

# TechLine

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## In this issue:

- Rail Replacement Planning
- [Contact Us](#)

## Rail Replacement Planning

Rail represents a railway's costliest asset. It's no wonder, then, that railways pay close attention to rail wear and surface conditions, especially in curves where gauge-face wear can dramatically reduce the life of rail in track. Thanks to automated rail profile measurement systems, which are found on most rail-bound and hi-rail geometry cars, accurate rail profile and wear measurement data are readily available.

replacement plans. Software programs, such as the *Holland Co.'s Industrial Metrics' Rangecam* Track View and Track Analyst programs, allow engineering/maintenance personnel to not only view current rail profile conditions, but to query the data for vertical, gauge or combined wear — the types of conditions that dictate corrective maintenance activities, such as rail grinding or rail replacement.

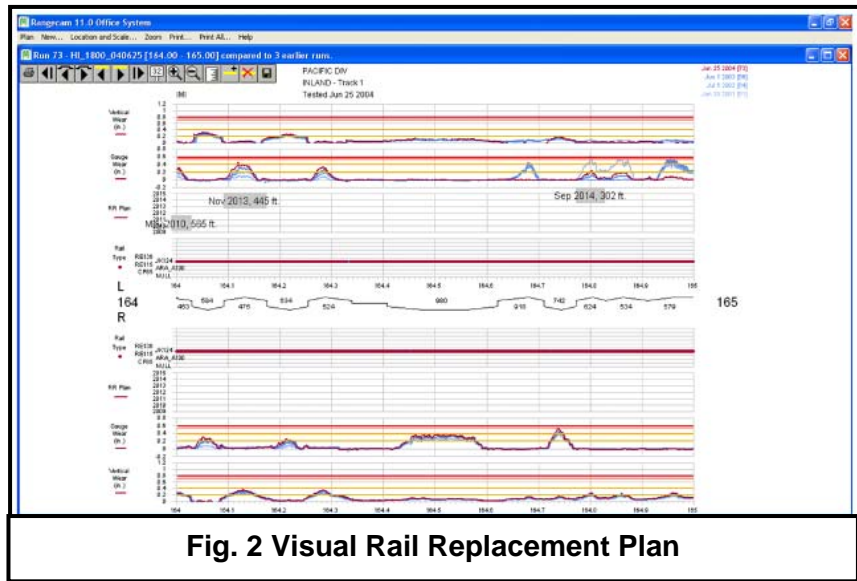
While identifying rail in need of replacement is good, determining when rail will need to be

Track	Start	End	Side	Replacement/Combant	Rail	Name	Curvature	Curve	Gauge	Class	Start Date	End Date	Year Total						
1	163.921	164.0254 (LH)		565	100	K-124	Curve	463 R	7.7	0.029	0.363	0.317	BLR	3	Jun01	Jun-04	May-10	565	565
10	176.253	176.4486 (LH)		680	100	K-124	Curve	470 R	2.9	0.011	0.117	0.138	MLR	2	Jul02	Jun-04	Aug-12	680	680
11	178.968	179.2475 (LH)		1400	100	K-124	Curve	476 R	4.1	0.084	0.161	0.189	MLR	2	Jul02	Jun-04	Jun-12	1400	1400
12	181.1217	181.2969 (LH)		905	100	K-124	Curve	474 R	3.1	0.012	0.111	0.123	MLR	2	Jul02	Jun-04	Nov-12	905	3213
13	183.9476	183.951 (RH)		378	100	K-124	Curve	488 L	5.6	0.016	0.222	0.248	BLR	3	Jun01	Jun-04	Jul-13	378	378
14	184.0912	184.1749 (LH)		446	100	K-124	Curve	475 R	6.2	0.031	0.194	0.232	MLR	3	Jun01	Jun-04	Nov-13	446	446
15	185.4537	185.5744 (LH)		634	100	K-124	Curve	488 R	3.9	0.013	0.161	0.166	MLR	2	Jul02	Jun-04	May-13	634	634
16	172.2478	172.4267 (RH)		998	100	K-124	Curve	1174 L	10.6	0.064	0.307	0.391	BLR	6	Nov07	Jun-04	Oct-15	998	998
17	179.6688	179.9659 (LH)		1046	100	K-124	Curve	477 R	3	0.016	0.11	0.12	MLR	2	Jul02	Jun-04	Sep-13	1046	3469
18	184.7728	184.8297 (LH)		302	100	K-124	Curve	504 R	2.6	0.011	0.302	0.193	MLR	2	Jul02	Jun-04	Sep-14	302	302
19	185.6238	185.6000 (RH)		501	100	K-124	Curve	470 L	3	0.006	0.11	0.124	MLR	2	Jul02	Jun-04	Jun-14	501	501
20	186.3861	186.4988 (RH)		306	100	K-124	Curve	534 L	4.3	0.011	0.36	0.18	MLR	2	Jul02	Jun-04	Mar-14	306	306
21	175.5751	175.6706 (RH)		641	100	K-124	Curve	496 L	5.2	0.015	0.201	0.224	BLR	3	Jun01	Jun-04	Jan-14	641	641
22	180.7974	181.021 (RH)		1235	100	K-124	Curve	483 L	3.7	0.001	0.153	0.164	MLR	2	Jul02	Jun-04	Apr-14	1235	3339
23	183.7237	183.8476 (LH)		641	100	K-124	Curve	492 R	5.6	0.034	0.186	0.224	MLR	3	Jun01	Jun-04	Feb-15	641	641
24	186.7621	186.8421 (RH)		421	100	K-124	Curve	452 L	3.6	0.002	0.148	0.161	MLR	2	Jul02	Jun-04	Aug-15	421	421
25	175.6786	175.7377 (LH)		487	100	K-124	Curve	479 R	2.9	0.005	0.134	0.141	MLR	2	Jul02	Jun-04	Mar-15	487	487
26	178.9503	178.9488 (RH)		687	100	K-124	Curve	470 L	3.3	0.004	0.148	0.157	MLR	2	Jul02	Jun-04	Feb-15	687	687
27	180.1353	180.2508 (RH)		778	94	K-124	Curve	911 L	10.3	0.09	0.268	0.354	BLR	7	Apr07	Jun-04	Dec-15	778	778
28	181.8717	181.7509 (LH)		420	68	K-124	Curve	801 R	9.9	0.086	0.214	0.316	BLR	7	Apr07	Jun-04	Sep-15	420	3445

Figure 1. Rail Replacement Forecast

replaced based on wear trends before it reaches its change-out limits is better. *Rangecam* Track Analyst software incorporates a rail replacement planning module that does just that: it calculates rail wear rates by time or tonnage and projects the dates at which each rail segment (curves and tangent segments) will meet the railway's unique rail wear limits. The information is presented in report form (see Figure 1) and graphically in a visual rail replacement plan (see Figure 2).

While both reports are important planning tools, a Visual Rail Replacement plan allows planners to cross reference the data by double clicking on the wear charts to obtain a “two-up” profile window (see Figure 3), which shows the current and historical wear at any given location — an invaluable tool for examining wear conditions at specific locations in track, and verifying the replacement planning report.

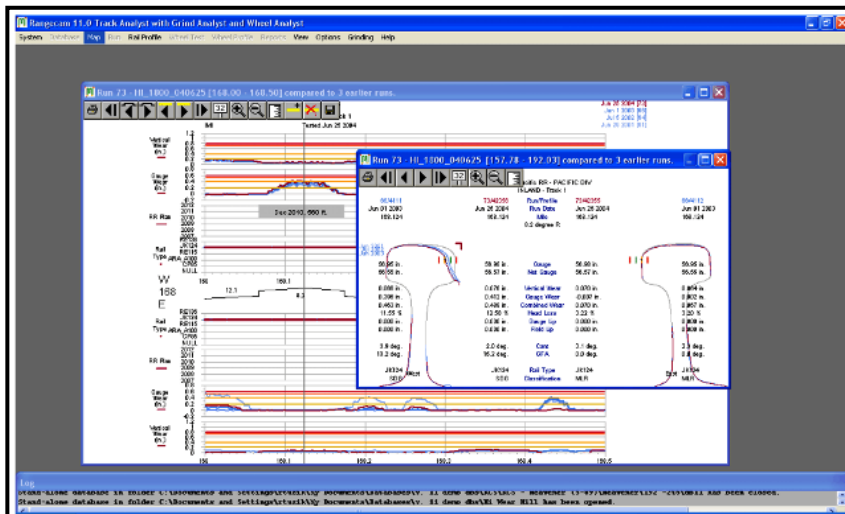


**Fig. 2 Visual Rail Replacement Plan**

## Rail Replacement Plan

Reliable rail replacement forecasting requires accurate information about the measured rail type. The software must be able to accurately identify and model the rail section in order to determine wear. This typically requires accurate rail head, web and base measurements. While some railways model only the head of the rail, with one or two reference points at the base to

identify wear, several railways and all of Holland’s TrackSTAR vehicles measure the complete rail profile.



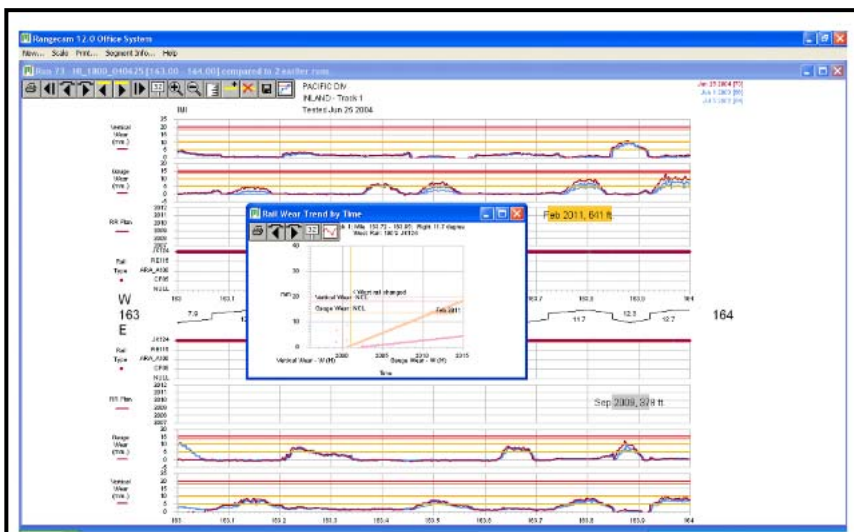
**Fig. 3, Rail Wear and Scheduled Changeout Date with a "Two-Up Profile Window Fig. 2 Visual**

Rail profiles are typically collected at 10-foot intervals, though they can be collected more frequently in tight-radius curves, for example, if necessary. The profile data is imported (along with geometry data) and aligned to previously collected data, when available. This allows the data to be reviewed along with critical geometry data such as curvature, crosslevel, gauge, etc., and track

features, such as turnouts, road crossings, bridges, tunnels, etc., in order to get a more complete picture of the overall track conditions at any given location. The corresponding data can help maintenance planners understand “spikes” or unusual wear patterns in the data, and better decide how to deal with them.

## Rail maintenance planning software provides several ways to examine rail wear:

- reports (generated by queries) identifying specific wear conditions such as 3/8-inch gauge-face wear or 5/8-inch vertical wear, etc.
- “two-up” profiles that show the actual measured rail profile shapes. These are typically overlaid with previously collected data to show wear over time.
- charts that graphically illustrate vertical, gauge and combined wear, along with percentage of head loss. This data can be looked at on a curve-by-curve (track segment) basis, by mile, or by milepost location. Rangecam allows the user to magnify any segment of the chart or to drill down to an individual profile for a closer look at wear conditions anywhere on the system.
- rail trend charts that show when railroad-defined wear limits will be crossed for each curve, if the historical wear trends continue. The software automatically recognizes when rail has been replaced, and restarts the trend line after the replacement date. This information can also be augmented by a graph showing the wear history of each measured profile within the segment (see Figure 4).



**Figure 4. Rail Wear Trend charts show when rail will each near condemning limits.**

The rail replacement planning software can also query the database to identify rail that has reached or is approaching its replacement limits, based on the rail section, historical wear and the railway’s replacement criteria. Three data sets (historical runs) or more are typically required to accurately project replacement dates. A rail replacement forecast report can be printed for distribution and verification in the field, as needed. The information can also be used to generate a Visual Rail Replacement Plan that

graphically shows the length and location of each rail (right or left) that is identified for replacement for each segment of track. The report can be edited on screen to change the date of a projected replacement to coincide with rail/tie gang schedules, or to extend or reduce the length of the rail scheduled for replacement.

Railways that collect rail profile data on a regular basis have a wealth of data that can be used to plan maintenance. They can do it by manually working through the measurement data, or

they can use sophisticated software programs that provide a better opportunity to replace rail at the optimal time – neither too late nor too early in its lifecycle.

### **Contact Us**

**TechLine is a publication of the RMSS Division of: Holland L.P.**

**1000 Holland Drive  
Crete, Illinois 60417-2120**

**USA**

**Phone: 708-672-2300**

**FAX: 708-672-0119**

**E-Mail: [Postmaster@hollandco.com](mailto:Postmaster@hollandco.com)**

**Website: [www.hollandco.com](http://www.hollandco.com)**