



## Data Summary: Wheel Profile Detector

### Table of Contents

Synopsis .....	2
Purpose.....	2
Background.....	2
Data Summary Elements .....	3
Data Summary Roll Up Example.....	11
Opening Criteria .....	13
Update Criteria .....	13
Closing / Reset Criteria.....	13
Appendix A – EHMS Display Information.....	14
Appendix B – Wheel Profile Detector Data Summary Rules and Definitions .....	15

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# Synopsis

## Purpose

The Wheel Profile Detector (WPD) data summary provides information on freight car wheels condition using measurements-based data reported from Wheel Profile Detector systems.

## Background

Wheel Profile Detectors are automatic wayside systems that measure wheel profiles of moving trains using laser and optical scanning devices to take images of the flange, tread, etc. The goal of the WPD data summary is to get an aggregate view of these measurements. The data summary can be used to perform wheel trend analysis and determine wheel wear and condition. When worn beyond limits, the wheels can be scheduled for replacement.

## Data Summary Elements

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Type	Type		TEXT		
Format Version	Format Version	Version of the format used to create the Data Summary	NUMBER [1.0-999.99]		
CreationTMST	Date opened	GMT timestamp for when the data summary was created and the time zone offset of the originating data location.	TIMESTAMP	Earliest	Update when data summary created
RR_DB_Key	Key from originating railroad	Database key from the originating railroad (or detector owner)	NUMBER [0 - 999999999]		
LastUpdateTMST	Date of last update	GMT timestamp for when the data summary was last updated (any change other than closing) and the time zone offset of the originating data location.	TIMESTAMP	Last	Update every time data summary is updated, including when it is opened.
DSType	Type of Data Summary	Data summary type	TEXT		
DS_Owner/Reporting_System	Who created the Data Summary	Company ID (from Railinc) of the owner/creator of data summary	TEXT		
EquipmentMark	Equipment Mark	Current equipment initial	TEXT		
EquipmentNumber	Equipment Number	Current equipment number	NUMBER [0 - 999999999]		
Location	Location	Location of the component			
ComponentType	Component type	BASE	TEXT		
ComponentName	Part of the component location	BASE	TEXT		
ComponentValue	Value for the component location		TEXT		
State	Data Summary state	Current status of Open, Closed, Perpetual or Nullified	TEXT		Update when data summary state changes
Passing_tmst_1	Last Passing Timestamp	Timestamp of the last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_1	Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	
Rim_Thickness_1	Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Rim Thickness down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Flange_Height_1	Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Flange Height down 1 position.
Flange_Thickness_1	Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Flange Thickness down 1 position.
Hollow_Tread_1	Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Hollow Tread down 1 position.
Back_To_Back_1	Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Back To Back down 1 position.
Reference_Groove_1	Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Reference Groove down 1 position.
Rim_Wear_Rate_1	Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_1; move other Rim Wear Rate down 1 position.
Passing_tmst_2	Second to Last Passing Timestamp	Timestamp of the second to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_2	Second to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_2; move other mismatched numbers down 1 position.
Rim_Thickness_2	Second to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Rim Thickness down 1 position.
Flange_Height_2	Second to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Flange Height down 1 position.
Flange_Thickness_2	Second to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Flange Thickness down 1 position.
Hollow_Tread_2	Second to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Hollow Tread down 1 position.
Back_To_Back_2	Second to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Back To Back down 1 position.
Reference_Groove_2	Second to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Reference Groove down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Rim_Wear_Rate_2	Second to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_2; move other Rim Wear Rate down 1 position.
Passing_tmst_3	Third to Last Passing Timestamp	Timestamp of the Third to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_3	Third to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_3; move other mismatched numbers down 1 position.
Rim_Thickness_3	Third to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Rim Thickness down 1 position.
Flange_Height_3	Third to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Flange Height down 1 position.
Flange_Thickness_3	Third to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Flange Thickness down 1 position.
Hollow_Tread_3	Third to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Hollow Tread down 1 position.
Back_To_Back_3	Third to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Back To Back down 1 position.
Reference_Groove_3	Third to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Reference Groove down 1 position.
Rim_Wear_Rate_3	Third to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_3; move other Rim Wear Rate down 1 position.
Passing_tmst_4	Fourth to Last Passing Timestamp	Timestamp of the Fourth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_4	Fourth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_4; move other mismatched numbers down 1 position.
Rim_Thickness_4	Fourth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Rim Thickness down 1 position.
Flange_Height_4	Fourth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Flange Height down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Flange_Thickness_4	Fourth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Flange Thickness down 1 position.
Hollow_Tread_4	Fourth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Hollow Tread down 1 position.
Back_To_Back_4	Fourth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Back To Back down 1 position.
Reference_Groove_4	Fourth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Reference Groove down 1 position.
Rim_Wear_Rate_4	Fourth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_4; move other Rim Wear Rate down 1 position.
Passing_tmst_5	Fifth to Last Passing Timestamp	Timestamp of the Fifth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_5	Fifth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_5; move other mismatched numbers down 1 position.
Rim_Thickness_5	Fifth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Rim Thickness down 1 position.
Flange_Height_5	Fifth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Flange Height down 1 position.
Flange_Thickness_5	Fifth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Flange Thickness down 1 position.
Hollow_Tread_5	Fifth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Hollow Tread down 1 position.
Back_To_Back_5	Fifth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Back To Back down 1 position.
Reference_Groove_5	Fifth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Reference Groove down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Rim_Wear_Rate_5	Fifth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_5; move other Rim Wear Rate down 1 position.
Passing_tmst_6	Sixth to Last Passing Timestamp	Timestamp of the Sixth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_6	Sixth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_6; move other mismatched numbers down 1 position.
Rim_Thickness_6	Sixth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Rim Thickness down 1 position.
Flange_Height_6	Sixth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Flange Height down 1 position.
Flange_Thickness_6	Sixth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Flange Thickness down 1 position.
Hollow_Tread_6	Sixth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Hollow Tread down 1 position.
Back_To_Back_6	Sixth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Back To Back down 1 position.
Reference_Groove_6	Sixth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Reference Groove down 1 position.
Rim_Wear_Rate_6	Sixth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_6; move other Rim Wear Rate down 1 position.
Passing_tmst_7	Seventh to Last Passing Timestamp	Timestamp of the Seventh to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_7	Seventh to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_7; move other mismatched numbers down 1 position.
Rim_Thickness_7	Seventh to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Rim Thickness down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Flange_Height_7	Seventh to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Flange Height down 1 position.
Flange_Thickness_7	Seventh to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Flange Thickness down 1 position.
Hollow_Tread_7	Seventh to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Hollow Tread down 1 position.
Back_To_Back_7	Seventh to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Back To Back down 1 position.
Reference_Groove_7	Seventh to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Reference Groove down 1 position.
Rim_Wear_Rate_7	Seventh to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_7; move other Rim Wear Rate down 1 position.
Passing_tmst_8	Eighth to Last Passing Timestamp	Timestamp of the Eighth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_8	Eighth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_8; move other mismatched numbers down 1 position.
Rim_Thickness_8	Eighth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Rim Thickness down 1 position.
Flange_Height_8	Eighth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Flange Height down 1 position.
Flange_Thickness_8	Eighth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Flange Thickness down 1 position.
Hollow_Tread_8	Eighth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Hollow Tread down 1 position.
Back_To_Back_8	Eighth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Back To Back down 1 position.
Reference_Groove_8	Eighth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Reference Groove down 1 position.



Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Rim_Wear_Rate_8	Eighth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_8; move other Rim Wear Rate down 1 position.
Passing_tmst_9	Ninth to Last Passing Timestamp	Timestamp of the Ninth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_9	Ninth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_9; move other mismatched numbers down 1 position.
Rim_Thickness_9	Ninth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Rim Thickness down 1 position.
Flange_Height_9	Ninth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Flange Height down 1 position.
Flange_Thickness_9	Ninth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Flange Thickness down 1 position.
Hollow_Tread_9	Ninth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Hollow Tread down 1 position.
Back_To_Back_9	Ninth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Back To Back down 1 position.
Reference_Groove_9	Ninth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Reference Groove down 1 position.
Rim_Wear_Rate_9	Ninth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_9; move other Rim Wear Rate down 1 position.
Passing_tmst_10	Tenth to Last Passing Timestamp	Timestamp of the Tenth to last passing by a WPD detector	TIMESTAMP	Descending	Update for each passing and move other passing timestamps down 1 position
Wheelset_Change_Date_10	Tenth to Last Wheelset Change Date	Wheelset Change Date	TIMESTAMP	Correlated	Correlated to Passing_tmst_10; move other mismatched numbers down 1 position.
Rim_Thickness_10	Tenth to Last Rim Thickness	Wheel Rim Thickness	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Rim Thickness down 1 position.

Element Name	Element Text	Element Description	Format	Aggregation Method	Action
Flange_Height_10	Tenth to Last Flange Height	Wheel Flange Height	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Flange Height down 1 position.
Flange_Thickness_10	Tenth to Last Flange Thickness	Wheel Flange Thickness	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Flange Thickness down 1 position.
Hollow_Tread_10	Tenth to Last Hollow Tread	Wheel Hollow Tread	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Hollow Tread down 1 position.
Back_To_Back_10	Tenth to Last Back To Back	Wheel Back To Back	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Back To Back down 1 position.
Reference_Groove_10	Tenth to Last Reference Groove	Wheel Reference Groove	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Reference Groove down 1 position.
Rim_Wear_Rate_10	Tenth to Last Rim Wear Rate	Rim Wear Rate	NUMBER	Correlated	Correlated to Passing_tmst_10; move other Rim Wear Rate down 1 position.

## Data Summary Roll Up Example

Element Name	Aggregation	RR1	RR2
Type	WPD	WPD	WPD
Open Date	11-30-2016 11:00	12-08-2016 11:00	11-30-2016 11:00
Tenth to Last Event Date	12-08-2016 11:00	12-08-2016 11:00	11-30-2016 11:00
Count of DS Creators	2	n/a	n/a
EquipmentMark	AKX	AKX	AKX
EquipmentNumber	0000223344	0000223344	0000223344
Location			
ComponentType	WHEEL	WHEEL	WHEEL
ComponentName	WHEEL	WHEEL	WHEEL
ComponentValue	03L	03L	03L
State	O	O	O
Passing_tmst_1	12-08-2016 11:00	12-08-2016 11:00	11-30-2016 11:00
Wheelset_Change_Date_1	12-07-2016		
Rim_Thickness_1	26.1	26.1	26.5
Flange_Height_1	35.8	35.8	35.9
Flange_Thickness_1	31.3	31.3	31.3
Hollow_Tread_1	1.9	1.9	1.6
Back_To_Back_1	52.95	52.95	52.95
Reference_Groove_1			
Rim_Wear_Rate_1	0.000120627	0.000120627	0.000120431
Passing_tmst_2	12-07-2016 11:00	12-07-2016 11:00	
Wheelset_Change_Date_2			
Rim_Thickness_2	26.4	26.4	
Flange_Height_2	35.6	35.6	
Flange_Thickness_2	30.5	30.5	
Hollow_Tread_2	1.7	1.7	
Back_To_Back_2	52.95	52.95	
Reference_Groove_2			
Rim_Wear_Rate_2	0.000174368	0.000174368	
Passing_tmst_3	11-30-2016 11:00		
Rim_Thickness_3	26.5		
Flange_Height_3	35.9		

Element Name	Aggregation	RR1	RR2
Flange_Thickness_3	31.3		
Hollow_Tread_3	1.6		
Back_To_Back_3	52.95		
Reference_Groove_3			
Rim_Wear_Rate_3	0.000120431		

## **Opening Criteria**

A new Wheel Profile Detector data summary will be created for equipment if a Wheel Profile Detector data summary does not already exist for the asset and location and a Wheel Profile Detector train passing is reported for that equipment.

## **Update Criteria**

A Wheel Profile Detector data summary will be updated on each pass by a Wheel Profile Detector if a data summary already exists.

## **Closing / Reset Criteria**

A Wheel Profile Detector data summary does not close from data reads. Once opened, the data summary continues to aggregate passing timestamps. A data summary will close for the following administrative actions:

- Close condition: deleted in UMLER. Message must come from UMLER system.
- Close condition: Administrative - Opened in Error (due to detector error, AEI matching error, or incorrect AEI tag placement). Message may come from web service or from EHMS website input.

## **Appendix A – EHMS Display Information**

### **Opening Criteria Display Text**

Any Wheel Profile Detector train passing.

### **Autoclose Display Text**

A Wheel Profile Detector data summary shall always remain open.

## Appendix B – Wheel Profile Detector Data Summary Rules and Definitions

The Wheel Profile Detector data summary uses the following definitions:

<b>Term</b>	<b>Definition</b>
Back To Back	Back To Back measured by Wheel Profile Detector. Reported in inches.
Flange Height	Flange Height measured by Wheel Profile Detector. Reported in inches.
Flange Thickness	Flange Thickness measured by Wheel Profile Detector. Reported in inches.
Hollow Tread	Hollow Tread measured by Wheel Profile Detector. Reported in mm.
Reference Groove	Reference Groove measured by Wheel Profile Detector. Reported in inches.
Rim Thickness	Rim Thickness measured by Wheel Profile Detector. Reported in inches.
Rim Wear Rate	$\frac{((\text{Rim thickness at second to last passing}) - (\text{Rim thickness at last passing}))}{((\text{Mileage at second to last passing}) - (\text{Mileage at last passing}))}$
Wheelset Change Date	Last wheelset change date as reported in Umler.