

*AI Unmanned mobile technology
based on Digital twin Smart City construction*



GEOSPATIAL INFORMATION
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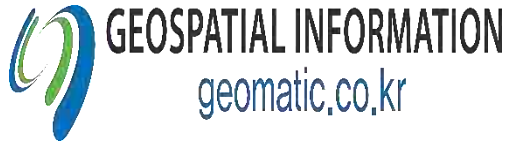
01 About us



About us

Development of UAV system and
UAV surveying service

Agricultural sensing, consulting
Marine surveying



Business Areas










Integrated business with
GIS, UAV, IOT, VR

Public surveying
3D solution development

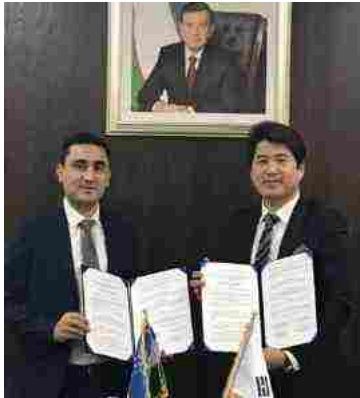


언제, 어디서든 대상지 촬영해 입체지도 제작가능

• Status of R&D performance related drones •

| | | |
|--|--|---|
| <p>Ministry of Science and ICT</p> | <p>Development of an UAV system for monitoring based on 3D spatial information</p> |  |
| <p>Ministry of maritime affairs</p> | <p>Development of local coastal disaster response system using small UAV</p> |  |
| <p>Ministry of agriculture, food and rural affairs</p> | <p>Development of UAV-based remote sensing technology for monitoring crop growth of major crops</p> |  |
| | <p>Development of drones based crop sensing information and mapping technology</p> |  |
| <p>KAIA</p> | <p>Rapid diagnosis and evaluation of bridge structure based on UAV inspection equipment</p> |  |
| <p>Small and medium business administration</p> | <p>Development of multi-dimensional spatial information module for UAV multi sensor mounting</p> |  |
| <p>Rural development administration</p> | <p>Development of UAV based fire blight prevention system</p> |  |
| <p>KAIA (2018.4)</p> | <p>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</p> |  |
| <p>KAIA (2018.4)</p> | <p>Development of technology for efficient management of slope and road pavement using UAV</p> |  |

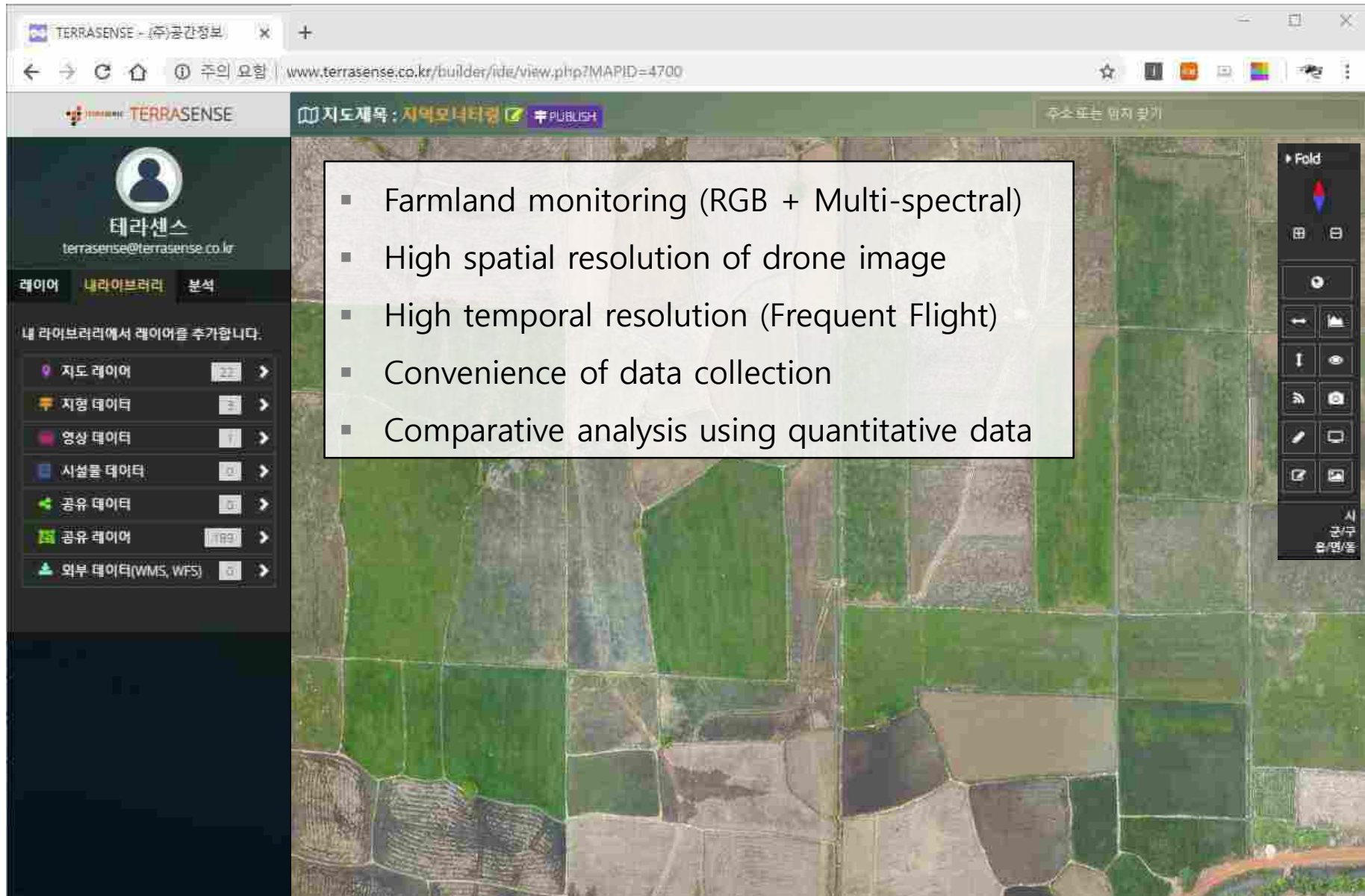
Work (Service and national R & D business)



Work (System development, manufacturing, sales)



Work (Precision Agriculture Consulting)



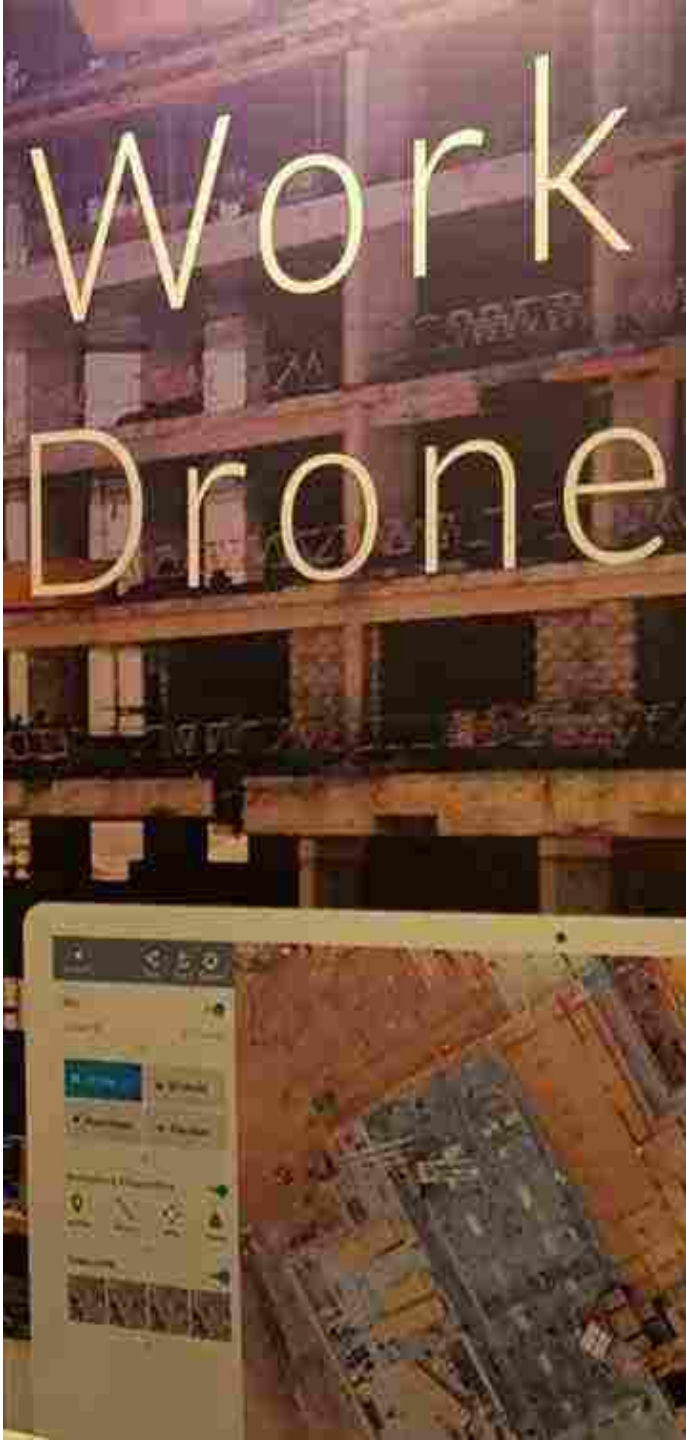
The screenshot displays the TERRASENSE web application interface. The browser address bar shows the URL www.terrasense.co.kr/builder/ide/view.php?MAPID=4700. The interface includes a user profile section for '테라센스' (Terrasense) with the email terrasense@terrasense.co.kr. A sidebar on the left lists various data layers: 지도 레이어 (Map Layer), 지형 데이터 (Topographic Data), 영상 데이터 (Image Data), 시설물 데이터 (Facility Data), 공유 데이터 (Shared Data), 공유 레이어 (Shared Layer), and 외부 데이터(WMS, WFS) (External Data (WMS, WFS)). The main area shows a high-resolution drone image of a farmland plot. A text box overlaid on the image lists the following features:

- Farmland monitoring (RGB + Multi-spectral)
- High spatial resolution of drone image
- High temporal resolution (Frequent Flight)
- Convenience of data collection
- Comparative analysis using quantitative data

The interface also features a 'Fold' button, a '주소 또는 위치 찾기' (Find address or location) button, and a 'PUBLISH' button. The map area shows a grid of fields with varying colors, likely representing different data layers or analysis results.

Work (Precision Agriculture Consulting)

The screenshot shows a web browser window with the URL www.terrasense.co.kr/builder/ide/view.php?MAPID=4700. The page header includes the TERRASENSE logo, a map title '지도제목 : 지역모니터링', and a 'PUBLISH' button. A user profile for '테라센스' (terrasense@terrasense.co.kr) is visible on the left. The main content is a 3D aerial view of a rural landscape with green fields and a central pond. A white box with the text '3D Geo-information' is overlaid on the map. A sidebar on the left contains a '레이어' (Layers) section with a '내 라이브러리' (My Library) tab and a list of layer types: 지도 레이어 (23), 지형 데이터 (3), 영상 데이터 (1), 시설물 데이터 (0), 공유 데이터 (0), 공유 레이어 (189), and 외부 데이터(WMS, WFS) (0).

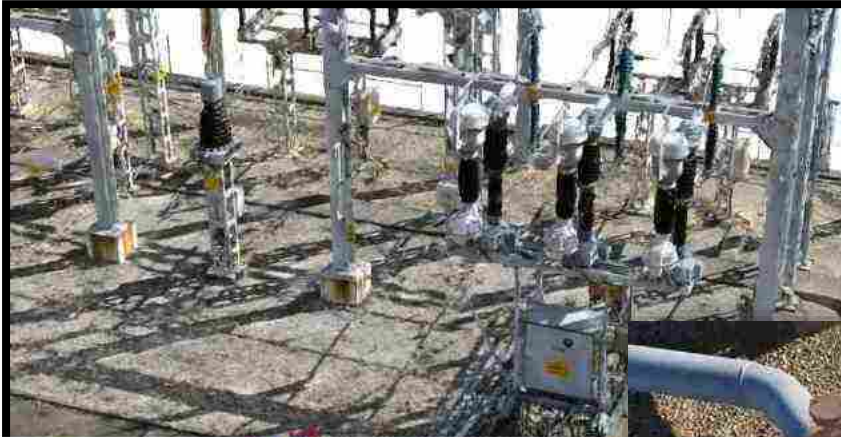


02 Intro to Drone Digital twin



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



③ Signal point survey



⑥ Drone shooting



④ Drone inspection



⑤ Flight route settings

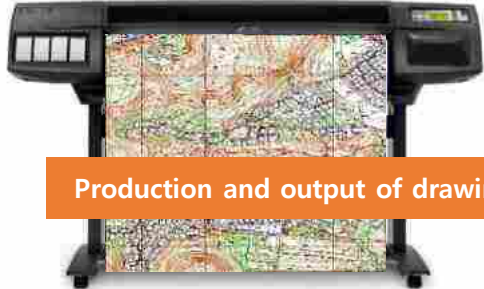
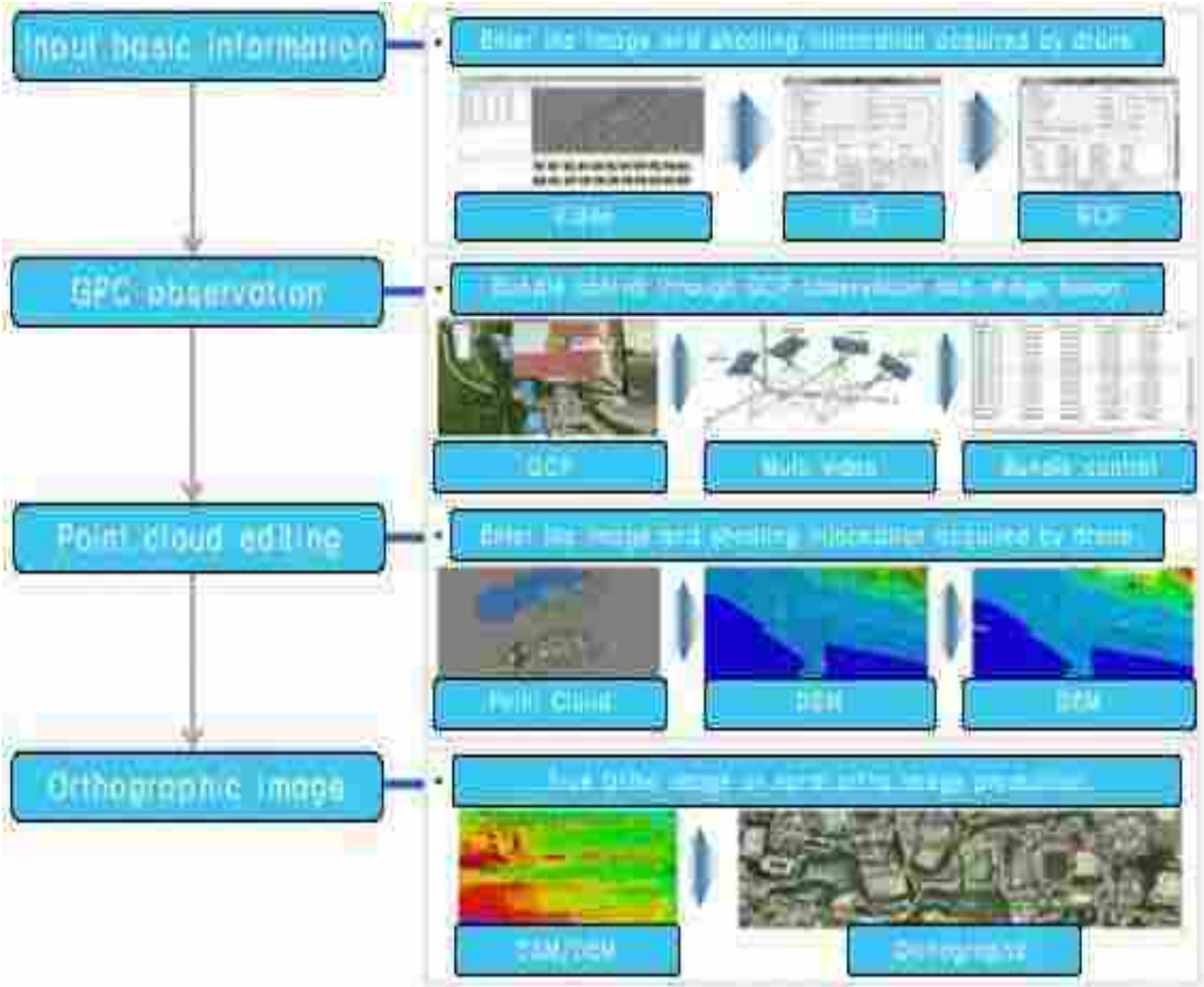


⑦ Check data

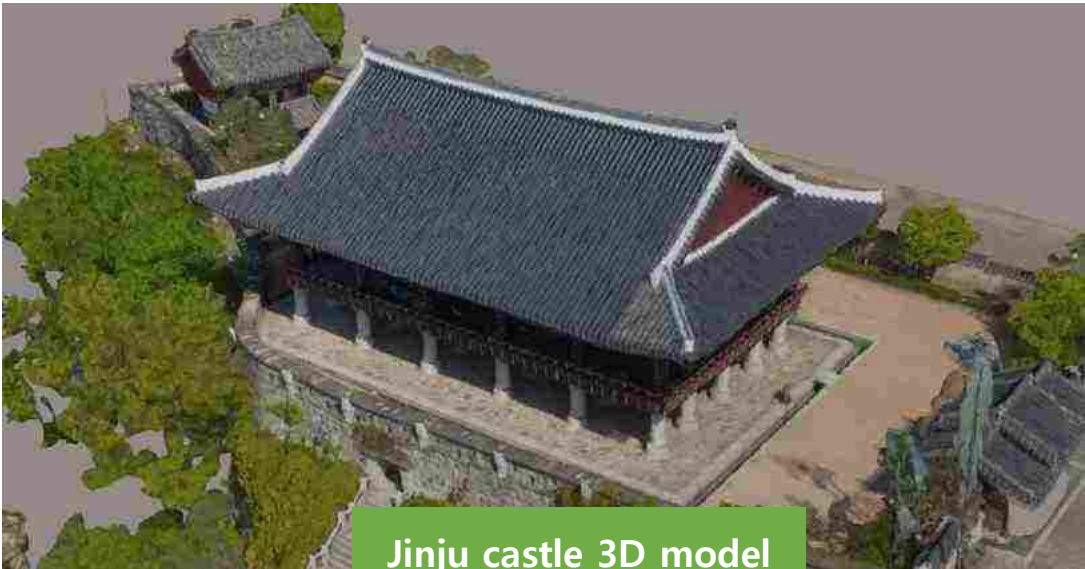


Drones survey image process

Digital elevation model and orthographic image production procedure



Building 3D Mapping Digital Twin



Jinju castle 3D model



Pangyo NAVER 3D model

03

Use case of Drone Digital twin DB

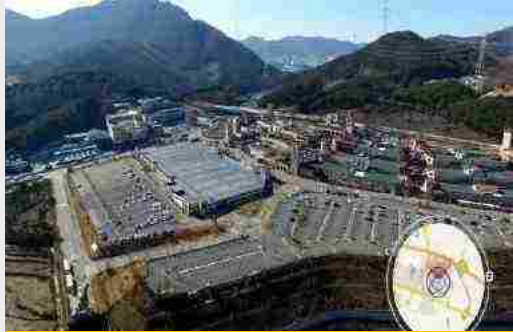


Use case of LH Korea Land Corporation



Korea Land Corporation

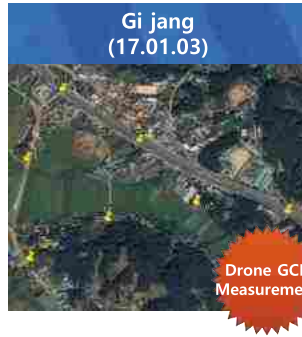
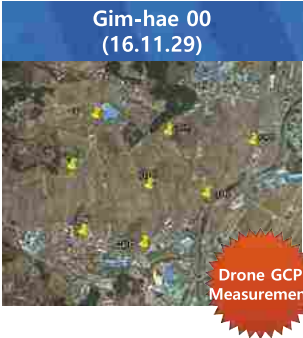
- A study on drones application
- Drone shooting and field test 12 location / 21 km²
- Build high-precision spatial information
- Development of pilot system for management



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

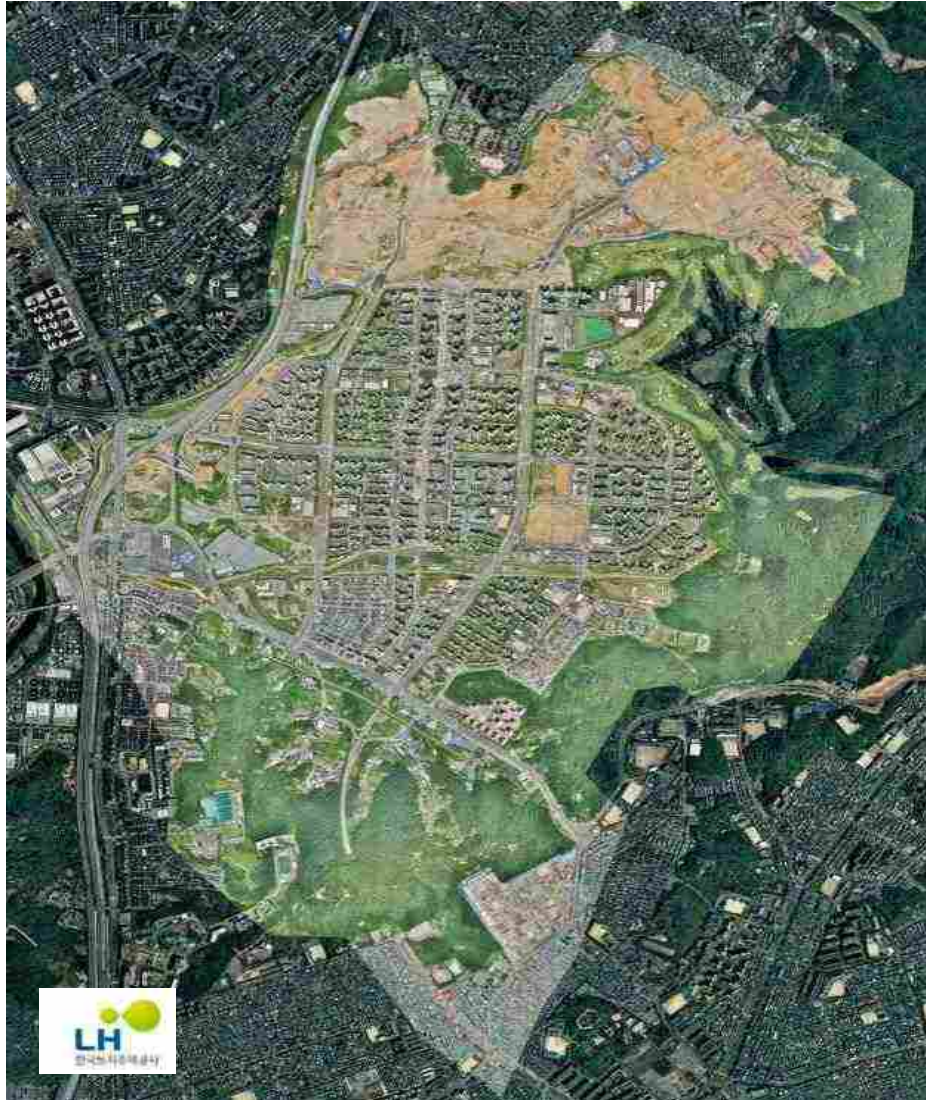


Gimpo Han river city Drone survey (2017.04)

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



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



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



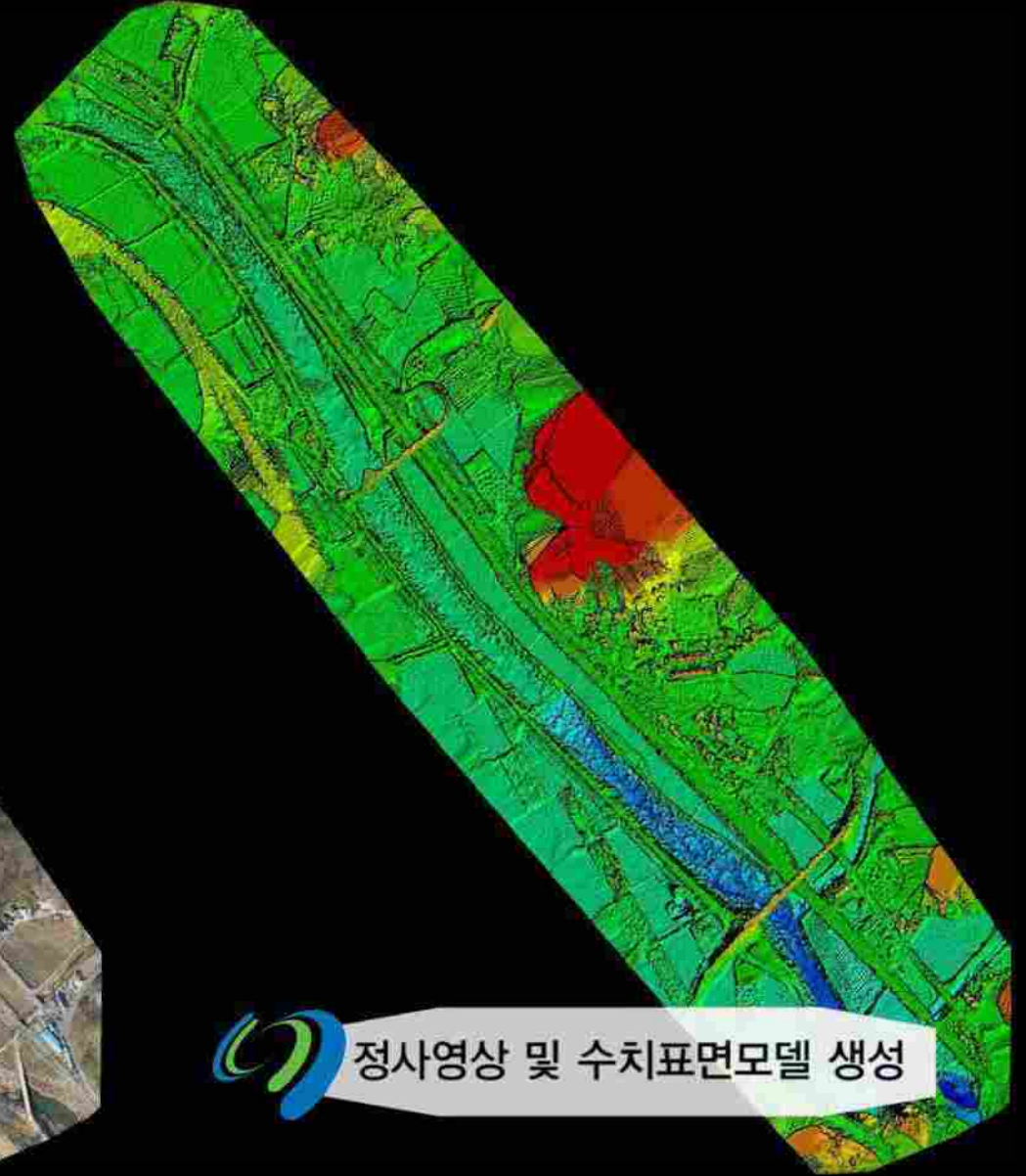
Study on the use of drones cadastral re-survey

(Use for explaining materials for Citizen about cadastral re-survey site)

3D model + Cadastral map + Survey overlap



A cadastral survey using drone digital twin



정사영상 및 수치표면모델 생성

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

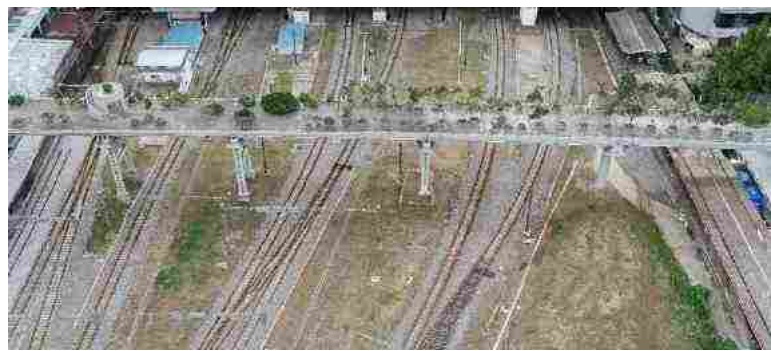


Seoul institute of science
2018.9



Seoul (2018, Construction of digital twin DB)

Seoul road
2018.9



Seoul (2018, Construction of digital twin DB)



Seoul city hall
2018.9



Seoul (2018, Construction of digital twin DB)

The screenshot displays a drone simulation interface with a central 3D map of Seoul. A yellow grid-like mission path is overlaid on the map. The interface includes a left sidebar with mission management tools, a top control bar with flight status buttons, and a right sidebar with real-time drone data. A 'Preview' window in the bottom left shows a zoomed-in view of a baseball field. A '드론사진촬영' (Drone Photo Shooting) control is visible in the bottom right.

MapBox Satellite

WARNING GO TO HOME GO TO START HOLD RESUME MISSION START MISSION RESTART BLOCK GO LAND ABORT LANDING LAND NOW

My Mission 50

My black #1 39:05 38 cm/pw 32.1 kg

EP-01-008
162 m/ATO
135 m/AMSL
2:33
GNSS status: Standalone
→ Wpt 2, Rte 1

Drone: Simulator (EP-01-008)

SEOUL.U
나와 너의 서울 Rte.1

Autonomy

| Battery | Flight time | Home distance | Link quality | Estimated wind |
|---------------|------------------------|---------------|------------------|----------------|
| 100% (11.9 V) | 02:32 1 flight (37:46) | 595 m (00:53) | 95% (3.8 Kbit/s) | 1.3 m/s |

Flight data

| | |
|-------------------------------|-----------------------|
| Drift speed: 9.9 m/s | Latitude: 37.525417 |
| Altitude: 164.5 m/AMSL | Longitude: 126.977389 |
| Ground sensor height: 150.4 m | |

Instruments

| Temperature | Camera | GNSS |
|-------------|--------|--|
| 35.0°C | 50.5°C | Satellite: 15 Accuracy: 4.277 m Mode: Standalone |

Identification

| | |
|-------------------|-----------------------|
| Name | Simulator (EP-01-008) |
| Drone Flight Log: | EP-01-008_0008_b63 |

Camera information

| | |
|------------------|-----------------------|
| Camera type | S,6,0,A,1,1,0 |
| Camera state | On |
| Number of photos | 9 |
| External storage | 0.95% free of 30.0 GB |

Simulator

25 m/s ALT m/ATO 115 120 130 140 150 160 165

드론사진촬영

150 160 170 S 190 200 210 220 230 150

37.53433° N 126.976307° E 15 m/AMSL Improved SBDM

- Utilize the construction & engineering field

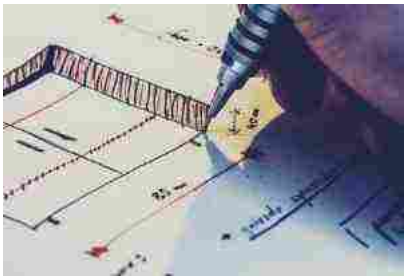


Digital twin construction site

Changes in construction project planning and preparation work



Manual CAD drawings



Change!



Photo + 3D drawings, subject mapping



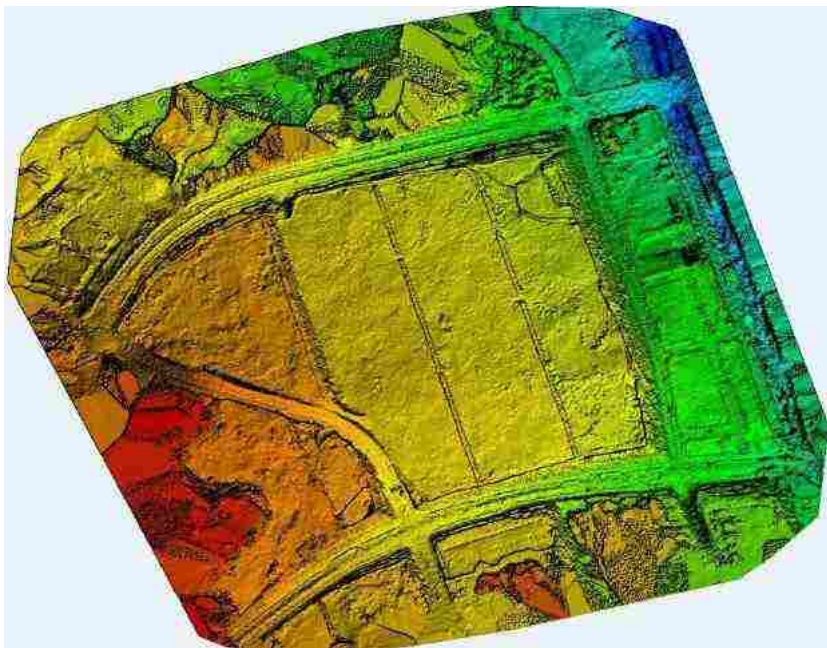
On-site consultation



3D model utilization simulation

Business candidate site (Preliminary investigation)

Identify the status of business districts, utilize investment review



General photos, videos, map overlays, simulations

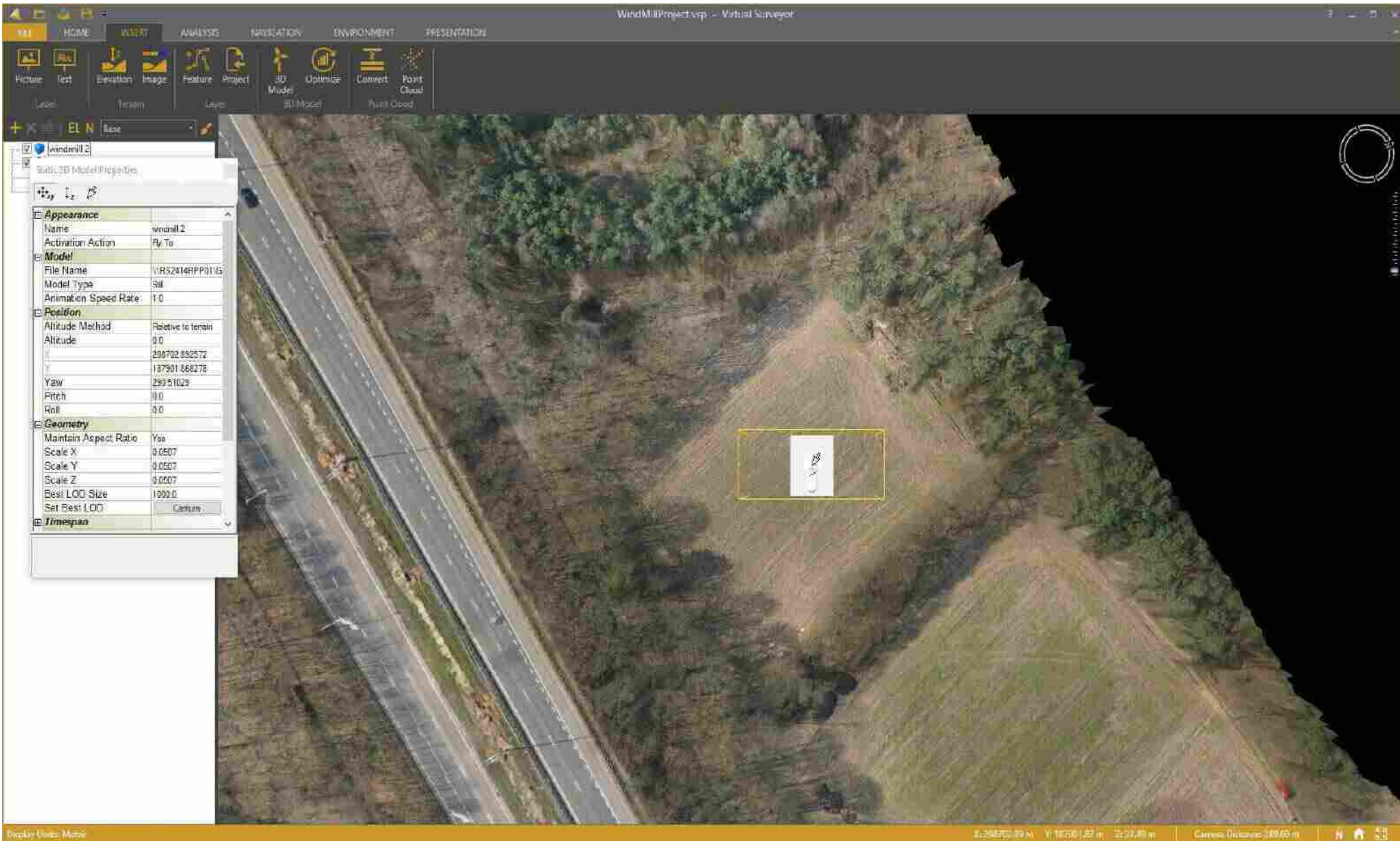
3D Model and bird's eye perspective

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

Insert 3D model



Positioning and pre-simulation of various structures



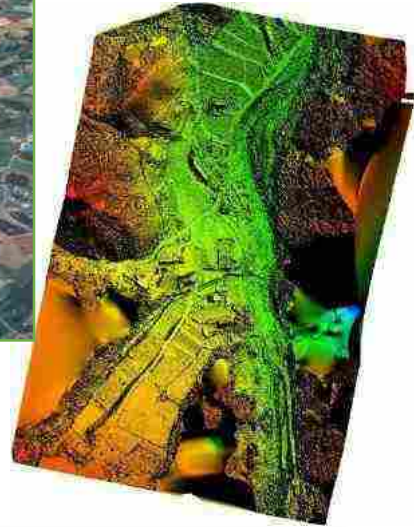
Change of topography survey



Long work time



Survey by manpower



Drone processing + Short work time

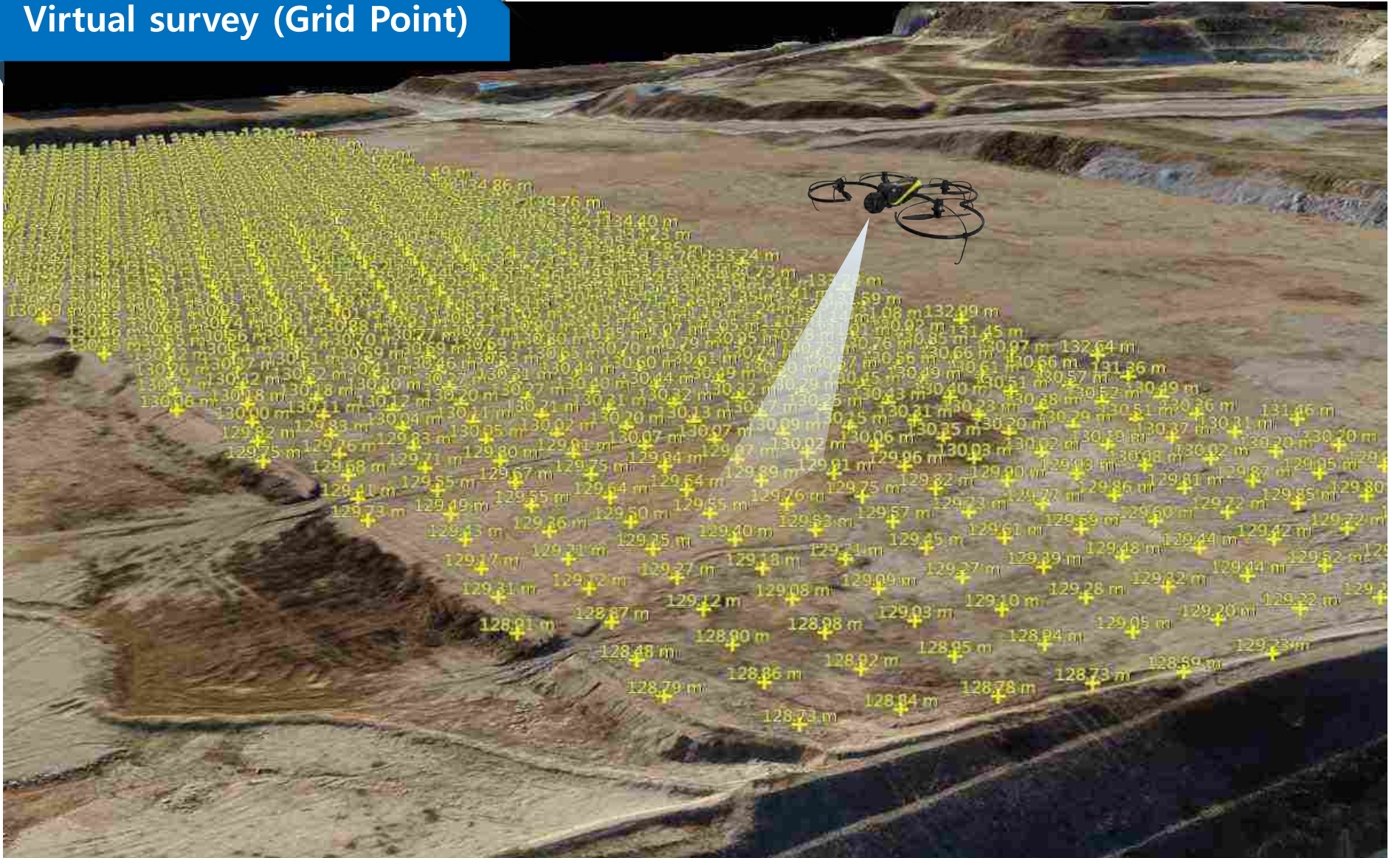
Change!



Automatic route drone survey with one person

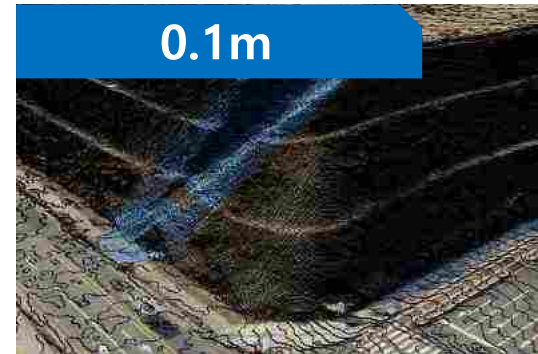
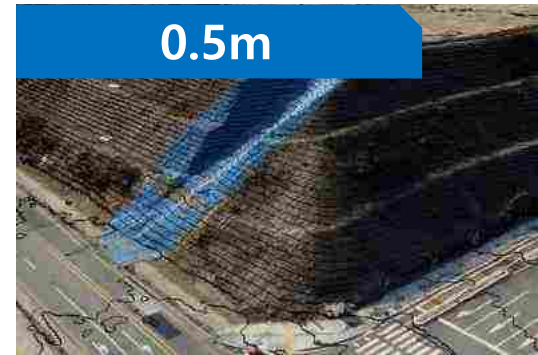
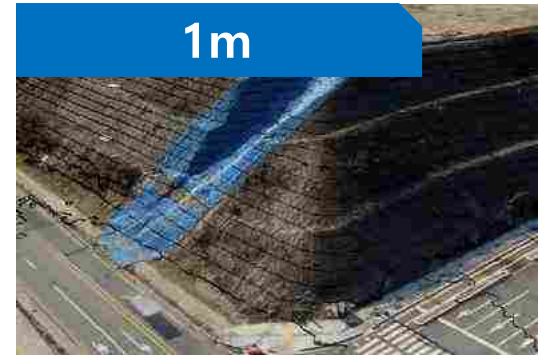
Survey on land based on UAV

Virtual survey (Grid Point)



Construction site survey (Contour survey)

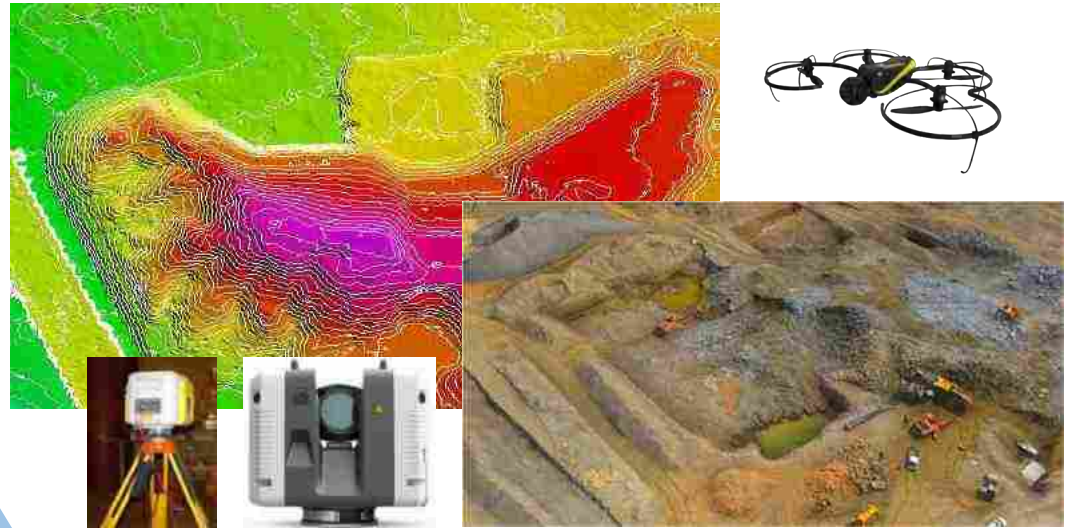
Contour map



Change of design and construction planning work



Calculate soil volume based on 2D desing

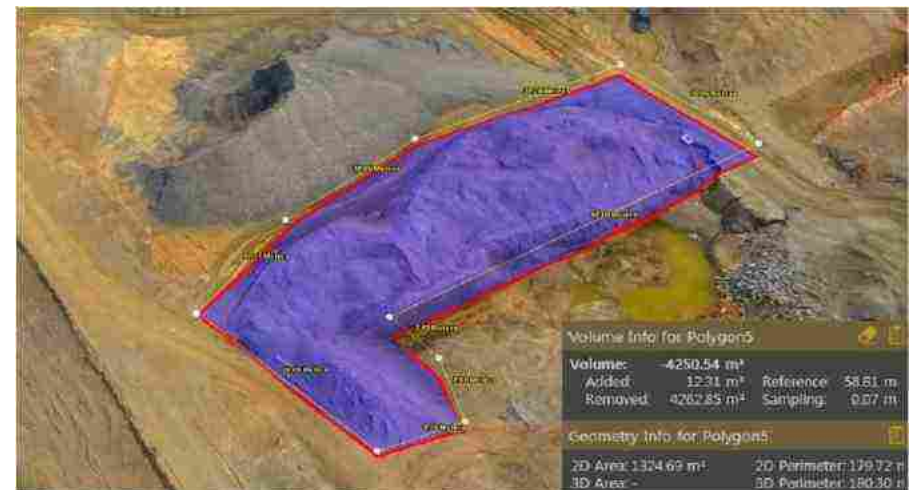


Change!

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



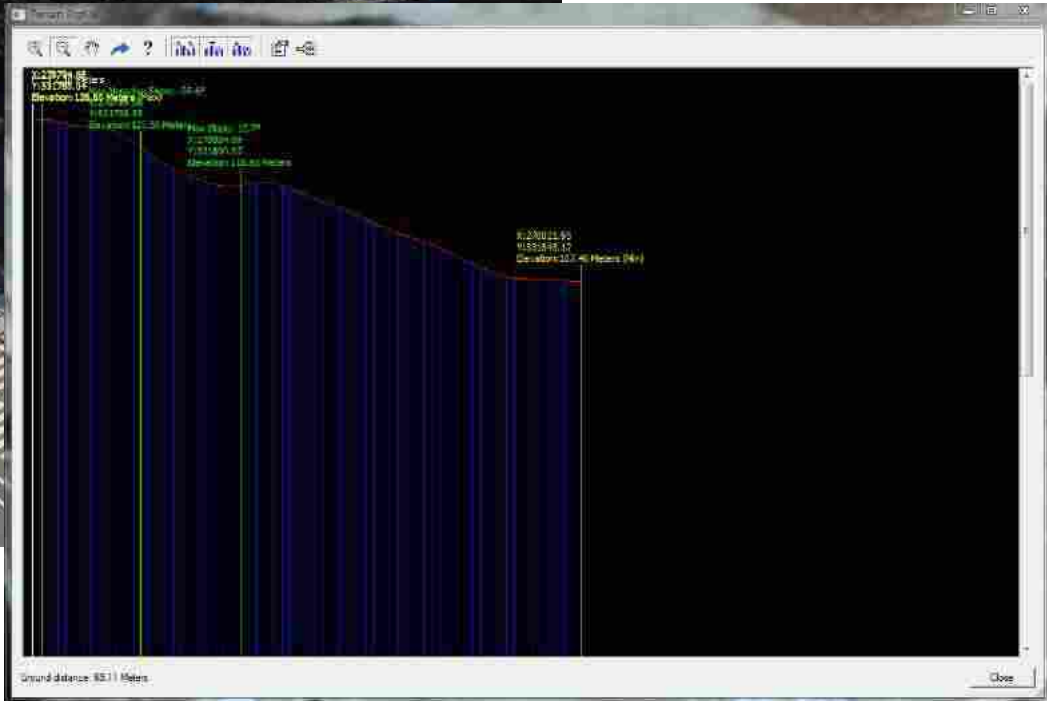
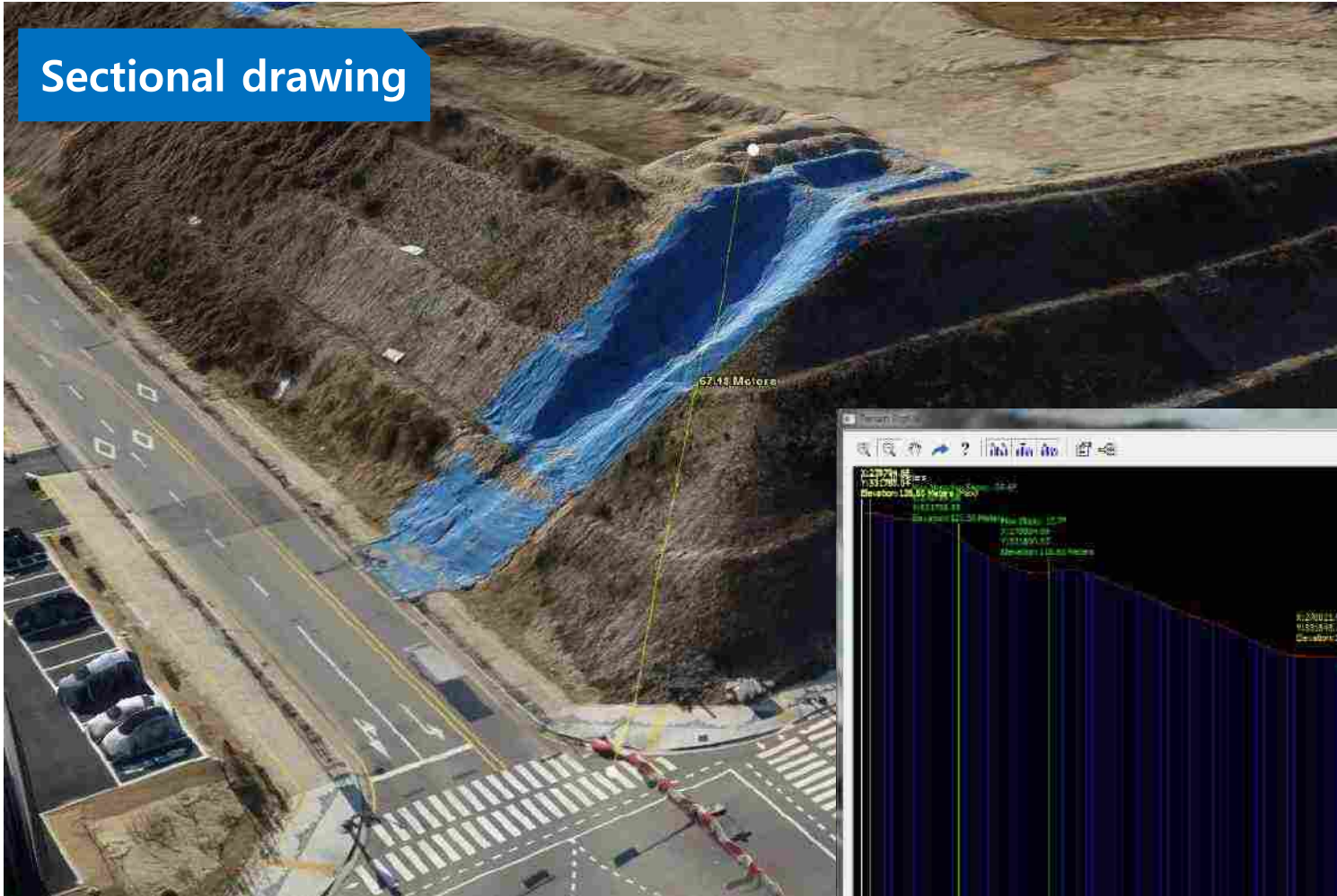
Incorrect calculation of soil volume by design



Reduced soil calculation time

Utilizing 3D topographic model of design work

Sectional drawing

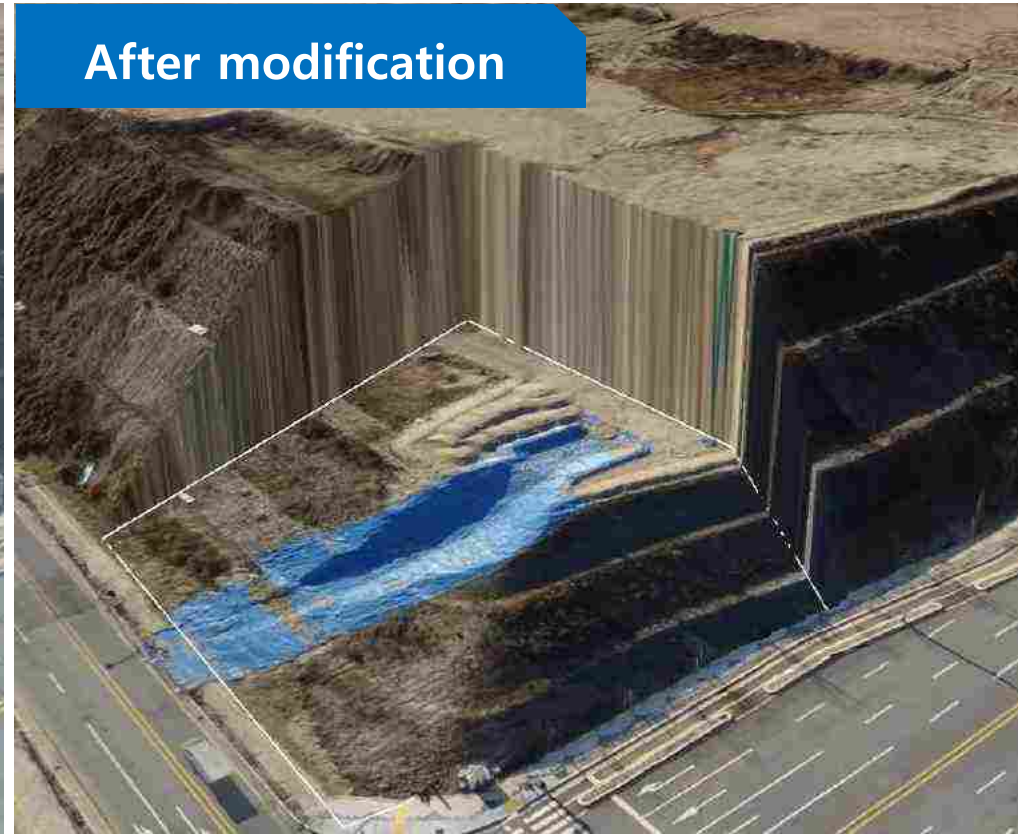


Utilizing 3D topographic model of design work (Modification of topographic features)

Before modification



After modification



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



| Reference area | Length | Area |
|----------------|----------|------------------------|
| A area | 1147.67m | 56074.14m ² |
| B area | 1155.02m | 58294.34m ² |
| C area | 1088.10m | 46142.79m ² |

Utilization of landscape design (Locating grass and tree planting)

1. Planned location survey



2. Arrangement simulation



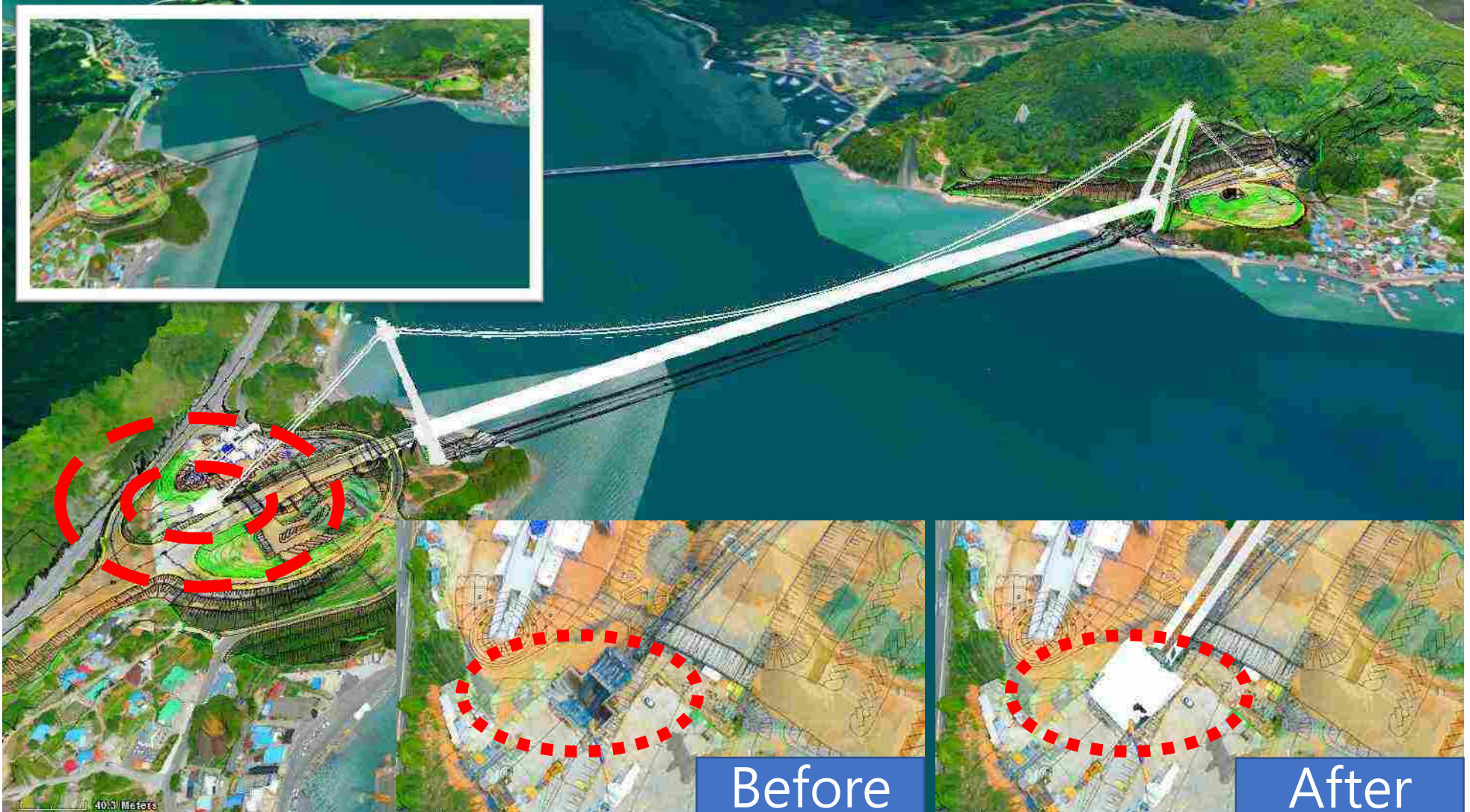
3. Confirmation



- 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 .

(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



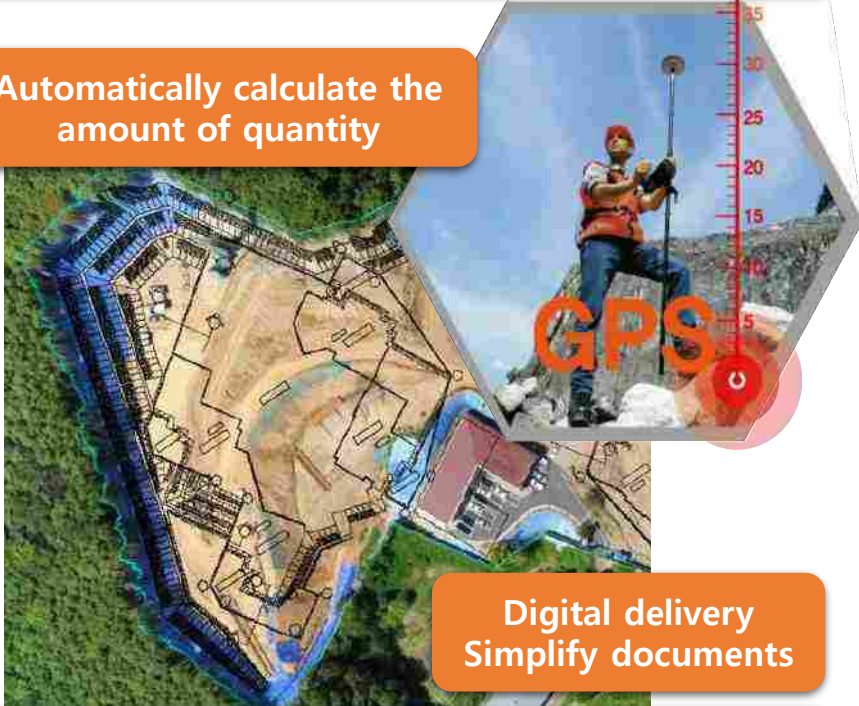
Daily or monthly field work

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

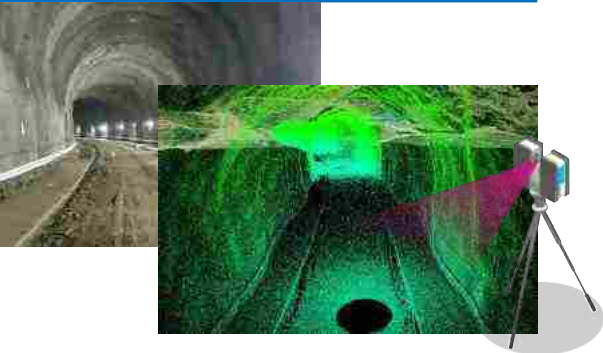


17.09.14

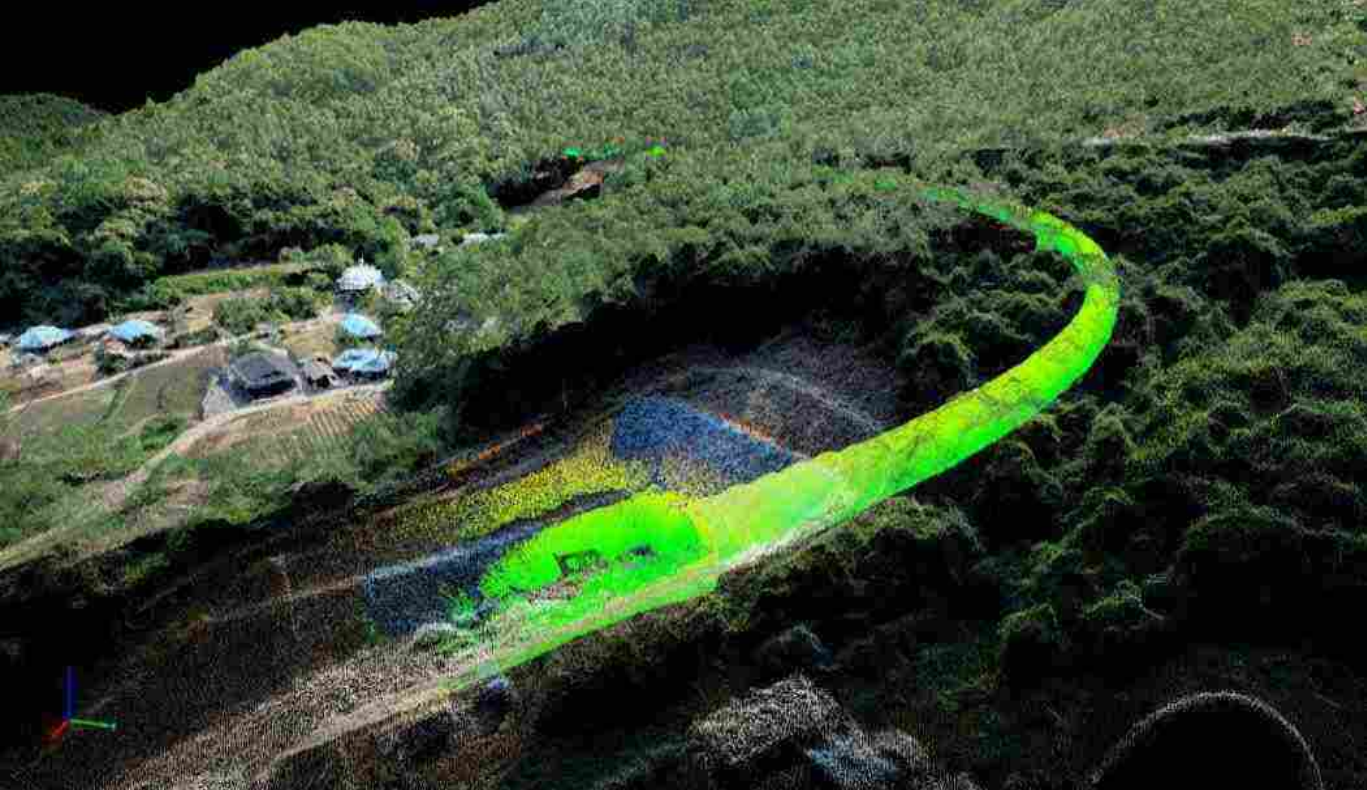
Railway and tunnel

- 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



Ground Laser Scanner / Drone Point Cloud Integration



Drone Point Cloud



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 | | | ② 시 | | | 추가수량 (① - ②) | 비 | 고 |
|-----------|---|--------------|----------------|----|-------|-------|-------|-----|-------|-------|-------|-----------------|-----|-----------------|
| | | | | | | 합 | 증 | NET | ADD | 수 | 량 | | | |
| | 레미콘 | 25-24-120,무근 | m ³ | 2% | 7,489 | 7,639 | 7,639 | 2% | 7,489 | 7,639 | 7,639 | 1,062 | | |
| TETRA NEO | (해상수상) | 120톤급 | EA | | 814 | 814 | 814 | | 644 | 644 | 644 | 170 | | |
| | (해상수중) | 120톤급 | EA | | 554 | 554 | 554 | | 525 | 525 | 525 | 29 | | |
| | (수중침하) 현 지 반 차 이 도 면 외 침 하 (테 트 라 자 중) | 120톤급 | EA | | 64 | 64 | 64 | | 55 | 55 | 55 | | | 지반차이 및 침하 |
| | | | | | | | | | 194 | 194 | 194 | | | |
| | 소 | 계 | EA | | | | | | | | | 1,418 | 199 | |

Change of construction



A lot of manpower

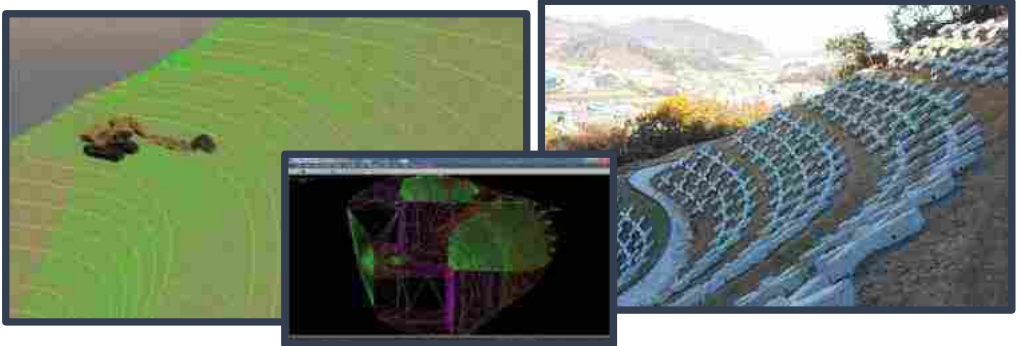


Excavation location, depth verification etc.

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



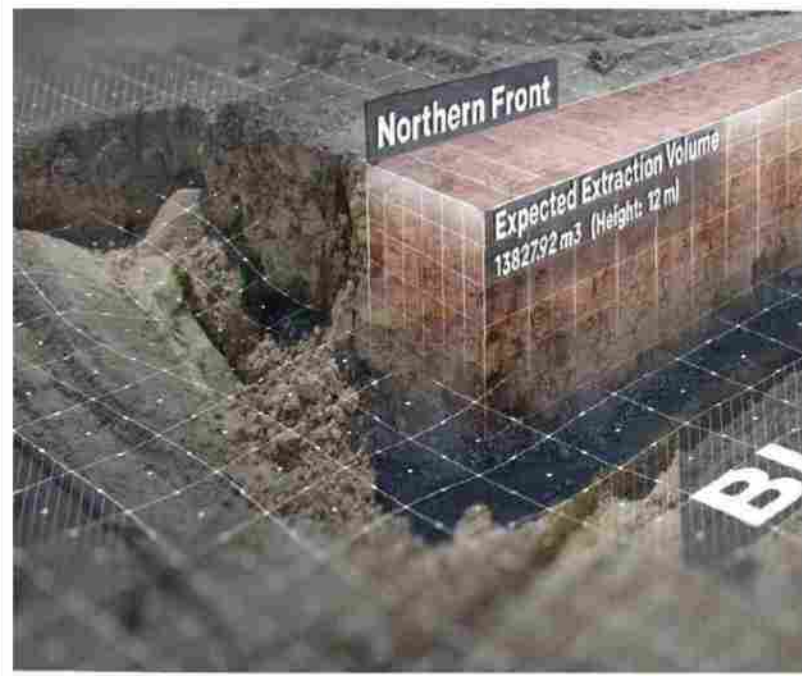
Construction management platform

Various simulations

Service development through drones



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



Limestone mine management (Platform)

Sketchfab EXPLORE STORE COMMUNITY

SAVE VIEW

FEATURE THIS MODEL

태도2012 인스피어

건설레스토프레드키

TRUCK!

정선생태의물결

정선생태사슴극장

금산이탈장

LIKE MODEL

samcheck

Like Embed Share

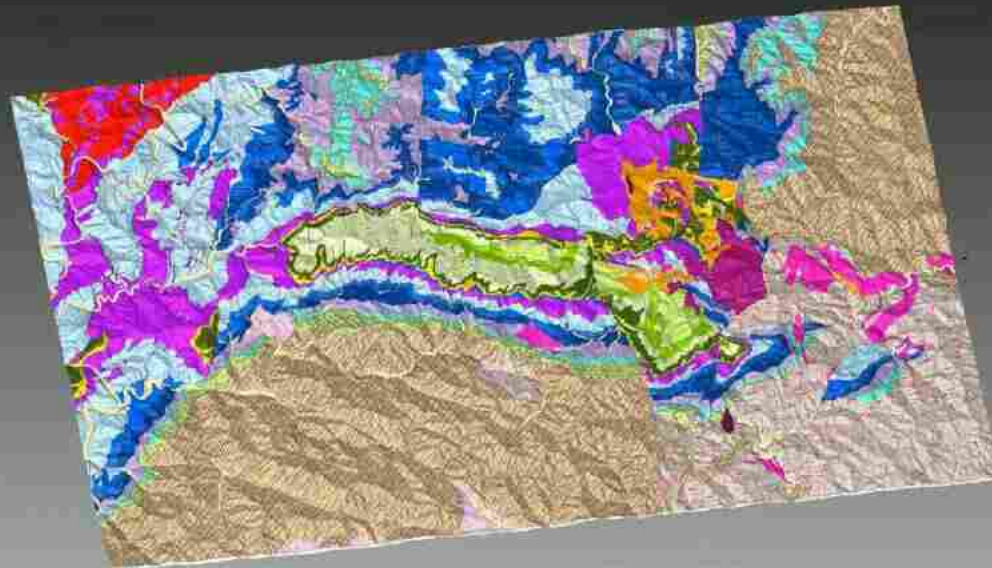
47 Triangles 12.5M Vertices 4.4M Meters

Comments

- 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

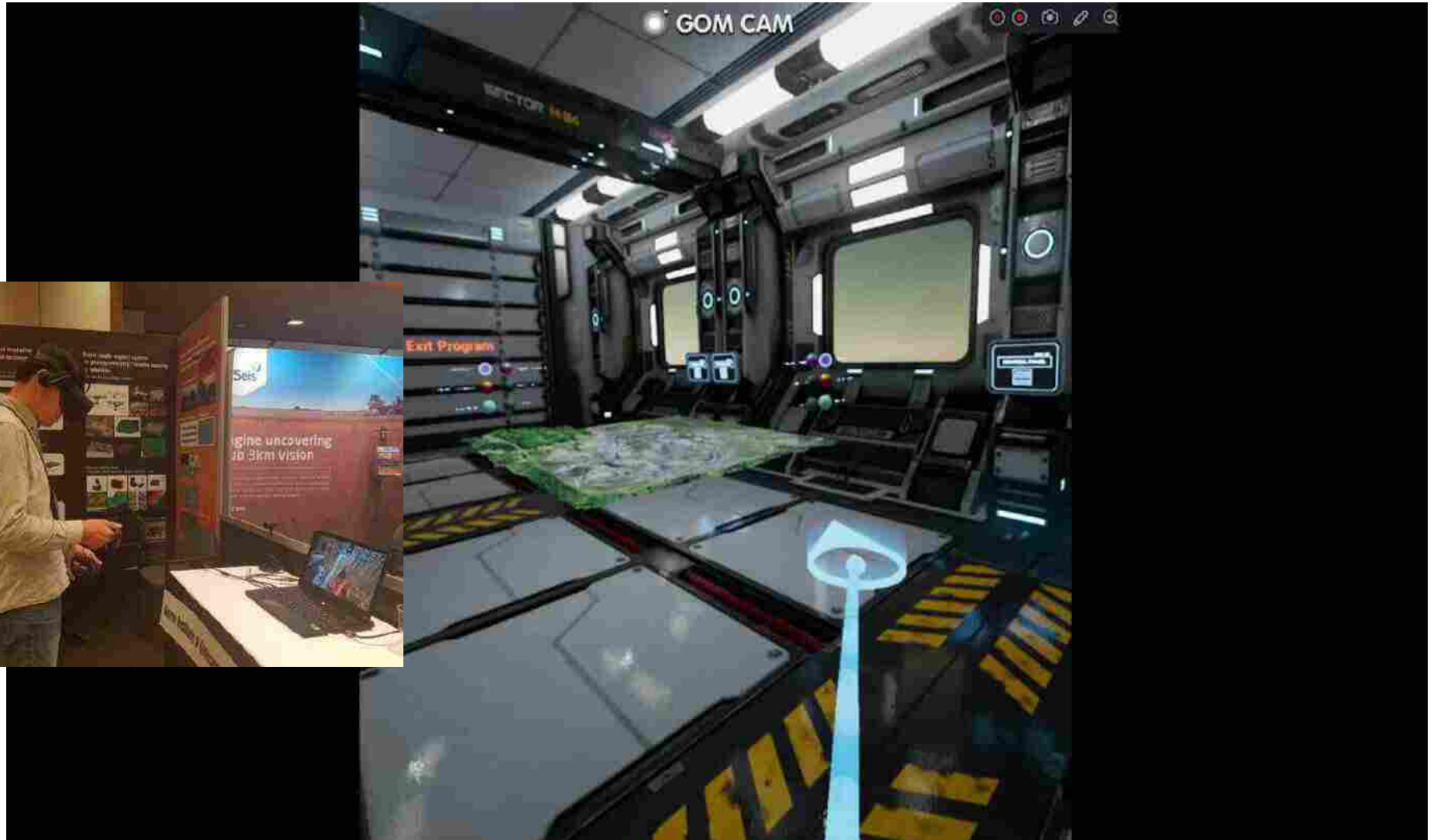


compiled geological map using 1:25,000, 1:50,000, 1:250,000 scale (66km x 36km)



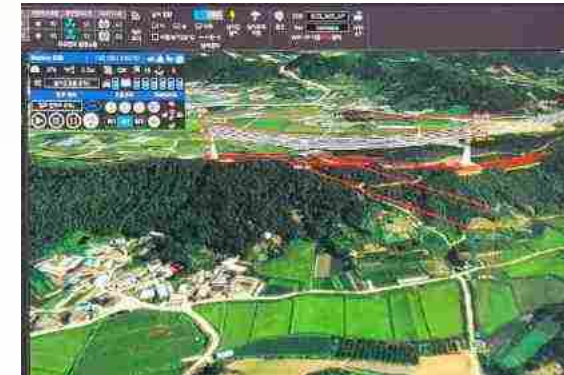
VR mine management

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

19.05.22



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

| 2D Area(m ²) | 76130.830 | 3D Area(m ²) | 78302.130 | Difference(m ³) |
|--------------------------|--------------|--------------------------|--------------|-----------------------------|
| 2D Perimeter(m) | 1381.210 | 3D Perimeter(m) | 1402.180 | |
| Date | Reference(m) | Volume(m ³) | | |
| 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 성북동
2차 공공주택사업

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

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

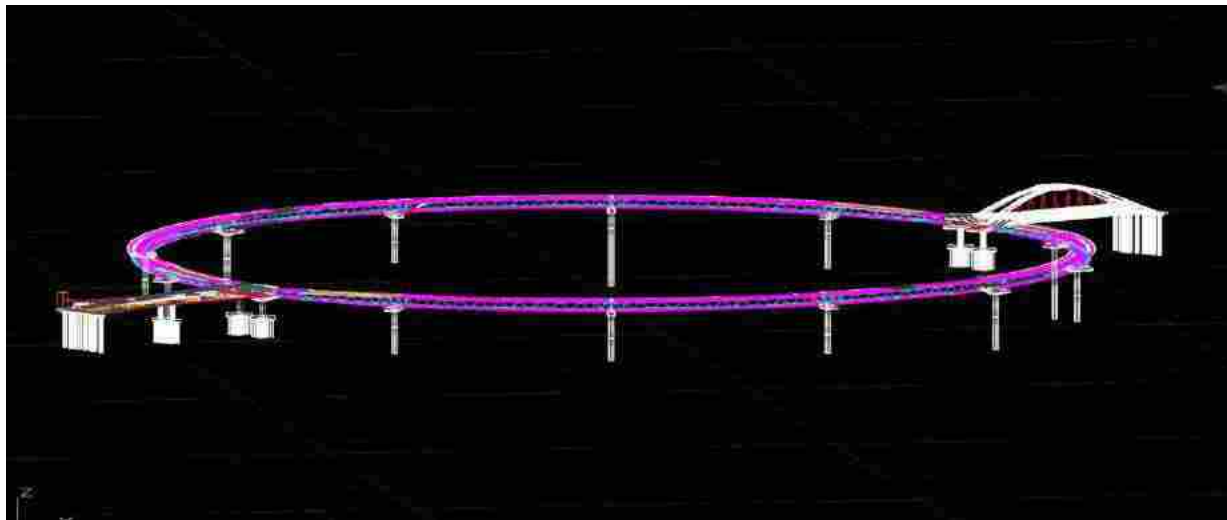
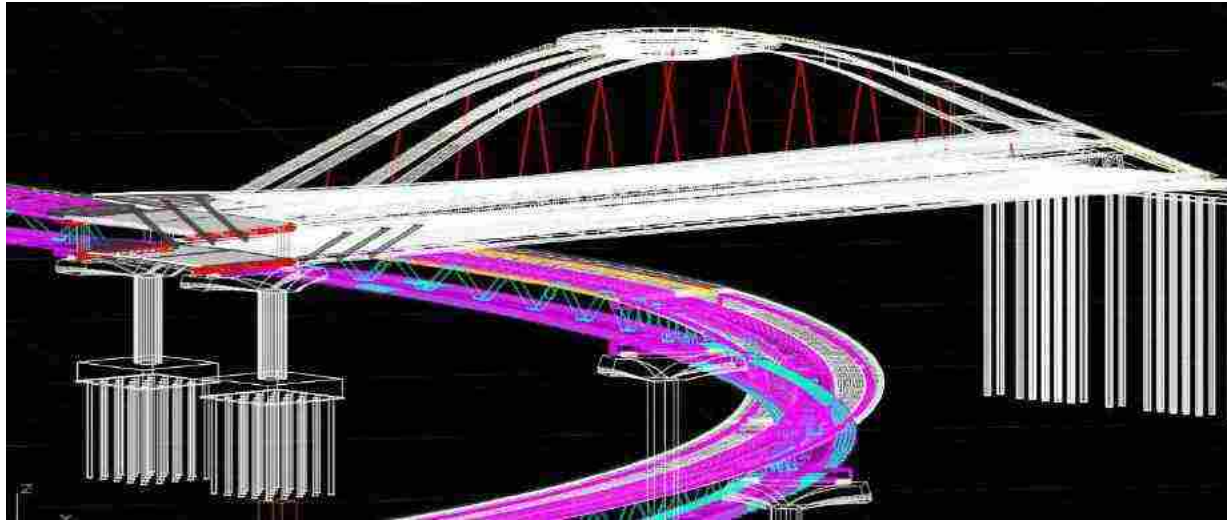


▶ Bird's eye view in Sejong-city Geumgang pedestrian bridge



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

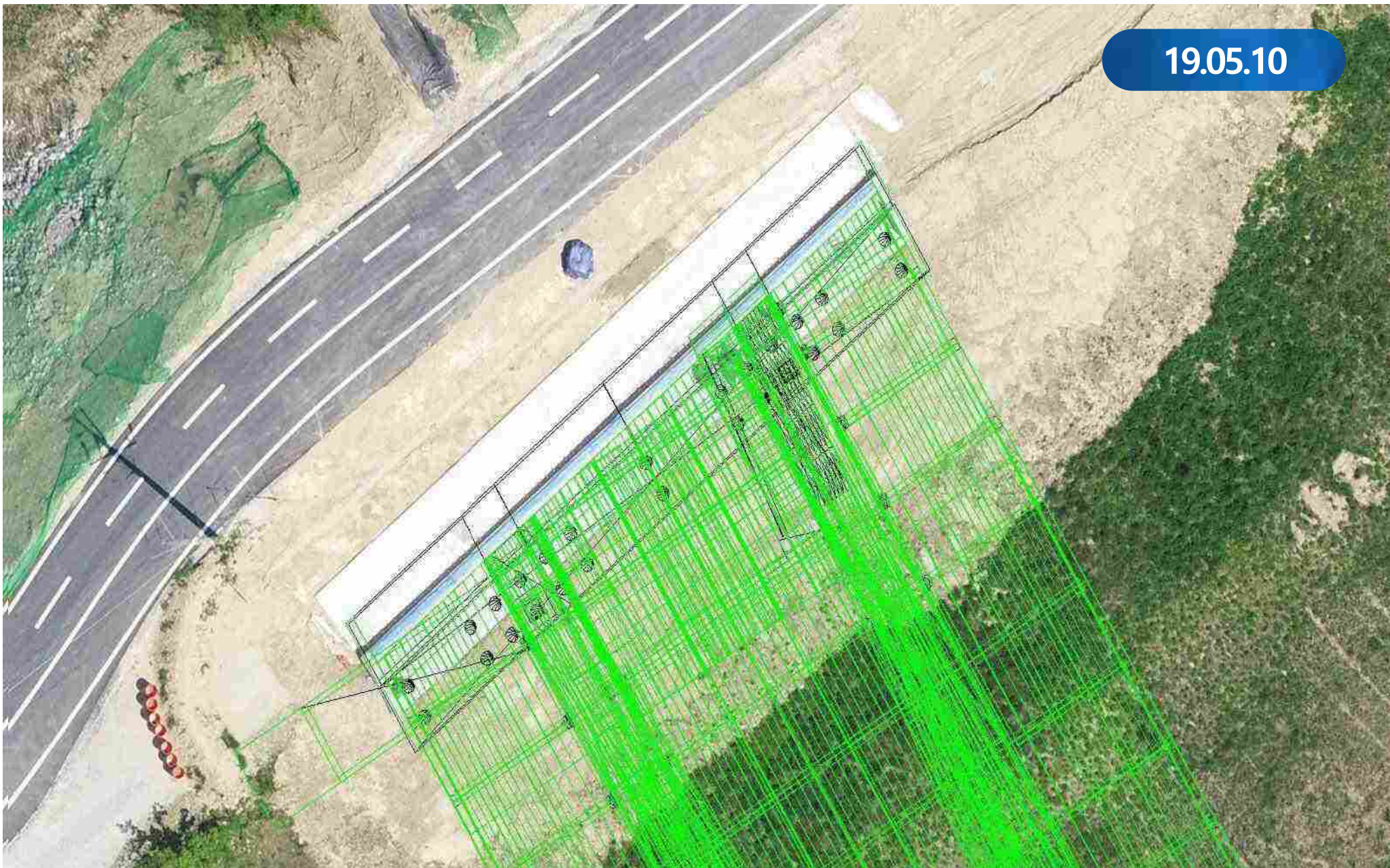
Orthomosaic image + 2D drawing overlay in Geumgang pedestrian bridge

19.05.10



▶ Orthomosaic image + 2D drawing overlay in Geumgang pedestrian bridge

19.05.10



➤ Digital twin + BIM in Sejong-city Geumgang pedestrian bridge



▶ Digital twin + BIM in Sejong-city Geumgang pedestrian bridge



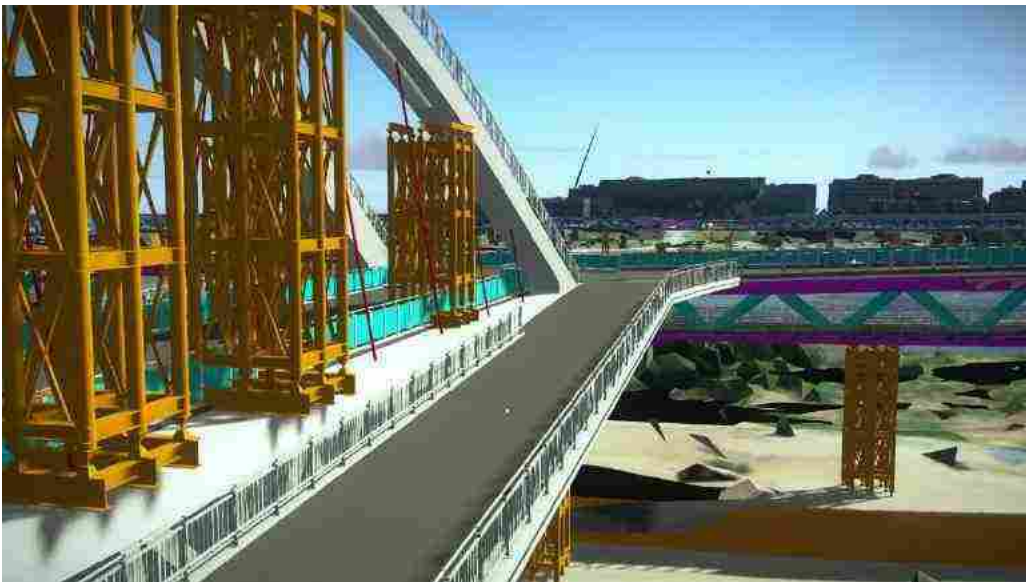
▶ Digital twin + BIM in Sejong-si Geumgang pedestrian bridge



▶ Digital twin + BIM in Sejong-city Geumgang pedestrian bridge



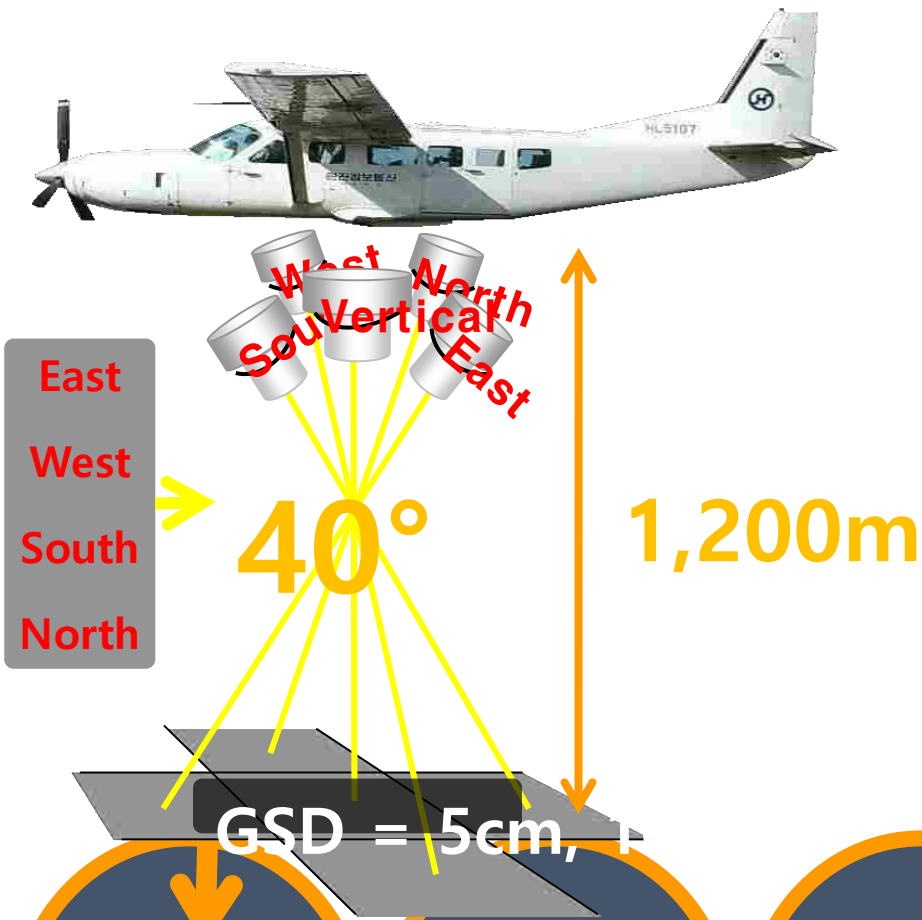
▶ Digital twin + BIM in Sejong-city Geumgang pedestrian bridge Simulation



➤ Digital twin + BIM in Sejong-city Geumgang pedestrian bridge



Manned air multidimensional stereoscopic image method



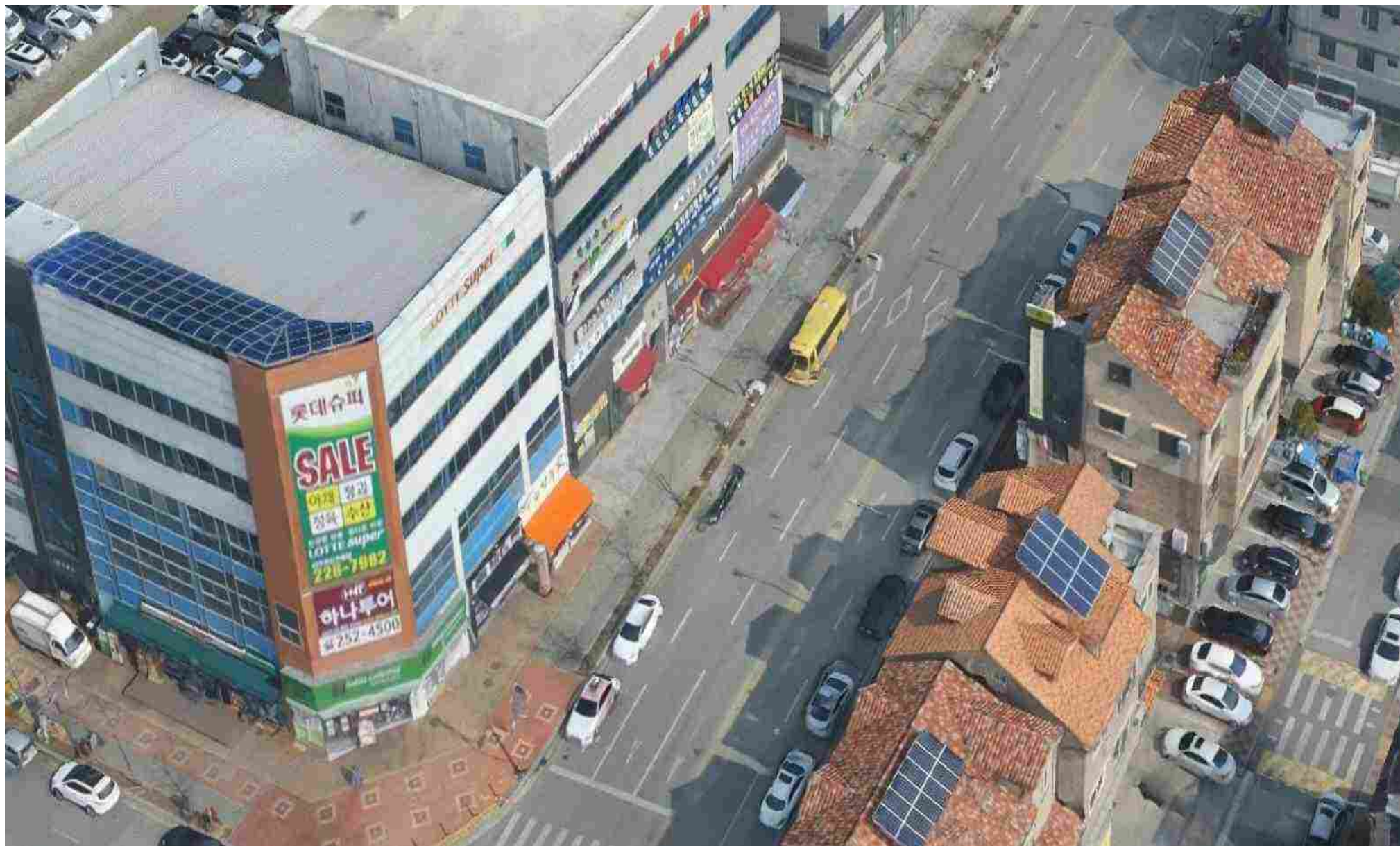
Pictometry oblique imagery



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)



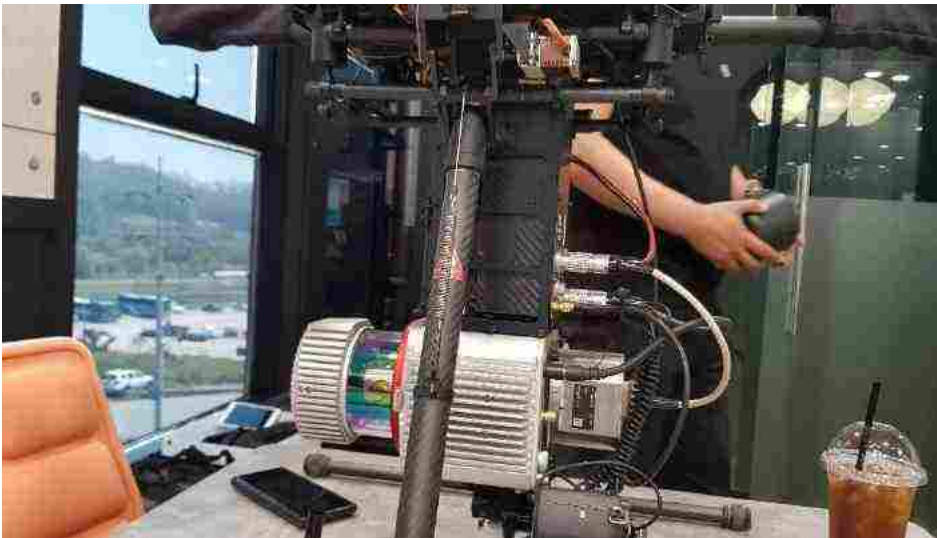
Drone Digital twin city (Jeonbuk Provincial Government)



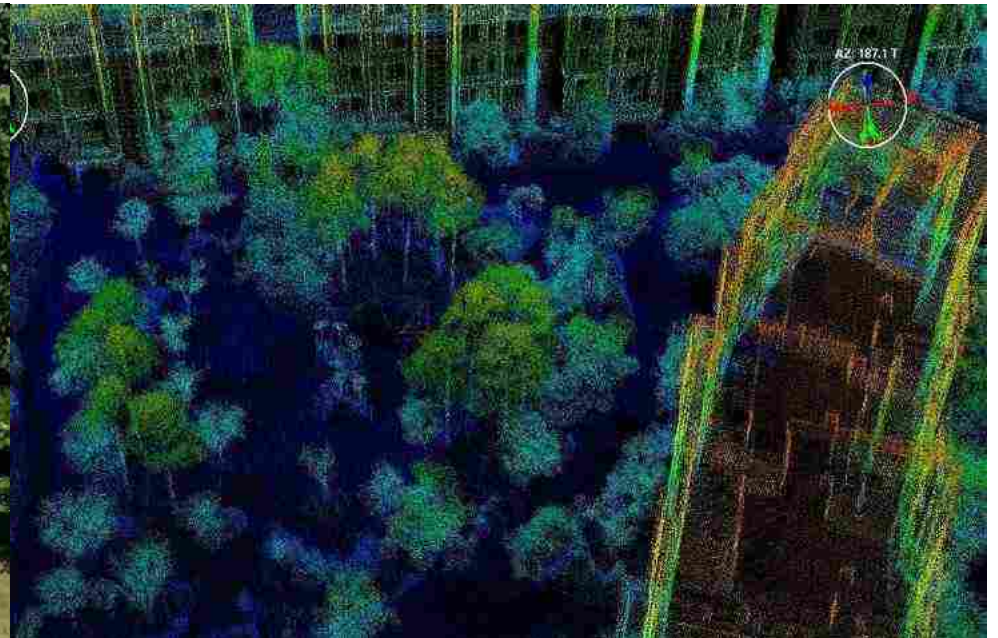
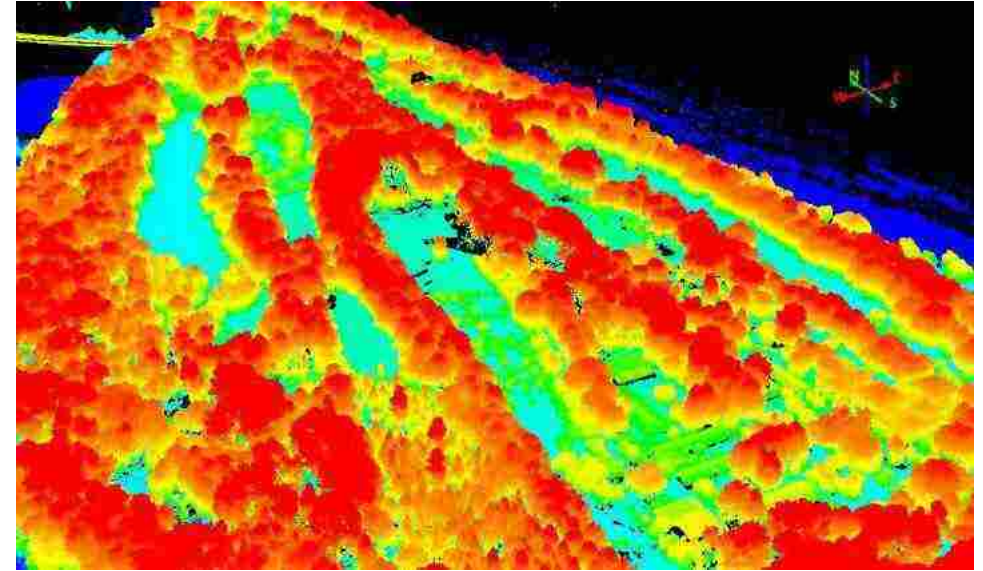
Drone Digital twin city (Seoul Dongdaemun)



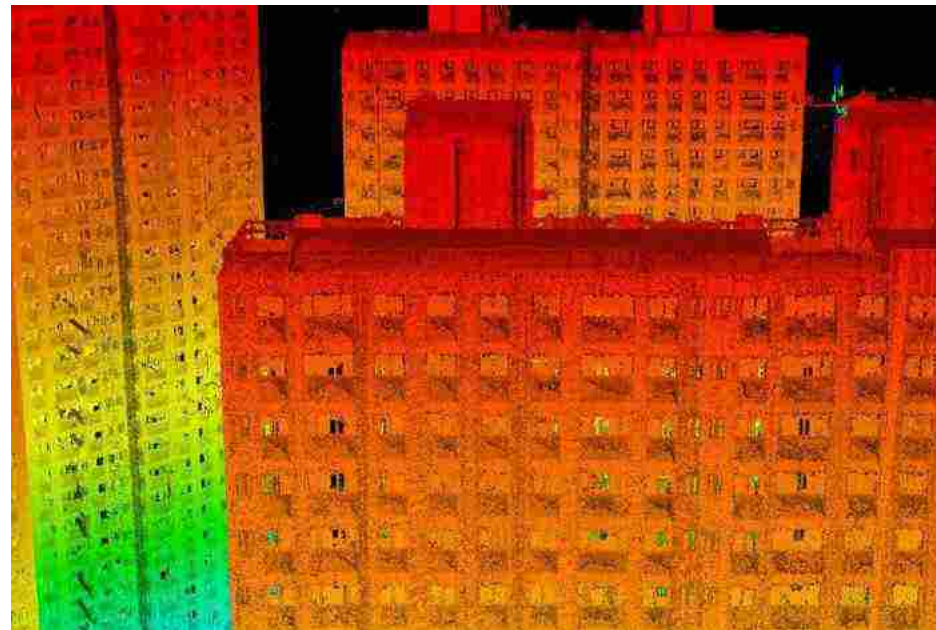
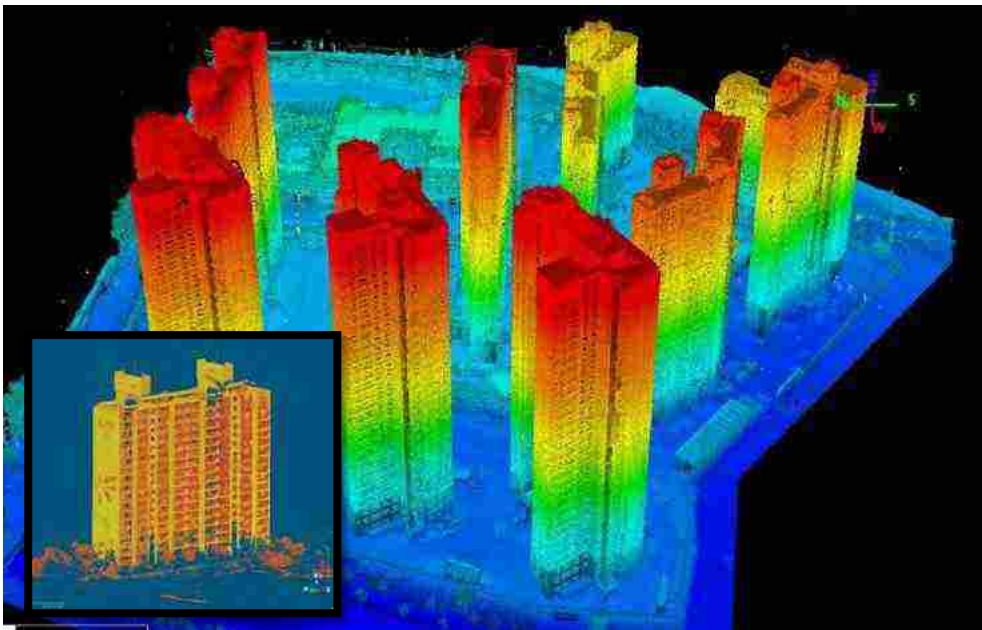
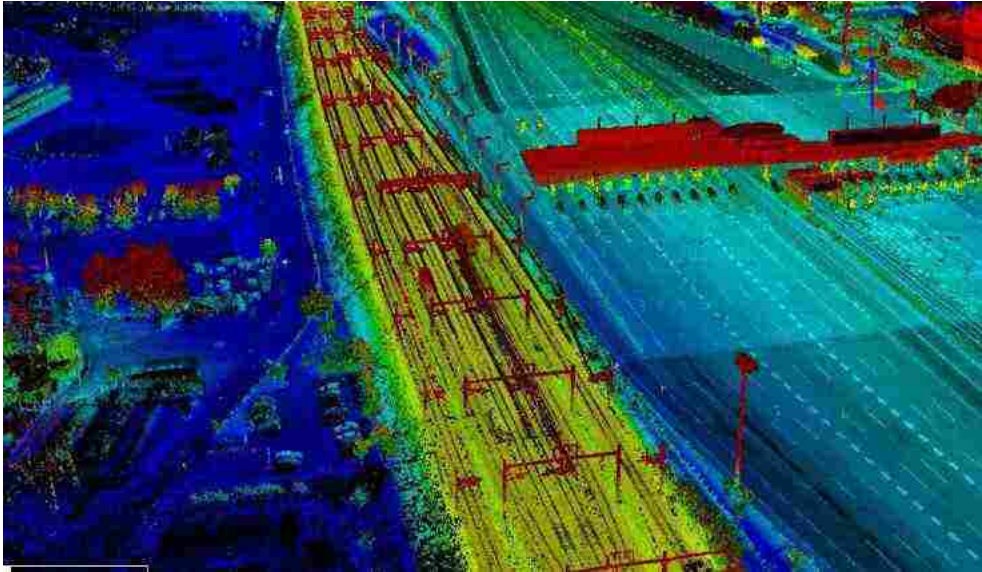
3D LiDAR scanning system for drones



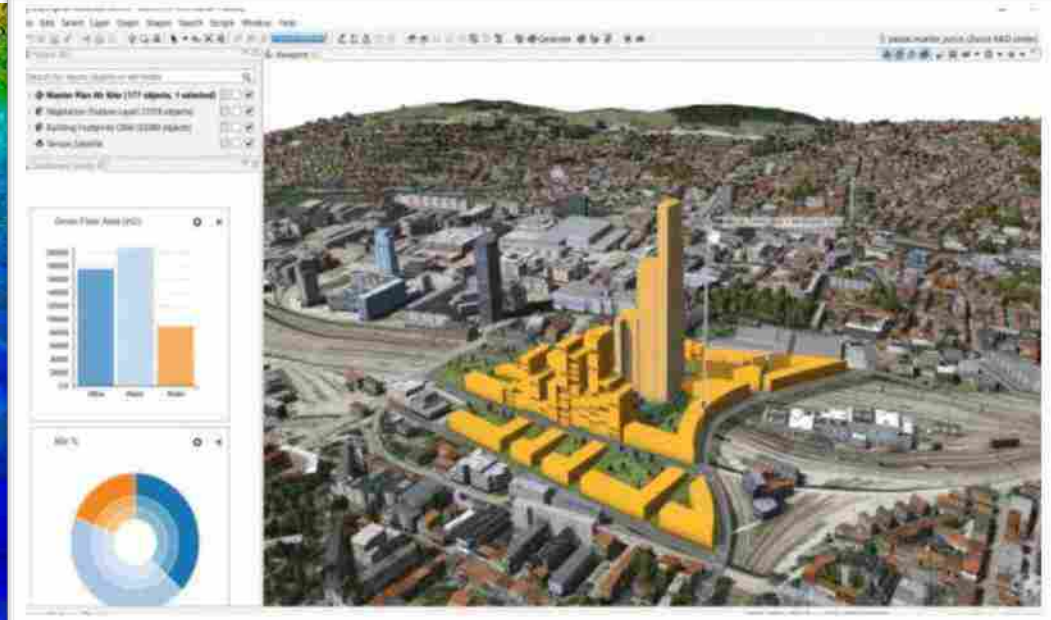
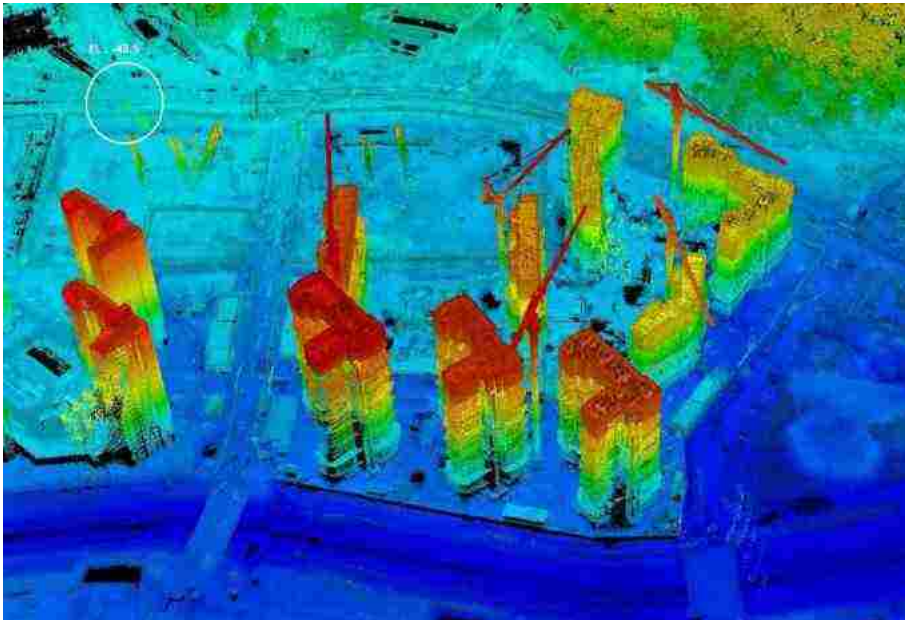
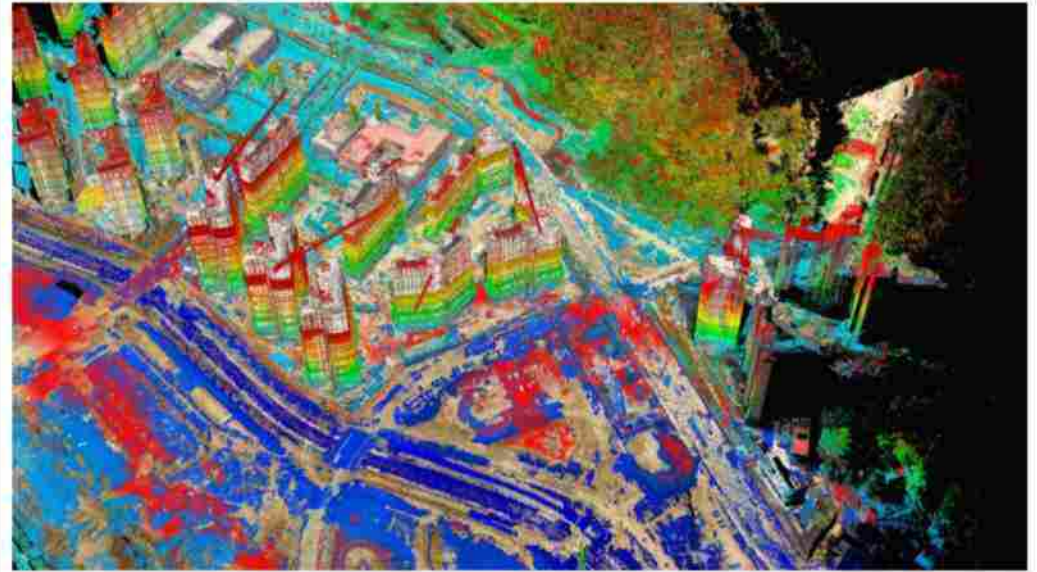
Precision DEM construction in forest using 3D LiDAR scanning



Digital twin City construction using 3D LiDAR scanning



DEM construction of building site using 3D LiDAR scanning



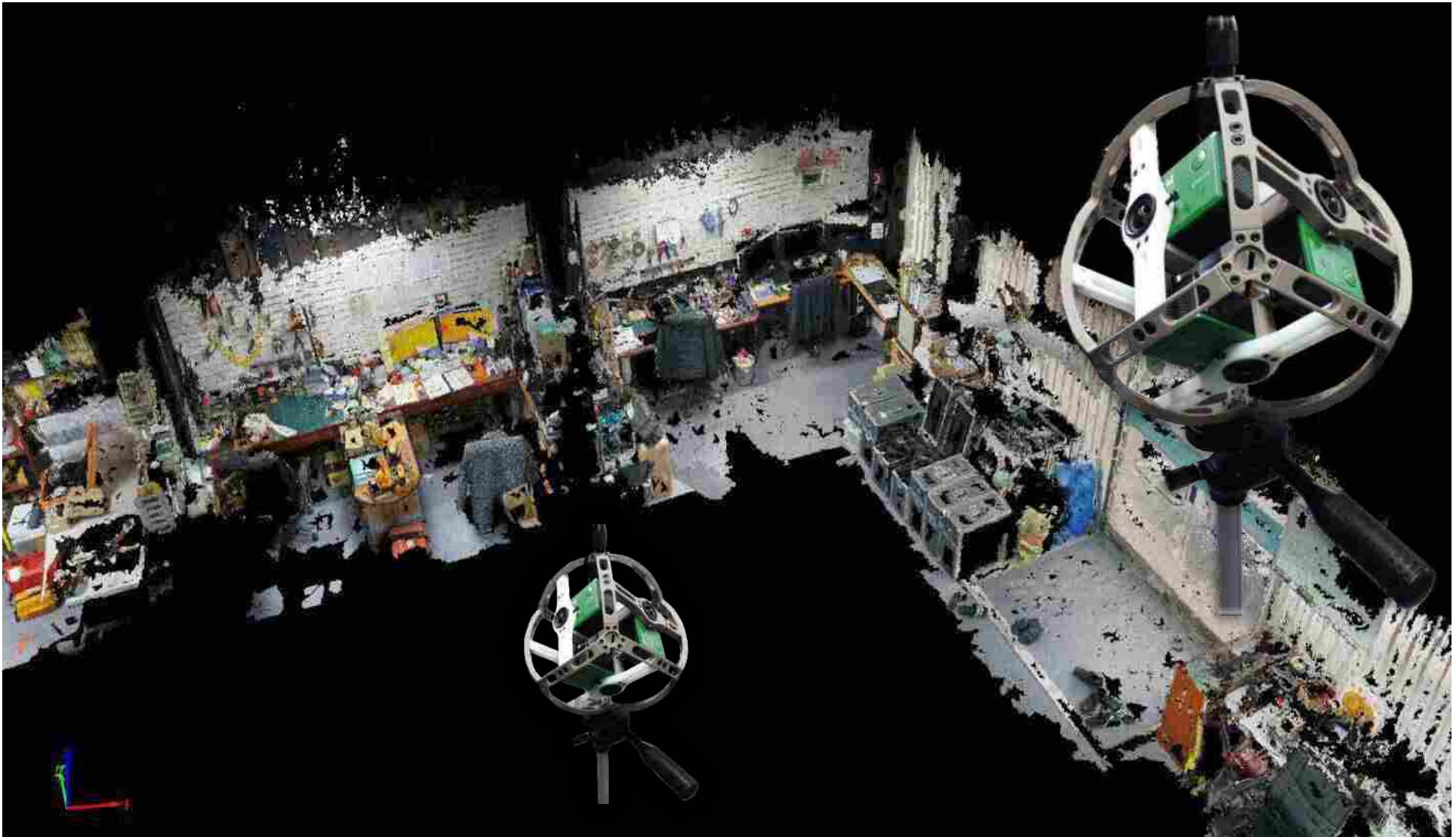
MMS-based Digital twin City construction

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



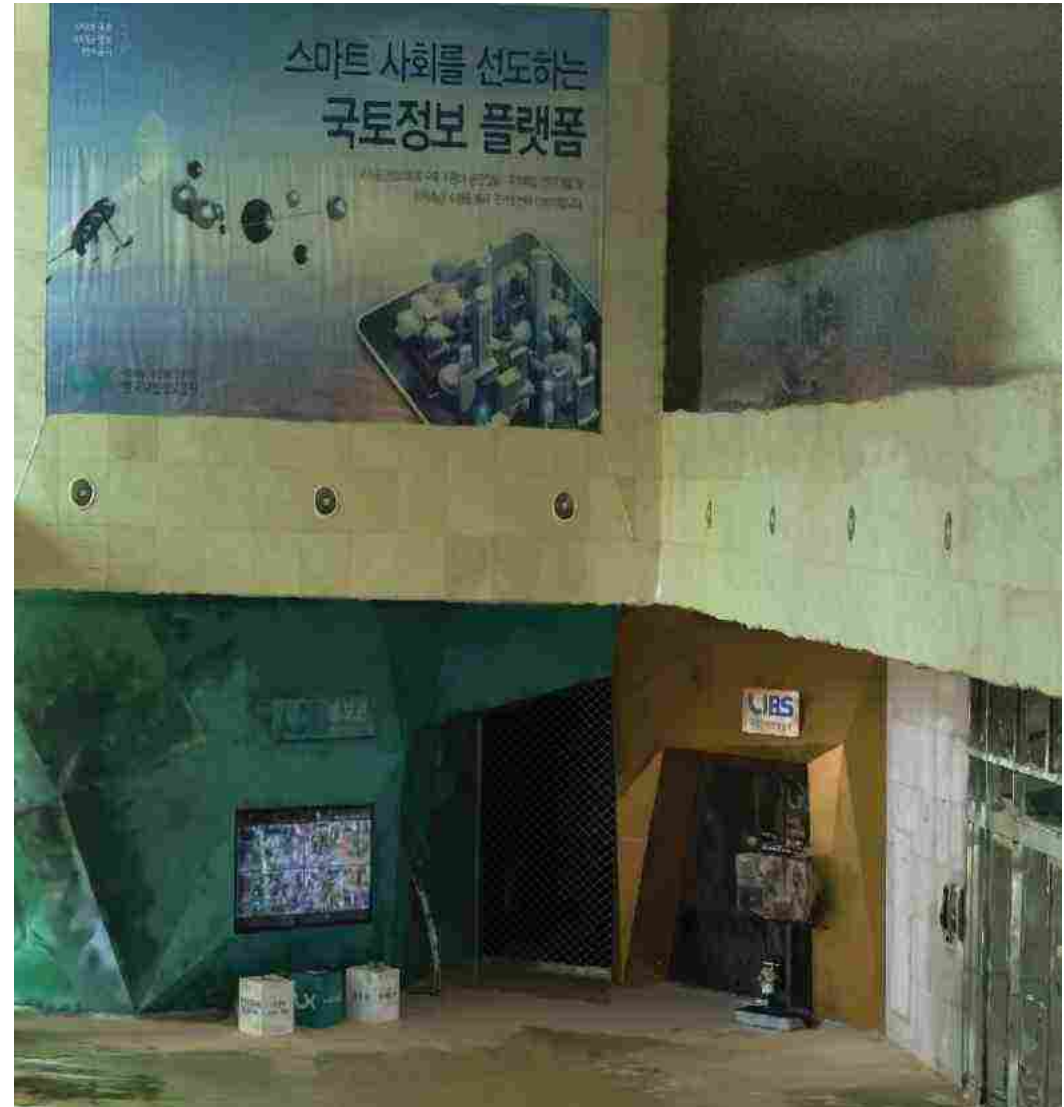
AI Utilization of digital twin DB in Unmanned vehicle

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



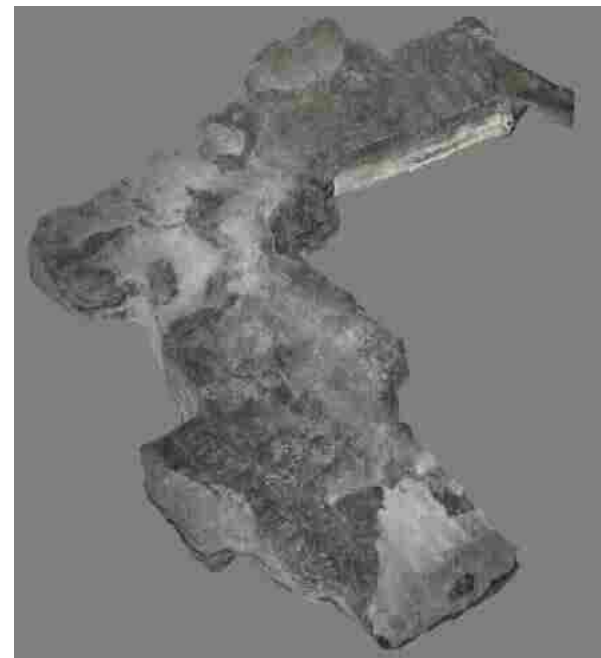
Unmanned vehicle based Indoor Digital twin DB construction (3D modeling)

**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






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Thank you for your attention