Visualisation Methodology for Informed Decision-making Applied to Smart City and Digital Twin contexts

Results of the PoliVisu, DUET and COMPAIR H2020 EU Projects *1

Overview of the research data

TITLE

Visualisation Methodology for Informed Decision-making Applied to Smart City and Digital Twin contexts

VERSION

1.0

RESEARCH MATERIAL IDENTIFIER

Research material: 10.5281/zenodo.17379999

Nr.	Tab name	Title	Caption
1	Table 1 Cases	TABLE 1: Overview of the smart city-related visualisation cases using the visualisation methodology	-
2	Table 2 VisualisationTechniques	TABLE 2: Overview of visualisation cases and their potential use in the policy cycle	Caption: Smart City Visualisation Cases versus Policy-making Cycle Phases
3	Table 3 VisualisationCases	TABLE 3: Quantitative overview of visualisation techniques and their potential use in the policy cycle	Caption: Smart City Visualisation Instrument versus Policy-making Cycle Phases
4	Table A1	TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data	Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)
5	Table A2	TABLE RESEARCH DATA 2: Visualisation Methodology - Steps	Caption: Visualisation methodology step-by-step approach (case level)

6	Table A3	TABLE RESEARCH DATA 3: Visualisation techniques overview	Caption: Overview of the used visualisation techniques, characteristics and use
7	Table 2 & 3 Preparation - Scoring	TABLE RESEARCH DATA 4: Policy cycle case mapping	Caption: Results of the individual scoring of each case for the policy cycle (sub)phases

Nr.	File name + document type	Title	Caption
1	Cases - Visuals (Presentation)	Case Visualisations	-

*1 Policy Development based on Advanced Geospatial Data Analytics and Visualisation (PoliVisu), EU H2020 project, https://cordis.europa.eu/project/id/769608
Digital Urban European Twins for smarter decision making (DUET), EU H2020 project, https://cordis.europa.eu/project/id/870697
Community Observation Measurement & Participation in AIR Science (COMPAIR), EU H2020 project, https://cordis.europa.eu/project/id/101036563

TABLE 1: Overview of the smart city-related visualisation cases using the visualisation methodology

Nr.	Smart city-related Visualisation Cases (Location & Title)	Visualisation Content
1	Berlin (DE), Flanders (BE) - Dynamic exposure visualisation dashboard	Dashboard visualising the exposure to fine dust levels (PM2.5) during travel routes on a geospatial map and on graphs visualising levels related to travel distance and exposure time
2	Issy-les-Moulineaux (FR) - Traffic dashboard	Traffic dashboard visualising traffic delay, traffic blackspots and free flow speed for Issy-Les-Moulineaux and its surroundings
3	Police zone Voorkempen (BE) - Trajectory speed limit enforcement dashboard	Dashboard visualising aggregated average speed control camera data, envisioning live and historical traffic volumes and average speeds
4	Solva region (BE) - Regional traffic behaviour	Dashboard visualisation of origin-destination patterns of floating car data on a regional scale in South-Eastern Flanders and its surroundings
5	Herzele (BE) - Interactive school street dashboard	Dashboard visualising results from multiple sensor types (traffic, air quality PM, NO2, BC) allowing the comparison of two groups of sensors before and after a moment in time (when the measure has been implemented) - Applied on a school street implementation case
6	Mechelen/Flanders (BE) - Interactive school street dashboard	Dashboard visualising traffic count data (cars, big vehicles, cyclists and pedestrians) in and around school streets before and after the implementation of a school street
7	Sint-Niklaas (BE) - Local mobility scheme/plan dashboard	Dashboard visualising results from multiple sensor types (traffic, air quality PM, NO2, BC) allowing the comparison of two groups of sensors before and after a moment in time (when the measure has been implemented) - Applied on a local mobility scheme/plan implementation case
8	Flanders (BE) - Interactive road safety map	Interactive road safety heatmap for Flanders visualising heatmaps, line and point maps included advanced geo-time and content selection possibilities
9	Ghent (BE) - Student displacements	Choropleth map visualising dorm higher education student displacements during a reference period in Ghent by using mobile telecommunication data
10	Pilsen (CZ) - Interactive road accident map	Interactive road accident heatmap for Pilsen visualising heatmaps and point maps included advanced geo-time and content selection possibilities
11	Pilsen (CZ) - Interactive sensor based live and historic traffic map	Interactive map visualising live and historic traffic volumes in Pilsen, including advanced data geo-time and content selection possibilities
12	Pilsen (CZ) - Traffic measure impact modelling comparison	Traffic volume and intensity line delta map of the results of a traffic calculation using the Pilsen traffic model
13	Pilsen (CZ) - Traffic volume impact simulation modelling	Traffic volume and intensity line map visualisation of a traffic calculation using the Pilsen traffic model
14	Issy-les-Moulineaux (FR) - Travel planning app	Optimal multimodal route calculation mobile visualisation app (My Anatol app) offering sustainable route suggestions
15	Pilsen (CZ) - Impact of roadworks simulation	Traffic volume and intensity line map visualisation of the impact of planned roadworks using the Pilsen traffic model

16	Athens (GR) Digital Twin - Green squares planning	Visualising the impact of 3D terrain assets (e.g. buildings, constructions, trees, water, street furniture) on the comfort of urban spaces related to liveability, e.g. by avoiding heat stress, using a Digital Twin
17	Athens (GR) Digital Twin - Traffic load & creation of a pedestrian and cycling route	Visualising traffic volumes, air quality impact, noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case transforming roads towards low traffic zones to promote walking and cycling
18	Pilsen (CZ), Ghent (BE) Digital Twin - Impact of road closures	Visualising traffic volumes, air quality impact, and noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case road closures on an existing network
19	Pilsen (CZ) Digital Twin - Ring road construction impact	Visualising traffic volumes, air quality impact, noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case new road infrastructure
20	Pilsen (CZ) Digital Twin - Solar equipment locations in the city park	Visualising the impact of 3D terrain assets (e.g. buildings, other constructions, e.g. bridges, trees) on the potential shadow impact on solar panels in a Digital Twin

TABLE 2: Overview of visualisation cases and their potential use in the policy cycle

Caption: Smart City Visualisation Cases versus Policy-making Cycle Phases

		Policy Design				Policy Implementation				Policy Evaluation	
		Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	Ongoing monitoring	Communication	Impact assessment	Problem (re) structuring
Case	Dashboard visualisation										
	Visualisation DB										
1	Berlin (DE), Flanders (BE) - Dynamic exposure visualisation dashboard	*YES*	-	-	-	-	-	*YES*	*YES*	-	-
2	Issy-les-Moulineaux (FR) - Traffic dashboard	*YES*	-	-	-	-	-	-	*YES*	*YES*	-
3	Police zone Voorkempen (BE) - Trajectory speed limit enforcement dashboard	-	*YES*	-	-	-	-	*YES*	-	*YES*	*YES*
4	Solva region (BE) - Regional traffic behaviour	*YES*	*YES*	-	-	-	-	-	-	-	-
	PolicyDB										
5	Herzele (BE) - Interactive school street dashboard	*YES*	-	-	*YES*	-	-	*YES*	*YES*	*YES*	-
6	Mechelen/Flanders (BE) - School street dashboard	*YES*	*YES*	-	-	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
7	Sint-Niklaas (BE) - Local mobility scheme/plan dashboard	*YES*	-	*YES*	*YES*	*YES*	-	*YES*	*YES*	*YES*	*YES*
	Intensity map visualisation										
8	Flanders (BE) - Interactive road safety map	*YES*	*YES*	-	-	*YES*	-	-	*YES*	*YES*	-
9	Ghent (BE) - Student displacements	*YES*	*YES*	-	-	-	-	-	-	-	-
10	Pilsen (CZ) - Interactive road accident map	*YES*	*YES*	-	-	-	-	-	*YES*	*YES*	-
11	Pilsen (CZ) - Interactive sensor based live and historic traffic map	*YES*	-	-	-	-	-	-	*YES*	*YES*	-
12	Pilsen (CZ) - Traffic measure impact modelling comparison	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	-	*YES*	*YES*
13	Pilsen (CZ) - Traffic volume impact simulation modelling	*YES*	-	-	-	-	-	-	*YES*	-	-
	Algorithm visualisation										
14	Issy-les-Moulineaux (FR) - Travel planning app	-	-	-	-	-	-	-	*YES*	-	-

15	Pilsen (CZ) - Impact of roadworks simulation	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
	Digital Twin visualisation										
16	Athens (GR) - Digital Twin, Green squares planning	*YES*	-	*YES*	*YES*	*YES*	-	-	*YES*	-	-
17	Athens (GR) - Digital Twin, Traffic load & creation of a pedestrian and cycling route	*YES*	-	-	*YES*	*YES*	-	-	*YES*	*YES*	-
18	Pilsen (CZ), Ghent (BE) - Digital Twin, Impact of road closures	*YES*	*YES*	*YES*	*YES*	*YES*	-	-	*YES*	*YES*	*YES*
19	Pilsen (CZ) - Digital Twin, Ring road construction impact	*YES*	*YES*	*YES*	*YES*	*YES*	-	-	*YES*	*YES*	*YES*
20	Pilsen (CZ) - Digital Twin, Solar equipment locations in the city park	*YES*	-	*YES*	*YES*	*YES*	*YES*	-	-	*YES*	-

[2]

TABLE 3: Quantitative overview of visualisation techniques and their potential use in the policy cycle

Caption: Smart City Visualisation Instrument versus Policy-making Cycle Phases

Phase	Policy Design				Policy Implementation				Policy Evaluation	
Subphase	Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	Ongoing monitoring	Communication	Impact assessment	Problem (re) structuring
Dashboard visualisation	6/7	3/7	1/7	2/7	2/7	1/7	5/7	5/7	5/7	3/7
-Visualisation DB	*3/4*	*2/4*	*0/4*	*0/4*	*0/4*	*0/4*	*2/4*	*2/4*	*2/4*	*1/4*
-PolicyDB	*3/3*	*1/3*	*1/3*	*2/3*	*2/3*	*1/3*	*3/3*	*3/3*	*3/3*	*2/3*
Intensity map visualisation	6/6	4/6	1/6	1/6	2/6	1/6	1/6	4/6	4/6	1/6
Algorithm visualisation	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/2	1/2	1/2
Digital Twin visualisation	5/5	2/5	4/5	5/5	5/5	1/5	0/5	4/5	4/5	2/5
Percentage / subphase	90%	50%	35%	45%	50%	20%	35%	75%	70%	35%
Percentage / phase	55%				45%				53%	

²

TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data

Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)

Case	Visualisation link nr.	Pilot	Initial request	Policy Elements	Visualisation Goal (related to the request & policy elements)	Description of main data fields	Main Visualisation Techniques	Visualisation Tool	Visualisation summary	Policy-making cycle (except the communication element)	Project
1	-	Flanders/Berlin	As a citizen, I want to know my exposure to air pollution during a displacement.	Policy goal: Supporting environmental awareness	Evaluating the impact of air quality, including fine dust (PM) and black carbon (BC), during routes by bike and foot.	Output of Air quality sensor, built-in GPS (e.g. Sodaq PM) or Air quality sensor with no GPS, Mobile phone GPS link (e.g. BC meter): - Location X, Y - Time - Exposure PM2.5, PM10 in microgram/m²	- Dynamic exposure dashboard interface - 2D Trip visualisation map - Air Quality exposure line chart - Air Quality exposure cumulative line chart - Selection table (trip selection interface) - Selection and filter options	Reusable Compair Dynamic Exposure Visualisation dashboard	Dashboard including a map visualisation of routes. Route segments have the colour of the air quality measured at the segment. Excposure line chart showing air quality (fine dust particles, black carbon) by trip duration and distance, combined with a cumulative exposure line chart showing the same information. Model simulation of the inhaled dose based on sex, age and activity level.	Problem stetting: Dynamic exposure visualisation	Compair
1	1.1	Flanders/Berlin	Idem	Idem	Visualise the level of exposure of the route on a city map.	Idem	- 2D Trip visualisation map	Idem	2D Map, segments (measurements intervals + location).	Idem	Compair
1	1.2	Flanders/Berlin	Idem	Idem	Visualise the level of exposure during the route compared to the WHO health guideline.	Idem	- Air Quality exposure line chart - Air Quality exposure cumulative line chart	Idem	Line chart visualising the PM (fine dust in ug/m2), black carbon exposure compared to the WHO guidelines.	Idem	Compair
1	1.3	Flanders/Berlin	Idem	Idem	Visualise the model output of the inhaled doses during the route.	Idem	- Air Quality exposure cumulative line chart	Idem	Cumulative line chart visualising inhaled doses model simulation results in ng/m3.	Idem	Compair
2	2.1	Issy-les-Moulineaux	As a policymaker, I want to know the location and volume of past traffic in the South Paris region.	Policy goal: Getting better insights	Overviewing traveller time impact by combining road segment-based map views and tables, allowing for comparing and ordering lost time in traffic.	Floating car data of wasted time for road segments: - Location (road segment geometry) - Average speed per segment - Lost time "average of extra time spent vs. time without traffic" (quantitative) - Time	- Floating car data mobility dashboard - Traffic speed and delay time distribution histogram - Line-based free flow map - Table (lost time) - Free-flow distribution heatmap matrix - Time period selector	Custom-built floating car data mobility dashboard for Issy-Les-Moulineaux	Dashboard containing multiple visualisations to evaluate traffic-related delays in the Southern Paris region. The dashboard offers a 2D City map view by road segments, flow-line maps to discover (weekly) returning patterns, and tables and heatmaps for comparing two periods in time.	Problem-setting, impact assessment: Reduce Congestion	PoliVisu
2	2.2	Issy-les-Moulineaux	Idem	Idem	Visualisation of the driving speed and delay time (per hour during the day).	Idem	-Traffic speed and delay time distribution histogram	Idem	Visualisation of the driving speed and delay time per hour during the day as a histogram.	Idem	PoliVisu
2	2.3	Issy-les-Moulineaux	Idem	Idem	Visualise how much the speed decreases on road segments in Issy compared to the normal situation for specific periods and timings. Show current/actual “Time lost” per road segment.	Idem	- Line-based free flow map	Idem	Visualisation-based line-based free flow map where the heat of the road segment is defined by the extra time spent due to traffic, versus the theoretical free-flow speed, by showing the speed percentage of free-flow speed (red = slower, green = legal speed, blue = faster)	Idem	PoliVisu
2	2.4	Issy-les-Moulineaux	Idem	Idem	Visualise a list of moments with the highest "lost times" and a list of road segments ordered by "Total time lost".	Idem	- Table (lost time)	Idem	Table summarising the moments with the highest delay times and blackspots.	Idem	PoliVisu
2	2.5	Issy-les-Moulineaux	Idem	Idem	Visualise the average percentage from free flow during a specific time period for the Issy-Les-Moulineaux area.	Idem	- Free-flow distribution heatmap matrix	Idem	Free-flow distribution heatmap matrix depicting the speed percentage from free flow during the day for an entire week, using percentage visualisation combined with colour gradients.	Idem	PoliVisu
3	-	Vlaanderen (Voorkempen)	As a police or local community employee responsible for road safety, I want to get better insights into the driver's behaviour (over time) in trajectory control zones.	Policy goal: Getting better insights Policy objective: Evaluating if speed control measures are leading to behavioural changes	Visualising the moment, quantity and speed of vehicles in the installed trajectory control zones that allow comparison between control zones, timing for policy evaluation and future policy development.	- Location speed control zones - ANPR data (pseudonimized), including hashed numberplate data, average speed, time, vehicle type (Raw ANPR data was translated to statistics per trajectory per hour in buckets per speed category)	- Average speed control dashboard - Heatmap - Flow rate diagram - Average speed control infraction histogram	Reusable ANPR average speed control dashboard	Dashboard containing multiple visualisations, including 2D visualisations of trajectory control zones using line segments; a heatmap depicting relative infractions, flow rate diagrams depicting the average speed, number of vehicles and time period; histograms depicting the percentage of infractions, near infractions over time.	Policy formulation, monitoring, impact assessment: Identifying trajectory control zones with a high level of speeding infractions.	PoliVisu
3	3.1	Vlaanderen (Voorkempen)	Idem	Idem	Visualising the relative percentage of infractions at a typical moment during the week.	Idem	- Heatmap (time, infraction percentage)	Idem	Heatmap depicting relative infractions spread over weekdays on an hourly basis.	Idem	PoliVisu
3	3.2	Vlaanderen (Voorkempen)	Idem	Idem	Visualising the average speed relative to the number of vehicles and time period (during the day).	Idem	- Flow rate diagram (average speed, number of vehicles)	Idem	Visualising the average speed relative to the number of vehicles and the time period (morning, day, evening, night).	Idem	PoliVisu
3	3.3	Vlaanderen (Voorkempen)	Idem	Idem	Visualising the number of infractions and near infractions over time to monitor the long-term evolution of speed behaviour.	Idem	- Average speed control infraction histogram (infraction percentage, time)	Idem	Visualising, on average, the speed control zone, the number of infractions and near infractions over time (long-term evolution of speed behaviour).	Idem	PoliVisu
4	4.1	Vlaanderen (Solva)	As a mobility expert, I want an overview of traffic flows within the South-East Flanders region, including both incoming and outgoing traffic.	Policy goal: Getting better insights	Geospatial visualisation of displacements from one place to another inside the Solva region and from outside to the Solva region.	- Locations (local community) - Displacements between and inside a local community (aggregated) - Trip time (aggregated)	- Sankey route distribution diagram	TomTom Dashboard	Sankey route distribution diagram depicting the traffic volumes over a period of time between origin and destination locations (local communities).	Problem-setting, policy formulation: Motorised road transport trip distribution.	PoliVisu

TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data

Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)

Case	Visualisation link nr.	Pilot	Initial request	Policy Elements	Visualisation Goal (related to the request & policy elements)	Description of main data fields	Main Visualisation Techniques	Visualisation Tool	Visualisation summary	Policy-making cycle (except the communication element)	Project
4	4.2	Vlaanderen (Solva)	Idem	Idem	Provide a schematic overview of the most popular origin-destination patterns from the Solva region.	Idem	- Origin-destination matrix diagram and heatmap	Idem	Matrix depicting routes (origins) from a selection of places (local communities) toward a selection of places (destinations) using colour gradients to visualise the route volumes.	Idem	PoliVisu
4	4.3	Vlaanderen (Solva)	Idem	Idem	Geospatial visualisation of the most popular destination from a single origin.	Idem	- Traffic flow line/trip distribution map	Idem	2D map visualising the direction of routes from the origin to the destination local communities in percentages (origin = 100% distributed to multiple destinations).	Idem	PoliVisu
5	-	Vlaanderen (Herzele)	As a city official, teacher, and citizen, I want to evaluate the impact of the implementation of a school street at the school and the surrounding streets.	Policy goal: Getting better insights Policy action: Implementation of a school street	Getting insight into the effects of a school street (test) implementation on traffic volumes and air quality impact.	Output of: - Traffic counting sensors (nr of pedestrians, cyclists, cars, big vehicles) - Air quality sensors (NO2, PM, BC) - Location (X, Y)	- Policy Monitoring Dashboard for Traffic and Air Quality - 2D Sensor location map - Bar chart (traffic mode changes, changes in pollutant exhaust)	Reusable compair policy monitoring dashboard (PMD)	A dashboard showing measurements from one group of target sensors and a second group of surrounding sensors before and after a threshold (typically the implementation of a policy measure). The dashboard can present comparable visuals for each sensor type (traffic sensor, air quality sensor). The dashboard supports only fixed sensors.	Problem-setting, policy decision, monitoring, impact assessment: Policy Monitoring school streets.	Compair
5	5.1	Vlaanderen (Herzele)	Idem	Idem	Geospatial overview of the sensor locations to get an overview of the area.	Idem	- 2D Sensor location map	Idem	Visualisation of the location of fixed sensors per group (in this case, school street versus neighbourhood) and per type of sensor, including traffic counting sensors and air quality sensors.	Idem	Compair
5	5.2	Vlaanderen (Herzele)	Idem	Idem	Statistical overview of the changes in the use of traffic modes and the differences in air quality.	Idem	- Bar chart (traffic mode changes, changes in pollutant exhaust)	Idem	Bar chart depicting changes in traffic mode (positive and negative) and air quality pollutants before and after a fixed moment in time (in this case, implementing a school street).	Idem	Compair
6	6.1	Vlaanderen (Mechelen)	As a city official, teacher and citizen, I want an easy-to-interpret data overview to compare traffic volumes before and after the implementation of a school street.	Policy goal: Getting better insights Policy strategy: school street as part of a broader mobility policy Policy action: Implementation of a school street	Display the difference in distribution over the different traffic modes before and after the introduction of a school street, in the street of the school, as well as in the neighbouring streets.	Traffic count data, sensor location data, time data, and weather data	- school street implementation dashboard - 2D Map, - Bar chart (advanced) - Comparative trend analysis line chart - Pie chart (modal split)	Custom-built school street dashboard	A set of graphs connected to a time window selected by the end user. The graphs show the number of people travelling using a particular transport mode. When a second time window is selected, the delta between the periods is also shown.	Problem-setting, policy formulation, policy implementation and evaluation: Policy impact of extending the introduction of school streets in Mechelen.	PoliVisu
6	6.2	Vlaanderen (Mechelen)	Idem	Idem	Visualising Visualising the location of the school street sensor and sensors in the surrounding streets.	Line data of road segments where a traffic sensor is installed: - Location (X, Y) - Categorisation (school street vs surrounding streets)	- 2D Map	Idem	school street sensor locations using street segments (to anonymise the exact location of the sensor placed at a citizen's home).	Idem	PoliVisu
6	6.3	Vlaanderen (Mechelen)	Idem	Idem	Visualising the use of transport modes, including the visualisation of policy targets (e.g., the number of counted cyclists at the school gate).	- Time (date, hour) / Begin time, End time - Counts per transport mode - Sensor group (school street, surrounding streets)	- Bar chart (advanced)	Idem	Combination of bar charts (with the possibility to switch categories on and off), allowing comparison between time periods, combined with the visualisation of a policy norm.	Idem	PoliVisu
6	6.3	Vlaanderen (Mechelen)	Idem	Idem	Visualising traffic over the course of the day, a school street was implemented to assess the school street effect.	- Time (date, hour) / Begin time, End time - Counts per transport mode - Sensor group (school street, surrounding streets)	- Comparative trend analysis line chart	Idem	Trend analysis line chart visualising each transport mode to evaluate the effect of a school street implementation compared to the hours before and after the school street closure.	Idem	PoliVisu
6	6.4	Vlaanderen (Mechelen)	Idem	Idem	Visualisation of the modal split (percentage of measured transport modes - walking, cycling, car, heavy vehicles).	- Grouping (before/after implementation & school street/surrounding streets) - Modal split percentages	- Pie chart (modal split)	Idem	Pie charts visualising the modal split (school street and neighbourhood) and between two periods in time (if a second period has been selected).	Idem	PoliVisu
7	7.1	Vlaanderen (Sint-Niklaas)	As a city official, citizen, I want to quantify the effects of a new traffic scheme in terms of the amount, kind of traffic and speed on the affected roads.	Policy objective: Implementation of a traffic scheme to decrease flowing traffic Policy action: Implementing a local traffic scheme	Visualisation of the evolution in traffic volumes and driving speed in the affected streets.	- Time (date, hour) - Counts per transport mode - Driving speed - Sensor location & road segment location	- Traffic count data mobility dashboard - 2D Sensor location Map - Stacked bar and line charts (detailed traffic volumes) - Histogram (driving speed) - Pie chart (modal split)	Telraam dashboard	Dashboard combining 2D sensor location map, stacked bar & line charts depicting traffic volumes, histograms depicting driving speed and a pie chart depicting the modal split.	Policy design, implementation support and evaluation: Impact of implementing a new traffic scheme in a neighbourhood in Sint-Niklaas.	Compair
7	7.2	Vlaanderen (Sint-Niklaas)	Idem	Idem	Geospatial overview of the sensor locations to get an overview of the area.	- Sensor location & road segment location - Traffic volumes	- 2D Sensor location Map	Idem	2D map with sensor locations (road segments), segment colour depicting relative traffic volume.	Idem	Compair
7	7.3	Vlaanderen (Sint-Niklaas)	Idem	Idem	Visualisation of the detailed traffic volumes of a street segment (hour of the day spanning a multiple-day period).	- Time (date, hour) - Counts per transport mode - Sensor location & road segment location	- Stacked bar and line charts (detailed traffic volumes)	Idem	Stacked bar chart (traffic modes), for each hour over a period of one week; Line chart depicting the traffic volumes per transport mode for each hour of one day.	Idem	Compair

TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data

Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)

Case	Visualisation link nr.	Pilot	Initial request	Policy Elements	Visualisation Goal (related to the request & policy elements)	Description of main data fields	Main Visualisation Techniques	Visualisation Tool	Visualisation summary	Policy-making cycle (except the communication element)	Project
7	7.4	Vlaanderen (Sint-Niklaas)	Idem	Idem	Visalisation of the driving speed.	- Time (date, hour) - Driving speed - Sensor location & road segment location	- Histogram (driving speed)	Idem	Histogram of the driving speed distribution; Driving speed V85 (percentile) norm, per hour.	Idem	Compair
7	7.5	Vlaanderen (Sint-Niklaas)	Idem	Idem	Visualisation of the relative use of transport modes (modal split).	- Time (data, hour) - Sensor location & road segment - Counts per transport mode	- Pie chart (modal split)	Idem	Pie chart visualising the modal split per transport mode (percentages visualisation).	Idem	Compair
8	8.1	Vlaanderen	As a city official, school management, and citizen, I want to know where accidents have happened in recent years, to know where black spots are located, related to speed measures and specific locations like schools.	Policy goal: Getting better insights Policy objective: Evaluating policy measures like speed control implementations and infrastructure changes	Visualise locations where accidents happened in Flanders in the last 5 years. Show accident information to find black spots. Visualise relevant data like trajectory control zones.	Point data set of traffic incidents - Location (X, Y) - Time and date - Weather, road and traffic conditions - Modes of transport - Consequence for people involved - Trajectory control zones - Schools - Administrative borders	- 2D Interactive heatmap dashboard - Interactive charts	WebGlayer Interactive integrated accident heatmap and dashboard	WebGLayer accident map-based interactive point map, heatmap, and graphs (bar charts, histograms, line graphs) showing the locations of accidents with relevant attributes, allowing for investigation of the severity and whether the location is the primary contributor to the accident or other factors (like alcohol) at specific moments in time—visualisation of the location in relation with implemented traffic measures and nearby places like schools.	Problem-setting, policy formulation, implementation planning and impact assessment: Identify accident black spots.	PoliVisu
9	9.1	Vlaanderen (Ghent)	As a city official, I want to know where dorm students are situated in the city during the week.	Policy goal: Getting better insights	Display where dorm students are located on average during the week (when the classes take place).	- Selection of Proximus customers (Dorm student behaviour) - Location (X, Y) between GSM antennas - Time (day, hour)	- Polygon chloropleth map - Bar charts (histogram)	QGIS	The visualisation shows the difference in location and residence level of detected dorm students (based on their displacement behaviour) in Ghent during the weekdays and during the periods of the day. The map is divided into triangular zones based on the GSM masts' locations provided by mobile phone provider Proximus.	Problem-setting and policy formulation: Visualise student residencies during the week at different moments during the day.	PoliVisu
9	9.2	Vlaanderen (Ghent)	As a city official, I want to know where dorm students are situated during the day and evening.	Idem	Display where dorm students are located on average during the day and during the night in weekdays (during the academic year, when classes take place).	- Selection of Proximus customers (Dorm student behaviour) - Location (X, Y) between GSM antennas - Time (day, hour) - High school & university campus locations	- Polygon chloropleth map	Idem	The visualisation shows the difference in location of detected dorm students (based on their displacement behavior) in Ghent during the day and during the night in Ghent in relation to the higher education campusses. The map is divided into triangular zones based on the GSM masts' locations provided by mobile phone provider Proximus.	Idem	PoliVisu
10	10.1	Pilsen	As a city official, citizen, I want to know where accidents have map happened in the last years to know the traffic incident locations and its causes.	Policy goal: Getting better insights	Explore and investigate traffic incidents (traffic accidents and other police records, such as speeding & other driving-related offences) in time and space to discover patterns, correlations, and outliers using aggregated data.	Point data set of traffic incidents (accidents and traffic-related offences) - Location (X, Y) - Time and data - Weather, road and traffic conditions - Accident info: Severity, culprit, alcohol/drugs, cause, vehicle classification, location details (nominal) - Speeding offences (interval) - Classification of driving offences - pedestrians, speeding, cyclists, parking, rule violation (nominal) - Offences: vehicles' country of registration (nominal) - Temporal dimensions (quantitative) - Administrative borders	- 2D Interactive heatmap dashboard - Interactive charts	WebGlayer Interactive integrated accident heatmap and dashboard	WebGLayer accident map-based interactive point map, heat map, and graphs (bar charts, histograms, line graphs) showing the locations of accidents with relevant attributes, allowing for investigation of the severity and whether the location is the primary contributor to the accident or other driving-related offences (like alcohol, drugs) at specific moments in time.	Problem-setting, policy formulation and impact assessment: Identify accident black spots.	PoliVisu
11	11.1	Pilsen	As a city official, I want to see the current traffic volume in the city and how it has changed over time.	Policy goal: Getting better insights	Explore and investigate traffic volume on road segments over time and space to discover patterns, correlations, and outliers using aggregated data.	Line data set of traffic volume for road segments - Location (road segment geometry) - Traffic volume provided by street detectors (quantitative) - Direction of traffic on segments (geometry - angle) - Temporal dimensions (quantitative)	- 2D Interactive traffic line map - Interactive charts	WebGlayer line map	WebGLayer-based heatmap of traffic volumes, where traffic volume determines the heat of each road segment, and interactive histograms and calendar functions allow selection and visualisation.	Problem-setting and impact assessment: Traffic data analysis & evaluation of past policy measures.	PoliVisu
11	11.2	Pilsen	As a city official, I want to see the current traffic intensity (free-flow level) in the city and how it has changed over time.	Idem	Explore and investigate traffic intensity (free flow) on road segments relative to road capacity over time and space to discover patterns, correlations, and extremes using aggregated data.	Line data set of traffic level for road segments - Location (road segment geometry) - Traffic intensity provided by street detectors (quantitative) - Road segment capacity (quantitative) - Direction of traffic on segments (geometry - angle) - Temporal dimensions (quantitative)	- 2D Interactive traffic line map - Interactive charts	Idem	WebGLayer-based heatmap of traffic intensity, where traffic volume and road capacity determine the heat of each road segment, and interactive histograms and calendar functions allow selection and visualisation.	Idem	PoliVisu

TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data

Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)

Case	Visualisation link nr.	Pilot	Initial request	Policy Elements	Visualisation Goal (related to the request & policy elements)	Description of main data fields	Main Visualisation Techniques	Visualisation Tool	Visualisation summary	Policy-making cycle (except the communication element)	Project
12	12.1	Pilsen	As a city official, I want to be able to compair the differences in traffic volume (by comparing two moments in time or by comparing two traffic model calculations).	Policy objective: Evaluation of whether the goals in terms of traffic reduction can be achieved Policy strategy: Evaluating traffic management measures as part of a broader mobility and smart city scheme	Visualise the change in traffic volumes due to policy measures impacting the use of roads.	Line data set of traffic volume for road segments - Location (road segment geometry) - Increase/decrease in traffic volume (quantitative) - Traffic volume (quantitative) - Relation of traffic volume to road segment capacity (quantitative) - Moment in time (ordinal)	- 2D Traffic volume delta map	Traffic Modeller	Traffic Modeller-based line map depicting road segment-based traffic volume level changes (deltas) using colour gradients from pink to red. The data and time selected allow for the selection of a moment in time.	Policy design, implementation and evaluation of road management measures.	Polivisu
13	13.1	Pilsen	As a city official, I want to be able to see the absolute and relative traffic numbers evolve over time.	Policy goal: Getting better insights	Visualising the traffic volumes of a traffic model calculation to evaluate traffic volumes and volumes related to road capacity.	Line data set of traffic volume for road segments - Location (road segment geometry) - Traffic volume (quantitative) - Relation of traffic volume to road segment capacity (quantitative) - Moment in time (ordinal)	- 2D Traffic model volume map	Traffic Modeller	Traffic Modeller-based line map depicting road segment-based traffic, where the line thickness represents the traffic volume, and the colour gradient represents the volume related to the road capacity. The data and time selected allow for the selection of a moment in time.	Problem-setting: Congestion overview.	PoliVisu
14	14.1	Issy-les-Moulineaux	As a city official, I want to guide visitors, including guiding cars/lorries, not along unwanted routes.	Policy goal: Getting better insights	Visualising the best algorithm-based calculated (multimodal) route, including travel instructions and environmental impact.	Output of: - Multimodal route calculation algorithm - Multimodal environmental effect calculation (CO2 calculator) - Multimodal financial cost calculator	- Travel planning algorithm mobile app	MyAnatol Multimodal route planner app	A city map visualising the best route based on your origin/destination and travel preferences, presenting multimodal route options combining motorised modes, public transport and walking—an integrated dashboard displaying environmental impact and cost.	Communication: Guiding (car) visitors to their destination, avoiding unwanted routes; Policy objective: promote multimodal transport.	PoliVisu
15	15.1	Pilsen	As a city offical, I want to get an overview of the impact on traffic of planned roadworks.	Policy goal: Getting insights into the effects of planned roadworks Policy strategy: Avoiding conflicting roadworks	Simulate as a policymaker the impact of planned roadworks; Inform citizens about the time schedules for planned roadworks in the city.	Point/Line data set of roadworks - Location (X, Y) - Location description (nominal) - Planned start date - Planned end date - Type (nominal) - Impact on traffic (nominal) - Direction of the road (nominal) - Description (nominal)	2D Traffic model scenario analysis map	Traffic Modeller	Displaying actual and planned roadworks in a map application according to the selected date in the calendar. Integration with an interactive calendar and timeline with roadworks (timeline chart) to navigate in time to evaluate the impact of multiple roadworks planned at the same time (15?2).	Policy design, implementation and evaluation: "To be ready for extraordinary events influencing traffic" - to improve the coordination of roadworks.	PoliVisu
15	15.2	Pilsen	As a city offical, I want to get an overview of the impact on traffic of planned roadworks.	Policy goal: Getting insights into the effects of planned roadworks Policy strategy: Avoiding conflicting roadworks	Simulate as a policymaker the impact of planned roadworks; Inform citizens about the time schedules for planned roadworks in the city.	Roadworks database - Location (typical street segment) - Roadwork description (driving direction, capacity per direction) - Start- and end time	- Timeline chart of roadworks	Traffic Modeller	Displaying the output of the Pilsen roadworks database as a timeline of potential overlapping roadworks to provide input to the traffic model.	Idem	PoliVisu
16	16.1	Athens	As a policymaker, I want to simulate the planning of green spaces in the city.	Policy goal: Getting better insights Policy strategy: Part of the city's strategy towards a more climate-resilient city Policy action: Implementing urban greenery	Simulating the shadow impact of adding greenery and public equipment like benches.	Output of: - 3D Visualisation of buildings, trees (and other meaningful infrastrctures) and incidence of light	- 3D Digital terrain visualisation of landscape elements.	Duet CityTwin.eu	Digital Twin 3D visualisation (including shadow impact visualisation).	Problem-setting, scenario analysis, implementation planning: Simulating the shadow impact of adding greenery and public equipment like benches.	Duet
17	17.1	Athens	As a city official, I want to evaluate the impact on traffic in the area of transforming Stadiou Street in the centre of Athens into a complete pedestrian and cycling route.	Policy goal: Getting better insights Policy action: Evaluate the impact of the road closure	Visualise the effects of car traffic in the neighbourhood.	Output of: - 2D City map visualisation - Location of the road construction (including driving directions) - Traffic model (traffic volumes including deltas)	- 3D Traffic volume delta map	Duet CityTwin.eu	2D Digital Twin map visualisation of the results of an air quality model, displaying deltas using colour gradients to visualise decreases and increases in ambient air quality.	Problem-setting, decision support, implementation planning and impact assessment: Evaluating the effect of transforming a street into a pedestrian and cycle route.	Duet
17	17.2	Athens	As a city official, I want to evaluate the impact on traffic in the area of transforming Stadiou Street in the centre of Athens into a complete pedestrian and cycling route.	Policy goal: Getting better insights Policy action: Evaluate the impact of the road closure	Visualise the effects of car traffic and air quality in the closed street and the surrounding streets.	Output of: - 3D Visualisation - Location of the road closure for car traffic (including driving directions) - Traffic model (traffic volumes including deltas) - Air quality (PM, NO2) (volumes including deltas)	- 3D Air quality map	Duet CityTwin.eu	Digital Twin visualisation of traffic measures' impact on ambient air quality, using 3D map data and a traffic model as input to an air quality model, with colour gradients to visualise absolute volumes and deltas.	Idem	Duet
18	18.1	Pilsen/Ghent	Simulating the impact of bridge closure scenarios to assess the future impact on traffic intensity, air quality and noise caused by traffic.	Policy goal: Getting better insights (Ghent) Policy objective: Effect of the bridge closure compared to the expected goal of traffic reduction (Pilsen) Policy strategy: Bridge closure as part of a city-wide SUMP (Pilsen)	Visualise the effects of car traffic in the neighbourhood.	Output of: - 2D City map visualisation - Location of the road construction (including driving directions) - Traffic model (traffic volumes including deltas)	- 2D Traffic volume delta map	Duet CityTwin.eu	2D Digital Twin map visualisation of the results of an air quality model, displaying deltas using colour gradients to visualise decreases and increases in ambient air quality.	Policy design, implementation planning and policy evaluation: Impact of road closures.	Duet

TABLE RESEARCH DATA 1: Visualisation Methodology - Analysis data

Caption: Overview of the initial request, policy elements, visualisation goals, data fields and chosen visualisation techniques and tools (grouped by initial requests)

Case	Visualisation link nr.	Pilot	Initial request	Policy Elements	Visualisation Goal (related to the request & policy elements)	Description of main data fields	Main Visualisation Techniques	Visualisation Tool	Visualisation summary	Policy-making cycle (except the communication element)	Project
18	18.2	Pilsen/Ghent	Simulating the impact of bridge closure scenarios to assess the future implications for noise caused by traffic.	Idem	Visualise the effects of traffic on noise distribution in the neighbourhood.	Output of: - 3D Visualisation - Location of the road construction (including driving directions) - Traffic model (traffic volumes including deltas) - Noise (DB) (volumes including deltas)	- 3D Noise distribution point	Duet CityTwin.eu	Digital Twin visualisation of the impact of traffic measures on ambient noise distribution, using 3D map data and a traffic model as inputs to a noise model, with coloured points on the map to visualise noise volumes.	Idem	Duet
18	18.3	Pilsen/Ghent	Simulating the impact of bridge closure scenarios to assess the future effects on air quality caused by traffic.	Idem	Visualise the effects of traffic on air quality in the neighbourhood.	Output of: - 3D Visualisation - Location of the road construction (including driving directions) - Traffic model (traffic volumes including deltas) - Air quality (PM, NO2) (volumes including deltas)	- 3D Digital air quality delta map	Duet CityTwin.eu	Digital Twin visualisation of traffic measures' impact on ambient air quality, using 3D map data and a traffic model as input to an air quality model, with colour gradients to visualise absolute volumes and deltas.	Idem	Duet
19	19.1	Pilsen	Simulating the impact of the ring construction to assess the future implications on traffic intensity.	Policy goal: Realisation of a ring road to avoid north-south traffic through the city centre Policy strategy: Realisation of a western-ring road as part of the Pilsen SUMP	Visualise the planned western ring road bypass and its impact on the city's traffic.	Output of: - 3D Visualisation - Location of the road construction (including driving directions) - Traffic model (traffic volumes including deltas)	- 2D Traffic volume delta map (inside a Digital Twin)	Duet CityTwin.eu	2D Traffic model visualisation as part of a Digital Twin implementation. Display on a map the effect on traffic volume caused by an extension of the traffic model and the redistribution of traffic over the extended network.	Policy design, implementation planning and policy evaluation: Simulating the western-ring road construction impact on traffic in the city.	Duet
20	20.1	Pilsen	As a policymaker, I want to improve the lives of the city's citizens by installing smart equipment, such as solar benches, cameras, and parking meters, in the city's parks.	Policy strategy: City's smart city policy Policy action: Finding the best location for implementation	Visualising the shadow impact to find suitable spots for installing solar equipment.	Output of: - 3D Visualisation of buildings and incidence of light	- 3D Solar impact map	Duet CityTwin.eu	3D Solar impact map displaying the sunshine's impact on locations for every possible date and time.	Problem-setting, scenario analysis, decision implementation: Solar equipment impact.	Duet

TABLE RESEARCH DATA 2: Visualisation Methodology - Steps

Caption: Visualisation methodology step-by-step approach (case level)

Case Nr	Case title	Visualisation content	Policy Element (Step 1)	Visualisation Goal (Step 2)	Description of main data fields (Step 3)	Visualisation Techniques (Step 4)	Functional Specifications (with a focus on visualisation specs) (Step 5)	Specify visualisation(s) and Tools (Step 6)
1	Berlin (DE), Flanders (BE) - Dynamic exposure visualisation dashboard	Dashboard visualising the exposure to fine dust levels (PM2.5) during travel routes on a geospatial map and on graphs visualising levels related to travel distance and exposure time	Problem-setting: Evaluating the impact of air quality, including fine dust (PM) and black carbon (BC), during routes by bike, foot	Visualising the air quality during displacements, measuring location and time (PM, BC)	Processed output of: - Air quality sensor, built-in GPS (e.g. Sodaq PM) - Air quality sensor, no GPS, Mobile phone GPS link (e.g. BC meter)	Dashboard visualisation depicting: - Multiple visualisation techniques for visualising air quality on a 2D road segment visualisation - Line graphs (time, sensor value) - Line graphs (distance, sensor value)	- 2D map with an overview of trips and measured air quality (per segment) - Time period selector - Sensor type selector - Transport mode selector - Trip overview (Selection table depicting distance, time, transport mode) - Visualisation of the air quality exposure chart (related to distance or time) - Visualisation of cumulative air quality exposure chart (related to distance or time) - Visualisation of the inhaled dose simulation (as a cumulative chart) - Visualisation of the WHO guideline	Reusable Dynamic Exposure Visualisation dashboard - Dashboard interface - Trip visualisation map - Air Quality exposure line chart - Air Quality exposure cumulative line chart - Selection table (trip selection interface) - Selection and filter options
2	Issy-les-Moulineaux (FR) - Traffic dashboard	Traffic dashboard visualising traffic delay, traffic blackspots and free flow speed for Issy-Les-Moulineaux and its surroundings	Policy goal: Getting better insights- and reducing congestion	Visualise how much time a traveller loses on road segments in Issy compared to the ideal situation (no traffic) for specific periods and timings. Show current/actual “Time lost” per road segment.	Line data set of wasted time for road segments depicting: - Location (road segment geometry) - lost time "average of extra time spent vs. time without traffic" (quantitative) - time window	Dashboard visualisation including: - Traffic flow line map depicting average speed related to road capacity - Colour matrix diagram depicting lost travel time - Speed distribution map	- 2D map visualising the free-flow traffic per road segment - Period selection - Visualisation of the average speed for a selected day/period - Visualisation of the delay time (min) for a selected day/period - Visualisation of the free flow percentages for an entire week/day in a comprehensible way (heatmap) - Congestion delay overview tables	Custom-built floating car data mobility dashboard - Traffic speed and delay time distribution histogram - Line-based free flow map - Table (lost time) - Free-flow distribution heatmap matrix - Time period selector
3	Police zone Voorkempen (BE) - Trajectory speed limit enforcement dashboard	Dashboard visualising aggregated average speed control camera data, envisioning live and historical traffic volumes and average speeds	Problem-setting: Evaluating the impact of average speed control enforcement	Visualising the long-term impact of average speed control zones on speed, fines and even traffic safety (accidents)	Pseudonymised ANPR Average speed control data, including: - Camera location - Average speed control zones (lines geometry) - Time (date and hour) - Average speed	Dashboard visualisation including: - Location of the average speed zone (X, Y coordinates) and max. speed zone limit (50km/h, 70km/h) - Line chart per average speed zone (time of the day, multiple speed limits) - Line chart per average speed zone limit (time of the day, multiple speed limits) - Line chart per speed zone limit category (time, multiple speed limits) - Line chart per average speed zone limit category (time, multiple speed limits) - Average speed per time of the day per average speed zone direction (time of the day, average speed)	- 2D map of the average speed control zones - Visualise average speed control infractions for a week/hour in a comprehensible way (heatmap) - Visualise the average speed for all cars per day zone (night, morning, afternoon, evening, late evening) for each driving direction - Visualise the infraction percentage history from the implementation date - Visualise the near-infraction percentage (tolerance margin) history from the implementation date	Reusable ANPR average speed control dashboard - Average Speed Control Dashboard - Heatmap - Flow rate diagram - Average speed control infraction histogram
4	Solva region (BE) - Regional traffic behaviour	Dashboard visualisation of origin-destination patterns of floating car data on a regional scale in South-Eastern Flanders and its surroundings	Policy goal: Getting insight into the regional mobility streams	Display the displacement patterns (by car) in the South East Flanders region	Processed floating car data - based on a minimal set of raw data, including: - 2D map of road segments - Location (trajectory) - Time (date and hour)	Dashboard visualisation including: - 2D trajectory diagram (road segments) - Sankey distribution diagram - Origin-destination diagram - Trip distribution diagram	N/A	N/A
5	Herzele (BE) - Interactive school street dashboard	Dashboard visualising results from multiple sensor types (traffic, air quality PM, NO2, BC) allowing the comparison of two groups of sensors before and after a moment in time (when the measure has been implemented) - Applied on a school street implementation case	Policy goal: Getting insight into the effects of a school street (test) implementation	Visualise the effects of the implementation of a measure on traffic and air quality before and after implementation at multiple geospatial areas	Output of: - Traffic counting sensors (nr of pedestrians, cyclists, cars, big vehicles) - Air quality sensors (NO2, PM, BC) - Location (road segment geometry)	Policy dashboard visualisation including: - 2D road segment map visualisation sensor locations (X, Y, sensor type and category) - Bar graph with traffic counting sensor measurement per sensor over time - Bar graph with air quality sensor results per sensor over time - Comparison bar graph of two groups of sensors (target and surrounding group) per sensor category	- Visualise school street location - Visualise sensor locations (multiple sensors depicted as line segments/points) - Visualise comparative trends (during school street implementation and just before and after) for traffic modes and air quality - Policy goal/threshold visualisation - Allow advanced selections (select and deselect attributes for a better overview	Reusable compair policy monitoring dashboard (PMD) - 2D Sensor location map - Bar chart (traffic mode changes, changes in pollutant exhaust)

Case visual nr.	Initial request(s-	Processed personal data involved	Reasoning
1.1 - 1.4	Dynamic exposure visualisation	Yes	Individual routes are recorded (after consent)
2.1	- A map of the past traffic in the Issy region - Delay Due to Traffic Map for Issy-les-Moulineaux & surroundings	Yes	Individual route data has been processed
3.1 - 3.3	Average speed control driving behaviour impact dashboard	Yes	Individual route data using numberplate information has been processed. In Belgium numberplate information is considered personal data
4.1 - 4.3	Visualisation of origin - destination patterns on a regional scale	Yes	Individual route data has been processed
5.1 - 5.2	Policy Monitoring of school streets	Yes	The Telraam Device used anonymises traffic counting data. The precise location of the device is not shown

TABLE RESEARCH DATA 2: Visualisation Methodology - Steps

Caption: Visualisation methodology step-by-step approach (case level)

Case Nr	Case title	Visualisation content	Policy Element (Step 1)	Visualisation Goal (Step 2)	Description of main data fields (Step 3)	Visualisation Techniques (Step 4)	Functional Specifications (with a focus on visualisation specs) (Step 5)	Specify visualisation(s) and Tools (Step 6)	Case visual nr.	Initial request(s-	Processed personal data involved	Reasoning
6	Mechelen/Flanders (BE) - Interactive school street dashboard	Dashboard visualising traffic count data (cars, big vehicles, cyclists and pedestrians) in and around school streets before and after the implementation of a school street	Policy action: Pre- and post-measurement of a schoostreet implementation measure	Visualising the long-term impact of the implementation of a school street by measuring the period before the implementation and after the implementation in the school street itself and the surrounding neighbourhood	Output of: - Traffic counting sensors (nr of pedestrians, cyclists, cars, big vehicles) - Time (date and hour) - Weather conditions (dry, rain, snow)	Policy dashboard visualisation depicting a school street implementation, including: - 2D road segment map visualising sensor locations (X, Y, school street sensor or neighbourhood sensor) - Traffic counting sensor measurements per sensor - Modal split before and after implementation, school street versus neighbourhood - Traffic volumes before and after implementation, school street versus neighbourhood per transport mode - Policy norm/target visualisation	- Visualise school street location - Visualise sensor locations - Time period selection (reference period and comparison period - Visualise traffic mode volumes (for sensor selections) - Visualise comparative trends (during school street implementation and just before and after) - Policy goal/threshold visualisation - Allow advanced selections (select and deselect attributes for a better overview - Visualise model split changes (reference and comparison period)	Custom-built school street dashboard - 2D Map, - Bar chart (advanced) - Comparative trend analysis line chart - Pie chart (modal split)	6.1 - 6.4	- Display the difference in distribution over the different traffic modes before and after the introduction of a school street, in the street of the school as well as in the neighbouring streets - Evaluation Report: Impact of the policy to introduce school streets in Mechelen	Yes	The Telraam Device used anonymises traffic counting data. The precise location of the device is not shown
7	Sint-Niklaas (BE) - Local mobility scheme/plan dashboard	Dashboard visualising results from multiple sensor types (traffic, air quality PM, NO2, BC) allowing the comparison of two groups of sensors before and after a moment in time (when the measure has been implemented) - Applied on a local mobility scheme/plan implementation case	Policy goal: Getting insight into the effects of a mobility scheme (test) implementation	Visualise the effects of the implementation of a measure on traffic and air quality before and after implementation at multiple geospatial areas	Output of: - Traffic counting sensors (nr of pedestrians, cyclists, cars, big vehicles) - Air quality sensors (NO2, PM, BC) - Sensor Location - fixed sensors (X, Y coordinate)	Policy dashboard visualisation depicting a local mobility plan implementation, including: - 2D road segment map visualising sensor locations (X, Y, target group and surrounding sensors) - Traffic counting sensor measurements per sensor - Modal split before and after implementation, target group and surrounding sensors - Traffic volumes before and after implementation, target group and surrounding sensors per transport mode - Policy norm/target visualisation	N/A	N/A	7.1 - 7.5	Implementing a local mobility scheme/plan	Yes	The Telraam Device used anonymises traffic counting data. The precise location of the device is not shown
8	Flanders (BE) - Interactive road safety map	Interactive road safety heatmap for Flanders visualising heatmaps, line and point maps included advanced geo-time and content selection possibilities	Problem-setting: Identify the road safety situation	Visualising locations where accidents happened in Flanders in the last 5 years. Regarding the accidents, display information relevant to finding black spots due to the infrastructure	Point data set of traffic incidents: - Accident Locations - Date and time of the accident - Weather conditions - Road and traffic conditions - Modes of transport - Consequence for people involved - School locations Line data set depicting: - Average speed control zones	Intensity map visualisation depicting: - Interactive 2D road segment map including advanced interactive selection mechanisms (time, metadata interactive selection widgets) - Heatmap visualising road accident locations and accident metadata - Line map depicting average speed control zones - Point of interest locations (e.g. schools)	- Visualise the road network in 2D - Visualise traffic incidents as points - Visualise schools - Visualise traffic incidents as a heatmap - Visualise administrative borders - Interactive time selection - Interactive attribute data selection (traffic modes, weather conditions, accident type, accident causes)	Reusable 2D Interactive heatmap dashboard - WebGLayer - Interactive charts	8.1	Road Accident Heatmap for Flanders	Yes	Selection of accident data was made to avoid the recognition of who was involved
9	Ghent (BE) - Student displacements	Choropleth map visualising dorm higher education student displacements during a reference period in Ghent by using mobile telecommunication data	Problem-setting: Getting insights into student displacements	Display on a map the areas with the highest number of students and impact in Ghent	Output of selected, processed cellular data (anonymised and pseudonymised): - Mobile phone network zones (triangulated) - Number of counted mobile phones (part of the selection) - Time (selected time window)	Intensity map visualisation depicting: - Polygon choropleth map	N/A	N/A	9.1 - 9.2	Mobile telecommunication data visualisation in Ghent	Yes	Anonymised and aggregated mobile phone data derived from geospatial/time profiles using GSM poles was used to profile "student behaviour"
10	Pilsen (CZ) - Interactive road accident map	Interactive road accident heatmap for Pilsen visualising heatmaps and point maps included advanced geo-time and content selection possibilities	Problem-setting: Identification and agenda-setting via traffic data analysis and evaluation of past policy measures	Visualise traffic volume on road segments in time and space to explore and discover patterns, correlations and extremities using aggregated data	Point data set of traffic incidents: - Accident Locations - Date and time of the accident - Weather conditions - Road and traffic conditions - Modes of transport - Consequences for people involved	Intensity map visualisation depicting: - Interactive 2D road segment map including advanced interactive selection mechanisms (time, metadata interactive selection widgets) - Heatmap visualising road accident locations and accident metadata - Point of interest locations (e.g. schools)	- Visualise the road network in 2D - Visualise traffic incidents as points - Visualise traffic incidents as a heatmap - Visualise administrative borders - Interactive time selection - Interactive attribute data selection (traffic modes, weather conditions, accident type, accident causes)	Reusable 2D Interactive heatmap dashboard - WebGLayer - Interactive charts	10.1	- A map visualising traffic volumes - Traffic Volume & intensity map for Pilsen	Yes	Selection of accident data was made to avoid the recognition of who was involved
11	Pilsen (CZ) - Interactive sensor based live and historic traffic map	Interactive map visualising live and historic traffic volumes in Pilsen, including advanced data geo-time and content selection possibilities	Policy goal: Reduce congestion	Showing actual, historical traffic volume for each road segment	Line data set of traffic volume for road segments: - Location (road segment geometry) - Traffic volume (quantitative) - Date "past, current, future" (ordinal) - Time of the day	Intensity map visualisation depicting: - Interactive 2D road segment map including advanced interactive selection mechanisms (time, metadata interactive selection widgets) - Choropleth line map	- Visualise the road network in 2D - Visualise road segments where traffic is available - Visualise traffic level (volume) - Visualise traffic intensity - Interactive time selection	Reisable 2D Interactive traffic line map - WebGLayer - Interactive charts	11.1 - 11.2	- A map visualising traffic volumes - Live and Historic Traffic Volume Map for Pilsen	No	The traffic data used is collected via traffic loops, which doesn't contain personal information

TABLE RESEARCH DATA 2: Visualisation Methodology - Steps

Caption: Visualisation methodology step-by-step approach (case level)

Case Nr	Case title	Visualisation content	Policy Element (Step 1)	Visualisation Goal (Step 2)	Description of main data fields (Step 3)	Visualisation Techniques (Step 4)	Functional Specifications (with a focus on visualisation specs) (Step 5)	Specify visualisation(s) and Tools (Step 6)	Case visual nr.	Initial request(s-	Processed personal data involved	Reasoning
12	Pilsen (CZ) - Traffic measure impact modelling comparison	Traffic volume and intensity line delta map of the results of a traffic calculation using the Pilsen traffic model	Policy goal: Impact evaluation	Displaying the differences in traffic volumes and intensities for these road segments influenced by the simulated measure	Line data set of traffic volume and intensity for road segments: - Location (road segment geometry) - Difference in traffic volume (quantitative) - Difference in traffic intensity (quantitative) - Moment in time (ordinal)	Intensity map visualisation depicting: - Intensity flow line map where: colour = increase/decrease of traffic intensitiy; line width = traffic volume; line colour = traffic intensity	- Visualise the road network in 2D - Visualise traffic volume deltas by comparing two points in time - Visualise traffic volume deltas by comparing two model calculations - Time navigation - Time selection - Model calculation selection	Reusable 2D Traffic volume delta map - Traffic Modeller	12.1	-	No	The traffic data used is collected via traffic loops, which doesn't contain personal information
13	Pilsen (CZ) - Traffic volume impact simulation modelling	Traffic volume and intensity line map visualisation of a traffic calculation using the Pilsen traffic model	Policy goal: Reduce congestion	Visualising the increase/decrease in traffic volume to compare two moments in time by allowing an expert to select those moments using either measured data from the past or predicted data (model)	Line data set of traffic volume for road segments: - Location (road segment geometry) - Increase/decrease in traffic volume (quantitative) - Traffic volume (quantitative) - Relation of traffic volume to road segment capacity (quantitative) - Moment in time (ordinal)	Intensity map visualisation depicting: - Intensity flow line map where colour = increase/decrease of traffic intensity; line width = traffic volume; line pattern relation of traffic volume to road segment capacity *Text and position (in the form of a calendar widget) will be used to select the periods for which the traffic status will be compared*	- Visualise the traffic network as segments in 2D - Visualise traffic volume - Visualise traffic intensity - Automated time navigation	Reusable 2D Traffic model volume map - Traffic Modeller	13.1	- A map visualising traffic volumes - Traffic Volume Delta Map for Pilsen	No	The traffic data used is collected via traffic loops, which doesn't contain personal information
14	Issy-les-Moulineaux (FR) - Travel planning app	Optimal multimodal route calculation mobile visualisation app (My Anatol app) offering sustainable route suggestions	Policy goal: Optimal multimodal route planning to enhance the use of sustainable transport modes and to ensure liveability of neighbourhoods	Visualise the optimal travel options, including the time and ecological costs of travel alternatives	Line data set of route visualisation(s): - Route visualisation (multimodal, every mode with its specific colour) - Travel modes - Travel time - Travel cost (price, duration, CO^2 exhaust)	Algorithm visualisation: - 2D mobile multimodal travel route map - Mobile app planning interface including route visualisation (per mode) - depicting alternative sustainable options - App interface depicting travel metadata (transport modes, time schedules, cost)	N/A	N/A	14.1		Yes	Making sure that the route selected and driven is not stored as part of your personal profile - anonymized and aggregated output data
15	Pilsen (CZ) - Impact of roadworks simulation	Traffic volume and intensity line map visualisation of the impact of planned roadworks using the Pilsen traffic model	Policy goal: Reduce roadworks impact on increase of congestion	Informing the citizens about the impact and time schedules for planned roadworks in the city	Point/Line data set of roadworks: - Location (X, Y) - location description (nominal) - planned start date - planned end date - type (nominal) - impact on traffic (nominal) - direction of the road (nominal) - description (nominal)	Algorithm visualisation depicting: - Intensity flow line map where: colour = increase/decrease of traffic intensity; line width = traffic volume; line colour = traffic intensity - Roadwork point/segment (location, icon for impact) - Interactive calendar widget overviewing planned roadworks related to time - Time slider (per hour) widget to overview the expected traffic volumes - Time-related list of roadworks, including metadata	- Visualise the traffic network as segments in 2D - Visualise planned roadworks - Visualise the planned roadwork schedule - Time navigation - Add traffic measures to the existing terrain (as input for the simulation) - Visualise the implemented traffic measures (e.g. road closure sign) - Visualisation of the road network volumes (model calculation results) - Visualisation of the road network volume changes (model calculation results)	Reusable 2D Traffic model scenario analysis map - Traffic Modeller - Timeline chart of roadworks	15.1 - 15.2	- A map visualising planned roadworks	No	The traffic data used is collected via traffic loops, which doesn't contain personal information
16	Athens (GR) - Digital Twin, Green squares planning	Visualising the impact of 3D terrain assets (e.g. buildings, constructions, trees, water, street furniture) on the comfort of urban spaces related to liveability, e.g. by avoiding heat stress, using a Digital Twin	Policy action: Simulating the shadow impact of adding greenery and public equipment like benches	Display in 3D the sunshine's impact on leisure locations (e.g. trees and benches) for every date and time	Output of: - 3D Visualisation of buildings, trees (and other meaningful infrastructures) and incidence of light	Digital Twin visualisation depicting: - 3D map visualisation of buildings and infrastructures - Shadow impact model visualisation	- Navigatable 3D visualisation of city infrastructure - CRUD terrain elements like benches, trees - Shadow impact simulation and visualisation of every moment during the year - Time navigation	DUET Cesium-based Local Digital Twin prototype - 3D Digital terrain visualisation of landscape elements	16.1	Green square planning	No	No private personal data are involved
17	Athens (GR) - Digital Twin, Traffic load & creation of a pedestrian and cycling route	Visualising traffic volumes, air quality impact, noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case transforming roads towards low traffic zones to promote walking and cycling	Policy goal: Evaluating the impact of the close-by traffic load of transforming Stadiou Street in the centre of Athens into a complete pedestrian and cycling route	Display on a 3D map the effect on traffic volume, air quality and noise pollution caused by traffic of changes in existing infrastructure	Output of: - 3D Visualisation - Location of the road closure for car traffic (including driving directions) - Traffic model (traffic volumes including deltas) - Air quality (PM, NO2) (volumes including deltas) - Noise (DB) (volumes including deltas)	Digital Twin visualisation depicting: - 3D map visualisations of buildings and infrastructure - Heatmap visualising differences (delta) for PM and NO2 (air quality), DB - Line segments (colour and thickness) for traffic volumes - 3D Buildings to depict street canyons	- Visualise the city in 3D - Add traffic measures to the existing terrain (as input for the simulation) - Visualise the implemented traffic measures (e.g. road closure sign) - Visualisation of the road network volumes (model calculation results) - Visualisation of the road network volume changes (model calculation results) - Visualisation of the impact of changes in air quality - Visualisation of the impact of changes in air noise distribution (by traffic)	DUET Cesium-based Local Digital Twin prototype - 3D Traffic model volume delta map - Traffic Modeller (LDT integration) - 3D Air quality delta map - TNO	17.1 - 17.2	Creating pedestrian and cycling (car free) routes	No	The traffic data used is collected via traffic loops, which doesn't contain personal information

TABLE RESEARCH DATA 2: Visualisation Methodology - Steps

Caption: Visualisation methodology step-by-step approach (case level)

Case Nr	Case title	Visualisation content	Policy Element (Step 1)	Visualisation Goal (Step 2)	Description of main data fields (Step 3)	Visualisation Techniques (Step 4)	Functional Specifications (with a focus on visualisation specs) (Step 5)	Specify visualisation(s) and Tools (Step 6)	Case visual nr.	Initial request(s-	Processed personal data involved	Reasoning
18	Pilsen (CZ), Ghent (BE) - Digital Twin, Impact of road closures	Visualising traffic volumes, air quality impact, and noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case road closures on an existing network	Problem-setting: Getting insight into the effect of a road closure measure	Display on a 3D map the effect on traffic volume, air quality and noise pollution caused by traffic of changes in existing infrastructure	Output of: - 3D Visualisation - Location of the road closure for car traffic (including driving directions) - Traffic model (traffic volumes including deltas) - Air quality (PM, NO2) (volumes including deltas) - Noise (DB) (volumes including deltas)	Digital Twin visualisation depicting: - 3D map visualisations of buildings and infrastructure - Heatmap visualising differences (delta) for PM and NO2 (air quality), DB - Line segments (colour and thickness) for traffic volumes - 3D Buildings to depict street canyons	- Visualise the city in 2D and 3D - Add traffic measures to the existing terrain (as input for the simulation) - Visualise the implemented traffic measures (e.g. road closure sign) - Visualisation of the road network volumes (model calculation results) - Visualisation of the road network volume changes (model calculation results) - Visualisation of the impact of changes in air quality - Visualisation of the impact of changes in air noise distribution (by traffic)	DUET Cesium-based Local Digital Twin prototype - 2D/3D Traffic model volume delta map - Traffic Modeller (LDT integration) - 3D Air quality delta map - TNO, VITO - 3D Noise Distribution point map - TNO	18.1 - 18.3	Impact of road closures	No	The traffic data used is collected via traffic loops, which doesn't contain personal information
19	Pilsen (CZ) - Digital Twin, Ring road construction impact	Visualising traffic volumes, air quality impact, noise pollution impact (absolute volumes and deltas) in a 3D Digital Twin environment - case new road infrastructure	Problem-setting: Getting insight into the effect of a new ring road	Display on a 3D map the effect on traffic volume, air quality and noise pollution caused by traffic of new road infrastructure impacting the city	Output of: - 3D Visualisation - Location of the road closure for car traffic (including driving directions) - Traffic model (traffic volumes including deltas) - Air quality (PM, NO2) (volumes including deltas) - Noise (DB) (volumes including deltas)	Digital Twin visualisation depicting: - 3D map visualisations of buildings and infrastructure - Heatmap visualising differences (delta) for PM and NO2 (air quality), DB - Line segments (colour and thickness) for traffic volumes - 3D Buildings to depict street canyons	- Visualisation of the road network volumes (model calculation results) - Visualisation of the road network volume changes (model calculation results) - Visualisation of the impact of changes in air quality - Visualisation of the impact of changes in air noise distribution (by traffic) - Visualisation of the new ring road trajectory	DUET Cesium-based Local Digital Twin prototype - Reusable 2D Traffic model volume map - Traffic Modeller (LDT integration)	19.1	Ring road construction impact	No	The traffic data used is collected via traffic loops, which doesn't contain personal information
20	Pilsen (CZ) - Digital Twin, Solar equipment locations in the city park	Visualising the impact of 3D terrain assets (e.g. buildings, other constructions, e.g. bridges, trees) on the potential shadow impact on solar panels in a Digital Twin	Policy action: Simulating the shadow impact on solar equipment efficiency	Display in 3D the sunshine's impact on locations for every date and time	Output of: - 3D Visualisation of buildings, trees (and other meaningful infrastructures) and incidence of light	Digital Twin visualisation depicting: - 3D map visualisation of buildings and infrastructures - Shadow impact model visualisation	- Navigatable 3D visualisation of city infrastructure - CRUD solar infrastructure location - Shadow impact simulation and visualisation of every moment during the year - Time navigation	DUET Cesium-badsed Local Digital Twin prototype - 3D Solar impact map (Cesium)	20.1	Solar equipment impact visualisation	No	No private personal data are involved

* PM = Particular Matter / BC = Black Carbon / CO^2 = Carbon Dioxide / DB = Noise

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
1	Dynamic Exposure Visualisation Dashboard (DEV-D)	Visualisation of geospatial & time-based data measuring air quality and ambient conditions like humidity and temperature to interpret route conditions	Dashboard visualising travel routes, fine dust and BC exposure in line graphs (normal and cumulated graphs)	Air quality data (PM), ambient data (temperature, humidity), GPS coordinates	Geospatial & time-based visualisation of IoT data (air quality and ambient conditions)	Dynamic Exposure Visualisation Dashboard	Berlin (DE), Flanders (BE)	1.1	COMPAIR	Project Development
1	2D Trip visualisation map	Spatial visualisation of individual trips, visualising the air quality (PM levels) along the route	2D Map route visualisation depicting road segments PM-exposure levels	Air quality data (PM), ambient data (temperature, humidity), GPS coordinates	Geospatial & time-based visualisation of IoT data (air quality and ambient conditions)	Dynamic Exposure Visualisation Dashboard	Berlin (DE), Flanders (BE)	1.2	COMPAIR	Project Development
1	Air Quality exposure line chart	Line chart visualisation of exposure levels compared to the WHO air quality minimum target	Line chart depicting distance or time with the fine dust particles (µg/m2) compared with the WHO guideline or black carbon (ng/m3) exposure	Air quality data (PM, BC), ambient data (temperature, humidity), GPS coordinates	Geospatial & time-based visualisation of IoT data (air quality and ambient conditions)	Dynamic Exposure Visualisation Dashboard	Berlin (DE), Flanders (BE)	1.3	COMPAIR	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
1	Air Quality Cumulative exposure line chart	Line chart visualisation of cumulative exposure levels compared to the cumulative WHO air quality guideline	Line chart depicting distance or time with the cumulative fine dust particles (µg/m2) compared with the cumulative WHO guideline or cumulative black carbon emission (ng/m3) exposure	Air quality data (PM, BC), ambient data (temperature, humidity), GPS coordinates	Geospatial & time-based visualisation of IoT data (air quality and ambient conditions)	Dynamic Exposure Visualisation Dashboard	Berlin (DE), Flanders (BE)	1.3	COMPAIR	Project Development
1	Air Quality Cumulative exposure line chart	Line chart visualisation of the inhaled dose exposure model output	Line chart depicting distance or time with the cumulative fine dust particles (µg/m2)	Air quality data (PM, BC), ambient data (temperature, humidity), GPS coordinates	Geospatial & time-based visualisation of IoT data (air quality and ambient conditions) processed by an inhaled dose simulation algorithm	Dynamic Exposure Visualisation Dashboard	Berlin (DE), Flanders (BE)	1.4	COMPAIR	Project Development
2	Floating car data mobility dashboard	Overview of the historical traffic flows	Dashboard, multiple visualsations	Floating car data	Multiple types	Custom built dashboard with Angular	Issy-Les-Moulineaux (FR), Solva (BE)	2.1	PoliVisu	Project Development
2	Traffic speed and delay time distribution histogram	Overview of the speed and time delay (during the day)	Line chart (single line)	Floating car data	Graph traffic time and speed delay processing (hourly)	Custom built line graph with Angular	Issy-Les-Moulineaux (FR)	2.1	PoliVisu	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
2	Line-based free flow map	Overview of the speed compared to the free float speed on a road segment	Line map visualisation (line segment colour scale)	Floating car data	Geospatial & time-based visualisation of traffic redistribution free flow speed	Custom built free flow map with Angular	Issy-Les-Moulineaux (FR)	2.1	PoliVisu	Project Development
2	Table (lost time)	Overview of the most congested days and most congested road segments	Table	Floating car data	Traffic time and speed delay processing (hourly)	Custom built matrix table with Angular	Issy-Les-Moulineaux (FR)	2.1	PoliVisu	
2	Free-flow distribution heatmap matrix	Hour/day overview of the free flow speed	Matrix table (value, colour scale)	Floating car data	Graph Traffic time delay processing (hourly/daily)	Custom built matrix table with Angular	Issy-Les-Moulineaux (FR)	2.1	PoliVisu	Project Development
3	Average speed control dashboard	Dashboard providing historical and recent data about average speed control zones	Dashboard visualising average speed control data using bar charts, pie charts, line charts and matrix visualisations	Pseudonymized historical ANPR data	Geospatial & time-based processing of pseudonymized ANPR data	Macq Sa - M3, custom built	Policezone Voorkempen (BE)	-	PoliVisu	Project Development
3	Heatmap	Visualising the relative percentage of infractions at a typical moment during the week	Heatmap (time, infraction percentage)	Pseudonymized historical ANPR data	Geospatial & time-based processing of pseudonymized ANPR data	Macq Sa - M3, custom built	Policezone Voorkempen (BE)	3.1	PoliVisu	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
3	Flow rate diagram	Visualising the average speed relative to the number of vehicles and time period (during the day)	Flow rate diagram (average speed, number of vehicles)	Pseudonymized historical ANPR data	Geospatial & time-based processing of pseudonymized ANPR data	Macq Sa - M3, custom built	Policezone Voorkempen (BE)	3.2	PoliVisu	Project Development
3	Average Speed Control Infraction Histogram	Visualising the relative percentage of infractions and near infractions over time to monitor long-term effects	Average speed control historgram (infraction percentage, time)	Pseudonymized historical ANPR data	Geospatial & time-based processing of pseudonymized ANPR data	Macq Sa - M3, custom built	Policezone Voorkempen (BE)	3.3	PoliVisu	Project Development
4	Sankey distribution diagram	Distributions of origin destination between places (local communities & cities)	Sankey diagram (line diagram - line thickness, line colour)	Floating car data	Graph processing of origin/destination of displacement counts	TomTom Move	Solva (BE)	4.1	PoliVisu	Existing Toolset
4	Origin-Destination matrix diagram and heatmap	Origin/destination distribution diagram, visualizing the distribution of trips between local communities and in the community itself	Matrix table (value, colour scale)	Floating car data	Graph processing of origin/destination displacement counts	TomTom Move	Solva (BE)	4.2	PoliVisu	Existing Toolset

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
4	Traffic flow line/trip distribution map	Origin/destination distribution to get geospatial insights into displacement patterns	Line and area map visualising trips (line coulor - grey scale, area colour fade out)	Floating car data	Geospatial & time-based processing and visualisation of origin/destionation displacment counts	TomTom Move	Solva (BE)	4.3	PoliVisu	Existing Toolset
5	Policy Monitoring Dashboard for Traffic and Air Quality Sensor	Getting insights into the effects of measured traffic and air quality before and after a reference moment	Dashboard, multiple visualsations	Fixed traffic sensors (measuring multiple traffic modes), fixed air quality sensors (fine dust, black carbon, NO2)	Geospatial & time-based visualisations	Compair Policy Monitoring Dashboard (PMD)	Vlaanderen (Herzele)	5.1	COMPAIR	Project Development
5	2D Sensor Location Map	Geospatial overview of fixed sensor location to get an overview of an area	2D Map with sensor locations (line segments, points depending on the sensor type)	Fixed traffic sensors (measuring multiple traffic modes) (Herzele, Mechelen) Fixed air quality sensors (fine dust, black carbon, NO2) (Herzele)	Map visualisation	Compair Policy Monitoring Dashboard (PMD), Custom-built Dashboard for school streets	Vlaanderen (Herzele, Mechelen, Sint-Niklaas)	5.1; 6.2; 7.2	PoliVisu; COMPAIR	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
5	Bar chart	Overview of the traffic and air quality impact	Bar charts visualise positive and negative values before and after a reference period	Fixed traffic sensors (measuring multiple traffic modes), fixed air quality sensors (fine dust, black carbon, NO2)	Bar chart	Compair Policy Monitoring Dashboard (PMD)	Vlaanderen (Herzele)	5.2	COMPAIR	Project Development
6	school street implementation dashboard	Dashboard providing historical and live data about the traffic in and around school streets to evalu! ate a school street implementation	Dashboard visualising traffic count data around schools using bar charts, line chars, modal split pie charts and trend analysis line charts.	Telraam traffic count data (aggregated data of traffic counts per transport mode), location data (schools) and weather information	Geospatial & time-based processing and visualisation of traffic count data	Custom built with Angular	Mechelen (BE)	6.1	PoliVisu	Project Development
6	Bar chart (advanced)	Visualising bike use, including links with the policy targets, and the possibility to hide and show categories	Bar chart (advanced) including other information (policy goal and weather conditions)	Number of cyclists, policy target	time-based processing and visualisaiton of traffic count data (cyclists)	Custom built with Angular	Mechelen (BE)	6.3	PoliVisu	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
6	Comparative trend analysis line chart	Analysing the difference in use of transport modes between two time periods	Line graph visualising the difference between two periods	Number of road users	time-based processing and visualisaiton of the difference in traffic count data between two periods (cyclists, pedstrians, cars, big vehicles)	Custom built with Angular	Mechelen (BE)	6.3	PoliVisu	Project Development
6	Line chart (advanced)	Visualising the traffic during the hours of the day a school street was implemented	Line chart (advanced) including weather information and the possibility to switch on and off categories	Number of road users, weather information	time-based processing and visualisaiton of traffic count data (cyclists, pedstrians, cars, big vehicles)	Custom built with Angular	Mechelen (BE)	6.3	PoliVisu	Project Development
6	Modal split pie chart	Modal split visualisation (distribution between transport modes)	Pie chart visualising the modal split	Number of road users	time-based processing and visualisaiton of traffic count data (cyclists, pedstrians, cars, big vehicles)	Custom built with Angular	Mechelen, Sint-Niklaas (BE)	6.4; 7.5	PoliVisu	Project Development, Telraam.net dashboard
7	Traffic count data mobility dashboard	Visualisation of the Telraam.net traffic sensor data counting pedestrians, cyclists, cars and big vehicles and vehicle speed	Dashboard, multiple visualsations	Telraam citizen science sensors	time-based AI picture processing anonymised and aggregated	Telraam.net dashboard	Sint-Niklaas (BE)	7.1	COMPAIR	Existing Toolset

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
7	Stacked bar and line charts (traffic volumes)	Visualisation of detailed traffic volumes of a street segment (hour of the day for a multiple-day period)	Stacked bar and line chart	Telraam citizen science sensors	time-based AI picture processing anonymised and aggregated	Telraam.net dashboard	Sint-Niklaas (BE)	7.3	COMPAIR	Existing Toolset
7	Histogram (driving speed)	Visualisation of the traffic speed to get an overview of the traffic behaviour	Histogram (driving speed, and V85 percentile over daytime)	Telraam citizen science sensors	time-based AI picture processing anonymised and aggregated	Telraam.net dashboard	Sint-Niklaas (BE)	7.4	COMPAIR	Existing Toolset
8, 10	2D Interactive heatmap dashboard	Better insights in the location and type of incidents	Heatmap displaying the accident hotspot locations (colour and area size) combined with other data sources	Anonymized accident data + other relevant data sources (for ex. schools, average speed control zones)	Geospatial & time-based processing and visualisation of road accidents	WebGLayer	Flanders (BE), Pilsen (CZ)	8.1; 10.1	PoliVisu	Project Development
8, 10	Interactive charts	Better insights into the location and type of attribute data	Interactive bar and line charts allowing interactive selection	Geospatial & time-based dataset with attribute data	Geospatial & time-based processing	WebGLayer	Flanders (BE), Pilsen (CZ)	8.1; 10.1; 11.1; 11.2	PoliVisu	
9	Polygon choropleth map	Map visualizing dorm student movements during the academic year	Choropleth map (Colour scale), base road map, main university and high-school buildings	Mobile phone data (location, time) of a selected group based on a geo-time-based profile selection	Geospatial & time-based processing and visualisation of mobile phone data	QGis	Ghent (BE)	9.1; 9.2	PoliVisu	Existing Toolset

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
11	2D Interactive traffic line map	Visualising the traffic level and intensity of each road segment	2D Interactive line map visualisation (using a colour scale), interactive histograms and calendar selector.	Traffic sensors (traffic loops and counting cameras)	Geospatial & time-based processing and visualisation of traffic conut data	WebGLayer	Pilsen (CZ)	11.1; 11.2	PoliVisu	Project Development
12	2D Traffic volume delta map	Visualising the traffic volume changes between two moments in time to evaluate a traffic increase or decrease	Line segments (road segments) visualisation (colour scale)	Traffic model (model based on traffic counts, census and road network data)	Geospatial & time-based processing and visualisation of traffic model data	Traffic modeller	Pilsen (CZ)	12.1	PoliVisu	Project Development
13, 19	2D Traffic model volume map	Visualising the traffic volumes of a traffic model calculation to evaluate traffic volumes and volumes related to road capacity	Line segments (road segments) visualisation (colour scale, line thickness) and absolute numbers	Traffic model (model based on traffic counts, census and road network data)	Geospatial & time-based processing and visualisation of traffic model data	Traffic modeller	Pilsen (CZ)	13.1; 19.1	PoliVisu	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
14	Travel planning algorithm mobile app	Visualise the outcome of a traffic model calculation (standard traffic model versus simulated scenarios).	Application (Multiple visualisations), including a 2D route-planning app (routes with colour-coded traffic modes), panes visualising the multimodal route as a timeline, and detailed information about public transport lines and expected delay times.	Origin, destination, available and desired transport modes	Multimodal route planning algorithm, cost calculating algorithms for financial cost and environmental cost (CO2)	MyAnatol multimodal route planner app	Issy-Les-Moulineaux (FR)	14.1	PoliVisu	Existing Toolset
15	2D Traffic model scenario analysis map	Visualise the outcome of a traffic model calculation (standard traffic model versus simulated scenarios).	Line segments (road segments) visualisation (colour scale, line thickness) and absolute numbers	Traffic model (model based on traffic counts, census and road network data)	Geospatial & time-based processing and visualisation of traffic model data	Traffic modeller	Pilsen (CZ)	15.1	PoliVisu	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
15	Timeline chart of roadworks	Visualising an overview of the planned roadworks	Horizontal bar chart	Database with planned roadworks (location street segment, start and end period, roadwork data - driving direction, capacity per direction)	time-based visuaisalisation	Traffic modeller	Pilsen (CZ)	15.2	PoliVisu	Project Development
16	3D Digital Terrain visualisation of landscape elements	Visualise the effect of new landscape elements on the neighbourhood	3D Digital Twin simulation modelling (shade/light algorithm)	3D City model	3D Map shadow visualisation model algorithm	Local Digital Twin	Athens (GR)	16.1	DUET	Project Development
17, 18	2D, 3D Traffic volume delta map	Visualise the effect of a traffic model outcome compared to a base situation	Visualisation of a traffic model output in a Digital Twin 2D or 3D environment	Traffic model (model based on traffic counts, census and road network data)	Geospatial & time-based processing and visualisation of traffic model data	Local Digital Twin	Ghent (BE), Pilsen (CZ)	17.1; 18.1	DUET	Project Development
17, 18	3D Air quality delta map	Visualising the effect of traffic and traffic measures on the ambient air quality	3D Digital Twin simulation modelling (air quality model visualisation)	3D City model, traffic model, air quality model	3D Digital Twin simulation modelling (Traffic model output as input for the air quality model visualisation)	Local Digital Twin	Athens (GR), Pilsen (CZ)	17.2; 18.3	DUET	Project Development

TABLE RESEARCH DATA 3: Visualisation techniques overview

Caption: Overview of the used visualisation techniques, characteristics and use

Pilot	Visualisation technique		Characteristics			Use		Case visual nr.	Project	Tool
nr	Name	Visualisation goal (related to the visualisation technique)	Visualisation type	Type of input	Type of processing	Tools	Pilots	Nr	Name	(project dev / existing)
18	3D Noise distribution point map	Visualising the effect of traffic and traffic measures on the ambient noise distribution	3D Digital Twin simulation modelling (noise model visualisation)	3D City model, traffic model, noise distribution model	3D Digital Twin simulation modelling (Traffic model output as input for the noise model distribution visualisation)	Local Digital Twin	Athens (GR), Pilsen (CZ)	18.2	DUET	Project Development
20	3D Solar impact map	Visualising the shadow impact to find suitable spots for installing solar equipment	3D Digital Twin simulation modelling (shade/light algorithm)	3D City model	3D Map shadow visualisation model algorithm	Local Digital Twin	Pilsen (CZ)	20.1	DUET	Project Development

TABLE RESEARCH DATA 4: Policy cycle case mapping

Caption: Results of the individual scoring of each case for the policy cycle (sub)phases

Legend

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring

Relevant phase in the policy cycle (See figure 1)	Visualisation is useful	Visualisation has no direct use
Relevant sub-phase in the policy cycle (See figure 1)	Visualisation is useful	Visualisation has no direct use

Nr.	Project link	Visualisation type, pilot case name, policy-making cycle mapping
1	H2020 COMPAIR	**Type: Dynamic Exposure Visualisation Dashboard (Visualisation DB)**

Berlin (DE), Flanders (BE) - Dynamic exposure visualisation

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1						1	1		

2	H2020 PoliVisu	**Type: DASHBOARD VISUALISATION (VISUALISATION DB)**

Issy-Les-Moulineaux (FR) - Traffic dashboard

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1							1	1	

3	H2020 PoliVisu	**Type: DASHBOARD VISUALISATION (VISUALISATION DB)**

Police zone Voorkempen (BE) - Trajectory speed limit enforcement dashboard

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
	1					1		1	1

4	H2020 PoliVisu	**Type: ROUTE DISTRIBUTION DIAGRAMS (VISUALISATION DB)**

Solva region (BE) - Regional traffic behaviour

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1	1								

5 H2020 COMPAIR — **Type: Policy Monitoring Dashboard school street (Policy DB)**

Herzele (BE) - Interactive school street dashboard

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1			1			1	1	1	

6 H2020 PoliVisu — **Type: DASHBOARD - POLICY TOOL (POLICY DB)**

Mechelen/Flanders (BE) - Interactive school street dashboard

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1	1			1	1	1	1	1	1

7 H2020 COMPAIR — **Type: Policy Monitoring Dashboard Local Mobility Scheme (Policy DB)**

Sint-Niklaas (BE) - Local mobility scheme/plan dashboard

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1		1	1	1		1	1	1	1

8 H2020 PoliVisu — **Type: INTENSITY MAP (INTENSITY MAP VISUALISATION)**

Flanders (BE) - Interactive road safety map

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1	1			1			1	1	

9 H2020 PoliVisu — **Type: OVERVIEW MAP (INTENSITY MAP VISUALISATION)**

Ghent (BE) - Student displacements

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communi-cation	Impact assessment	Problem (re)structur-ing
1	1								

10 H2020 PoliVisu — **Type: INTENSITY MAP (INTENSITY MAP VISUALISATION)**

Pilsen (CZ) - Interactive road accident map

Policy Design				Policy implementation				Policy evaluation	

Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1	1						1	1	

11 H2020 PoliVisu **Type: INTENSITY MAP (INTENSITY MAP VISUALISATION)**

Pilsen (CZ) - Interactive sensor based live and historic traffic map

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1							1	1	

12 H2020 PoliVisu **Type: INTENSITY MAP (INTENSITY MAP VISUALISATION)**

Pilsen (CZ) - Traffic measure impact modelling comparison

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1	1	1	1	1	1	1		1	1

13 H2020 PoliVisu **Type: INTENSITY MAP (INTENSITY MAP VISUALISATION)**

Pilsen (CZ) - Traffic volume impact simulation modelling

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1							1		

14 H2020 PoliVisu **Type: OPTIMISATION (ALGORITHM VISUALISATION)**

Issy-Les-Moulineaux (FR) - Travel planning app

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
							1		

15 H2020 PoliVisu **Type: SIMULATION MODEL VISUALISATION (ALGORITHM VISUALISATION)**

Pilsen (CZ) - Impact of roadworks simulation

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implemen-tation plan	Implemen-tation	On-going monitoring	Communication	Impact assessment	Problem (re)structur-ing
1	1	1	1	1	1	1	1	1	1

16 H2020 DUET **Type: DIGITAL TWIN (DIGITAL TWIN VISUALISATION)**

Athens (GR) Digital Twin - Green squares planning

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1		1	1	1			1		

17	**H2020 DUET**	**Type: DIGITAL TWIN (DIGITAL TWIN VISUALISATION)**

Athens (GR) Digital Twin - Traffic load & creation of a pedestrian and cycling route

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1			1	1			1	1	

18	**H2020 DUET**	**Type: DIGITAL TWIN (DIGITAL TWIN VISUALISATION)**

Pilsen (CZ), Ghent (BE) Digital Twin - Impact of road closures

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1	1	1	1	1			1	1	1

19	**H2020 DUET**	**Type: DIGITAL TWIN (DIGITAL TWIN VISUALISATION)**

Pilsen (CZ) Digital Twin - Ring road construction impact

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1	1	1	1	1			1	1	1

20	**H2020 DUET**	**Type: DIGITAL TWIN (DIGITAL TWIN VISUALISATION)**

Pilsen (CZ) Digital Twin - Solar equipment locations in the city park

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
1		1	1	1	1			1	

Totals	**Overview results**

Policy Design				Policy implementation				Policy evaluation	
Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
18	10	7	9	10	4	7	15	14	7

	Visualisation solution									
	Policy Design				Policy implementation				Policy evaluation	
MATCH	Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
Dashboard visualisation	6	3	1	2	2	1	5	5	5	3
-Visualisation DB	3	2	0	0	0	0	2	2	2	1
-PolicyDB	3	1	1	2	2	1	3	3	3	2
Intensity map visualisation	6	4	1	1	2	1	1	4	4	1
Algorithm visualisation	1	1	1	1	1	1	1	2	1	1
Digital Twin visualisation	5	2	4	5	5	1	0	4	4	2
Totals	44				36				21	

	Policy Design				Policy implementation				Policy evaluation	
TOTALS	Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
Dashboard visualisation	7	7	7	7	7	7	7	7	7	7
-Visualisation DB	4	4	4	4	4	4	4	4	4	4
-PolicyDB	3	3	3	3	3	3	3	3	3	3
Intensity map visualisation	6	6	6	6	6	6	6	6	6	6
Algorithm visualisation	2	2	2	2	2	2	2	2	2	2
Digital Twin visualisation	5	5	5	5	5	5	5	5	5	5
Totals	80				80				40	

	Policy Design				Policy implementation				Policy evaluation	
PERCENTAGE	Problem-setting	Policy formulation	Scenario analysis	Decision	Implementation plan	Implementation	On-going monitoring	Communication	Impact assessment	Problem (re)structuring
Dashboard visualisation	85.71%	42.86%	14.29%	28.57%	28.57%	14.29%	71.43%	71.43%	71.43%	42.86%
-Visualisation DB	75.00%	50.00%	0.00%	0.00%	0.00%	0.00%	50.00%	50.00%	50.00%	25.00%
-PolicyDB	100.00%	33.33%	33.33%	66.67%	66.67%	33.33%	100.00%	100.00%	100.00%	66.67%
Intensity map visualisation	100.00%	66.67%	16.67%	16.67%	33.33%	16.67%	16.67%	66.67%	66.67%	16.67%
Algorithm visualisation	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	100.00%	50.00%	50.00%
Digital Twin visualisation	100.00%	40.00%	80.00%	100.00%	100.00%	20.00%	0.00%	80.00%	80.00%	40.00%