

Integration of multi-scale BIM and AI for Railway Asset Management towards Net Zero

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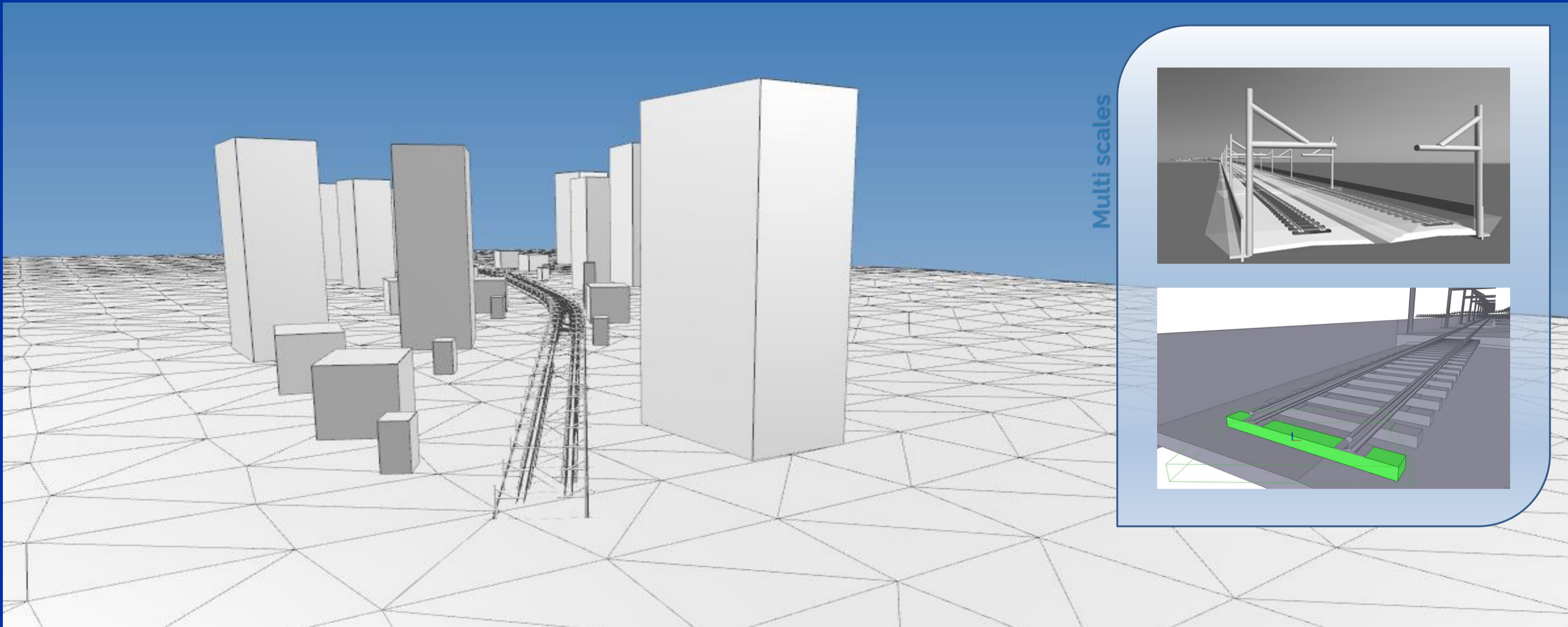
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Integration of multi-scale BIM and AI for Railway Asset Management towards Net Zero

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UNIVERSITY OF BIRMINGHAM



OBJECTIVE

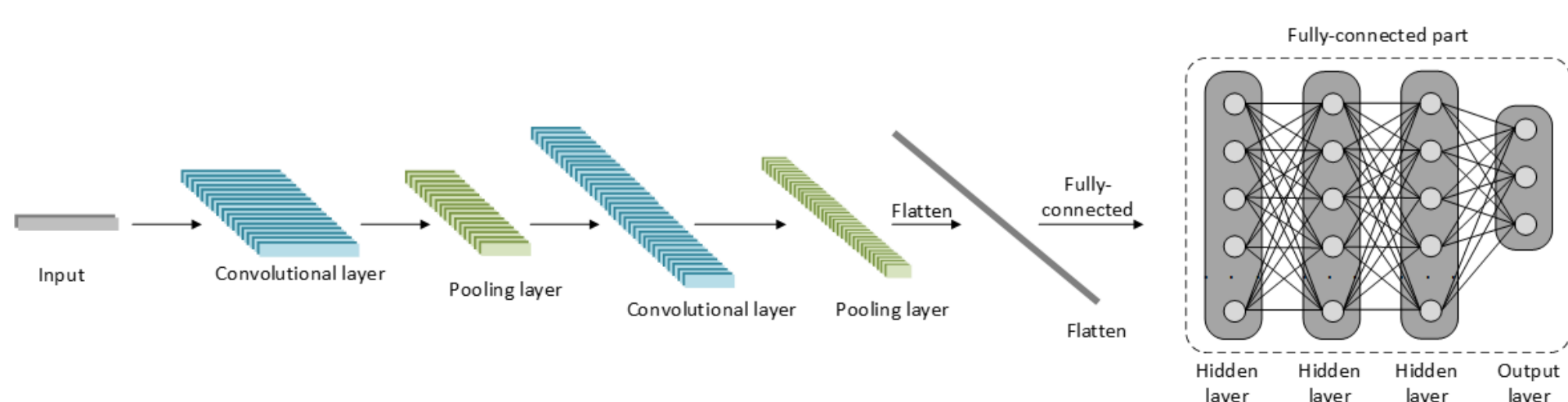
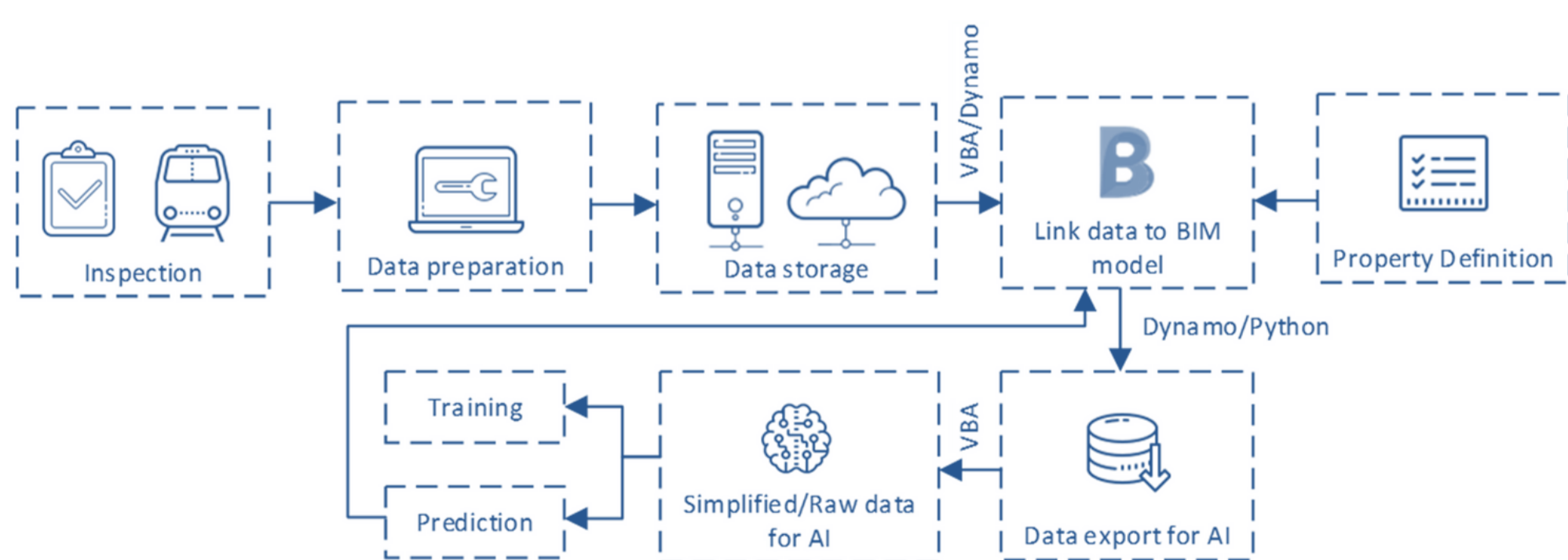
To integrate and co-simulate BIM and AI for railway asset management by create a systems approach to integrate them together and utilize for the whole life project

BACKGROUND

The demand of railway transportation is souring but railway asset management technologies are insufficient. Every phase of railway lifecycle is critical. Therefore, a new tool capable of whole-life asset management is necessary to improve overall efficiency of railway systems towards net zero emission.

METHODOLOGY

- BIM and AI model development
- BIM and AI integration using real-world data processing
- Multi-scale BIM co-simulations for cross functional analyses
- Technical robustness assurance for AI
- Novel AI models for fulfilling multi-purposes of AI models



An example of CNN model

RESULTS

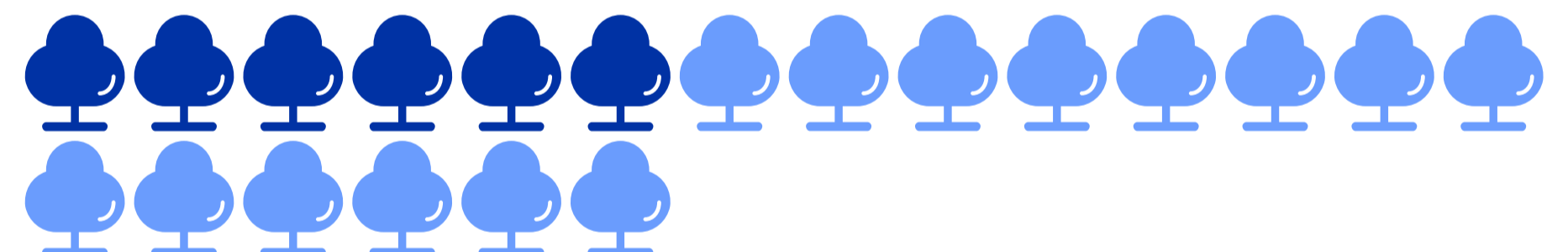
MAINTENANCE COSTS (**reduced by 68%**)



MAINTENANCE ACTIVITIES (**reduced by 61%**)



CARBON EMISSIONS (**reduced by 65%**)



FINDINGS

- Developed approaches improve intelligent asset management
- Performances & robustness of AI models are satisfying
- Insights are discovered
- Asset management are optimized towards net zero
- Data-driven approach can be achieved

CONCLUSION

- Integration of BIM and AI can improve the asset management
- Data management is key
- Decision making is supported
- This is the world's first integration of BIM and AI for rail asset management

KEY PUBLICATIONS

- Sresakoolchai, J., & Kaewunruen, S. (2021). Integration of building information modeling (BIM) and artificial intelligence (AI) to detect combined defects of infrastructure in the railway system. In Resilient Infrastructure: Select Proceedings of VCDRR 2021 (pp. 377-386). Singapore: Springer Singapore.
- Sresakoolchai, J., & Kaewunruen, S. (2021). Integration of building information modeling and machine learning for railway defect localization. IEEE Access, 9, 166039-166047.
- Sresakoolchai, J., Hamarat, M. and Kaewunruen, S., 2023. Automated machine learning recognition to diagnose flood resilience of railway switches and crossings. Scientific reports, 13(1), p.2106.
- Sresakoolchai, J. and Kaewunruen, S., 2022. Prognostics of unsupported railway sleepers and their severity diagnostics using machine learning. Scientific reports, 12(1), pp.1-10.



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