



# A working SDI: the Road Cadaster of Regione Friuli-Venezia Giulia

Integrated web and mobile GIS with 3D LIDAR support

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# About 3DGIS



- Italian GIS software house.
- **Opensource** solution provider.
- **Geospatial standards** adoption.
- Long time experience in geospatial software development.
- 3DGIS helps public and private organizations to **extract knowledge from location data**.

# SDI in the public sector



- 3D GIS helps organizations to **design, build, maintain and use their SDI.**
- 3D GIS software is based on the coordination of **standard de facto open-source software** and custom business logic.
- SDI is a **great opportunity.**
- Data knowledge and sharing among departments help **improving processes.**

# Friuli-Venezia Giulia road cadaster



## Tender request

- **Survey and database production** of the regional road cadaster.
- Data structure is based on DM 2001 (a specific Italian regulation), plus a few addition.
- Past **experiences of both road cadaster and 3D urban data management** have set the foundations upon which our solution proposal has been built.

# Our proposal



- We wanted to take into account the **complete data lifecycle** of both graph and non-graph data, **from collection to update**, leveraging SDI.
- Survey involved a **Mobile Mapping System and a Helicopter**, for both imagery and LIDAR acquisition.
- A **WebGIS has been developed** to make 2D and 3D data work together, streaming **LiDAR directly in the browser**.
- An **Android app** has also been developed to bring data on the field.

**3.380** km roads

**7.082.583** events

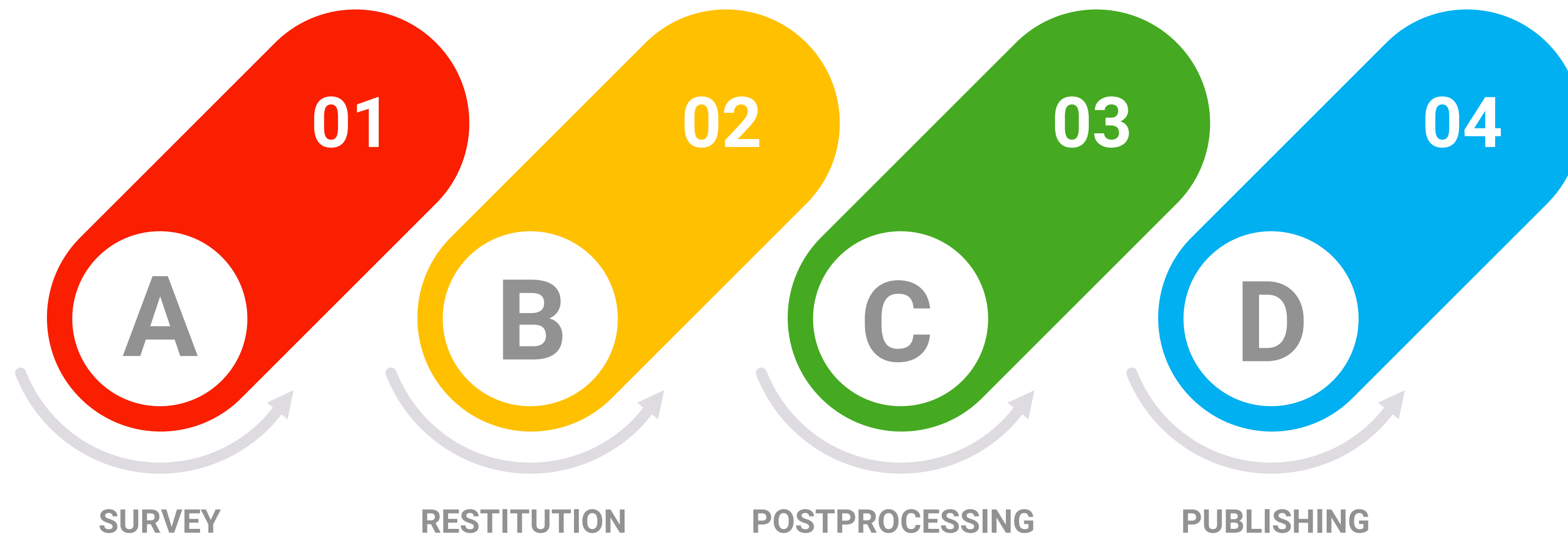
**24.250** GB imagery & LIDAR

**2.000+** GCP

# Road data lifecycle

## From acquisition to maintenance

- One aim of the project is to **enable the subsequent update of road data** and the collection of newly built roads.



# Road data lifecycle



## Data restitution process





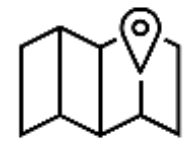
# Overall system design



## INTERNAL



**PostgreSQL  
PostGIS**



**Geoserver**



**Geowebcache**



**Geonetwork**



**CKAN**

## BUSINESS LOGIC

### CARTO PLATFORM

**Road data processor**

**WebGIS**

**LIDAR & Imagery  
processor**

**Android app**

**Webservices**

**3D viewer**

## EXTERNAL



**S3 API STORAGE**



**QGIS**



**OGC SERVICES**



**REST API USERS**

# Designed for cloud computing



- Every business tier component is based on the **Service Oriented Architecture** paradigm.
- Every piece of the software solution is running in a **container** and is orchestrated / deployed automatically.
- Most **data storage leverages the Object Based paradigm** (S3 API).
- The platform has been named **carto**.

# The carto ecosystem



## Data visualisation and orchestration platform

### DATA PROCESSING

CARTO RDP

LIDAR  
PROCESSOR

IMAGERY  
PROCESSOR

### WEBGIS

CARTO.WEB

CITYVU

### MOBILE

CARTO.APP

# The carto ecosystem



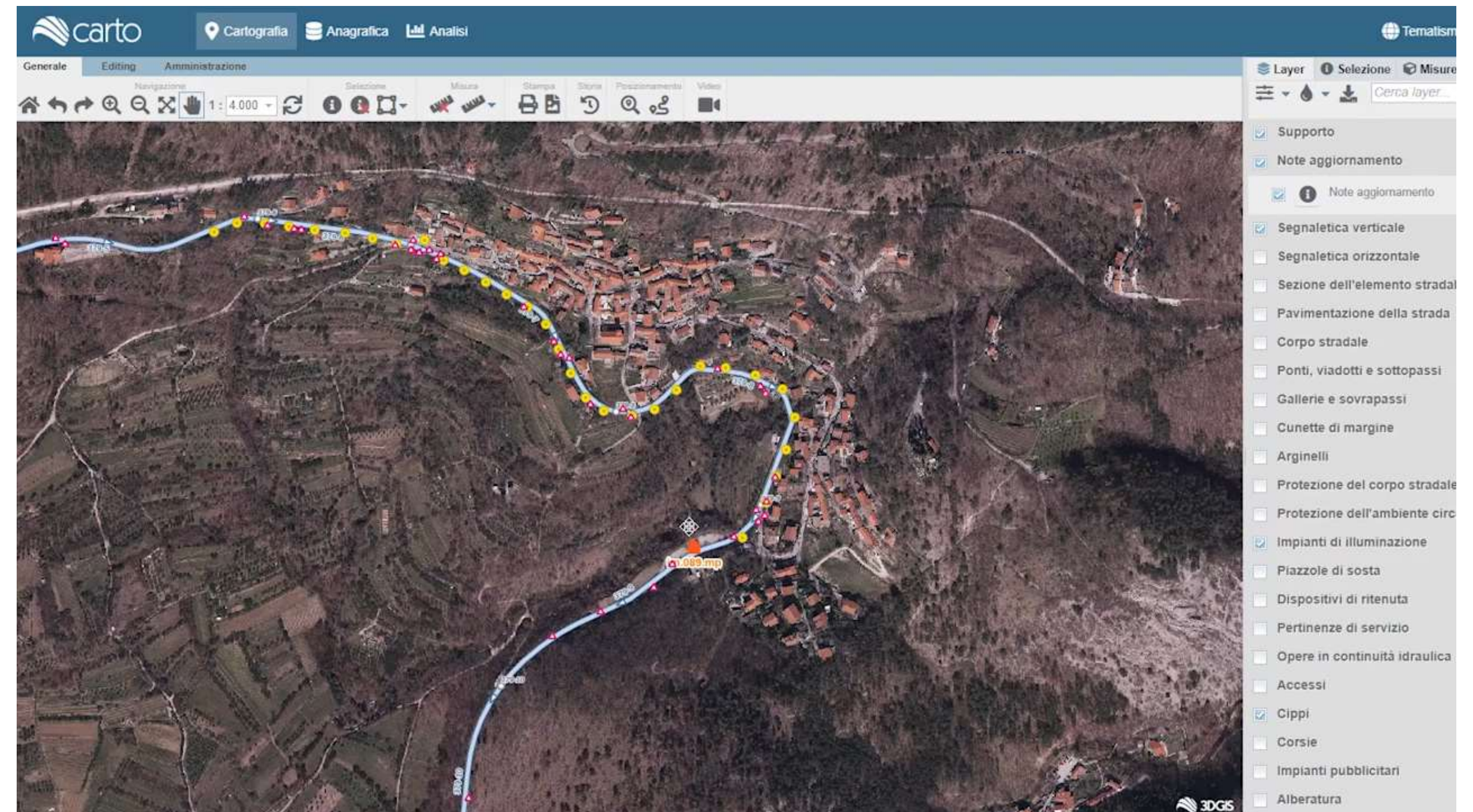
## Features worth noting

- **Web-based geometric editing** with access control and **versioning / auditing**
- 3D support + 2.5D augmentation
- **Typed dynamic data model**
- Road imagery and LiDAR integration
- Data analysis tool
- **Mobile app**
- OGC WMS / WMTS services and **REST API**
- **OGC services relay** with permission management

# Road data management

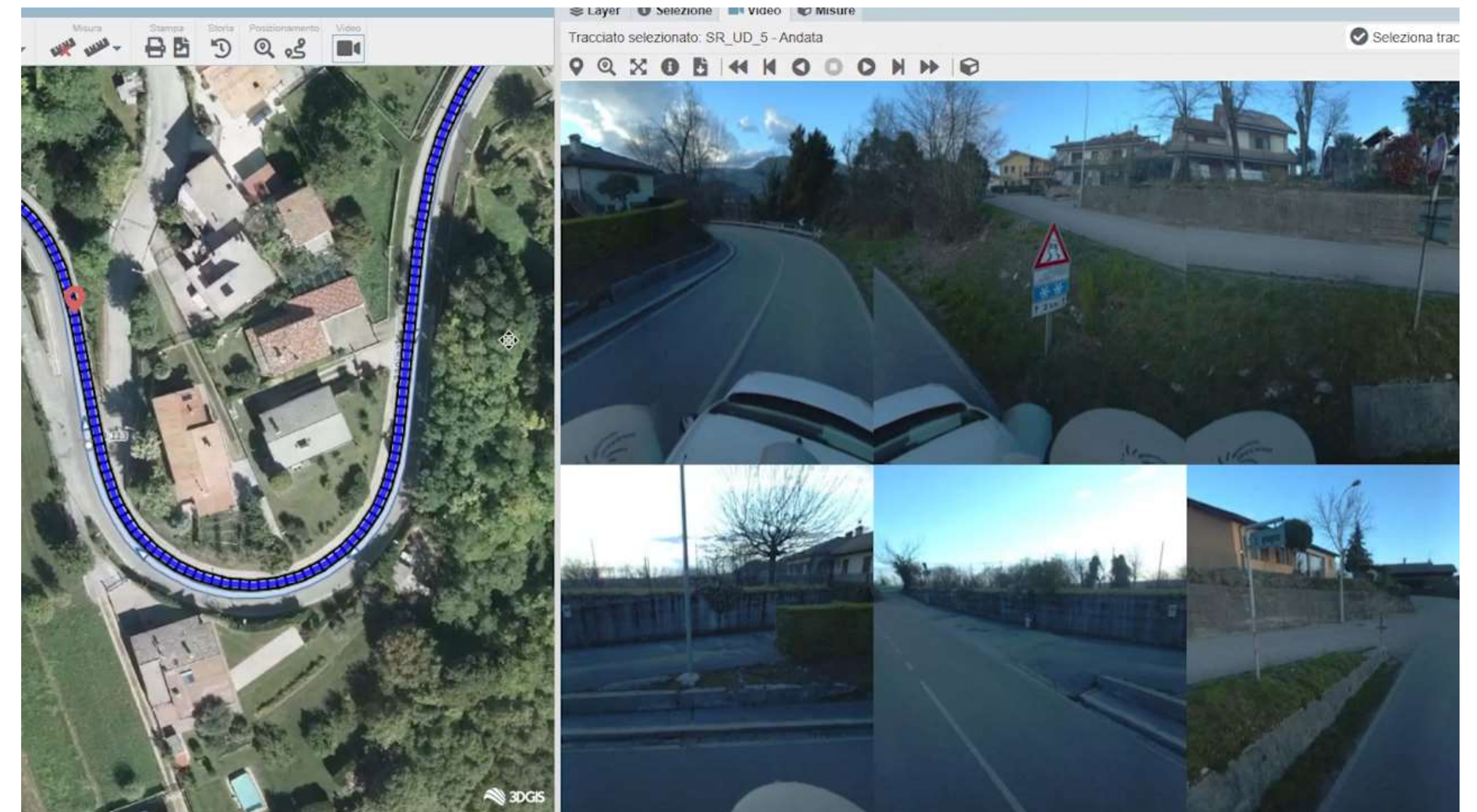


- Carto manages **data acquisition and update**.
- Changes are tracked.
- Road events organized in classes.
- Road signs drawn on the map.



# Imagery and LiDAR

- We had to process about 40 TB of raw data (imagery and LIDAR).
- Preprocessing is an intensive task.
- LIDAR visualization is made possible by Cityvu, which communicates with Carto using web socket.



# Analysis tool



- Current geodatabase accounts for more than 2500 events per kilometer.
- Large sets of **data need to be analyzed with automated tools**, with user defined rules.
- We built a tool for that.

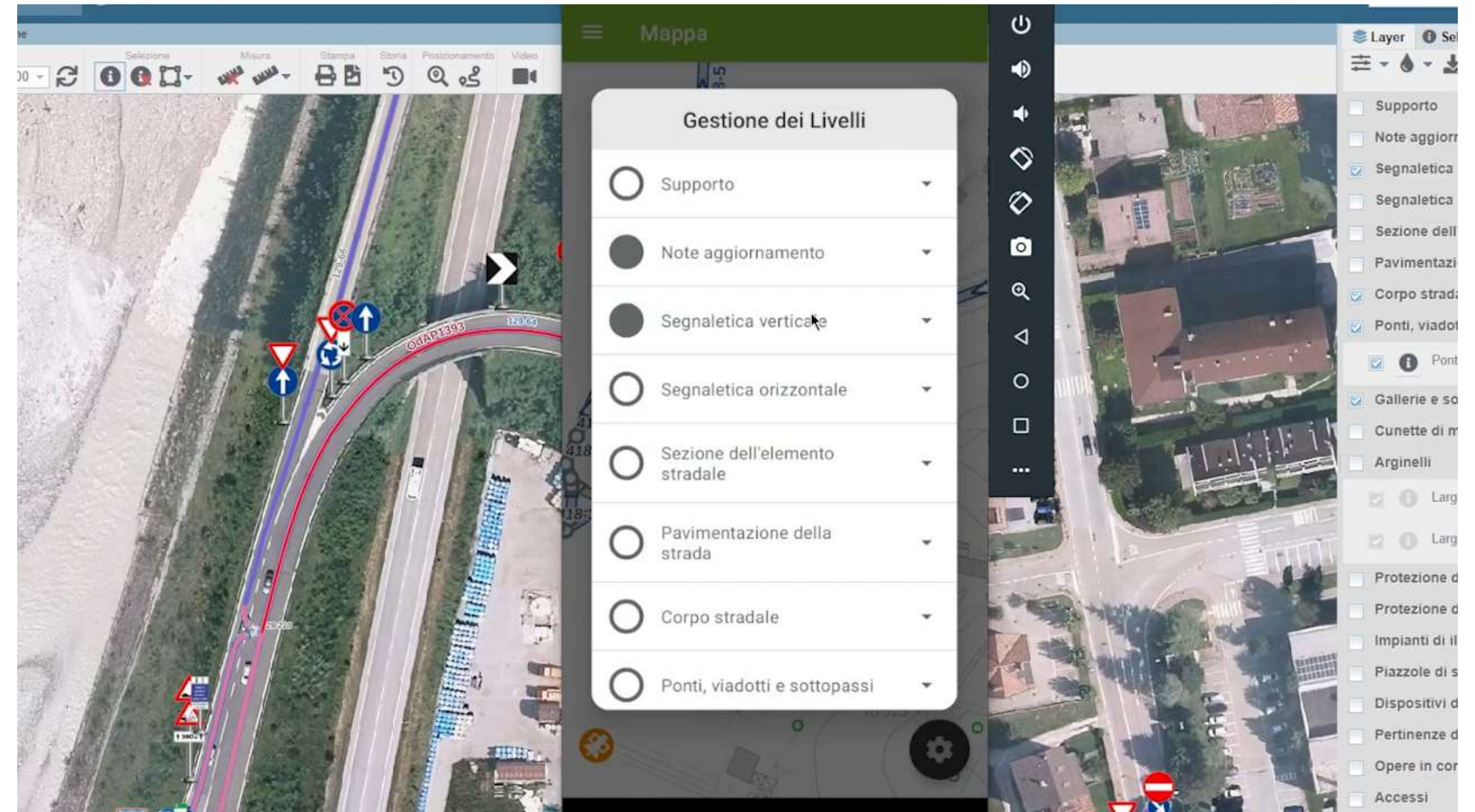
The screenshot shows the 'Modelli' (Models) interface in the Carto application. The interface includes a search bar at the top left, a navigation menu on the left with options like 'Editor modello', 'Modelli', 'Elaborazioni', and 'Grafici', and a main table of models. The table has columns for 'ID', 'Nome', 'Utente', and 'Esegui in automatico'. The table contains 17 rows of data, each representing a different analysis model.

ID	Nome	Utente	Esegui in automatico
17	Ponti e viadotti con luce minore di 6	Maria Anna Boniello	No
12	Ponti e viadotti con luce maggiore di 6 m	Maria Anna Boniello	No
14	Lunghezza per route di ponti e viadotti con luce superiore ai 6 m	Maria Anna Boniello	No
18	Lunghezza per route delle strade da geometria 2 2	Erik Sferco	No
5	Lunghezza per route delle strade da geometria 2	Nicola Tripani	No
1	Lunghezza per route delle strade da geometria	3D GIS	No
9	Lunghezza per route delle gallerie lunghezza superiore 200 m	Maria Anna Boniello	No
4	Lunghezza per route delle gallerie	3D GIS	No
2	Lunghezza per route dei ponti	3D GIS	No
13	Lunghezza per route dei cavalcavia	Maria Anna Boniello	No
8	Lunghezza del percorso principale delle route da geometria 2	Nicola Tripani	No
6	Lunghezza del percorso principale delle route da geometria	Francesco Dolcetto	No
7	Lunghezza del percorso laterale delle route da geometria	Francesco Dolcetto	No
3	Luce totale ponti per route	3D GIS	No
10	Gallerie lunghezza superiore 200 m	Maria Anna Boniello	No
15	Conteggio Ponti e viadotti	Maria Anna Boniello	No
16	Conteggio gallerie e sovrappassi	Maria Anna Boniello	No
11	Cavalcavia	Maria Anna Boniello	No

# Carto.app



- Operators working on very large road assets could need **data access directly on the field**, to inspect or update road data.
- We developed an **Android app that can be used to view and edit data** in every place.





# Next steps



- **Integrated maintenance planning and workforce management.**
- **Business intelligence** support for analysis tool.
- AR / VR support.
- **INSPIRE theme** for transportation data.

# Conclusions



- Our solution leverages the **intrinsic power of the spatial data infrastructure.**
- Customer is planning to distribute data access to the municipalities.
- We created a **common framework for road data management**, which can be employed to support a variety of needs.
- In fact, the **system has already been extended** and now includes cyclable paths.

# Q & A

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