

# BIM and Digital Twins in Geotechnical Engineering

*TC222 Geotechnical BIM and DT*



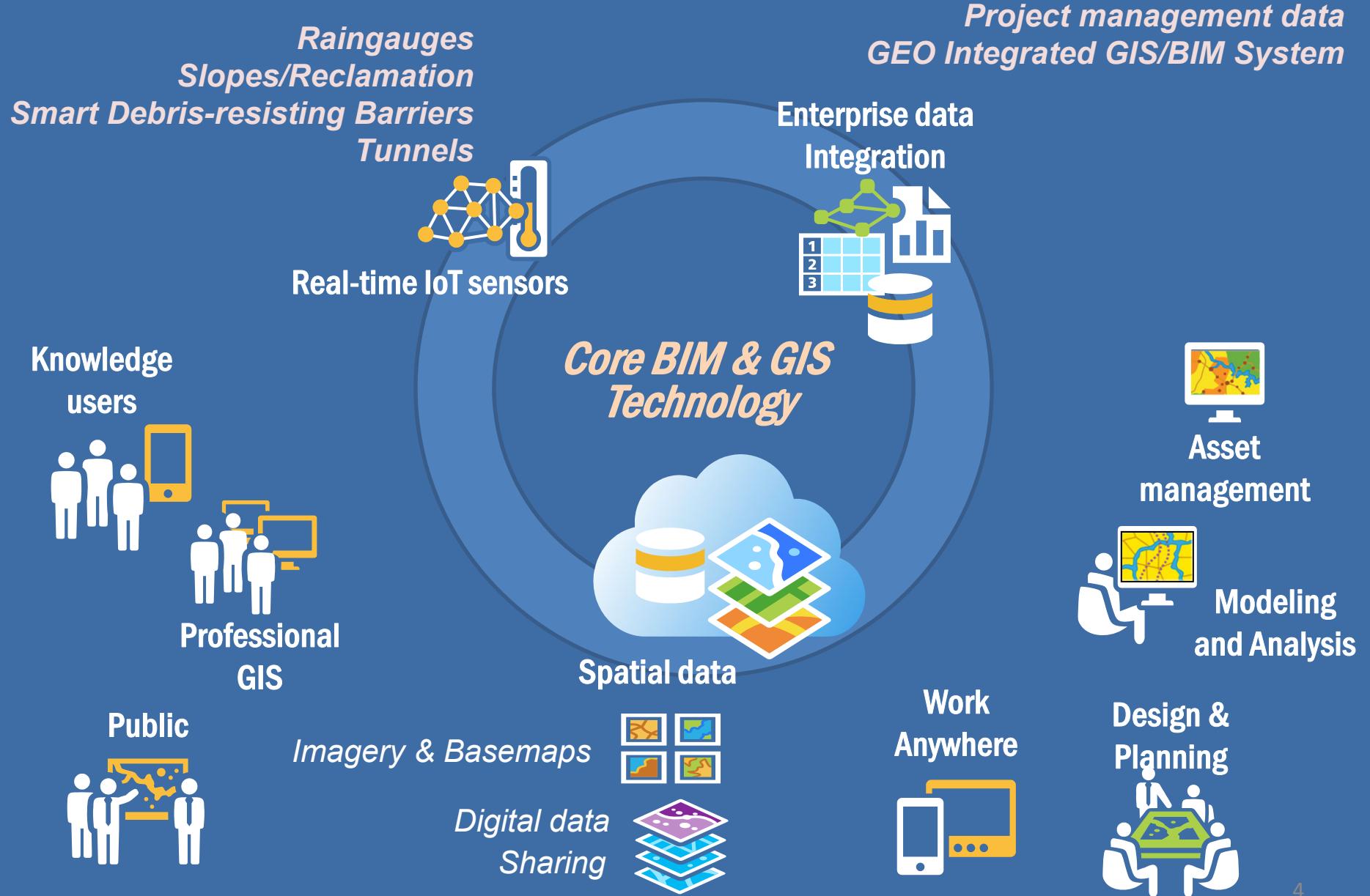
Raymond KOO  
Geotechnical Engineering Office  
Civil Engineering and Development Department  
The Hong Kong SAR Government

# Outline of Presentation

- Geotechnical Information Infrastructure in Hong Kong
- Applications of BIM and Digital Twins Technology
  - *Smart Landslide Debris-resisting Barriers*
  - *Po Shan Drainage Tunnels*
- Digital Design Automation

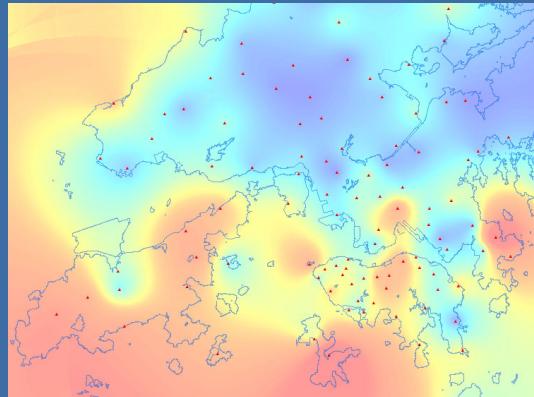
# **Part 1 - Geotechnical Information Infrastructure**

# Geotechnical Information Infrastructure



# Geotechnical Information Infrastructure

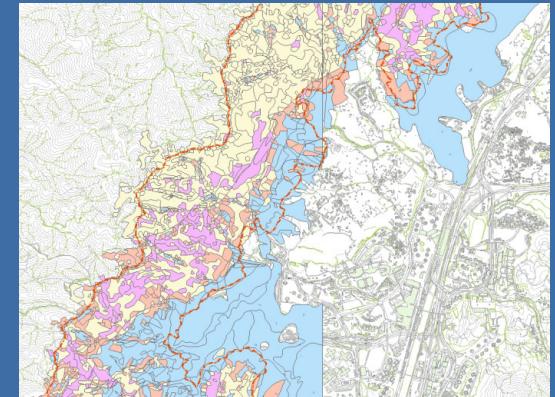
/// Vast amount of geotechnical information that are spatially enabled



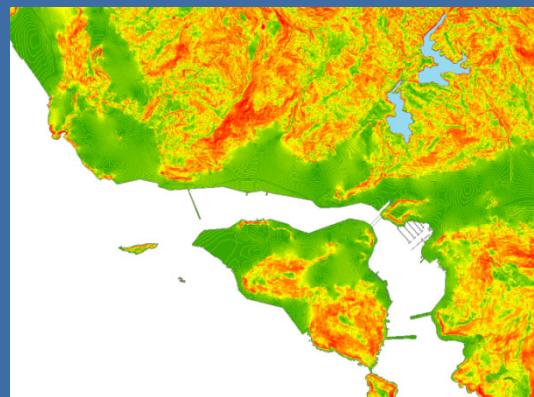
rainfall data



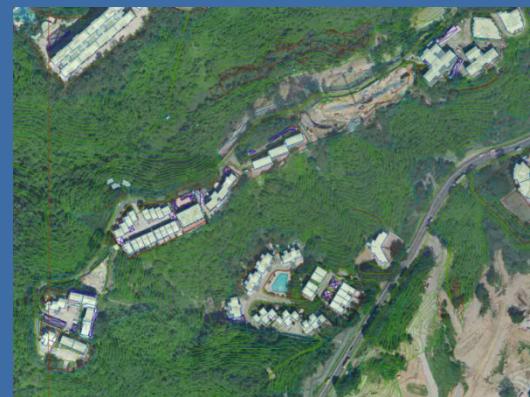
slope boundary



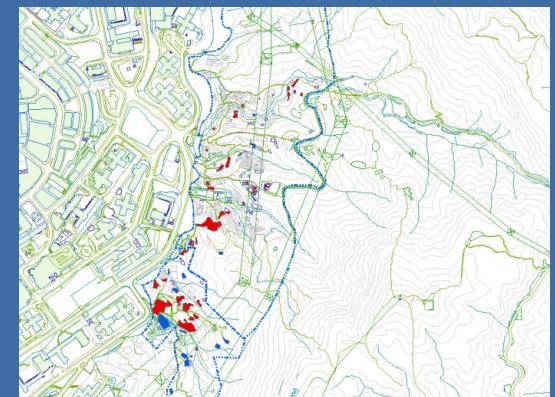
landslide susceptibility



digital elevation model

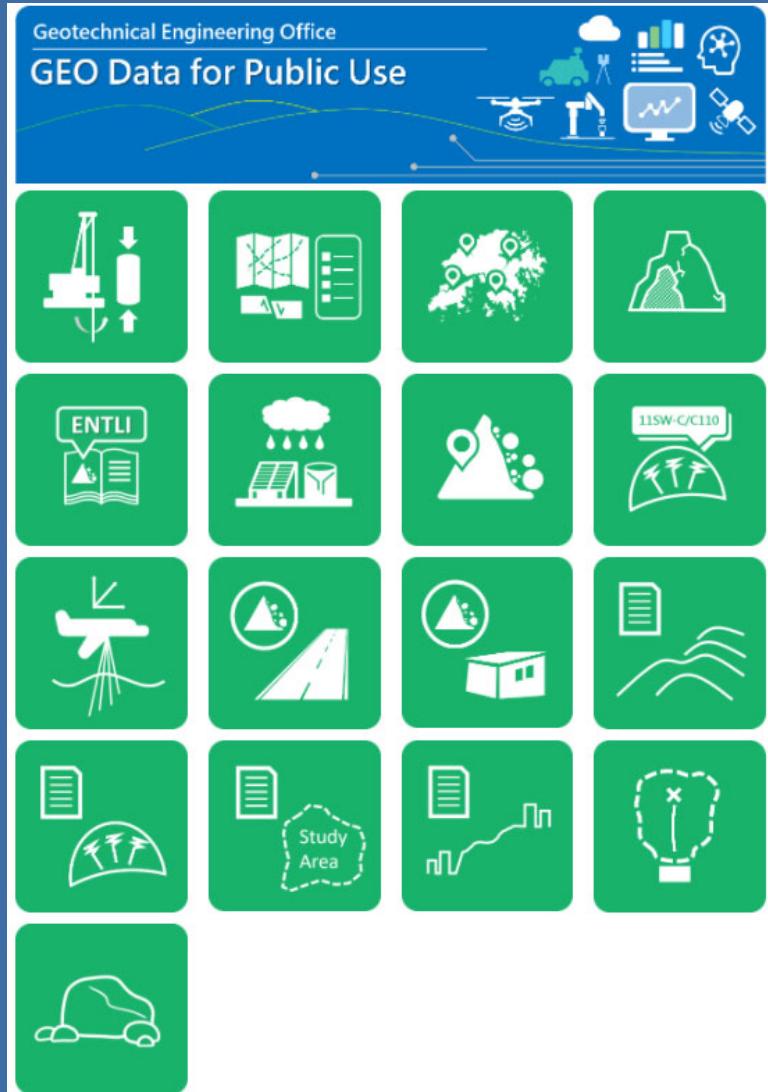


ortho-rectified aerial photo



squatters area

# Integrated GEO Information System



➤GEO Open Data include:

- Slope inventory
- LiDAR data
- Borehole AGS data
- Laboratory test data
- Rainfall data
- Landslide data
- Debris flow data
- etc.

# Integrated GEO Information System

GINFO - GEOTECHNICAL INFORMATION SYSTEM

ginfo.cedd.hksar/ginfomaps/GInfoMap.aspx

GINfo Homepage | GINFO - GEOTECHNICAL INFORMATION SYSTEM | GEOTECHNICAL INFORMATION SYSTEM | Integrated GEO Inf... | Intranet GEO Smart... | GEO Smart Platfor... | GEO KM Portal (Sha... | Integrated GEO Inf... | HKSS Website | Open Data - GEO, C... | SROS | GEO Knowledge Ca... | 3D GIS Demo Platfo... |

GEOTECHNICAL INFORMATION INFRASTRUCTURE  
POWERED BY ARCGIS

SlopeInfo District Council... District Area... Search Print Refresh

Scale : 1:1000 | Min : 836301E 818832N Max : 836809E 819053N | Position : 836713E 818927N

Welcome, TANG CHRIS SAI CHUNG

11NW-D/C 101 (3D)

11NW-D/C 101

11NW-D/C 569 11NW-D/C 93 11NW-D/C 91 11NW-D/C 457 11NW-D/CR 611 11NW-D/CR 458 11NW-D/FR 50 11NW-D/FR 261 11NW-D/C 456 11NW-D/C 452 11NW-D/C 465 11NW-D/C 98 11NW-D/C 550 11NW-D/C 450 11NW-D/CR 97 11NW-D/C 448

11NW-D/C 457 11NW-D/C 456 74.6 King's Park Service Reserve Playground 足球場 Football Field (下富京士柏上配) WT WT 11NW-D/FR 50 11NW-D/FR 261 11NW-D/C 453 道路 CHUNG HAU STREET 11NW-D/F 262 11NW-D/FR 38 11NW-D/F 258 11NW-D/F 39 11NW-D/C 452 11NW-D/C 451 11NW-D/C 450 11NW-D/C 449 11NW-D/C 448 11NW-D/C 447 11NW-D/C 446 11NW-D/C 445 11NW-D/C 444 11NW-D/C 443 11NW-D/C 442 11NW-D/C 441 11NW-D/C 440 11NW-D/C 439 11NW-D/C 438 11NW-D/C 437 11NW-D/C 436 11NW-D/C 435 11NW-D/C 434 11NW-D/C 433 11NW-D/C 432 11NW-D/C 431 11NW-D/C 430 11NW-D/C 429 11NW-D/C 428 11NW-D/C 427 11NW-D/C 426 11NW-D/C 425 11NW-D/C 424 11NW-D/C 423 11NW-D/C 422 11NW-D/C 421 11NW-D/C 420 11NW-D/C 419 11NW-D/C 418 11NW-D/C 417 11NW-D/C 416 11NW-D/C 415 11NW-D/C 414 11NW-D/C 413 11NW-D/C 412 11NW-D/C 411 11NW-D/C 410 11NW-D/C 409 11NW-D/C 408 11NW-D/C 407 11NW-D/C 406 11NW-D/C 405 11NW-D/C 404 11NW-D/C 403 11NW-D/C 402 11NW-D/C 401 11NW-D/C 400 11NW-D/C 399 11NW-D/C 398 11NW-D/C 397 11NW-D/C 396 11NW-D/C 395 11NW-D/C 394 11NW-D/C 393 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11NW-D/C 101 (3D)

[Graphical Search] [3D View]

Menu

Map Content

Search

Textual Search

Man-made Features

11 NW-D C 101

e.g. 11SW-C/C110

Graphical Search

Man-made Features

Buffer (m)

Tools

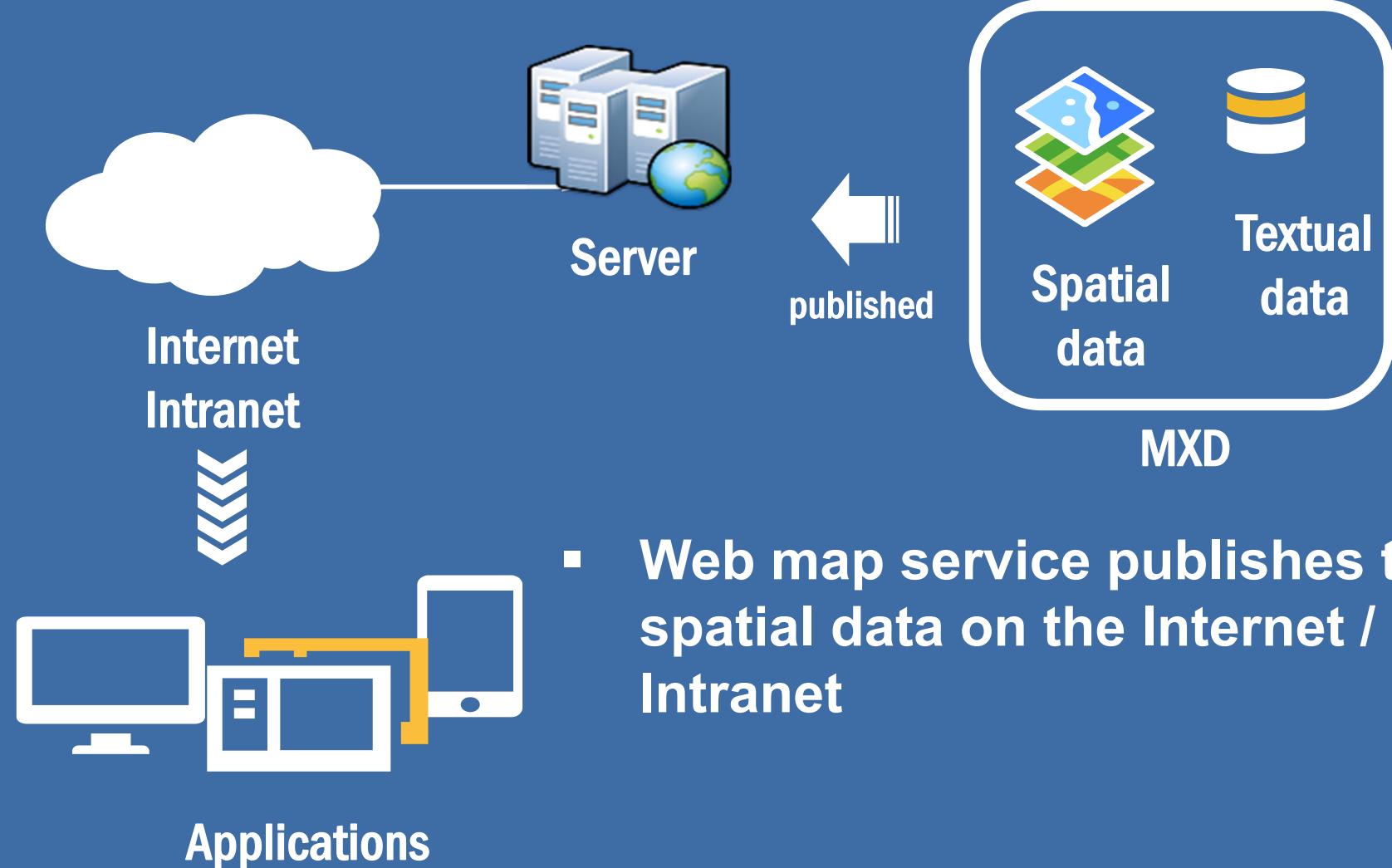
Draw and Measure

Real Time Rainfall

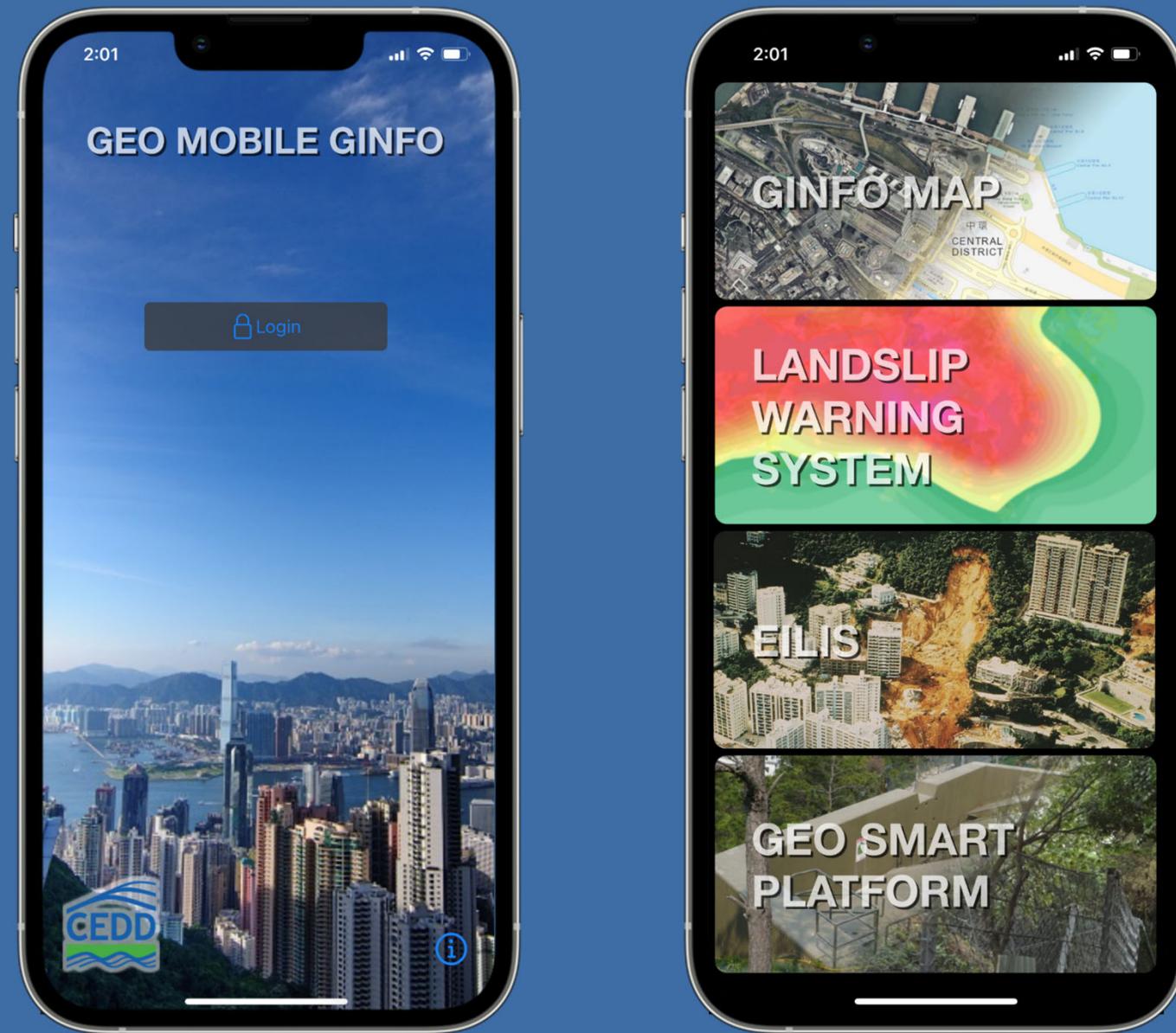
Legend

7

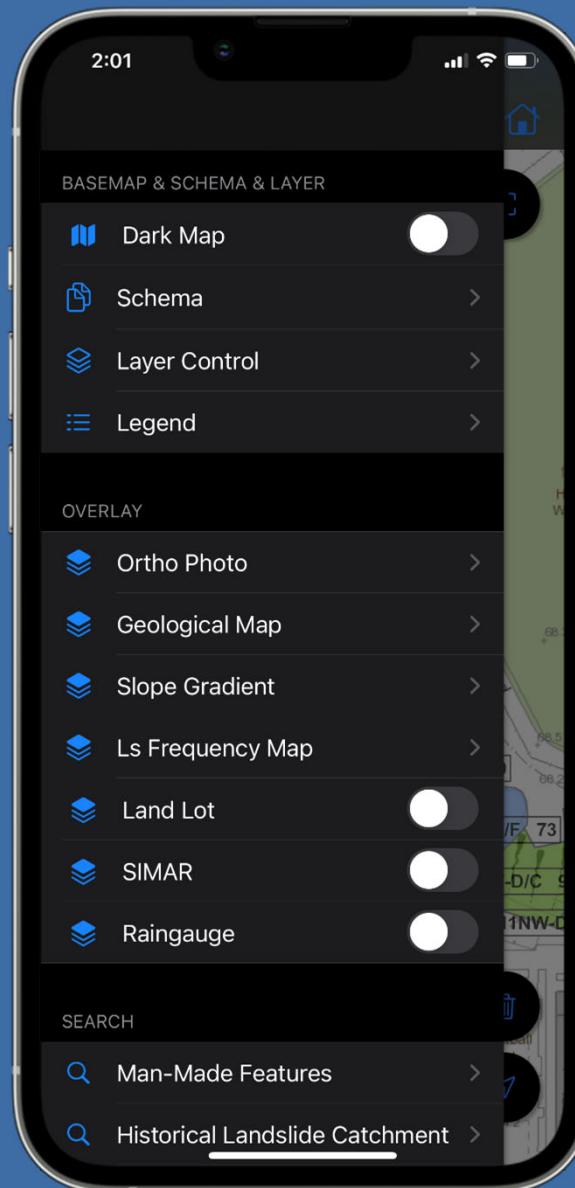
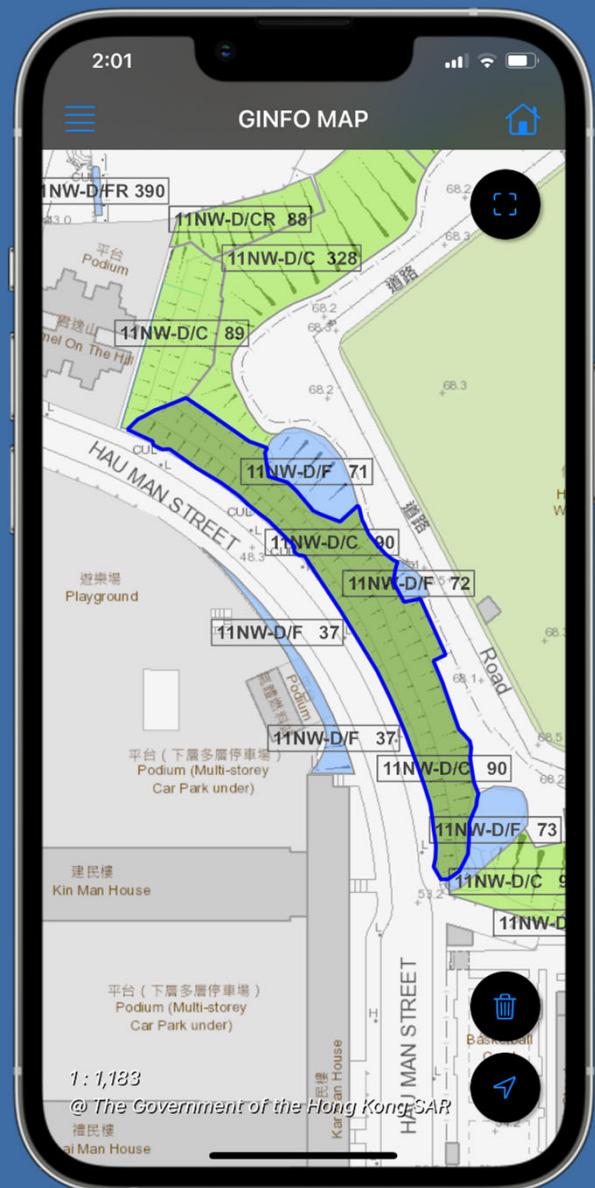
# Web Map Services



# Mobile device



# Mobile device

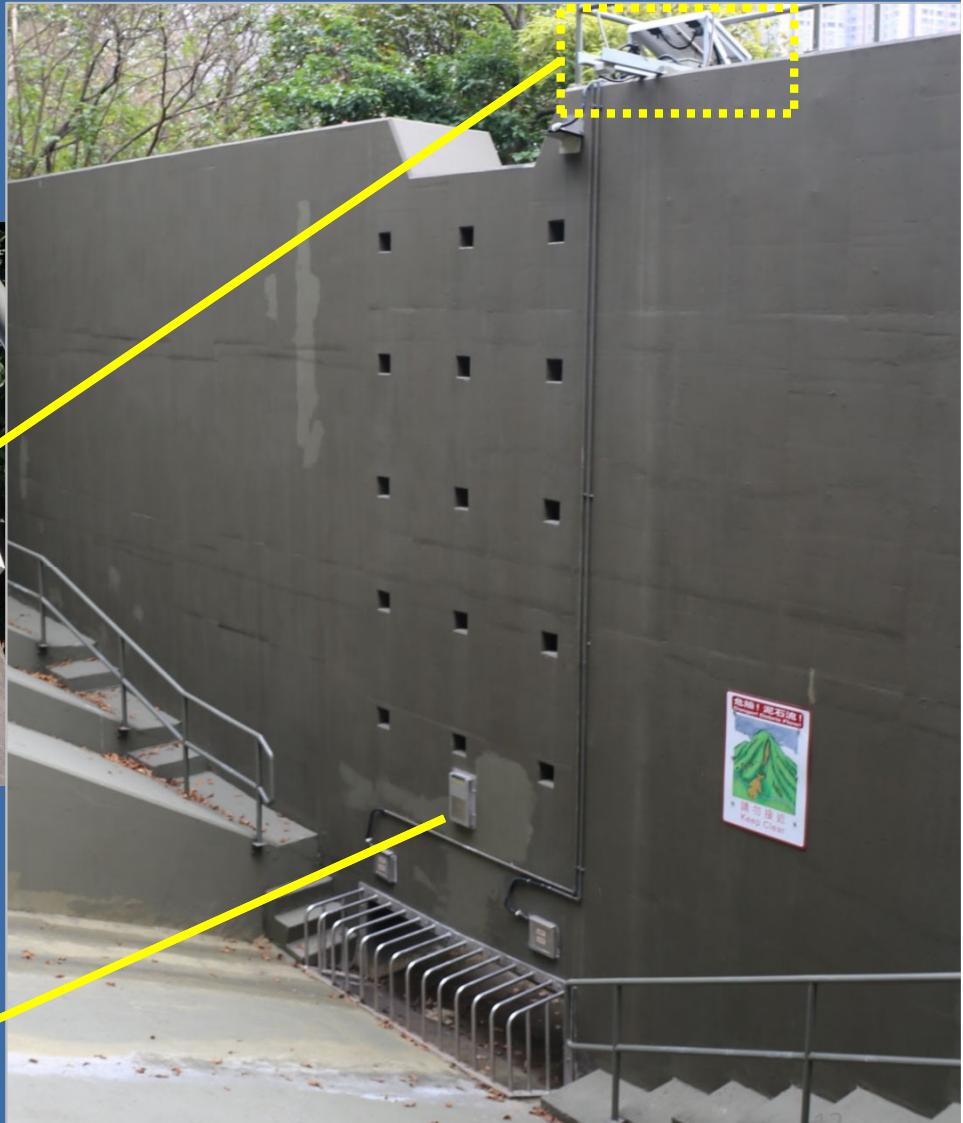
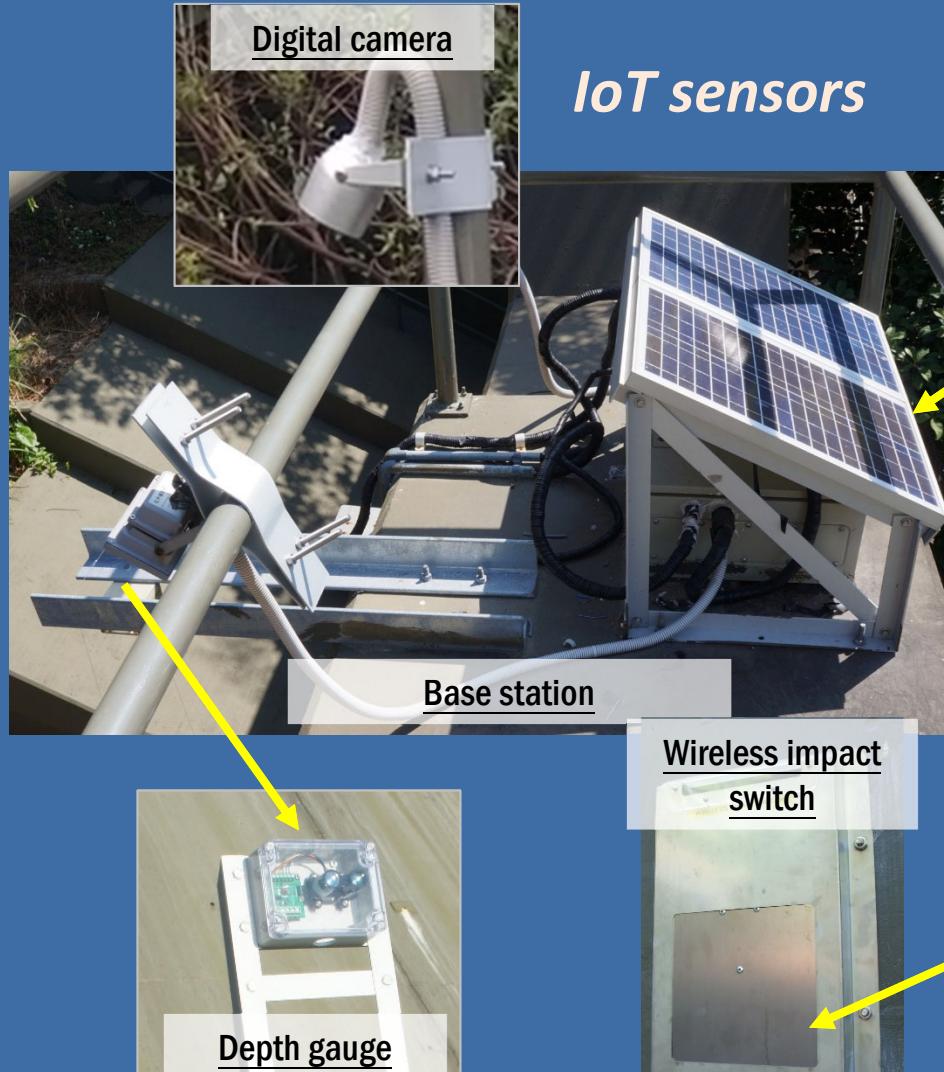


## Part 2 – Applications of BIM and Digital Twins Technology

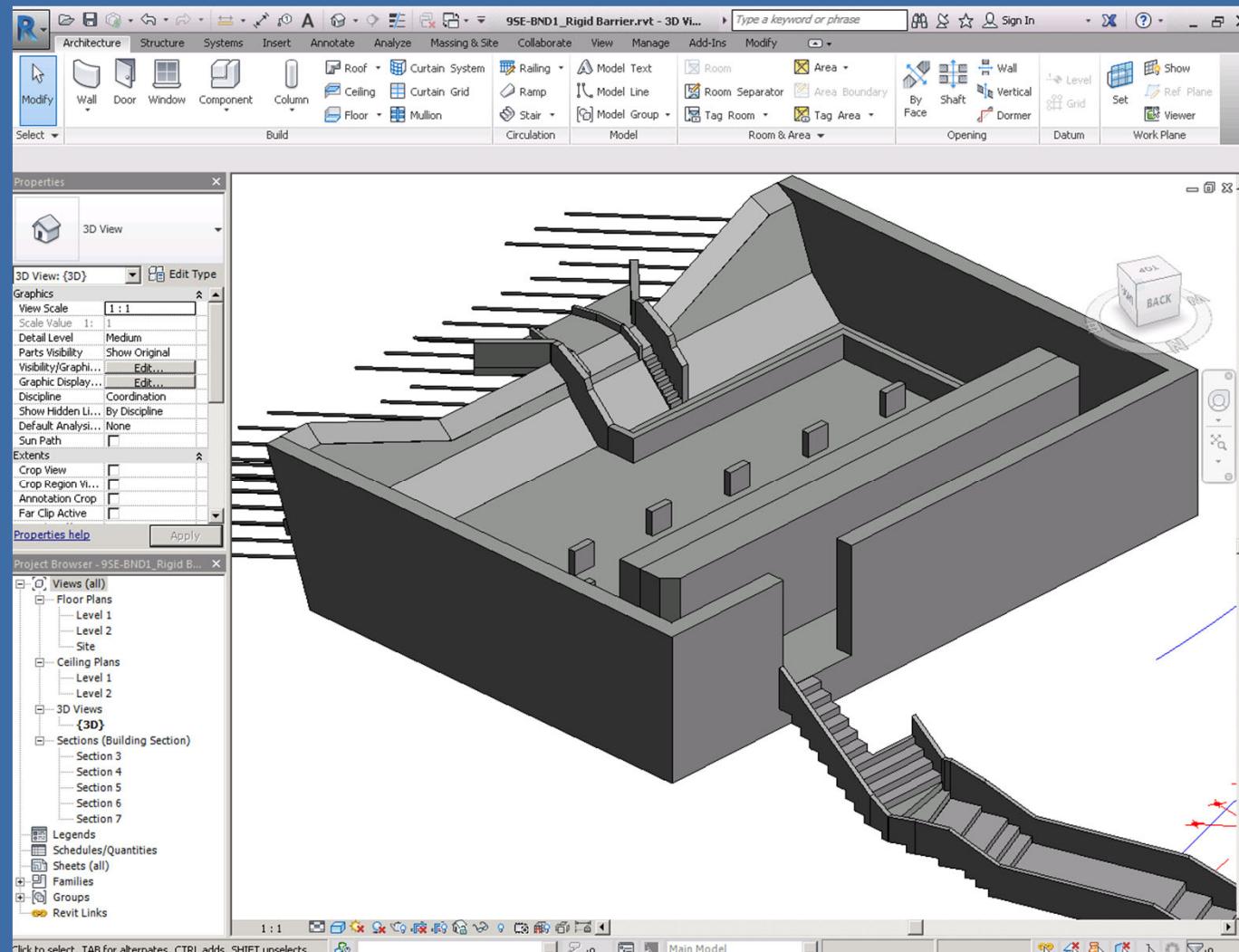
*Smart Landslide Debris-resisting Barriers*

# Digital Twin - Smart Barrier System

## (To detect landslide debris flow impact)



# Integration with BIM



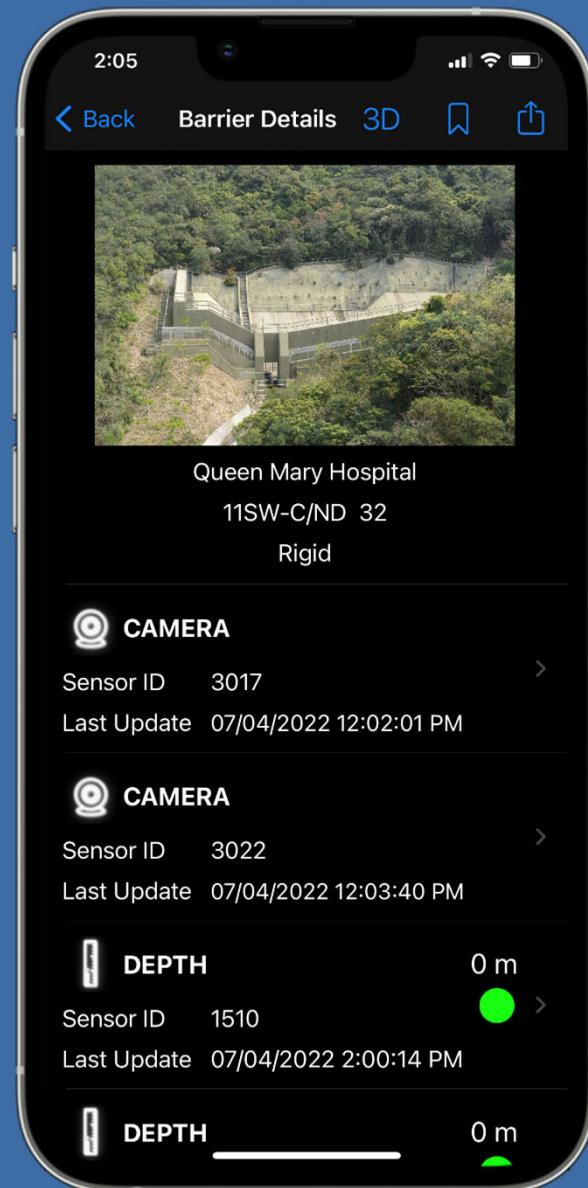
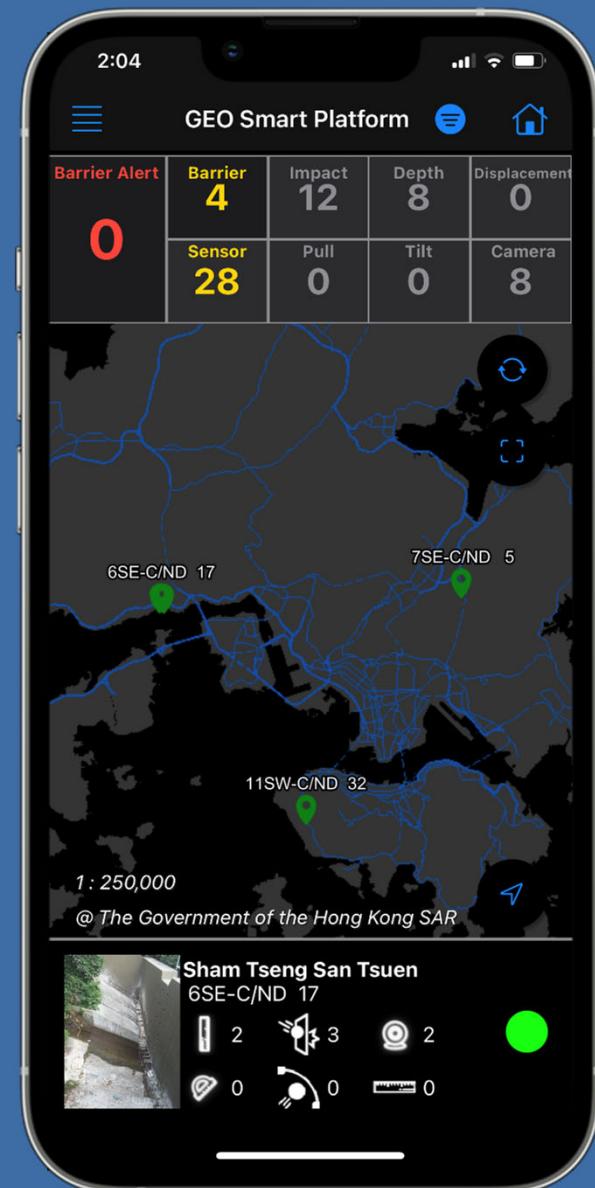
Building Information Modelling (BIM) Data

# Integration with BIM

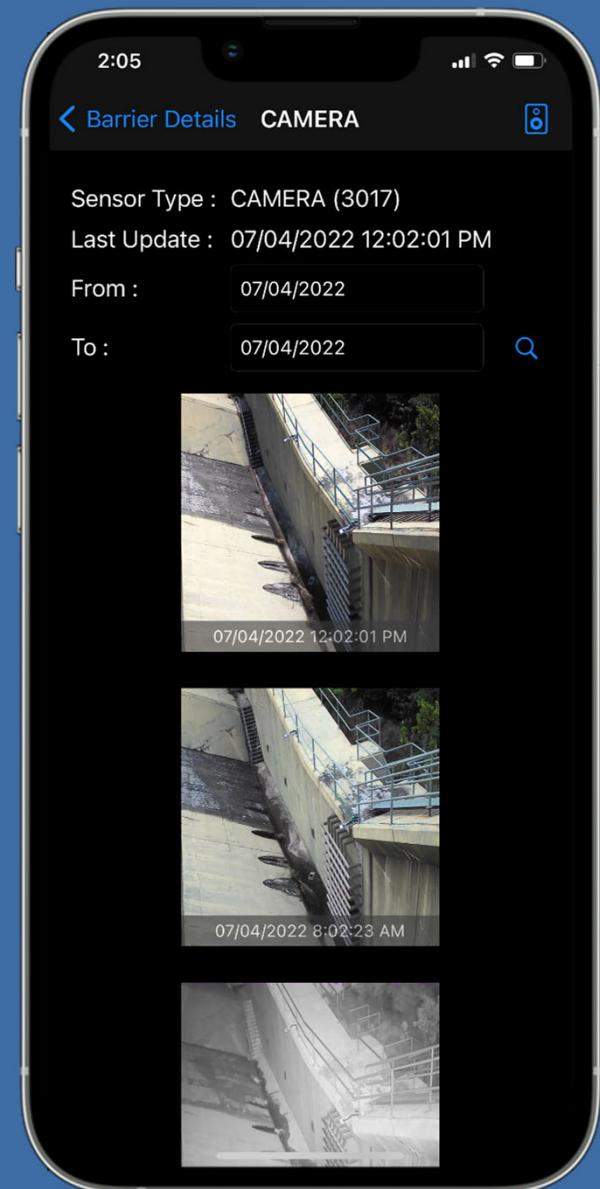


Building Information Modelling (BIM) Data

# Mobile Device



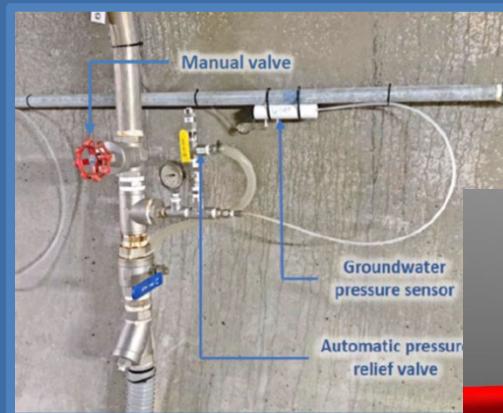
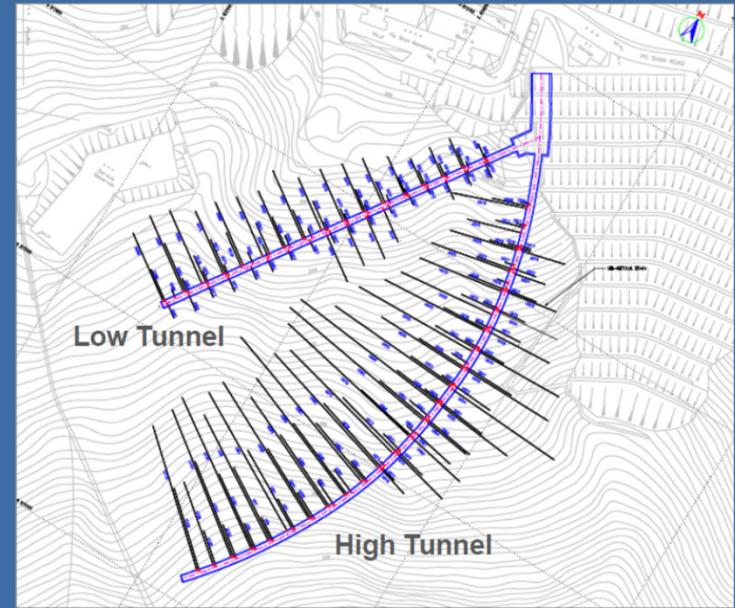
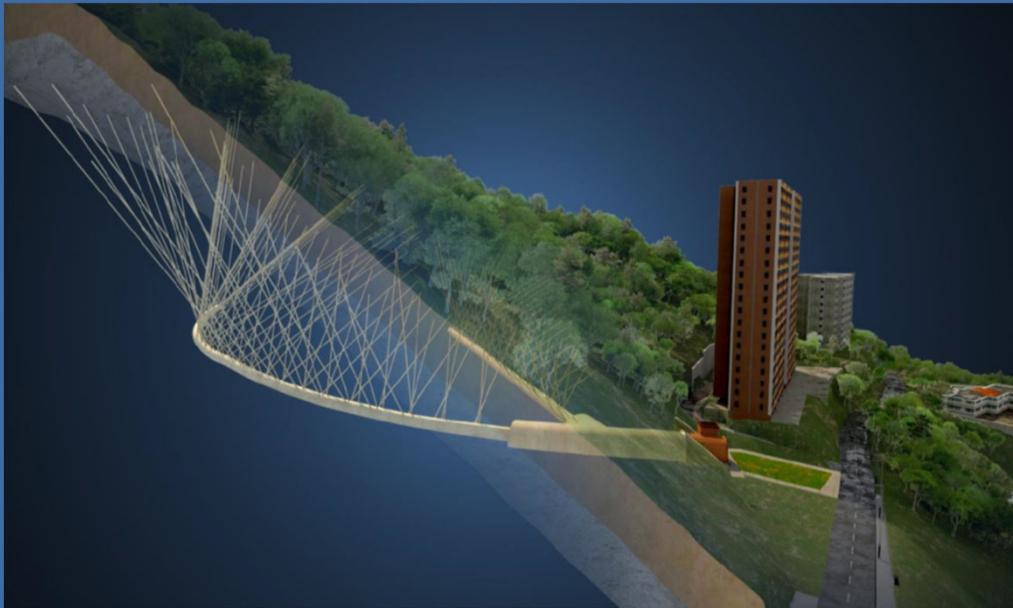
# Mobile Device



## Part 2 – Applications of BIM and Digital Twins Technology

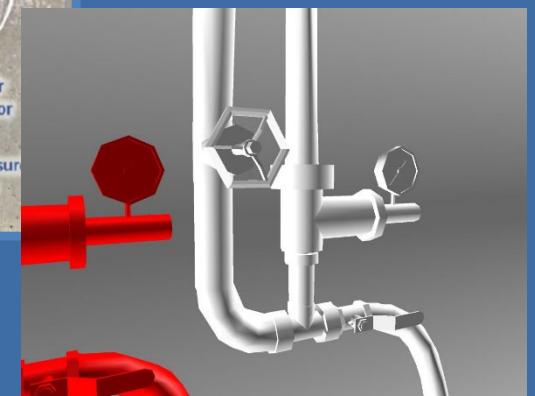
*Po Shan Drainage Tunnels*

# Po Shan Drainage Tunnels



*Site measurement devices (e.g. pressuremeters)*

*IoT sensors*



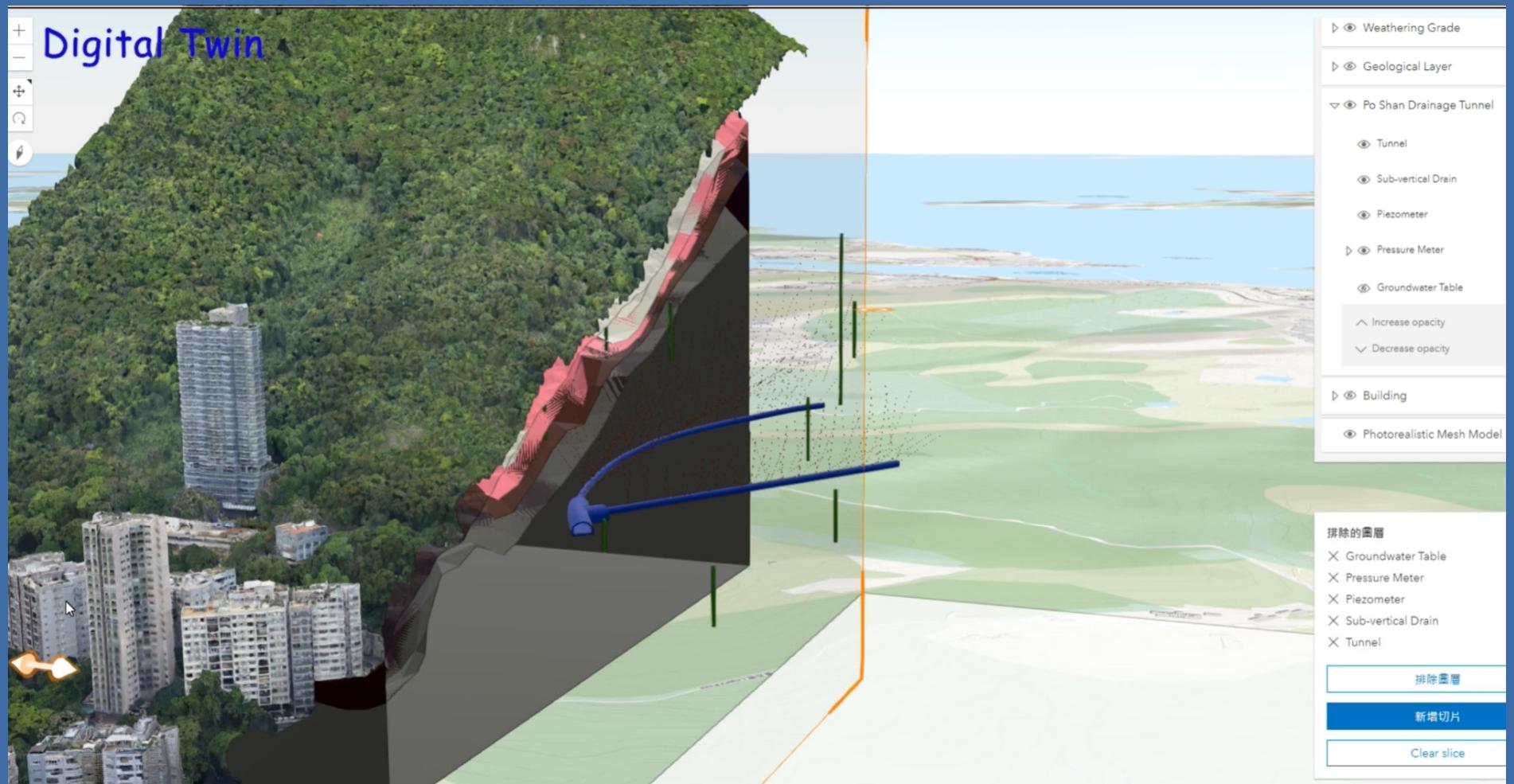
# Po Shan Drainage Tunnels

The screenshot displays a web-based geospatial application interface for the Geotechnical Information Infrastructure (GINFO). The main view shows a 3D perspective of a residential building complex situated on a hillside, surrounded by dense greenery. A callout box highlights the building labeled "11NW-D/C 101". To the right of the 3D view is a detailed 2D map of the area, showing various drainage features and labels such as "Kings Park Service Reserve", "Playground", "Football Field", "W.T.", "CHUNG HAU STREET", and "WIP Jan 2022". The map also includes elevation markers like "74.6", "51.0", "48.5", "47.9", "47.5", "47.0", and "46.4". On the far left, there is a legend and some administrative information. The top navigation bar includes links to the GINFO homepage, district council areas, and various GEO-related services. The right side of the interface contains a search panel with tabs for "Search" (selected), "Textual Search", and "Graphical Search", along with other menu options like "Tools", "Draw and Measure", "Real Time Rainfall", and "Legend".

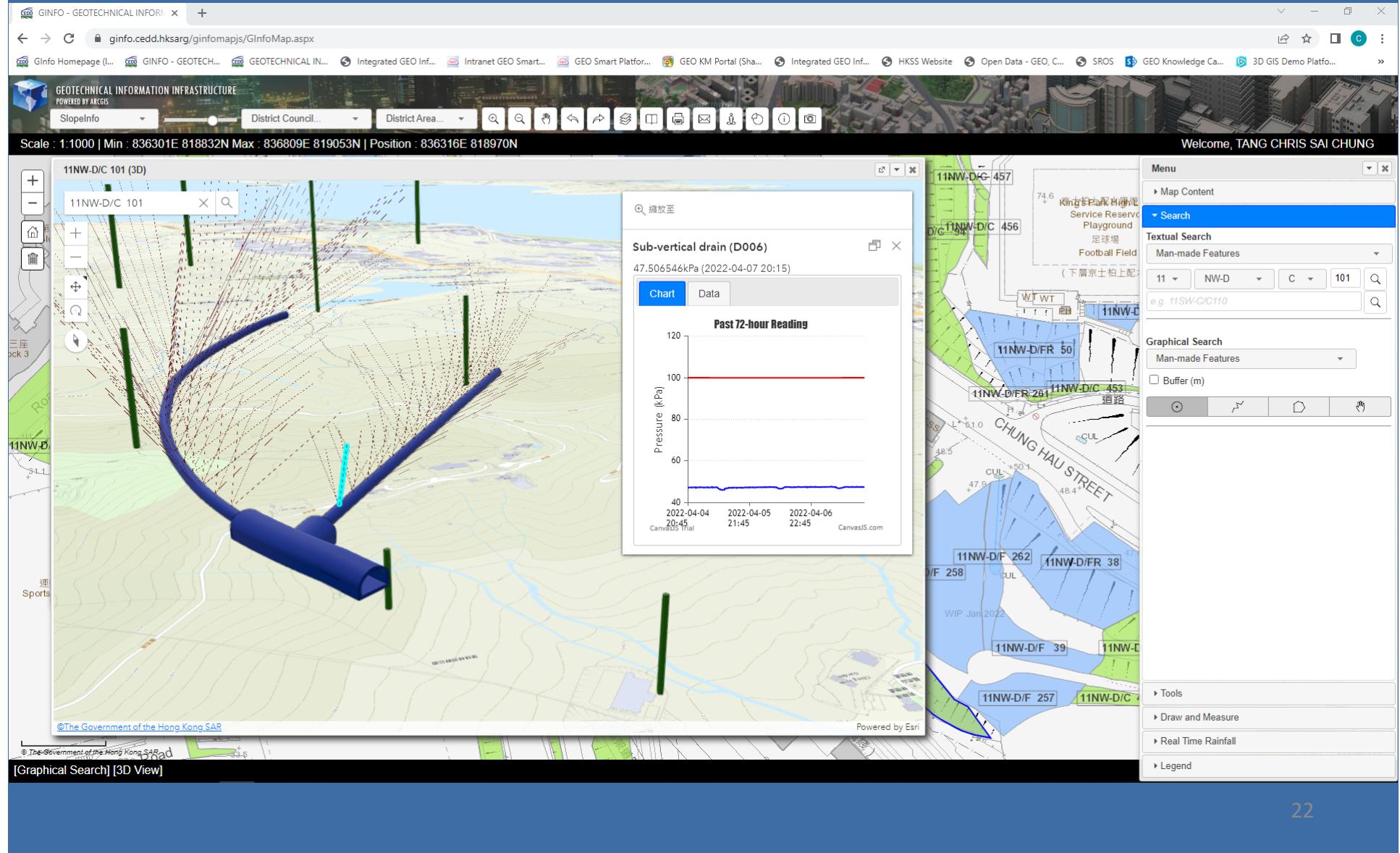
# Po Shan Drainage Tunnels



# Po Shan Drainage Tunnels

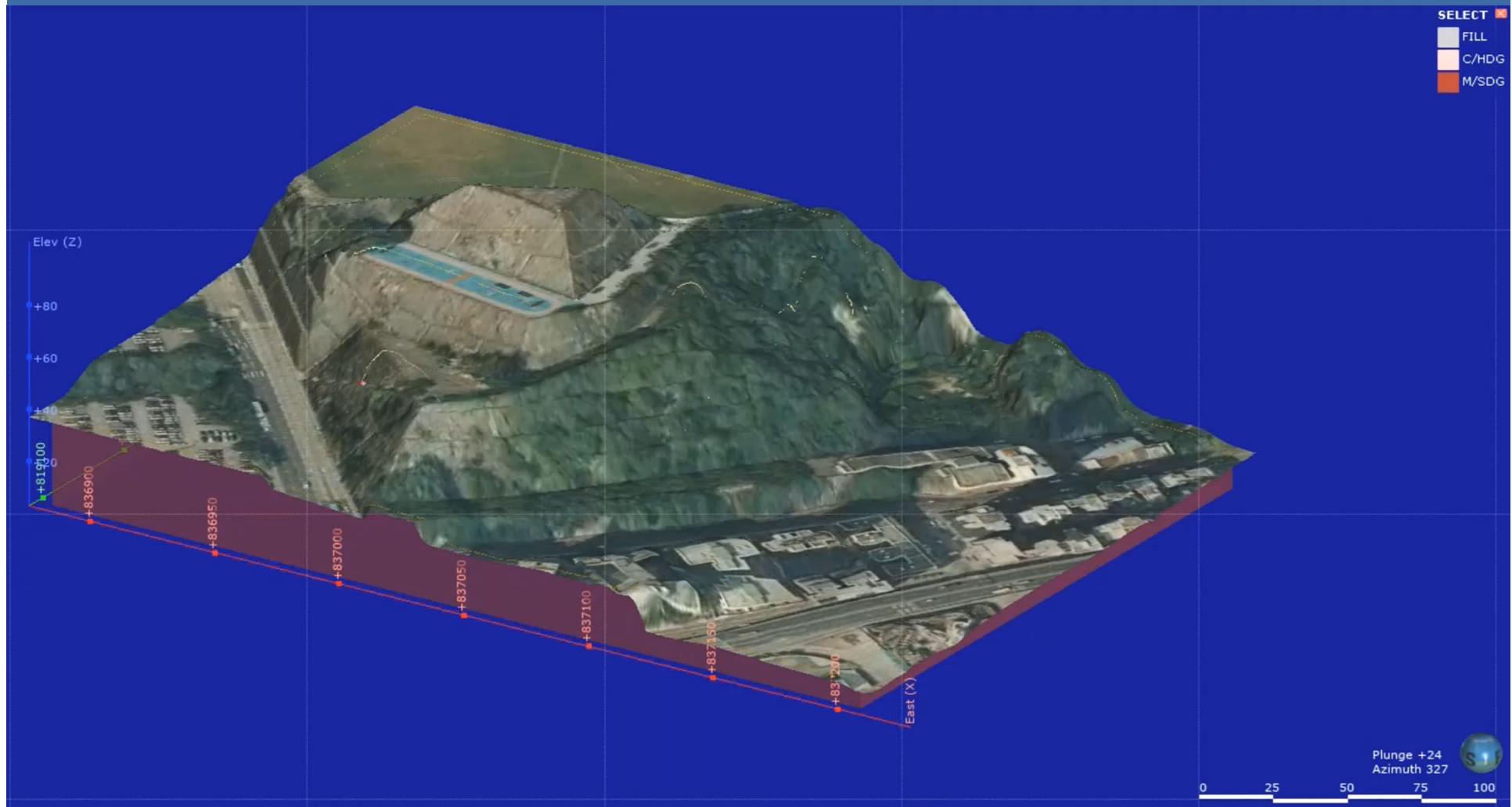


# Po Shan Drainage Tunnels



# Part 3 – Digital Design Automation

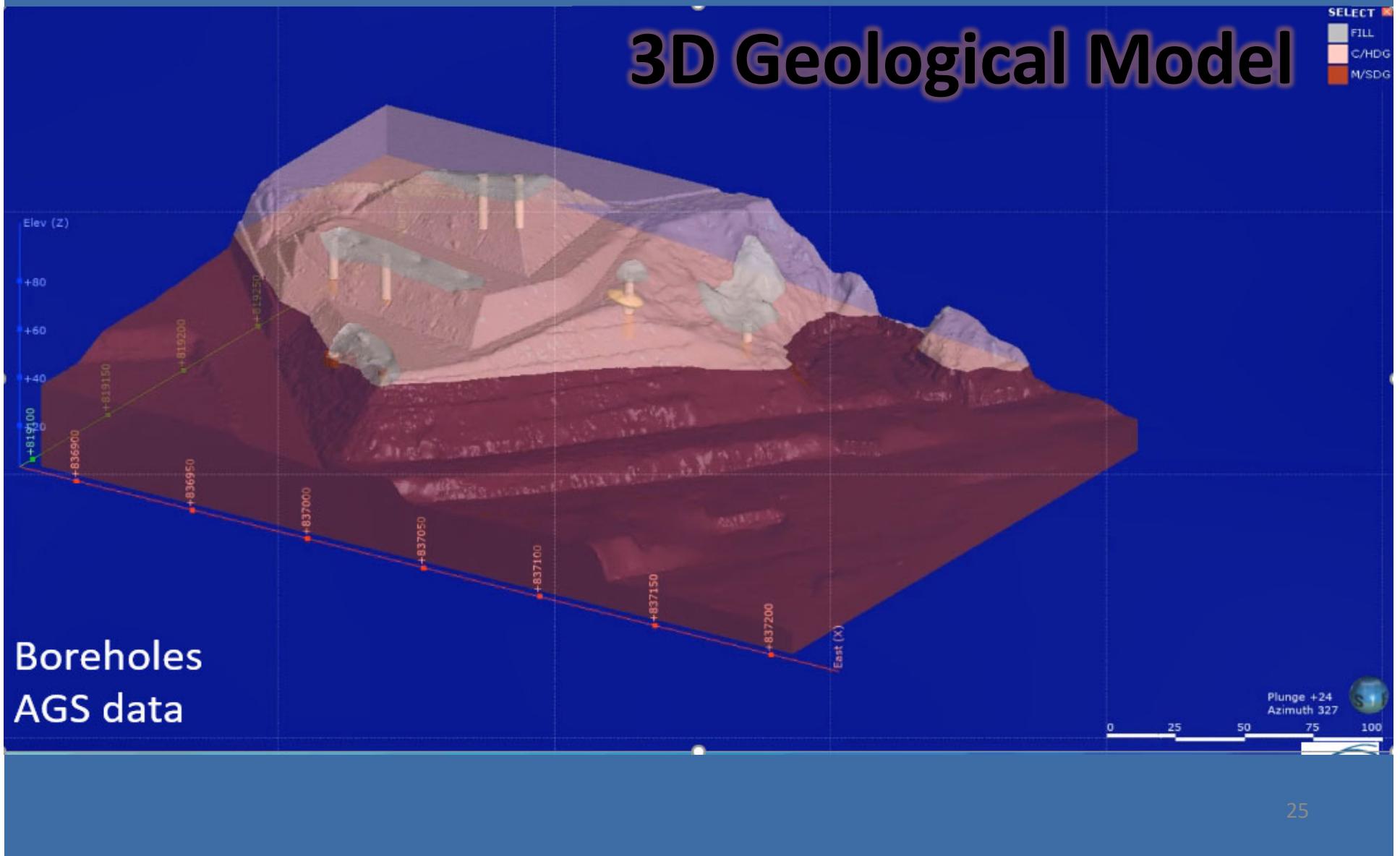
# Digital Design Automation Coupled with BIM



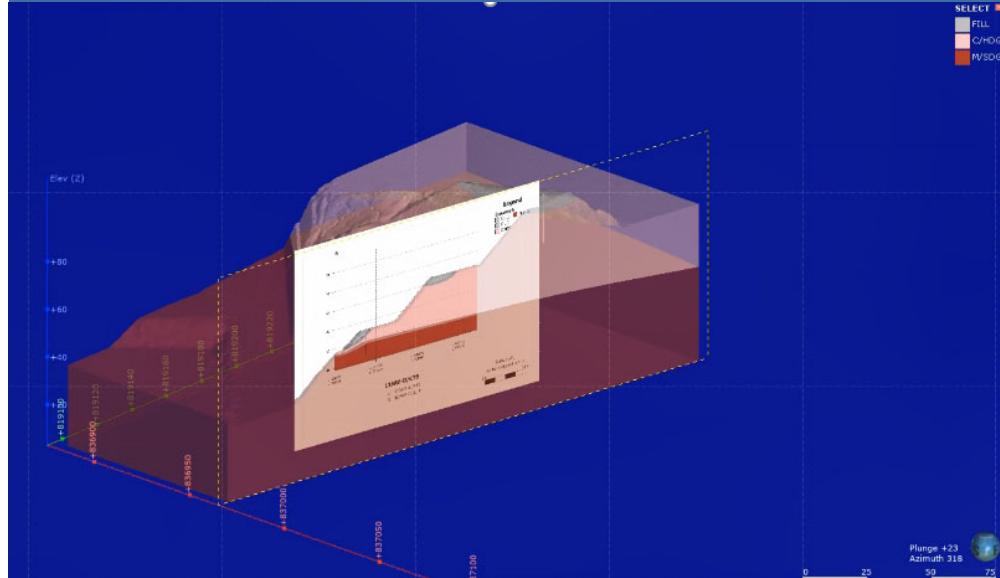
Slope stability assessment

# Digital Design Automation Coupled with BIM

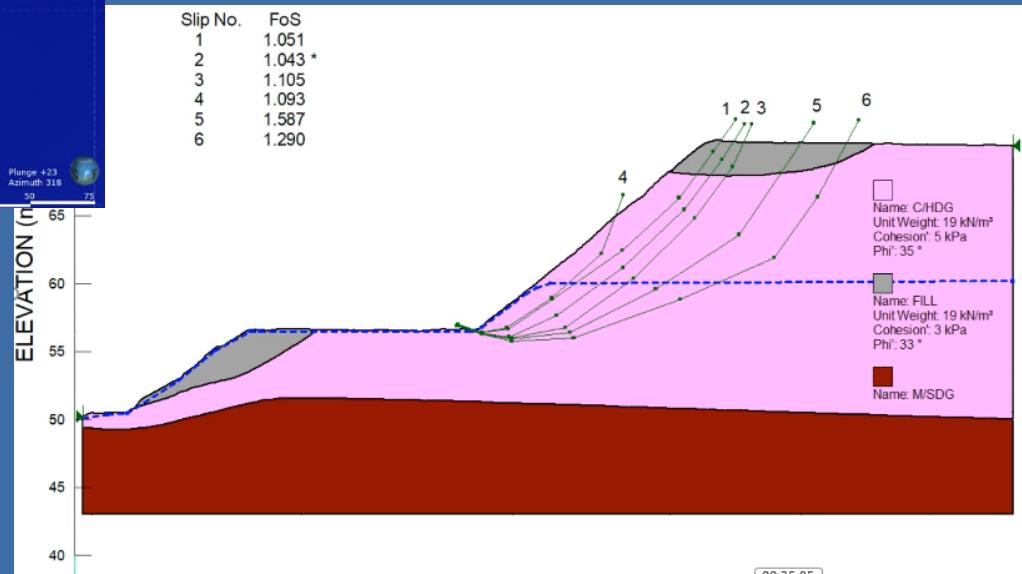
# 3D Geological Model



# Digital Design Automation Coupled with BIM



## Slope Stability Assessment



# The End