Building Renovation Passports

Summary of the identified gaps within the data model, and the proposed locations & details for extensions

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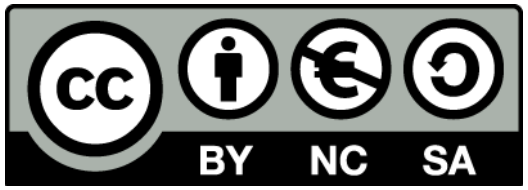


Links

- MSc Management in the Built Environment thesis document:
  Towards a Dutch Building Renovation Passport | TU Delft Repository
- MSc Geomatics thesis document:
  Investigation on the data model requirements for Building Renovation Passports | TU Delft Repository
- GitHub repository of the code written for the MSc Geomatics thesis:
  https://github.com/DaanSchlosser/CityGML2.0-EnergyADE3.0_creator
- Zenodo archive of this GitHub repository (archived per GitHub release):
  https://doi.org/10.5281/zenodo.20612452
- 4TU.ResearchData archive of relevant inputs, outputs, figures, etc. related to the GitHub repository & MSc Geomatics thesis:
  https://doi.org/10.4121/89f8909b-4473-4958-8f93-46b55546764d

Defining the Minimum Set of Required Data (MSRD)

1

Review past initiatives

Review of 14 EU logbook/passport initiatives.

Through research output, policy documents, web-platforms, software, Excel files, etc.

2

Compare them field by field

Break each model into fields; group them by meaning into 13 modules across 3 layers (repository, assessment, functional).

Match up fields that mean the same thing but are named differently.

3

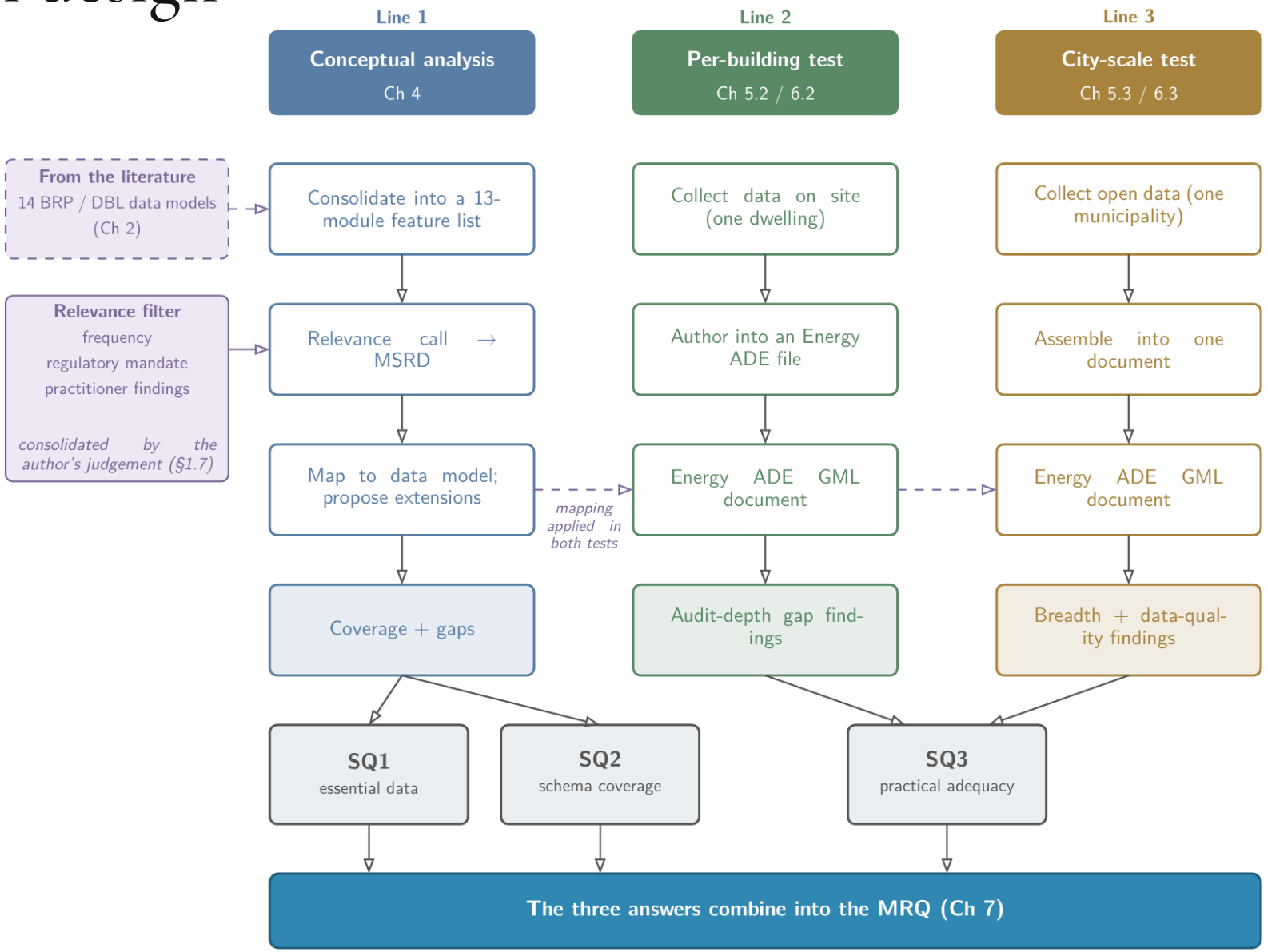
Define the MSRD

Relevance filter: weigh how often a field appears, what the EU directive (EPBD) requires, and what practitioners need.

Relevant? → into the MSRD.

BRP, building renovation passport · DBL, digital building logbook · EPBD, Energy Performance of Buildings Directive · MSRD, minimum set of required data

Research design



SQ, Sub-Question

Relevance filter

1. Frequency | Existing initiatives

ID	Initiative	Aim	Type	Building types	Year(s)	Geographic scope
I1	EUB SuperHub DBL	Development of DBL structure for all types of buildings	Data model proposal	Entire stock	June 2021 to Dec. 2024	Transnational (7 countries)
I2	ALDREN	DBL/BRP development for deep renovation of non-residential buildings	Data model proposal	Non-residential	Nov. 2017 to Sep. 2020	Transnational (8 countries)
I3	Gómez-Gil et al.	Academic proposal for DBL data structure	Data model proposal	Entire stock	Oct. 2024	European (comparative analysis)
I4	iBRoad	BRP development for residential buildings, later integrated with EPC schemes and extended to multi-family and public buildings	Data model proposal including roadmap	Residential	June 2017 to Aug. 2024	Transnational (7 countries)
I5	Woningpas	Digital building passport and renovation decision-making support tool	Implementation	Entire stock	Dec. 2018 to ongoing	Regional (Flanders, Belgium)
I6	X-tendo	Next-generation EPC schemes toolbox	Data model proposal	Entire stock	Sep. 2019 to Aug. 2022	Transnational (10 countries)
I7	EU DBL (by Ecorys)	EU Framework for Digital Building Logbooks	Framework study	Entire stock	Nov. 2023	European
I8	BUILDCHAIN	Blockchain-based DBL for trustworthy building lifecycle knowledge	Data model proposal	Entire stock	Jan. 2023 to June 2026	Transnational (6 countries)
I9	OneClickRENO	Automatically generated, customisable BRPs via web tools	Data model + tool	Entire stock	Nov. 2023 to Oct. 2026	Transnational (5 countries)
I10	EPA (by Vitec Vabi)	Software for energy auditors to calculate energy usage and generate EPC scores	EPC software	Entire stock	Since 2008	National (Netherlands)
I11	BuurtWarmteWijzer	Digital tool for residents to explore district heating options and assess collective heat network feasibility	Decision-support tool	Residential	Since 2020	National (Netherlands)
I12	CLÉA	Digital building logbook for housing information management, maintenance tracking, and energy renovation support	Implementation	Residential	Since 2020	National (France)
I13	iSFP	Individual Building Renovation Roadmap (Germany's national BRP)	Implementation	Residential	Since July 2017	National (Germany)
I14	Hoomdossier	Digital building dossier used by energy coaches to gather building data and support residents with renovation advice	Implementation	Residential	Since 2018	National (Netherlands)

The 14 assessed initiatives (I1-I14), the raw material the MSRD is synthesised from. Own work.

1. Frequency | Comparing the initiatives

Feature	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	Total	%
Building address details	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	14	100%
Building identification (Cadastral/INSPIRE)	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			11	79%
Ownership details and occupancy details	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	12	86%
Geospatial Coordinates (latitude, longitude, altitude)	✓	✓	✓	✓		✓	✓				✓				7	50%
DBL author/ assessor qualifications and information	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	10	71%
Details on the building with building-unit relation			✓	✓	✓		✓		✓	✓	✓				7	50%
Timestamps on collection, provision or modification**			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		10	71%
Building owner address details			✓							✓		✓	✓	✓	5	36%

Module 1 as an example: each field against the 14 initiatives (I1-I14), and its frequency. Own work.

2. EPBD IV | What a renovation passport must contain

- the building's current energy performance and the applicable national renovation requirements, such as minimum energy performance standards and any fossil-fuel phase-out dates;
- a staged renovation roadmap, presented graphically, with an explanation of the order in which the steps should be carried out;
- for each step, an estimate of the energy savings, the reduction in operational greenhouse-gas emissions, the energy-bill savings, and the energy-performance class reached afterwards;
- the share of renewable energy that could be generated and self-consumed after renovation, including any potential connection to district heating or cooling;
- wider information covering construction-product circularity, whole-life-cycle emissions, health, comfort, indoor environmental quality, and climate-adaptation capacity; and
- pointers to available financial support and to one-stop-shop advisory services.

3. Practitioner findings | Interview respondents

Code	Stakeholder group	Sector
P01	Homeowner	Private
P02	*Energieloket*	Public-funded
P03	Government (national)	Public
P04	Government (national)	Public
P05	Homeowner / Private landlord	Private
P06	Energy advisor / energy coach	Non-profit
P07	Energy advisor / energy coach	Non-profit
P08	Government (municipal)	Public
P09	Energy advisor / energy coach	Non-profit
P10	Contractor / installer	Private
P11	Government (municipal)	Public
P12	Government (municipal)	Public
P13-P15	Contractor / installer	Private
P16	Citizen initiative	Non-profit
P17	Energy cooperative	Non-profit

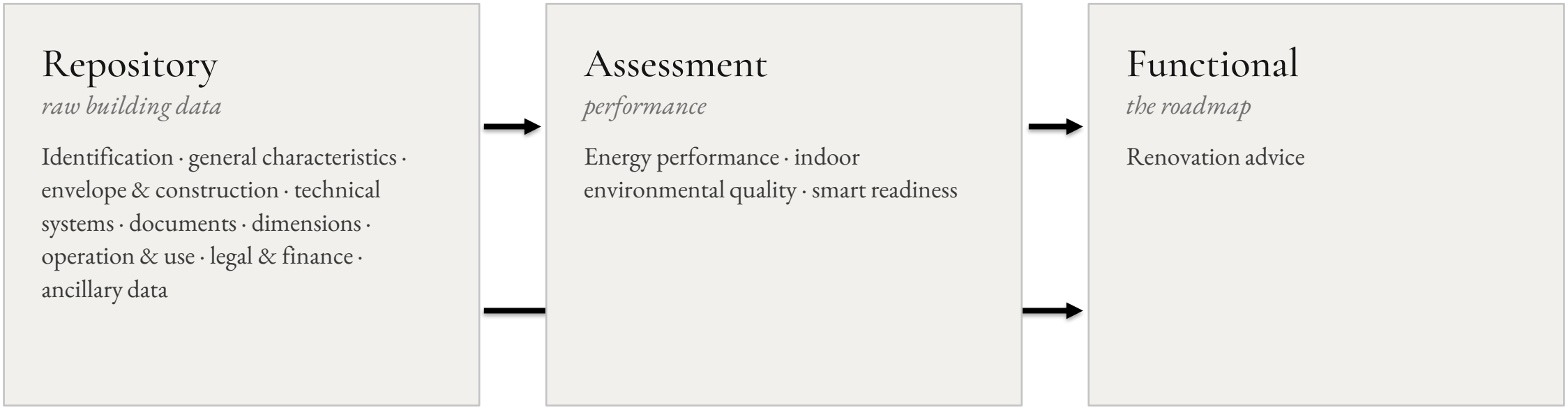
Anonymised list of participants and their roles. Own work.

3. Practitioner findings | Interview themes

- The building data they consider, and what is a must-have against a nice-to-have
- How they gather that data in practice, and from which (external) sources
- Where data is unavailable, and how they deal with that (estimation, proxies)
- Where the data is stored, who can access it, and what they share with others
- The software and tools they use, the inefficiencies they face
- A closing reaction to a live example of the data model

The Minimum Set of Required Data

276 fields · 13 modules · 3 layers

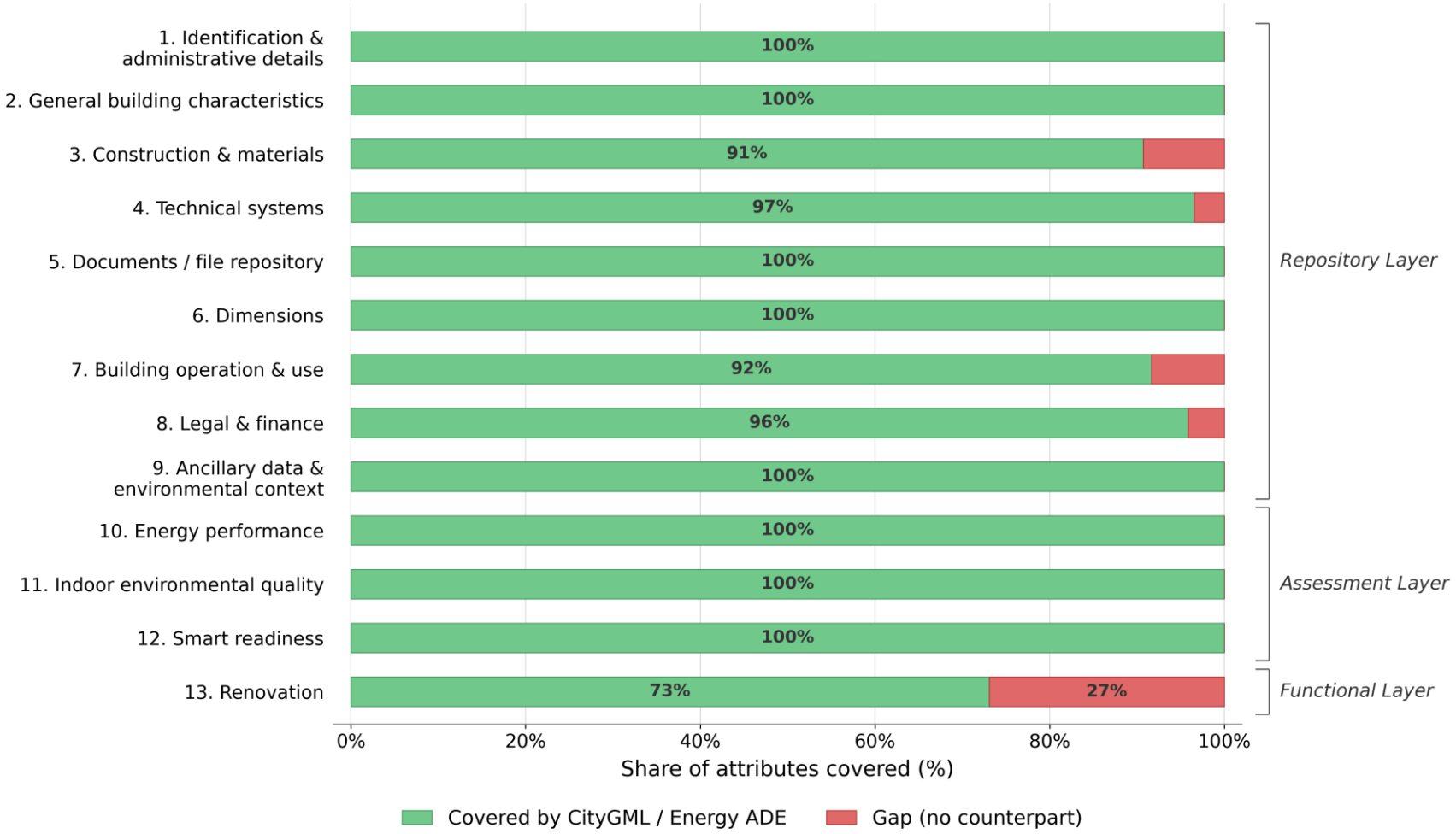


Mapping the MSRD to CityGML + Energy ADE

Feature	%	MSRD	Module	Class	Attribute	Type
Building address details	100%	Yes	Core*	Address	Multiple	Multiple
Building identification (Cadastral/INSPIRE)	79%	Yes	Core	_CityObject	identifier	Code [0..1]
Ownership details and occupancy details	86%	Yes	Building Building	_AbstractBuilding _AbstractBuilding	bdgOwnerName bdgOwnershipType	CharacterString [0..1] OwnershipTypeValue [0..1]
Geospatial Coordinates (latitude, longitude, altitude)	50%	Yes	Core	_CityObject	referencePoint	GM_Point [0..1]
DBL author/ assessor qualifications and information	71%	Yes	DataTypes	Metadata	Multiple	Multiple
Details on the building with building-unit relation	50%	Yes	Building	BuildingUnit	N/A (done by composition)	
Timestamps on collection, provision or modification**	71%	Yes	Core Core	AbstractADEFeature AbstractADEFeature	creationDate terminationDate	Date [0..1] Date [0..1]
Building owner address details	36%	No	✗			

Module 1: each MSRD field assigned its place in the model. Own work.

262 of 276 fields covered ≈ 95%



Coverage of the MSRD as defined here (via the relevance filter, not an external ground truth); 100% for 8 of 13 modules. Own work.

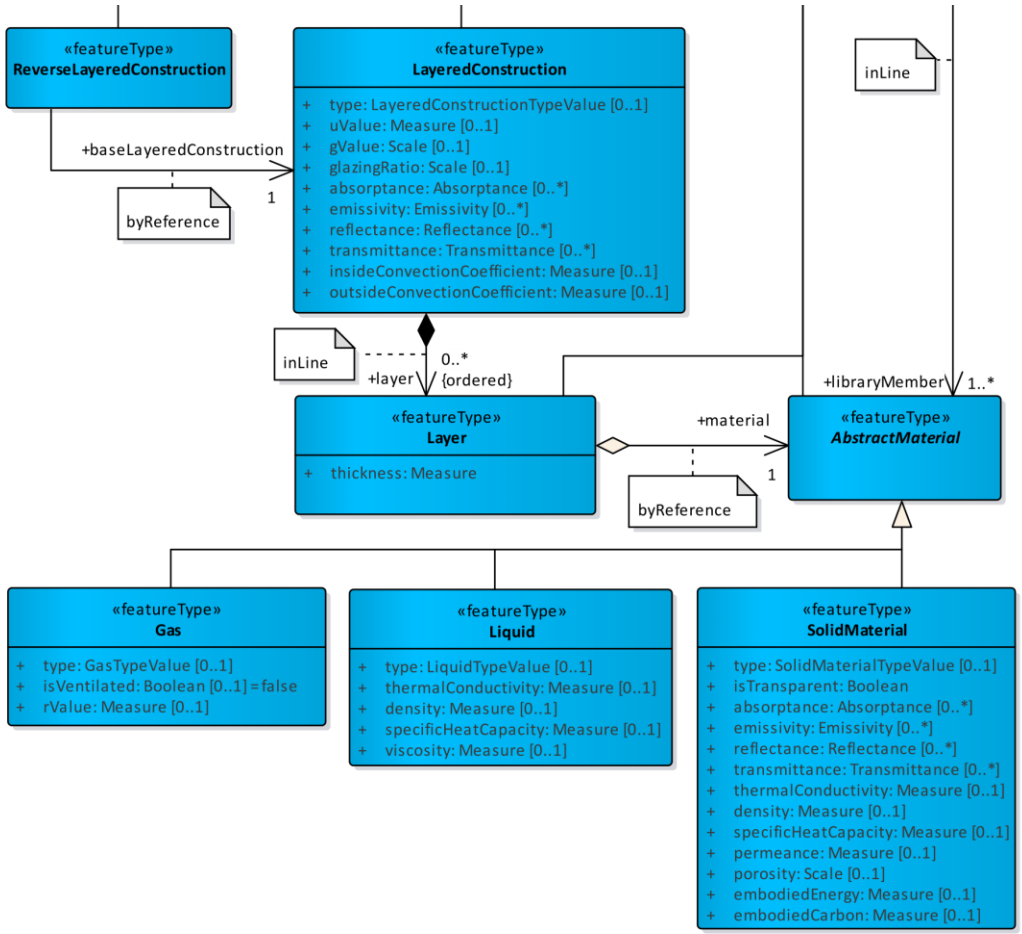
Feature	%	MSRD	Module	Class	Attribute	Type
High-level envelope & construction						
The high-level type of construction	29%	Yes	Layered construction	LayeredConstruction	type	LayeredConstructionTypeValue [0..1]
The high-level facade type (glass, steel, etc.)	36%	Yes	Layered construction	LayeredConstruction	type	LayeredConstructionTypeValue [0..1]
The main structure of the building	36%	Yes	Building	_AbstractBuilding	bdgConstructionWeight	ConstructionWeightValue [0..1]
Identified damages (cracks, degradation, etc.)	14%	Yes	✗			
Identified post-catastrophic damages	7%	Yes	✗			
Details on thermal bridges	43%	Yes	Building	_BoundarySurface	bdgBdrySurfAdditionalThermal-BridgeUValue	Measure [0..1]
Internal heat capacity per m²	29%	Yes	Building	AbstractZone	heatCapacity	Measure [0..1]
Infiltration rate (1/h)	36%	Yes	Building	AbstractZone	infiltrationRate	Measure [0..1]
Openings (Windows, Skylights, Doors)						
Only description of the necessity of describing openings	7%	N/A	N/A			
Indication what kind of opening it is	57%	Yes	Building	AbstractZoneOpening	N/A (done by composition)	
Total area of the opening (m²)	50%	Yes	Building	_Opening	bdgOpnArea	Area [0..1]
g-value of the opening	43%	Yes	Layered construction	LayeredConstruction	gValue	Scale [0..1]
Type of the window glazing (single, double, triple, etc.)	64%	Yes	Layered construction	LayeredConstruction	type	LayeredConstructionTypeValue [0..1]
The type of sun shading (e.g. no shading, external, etc.)	36%	Yes	Devices	MovableShadingDevice	type	ShadingDeviceTypeValue
Frame to glass proportion/ percentage indication	36%	Yes	Layered construction	LayeredConstruction	glazingRatio	Scale [0..1]
The materials of the opening, like frame, glazing, etc.	36%	Yes	Layered construction	SolidMaterial	type	SolidMaterialTypeValue [0..1]
Frame U-value (W/m²K)	36%	Yes	Layered construction	LayeredConstruction	uValue	Measure [0..1]
Glazing U-value (W/m²K)	29%	Yes	Layered construction	LayeredConstruction	uValue	Measure [0..1]
Total U-value of the opening (W/m²K)	71%	Yes	Layered construction	LayeredConstruction	uValue	Measure [0..1]
Orientation of the opening	29%	Yes	Building	_Opening	bdgOpnAzimuth	Angle [0..1]
Light Transmission (LT) factor	14%	Yes	Layered construction	LayeredConstruction	transmittance	Transmittance [0..*]
Producer/ Brand	14%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Model number	14%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Airtightness class	14%	Yes	✗			
Total height & total width	21%	Yes	Building	_Opening	geometry	lod3MultiSurface
Digital Product Passport	7%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Specific mention of images/photographs of the opening	7%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Quantity of identical openings	7%	Yes	✗			
Source used (e.g. by inspection or by specifications)	7%	Yes	DataTypes	Metadata	source	CharacterString [0..1]
Description of the state of the opening (e.g. leaky)	14%	Yes	Core	_CityObject	status	StatusValue [0..1]

Module 3 (Construction & materials, Part I): envelope & openings mapped onto CityGML + Energy ADE. Own work.

Feature	%	MSRD	Module	Class	Attribute	Type
Identified damages (cracks, degradation, etc.)	14%	Yes	✗			
Identified post-catastrophic damages	7%	Yes	✗			
Airtightness class	14%	Yes	✗			
Quantity of identical openings	7%	Yes	✗			

Module 3: BRP-relevant fields with no Energy ADE counterpart (✗). Own work.

The Energy ADE models construction performance (U-value, g-value, layers, materials), but offers no typed slot for observed condition / damage, nor a per-opening airtightness class.



Energy ADE 3.0 (beta 8) — Layered construction package. Source: Energy ADE beta 8 UML documentation

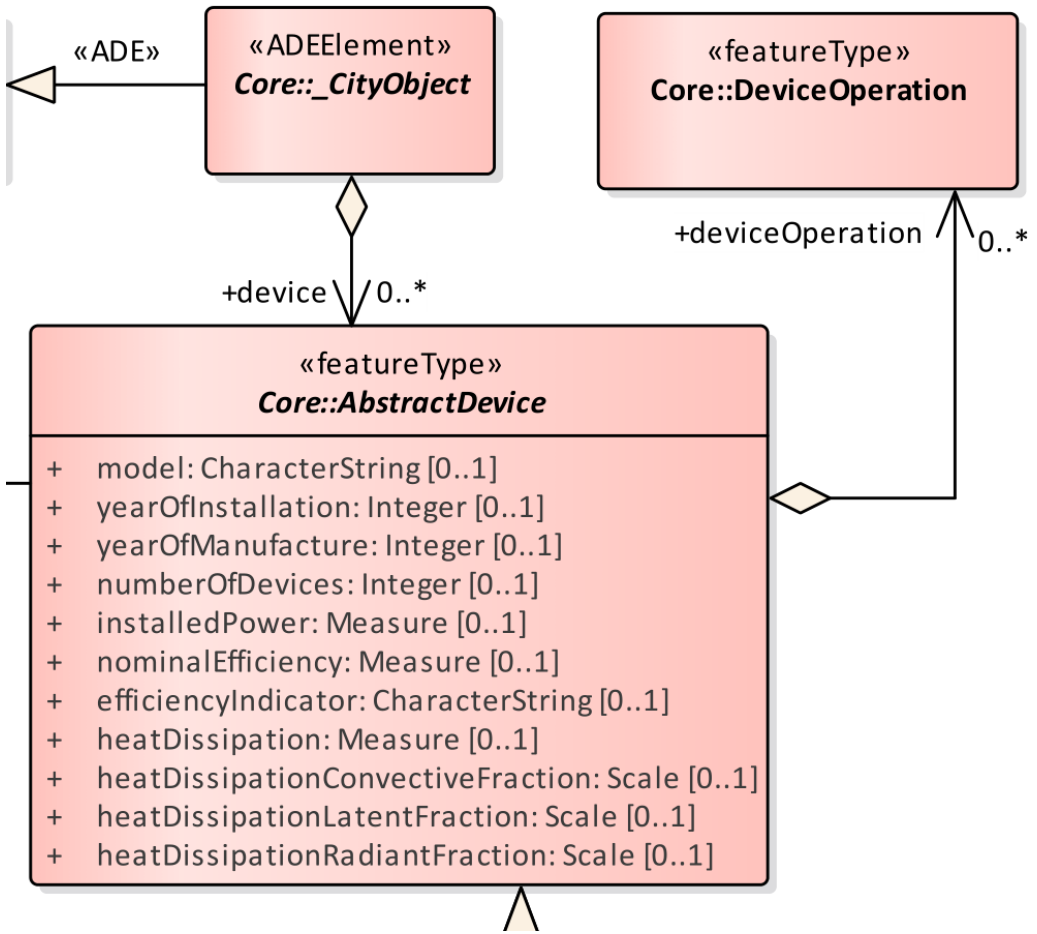
Feature	%	MSRD	Module	Class	Attribute	Type
System inventory (Heating / DHW / Cooling / Ventilation / Lighting / Shading / BMS)						
Presence indicatable per system?	100%	Yes	Devices	AbstractDevice	Multiple	Multiple
System category	100%	Yes	Core	DeviceOperation	type	DeviceOperationTypeValue
How grouped the system is (e.g. (de)centralised)	43%	Yes	Devices	ThermalDistribution	distributionPerimeter	DistributionPerimeterTypeValue [0..1]
Served area / served units	43%	Yes	DataTypes Devices	CityObjectRelation ThermalDistribution	relationType distributionPerimeter	RelationTypeValue DistributionPerimeterTypeValue [0..1]
System description field (e.g. its type)	71%	Yes	Core*	AbstractGMLType	gml:description	gml:StringOrRefType
System description						
Energy carrier / source	100%	Yes	Resources Resources	Energy Energy	energyCarrier source	EnergyCarrierValue [0..1] EnergySourceValue [0..1]
Technology / system type	79%	Yes	Devices	AbstractDevice	Multiple	Multiple
Distribution type / medium	43%	Yes	Devices	ThermalDistribution	medium	MediumTypeValue [0..1]
Performance parameters						
Efficiency metric (e.g. heat recovery COP)	50%	Yes	Devices	AbstractDevice	efficiencyIndicator	CharacterString [0..1]
Rated capacity (e.g. in kW)	58%	Yes	Devices	AbstractDevice	installedPower	Measure [0..1]
Recorded efficiency value	50%	Yes	Devices Core	AbstractDevice DeviceOperation	nominalEfficiency yearlyGlobalEfficiency	Measure [0..1] Decimal [0..1]
Control / automation class (manual, fully integrated, etc.)	33%	Yes	✗			
Renewable contribution indicator	92%	Yes	Resources	Energy	source	EnergySourceValue [0..1]
Emissions factor / CO_2 intensity available	50%	Yes	Resources	AbstractResource	co2Equivalent	Measure [0..1]
Asset identity & lifecycle						
Manufacturer / producer	33%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Model name/number	25%	Yes	Devices	AbstractDevice	model	CharacterString [0..1]
Installation year	75%	Yes	Devices	AbstractDevice	yearOfInstallation	Integer [0..1]
Unique asset ID / serial number	8%	No	Core	_CityObject	identifier	Code [0..1]
Expected lifespan / end-of-life year	25%	Yes	Core	_CityObject	validTo	DateTime [0..1]
Condition / state rating	25%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Maintenance record present	42%	Yes	Core	Intervention	type	InterventionTypeValue
Last maintenance / inspection date	25%	Yes	Core	Intervention	interventionStartDate	Date [0..1]
Metering, monitoring & evidence						
System-level sub-metering available	25%	Yes	Core	SensorData	type	SensorDataTypeValue
Annual energy use per system recorded	50%	Yes	Resources	AbstractResource	amount	Measure [0..1]
Operational data available	50%	Yes	Resources	AbstractResource	Multiple	Multiple
BMS/IoT integration link	25%	Yes	Time Series	SensorConnection	Multiple	Multiple
Documents attached for the system	33%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Evidence/source type	42%	Yes	DataTypes	Metadata	acquisitionMethod	DataAcquisitionMethodValue [0..1]
Data collection date	25%	Yes	Time Series Time Series	RegularTimeSeries RegularTimeSeries	startTimestamp endTimestamp	DateTime DateTime
Recommended upgrade measure per system	42%	Yes	Core Core	Intervention Intervention	type action	InterventionTypeValue InterventionActionValue [0..1]

Module 4 (Technical systems): each MSRD field mapped onto CityGML + Energy ADE. Own work.

Feature	%	MSRD	Module	Class	Attribute	Type
Control / automation class (manual, fully integrated, etc.)	33%	Yes	✗			

Module 4: BRP-relevant field with no Energy ADE counterpart (✗). Own work.

Devices carry type, efficiency and lifecycle on AbstractDevice / DeviceOperation, but there is no control / automation class (manual to fully integrated).



Energy ADE 3.0 (beta 8) — Devices package: AbstractDevice & DeviceOperation. Source: Energy ADE beta 8 UML documentation

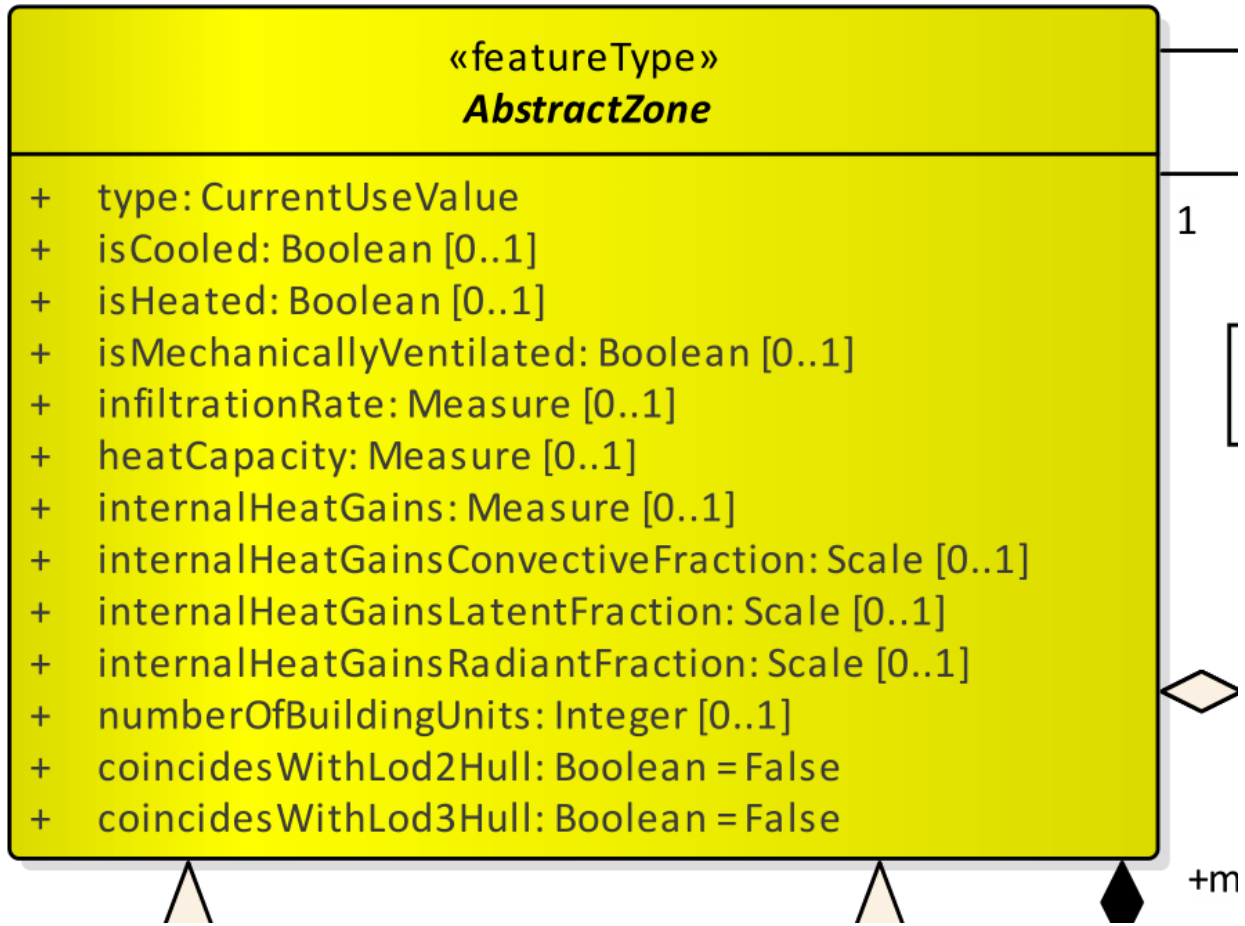
Feature	%	MSRD	Module	Class	Attribute	Type
Behavioural patterns/ user profile	71%	Yes	Building	AbstractZone	Multiple	Multiple
Number of occupants	57%	Yes	Building	Occupants	numberOfOccupants	Integer [0..1]
			Building	Occupants	type	OccupantsTypeValue
			Building	Occupants	occupancySchedule	AbstractSchedule [0..1]
Set points for heating and cooling	57%	Yes	Building	AbstractZone	heatingSchedule	AbstractSchedule [0..1]
			Building	AbstractZone	coolingSchedule	AbstractSchedule [0..1]
Hot water usage intensity (low, medium, high)	36%	Yes	Resources	Energy	amount	Measure [0..1]
			Core	_CityObject	indicator	Indicator [0..*]
Annual usage days	14%	Yes	Core	AbstractSchedule	temporalExtent	TM_IntervalLength [0..1]
Daily HVAC system operating hours	21%	Yes	Building	AbstractZone	heatingSchedule	AbstractSchedule [0..1]
			Building	AbstractZone	coolingSchedule	AbstractSchedule [0..1]
			Building	AbstractZone	mechanicalVentilationSchedule	AbstractSchedule [0..1]
Ventilation habits	29%	Yes	Building	AbstractZone	mechanicalVentilationSchedule	AbstractSchedule [0..1]
			Building	AbstractZone	isMechanicallyVentilated	Boolean [0..1]
Room for auditor advice regarding usage habits	29%	Yes	✗			
Heating usage intensity (low, medium, high)	21%	Yes	Resources	Energy	amount	Measure [0..1]
			Core	_CityObject	indicator	Indicator [0..*]
Cooling usage intensity (low, medium, high)	14%	Yes	Resources	Energy	amount	Measure [0..1]
			Core	_CityObject	indicator	Indicator [0..*]
Electricity usage intensity (low, medium, high)	21%	Yes	Resources	Energy	amount	Measure [0..1]
			Core	_CityObject	indicator	Indicator [0..*]
Owner satisfaction regarding room temperature	7%	No	✗			
The type of cooking (electric vs. gas)	21%	Yes	Core	DeviceOperation	type	DeviceOperationTypeValue

Module 7 (Building operation & use): each MSRD field mapped onto CityGML + Energy ADE. Own work.

Feature	%	MSRD	Module	Class	Attribute	Type
Room for auditor advice regarding usage habits	29%	Yes	✗			

Module 7: BRP-relevant field with no Energy ADE counterpart (✗). Own work.

Occupancy and use map onto AbstractZone, but the auditor's advice on usage habits has no structured field (only the generic indicator).



Energy ADE 3.0 (beta 8) — Building package: AbstractZone. Source: Energy ADE beta 8 UML documentation

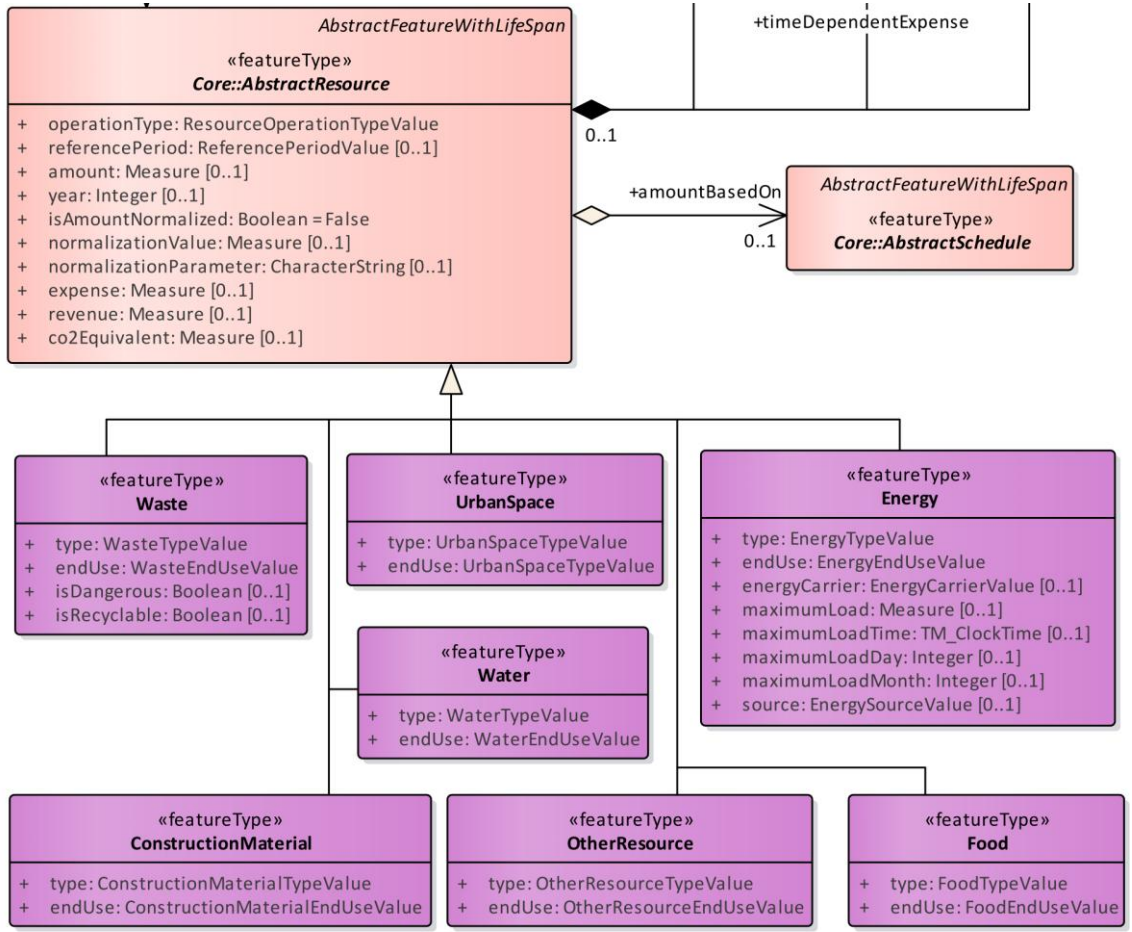
Feature	%	MSRD	Module	Class	Attribute	Type
Property valuations						
Property tax valuation / Official value	50%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Market value / Property value	50%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Annual maintenance cost	43%	Yes	Resources	AbstractResource	expense	Measure [0..1]
Renewal / Renovation cost	43%	Yes	Resources	AbstractResource	expense	Measure [0..1]
Rental value / Annual rent	29%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Property yield (%)	29%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Lifecycle and maintenance costs		Yes	Resources	AbstractResource	expense	Measure [0..1]
Sales transaction value / Property price paid	7%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Life Cycle Cost (LCC)	14%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Valuation metadata						
Valuation date	36%	Yes	Core*	_CityObject	creationDate	Date [0..1]
Valuation method / approach	29%	Yes	DataTypes	Metadata	acquisitionMethod	DataAcquisitionMethodValue [0..1]
Valuation conducted by (name/contact)	29%	Yes	DataTypes	Metadata	author	CharacterString [0..1]
Valuation document (linked file)	21%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Financial data collecting date / last update	14%	Yes	Core*	_CityObject	creationDate	Date [0..1]
Valuation purpose	7%	No	✗			
Valuation cost (€)	7%	No	✗			
Property selling date	7%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Economic observation period (years)	14%	Yes	Resources	AbstractResource	referencePeriod	ReferencePeriodValue [0..1]
Operational energy costs						
Annual energy costs (total)	50%	Yes	Resources	Energy	expense	Measure [0..1]
Annual energy cost by carrier (electricity/ gas/ etc.)	57%	Yes	Resources	Energy	expense	Measure [0..1]
Annual water cost	29%	Yes	Resources	Water	expense	Measure [0..1]
Subsidies / Grants / Financial programs	36%	Yes	✗			
Annual energy cost by use (heating/ cooling/ etc.)	7%	Yes	Resources	Energy	expense	Measure [0..1]
Building insurance cost	7%	No	✗			
Certification costs (EPC/ BREEAM/ LEED/ etc.)	7%	No	✗			
Legal and property documents						
Tenancy agreement	36%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Insurance policy / document	21%	No	Core*	_CityObject	externalReference	ExternalReference [0..*]
Clean soil statement	14%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Permits and licenses						
Building / Construction / Use permits	50%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Maintenance service contract / log	36%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Utility contracts	29%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Ownership information						
Owner information	43%	Yes	Building	_AbstractBuilding	bdgOwnerName	CharacterString [0..1]
Legal / Fiscal property registration	29%	Yes	Core*	_CityObject	externalReference	ExternalReference [0..*]
Tenant information	14%	No	✗			

Module 8 (Legal & finance): each MSRD field mapped onto CityGML + Energy ADE. Own work.

Feature	%	MSRD	Module	Class	Attribute	Type
Subsidies / Grants / Financial programs	36%	Yes	✗			

Module 8: BRP-relevant field with no Energy ADE counterpart (✗). Own work.

The Resources module models AbstractResources bought and sold as expense / revenue flows, but this is not ideal for standalone subsidies and grants



Energy ADE 3.0 (beta 8) — Resources package: AbstractResource & Energy. Source: Energy ADE beta 8 UML documentation

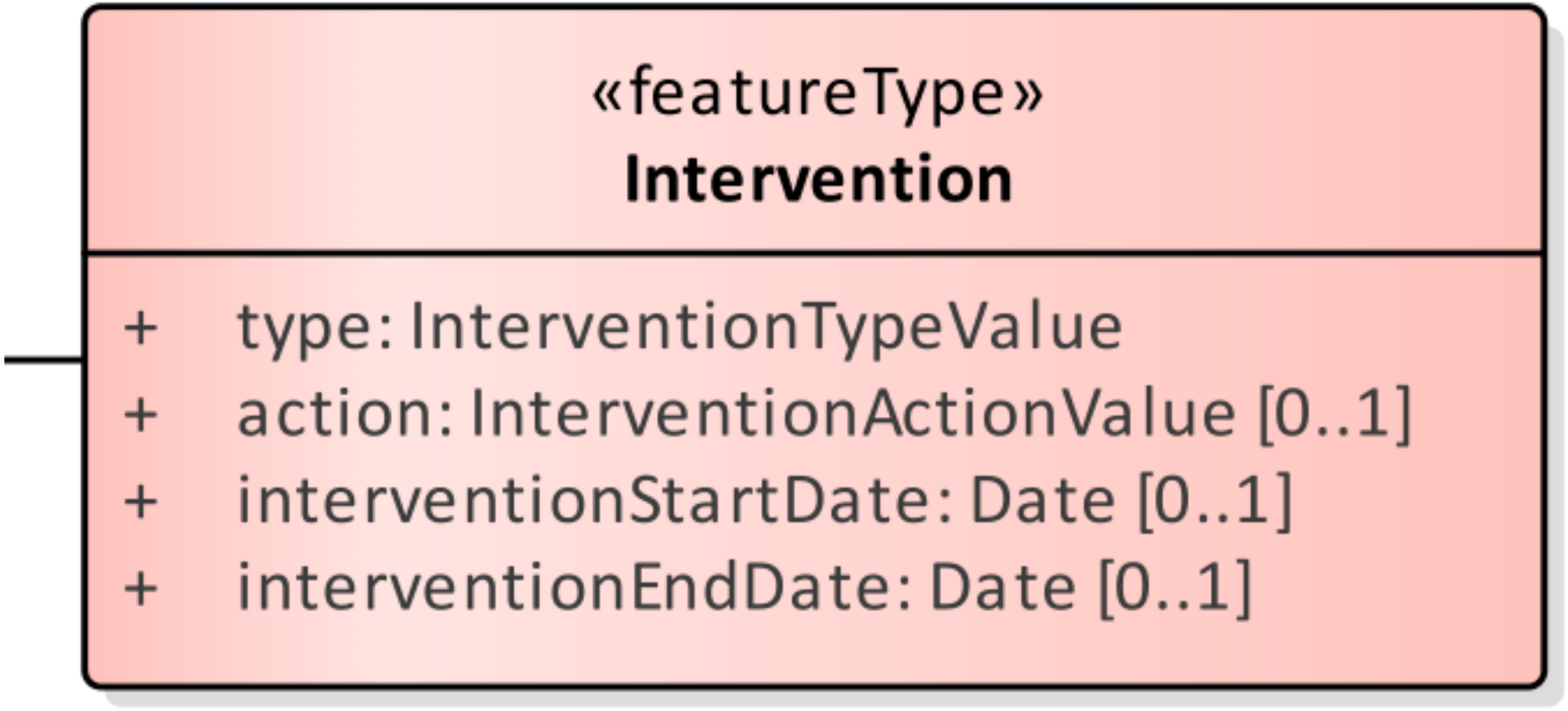
Feature	%	MSRD	Module	Class	Attribute	Type
Only general recommendation to include renovation data	21%	N/A	N/A			
Administrative (step) information						
Renovation measure proposals on specific elements	71%	Yes	Core	Intervention	action	InterventionActionValue [0..1]
			Core	Intervention	type	InterventionTypeValue
			Core	Intervention	interventionStartDate	Date [0..1]
			Core	Intervention	interventionEndDate	Date [0..1]
Textual renovation (stage) description	64%	Yes	✗			
Year of this renovation/ stage	43%	Yes	Core	Intervention	interventionStartDate	Date [0..1]
Attachable documents which relate to the renovation	57%	Yes	Core	AbstractADEFeature	externalReference	ExternalReference [0..*]
Achieved/ desired renovation depth (descriptive)	36%	Yes	✗			
Energy & resource consumption improvements						
Resource consumption (kWh) vs. pre-renovation	79%	Yes	Resources	Energy	amount	Measure [0..1]
Energy label before/after (letter or colour)	64%	Yes	Building	EnergyPerformanceCertificate	label	CharacterString
Resource demand (kW) vs. pre-renovation	43%	Yes	Resources	Energy	maximumLoad	Measure [0..1]
Energy efficiency before / after renovation	43%	Yes	Core	DeviceOperation	yearlyGlobalEfficiency	Decimal [0..1]
Finances						
Investment costs per measure/ step	71%	Yes	Resources	OtherResource	expense	Measure [0..1]
Current total energy costs per year	57%	Yes	Resources	AbstractResource	expense	Measure [0..1]
Business as usual costs (or if it can be derived)	50%	Yes	Resources	AbstractResource	revenue	Measure [0..1]
Public funding program details	50%	Yes	Resources	Energy	expense	Measure [0..1]
Public funding investment amount (available)	43%	Yes	Resources	AbstractResource	revenue	Measure [0..1]
Overall total investment costs (staged or all at once)	21%	Yes	Resources	OtherResource	expense	Measure [0..1]
Tax incentive (name)	14%	Yes	Core	AbstractADEFeature	externalReference	ExternalReference [0..*]
Reasoning & timelining						
Renovation measure priority level	50%	Yes	✗			
Motivation on why this specific measure is necessary**	29%	Yes	✗			
Estimation of the renovation works time**	14%	Yes	✗			
The first/best opportunity to do this renovation**	14%	Yes	✗			
Ideal season for executing the renovation step**	14%	Yes	✗			
Non monetary benefits						
Indication of new thermal comfort**	43%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Descriptive explanation of other non-monetary benefits**	36%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Negatives						
Constraints that limit/block certain renovations	36%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Estimation of users' disruption**	14%	Yes	Core	_CityObject	indicator	Indicator [0..*]
Renovation risks (e.g. mold growth if not done properly)	21%	Yes	Core	_CityObject	indicator	Indicator [0..*]

Module 13: each MSRD field assigned its place in the model. Own work.

Feature	%	MSRD	Module	Class	Attribute	Type
Reasoning & timelining						
Renovation measure priority level	50%	Yes	✗			
Motivation on why this specific measure is necessary**	29%	Yes	✗			
Estimation of the renovation works time**	14%	Yes	✗			
The first/best opportunity to do this renovation**	14%	Yes	✗			
Ideal season for executing the renovation step**	14%	Yes	✗			

Module 13: each MSRD field assigned its place in the model. Own work.

Intervention captures one measure (action, type, dates); the roadmap as an ordered, described sequence of steps is not modelled.



Energy ADE 3.0 (beta 8) — Core package: Intervention. Source: Energy ADE beta 8 UML documentation

What is still missing, and should be added

Renovation roadmap

Missing now

The model records one planned measure, but not the renovation as an ordered, described sequence of steps, each with its timing, depth, and expected effect on energy and cost. This is the largest gap.

To add

A structure that groups the ordered steps into one roadmap, queryable inside Energy ADE now, with the draft Scenario ADE as a richer route later.

Cost & finance

Missing now

Costs and revenue tied to energy use already fit, but subsidies, grants, insurance and certification (the one-off costs) have no place in the model.

To add

A home for these one-off costs, not necessarily tied to resources

Thank you