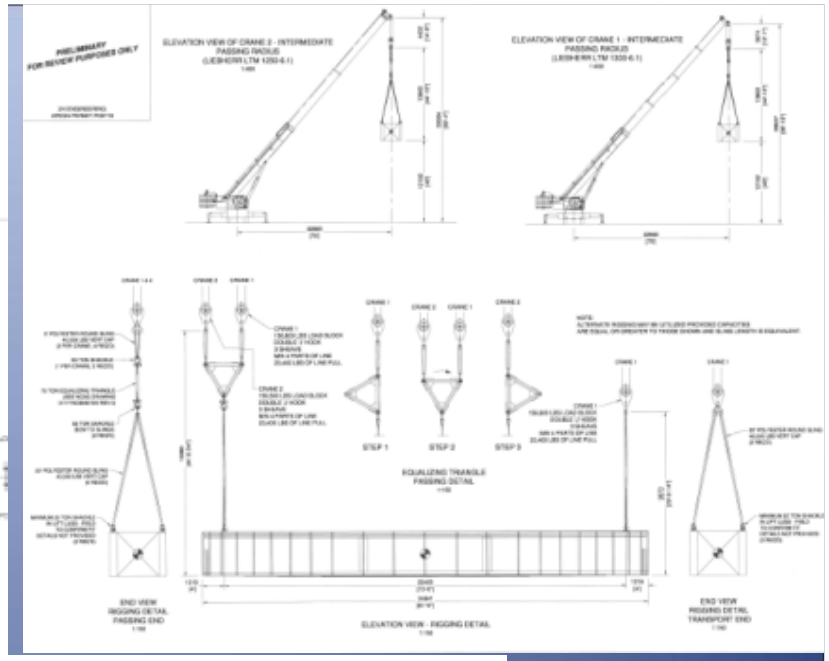
ID	Task Name	Duration	Start	Finish	Predecessors
1	**Grading**	**11.5 days**	**Tue 16/05/03**	**Sat 16/05/14**	
2	**East End Grade**	**11.5 days**	**Tue 16/05/03**	**Sat 16/05/14**	
3	Fill and Compact to Piles	36 hrs	Tue 16/05/03	Wed 16/05/04	
4	Piezo Trench	8 hrs	Tue 16/05/03	Tue 16/05/03	
5	Grade Construction Track Realignme	12 hrs	Tue 16/05/03	Tue 16/05/03	
6	Reslope and Waste Topsoil on Slope	48 hrs	Wed 16/05/04	Sat 16/05/07	
7	Seeding	12 hrs	Sun 16/05/08	Sun 16/05/08	6
8	Riprap River Bank	6 hrs	Tue 16/05/10	Wed 16/05/11	164
9	Final South Side Fill and Compact	48 hrs	Wed 16/05/11	Fri 16/05/13	63,12
10	Fill and Compact Between Piles	48 hrs	Tue 16/05/10	Thu 16/05/12	63,64FS-12 hrs
11	Final North Side Fill and Compact	48 hrs	Wed 16/05/11	Fri 16/05/13	64,12,67
12	River Toe Shear Key	12 hrs	Tue 16/05/10	Wed 16/05/11	164
13	Drainage	12 hrs	Sat 16/05/14	Sat 16/05/14	14
14	Dig up Exit Ramp	12 hrs	Fri 16/05/13	Sat 16/05/14	11
15	Subballast	24 hrs	Fri 16/05/13	Sat 16/05/14	11FS-12 hrs
16	**West End Grade**	**11.5 days**	**Tue 16/05/03**	**Sat 16/05/14**	
17	North Shear Key	12 hrs	Tue 16/05/03	Tue 16/05/03	
18	Fill and Compact to Piles	12 hrs	Tue 16/05/03	Wed 16/05/04	17
19	Reslope and Waste Topsoil on Slope	48 hrs	Wed 16/05/04	Sat 16/05/07	18
20	Seeding	12 hrs	Wed 16/05/11	Wed 16/05/11	19,64
21	Riprap River Bank	6 hrs	Tue 16/05/10	Wed 16/05/11	60,64
22	Final South Side Fill and Compact	48 hrs	Wed 16/05/11	Fri 16/05/13	67
23	Fill and Compact Between Piles	48 hrs	Tue 16/05/10	Thu 16/05/12	64
24	Final North Side Fill and Compact	48 hrs	Thu 16/05/12	Sat 16/05/14	64,22FS-36 hrs
25	Drainage	12 hrs	Sat 16/05/14	Sat 16/05/14	24
26	Subballast	24 hrs	Fri 16/05/13	Sat 16/05/14	24FS-12 hrs
27	**Bridge Work**	**8.5 days**	**Tue 16/05/03**	**Wed 16/05/11**	
28	Complete Pile Driving on Pier 5 (13 of 15 Piles)	12 hrs	Tue 16/05/03	Tue 16/05/03	
29	Starts West abutment Pier Bracing	12 hrs	Tue 16/05/03	Tue 16/05/03	
30	Complete Pile Driving on Pier 5	12 hrs	Tue 16/05/03	Wed 16/05/04	28,29
31	Complete Pier 6 Piles	12 hrs	Tue 16/05/03	Wed 16/05/04	28,29
32	Complete Driving Pier 4 Piles	12 hrs	Tue 16/05/03	Wed 16/05/04	28,29
33	Drive Bottoms of Pier 1	12 hrs	Tue 16/05/03	Wed 16/05/04	28,29
34	Start Framing Pier 5	12 hrs	Wed 16/05/04	Wed 16/05/04	33
35	Complete Pier 7 Piles	12 hrs	Wed 16/05/04	Wed 16/05/04	33
36	Start East Abutment Bracing	12 hrs	Wed 16/05/04	Wed 16/05/04	33
37	Complete Driving Pier 1 Piles	12 hrs	Wed 16/05/04	Wed 16/05/04	33
38	Shop fabricate grillage	84 hrs	Wed 16/05/04	Sat 16/05/07	33
40	Drive bottoms of Pier 8	12 hrs	Wed 16/05/04	Thu 16/05/05	37
41	Start Pier 4 Framing	12 hrs	Wed 16/05/04	Thu 16/05/05	37
42	Drive Pier 2 & 3 Bottoms	12 hrs	Wed 16/05/04	Thu 16/05/05	37
43	Pier 5 Framing	12 hrs	Thu 16/05/05	Thu 16/05/05	42
44	Start to Place T-sections	12 hrs	Sat 16/05/07	Sun 16/05/08	38
45	Complete Driving Pier 8	12 hrs	Thu 16/05/05	Thu 16/05/05	42
46	Continue Pier 4 Framing	12 hrs	Thu 16/05/05	Thu 16/05/05	42
47	Pier 1 Bracing	12 hrs	Thu 16/05/05	Thu 16/05/05	42
48	Pier 5 Weld T-Sections	12 hrs	Sun 16/05/08	Sun 16/05/08	44
49	Pier 8 Bracing & Pile Cut-offs	12 hrs	Thu 16/05/05	Fri 16/05/06	47
50	Complete Pier 1 Bracing	12 hrs	Thu 16/05/05	Fri 16/05/06	47
51	Continue Pier 4 Framing	12 hrs	Thu 16/05/05	Fri 16/05/06	47
52	Weld and Drill Pier 5 Grillage	12 hrs	Sun 16/05/08	Mon 16/05/09	38,48
53	Start Bracing Pier 7	12 hrs	Fri 16/05/06	Fri 16/05/06	51
54	Start Pier 4 Grillage	12 hrs	Sat 16/05/07	Sun 16/05/08	51,38
55	Pier 2 Bracing	12 hrs	Fri 16/05/06	Fri 16/05/06	51
56	Install Cap Pier 7	12 hrs	Fri 16/05/06	Sat 16/05/07	55
57	Continue Pier 5 Welding & Drilling Grilla	12 hrs	Mon 16/05/09	Mon 16/05/09	52
58	Weld and Drill Pier 4 Grillage	12 hrs	Sun 16/05/08	Sun 16/05/08	38,54
59	Pier 3 Bracing	12 hrs	Fri 16/05/06	Sat 16/05/07	55
60	Install Caps Pier 8 & 6	12 hrs	Sun 16/05/08	Mon 16/05/09	58
61	Bracing Pier 3	12 hrs	Sun 16/05/08	Mon 16/05/09	58
62	Continue Welding on Pier 4	12 hrs	Sun 16/05/08	Mon 16/05/09	58
63	Install Caps Pier 2 & 3	12 hrs	Sat 16/05/07	Sat 16/05/07	59
64	Continue Welding Piers on East & West	24 hrs	Mon 16/05/09	Tue 16/05/10	57
65	Install Steel Span	12 hrs	Tue 16/05/10	Wed 16/05/11	57,58,62,64
66	Install 8 Concrete Spans	12 hrs	Wed 16/05/11	Wed 16/05/11	65
67	Bridge Work Complete	0 days	Wed 16/05/11	Wed 16/05/11	66
68	**Track Work**	**11.79 days**	**Wed 16/05/04**	**Sun 16/05/15**	
69	Construct new grade east end revision	36 hrs	Wed 16/05/04	Thu 16/05/05	
70	line over track east end revision	24 hrs	Fri 16/05/06	Sat 16/05/07	69
71	Construct grade west end revision	24 hrs	Thu 16/05/05	Fri 16/05/06	
72	Line over track west end revision	24 hrs	Sun 16/05/08	Mon 16/05/09	71,70
73	Track Construction with panels East End	12 hrs	Sat 16/05/14	Sat 16/05/14	15
74	Track construction with panels West End	12 hrs	Sat 16/05/14	Sun 16/05/15	26
75	Ballast Dump and Surface	24 hrs	Sat 16/05/14	Sun 16/05/15	73
76	Track In Service	0 days	Sun 16/05/15	Sun 16/05/15	75

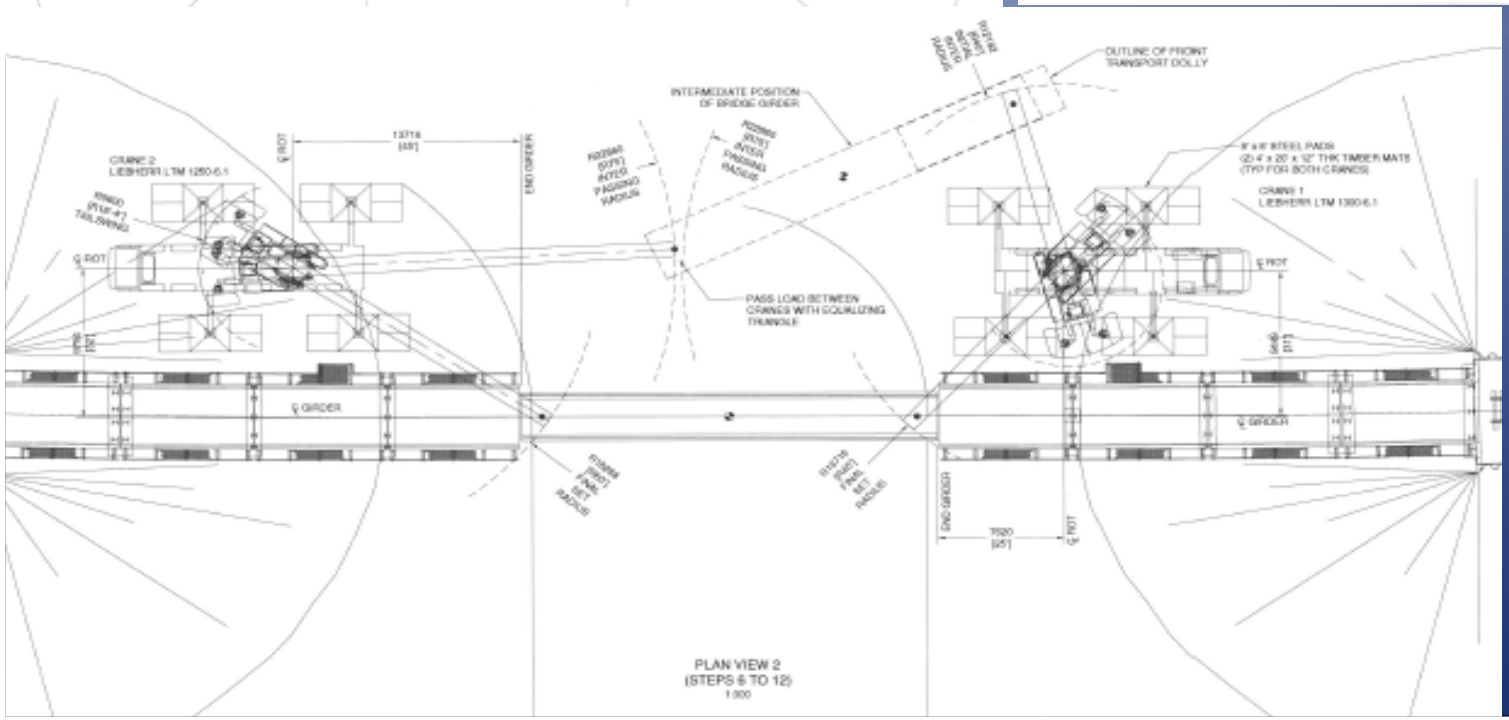
Updated schedule developed May 4th
Identifying activities and timeline to in service for Sunday May 15, 2016


S-65

Accelerated Construction… Accelerated


PRELIMINARY
FOR REVIEW PURPOSES ONLY
LOADING DIAGRAM
PLAN VIEW 1
(STEPS 1 TO 5)


PRELIMINARY
FOR REVIEW PURPOSES ONLY
ELEVATION VIEW OF CRANE 2 - INTERMEDIATE PASSING RADIUS
ELEVATION VIEW OF CRANE 1 - INTERMEDIATE PASSING RADIUS
EQUALIZING TRIANGLE RIGGING DETAIL
ELEVATION VIEW - RIGGING DETAIL


OUTLINE OF FRONT TRANSPORT DOLLY
INTERMEDIATE POSITION OF BRIDGE GIRDER
8' x 8' STEEL PADS
(2) 4' x 20' x 12" THK TIMBER MATS
(TYP FOR BOTH CRANES)
CRANE 2
LIEBHERR LTM 1250-6.1
CRANE 1
LIEBHERR LTM 1300-6.1
PASS LOAD BETWEEN CRANES WITH EQUALIZING TRIANGLE
PLAN VIEW 2
(STEPS 6 TO 12)


OVERSIZE LOAD

YouTube CA

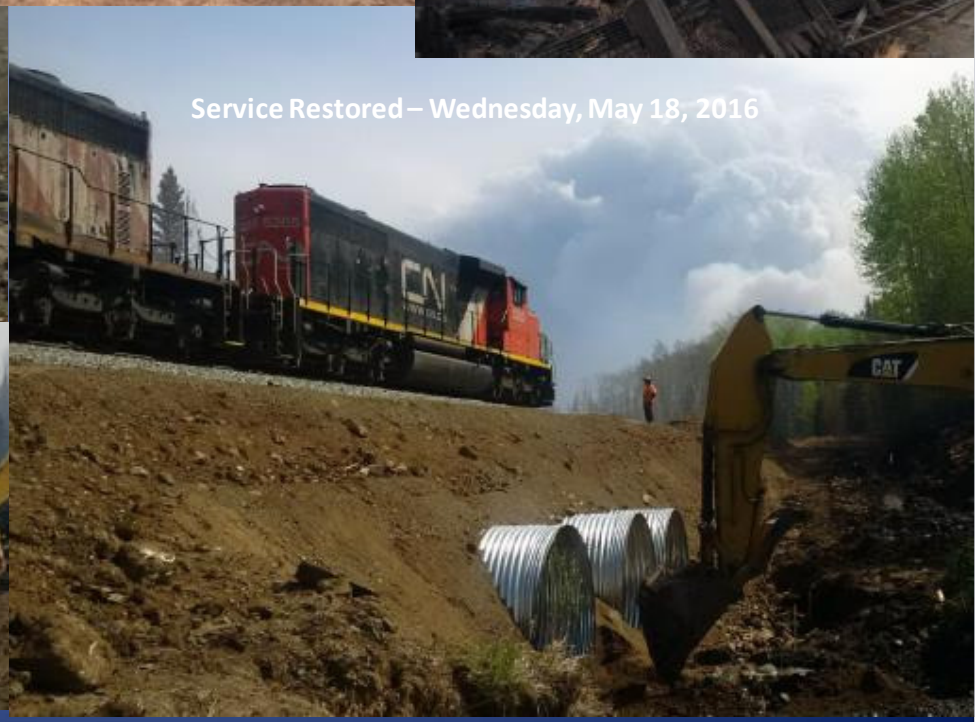
https://www.youtube.com/watch?v=XhdVW6lp7yQ

Huge Fire Destroys Trestle, Engineers rebuild in 20 days.

Sunday May 15, 2016

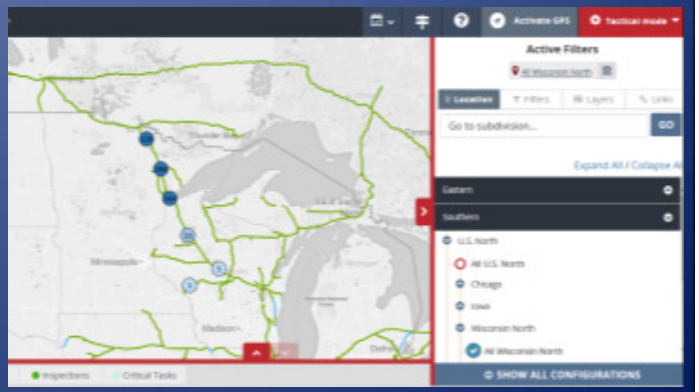
20 days after the fire - service is restored

Fort McMurray
Forest Fire
May 2016

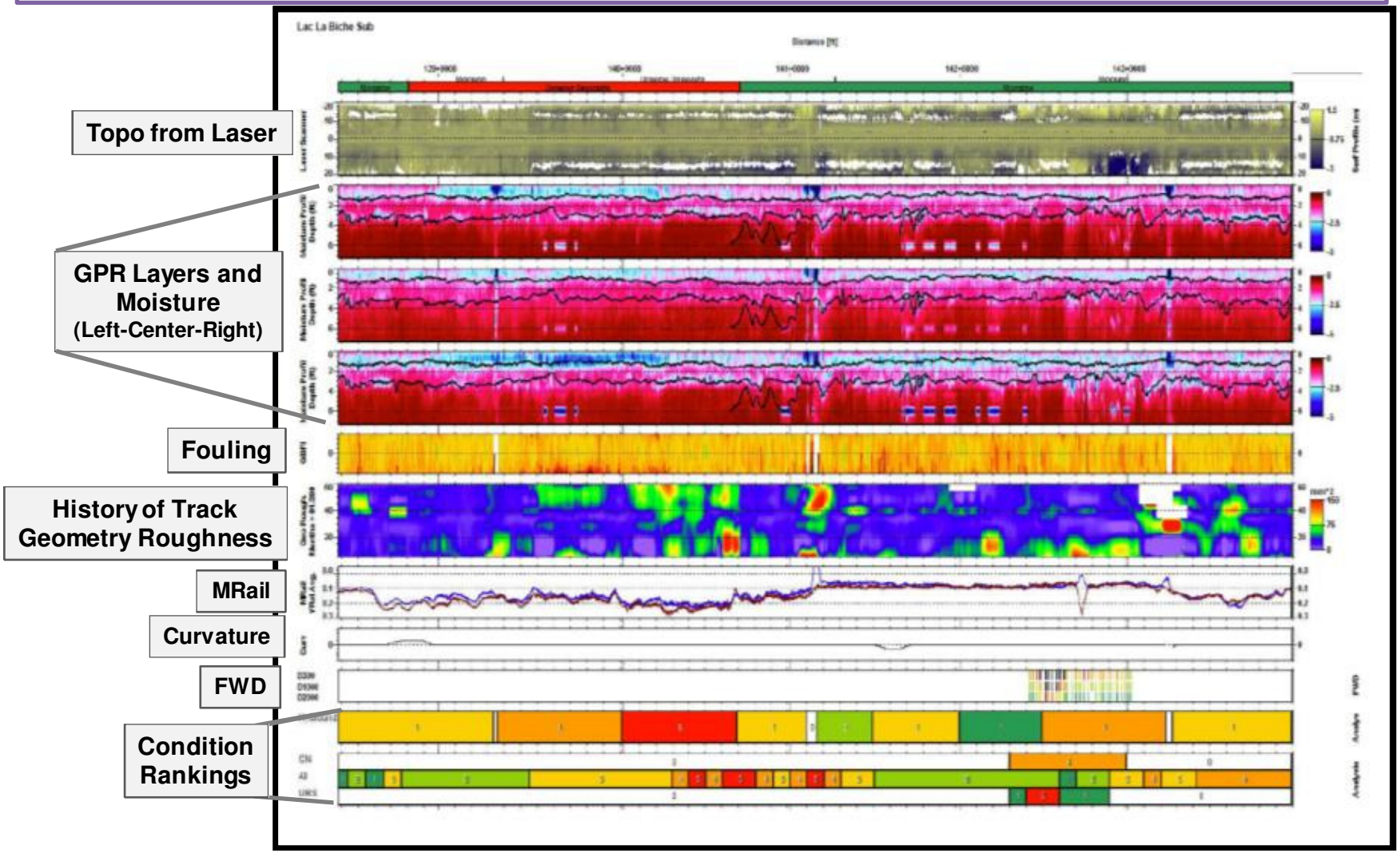


New Technology Projects

1) Vehicle Track Interaction (V/TI) units
2) Hi-rail gauge restraint measurement vehicle
3) Autonomous track inspection vehicle using LiDAR technology
4) Ground penetrating radar (GPR) system
5) UAV equipment for inspections
6) Lone worker and automated train approaching warning systems
7) Collision avoidance systems for hi-rail vehicles
8) Track geometry push equipment for yard track inspections
9) Data prioritization program – Engineering Reliability Analytics system



Sample illustration of results using up to 15 performance indicators to perform analysis and determine condition ranking and source of problems

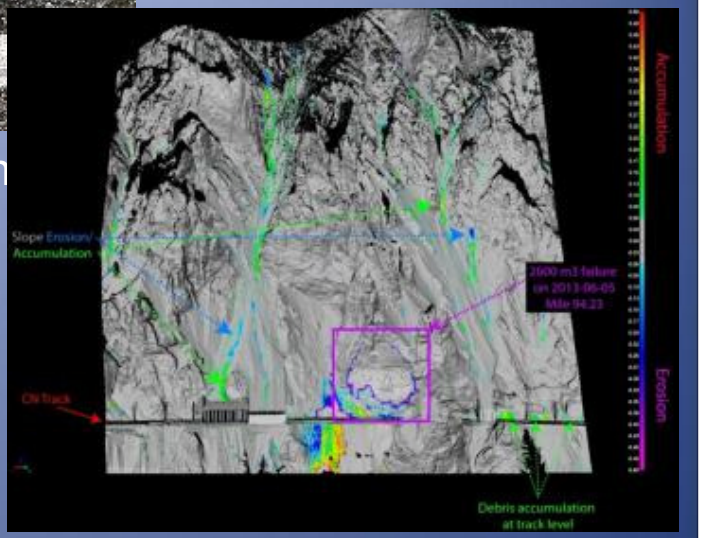


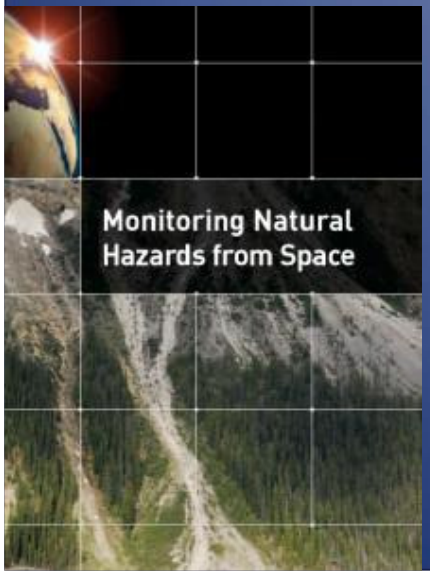
Need to continue to implement and incorporate new technologies to keep improving safety performance against natural hazards

Change detection technology built on interforometric LIDAR .

Lidar scans and images captured by Drones and UAV's patrolling tracks.

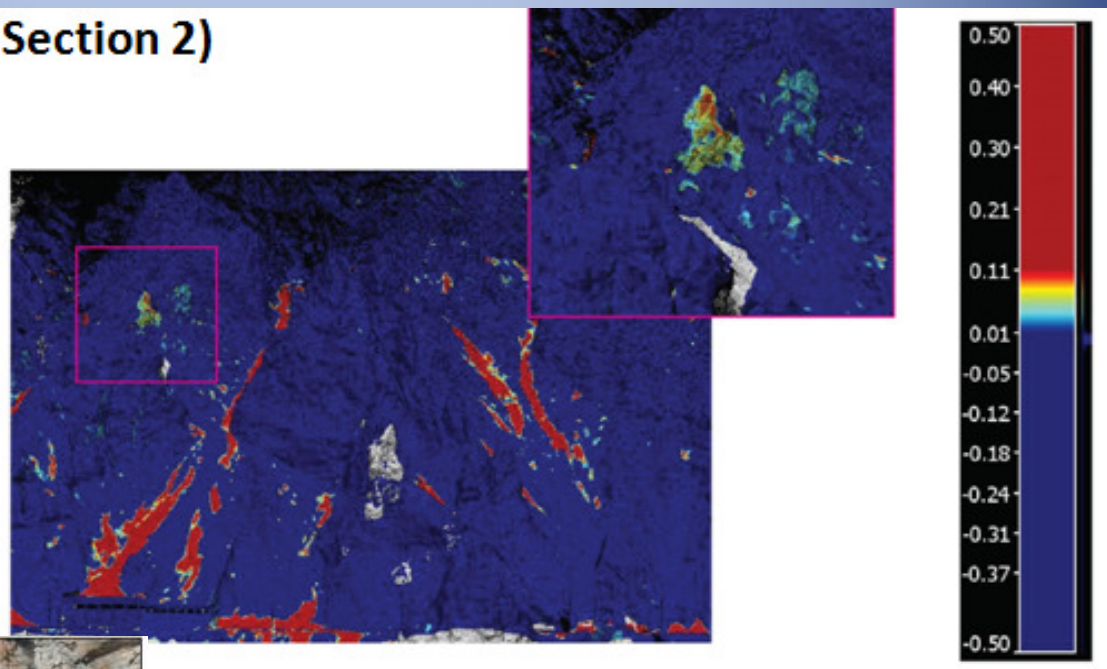
Monitoring ground deformation automatically be sattelites.

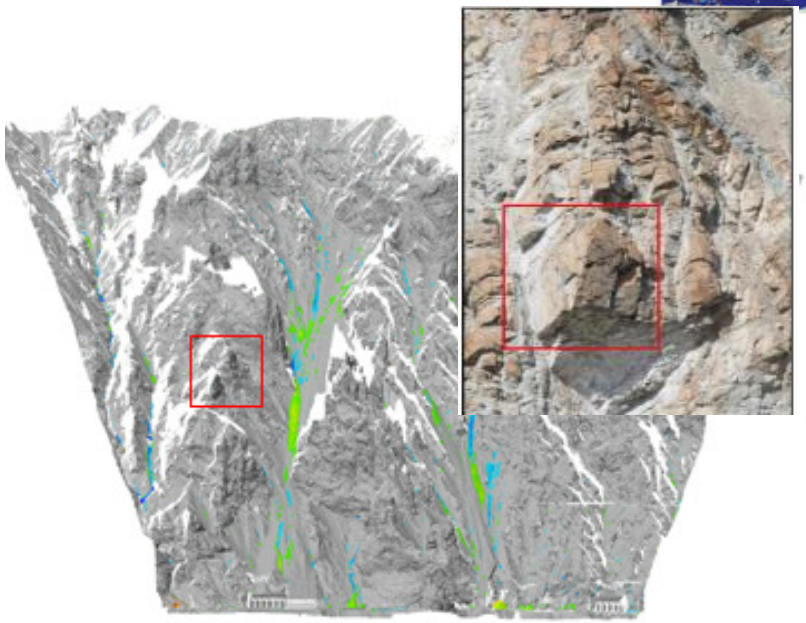


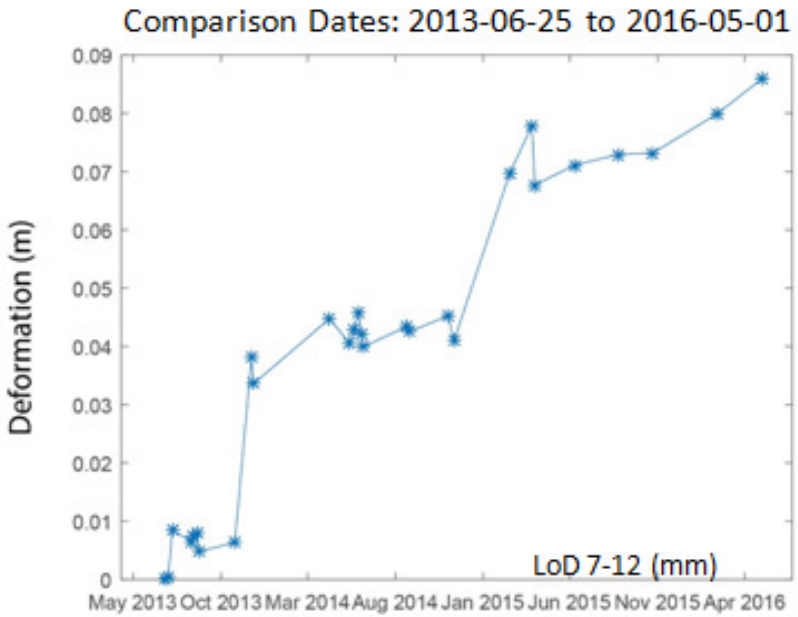


Ashcroft Mile 94-94.6 (WCW Section 2)

- Approximately 400 m^3 potential volume
- Deforming since fall of 2013
- Continued deformation since February 13, 2016 (last update)

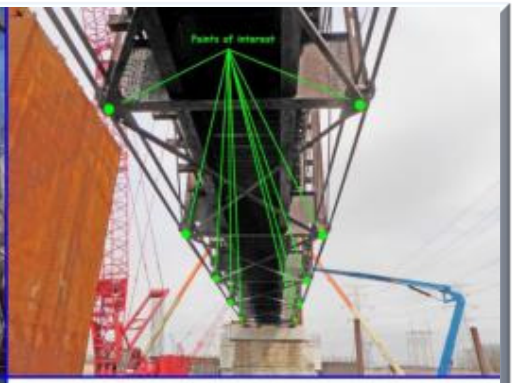


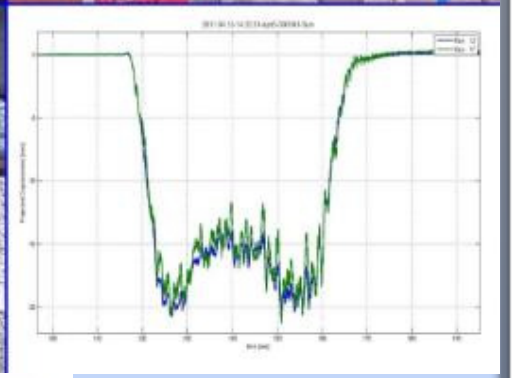


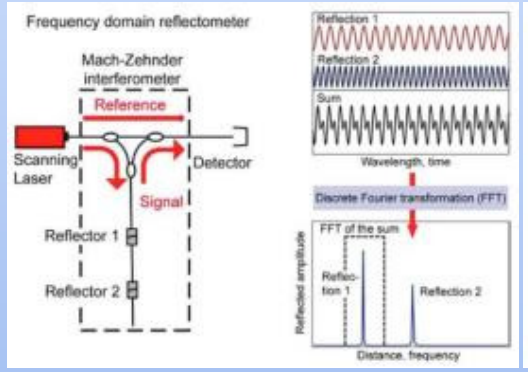


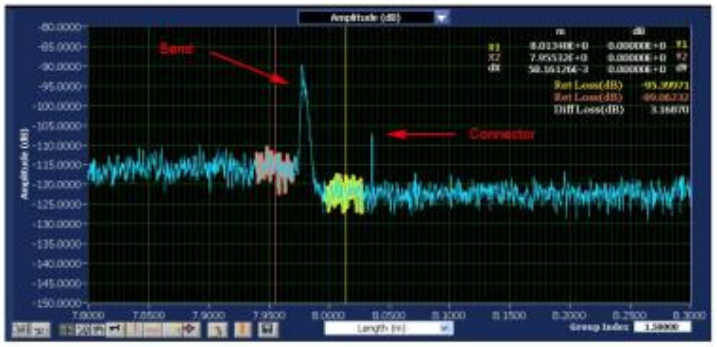
Bridge Testing and Assessment – Applying New Technologies

- Radar displacement measurement
- Remote monitoring – backscatter fiber optic sensing
- Sonar – echoscope inspections
- UAV – drone Inspection









Displacement Measurement by Radar - Case study: 26.36 Halton

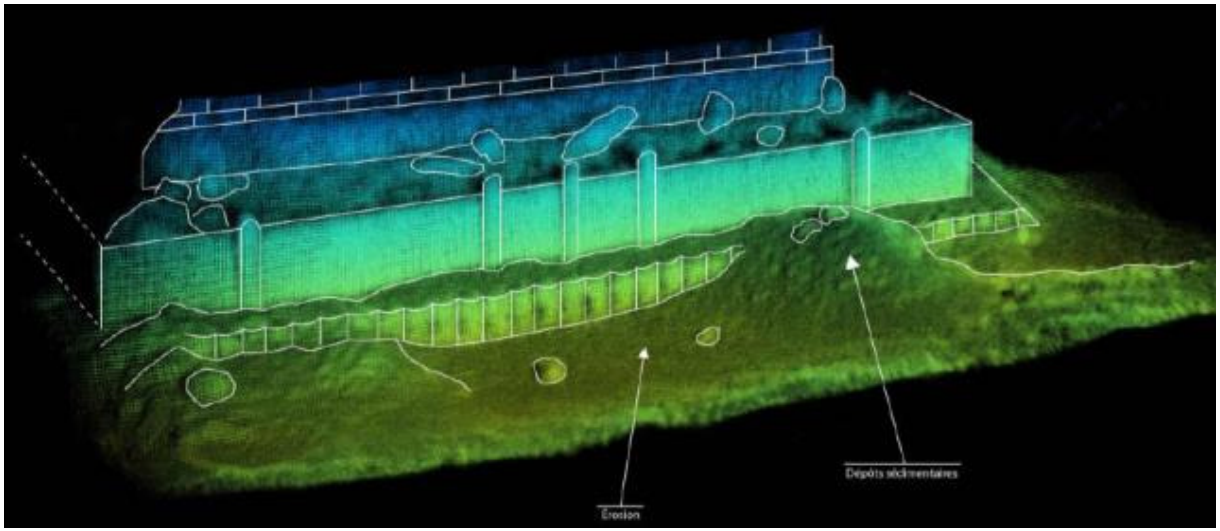
- Displacement measurement by radar technology does not require a fixed reference point immediately next to the point of interest.
- Displacements are derived from the minute changes in distance between the transmitter and targets.

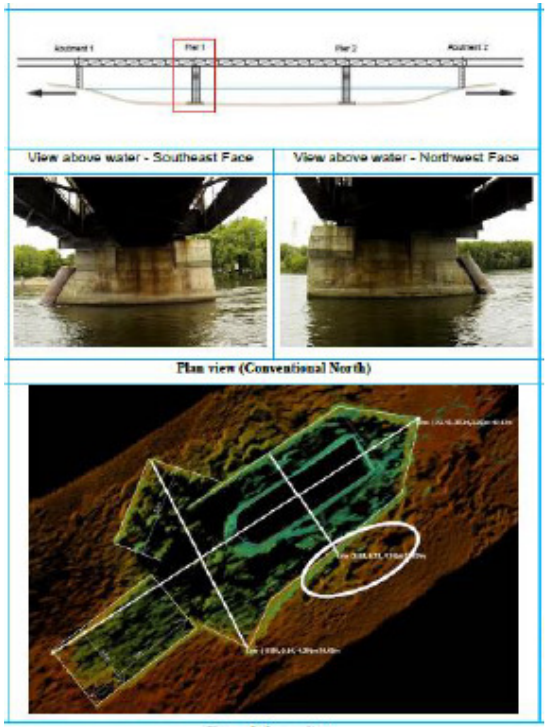
- 600’ long viaduct, 57’ tall piers, 6-100’ DPGs.

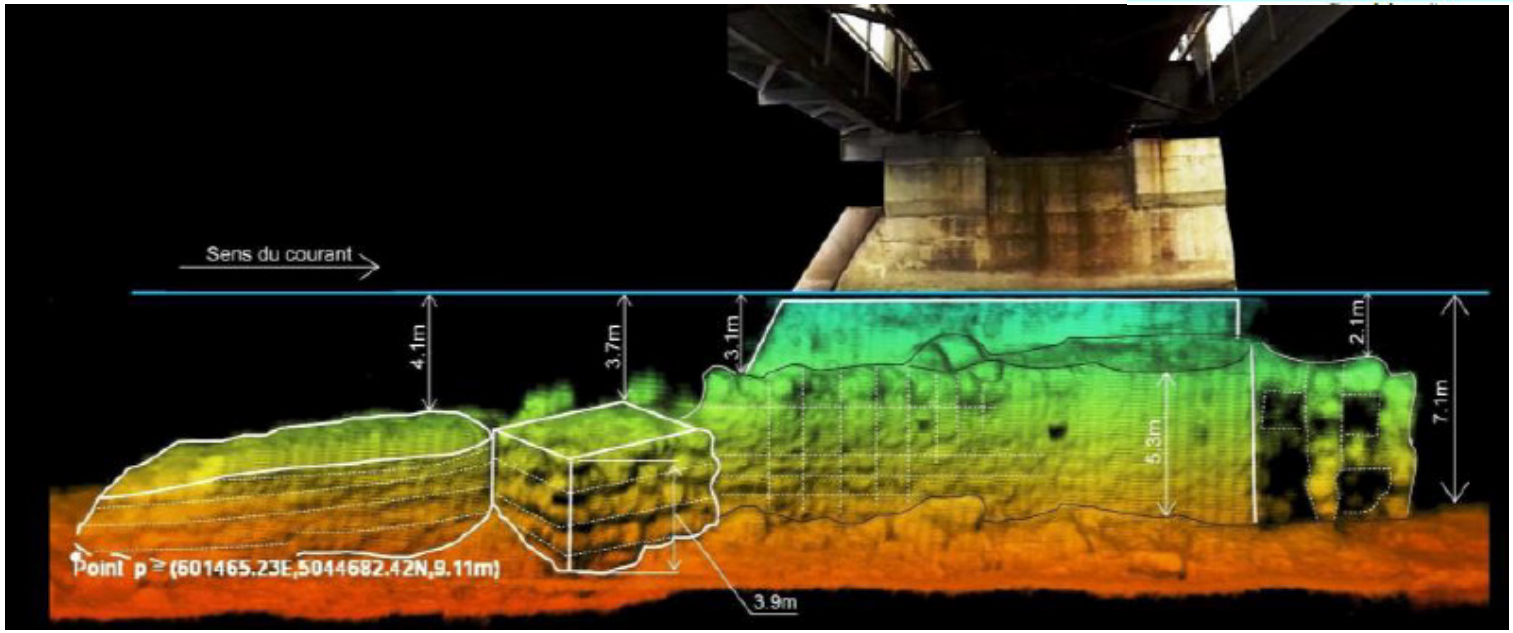
- Moderate lateral movement was reported at this location. The tall slender piers were suspected as a possible source.
- In order to assess the situation, measurements of the actual displacements of the piers and spans are needed.
- Since traditional measurement using displacement transducers is not feasible at this location due to the height, this offered a good opportunity to evaluate the DIC technology.

Findings – perceived lateral movement originated at the tall pedestals not as a result of pier movement

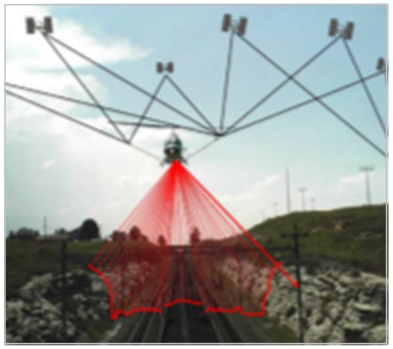
3D ECHOSCOPE® SONAR SURVEYS - BRIDGES







Preparing for PTC



Enabling PTC operations is a massive undertaking requiring significant effort & resources:

- Install 1,750 control points (wayside interface units) at all signals and switches along 39 CN subdivisions.
- Geo-map 5,093 track miles using aerial and ground data capture & converting to GIS database (6 days effort per mile).
- Equip 550 locomotive with onboard computer processors and new display & communications equipment for crews.
- Install 175 new wayside data radio base stations every 25 miles to effectively support radio communications.
- Install Wi-Fi capability in all yards.
- Establish processes, policies and procedures for technical support, incident escalation & resolution.
- Complete multiple rounds of testing to ensure all components work as expected.
- Provide the FRA with required documents demonstrating compliance.
- Train some 5,000 employees across multiple functions

PTC must be enabled within the new timeframe & seamlessly integrated within current day-to-day operations

Thank You