

NOISE OF EXPANSION JOINT : HOW TO CHARACTERIZE IT?

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12 APRIL 2016
STERREBEEK



DIRECTION GÉNÉRALE OPÉRATIONNELLE
DES ROUTES ET DES BÂTIMENTS

1. WHAT'S THE PROBLEM?

- **From 2013 and even before**
 - Several complaints
 - Change of joints
 - **Tests with method**
 - **Analyse of results**
 - **How to deal with this approach?**
- **Question ?**
 - How to characterize this incremental noise?
- **Evolution**
 - Ways to investigate?
 - **Internal research**
 - **Master thesis**
 - **External study**



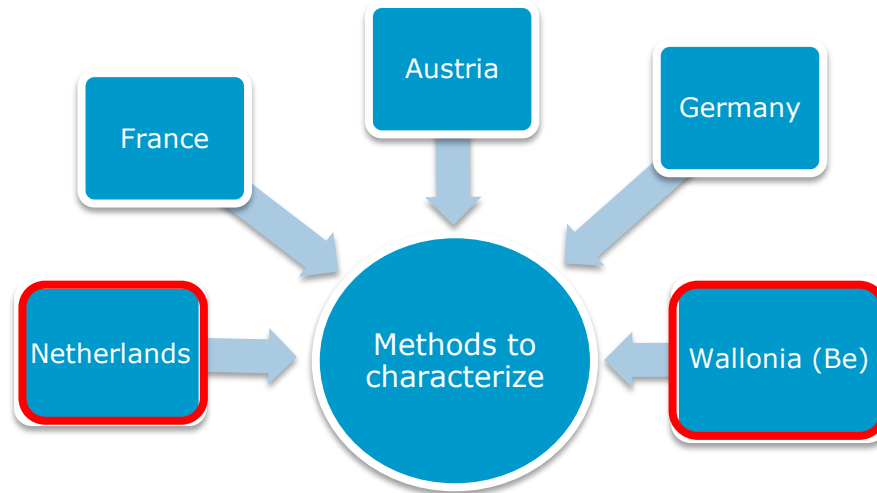
2. RESEARCH 1 (2014-2015)

- **Aim of thesis**

- Existing Methods in Europe
 - **Comparison with method used in Wallonia**
- Analyse
- Apply to a test case
- Critical analysis
 - **Results**
 - **Methods**
- What next?



- **Existing methods in Europe**



- Analyse
 - **Possibility to use them?**
- Choice
 - **Netherlands (RTD 1007-3)**
 - **Wallonia (Method usually use till 2014)**

- **Method used in Wallonia**

- Aims of method:

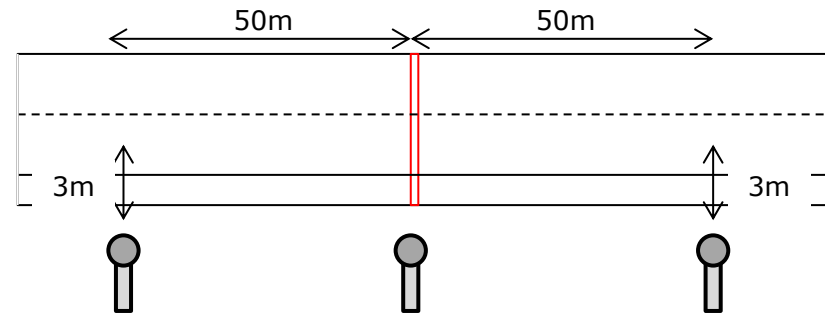
- **Limit incremental noise coming from joint**

- Max +5dB(A) pour les joints Cantilever
 - Max +8dB(A) pour les joints à hiatus



- Method

- **3 sound level meters**



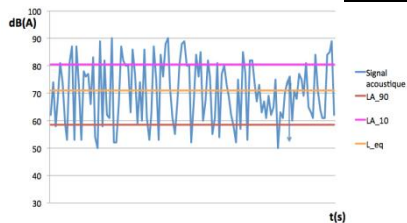
Height : 1.3m

- **Parameter**

- » $L_{A,eq}$

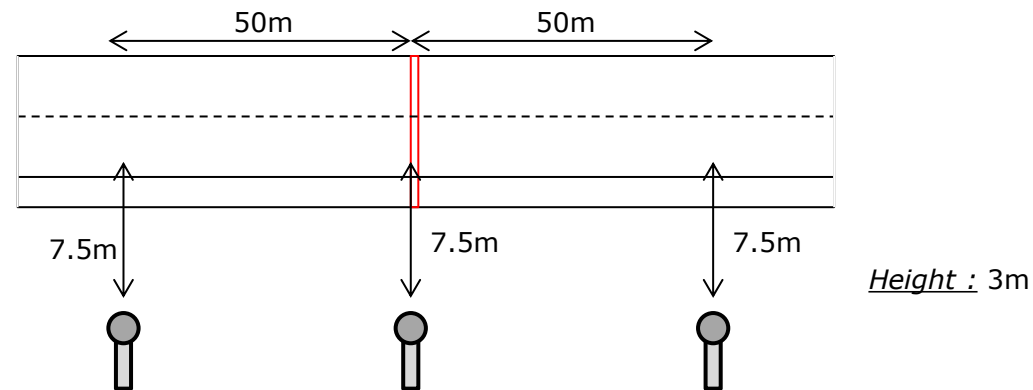
- **Conditions :**

- Fluid and steady traffic flow (L_{A10} , L_{Aeq} and L_{A90} contained in interval of 10 dB)
 - Constant speed (120 km/h) for at least 1 our
 - Min 10 datasets



- **RTD 1007-3 (Netherlands)**

- Based on "Statistical Pass-By Method" (SPB)
- Determination of : $L_{A,max}$
 - **Over the expansion joint**
 - **Over the road surface**
 - 50m → both side of joint



- Comparison of results

$$L_{A,max, joint} - L_{A,max,road surface} < 5dB(A)$$

- **RTD 1007-3 « modified »**

- Problem

- **Distance sound meter and middle of lane**

- Proposal of study

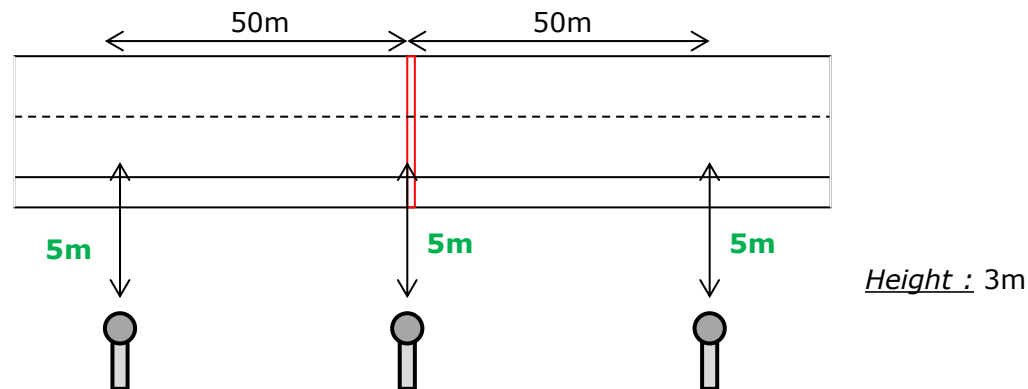
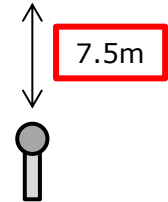
- **Modify distance**

- 5m from middle of the lane

- **Use theoretical law (hemispheric sound propagation law)**

- Calculate value at 7.5m

- Use RTD 1007-3



- **Comparison and conclusions**

- Method used in Wallonia

- **All results**

- Always invalid conditions of measurements
 - $L_{A,eq}$ unrepresentative of incremental noise

- **No reference for defined limits**

- RTD 1007-3 and RTD 1007-3 modified

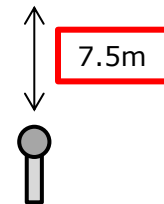
- **Method ISO (SPB)**

- **Characterize expansion joint in its environment**

- **Existed references**

- **Problem**

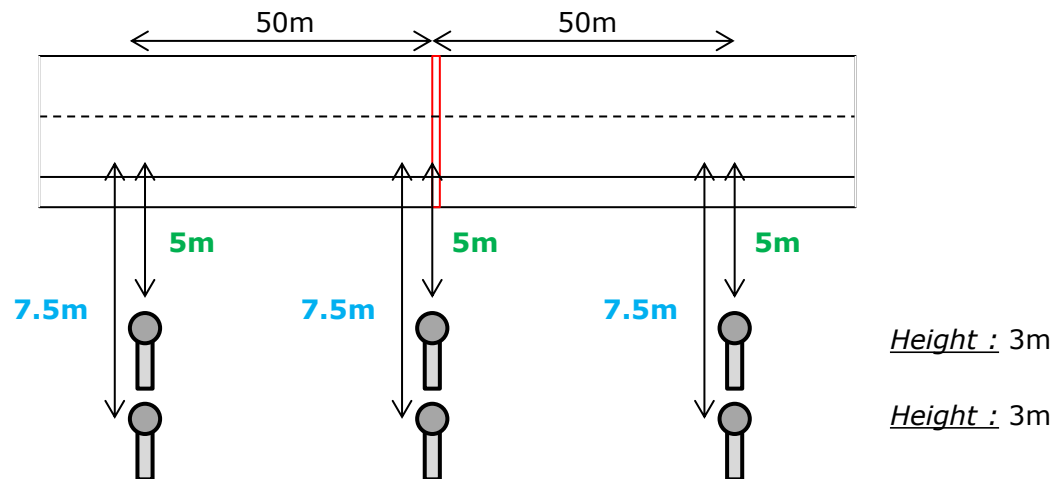
- Distance sound meter and middle of lane
 - Test : 5m from middle of lane
 - » Interesting results



3. RESEARCH 2 (2015-2016)

- **Aim of thesis**

- Based on conclusions of Research 1
- Enlarge test “RTD 1007-3 modified”
- Apply method to different expansion joints
- Repeatability of method ?



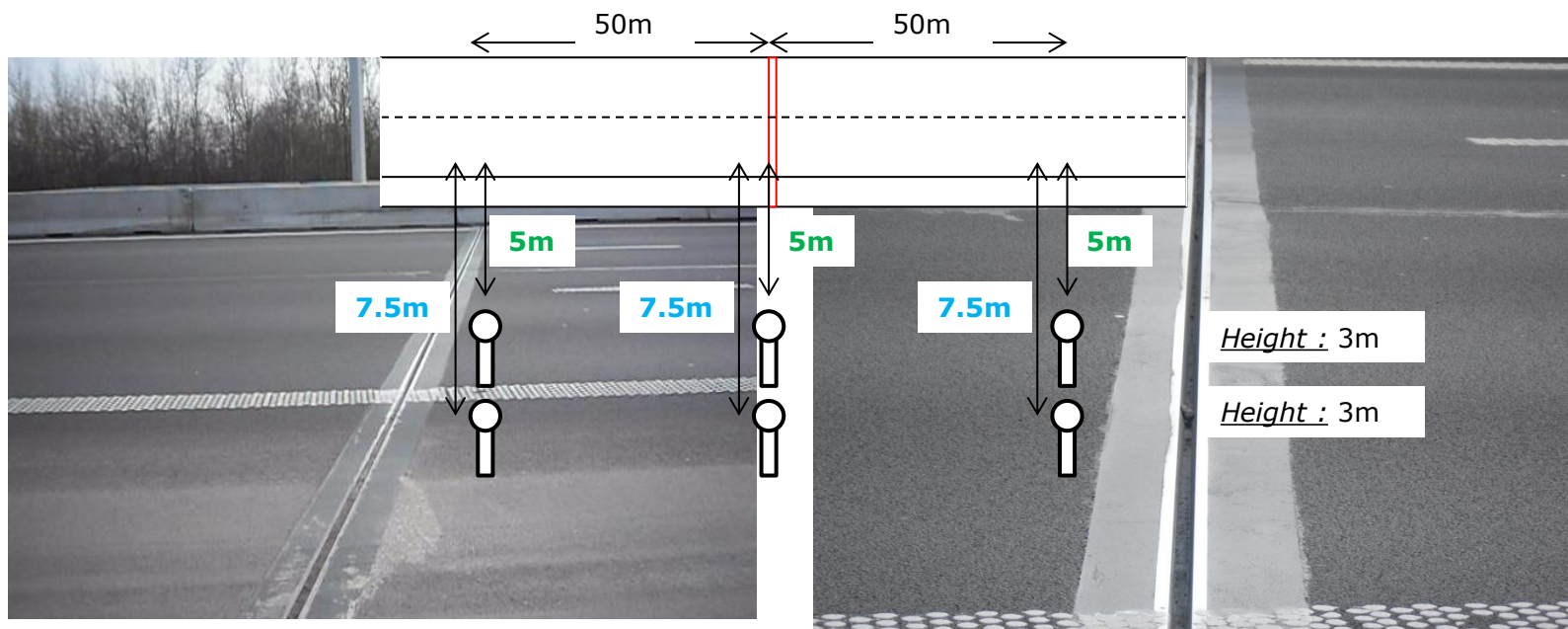
- **Expansion Joint 1 : Villers-le-Bouillet (Liège)**

- In both directions
 - **2 x 3 lanes**
 - **2 expansion joints**
 - **Replaced in 2013**
 - **New road surface (SMA)**



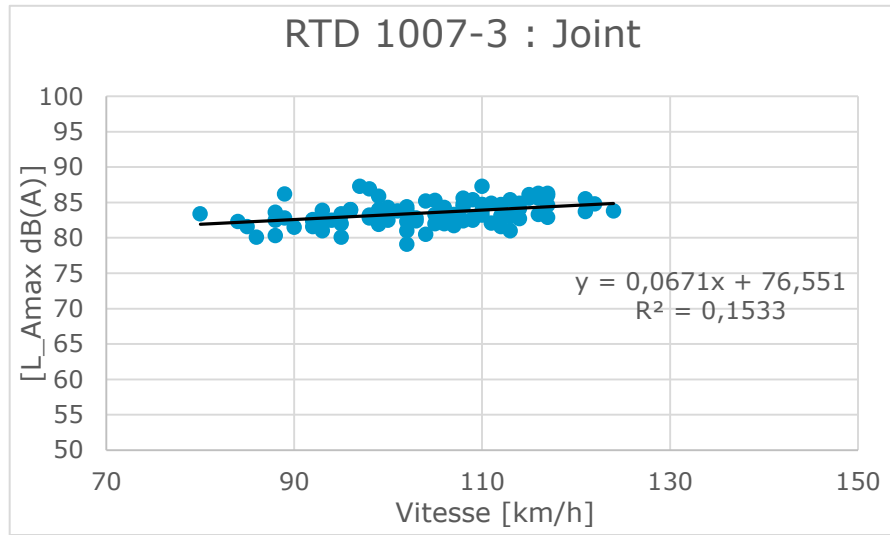
– Results

- **Direction : Liège**
- **Simple joint in resin**



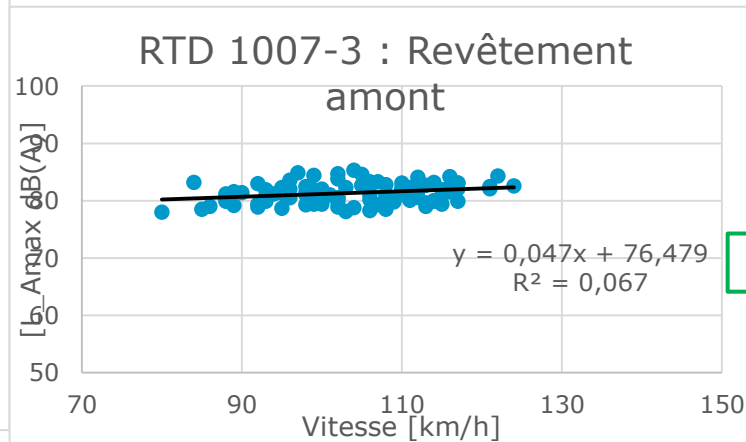
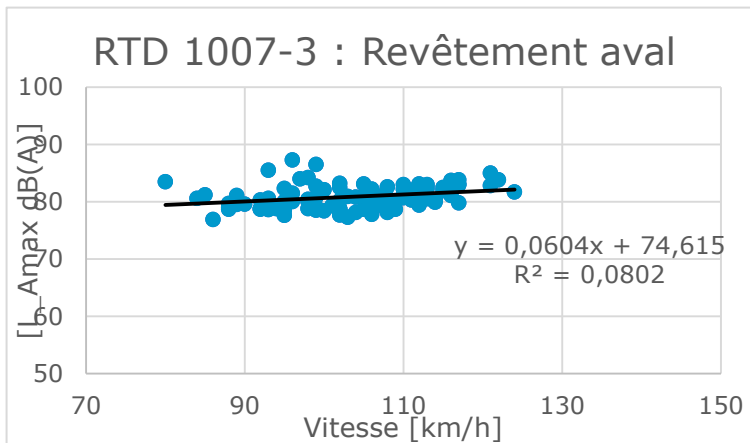
- **Results « RTD 1007-3 »**

- Expansion joint



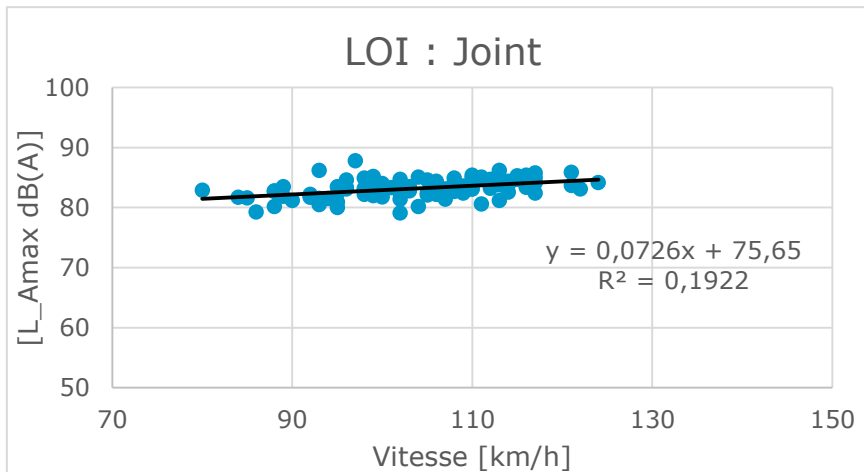
$L_{A, \max, \text{joint}} = 84.6 \text{ dB(A)}$

- Road surface



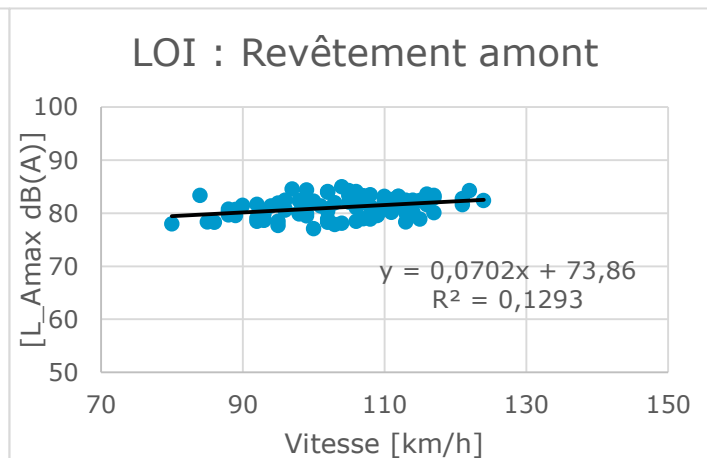
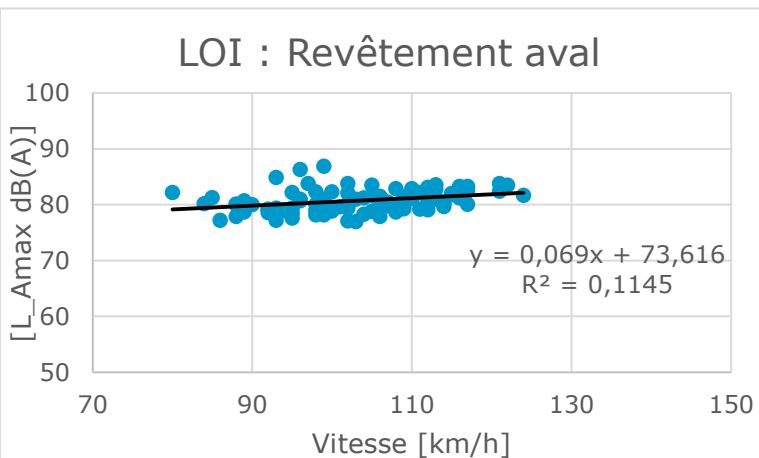
$L_{A, \max, \text{surf}} = 81.99 \text{ dB(A)}$

- **Results « RTD 1007-3 modified »**
 - Expansion joint



$$L_{A, \max, \text{joint}} = 84.36 \text{ dB(A)}$$

- Road surface



$$L_{A, \max, \text{joint}} = 82.09 \text{ dB(A)}$$

- **Comparison**

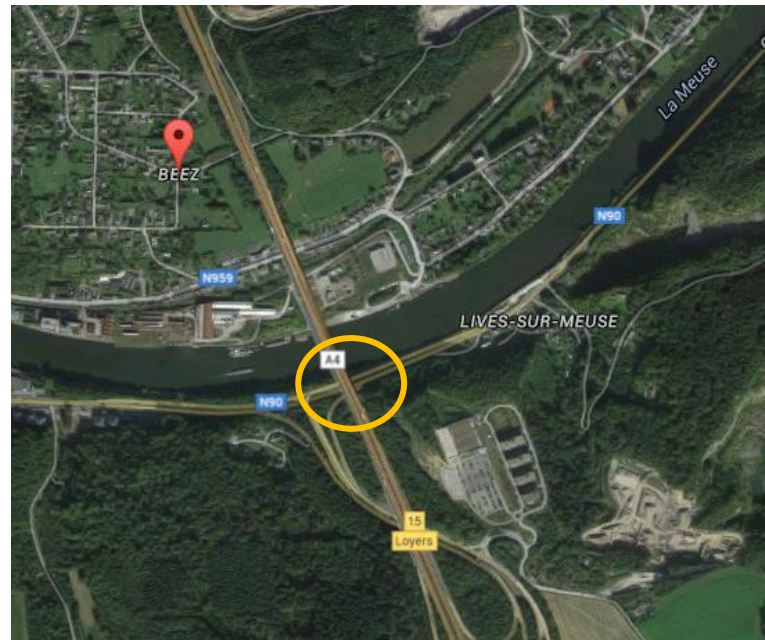
	<i>RTD 1007-3</i>	<i>RTD 1077-3 modified</i>
Joint	84.6	84.36
Road surface	81.99	82.09

- Incremental sound = 5dB(A)

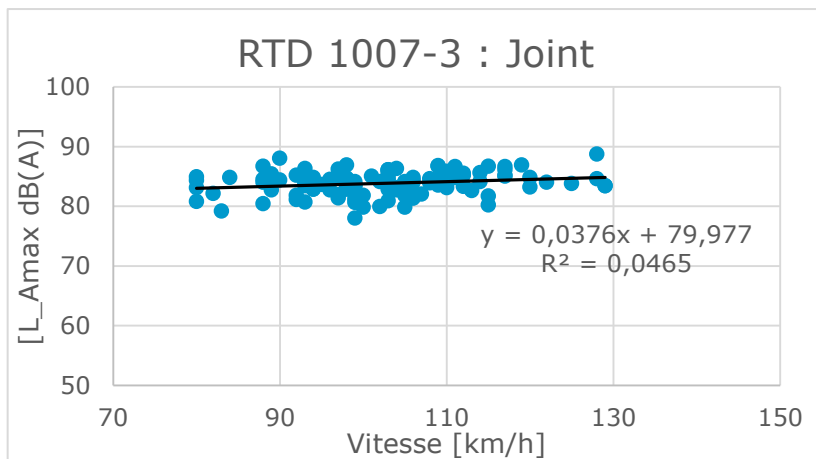
<i>RTD 1007-3</i>	<i>RTD 1077-3 modified</i>
2.61	2.27

- **Expansion Joint 2 : Beez (Namur)**

- In both directions
 - **2 x 3 lanes**
 - **Low Noise Modular joints**
 - **Replaced in 2013**

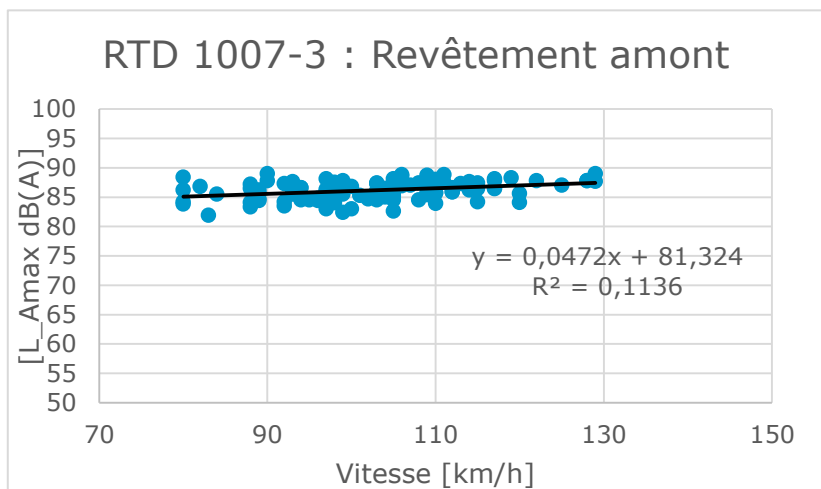


- **Results « RTD 1007-3 »**
 - Expansion joint



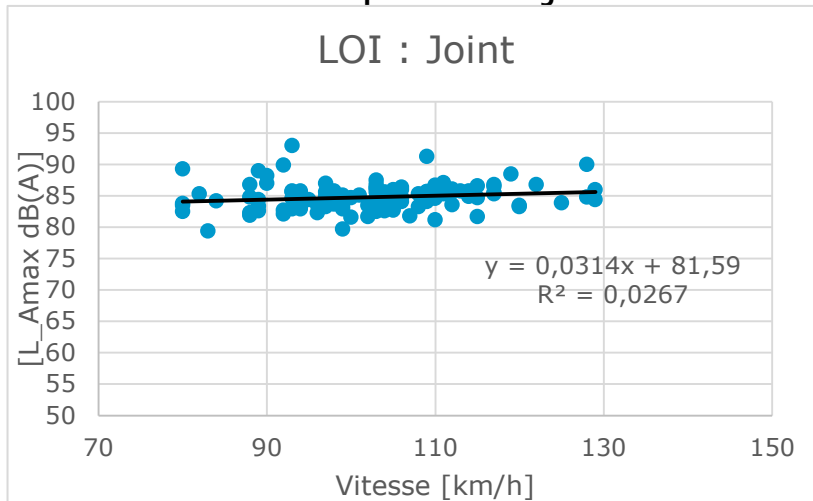
$$L_{A, \max, \text{joint}} = 84.49 \text{ dB(A)}$$

- Road surface



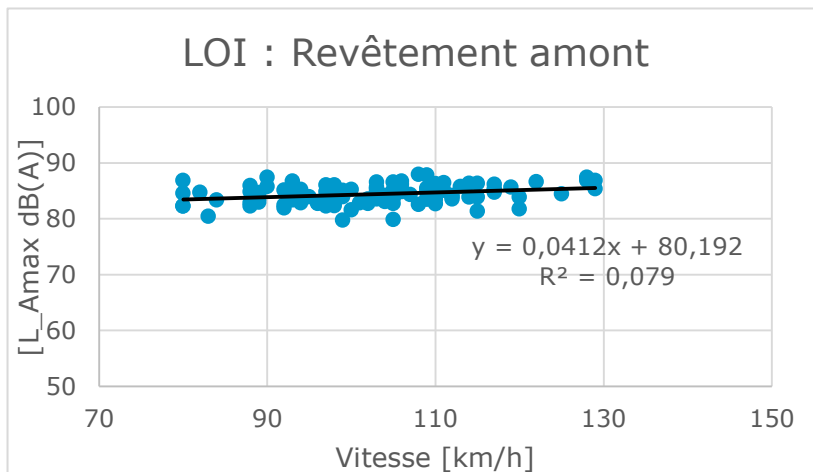
$$L_{A, \max, \text{surf}} = 86.99 \text{ dB(A)}$$

- **Results « RTD 1007-3 modified »**
 - Expansion joint



$$L_{A, \max, \text{joint}} = 85.36 \text{ dB(A)}$$

- Road surface



$$L_{A, \max, \text{surf}} = 85.14 \text{ dB(A)}$$

- **Comparison**

	<i>RTD 1007-3</i>	<i>RTD 1077-3 modified</i>
Joint	84.49	85.36
Road surface	86.99	85.14

- Incremental sound = 5dB(A)

<i>RTD 1007-3</i>	<i>RTD 1077-3 modified</i>
-2.50	0.22

• All results

		RTD 1007-3 L_Amax [dB(A)]	LOI L_Amax [dB(A)]
Villers vers Namur côté Liège 3/12/2015	Joint :	83.81	83.37
	Revêtement :	81.87	81.04
	Emergence	1.94	2.33
Villers vers Namur côté Namur 3/12/2015	Joint :	84.21	83.31
	Revêtement :	81.74	80.91
	Emergence	2.47	2.40
Villers vers Liège côté Namur 24/02/2016	Joint :	84.45	84.93
	Revêtement :	81.71	81.91
	Emergence	2.74	3.02
6/04/2016	Joint :	-	84.43
	Revêtement :	82.47	80.92
	Emergence	-	3.51
6/04/2016	Joint :	-	83.76
	Revêtement :	81.70	80.49
	Emergence	-	3.26
6/04/2016	Joint :	-	84.34
	Revêtement :	82.31	80.90
	Emergence	-	3.44
Villers vers Liège côté Liège 24/02/2016	Joint :	84.60	84.36
	Revêtement :	81.99	82.09
	Emergence	2.61	2.27
6/04/2016	Joint :	-	85.34
	Revêtement :	81.97	80.60
	Emergence	-	4.74
6/04/2016	Joint :	-	85.75
	Revêtement :	82.55	81.10
	Emergence	-	4.65

Andenne vers Liège côté Namur 25/02/2016	Joint :	85.03	-
	Revêtement :	83.20	82.91
	Emergence	1.83	-
Andenne vers Liège côté Liège 25/02/2016	Joint :	85.61	-
	Revêtement :	83.68	83.32
	Emergence	1.93	-
Beez 25/02/2016	Joint :	84.49	85.36
	Revêtement :	86.99	85.14
	Emergence	-2.50	0.22
25/02/2016	Joint :	83.93	85.22
	Revêtement :	88.29	85.45
	Emergence	-4.36	-0.23
Aywaille vers Luxembourg 7/04/2016	Joint :	87.88	87.50
	Revêtement :	84.17	83.49
	Emergence	3.71	4.00
7/04/2016	Joint :	87.88	-
	Revêtement :	84.17	83.67
	Emergence	3.71	-



4. CONCLUSIONS

- **And now ?**
 - Research 3 needed ?
 - **Other tests ?**
 - **Other type of joints ?**
 - Requirements in QUALIROUTES
 - **Increase quality of joint**
 - **Enough experience?**
 - Way chosen good?

To be continued ...



THANKS FOR YOUR ATTENTION

QUESTIONS ?



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