AI Unmanned mobile technology based on Digital twin Smart City construction

GEOSPATIAL INFORMATION
geomatic.co.kr

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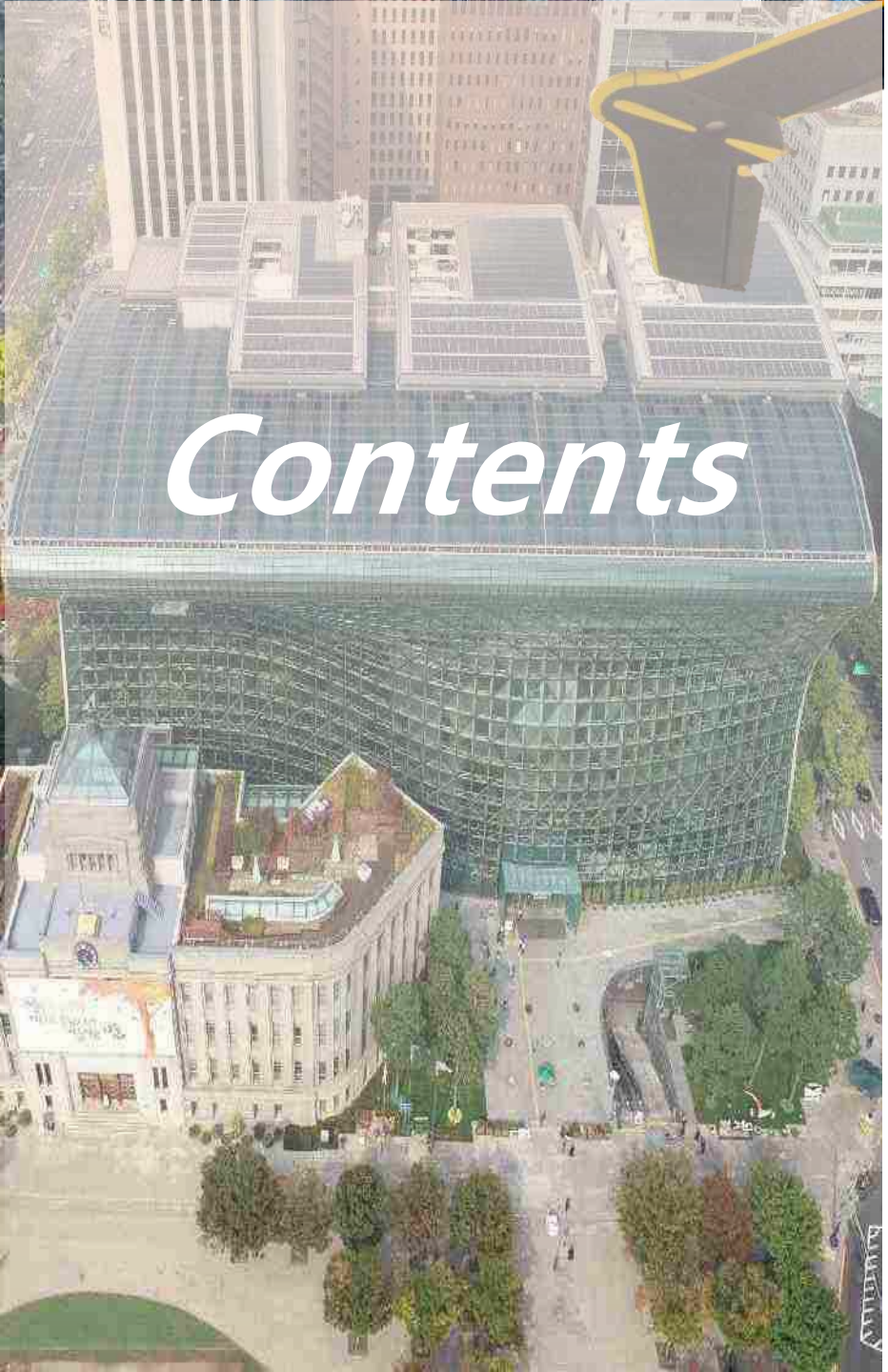

Contents

01 About us

About us

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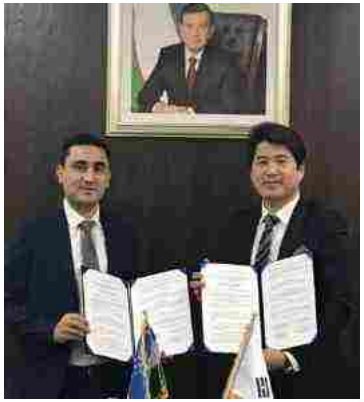
Business Areas

- Development of UAV system and UAV surveying service
- Agricultural sensing, consulting
  Marine surveying
- Integrated business with GIS, UAV, IOT, VR
- Public surveying
  3D solution development

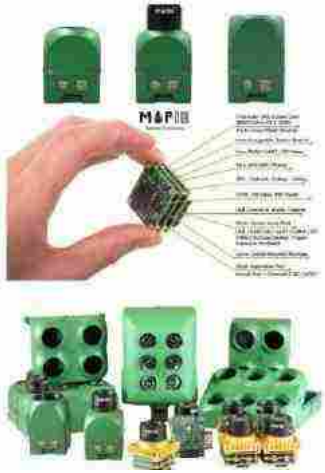
Status of R&D performance related drones

Ministry of Science and ICT	Development of an UAV system for monitoring based on 3D spatial information	
Ministry of maritime affairs	Development of local coastal disaster response system using small UAV	
Ministry of agriculture, food and rural affairs	Development of UAV-based remote sensing technology for monitoring crop growth of major crops	
	Development of drones based crop sensing information and mapping technology	
KAIA	Rapid diagnosis and evaluation of bridge structure based on UAV inspection equipment	
Small and medium business administration	Development of multi-dimensional spatial information module for UAV multi sensor mounting	 
Rural development administration	Development of UAV based fire blight prevention system	
KAIA (2018.4)	5cm-class precision analysis UAV image acquisition technology and multiple simultaneous connection CLOUD platform commercialization for the whole cycle integrated construction management and preemptive urban disaster recovery improvement	
KAIA (2018.4}	Development of technology for efficient management of slope and road pavement using UAV	

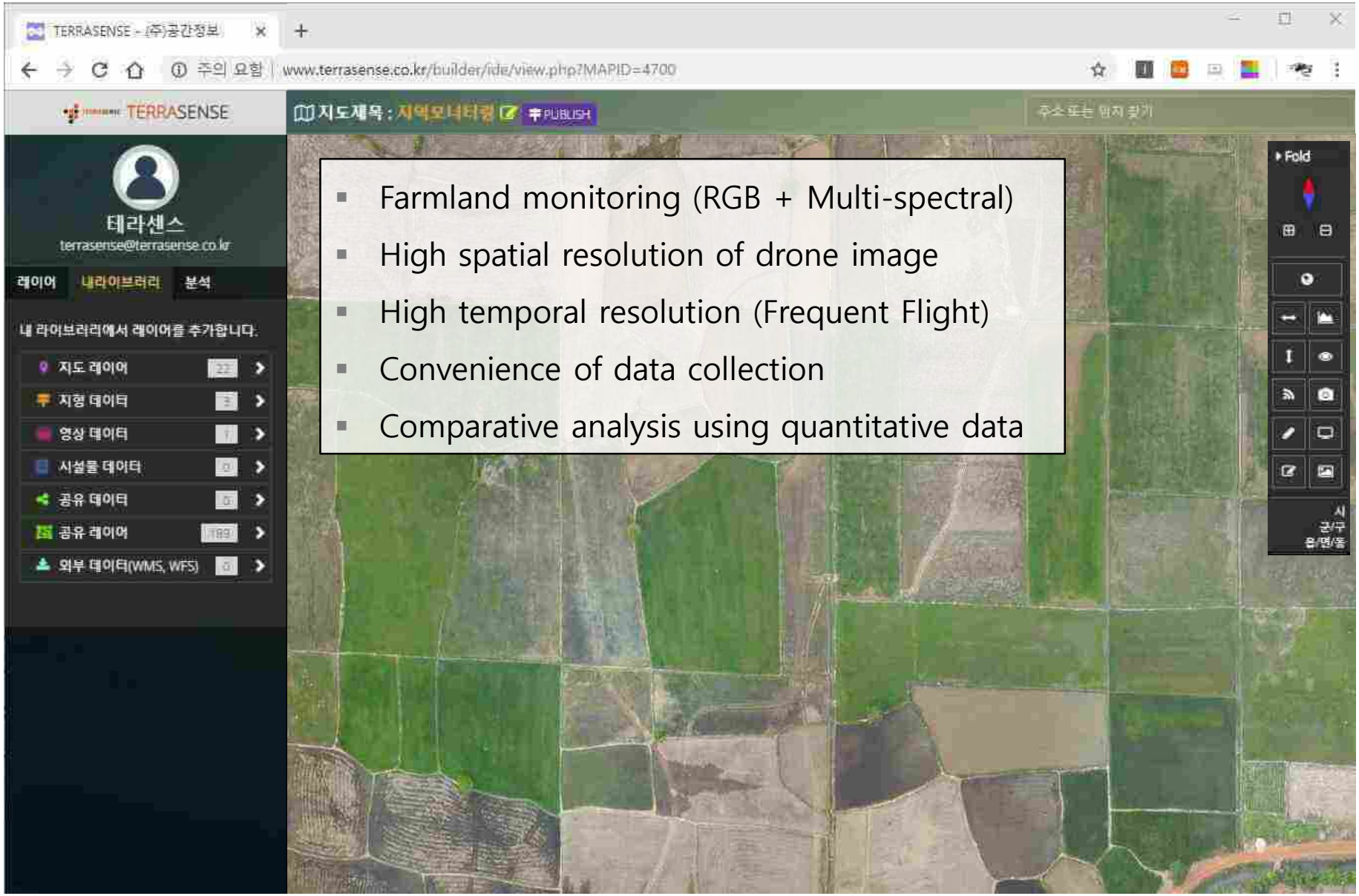
Work (Service and national R & D business)



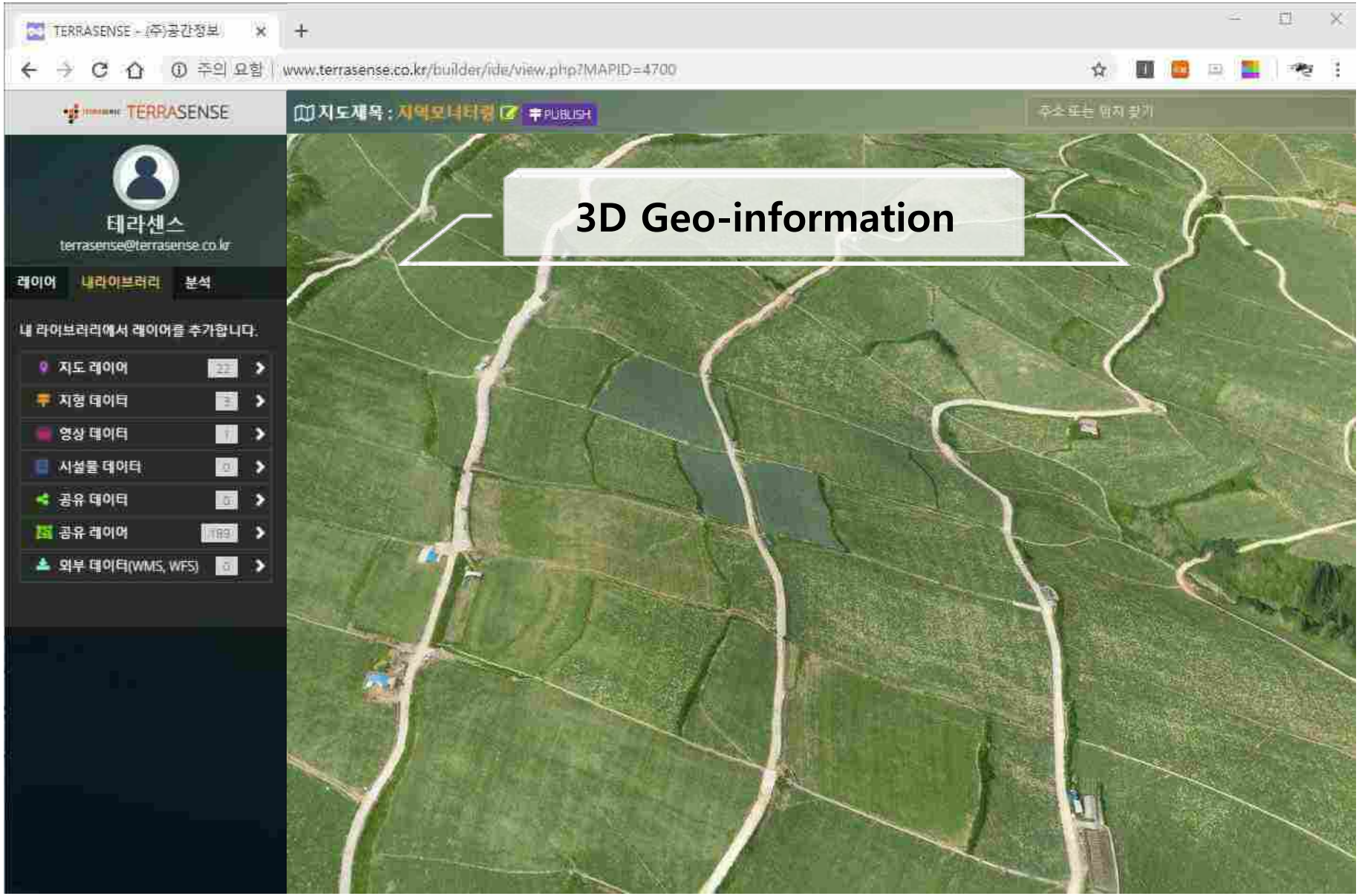
Work (System development, manufacturing, sales)

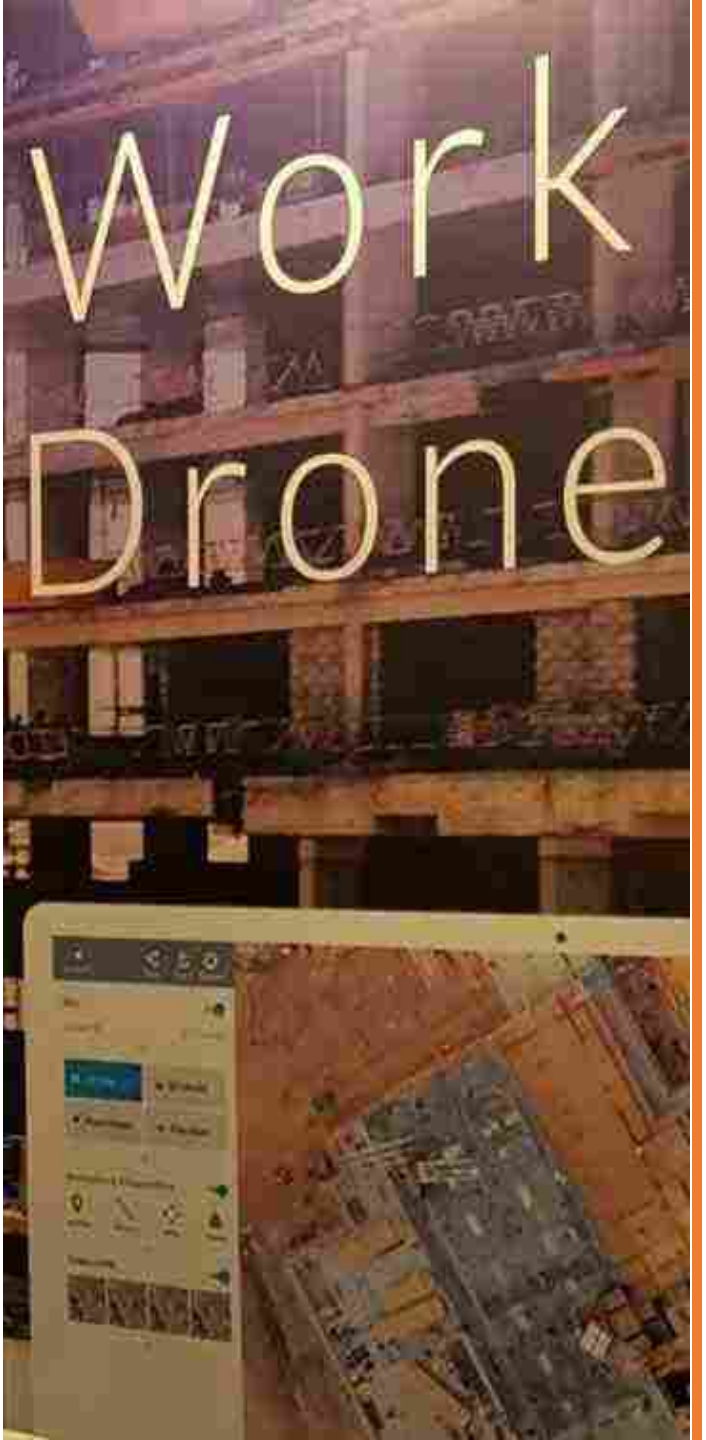


Work (Precision Agriculture Consulting)



Work (Precision Agriculture Consulting)





02 Intro to Drone Digital twin

Intro to Drone Digital twin

- **Technology that acquires accurate information about the characteristics of the real assets (current status, productivity, operation scenario, etc.) by creating and simulating digital twin of software virtualized assets instead of actual physical assets**
- **Application in various industries such as smart city, energy, aviation, health care, automobile, defense, etc.**
- **Expectancy effects of optimizing assets, minimizing incidents, and increasing productivity**
- **Streamlining of all processes from design to manufacturing and service**



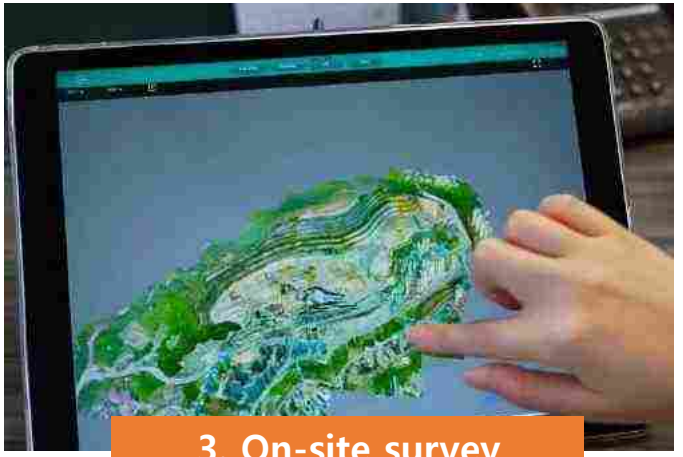



Intro to Drone Digital twin

- **With drone, the quality and performance of data is diversified and utilized in various field**

1. Drone flight

2. Digital twin construction



3. On-site survey

4. 3D drawing

5. 3D design BIM construction

6. Comparison of time series image

Field DB acquisition process

① Integrated control point

② Air photo signal

⑥ Drone shooting

Rotary-wing Drone

Fixed-wing Drone

③ Signal point survey

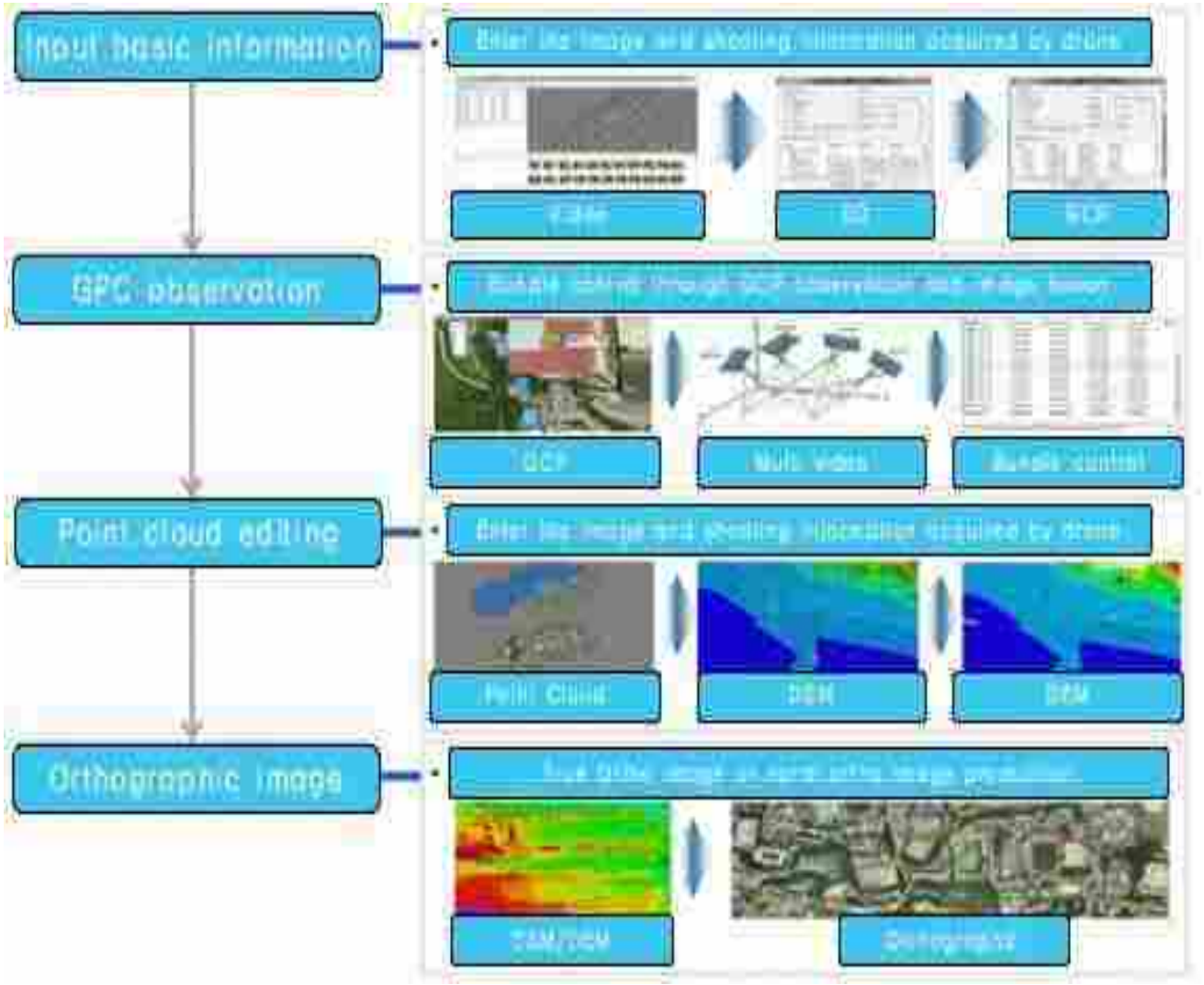
④ Drone inspection

⑤ Flight route settings

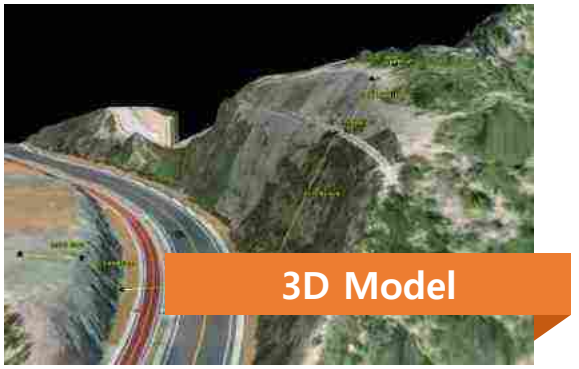
⑦ Check data

Drones survey image process

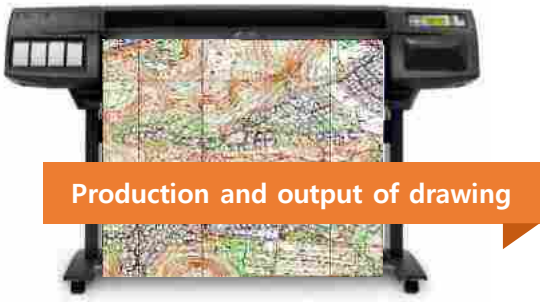
Digital elevation model and orthographic image production procedure



Orthographic



3D Model

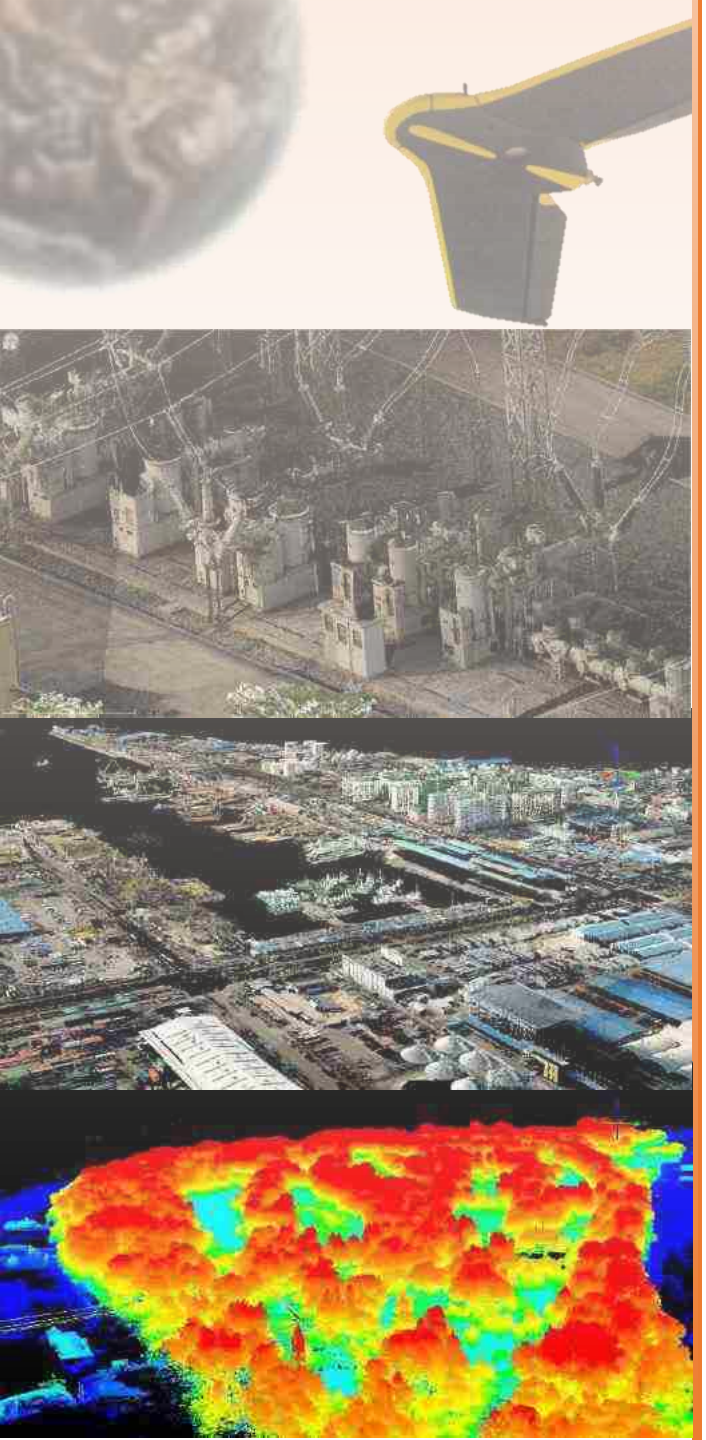


Production and output of drawing

Building 3D Mapping Digital Twin

Jinju castle 3D model

Pangyo NAVER 3D model

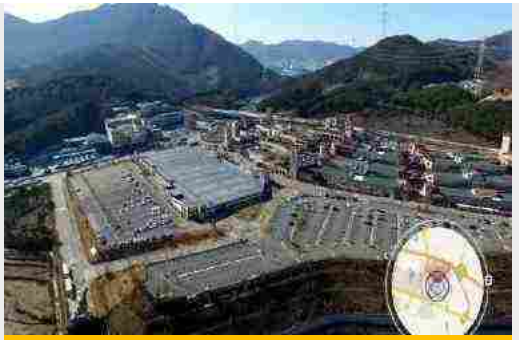


03 Use case of Drone Digital twin DB

Use case of LH Korea Land Corporation

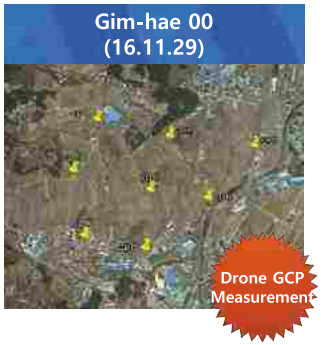
Korea Land Corporation

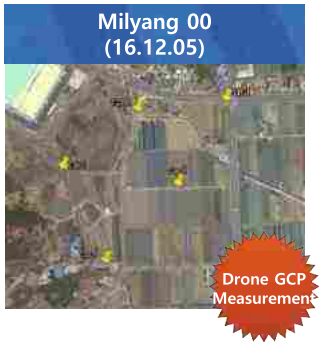
- A study on drones application
- Drone shooting and field test 12 location / 21 km2
- Build high-precision spatial information
- Development of pilot system for management

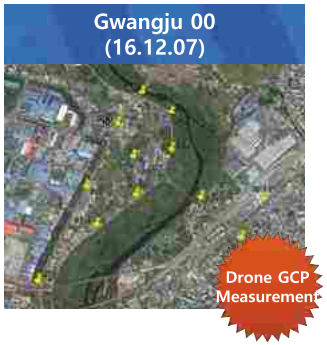


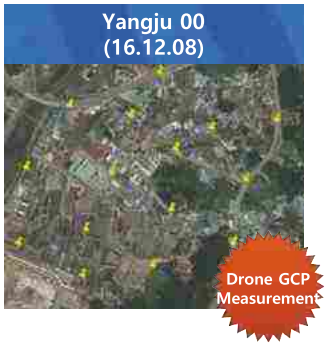
LH Candidate region video shooting

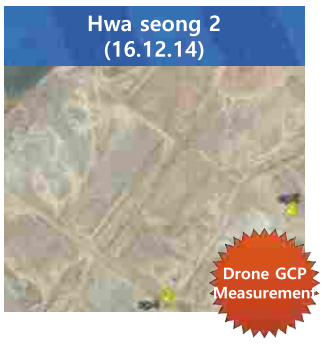
Building construction management

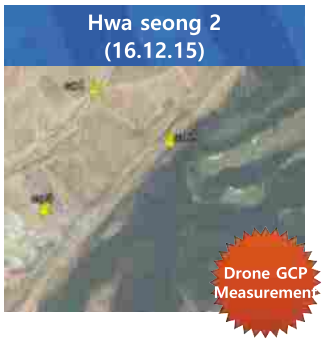








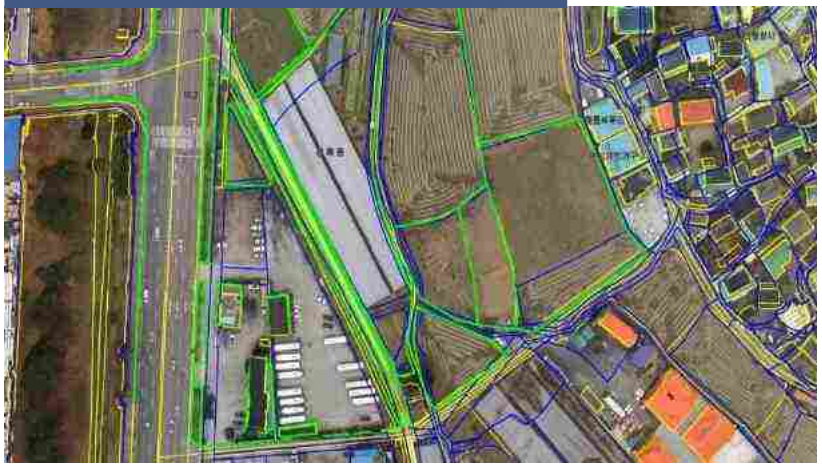




Use case of LH Korea Land Corporation

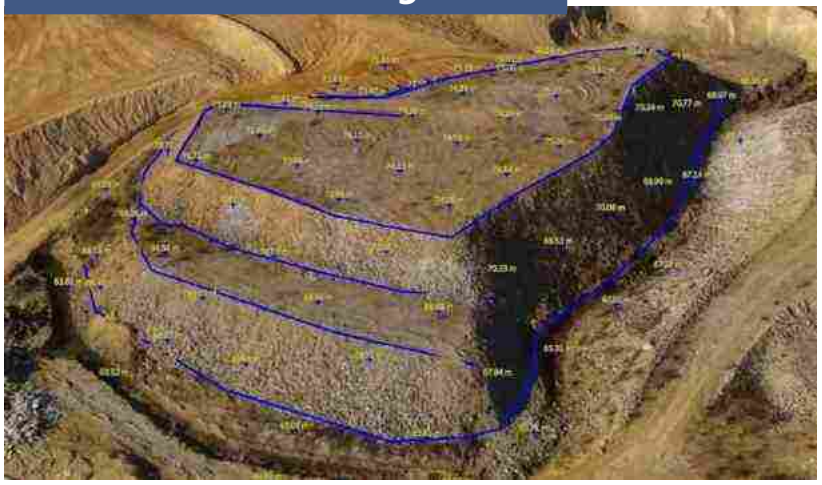
Korea Land Corporation

Candidate region selection



BIM

3-Dimensional management



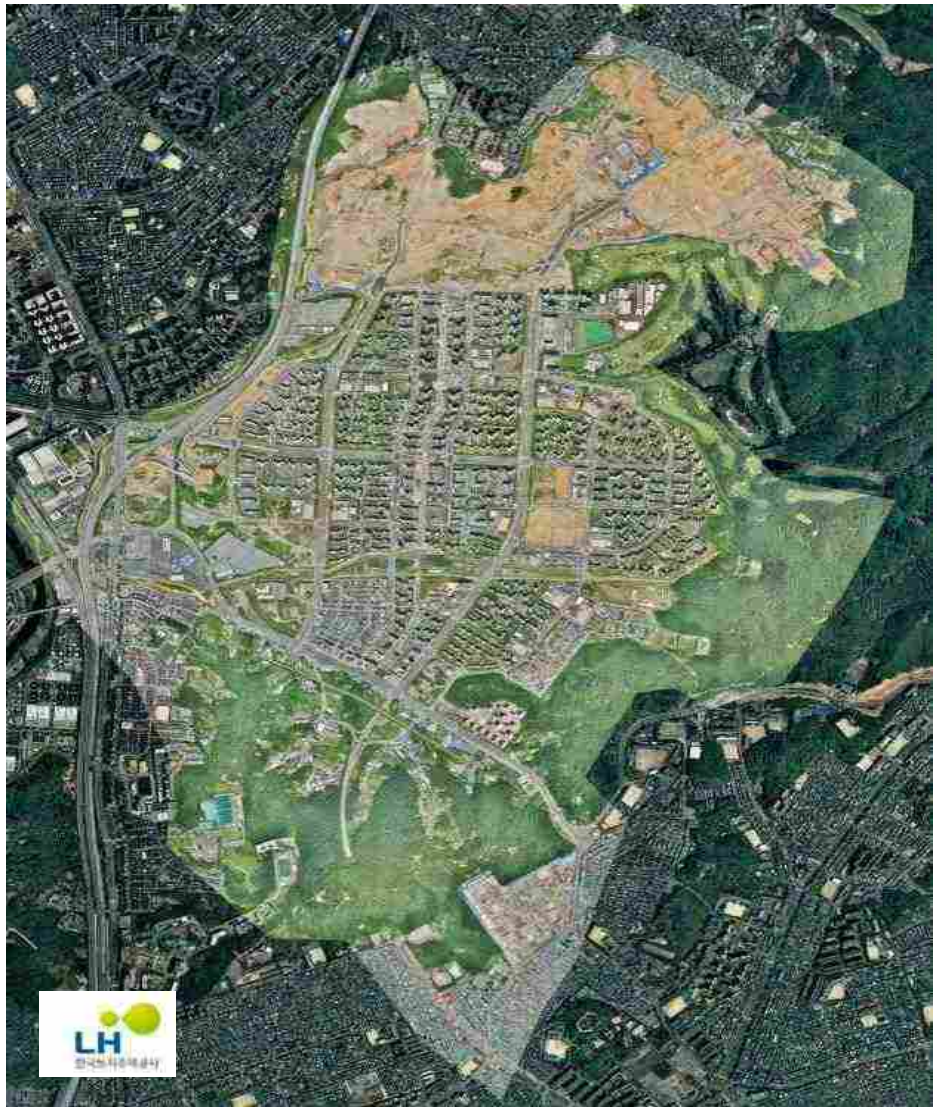
3D modeling / Safety inspection

Gimpo Han river city Drone survey (2017.04)

Cartography of the latest Digital twin map in new town
Application of civil complaint consultation and on-site survey

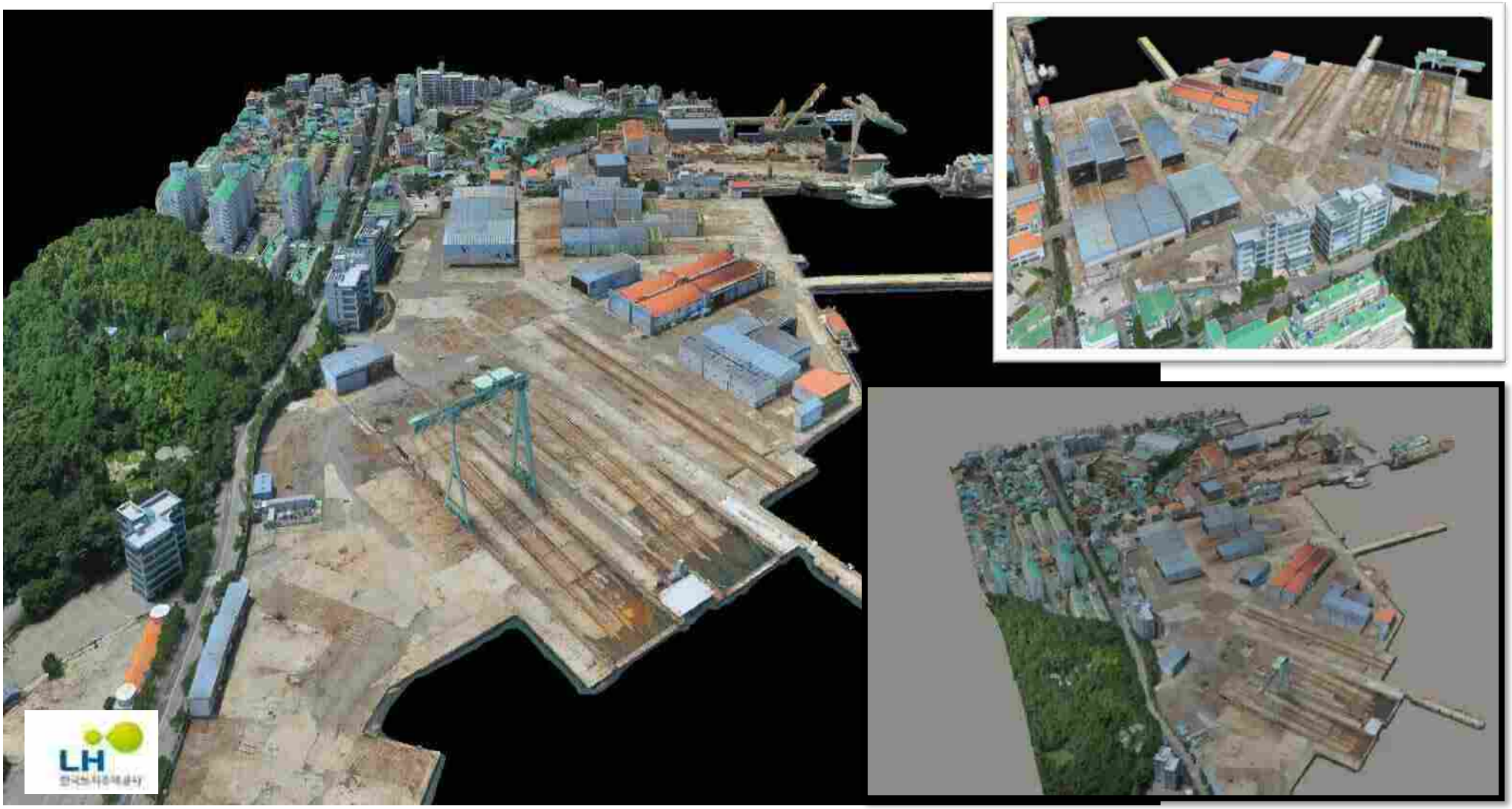
Yirye New town Drones Photogrammetry (2018.08)

Cartography of the latest Digital twin map in new town
Application of civil complaint consultation and on-site survey

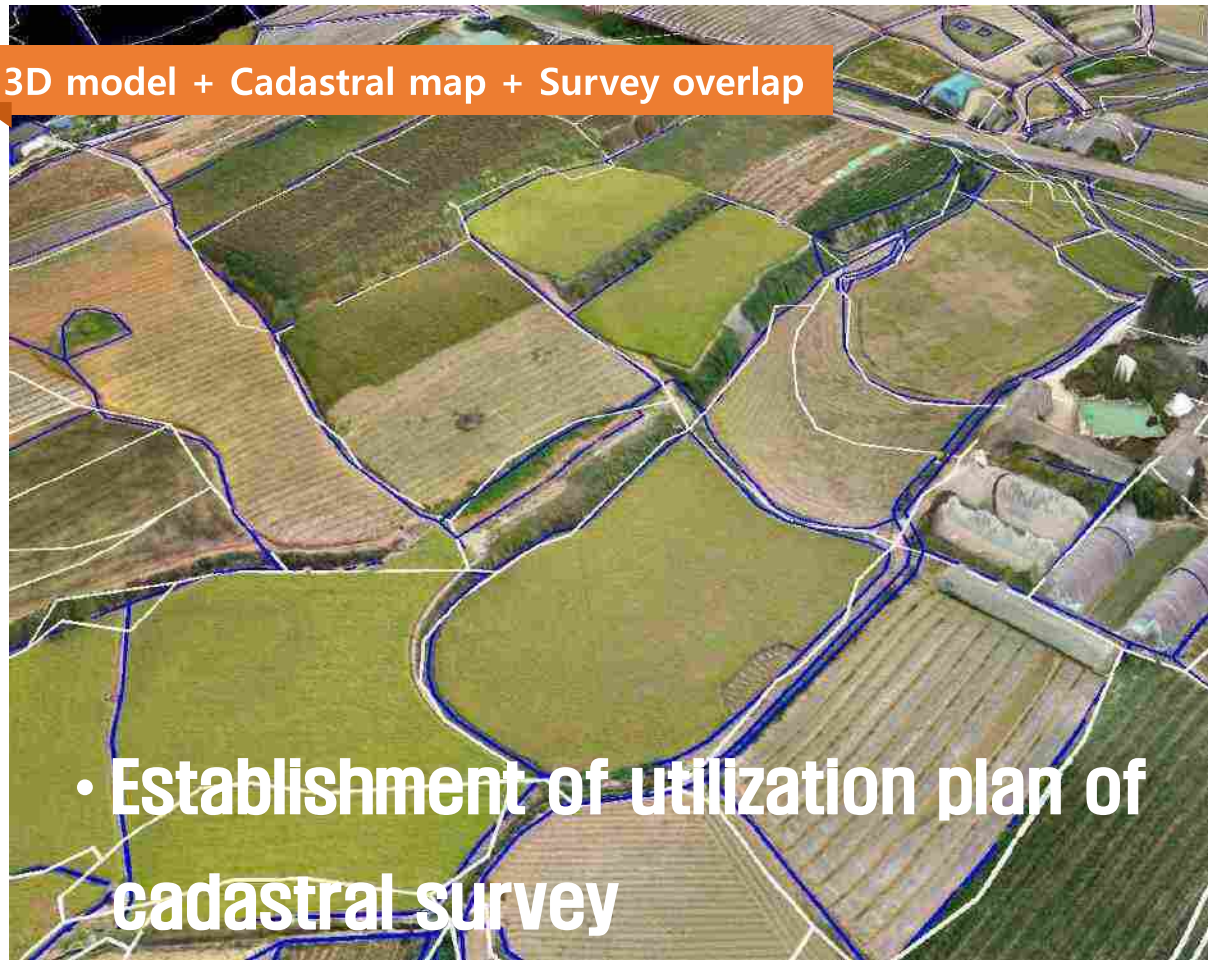


Tongyeong's close shipyard drone digital twin (2018.09)

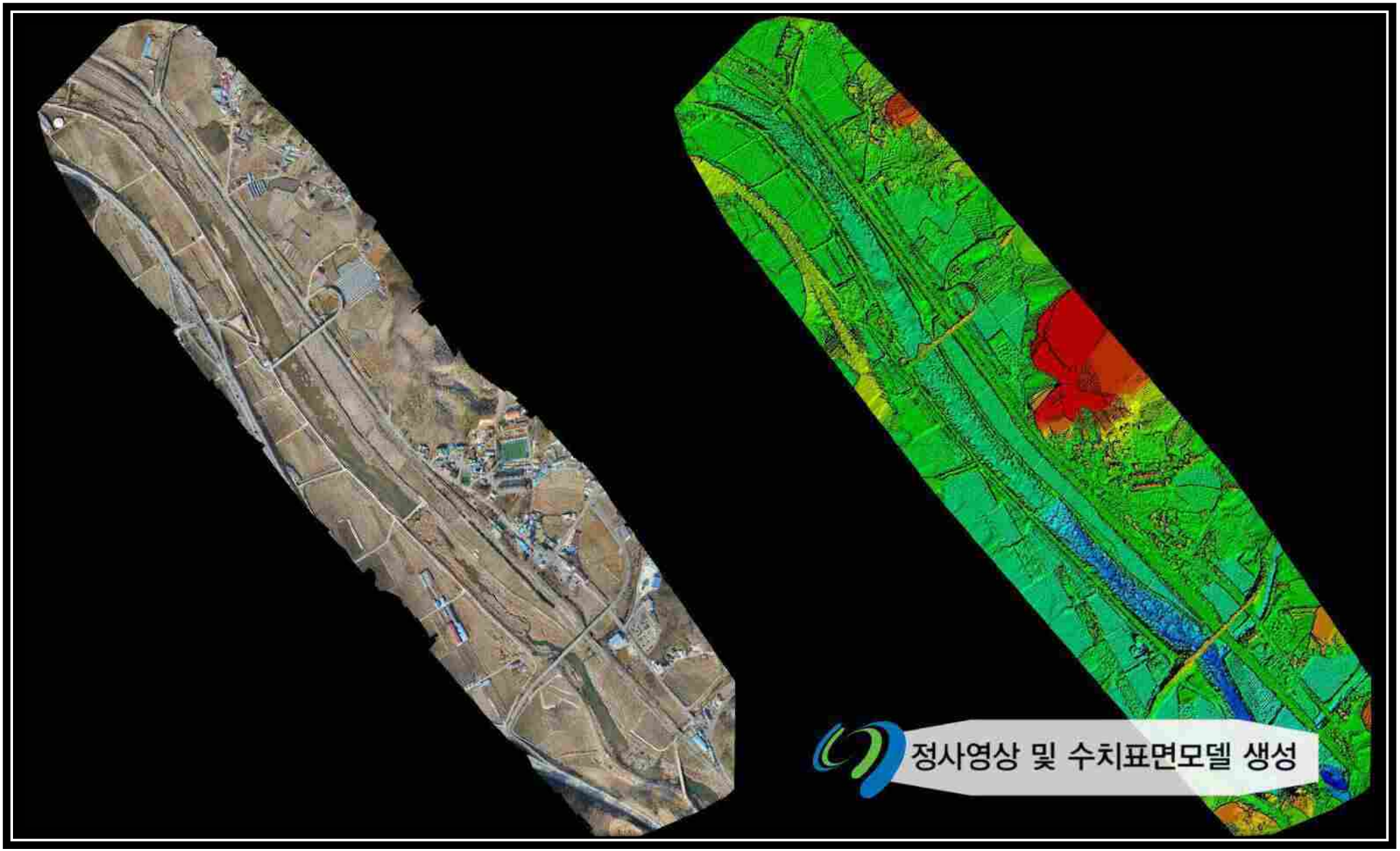
Public inspection for Citizen of close shipyard redevelopment
Idea proposal contest in the field based on Citizen participation



Study on the use of drones cadastral re-survey
(Use for explaining materials for Citizen about cadastral re-survey site)



A cadastral survey using drone digital twin



Seoul (Application of spatial information using drones)

- A-hyun new town and other 14 regional drone shooting and orthophoto production
- Establishment of high-precision spatial information
- Drones performance management pilot system development

Public development

Safety management

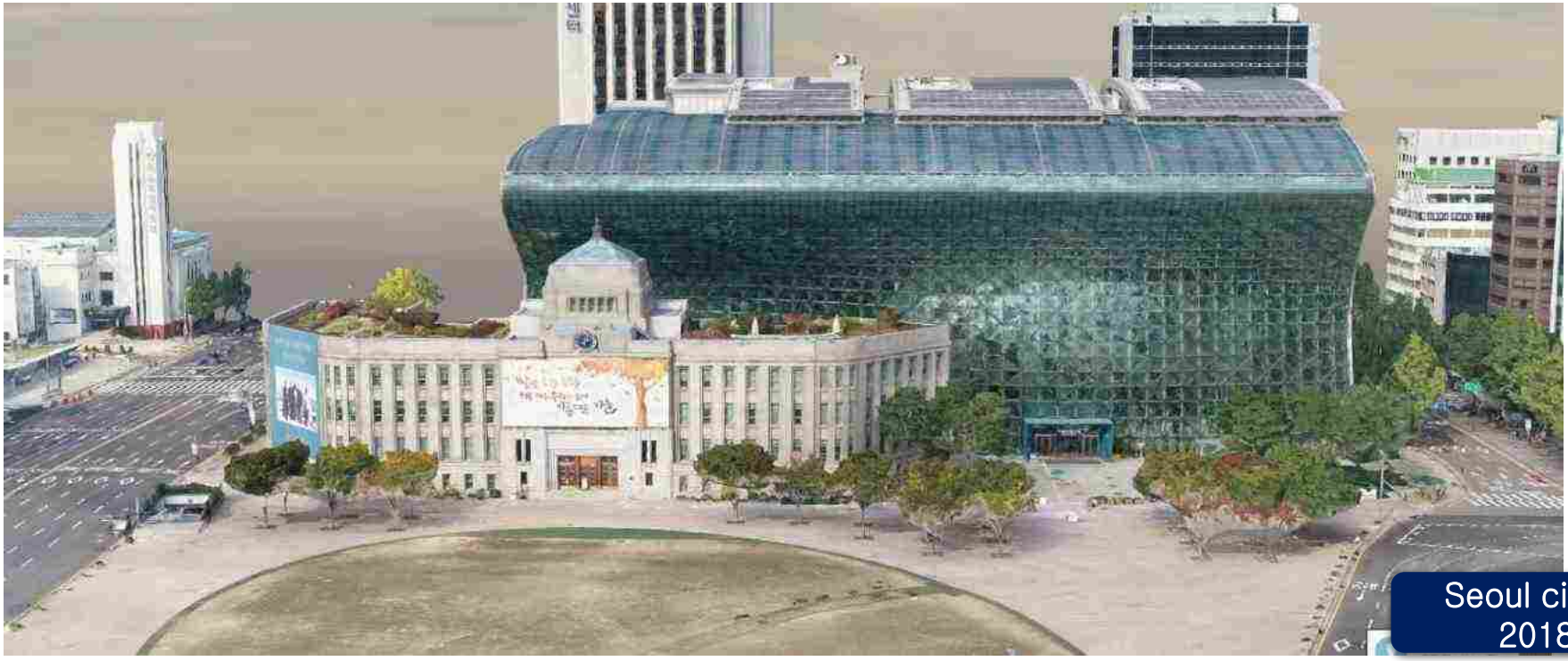
Seoul (2018, Construction of digital twin DB)

North seoul museum 2018.9

Seoul institute of science
2018.9

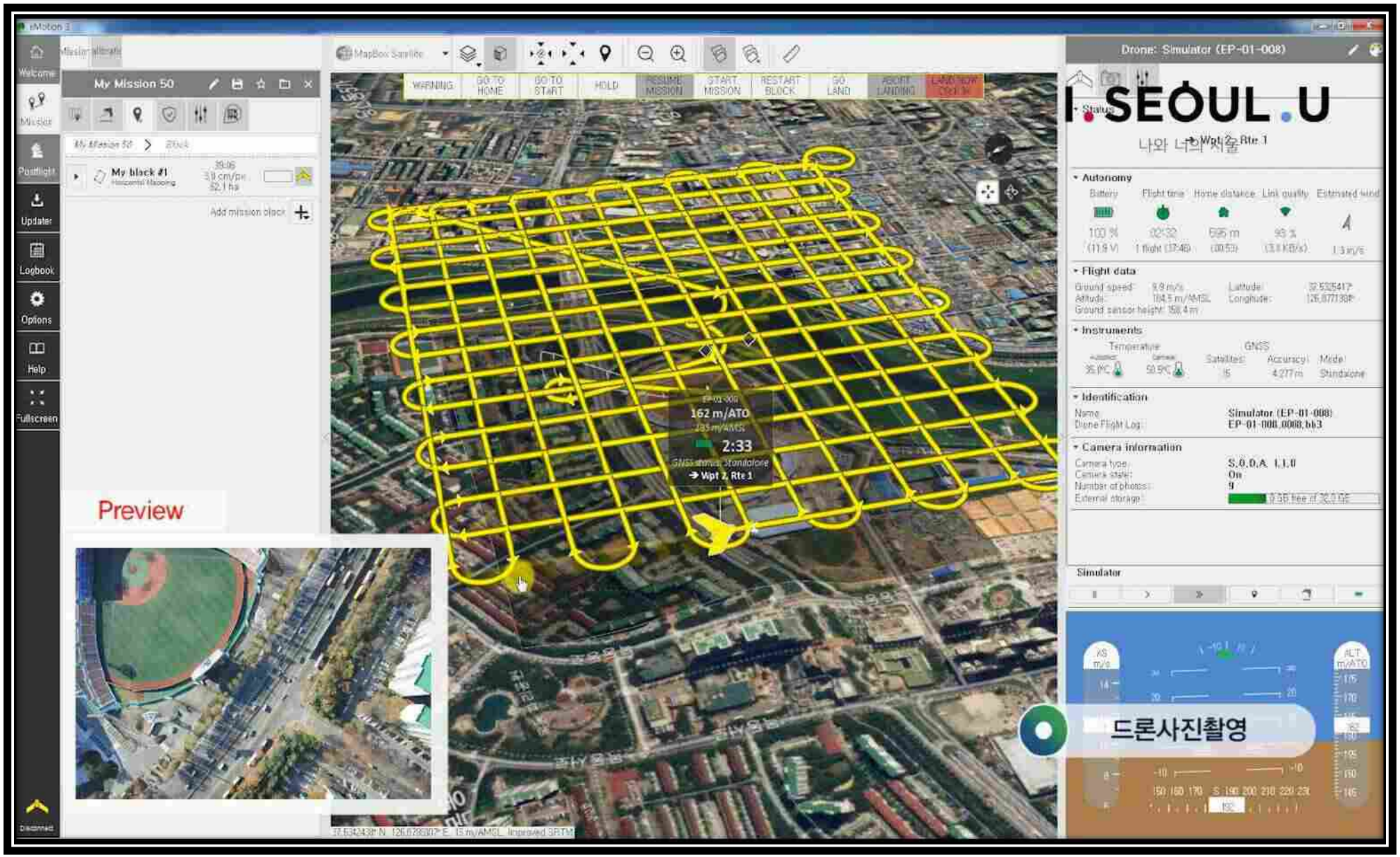
Seoul (2018, Construction of digital twin DB)

Seoul (2018, Construction of digital twin DB)



Seoul city hall
2018.9

Seoul (2018, Construction of digital twin DB)

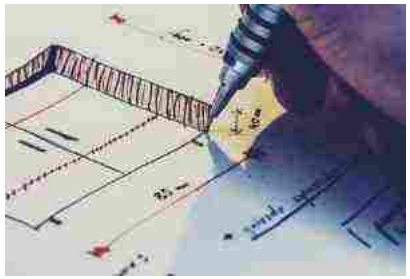


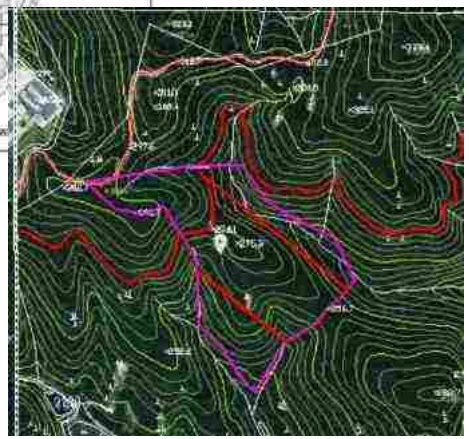
● Utilize the construction & engineering field

Digital twin construction site

Changes in construction project planning and preparation work

Manual CAD drawings





Change!

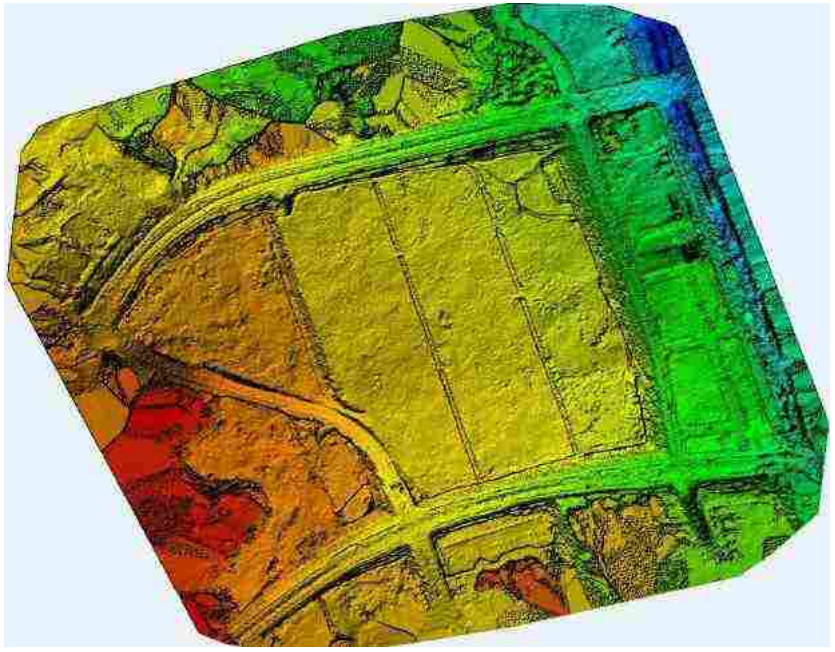
Photo + 3D drawings, subject mapping

On-site consultation

3D model utilization simulation

Business candidate site (Preliminary investigation)

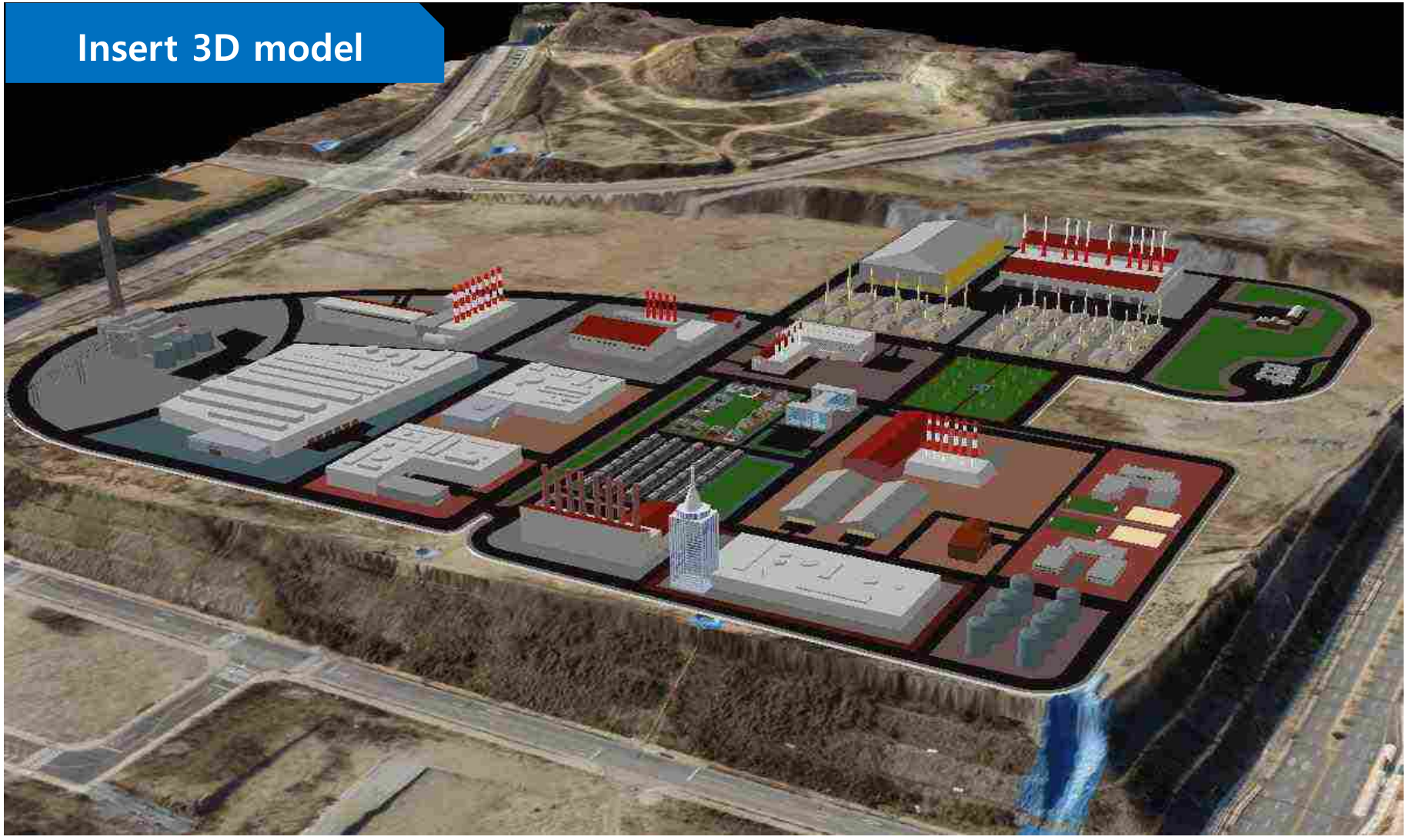
Identify the status of business districts, utilize investment review



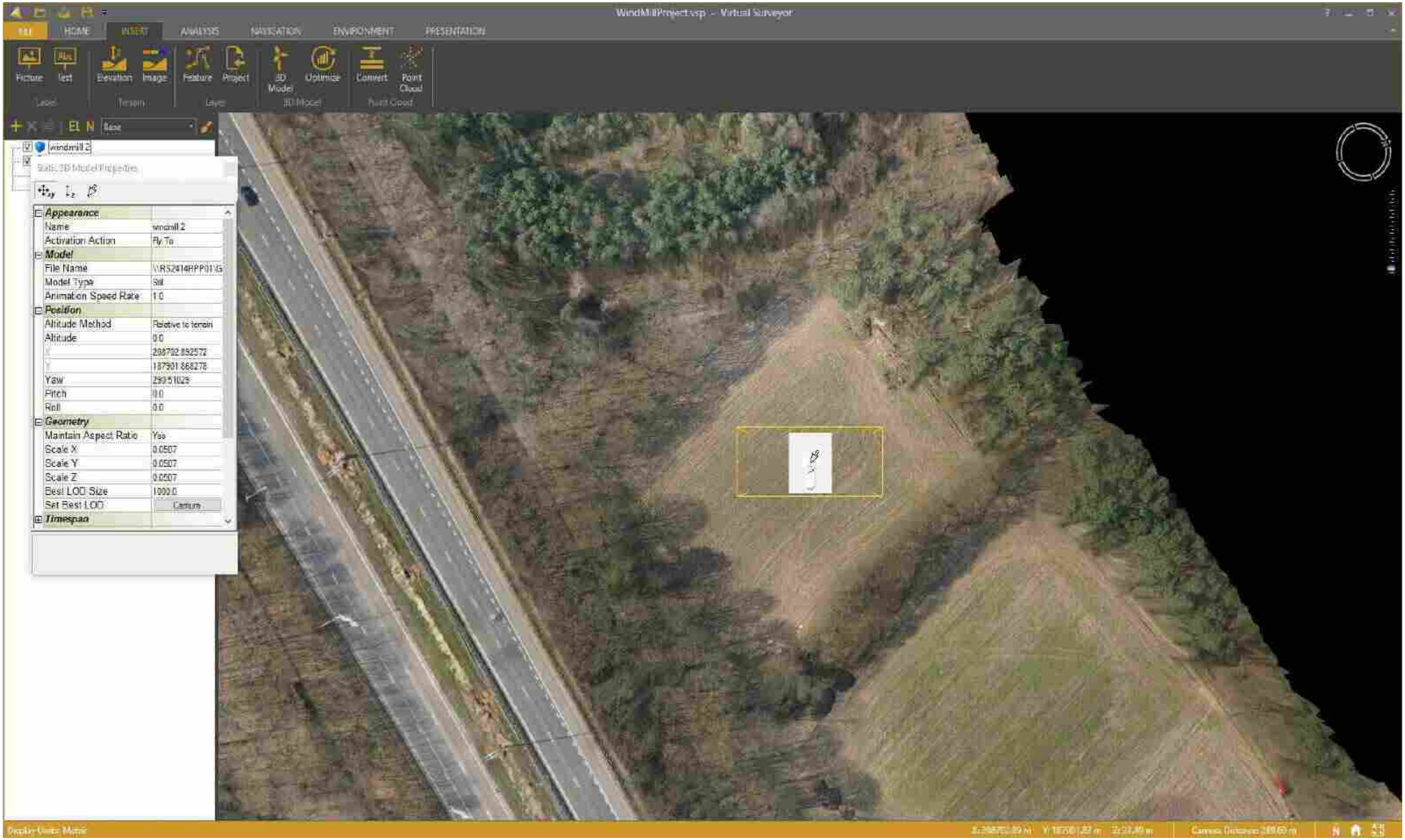
General photos, videos, map overlays, simulations

3D Model and bird's eye perspective

Sharing of accurate and quantitative design information about Change after Digital twin-based construction project



Positioning and pre-simulation of various structures



Change of topography survey

Long work time

Survey by manpower

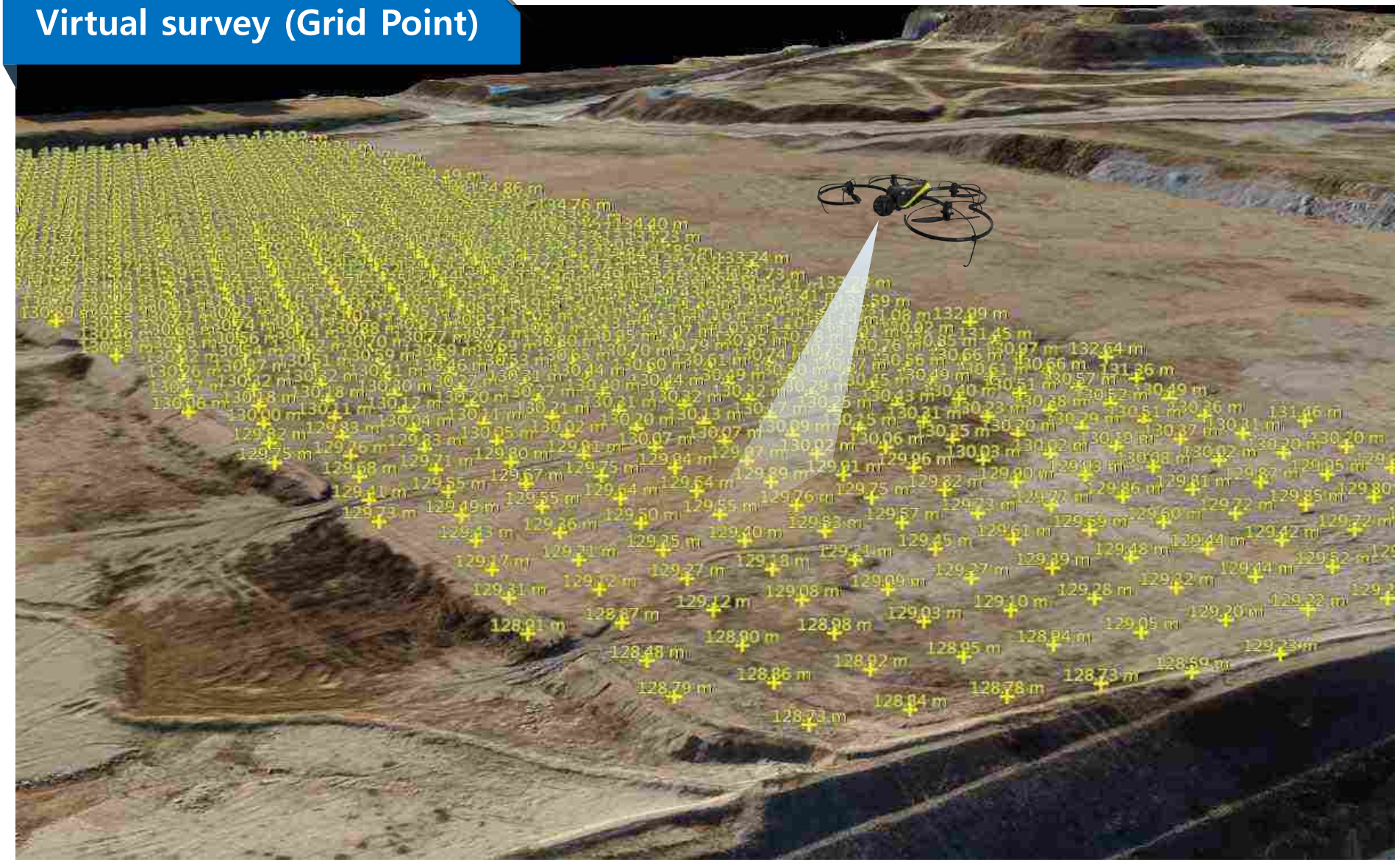
Change!

Drone processing + Short work time

Automatic route drone survey with one person

Survey on land based on UAV

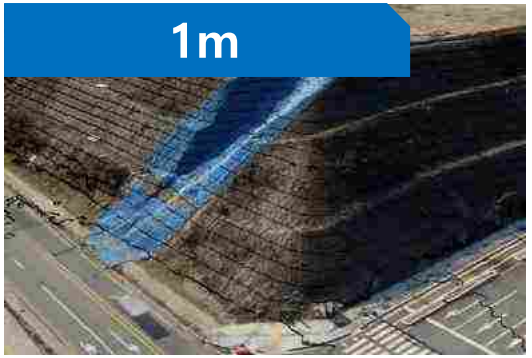
Virtual survey (Grid Point)



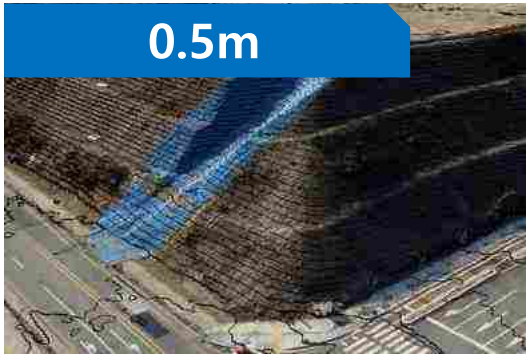
Construction site survey (Contour survey)

Contour map

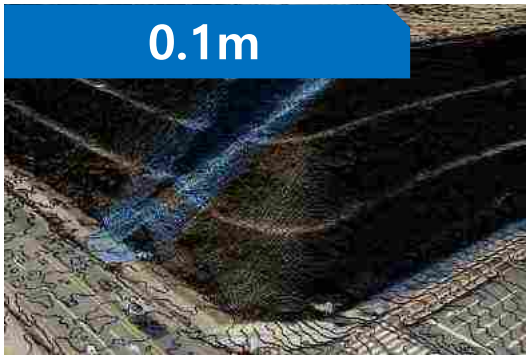
1m



0.5m

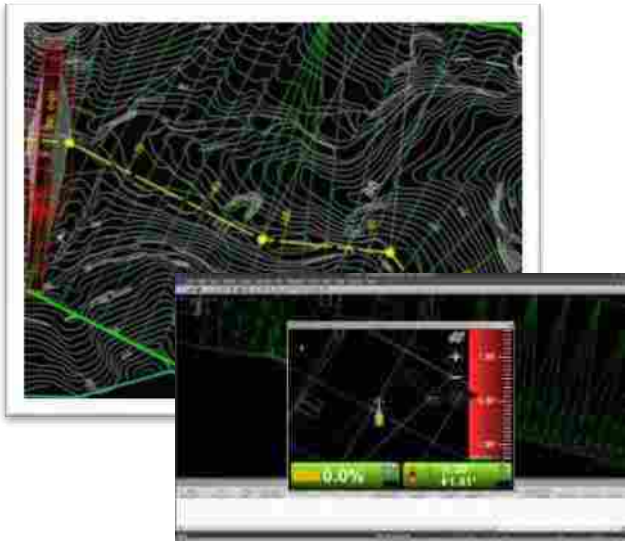


0.1m



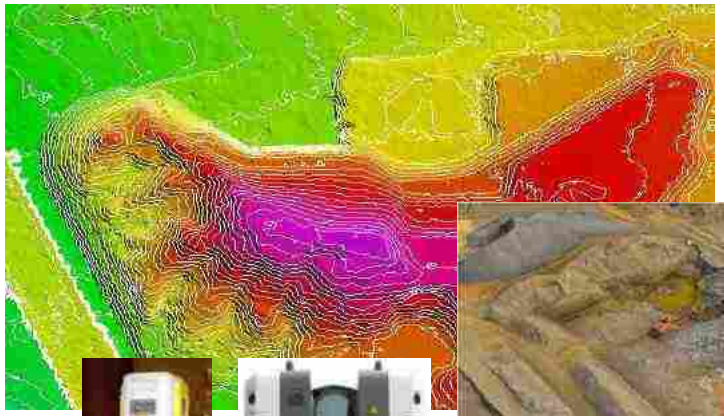
Change of design and construction planning work

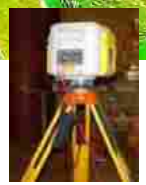
Calculate soil volume
based on 2D desing



Incorrect calculation of soil volume
by design

Change!



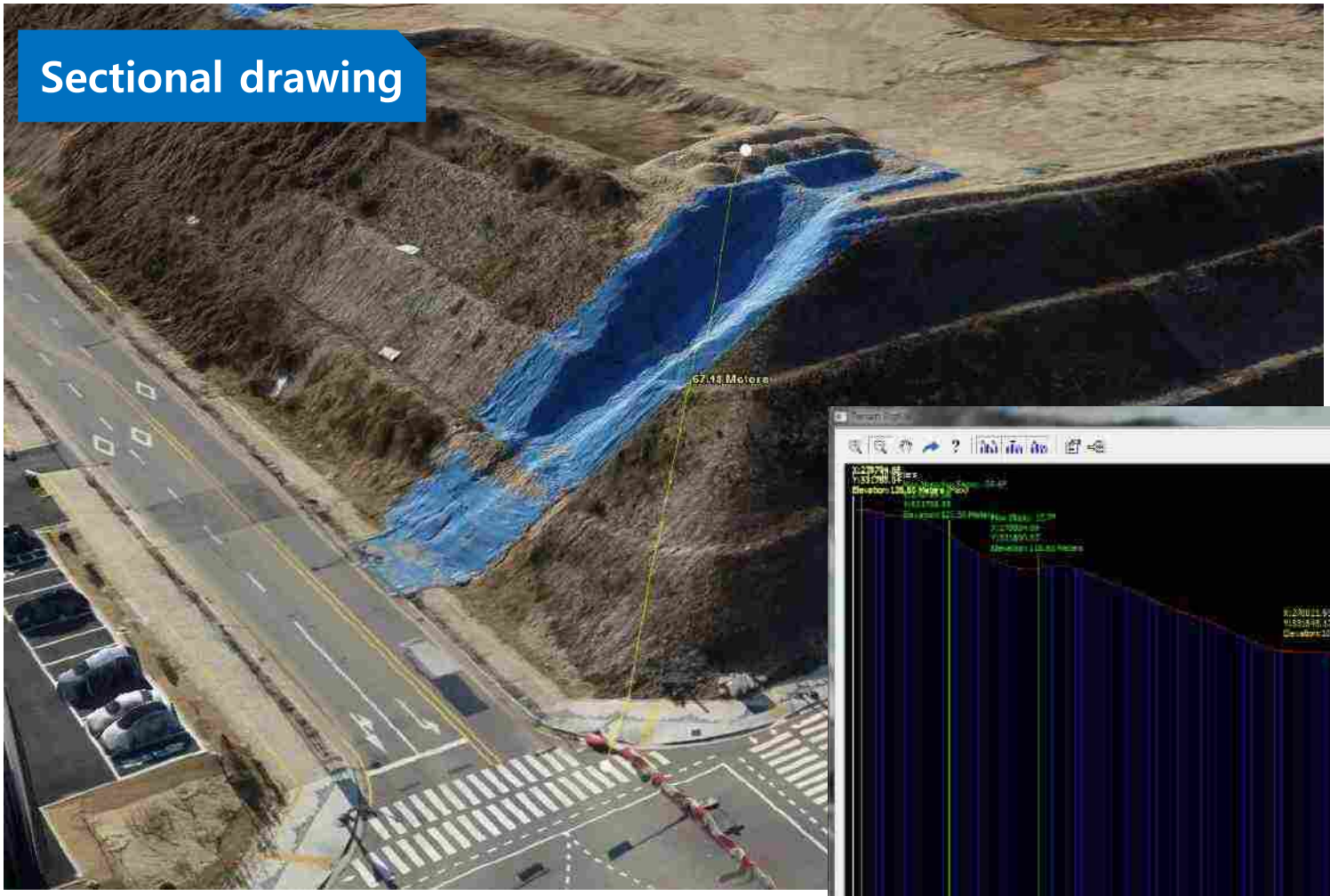


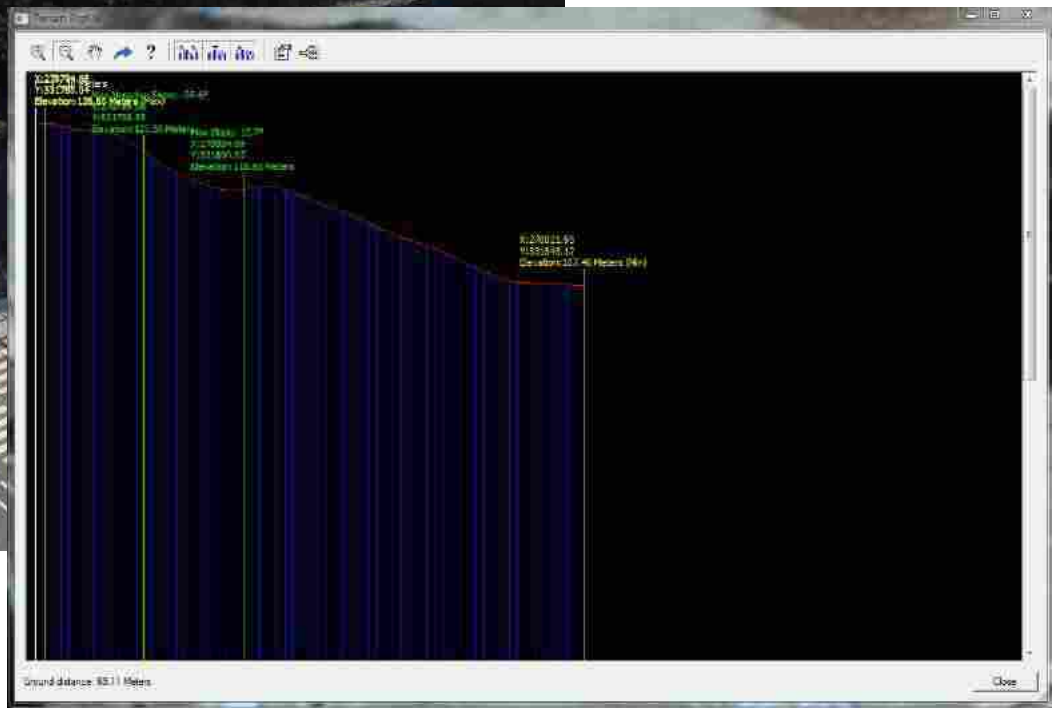
Create high-precision, short-term construction site 3D data

Reduced soil calculation time

Utilizing 3D topographic model of design work

Sectional drawing





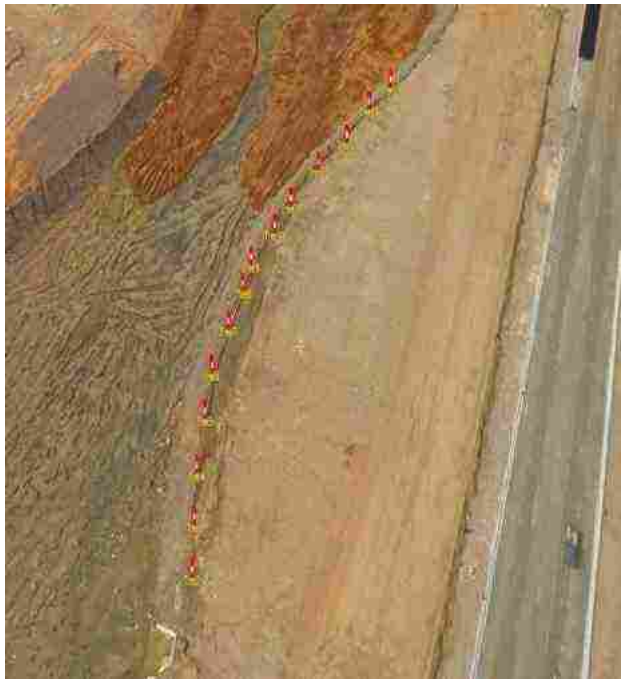
Utilizing 3D topographic model of design work
(Modification of topographic features)

Utilizing 3D topographic model of design work (Land split)

Reference area	Length	Area
A area	1147.67m	56074.14㎡
B area	1155.02m	58294.34㎡
C area	1088.10m	46142.79㎡

Utilization of landscape design
(Locating grass and tree planting)

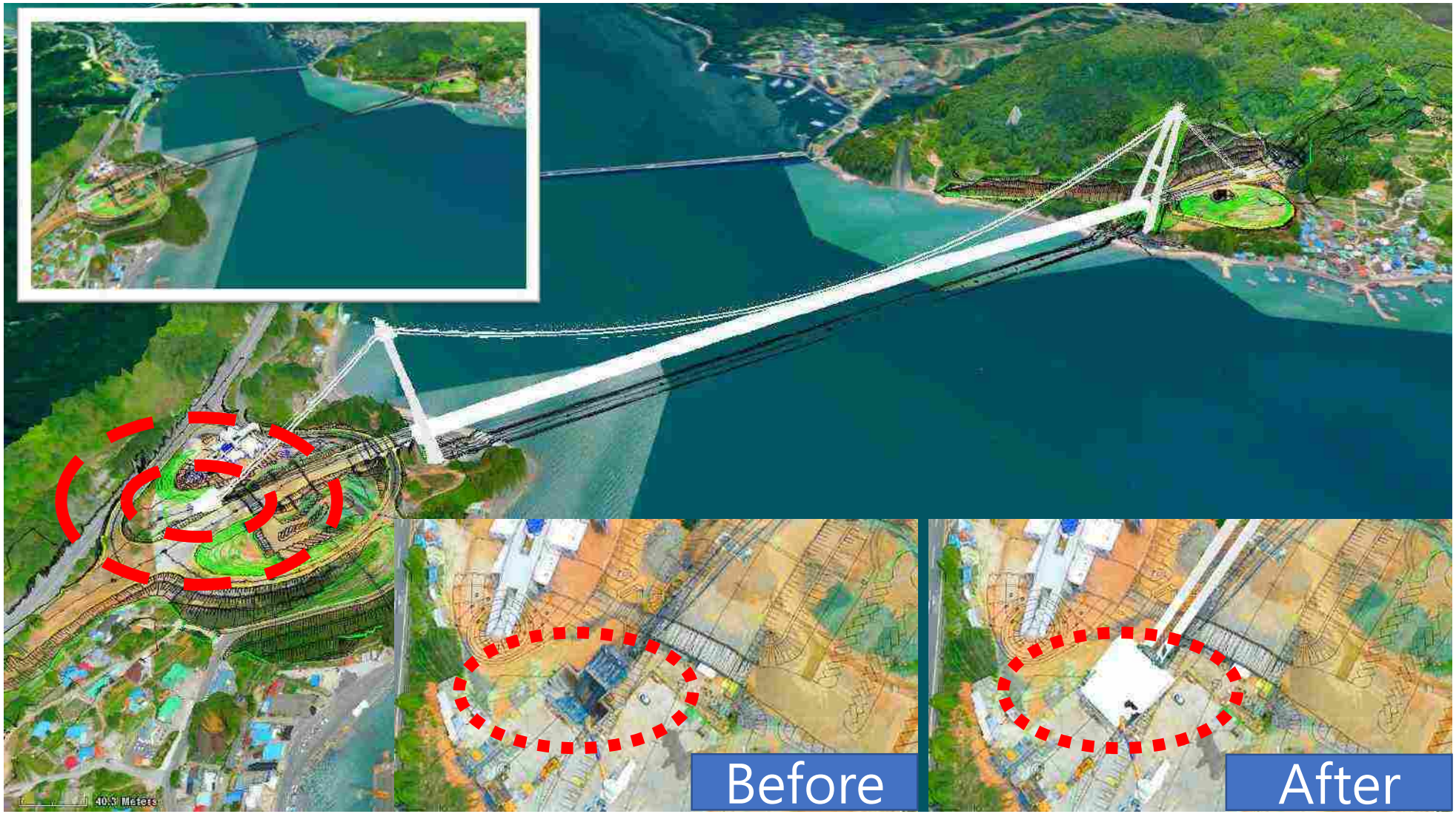
1. Planned location survey **2. Arrangement simulation** **3. Confirmation**



- **Based on the planned design, the planting, lawn planting, and landscaping structures can be matched to the surrounding landscape in accordance with the given process .**

Bridge design
(Design and construction simulation)

Combine bridge design data based on drones 3D terrain model to establish design and construction plan.



Change in construction survey and work

A lot of manpower

Daily or monthly field work

Change!

Reduction of time by using drone system

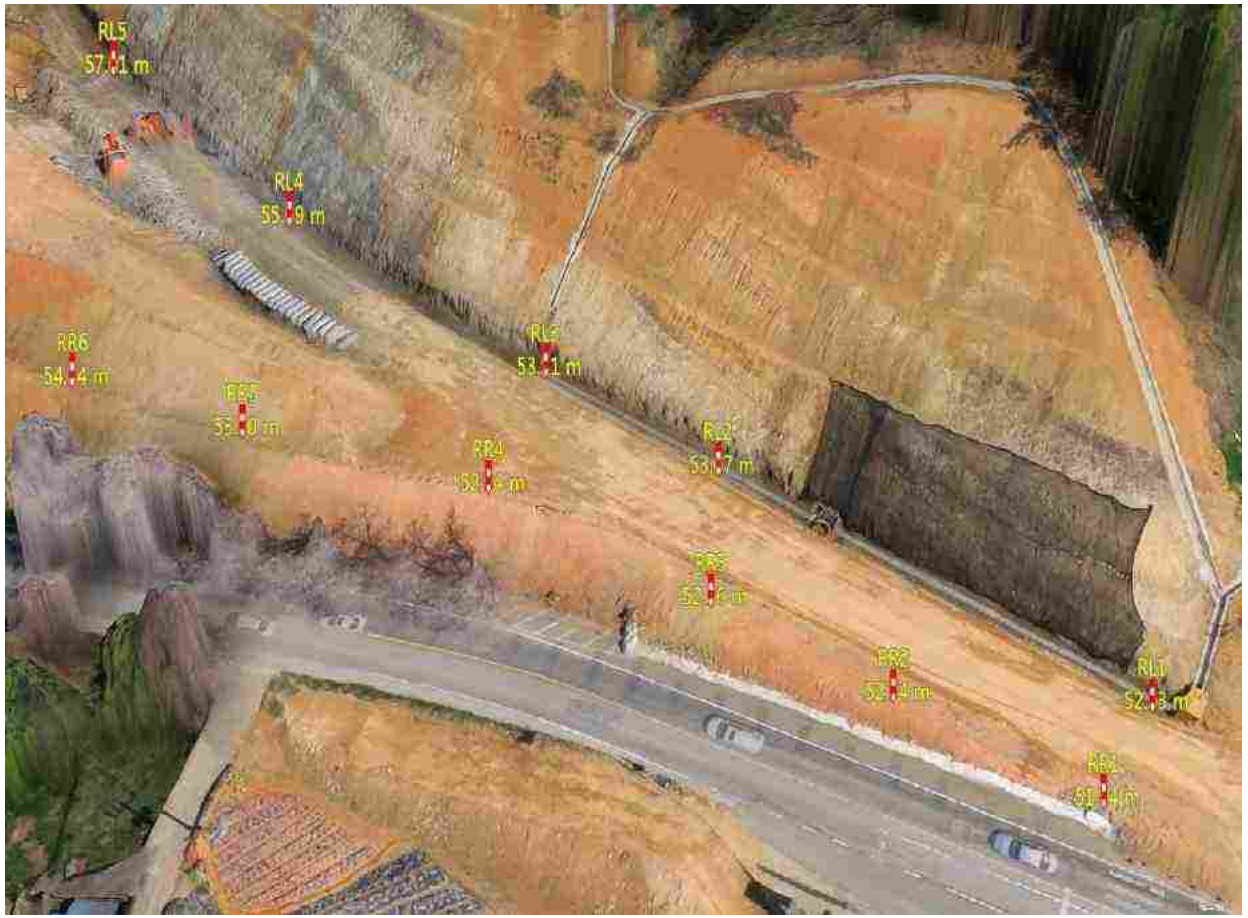
Automatically calculate the amount of quantity

Digital delivery
Simplify documents

Quantity survey based on drone 3D digital model

Virtual set out on construction site

Display the boundary of the construction site of the road structure on the 3D model.

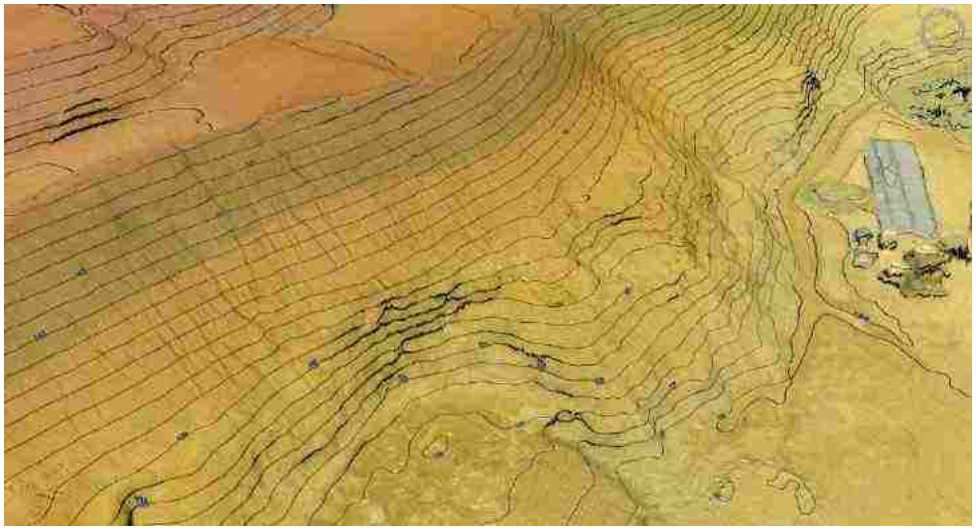


Projected and recorded in real time to 3D model.

Use and analysis of drone digital twin construction site

Slope safety management

Safety management against rainfall



Production of contour lines

Longitudinal / cross section utilization

Service of construction process management DB of site

17.06.16

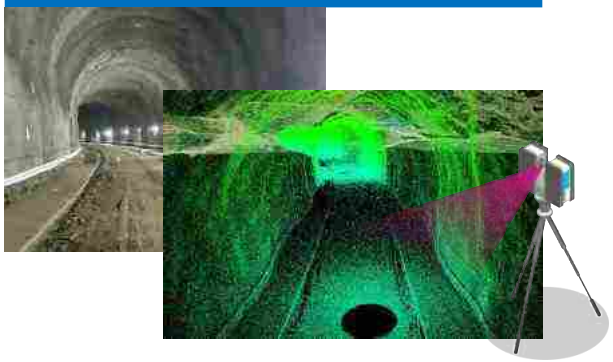
17.08.18

17.09.14

Railway and tunnel

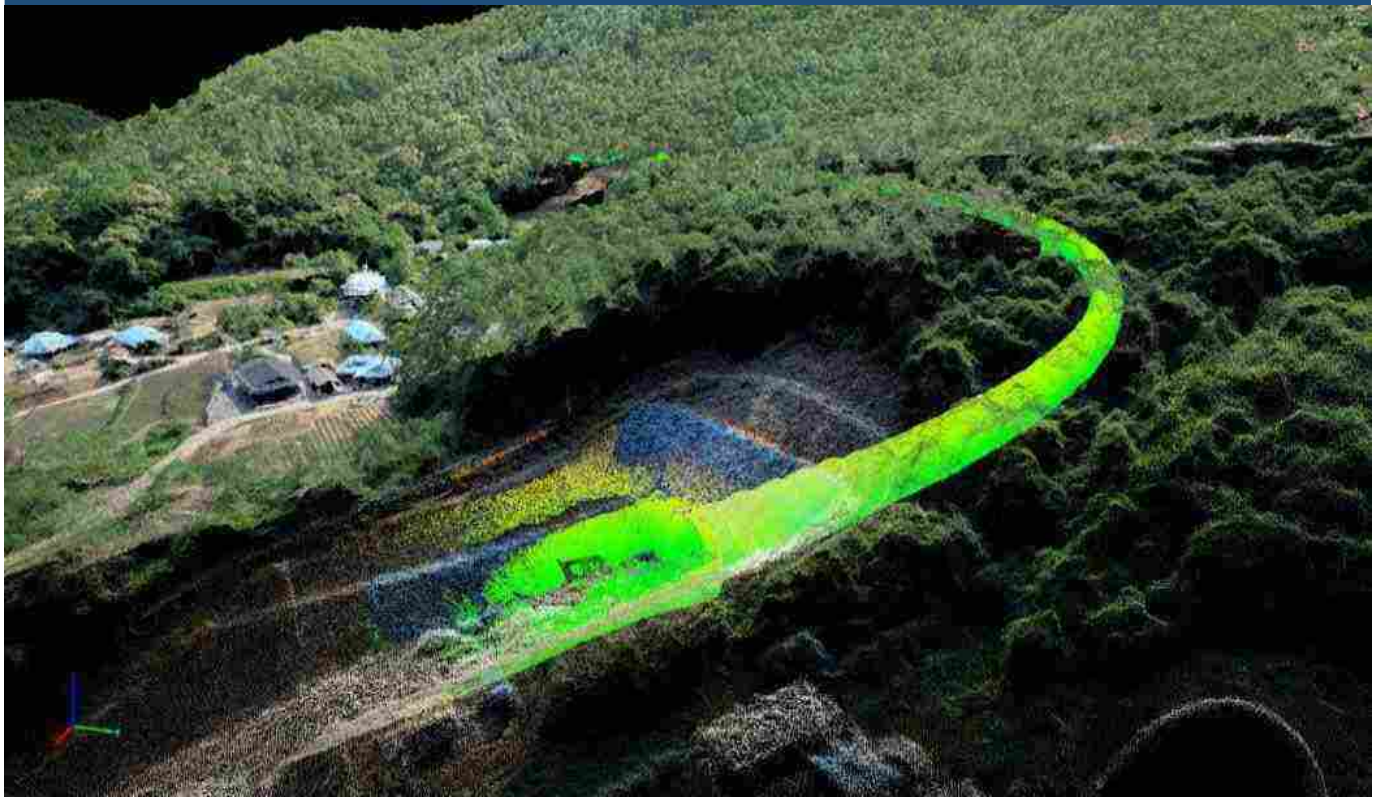
- Identify construction status through drone data and ground-level data integration
- Accurate RMSE error within 5cm to build on-site data with high accuracy
- Construction of process monitoring system by overlapping design and construction data

Tunnel Laser Scanner



Drone Point Cloud

Ground Laser Scanner / Drone Point Cloud Integration



Calculate Tetrapod quantity at port construction site

- Conduct volume comparison using 3D drone spatial information about Tetrapod which manpower is hard to access
- Compared with conventional surveying, the accuracy is more than 98%

공 종			규 격	단 위	① 설 계				② 시 공				추가수량 (① - ②)	비 고
					할 증	NET	ADD	수 량	할 증	NET	ADD	수 량		
레미콘			25-24-120,무근	㎥	2%	7,489	7,639	7,639	2%	7,489	7,639	7,639	1,062	
TETRA NEO	(해상수상)		12.0톤급	EA		814	814	814		644	644	644	170	
	(해상수중)		12.0톤급	EA		554	554	554		525	525	525	29	
	(수중침하)	현 지 반 차 이	12.0톤급	EA		64	64	64		55	55	55		지반차이 및 침하
		도 면 와 침 하 (테 트 라 자 중)								194	194	194		
	소 계			EA				1,432				1,418	199	

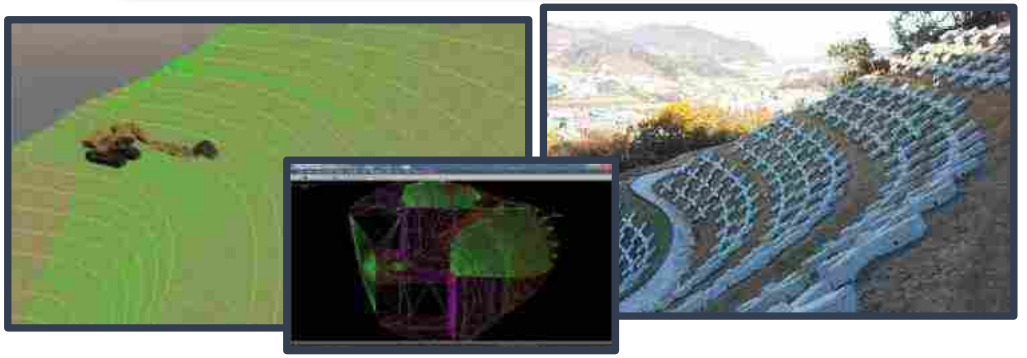
Change of construction

A lot of manpower

Excavation location, depth verification etc.

Change!

Machine control(MC) inclined sensor and GPS-independent surveying work



Excavation and slope work with the designed values

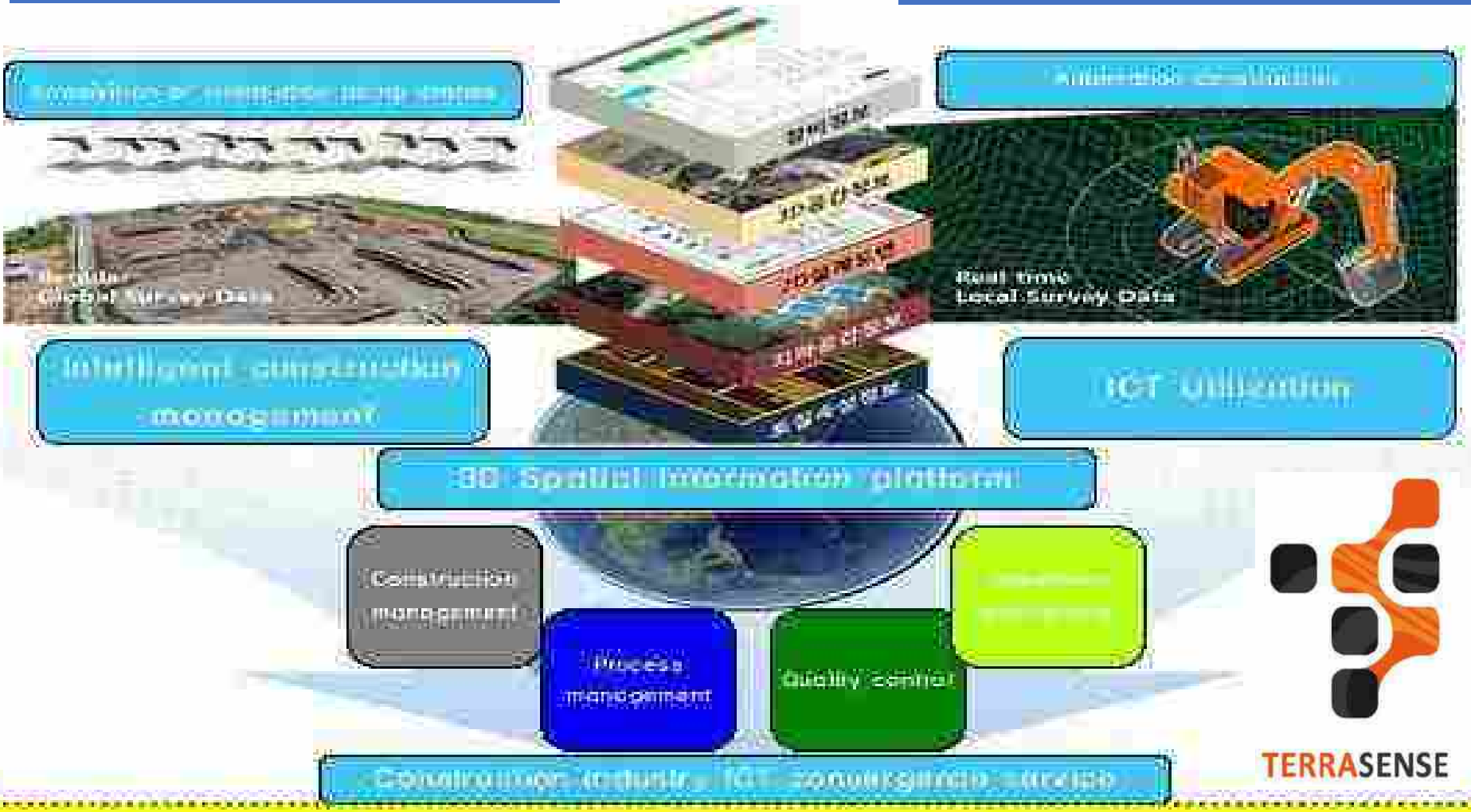
Automation of construction equipment(K-Construction)

Reduction of construction mistakes, no need for surveying, automatic control

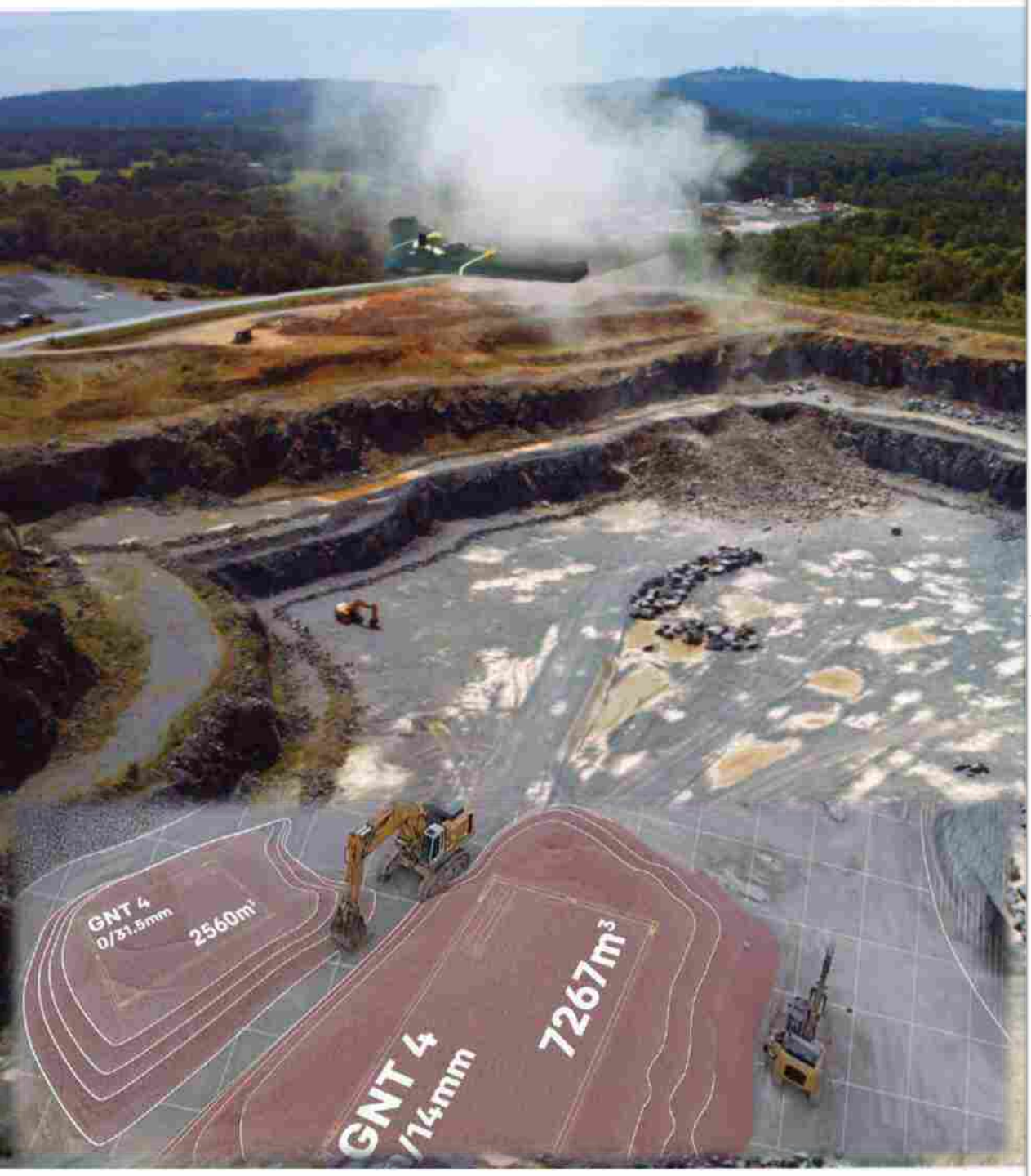
Construction management platform

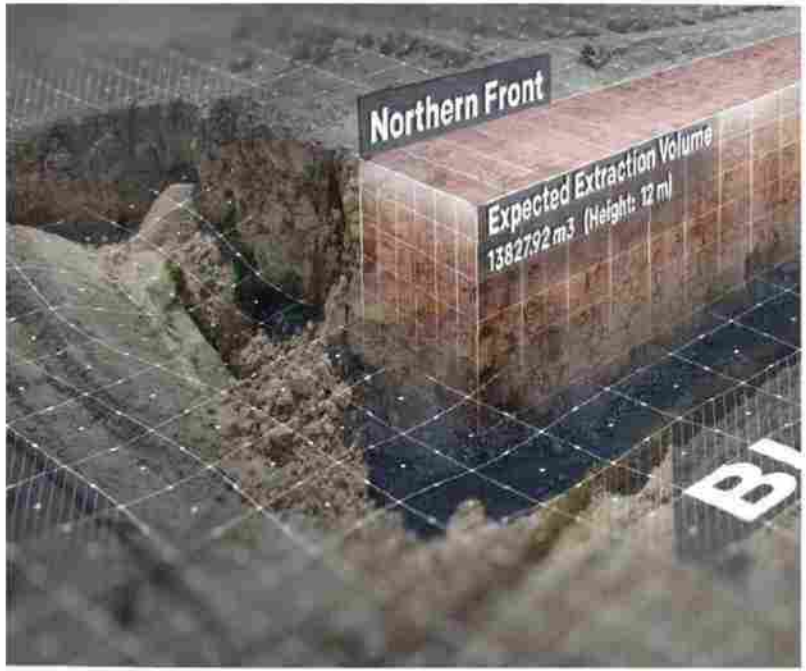
Various simulations

Service development through drones

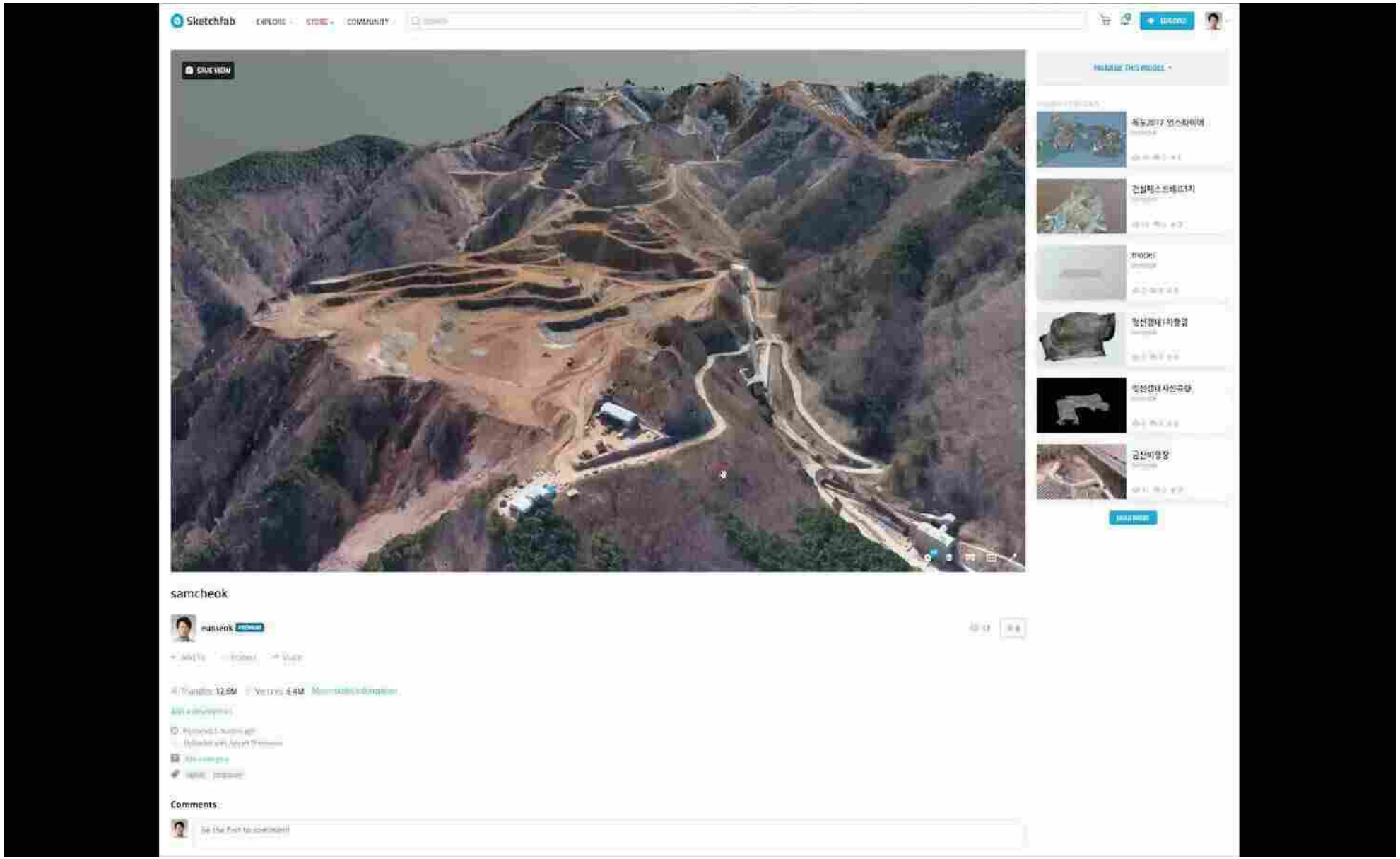


Improve productivity by shortening construction period, quality improvement and cost reduction


GNT 4
0/31.5mm
2560m³
GNT 4
/14mm
7267m³


Northern Front
Expected Extraction Volume
1382792 m3 (Height: 12 m)

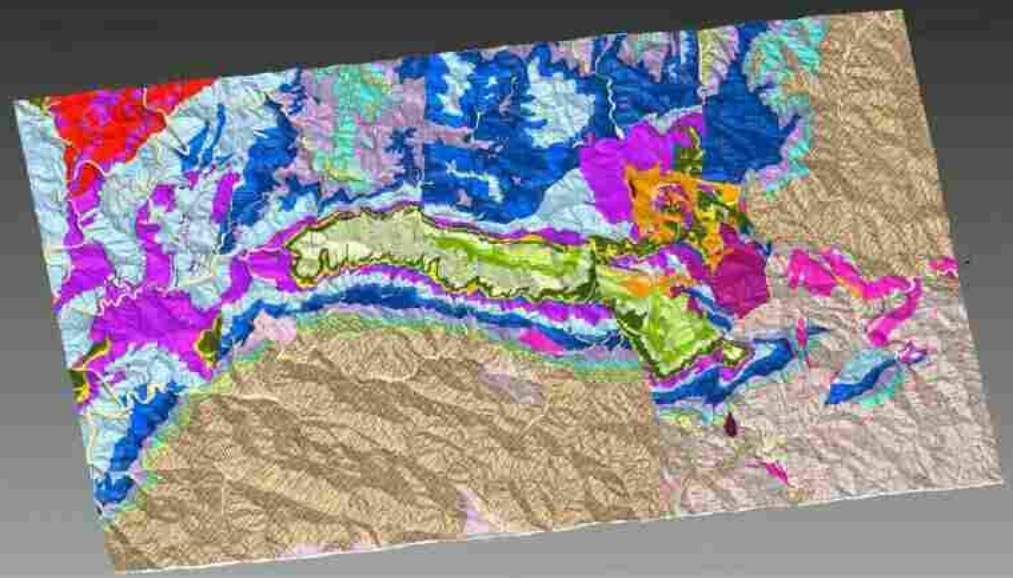
Limestone mine management (Platform)



Establishment of ground and underground DB

After collecting ground information, the 3D modeling of the ground is performed

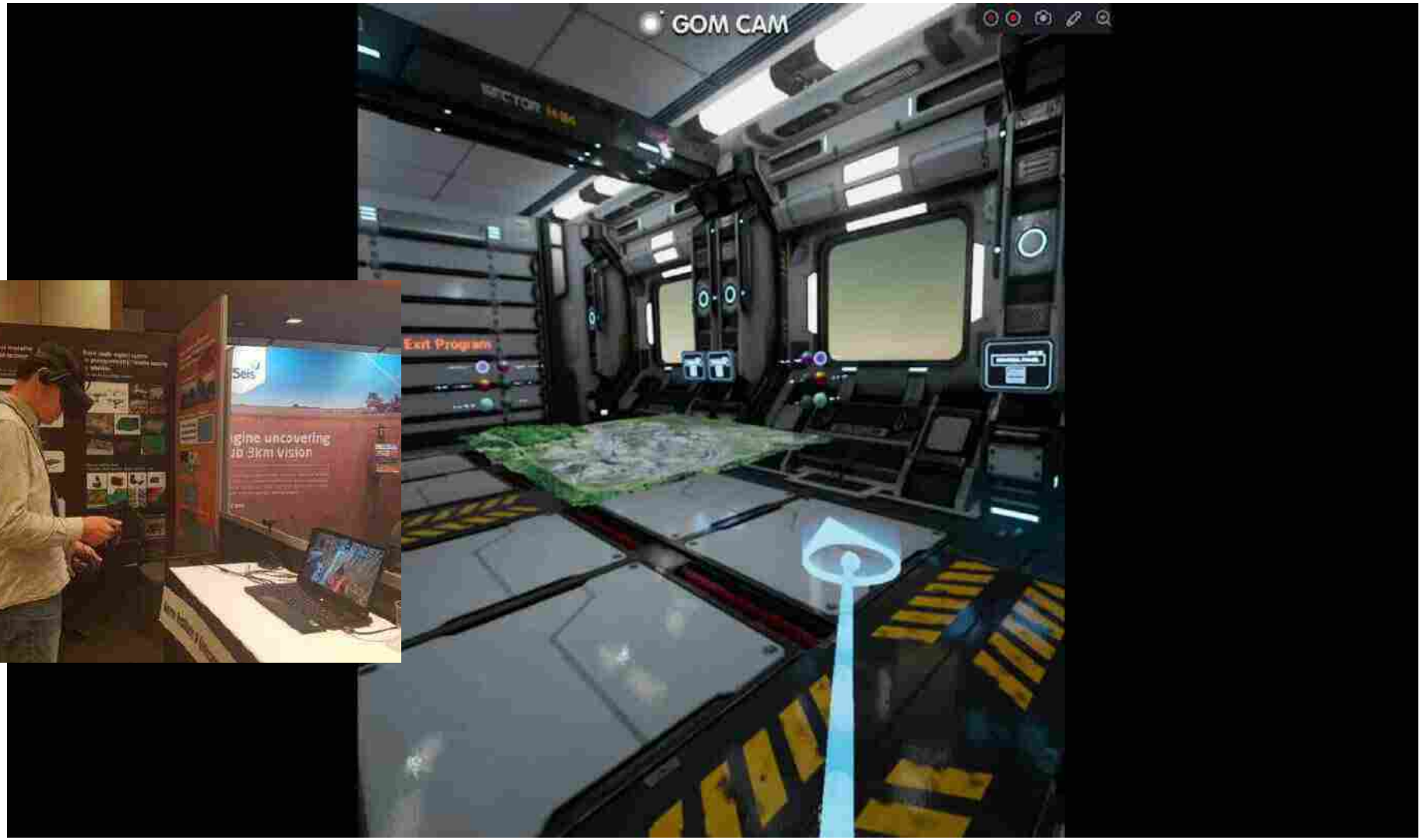
3D modeling DB construction of underground information

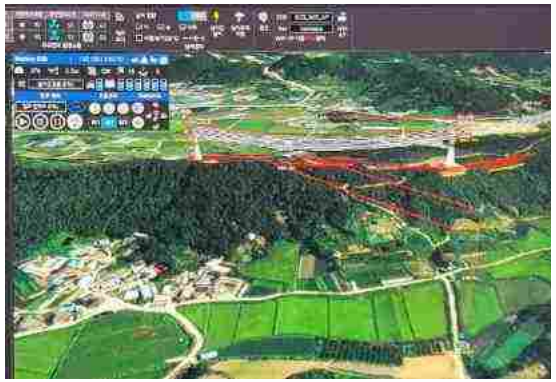


compiled geological map using 1:25,000, 1:50,000, 1:250,000 scale (66km x 36km)

VR mine management

Digital twin 정보를 이용한 시민 참여형 콘텐츠 제작 및 서비스 활용





04 Digital twin Smart City Construction

Digital twin construction case of building site in Yongin-si Seongbok-dong

(2018. 7. 13. ~ 2019. 5. 22. 13 times flight)

GCP measurement in 2nd public housing project in Yongin-city Seongbok-dong

Drone view in 2nd public housing project in Yongin-city Seongbok-dong

Drone view in 2nd public housing project in Yongin-city Seongbok-dong






Time-series Digital twin + 2D drawing overlay in the 2nd public housing project

Supply input-output table in 2nd public housing project in Seongbok-dong

2D Area(㎡)	76130.830	3D Area(㎡)	78302.130	Difference(㎥)
2D Perimeter(m)	1381.210	3D Perimeter(m)	1402.180	
Date	Reference(m)	Volume(㎥)		
18.07.14	100.000	Added:	0.000	0.000
		Removed:	-2298680.430	
18.08.01		Added:	0.000	-56611.710
		Removed:	-2242068.720	
18.08.21		Added:	0.000	-34390.160
		Removed:	-2207678.560	
18.09.11		Added:	0.000	-18096.270
		Removed:	-2189582.290	
18.10.11		Added:	0.000	-52727.300
		Removed:	-2136854.990	
18.10.25		Added:	0.000	-33604.120
		Removed:	-2103250.870	
18.11.15		Added:	0.000	-57698.040
		Removed:	-2045552.830	
18.12.06		Added:	0.000	-64753.350
		Removed:	-1980799.480	
19.01.11		Added:	0.000	-111387.720
		Removed:	-1869411.760	
19.01.28		Added:	0.000	-41346.91
		Removed:	-1828064.85	
19.03.06		Added:	0.000	-99001.91
		Removed:	-1729062.94	
19.04.15		Added:	0.000	-108924.28
		Removed:	-1620138.66	
19.05.22		Added:	0.000	-73208.94
		Removed:	-1546929.72	

Time-series video in 2nd public housing project in Yongin-city Seongbok-dong

용인 성복동
2차 공공주택사업

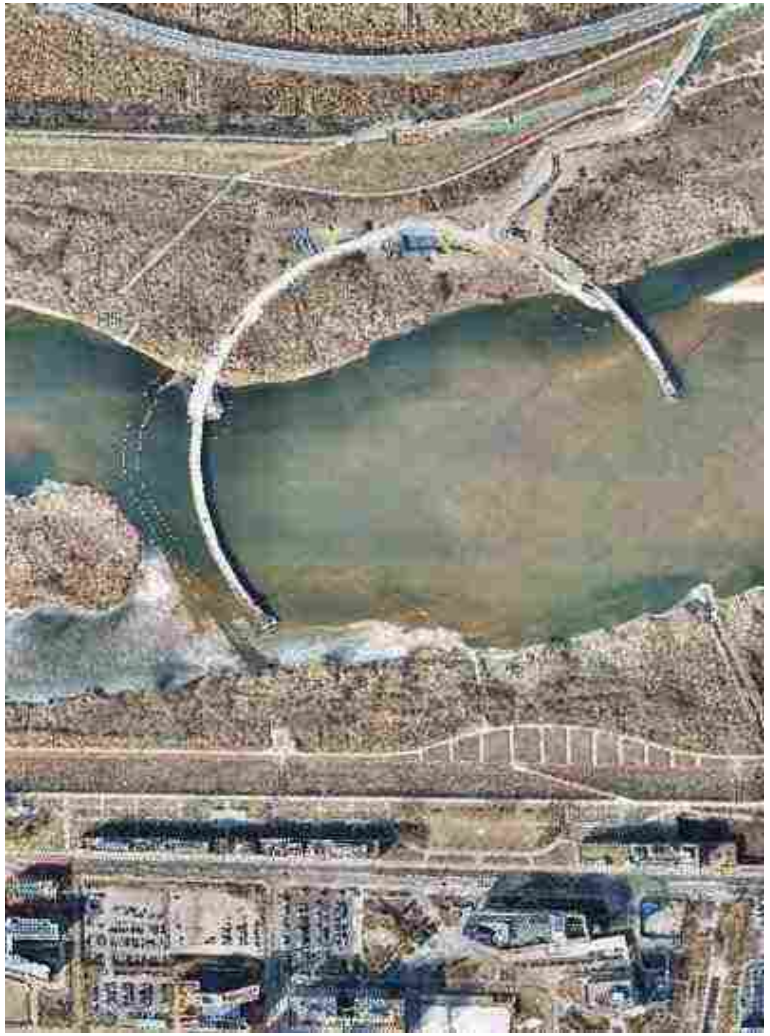
Digital twin construction case of building site in Sejong-si Geumgang pedestrian bridge

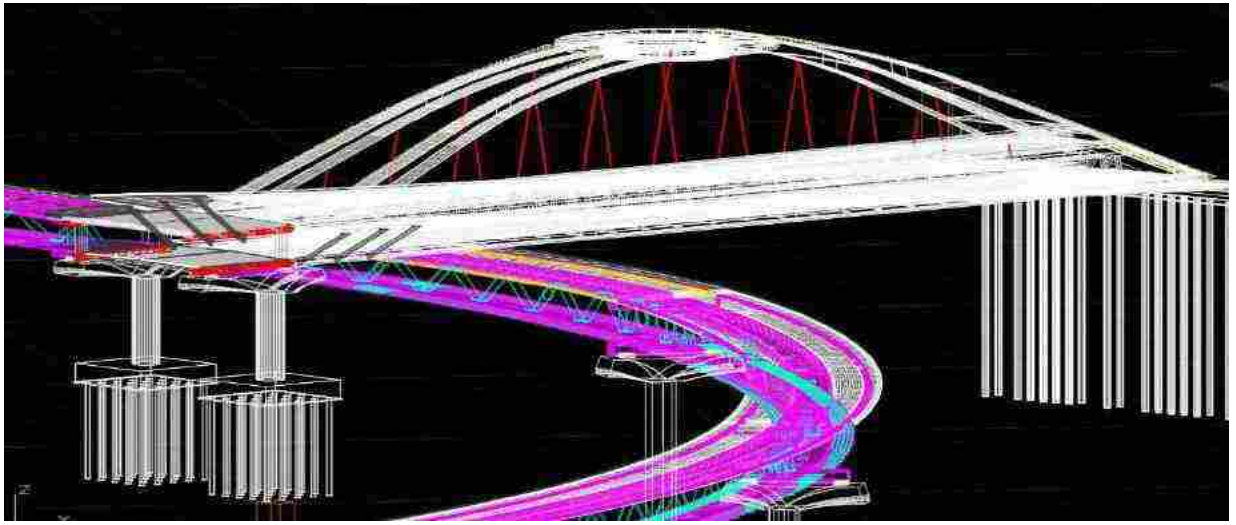
(2019. 1. 3. ~ 2019. 5. 10. 5 times flight)

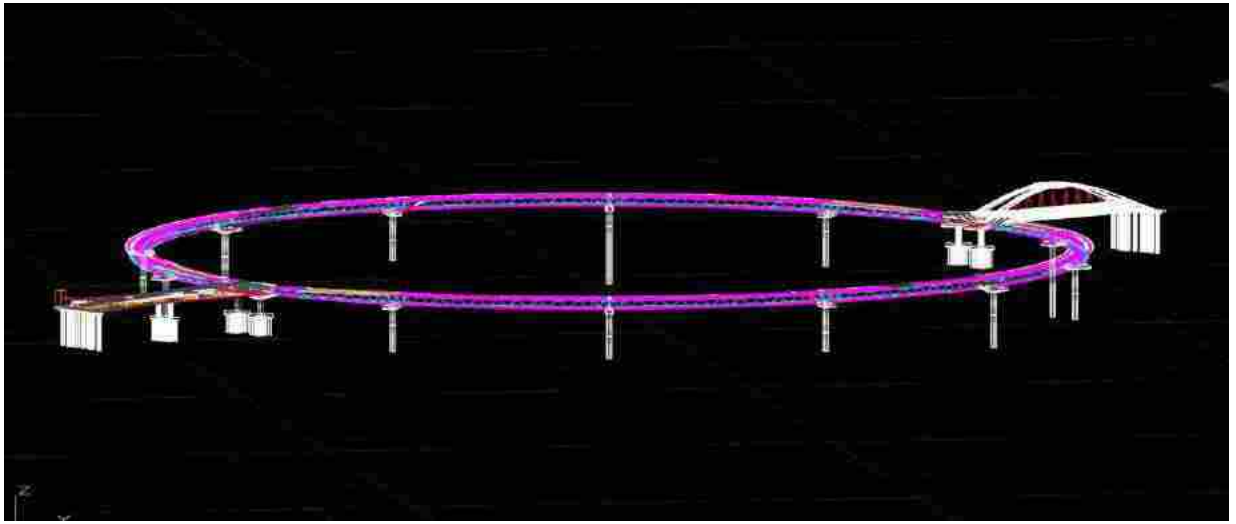
Bird's eye view in Sejong-city Geumgang pedestrian bridge

Utilization of digital twin DB and BIM

- DB construction for surveying and process progress by digital twin
- Confirmation of construction and systematic field management system with BIM data







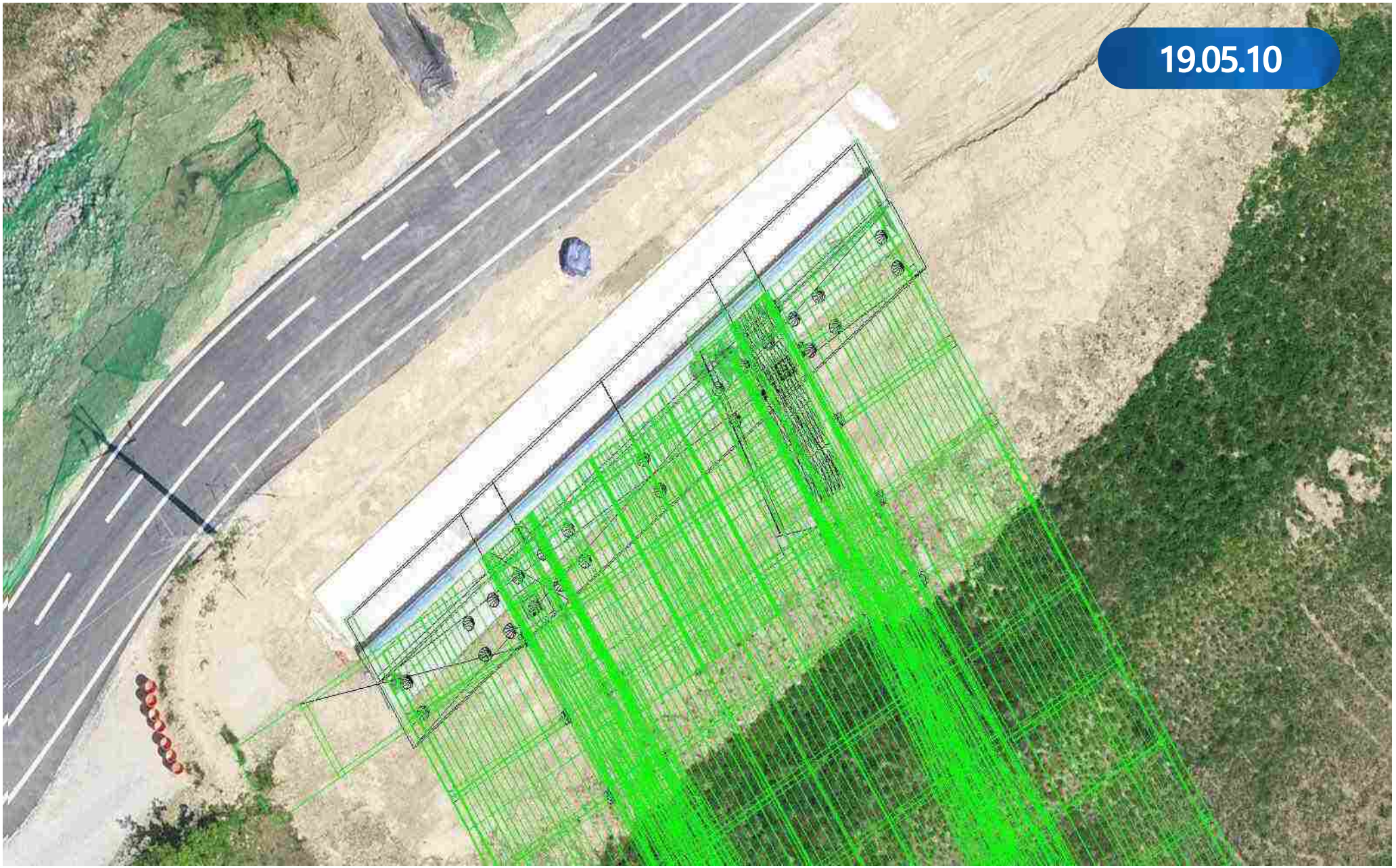
Time-series orthomosaic image in Sejong-city Geumgang pedestrian bridge

Time-series Digital twin in Sejong-si Geumgang pedestrian bridge

세종
금강보행교

Orthomosaic image + 2D drawing overlay in Geumgang pedestrian bridge

Orthomosaic image + 2D drawing overlay in Geumgang pedestrian bridge



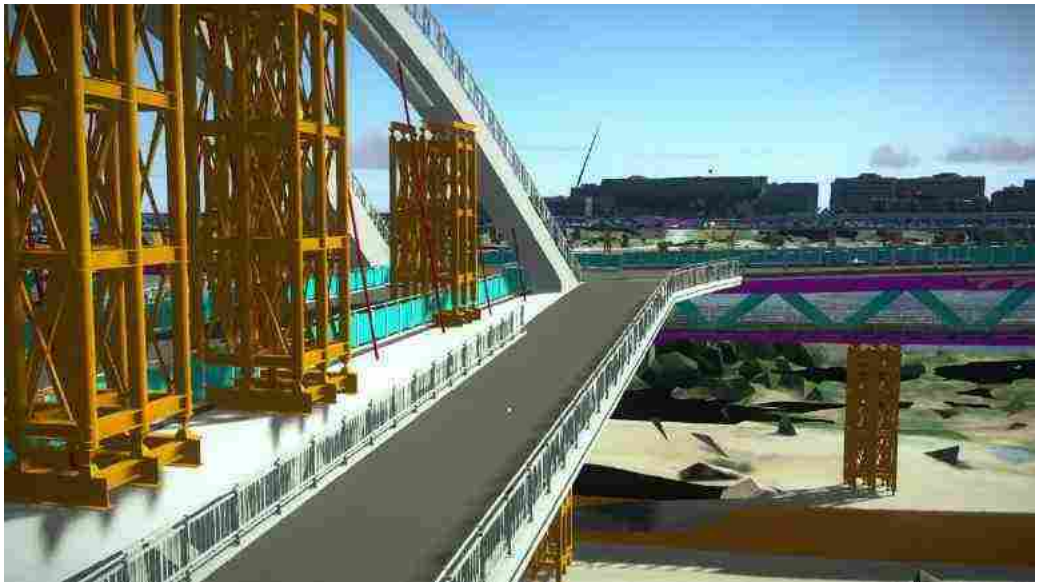
Digital twin + BIM in Sejong-city Geumgang pedestrian bridge

Digital twin + BIM in Sejong-city Geumgang pedestrian bridge

Digital twin + BIM in Sejong-si Geumgang pedestrian bridge

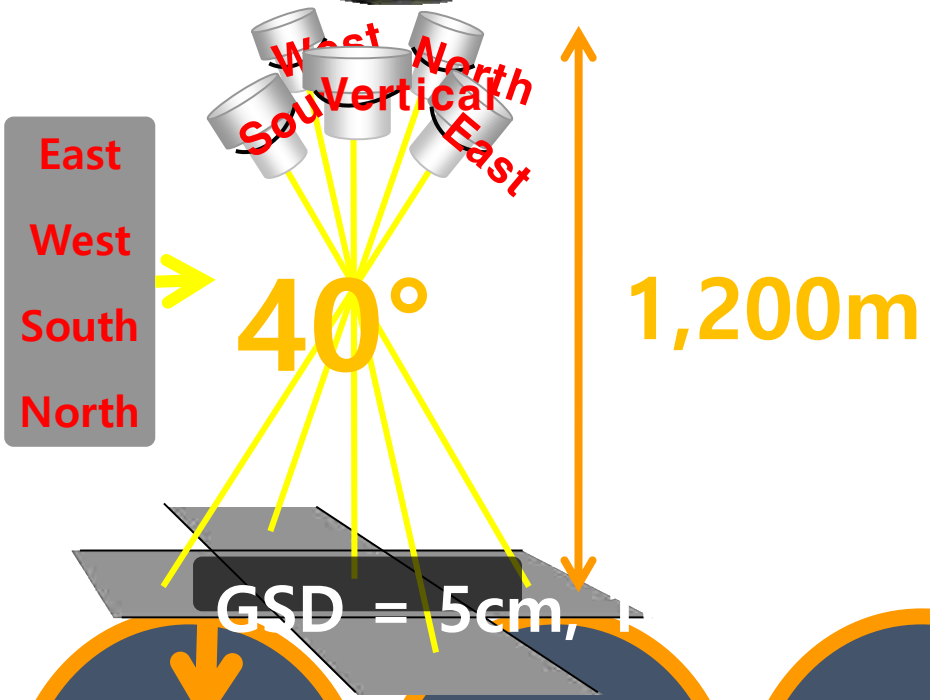
Digital twin + BIM in Sejong-city Geumgang pedestrian bridge

Digital twin + BIM in Sejong-city Geumgang pedestrian bridge **Simulation**

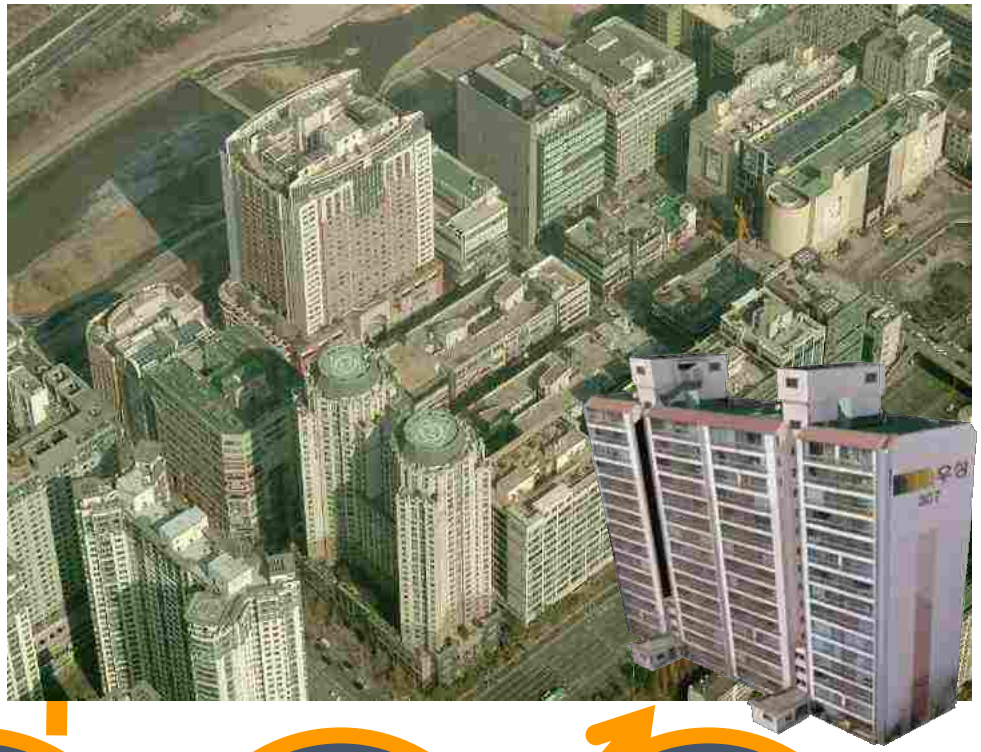


Digital twin + BIM in Sejong-city Geumgang pedestrian bridge

Manned air multidimensional stereoscopic image method



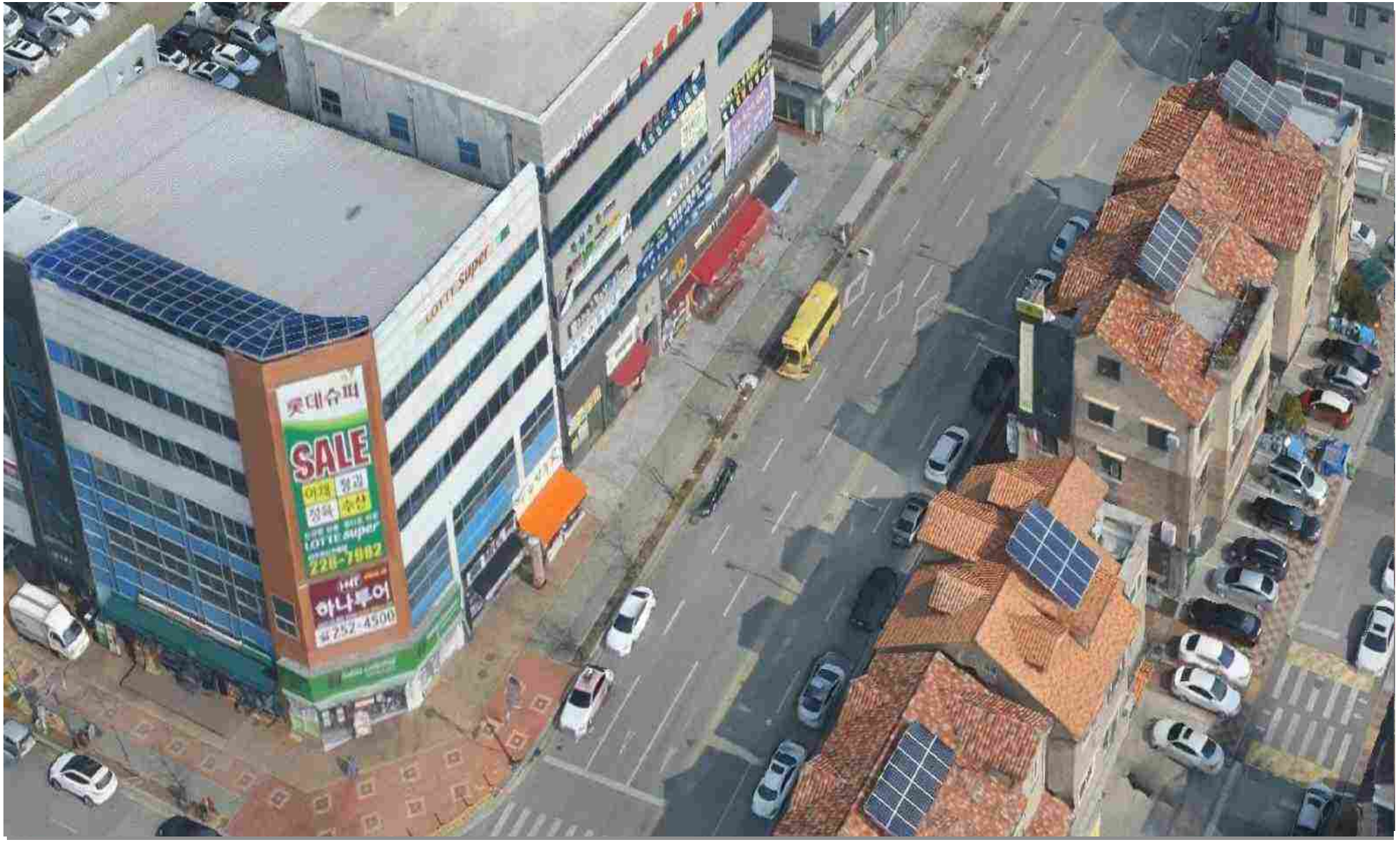
Pictometry oblique imagery



North | East | Ortho | West | South

Using fixed wing drones Digital twin performance (Naju)

Using fixed wing drones Digital twin performance (Jeon-ju)



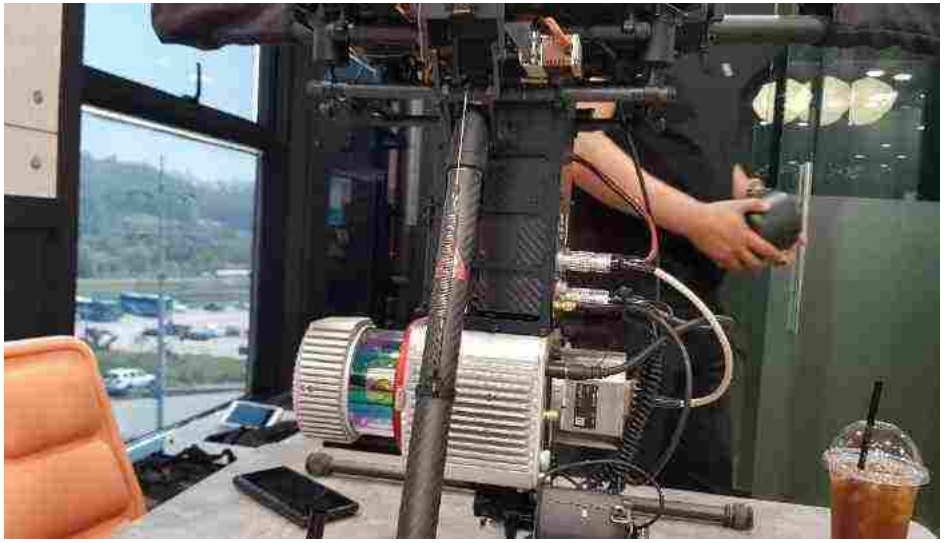
Using fixed wing drones Digital twin performance (Headquarters of LX)

Drone Digital twin city
(Jeonbuk Provincial Government)

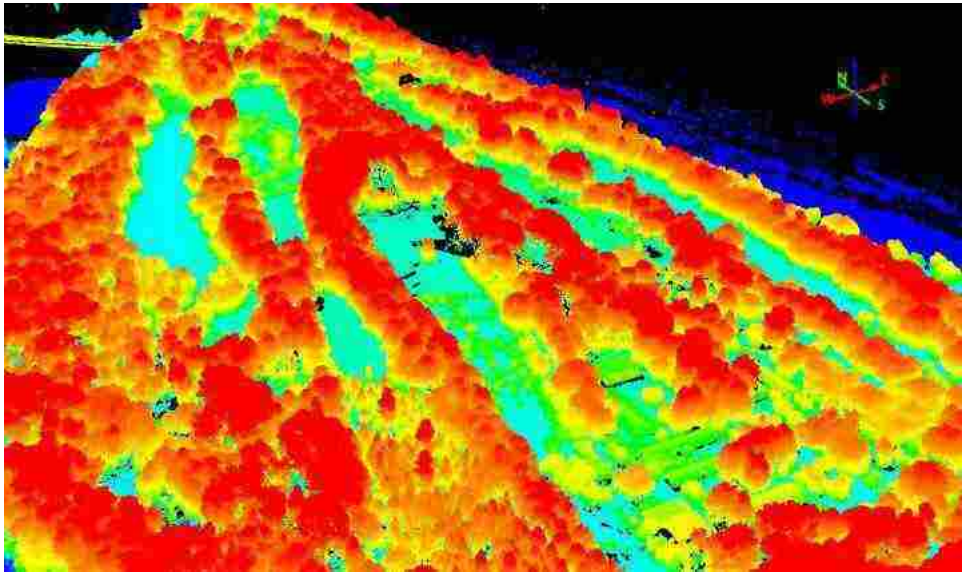
Drone Digital twin city
(Seoul Dongdaemun)

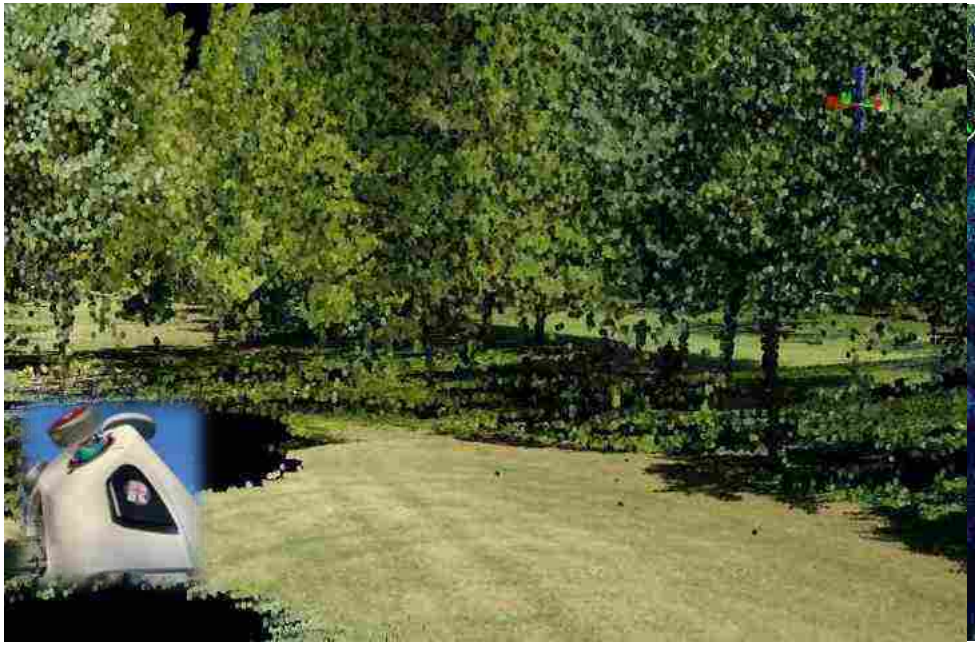
(주)공간정보
www.geomatic.co.kr

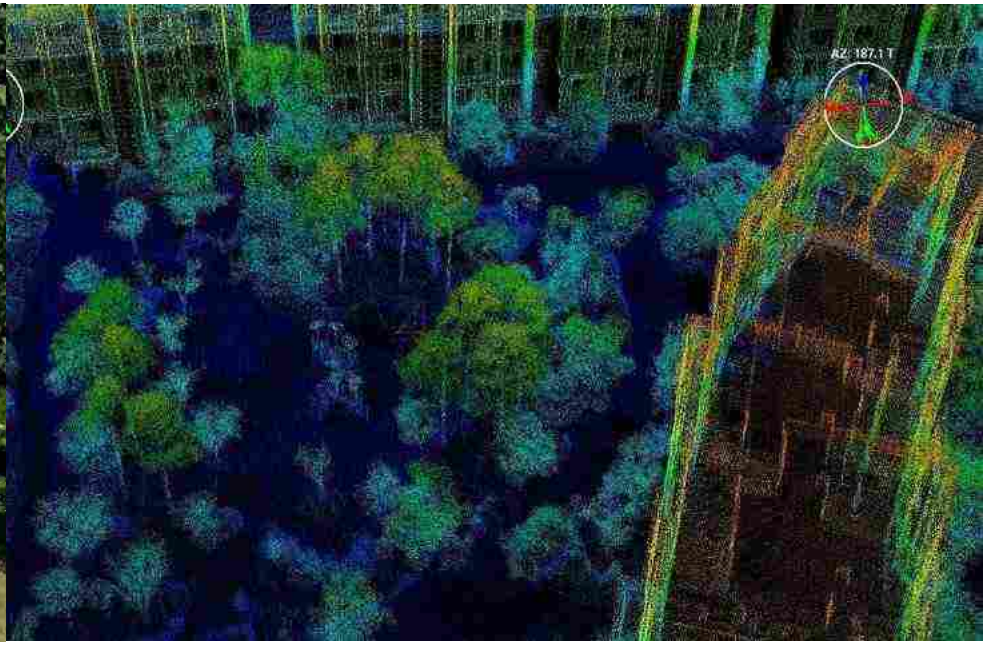
3D LiDAR scanning system for drones



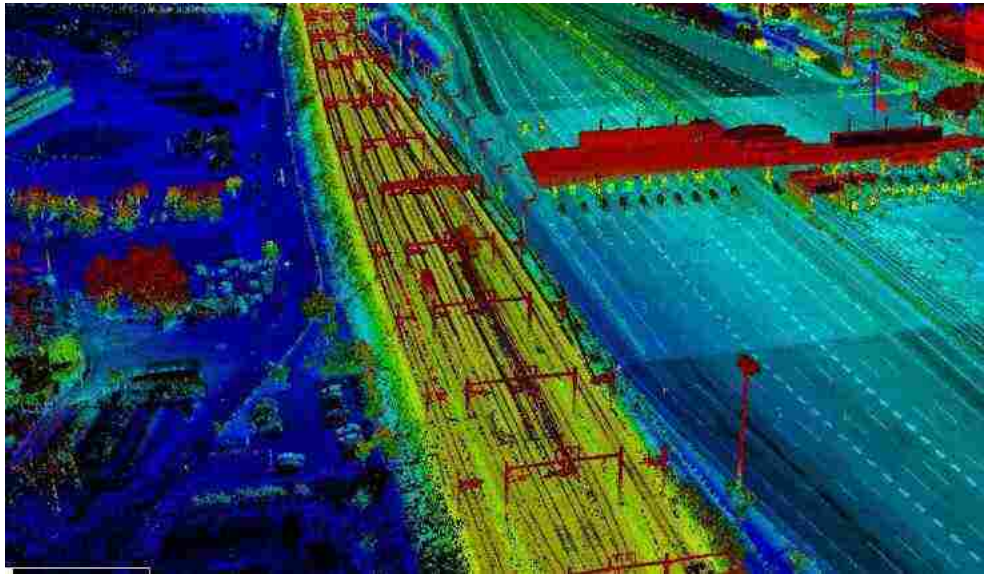
Precision DEM construction in forest using 3D LiDAR scanning

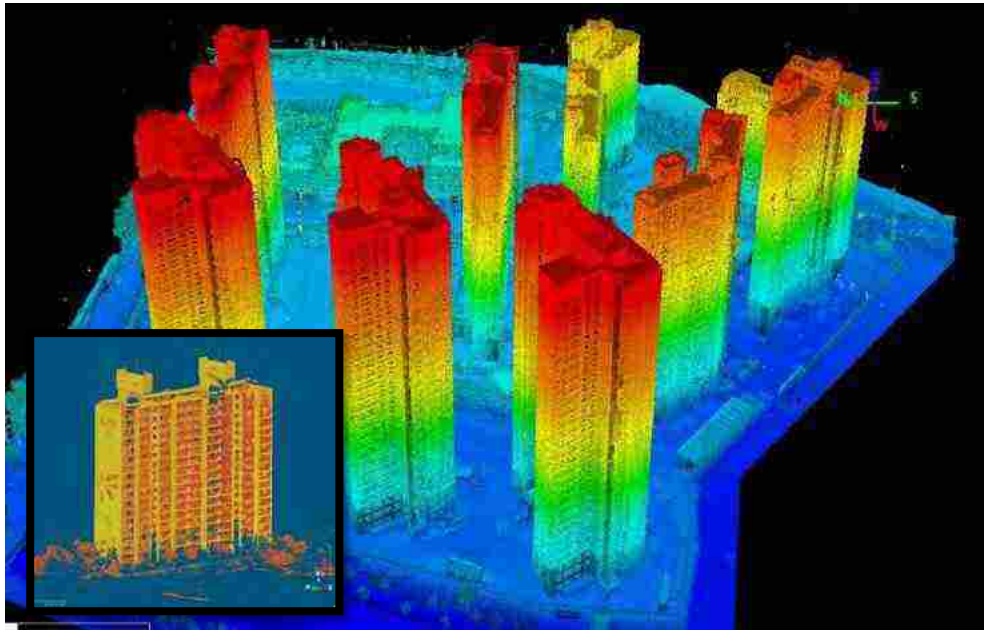


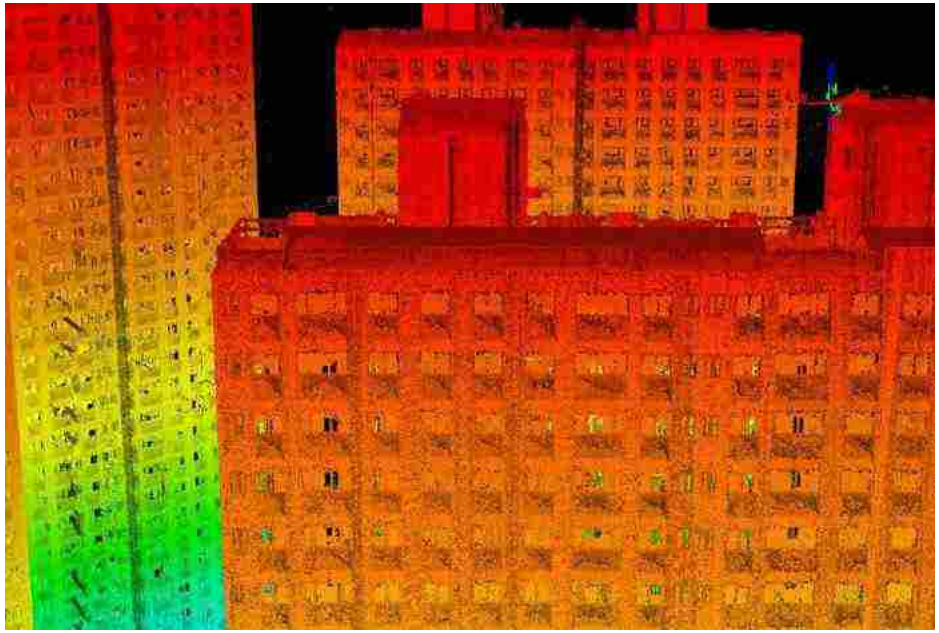




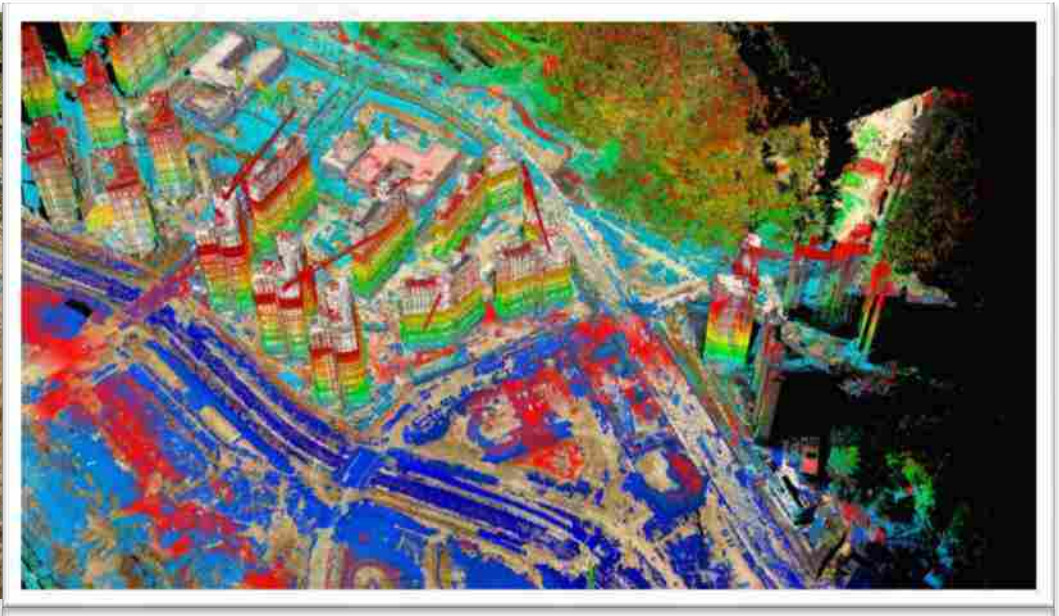
Digital twin City construction using 3D LiDAR scanning

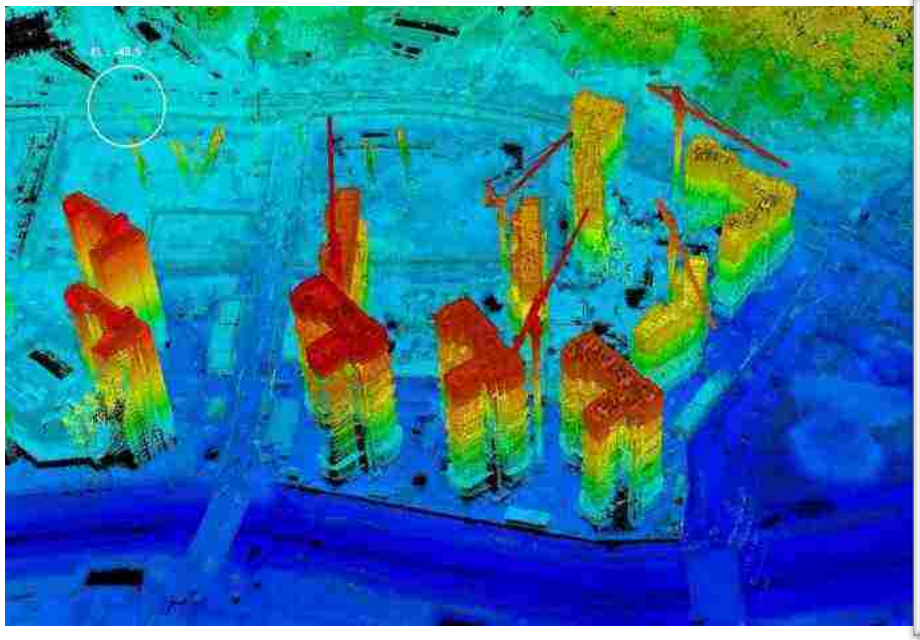


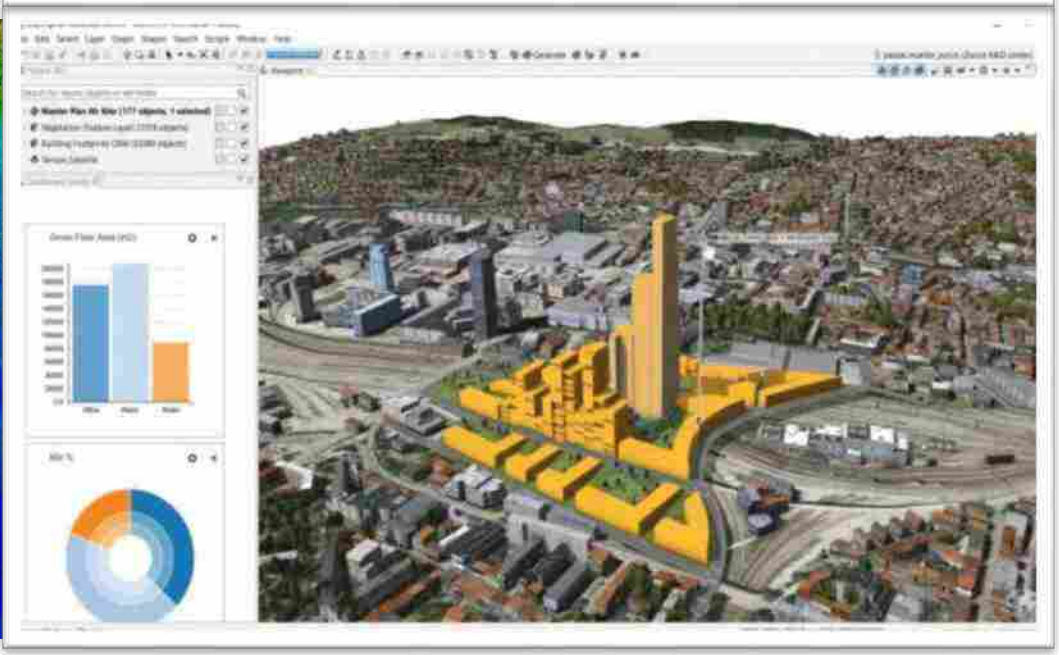




DEM construction of building site using 3D LiDAR scanning

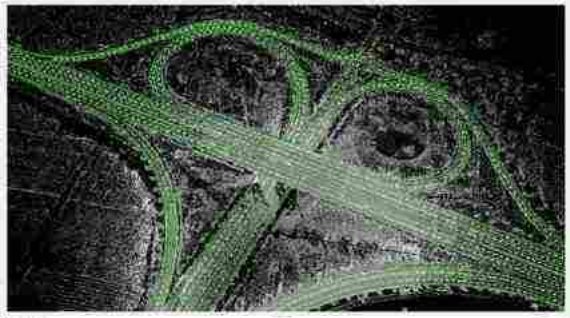


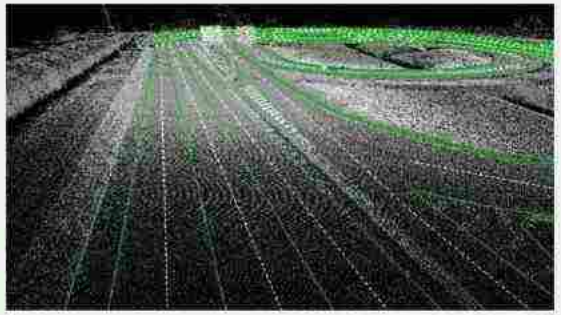


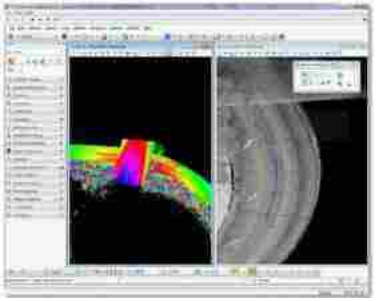


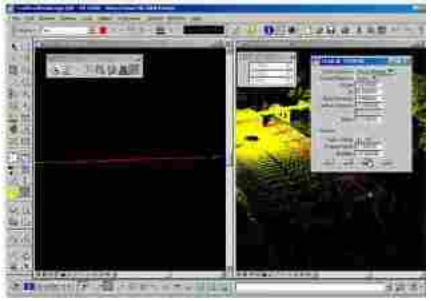
MMS-based Digital twin City construction

Construction of road map for auto-driving and road management information by applying MMS-based data acquisition of facilities around the road



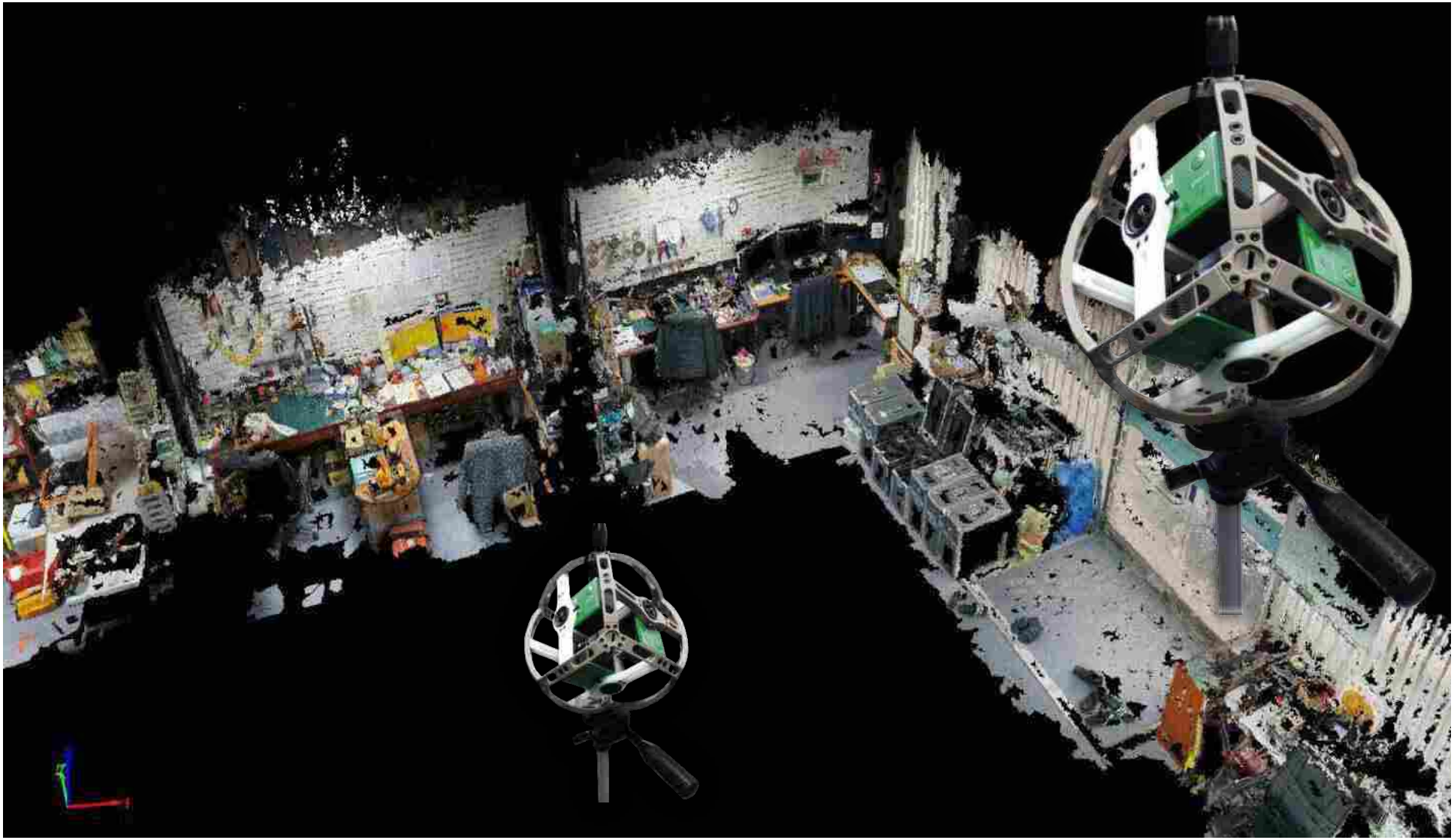






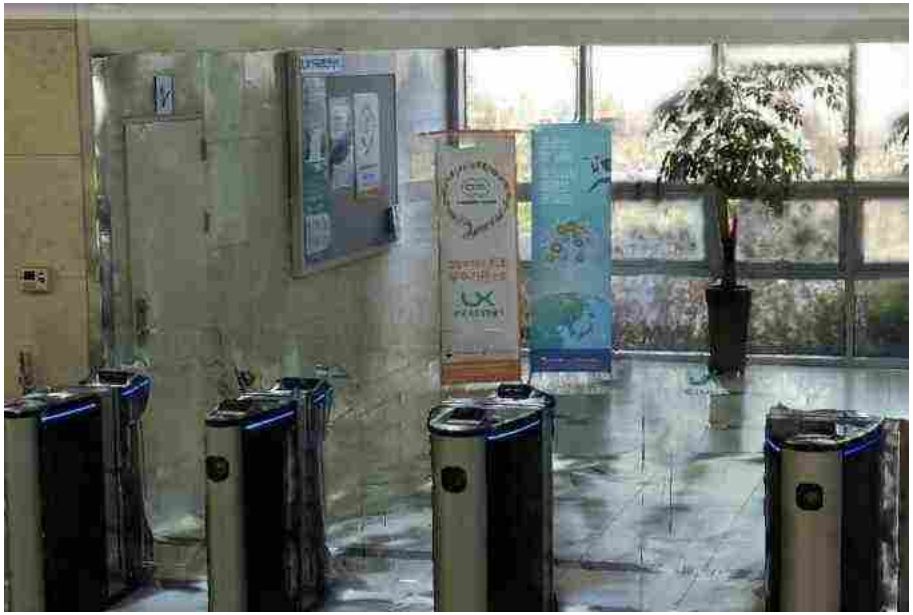
AI Utilization of digital twin DB in Unmanned vehicle

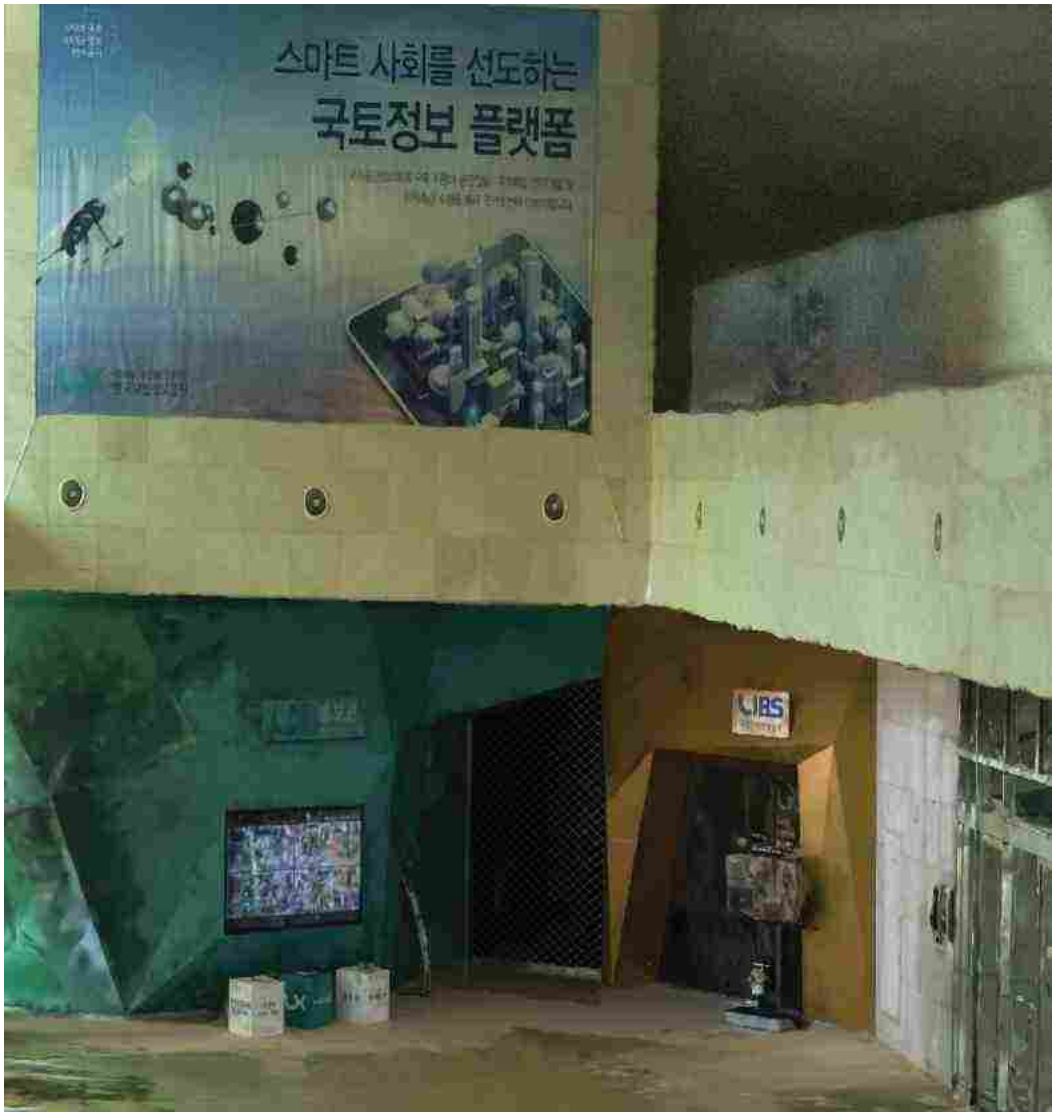
6 cameras can collect 3D information at the same time. Low cost / Simple operation



Indoor Digital twin DB Construction (LX headquarters lobby)

Digital twin DB Construction through processing of raw data acquired by indoor 3D collecting equipment





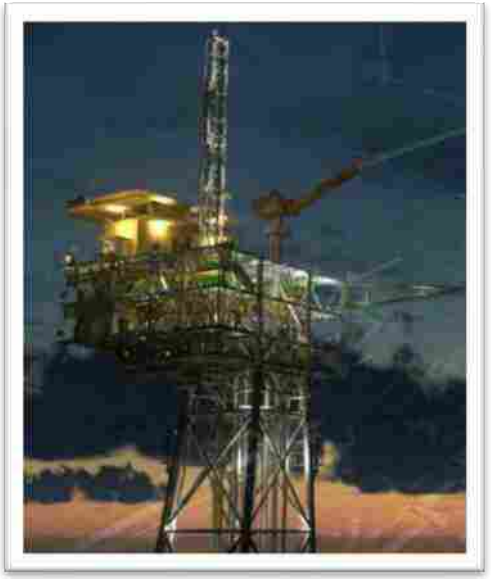
Unmanned vehicle based Indoor Digital twin DB construction (3D modeling)

BIM and interior design by post-processing modeling

based on indoor geo-information DB construction

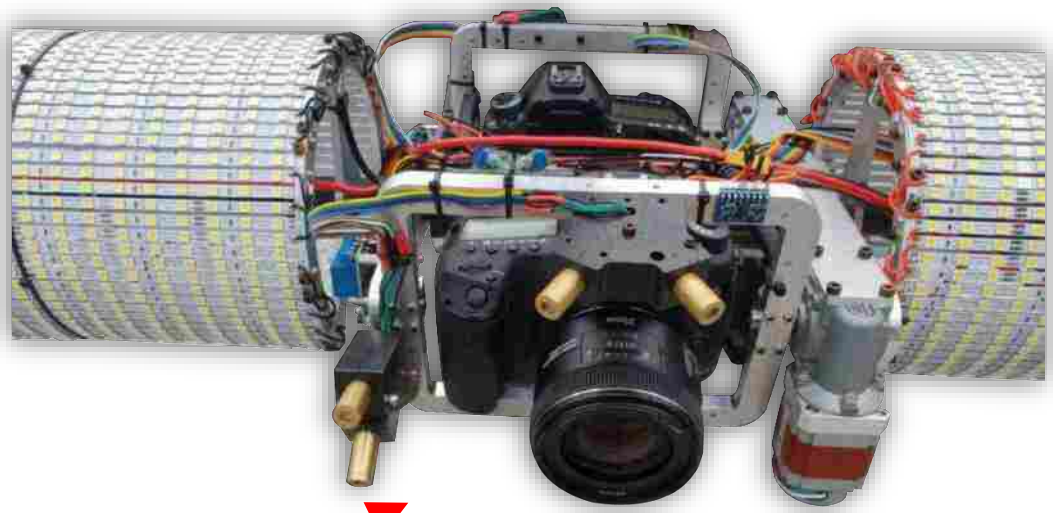


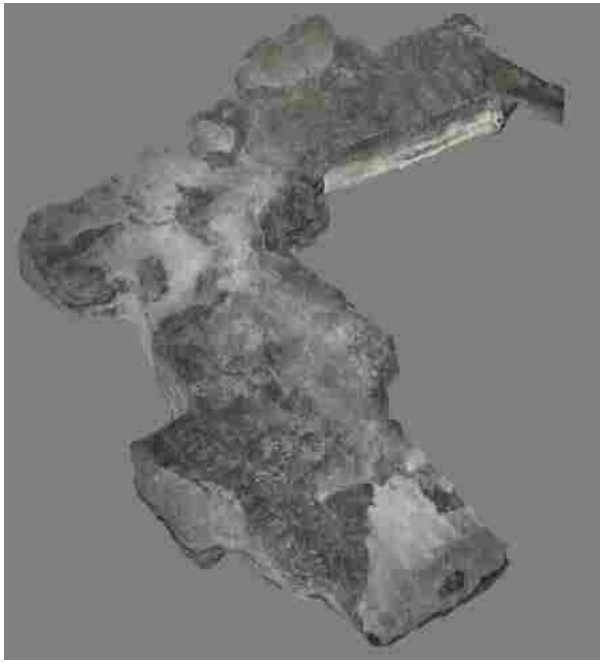


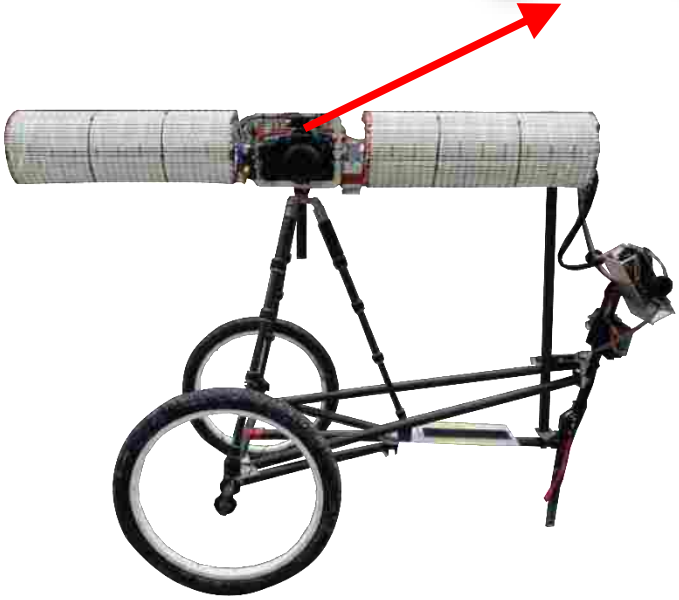


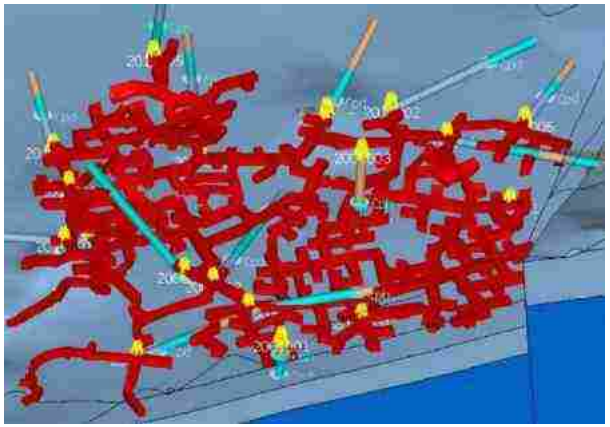

Underground space DB construction using AI unmanned vehicle

High resolution face mapping of various underground space under light shortage condition









Underground space DB construction using AI unmanned vehicle

3D geo-information construction of various underground spaces such as tunnels, underground roads, underground parking lots

Expected effect of Digital twin

Citizen participation and prior consultation in project site selection and planning stage

Remote handling of civil affairs in remote area

Offer of public service based on various 3D geo-information

GEOSPATIAL INFORMATION Co.,Ltd.

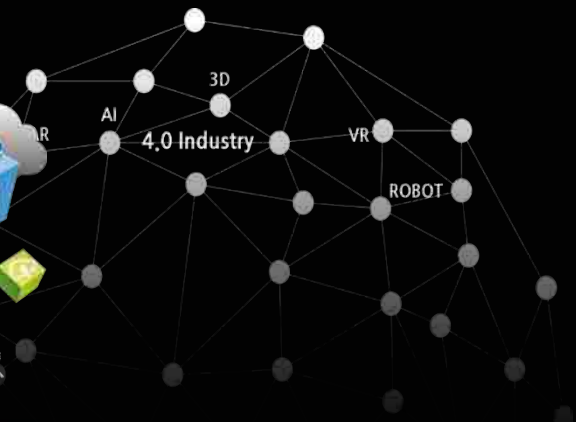
Headquarters 405, 26, Jeongbohwa-gil, Naju-si, Jeollanam-do, Korea

Laboratory 15, Subakdeung-ro 5 beon-gil, Nam-gu, Gwangju, Kor

Foreign Division 2F, 103, Saemal-ro, Songpa-gu, Seoul, Korea

062)385-3660 062)385-3661

http://www.geomatic.co.kr



Thank you for your attention