E-Laas

Energy optimal urban Logistics As A Service

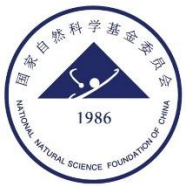
Deliverable report

Deliverable no.	D0.2
Deliverable title	Development of a set of attributes characterizing the scenario and the reference case
Scope of this report	WUT contribution to D0.2
Responsible partner	Warsaw University of Technology (WUT)
WP	0
WP title	Definition of scenarios and reference cases
WP leader	WUT, SU
WP involved partners	CUT, TU
Access	unlimited, online availability
License	CC BY 4.0
First version date	12.09.2023
Final version date	01.04.2026
Online publication date	02.06.2026

How to cite:
Szczepański, E., Izdebski, M., Jachimowski, R., Jacyna, M., Kłodawski, M., Lewczuk, K., Murawski, J., & Paszkowski, J. (2026). *Development of a set of attributes characterizing the scenario and the reference case* (Project E-Laas, Deliverable D0.2). Warsaw University of Technology.

Project implemented as part of the call ERA-NET Cofund Urban Accessibility and Connectivity (ENUAC China Call) organized by JPI Urban Europe and the National Natural Science Foundation of China (NSFC).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875022.



Project funding information

E-Laas project is carried out in an international consortium. Project coordinator in Europe: Chalmers University of Technology (Sweden), project coordinator in China: Shanghai University (China), consortium members: Tsinghua University (China), Warsaw University of Technology (Poland), cooperation partners: Stockholms stad, Trafikkontoret (Sweden), ParkUnload (Spain), Metropolis GZM (Poland), Shanghai Urban-Rural Construction and Transportation Department (China), Volvo Group Trucks Technology and Operations (Sweden).

- *The Chinese part of the project is funded by National Natural Science Foundation of China*

- *The Swedish part of the project is funded by Swedish Energy Agency*

- *The Polish part of the project is funded by the National Science Centre, Poland (project no. 2022/04/Y/ST8/00134). The value of the co-financing is PLN 878 107.00. Project duration 27/04/2023 - 26/04/2026 (36 months).*

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1. Summary

In line with the project proposal, report D0.2 concerns the development of a set of attributes characterising scenarios and reference cases. This requires preparing a description structure that makes it possible to classify urban freight logistics scenarios and compare reference cases for the purposes of further project work.
The attributes defined in D0.2 should make it possible to describe both real reference cases and potential virtual cases. In the current implementation of the project, however, this structure has been applied primarily to the description of the real reference case RC1 - GZM Metropolis and the scenarios subsequently developed in D0.3.
Report D0.2 develops an attribute structure enabling the description of reference cases, virtual reference cases, base scenarios and alternative scenarios. The basic concepts of the E-Laas Reference Case Repository are defined, and the data groups required for further modelling, what-if analyses, model validation and scenario assessment are indicated.
In particular, attributes were identified for describing the urban area, transport network, transport zones, sending and receiving points, transport modes, demand, operational parameters, energy, emission and cost parameters, user behaviour and potential KPI. This attribute set provides the basis for identifying scenarios in D0.3 and preparing input data for surveys, macro models, micro models and energy assessment analyses in WP2.
Report D0.2 retains the broad methodological character resulting from the project proposal. It also includes the possibility of defining Virtual Reference Cases, although within the current project scope they will not be developed as separate research cases in D0.3 or in subsequent WP2 reports. They are treated as a potential extension of the E-Laas methodology for further research, in particular for theoretical, comparative and scalability analyses.
Report D0.2 answers the question of which attributes and data should be used to describe cases and scenarios, whereas D0.3 answers the question of which urban logistics scenarios were identified for the GZM reference case. Thus, D0.2 forms the methodological and data layer, while D0.3 forms the scenario layer.

2. Introduction

The main intention of the work in WP0 is to develop a set of multimodal urban freight scenarios described by different attributes. These attributes are intended to support scenario comparison, classification and later use in modelling, optimisation and assessment of urban logistics solutions.
Report D0.2 has a methodological function. It does not identify scenarios in detail, as this is the task of D0.3, but defines the structure for describing reference cases and scenarios. In practice, this means preparing a common dictionary of data and attributes that can be used by project partners in later work packages.
D0.2 must therefore retain a broad set of attributes resulting from the project proposal, while at the same time indicating which attributes will be actively used in the configuration of D0.3 scenarios and which remain part of the broader E-Laas methodology or a potential extension in the future.

3. Purpose and scope

The purpose of report D0.2 is to develop a set of attributes characterising scenarios and reference cases in the E-Laas project. These attributes are intended to describe the structure of an urban logistics system, its components, participants, transport relations, input data and assessment indicators. The scope of the report includes:

- defining the main concepts used in the E-Laas case repository,
- defining the structure of the E-Laas Reference Case Repository,
- identifying the attributes of reference cases and virtual reference cases,
- identifying the attributes of base scenarios and alternative scenarios,
- organising the input data groups required for modelling and analyses,
- indicating the role of attributes in WP2, WP3, WP4 and M0.

The report does not include simulation results, survey results or detailed computational experiments. These elements are the subject of subsequent WP2 reports. D0.2 is also not the full M0 data repository, but defines the structure that enables such a repository to be created.

4. Main definitions and E-Laas Reference Case Repository structure

The main definitions related to the preparation of cases for experiments in E-Laas have been adopted and presented in Table 1.

Table 1. Main definitions

Term	Definition and role in the project
E-Laas Reference Case Repository	A database or structured data framework developed for the implementation of subsequent work packages. It contains reference cases, scenarios, variants, attributes and data needed for analyses.
Reference Case (RC)	The most general unit in the repository. It includes the characteristics of the studied urban area and its logistics system. In the current project, the main WUT case is RC1 - GZM Metropolis.
Virtual Reference Case (VRC)	A derived or theoretical case, e.g. an idealised urban area, a forecast-based case or a variant resulting from infrastructure development. In the current project, the VRC is not developed as a separate research case, but remains a possibility for further research.
Base Scenario (BS)	A base scenario describing the existing or reference organisation of a given urban logistics segment.
Alternative Scenario (AS)	An alternative scenario describing a change in relation to the base scenario, e.g. a change in modal split, demand, pick-up method or consolidation.
Attribute	A feature describing a case, scenario, participant, infrastructure object, transport mode, demand, user behaviour or assessment indicator.
KPI	An assessment indicator used to compare scenarios in operational, energy, emission, cost or service-quality terms.

The E-Laas Reference Case Repository should enable structured storage of information on reference cases, base scenarios, alternative scenarios and potential virtual cases. The repository structure should be general enough to cover different cities and different types of urban logistics systems, while also being detailed enough to support further modelling and analyses.

In the current project, the main application path is RC1 - GZM Metropolis and the BS/AS scenarios further developed in D0.3. The part concerning VRC, VBS and VAS remains an

element of the methodology and may be used in further research, but is not developed as a separate scope of the current WP2 work.
Schematically, the elements of E-Laas Reference Case Repository are shown in Fig. 1.

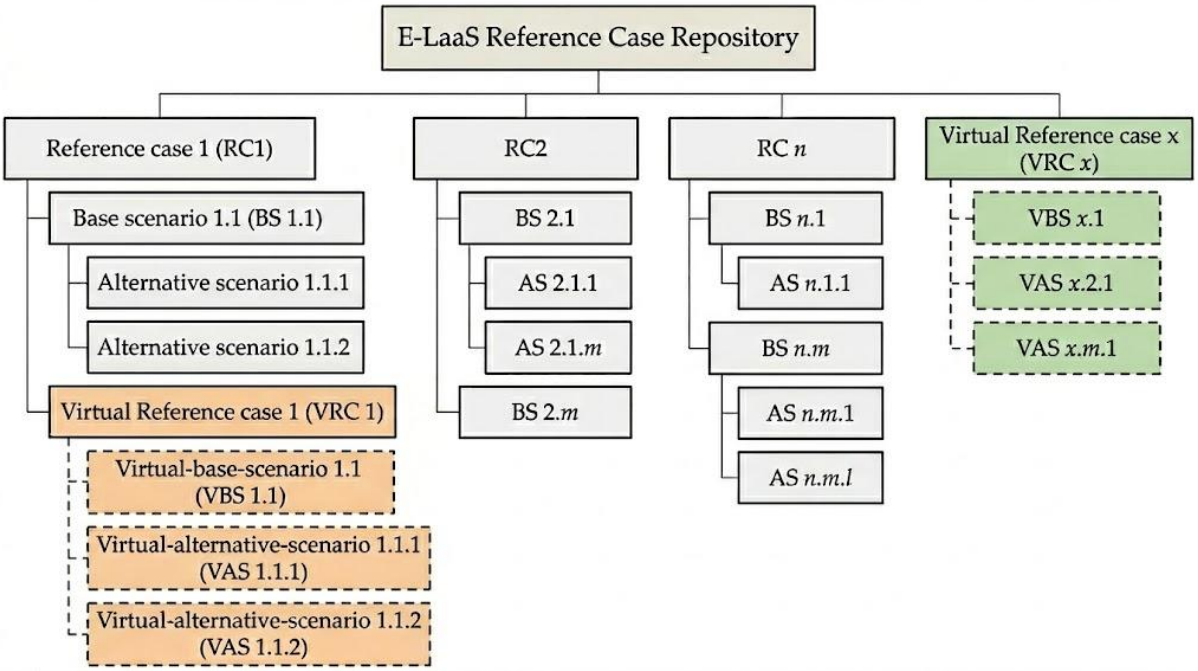

Fig. 1. The E-Laas Reference Case Repository

5. Reference case (and Virtual reference case) attributes

Reference case attributes describe the urban area and its transport and logistics system independently of any individual scenario. These attributes provide the context for all scenarios defined for a given case (Fig. 2).

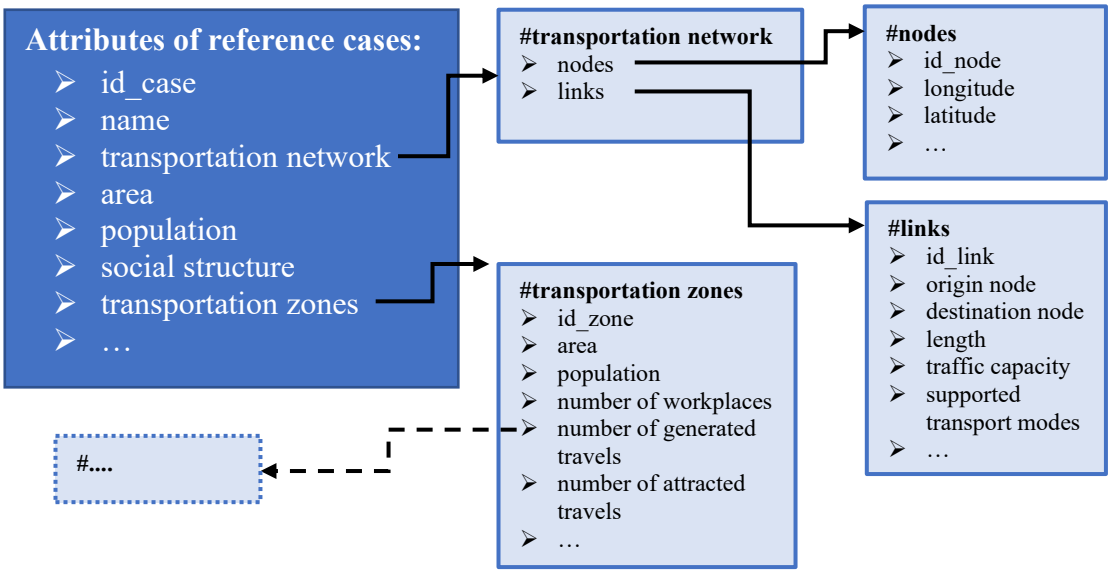

Fig. 2. Draft of example reference cases attributes

Table 2 presents grouped attributes for describing a reference case in the field of urban logistics. This dataset plays a key role in representing the multifaceted nature of transport networks, including nodes, network links, turning movements, transport systems, communication areas, points of interest (POI), line characteristics and stop characteristics. Each category is designed to capture a distinct aspect of the transport ecosystem, thereby offering a holistic picture of its operational dynamics, infrastructure capabilities and user interactions. In the context of scenario-based studies within the transport network, it should be noted that the data presented above will, by default, remain unchanged across different scenarios.

Table 2. Groups of reference case attributes

Attribute group	**Examples of attributes**	**Use in the project**
General attributes	reference_case_id, name, country, city/metropolitan area, urban area type	case identification and comparison of cities
Spatial attributes	area, density, land use, spatial structure, administrative units	defining the scope of analyses and the level of aggregation
Socio-economic attributes	population, workplaces, education places, activity generators, social structure	estimating demand potentials and user behaviour
Transport network attributes	nodes, links, length, speed, capacity, supported modes, restrictions	macro model, micro model, route and travel-time calculation
Zone attributes	zone_id, population, jobs, land-use functions, generated and attracted trips	macro model and scaling of results
Logistics demand attributes	parcel lockers, restaurants, hubs, catering companies, POI, demand generators	location of senders, receivers and service points
Modelling attributes	data availability, aggregation level, model compatibility, validation data	preparation of data for WP2 and M0

Virtual Reference Cases use the same attribute logic as Reference Cases, but they may describe hypothetical, theoretical or forecast-based cases. They may be created, for example, by changing the spatial structure of a city, the demand level, infrastructure development, new regulatory constraints or user behaviour. In the current implementation of the project, Virtual Reference Cases are not developed as independent research cases. Their inclusion in D0.2 has methodological and repository-related value. It maintains consistency with the project proposal and enables later extension of the E-Laas methodology to comparative studies, what-if analyses and scalability analyses.

Reference case attributes should describe the relatively stable urban context in which base and alternative scenarios are later placed. With respect to D0.3, this primarily means describing RC1 - GZM Metropolis as an area for which scenarios can be defined for ready-made food delivery, boxed meal delivery, parcel locker deliveries and direct parcel deliveries to individual recipients. These attributes should not be confused with the decision variables of scenarios: they describe the environment, constraints, network and demand potential within which scenarios are subsequently analysed (Table 3).

Table 3. Reference case attributes in the D0.3 scenario context

Attribute group	**Example attributes**	**Example for RC1 – GZM / D0.3**	**Use in modelling and analysis**
General and identification attributes	reference_case_id, name, country, responsible partner, data version, source, status	RC1 – GZM Metropolis, Polish reference case developed by WUT	case identification in the M0 repository and linkage with D0.3
Spatial attributes	area, spatial extent, urban area type, density, land-use structure, aggregation level	entire GZM, selected cities, districts, transport zones or test areas	selection of the analysis scale; transfer of micro-simulation results to the macro level

Socio-economic attributes	population, workplaces, education places, activity generators, social structure	residents, workplaces, service facilities, schools, hospitals, retail facilities	estimation of demand potential and characteristics of logistics service recipients
Transport zone attributes	zone_id, area, population, jobs, generated flows, attracted flows, dominant function	transport zones used in the macro model and for grouping similar areas	macro-simulation, clustering of zones, scaling of results
Transport network attributes	node_id, coordinates, link_id, length, capacity, speed, supported modes, restrictions	road network and paths (nodes and links) available for vehicles, bicycles, pedestrians and other transport modes	route, distance, travel-time and network-load calculation
Logistics facility attributes	hub_id, parcel_locker_id, concentration_point_id, location, access node, capacity, opening hours	courier hubs, parcel lockers, potential delivery concentration points	definition of sending, receiving and transshipment points in scenario 1.3
POI and demand generator attributes	POI type, coordinates, category, activity level, delivery relevance	restaurants, catering companies, residential buildings, parcel lockers	generation of tasks and location of demand in scenarios 1.1, 1.2 and 1.3
Traffic and operational context attributes	average speed, congestion level, heavy vehicle share, waiting time, travel time	road network load affecting delivery time and routing	parameterisation of macro and micro models and assessment of variants
Energy and environmental context attributes	fuel factors, electricity factors, CO2 factors, emission context, energy source assumptions	energy, fuel and emission factors used for KPI in WP2	comparison of scenarios in terms of energy consumption and emissions
Data quality and availability attributes	source, date, completeness, spatial resolution, assumption type, uncertainty	real data, synthetic data, expert data, data from OSM or transport models	validation, documentation of assumptions and assessment of model limitations

Reference case attributes can also be used at different modelling levels. Some of them support the macro-simulation model, some support micro-simulation, some support survey research, and some support later KPI assessment (Table 4). In D0.3, scenarios will be described at the structural level, while D0.2 indicates which data allow these scenarios to be translated into models and analyses.

Table 4. Groups of reference case attributes at different modelling levels

Modelling level	**Main attribute groups**	**Examples of attributes**	**Relation to D0.3**
Macro level	zones, network, socio-economic data, aggregate demand	zone population, jobs, area, generated/attracted flows, link capacity, average speed	determining demand potential and network load for scenarios 1.1, 1.2 and 1.3
Micro level	senders, receivers, facilities, vehicles, operations	restaurant location, recipient node, parcel locker capacity, vehicle capacity, loading time	detailed delivery-service logic in FlexSim and similar models
Survey and behavioural level	preferences, acceptance, choices, constraints	acceptable delivery time, acceptable walking distance, pick-up preference, acceptance of low-emission modes	user behaviour parameters in parcel-locker and door-delivery scenarios
Energy and emission level	energy use, fuel use, emission factors, vehicle parameters	kWh/km, l/100 km, CO2 factor, vehicle load, range	assessment of energy and emission KPI in WP2
Scenario comparison level	KPI, scenario status, assumptions, variants	delivery time, distance, energy, CO2, cost, punctuality, service quality	comparison of BS and AS scenarios and preparation of conclusions for M2

6. Scenario attributes (Base and Alternatives)

Scenario attributes describe a specific variant of the organisation of a logistics process (their general outline is shown in Fig. 3). While reference case attributes refer to a city or area, scenario attributes concern a selected urban logistics segment, such as food delivery, boxed meal delivery, parcel lockers or direct parcel deliveries (Table 5).

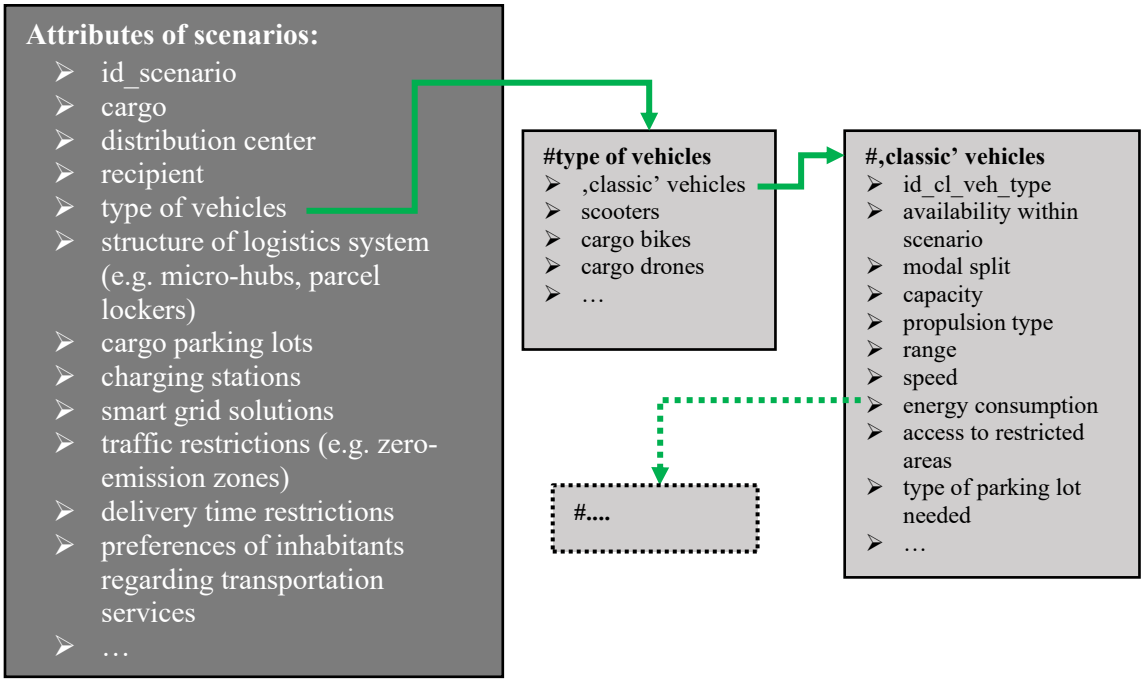

Fig. 3. General draft of scenario attributes

The scope of scenario attributes is broad because it must correspond to various possible configurations of urban freight logistics. This does not mean, however, that every attribute is changed in every scenario. For example, attributes related to charging infrastructure, parking or micro-hubs remain part of the broader E-Laas methodology, but they will not be analysed in the current D0.3 scenario set. These attributes are included in the work carried out by the Swedish research team. In the scenario studies conducted by WUT, the main variables include the delivery structure, modal split, demand, senders, receivers, parcel lockers, concentration points and KPI.

Table 5. Groups of scenario attributes

Scenario attribute group	**Examples**	**Relation to D0.3**
Scenario identification	scenario_id, reference_case_id, scenario type, parent scenario	BS/AS numbering for RC1 – GZM
Delivery segment	ready meal delivery, boxed meal delivery, parcel locker delivery, direct parcel delivery	main D0.3 scenarios
Senders and receivers	restaurants, catering companies, hubs, parcel lockers, individual recipients	transport relations and point locations
Cargo and demand	orders, parcels, volume, weight, time distribution, peak periods	task generation and demand-growth variants
Transport modes	combustion vehicles, electric vehicles, bicycles, e-bikes, scooters, e-scooters, drones	modal split and low-emission variants
Operational parameters	capacity, speed, service time, routing rules, consolidation time	micro model and delivery-service logic
Consolidation and delivery points	parcel lockers, concentration points, hubs, micro-delivery structures	consolidation and parcel pick-up variants
Energy, emission and cost attributes	fuel use, energy use, CO2 factors, unit costs	energy, emission and cost KPI
User behaviour and preferences	delivery preferences, pick-up distance, accepted time windows, willingness to use alternatives	surveys and D2.2
KPI attributes	time, distance, energy, fuel, CO2, cost, service quality	D2.3 and M2

Unlike reference case attributes, which describe a city or area, scenario attributes indicate who sends shipments, who receives them, what cargo is transported, which transport modes are allowed, which variables are modified and which KPI will be assessed. Table 6 below develops the general scenario attributes while maintaining consistency with the D0.3 scenario catalogue.

Table 6. Detailed specification of general scenario attributes

Attribute group	Detailed attributes	Examples in D0.3 scenarios	Role in scenario analysis
Scenario identification	scenario_id, parent_scenario_id, scenario_type, scenario_status, reference_case_id	BS 1.1, AS 1.1.1, BS 1.3, AS 1.3.6; status CS/SS/FS	scenario identification and the relationship between BS and AS
Delivery segment	delivery_segment, service_type, logistics process type	ready meal delivery, boxed meal delivery, parcel locker delivery, direct parcel delivery	classification of the logistics service type
Transport relation	origin_type, destination_type, intermediate_points, relation structure	restaurants -> recipients; catering companies -> recipients; hubs -> parcel lockers; hubs -> recipients	definition of the flow and process structure
Sender attributes	sender_id, sender_type, access_node, dispatch volume, opening hours, service capacity	restaurants, catering companies, courier hubs, sorting centres	generation of cargo streams and assignment to the network
Receiver attributes	receiver_id, receiver_type, access_node, demand, delivery preferences, accessibility	individual recipients, parcel lockers, concentration points	location of demand and recipient behaviour
Cargo attributes	cargo_type, parcel_type, weight, volume, perishability, handling requirements, mode eligibility	ready meals, boxed meals, parcels, future pharmaceuticals	selection of transport modes and service constraints
Demand attributes	daily demand, time distribution, peak hours, order frequency, demand growth, spatial distribution	meal orders, boxed-meal subscriptions, parcels to lockers, parcels to doors	task generation and demand-growth tests
Transport mode attributes	mode_id, mode_name, propulsion, capacity, speed, range, access restrictions, modal share	combustion vehicles, EV, bikes, e-bikes, scooters, e-scooters, drones	definition of modal split and transport mode constraints
Operational attributes	loading time, unloading time, service time, routing rule, vehicle availability, consolidation time	restaurant service time, parcel delivery time, consolidation time at the concentration point	micro-model logic and comparison of operational efficiency
Consolidation attributes	concentration_point_id, service area, throughput, operating hours, consolidation time, region assignment	AS 1.2.3 and AS 1.3.6	analysis of benefits from consolidation and delivery regionalisation
Behavioural attributes	pick-up mode, acceptable distance, time-window preference, acceptance of commissioned delivery	AS 1.3.2 and AS 1.3.3	linkage between D0.3 and user preference surveys in WP2
Energy, fuel and emission attributes	unit energy use, fuel use, emission factor, energy source, load-dependent factors	energy and CO2 KPIs in scenarios 1.1, 1.2, 1.3	energy and environmental assessment
Cost attributes	fuel cost, energy cost, labour cost, operating cost, delivery cost	cost of commissioned deliveries, vehicle operating cost, operating cost	economic analysis and support for SULP assessment
KPI attributes	delivery time, distance, energy, fuel, CO2, cost, service quality, punctuality, utilization	KPI indicated in D0.3 for each scenario	comparison of base and alternative scenarios
Delivery channel attributes	delivery_channel, home_delivery_share, parcel_locker_share, self_pickup_share, commissioned_delivery_share, drone_delivery_share, channel_variant	home delivery, parcel locker delivery, self-pick-up, commissioned last-mile delivery, drone-based delivery variants	description of demand split into delivery and pick-up channels and parameterisation of simulation variants, especially for common parcel demand

It should be noted that selected scenario attributes may be used as technical parameters of the simulation model. This applies primarily to the split of demand into delivery channels, the share of different forms of parcel collection, the share of zero- and low-emission modes, and the distinction between residential and office recipients. At the same time, all attributes defined in D0.2 may be used to describe the scenarios developed in D0.3. Examples of such use of attributes are presented in Table 7.

Table 7. Examples of using attributes to describe scenarios

D0.3 scenario	**Sender and receiver attributes**	**Demand and behaviour attributes**	**Operational and transport mode attributes**	**Main KPI attributes**
BS/AS 1.1 – Ready meal delivery	restaurants: id, node, dispatch potential; recipients: id, node, location, delivery address	number of orders, temporal distribution, peak hours, demand growth in AS 1.1.2 and AS 1.1.3	mode share, courier assignment, vehicle capacity, speed, service time, routing, low-emission and zero-emission vehicle variants	delivery time, distance, energy, fuel, CO2, served/unserved orders
BS/AS 1.2 – Boxed meal delivery	catering companies: id, node, dispatch volume; recipients: residential buildings and offices, id, node, repeated demand	daily boxed-meal demand, residential and office demand, night/morning delivery window, demand growth in AS 1.2.2 and AS 1.2.3	planned routes, time windows, vehicle capacity, transport mode structure, electric and zero-emission delivery variants	punctuality, distance, energy, CO2, vehicle utilization, served orders
BS/AS 1.3 – Parcel delivery channels	hubs: id, node, dispatch volume; parcel lockers and PUDO points: id, node, capacity; recipients: id, access node, delivery address	parcel demand, channel split, home delivery share, parcel locker share, PUDO share, self-pick-up behaviour, commissioned delivery share, drone delivery share	hub-to-recipient modes, hub-to-locker modes, recipient pick-up modes, last-mile delivery modes, locker/PUDO service capacity, channel-specific modal split	operator distance/time, user trip distance, delivery time, energy, CO2, accessibility, service quality, served parcels
AS 1.3.1–AS 1.3.10 – Parcel simulation variants	hubs, recipients, parcel lockers, PUDO points, delivery channels and selected delivery modes	low-emission and zero-emission vehicle structure, channel variants, direct delivery share, parcel locker share, PUDO share, drone delivery variants	vehicle capacity, route length, modal split by relation and channel, parcel type eligibility, last-mile delivery mode	distance, time, energy, fuel, CO2, cost, vehicle utilization, served parcels, channel-specific accessibility

In simulation implementation, parcel scenarios may be represented as one common parcel demand, which is then divided into service channels, such as home delivery, parcel lockers, PUDO points and self-pick-up. This approach clarifies the transition from the scenario catalogue to the simulation model input data.

7. Minimum attribute set for scenario definition

From the full set of attributes defined in D0.2, it is possible to identify a minimum set of attributes that allows the transition from a general scenario definition to its later use in modelling, comparative analyses and KPI assessment. This set is not a complete catalogue of all data that could be collected for an urban logistics system. Rather, it is a practical data structure required to describe scenarios consistent with the scope of D0.3. In D0.3, scenarios will be defined by transport relations, participants, transport modes, decision variables and KPI. For such a description to be used in WP2, WP3, WP4 and in the M0 repository, these elements must be assigned to specific data objects. In particular, attributes are needed to describe the

transport network, analysis areas, sending and receiving points, transport modes, demand, operational parameters and energy, emission and cost indicators (Table 8).

Table 8. Minimum attribute set for D0.3-compatible scenarios

Entity / object	**Minimum attributes**	**Purpose in D0.3 scenarios**
Transport network node	node_id, coordinates, node type, access to road network	Location of sending and receiving points, parcel lockers, hubs and concentration points, and their connection to the transport network.
Transport network link	link_id, origin_node, destination_node, length, speed, allowed modes	Calculation of routes, distances, travel times, availability of transport modes and energy consumption.
Urban zone / analysis area	zone_id, area, population, workplaces, land use, demand potential	Demand aggregation, description of transport zones and scaling of micro-level results to the macro level.
Sender	sender_id, sender type, node_id, operating hours, dispatch volume	Description of restaurants, catering companies, courier hubs, sorting centres and other points generating delivery flows.
Receiver	receiver_id, receiver type, node_id or zone_id, demand volume, time profile	Description of individual customers, parcel recipients, parcel-locker users and potential recipients of delivery services.
Parcel locker / pick-up point	point_id, node_id, capacity, demand volume, service area	Description of parcel lockers and pick-up points in BS/AS 1.3 scenarios.
Concentration point	point_id, node_id, capacity, operating hours, consolidation time, service area	Description of delivery concentration points in AS 1.2.3 and AS 1.3.6 scenarios.
Delivery task	task_id, sender_id, receiver_id, cargo type, volume, weight, time window	Basic unit of the micro model; represents an order, parcel or delivery task.
Transport mode / vehicle type	mode_id, propulsion type, capacity, speed, energy/fuel consumption, emission factor	Calculation of travel time, energy consumption, fuel use, CO2 emissions, capacity and transport-mode constraints.
Scenario parameter	parameter_id, scenario_id, parameter name, value, unit	Description of changes in relation to the base scenario, e.g. modal split, demand growth, share of self-pick-ups or commissioned deliveries.
KPI	kpi_id, definition, unit, aggregation level	Comparison of scenarios in operational, energy, emission, cost and service-quality terms.
Delivery channel / service channel	channel_id, scenario_id, home_delivery_share, parcel_locker_share, PUDO_share, self_pickup_share, commissioned_delivery_share, drone_delivery_share	Technical description of demand split, especially parcel demand, into delivery and pick-up channels used in simulation scenarios.

The above set of attributes creates a common language for describing scenarios. It helps maintain consistency between D0.2, D0.3 and subsequent WP2 reports. For scenarios marked in D0.3 as Core Scenarios, this set should be treated as the basic scope of input data. For scenarios marked as Future Scenarios, this set is indicative and does not imply full parameterisation in subsequent project reports.

However, not all attributes defined in D0.2 are active variables in every scenario. Some attributes serve as modelling background, such as the transport network, the distribution of basic sending and receiving points or the general structure of the area. Other attributes are directly changed in an alternative scenario and determine the difference between the base and alternative scenarios. Therefore, active attributes, i.e. attributes changed or tested in a scenario, and fixed/background attributes, i.e. attributes kept constant to ensure comparability of results, should be distinguished. This distinction is particularly important in further simulation experiments because it makes it possible to state clearly whether a change in KPI results from a change in demand, modal split, recipient behaviour or the introduction of concentration points. Table 9 presents the active attributes for the prepared scenarios. It mainly includes scenarios developed in the project, namely BS/AS 1.1, 1.2 and 1.3. Pharmaceutical and B2B scenarios,

marked respectively as BS/AS 1.4 and BS/AS 1.5, remain under consideration as future research proposals and are therefore not treated as an active scope of current modelling.

Table 9. Scenario-specific active attributes for core and supporting scenarios

Scenario	**Active attributes**	**Fixed/background attributes**	**Main modelling interpretation**
BS 1.1 – Ready meal delivery	restaurants, individual recipients, orders, delivery time, transport modes, courier/vehicle capacity	road network, base urban structure, current delivery organisation	Reference scenario for ready-made food delivery on demand.
AS 1.1.1 – Modal split change in ready meal delivery	modal_split_by_mode, vehicle type, energy/fuel factor, emission factor	number of restaurants, demand level, receiver locations	Assessment of the effect of changing transport mode while keeping the demand level unchanged.
AS 1.1.2 – Demand increase in ready meal delivery	demand_multiplier, order intensity, peak-hour demand, courier/vehicle utilisation, low-emission vehicle structure	restaurant locations, receiver distribution, network structure	Assessment of the system's robustness to an increase in the number of orders and a shift in the vehicle structure towards low-emission modes.
AS 1.1.3 – Increased demand and zero-emission structure in ready meal delivery	demand_multiplier, zero_emission_vehicle_share, vehicle type, energy factor, emission factor	restaurant locations, receiver distribution, network structure	Assessment of the effect of simultaneous demand growth and transition to a zero-emission transport mode structure in ready-made food delivery.
BS 1.2 – Boxed meal delivery	catering companies, residential recipients, office recipients, recurring demand, delivery windows, route structure, transport modes	road network, base demand structure, current delivery organisation	Reference scenario for planned boxed meal deliveries to residential buildings and offices.
AS 1.2.1 – Modal split change in boxed meal delivery	modal_split_by_mode, vehicle type, capacity, speed, energy/fuel factor	demand level, sender locations, receiver locations	Assessment of the effect of low-emission transport modes in planned deliveries.
AS 1.2.2 – Demand increase in boxed meal delivery	demand_multiplier, delivery density, vehicle utilisation, route load, electric vehicle structure	sender locations, delivery time window logic, receiver distribution	Assessment of scale effects and system overload under demand growth and vehicle structure change.
AS 1.2.3 – Increased demand and zero-emission structure in boxed meal delivery	demand_multiplier, zero_emission_vehicle_share, vehicle type, vehicle capacity, energy/fuel factor	sender locations, receiver locations, delivery time window logic, road network	Assessment of the effect of demand growth and increased use of low- and zero-emission vehicles in boxed meal deliveries to residential buildings and offices.
BS 1.3 – Unified parcel demand with delivery channel split	hubs, recipients, parcel lockers, PUDO points, parcel demand, package type distribution, delivery channel split	road network, base parcel demand, base hub locations, base parcel locker/PUDO locations	Reference scenario for common parcel demand divided into delivery and pick-up channels, including home delivery, parcel lockers and PUDO.
AS 1.3.1–AS 1.3.3 – Low-emission vehicle structure in parcel delivery	modal_split_by_relation, low_emission_vehicle_share, vehicle type, vehicle capacity, energy/fuel factor	parcel demand, channel split, hub locations, recipient locations, parcel locker/PUDO locations	Assessment of the effect of gradual changes in vehicle structure on time, distance, energy and emissions while maintaining the base parcel demand split into channels.
AS 1.3.4 – Drone-based last-mile parcel variant	drone_delivery_share, PL_to_home_mode, package_type_eligibility, vehicle/drone parameters, energy factor	parcel demand, parcel locker locations, eligible package types, base channel split	Assessment of the effect of using drones on a selected parcel service leg, while controlling the eligibility of shipment types.
AS 1.3.5–AS 1.3.10 – Parcel channel split variants	home_delivery_share, parcel_locker_share, PUDO_share, self_pickup_share,	hub locations, recipient locations, base parcel	Assessment of the effect of changing shares of parcel service channels, e.g. only

Scenario	Active attributes	Fixed/background attributes	Main modelling interpretation
	commissioned_delivery_share, drone_delivery_share, channel_variant	demand, parcel type distribution	parcel lockers, a major locker share, equal split, major direct delivery share or drone-based variants.

The above table shows that each alternative scenario should have a clearly defined mechanism of change. In food delivery scenarios, this mechanism is a change in modal structure, demand growth and a zero-emission variant. In boxed meal delivery scenarios, the mechanism is a change in vehicle structure, demand growth and the transition to electric or zero-emission variants. In parcel scenarios, the key element is common parcel demand divided into service channels, such as home delivery, parcel locker, self-pick-up, commissioned delivery or drone-based variants.
This approach prevents scenarios from becoming excessively broad. Instead of changing many parameters at once, each alternative scenario should test a specific organisational or technological mechanism. This enables later interpretation of results and the identification of which solution actually improves energy efficiency or service quality.

8. Use of attributes in modelling and analysis

The defined attributes have different functions in subsequent project stages. Some support the preparation of user preference surveys, some support the development of the macro-simulation model, some support the micro-simulation model, and some directly support KPI calculation. Attributes should therefore not be treated only as a list of input data. They link the scenario description with later modelling logic and result assessment.
The same attribute group may have different meanings at different levels of analysis. For example, at the macro level, receiver location may be used to determine the demand potential in a zone, while at the micro level it is a specific delivery point. Similarly, modal split is a scenario variant parameter at the scenario level, while in the micro model it may be used as a rule for assigning a task to a transport mode.
Table 10 presents how the most important attribute groups are used in surveys, the macro model, the micro model and KPI calculations. This table organises the relationship between D0.2 and further WP2 work.

Table 10. Use of attribute groups in survey, macro model, micro model and KPI assessment

Attribute group	Use in survey / D2.2	Use in macro model	Use in micro model	Use in KPI calculation
Receiver location and demand	Identification of recipient preferences and acceptance of delivery and pick-up forms.	Determination of demand potential in zones.	Generation of tasks and receiving points.	Number of served tasks, delivery time, service availability.
Sender and facility location	Identification of service types and how users use them.	Distribution of sources of urban flows.	Starting points of routes and tasks.	Route length, service time, energy.
Transport mode	Preferences regarding low-emission deliveries and acceptance of different delivery forms.	Share of transport modes in zones or relations.	Assignment of vehicles or couriers to tasks.	Energy, fuel, CO2, cost, time.
Modal split	Acceptance of changes in delivery or pick-up method.	Variant definition of the flow structure.	Rule for selecting the transport mode for a task.	Comparison of modal variants.

Attribute group	Use in survey / D2.2	Use in macro model	Use in micro model	Use in KPI calculation
Demand multiplier	Declared or assumed demand growth.	Change in flow intensity in zones.	Number of tasks generated in the simulation.	Number of served and unserved tasks, resource utilisation.
Parcel locker behaviour	Preferred pick-up method, acceptable walking distance, willingness to use commissioned delivery.	Generation of trips to pick-up points.	Model of self-pick-up or commissioned delivery.	Recipient energy use, emissions, pick-up time, service quality.
Concentration point attributes	Acceptance of consolidation, intermediate points and changes in delivery method.	Potential service areas of concentration points.	Task consolidation, route changes, assignment of recipients to points.	Degree of consolidation, distance, energy, emissions, cost.
Vehicle operational parameters	Indirectly: acceptance of specific delivery forms and vehicles.	Aggregated speed, availability and capacity parameters.	Capacity, speed, service time, range constraints.	Time, distance, vehicle utilisation, energy.
Energy and emission factors	Users' environmental awareness and acceptance of low-emission solutions.	Aggregated indicators for zones or relations.	Calculations at the route, vehicle or task level.	Energy consumption, fuel consumption, CO2.
Time windows	Recipient time preferences and tolerance for delays.	Temporal distribution of demand.	Task-service and route-planning constraints.	Punctuality, delays, waiting time.

The above table shows that D0.2 is not merely a data dictionary. It is a structure that mediates between the D0.3 scenarios and further models and analyses. It makes it possible to determine which data should be obtained from surveys, which from transport models, which from spatial data, and which from expert assumptions or the literature.
The link between attributes and KPI is of particular importance. Without it, scenarios would remain only organisational descriptions. Only assigning attributes to model variables and assessment indicators makes it possible to analyse the influence of individual variants on delivery time, route length, energy use, CO2 emissions, operating cost and service quality.

9. Limitations

Report D0.2 is methodological and structural in nature. Its purpose is not to collect complete numerical data for each scenario, but to define a coherent set of attributes that enables the description of reference cases, base scenarios and alternative scenarios. For this reason, some attributes are required, some are optional and some are contextual.
The most important limitation of the report is that not all attributes defined in the broad D0.2 structure are used as active variables in the D0.3 scenarios. This is intentional, because D0.3 focuses on selected scenarios that can be further developed in WP2. This applies primarily to ready-made food delivery, boxed meal delivery, deliveries to parcel lockers and direct parcel deliveries to individual recipients.
The second limitation is the varying availability of data for individual attribute groups. Network, location and descriptive data may be obtained from transport models, spatial data, public sources or data held by project partners. In contrast, data on user preferences, demand structure, recipient behaviour, operational parameters and actual service costs require further research, expert assumptions or calibration in WP2.
The third limitation is that some scenarios are left as future research proposals. This applies in particular to pharmaceutical and B2B scenarios, marked respectively as BS/AS 1.4 and BS/AS 1.5, which are valuable from a research perspective but would require separate data, models and regulatory and organisational assumptions. Their presence in D0.2 and D0.3 shows the possibility of extending the E-Laas methodology, but does not imply their full development in subsequent project reports.

The fourth limitation is that D0.2 does not determine the final structure of simulation and optimisation models. The report defines attributes that may feed the macro model, micro model, energy analyses, emission analyses and KPI assessment, but the detailed implementation of these data depends on the assumptions adopted in WP2, WP3 and WP4.
The adopted limitations do not reduce the usefulness of D0.2. On the contrary, they help organise the scope of data and indicate which attributes are key for the current scenarios and which represent methodological extensions or potential directions for further research. As a result, report D0.2 creates a coherent basis for D0.3, the M0 repository and further scenario analyses carried out in the E-Laas project.

10. Conclusions

Report D0.2 develops a set of attributes characterising scenarios and reference cases in the E-Laas project. The basic concepts used in the E-Laas Reference Case Repository structure are defined, including Reference Case, Virtual Reference Case, Base Scenario, Alternative Scenario, Attribute and KPI. As a result, the report provides a common conceptual and data structure for further project work.
The most important result of the report is the organisation of attributes describing the reference case and logistics scenarios. Reference case attributes relate primarily to the urban context, transport network, transport zones, spatial structure, socio-economic data, logistics point locations, and data quality and availability. Scenario attributes describe the specific organisation of logistics processes, including the delivery segment, transport relations, senders, receivers, transport modes, demand, operational parameters, user behaviour and assessment indicators.
Report D0.2 provides the basis for report D0.3. D0.2 specifies which attributes should be used to describe cases and scenarios, while D0.3 uses this structure to identify scenarios for reference case RC1 - GZM Metropolis. This means that D0.2 functions as the methodological and data layer, while D0.3 functions as the scenario layer.
The report also identifies the minimum set of attributes required to describe scenarios compatible with D0.3. This set includes, among others, transport network nodes and links, analysis zones, senders, receivers, parcel lockers, concentration points, delivery tasks, transport modes, scenario parameters and KPI. This approach makes it possible to move from a scenario description to its later use in macro modelling, micro modelling, user preference surveys and energy, emission and operational assessment.
An important element of the report is the distinction between active attributes and background attributes. Active attributes are those elements that change between a base scenario and an alternative scenario, such as modal split, demand level, parcel collection mode or use of concentration points. Background attributes, such as the basic transport network, area structure or initial locations of objects, remain constant to ensure comparability of results.
The report also shows how attributes can feed further work in WP2. Some attributes will be useful in surveys and user preference analysis, some in the macro-simulation model, some in the micro-simulation model, and some directly in KPI calculations. In this way, D0.2 supports the preparation of input data for further scenario analyses, simulation experiments and recommendations on sustainable urban logistics.

The report retains the broad methodological character resulting from the assumptions of the E-Laas project. It also includes the possibility of defining Virtual Reference Cases, although in the current implementation of the project they are treated as a potential extension of the methodology, not as a separate scope of further WP2 analyses. This approach maintains consistency with the project logic while also preserving coherence with the scope of scenarios developed in D0.3.

The defined attribute structure remains valid even if scenarios are later refined in simulation models, because it describes not only the original D0.3 scenario catalogue, but also the technical parameters used for implementation, such as demand split into delivery channels, modal structure, demand level, recipient type and assessment indicators.

In summary, D0.2 defines a coherent attribute structure that enables the description of reference cases, base scenarios and alternative scenarios. The report provides the basis for D0.3, supports preparation of the M0 repository and creates an organised data and conceptual basis for further modelling, simulation and decision-support work carried out in the E-Laas project.