Bydgoszcz
- analysis results

2050 CliMobCity
Interreg Europe

European Union
European Regional Development Fund

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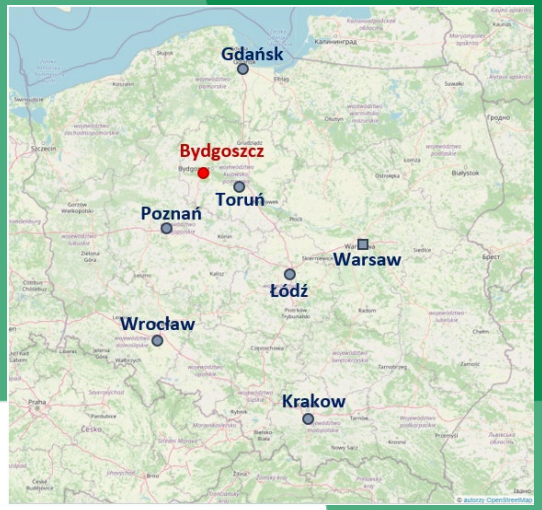
Introduction



Bydgoszcz: ~ 340k population
~600k+ in metro (FUA) area

- 9th largest city in Poland

Public transport:

- 11 tram lines
- ~ 48 bus routes

- annual ridership: **92m** passengers (2019)

Scope

- analysis for the Bydgoszcz city:

2020/21 base model

supply data – 2050
- PrT and PuT development plans

+

demand data – 2050
- socio-economic and LU forecasts

2050 base BAU model – [W0]
- as documented by the city

+

proposed interventions
- Leader and Supervisor, own proposals, **stakeholder meetings**…

2050 CliMobCity models – [W1], [W2]
- alternate **interventions'** scenarios

and CliMobCity plus models - [W1+], [W2+]
- additional **behavioural shifts'** scenarios

transport analysis
- journey parameters (GRADIENS)

+

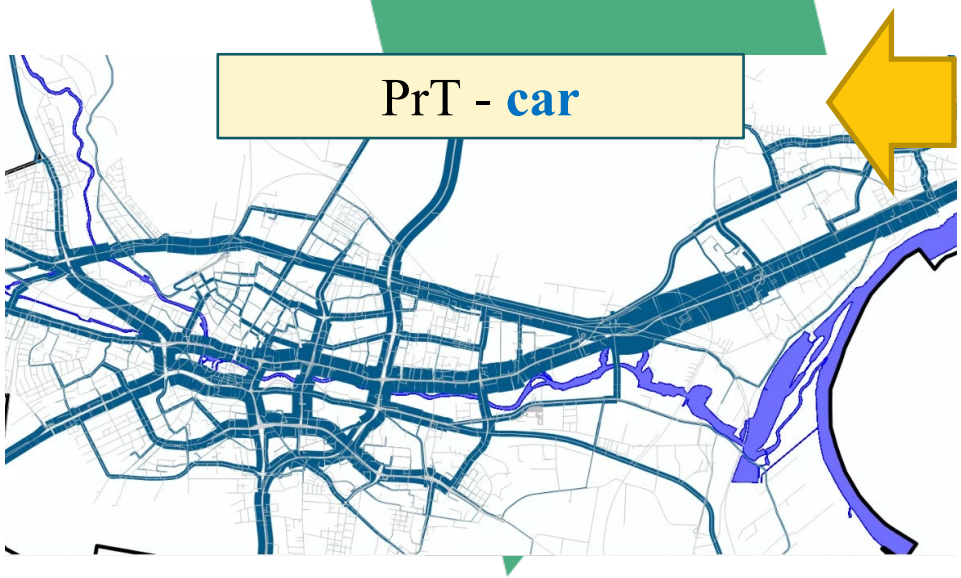
environmental analysis
- emissions' calculations (PIK)

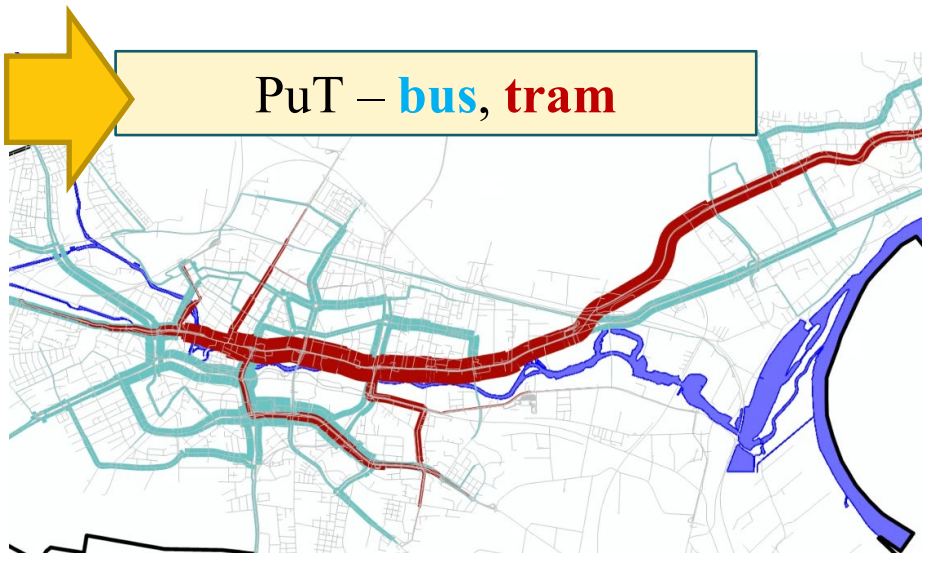
CliMobCity outputs
- conclusions and recommendations

Methodology

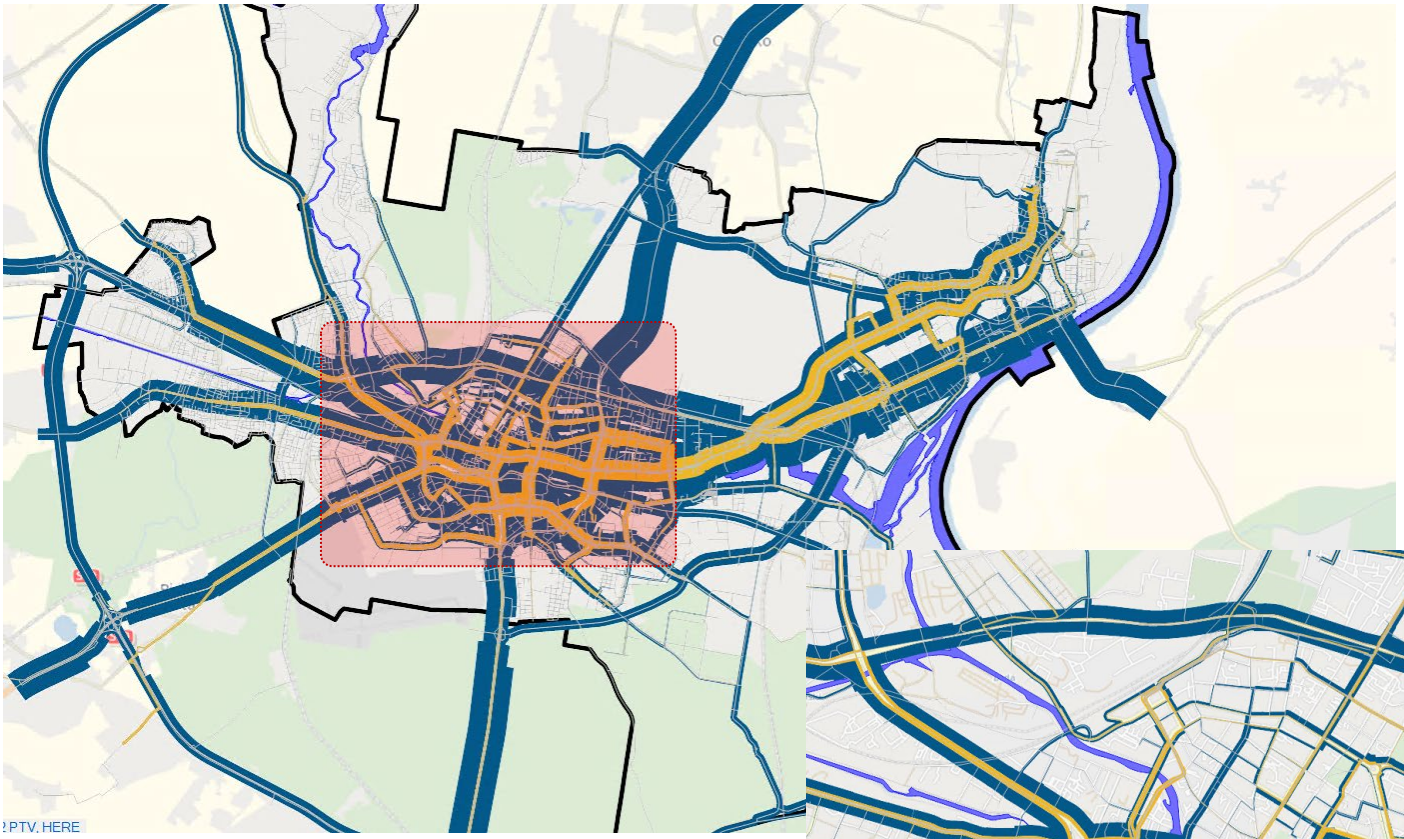
Bydgoszcz transport model (in PTV Visum):

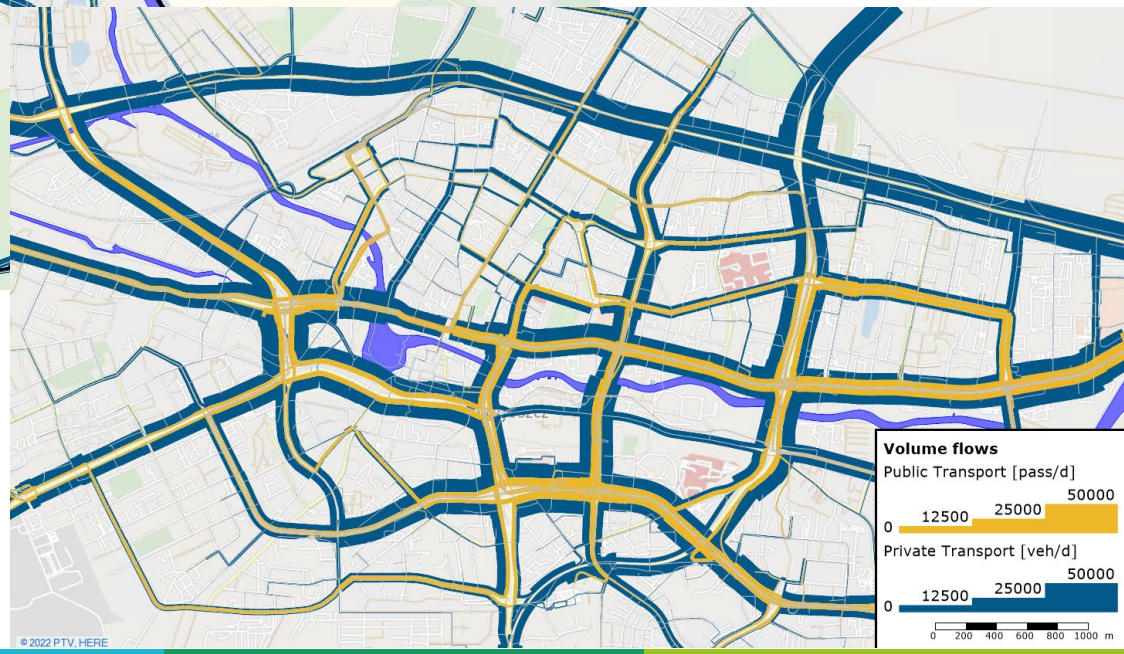
- multimodal – private & public transport, active modes
- network & demand data
- land-use and transport impacts
- outputs – numerical, graphical, qualitative…





Results – [W0] baseline flows





BAU [W0] – initial results

Bydgoszcz - scenario: [values per 24 hrs]		Modal Share (passenger trips only)				average occupancy
		% PrT (car)	% PuT	% Walk	% Cycle	[pass./ veh.]
base year	2021	50.4%	22.2%	26.2%	1.3%	1.23
future year - BAU	2050 [W0]	54.3%	21.7%	22.8%	1.2%	1.21

Bydgoszcz - scenario: [values per 24 hrs]		Network statistics					
		v_mean [km/h]		l_mean [km]		t_mean [mins]	
		PrT	PuT	PrT	PuT	PrT	PuT
base year	2021	49.3	21.4	10.0	4.8	12.2	13.4
future year - BAU	2050 [W0]	50.9	24.2	12.6	6.0	14.8	14.8

BAU outlook:

- rising travel distances – due to **suburbanisation**
- higher travel speeds – (road) network improvements
- *consequences?* ➔ **longer travel times**
  ➔ rising CO2 emissions

Analysis scenarios

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2050 BAU [W0]
reference scenario (business as usual)

Method ➔ **network model modifications:**
- graph: nodes, links, stops, lines
- parameters: travel speeds, times
- operations' data: timetables

(+ land-use input data)

2050 CliMobCity [W1]
hard investment expansion

focus: infrastructure policy
- **continued *suburbanisation***
- PT coverage extension
- central-area: clean traffic / pricing zone

2050 CliMobCity [W2]
soft, compact measures

focus: land-use policy
- **inner-city *reurbanisation***
- PT frequency maximisation
- limited road investment

- zero-emission bus fleet, P+R system
- central area: PT and access only

Method ➔ **demand model modifications:**
- 4-step model - mode choice
- travel utility adjustments

2050 CliMobCity [W1+]
hard investment expansion

2050 CliMobCity [W2+]
soft, compact measures

focus: travel behaviour policy
- **rising attractiveness of *non-car travel models***
- new modes' adoption: car-sharing, ride-pooling, e-bikes
- positive shifts in travellers' perceptions

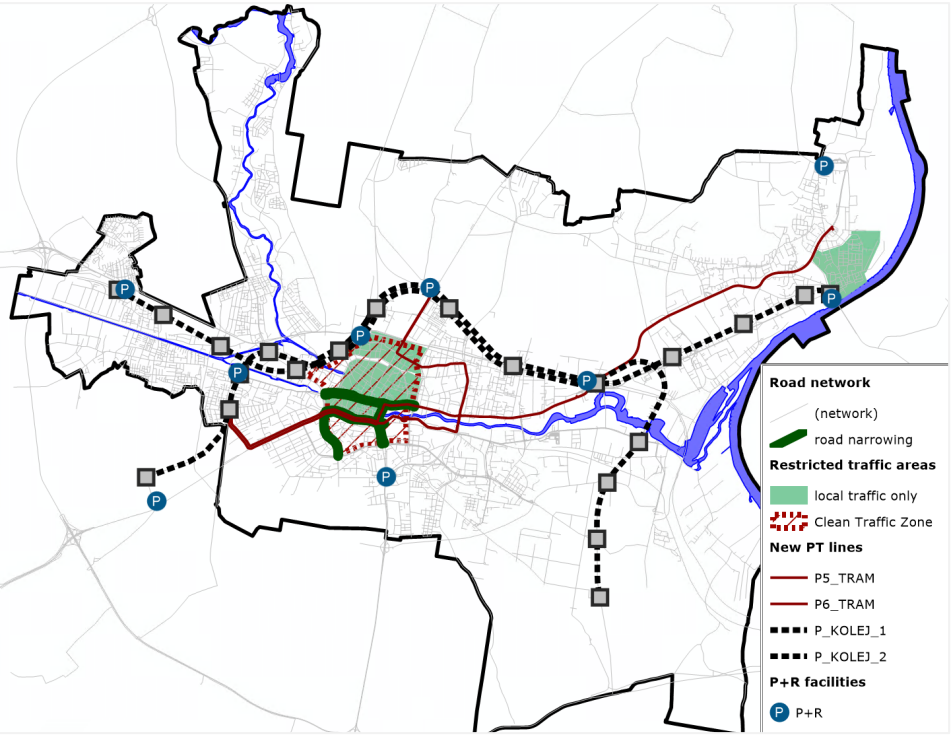
Scenario assumptions

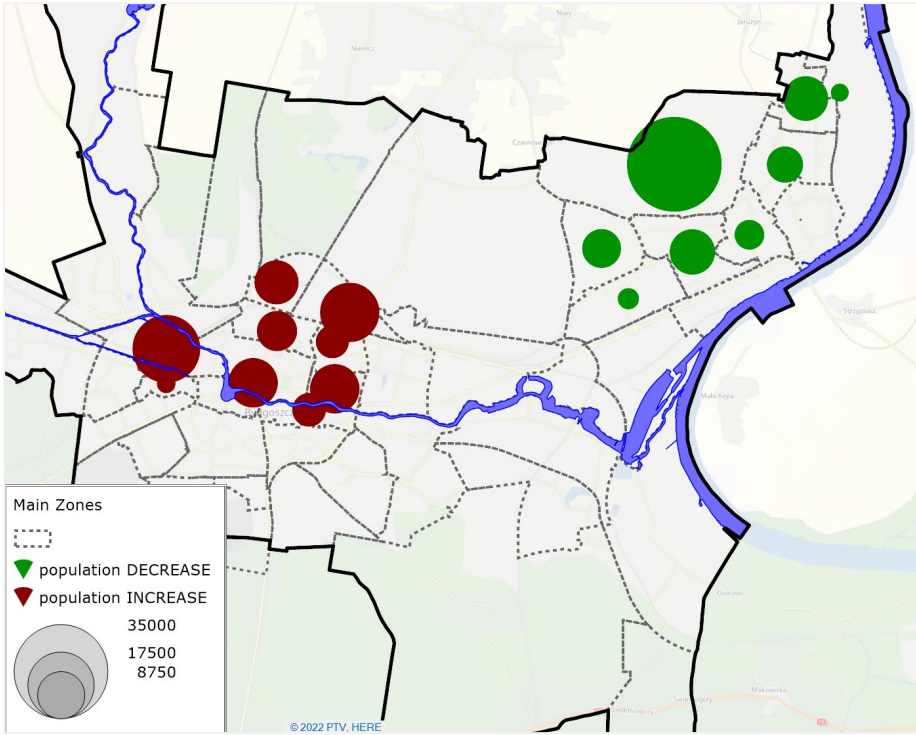
[W1] infrastructure policy

- central Bydgoszcz: road narrowing + LEZ
- tram and rail system **expansion**

[W2] land-use policy

- **reversal** of suburbanisation
- **existing** PT network – higher utilisation





(key interventions)

Results – O-D distribution

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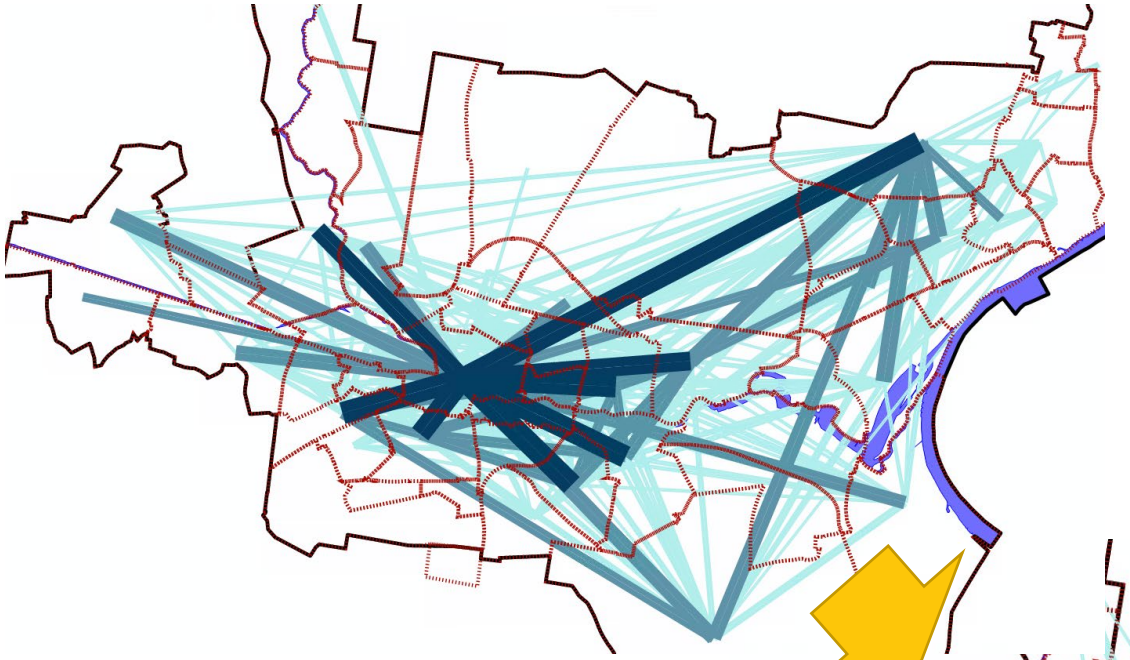
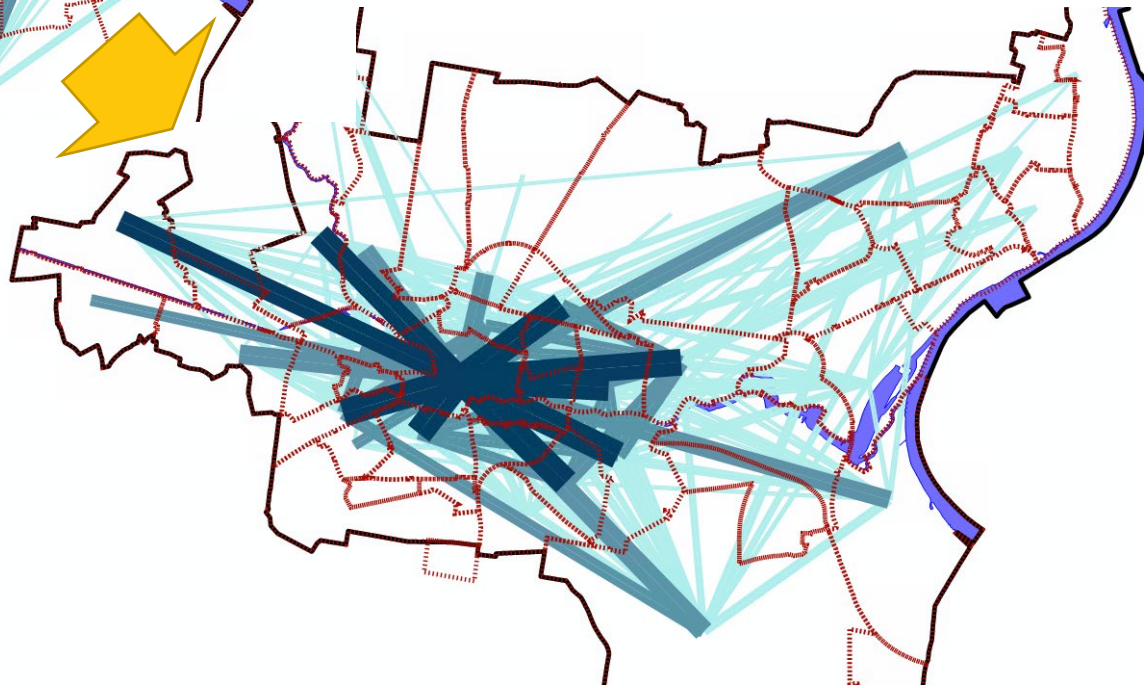


[W0] 2050

➔ sustained **suburbanisation**



[W2] 2050

➔ shift towards reurbanisation (**compact-city**)

Results – traffic flow changes

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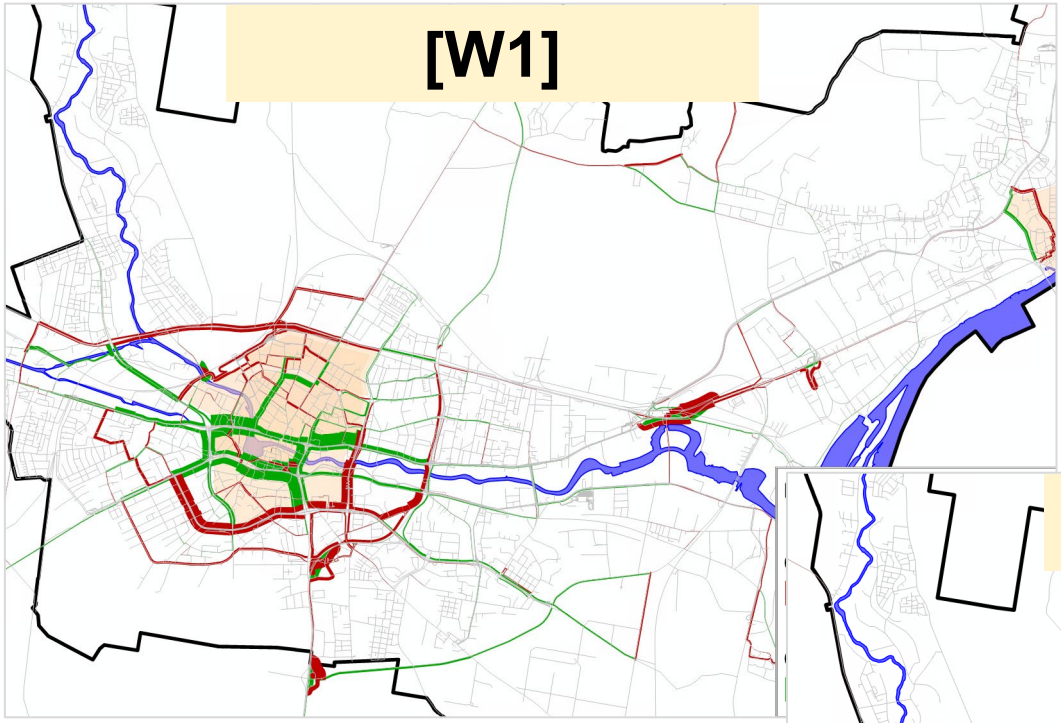
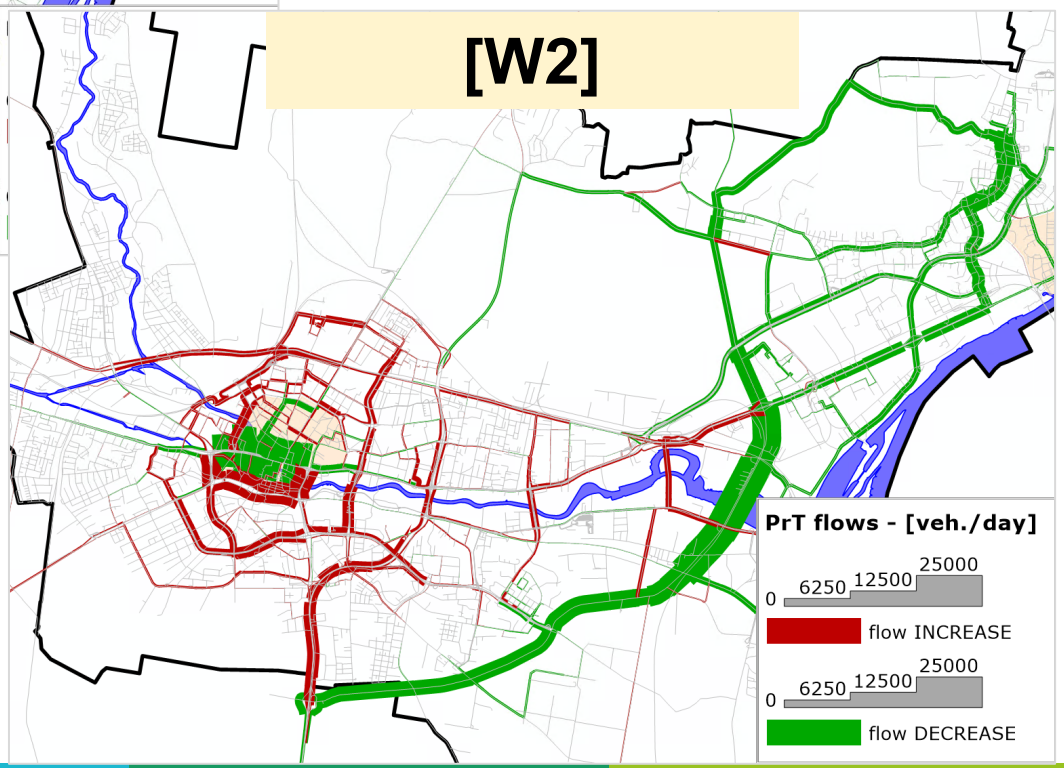




traffic loads in central area (W1 vs. W0):

- **34%** [veh-km]
- **23%** [veh-hrs]

Results – global summary

Network parameters		speed [km/h]		distance [km]		time [mins]		network loads [veh-km]
scenario:		PrT	PuT	PrT	PuT	PrT	PuT	PrT
2021 – BAU	[W0]	49.3	21.4	10.0	4.8	12.2	13.4	4.55m
2050 – BAU	[W0]	50.9	24.2	12.6	6.0	14.8	14.8	6.07m
2050 – CliMobCity	[W1]	50.5	27.2	12.5	6.1	14.9	13.4	6.11m
	[W2]	51.3	29.6	12.3	5.7	14.4	11.5	5.80m

- **PrT (car) modal share** – rising from 50% to 54% in the BAU scenario
- **[W1]** limited positive changes
  - ➔ car traffic loads decrease in the city centre only
  - ➔ network-wide: diminishing gains
- **[W2] substantial benefits:**
  - ➔ car usage falls to 51%
  - ➔ **higher PT ridership** – up to **40,000** extra [trips/day] **(+20%)**

Results – travel parameters

[W2] results vs. [W0]:

▪ **modal share**	**+ 2.0 p.p. for PuT**
▪ **network loads**	- 179.8 k [veh-km]
	- 3.2 k [veh-hrs]
▪ average speed	**- 0.5 [kph]**
▪ average travel time	**- 0.4 [mins]**

Implications?

- **travel time benefits** – *conservative estimates*:

  3,200 [hrs] * 300 * 4 [EUR/hr] = 3.84m [EUR per year]

and plus climate / safety / … gains…? ☺

Results – CO2 emissions

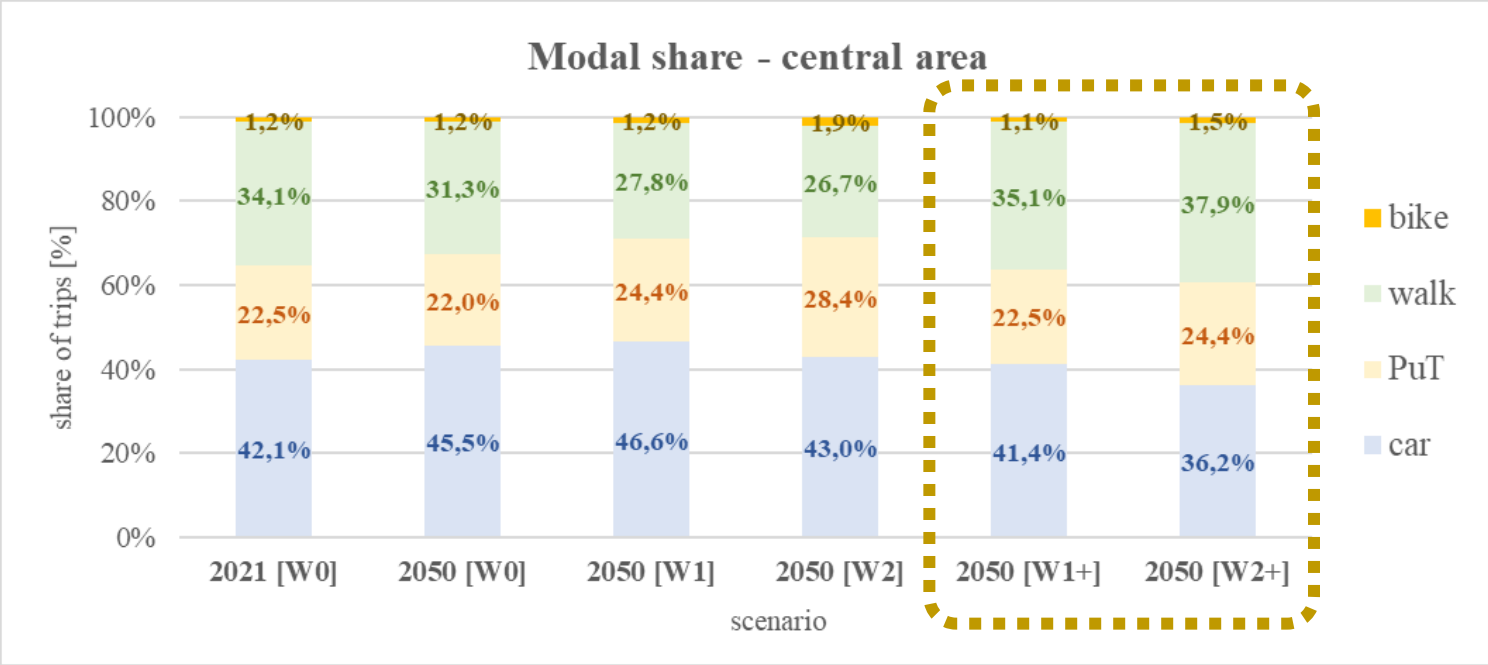
CO2 emissions – road transport in Bydgoszcz			total [tonnes]	Relative changes Δ [%]	
scenario:		zero-emission car fleet share [%]		vs. **2021**	vs. **2050 [W0]**
2021	**[W0]**	~ 0%	427,3	*n/d*	*b.d.*
2050	**[W0]**	~ 0%	478,1	**+ 12%**	*b.d.*
2050	**[W1]** – *infrastructure policy*	**16%** BEV + **7%** FCV	383,0	- 10%	- 18%
2050	**[W1]** – *infrastructure policy*	**30%** BEV + **13%** FCV	376,4	- 12%	- 21%
2050	**[W2]** – *land-use policy*	**16%** BEV + **7%** FCV	337,1	- 21%	**- 29%**
2050	**[W2]** – *land-use policy*	**30%** BEV + **13%** FCV	328,7	- 23%	**- 31%**

source: Gradiens – Visum model; PIK (Potsdam Institute for Climate Impact Research) - EuroCalc model

- **[W0] BAU:** rising CO2 emissions wrt. present-day values
- **[W2] vs. [W1] CliMobCity:** extra environmental gains with the inhibition of *urban sprawl* (synergy with other transport inverventions)

➔ yet - CO2 reductions substantially limited by **energy-mix sources**

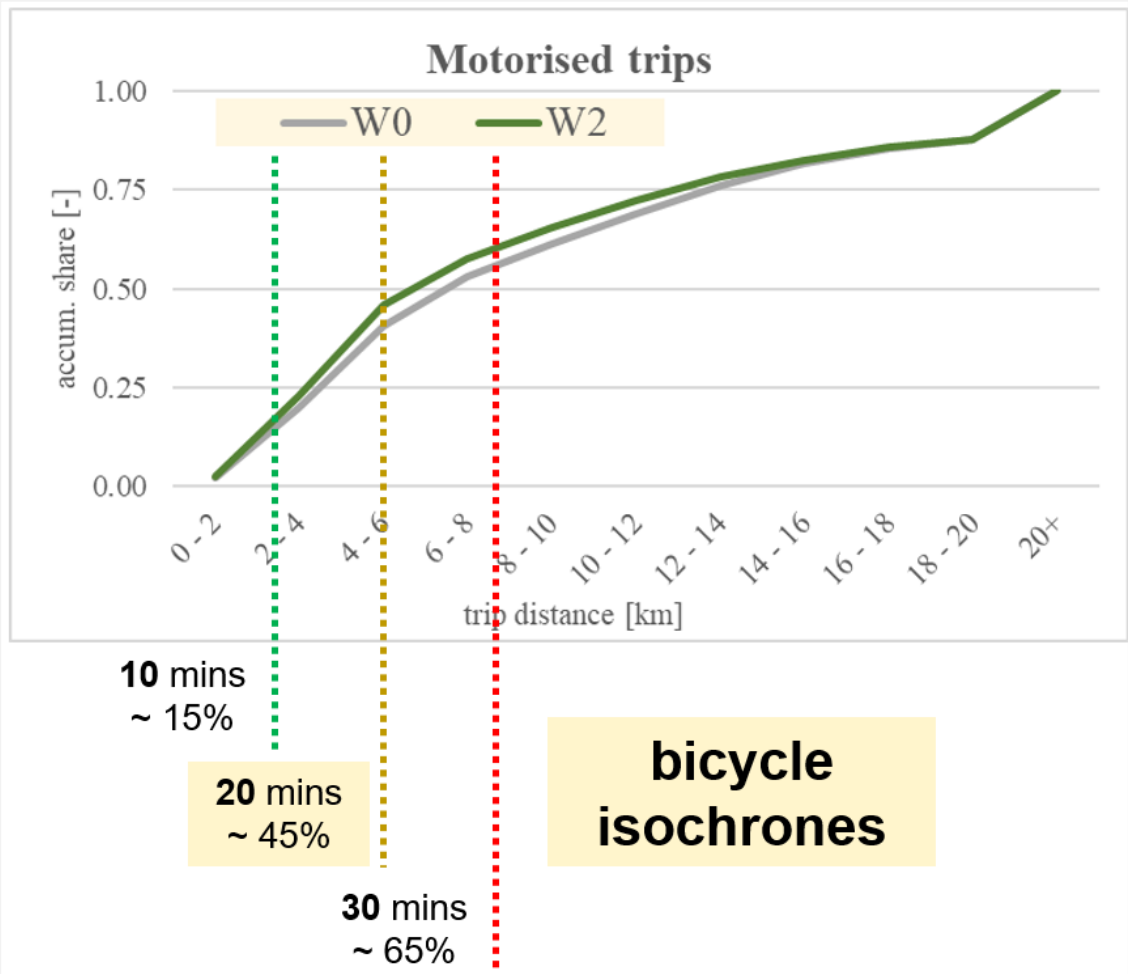
Results – *plus* scenarios



Long-term travel behaviour changes – fostering the [W1] and [W2] benefits:

- **additional trip changes:**
  PrT: - 25 000 [veh./d]
  PuT: + 20 000 [pass./d]
- **traffic loads:**
  [veh-km], [veh-hrs]: **– 8%**

Active modes' potential



CliMobCity - conclusions

Objectives:

- A. Reduce average trip distance
- B. Shift from car to sustainable modes
- C. Increase vehicle occupancy
- D. Switch to cleaner engines
- E. Organise less-consuming traffic flow

Recommendations:

1. Compact city development
2. Facilitating travel behaviour changes
3. Central-area car traffic restrictions
4. ITS development for public transport
5. Low-emission vehicle fleet
6. Promotion of car-pooling system
7. Bicycle network expansion
8. Metropolitan rail system development
9. Park and Ride system development
10. Ring road system expansion

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Thank you! ☺

questions, comments, feedback…?

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