

RAILER[®] SMS

Overview of RAILER[®] Sustainment Management System

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Background

- Thousands of miles of military, short line, and industrial track worldwide.
- Strategic importance to defense and private economy.
- Unique managements needs due to speed, traffic, and operations characteristics



The Challenge

- Requires timely maintenance and repairs to ensure reliable operations.
- M&R funding resources not consistently programmed on annual basis
- Lack of a standardized, objective system for reporting condition, readiness, and risk
- Limited railroad engineering expertise at many sites.



The Solution



- Accurate rail asset inventory
- Standardized and objective inspection process
- Decision Support (tactical and strategic levels) for:
 - Operational restrictions based on safety standards
 - Physical condition/readiness ratings for monitoring degradation
 - Short/long term maintenance and capital renewal strategies showing costs and affects of funding levels

The RAILER[®] Technology

- Supports facility managers with the following information:
 - What rail assets exist.
 - What defects and deficiencies exist and costs to fix.
 - What restrictions are imposed – and the affect on operations and readiness.
 - What is the physical track health/condition (ISR ratings).
 - Short and long term maintenance strategies showing costs and affects of funding levels.
 - Assists both installation and HQ level decision support through objective and consistent metrics

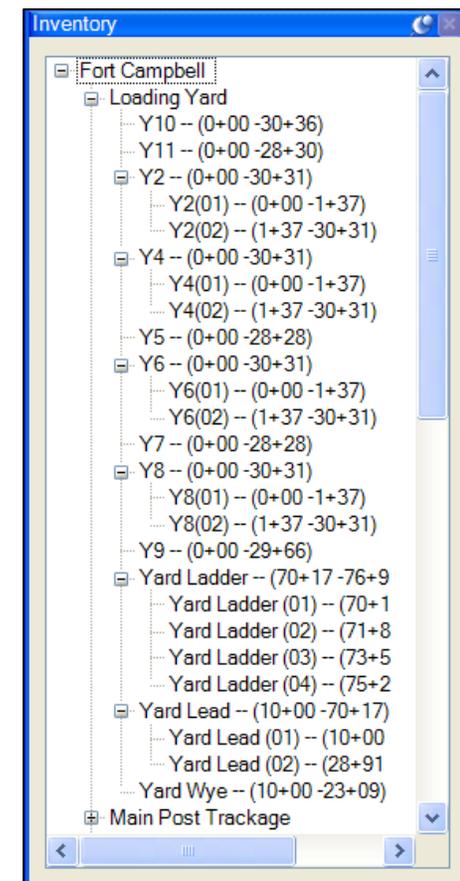
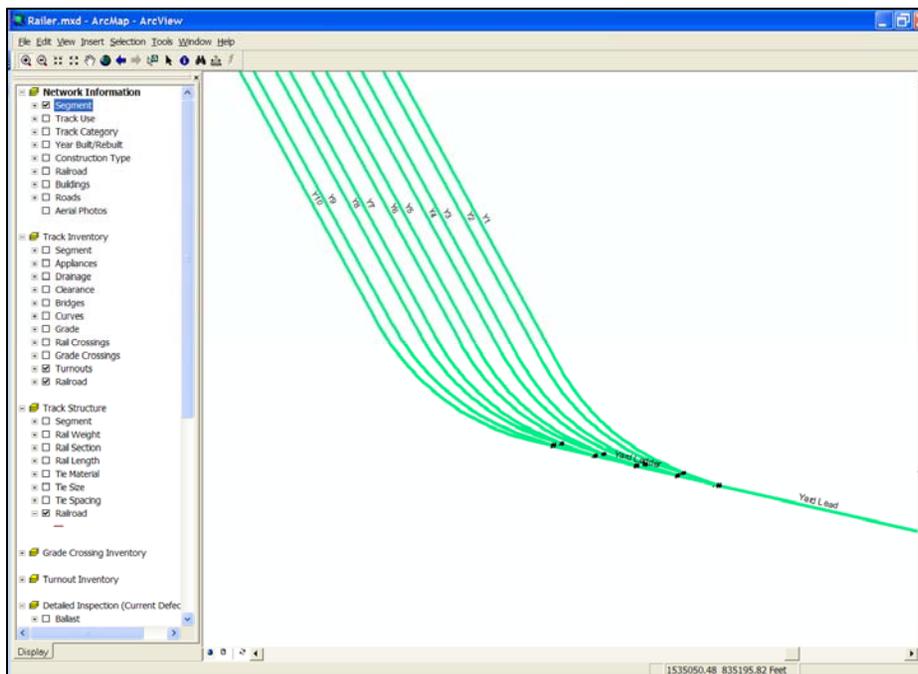
RAILER Process

- Inventory collection
- Detailed track inspection
- Condition Assessment
- Maintenance and Repair Planning
- Results reporting and GIS



Inventory

- Organize track network in a hierarchical basis
- Establish a track stationing scheme



Inventory (Continued)

- Specify the attributes of the track structure, track geometry layout, and track components
- Store the location of track components and changes in track attributes.

The screenshot displays the 'Track Inventory for A10' software interface. The main window shows input fields for 'Begin Station' (0+00) and 'End Station' (7+85). Below these are tabs for 'Rail Crossings', 'Clearances', 'Drainage', 'Bridges', and 'Appliances'. The 'Rail' section includes fields for 'Weight' (90 lbs/yd), 'Section' (90RA ft), and 'Length (avg)' (39). The 'Ties' section includes fields for 'Size' (7"x9"x8.5'), 'Material' (Hardwood-Softwood), and 'Spacing' (21.75 in). A 'CWR' checkbox is also present.

An 'Attributes of Rail Weight' dialog box is open, displaying a table with the following data:

Track ID	Begin	End	Length	Rail Weight	Rail Section	Rail Length	CWR	Tie Size	Tie Material	Tie Spacing
Masonville S	16+61	17+89	128 ft	115	115RE	39	No	7"x9"x8.5'	Hardwood-Softwood Mix	20.75
New Connec	4252+40	4395+07	14267 ft	115	115RE	80	No	7"x9"x8.5'	Hardwood	22.75
New North	0+00	11+02	1102 ft	115	115RE	39	No	7"x9"x8.5'	Hardwood	21.5
New South	0+00	11+08	1108 ft	115	115RE	39	No	7"x9"x8.5'	Hardwood	21.5
Siding Trk 1	0+00	52+35	5235 ft	115	115RE	80	No	7"x9"x8.5'	Hardwood	23.75
Siding Trk 2	0+00	49+43	4943 ft	115	115RE	80	No	7"x9"x8.5'	Hardwood	23.75
Y1	0+00	28+28	2828 ft	115	115RE	39	No	6"x8"x8"	Hardwood	20
Y10	0+00	30+36	3036 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Y2	0+00	30+31	3031 ft	115	115RE	39	No	6"x8"x8"	Hardwood	20
Y3	0+00	28+28	2828 ft	115	115RE	39	No	6"x8"x8"	Hardwood	20
Y4	0+00	30+31	3031 ft	115	115RE	39	No	6"x8"x8"	Hardwood	20
Y5	0+00	28+28	2828 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Y6	0+00	30+31	3031 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Y7	0+00	28+28	2828 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Y8	0+00	30+31	3031 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Y9	0+00	29+66	2966 ft	115	115RE	39	No	6"x8"x8.5'	Hardwood	20
Yard Ladder	70+17	76+92	675 ft	115	115RE	39	No	7"x9"x8.5'	Hardwood	20
Yard Lead	10+00	70+17	6017 ft	115	115RE	39	No	7"x9"x8.5'	Hardwood	19.25
Yard W/ve	10+00	23+09	1309 ft	115	115RE	80	No	7"x9"x8.5'	Hardwood	19.25

The dialog box also includes a 'Record' field showing '0' and a 'Show' dropdown set to 'All Selected'. The status bar indicates 'Records (0 out of 161 Selected)'.

Inspection Process

When a track defect or deviation is identified:

1. Record the location of the defect
2. Record the type of defect (from a pre-defined drop down list)
3. Identify severity, conduct measurements if required
4. Determine the quantity or density of the defect present

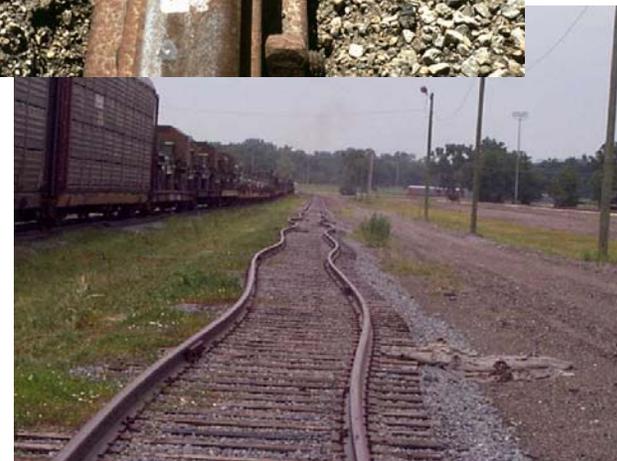
The screenshot shows a software interface titled "New Geometry Defect". It contains several input fields and a checkbox. Red circles and numbers 1 through 4 are overlaid on the form to indicate the steps from the list above:

- 1**: A red circle highlights the "Station" field, which contains "3" and "+ 13".
- 2**: A red circle highlights the "Meas. Type" dropdown menu, which is set to "Alignment".
- 3**: A red circle highlights the "Measurement" field, which contains "4" and "IN".
- 4**: A red circle highlights the "Aff. Length" field, which contains "150" and "TF".

Other fields include "Ref. Rail" (set to "N/A") and "Bridge Approach" (checkbox).

RAILER[®] Defects

- Each defect is linked to:
 - Operation/Restrictions standards
 - Condition Index Metric
 - Local Work Action to correct/repair



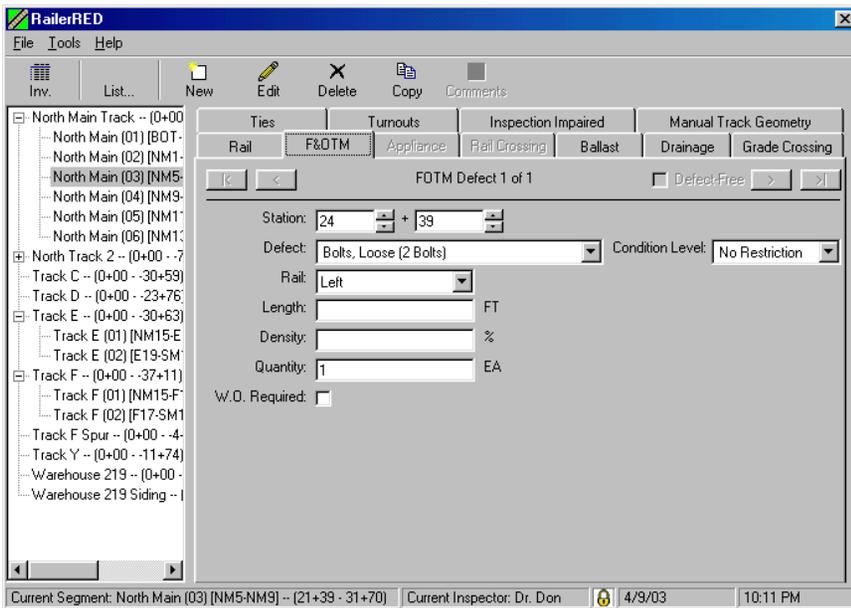
One inspection process feeds 3 separate requirements

RAILER[®] RED

- RAILER Remote Entry Database (RED)
- Field data collection program for tablet PCs
- Displays defects from past inspections
- Inventory updates
- Data is electronically transferred to/from RAILER



RAILER[®] Inspection



Collect Data in RAILER RED

RAILER[®] Inspection

The screenshot shows the RAILER RED software interface. The main window displays a project tree on the left with various track segments. A detailed inspection window is open, titled "Detailed Inspection for Track A13 - Segment A13". This window includes fields for Date (6/30/2005), Inspector (DRU), Begin Station (0+00), and End Station (6+90). It features several tabs for inspection categories: Ties, Rail, F&OTM (selected), Appliances, Rail Crossings, Ballast/Subgrade, Turnouts, Drainage, Impaired Insp., and Geometry. Below these tabs are checkboxes for "Defect Free" and "Non-destructive test". A table lists the inspection results:

Defect	Station	Rail	Length	Densit	Quantit	UM	Condition L	E/S W.O.#	MOA	Work Acti	Est. Cost	Date Fixed
▶ Bolts, Improper Position or Pattern (2 Bolts)	0+60	L			2	EA						
Bolts, Missing/Cracked/Or Broken (2 Bolts)	2+75	L			2	EA						
Spike, Improper Position	5+60	L			1	EA						
Rail Anchor, Missing	5+70	B	120	25	67	EA						

Collect Data in RAILER RED
Archive Inspection Results in
RAILER

RAILER® Inspection

The screenshot displays the RAILER RED software interface. On the left, a tree view shows track segments. The main window shows a 'Detailed Inspection for Track A13 - Segment A13' with fields for Date (6/30/2005), Inspector (DRU), and Station (0+00). Below this is a table of defects:

Defect	Station	Rail	Length
Bolts, Improper Position or Pattern (2 Bolts)	0+60	L	
Bolts, Missing/Cracked/Or Broken (2 Bolts)	2+75	L	
Spike, Improper Position	5+60	L	
Rail Anchor, Missing	5+70	B	120

On the right, the 'Report Viewer' displays a 'RAILER® Track Segment Inspection Report' for 10/22/2006. The report includes inspection details and tables for TIES, RAIL, F & OTM, BALLAST & SUBGRADE, and GEOMETRY.

TIES Inspection Date: 10/19/2006 Inspector: Grussing

Defect	Qty (EA)	Std Level
Total Number of Defective Ties	11	
Single Defective Tie	3	Full Compliance
Single Defective Joint Tie	3	Full Compliance
Isolated Defective Tie Cluster (2 Ties)	1	Full Compliance
Isolated Defective Tie Cluster (3 Ties)	1	10 MPH

RAIL Inspection Date: 10/19/2006 Inspector: Grussing

Defect	Rail	Location	Qty (EA)	Std Level
None				Defect Free

F & OTM Inspection Date: 10/19/2006 Inspector: Grussing

Defect	Rail	Location	Qty (EA)	Std Level
Bolts, Loose, All (4 Bolts)	L	4+00	1	10 MPH
Bolts, Loose, All (4 Bolts)	L	4+00	1	10 MPH
Bolts, Loose, All (4 Bolts)	L	4+00	1	10 MPH
Bolts, Loose (1 Bolt)	B	0+00	7	Full Compliance

BALLAST & SUBGRADE Inspection Date: 10/19/2006 Inspector: Grussing

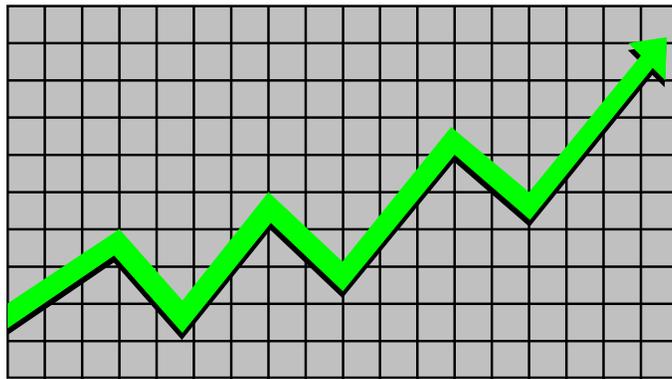
Defect	Side	Location	Qty (UM)	Std Level
Insuff Shoulder Ballast (4" Ave Depth)	B	0+00	250 LF	Full Compliance

GEOMETRY Inspection Date: 10/19/2006 Inspector: Grussing

Measurement Type	Location	Rail	Bridge App	Mens (in/ Rel Mens (in)	Qty (IF)	Std Level
Alignment	1+00	N/A	No	4.000 / 4.000	100	10 MPH

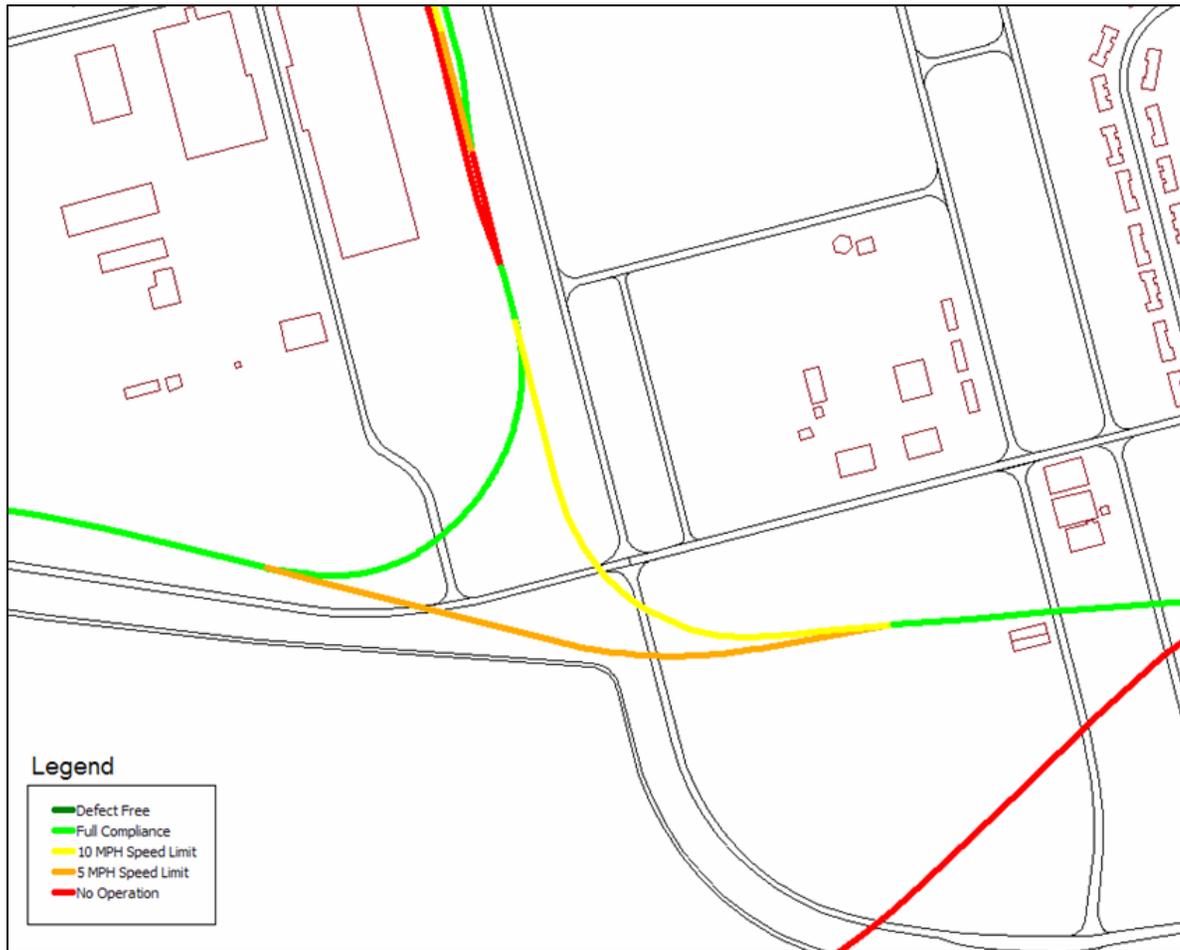
Collect Data in RAILER RED
 Archive Inspection Results in
 RAILER
**Generate Inspection Report and
 Findings**

Condition Assessment



- Transform inspection data into an objective/repeatable measure of track “health”
- Determine restrictions to train operations
- Compare condition of individual track segments
- Form a basis for determining rates of deterioration
- Communicate condition status and readiness of track network
- Use metric results in M&R analysis and generation

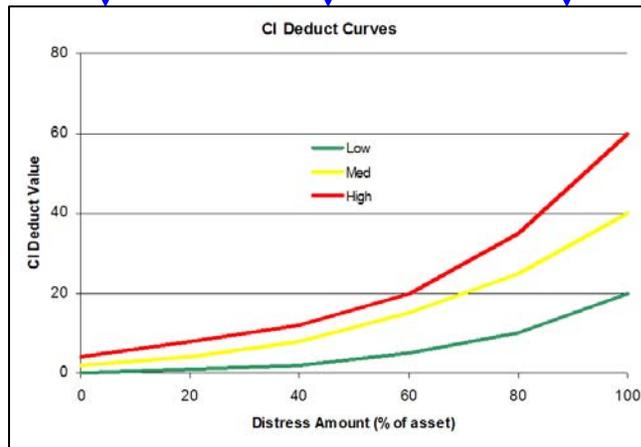
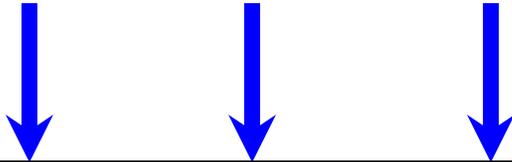
Track Standards in GIS



Displays track conditions and operating restrictions spatially on track network map

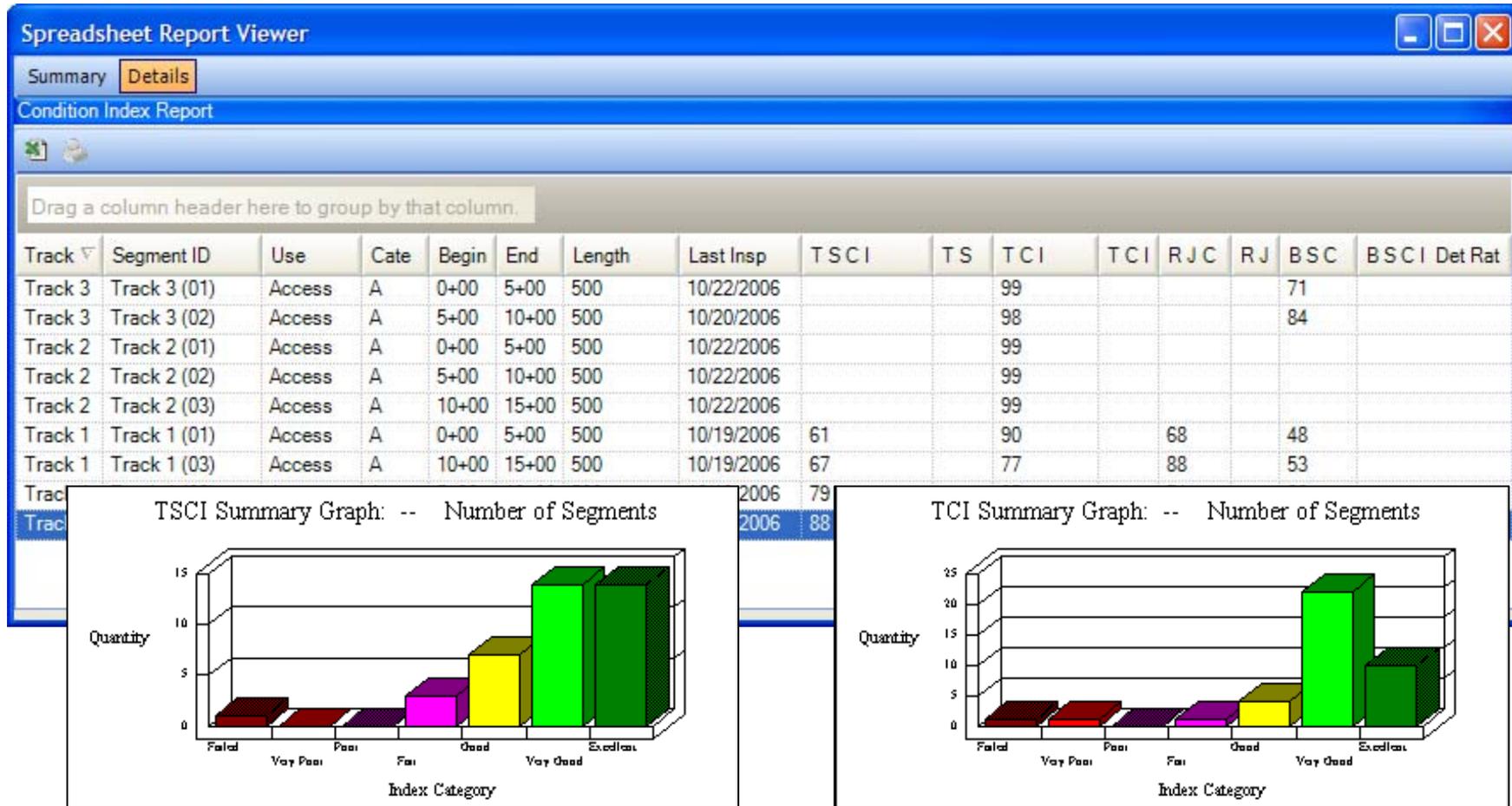
Condition Indexes (CI)

Distress Type **Distress Density** **Distress Severity**



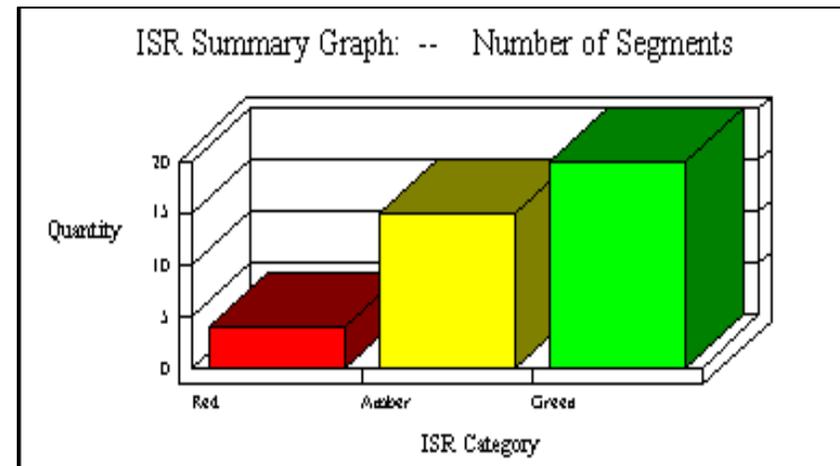
Condition Index	Descriptor
100-85 Good	Slight or no serviceability or reliability reduction
85-70 Satisfactory	Serviceability or reliability is degraded but adequate.
70-55 Fair	Serviceability or reliability is noticeably degraded
55-40 Poor	Significant serviceability or reliability loss.
40-25 Very Poor	Unsatisfactory serviceability or reliability reduction
25-10 Serious	Extreme serviceability or reliability reduction
10-0 Failed	Overall degradation is total.

Condition Indexes (CI)



Installation Status Report (ISR)

- Condition levels:
 - Red
 - Amber
 - Green
- Based on TSCI and Standard levels.



Work Planning

- Actionable corrective work plan is generated automatically based on:
 - Current inspection findings in database
 - Specified scope and plan horizon
 - Pre-defined policy that maps each defect to corrective work action
 - Comprehensive library of user-adjusted unit costs for repair actions
 - Prioritization metrics, yearly projected funding, and target condition levels

M&R Work Actions and \$\$\$

Description	U	Cost	Line Item
Install/Replace One Tie (6"x6"x8')	E	\$100.00	B0001
Install/Replace Two Ties (6"x6"x8')	E	\$200.00	B0002
Install/Replace Three Ties (6"x6"x8')	E	\$300.00	B0003
Install/Replace Four Ties (6"x6"x8')	E	\$400.00	B0004
Install/Replace Five Ties (6"x6"x8')	E	\$500.00	B0005
Reposition Tie	E	\$50.00	B0007
Tamp Ballast Around Tie & Tighten Hold Down	E	\$50.00	B0008
Clean Culvert	E	\$1,000.00	B0009
Install Culvert	E	\$30,000.00	B1010
Repair Culvert (Minor)	E	\$500.00	
Reconstruct Culvert	E		
Install or Replace Derail	E	\$500.00	B7091
Repair Derail	E	\$200.00	B4025
Tighten Derail	E	\$50.00	B3024
Clean Drainage Structure	E		
Install Drainage Structure	E		

A cost book maps each corrective work action to a unit cost and contract line item number

M&R Policies

M&R Policy

Local M&R: ERDC_Complete Repair Standard: U.S. Army

	Description	Std. Condition	M&R Trigger	Work Action	UM
<input type="checkbox"/>	Isolated Defective Tie Cluster (2 Ties)	Full Compliance	Follow Standard	Install/Replace Two Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Isolated Defective Tie Cluster (3 Ties)	10 MPH	Follow Standard	Install/Replace Three Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Isolated Defective Tie Cluster (4 Ties)	5 MPH	Follow Standard	Install/Replace Four Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Isolated Defective Tie Cluster (5 Ties)	No Operation	Follow Standard	Install/Replace Five Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Defective Tie Cluster (2 Ties) that Includes Joint	Full Compliance	Follow Standard	Install/Replace Two Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Defective Tie Cluster (3 Ties) that Includes Joint	10 MPH	Follow Standard	Install/Replace Three Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Defective Tie Cluster (4 Ties) that Includes Joint	5 MPH	Follow Standard	Install/Replace Four Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Defective Tie Cluster (5 Ties) that Includes Joint	No Operation	Follow Standard	Install/Replace Five Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Adjacent Defective Tie Cluster (2 Ties)	Full Compliance	Follow Standard	Install/Replace Two Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Adjacent Defective Tie Cluster (3 Ties)	10 MPH	Follow Standard	Install/Replace Three Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Adjacent Defective Tie Cluster (4 Ties)	5 MPH	Follow Standard	Install/Replace Four Ties (7"x9"x8.5')	EA
<input type="checkbox"/>	Adjacent Defective Tie Cluster (5 Ties)	No Operation	Follow Standard	Install/Replace Five Ties (7"x9"x8.5')	EA

Appliances
 Ballast/Subgrade
 Drainage
 F&OTM
 Grade Crossings
 Rail
 Rail Crossings
 Ties
 Turnouts

A policy maps each defect to a corrective work action

Work Plan Scope

The screenshot shows the 'M&R Plan' software window. The 'Plan ID' is 'Repair Off Post R/R and Ballast'. The 'General' tab is active, showing the following fields:

- Description: Ballast Reconditioning
- Plan Start Year: 2004
- Plan Horizon: 3 Year(s)
- Target Condition Level: 10 MPH Speed Limit
- Local M&R Policy: Best Practice
- Method of Accomplishment: DOT (Base)
- Prioritization Scheme: (empty)
- Funding Scheme: Unconstrained

Under the 'Components' section, the following checkboxes are visible:

- Appliances
- Drainage
- Grade Crossings
- Rail Crossings
- Turnouts
- Ballast/Subgrade
- F&OTM
- Rail
- Ties

Buttons for 'Network Scope' and 'Global M&R Selection' are at the bottom. A 'Plan Date:' field is also present.

Defines:

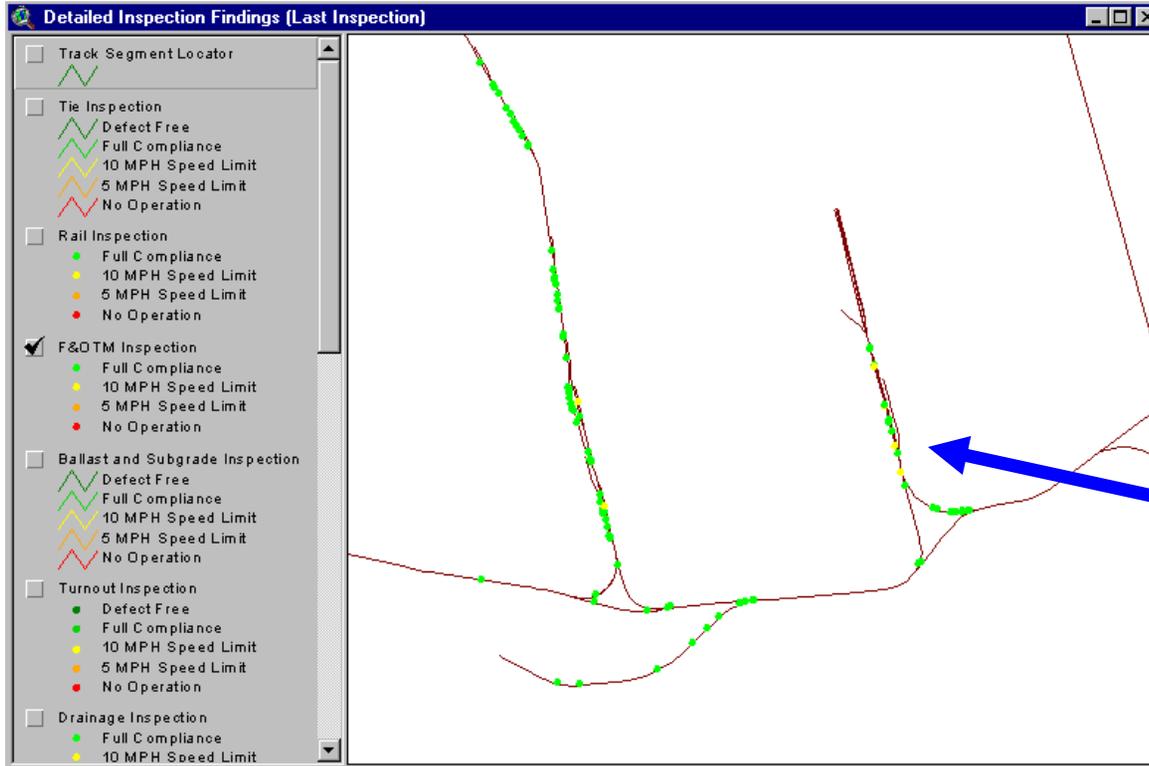
- Plan Horizon
- Target Condition Level
- Policy
- Prioritization Scheme
- Funding Scheme
- Components
- Segments

Work Plan Items

Segment ID	Component	Defect	Rail	Begin	End	ID	Qty	Standard	Work Action	LinItem	Unit Cost	Total Cost	UM	Priority
A(01)	Ballast	N/A	N/A	0	1602		70	N/A	Skim lift after tie Replacement	3019AA	\$1.72	\$120.40	TF	1
A(01)	FOTM	Bolts, Missing/Cracked/Or Broken (1 Bolt)	L	1345			1	Full Compliance	Install or Replace One Bolt	3020	\$8.33	\$8.33	EA	1
A(01)	FOTM	Tie Plate, Improper Size/Type, DS	R	1060			1	Full Compliance	Install or Replace Double Shoulder Tie	3021AB	\$18.15	\$18.15	EA	1
A(01)	Geometry	Alignment (1 in)		1482	1512		30	Full Compliance	Align Track	3019AE	\$3.36	\$100.80	TF	1
A(01)	Geometry	Alignment (4 in)		350	380		30	10 MPH Speed	Align Track	3019AE	\$3.36	\$100.80	TF	1
A(01)	Ties	Isolated Defective Tie Cluster (2 Ties)		0	1602		6	Full Compliance	Install/Replace Two Ties (7"x9"x8.5')	3016AB	\$137.40	\$824.40	EA	1
A(01)	Ties	Single Defective Joint Tie		0	1602		2	Full Compliance	Install/Replace One Tie (7"x9"x8.5')	3016AB	\$68.70	\$137.40	EA	1
A(01)	Turnout	Connecting Rod Bolts, Improper Position		0		T-B	1	Full Compliance	Reposition Connecting Rod Bolts	3015AS	\$12.14	\$12.14	EA	1
A(01)	Turnout	Cotter Keys, Missing		0		T-B	2	Full Compliance	Install Cotter Keys	No Number		\$0.00	EA	1
A(01)	Turnout	Cotter Keys, Missing		1602		T-C(S)	1	Full Compliance	Install Cotter Keys	No Number		\$0.00	EA	1
A(01)	Turnout	Debris In Crib Areas		1602		T-C(S)	1	Full Compliance	Clean Switch Crib Area	3015AM	\$93.89	\$93.89	EA	1
A(01)	Turnout	Frog Bolts, Improper Size		1602		T-C(S)	1	Full Compliance	Replace Frog Bolt Assembly	3015BC	\$289.72	\$289.72	EA	1
A(01)	Turnout	Head Blocks, Defective		0		T-B	1	5 MPH Speed	Install/Replace Head Block	3017	\$142.74	\$142.74	EA	Critical
A(01)	Turnout	Switch Stand, Loose		1602		T-C(S)	1	No Operation	Tighten/Respike/Adjust Switch Stand	3038AA	\$4.83	\$4.83	EA	Critical
A(01)	Turnout	Switch Ties, Defective (10 ft)		0		T-B	2	Full Compliance	Install/Replace 10' Switch Tie	3017	\$109.81	\$219.62	EA	1
A(01)	Turnout	Switch Ties, Defective (11 ft)		0		T-B	3	Full Compliance	Install/Replace 11' Switch Tie	3017	\$120.78	\$362.34	EA	1
A(01)	Turnout	Switch Ties, Defective (13 ft)		1602		T-C(S)	1	Full Compliance	Install/Replace 13' Switch Tie	3017	\$142.74	\$142.74	EA	1
A(01)	Turnout	Switch Ties, Defective (14 ft)		1602		T-C(S)	1	Full Compliance	Install/Replace 14' Switch Tie	3017	\$153.72	\$153.72	EA	1
A(01)	Turnout	Switch Ties, Defective (8.5 ft)		0		T-B	1	Full Compliance	Install/Replace 9' Switch Tie	3017	\$98.82	\$98.82	EA	1
A(01)	Turnout	Switch Ties, Defective (9 ft)		0		T-B	1	Full Compliance	Install/Replace 9' Switch Tie	3017	\$98.82	\$98.82	EA	1
A(01)	Turnout	Switch Ties, Defective (9 ft)		1602		T-C(S)	1	Full Compliance	Install/Replace 9' Switch Tie	3017	\$98.82	\$98.82	EA	1
A(01)	Turnout	Switch Ties, Defective Joint (14 ft)		0		T-B	1	Full Compliance	Install/Replace 14' Switch Tie	3017	\$153.72	\$153.72	EA	1

Work Plan list is generated automatically and can be exported to Microsoft® Excel™.

GIS Reporting



- GIS Shows:
 - Track Layout and Attributes
 - Inventory Items
 - Turnouts
 - Grade Crossings
 - etc
 - Defects
 - Track conditions
 - Work Items
 - Work History

Track Attributes

The screenshot displays the ArcMap interface with a map of rail tracks. The 'Identify Results' window is open, showing the following data:

Curves	
Field	Value
Track ID	A
Begin	0+00
End	5+30
Curvature	8.25
MaxSpeed	25
Superelevation	1.5

Conclusions

- The RAILER methodology helps rail managers achieve the following objectives:
 - Minimize lifecycle costs
 - Maximize performance
 - Manage risk
- And supports the following requirements with a single assessment approach:
 - Upward Condition/Readiness Reporting
 - Justifiable Work Plan Creation/Efficient allocation of repair and recapitalization resources

RAILER POCs

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Questions

