MONITORING THE EFFECTIVENESS OF TRAFFIC CONTROL CHANGES AT INTERSECTIONS USING SIMULATIONS

16th February 2026

BATS

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Problem

- Weather impacts behavior of drivers and pedestrians
- Traffic Control Strategies suitable for typical situations do not provide expected level of satisfaction for users during harsh weather conditions
- Active Mobility users are especially affected, because they are exposed to precipitation, cold and heat
- At the same time traffic lights are usually designed to provide best possible Level of Service for drivers, while providing green light for pedestrians and cyclists is an inconvenient necessity
- We aim to improve the conditions for Active Mobility users when the weather conditions are bad

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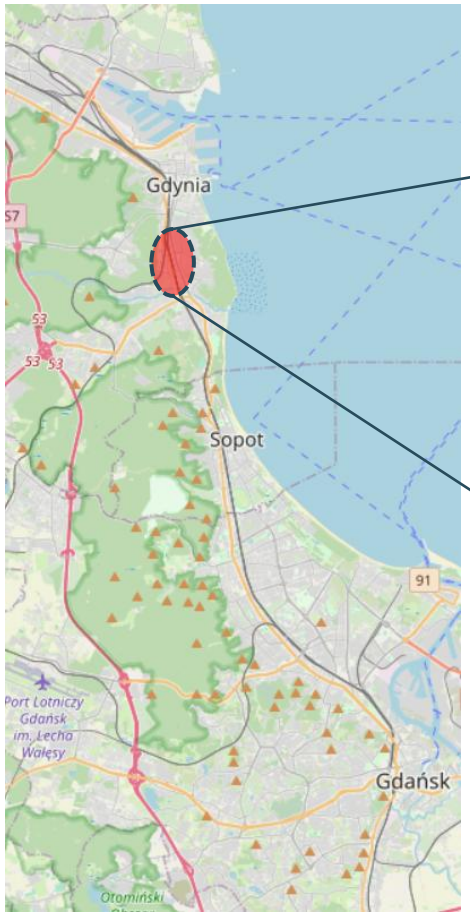
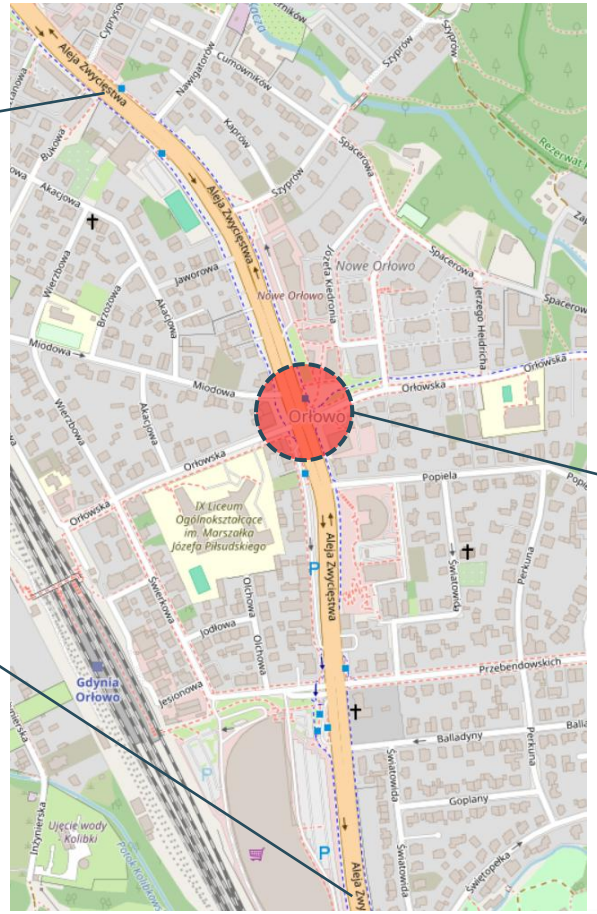
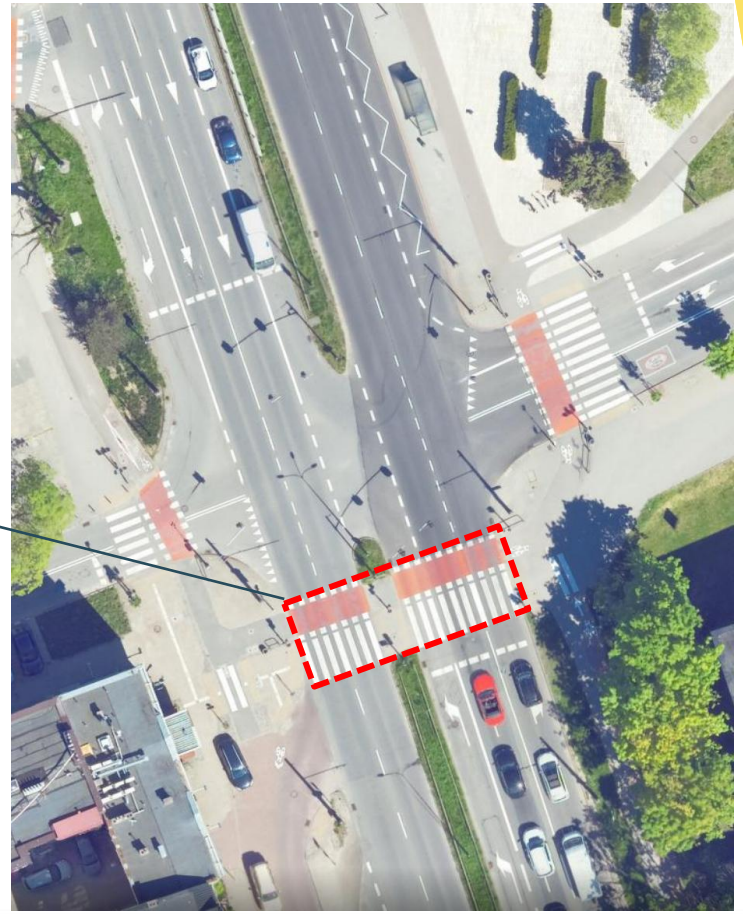
Selected test site







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Analysed weather conditions

Normal – between 10˚C and 20˚C, no precipitation

Heat – 23˚C and scorching sun

Rain – between 10˚C and 20˚C, rainfall

Snow – around 0˚C, snowfall

Source: ZDiZ Gdynia

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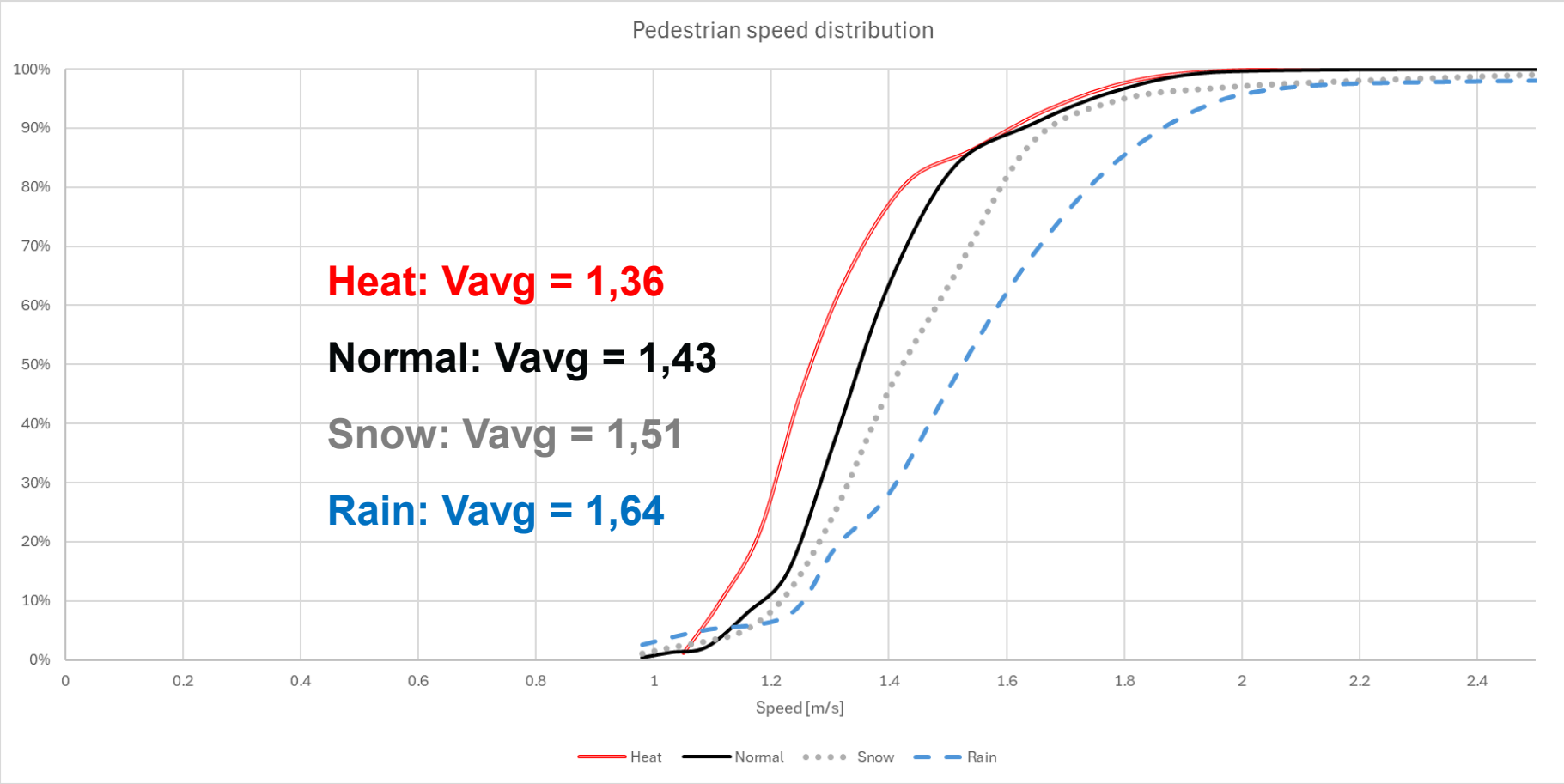
Pedestrian speed distributions



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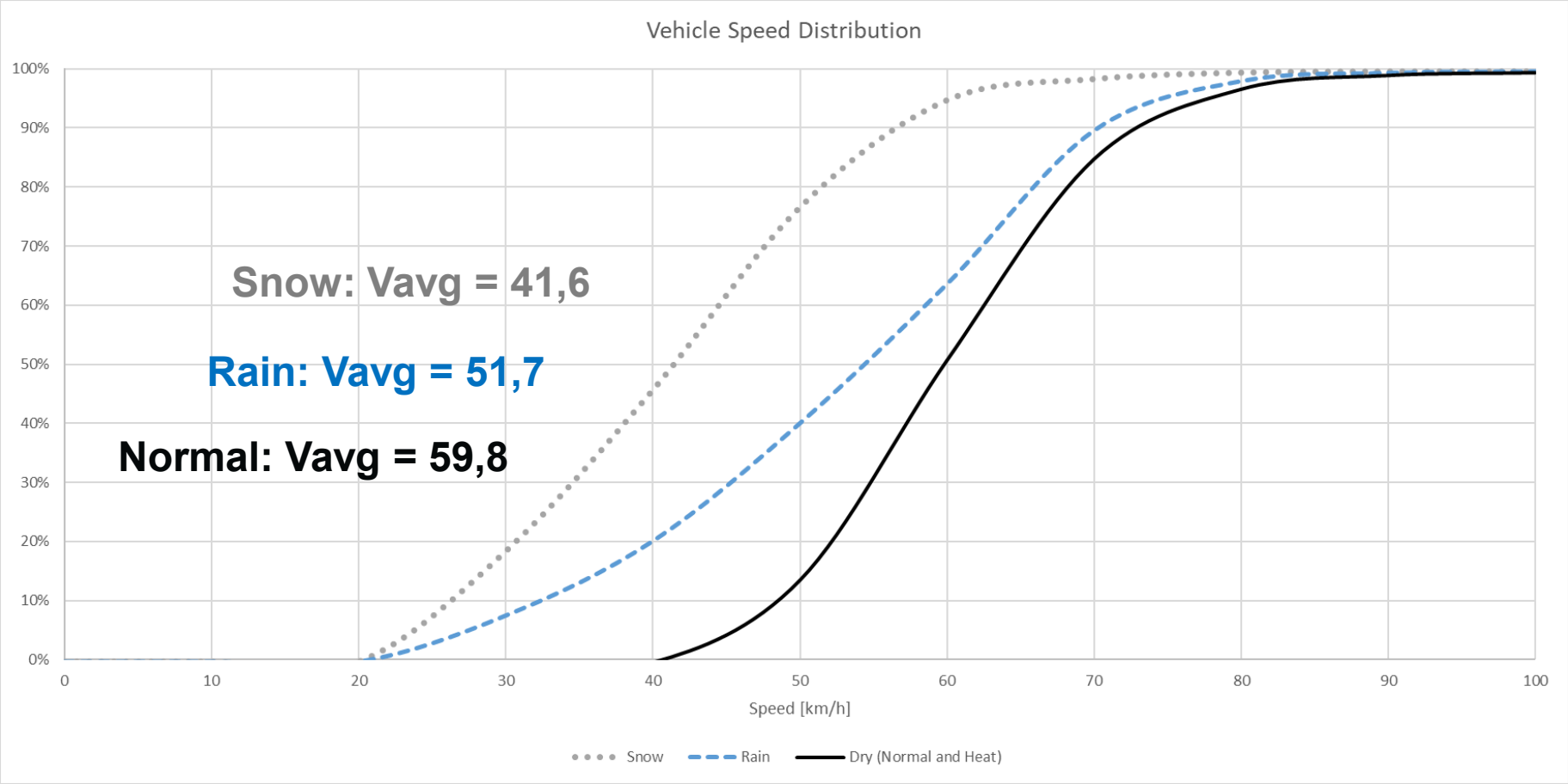
Vehicle speed distributions



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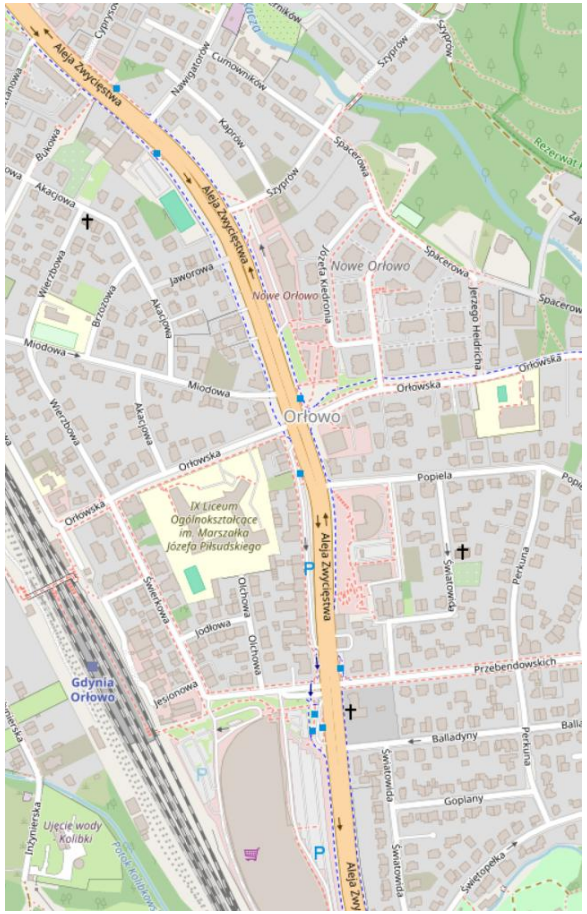
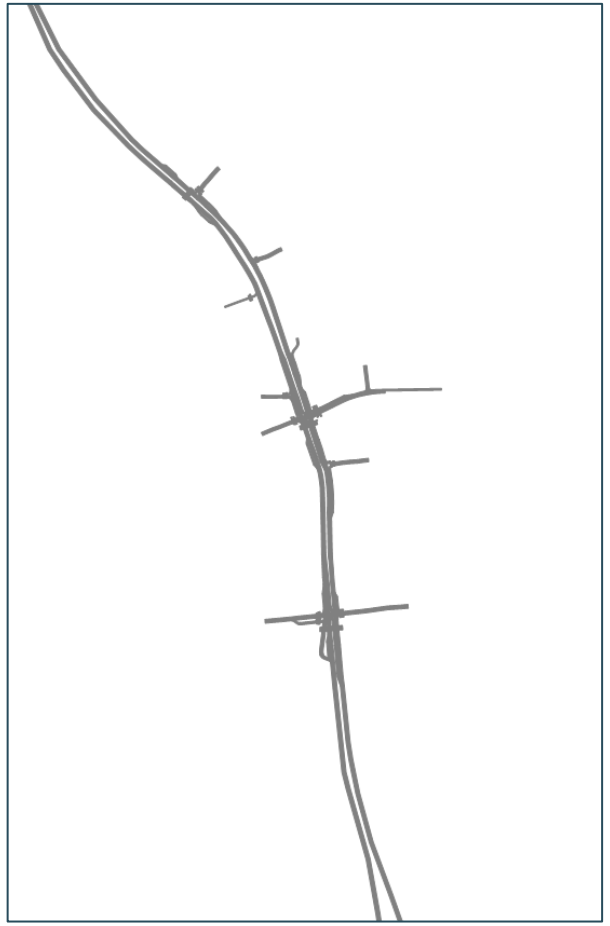
Scope of the model





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Tested traffic control strategies

Program	Pedestrian speed [m/s]	Max Pedestrian waiting time [s]	Cycle time [s]	Prefered conditions
3	1,2	99	120	Normal
5	1,2	59	80	Precipitation
6	1,4	52	70	Precipitation
7	0,86	93	120	Heat*
8	0,86	58	85	Heat*

*or unfavourable pavement conditions, resulting in significantly lower pedestrian speed because of obstacles like snowdrifts or precautions due to slippery surface

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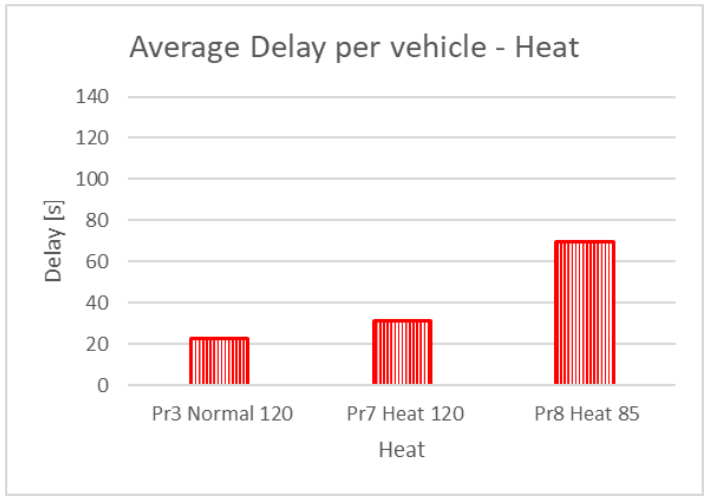
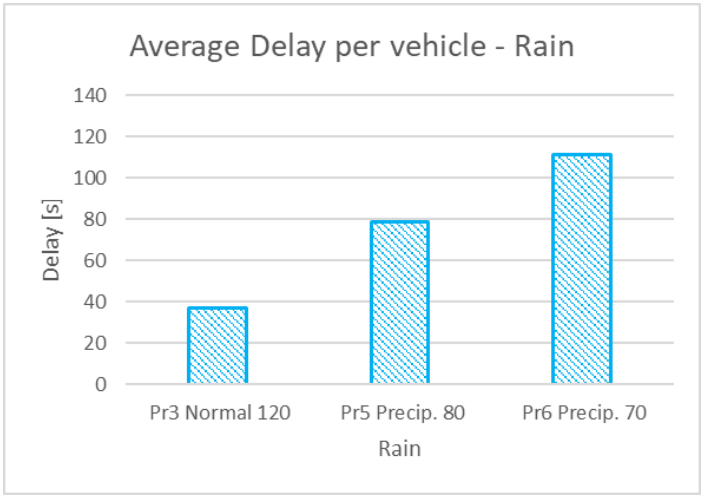
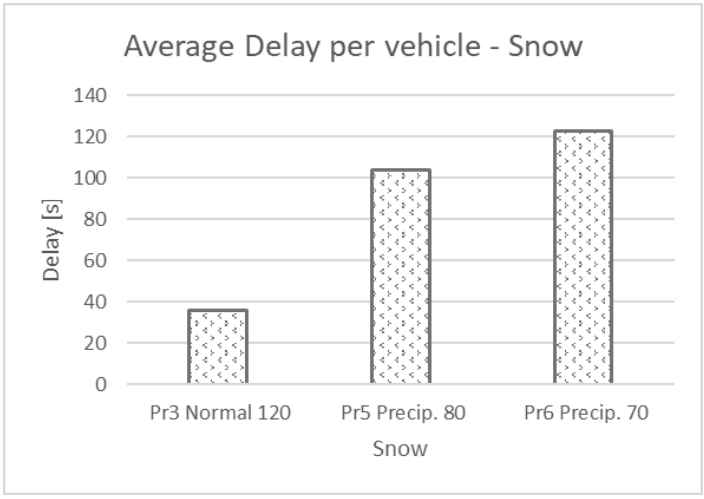
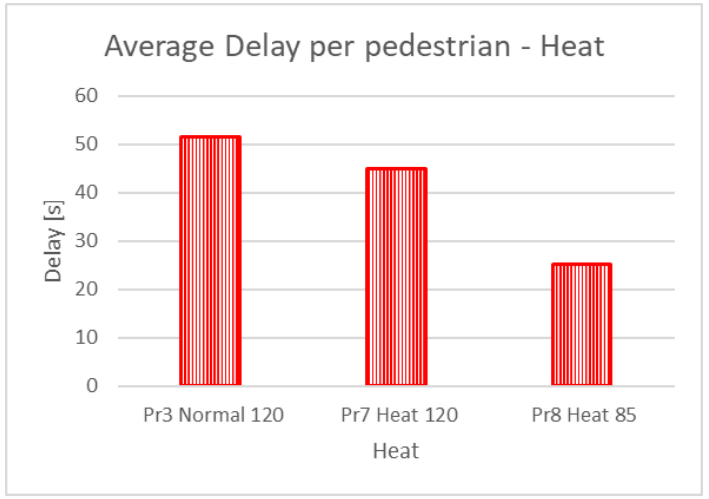
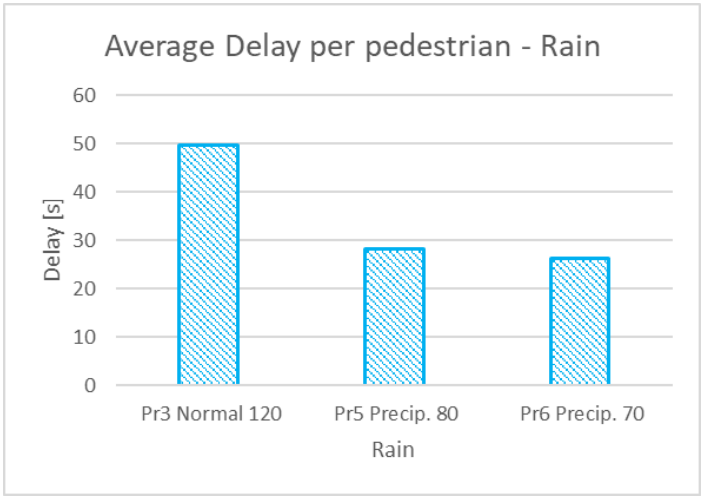
Results – different weather conditions

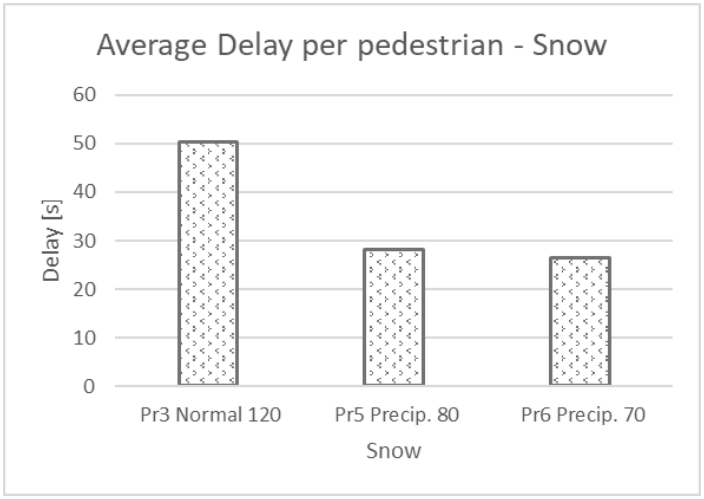












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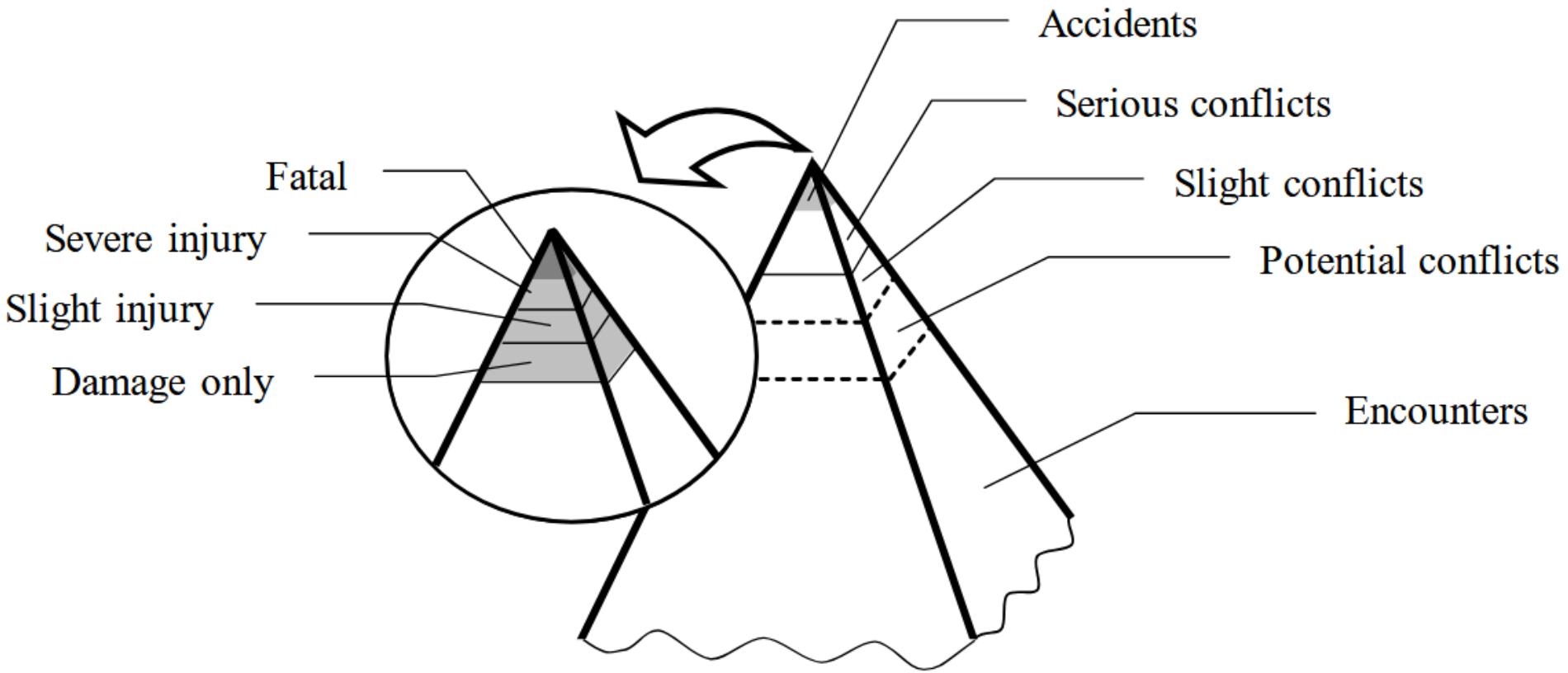
„Safety Pyramid”



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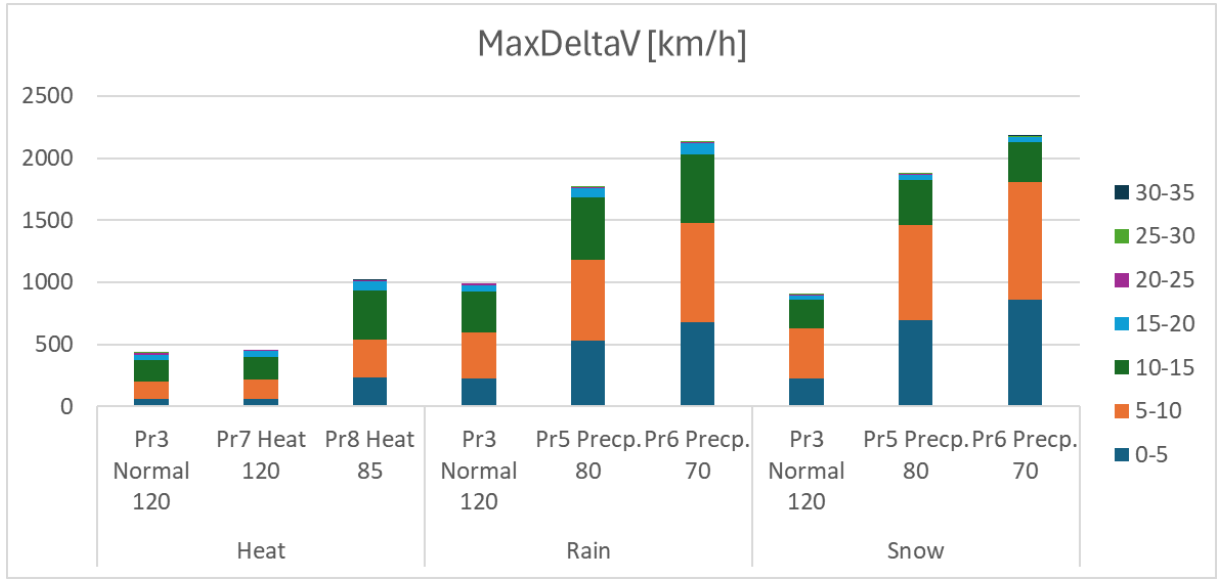
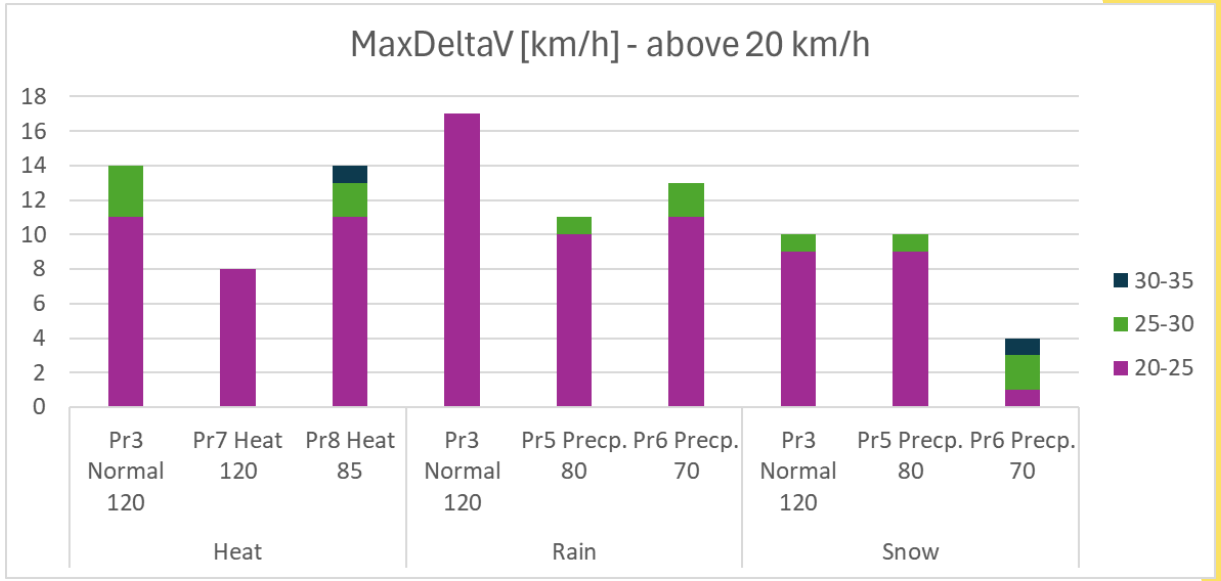
Results – different weather conditions





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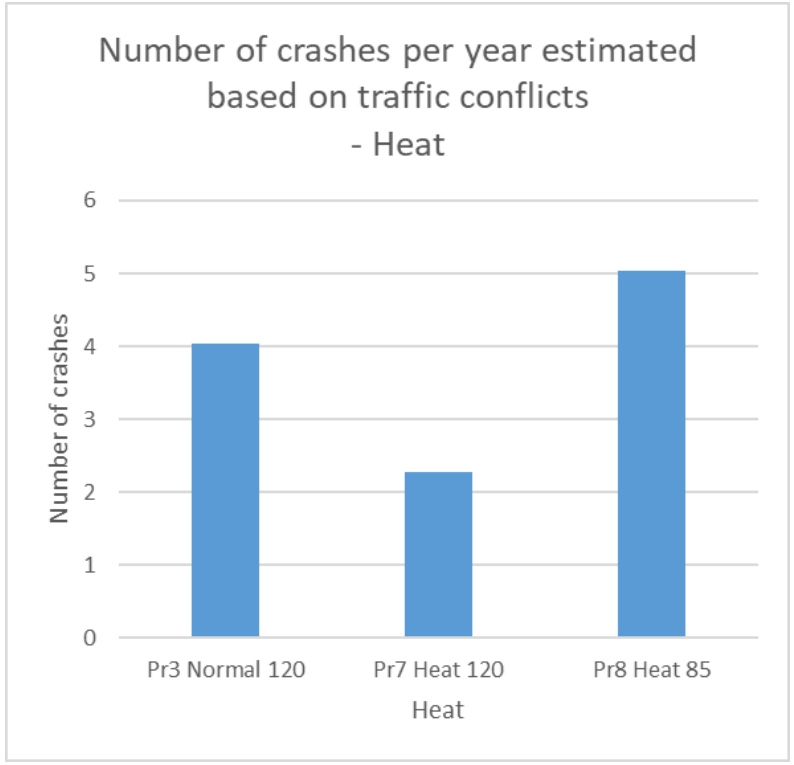
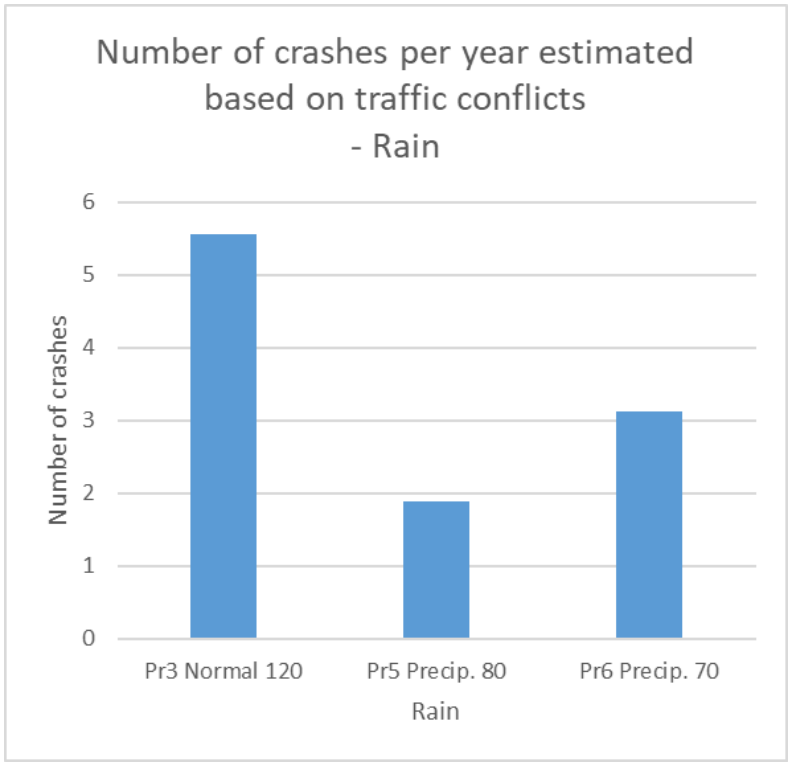
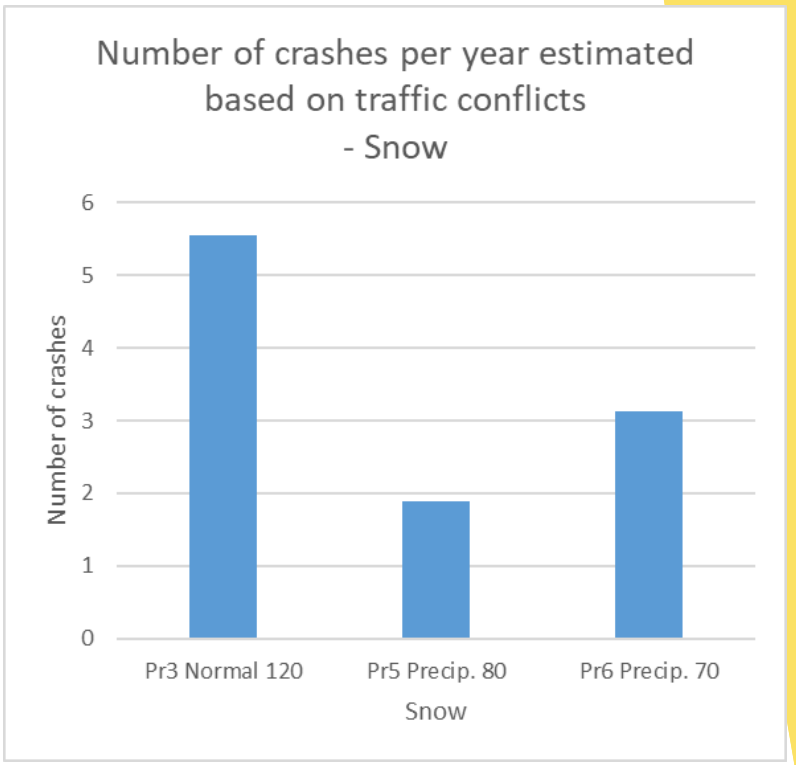
Number of accidents based on FHWA-HRT-08-049







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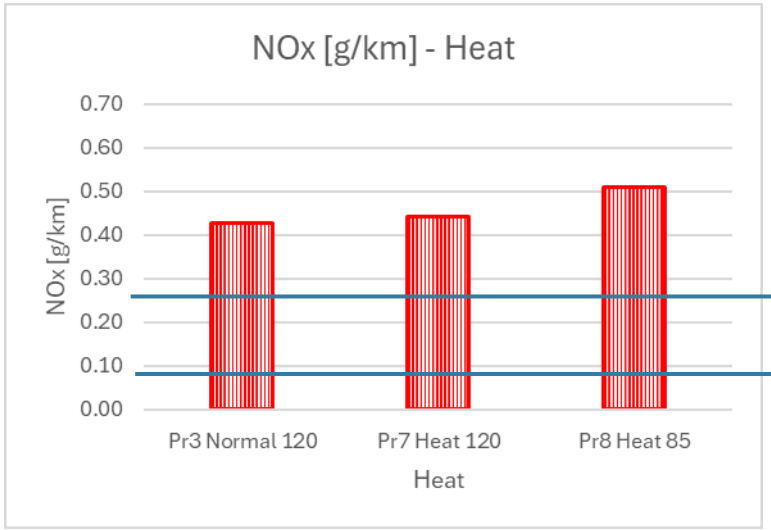
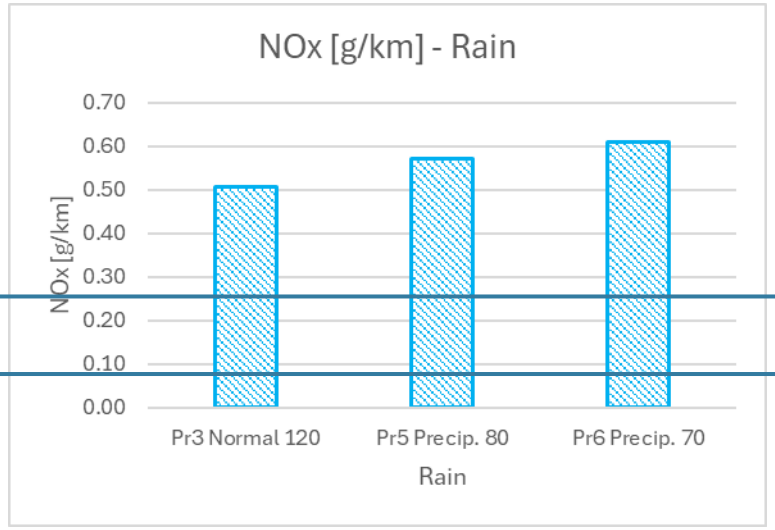
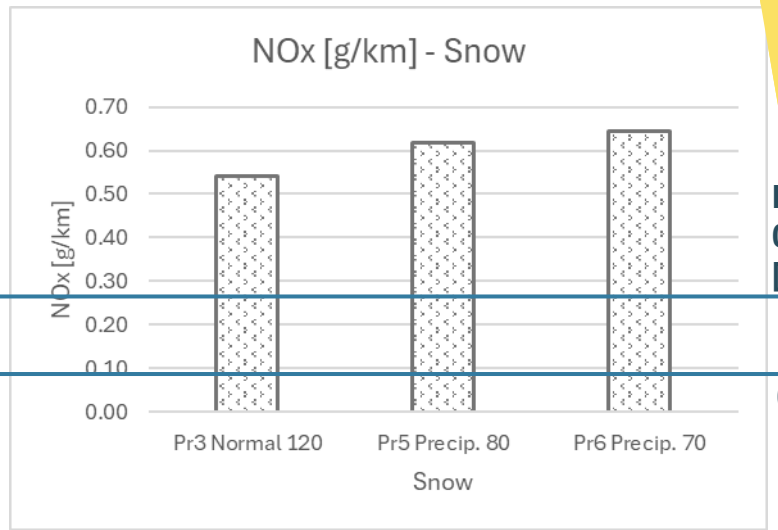
Emisje substancji szkodliwych – oszacowano wykorzystując COPERT5

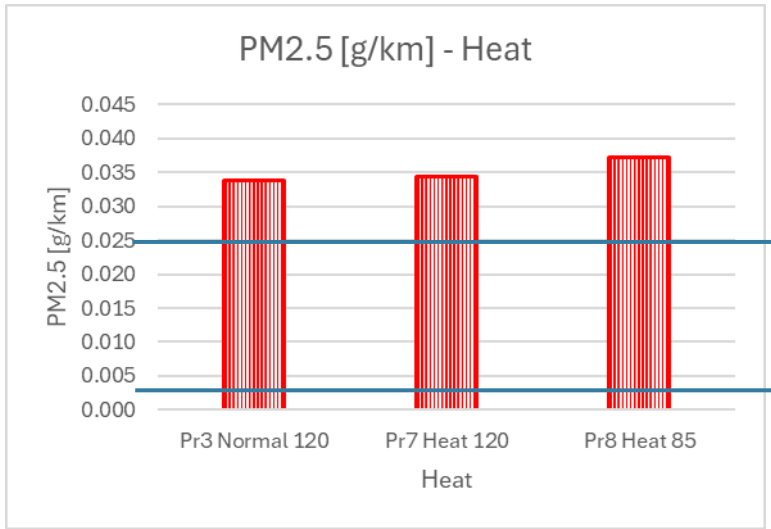


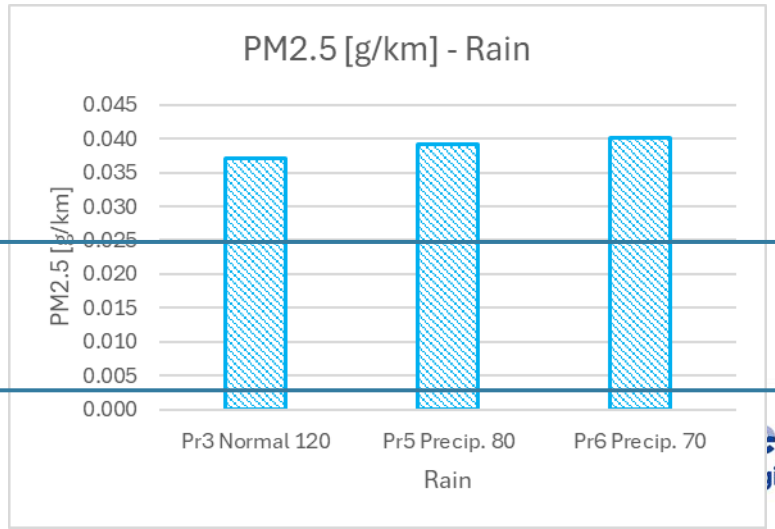


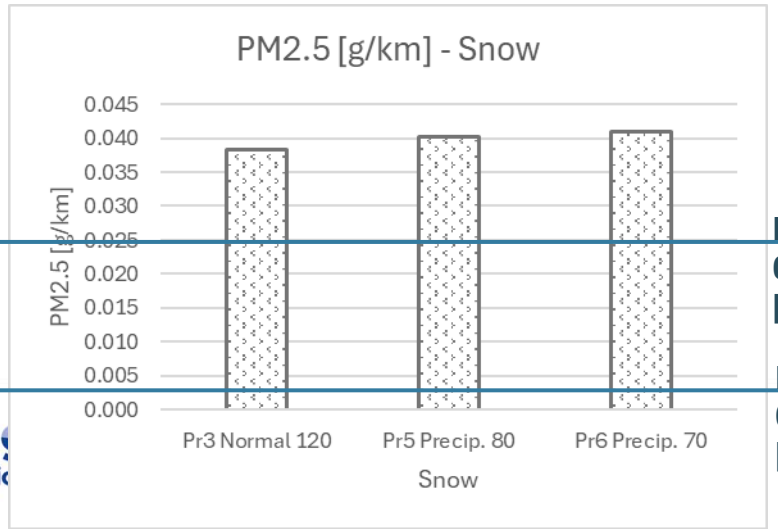


EURO4 0,25 [g/km]

EURO6 0,08 [g/km]







EURO4 0,025 [g/km]

EURO6 0,005 [g/km]

Summary

- Weather conditions significantly influence the behaviour of road users, including both drivers and pedestrians. Active mobility users (such as pedestrians and cyclists) are especially vulnerable to adverse weather, including rain, snow, and heat.
- Conventional traffic control strategies are typically optimised for vehicular traffic, while pedestrian and cyclist phases are often treated as secondary and inconvenient necessities within the signal programme.
- Simulation-based analyses and surrogate safety measures indicate that traffic signal adjustments can improve both efficiency and safety, particularly for vulnerable road users, under adverse weather conditions.

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Recommendations

- Pedestrian speeds are affected differently depending on the type o adverse weather: during rainfall, pedestrians often walk faster to avoid getting wet, while in conditions such as heat, they tend to slo down due to discomfort. These variations should be considered when designing signal timings.
- It is recommended that signal cycle lengths and green light durations for pedestrians be adapted dynamically in response to prevailing weather conditions. This approach can reduce delays for pedestrians and enhance safety for all users.
- Implementing weather-dependent signal control strategies including adjustment of signal parameters based on temperature, precipitation, or pavement conditions has shown promising results. Such measures may play a key role in supporting and encouraging active mobility in challenging weather.

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THANK YOU!

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