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European Visual Inspection Catalogue (EVIC) for freight wagon axles

Sampling Programme Implementation Guide

Joint Sector Group for ERA Task Force on wagon/axle maintenance
Brussels, October 2010

1 – Introduction

After the tragic accident in Viareggio, the European Railway Agency, the European NSAs and the Joint Rail Freight Sector agreed to investigate in the frame of the ERA Task Force the possibilities for a European approach for harmonised criteria and immediate and mid-term measures ascertaining an even enhanced railway safety in an appropriate way, taking into account the expressed several requests for amendment.

The sector proposes a European programme for Visual Inspections (EVIC) of the axles related to the risk domain operated in. Axles sorted out are brought to heavy maintenance including non destructive tests (NDT).
Inspections are prioritized according to identified potential risk domains.

A sampling programme with more in-depth NDT investigation of axles taken from the risk domains will be performed in parallel to prove the EVIC approach and to clarify the assumption of the defined risk domains.

2 – Aim of the sampling

The EVIC can be considered as a reference manual for RUs and keepers providing the criteria to freight wagon maintenance staff to visually identify damages, during light maintenance in workshops. A wheel-set/axle which doesn't meet the EVIC-criteria will be discarded from service and undergo the heavy maintenance with non-destructive tests (NDTs).

Additionally, a sample of axles which fulfil the EVIC and a sample of them which do not fulfil the EVIC criteria will be inspected in a special monitored maintenance programme with NDT ("the sampling programme").

Comparisons of the NDT results of "EVIC failed" and "EVIC passed" axles will be performed. The results will be compared also to the results from heavy maintenance currently undertaken. According to the return of experience, the sector will propose appropriate measures to deal with identified risk areas.

3 – Description of the sampling methods

3.1 Generality

According to the risk assessment, the sector identifies 4 different risks domains:

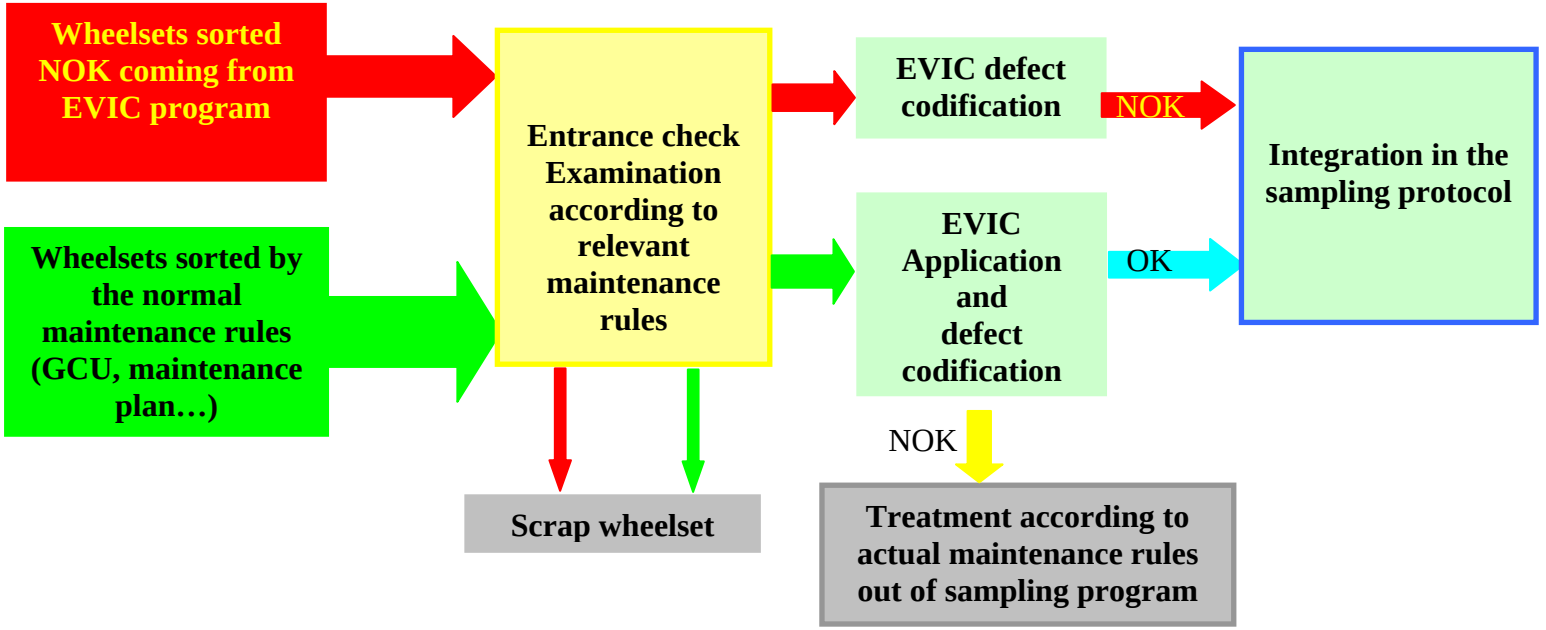
- corrosive conditions, vehicles transporting salt, potash, fertilizers ;
- high loading factor, wagon with 50% full loaded in service;
- impact due to drop loading, typical examples: scrap, clay, wood, coils, etc.;
- dangerous goods (RID).

Samples of axles from both states (1000 EVIC passed/ 1000 EVIC failed) taken from those 4 special traffics will be subject to each NDT system: manual UT, auto UT and MT as shown in the table below.

NDT system	Sampling theoretical	COR		High Loading		Drop Loading		RID	
		EVIC+	EVIC-	EVIC+	EVIC-	EVIC+	EVIC-	EVIC+	EVIC-
UT MAN	8000	1000	1000	1000	1000	1000	1000	1000	1000
UT auto	8000	1000	1000	1000	1000	1000	1000	1000	1000
MT	8000	1000	1000	1000	1000	1000	1000	1000	1000
Total	24 000	6000		6000		6000		6000	

3.2 Selection of the axles for the sampling programme

A possible way to select axles for the sampling programme (referred to activities in heavy maintenance) is described below.



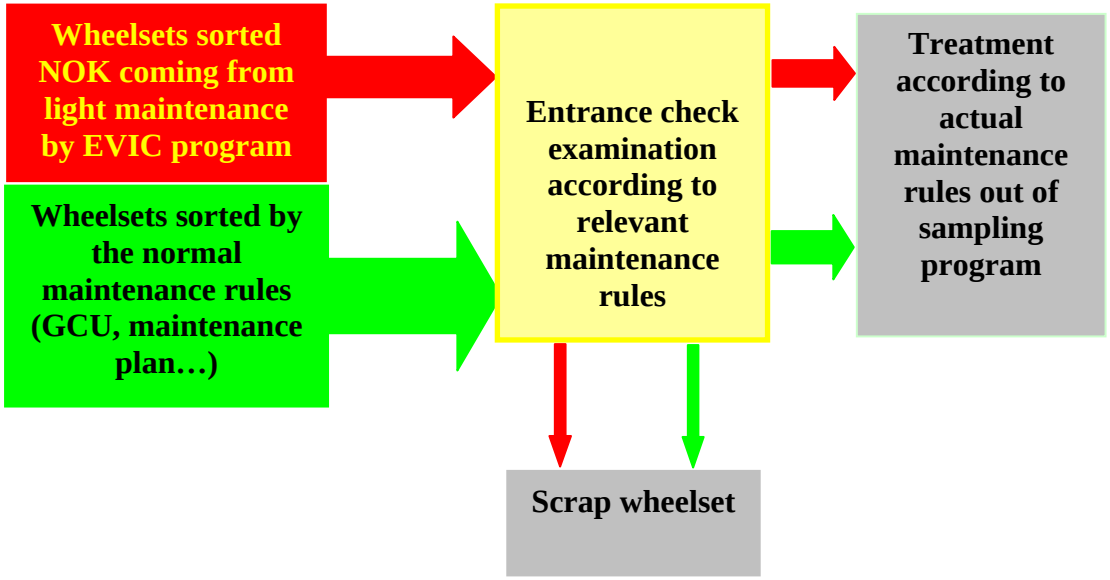
In light maintenance, only EVIC failed wheelset (red one) are removing from service, and then this is favourable for the sampling because these axles are sorted earlier than with the existing maintenance rules. EVIC passed wheelset stay under the vehicle; we cannot use them for the sampling. We can use if we accept to remove them from service but this will be increase the cost.

In the wheelset entering in heavy maintenance (green one), we can, by EVIC application, marked the EVIC OK wheelset (blue one). This is also favourable because these wheelset will be deposed by normal existing maintenance rules (the previous heavy maintenance is old or the mileage is important) and they are still in a good state.

The expertise according to the maintenance scheme allows eliminating non reparable wheelset (i.e. distort axles, wheel seat at the wear limit...) or to adapt the consistency of the repair (i.e. a wheelset come in for reprofiling but the size of the defect is too big so the wheel shall be replace).

This selection must be applied as far as the number of sampled axles is not equal to the target.

Once the number of sampled axles is equal to the target, the selection of the axles becomes:



3.3 Description of the sampling protocol

3.3.1. The different states of the sampling programme are described below

General information to be documented

The following information must be documented:

- workshop;
- wheelset type;
- wheelset number;
- risk domain: DG, HL, DL, COR;
- date, workshop and type of the last NDT.

For the following steps, the side of the axle must be clearly identified and remain the same during the whole process.

EVIC (cf. EVIC implementation guide)

The following information must be documented:

- EVIC result (category);
- Precise region where the EVIC defects occurred for later comparison to the NDT results (9 sections according to the picture showed in §7);
- Procedure for removing the coating (if needed).

NDT before treatment
The tests are realised according to the standard maintenance regime of the RU/Keepers, particularly the acceptance/failure criteria.

Tests are done with wheels mounted:
- MT on free surface, UT in wheel seat;
- Auto UT on the entire surface;
- Man UT; on the entire surface;

or with wheels dismounted (in MT system).

100% of the axle surface is checked.

The following information must be documented:
- NDT system apply at each section (Cf. § 3.3.2.);
- NDT detected failures section where failure occurred (9 sections according to the picture showed in §7);
- graphic detailing of the defect and the length as shown in §7;
- in case on automatic documentation of the NDT, the protocol must be kept.

Treatment
The following information must be documented: which procedure for surface correction (grinding, turning, depth, diameter, etc.).

NDT after treatment
The following information must be documented: type of NDT and NDT results after treatment (axle scraped or not).

3.3.2. NDT system parameters to be documented for the workshop concerning by the sampling programme (Cf. §9)

3.3.2.1 General

- Quality certification of the workshop
- Worker certification level
- Rejection criteria (length or depth and direction)
- NDT production average p/year
- Date of implementation of the process in the workshop

3.3.2.2 MT

- Surface preparation
- Magnetization technique, including (as appropriate) indicated current values, tangential field strengths, waveform, contact or pole, spacing, coil dimensions, etc.
- Detection media used, and contrast aid paint if used
- Application of detection media
- Viewing conditions
- Sensitivity

3.3.2.3 UT

- Surface preparation
- Technique:
    - Transmission
    - Pulse echo
- Probe
    - Single
    - Double (twin)
    - Separate (transmitter and receiver)

- Vibration mode
    - Longitudinal wave
    - Transverse wave
    - Lamb wave
    - Rayleigh wave

- Transducer
    - Frequency
    - Dimensions
    - Focusing probe

- Coupling media
  - Water
  - Contact paste
  - Oil
  - Grease
  - Cellulose paste

- Calibration blocks
- Reference blocks
- Sensitivity

3.4 Responsibilities of the person in charge of the sampling programme

The person in charge of the sampling programme per member will:

• organize the translation in the national language and the issuing of Sampling Programme Implementation Guide;

• manage all information of all concerned parties (workshops, etc.);

• collect the data for traceability and condense the collected information for the Joint Sector Group (see § 6).

4 – Programme

This is the decided programme for the beginning of the sampling

Member	Number of axles (total)	% of total	sampling theoretical	sampling decided	NDT System	COR	RID	High load	Drop load
PKP	*280 000*	*17%*	*4 065*	*4 000*	*UT man*	2000	0	1000	1000
SBB	*30 000*	*2%*	*436*	*600*	*UT man*	0	0	350	250
AAE	*40 000*	*2%*	*581*	*750*	*UT man*			50	700
SNCB	*60 000*	*4%*	*871*	*800*	*UT man*	0		400	400
HUPAC	*16 000*	*1%*	*232*	*300*	*UT man*		0	150	150
Total	**426 000**	**0**	**6 185**	**6 450**		**2 000**	**-**	**1 950**	**2 500**
DB SR D	*370 000*	*22%*	*5 372*	*5 000*	*UT auto*	3300	0	500	1200
TI	*115 000*	*7%*	*1 670*	*1 300*	*UT auto*	200		1100	
ÖBB	*60 000*	*4%*	*871*	*700*	*UT auto*			400	300
AAE	80 000	*5%*	*1 162*	*1 000*	*UT auto*			200	800
Total	**625 000**		**9 074**	**8 000**		**3 500**	**-**	**2 200**	**2 300**
UIP	*300 000*	*18%*	*4 356*	*6 000*	*MT*		6000		
SNCF	*291 000*	*18%*	*4 225*	*3 550*	*MT, UT man*	500		1850	1200
SLO	*11 000*	*1%*	*160*	*-*	*MT/ UT man*				
Total	**602 000**		**8 740**	**9 550**		**500**	**6 000**	**1 850**	**1 200**
Total	**1 653 000**		**24 000**	**24 000**		**6 000**	**6 000**	**6 000**	**6 000**

5 - Planning

The sampling will take place over a 12 month period after which an evaluation of the results and of the effectiveness of the campaign will be carried out to decide on the way forward. A preliminary evaluation of the results should be done after 6 months from the start of the campaign.

The campaign will start together with the EVIC programme (April 2010).
The status of the implementation will be reported in Task Force meeting.

6 – Recording the sampling programme

The results of the sampling programme must be recorded / traced.

The roles and TO DOs of the several parties involved are as follows:

6.1 - Workshops tasks

The workshops concerned by the sampling programme must:

- recorded the results of the sampling, in paper and/or in electronic file format, according to Traceability sheet shown §7;

- condense the results in electronic file according to the dedicated data sheet shown §8.1;

- send this file monthly to the person in charge of the sampling programme.

6.2 - Person in charge of the sampling programme tasks

The person in charge of the sampling programme must:

- collect the sampling monthly file from the workshops;

- summarize electronically the monthly results from all workshops according to the dedicated data sheet shown in §8.1;

- send this report monthly to the JSG.

6.3 - JSG tasks

- collect and summarize all the monthly report of the person in charge of the sampling programme;

- condense the results according to the presentation shown in §8.2.

7 – Traceability

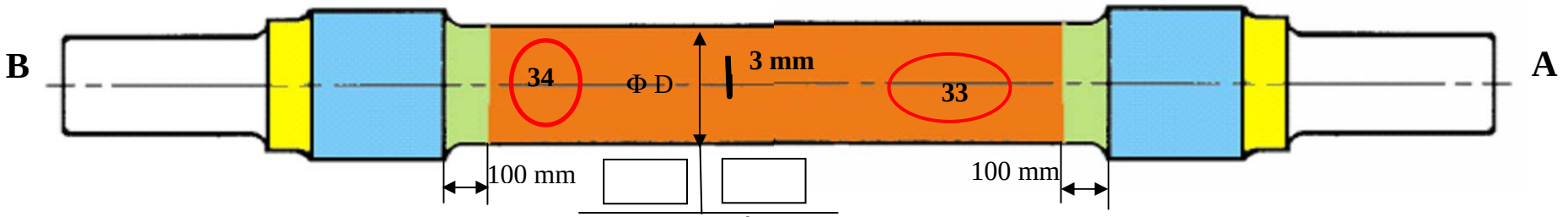
Workshop	Risk Domain	Wheelset type	Wheelset number	Date	Wheel dismounted	Bearing ring dismounted
TERGNIER	DG	9052	12345	24 / 02 / 2010	Yes / No	Yes / No

Previous axle maintenance with NDT

Date	Level	NDT System	Workshop				
15 /01/ 2001	COP	MT	Rennes				

EVIC APPLICATION

Zone	B journal	B abutment	B wheel seat	B transition radius (100 mm)	Shaft	A transition radius (100 mm)	A wheel seat	A abutment	A journal
EVIC defect category					33,34				
Roughness or UIC surface categories									



NDT before treatment

Zone / NDT System	B journal	B abutment	B wheel seat	B transition radius (100 mm length)	Shaft	A transition radius (100 mm length)	A wheel seat	A abutment	A journal
MT	No	No	No	No	Yes	No	No	No	No
Man UT									
Auto UT									
Eddy Current									
Defect in EVIC zone		Yes / No		Yes / No	Yes / No	Yes / No		Yes / No	

Treatment

Grinding the shaft central part 0,5 mm depth.

NDT after treatment

MT man ☐	UT auto ☐

Axle scraped for NDT reason	Yes / No
Axle scraped for other reason	Reason: ……..

User Manual for the completion of the data sheet

EVIC APPLICATION
Indicate for each zone the defect category number according to EVIC catalogue and if necessary marked on the axle drawing

NDT before treatment
Marked for each zone and in the relevant NDT system line if you have found a defect or not and marked the defect (form, direction and dimensions) on the axle drawing. (see example on drawing)

Treatment
Indicate which treatment has be done ie turning the shaft, or grinding locally or polishing locally

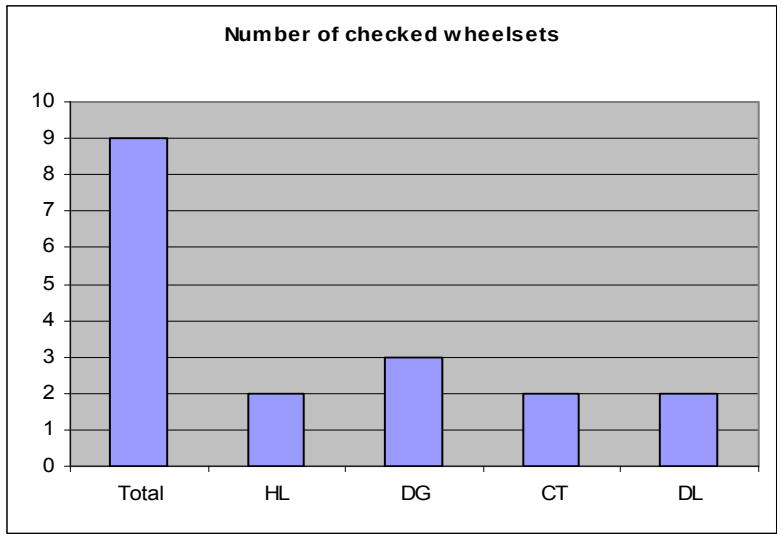
NDT after treatment
Marked a cross the used NDT system and if the axle is scraped or not.

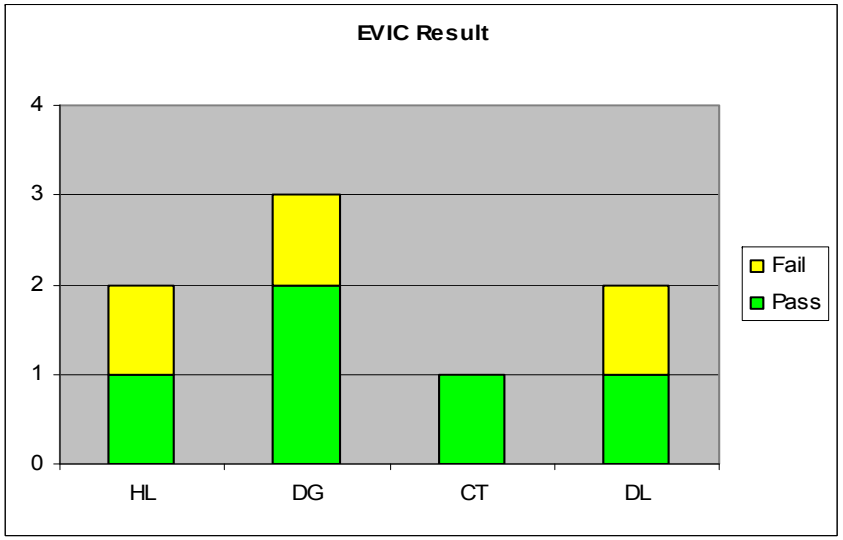
8 – Presentation of the results

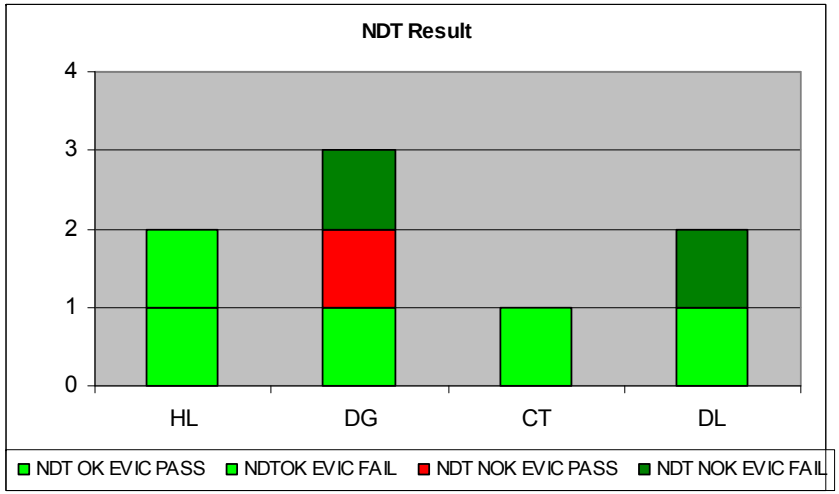
8.1 – Dedicated data sheet

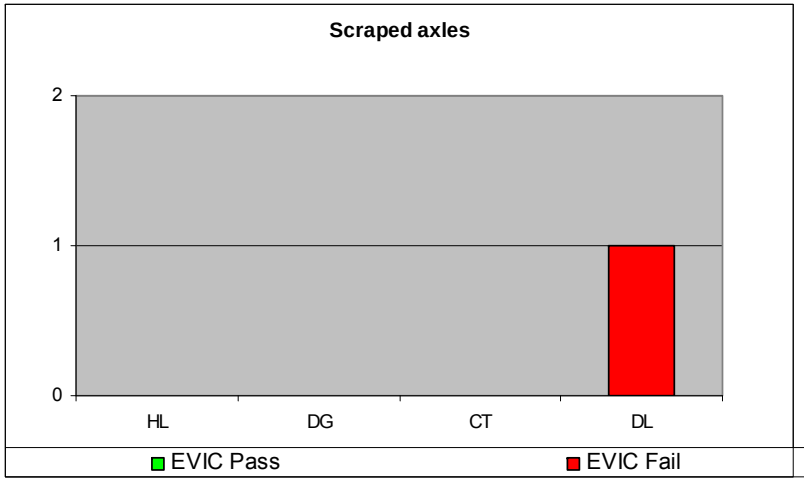
Original Wagon number if possible	Risk category	Wheelset number	Wheelset type	UIC Type	Axle judgement according normal maintenance rules	EVIC Result	NDT after EVIC and before treatment	NDT Defect in the EVIC zone	NDT after treatment
123456789012	High loading	1234	9052	AIII(2)	OK	OK	OK	No	OK
338089765432	Dangerous good	1235	9052	AIII(2)	OK	OK	NOK	No	OK
338089765433	Dangerous good	123	9052	AIII(2)	OK	NOK	NOK	No	OK
338089765434	Drop loading	12345	002	B	OK	OK	OK	Yes	OK
338089765435	High loading	865	9052	AIII(2)	OK	NOK	OK	Yes	OK
338089765436	Corrosive traffic	876	9056	No	OK	OK	OK	No	OK
338089765437	Drop loading	43	9052	AIII(2)	OK	NOK	NOK	No	NOK
338089765438	Corrosive traffic	12	9056	No	OK	C	NOK	No	NOK
338089765439	Dangerous good	456	9052	AIII(2)	OK	OK	OK	No	OK

8.2 – Example of presentation of the results









9 – Practical information

List of concerned wagons classes for the 4 risk domains, workshop(s) concerned by the sampling programme & Person in charge of the sampling programme

Members	Person in charge of the sampling programme	Workshop(s) concerned by the sampling	Wagon classes				
			Corrosive traffic	DG	High loading	Drop loading	Normal operation
PKP / IGTL	Ireneusz Gojski (IGTL)						
DB SR D	Michael Gerstner Michael.Gerstner@deutschebahn.com	Paderborn Eberswalde	Tamns x 886.0 Tamns x 893.1 Taoosy 894.0 Tanoos 896.0 Tanoos 896.1 Uaoos y 948.0 Tads 957.0 Tads y 957.1 Tads 958.0 Tads y 958.1 Talns x 968.1 Talns x 968.2 Talns x 968.6 Tds 930.0 Tds 932.0 Tds 934.0 Tds 937.0 Tds 938.0 Tds 940.0 Tds 941.0 Tds 942.0		Falns 121 Faals 151 Falrrs 152, 153 Fal(n)s 164, 165, 180, 182, 183	Falns 121, Faals 151Falrrs 152, 153 Fal(n)s 164, 165, 180, 182, 183 Fals 124, 128 Eaos 051, Eanos 052, Ealos 053, Eas 066, Eaos 075	
SNCB	Etienne Maenhout Etienne.maenhout@b-rail.be	AC Gentbrugge			Tads 1004 D1	Shimms	
ÖBB	Andreas Schachner Andreas.Schachner@oebb.at	TS Werk Knittelfeld			Falns	Shimmns	

Members	Person in charge of the sampling programme	Workshop(s) concerned by the sampling	Wagon classes				
			Corrosive traffic	DG	High loading	Drop loading	Normal operation
SBB	Thomas Bernet bernet.thomas@sbbcargo.com	SBB / FFS, IW Bellinzona			Fans-u, Shimmns, Shimms, (Snps), (Sps), Tagnpps, (Tgpps), Uacs, Ucs	Eanos, Eaos	
SNCF	Bernard Lafaix bernard.lafaix@sncf.fr	TC de Tergnier			S5*, T80, TADS	tombereau (E71, E79, E80) et grumier (R54, R55).	
UIP	Charles-Antoine Rivière	FERIFOS (ERMEWA) Brühl (VTG) ZntkOstroda (GATX)					
AAE	Johannes Nicolin Johannes.nicolin@aae.ch	TS Werk Knittelfeld for UT auto … for UT man					
HUPAC	Olga Wisniewska tech@cargorail.ch						
TI	Alessandro Corbizi A.corbizi@trenitalia.it	Osmannoro (FI)	Tadns		Falrrs(28) Sgns(34) Rhlmms		

NDT system parameters to be documented for the workshop concerning by the sampling programme

	SNCF	DB	SNCB	OBB	SBB	VPI	TI	PKP	AAE	HUPAC
General										
Quality certification of the workshop	ISO 9000 ISO 14000	ISO 9001/9002 ISO 14001	ISO 9001:2000	ISO9001	ISO 9000 ISO 14000 OHSAS 18001	ISO 9000 ISO 14000	ISO 9001			
Worker certification level	EN 473 N1 & N2	EN 473, DIN 27201-7 Level 1 a. 2	Internal training (similar to EN 473 N1 level)	EN 473 Level1 & 2	EN 473 MT 1 / 2	EN 473 MT 1 / 2 Prüfaufsicht level 2 / 3	EN 473 Lev.1, 2, 3			
Rejection criteria (length or depth and direction)	No indication (MT)	MT: length 2mm, transverse and diagonal, UT: depth 2mm, transverse	No crack allowed (MT)	2mm UT 3mm MT	2 mm cross direction	no linear indication	No indication (MT)			
NDT production average p/year	<TBD>	ca. 45000	10.000	~13500 UT ~13500 MT	~ 7000		UT _ 4000 MT _ 600			
Date of implementation of the process in the workshop	1970's	2001/2007	1970's	1996 MT 2005 UT	2005	2000	MT_1985 UT_(sixties)			

	SNCF	DB	SNCB	OBB	SBB	VPI	TI	PKP	AAE	HUPAC
MT										
Surface preparation	Blasting	blasting	Cleaning, brush	Brushing or turning	Blasting	Blasting	Grinding			
Magnetization technique	Rigid coil	rigid coil, current flow	Rigid coil	Coil	Rigid coil	Rigid coil	Rigid Coil			
Detection media	Fluorescent	fluorescent	fluorescent	Fluorescent	Fluorescent	Fluorescent	Fluorescent			
Application of detection media	Flow onto surface	spraying	spraying	Sprinkle on surface	Flow onto surface	Spray on surface, flow on surface (not often)	Flow onto surface			
Viewing conditions	EN ISO 9934	EN ISO 9934	EN ISO 9934		EN ISO 9934	EN ISO 9934	EN ISO 9934			
Sensitivity	0.1mm to 2mm depending on surface roughness	0,1mm	Depth ≥ 0.1 mm	<1mm	1mm to 1.5 mm depending on surface roughness	0.1mm possible, depending on surface	0.1mm to 2mm depending on surface			
	SNCF	**DB**	**SNCB**	**OBB**	**SBB**	**VPI**	**TI**	**PKP**	**AAE**	**HUPAC**
UT										
Surface preparation	blasting	blasting	Cleaning, brush	Brushing or turning	Blasting Grinding	Blasting Grinding (if surface must be improved)	cleaning on journal end surface			
Technique	Pulse echo	Pulse echo	Echo impulsion	Pulse echo	Impulse echo	Pulse with 2 -4 MHz	Pulse echo			
Probe	Double	Fased array	Single crystal, emitter and receiver	30 pcs.	single	single	Rotating			

	SNCF	DB	SNCB	OBB	SBB	VPI	TI	PKP	AAE	HUPAC
Vibration mode	Longitudinal wave from the end and transverse wave from surface	Transverse wave	Longitudinal and transversal waves	Longidudinal and transversal wave	Transverse wave from surface and Longitudinal wave if required	Longitudinal wave from the end and transverse wave from surface	Longitudinal wave from the journal end			
Transducer	<TBD>	<TBD>	Straight and angular / 2 to 4 MHz	2 MHz and 4 MHz	WB 45 – 2 WB 60 – 2 B 4 S or equal	must fulfil the requirements (e.g. WB 45-2, B 4 S)	3 transd. with ≠ angles			
Coupling media	Grease	Water	Mineral oil	Water	Ultragel II or equal	gel, grease	Oil			
Calibration blocks	Axle, bloc	Bloc (K1)	V1 block / ref. axle in AC-Salzinnes	Calibration bloc K1, K2	Axle, bloc	K1 (EN 12223)	Axle bloc			
Reference blocks	Bloc AFNOR B type	Axle	V1 block	Reference axle	K 1, K 2	VPIL 04, Annex 27	/			
Sensitivity	< 2 mm	2mm	2 mm	<2mm	< 1 mm	< 2 mm (roughly, depending on surface)	< 3 mm			