

**Interreg**



Co-funded by  
the European Union

**Italy – Croatia**

---

 **DIGITPORTS**

# 3D GIS and migration process from CAD – a case study

Matteo De Minicis

High Level Training on Digital Twin applications in Port  
ecosystems, Venice 28<sup>th</sup> Jan 2025

[www.italy-croatia.eu](http://www.italy-croatia.eu)

Interreg



Co-funded by  
the European Union

Italy – Croatia

 DIGITPORTS

# 3D GIS is a foundation for Digital Twins



# 3D buildings are significant assets in a 3D GIS

Not only for representation purposes

BIMs are a great place to start  
.. but they are often not  
available



## Case study - Digitalization of railway Stations Project

Centralize and normalize the **floor plans (CAD)** of the stations.

Standardizing the data model – **IMDF (Indoor Mapping Data Format)** of the Open Geospatial Consortium OGC

**Create a geodatabase** functional to the management of indoor spaces and indoor navigation.

Census and geolocate the relevant **units and equipment** for maintenance, regulatory and commercial activities.

**Automate** the drafting of **Station Usage Plans (PuDS)**

Start an **integration between management systems** on a floor plan basis.



**195 main Italian railway stations** involved along Italian railway network



# Indoor Mapping Data Format – Interoperability

IMDF Data Model (OGC standard)	Archibus (workplace mng.)	AutoCAD (floor plans)	GIS	SAP (PM & RE)	Cadastral
<b>Geographic Data</b> Site (Venue)	Site	Poligono	Site	Località	Particelle Cat. Terreni
<b>Location data</b> Fabbricato (Building + footprint) Piano (Floor) Locale (Unit)	Building Floor Room	Perimetro + Nome File File per Piani Perimetro + etichetta	Facility Level Unit	Fabbricati + altre SeTE	Particelle Cat. Fabbricati  Vani (planimetria)
<b>Assets (equipments)</b> Equipment (Fixture)	Equipment		POI	Impianti o SeTE	
<b>Management perimeters</b> Sezioni (Section) Geofence	Room Room	Perimetro + etichetta Perimetro + etichetta	Section Zone	Ogg. Architettonici Oggetti Locativi	Subalterno Cat. Fabb



## a) setup the workflow - POC Trastevere Station

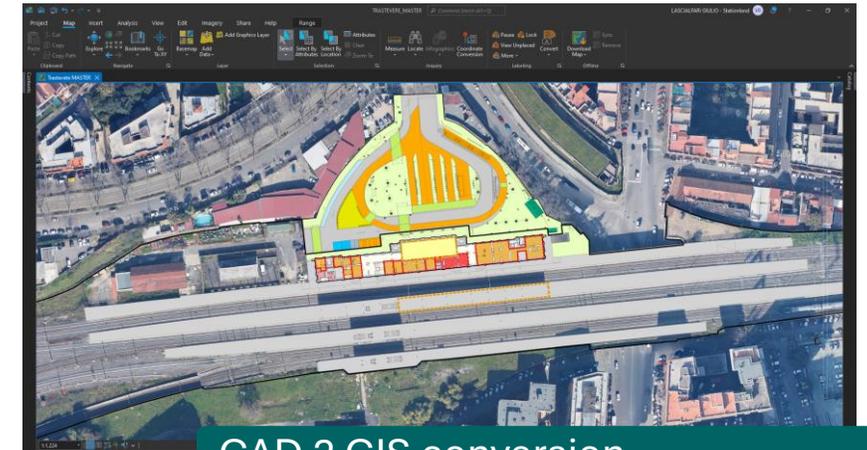
- 1) Preparation of the CAD environment of Georeferencing (one-off)
- 2) Georeferencing floor plans  
Creation of a basic CAD file for the georeferencing of the floor plans for all stations
- 3) Creating integration perimeters  
Using Architectural Objects, Cadastral objects, Rental Contracts, Functional areas of equal accessibility and visibility
- 4) Units creation and function pre-assignment  
Perimeter the rooms within each object and attribute a preliminary function of the units
- 5) CAD to GIS conversion and data integration
- 6) Deploying the GIS data in a central Geodatabase
- 7) Field verification and survey  
With the use of a Mobile App in the field, verification of unit functions and census of equipments



Integration perimeters



Units function pre-assignment



CAD 2 GIS conversion

# Workflow for Digitalization of 195 stations

**1** CAD Digitalization

CAD processing experts

**2** GIS Integration

GIS and CAD integration experts  
Knowledge of real estate and cadastral aspects

**3** Field survey

Maintenance and Commercial Asset Experts to be detected in the field

**Task#7 - Database Integration**  
Master data  
Technical data  
Architectural objects  
Rental properties  
Contracts

**Task#6 - Survey Equipment**  
Commercial relevance  
Maintenance relevance  
**Units**  
Type  
Access  
State

**Task#9 – database deploy**  
Unified Digital Model

**Task#8 - Database testing/Acceptance**

**Task#0 – Updating floor plans**

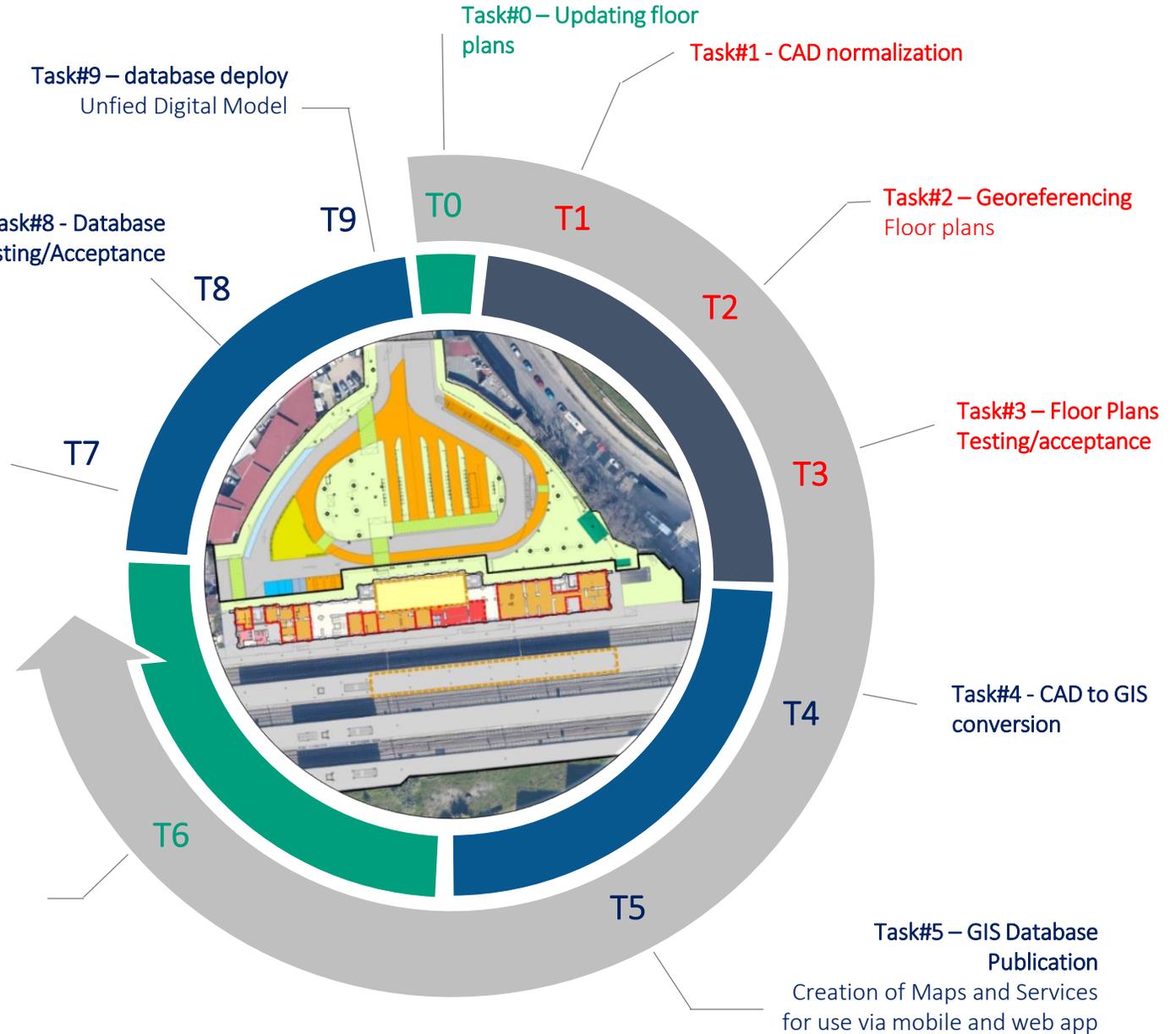
**Task#1 - CAD normalization**

**Task#2 – Georeferencing Floor plans**

**Task#3 – Floor Plans Testing/acceptance**

**Task#4 - CAD to GIS conversion**

**Task#5 – GIS Database Publication**  
Creation of Maps and Services for use via mobile and web app



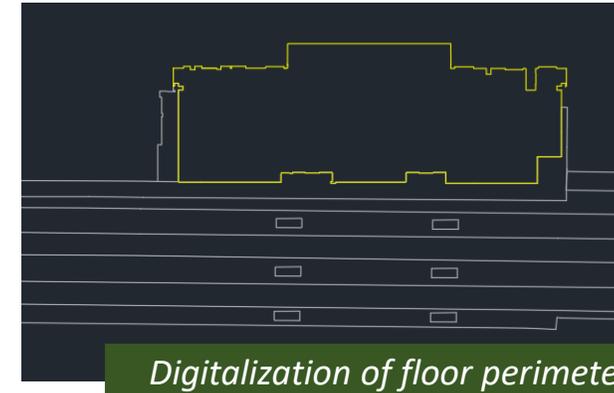
## 2) testing the digitalization process - POC Vicenza

### TASK 0: Updating of floor plans

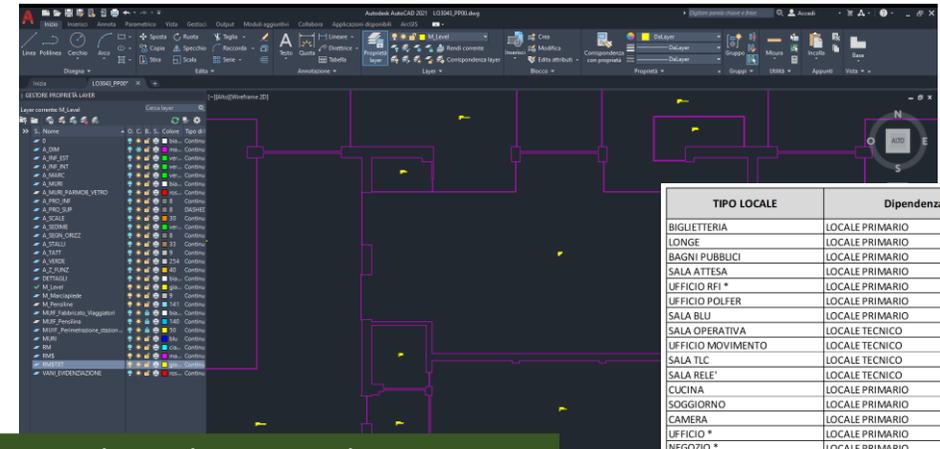
Pre-analysis on the status of the floor plans available

### TASK 1: CAD floor plan normalization - geometries & attributes

- CAD templates with layers according to standard nomenclature
- Digitalization of building floor perimeters;
- Geometry improvement processes:
  - geometries modified for connection with the detailed model of the floors: "Sidewalks" and "Porches"
  - newly created geometries: "Underpass", "Location Porche", "Station Square", "Parking Areas"
- Verification of the "Unit Type" nomenclature according to the data model specifications

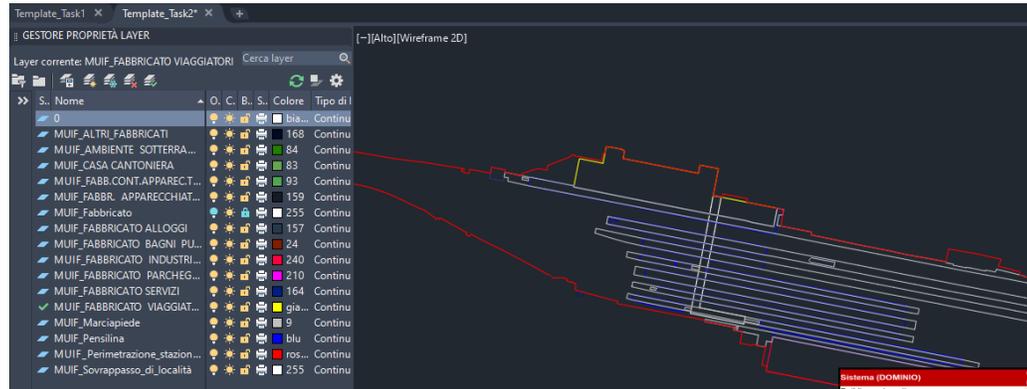


Digitalization of floor perimeters



Floor plan normalization

TIPO LOCALE	Dipendenza
BIGLIETTERIA	LOCALE PRIMARIO
LONGE	LOCALE PRIMARIO
BAGNI PUBBLICI	LOCALE PRIMARIO
SALA ATTESA	LOCALE PRIMARIO
UFFICIO RFI *	LOCALE PRIMARIO
UFFICIO POLFER	LOCALE PRIMARIO
SALA BILI	LOCALE PRIMARIO
SALA OPERATIVA	LOCALE TECNICO
UFFICIO MOVIMENTO	LOCALE TECNICO
SALA TLC	LOCALE TECNICO
SALA RELE'	LOCALE TECNICO
CUCINA	LOCALE PRIMARIO
SOGGIORNO	LOCALE PRIMARIO
CAMERA	LOCALE PRIMARIO
UFFICIO *	LOCALE PRIMARIO
NEGOZIO *	LOCALE PRIMARIO
MAGAZZINO	LOCALE PRIMARIO
RIPOSTIGLIO	LOCALE ACCESSORIO
SCOTTIETTO	LOCALE ACCESSORIO
BAGNO	LOCALE ACCESSORIO
BALCONE	LOCALE ACCESSORIO
TERRAZZO	LOCALE ACCESSORIO
ATRIO	LOCALE CONNETTIVO
CORRIDOIO	LOCALE CONNETTIVO
SCALE	LOCALE CONNETTIVO
ASCENSORE	LOCALE CONNETTIVO
* Altro da qualificare	



### TASK 2: CAD georeferencing

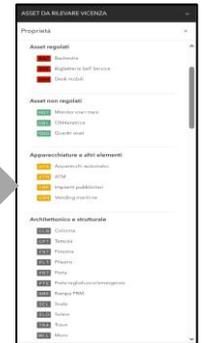
- Unique CAD template for georef. Plans
- CAD floor plans geographically placed

### TASK 3: CAD testing/acceptance

### TASK 4: CAD to GIS conversion and SAP data integration

### TASK 5: Data deploy in central data model

Sistema (DOMINIO)	Codice Asset (SOTTOTIPO)	Tipologico Asset (ALIAS SOTTOTIPO)	Mapping IFC
Building automation	RSM	Rack SEM	IfcUnaryControlElement
Gruppo asset regolati	BSS	Bigliettiere Self Service	
Gruppo asset regolati	DKM	Desk mobili	
Gruppo asset regolati	BAC	Banche	
Gruppo asset non regolati	OBL	Obliettrici	IfcBuildingElementProxy
Gruppo asset non regolati	QDO	Quadranti orari	
Gruppo asset non regolati	MOT	Monitor orari treni	
Gruppo apparecchiature e altri elementi	VDM	Vending machine	
Gruppo apparecchiature e altri elementi	APA	Apparecchi automatici	
Gruppo apparecchiature e altri elementi	ATM	ATM	
Gruppo apparecchiature e altri elementi	IMP	Impianti pubblicitari	
Gruppo arredi di stazione	RAB	Rastrelliere bici	IfcBuildingElementProxy
Gruppo arredi di stazione	SLA	Segrete a libero accesso	
Gruppo arredi di stazione	DEH	Dehor	
Gruppo arredi di stazione	FOR	Fioriere	
Gruppo arredi di stazione	FOR	Fontanelle	
Gruppo arredi di stazione	CST	Cestini	
Gruppo architettonico e strutturale	CLN	Colonna	IfcColumn
Gruppo architettonico e strutturale	CPT	Tettoia	IfcCovering
Gruppo architettonico e strutturale	FINT	Finestra	IfcWindow
Gruppo architettonico e strutturale	PRE	Porta	IfcDoor
Gruppo architettonico e strutturale	PTE	Porta tagliafuoco/emergenza	IfcDoor
Gruppo architettonico e strutturale	RMP	Rampa PPM	IfcRamp
Gruppo architettonico e strutturale	SCL	Scala	IfcStair
Gruppo architettonico e strutturale	SLO	Scala	IfcStair
Gruppo architettonico e strutturale	TRA	Trave	IfcBeam
Gruppo architettonico e strutturale	WLL	Muro	IfcWall
Gruppo architettonico e strutturale	PLT	Piastrino	IfcColumn
Impianto Antincendio	ADA	Apparato diffusione allarme	IfcAlarm
	AAA	Alimentazione idrica Antincendio	IfcDistributorSystem
	AVF	Attacco motopompa V.V.F.	IfcSuppressionTerminal
	CAI	Centrale antincendio	IfcUnaryControlElement

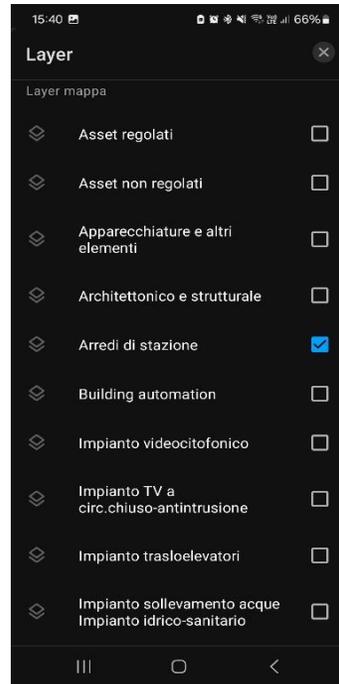


## TASK 6: Equipment survey and unit verification

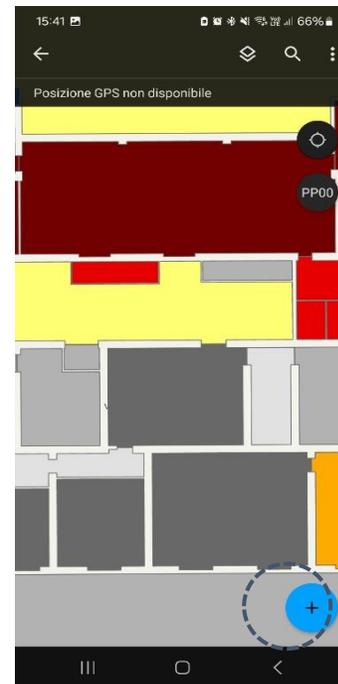
### Survey mobile app - Detecting equipments



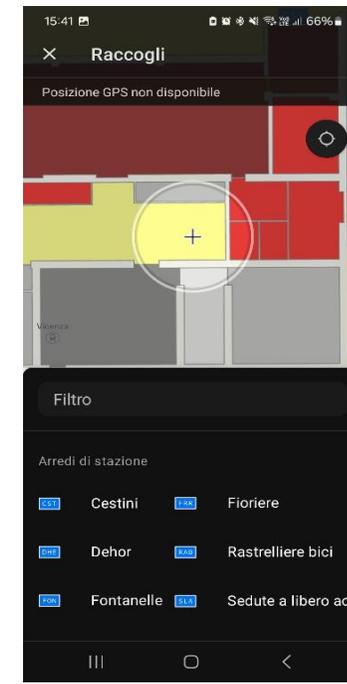
1. Data model published online (webGIS).



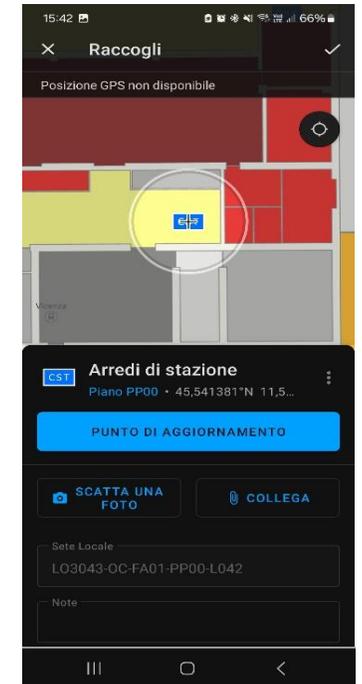
2. Choice of group/plant to detect equipment.



3. Zoom in to identify location.



4. Positioning and choice of the type of equipment to detect



5. Added information to the survey: photo, attachment, notes



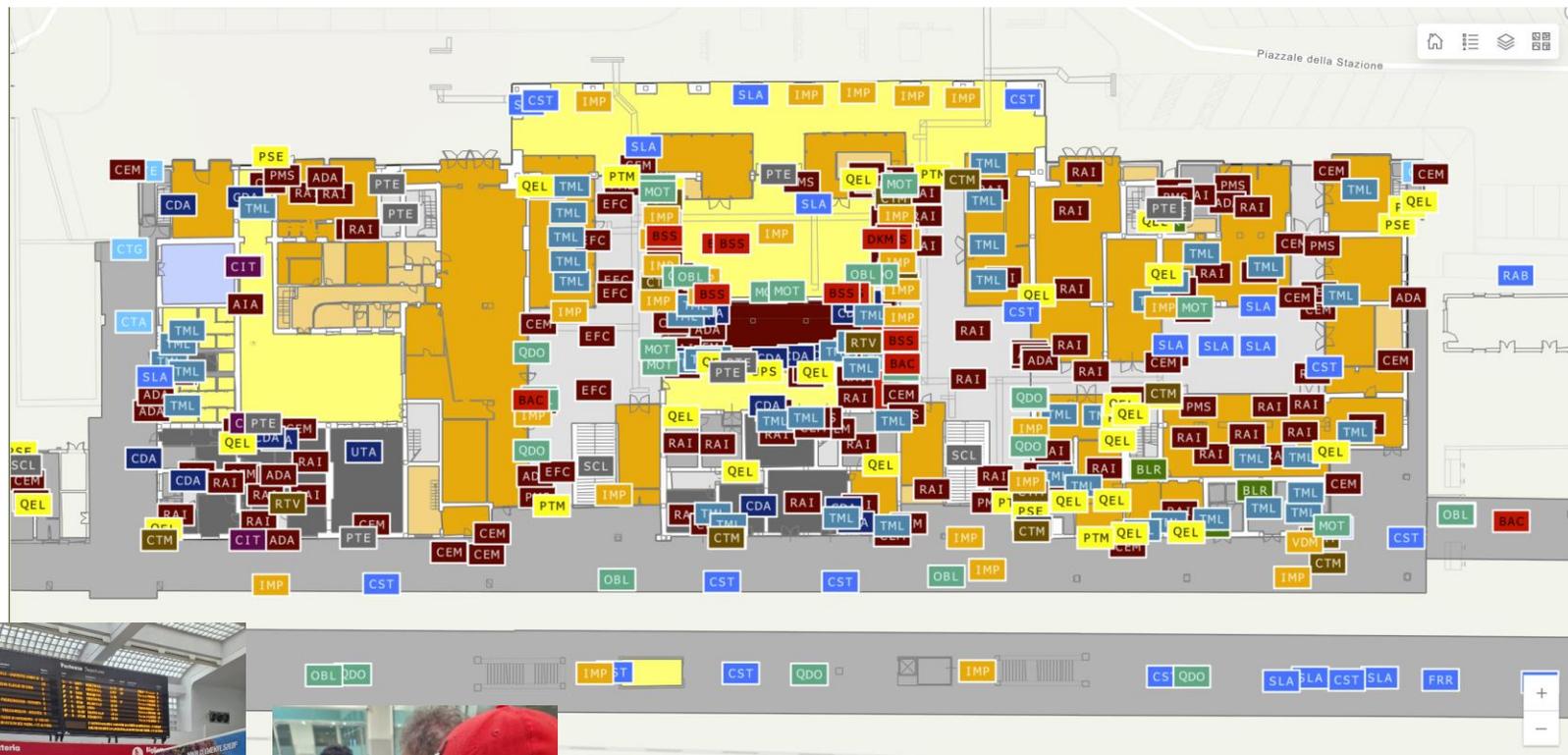
TASK 6: Survey results

600+ items detected

65 equipment types

261 units detected/verified

2 floors + 1 underpass  
4 sidewalks



STATO DI OCCUPAZIONE	Dipendenze	Descrizione
APERTO	TITOLO LOCATIVO LOCATO	Locale locato aperto
CHIUSO	TITOLO LOCATIVO LOCATO	Locale locato ma non in esercizio
LIBERO	TITOLO LOCATIVO NON LOCATO	locale libero
SOSPESO	TITOLO LOCATIVO LOCATO	Locate temporaneamente chiuso (lavori)
OCCUPATO	TITOLO LOCATIVO / NON LOCATO	Locale occupato senza titolo



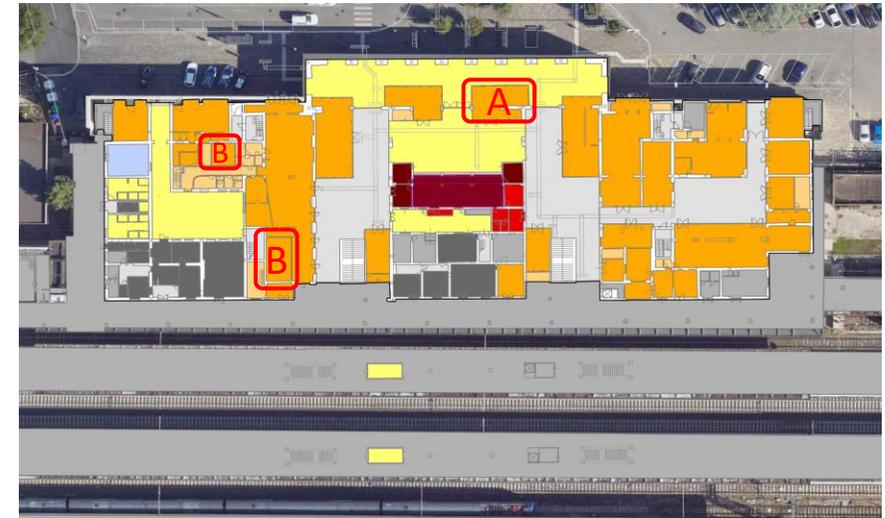
# POC Vicenza - Post-survey activities

TASK 7: Database integration

TASK 8: Database verification and testing

➤ Discrepancies and problems detected:

- Planimetric correction on a non-existent unit[A]
- units without access (walled) inside rented commercial premises[B]
- PUdS mismatch with occupancy status of units[C]
- Discrepancy between units present in PUdS Vicenza and Contracts



Digital model VICENZA Station



PUdS - Plan for the use of VICENZA Station





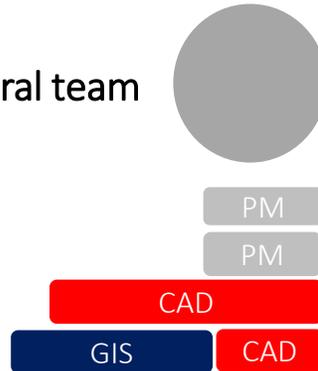
## c) Project - Working teams

### Central team

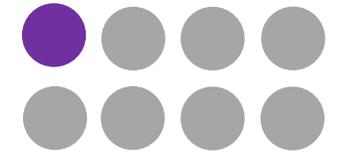
- Project Manager
- General staff
- CAD Expert Team
- 3 GIS/CAD Experts

#### Duties

- Centralization and management of floor plans
- Defining and Applying the Data Model
- Testing of collected data
- Training and support to the territory



### Regional Teams



- 1 Data Manager
- 1 CAD Expert
- Surveyors Team (spot)

#### Duties

- Testing of surveyed floor plans
- Survey of relevant assets



### Subcontractors



- Surveyors and CAD Team

#### Duties

- Planimetric update to the current state
- Normalization and georeferencing of floor plans
- Specific assets Survey



## c) Project - Execution plan

### *Preliminary activities*

**PH. 0** Preparatory activities for the start of the station digitalization project  
*By Q1 2024*

### *Digitalization activities*

**PH 1** Digitalization of the 195 Railway Stations  
*By Q3 2024*

### *Re-alignment activities*

**PH 2** Verification and alignment of the real estate database  
(cadastral remediation)  
*To be done*



**Interreg**



Co-funded by  
the European Union

**Italy – Croatia**

---

 **DIGITPORTS**

## Contacts



Esri Italia, IT



mdeminicis@esriitalia.it



+39 348 1934662 / +39 335 5758262



<https://www.italy-croatia.eu/it/web/digitports>