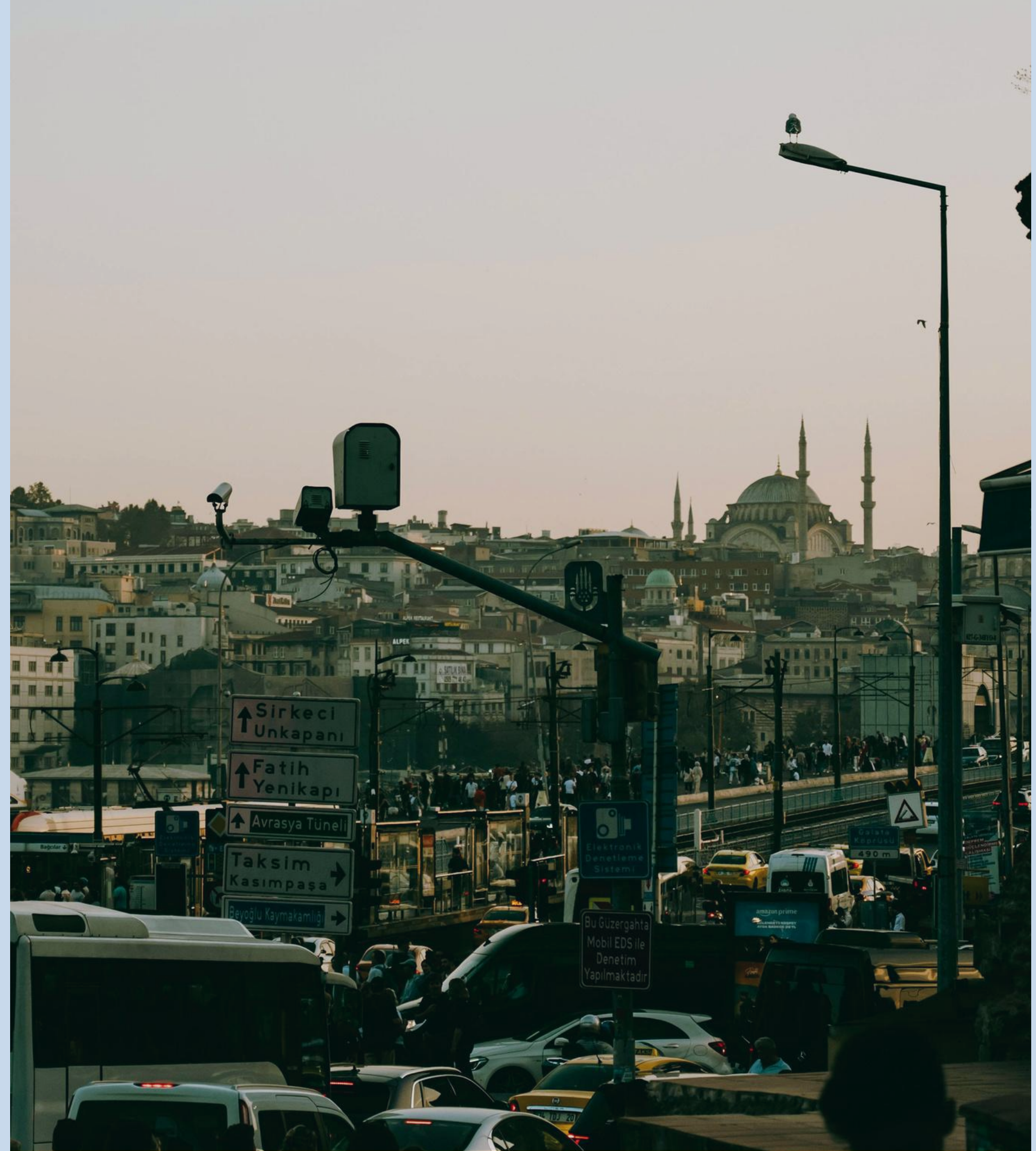




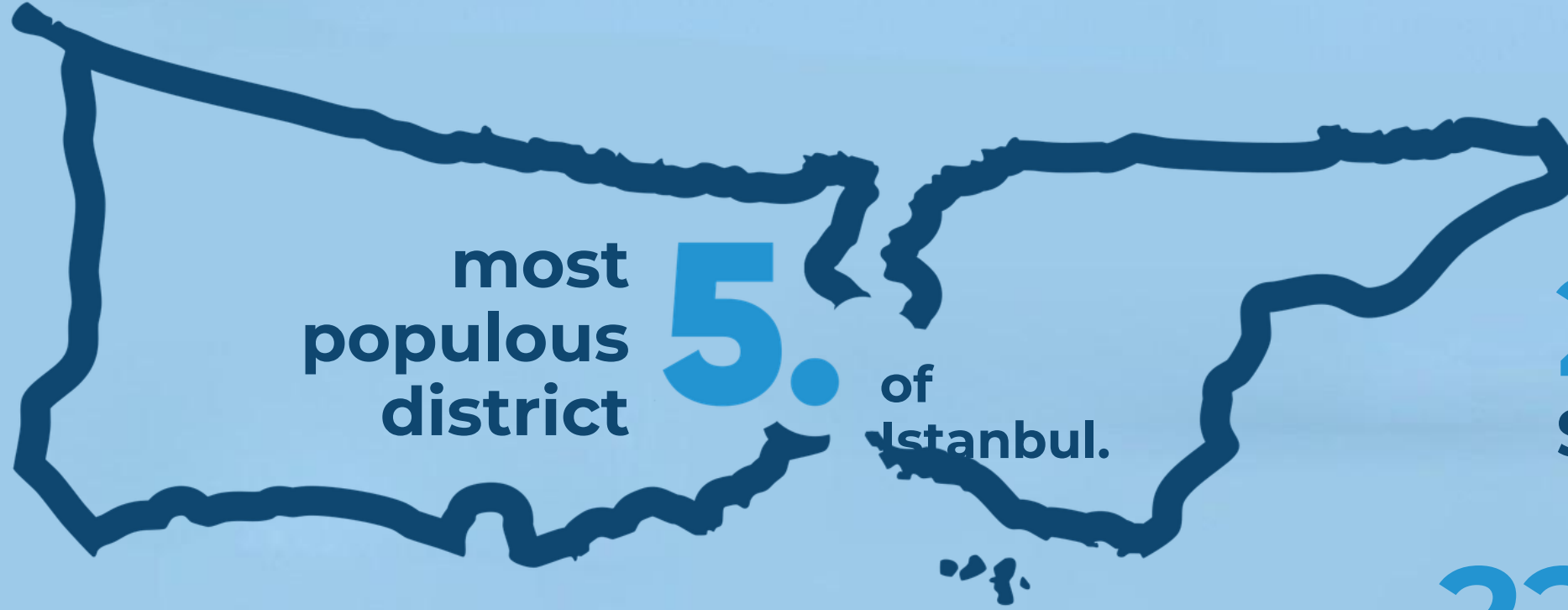
Digital Twin of the City: Sustainable Urban Management

Cüneyt YILMAZ
IT Manager





BAĞCILAR



most
populous
district

5.

of
Istanbul.

22 km²

Surface Area

22

District

Residing in Istanbul out of

every **100**
individuals

4.5 living in Bağcılar

32.165

Population density (number of
individuals per square kilometer)



707.635

Total Population

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Our Smart City Vision



To enhance the picture of life for our fellow citizens from Bağcılar.



To develop all services with a human-centered approach and to deliver them with technological support.



City > Intelligent City
Municipality > e-Municipality,
Citizens > Digital Citizens
Transforming



E-TRANSFORMATION

Chronology

26

History

Hardware
Infrastructure
Development, Digital
Archiving, Employee IT
Transformation

Establishing a
Secure Data
Infrastructure for
the Financial
System, Field
Applications

BAGBI AI-Powered
Chatbot and
Mobile Applications

2000

2005

2010

2015

2019

2022

Near Future

Management
Information
System, Mapping
and Numbering
Studies

Electronic Document
Management System(CRM),
Web Management System,
Process Management, Free
Internet Project, Integrated
Corporate Governance Platform

AI-Powered Smart
Application
Management

Blockchain, GIS-
Based AI
Applications,
Sustainable City
Management,
Metaverse

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Smart City Management



BAĞCILAR MUNICIPALITY SMART CITY MANAGEMENT
IS CARRIED OUT UNDER TWO MAIN HEADINGS



Digital Citizienship



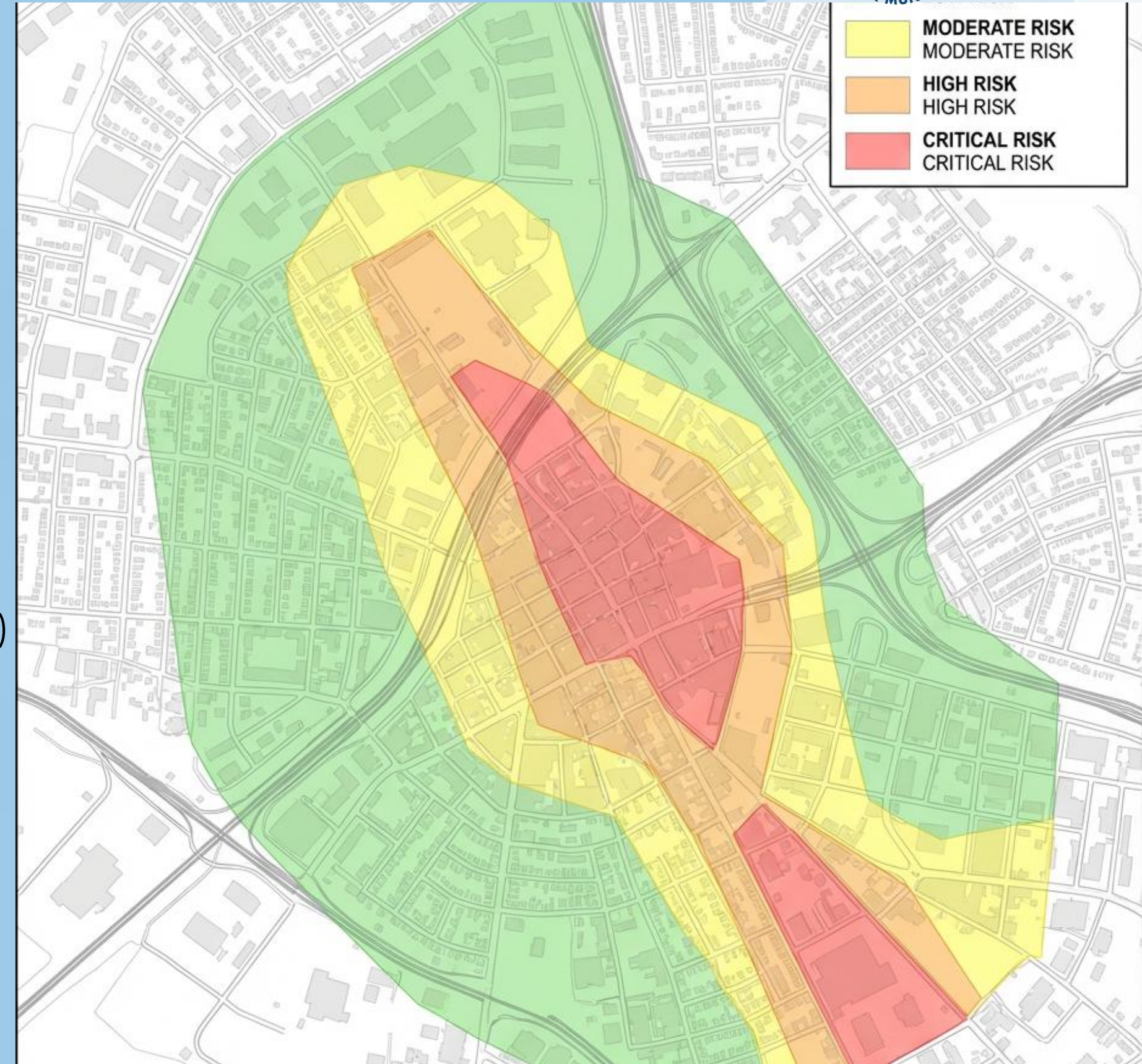
Digital City Twin

PROBLEM DEFINITION

Bagcilar Before Digital Transformation

The 5th most populous district of Istanbul ranks 4th among the regions with the highest earthquake risk.

- ⚠ 10,622 damaged buildings (Very Severe / Severe / Moderate)
- ⚠ Istanbul ranks 4th in terms of potential loss of life.
- ⚠ Building stock problems
- ⚠ Field inspections are entirely labor-intensive.



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Problem and Needs Analysis



Data and Field Challenges



%50+ Lack of Spatial Data

More than half of the 42,000 buildings lacked digital spatial data.



Manual Field Inspection Requirement

Each building had to be inspected individually to assess their risk and architectural condition.



Long Processing Times

Using traditional methods, creating applications took up to 210 seconds.

Operational Inefficiency and Cost



Paper-Based Manual Processes

Maintenance, repair, and licensing processes were entirely paper-based and progressed slowly.



Reactive Complaint Management

Problems could not be identified in advance; action was only taken after citizens complained.



High-Cost Field Patrols

The continuous employment of vehicles and personnel for the investigations resulted in high fuel and labor costs.

THE CURRENT SITUATION

- ✗ 70% of the 42,000 buildings lack up-to-date data.
- ✗ Lack of information about buildings constructed before 2007 — a 14-year data gap.
- ✗ Field and file information do not match.
- ✗ The 580 km road cannot be systematically monitored.

Outdated Data · Fieldwork

15-Year Data Gap (1992–2007)

Population: 707,635 · Earthquake Risk: High · Ranked 4th in Istanbul in terms of risk of fatalities.



Purpose/Vision

- Enabling the institution to quickly assess the situation **(risk analysis)** using up-to-date data in emergency and disaster situations.
- Enabling on-site inspections regarding **zoning regulations**.
- By **sustainably** monitoring the status of the building stock (licensed/unlicensed, risky/safe, etc.),
- By resolving the discrepancies between the actual situation on the ground and the situation in the file, **The aim is to update the building stock inventory.**

In addition, it will provide important infrastructure support for current and real-time building inventory in the city and for **strategic city management**.



Project Management

The technical coordination is carried out with the contribution of the IT Department and other units (Urban Design, Planning and Projects, Licensing and Inspection, Municipal Police, Financial Services, Zoning and Urban Planning).

To investigate the labor efficiency of conducting building inspections using 3D and 360° district views, a pilot study was conducted in Bağlar Neighborhood (LoD 2 level) and 17 buildings covering the building overhangs and ground footprint on 7th Street, using 3D sample drawings at LoD 2.5 level with LiDAR technology and 3D terrain imaging.

Using a mobile imaging tool, 360-degree panoramic street views (current) and LiDAR point cloud data have been collected and are now being published for the entire district.

Thus, the aim is to conduct efficient desk-based audits to verify current images and digital archive records of the entire district with less manpower.

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Solutions and Objectives



Four interconnected technology layers — a single platform, full coverage.



LiDAR Technology

- ✓ 580 km of street photography
- ✓ Precise 3D terrain data
- ✓ Point cloud technology



3D Modeling

- ✓ Digital twins of 42,000 buildings.
- ✓ LoD 2 & 2.5 detail level
- ✓ 360° panoramic images



IoT Sensor Network

- ✓ 52 sensors and cameras
- ✓ Noise, heat, smoke
- ✓ Real-time data and continuous monitoring.



AI System

- ✓ Decision support system integration
- ✓ Automatic illegal construction detection
- ✓ Scenario simulations

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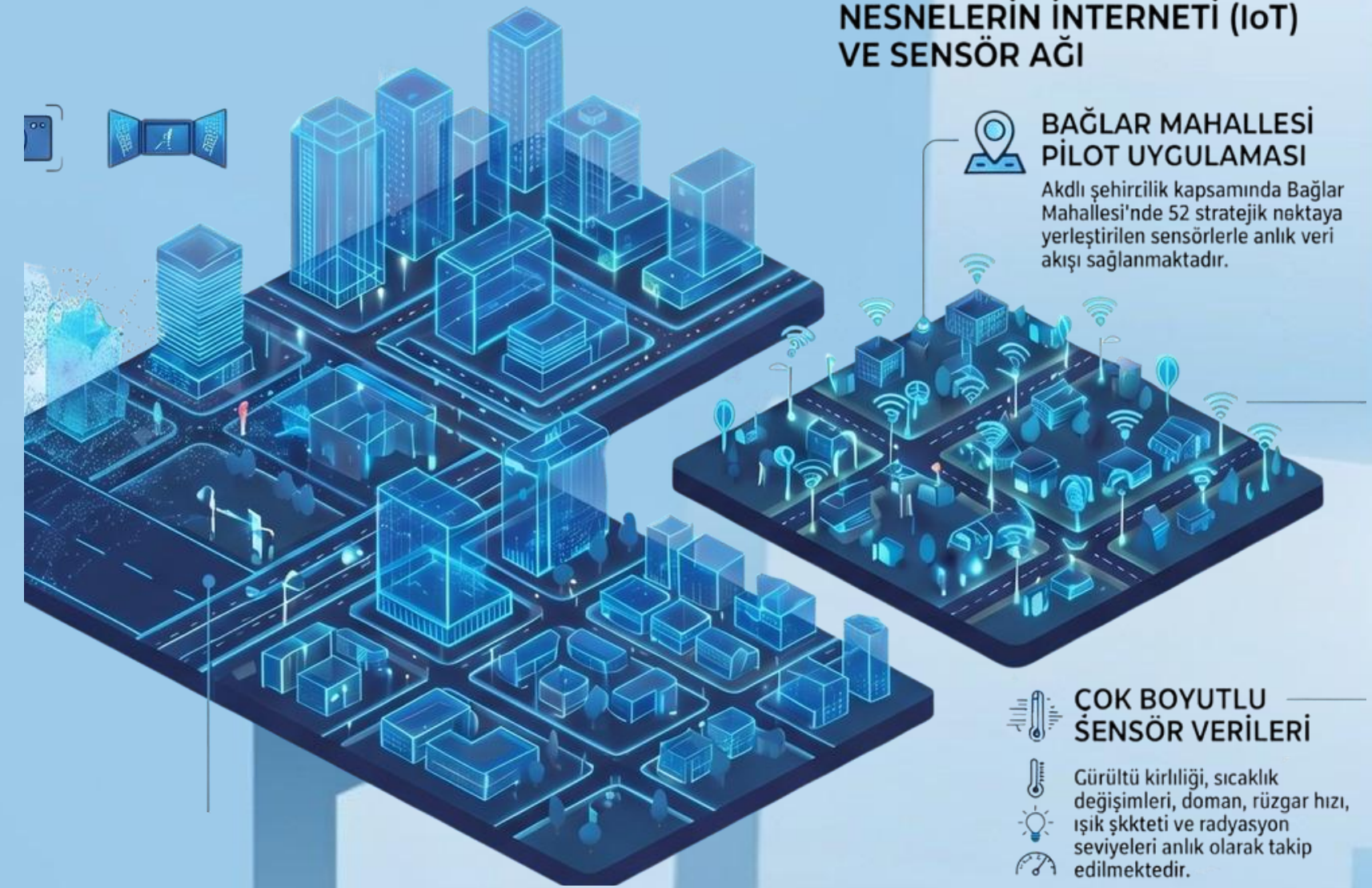
Solution: New Situation



NEW SITUATION

- ✓ All 42,000 structures are in 3D model and inventory.
- ✓ 360° panoramic street views — interactive access
- ✓ Building information updated in real time.
- ✓ Desk-based inspections and illegal construction detection.
- ✓ Scientific data infrastructure for disaster risk management.

100% District Coverage · 22 Neighborhoods
Smart City Infrastructure



Real-Time Data · Desk Monitoring

PHASE 1

1. Month



Preparation

- Project team setup
- Opening meeting
- AI Awareness Survey
- Staff training

PHASE 2

2–4. Month



Procurement & Tendering

- Technical requirements
- Tender processes
- Supplier selection
- Contract signatures

PHASE 3

5–8. Month



Application

- LiDAR images
- 3D model creation
- IoT sensor installation
- AI integration

PHASE 4

9–12. Month



Completion

- Hackathon competition
- Education & dissemination
- Reporting
- Technical visits

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Solutions and Innovation



SOLUTION AND INNOVATION

Safer Cities Through Artificial Intelligence and Innovation

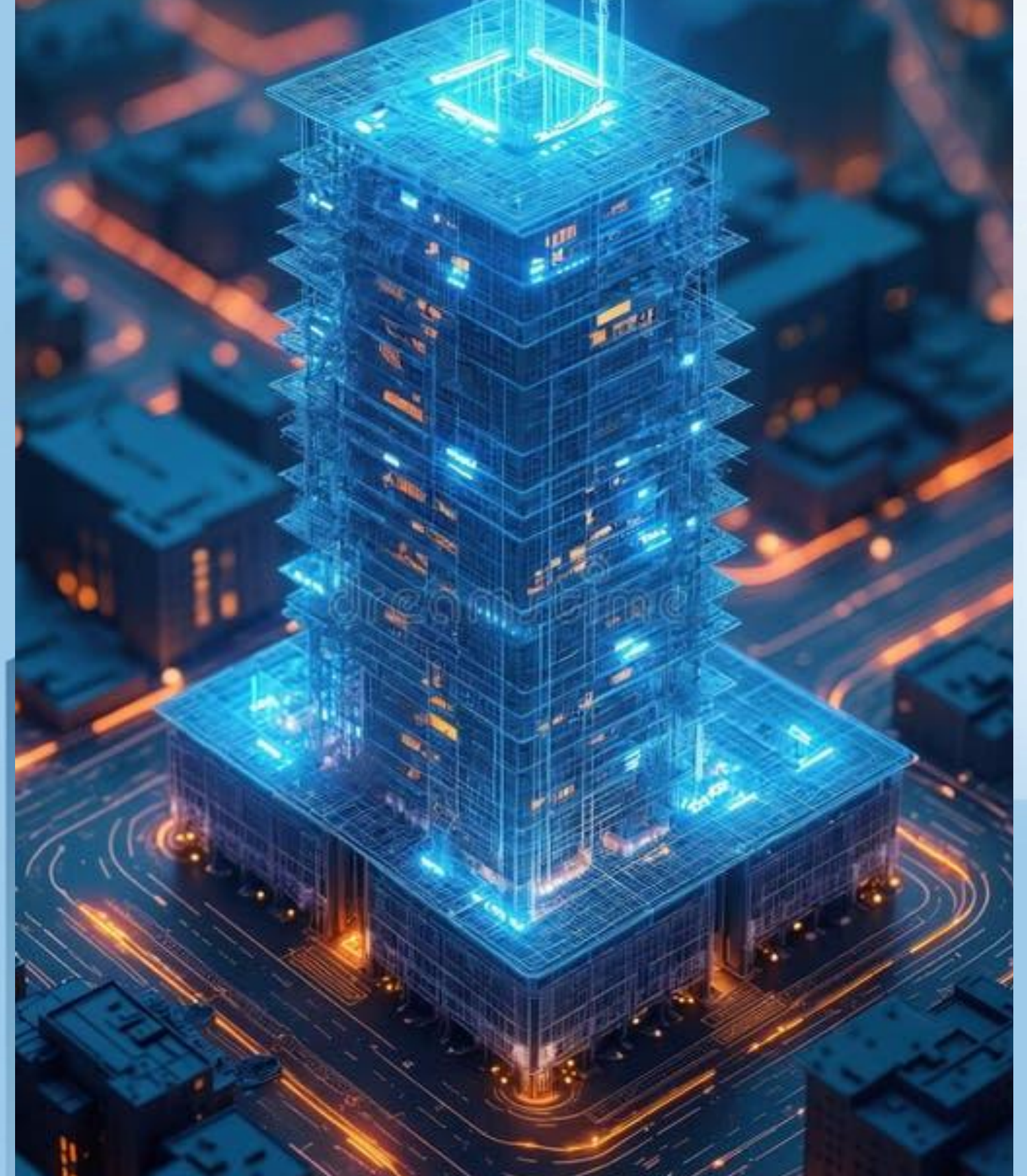
LiDAR · 3D Modeling · IoT · Artificial Intelligence — four technologies, one platform.

LiDAR Technology

3D Modeling

IoT Sensors

Artificial
intelligence



Transformation of Building Documents

Within the scope of the Digital City Twin Project, and in line with the building stock inventory updating efforts, documents relating to a total of 40.761 buildings located in Bağlar, Yenigün, Sancaktepe, Merkez, Barbaros, İnönü, Hürriyet, Kazımkarabekir, Çınar and Fevziçakmak neighborhoods have been converted into information using only the municipality's own resources.

Total number of buildings	40.761
Number of buildings for which a building suspension report was issued	9.865
Number of buildings with construction permits	21.501
Number of buildings with occupancy permits	11.125
Number of buildings with building registration certificates	4.179
Number of buildings with burned down/destroyed oved	8.413

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BEFORE - AFTER



Bağcılar: Bridging the Gap Between the Physical and Digital City

THE REAL FOUNDATION (URBAN DATA)

Comprehensive inventory updates across 13 neighborhoods, including Bağier, Yenigün, and Merkez.

23,134
UPDATED BUILDING
DATA POINTS

Capturing street-level and aerial imagery to document physical state.



Integration of building permits, occupancy certificates, and disaster risk records into a singular physical database.



AI-POWERED DIGITAL CITY TWIN

- A virtual model designed for disaster management, urban planning, and proactive citizen services.
- utilizing LiDAR Mapping.

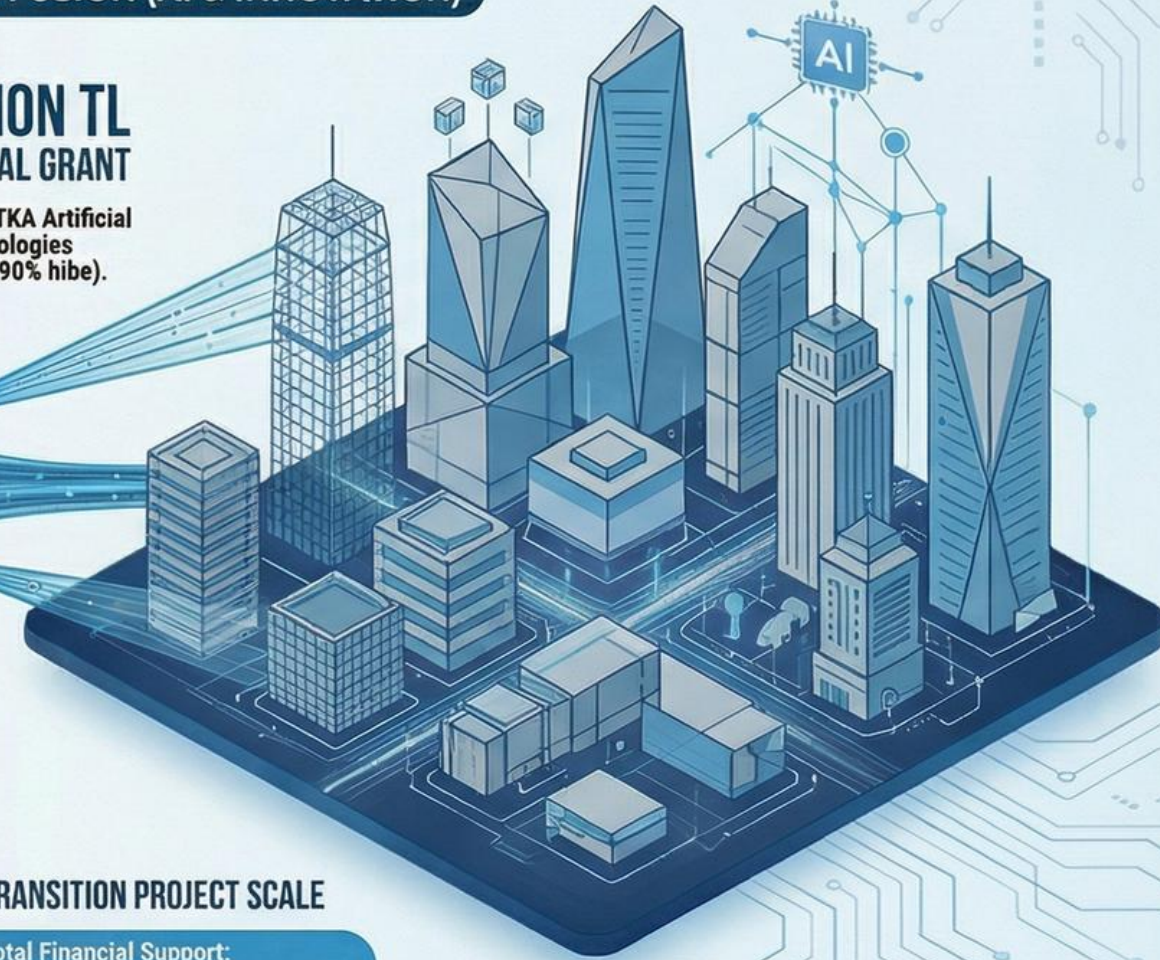
THE DIGITAL FUSION (AI & INNOVATION)

14 MILLION TL
FINANCIAL GRANT

Secured via the ISTKA Artificial Intelligence Technologies Support Program (90% hibeler).

DIGITAL TRANSITION PROJECT SCALE

- Total Financial Support: 14,000,000 TL (137%A)
- Data Update Coverage: 23,134 Physical Buildings
- Technology Core: AI & LiDAR Mapping

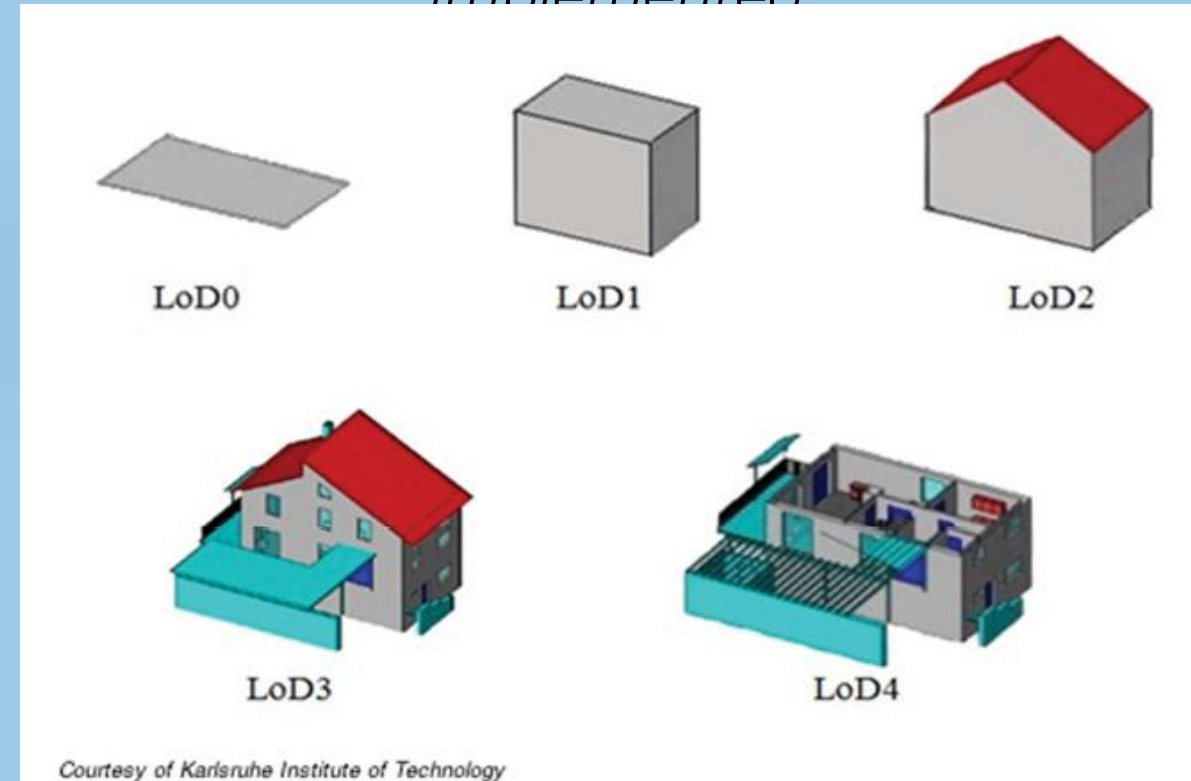


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Project Scale - Bağlar Pilot



Pilot success has been scaled up to the entire district — LoD 2 and 2.5 detail levels were implemented



Courtesy of Karlsruhe Institute of Technology



📶 Sensor Network

52 Sensors (Pilot) and Cameras

- ✓ Temperature, noise, and smoke are being monitored.
- ✓ Real-time data stream

🏠 3D Kent Models

Digital Model of All Structures

- ✓ LoD 2–2.5 level of detail
- ✓ Bağlar Neighborhood full coverage

🔗 System Integration

100+ Mobile/Web Integrations

- ✓ Connected to the Management Information System
- ✓ Access to real-time data

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Measurable Outputs



42.000

Digitized Structure

3D model + detailed inventory



580

Square meters drawn

22 neighborhoods fully covered



2.235

Oblique Survey Hectare

Orthophoto, aerial photograph.



27.500

City Inventory

Signs, traffic signs, sidewalks, etc.



707.635

Beneficiary Citizen

Direct and indirect



12

Project Duration

Month (October 2025–September 2026)

From Project to Corporate System

Administrative Unit: Information Technology Department



Staff Capacity

20-person technical team
Artificial Intelligence training planning



Corporate Ownership

Prioritization in the strategic plan
All directorates are active users.



Technology Upgrade

Periodic system updates
Adding new data modules

Transition to 3D-Enabled E-Permits

End-to-end visualization and tracking of all permit processes (new construction, renovation, demolition, etc.) on the 3D digital twin from application to approval.

© 2021–2025 National AI Strategy

Objective 6.2: Structural and competency transformation towards the effective use of artificial intelligence technologies in public institutions.

📄 Republic of Turkey 2024–2026 Medium-Term Program

Digital Transformation: Aiming to ensure savings, security, and continuity in public service delivery.

|| Twelfth Development Plan 2024–2028

Smart management applications aimed at making public buildings more efficient.

🌐 2024–2030 National Smart Cities Strategy

Native smart city technologies · Metaverse and interactive digital twin applications

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Impact Model - Adaptability



Beginning

The Bağcılar model is becoming the national standard.

**1
District**

Bagcilar Municipality



Artificial Intelligence Platform — Successful Pilot
707,635 citizens · 42,000 buildings

Potential

**39
Districts**

39 Istanbul Districts



Same model — same platform.
Istanbul has a population of 15+ million.

Vision

**81
City**

81 Provinces of Türkiye



National Smart City Standard

Türkiye's Digital Transformation Vision for the Century

Objective

World

Global Goal



International Scope

Exporting the smart city model to cities around the world.

Budget Structure



● ISTKA Support ● Municipality Share



📁 **548.965 USD (%100)**

Total Project Budget

12-month implementation budget

📈 **322.130 USD (%59)**

Requested Support

Istanbul Development Agency (ISTKA) grant

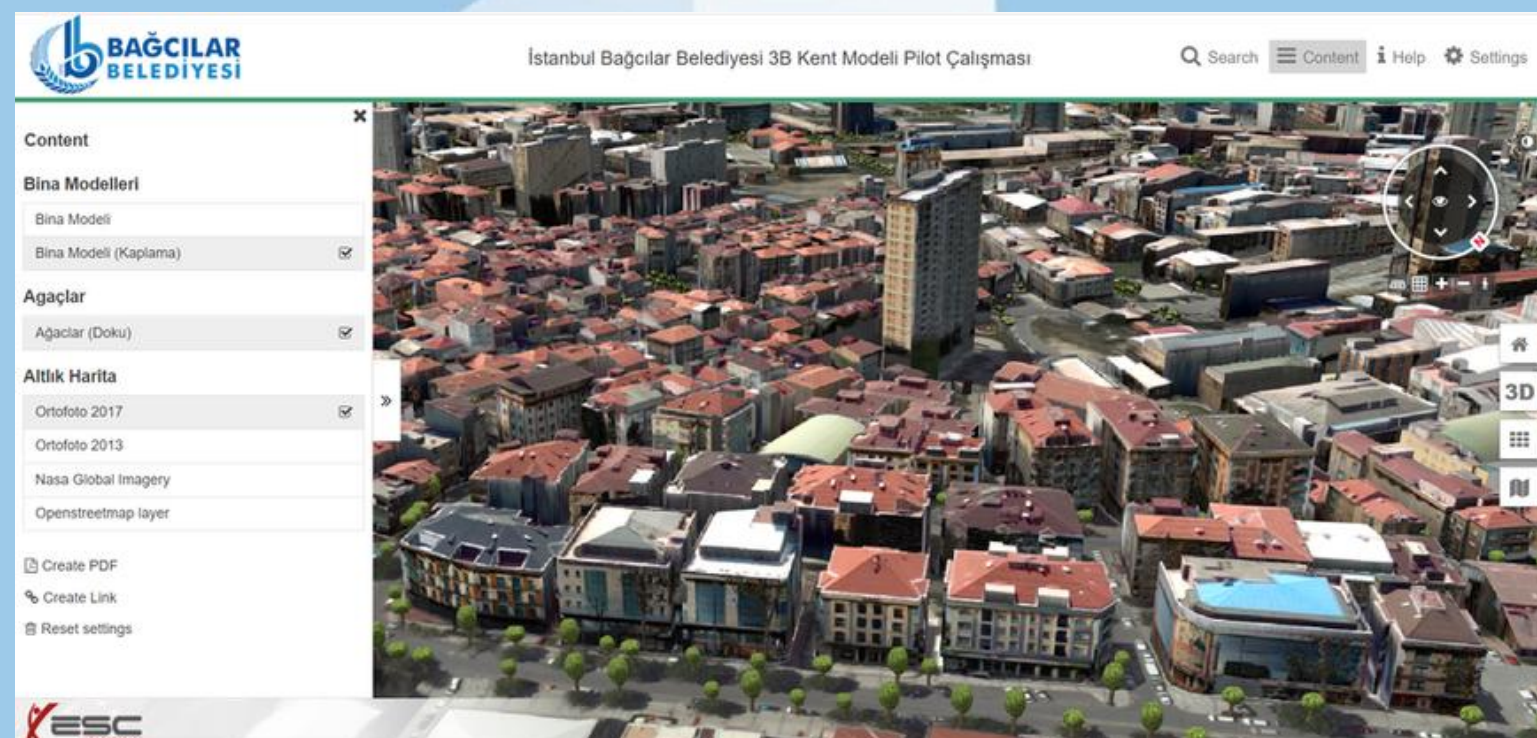
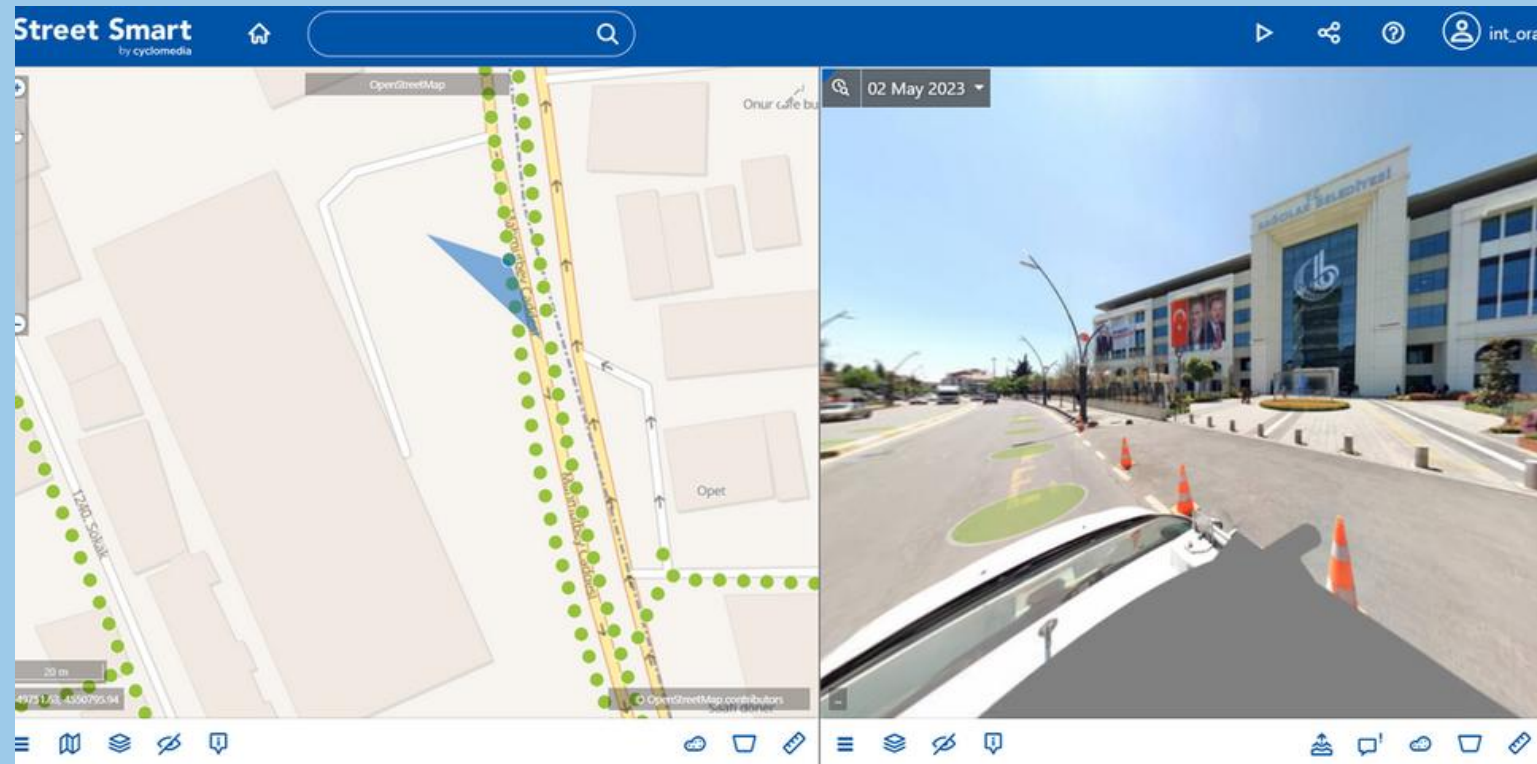
🏛️ **226.835 USD (%41)**

Municipality's Own Contribution

Corporate commitment and ownership

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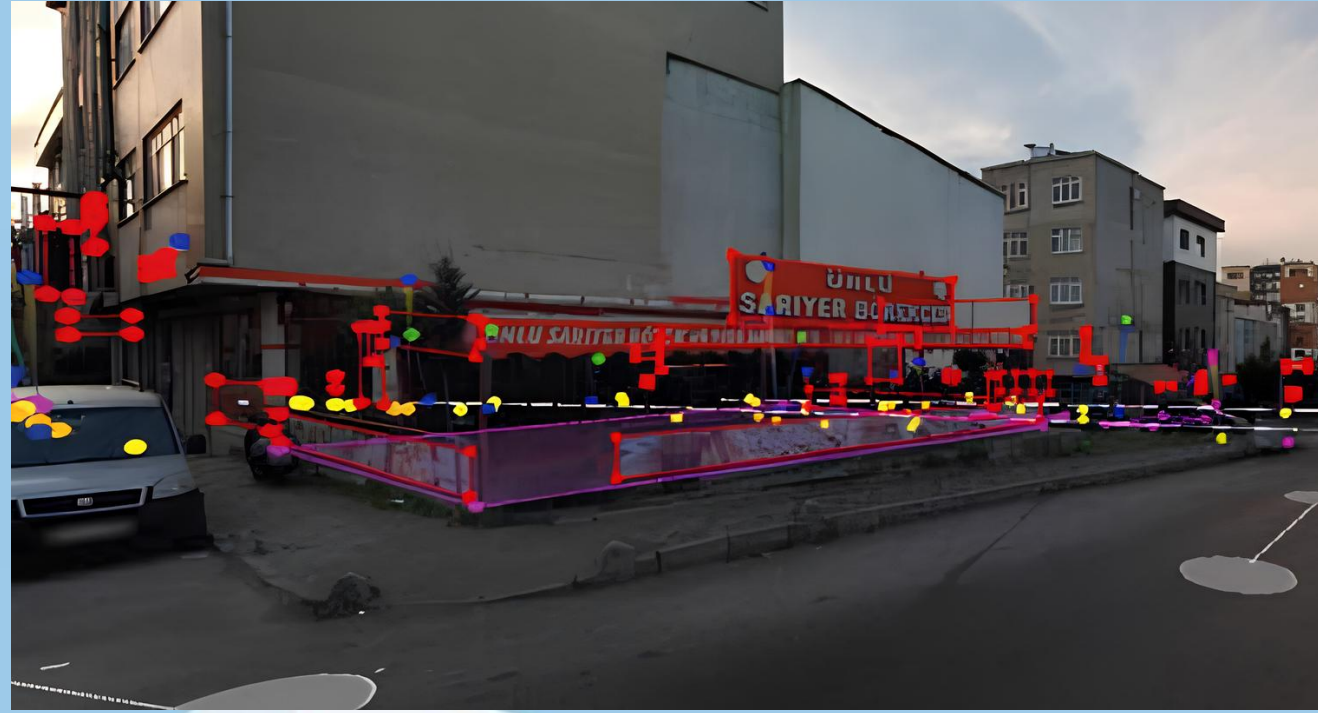
Pilot Study Outputs



- Designing an application for Bağcılar Municipality,
- Mobile mapping studies (360° panoramic image capture and LIDAR point cloud) specifically for Bağlar Neighborhood.
- Specifically for Bağlar Neighborhood, the 3D city model was created using two different methods.
 - 3D city model using aerial photographs from TKGM (Turkish General Directorate of Land Registry and Cadastre).
 - 3D city model created using aerial photos taken from a drone.
- Matching building-based attribute information with the database.
- Work has been carried out to collect inventory information.

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Pilot Study Outputs



Bina Bilgileri
Mahalle ID : 13
Mahalle Adı : BAĞLAR
Ada : 2612
Parsel : 30
Yapı Adı : İNSA APT
Bağımsız Bölüm Adedi : 20
Bina Kimlik No : 18274440



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Building Management Software Infrastructure



Bagcilar Municipality Management Information System Zoning Affairs Module

Mobile GIS Map Module

Arama

Ana Sayfa İşler SMS e-Posta Mesaj Tapu TAKPAS KPS HES Harita Sık Kullanılanlar Yardım Çıkış

Yapı Bilgileri Yapı İzleme

Yapı Bilgileri

Kayıt No	Kayıt Tarihi	Mahalle
		BAĞLAR Mah.
55195	17.05.2024	BAĞLAR Mah.
55175	04.04.2024	BAĞLAR Mah.
55140	12.02.2024	BAĞLAR Mah.
55128	10.01.2024	BAĞLAR Mah.
55124	10.01.2024	BAĞLAR Mah.
55119	10.01.2024	BAĞLAR Mah.
55081	25.12.2023	BAĞLAR Mah.
55065	01.12.2023	BAĞLAR Mah.
54948	26.09.2023	BAĞLAR Mah.
54947	26.09.2023	BAĞLAR Mah.
54946	26.09.2023	BAĞLAR Mah.
54939	26.09.2023	BAĞLAR Mah.
54938	26.09.2023	BAĞLAR Mah.
54937	26.09.2023	BAĞLAR Mah.
54936	26.09.2023	BAĞLAR Mah.
54935	26.09.2023	BAĞLAR Mah.

Yapı Bilgileri

Kayıt Bilgileri

* Kayıt No / Tarih 55065 01.12.2023

Kapama Tarihi

Yapı Bilgileri

* Adres BAĞLAR Mah., 35. Sok. (ÇELİK) No : 13-15 [/ 2862 / 38], 488875782

Ruhsat Durumu Ruhsatlı

İskan Durumu İskansız

Yanma/Yıkılma Durumu Yıkılan

Yapı Durumu

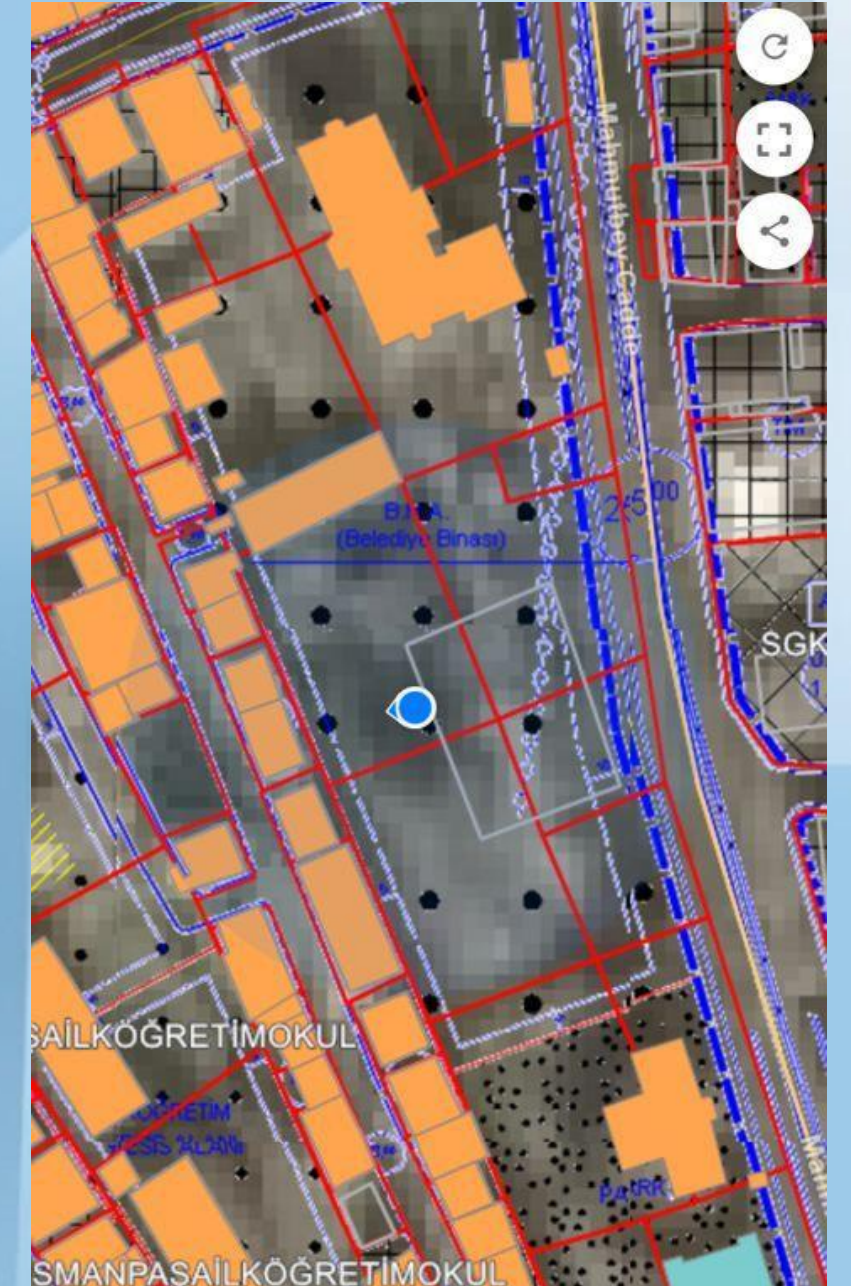
Dosya IMP_18221-MEHMET DÖNMEZ [2862/38]

Açıklama Değişim

Güncelle

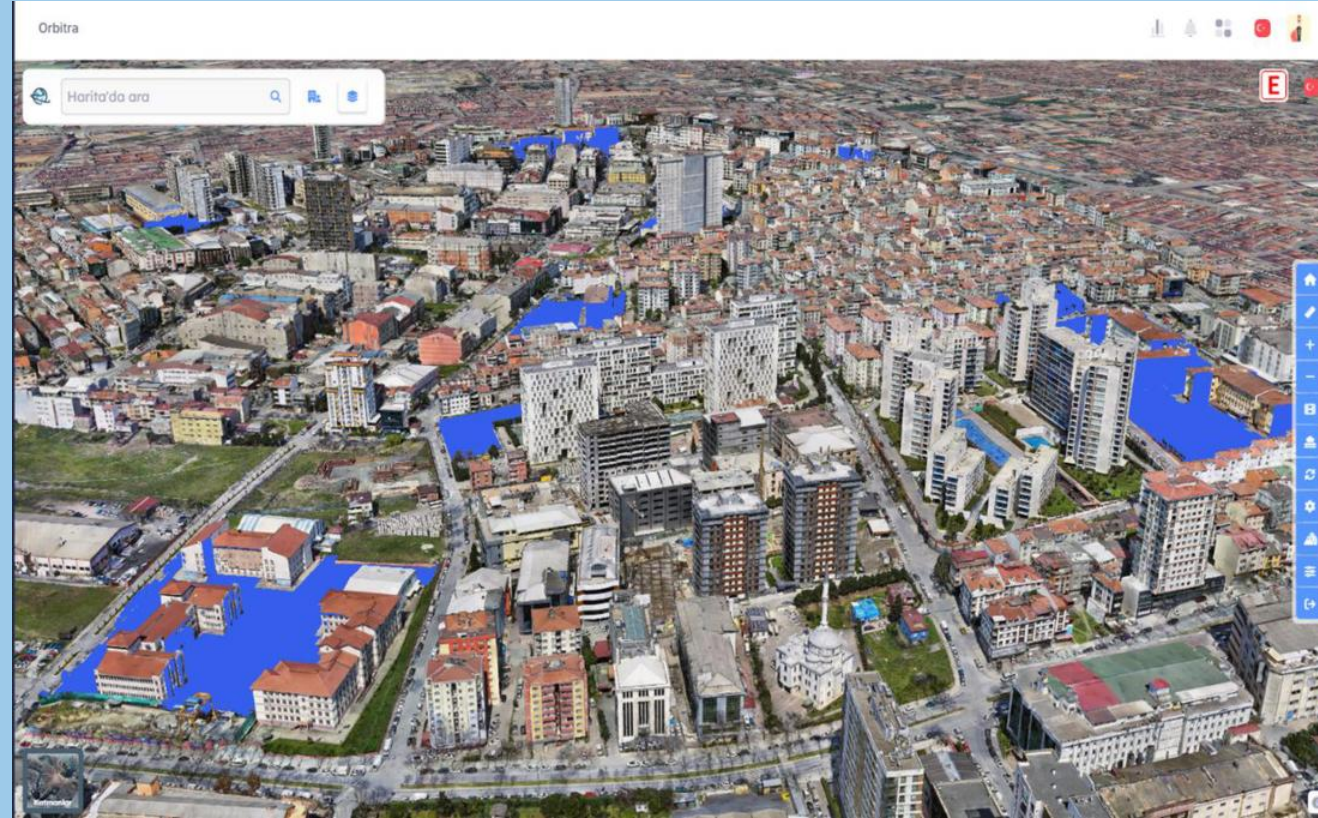
Bülten Arama Dosya Gözet

cityplus

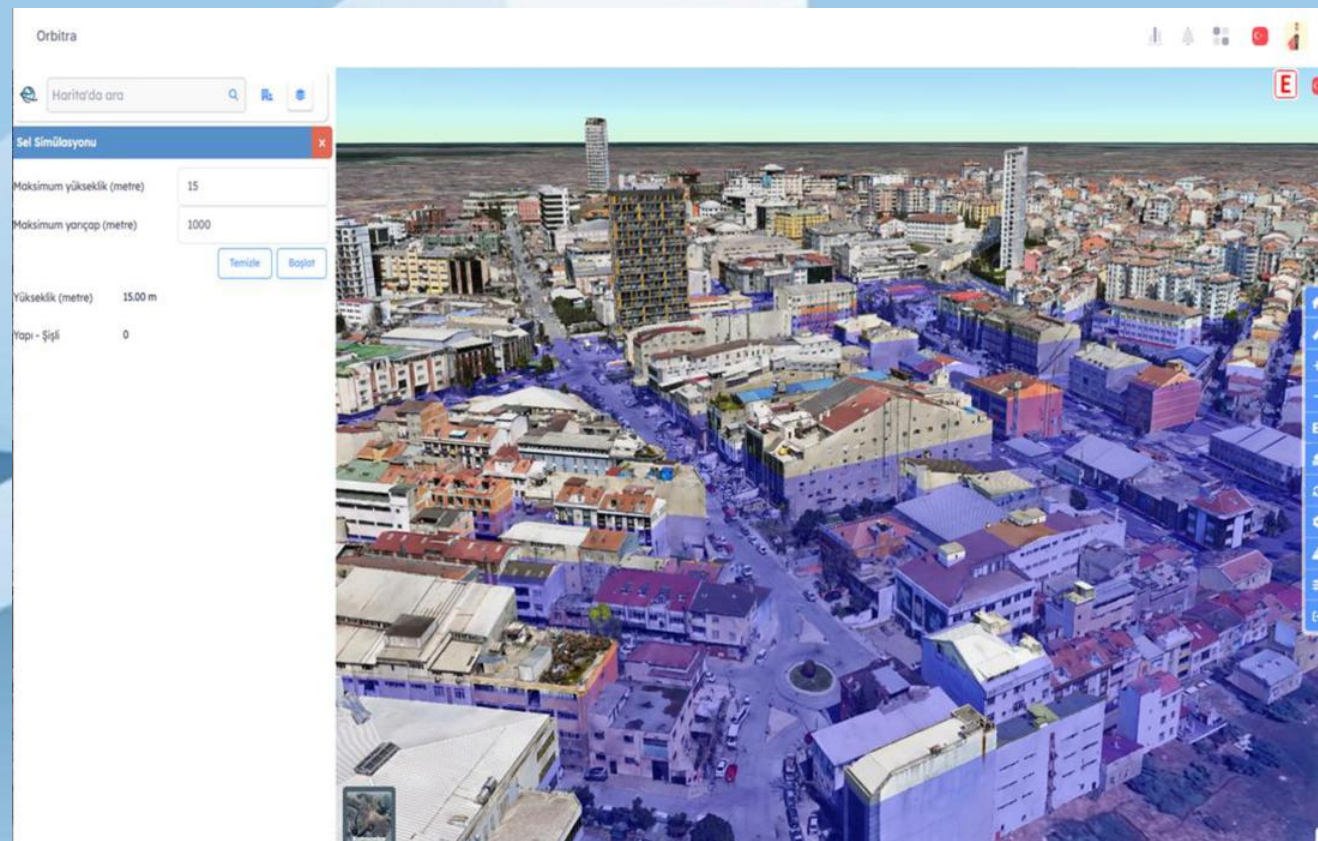


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Simulation and Scientific Analysis



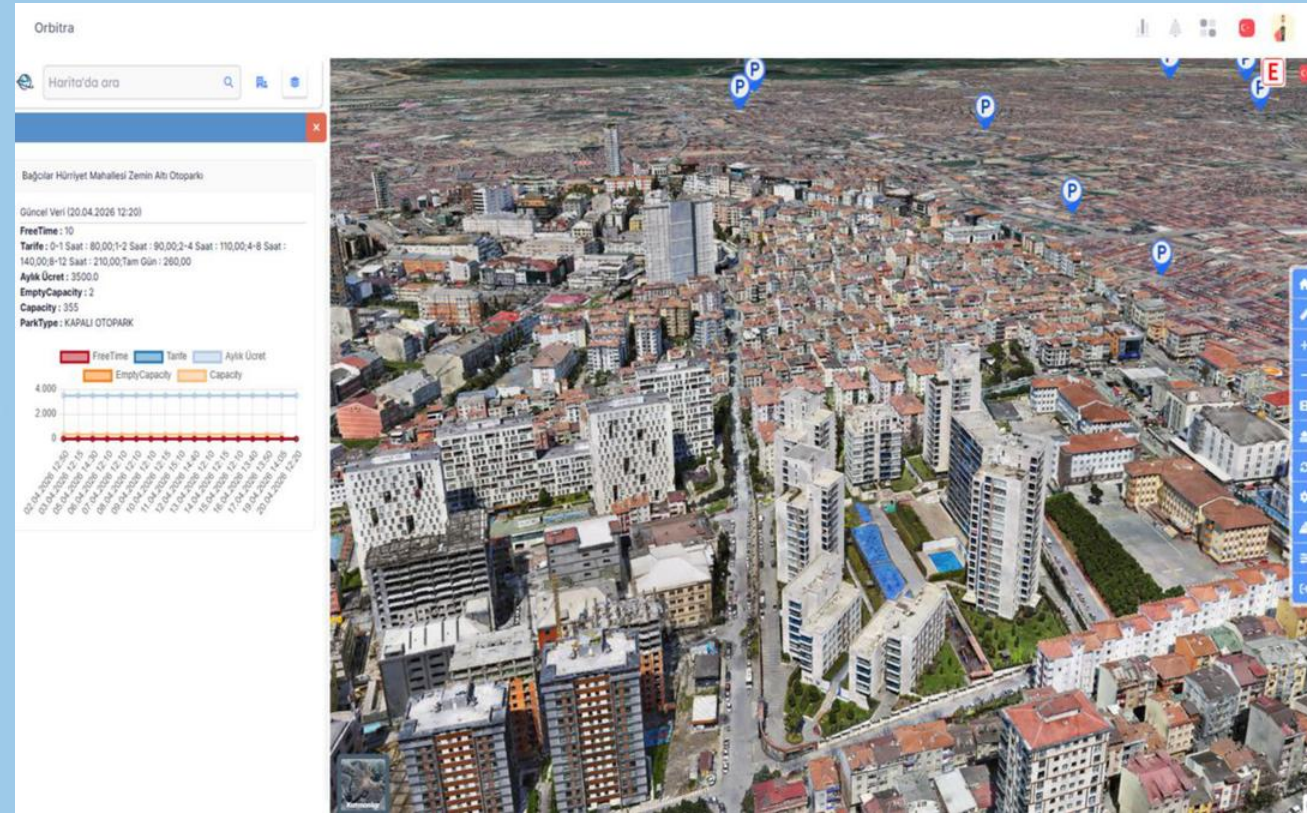
Earthquake assembly areas are evaluated using spatial analyses to ensure the safe gathering of the public after a disaster, considering location, accessibility, and environmental risk factors together.



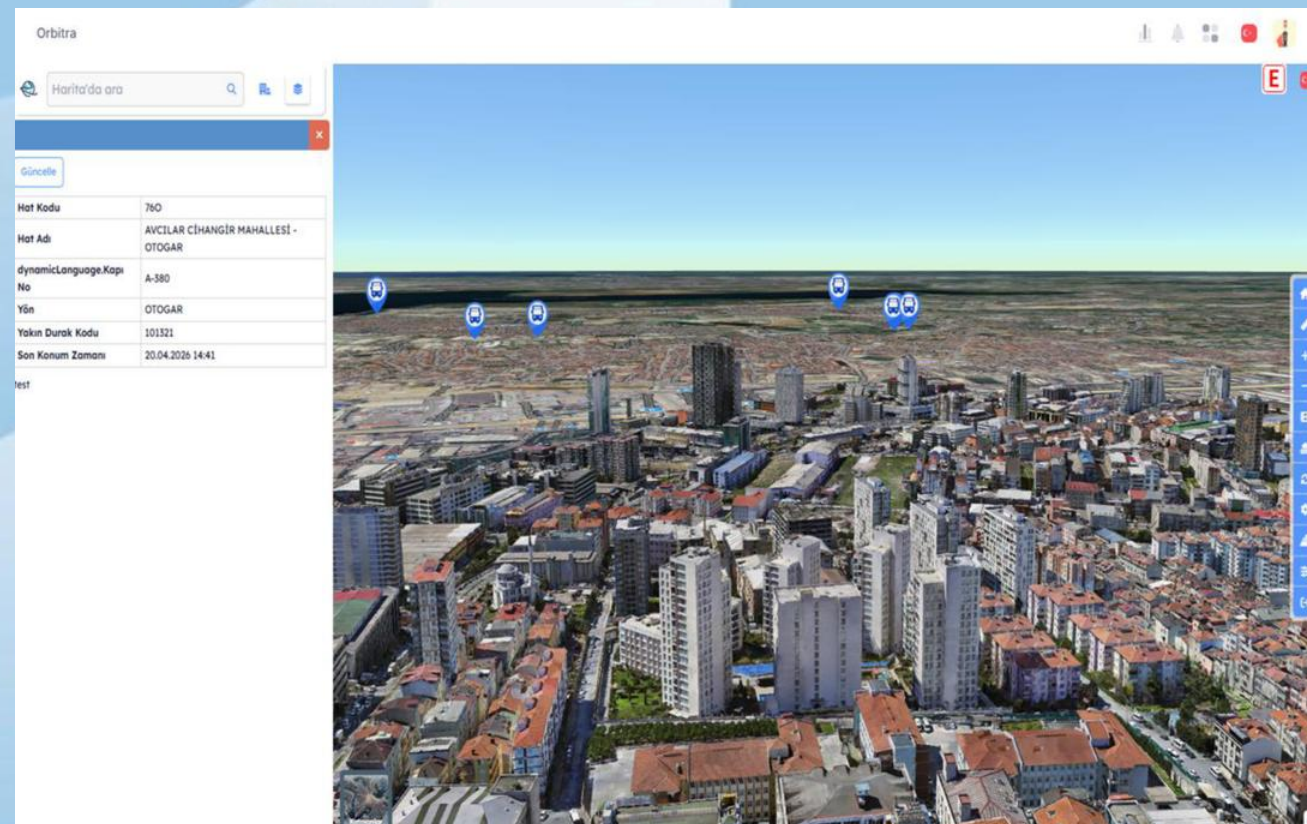
Flood simulation, in heavy rainfall and flood scenarios
By modeling the spread, depth, and impact area of water, it enables the early identification of risky areas.

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Simulation and Scientific Analysis



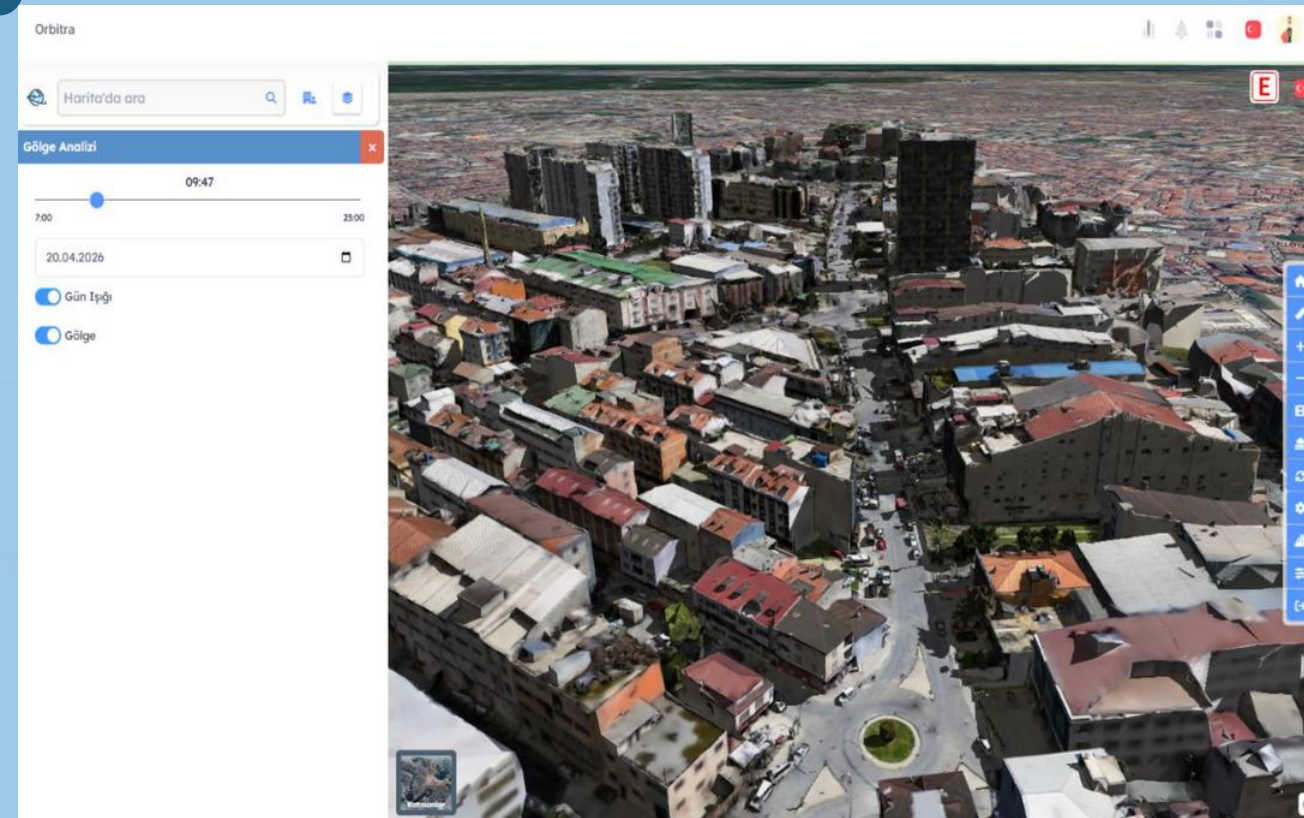
Real-time display of parking lot occupancy rates allows for monitoring and managing the usage of **available parking spaces** in real-time and with historical data.



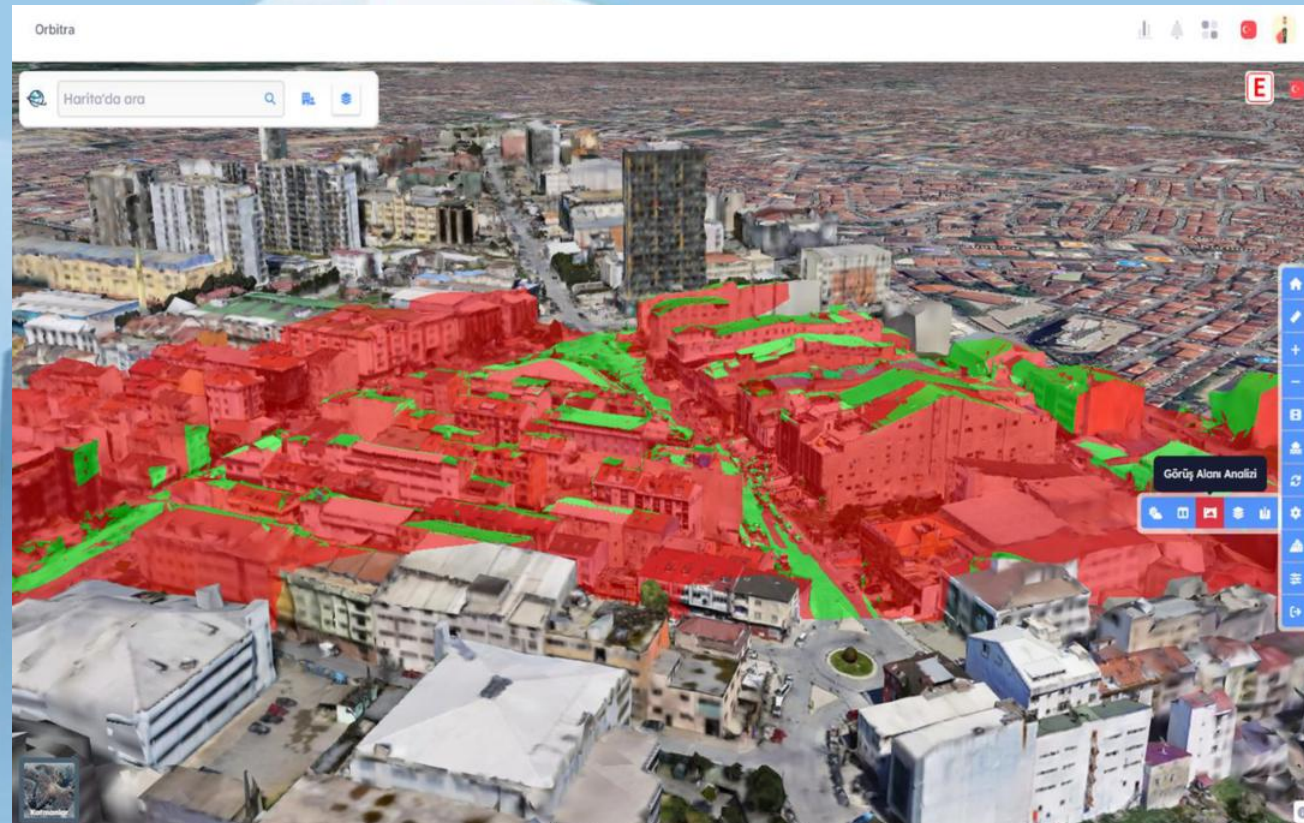
Bus route tracking, public transport
It enables the real-time tracking of the location and movements of vehicles.

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Simulation and Scientific Analysis



Shadow analysis allows for the temporal and spatial evaluation of the shadow effects created by structures and topography depending on the sun's position throughout the day.

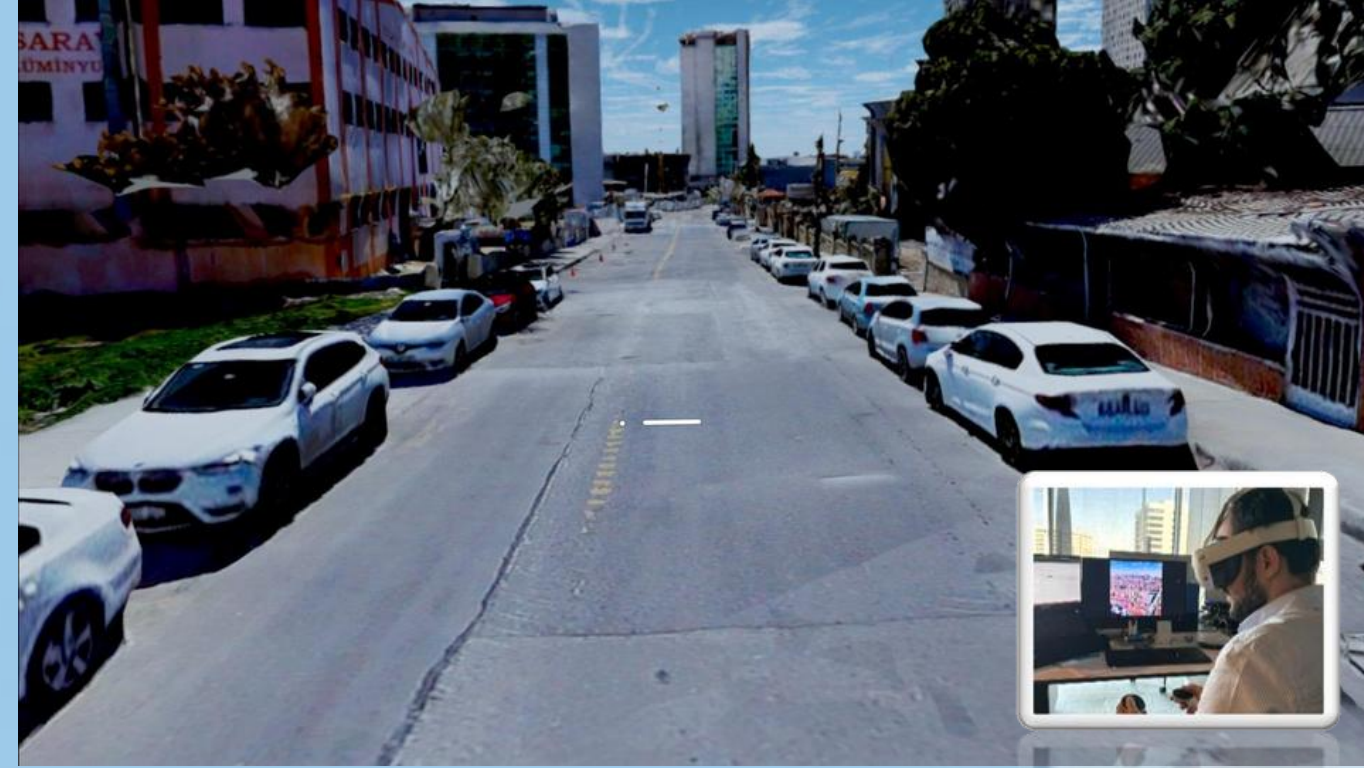


Field of **view analysis** is the analysis of the surroundings from a specific point.

It contributes to the urban planning process by spatially determining which areas are visible and which are outside the scope of view.

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Simulation and Scientific Analysis



Viewing mesh models with **VR** enables interactive examination of three-dimensional city and terrain models in a virtual reality environment.

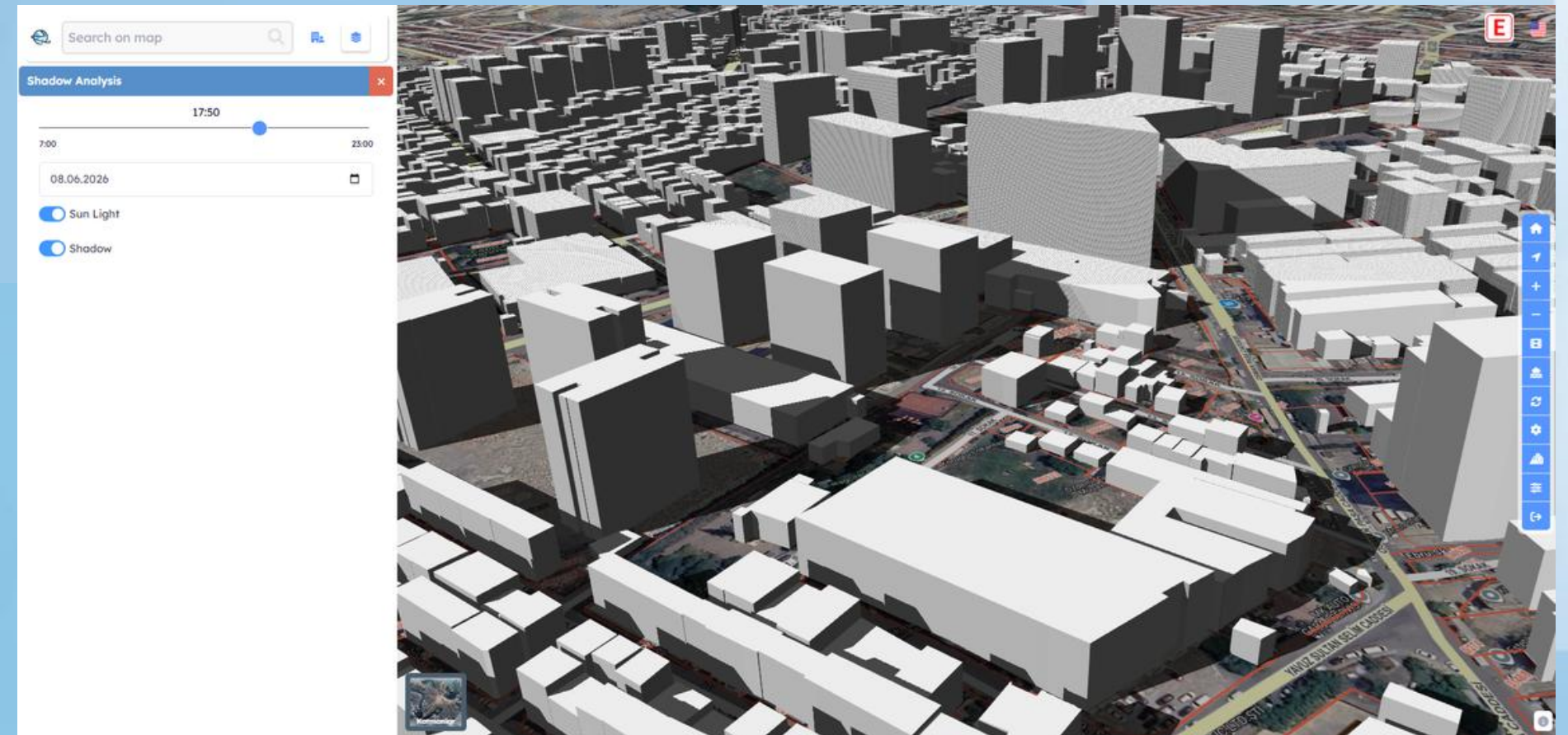


Shadow Analysis and Application Examples

In urban planning processes, sunlight duration and shadow lengths are simulated to optimize energy efficiency and quality of life.

Analysis Results:

- ⚙️ Seasonal daylight simulations
- 🏠 Impact of new projects on surrounding structures
- 🌿 Green space sun exposure optimization



Field and Zoning Inspections

Field Inspection

With tablet and IoT support, teams can enter data in real-time in the field and work in sync with the central system.

Zoning Inspection

By comparing the licensed project with the current situation on the site using a 3D model, discrepancies are identified immediately.

Roads & Sidewalks

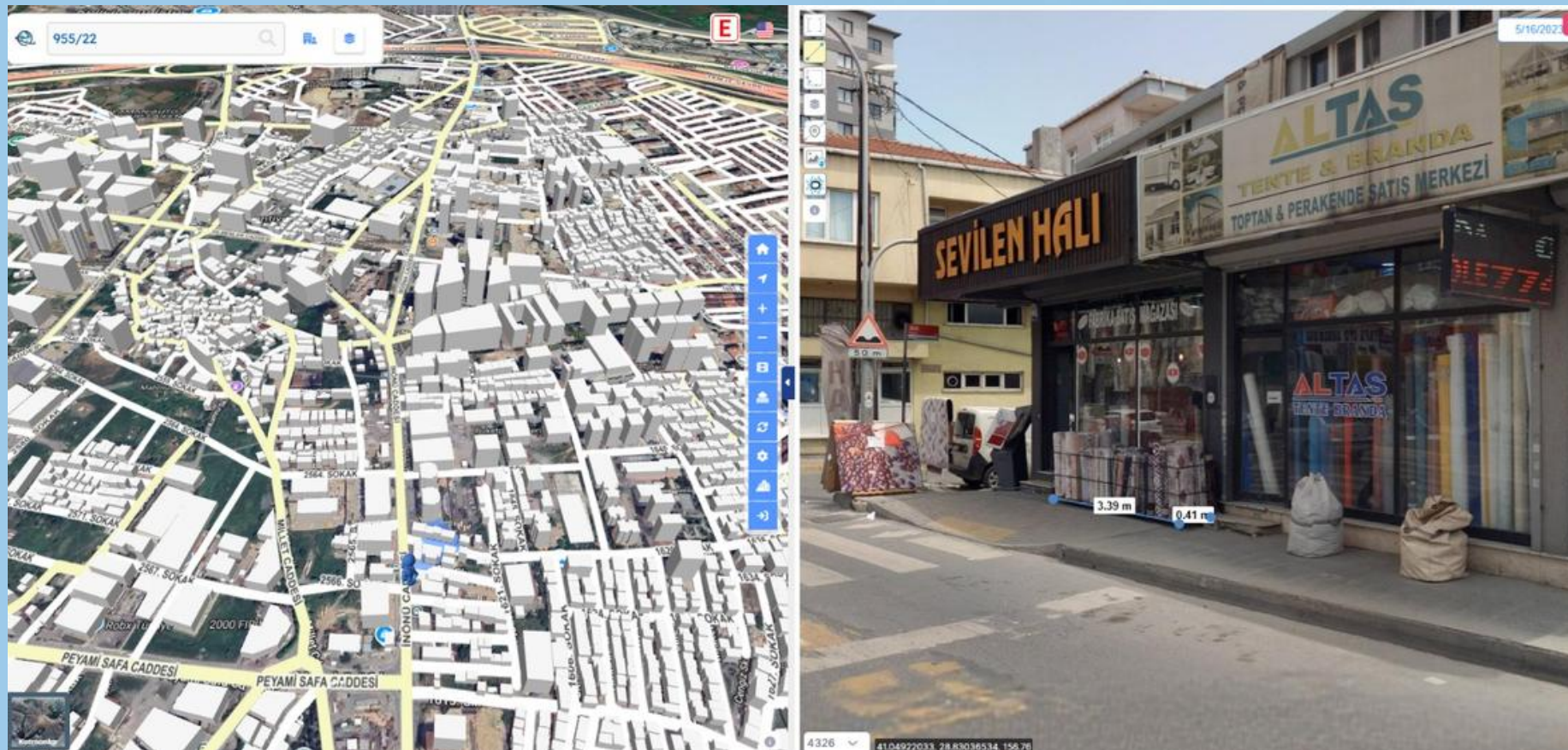
Infrastructure and superstructure construction projects are planned on the digital twin, and costs and timelines are tracked.

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Simulation and Scientific Analysis



Occupancy and Area Management



Occupancy rates in public spaces are monitored with millimeter precision via digital twins, preventing revenue loss and protecting pedestrian access.

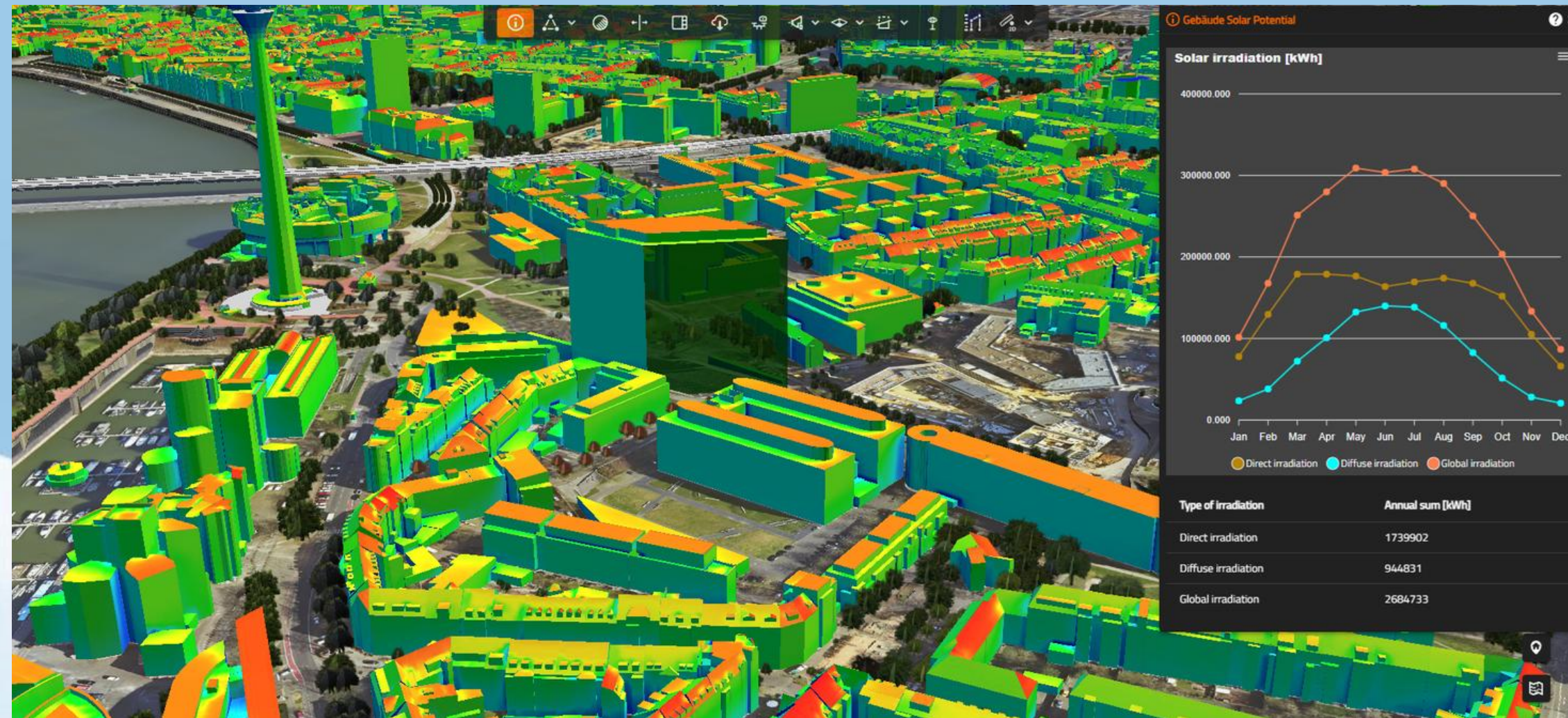
■ **Video-Assisted Monitoring:** Field data is processed using video analysis systems.

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Simulation and Scientific Analysis



Environmental and Energy Management



Energy Maintenance and Forecasting

AI-powered predictive analytics can detect faults in power lines before they occur.

Heat Island Analysis

By mapping temperature intensities in the district, cooling design strategies are developed for urban transformation projects.

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Simulation and Scientific Analysis



Interactive City Experience

Citizens and technical teams can explore projects even before they are completed through VR (Virtual Reality) screen sharing.

-  Real-time VR meetings
-  Transparency in project participation processes.
-  English video and global promotional infrastructure



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Recognizing Success: Awards and Grants



Bagcilar Municipality's leadership in digital transformation is evidenced not only by numbers but also by prestigious awards won at the national level. Each success is tangible proof of our technological vision and teamwork.

ISTKA Artificial Intelligence Digital Twin Project

With a grant of 14 million TL, one of Türkiye's largest digital twin projects is being implemented. This project will set a new standard for data-driven decision-making in urban management.

- Supported by a 90% grant rate.
- Revolutionary in urban planning.
- AI-based predictive systems

5 National Awards

Our digital transformation leadership has been recognized at prestigious platforms such as The Smart Way in Transportation, CIO Awards, Technology Captains, and KentFEST.

- CIO of the Year - Public Sector
- Technology Captains Innovation Award
- KentFEST Best Digital Municipality
- E-Government Leadership Award
- Smart City Application Award





Digital Twin of the City: Sustainable Urban Management

Cüneyt YILMAZ

IT Manager