GEOSPATIAL WORLD FORUM

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Setting the scene: Accurate location information about underground is essential for powering our future planet

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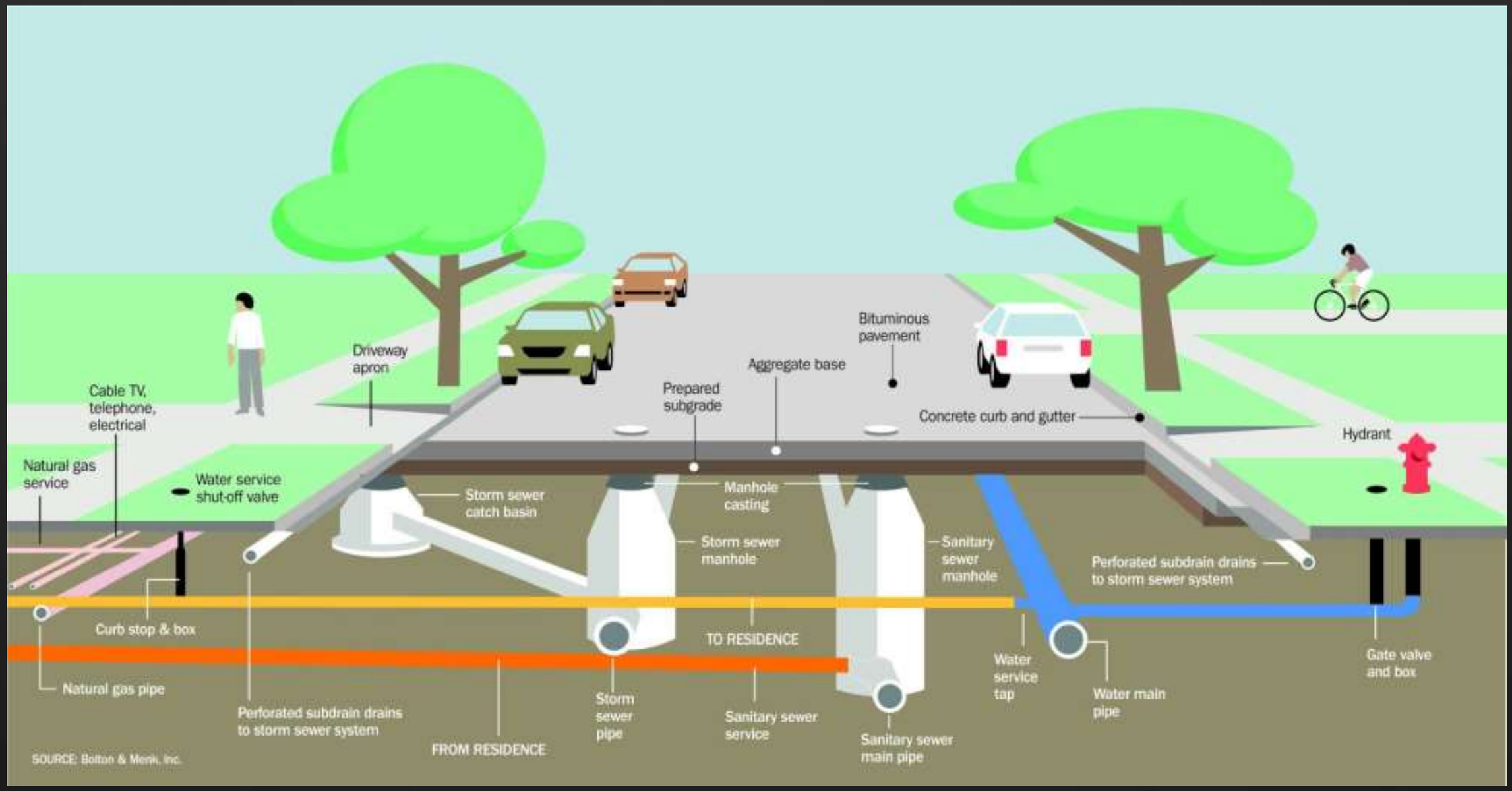
THE WORLD IS CHANGING

#GWF2019

Subsurface infrastructure is often ignored

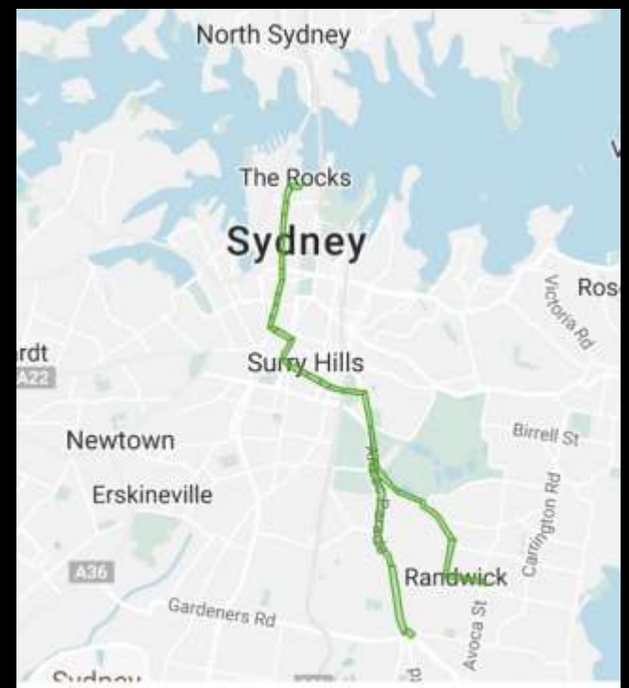


From: “GEOSPATIAL INFORMATION: The Key to Smart Infrastructure Investments, A Paper of the National Geospatial Advisory Committee” (www.fgdc.gov/ngac) – December 2017

Sydney Light Rail Project

$2.1 billion PPP project for 12 km of light rail to be completed by 2019

- Before construction 500 existing subsurface utilities were identified for relocation
- During construction 400 unmapped utility services were encountered



Study estimated that project could have been completed at least one and a half years sooner If a complete and reliable 3D map of underground infrastructure had been available at project planning stage

Project remains ‘on time and on budget’ - only because risk of unidentified underground utilities included in original contract pricing and schedule

Source

Between The Poles

3D modeling underground infrastructure for highway construction – Alabama DoT

I-20/I-59 Corridor - $750 million project.

- Interchange situated in Birmingham's business district.

Created a 3D model of above and below-ground utilities.

- Potholing, scanning with ground penetrating radar, and existing as-built records

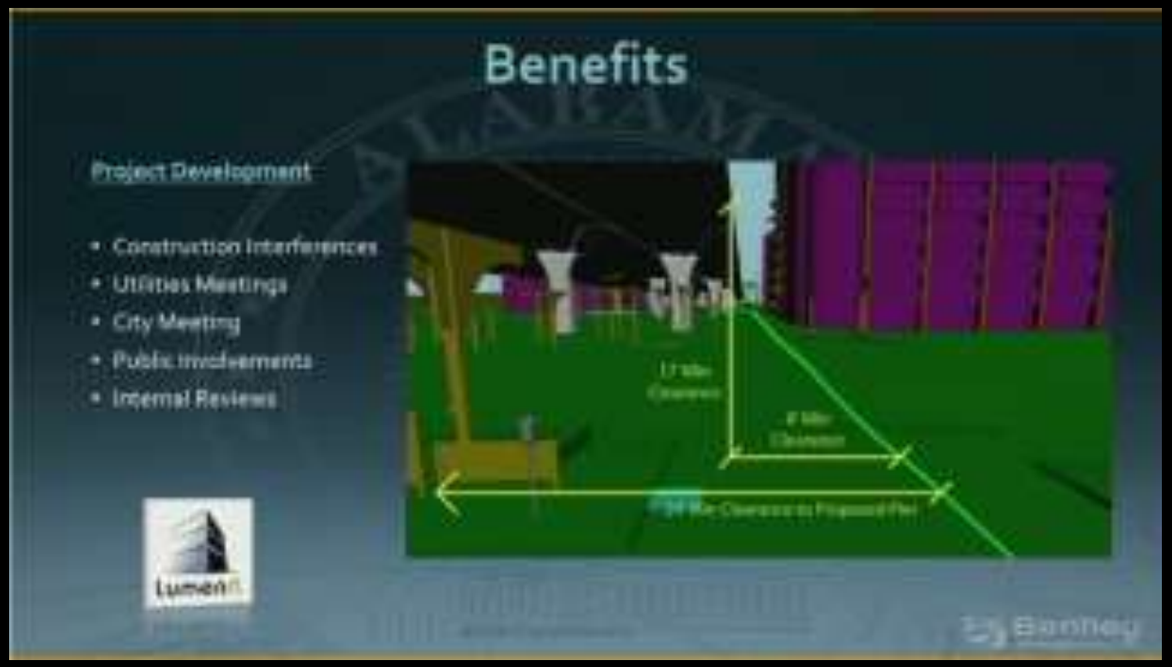
- 3D model provided to every contractor bidding on project

3D modeling undergound infrastructure for highway construction – Alabama DoT

- ALDOT estimates that 3D model of underground infrastructure saved over $10 million

- To date the project is on budget and on schedule.

- After completion of the project ALDOT plans to retain the 3D model which can be reused for other projects in the same area.



Key facts about unreliable and incomplete information about subsurface infrastructure

Risk to the public and drag on the economy

Risk to public

- 1,906 injuries and 421 deaths over past 20 years

$ 50 billion drag on the U.S. economy annually

- 390,366 hits in 2016
- $4000 direct cost per hit
- Underground utility conflicts and relocations are number one cause for project delays during road construction *(FHWA)*
- 10-30% routinely added to construction bids

Source : Common Ground Alliance

Direct cost of underground utility strikes in UK

Electricity	£ 970
Gas	£ 485
Telecom	£ 400
Fibre-optic	£ 2,800
Water	£ 300-980

Indirect costs estimated to be 30X direct

- (traffic disruption, injuries and health impact)

Nicole Metje, Bilal Ahmad, Stephen Michael Crossland, Causes, impacts and costs of strikes on buried utility assets , Proceedings of the Institution of Civil Engineers - Municipal Engineer, Volume 168 Issue 3, September, 2015, pp. 165-174

Source: Nicole Metje, University of Birmingham

Information about underground is rarely shared

Every construction project requires locating underground utilities

- Location of utilities “rediscovered” with each construction project
- Locate industry estimated to be $10 billion annually

Source

ROI of investing in improving information about underground utilities

US$ 21.00 saved for every US$1.00 spent on elevating quality of underground information

- Pennsylvania State University 2007 study sponsored by Pennsylvania Department of Transportation

€ 16 saved for every € invested in improving the reliability information of underground infrastructure - Lombardy, Italy

- ROI estimated from economic analysis of Milan pilot of underground utility mapping using GPR

Source Source

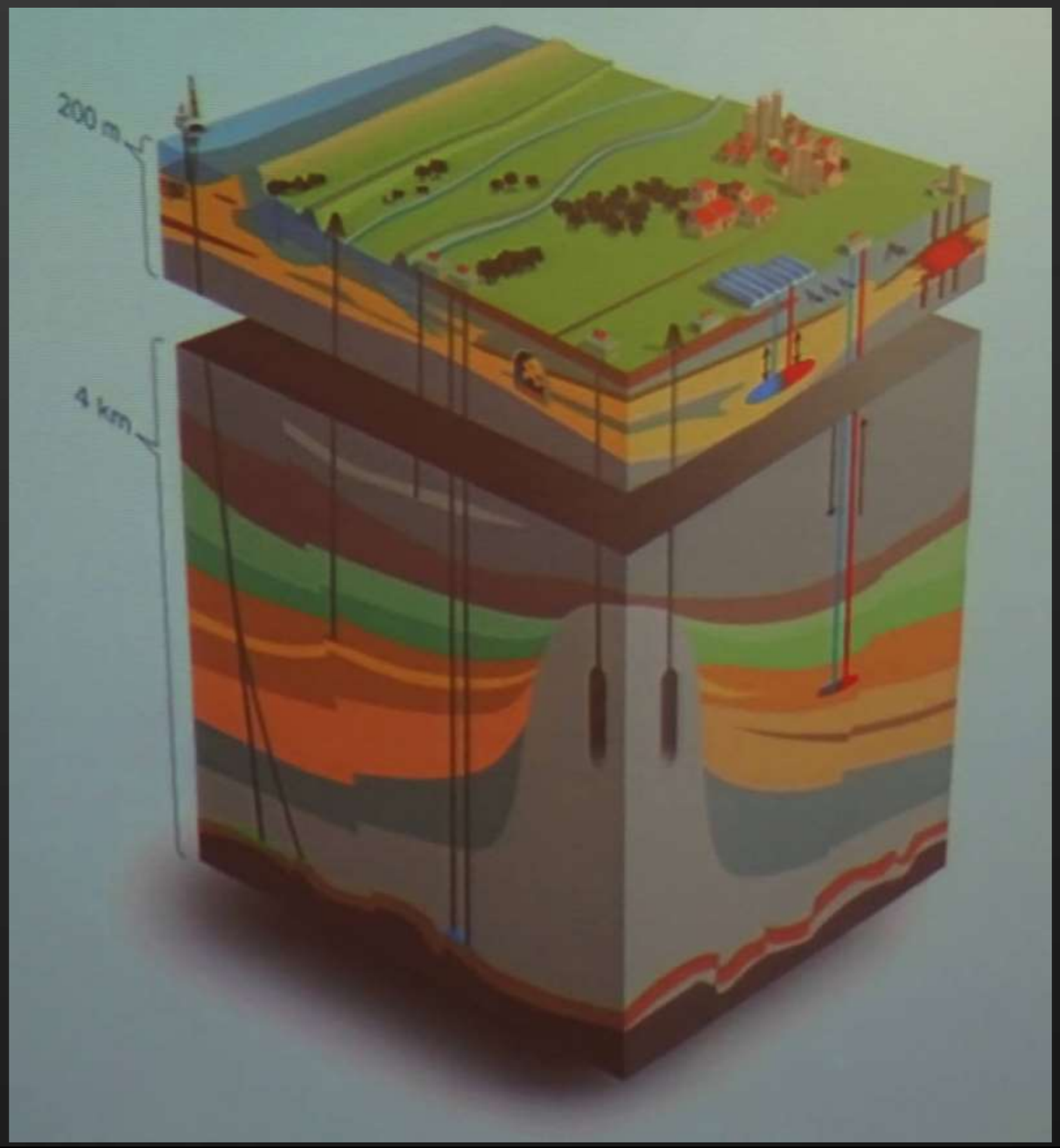
Sharing information about the underground

National initiative to share information about underground (geotechnics) in the Netherlands

Basisregistratie Ondergrond (BRO)

Beginning in 2018 whenever excavation is performed, information about subsurface must be reported to the Key Registry

Open and accessible - covered by Netherlands open data policy



Basisregistratie Ondergrond (BRO) legislation passed by States General in 2015

Source

Standard for sharing information about underground

MUDDI

- Use cases: routine street excavations (EX), emergency response (ER), utility maintenance programs (OM), large scale construction projects (AE), disaster planning and response (DP), and smart cities programs (SC).
- Build on existing reference/target models.
  - Infrastructure: CityGML with Utility Network ADE (Application Domain Extension) , INSPIRE Utility Networks, IMKL (Information model for cable and pipes), BIM-IFC, Land and Infrastructure Conceptual Model (LandInfra), Singapore Underground Geospatial Model, PipelineML, Underground Pipeline Information Management System, CIM (Common Information Model), Multispeak, ESRI Utility Model, and GEOfeature.
  - Geotechnics: GeoSciML, INSPIRE Geology, GroundwaterML, BGS National Geological Model, EarthResourceML, GeoTOP, SoilEML, IFC Geotechnical Extension, MINnD, and BoreholeIE.

Source

Mapping subsurface infrastructure for cities, regions and countries

International Efforts to Geolocate Underground Facilities

- Sao Paulo, Brazil – The City of Sao Paulo's GeoCONVIAS project integrates data from 20 to 30 utilities which operate in the city of Sao Paulo.
- France – A nation-wide multi-billion euro project underway to map France's underground utility infrastructure to 40 cm.
  - PLAN CORPS de RUE SIMPLIFIE* (PCRS)
- Chicago – Innovative pilot to collect photos of excavations, extract 3D data and share
- Milan – Region of Lombardy, pilot for expo site used GPR to identify undergound utilities
- Penang, Malaysia – Penang-s Sutra D'Bank(Penang State Government Subterranean Data Bank is maintained by a joint venture company EQUARATER (PENANG).
- Bahrain - Bahrain's Intelligent Decision Support System (iDSS) provides single repository for all underground facilities.
- Rio de Janeiro, Brazil - The City of Rio de Janeiro has a similar project GeoVias funded by the government of the City of Rio de Janeiro and four utilities.
- Las Vegas, Nevada – Pilot project to map above and below-ground utilities along the Strip

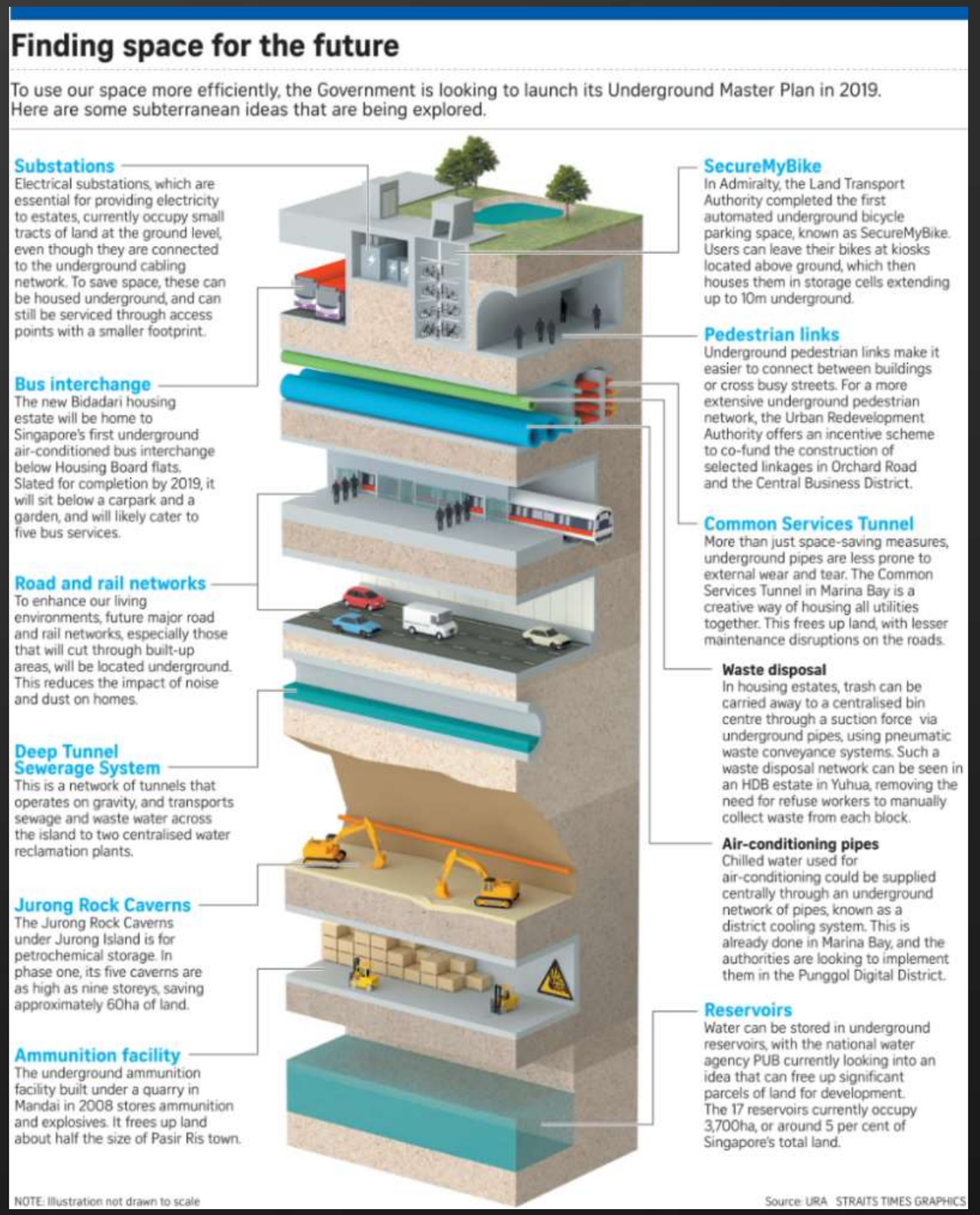
PCRS 2.0 http://cnig.gouv.fr/?page_id=11745

International Efforts to Geolocate Underground Facilities (cont.)

- Tokyo, Japan (now deployed in major Japanese cities) – Many years ago Tokyo developed the mainframe-based Road Administration Information Center (ROADIC) system. Now used in 11 major Japanese cities.
- Sarajevo, Bosnia – Over 40 years ago as part of the permitting process, Sarajevo mandated the recording the location of all utility and telecommunications infrastructure in the city.
- Calgary, Alberta – A number of years ago the City Government passed a by-law which mandated that all utilities and telecoms working within city limits must provide data showing the geolocation of their infrastructure to the city's Joint Utility Mapping Project (JUMP).
- State of Jalisco, Mexico - The Instituto de Información Territorial del Estado de Jalisco developed an integrated infrastructure database for the State of Jalisco.
- Edmonton, Alberta - Edmonton, Alberta has a shared facilities mapping database.

Masterplan of umderground spaces in Singapore

- In Singapore the Urban Redevelopment Authority is planning to have a masterplan of Singapore's underground spaces ready by 2019.
- To be released as part of the next Master Plan guiding Singapore's development in the medium term.



Learn more

Initiative to create a national digital twin in UK included underground

National digital twin (of above- and below-ground assets) key concept for the UK government.

- Based on foundation concept: digital model equally important as physical assets.
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- Project Iceberg is an exploratory project undertaken by the British Geological Survey, Ordnance Survey and the Future Cities Catapult to investigate ways to integrate data and services relating to the underground with other city data.

Learn more

US Initiative to create national infrastructure map

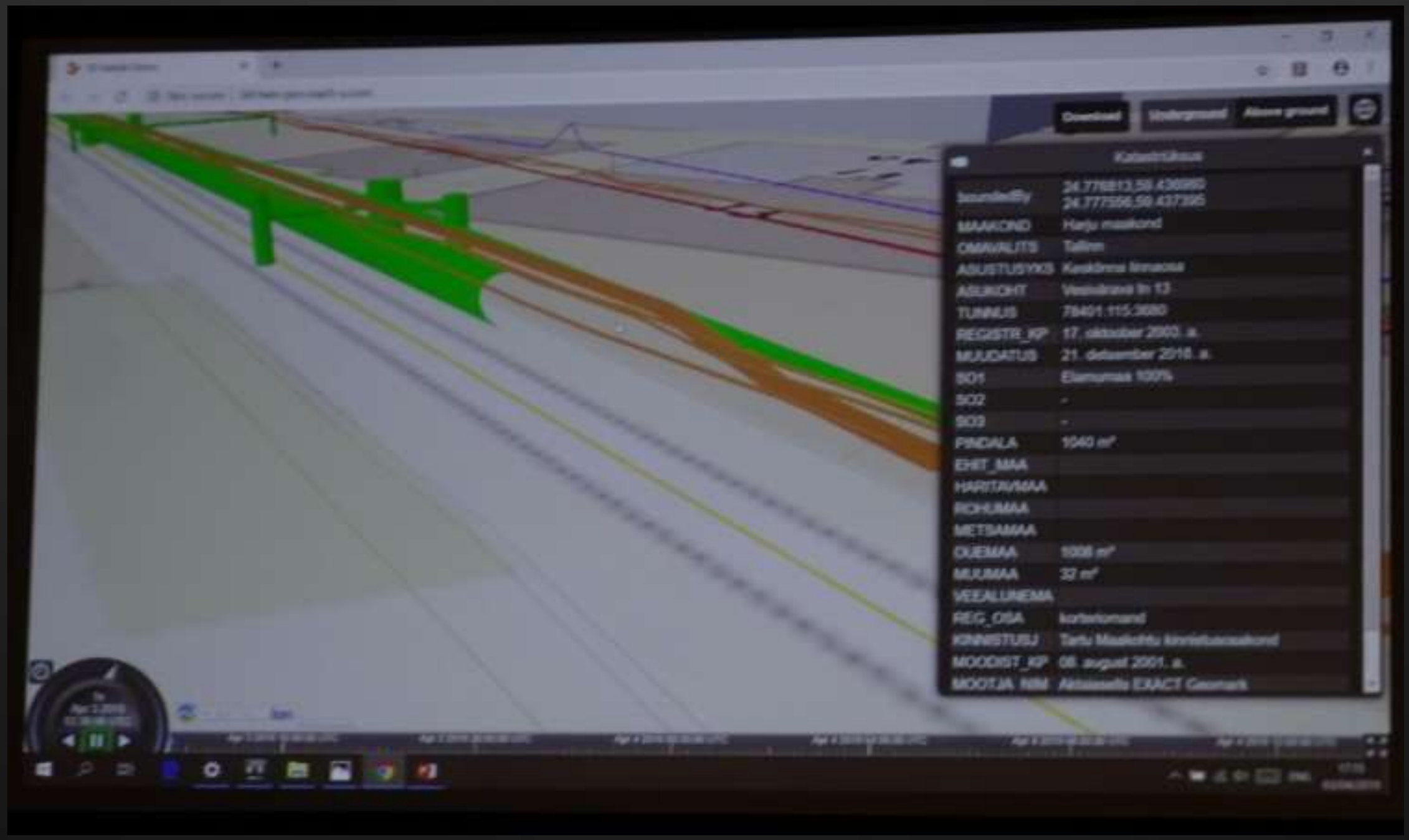
Building a shared map of the nation's infrastructure to enable smart Investments

- Business driver: Help prioritize and motivate infrastructure investment
- Initiative supported by National Academy o
  Public Administration, National Academy of
  Construction, American Geographical
  Society, Arizona State University

Summit May 1, 2018 - Potential for GIS technology to inform the development of a national infrastructure map

Learn more

Estonia - Digital Twin includes above and below ground



Some takeaways

Unreliable information about location of underground infrastructure costs $ trillions every year

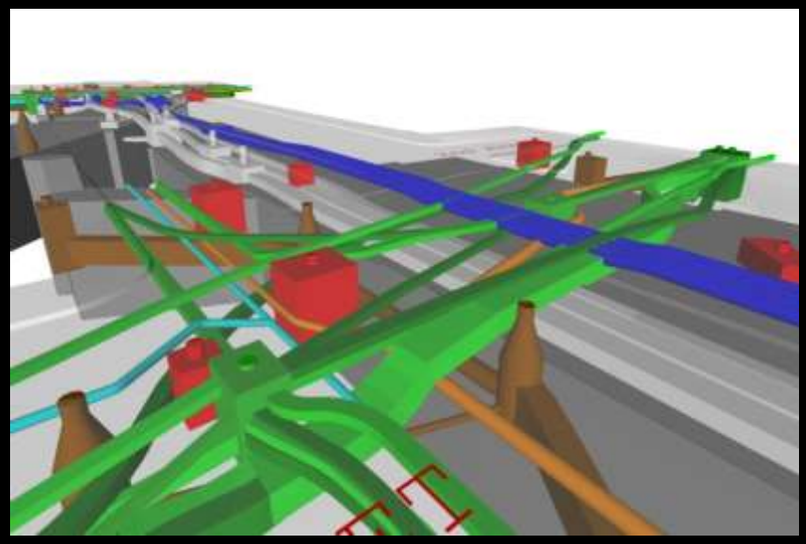
- Adds risk to every construction project

Location data about subsurface utilities and geotechnics is rarely shared

- BRO initiative in the Netherlands
- OGC MUDDI initiative

Cities, regions, and nations recognizing the benefits of reliable underground infrastructure

- National initiatives to create digital twins of underground geotechnics and infrastructure



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