



## **Data Summary: Acoustic TADS**

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# Synopsis

## Purpose

The Trackside Acoustical Detection System (TADS®) Data Summary is used to identify internal wheel bearing defects before reaching an industry condemnable level for the purpose of preventative maintenance planning.

## Background

The TADS acoustic detection device records audio from a train passing and produces train and axle based files with three main descriptors: Defect, Rank, and Type. This data summary uses those descriptors as the vehicle for data exchange with the industry.

Goals of the data summary include:

- 1) Data summaries are only opened with a high confidence in a rolling surface fault.
- 2) Data summaries are to contain information suitable for prioritizing bearing removals.
- 3) Data summaries are to contain information suitable for indicating: remediation of a problem (support for autoclose) or a data integrity error that led to a false opening.

Descriptors:

**Defect:** A yes/no field that existence of a defect based on the contents of the type field.

**Defect Rank:** The ranking of the detector defect. Values range 1-5, generated whenever a valid pass has been processed without error. Level 5 is the most severe ranking.

**Defect Type:** The type of the bearing defect. Type includes CUP, CONE, ROLLER, MULTIPLE, UNKNOWN, AND GROWLER.

Locomotives are analyzed for at least one class however no values are sent for them. A locomotive is determined by the AEI Equipment Group Code for locomotives ("D").

## Data Summary Elements

Note that there are duplicate sets of elements for detector reads. The first set includes reads from both validated and non-validated detectors. The second set contains reads from validated detectors only. The second set of elements are responsible for opening acoustic bearing detector (ABD) alerts.

	Element Name	Element Text	Element Description	Format	Aggregation Method	Action
	Type	Type		TEXT		
HEADER	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
	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 - 9999999999]		
	Location	Location	Location of the component			
	ComponentType	Component type		TEXT		
	ComponentName	Part of the component location		TEXT		
	ComponentValue	Value for the component location		TEXT		
	ComponentName	Part of the component location		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
ELEMENTS	The following elements are populated with values from both validated and non-validated detectors.					
	OPENING_DEFECT	First defect	Defect that is responsible for opening the data summary	TEXT	First	Created during data summary creation
	LAST_DEFECT	Latest defect	Latest defect recorded	TEXT	Latest	Updated on defect
	LAST_DEFECT_RANKING	Ranking of latest defect	Ranking of latest defect recorded	INTEGER	Latest	Updated on defect
	CNT_TADS_READS	Count of readings	Count of readings	INTEGER	Sum	Updated each reading
	CNT_WITHOUT_DEF	Count without defects	Count of readings where no defects were detected	INTEGER	Sum	Update on no defects
	FIRST_DEF_TIMESTAMP	First timestamp of any defect	First timestamp of reading with either cup/cone/roller/growler/multi defect	TIMESTAMP	First	Created during data summary creation
	FIRST_GRWL_TIMESTAMP	First timestamp of growler defect	First timestamp of reading with growler defect	TIMESTAMP	First	Updated on first occurrence
	CNT_CUP_DEF	Count of cup defects	Count of readings with cup defects	INTEGER	Sum	Updated on defect
	CNT_CONE_DEF	Count of cone defects	Count of readings with cone defects	INTEGER	Sum	Updated on defect
	CNT_ROLR_DEF	Count of roller defects	Count of readings with roller defects	INTEGER	Sum	Updated on defect
	CNT_GRWL_DEF	Count of growler defects	Count of readings with growler defects	INTEGER	Sum	Updated on defect
	CNT_MULT_DEF	Count of multi-defects	Count of readings with multi-defects	INTEGER	Sum	Updated on defect
	CNT_UNKNWN_DEF	Count of unknown defects	Count of readings with unknown defects	INTEGER	Sum	Updated on defect
	MAX_CUP_DEFECT_RANK	Maximum cup defect ranking	Maximum ranking of cup defects	INTEGER	Maximum	Updated on defect
	MAX_CONE_DEFECT_RANK	Maximum cone defect ranking	Maximum ranking of cone defects	INTEGER	Maximum	Updated on defect
	MAX_ROLR_DEFECT_RANK	Maximum roller defect ranking	Maximum ranking of roller defects	INTEGER	Maximum	Updated on defect
	MAX_GROW_DEFECT_RANK	Maximum growler defect ranking	Maximum ranking of growler defects	INTEGER	Maximum	Updated on defect
	MAX_MULT_DEFECT_RANK	Maximum multi-defect ranking	Maximum ranking of multi-defects	INTEGER	Maximum	Updated on defect
	MAX_UNKNWN_DEFECT_RANK	Maximum unknown defect ranking	Maximum ranking of unknown defects	INTEGER	Maximum	Updated on defect

The following elements are populated with values from validated detectors only.

OPENING_DEFECT_VALID	First defect	Validated defect that is responsible for opening the data summary	TEXT	First	Created during data summary creation
LAST_DEFECT_VALID	Latest defect	Latest validated defect recorded	TEXT	Latest	Updated on defect
LAST_DEFECT_RANKING_VALID	Ranking of latest defect	Ranking of latest validated defect recorded	INTEGER	Latest	Updated on defect
CNT_TADS_READS_VALID	Count of readings	Count of validated readings	INTEGER	Sum	Updated each reading
CNT_WITHOUT_DEF_VALID	Count without defects	Count of validated readings where no defects were detected	INTEGER	Sum	Update on no defects
FIRST_DEF_TIMESTAMP_VALID	First timestamp of any defect	First timestamp of validated reading with either cup/cone/roller/growler/multi defect	TIMESTAMP	First	Created during data summary creation
FIRST_GRWL_TIMESTAMP_VALID	First timestamp of growler defect	First timestamp of validated reading with growler defect	TIMESTAMP	First	Updated on first occurrence
CNT_CUP_DEF_VALID	Count of non-val. cup defects	Count of readings with validated cup defects	INTEGER	Sum	Updated on defect
CNT_CONE_DEF_VALID	Count of non-val. cone defects	Count of readings with validated cone defects	INTEGER	Sum	Updated on defect
CNT_ROLR_DEF_VALID	Count of non-val. roller defects	Count of readings with validated roller defects	INTEGER	Sum	Updated on defect
CNT_GRWL_DEF_VALID	Count of non-val. growler defects	Count of readings with validated growler defects	INTEGER	Sum	Updated on defect
CNT_MULT_DEF_VALID	Count of non-val. multi-defects	Count of readings with validated multi-defects	INTEGER	Sum	Updated on defect
CNT_UNKNWN_DEF_VALID	Count of non-val. unknown defects	Count of readings with validated unknown defects	INTEGER	Sum	Updated on defect
MAX_CUP_DEFECT_RANK_VALID	Maximum non-val. cup defect ranking	Maximum validated ranking of cup defects	INTEGER	Maximum	Updated on defect
MAX_CONE_DEFECT_RANK_VALID	Maximum non-val. cone defect ranking	Maximum validated ranking of cone defects	INTEGER	Maximum	Updated on defect
MAX_ROLR_DEFECT_RANK_VALID	Maximum non-val. roller defect ranking	Maximum validated ranking of roller defects	INTEGER	Maximum	Updated on defect
MAX_GROW_DEFECT_RANK_VALID	Maximum non-val. growler defect ranking	Maximum validated ranking of growler defects	INTEGER	Maximum	Updated on defect
MAX_MULT_DEFECT_RANK_VALID	Maximum non-val. multi-defect ranking	Maximum validated ranking of multi-defects	INTEGER	Maximum	Updated on defect

MAX_UNKNWN_DEFECT_RANK_VALID	Maximum non-val. unknown defect ranking	Maximum validated ranking of unknown defects	INTEGER	Maximum	Updated on defect
The following elements indicate whether autoclose is in progress.					
TMST_1_without_PROBLEM	Timestamp of last read without defects	Last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
TMST_2_without_PROBLEM	Timestamp of 2 <sup>nd</sup> to last read without defects	Second to last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
TMST_3_without_PROBLEM	Timestamp of 3 <sup>rd</sup> to last read without defects	Third to last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
TMST_4_without_PROBLEM	Timestamp of 4 <sup>th</sup> to last read without defects	Fourth to last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
TMST_5_without_PROBLEM	Timestamp of 5 <sup>th</sup> to last read without defects	Fifth to last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
TMST_6_without_PROBLEM	Timestamp of 6 <sup>th</sup> to last read without defects	Sixth to last timestamp of reading for which no defect was detected.	TIMESTAMP	Latest	Update timestamp if reading has no defect, and move other good reading timestamps down 1 position
LAST_TMST_with_PROBLEM	Timestamp of last read with any defect	Last timestamp of reading with any defect	TIMESTAMP	Latest	Updated each reading with defect

## Data Summary Roll Up Example

Element Name		Aggregation	RR1	RR2	RR3
HEADER	Type	DS	DS	DS	DS
	Format Version	1	1	1	1
	CreationTMST	2013-03-01T11:11:11-05:00	2013-01-01T11:11:11-05:00	2013-01-03T11:11:11-05:00	2013-03-01T11:11:11-05:00
	RR_DB_Key		772762	657646	346545
	LastUpdateTMST	2013-03-27T11:11:11-05:00	2013-02-27T11:11:11-05:00	2013-03-12T11:11:11-05:00	2013-03-27T11:11:11-05:00
	DSType	Acoustic Bearing	Acoustic Bearing	Acoustic Bearing	Acoustic Bearing
	DS_Owner/Reporting_System		RR1	RR2	RR3
	EquipmentMark	CSXT	CSXT	CSXT	CSXT
	EquipmentNumber	610555	610555	610555	610555
	Location				
	ComponentType	BEARING	BEARING	BEARING	BEARING
	ComponentName	AXLE	AXLE	AXLE	AXLE
	ComponentValue	2	2	2	2
	ComponentName	SIDE	SIDE	SIDE	SIDE
	ComponentValue	L	L	L	L
	State	O	O	O	O
ELEMENTS	OPENING_DEFECT	CUP	CUP	CUP	CUP
	LAST_DEFECT	ROLLER	GROWLER	ROLLER	ROLLER
	LAST_DEFECT_RANKING	4	5	3	4
	CNT_TADS_READS	49	22	12	15
	CNT_WITHOUT_DEF	2		1	1
	FIRST_DEF_TIMESTAMP	2013-01-01T11:11:11-05:00	2013-01-01T11:11:11-05:00	2013-01-15T11:11:11-05:00	2013-02-01T11:11:11-05:00
	FIRST_GRWL_TIMESTAMP	2013-01-10T11:11:11-05:00	2013-01-10T11:11:11-05:00	2013-01-17T11:11:11-05:00	2013-02-10T11:11:11-05:00
	MAX_CUP_DEFECT_RANK	1	1		
	MAX_CONE_DEFECT_RANK	12	3	4	5
	MAX_ROLR_DEFECT_RANK	11	4	3	4
	MAX_GROW_DEFECT_RANK				
	MAX_MULT_DEFECT_RANK				
	MAX_UNKNWN_DEFECT_RANK				
	MAX_CUP_DEFECT_RANK_NVLD	2	2		
	MAX_CONE_DEFECT_RANK_NVLD				
	MAX_ROLR_DEFECT_RANK_NVLD				

Element Name	Aggregation	RR1	RR2	RR3
MAX_GROW_DEFECT_RANK_NVLD	4	4		
MAX_MULT_DEFECT_RANK_NVLD				
MAX_UNKNWN_DEFECT_RANK_NVLD				
CNT_CUP_DEF	1	1		
CNT_CONE_DEF	6	2	1	3
CNT_ROLR_DEF	6	3	2	1
CNT_GRWL_DEF				
CNT_MULT_DEF				
CNT_UNKNWN_DEF				
CNT_CUP_DEF_NVLD	4	2	1	1
CNT_CONE_DEF_NVLD				
CNT_ROLR_DEF_NVLD				
CNT_GRWL_DEF_NVLD				
CNT_MULT_DEF_NVLD				
CNT_UNKNWN_DEF_NVLD				
TMST_1_without_PROBLEM	2013-07-10T11:11:11-05:00	2013-07-10T11:11:11-05:00	2013-07-08T11:11:11-05:00	2013-07-03T11:11:11-05:00
TMST_2_without_PROBLEM	2013-07-04T11:11:11-05:00	2013-07-04T11:11:11-05:00		2013-06-03T11:11:11-05:00
TMST_3_without_PROBLEM	2013-07-01T11:11:11-05:00	2013-07-01T11:11:11-05:00		
TMST_4_without_PROBLEM				
TMST_5_without_PROBLEM				
TMST_6_without_PROBLEM				
LAST_TMST_with_PROBLEM	2013-04-10T11:11:11-05:00	2013-04-10T11:11:11-05:00	2013-05-01T11:11:11-05:00	2013-05-12T11:11:11-05:00



## Opening Criteria

If a data summary creator does not have an open data summary for the asset and location, a new data summary will be opened if **either** of the following conditions are met:

- a) Either CUP/CONE/ROLLER/GROWLER/MULTI/UNKNOWN Defect flag is set
- b) Another data summary creator has an open data summary for that asset and location

## Closing Criteria

- a) Administrative -Opened in Error (due to detector error, AEI matching error, incorrect AEI tag placement). Message may come from web service or from EHMS website input.
- b) Deleted in UMLER. Message must come from UMLER system.
- c) Autoclose logic: six sequential reads without problem (for any open data summaries on a bearing). A problem is defined as any defect flag that is set. If there exists 6 consecutive timestamps *after* the last timestamp with problem, a close message will be published effecting a close of all data summaries for that asset/location.

## Additional Information

**Note:** Autoclose timestamps (e.g., TMST\_n\_without\_PROBLEM) are reset to null when LAST\_TMST\_with\_PROBLEM is greater. Autoclose timestamps (e.g., TMST\_n\_without\_PROBLEM) are cascaded (when a more recent one is found, it takes #1 position and #1 moves to #2, etc.)

## **Appendix A - EHMS Display Information**

### **Opening Criteria Display Text**

A reading with any defect, including cup, cone, roller, growler, multi, and unknown.

### **Autoclose Display Text**

6 consecutive reads with no defects.