Leveraging BIM/IFC for the Registration of Spatial Plans and Compliance Checks and Permitting in Estonia based on LADM Part 5 - Spatial Plan Information

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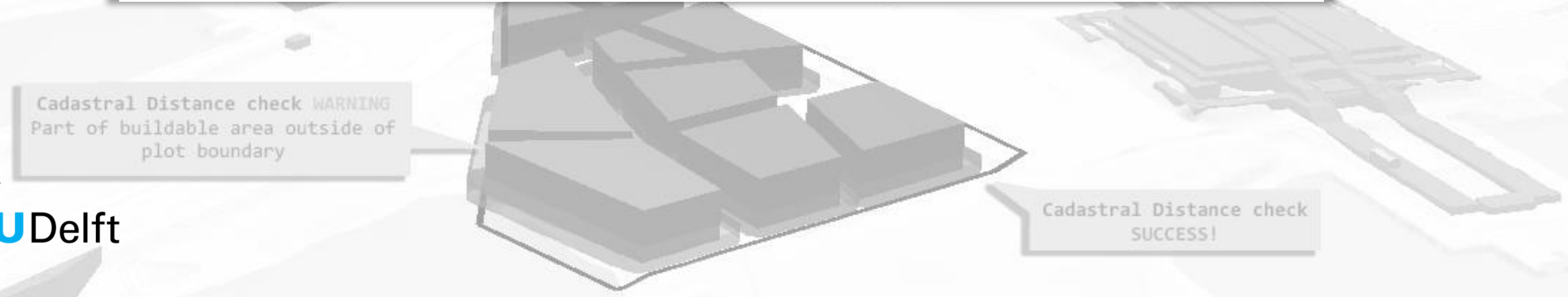
Peter VAN OOSTEROM — **TU Delft, NETHERLANDS**



Cadastral Distance check WARNING
Part of buildable area outside of plot boundary
Cadastral Distance check
SUCCESS!

FUTURE INSIGHT

TU Delft

Contents

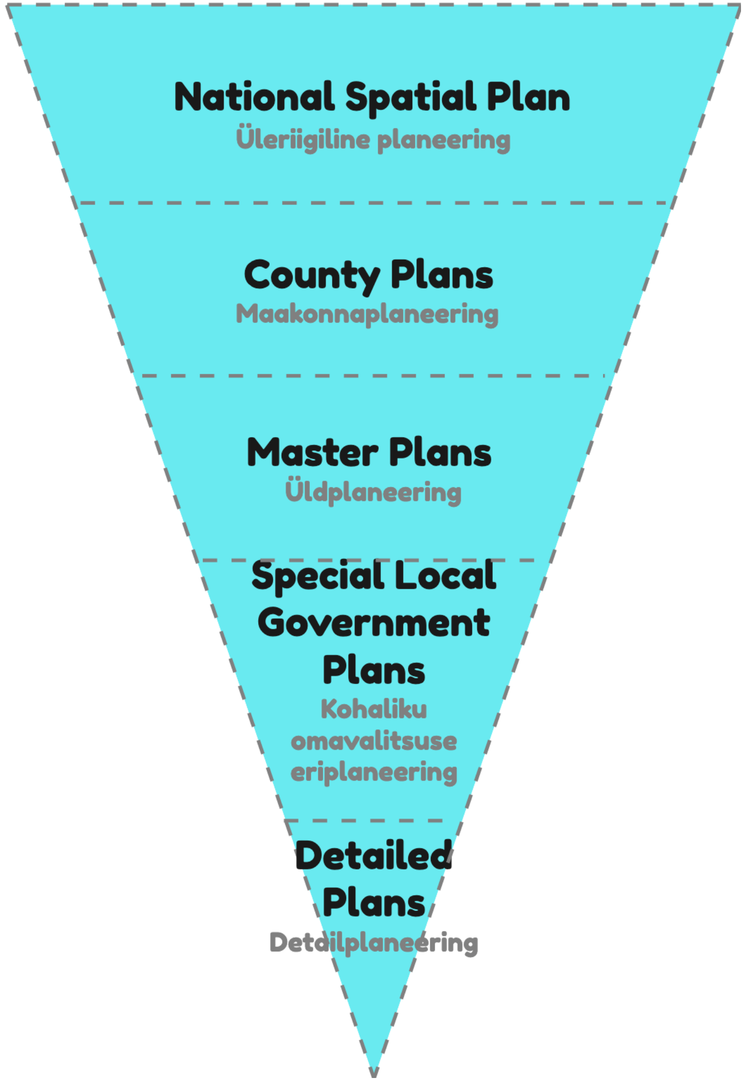
1. Introduction

2. Country Profile of Estonia

3. Implementation

4. Conclusion and Future Research

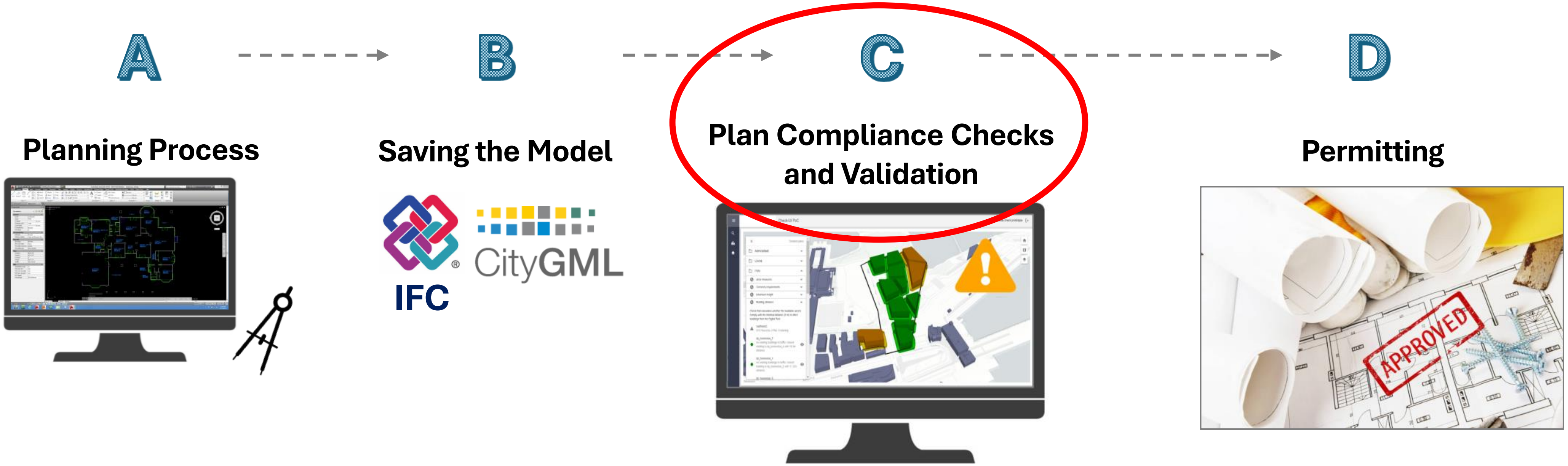
Estonia Hierarchical Spatial Plans



1. Introduction

Research Problem

Hierarchical Spatial Plans as basis for Permitting



A

Planning Process

B

Saving the Model

C

Plan Compliance Checks and Validation

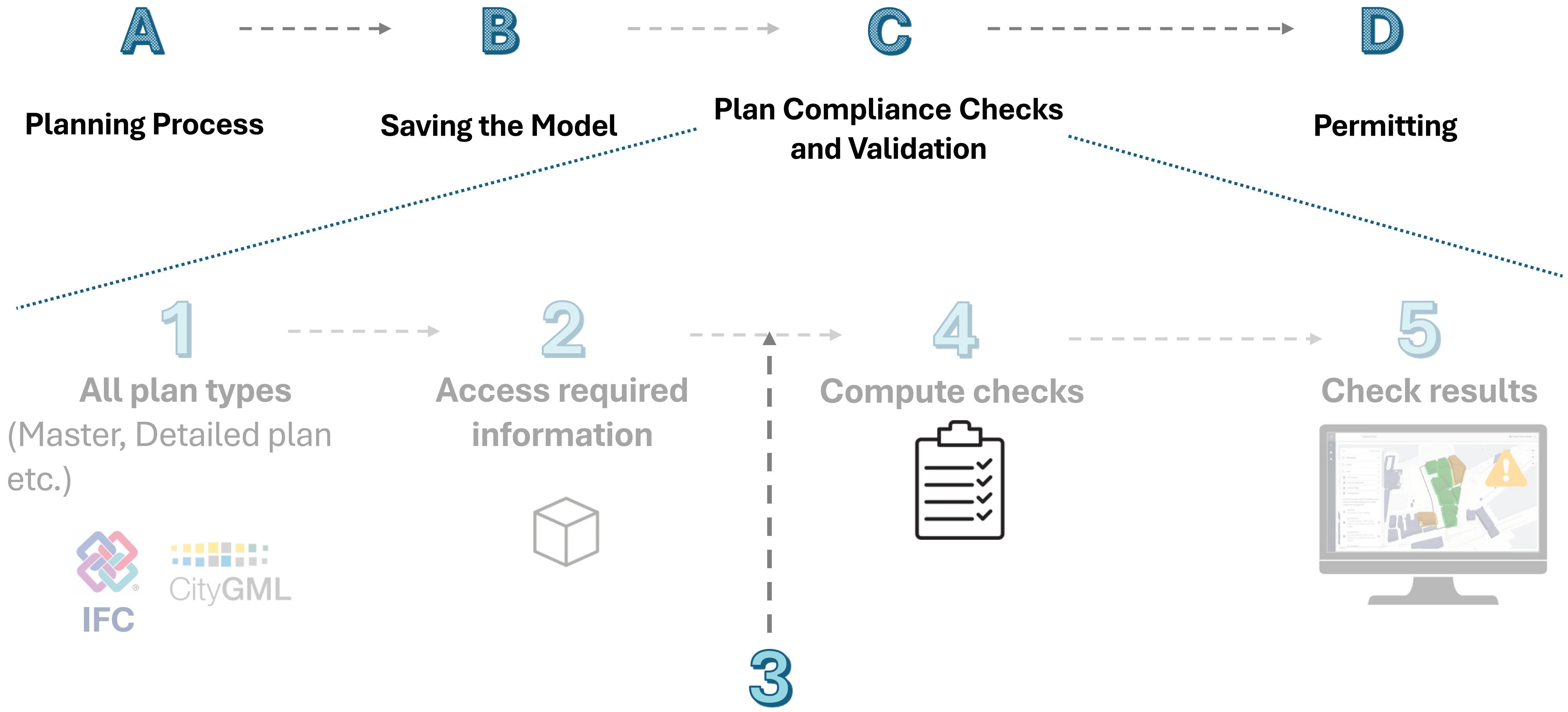
D

Permitting

(e.g., Detailed Plan against Master Plan's regulations)

1. Introduction

Scope



A Planning Process

B Saving the Model

C Plan Compliance Checks and Validation

D Permitting

1 All plan types (Master, Detailed plan etc.)

2 Access required information

4 Compute checks

5 Check results

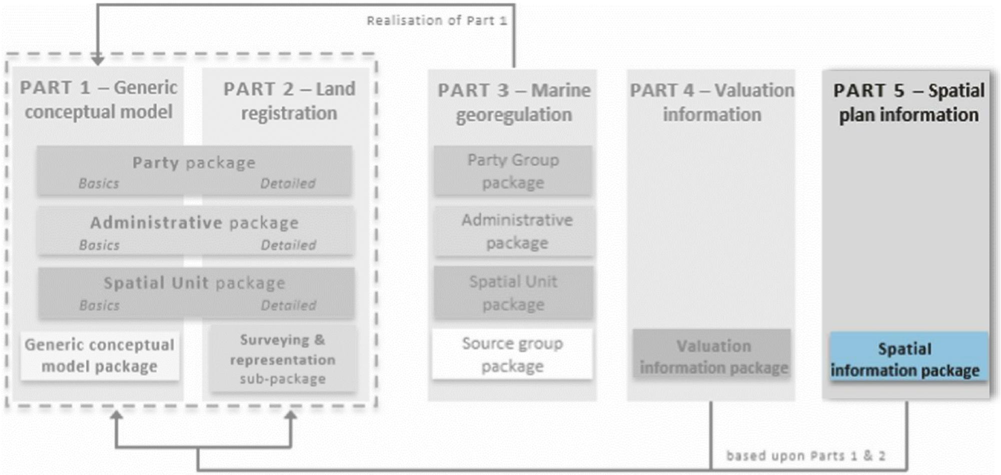
3

Store information through LADM Part 5

LADM can help to structure the plan data that is necessary to be able to execute the checks in a standardized and structured way.

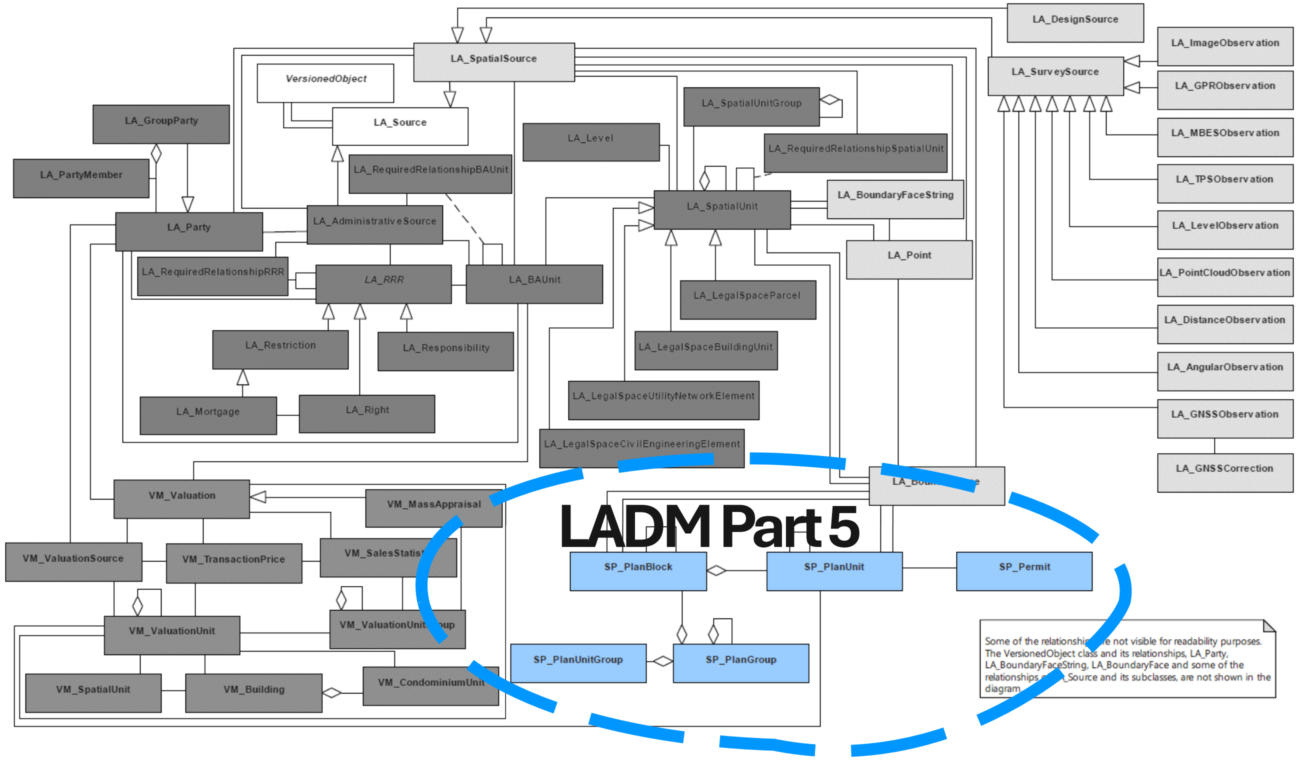
1. Introduction

Scope



Realisation of Part 1
PART 1 – Generic conceptual model
PART 2 – Land registration
Party package
Basics
Detailed
Administrative package
Basics
Detailed
Spatial Unit package
Basics
Detailed
Generic conceptual model package
Surveying & representation sub-package
PART 3 – Marine georegulation
Party Group package
Administrative package
Spatial Unit package
Source group package
PART 4 – Valuation information
Valuation information package
PART 5 – Spatial plan information
Spatial information package
based upon Parts 1 & 2

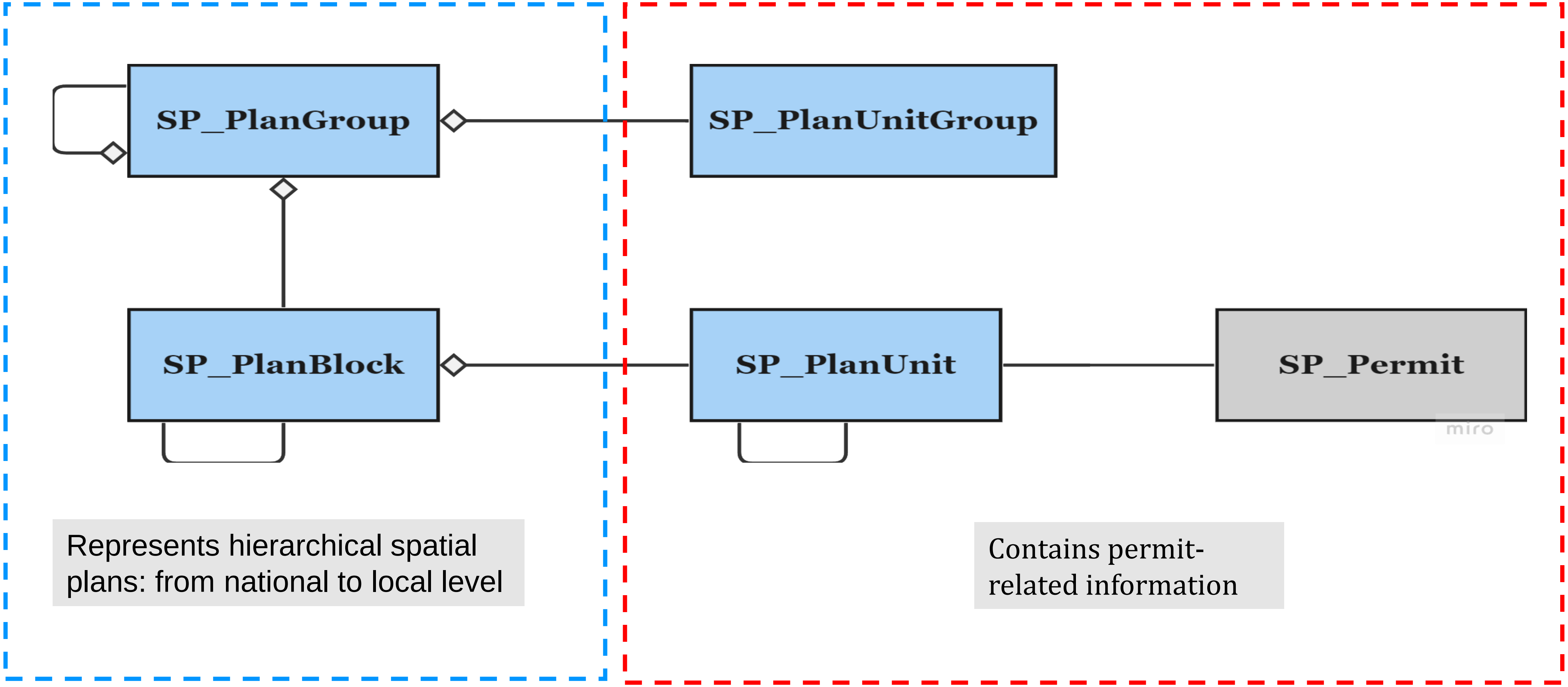
LADM Part 5: Spatial Plan Information



1. Introduction

Scope

LADM Part 5



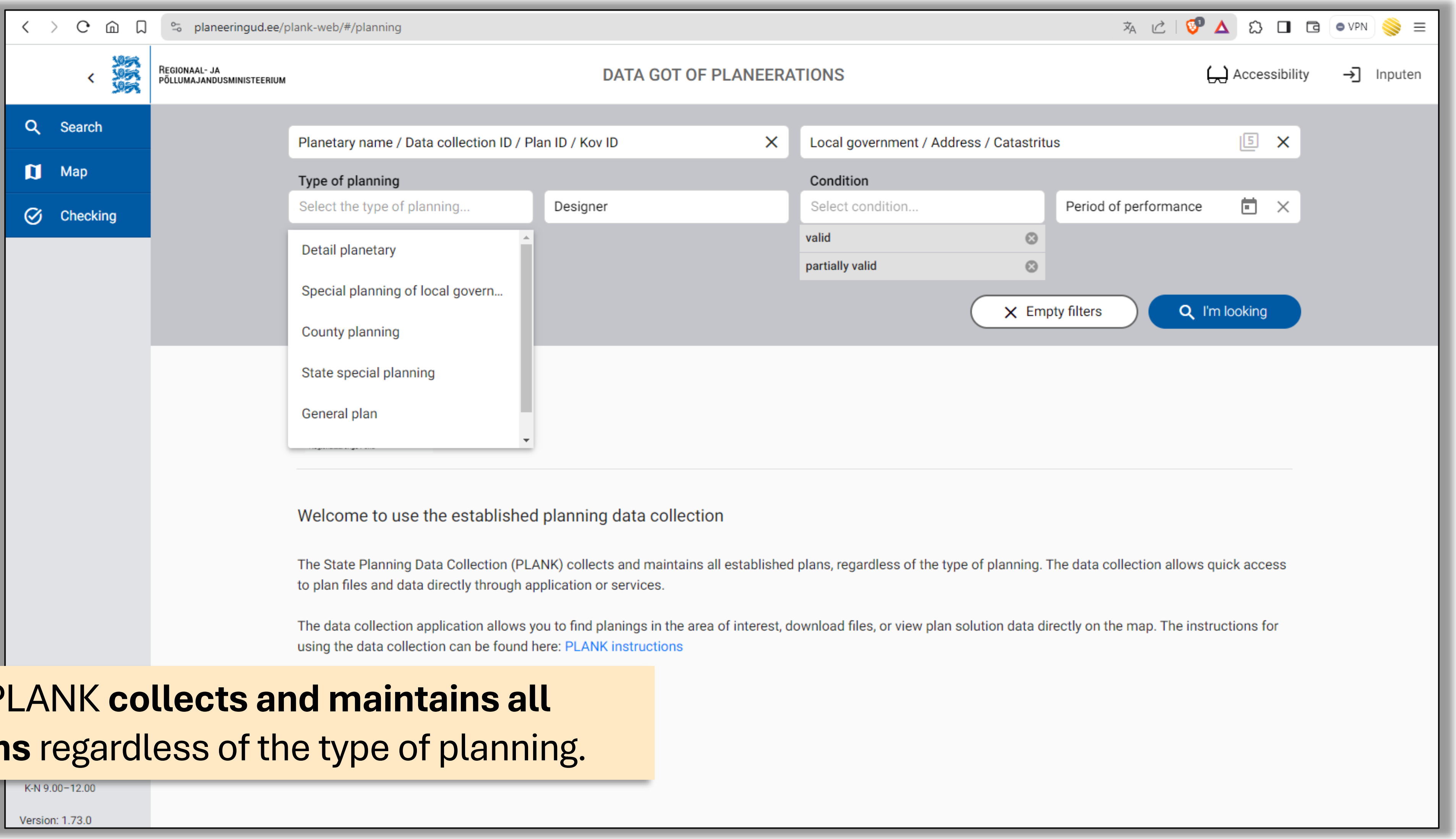
Represents hierarchical spatial plans: from national to local level

Contains permit-related information

1. Case Study: Estonia

Estonia’s PLANK

Planetary Data Collection *(PLANK)* platform


planeeringud.ee/plank-web/#/planning
REGIONAAL- JA PÕLLUMAJANDUSMINISTEERIUM
DATA GOT OF PLANEERATIONS
Accessibility
Inputen
Search
Map
Checking
Planetary name / Data collection ID / Plan ID / Kov ID
Local government / Address / Catastritus
Type of planning
Select the type of planning...
Designer
Condition
Select condition...
Period of performance
Detail planetary
Special planning of local govern...
County planning
State special planning
General plan
valid
partially valid
Empty filters
I'm looking
K-N 9.00−12.00
Version: 1.73.0

Welcome to use the established planning data collection

The State Planning Data Collection (PLANK) collects and maintains all established plans, regardless of the type of planning. The data collection allows quick access to plan files and data directly through application or services.

The data collection application allows you to find planings in the area of interest, download files, or view plan solution data directly on the map. The instructions for using the data collection can be found here: PLANK instructions

The nationwide PLANK **collects and maintains all established plans** regardless of the type of planning.

1. Introduction

Methodology

i. Create a country profile for Estonia in LADM Part 5

ii. Create and use the LADM database to store data

PostgreSQL

iii. Develop an import script to import plans to the database

FME

iv. Integration with the compliance checks

2. Estonia country profile

Relevant information/knowledge

1. **The administrative system and the legal framework** of Estonia regarding spatial plans

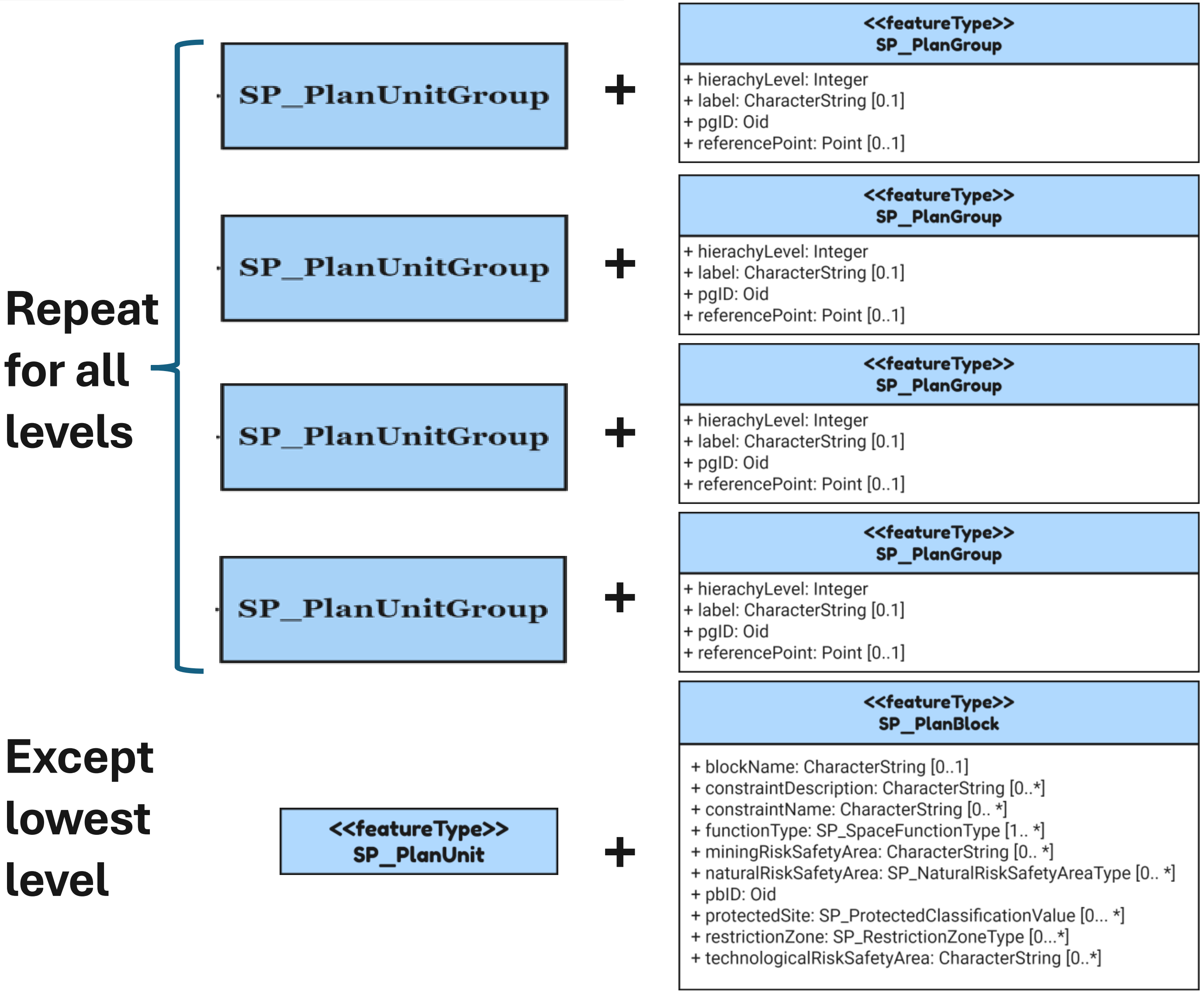
2. How each plan affects the other plan (**spatial plan hierarchy**)

3. **Data specific requirements** (e.g., layer requirements) to understand the data

4. **The existing database model's structure (PLANK)** for understanding what kind of data is stored from the plans and how they are used together

2. Estonia country profile

LADM Part 5



Repeat for all levels

SP_PlanUnitGroup +

SP_PlanUnitGroup +

SP_PlanUnitGroup +

SP_PlanUnitGroup +

Except lowest level

<<featureType>>
SP_PlanUnit +

LADM Classes

<<featureType>>
SP_PlanGroup

+ hierachyLevel: Integer
+ label: CharacterString [0.1]
+ pgID: Oid
+ referencePoint: Point [0..1]

<<featureType>>
SP_PlanGroup

+ hierachyLevel: Integer
+ label: CharacterString [0.1]
+ pgID: Oid
+ referencePoint: Point [0..1]

<<featureType>>
SP_PlanGroup

+ hierachyLevel: Integer
+ label: CharacterString [0.1]
+ pgID: Oid
+ referencePoint: Point [0..1]

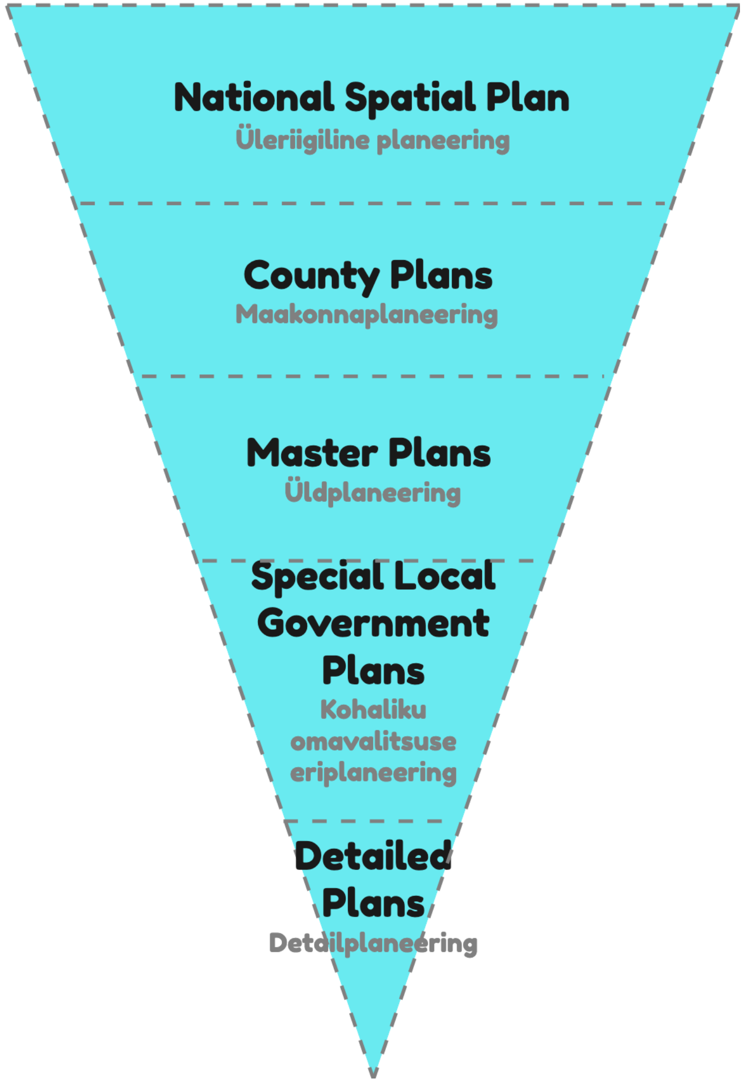
<<featureType>>
SP_PlanGroup

+ hierachyLevel: Integer
+ label: CharacterString [0.1]
+ pgID: Oid
+ referencePoint: Point [0..1]

<<featureType>>
SP_PlanBlock

+ blockName: CharacterString [0..1]
+ constraintDescription: CharacterString [0..*]
+ constraintName: CharacterString [0.. *]
+ functionType: SP_SpaceFunctionType [1.. *]
+ miningRiskSafetyArea: CharacterString [0.. *]
+ naturalRiskSafetyArea: SP_NaturalRiskSafetyAreaType [0.. *]
+ pbID: Oid
+ protectedSite: SP_ProtectedClassificationValue [0... *]
+ restrictionZone: SP_RestrictionZoneType [0...*]
+ technologicalRiskSafetyArea: CharacterString [0..*]

Estonia Spatial Plans



National Spatial Plan
Üleriigiline planeering

County Plans
Maakonnaplaneering

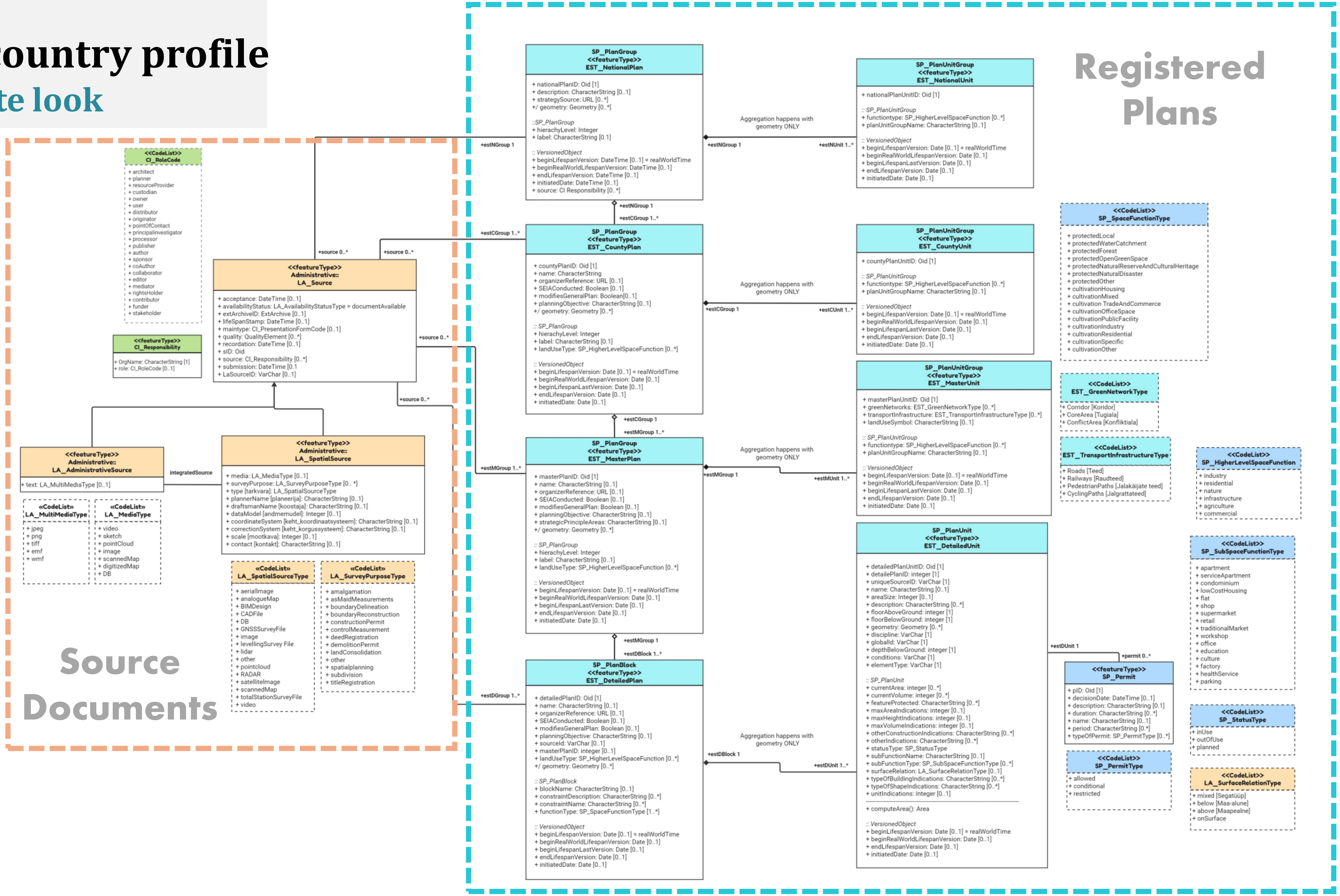
Master Plans
Üldplaneering

Special Local Government Plans
Kohaliku omavalitsuse eriplaneering

Detailed Plans
Detailplaneering

2. Estonia country profile

Complete look



Source Documents

Registered Plans

<<CodeList>> CI_RoleCode
+ architect
+ planner
+ resourceProvider
+ custodian
+ owner
+ user
+ distributor
+ originator
+ pointOfContact
+ principalinvestigator
+ processor
+ publisher
+ author
+ sponsor
+ coAuthor
+ collaborator
+ editor
+ mediator
+ rightsHolder
+ contributor
+ funder
+ stakeholder

<<featureType>> CI_Responsibility
+ OrgName: CharacterString [1]
+ role: CI_RoleCode [0..1]

<<featureType>> Administrative:: LA_Source
+ acceptance: DateTime [0..1]
+ availabilityStatus: LA_AvailabilityStatusType = documentAvailable
+ extArchiveID: ExtArchive [0..1]
+ lifeSpanStamp: DateTime [0..1]
+ maintype: CI_PresentationFormCode [0..1]
+ quality: QualityElement [0..*]
+ recordation: DateTime [0..1]
+ sID: Oid
+ source: CI_Responsibility [0..*]
+ submission: DateTime [0.1
+ LaSourceID: VarChar [0..1]

<<featureType>> Administrative:: LA_AdministrativeSource
+ text: LA_MultiMediaType [0..1]

«CodeList» LA_MultiMediaType
+ jpeg
+ png
+ tiff
+ emf
+ wmf

«CodeList» LA_MediaType
+ video
+ sketch
+ pointCloud
+ image
+ scannedMap
+ digitizedMap
+ DB

<<featureType>> Administrative:: LA_SpatialSource
+ media: LA_MediaType [0..1]
+ surveyPurpose: LA_SurveyPurposeType [0.. *]
+ type [tarkvara]: LA_SpatialSourceType
+ plannerName [planeerija]: CharacterString [0..1]
+ draftsmanName [koostaja]: CharacterString [0..1]
+ dataModel [andmemudel]: Integer [0..1]
+ coordinateSystem [keht_koordinaatsysteem]: CharacterString [0..1]
+ correctionSystem [keht_korgussysteem]: CharacterString [0..1]
+ scale [mootkava]: Integer [0..1]
+ contact [kontakt]: CharacterString [0..1]

«CodeList» LA_SpatialSourceType
+ aerialImage
+ analogueMap
+ BIMDesign
+ CADFile
+ DB
+ GNSSSurveyFile
+ image
+ levellingSurvey File
+ lidar
+ other
+ pointcloud
+ RADAR
+ satelliteImage
+ scannedMap
+ totalStationSurveyFile
+ video

«CodeList» LA_SurveyPurposeType
+ amalgamation
+ asMaidMeasurements
+ boundaryDelineation
+ boundaryReconstruction
+ constructionPermit
+ controlMeasurement
+ deedRegistration
+ demolitionPermit
+ landConsolidation
+ other
+ spatialplanning
+ subdivision
+ titleRegistration

SP_PlanGroup <<featureType>> EST_NationalPlan
+ nationalPlanID: Oid [1]
+ description: CharacterString [0..1]
+ strategySource: URL [0..*]
+/ geometry: Geometry [0..*]

::SP_PlanGroup
+ hierachyLevel: Integer
+ label: CharacterString [0.1]

:: VersionedObject
+ beginLifespanVersion: DateTime [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: DateTime [0..1]
+ endLifespanVersion: DateTime [0..1]
+ initiatedDate: DateTime [0..1]
+ source: CI Responsibility [0..*]

SP_PlanGroup <<featureType>> EST_CountyPlan
+ countyPlanID: Oid [1]
+ name: CharacterString
+ organizerReference: URL [0..1]
+ SEIAConducted: Boolean [0..1]
+ modifiesGeneralPlan: Boolean[0..1]
+ planningObjective: CharacterString [0..1]
+/ geometry: Geometry [0..*]

:: SP_PlanGroup
+ hierachyLevel: Integer
+ label: CharacterString [0.1]
+ landUseType: SP_HigherLevelSpaceFunction [0..*]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanGroup <<featureType>> EST_MasterPlan
+ masterPlanID: Oid [1]
+ name: CharacterString [0..1]
+ organizerReference: URL [0..1]
+ SEIAConducted: Boolean [0..1]
+ modifiesGeneralPlan: Boolean [0..1]
+ planningObjective: CharacterString [0..1]
+ strategicPrincipleAreas: CharacterString [0..1]
+/ geometry: Geometry [0..*]

:: SP_PlanGroup
+ hierachyLevel: Integer
+ label: CharacterString [0..1]
+ landUseType: SP_HigherLevelSpaceFunction [0..*]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanBlock <<featureType>> EST_DetailedPlan
+ detailedPlanID: Oid [1]
+ name: CharacterString [0..1]
+ organizerReference: URL [0..1]
+ SEIAConducted: Boolean [0..1]
+ modifiesGeneralPlan: Boolean [0..1]
+ planningObjective: CharacterString [0..1]
+ sourceId: VarChar [0..1]
+ masterPlanID: integer [0..1]
+ landUseType: SP_HigherLevelSpaceFunction [0..*]
+/ geometry: Geometry [0..*]

:: SP_PlanBlock
+ blockName: CharacterString [0..1]
+ constraintDescription: CharacterString [0..*]
+ constraintName: CharacterString [0..*]
+ functionType: SP_SpaceFunctionType [1..*]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanUnitGroup <<featureType>> EST_NationalUnit
+ nationalPlanUnitID: Oid [1]

:: SP_PlanUnitGroup
+ functiontype: SP_HigherLevelSpaceFunction [0..*]
+ planUnitGroupName: CharacterString [0..1]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanUnitGroup <<featureType>> EST_CountyUnit
+ countyPlanUnitID: Oid [1]

:: SP_PlanUnitGroup
+ functiontype: SP_HigherLevelSpaceFunction [0..*]
+ planUnitGroupName: CharacterString [0..1]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanUnitGroup <<featureType>> EST_MasterUnit
+ masterPlanUnitID: Oid [1]
+ greenNetworks: EST_GreenNetworkType [0..*]
+ transportInfrastructure: EST_TransportInfrastructureType [0..*]
+ landUseSymbol: CharacterString [0..1]

:: SP_PlanUnitGroup
+ functiontype: SP_HigherLevelSpaceFunction [0..*]
+ planUnitGroupName: CharacterString [0..1]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

SP_PlanUnit <<featureType>> EST_DetailedUnit
+ detailedPlanUnitID: Oid [1]
+ detailePlanID: integer [1]
+ uniqueSourceID: VarChar [1]
+ name: CharacterString [0..1]
+ areaSize: Integer [0..1]
+ description: CharacterString [0..*]
+ floorAboveGround: integer [1]
+ floorBelowGround: integer [1]
+ geometry: Geometry [0..*]
+ discipline: VarChar [1]
+ globalId: VarChar [1]
+ depthBelowGround: integer [1]
+ conditions: VarChar [1]
+ elementType: VarChar [1]

:: SP_PlanUnit
+ currentArea: integer [0..*]
+ currentVolume: integer [0..*]
+ featureProtected: CharacterString [0..*]
+ maxAreaIndications: integer [0..1]
+ maxHeightIndications: integer [0..1]
+ maxVolumeIndications: integer [0..1]
+ otherConstructionIndications: CharacterString [0..*]
+ otherIndications: CharacterString [0..*]
+ statusType: SP_StatusType
+ subFunctionName: CharacterString [0..1]
+ subFunctionType: SP_SubSpaceFunctionType [0..*]
+ surfaceRelation: LA_SurfaceRelationType [0..1]
+ typeOfBuildingIndications: CharacterString [0..*]
+ typeOfShapeIndications: CharacterString [0..*]
+ unitIndications: Integer [0..1]

+ computeArea(): Area

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

<<CodeList>> SP_SpaceFunctionType
+ protectedLocal
+ protectedWaterCatchment
+ protectedForest
+ protectedOpenGreenSpace
+ protectedNaturalReserveAndCulturalHeritage
+ protectedNaturalDisaster
+ protectedOther
+ cultivationHousing
+ cultivationMixed
+ cultivation TradeAndCommerce
+ cultivationOfficeSpace
+ cultivationPublicFacility
+ cultivationIndustry
+ cultivationResidential
+ cultivationSpecific
+ cultivationOther

<<CodeList>> EST_GreenNetworkType
+ Corridor [Koridor]
+ CoreArea [Tugiala]
+ ConflictArea [Konfliktiala]

<<CodeList>> EST_TransportInfrastructureType
+ Roads [Teed]
+ Railways [Raudteed]
+ PedestrianPaths [Jalakäijate teed]
+ CyclingPaths [Jalgrattateed]

<<CodeList>> SP_HigherLevelSpaceFunction
+ industry
+ residential
+ nature
+ infrastructure
+ agriculture
+ commercial

<<CodeList>> SP_SubSpaceFunctionType
+ apartment
+ serviceApartment
+ condominium
+ lowCostHousing
+ flat
+ shop
+ supermarket
+ retail
+ traditionalMarket
+ workshop
+ office
+ education
+ culture
+ factory
+ healthService
+ parking

<<featureType>> SP_Permit
+ pID: Oid [1]
+ decisionDate: DateTime [0..1]
+ description: CharacterString [0.1]
+ duration: CharacterString [0..*]
+ name: CharacterString [0..1]
+ period: CharacterString [0.*]
+ typeOfPermit: SP_PermitType [0..*]

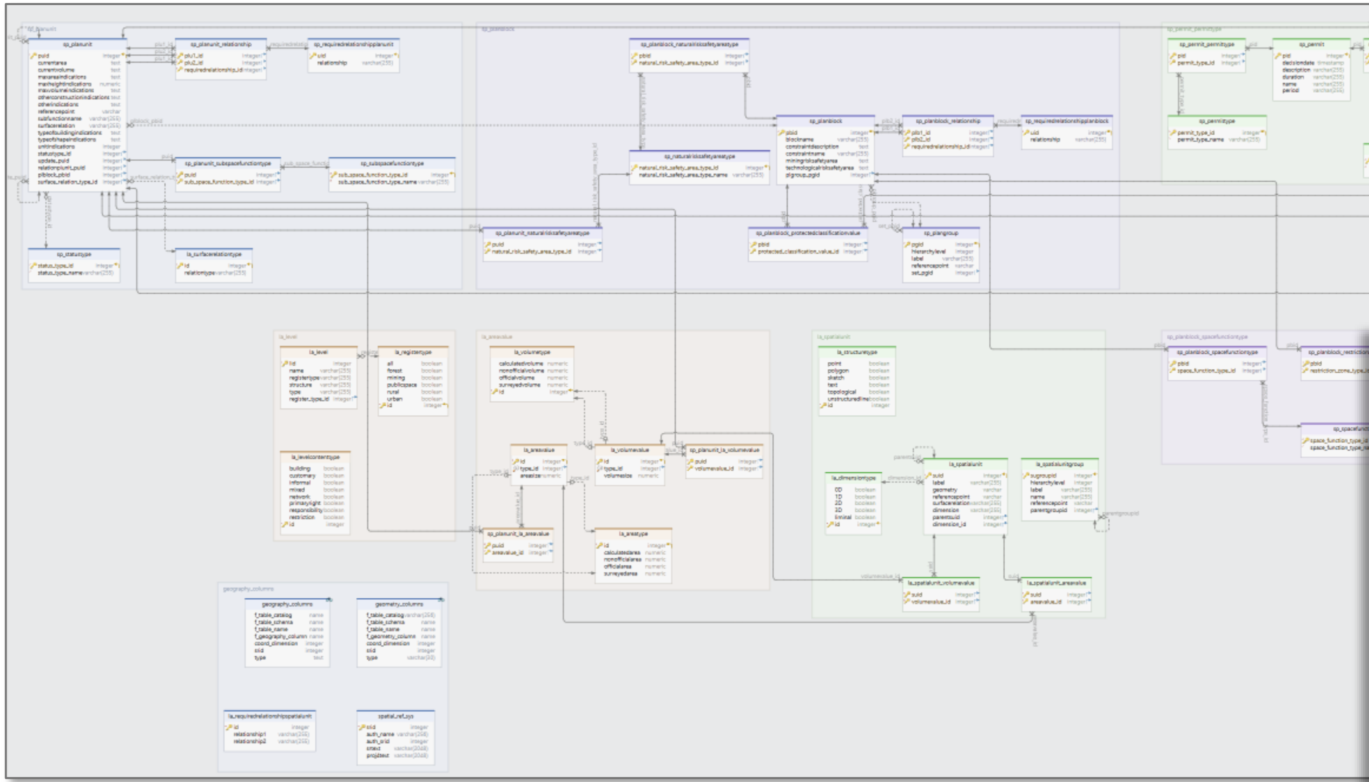
<<CodeList>> SP_PermitType
+ allowed
+ conditional
+ restricted

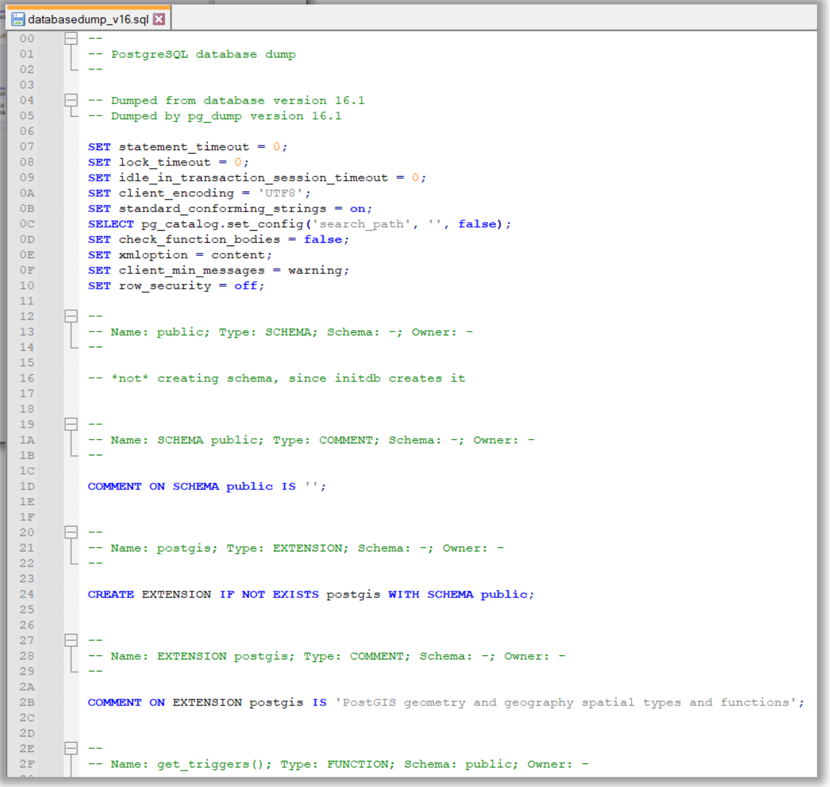
<<CodeList>> SP_StatusType
+ inUse
+ outOfUse
+ planned

<<CodeList>> LA_SurfaceRelationType
+ mixed [Segatüüp]
+ below [Maa-alune]
+ above [Maapealne]
+ onSurface

3. Implementation

LADM Database Setup (from UML to SQL/DDL)



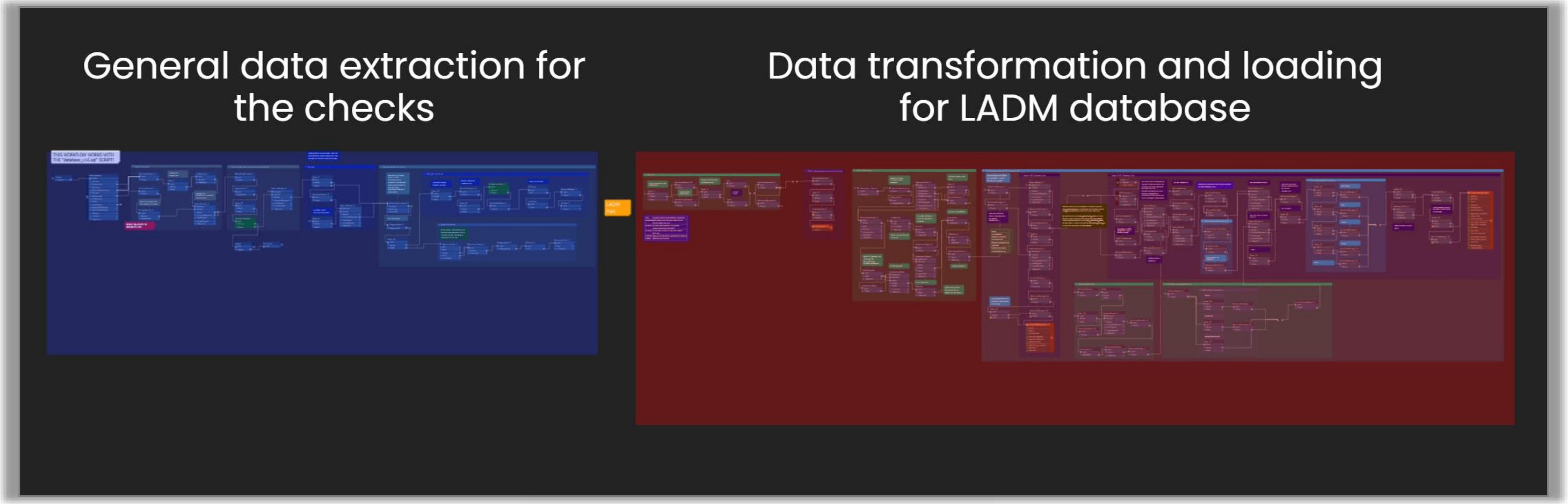


```
--
-- PostgreSQL database dump
--

-- Dumped from database version 16.1
-- Dumped by pg_dump version 16.1

SET statement_timeout = 0;
SET lock_timeout = 0;
SET idle_in_transaction_session_timeout = 0;
SET client_encoding = 'UTF8';
SET standard_conforming_strings = on;
SELECT pg_catalog.set_config('search_path', '', false);
SET check_function_bodies = false;
SET xmloption = content;
SET client_min_messages = warning;
SET row_security = off;

--
-- Name: public; Type: SCHEMA; Schema: -; Owner: -
--

-- *not* creating schema, since initdb creates it


--
-- Name: SCHEMA public; Type: COMMENT; Schema: -; Owner: -
--

COMMENT ON SCHEMA public IS '';


--
-- Name: postgis; Type: EXTENSION; Schema: -; Owner: -
--

CREATE EXTENSION IF NOT EXISTS postgis WITH SCHEMA public;


--
-- Name: EXTENSION postgis; Type: COMMENT; Schema: -; Owner: -
--

COMMENT ON EXTENSION postgis IS 'PostGIS geometry and geography spatial types and functions';


--
-- Name: get_triggers(); Type: FUNCTION; Schema: public; Owner: -
```

Creation of a database in PostgreSQL of the new Estonia profile in LADM

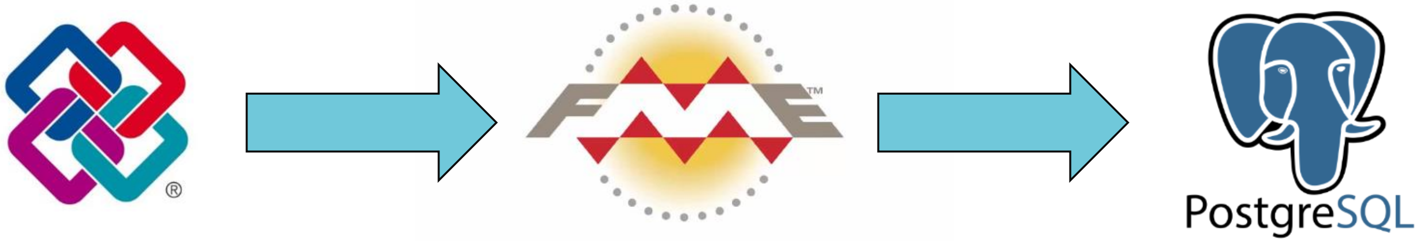
3. Implementation

Import plans to the database



General data extraction for the checks

Data transformation and loading for LADM database



PLAN data
(IFC etc.)

Mapping IFC attributes to classes/attributes in LADM database

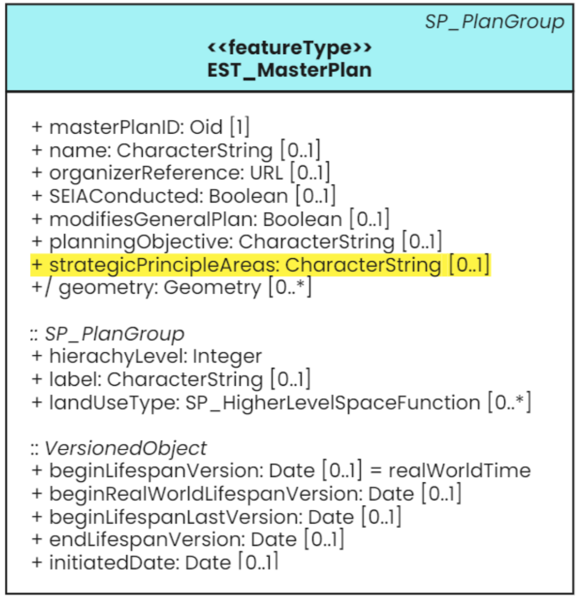
LADM P5 Database

3. Implementation

Scenarios where LADM can be used for Checks

CHECK: *Compare the two most recent versions of the Detailed Plan "Central Park" to assess whether they meet the Master Plan's **greenery requirement** of at least 30% of the total plan area*

Classes from LADM used for this check



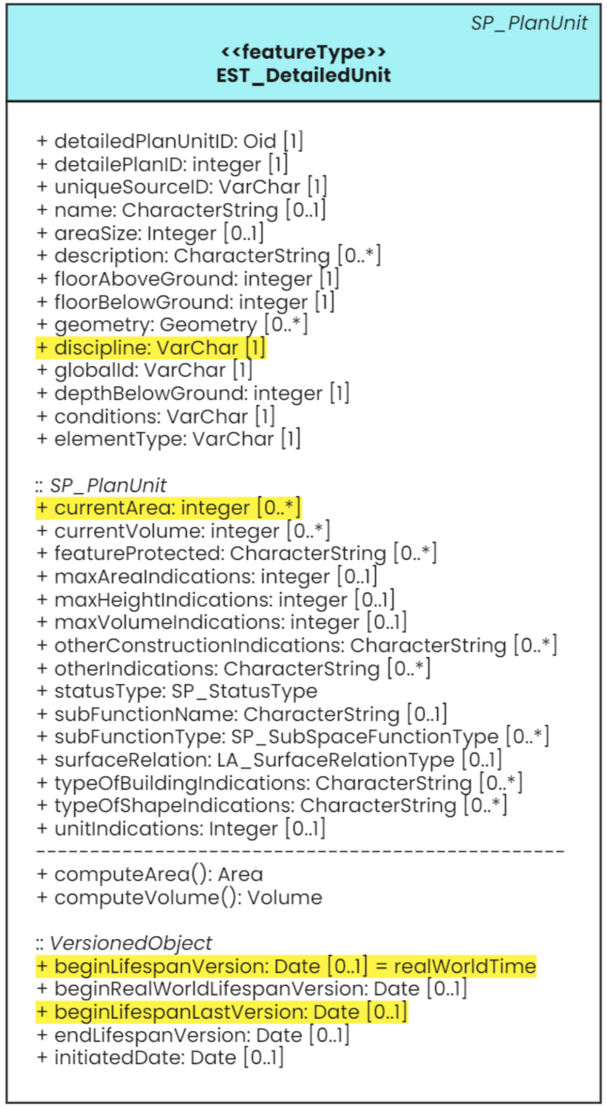
SP_PlanGroup

<<featureType>>
EST_MasterPlan

+ masterPlanID: Oid [1]
+ name: CharacterString [0..1]
+ organizerReference: URL [0..1]
+ SEIAConducted: Boolean [0..1]
+ modifiesGeneralPlan: Boolean [0..1]
+ planningObjective: CharacterString [0..1]
+ strategicPrincipleAreas: CharacterString [0..1]
+/ geometry: Geometry [0..*]

:: SP_PlanGroup
+ hierachyLevel: Integer
+ label: CharacterString [0..1]
+ landUseType: SP_HigherLevelSpaceFunction [0..*]

:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]



SP_PlanUnit

<<featureType>>
EST_DetailedUnit

+ detailedPlanUnitID: Oid [1]
+ detailePlanID: integer [1]
+ uniqueSourceID: VarChar [1]
+ name: CharacterString [0..1]
+ areaSize: Integer [0..1]
+ description: CharacterString [0..*]
+ floorAboveGround: integer [1]
+ floorBelowGround: integer [1]
+ geometry: Geometry [0..*]
+ discipline: VarChar [1]
+ globalId: VarChar [1]
+ depthBelowGround: integer [1]
+ conditions: VarChar [1]
+ elementType: VarChar [1]

:: SP_PlanUnit
+ currentArea: integer [0..*]
+ currentVolume: integer [0..*]
+ featureProtected: CharacterString [0..*]
+ maxAreaIndications: integer [0..1]
+ maxHeightIndications: integer [0..1]
+ maxVolumeIndications: integer [0..1]
+ otherConstructionIndications: CharacterString [0..*]
+ otherIndications: CharacterString [0..*]
+ statusType: SP_StatusType
+ subFunctionName: CharacterString [0..1]
+ subFunctionType: SP_SubSpaceFunctionType [0..*]
+ surfaceRelation: LA_SurfaceRelationType [0..1]
+ typeOfBuildingIndications: CharacterString [0..*]
+ typeOfShapeIndications: CharacterString [0..*]
+ unitIndications: Integer [0..1]

+ computeArea(): Area
+ computeVolume(): Volume

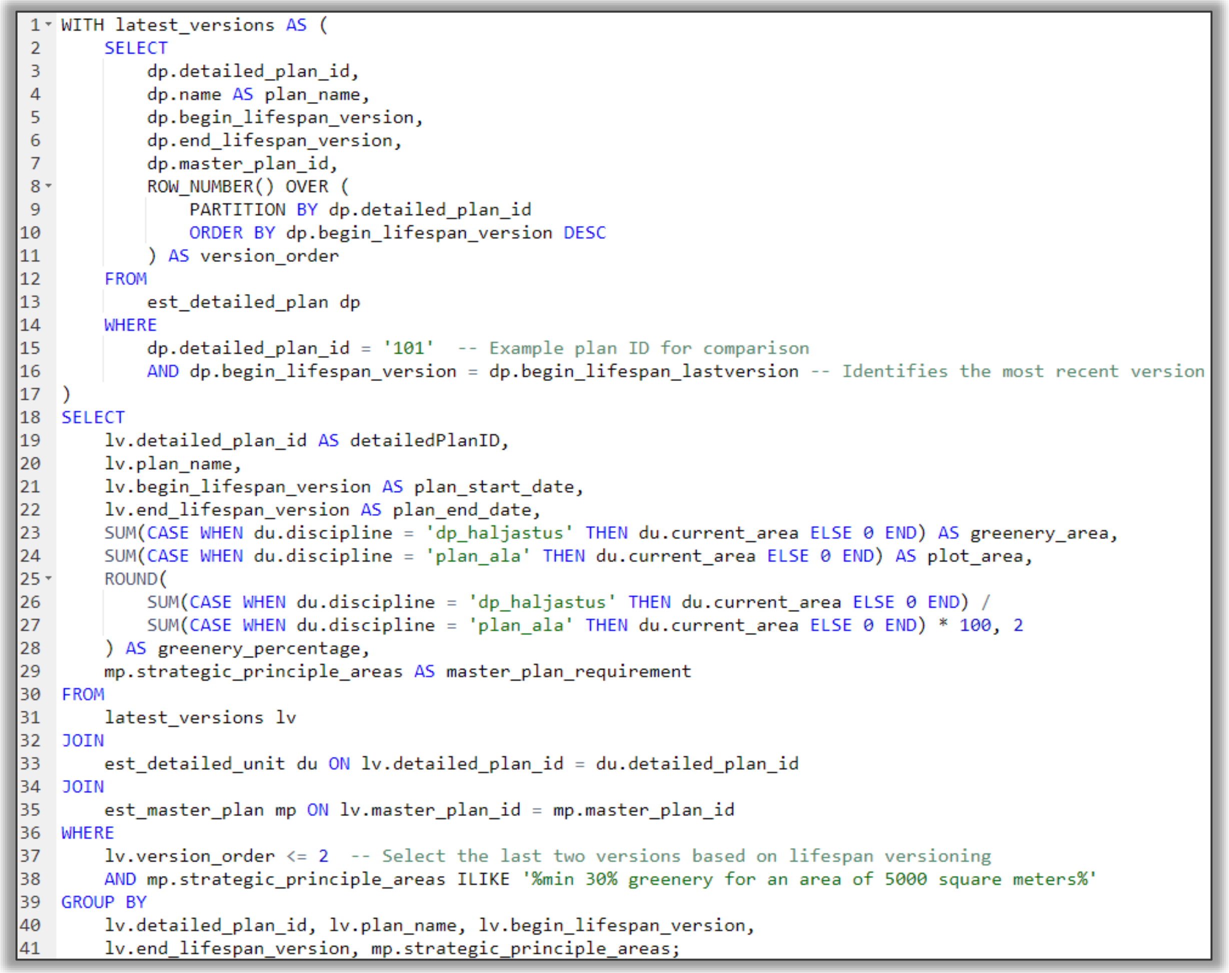
:: VersionedObject
+ beginLifespanVersion: Date [0..1] = realWorldTime
+ beginRealWorldLifespanVersion: Date [0..1]
+ beginLifespanLastVersion: Date [0..1]
+ endLifespanVersion: Date [0..1]
+ initiatedDate: Date [0..1]

3. Implementation

Scenarios where LADM can be used for Checks

CHECK: *Compare the two most recent versions of the Detailed Plan “Central Park” to assess whether they meet the Master Plan's* ***greenery requirement*** *of at least 30% of the total plan area*

Example SQL query in the database



```sql
WITH latest_versions AS (
    SELECT
        dp.detailed_plan_id,
        dp.name AS plan_name,
        dp.begin_lifespan_version,
        dp.end_lifespan_version,
        dp.master_plan_id,
        ROW_NUMBER() OVER (
            PARTITION BY dp.detailed_plan_id
            ORDER BY dp.begin_lifespan_version DESC
        ) AS version_order
    FROM
        est_detailed_plan dp
    WHERE
        dp.detailed_plan_id = '101'  -- Example plan ID for comparison
        AND dp.begin_lifespan_version = dp.begin_lifespan_lastversion -- Identifies the most recent version
)
SELECT
    lv.detailed_plan_id AS detailedPlanID,
    lv.plan_name,
    lv.begin_lifespan_version AS plan_start_date,
    lv.end_lifespan_version AS plan_end_date,
    SUM(CASE WHEN du.discipline = 'dp_haljastus' THEN du.current_area ELSE 0 END) AS greenery_area,
    SUM(CASE WHEN du.discipline = 'plan_ala' THEN du.current_area ELSE 0 END) AS plot_area,
    ROUND(
        SUM(CASE WHEN du.discipline = 'dp_haljastus' THEN du.current_area ELSE 0 END) /
        SUM(CASE WHEN du.discipline = 'plan_ala' THEN du.current_area ELSE 0 END) * 100, 2
    ) AS greenery_percentage,
    mp.strategic_principle_areas AS master_plan_requirement
FROM
    latest_versions lv
JOIN
    est_detailed_unit du ON lv.detailed_plan_id = du.detailed_plan_id
JOIN
    est_master_plan mp ON lv.master_plan_id = mp.master_plan_id
WHERE
    lv.version_order <= 2  -- Select the last two versions based on lifespan versioning
    AND mp.strategic_principle_areas ILIKE '%min 30% greenery for an area of 5000 square meters%'
GROUP BY
    lv.detailed_plan_id, lv.plan_name, lv.begin_lifespan_version,
    lv.end_lifespan_version, mp.strategic_principle_areas;
```

3. Implementation

List of Compliance Checks

1. Version comparison of detailed plans (DP vs DP)
2. **Maximum building height (DP vs MP)**
3. Building distance (DP)
4. Cadastral border distance (DP)
5. Fire hydrants (DP vs MP)
6. **Greenery demands (%) (DP vs MP)**
7. General access to the plot (DP vs MP)
8. Protected area requirements (DP vs MP)
9. Check area measures (DP vs MP)
10. Design in buildable area (DP)

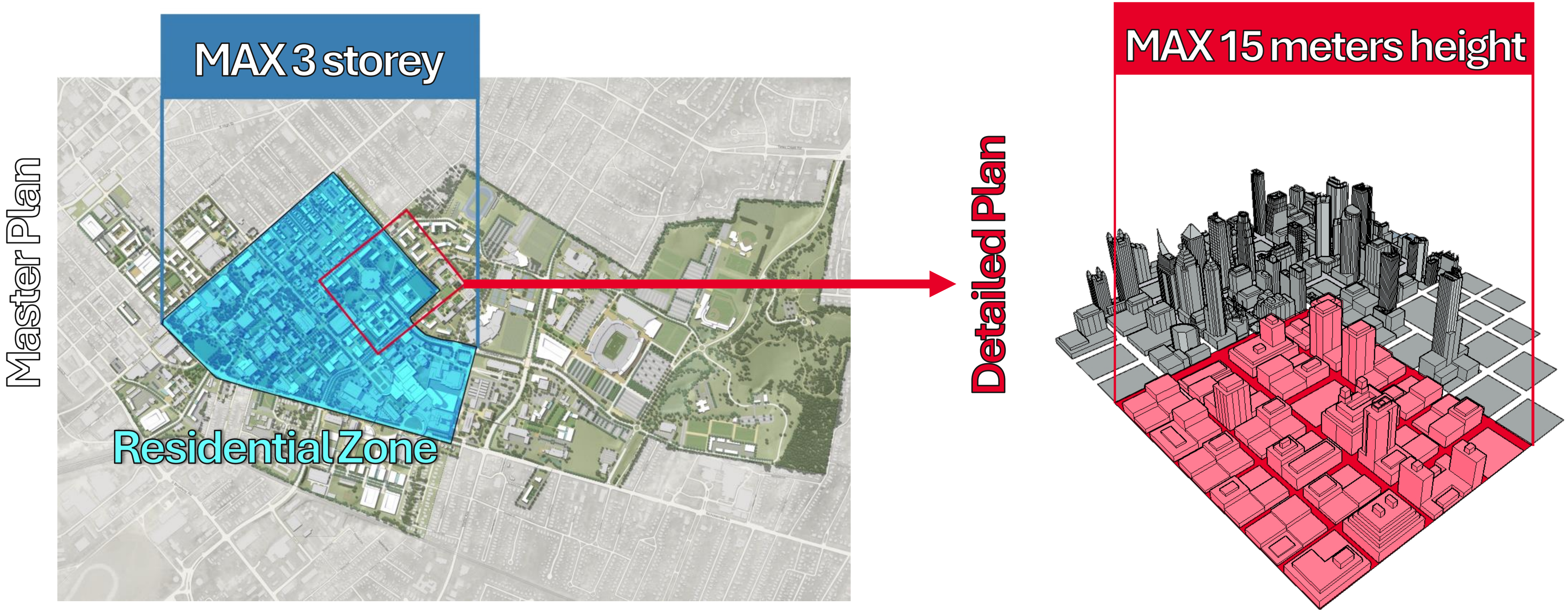
Some checks need only Detailed Plans (DP) for local rules, while others need both Master and Detailed Plans (MP-DP) for broader compliance.

[Detailed Plans (DP), Master Plans (MP)]

4. Implementation

List of Compliance Checks: *Example*

Does the Detail Plan comply against Master Plan regulations w.r.t. Maximum building height ?

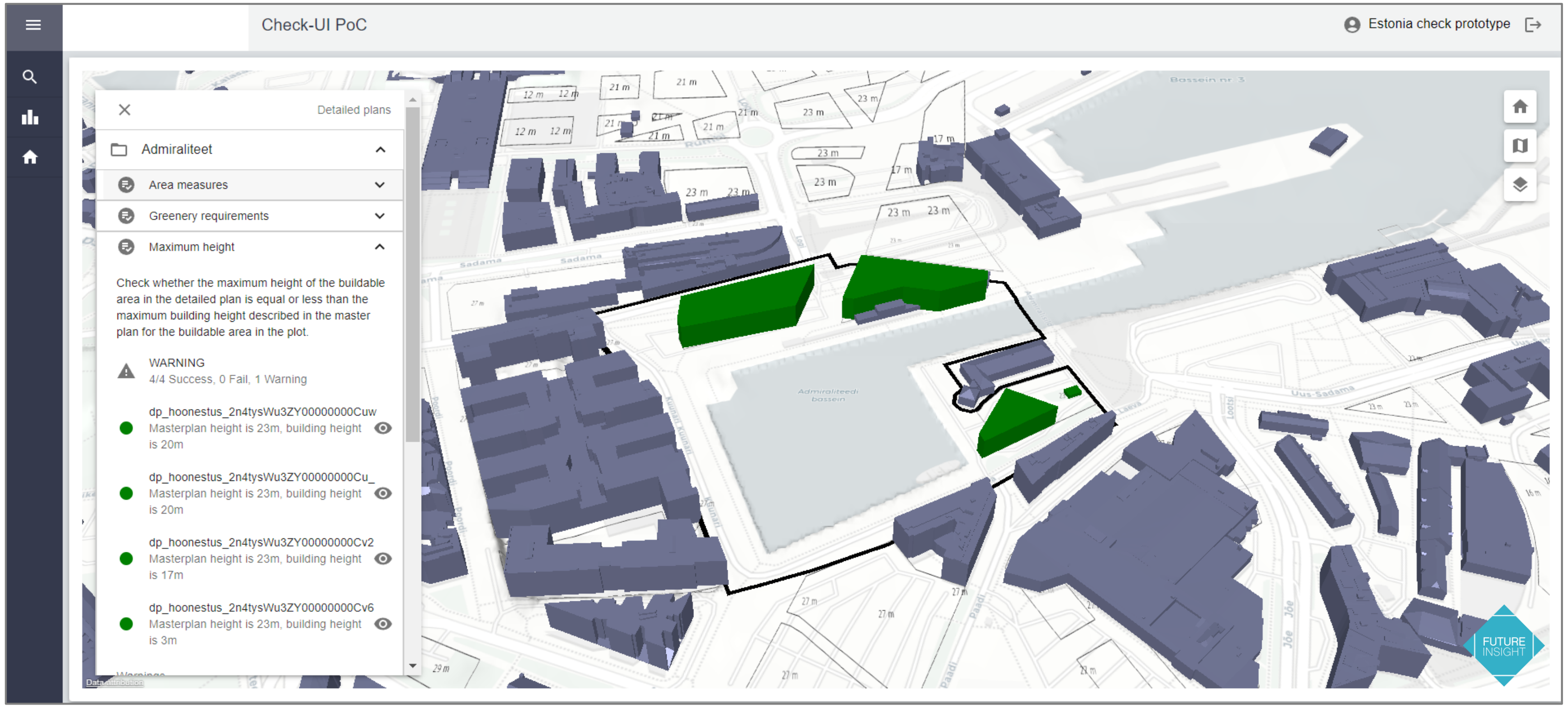


4. Implementation

List of Compliance Checks: *Example*

“The height of the buildable area in Detailed Plan cannot exceed the max. height of the Master Plan”

Visualize the results of the detailed plan check



Check whether the maximum height of the buildable area in the detailed plan is equal or less than the maximum building height described in the master plan for the buildable area in the plot.

WARNING
4/4 Success, 0 Fail, 1 Warning

● dp_hoonestus_2n4tysWu3ZY00000000Cuw
Masterplan height is 23m, building height is 20m

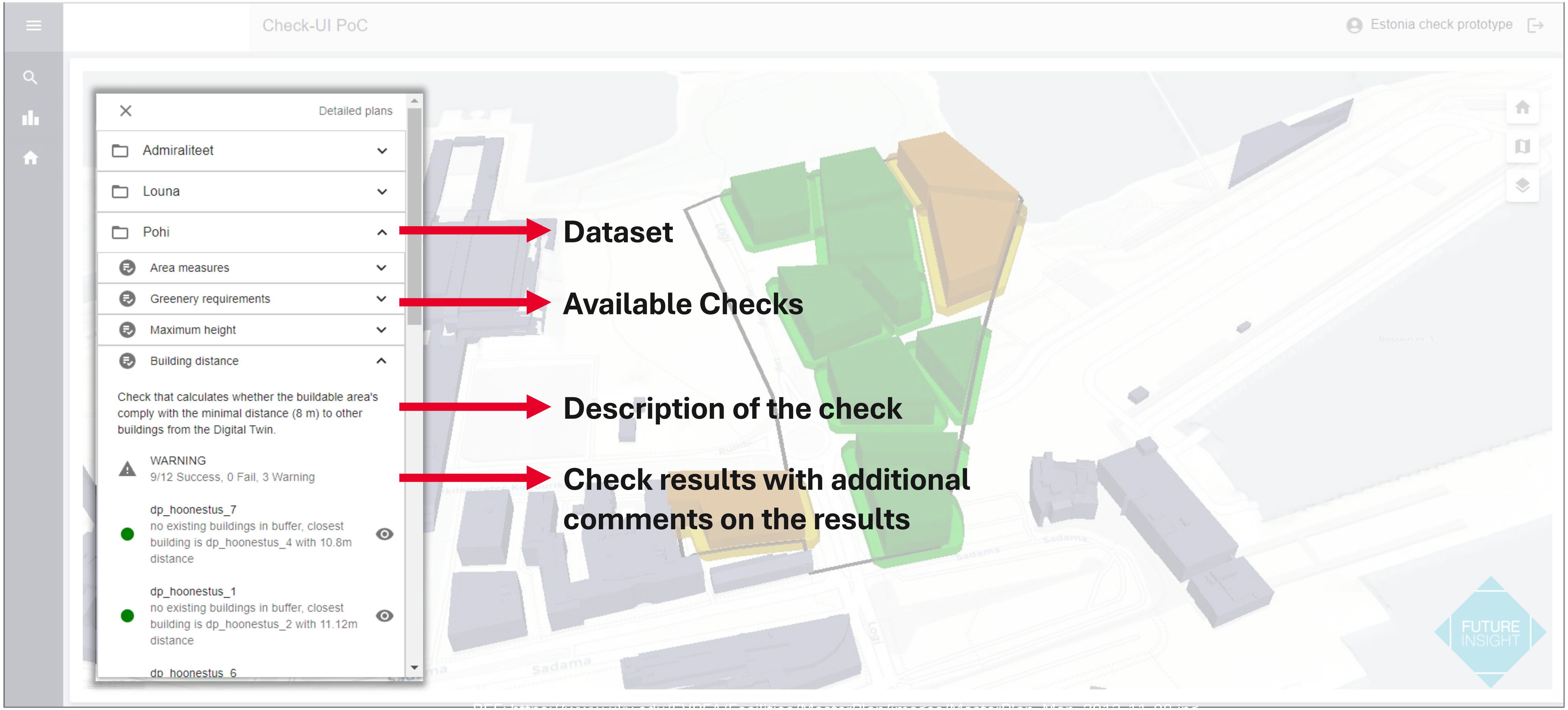
● dp_hoonestus_2n4tysWu3ZY00000000Cu_
Masterplan height is 23m, building height is 20m

● dp_hoonestus_2n4tysWu3ZY00000000Cv2
Masterplan height is 23m, building height is 17m

● dp_hoonestus_2n4tysWu3ZY00000000Cv6
Masterplan height is 23m, building height is 3m

4. Implementation

Options in the user interface



Check-UI PoC

Estonia check prototype

Detailed plans

- Admiraliteet
- Louna
- Pohi
  - Area measures
  - Greenery requirements
  - Maximum height
  - Building distance

Check that calculates whether the buildable area's comply with the minimal distance (8 m) to other buildings from the Digital Twin.

WARNING
9/12 Success, 0 Fail, 3 Warning

● dp_hoonestus_7
no existing buildings in buffer, closest building is dp_hoonestus_4 with 10.8m distance

● dp_hoonestus_1
no existing buildings in buffer, closest building is dp_hoonestus_2 with 11.12m distance

dp_hoonestus_6

Dataset

Available Checks

Description of the check

Check results with additional comments on the results

REF: https://www.uky.edu/EVPFA/Facilities/MasterPlan/images/MasterPlan_Map_2013-11-08.jpg

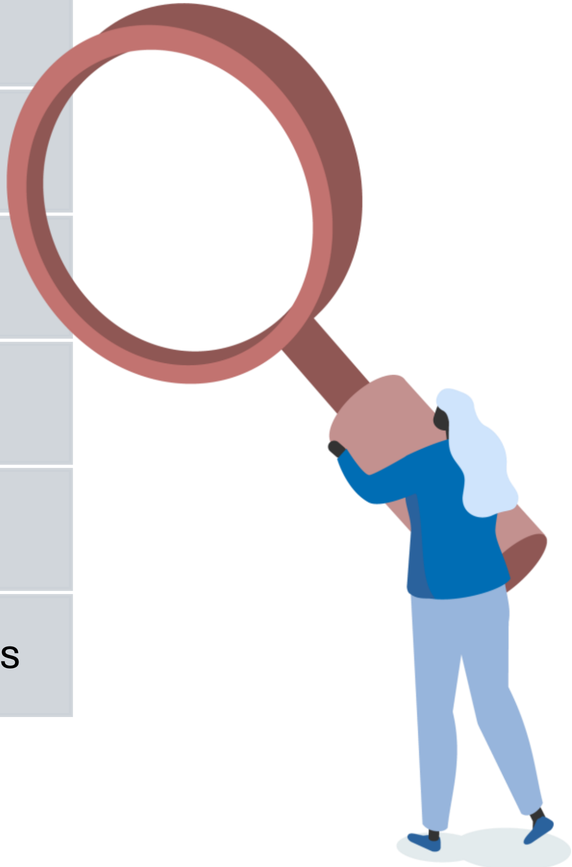
5. Conclusion

- The integration of LADM Part 5 with BIM/IFC models improves standardization and interoperability in compliance checks between spatial plans, enhancing quality and consistency of plans as basis for the permitting process in Estonia

- The case study demonstrated that using digital models streamlines the compliance check process, reducing errors and improving efficiency compared to traditional manual methods

4. Future Research

Scale	Scale the prototype to real-world workflows with larger datasets
Improve	Improve IFC-LADM mapping and standardize urban-scale data use
Explore	Explore CityGML’s potential for planning and zoning checks
Establish	Establish consistent frameworks for Estonian spatial planning data
Integrate	Integrate additional LADM standards for comprehensive systems
Test	Test LADM Part 5 in diverse countries and planning contexts
Develop	Develop advanced algorithms for more thorough compliance checks



4. ISO DIS 19152-5 feedback

- LADM Part 5 classes and attributes align well with spatial plan data and infrastructure of Estonia
- The framework is flexible enough to add or omit necessary features

- The Geometry attribute is notably missing from plan classes (e.g., SP_PlanUnit, SP_PlanUnitGroup), indirect via LA_BoundaryFaceString and LA_BoundaryFace
- It would be helpful for the standard to include example country profiles to assist with implementation

Thank you.