



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Open-source data and software for noise and vibration modelling in the Netherlands

Arnaud Kok & Rob van Loon



About RIVM

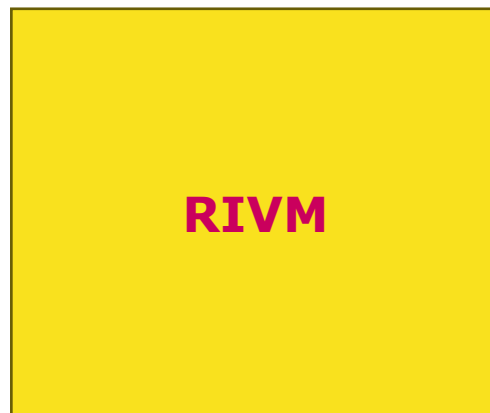
- Research Institute
 - 2500 Employees
 - Health and the Environment
- Noise
 - Centre for Environmental Quality
 - Data/software/methods
 - Centre for Sustainability, Environment and Health
 - Health Impact assessment
 - Dose-response curves





What do you need for noise calculations

- › Calculation methods
- › Data on the surroundings
- › Data on sound sources
- › Software





Calculation methods

- First developed in the 80's
 - Similar to ISO 9613 (rail, road, wind turbine and industry noise)
 - Point to point description
 - Incremental changes over the years
 - Some times more substantial
- Codified in legal documents
 - Freely accessible

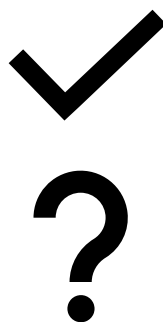
$$L_{eq} = L_E + \Delta L_{GU} - \Delta L_L - \Delta L_B - \Delta L_{SW} - \Delta L_R - C_m$$





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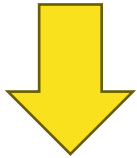
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Data

- › Freely available datasets
 - Aerial photographs (2x each year)
 - Lidar data (every 3 years)
 - DSM & DTM models
 - Building contours (continuously)
 - Roads/Railways
 - Land use data (continuously)

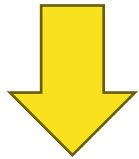


3D Noise model



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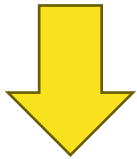
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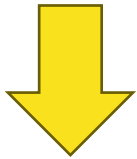
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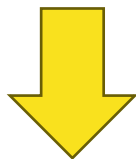
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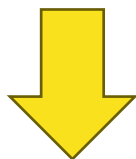
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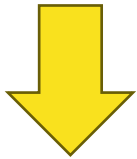
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3D Noise model



IN 3D





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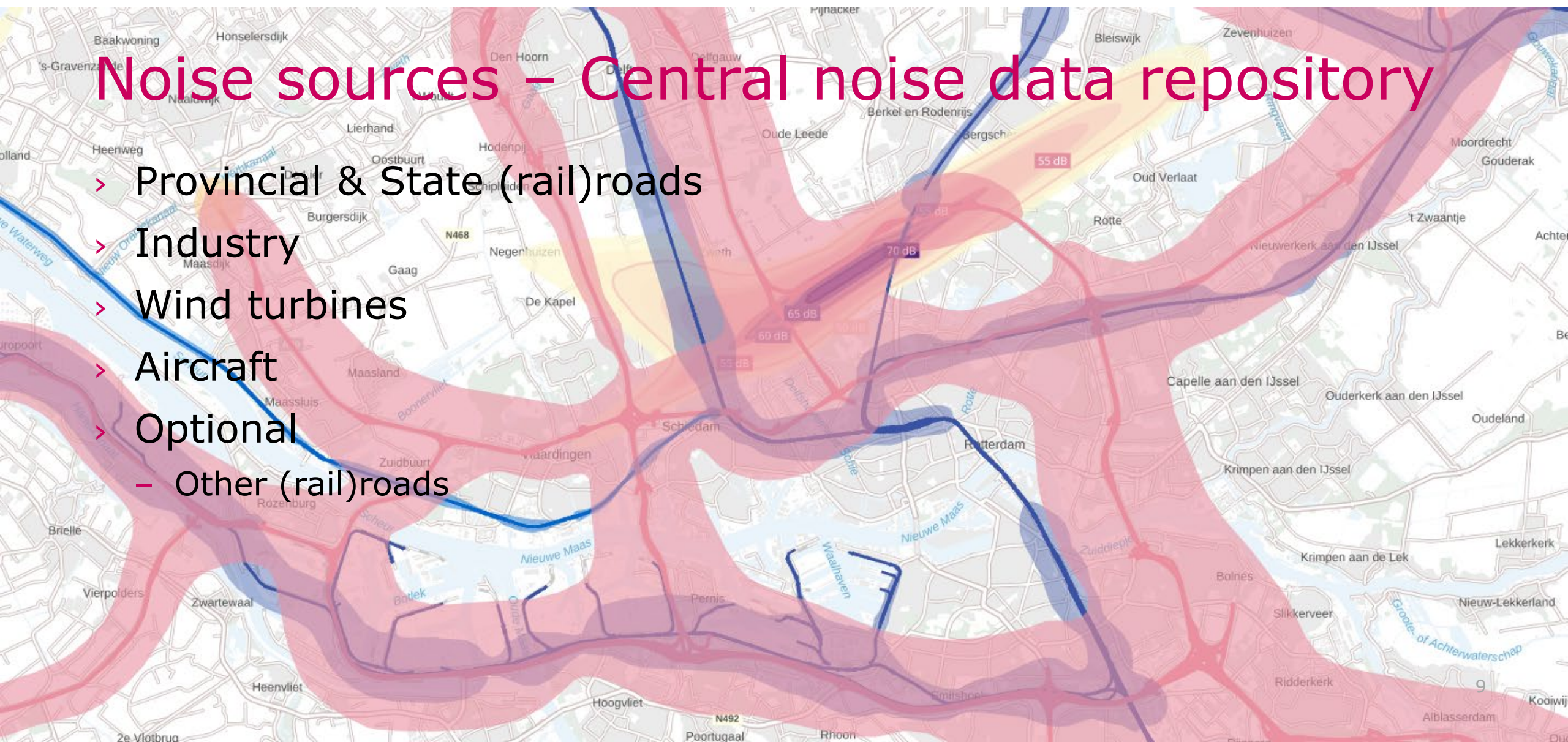
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Noise sources – Central noise data repository

- > Provincial & State (rail)roads
- > Industry
- > Wind turbines
- > Aircraft
- > Optional
 - Other (rail)roads





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Software in NL

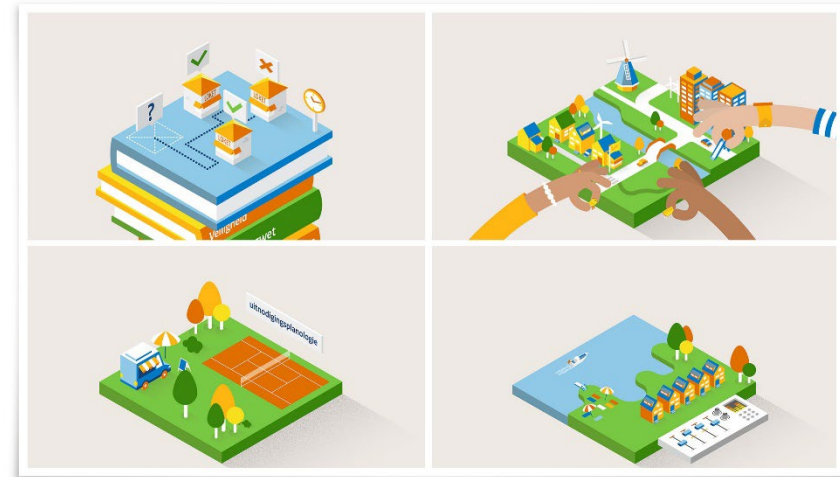
- › First commercial applications 1980-1990
- › Two competing companies
 - One has separate ownership of GUI and core
- › No software code at RIVM
 - Need assistance to test changes in method
- › Start from scratch?
 - Still complex (especially the pathfinder)
 - Expensive
 - Needs to be fully compliant
 - What's the uptake?

Status Quo



What changed?

- > 2025 Start of new Environment and planning act
 - Large overhaul of calculation methods
 - Much work for commercial companies



Is RIVM interested in taking over
a calculation core?



The Good

- › Jumpstart your code
- › Efficient pathfinder already implemented
- › Possible to have a single core with multiple GUI's
- › Open source route available
- › Improve maintenance of calculation methods





The Bad

- › What are we getting into?
- › Some of the changes in the method are complex
- › Continued commitment and investment needed
- › No guarantee on uptake





The Ugly

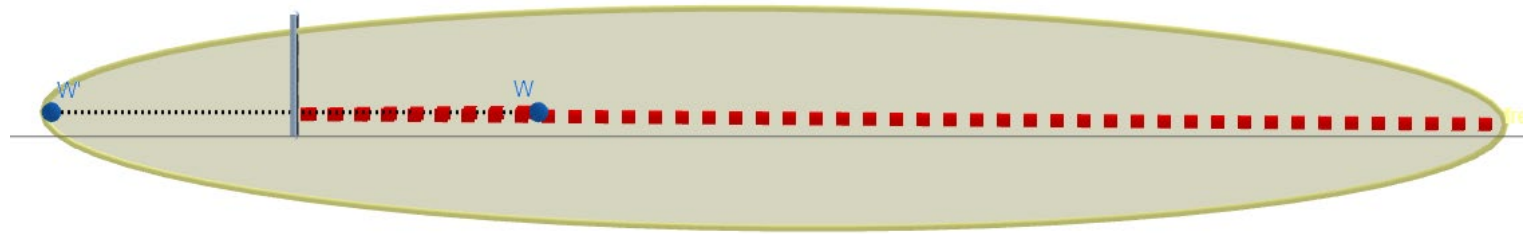
- › Learning other mans code
- › Alot of history (code was adapted from FORTRAN)
- › Written for propriety compiler
- › Needs cleanup (some functions no longer used)





Biggest challenge: Reflections

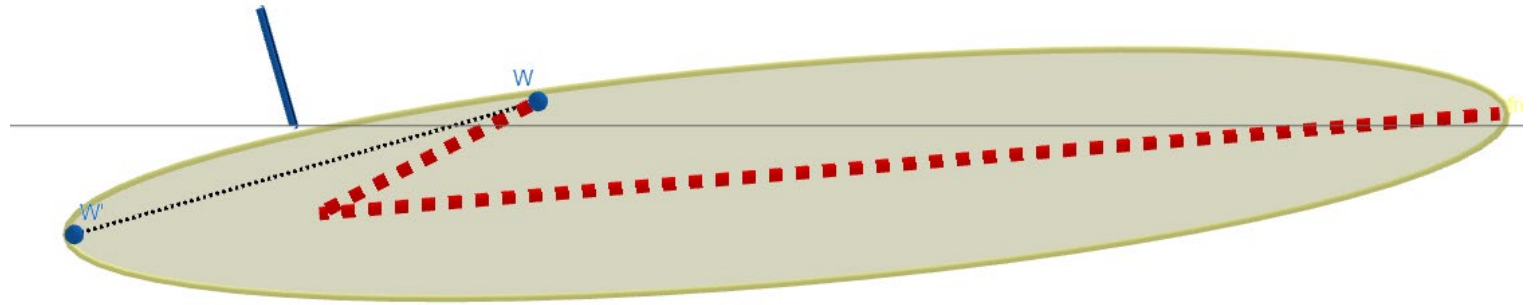
- > Use Fresnel zone
- > Fully in 3D
 - Paths dependent on source/receiver heights
 - Code much less efficient





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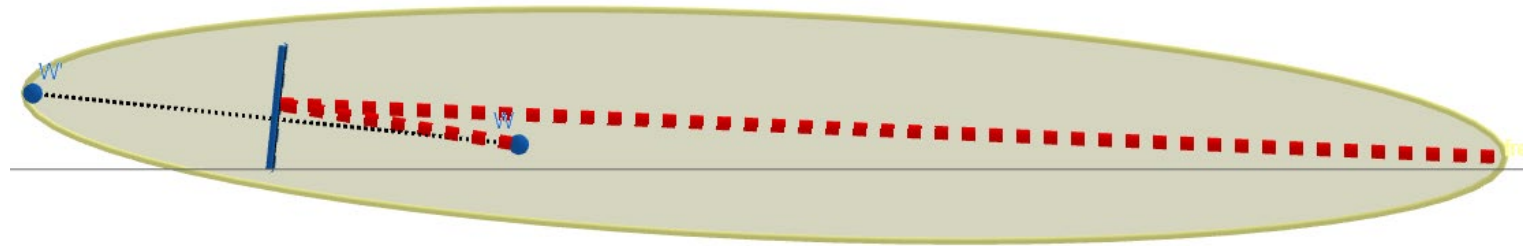
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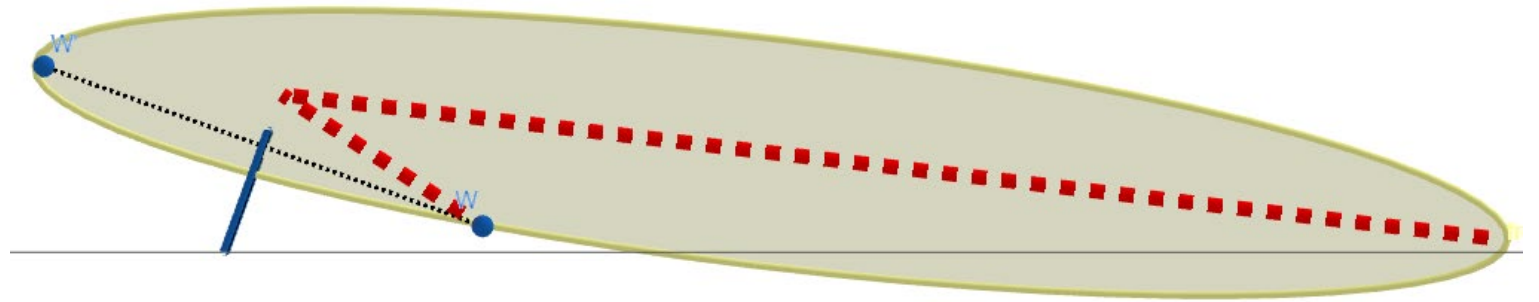
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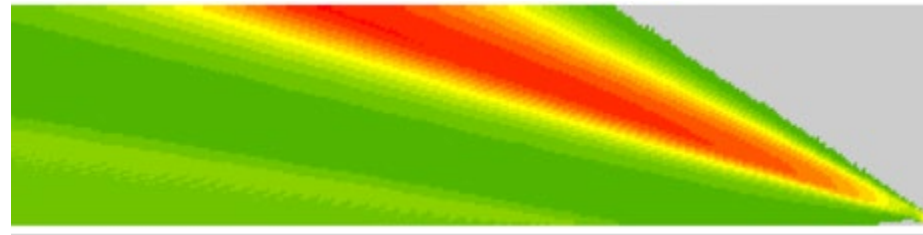
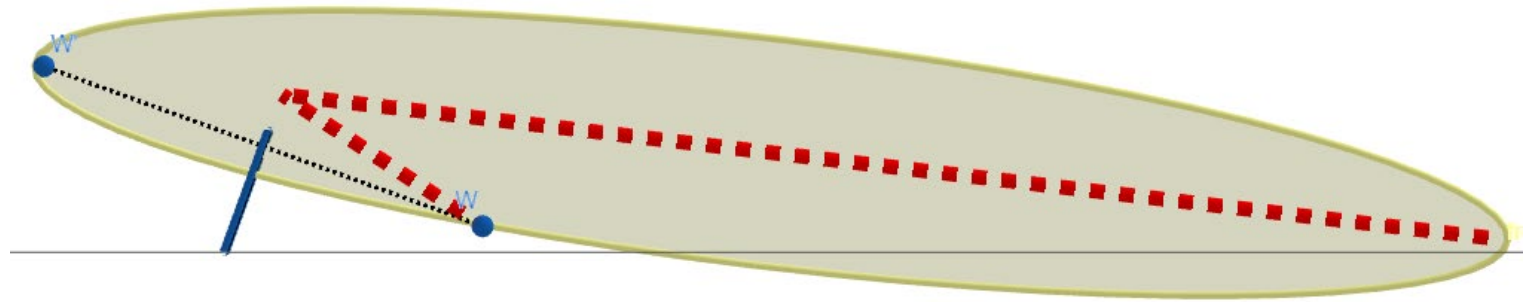
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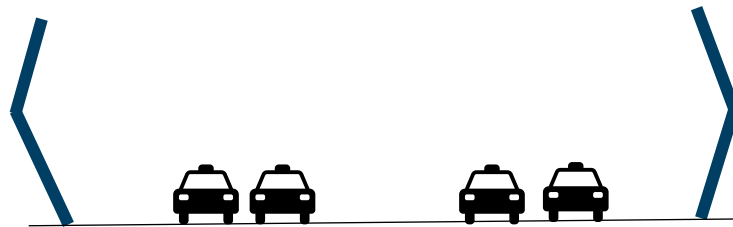
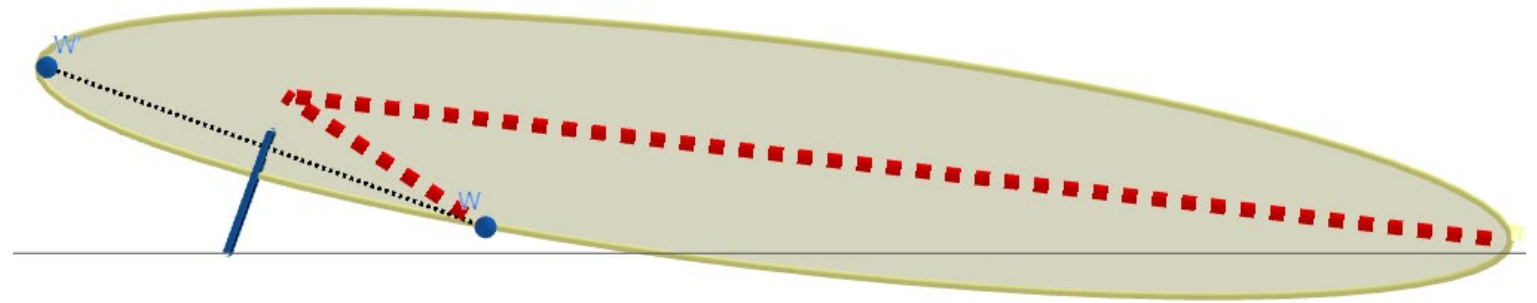
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The result

- › Calculation core available!
 - www.rivm.nl/geluid/rekenmodellen-en-tools/rekenhart-geluid
- › QGIS plugin available (free)
- › Used in commercial GUI
- › Source code later this year





And Vibrations

- › Data on subsoil
- › Data on source and emissions
- › Data on buildings
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And Vibrations

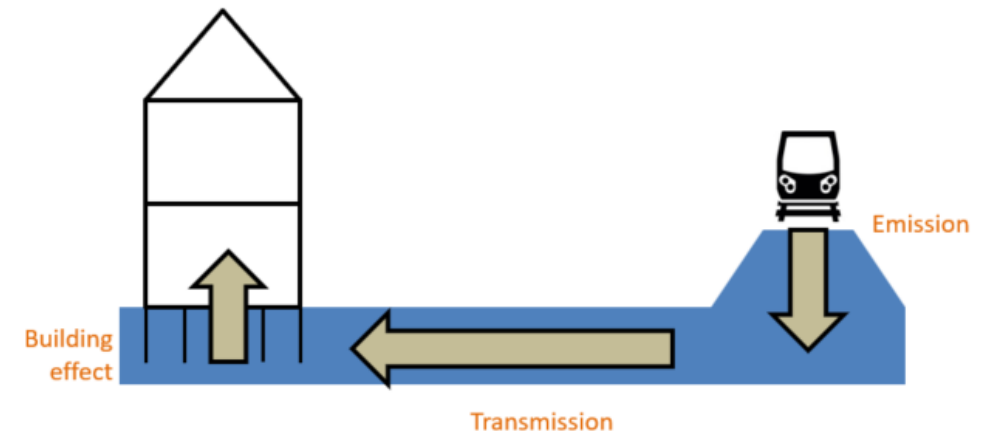
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Software

- Python Modules
 - Subsurface modelling
 - Finite element transmission
 - Analytical building model
 - Postprocessing
- Controller UI
 - Database with emission data
 - Parsing models
 - Communication between modules



github.com/rivm-syso/ours



Conclusion

- > Open source is the way to go
 - Not only software but also data!
- > Development does cost time and money
- > Long term commitment required
- > Cost for society as a whole is lower

This is the official GitHub organizational account of the National Institute for Public Health and the Environment (RIVM) of the Netherlands. *We are dedicated to promoting transparency, collaboration, and reproducibility in public health and environmental research.*

