Bridging Design and Assessment:

A BIM-to-Microsimulation Framework

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Knowledge Transfer

Speculation: Most influential technologies are not the ones create knowledge!

Image: Theodor Galle, after Jan van der Straet, Impressio Librorum, from Nova Reperta, c. 1610. Princeton University Art Museum.

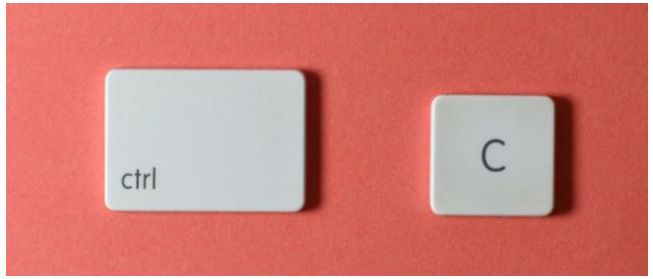

Image: Miguel Á. Padriñán / Pexels

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Interconnected Digital Systems

Agenda:

- Introduction
- Case Study
- Conceptual BIM
- Network Entities
- Routing
- Results
- Further Research

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Infrastructure BIM

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Image: RUT MIIT on Unsplash, “An aerial view of a city with a train station.”

- Currently, the implementation of BIM in infrastructure is increasing, but it lacks methods to transfer (Ctrl + C) data between systems despite its feasibility.
- One example is BIM and Microsimulation

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Anatomy of Civil 3D Corridors

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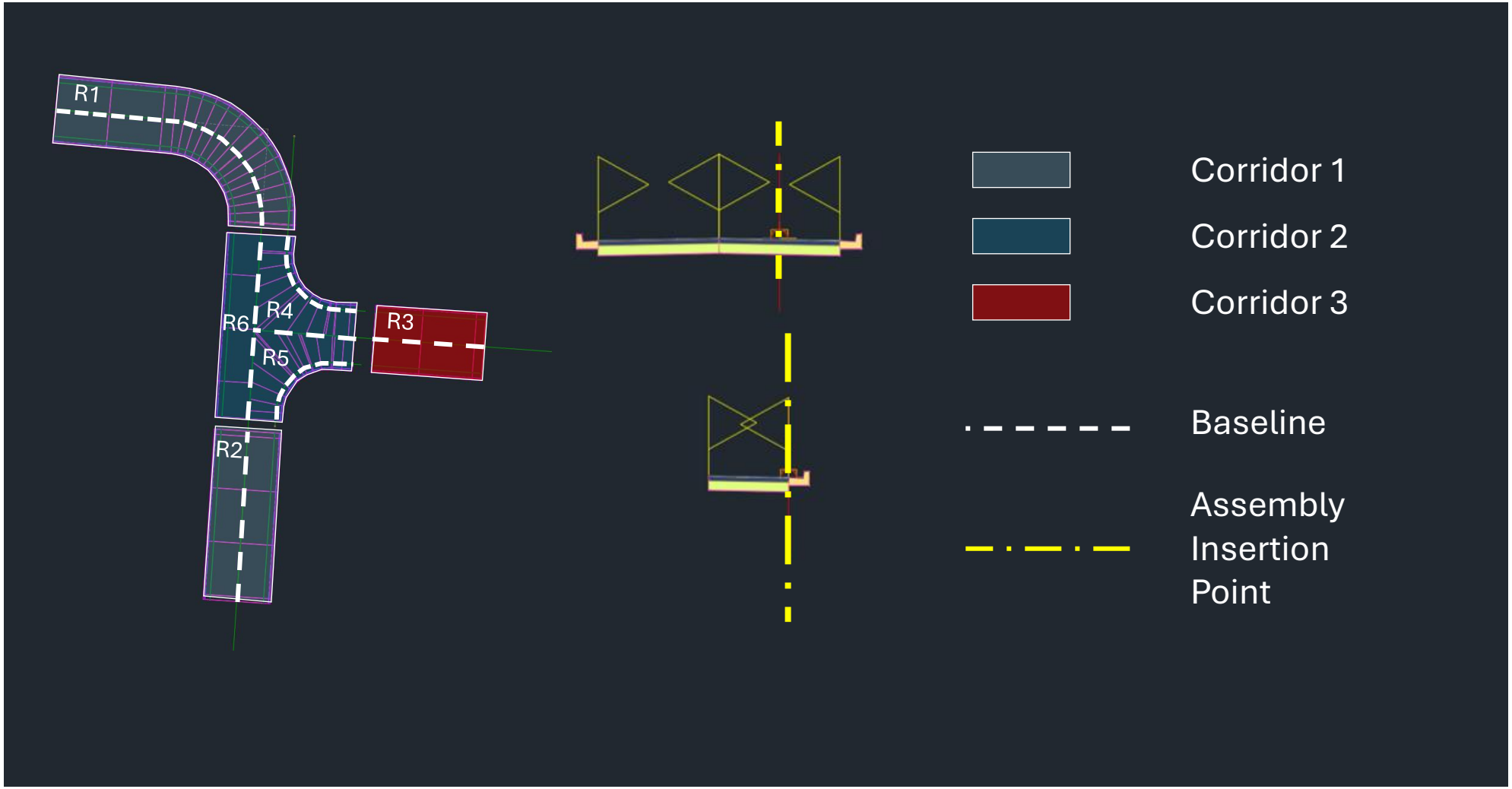

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HotMap: Case study identification

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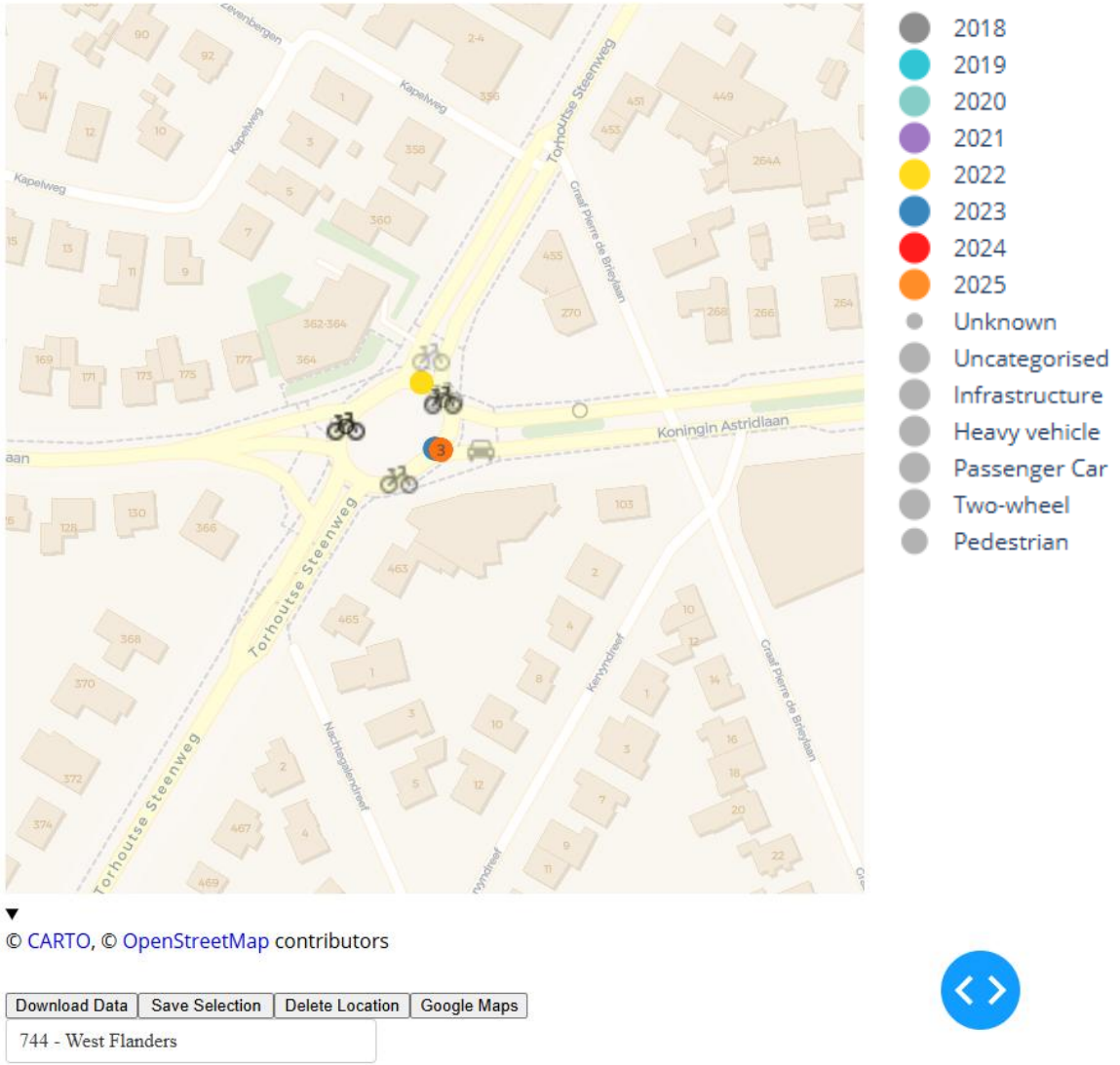

HotMap: A map-based web application combining:

- OpenStreetMaps data
- Geolocations of traffic crashes (Statbel)
- Locations of dangerous points (Flanders Digital Agency)

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HotMap: Case study identification

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Base Image: Geopunt / Agentschap Digitaal Vlaanderen

2021	Car	Car
2021	Car	Car
2023	Car	Car
2017	Car	Car
2018	Car	Car
2018	Car	Car
2017	Car	Car
2018	Car	Car
2018	Car	Car
2018	Car	Car
2019	Car	Car
2017	Car	Other road user
2022	Car	Moped
2024	Motorcycle	Self
2024	Bicycles	Bicycles
2021	Motorcycle	Self
2021	Car	Bicycles
2021	Car	Pedestrian

2017	Car	Obstacle
2020	Car	Obstacle
2019	Car	Light Truck
2022	Car	Truck
2018	Truck	Light Truck
2021	Car	Light Truck
2022	Light Truck	Car
2017	Truck	Car
2019	Car	Car
2024	Car	Car
2020	Car	Car
2020	Car	Car
2023	Car	Car
2022	Car	Car
2022	Car	Car
2021	Car	Car

The intersection of Evence Coppéelaan and Westerring in Genk has been consistently found to be dangerous over the last 8 years

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OSM and DTM

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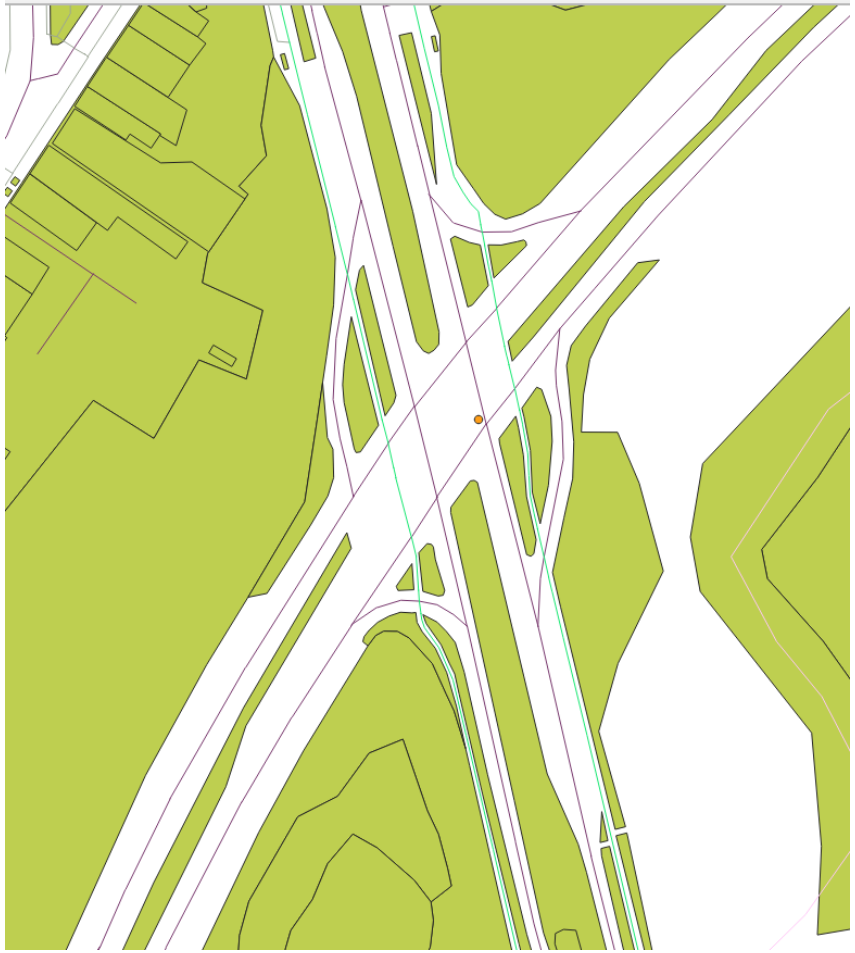
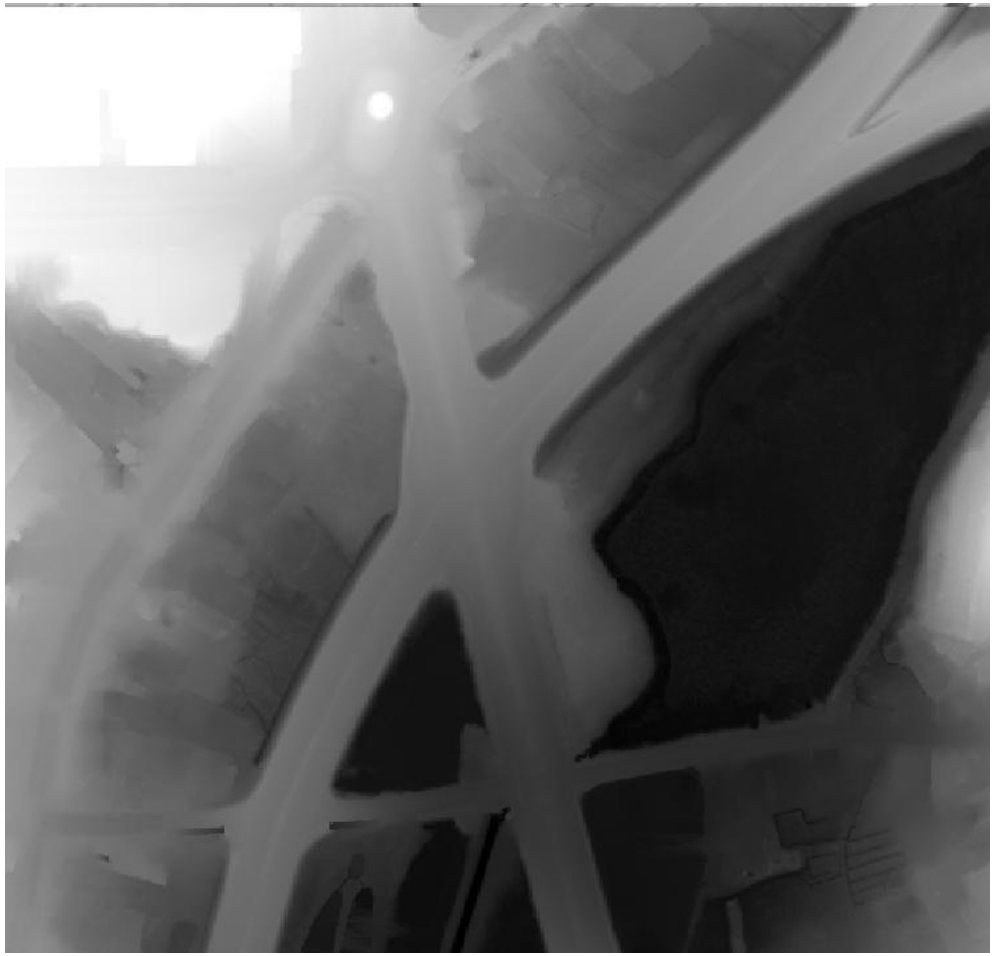
EPSG 31370: Belgian Lambert 72



Data: OpenStreetMap Contributors



Data: Flanders Digital Agency

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Conceptual BIM Model

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- Introduction
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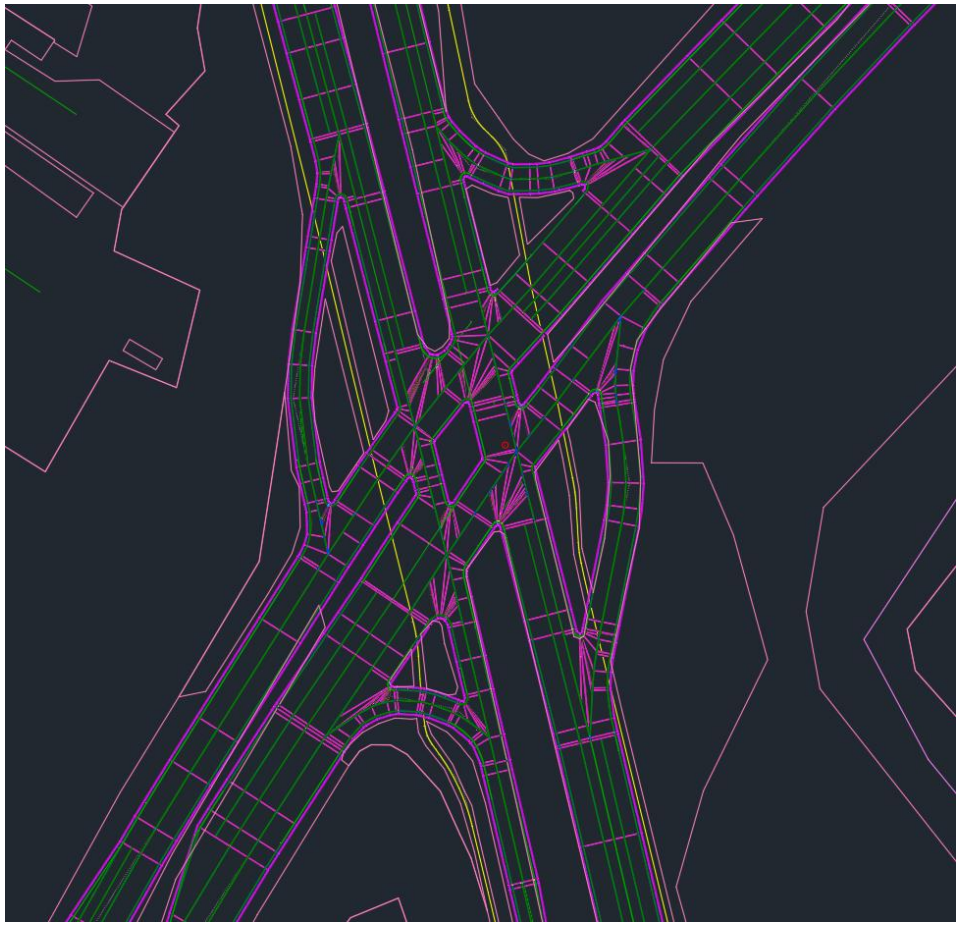
Road Alignments in Civil 3D



Road Corridors

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NetExport: Primary Node References

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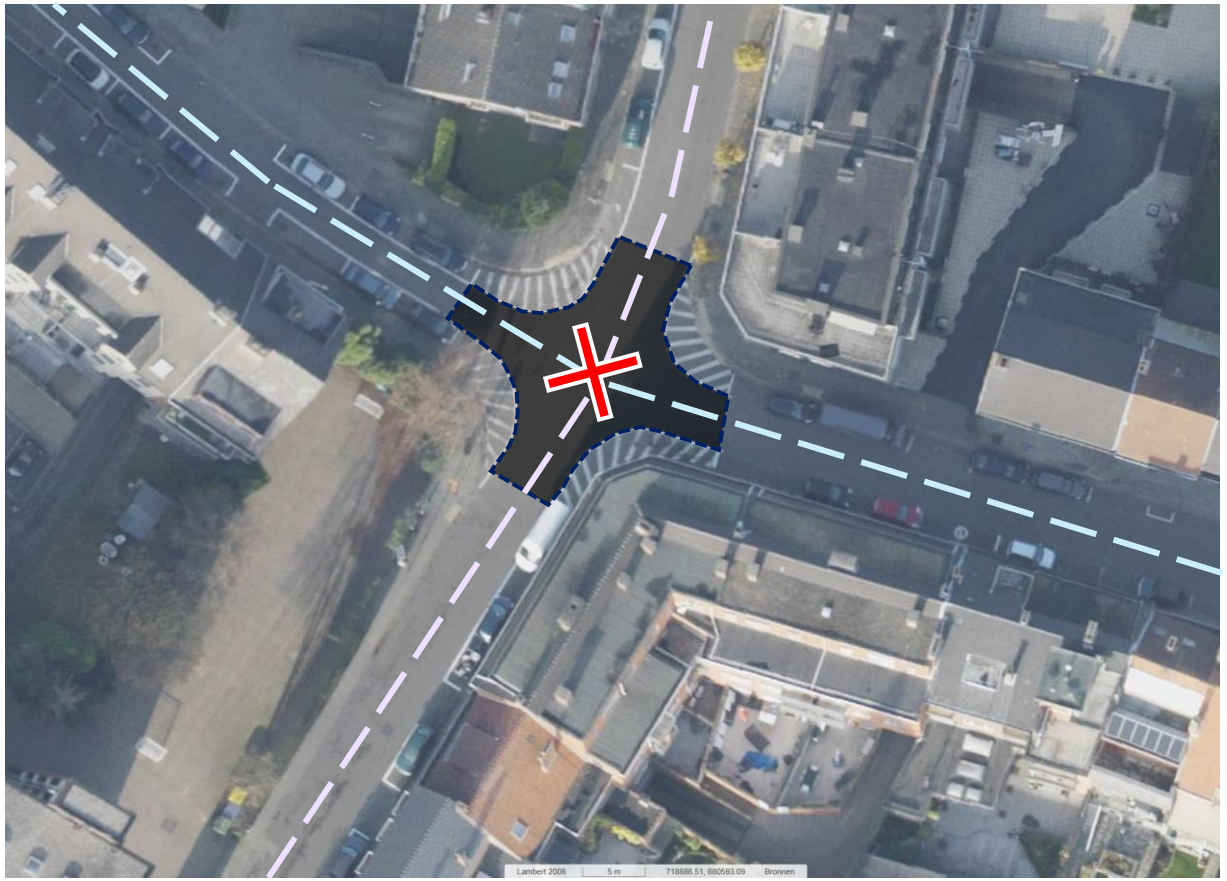

Base Image: Geopunt / Agentschap Digitaal Vlaanderen

Primary Node Reference:
Intersections of two alignments

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NetExport: Transition Node References

Agenda:

- Introduction
- Case Study
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Base Image: Geopunt / Agentschap Digitaal Vlaanderen

Transition Node Reference: Characteristic changes in cross-sections.

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NetExport: Edge References

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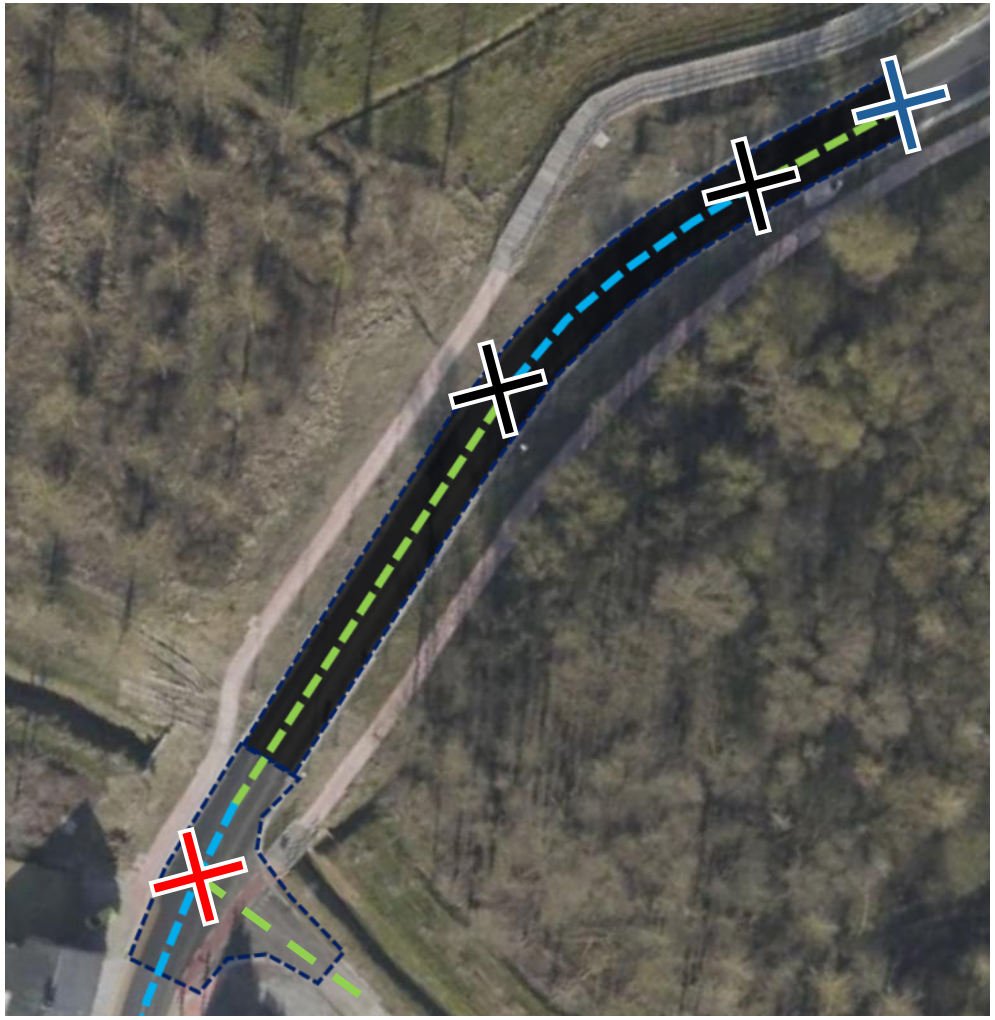

Base Image: Geopunt / Agentschap Digitaal Vlaanderen

Straight Edge Reference

Curved Edge Reference

Auxiliary Node References:
Characteristic changes in horizontal road alignments

Pole Node References:
Termination points

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NetExport: Lane Information

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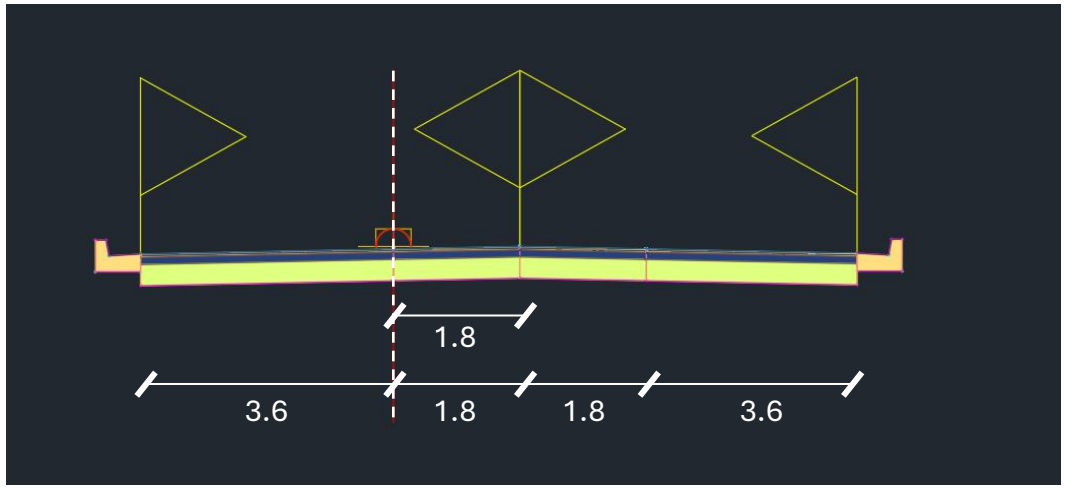

Assembly: Civil 3D definition of the road cross-section.

Assemblies are modelled taking the OSM line as the insert point.

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NetExport: Validation

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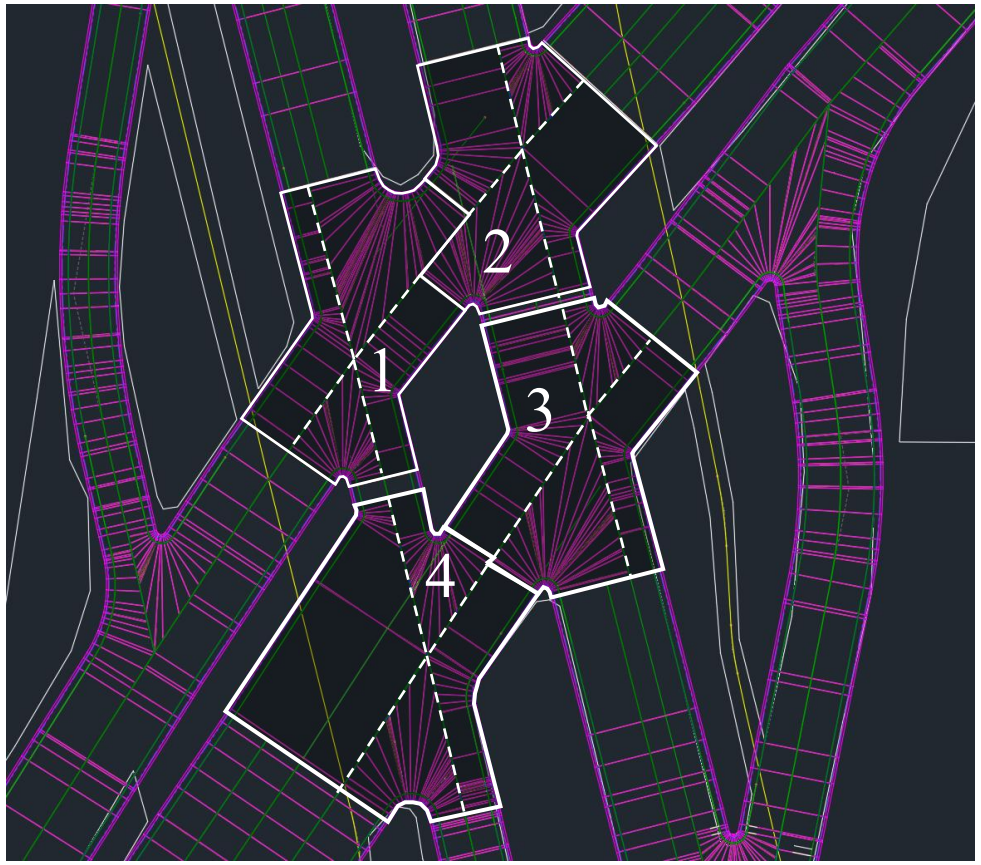

A modelling practice that requires validation and self-adjustment.

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SUMOFit: Routing

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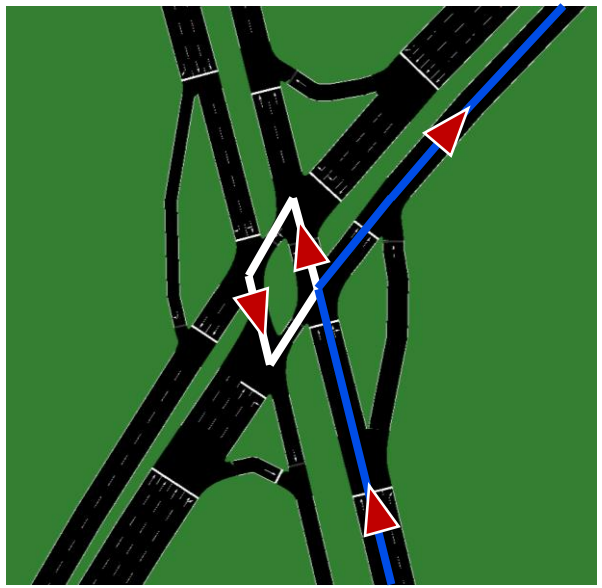
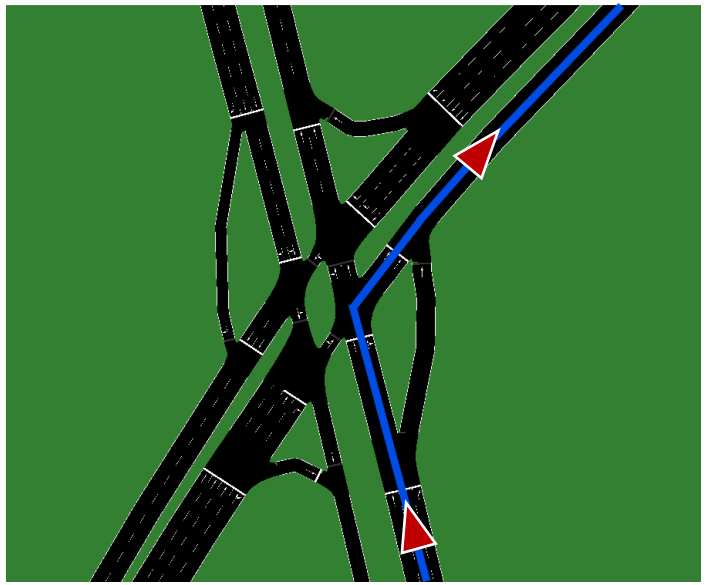
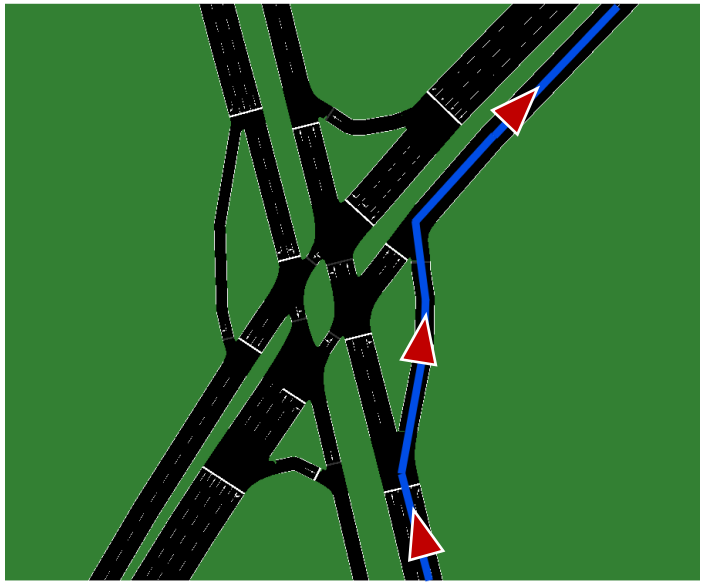


Identification of Internal Loops



Option-1



Option-2

A recursive routing algorithm identifies internal loops and registers them as a “Loop” entity.

Loop-free routes are preferred in the final set.

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SUMOFit: Loop Realisation Form

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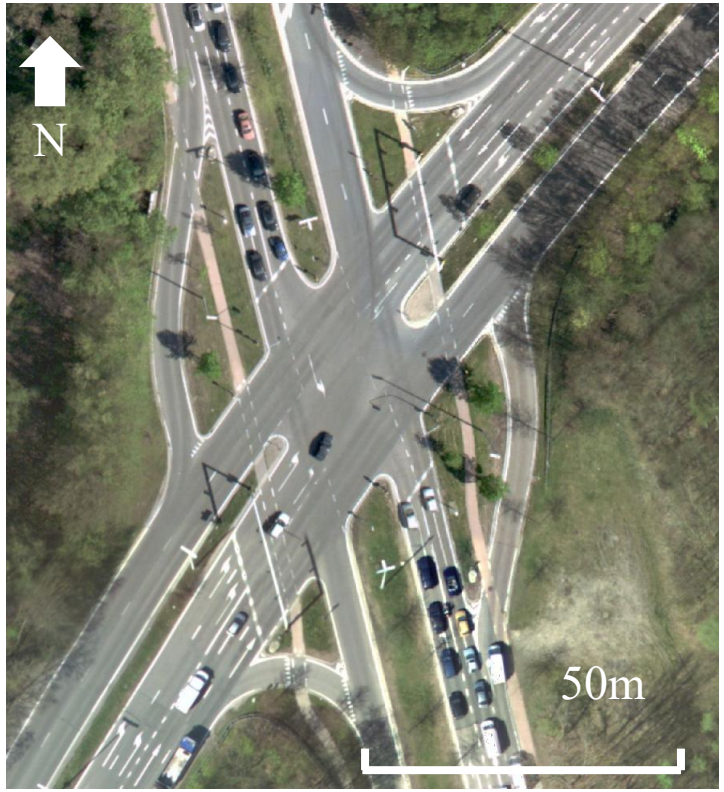

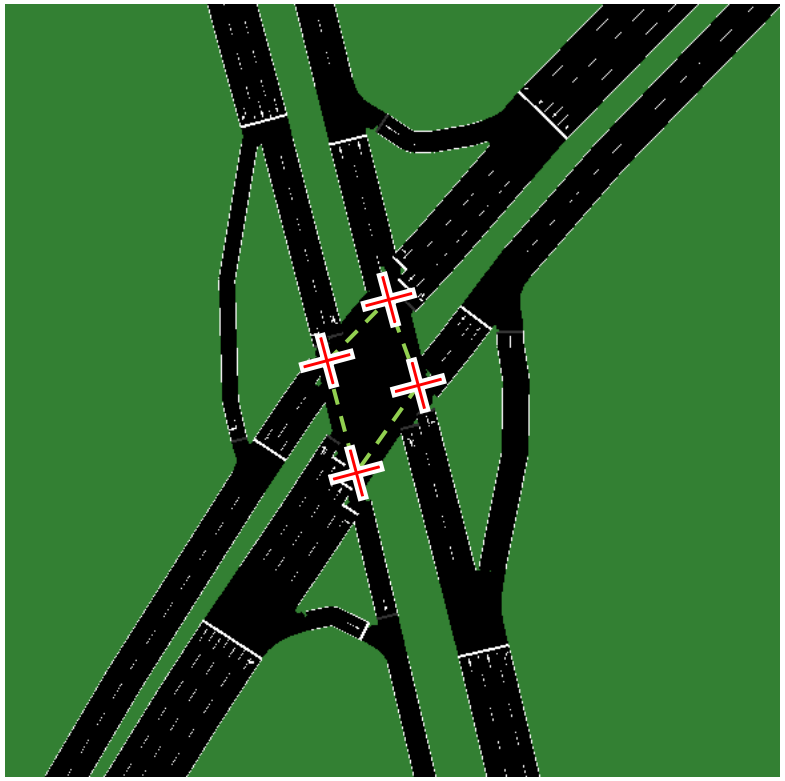

Any internal node element can trigger a change in the realisation form of the “Loop” entity

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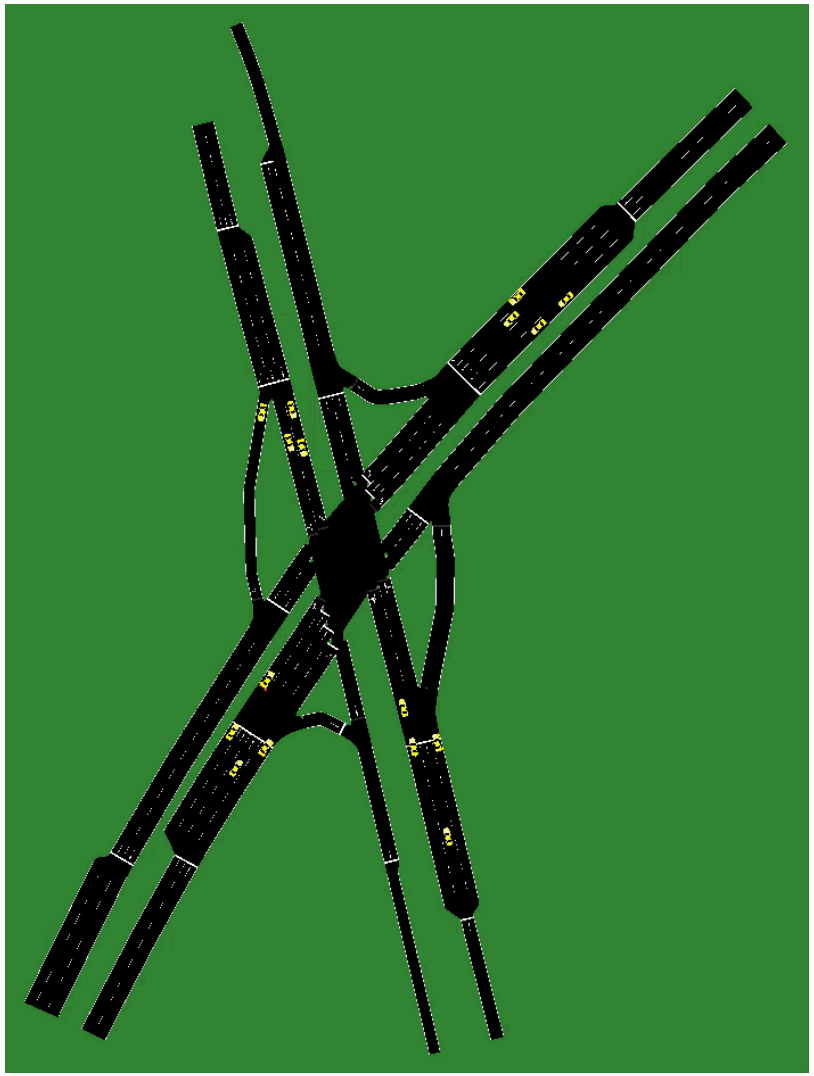

- Primary Nodes: 12,
- Transition Nodes: 7,
- Auxiliary Nodes: 44,
- Pole Nodes: 8,
- Edges: 75,
- Lanes: 49,
- Unknown: 0

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SUMOFit: Further Research

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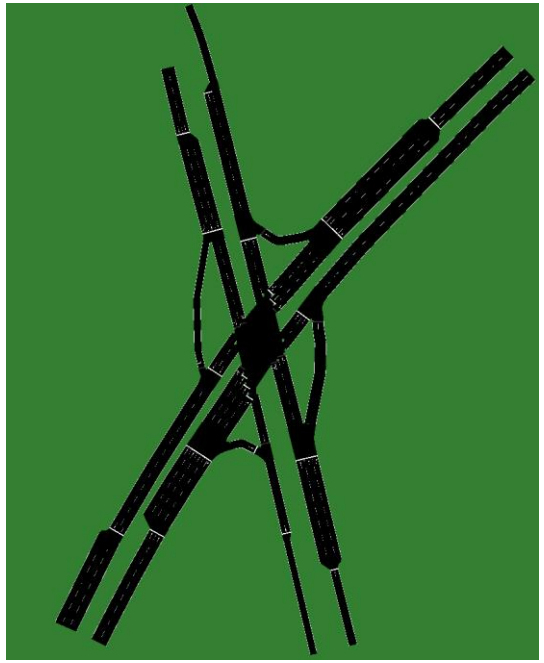
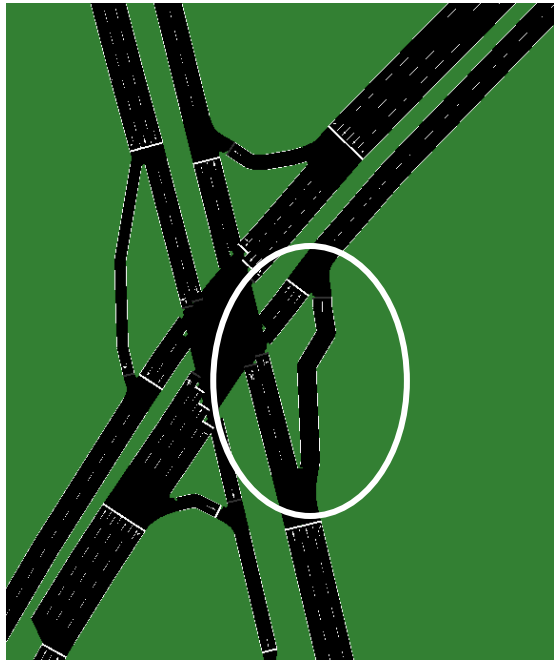
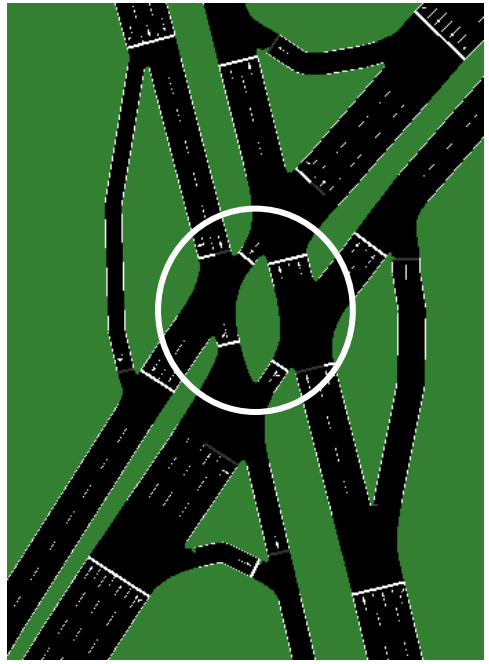
Baseline



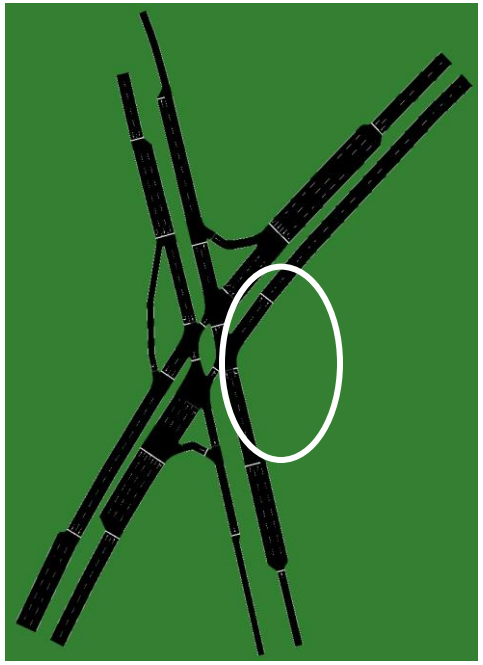
Coordinate Update



Realisation Form



Diagonal Connection



Further research aims to build an infrastructure for agentic modifications.

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IVORY

AI for Vision Zero in Road Safety Doctorates Network

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Cegeka, Corda 3 Kempische Steenweg 3073500 Hasselt

UHasselt, The Transportation Research Institute, Martelarenlaan 42, Hasselt 3500, Belgium

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