



Belgisch **Wegen**congres Congrès belge de la **Route**

LEUVEN · 4-7.04.2022

TSD and RAPTOR – high speed deflection and prospects in asset management



Historical devices



Deflectograph Flash

Benkelman beam

FWD

Curviameter



Focus on TSD (GREENWOOD 1/2)



Overall dimensions : 14,95 (14,40) x 2,55 m

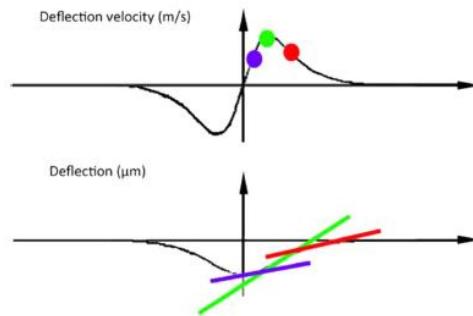
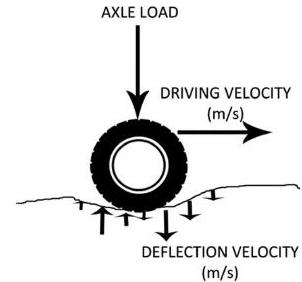
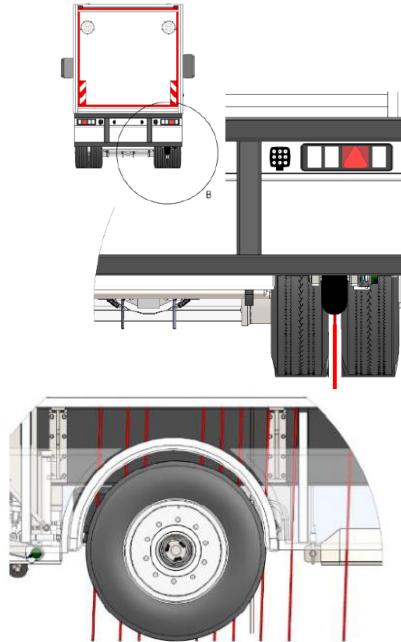
Up to 10 tons load – single axle with dual wheels

Based on Doppler velocimetry

Measures the vertical acceleration of the pavement under the load



Focus on TSD (GREENWOOD 2/2)



TSDs on a global scale



The TSD family



TSD 1: Danish Road Directorate
Denmark



TSD 2: Highways Agencies
United Kingdom



TSD 3: ANAS
Italy



TSD 4: IBDIM
Poland



TSD 5: SANRAL
South Africa



TSD 6: RIOH
China



TSD 7: Greenwood Engineering
Denmark



TSD 8: ARRB
Australia



TSD 9: ARRB
United States of America



TSD 10: VNA
South Africa



TSD 11: Shanghai Municipality
China



TSD 12: ARRB
Australia



TSD 14: BAST
Germany



TSD 15: Wuppertal
Germany



TSD 16: Highways England
United Kingdom

Focus on RAPTOR (Dynatest/Ramboll 1/2)



Overall dimensions : 13 x 2,50 m

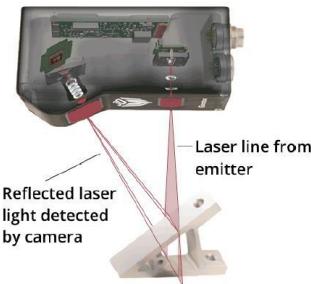
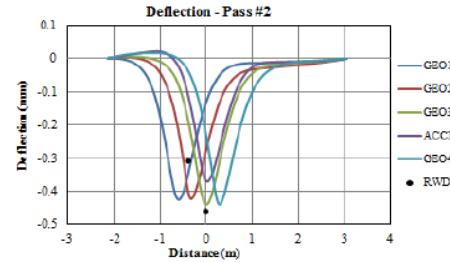
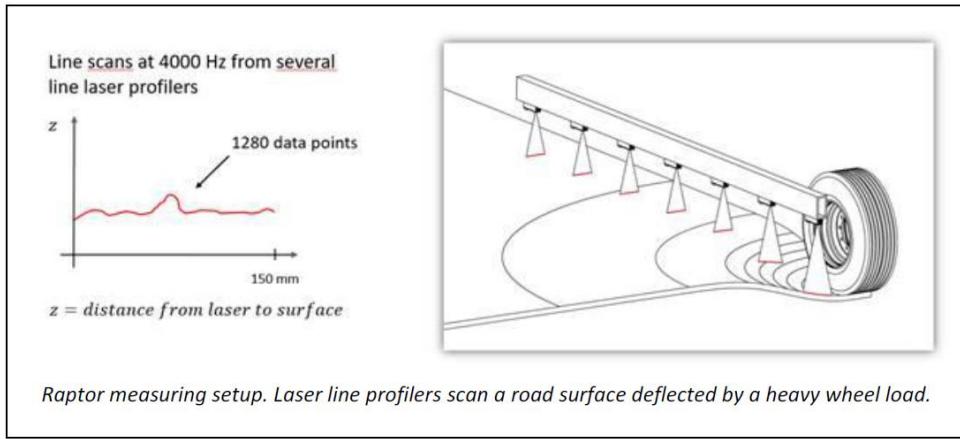
Up to 10 tons load – single axle with supersingle wheel

Based on interferometry and image recognition

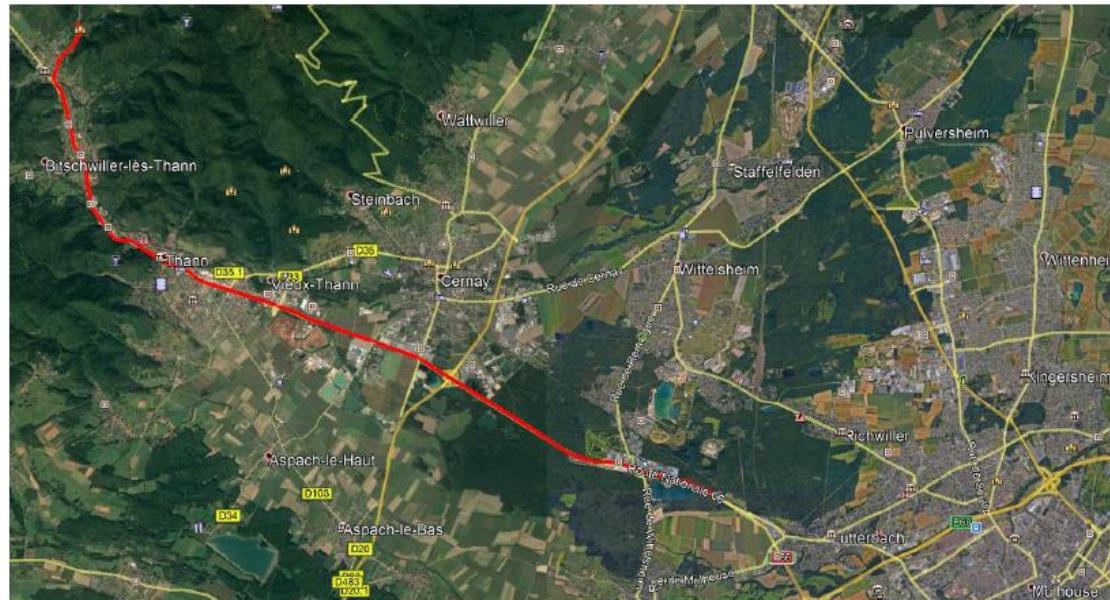
Measures the deformation under the load



Focus on RAPTOR (Dynatest/Ramboll 2/2)

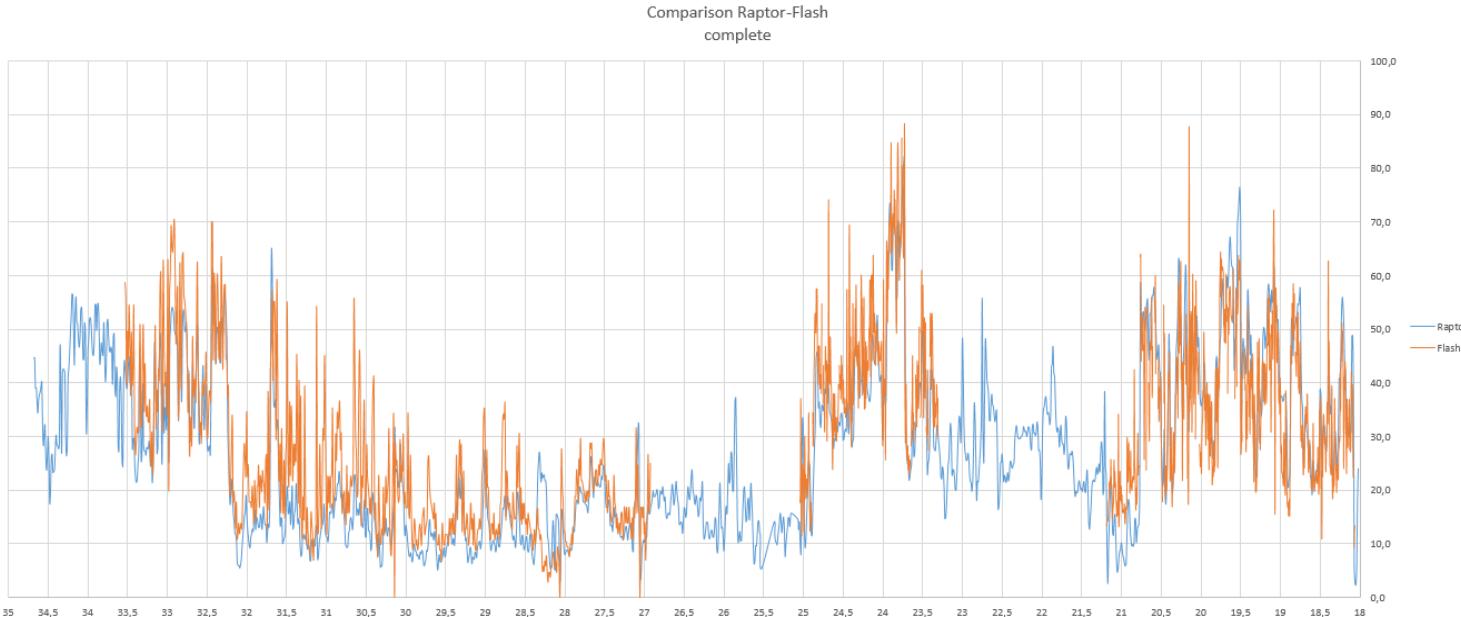


Test section – RN66



07/04/2022

Measurements

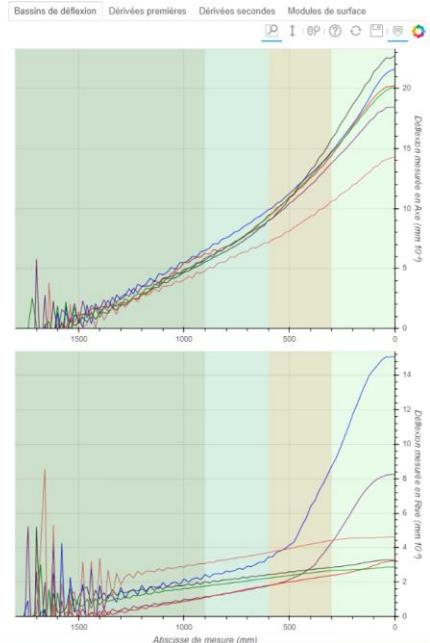
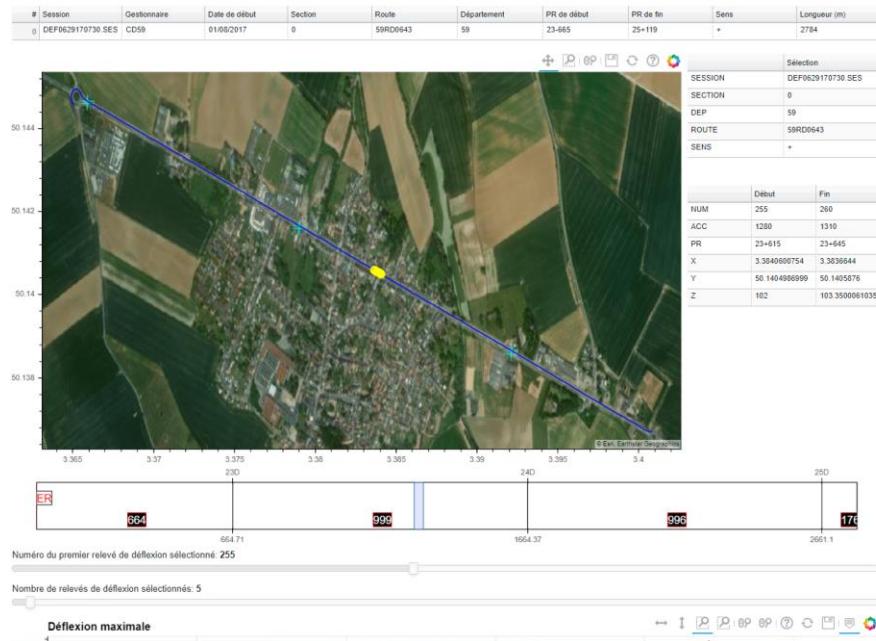


07/04/2022

Visualisation



Definx Website (internal POC)

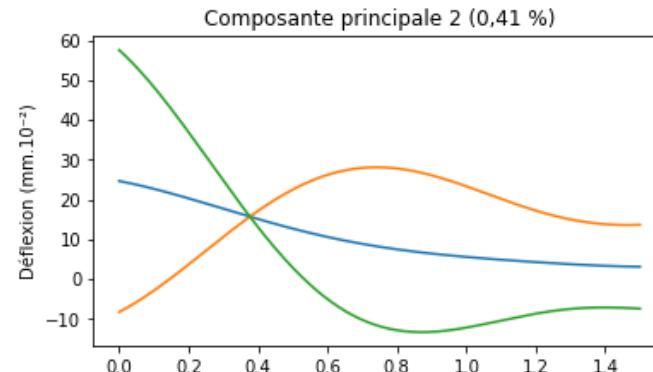
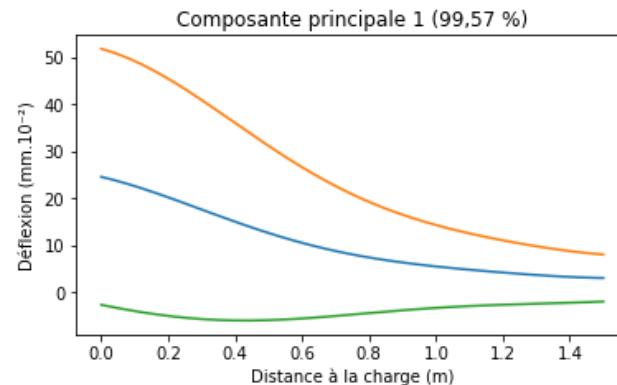


Possible methodological openings



Principal component analysis (PCA) of the deflection bowls

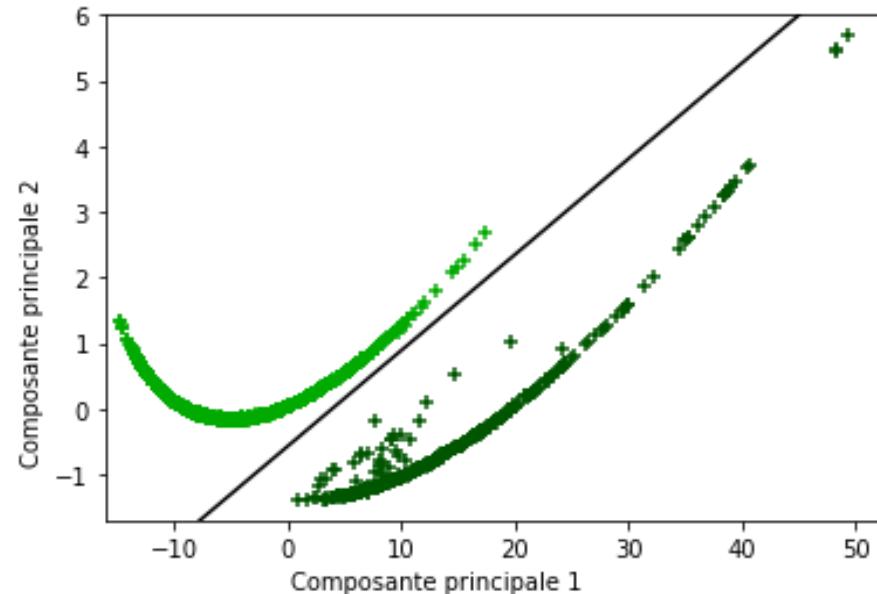
- Deflection bowls characterised by 2 or 3 components
- Keeps more than 99% of the information (99% of the explained variance)



Possible methodological openings



Principal component analysis (PCA) of the deflection bowls

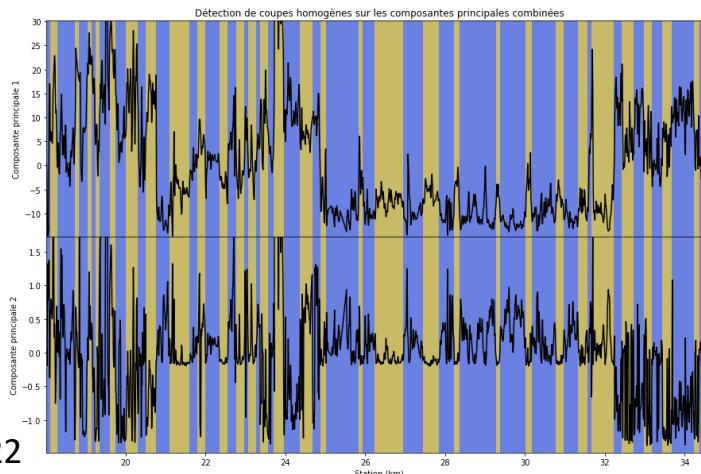


Possible methodological openings

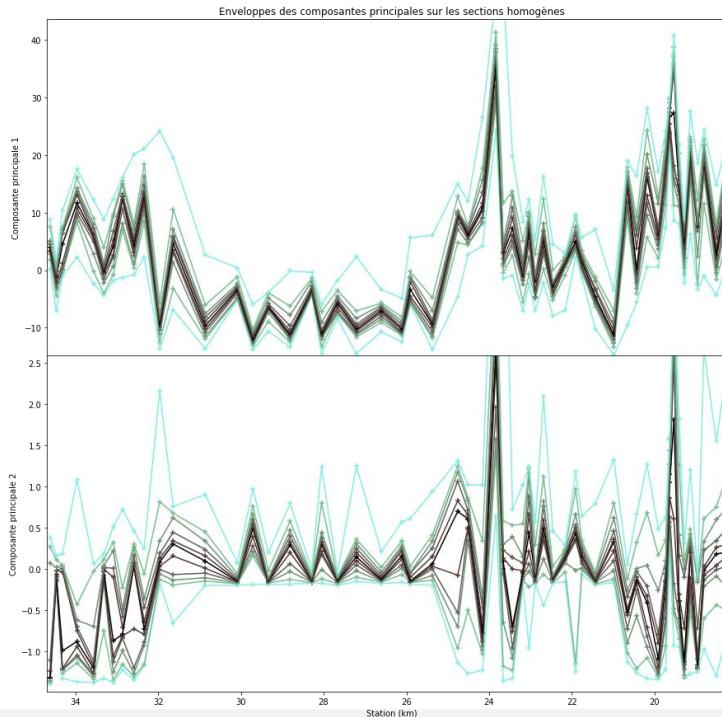


Synthesis of homogenous sections

- PCA on some of the statistics of the sections (quartiles, ...)



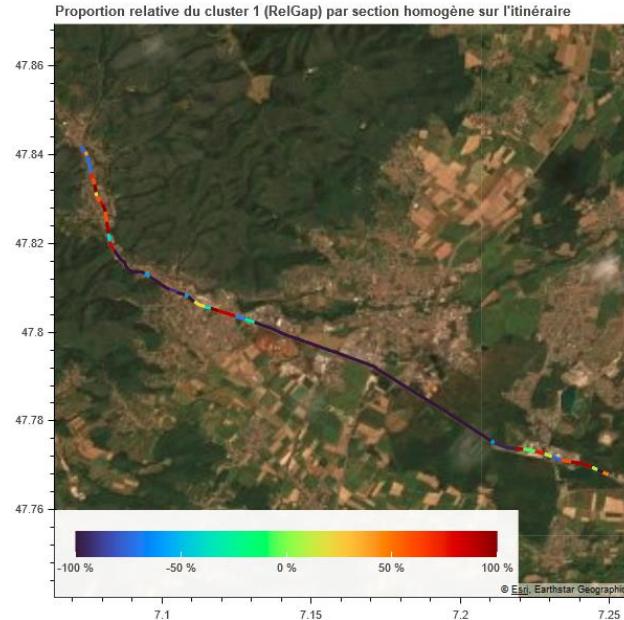
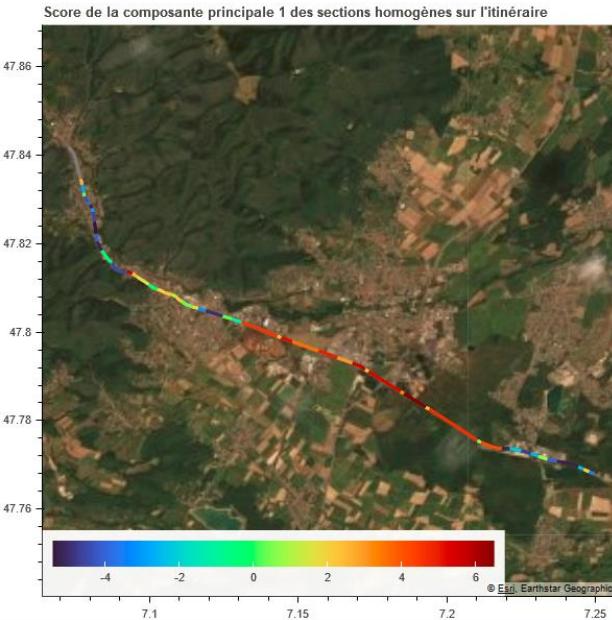
07/04/2022



Possible methodological openings



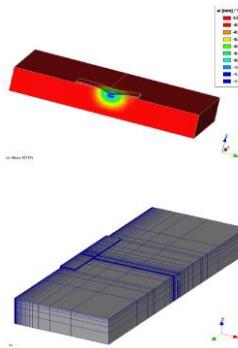
Visual representation of some results



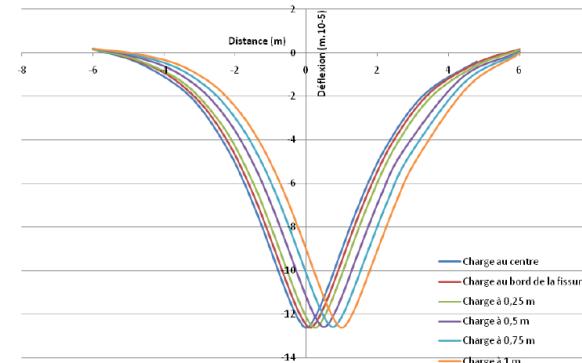
Global prospects



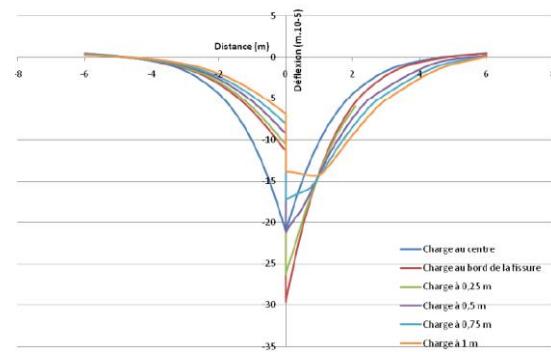
Cross-validation with indexes produced by other measurement devices
Evolutions regarding common practices in road monitoring and asset management systems



Chaussée Semi Rigide Mono Couche_Interface
Collée_Couches non fissurées_Déplacement Charge



Chaussée Semi Rigide Mono Couche_Interface
collée_Couches 1-2 fissurées_Déplacement Charge



Global prospects



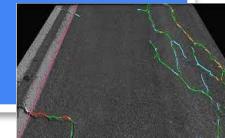
CereMap3D

- Surveys the road and its environment
- Continuous 3D point cloud



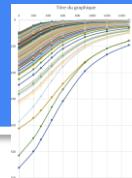
Aigle 3D

- Monitors the visible deformations and degradations on the surface of the road
- « At rest » state
- Representation of the condition of the road
- Continuous 3D point cloud



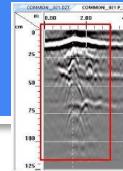
Déflectographe

- Structural condition of the road
- « Pulse » response
- Representation of the condition of the road
- Deflection bowls



Radar

- Interface detection
- Continuous monitoring
- Depths of layers



High Speed Deflection



Thank you for your attention !

07/04/2022



Belgisch **Wegen**congres
Congrès belge de la **Route**
LEUVEN • 4-7.04.2022



UNE ORGANISATION



ABR

Association
Belge de la Route



**AGENTSCHAP
WEGEN & VERKEER**

AVEC LE SOUTIEN DE



Centre de
recherches routières



BRUXELLES MOBILITÉ
SERVICE PUBLIC RÉGIONAL DE BRUXELLES

 **Wallonie**
mobilité infrastructures
SPW



FBEV
Fédération Belge des Entrepreneurs de Travaux de Voirie asbl



Contact

 Alain HEBTING – Emmanuel DELAVAL

 03.88.77.46.18 / 06.38.41.45.41

03.20.48.49.68 / 06.60.97.84.28

 alain.hebting@cerema.fr – emmanuel.delaval@cerema.fr

