

# Conversion of existing railway source data to use CNOSSOS-EU

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## The **health** impact

- **65% of Europeans living in major urban areas are exposed to high noise levels above 55dB Lden and 50dB Lnight, and more than 20% to night time noise levels linked to frequent adverse health effects**

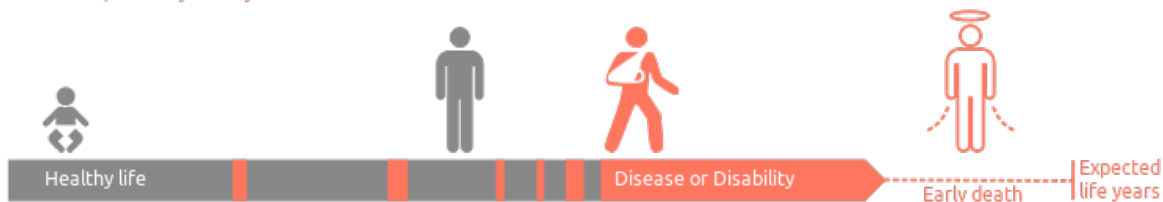


### DALY

**Disability Adjusted Life Years** is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

$$= \text{YLD} + \text{YLL}$$

Years Lived with Disability      Years of Life Lost



- **1-2 Million Disability Adjusted Life Years (DALY)**
- **30-50.000 premature deaths**



## *Implementation and the REFIT*



- **Directive 2002/49/EC:** achieve a common European approach to avoid, prevent or reduce the effects of exposure to environmental noise harmful for health
  - **Actions:** noise mapping + action planning in 5-year cycles
  - **Excludes:** limit values + prescribed measures

The health  
impact

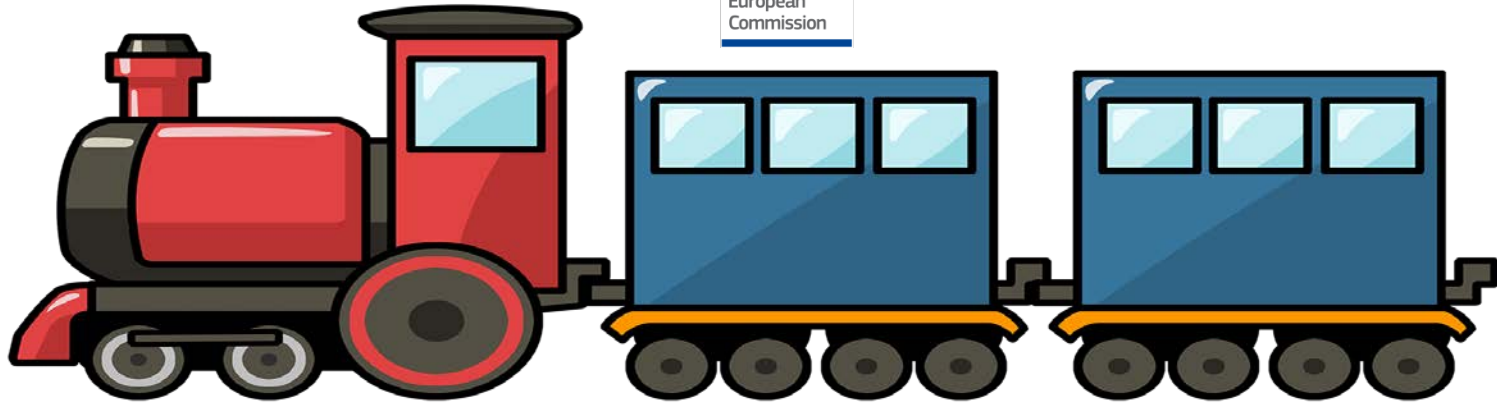
The costs

The situation in  
the EU

The 7th EAP

Implementation  
and the REFIT

Summary



- New Annex II (CNOSSOS-EU) adopted by the Commission after agreement of EU Parliament and EU Council (Commission Directive (EU) 2015/996)
- Addresses methodology to calculate railway noise in the EU
- Contains a baseline set of **input values**
- Contains requirements concerning **accuracy** of the input values
- Requires **additional data** gathering/conversion

# Features (1/2)

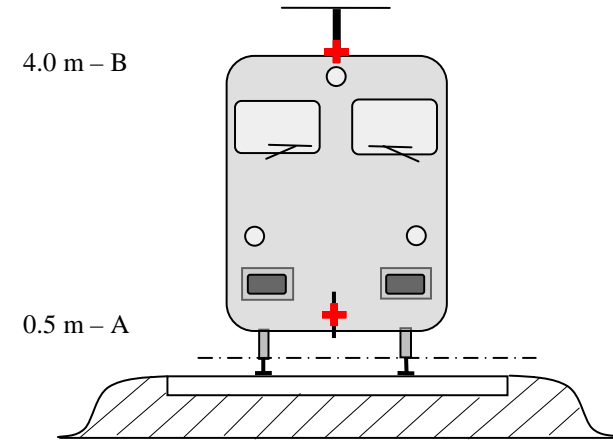
*2 source heights*

*Railway vehicles described in function of:*

- Vehicle type
- Axles/vehicle
- Brake type
- Wheel measure

*Track described in function of:*

- Type of track base
- Roughness
- Rail pad
- Additional measure
- Joints
- Curvature



# Features (2/2)

$L_{r,TR,i}$  and  $L_{r,VEH,i}$  for rail and wheel roughness

$A_{3,i}$  for the contact filter

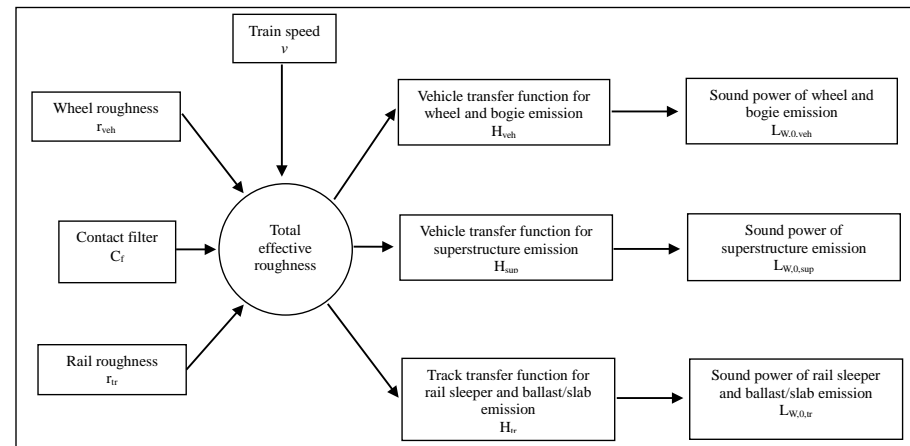
$L_{H,TR,i}$   $L_{H,VEH,i}$  and  $L_{H,VEH,SUP,i}$  for transfer functions

$L_{R,IMPACT,i}$  for impact noise

$L_{W,0,idling}$  for traction noise

$L_{W,0,1}$ ,  $L_{W,0,2}$ ,  $a_1$ ,  $a_2$  for aerodynamic noise

Squeal noise



# The vehicles

# Classification of vehicles

Digit	1	2	3	4
Descriptor	Vehicle type	Number of axles per vehicle	Brake type	Wheel measure
Explanation of the descriptor	A letter that describes the type	The actual number of axles	A letter that describes the brake type	A letter that describes the noise reduction measure type
Possible descriptors	<b>h</b> high speed vehicle (>200 km/h)	<b>1</b>	<b>c</b> cast-iron block	<b>n</b> no measure
	<b>m</b> self-propelled passenger coaches	<b>2</b>	<b>k</b> composite or sinter metal block	<b>d</b> dampers
	<b>p</b> hauled passenger coaches	<b>3</b>	<b>n</b> non-tread braked, like disc, drum, magnetic	<b>s</b> screens
	<b>c</b> city tram or light metro self-propelled and non-self-propelled coach	<b>4</b>		<b>o</b> other
	<b>d</b> diesel loco	etc.		
	<b>e</b> electric loco			
	<b>a</b> any generic freight vehicle			
	<b>o</b> other (i.e. maintenance vehicles etc.)			



**Question:**  
**how do I convert my existing  
database of trains?**

# Vehicle conversion of existing databases

- *Split trains or vehicles (as defined in national methods)*
  - > *into single vehicles*
- *Assess wheel size*
- *Braking system in use*
  - > *cast-iron tread brakes, composite tread brakes or disc brakes*
  - > *assumed roughness*
- *The only excluded are vehicles with wheel dampers*
- *Diesel Multiple Unit, Electric Multiple Unit and Electric Locomotive*
  - > *traction noise*
- *Depending on max speed*
  - > *Aerodynamic noise*

# Example: vehicle conversion

RMR Train Cat		CNOSSOS ID					
		Veh TF	Contact filter	Wheel roughness	Traction noise*	Default length m	Axles/ vehicle
Cat 1	All	3	6	3	10	26	4
Cat 2	ICM-III, ICR trailer vehicles, DDM-1 trailer vehicles, SNCF passenger coaches and TEE	3	6	3	10	26	4
	ICR 1700 locomotive, DDM-1 1800 locomotive and Belgian locomotives	6	6	3	9	18	4
Cat 3	All	3	6	5	10	26	4
Cat 4	Freight wagons	3	6	3	-	Variable	Variable
Cat 5	DE1, DE2, DE3	3	6	3	8	25	4
	2200 and 2300 locomotive	3	6	3	3	14	4
	2400 and 2500 locomotive	3	6	3	3	13	4
Cat 6	All	3	6	5	8	26	4
Cat 7	All	3	6	5	10	15	3
Cat 8	ICM IV and IRM	3	6	5	10	26	4
	DDM 2/3	3	6	3	10	26	4
Cat 9	TGV PBA type, power car	3	6	3	9	20	4
	TGV PBA type, trailer car adjacent to power car	3	6	5	-	20	3
	TGV PBA type other trailer cars	3	6	5	-	20	2
Cat 10	ICE-3 type assuming no wheel dampers	3	6	5	10	25	4
					*Where appropriate		

# The tracks

# Classification of tracks

Digit	1	2	3	4	5	6
Descriptor	Track base	Railhead Roughness	Rail pad type	Additional measures	Rail joints	Curvature
Explanation of the descriptor	Type of track base	Indicator for roughness	Represents an indication of the 'acoustic' stiffness	A letter describing acoustic device	Presence of joints and spacing	Indicate the radius of curvature in m
Codes allowed	<b>B</b> Ballast	<b>E</b> Well maintained and very smooth	<b>S</b> Soft (150-250 MN/m)	<b>N</b> None	<b>N</b> None	<b>N</b> Straight track
	<b>S</b> Slab track	<b>M</b> Normally maintained	<b>M</b> Medium (250 to 800 MN/m)	<b>D</b> Rail damper	<b>S</b> Single joint or switch	<b>L</b> Low (1000-500 m)
	<b>L</b> Ballasted bridge	<b>N</b> Not well maintained	<b>H</b> Stiff (800-1000 MN/m)	<b>B</b> Low barrier	<b>D</b> Two joints or switches per 100 m	<b>M</b> Medium (Less than 500 m and more than 300 m)
	<b>N</b> Non ballasted bridge	<b>B</b> Not maintained and bad condition		<b>A</b> Absorber plate on slab track	<b>M</b> More than two joints or switches per 100 m	<b>H</b> High (Less than 300 m)
	<b>T</b> Embedded track			<b>E</b> Embedded rail		
	<b>O</b> Other			<b>O</b> Other		

**Question:**  
**how do I convert my existing  
database of tracks?**

# Track conversion of existing databases

➤ *rail roughness*

*very few cases of definition of this parameter in EU, most likely assumed and not explicitly mentioned in calculation methods*

➤ *track base & rail pad type*

*Where track types are described in national methods it has been possible to choose an appropriate equivalent CNOSSOS type in a selection of cases.*

# Example: track conversion

RMR Track Cat "b"		Track Transfer ID
1	Monoblock	4
	Bi-block	7
2	Wooden	9
3	See impact correction table below for jointed track	
4	"Blocks" - not catered for in CNOSSOS - would require additional source data acquisition	
5	"Blocks" - not catered for in CNOSSOS - would require additional source data acquisition	
6	"Adjustable rail fixation" - not catered for in CNOSSOS - would require additional source data acquisition	
7	"Adjustable rail fixation" - not catered for in CNOSSOS - would require additional source data acquisition	
8	"Poured in" not catered for in CNOSSOS - would require additional source data acquisition	
9	"Level crossings" not catered for in CNOSSOS - would require additional source data acquisition	

RMR Joints "m"		Impact noise ID	RMR Structure		Bridge constant ID
1	Jointless rails (fully welded tracks) with or without jointless switches or crossings	1		TT & U-type bridge - predominantly concrete or masonry	3
2	Rails with joints ( = tracks with joints) or an isolated switch	3		TT & U-type bridge - predominantly steel	4
3	Switches and crossings with joints, 2 per 100m	3		Plate & girder bridge	4
4	More than 2 switches per 100m	2		Steel deck bridge	4



## Cnossos\_EU 2

*Common method shall be*

- ***Consistent*** and capable to provide ***comparable*** results
- To produce plausible maps with ***plausible*** results
- The burden should be balanced against the impact
- Only essential parameters, i.e. causing variations of more than  $\pm 2$  dB(A) at 95% confidence interval

# Cnossos-EU

*Specified in new Annex II to 2002/49/EC*

*“accuracy of input values:*

*All input values affecting the noise emission of a source shall be determined with at least the accuracy corresponding to an uncertainty of  $\pm 2$  dB(A) in the emission level of the source (all other parameters left unchanged)”*

# Cnossos-EU

*“Use of default values*

*...the input data shall reflect the actual usage. In general there shall be no reliance on default values or assumptions. Default input values and assumptions are accepted if the collection of real data is associated with disproportionately high costs.”*

# Conclusions

- As an interim initial approach, look-up tables are provided to convert existing national methods.
- This facilitates the initial move towards the new Annex II
- National appropriate conversion tables (eventually automatically convert existing models) might be developed in the coming years

# Questions?