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DEUFRABASE : Une base de données Franco-Allemande pour l'acoustique des revêtements routiers

M. Bérengier, J. Picaut, A. Béguère, N. Fortin, M.A. Pallas
IFSTTAR – AME – LAE



Cerema DTerNC – Rouen – 11 & 12 mai 2017



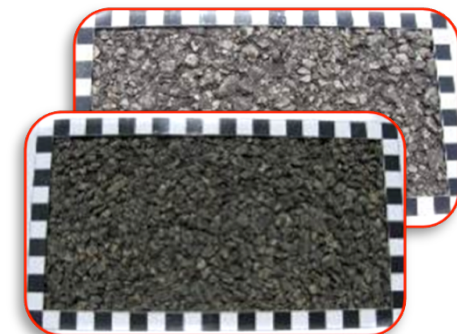
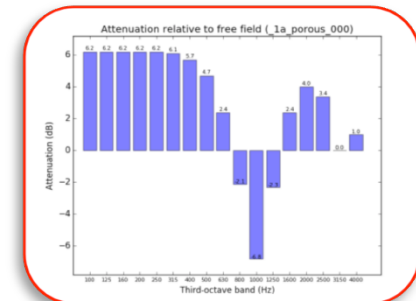
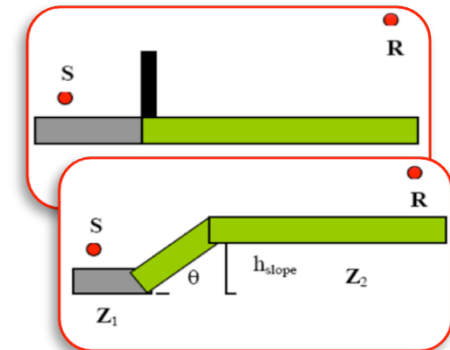
Contexte

- Elaborée dans le cadre de deux projets **PREDIT – DEUFRAKO (P2RN et ODSURF)**
- Financement **ADEME**
- Pilotage de la **BASt (Projet P2RN – Version 1)**
- Pilotage par l'**Ifsttar – LAE (Projet ODSURF – Version 2)**



Historique de la DEUFRABASE (1)

- Première version (Projet P2RN)
 - Détermination des géométries des cas d'étude
 - Calcul des atténuations en propagation par des modèles adaptés (analytiques, PE, BEM)
 - Choix des revêtements
 - Choix des trafics
 - Mise en libre service sur un site hébergé par la BAST



Historique de la DEUFRABASE (2)

- Mise à jour de la base (Projet ODSURF)
 - Refonte de la structure de la base
 - Possibilité d'extension à moindre coût à de nouvelles configurations de calcul et de nouveaux indicateurs
 - Validation
 - En accès libre sur un site hébergé par l'Ifsttar



DEUFRABASE – Version 2

- Présentation de la structure
- Détails des onglets
- Démarches de validation
- Calcul et résultats

<http://deufrabase.ifsttar.fr/>



Présentation de la DEUFRABASE – Version 2



Principe du calcul des niveaux sonores

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METHODOLOGY

PRINCIPLE

NOISE LEVEL CALCULATION

INPUT PARAMETERS

CASE STUDIES

VALIDATION

Noise level calculation

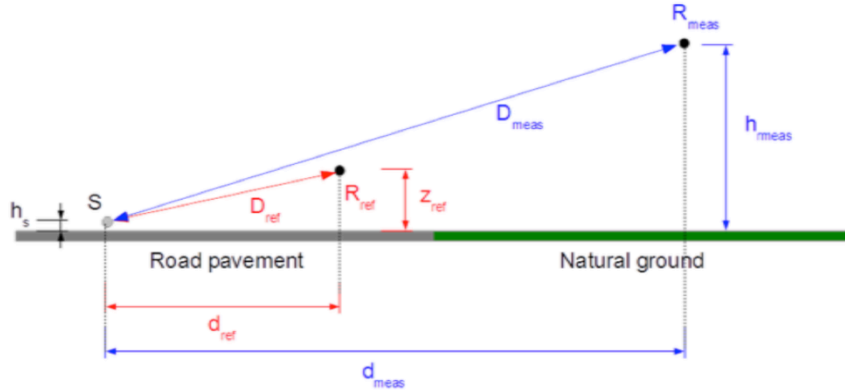


Diagram illustrating the noise level calculation principle. The diagram shows a source S at height h_s on a road pavement. A reference receiver R_{ref} is located at a distance d_{ref} from the source and at a height z_{ref} above the road pavement. A measured receiver R_{meas} is located at a distance d_{meas} from the source and at a height h_{meas} above the natural ground. The ground profile transitions from road pavement to natural ground.

Equivalent sound level at a reference receiver R_{ref}

From the measured $L_{A,max}$, the equivalent sound level $L_{A,eq}[T]$ for the reference period T can be obtained from the general equation [BÉRENGIER, 1999]:

$$L_{A,eq}[T](R_{ref}) = L_{A,max}(V_{ref}) + 10 \log_{10} \left(\frac{\pi D_{ref}}{V_{ref} \times T} \right)$$

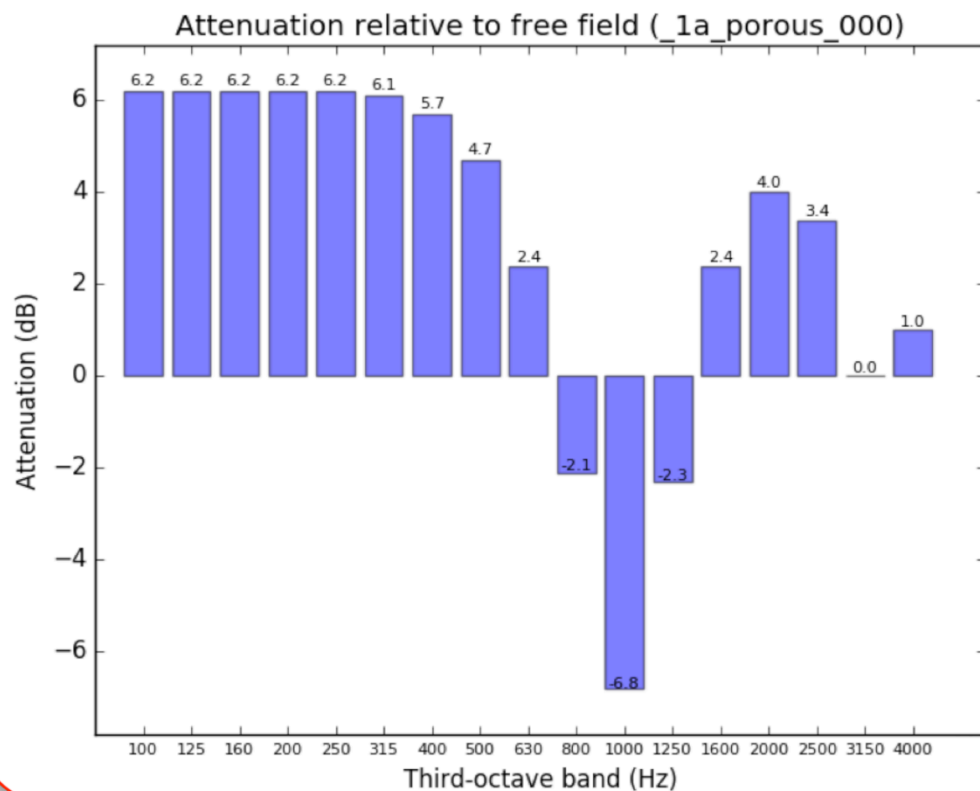
Paramètres d'entrée (1)

- Impédance des sols (chaussée et environnement proche)
- Gradient vertical vitesse du son
- Pente
- Ecran anti bruit
- Position de la source et du récepteur

Other ressources

Environmental Acoustics Laboratory
 I-Simpa: a room acoustics software
 Noise-Planet.org: ressources for enviro
 measurement and modelling

- Noise barrier:
 - No barrier;
 - Barrier of height $h_{\text{barrier}}=2$ m at $d(S,\text{screen})=4$ m from the source S ;
- Source and receiver positions:
 - The height of the source S is $h_S=0.05$ m for all configurations;
 - Depending on the configuration, the height of the receiver R is $h_R=1.2$ m, 2 m or 3 m;
 - The distance between the source and the receiver is $d(S,R)=7.5$ m, 40 m, 50 m and 200 m, depending on the road



Paramètres d'entrée (2)

- Spectres des L_{Amax} 1/3 octave (VL : 90 et 110 km/h ; PL : 80 km/h)

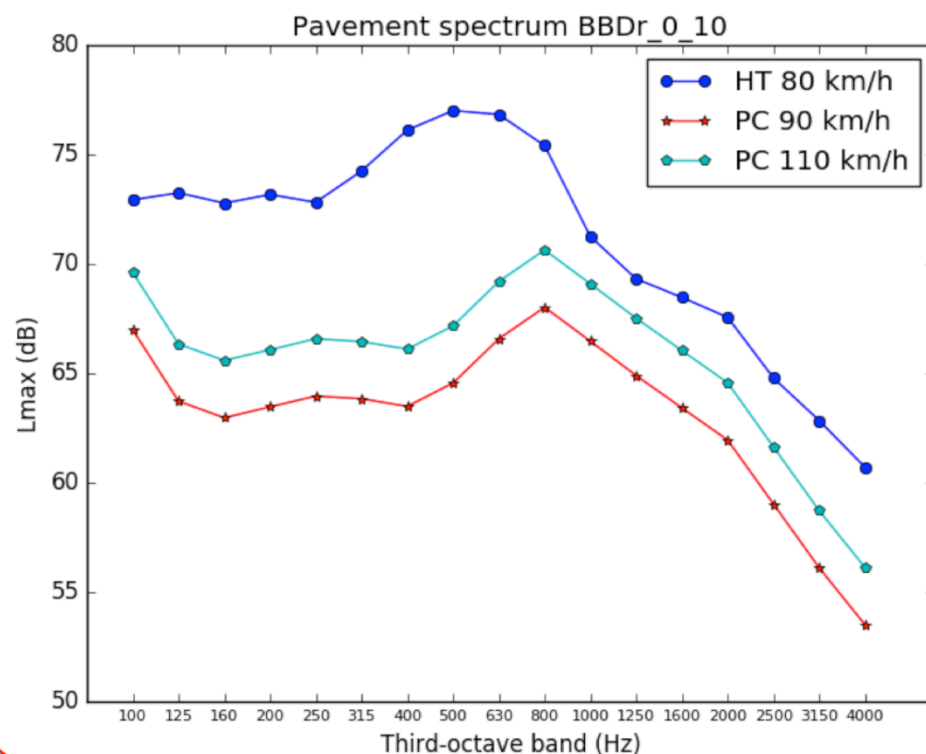
PRINCIPLE
NOISE LEVEL CALCULATION
INPUT PARAMETERS
ROAD GEOMETRIES
PAVEMENT DATA
TRAFFIC DATA
CASE STUDIES
VALIDATION

General considerations

The DEUFRABASE uses, by default, porous and dense [French and German road pavements](#). However, users have the possibility to upload data concerning their [own road pavements](#).

Note that, in the DEUFRABASE, if you choose a road geometry with a dense ground (respectively, a porous ground), you will be able to select des

For e
ri



User road pavement data

Users can use their own road pavement data, for both the PC ('pc' in the filename) and the HT ('ht' in the filename), by uploading two

for static/images/spectrum/spektrum_BBDr_0_14.png

Paramètres d'entrée (3)

DEUFRABASE

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METHODOLOGY

PRINCIPLE

NOISE LEVEL CALCULATION

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VALIDATION

Traffic data

General considerations

$L_{A,eq,1h}$ calculation:

- The calculation of the $L_{A,eq,1h}$ needs the traffic data (HT) on a 1h-period.

$L_{A,eq,24h}$ (and L_{den}) calculation:

- The $L_{A,eq,24h}$ calculation needs the traffic data every hour of the day.
- In order to be as representative as possible, the traffic data should be based on Friday.
- Within the DEUFRABASE, a mean between the German and French traffic data.

For both calculations, one needs to consider:

- Two representative road situations at a case, a safety lane of 2m width is considered.
- By default, the distribution of vehicle (VPD), following this rule:

Number of lanes	PC distribution
(2 x 1)	VPL = 100%
(2 x 2)	Slow lane: 50% Fast lane: 50%

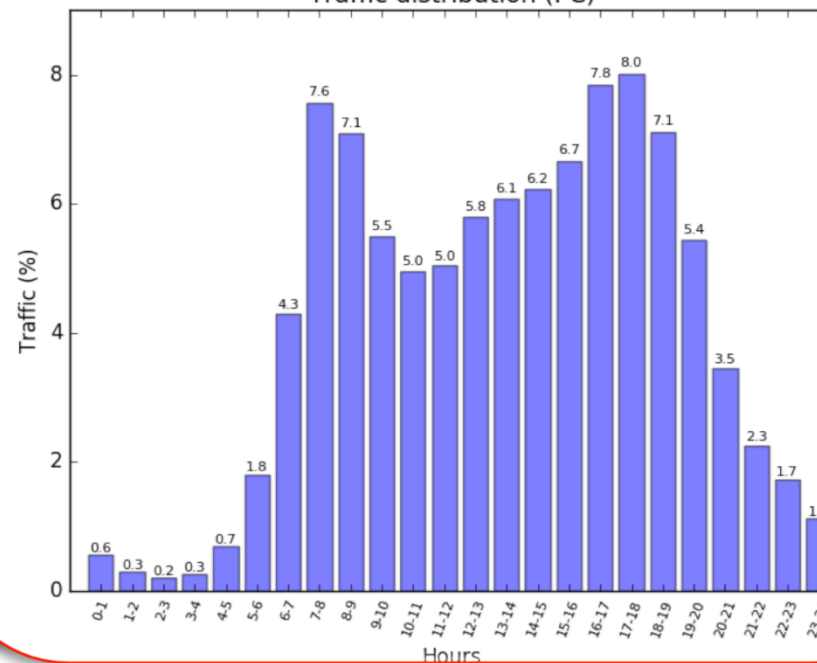
deufraKO

(2 x 1) lanes

Important remarks:

- For the $L_{A,eq,1h}$ calculation, the traffic data are applied for a 1h-period.
- For the $L_{A,eq,24h}$ (and L_{den}) calculation, the traffic data are applied over the 24h-period of the day. In this case, the daily percentage volumes of traffic (PC and HT) are defined as the mean values of the German and French volume of traffic, for PC and HT respectively. The mean traffic for Germany is the mean value based on nine different motorway counting points. The mean traffic for France is based on twenty seven counting points around the Ifsttar test tracks (at Nantes). Figures below show the traffic distribution (PC).

Traffic distribution (PC)



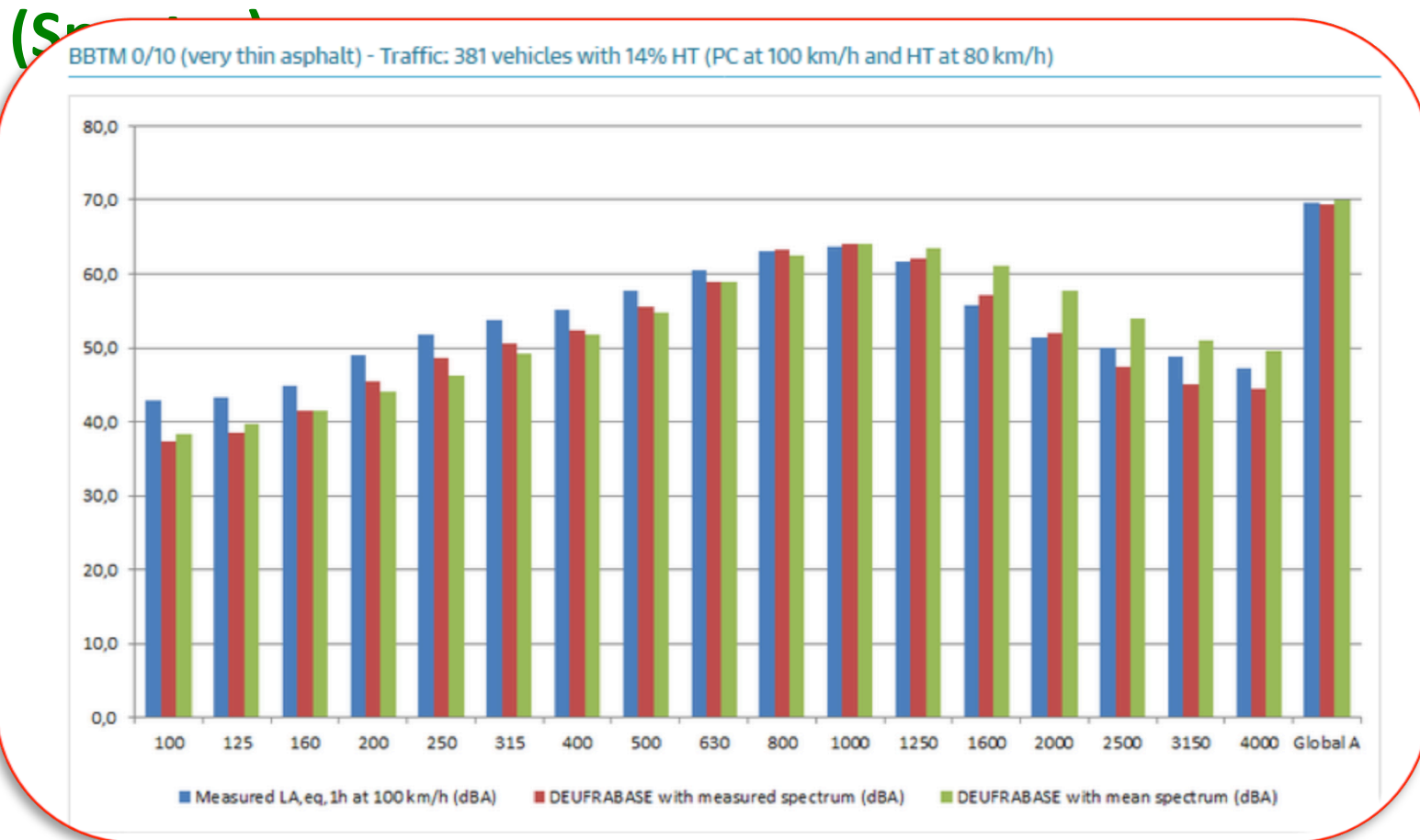
- Pourcentages horaires moyens VL et PL basés sur une sélection de voies rapides françaises et allemandes

Possibilité de calculs complémentaires

- Calcul du L_{den} en tenant compte des conditions de propagation différentes entre la journée et la nuit
- Identification du L_{Amax} à partir du calcul du $L_{Aeq}(1h)$
- Calcul d'un correctif de vitesse

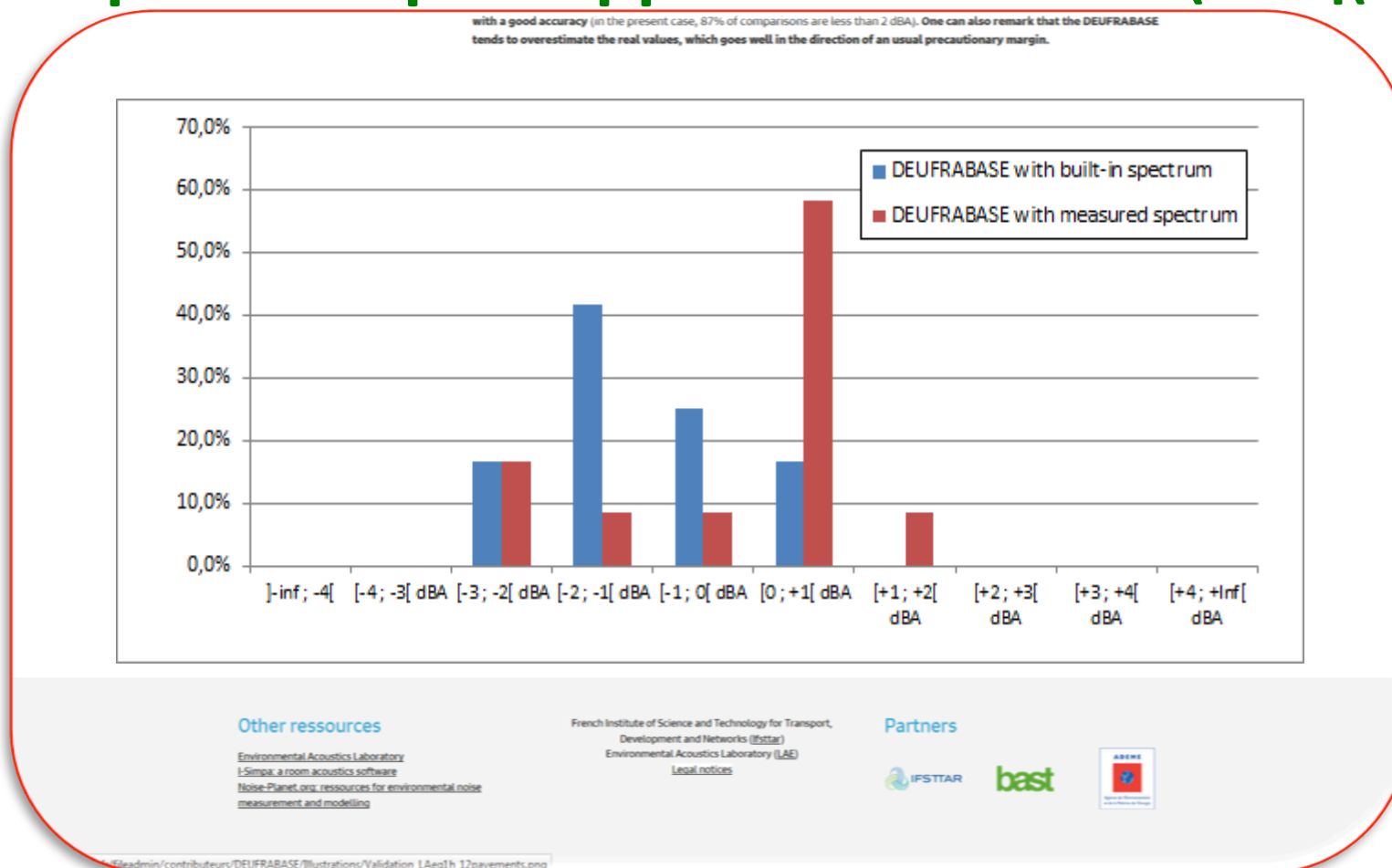
Validation de la méthode (1)

- Comparaison par rapport à la mesure



Validation de la méthode (2)

- Comparaison par rapport à la mesure (LAeq(1h))



Lancement du calcul (1)

- Choix de la géométrie et des conditions de propagation



Lancement du calcul (2)

- Choix du revêtement

DEUFRABASE v2.0-beta-4-gb3fdcd4

Geometry << Pavement >> Traffic Results Restart

Please choose one or more pavements:

☐ BBDr 0/10	☐ BBTM 0/14	☐ ES 10/14	☐ SMA 0/8 LA
☐ BBDr 0/14	☐ BBTM 0/6 type 1	☐ ES 6/10	☐ SMA 0/8 S
☐ BBDr 0/6	☐ BBTM 0/6 type 2	☐ GA 0/5	☐ WB 0/5
☒ BBM 0/10	☐ BBTM 0/8 type 1	☐ GA 0/5 LA	☐ WB 0/8
☐ BBSG 0/10	☐ BBUM 0/10	☐ OPA 0/8	☐ ZBJT
☐ BBSG 0/14	☐ BBUM 0/6	☐ SMA 0/11	☐ ZBJT 0/16 Kamm
☐ BBTM 0/10 type 1	☐ BC	☐ SMA 0/11 S	☐ ZBKR 0/16
☐ BBTM 0/10 type 2	☐ ECF	☐ SMA 0/5 LA	☐ ZWOPA 0/8

Or check "My own pavement spectrum" to upload your own pavement spectrum:

☐ My own pavement spectrum
Be sure that the choosen geometry is compatible with the pavement (for example a 'porous' pavement with a 'porous' geometry)

[Get Templates](#)

Please upload the passenger cars spectrum:

Aucun fichier sélectionné.

Please upload the heavy trucks spectrum:

Aucun fichier sélectionné.

Your selection:

Geometry selected:

- 1d_dense_025

Lancement du calcul (3)

- Choix du trafic

DEUFRABASE v2.0-beta-4-gb3fcd4

Define general traffic data:

☒  1 lane per direction

☐  2 lanes per direction

Please select personal car speed:
90 km/h

Please select calculation type:
☐ LAeq,1h
☒ LAeq,24h and Lden

Define traffic distribution:

Number of vehicles per direction:
2000

Heavy trucks percentage (speed is fixed to 80 km/h by default):
10 %

☐ Check to use your own traffic data (for LAeq,24h and Lden only)

[Get Templates](#)

Please upload the passenger cars traffic data:
 Aucun fichier sélectionné.

Please upload the heavy trucks traffic data:
 Aucun fichier sélectionné.

Your selection:

Geometry selected:
• 1d_dense_025

Pavement(s) selected:
• BBM_0_10

Présentation des résultats (1)

- LAeq (1h)



Présentation des résultats (2)

- LAeq(24h) et Lden



Extraction des données

Category	BBDr_0_10	BBDr_0_14	BBDr_0_6	BBTM_0_10_type_2	BBTM_0_6_type_2	OPA_0_8
0-1	45,00	47,10	43,80	44,90	43,00	46,00
1-2	44,20	46,10	42,90	44,10	42,10	44,70
2-3	44,20	46,10	42,90	44,20	42,20	44,50
3-4	45,30	47,20	44,00	45,30	43,40	45,60
4-5	47,50	49,40	46,20	47,40	45,50	48,10
5-6	50,00	52,10	48,80	49,90	48,00	51,00
6-7	52,60	54,70	51,30	52,40	50,50	53,90
7-8	54,40	56,60	53,20	54,20	52,30	56,00
8-9	54,40	56,50	53,10	54,20	52,30	55,90
9-10	54,10	56,20	52,80	54,00	52,00	55,30
10-11	53,90	56,00	52,70	53,80	51,90	55,10
11-12	54,00	56,10	52,70	53,90	51,90	55,10
12-13	53,80	55,90	52,50	53,60	51,70	55,20
13-14	53,90	56,00	52,60	53,70	51,80	55,30
14-15	54,20	56,30	52,90	54,00	52,10	55,50
15-16	54,30	56,40	53,00	54,10	52,10	55,70
16-17	54,40	56,60	53,20	54,30	52,30	56,00
17-18	54,00	56,30	52,80	53,80	51,90	55,80
18-19	53,30	55,60	52,10	53,10	51,10	55,20
19-20	52,20	54,50	51,00	52,00	50,00	54,10
20-21	50,60	52,80	49,40	50,40	48,40	52,30
21-22	49,00	51,20	47,80	48,80	46,90	50,60
22-23	47,80	50,00	46,60	47,60	45,70	49,40
23-24	46,40	48,50	45,10	46,20	44,30	47,90
Lden	55,60	57,70	54,30	55,40	53,50	56,90

Perspectives

- **Version 3 de la DEUFRABASE**
 - Amélioration de son ergonomie
 - Large diffusion via internet

Contacts :

michel.berengier@ifsttar.fr

judicael.picaut@ifsttar.fr

nicolas.fortin@ifsttar.fr

Lien :

<http://deufrabase.ifsttar.fr>

Merci de votre attention

Ifsttar

Centre de Nantes

Route de Bouaye, CS 4

44344 Bouguenais Cedex - France

Tél. +33 (0)2 40 84 03 68

Fax. +33 (0)2 40 84 59 92

www.ifsttar.fr

michel.berengier@ifsttar.fr