Context for Canadian Underground Infrastructure Register

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THE WORLD IS CHANGING

Context for Canadian Underground Infrastructure Register

Global awareness of the critical importance of mapping underground infrastructure

- Underground utility damage is expensive
- Global national initiatives to reduce underground utility damage
- Time is right for CUIR
- Growing interest in subsurface digital twins
- Advances in technology
  - Remote detection
  - Reality capture
  - Mobile+cloud solutions
  - Evolving standards
- Requires centralized, trusted organization to provide governance for sharing underground data
- Data quality: legislation and regulations
- Responsibility for data quality
- No silver bullet

Canadian Underground Infrastructure Registry

New initiative to map and share information about undeground infrastructure in Canada

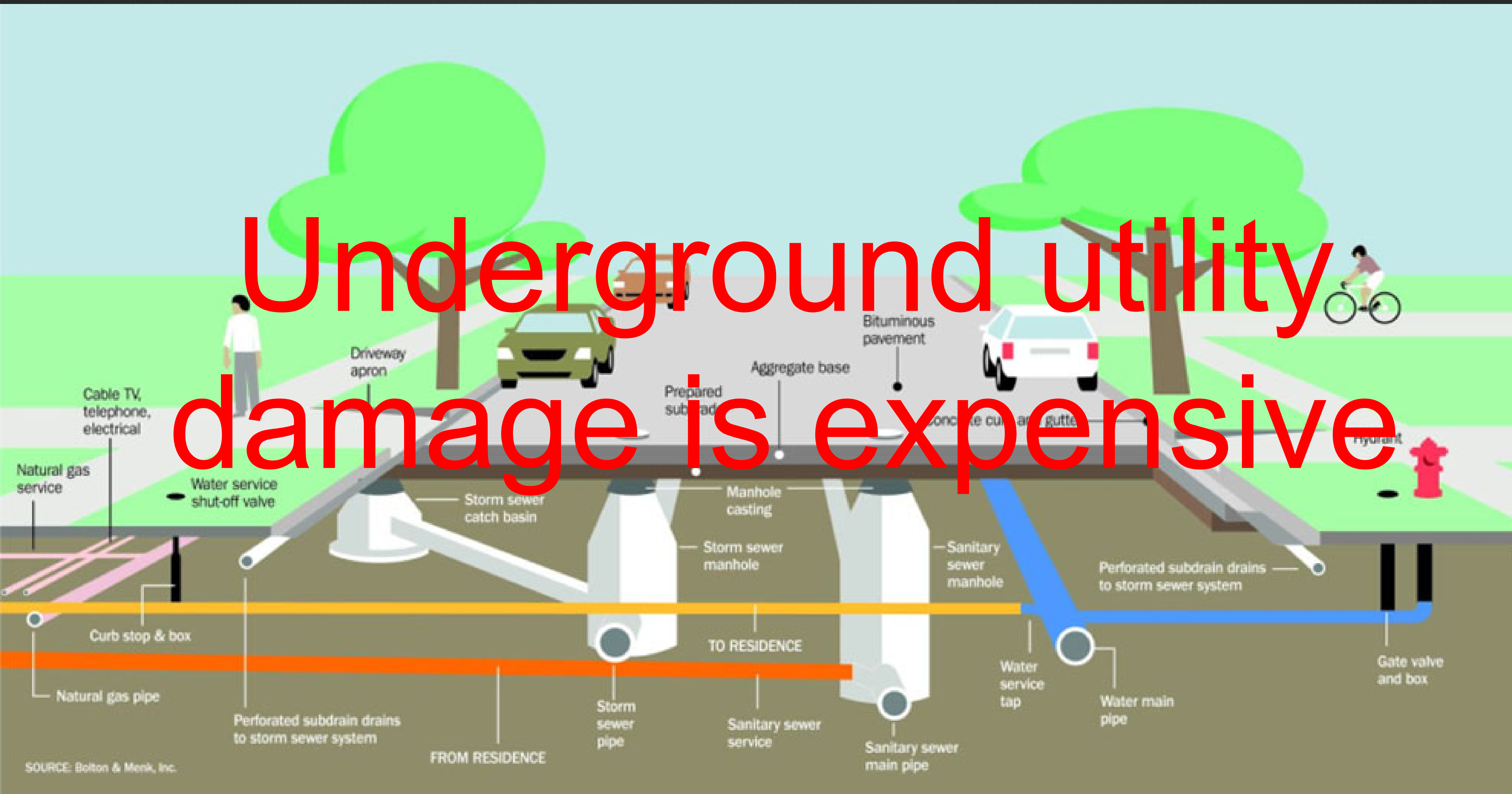
Broad participation

- Surveyors
- Construction industry
- Utility and pipeline network owners
- Transportation agencies
- Government
- Locate industry

Contact: Steve Slusarenko <sslusarenko@prostarcorp.com>

Industry, economic and societal cost of underground utility damage

Underground utility damage is expensive



Underground utilities are a major cause of construction delays

Underground utility conflicts and relocations are a leading cause of project delays during road construction

❖*Federal Highway Authority*

Impact of not knowing location of subsurface infrastructure on construction

- Construction bids are routinely inflated by *10-30%* to accommodate risk associated with unknown or poorly located underground utilities

- In U.S. according to FHWA underground utility conflicts and relocations are a major cause of project delays during road construction

Source

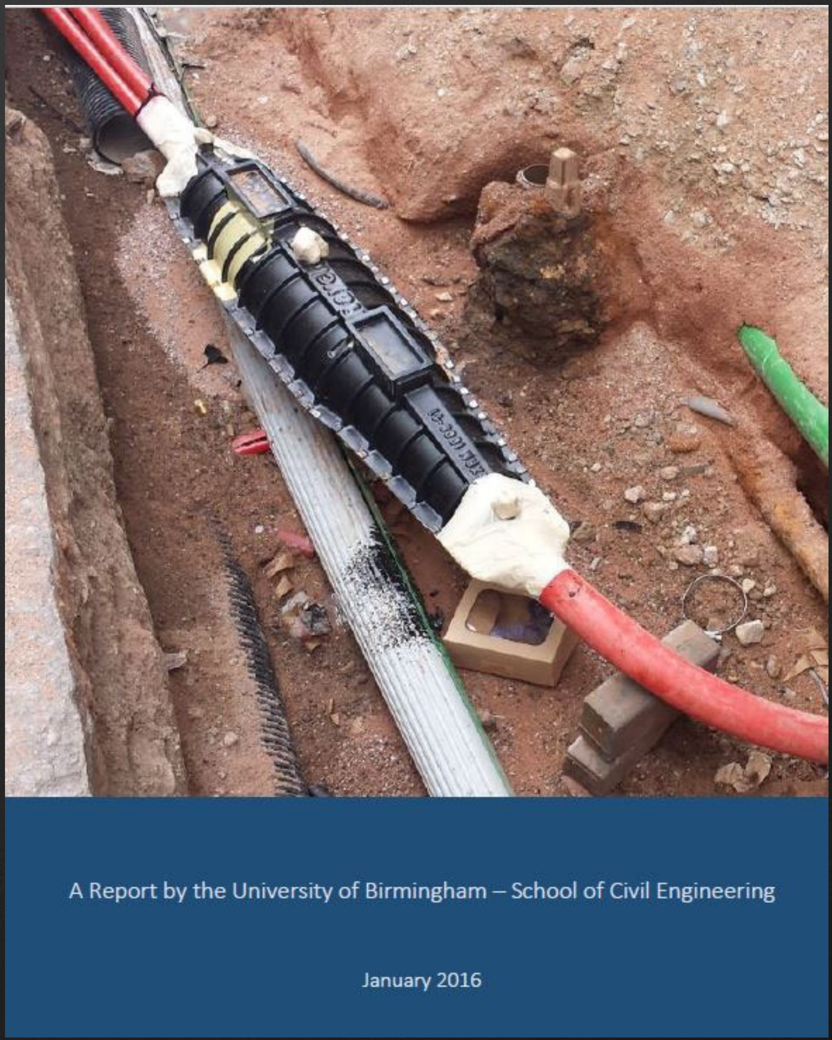
Direct cost of underground utility strikes

Electricity	£ 970
Gas	£485
Telecom	£400
Fibre-optic	£2800
Water	£300-980

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

Total cost of underground utility strikes

29 X direct cost



WHAT DO UTILITY STRIKES REALLY COST? Dr. Lewis Makana, Dr. Nicole Metje, Prof. Ian Jefferson, and Prof. Chris Rogers, University of Birmingham, School of Civil Engineering, College of Engineering and Physical Sciences, 04/01/2016

Underground utilities are a major drag on national economies

Estimated annual cost to national economy

- $ 30 billion in the U.S.
- £ 2.4 billion in the U.K.
- € 1 billion in the Netherlands
- $ 3 billion in Canada

Comparison: Mortality from underground utility damage and civil aviation accidents

U.S. underground utility damage
(20 years)

Hundreds of deaths

Thousands of injuries

U.S. commercial aviation crashes
(20 years)

403 deaths*

*Major crashes excluding 9/11

Comparison of U.S. and Japan shows that these incidents are preventable

United States	Japan
(2016)	(2016)
390,368	134
Common Ground Alliance	Japan Construction Industry Association

Something can be done

ROI studies show benefits of improved locating of underground utilities

$11.39 saved for every $1.00 spent on SUE

- 2012 study of 30 Pennsylvania Department of Transportation (PennDOT) projects
  - 22 projects utilized subsurface utility engineering (SUE)
  - 8 non-SUE projects

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

- 2007 study by Pennsylvania State University 2007
- For Pennsylvania Department of Transportation (PennDOT)

- In addition many unquantifiable benefits

Recent global initiatives to reduce underground utility damage

National Initiatives to Reduce Utility Damage

National Underground Assets Registry (UK)

Use cases:

- safe digging to avoid utility strikes
- on-site construction efficiency
- site planning
- data exchange
- improved coordination

Sponsored by Geospatial Commission

- Objectives:
  - Unlock economic opportunities offered by geospatial data
  - Create secure means to share information about underground infrastructure among local government organizations, and utility and telecom network operators
    - Buried electricity and telecom cables, and gas and water pipes
- Initiated with £3.9 million allocated for two pilot projects

North East England Pilot for sharing underground utility and telecom location data

Initiated by Ordnance Survey and Northumbrian Water in 2018

- 30 local authorities, utilities, and telecoms in Newcastle agreed to share data
- Created ‘Common Infrastructure map’ of sample areas around Newcastle

North East England Underground Infrastructure Hub (NEUIH) accessible over web to handhelds

- Almost full water, gas, electricity and telecom vector data
- Each utility steward of its own data
- Shared among local authorities, utilities, and telecoms
- Interoperability based on OGC standards
  - Tested with three different GIS systems

Central London Pilot for sharing underground utility and telecom location data

Sponsored by Geospatial Commission in 2018/2019

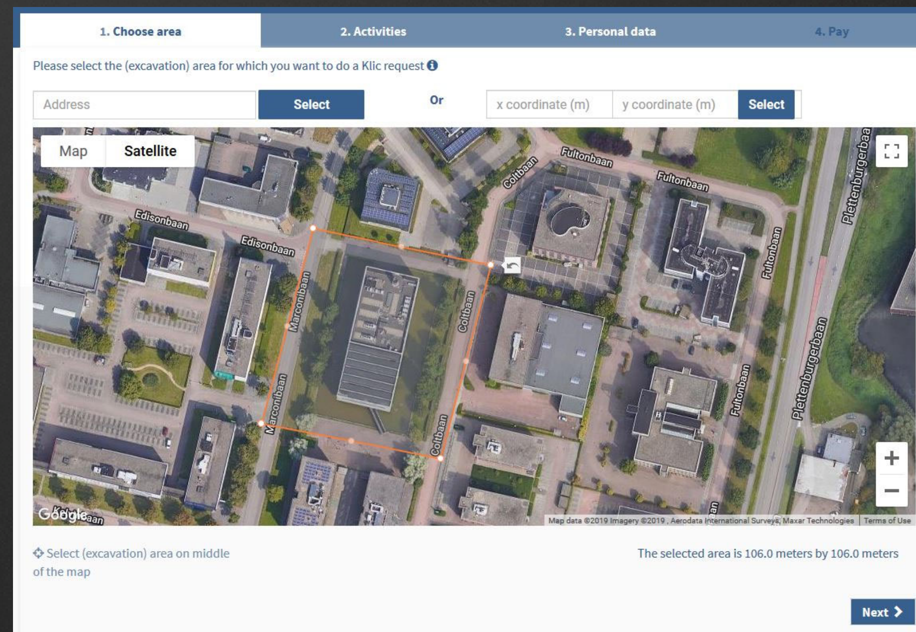
- Common Infrastructure map covering six boroughs using OS test system based on ETL
- 22 local authorities, utilities, and telecoms
- Vector and raster data

Both pilots scheduled to complete March 2020

- Cabinet-level decision whether to proceed with national system for England and Wales
- Bids for national implementation could be invited as early as 2020

Netherlands: KLIC-Online one-call system

Planned excavations within the next 20 days must be reported to KLIC

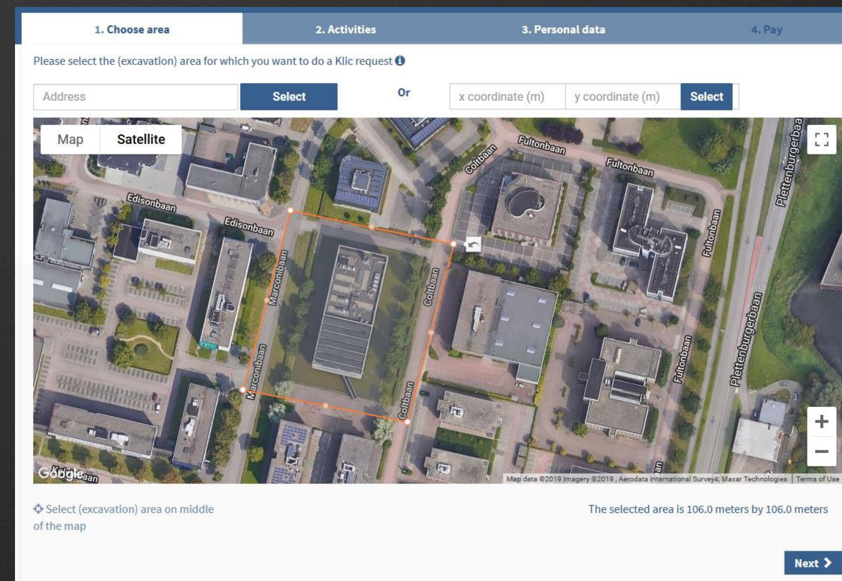


▪€ 32 charge for every information request

Access to maps of all underground infrastructure and names of the network operators provided within 24 hours

▪For high consequence utility lines (gas transmission and high voltage electric lines) excavator must contact network operator for supervised excavation

Netherlands: KLIC-Online one-call system



Benefits

- Construction efficiency
- Reliable statistics on underground utility damage during excavation

But…

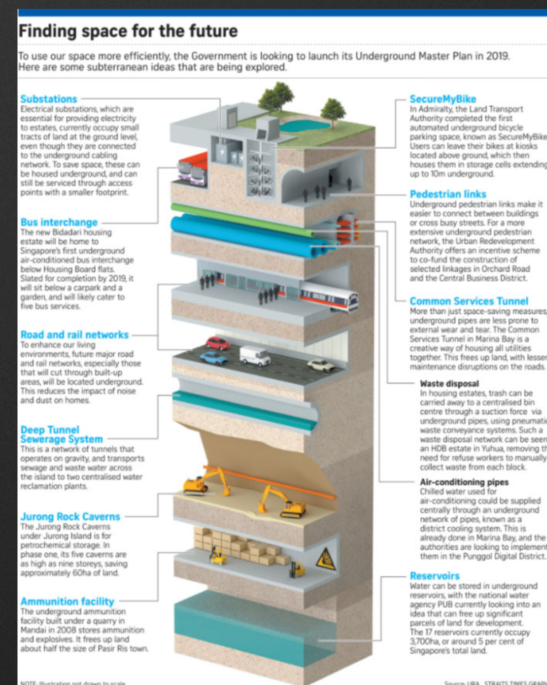
- KLIC has not reduced utility damage during excavation
- KLIC not used for planning and engineering design

Singapore standard for surveying new underground assets

Released 2017 by Singapore Land Authority (SLA)

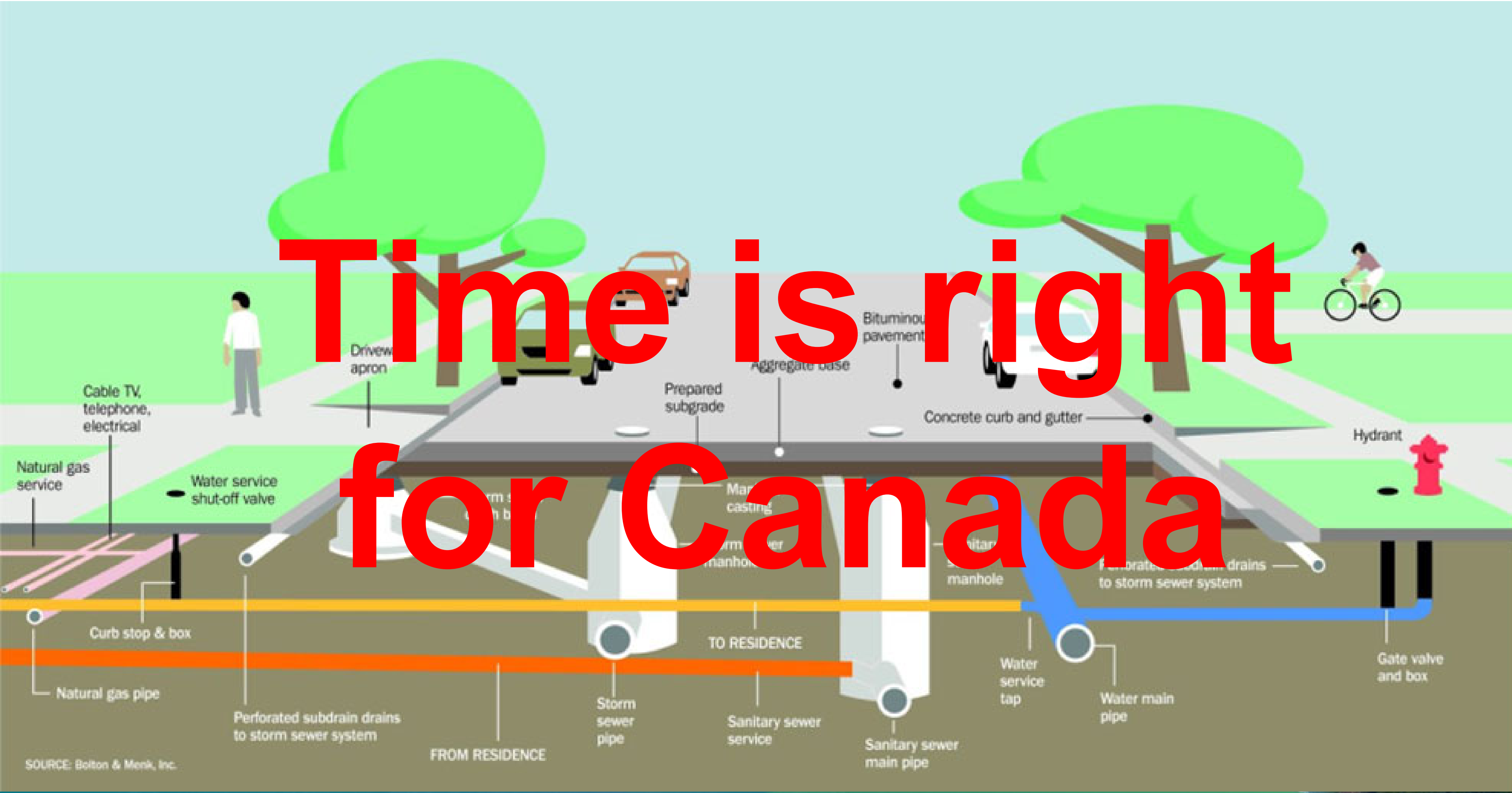
Requires survey of new underground utilities

- Registered surveyor
- Accuracy of ±100 mm in XY and Z
- Must use total station, GNSS Real Time Kinematic (RTK), or 3D Laser scanning



Learn more

Now is an opportune time to develop a national asset register for Canada



Not recording and sharing location of underground infrastructure is wasteful

- U.S. devotes estimated $10 billion annually to locating underground utilities prior to and during construction.

- Information is rarely recorded and shared.

- Result: Same infrastructure located over and over again.

Damage prevention in North America

One call (811) centres

- Legislated by every state in US and some provinces in Canada
- Information requests free for excavators

ONTARIO ONECALL

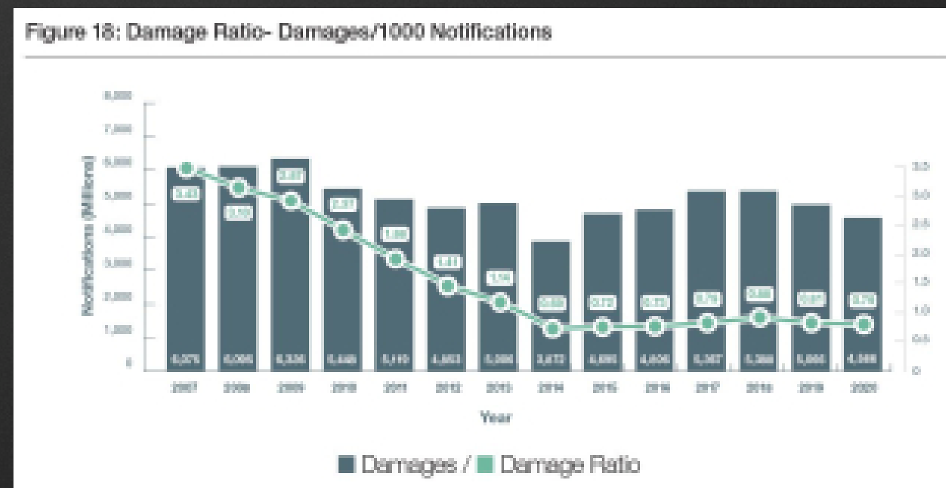
- Requires site visit by all network owners operating at site
- Only required to mark (paint or flag) the ground

Typically not recorded, no exchange of digital or paper maps, and not captured digitally

North American damage prevention has reached an inflection point (CGA)

North American one call system has become highly inefficient

- Rate of damage to infrastructure has remained stagnant



Blue bars - damages
Green line - ratio of damages per 1000 one call notifications.

- Not achieving its primary goal of reducing damage to underground infrastructure

Between The Poles

Barriers to developing a national register have been shown to be surmountable

- Lack of the political will to share information

The NUAR project in the UK has demonstrated that an agreed legal framework and a high standard of security and data protection enables network operators to share their data

- Lack of a centralized, trusted organization providing the governance for a national underground infrastructure register

Historically several different apporaches have been used. In North America the one call system may provide a basis that minimized changes from current practice

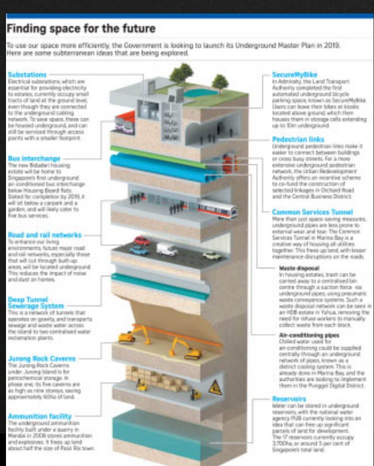
Many jurisdictions have recognized the value of underground infrastructure information

Americas

Colorado (US), Calgary, Edmonton (Canada), Sao Paulo, Rio de Janeiro (Brazil), New York, Alabama (US), Jalisco (Mexico), Pernambuco (Brazil), British Columbia (Canada)

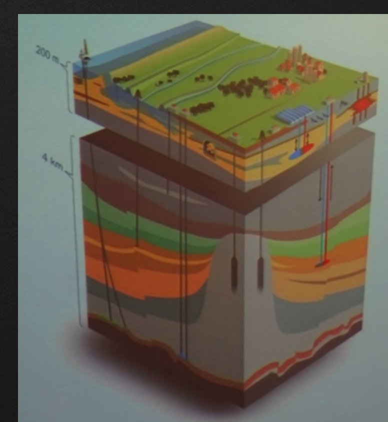
Europe

Netherlands, Flanders (Belgium), France, Lombardy (Italy), Sarajevo (Bosnia), Bern, Zurich (Switzerland), Newcastle(UK), Scotland, Estonia



Asia Pacific

Japan, Singapore, Sydney (Australia), Bahrain, Delhi (India), North Shore City (New Zealand), Malaysia

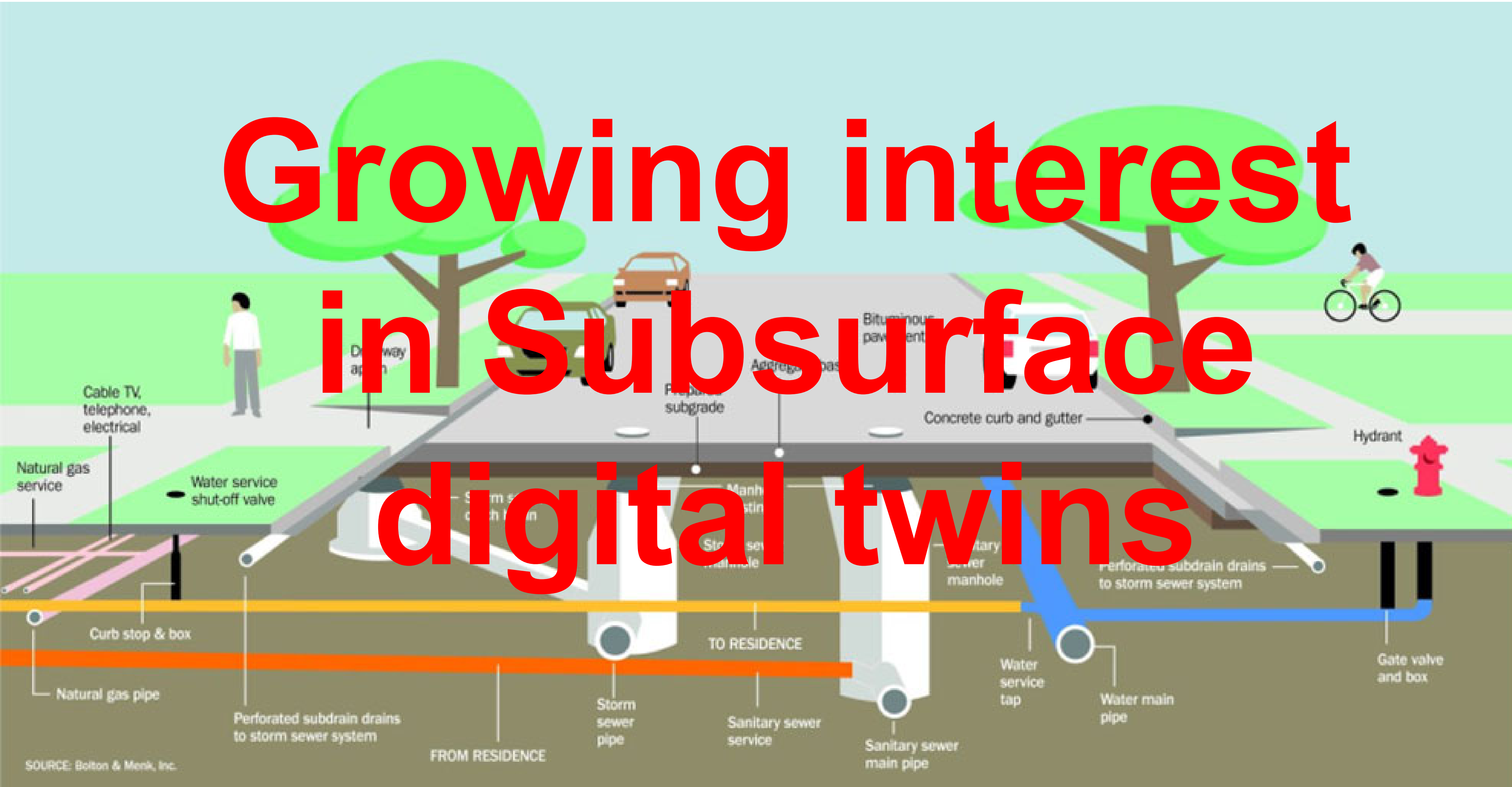


Between The Poles

Organizational alternatives for sharing location information about underground utilities

- **Government mandate**
  - City of Calgary (JUMP), France (DT DICT)
- **Government voluntary**
  - *Vault (Scotland)*
  - NUAR (England, Wales, Northern Ireland)
- **NGO consortium**
  - City of Toronto's Digital Map Owners Group (DMOG)
  - *ICI Society* - British Columbia
  - DIGDAT (Anglian Water)
- **Industry association**
  - *Common Ground Alliance* (North America).
  - *Utility Strike Avoidance Group* (UK)
- **Call-before-you-dig**
  - KLIP - Belgium
  - KLIC - Netherlands
  - One-Call - U.S. and Canada
- **Private and PPP**
  - *LineSearchBeforeUdig*
  - Single owner: industrial campuses, private universities, private hospital campuses,…
- **Regulatory (quality mandate)**
  - Brazil electric power* (*ANEEL*)

Cities, regions, and nations are priortizing digital twins as a foundation for smart infrastructure

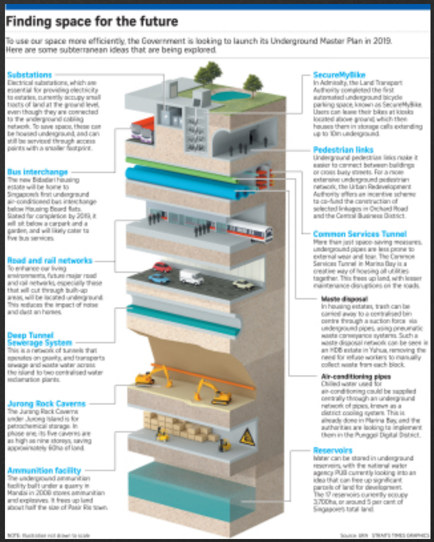


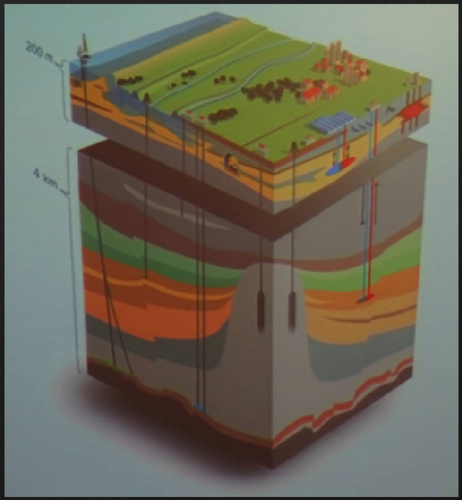
Growing interest in Subsurface digital twins

Growing focus on subsurface digital twins

Key differences with above-surface digital twins

- Fitness for purpose
- Accessibility
- Data quality





Fitness for purpose: use cases

Priority

- Reducing utility damage during construction
- Efficiency of planning
- Efficiency of engineering design
- Efficiency of construction

Others

- Emergency response
- Disaster planning
- Strategic planning for smart cities

Accessibility: data is often privately owned: Organizational alternatives

Government mandate

- France, Japan, Calgary, Sarajevo, Bern, Jalisco MX, Sao Paulo, Rio de Janeiro
- Netherlands (*BRO*)**
- PHMSA (US)
- Airports, Ministry of Defence, universities, ports, hospital campuses,…

Government voluntary

- Scotland, England/Waled/Northern Ireland
- U.S. *Critical Information Protection Program**
- Singapore *GeoSpace**

NGO consortium

- *Integrated Cadastral Information Society -* British Columbia*

Mandated Call-before-you-dig

- KLIP - Belgium
- KLIC - Netherlands
- One-Call - U.S. and Canada

Private Call-before-you-dig

- *LinesearchbeforeUdig (UK), digdat (UK)*
- *PelicanCorp (Australia, US, UK, Singapore)*

Regulatory rule

- Montana, Colorado, Ofwat (England/Wales), Las Vegas

Industry association or consortium

- *Common Ground Alliance**** - N.A.
- *Utility Strike Avoidance Group**** - UK

** Does not provide information about underground utilities suitable for damage prevention.*
*** Geotechnics only *** Statistics about underground utility damage*

Huge issue: Data quality

“WHITE-LINING AND UPDATED FACILITY MAPS MAY BE THE DAMAGE PREVENTION INDUSTRY’S MOST EFFECTIVE PATHS TO TIMELIER AND MORE ACCURATE LOCATES. “

CGA White Paper 2020

“Virtually all stakeholders are aware that much of the available information is unreliable and that this has repeatedly led to losses of time, money and opportunities.”

Singapore Digital Underground

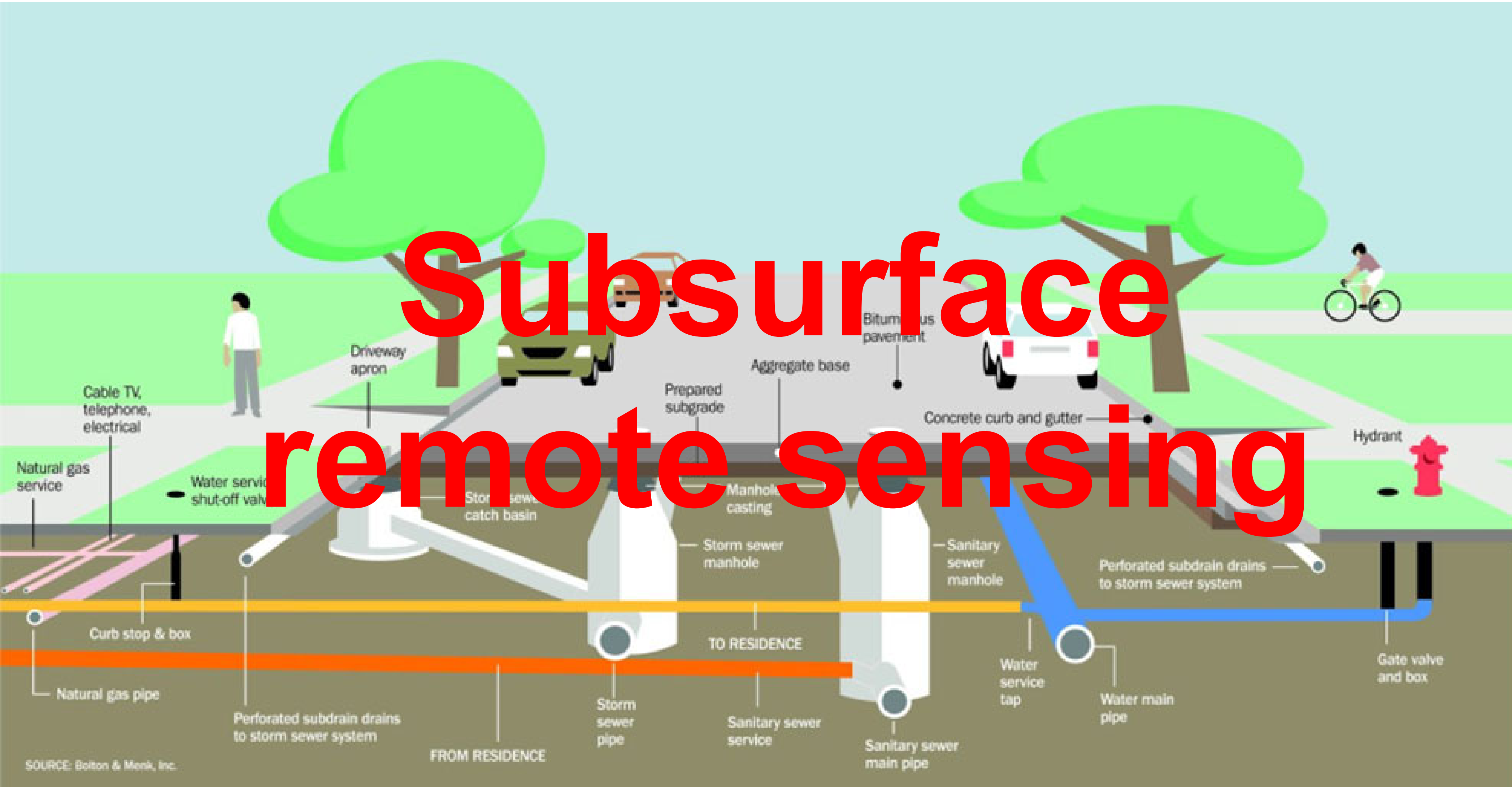
Data quality is a major problem

One of the biggest causes of damage to underground infrastructure is low data quality of utility records

Jurisdictions are addressing the problem with new legislation and regulations

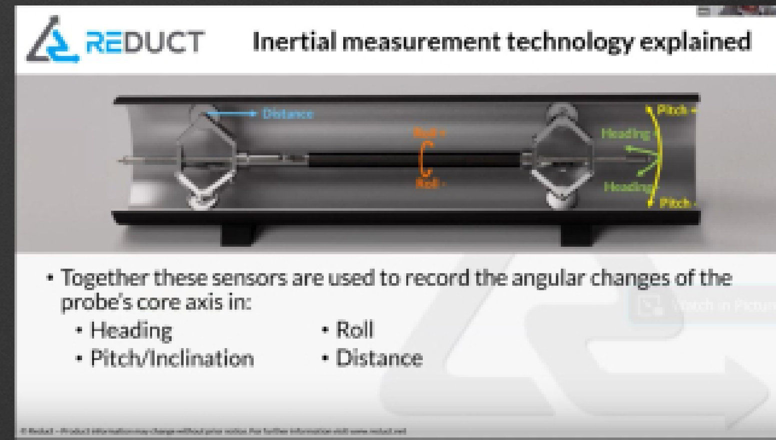
- Mandating high quality “as-builts”
- Mandating SUE surveys prior to engineering design
- Requiring assigment of quality standards such as ASCE 38 and CSA S-250

Innovations in remote detection technologies



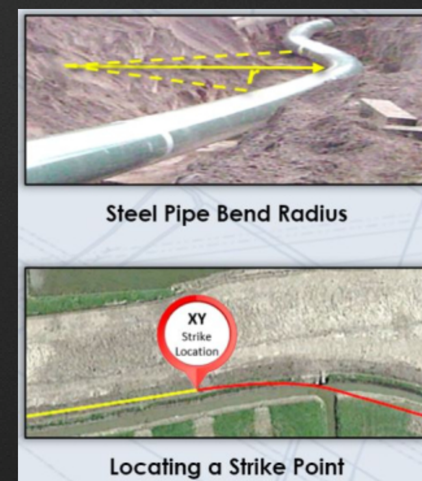
Subsurface remote sensing

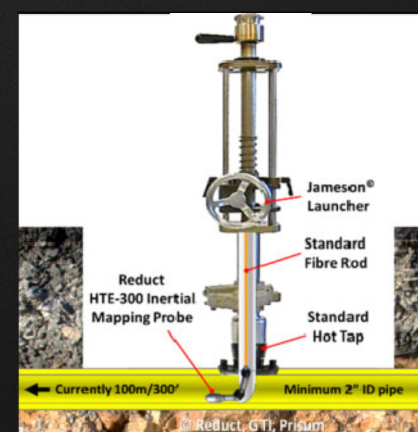
Inertial 3D mapping of pipe networks



Inertial sensor can map hundreds of meters of underground pipe networks

- Module contains inertial sensors and onboard memory – no cables
- Captures heading, roll, distance, and pitch/inclination
- Can be used to map <u>live</u> 2” gas lines
- Precision ±15 cm in X, Y and Z





Reduct DuctRunner

Ground penetrating radar scanning at roadway speeds

Vehicle-mounted GPR array
- Scan at roadway speeds
- No boots on the pavement

Combine with LiDAR
- Simultaneous above and below ground reality capture
- Post-processed to create 3D model of above and below-ground infrastructure

ImpulseRadar, Earth Radar, Leica Geosystems

Satellite imagery to map underground infrastructure

Historical high-resolution satellite and aerial imagery

- Applies computer vision algorithms
- Training sets for machine learning developed for different biomes

Deliverable: *utility conflict map*

- Shows location of all underground utilities and pipelines intersecting a proposed construction project.
- Benefits: Safer, faster, non-disruptive compared to ground-based detection

Magnetometry with a drone

Detects magnetic field emitted by underground conducting objects

▪Magnetic signal from metallic pipe enhanced by electric signal generator

Five 3-axis fluxgate magnetic sensors, GNSS+RTK capacity, and high-precision inertial unit

•Light enough (2,5 kg) to mount on a drone

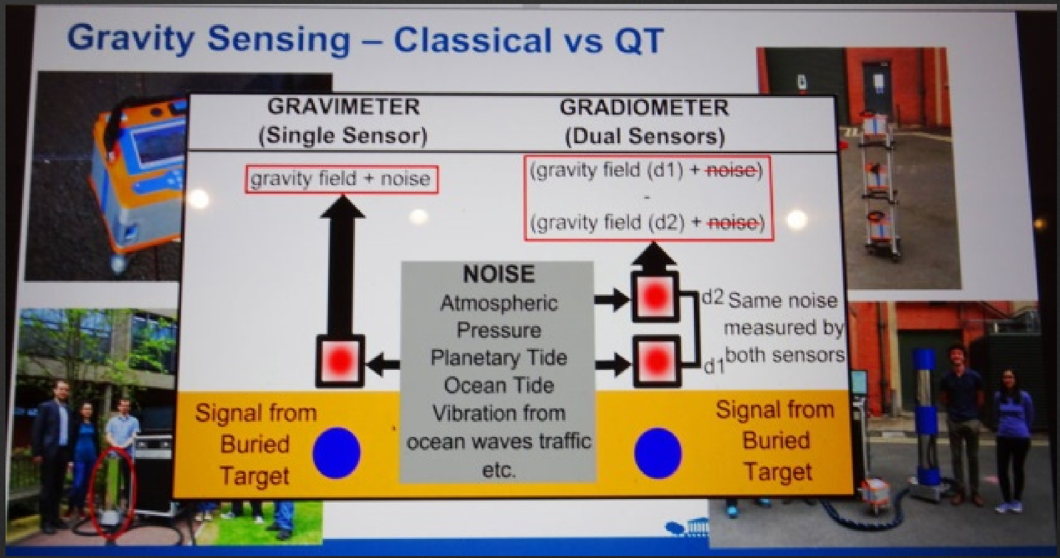
•Average precision 6.1 inches (15 cm)

Benefits: Safe, fast, accurate

Quantum technology gravimetry

Measures gravity gradient

- Dual sensors using two clouds of cold rubidium atoms
- Dual sensors cancel out noise



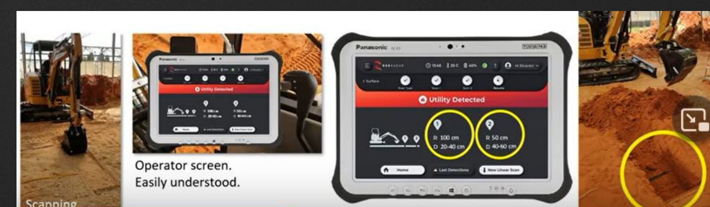
Improvements compared to conventional gravimetry

- More sensitive
- Much faster survey

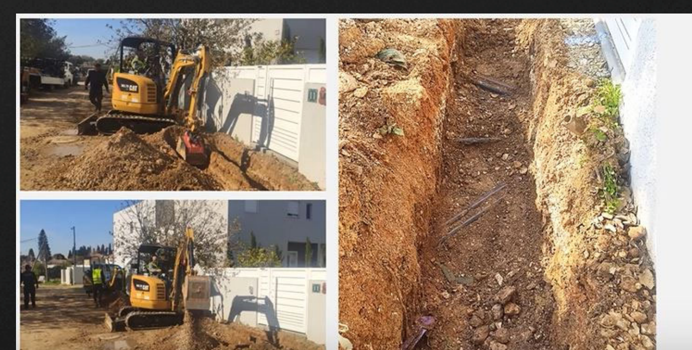
Real time underground utility detection and damage prevention

Live Dig Radar (LDR) enables excavation equipment operator to detect and avoid utilities in real time while he is excavating.

•Integrates ground penetrating radar into a digging bucket

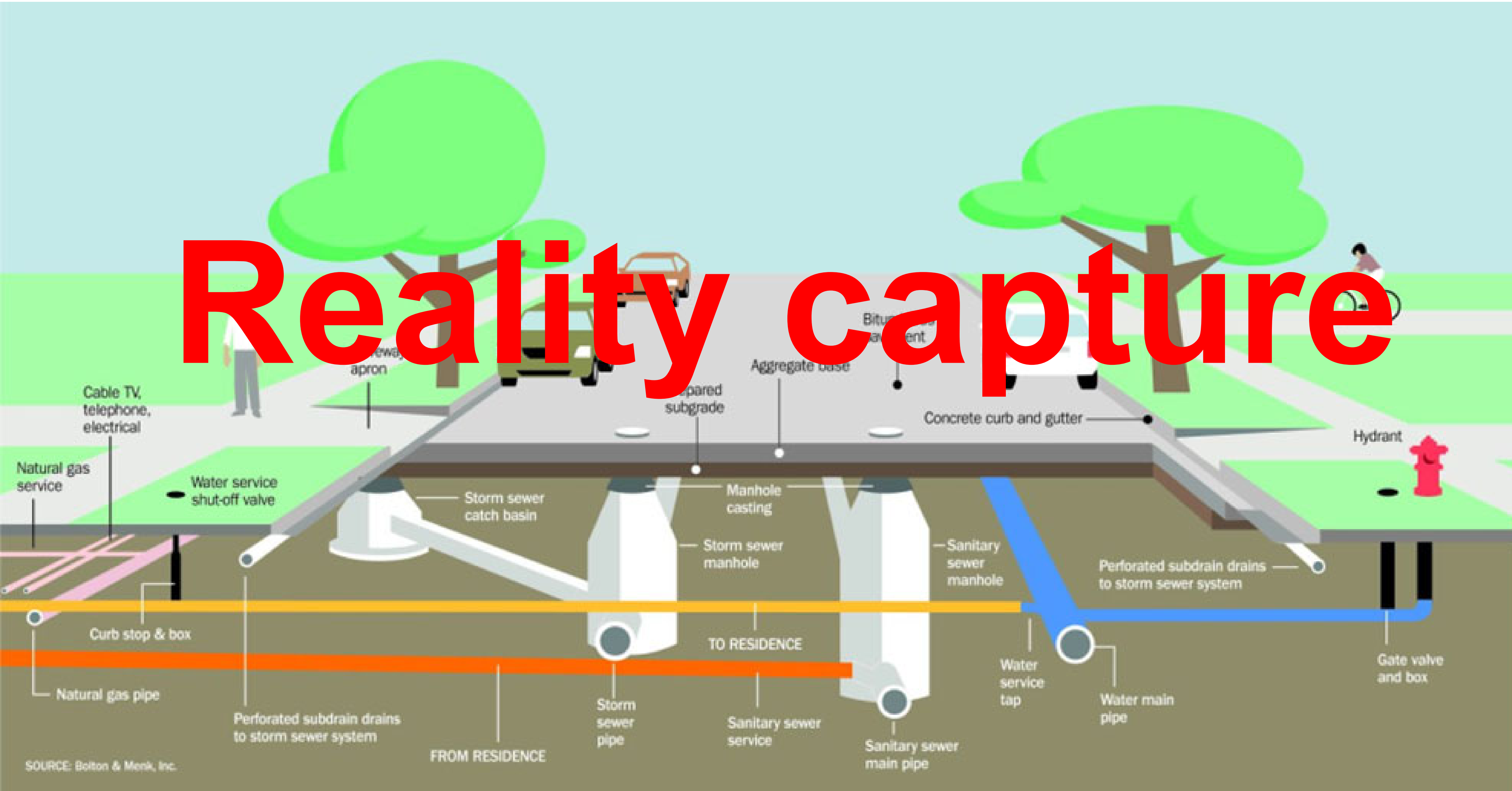


•Detects any type of utility including metallic and nonmetallic pipes, cables, communication lines in plastic conduits, and ducts



•Tablet in operator’s cabin provides immediate audible and visual alerts

Applying reality capture technology to map new and relocated underground



LiDAR scanning pipelines

Real-time capture of newly installed pipeline

- LiDAR and photo cameras
- High accuracy location - GNSS with base station correction
- Depth and other information
- Truck-mounted rig
- Supports 3D walk-throughs in mixed reality (MR)

Lux Modus

Scanning newly installed underground utilities with a smartphone

Reality capture with smartphone

- Use RTK base station or accurately surveyed control points
- Accurate to ± 5 cm
- Can be reliably captured by construction crew – does not require survey crew on-site

Can also be applied to utilities exposed during SUE survey

AVUS, Geosystems

Utilities adopt point cloud as-builts for underground utilities

Denmark water utilities capturing/sharing point clouds of underground utilities

- For newly installed or exposed utilities
- Capture with a mobile phone
- Uses surveyed control points
- Accessible in field with smart phone

Does not require RTK equipment or survey crew onsite

- Can be reliably captured by construction crew

Keeping utility GIS up to date
Automated recognition and attribute capture

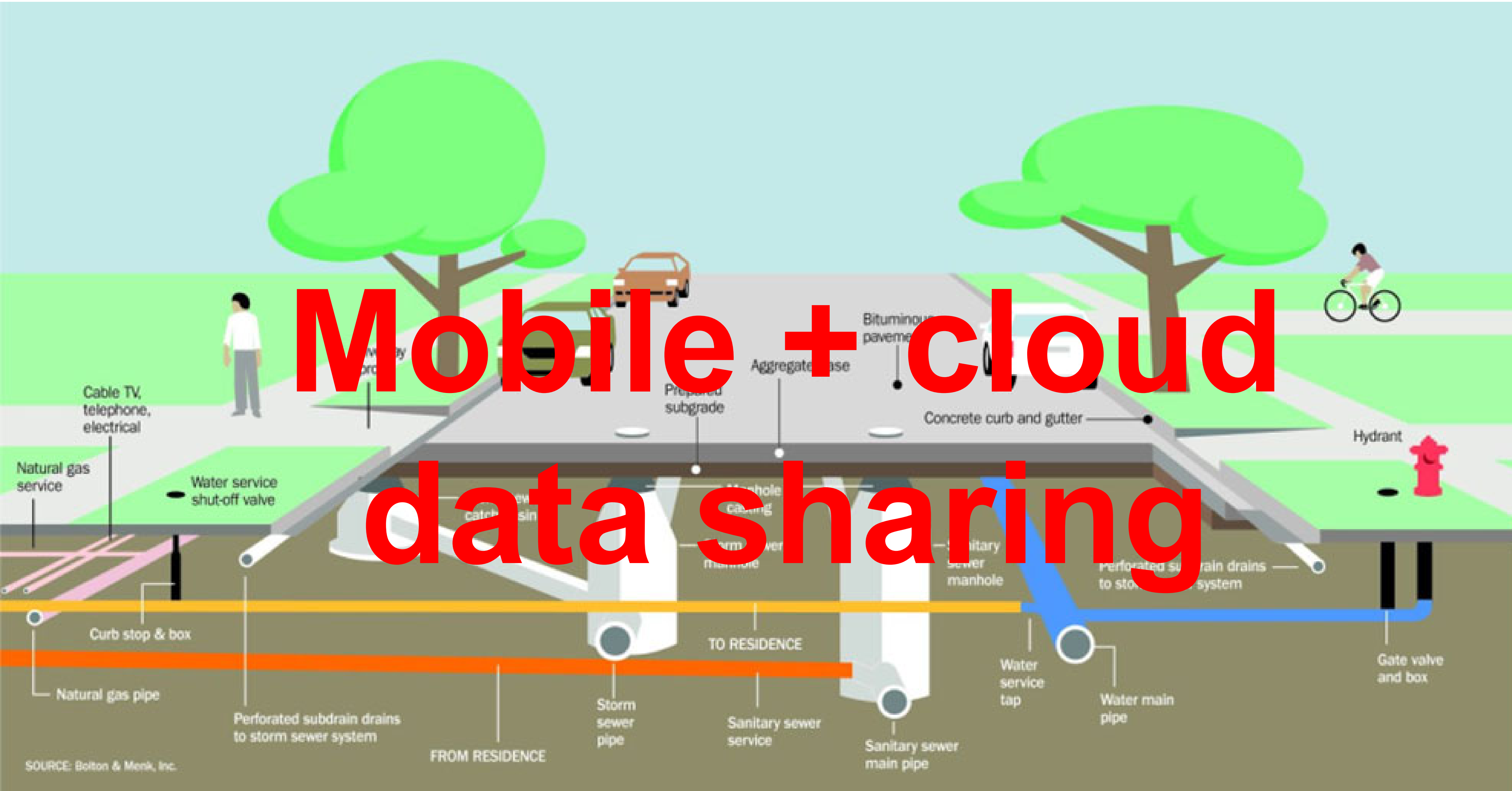
Deep learning to automate recognition of utility facilities

- Automated capture of attribute information in the field with mobilw phone
- Scanning bar and QR codes and text for work order number, serial number, manufacturer and other attribute information

- GNSS + RTK to record the location of equipment
- Pushed up to the cloud and shared.

SSP Innovations

Mobile and cloud technology to record and share the location of underground utilities



Mobile + cloud data sharing

Colorado DoT: Mobile + cloud real-time data capture and sharing

Mobile app captures high accuracy data in field including metadata

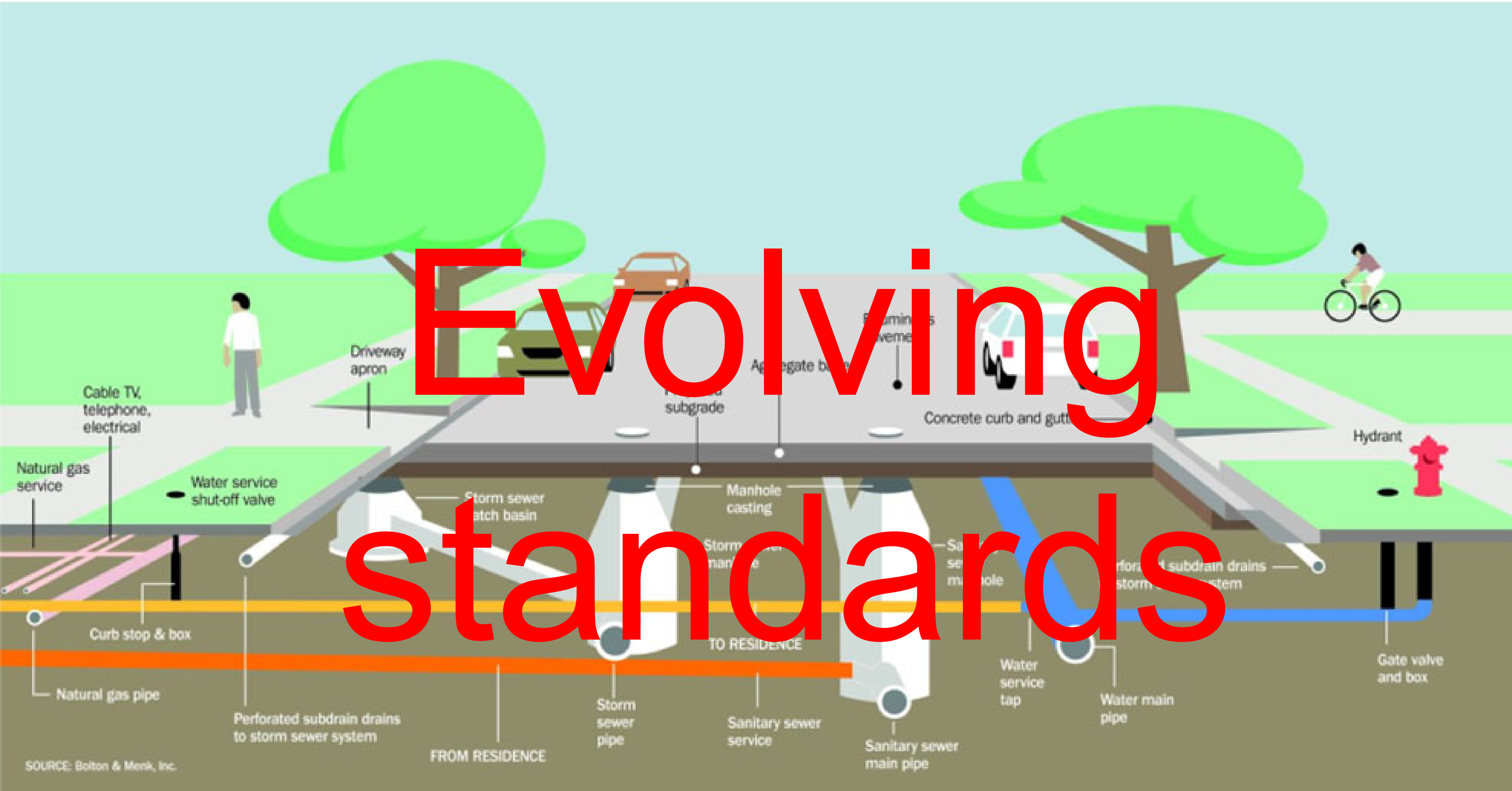
cm location accuracy (GNSS with RTK)

Cloud-based enabling immediate sharing of data among CDOT, construction contractors, network operators and locators

Mandated for everyone working or owning infrastructure in the public ROW

Prostar Pointman

Standards for location information about underground infrastructure are evolving



Evolving standards

Quality standards evolve to pace innovations

1983 – Japan Road Information Center (ROADIC)

1998 – Japan, Road Management System (ROADIS)

2002 – ASCE 38-02 Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data

2006 – Malaysia Standard Guideline for Underground Utility Mapping

2011 – Canada S-250-11

2012 – France Presidential Decree (DT DICT)

2013 – Australia AS 5488-2013

2014 – U.K. PAS 128:2014 Specification for underground utility detection, verification and location

2015 - Ecuador NTE INEN 2873

2017 – U.K PAS 256 Buried services – Collection, recording and sharing of location information data

2019 – Australia AS 5488.2019

2020 – Canada CSA S-250:20

2021 – U.K. Revised PAS 128

2022 – U.S. ASCE 38-22 Standard Guideline for Investigating and Documenting Existing Utilities

2022 – U.S ASCE 75-22 Standard Guideline for Recording and Exchanging Utility Infrastructure Data

2022 – Australia Revised AS 5488.2019

CSA S-250 "Mapping of underground utility infrastructure"

Underground utility “as-built standard” for Canada

- Adopted by *Ministry of Transportation of Ontario* and the Ontario transit authority *Metrolinx*
- Adopted by utility owners such as *Enbridge*
- Recommended by *Transportation Association of Canada*
- One of the first to specify <u>positional accuracy</u>

Accuracy level	Absoluet accuracy(mm)
1	+/- 25
2	+/- 100
3	+/- 300
4	+/- 1000

OGC data interoperability standard for underground utility data

Making location count.

MUDDI Standards Working Group (SWG)

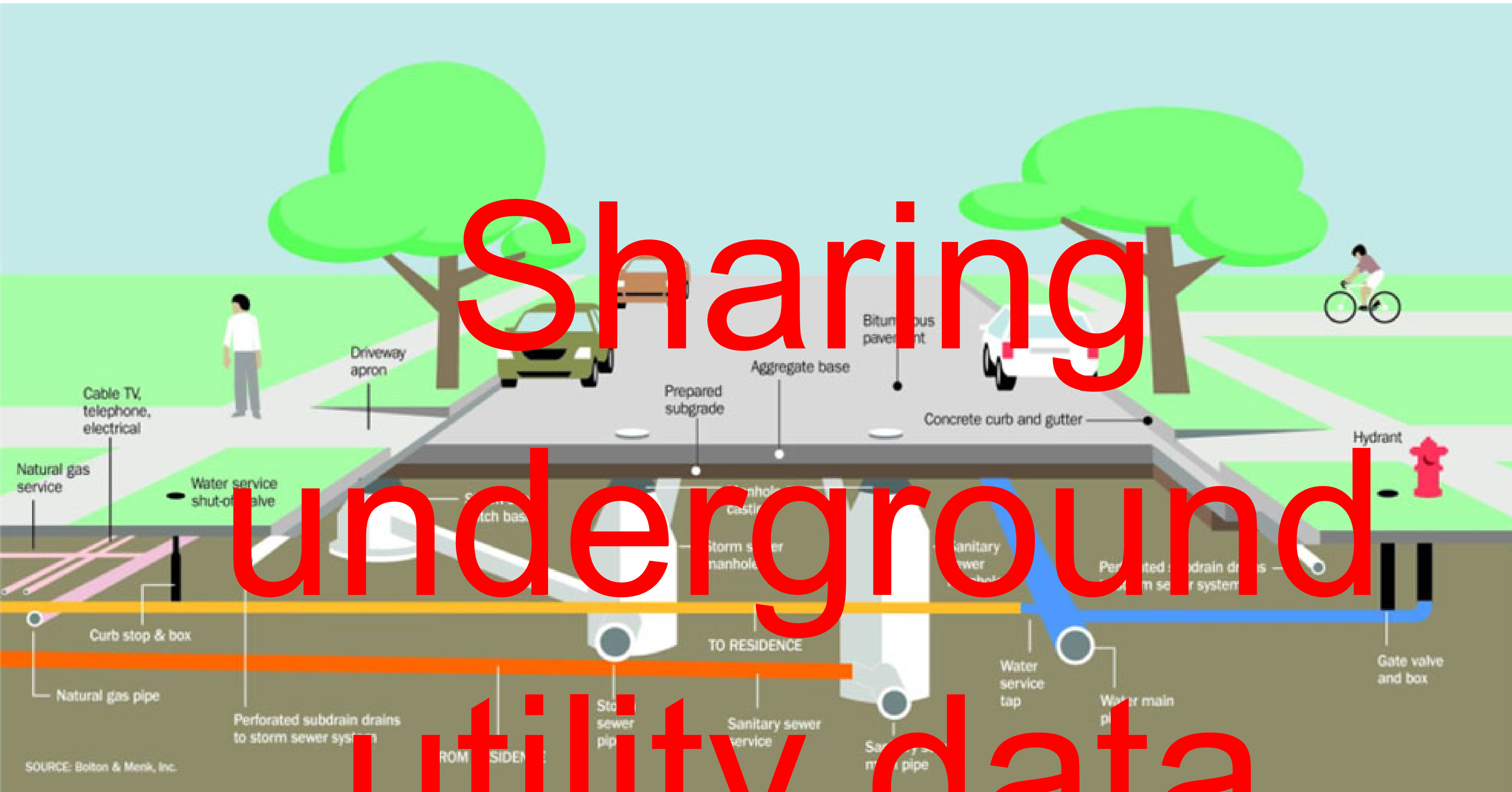
- Goal: Standard geospatial underground utility data models for data interoperability and integration
- Based on industry standard data models that represent different aspects of the underground

Infrastructure: *CityGML, buildingSMART IFC, LandInfra, CIM (Common Information Model), Multispeak, ESRI Utility Model,…*

Geotechnics: *GroundwaterML, INSPIRE Geology, BGS National Geological Model, …*

Between The Poles

Accessibility: current mechanisms for sharing underground utility data among stakeholders.



Sharing underground data: City of Calgary

Network operator required to submit as-built drawings to the City

- Accuracy: ±350mm horizontally and vertically
- Quality: CSA S250

Provides for inspections by City

- Cost of inspections shared between network operator and City
- If inspection reveals deficiencies, equipment can be declared non-compliant
- Non-compliant equipment must be brought into compliance at network operator's expense.

Shared liability: network operator liable 100%

- Direct costs for relocations of non-compliant equipment
- Indirect costs including damages, liabilities, re-design costs and delay costs resulting from network operator's non-compliant equipment.

Sharing underground data in North America

One call 811 centres

- Legislated by every state in US and most provinces in Canada
- Mandatory membership (with fees) for all utility and telecom operators
- Information requests free for excavators

- Requires site visit by all network owners operating at site
- Required to mark (paint or flag) the ground

Typically not recorded, no exchange of digital or paper maps, and not captured digitally

Sharing underground data in England: Private one-call centre

LinesearchbeforeUdig (LSBUD)

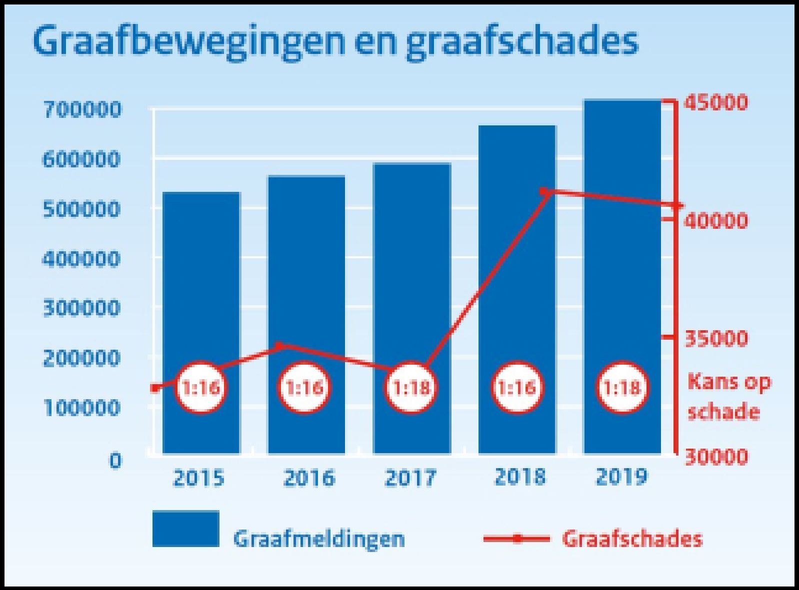
- Voluntary
- For-profit
- All fuel transmission companies, 70% of electric power network operators
- Assets of hundreds of thousands of kilometers of underground and overhead electricity, gas, high pressure fuel, water and fibre optic pipes and cables
- Processes over 2.5 million inquiries/year

Owned by Fisher German LLP and PelicanCorp. PelicanCorp runs one-call centres in Indiana, Kentucky, Alberta, British Columbia, New Zealand, Australia, Ireland, and Singapore.

Sharing underground data in the Netherlands: KLIC

KLIC-Online one-call system

- Planned excavations within the next 20 days must be reported to KLIC
- € 32 charge for information request
- Entirely on-line

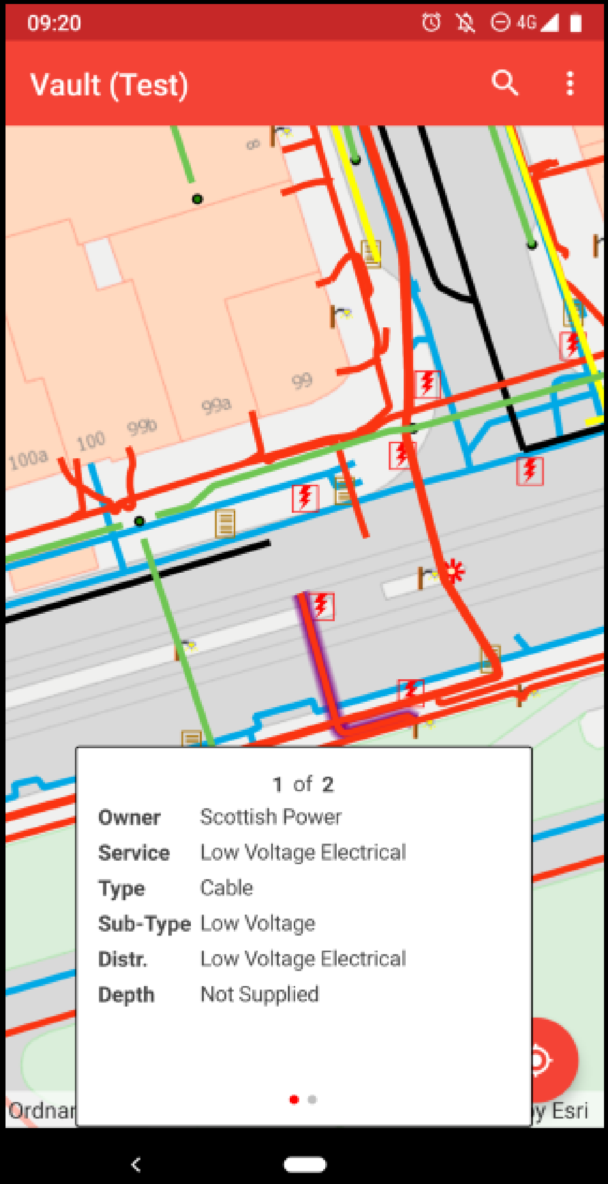


- Efficient - Maps (as-builts) of underground infrastructure provided within 24 hours
- Mandatory reporting of damage incidents

Voluntary sharing of underground data: Scotland

Vault System

- In 2012 voluntary collaboration among national and local government transport agencies and over 70 network operators
- Agreed to share information about the location of underground infrastructure
- Harmonized data model, terminology, and symbology
- MasterMap basemap



Sharing underground data: France’s DT DICT system

Presidential Decree 2012

Principle: Uncertainty greater than 40 cm in *critical infrastructur*e jeopardizes construction projects

Cost of improving data quality borne by network operator

- Network operators expected to provide maps accurate to 40 cm
- Alternative: Project manager carries out *investigations complémentaires* (IC) with <u>cost borne by the network operator</u>

DT DICT effective in reducing underground damage by 2 % annually

Year	Damage incidents	Year over year change	Total DTs	Damage rate (% of DTs)	% DTs submitted digitally
2013	24,441		3,437,274	0.71 %	29 %
2014	19,317	-21 %	3,263,725	0.59 %	35 %
2015	18,382	- 5 %	3,349,224	0.55 %	85 %
2016	16,994	- 8 %	3,516,665	0.48 %	89 %
2017	16,698	- 2 %	3,750,933	0.45 %	92 %
2018	16,344	- 2 %	3,966,390	0.41 %	93 %
2019	16,025	- 2 %	4,181,769	0.38 %	93 %

Regulating the public ROW
Colorado DoT

Accurate as-builts must be submitted to CDOT after completion of construction

- Compliant with ASCE 75 utility “as-installed” standard
- Location accuracy 0.3 feet (100 mm)
- Stamped by a professional engineer (PE) or professional land surveyor (PLS)
- Electronic submissions are mandatory

Colorado Revised Statues Title 9, Article 1.5 Excavation Safety

Regulating the public ROW
Colorado DoT

Mandatory SUE survey during planning and early design

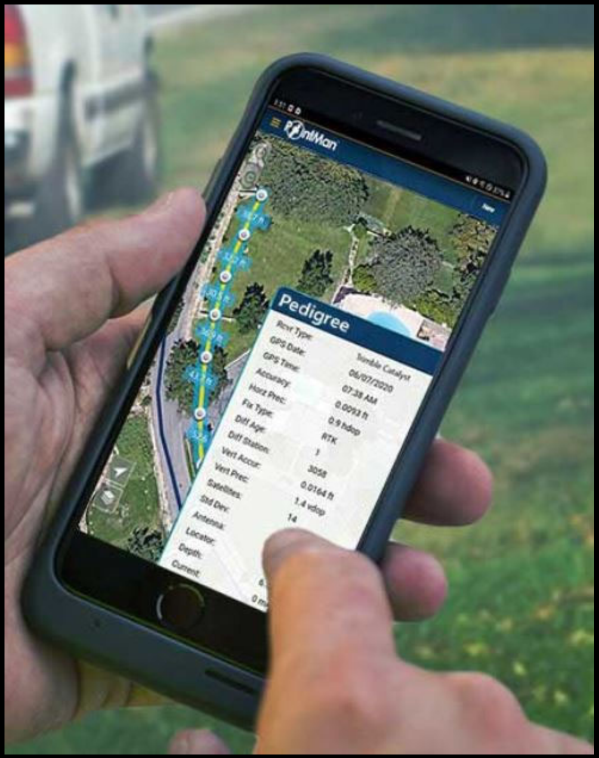
- Utility and telecom network owners and operators are required to provide best available records
- SUE survey must locate all underground facilities to ASCE QL B or better
- Stamped by a professional engineer (PE) or professional land surveyor (PLS)
- SUE survey submittted to CDOT

Colorado Revised Statues Title 9, Article 1.5 Excavation Safety

Regulating the public ROW
Colorado DoT

Mandatory mobile+cloud solution

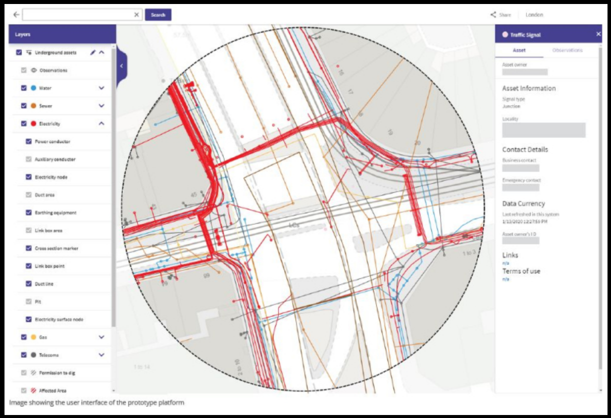
- All contractors working in the public ROW
- All network operators with equipment in the public ROW
- All locators and others working in the public ROW



National Underground Asset Register (UK)

Bottom-up initiative by network owners in North East England and Central London

- Over 40 utility network operators and local government agencies agreed on legal framework for sharing data

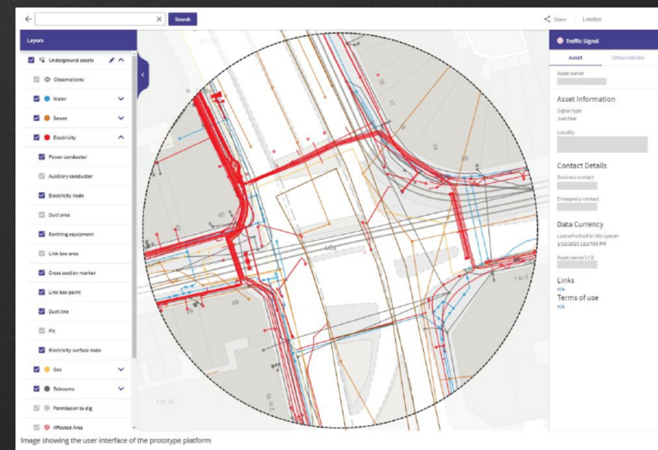


Adopted and funded as national initiative by Geospatial Commission

- Digital map of all underground utilities to be built collaboratively by industry and government
- To be extended to all of England, Wales and Northern Ireland by 2024
- Build stage of NUAR announced Sep 2021

Achieved high level of participation among network owners and govt agencies

Foundation for two successful pilots provided by an agreed legal framework for data sharing among network owners and others.



- Each network owner remained the custodian of its own data.
- Provides for clear accountability chains in terms of ownership, governance and regulation.

High standard of data security and data protection also key for achieving high level of participation

How NUAR is to be run and funded has not been decided

Open questions

- To achieve 100% participation should NUAR be made mandatory ?
- How should NUAR should be run once it is fully operational including the status and remit of the responsible organization ?
- Should NUAR charge user fees to network owners, excavators, or other users of the data

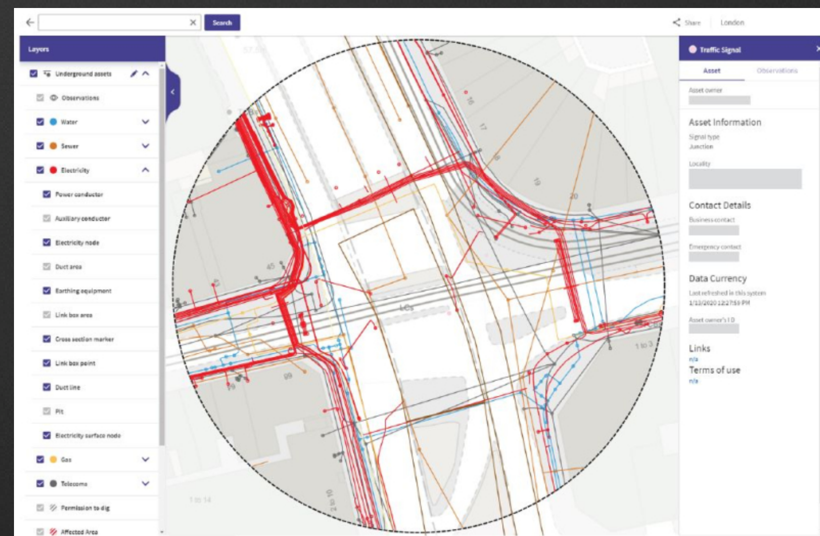
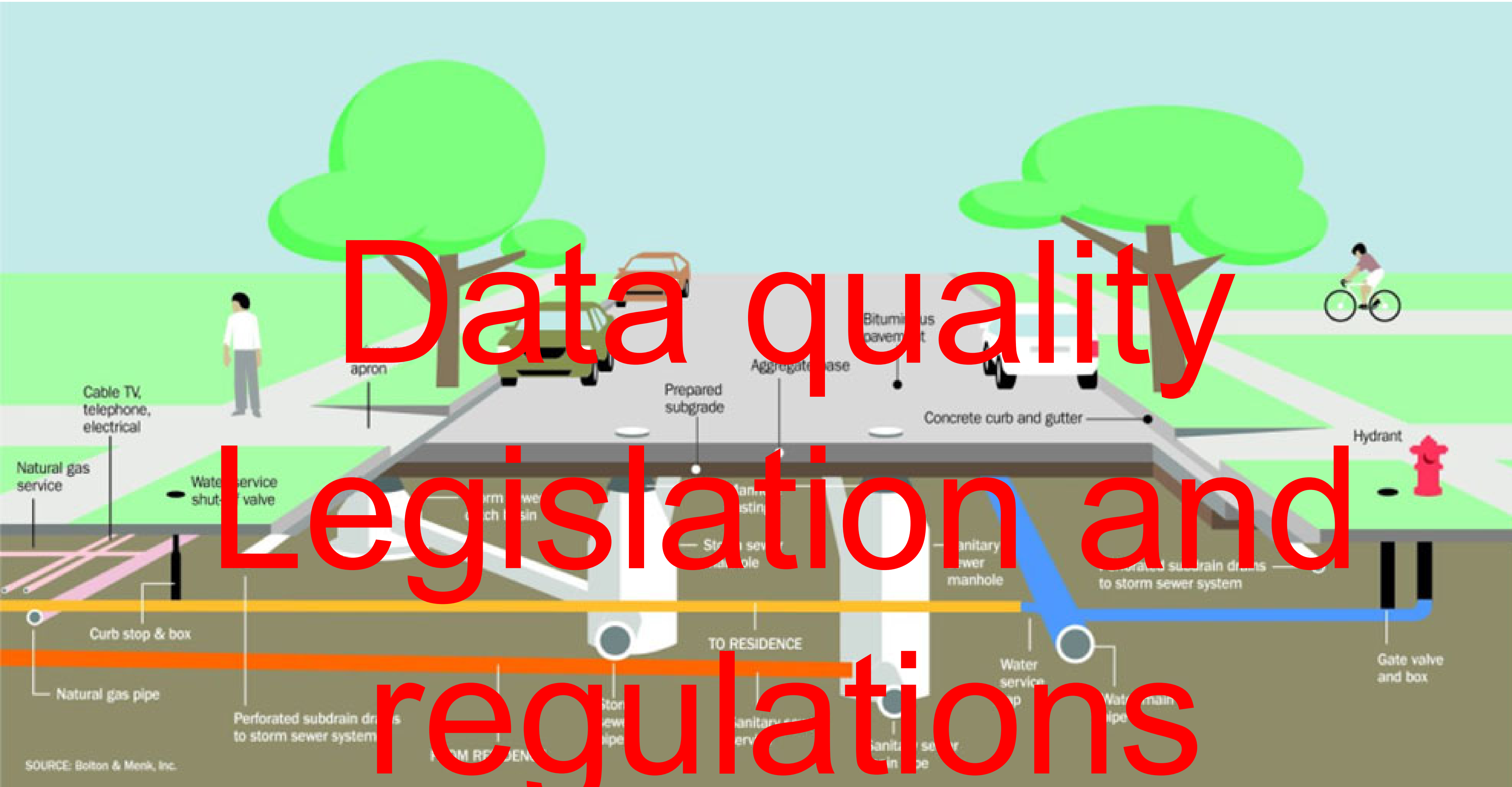


Image showing the user interface of the prototype platform

Jurisidictions are implementing legislation and regulations to improve data quality.



Data quality

Legislation and regulations

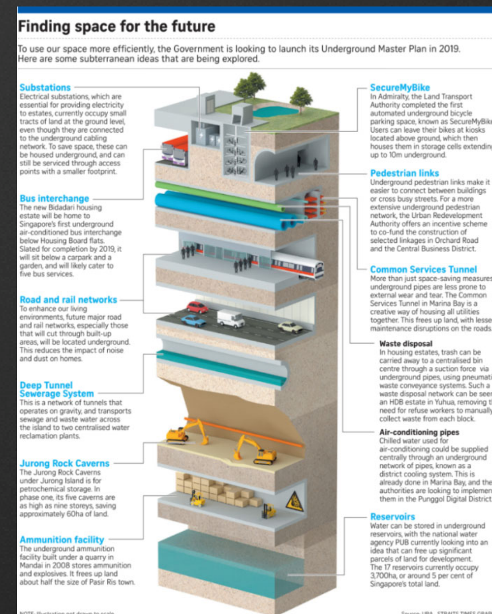
Not recording and sharing location of underground infrastructure is expensive

- Estimated U.S. devotes $10 billion + annually to locating underground utilities

- Information is rarely recorded and shared.

- Result: Same infrastructure located over and over again.

Improving underground data quality in Singapore: As-builts



2017 Singapore Land Authority (SLA)

- Contractual
- Requires survey of new underground utilities by a registered surveyor

- Required equipment: Total station, GNSS Real Time Kinematic (RTK), or 3D Laser scanning
- Required accuracy ±100 mm in XY and Z

Improving data quality in Colorado ROW: As-builts

Accurate as-builts must be submitted to CDOT after completion of construction

- Compliant with ASCE 75 utility “as-installed” standard
- Location accuracy 0.3 feet (100 mm)
- Stamped by a professional engineer (PE) or professional land surveyor (PLS)
- Electronic submissions are mandatory

Colorado Revised Statues Title 9, Article 1.5 Excavation Safety

Improving data quality in Colorado ROW: SUE

Mandatory SUE survey during planning and early design

- Utility and telecom network owners and operators are required to provide best available records
- SUE survey must locate all underground facilities to ASCE QL B or better
- Stamped by a professional engineer (PE) or professional land surveyor (PLS)
- SUE survey submittted to CDOT

Colorado Revised Statues Title 9, Article 1.5 Excavation Safety

Improving data quality in Colorado ROW: Standards

Mandatory SUE and "as-installed" standards

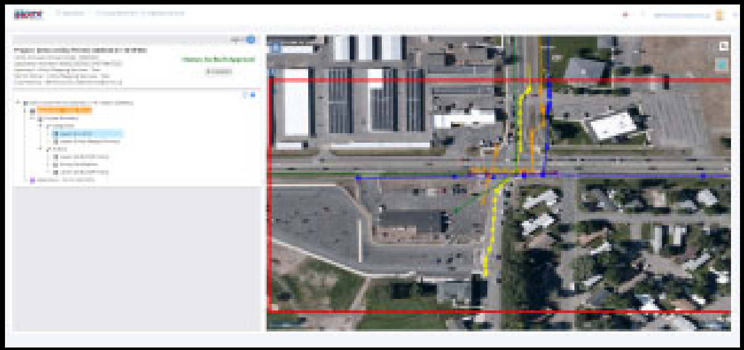
- ASCE 38-22 SUE standard
- ASCE 75-22 "As installed" standard

Compliant with Open Geospatial Consortium's MUDDI standard

Improving data quality in the Montana ROW: As-builts

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Permitting system to regulate utilities in the public right-of-way



- Requires "as built" survey of newly installed equipment
- ± 0.3 feet accuracy
- Stamped by PE or PLS

Liabilities:

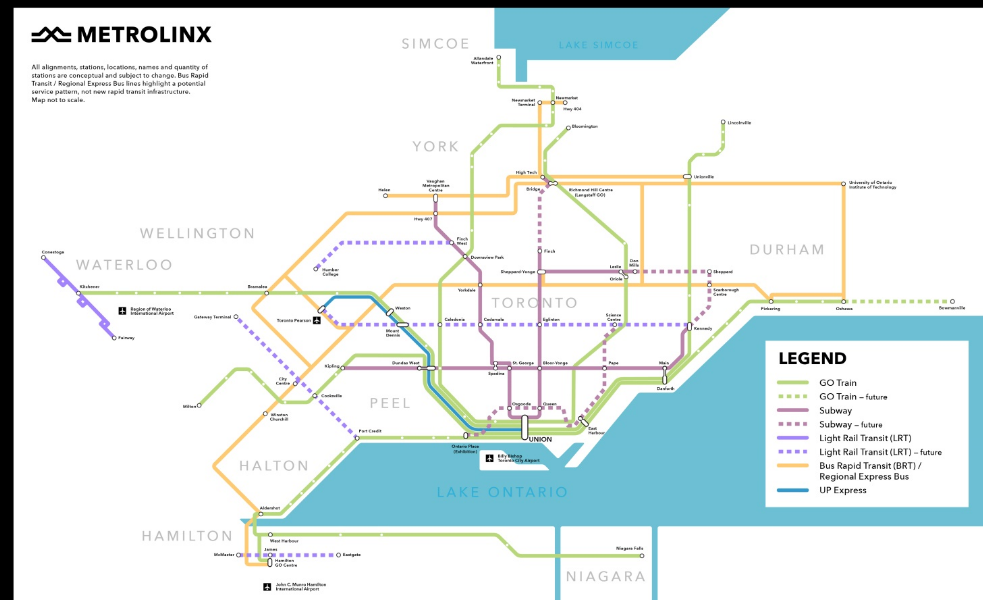
•Network owners/operators can be held liable if during a future project the utility location accuracy is not within the certified accuracy and results in change orders, delays and other impacts to the project

On-line permitting system for Montana Department of Transportation developed by Geo-works

Improving underground data quality: Ontario

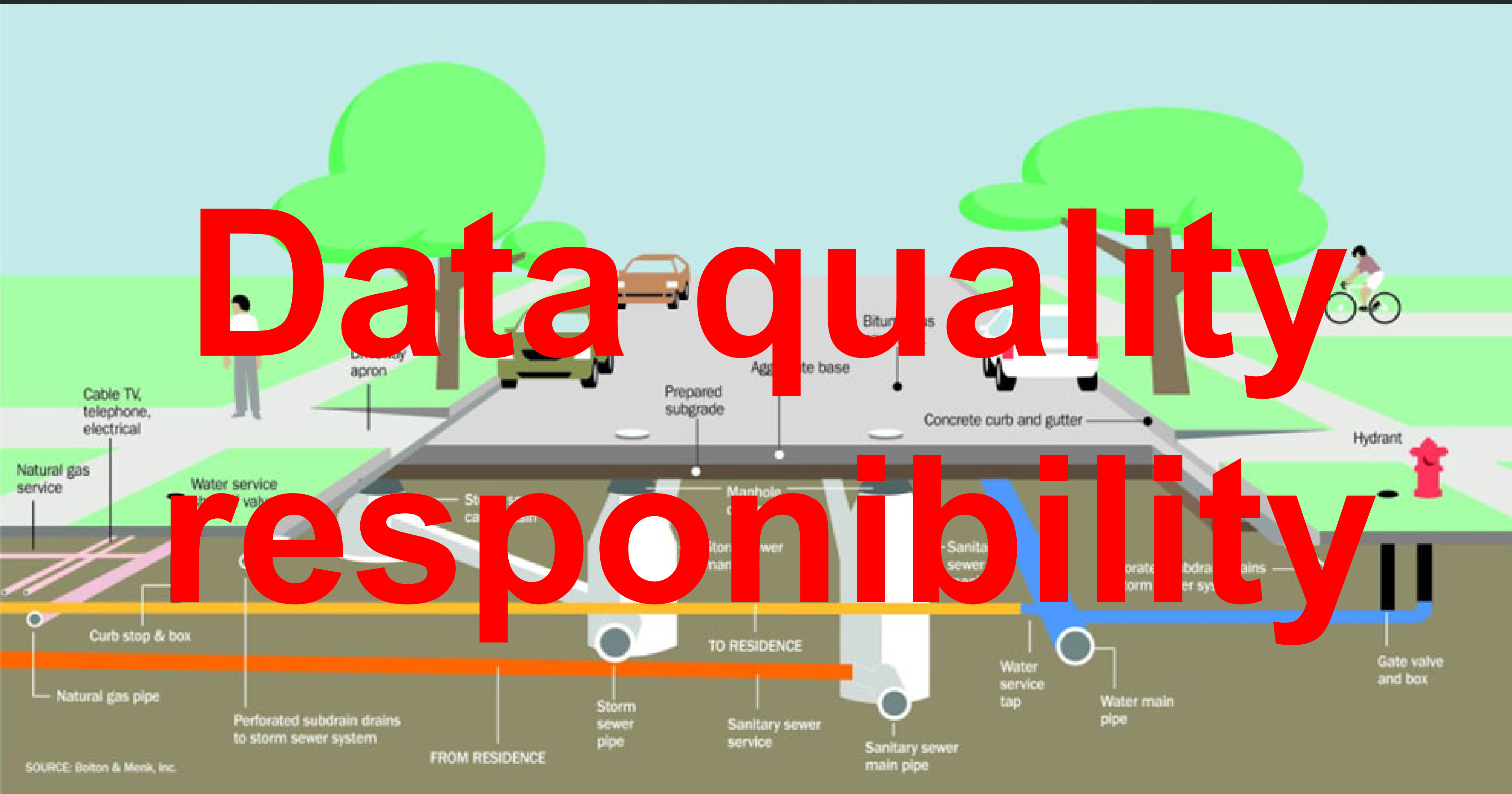
Build Transit Better Act

- Changes to Ontario One Call supports design requests
- Requires subsurface utility engineering (SUE) surveys to improve quality of existing location data
- Required standards: CSA S-250 and ASCE 38
- Infrastructure Ontario and Metrolinx encourage early collaboration among project team and utility owners/operators



Supported by changes to Ontario One Call legislation

Data quality does not just happen, someone has to take responsibility for each data element collected during a project.



Data quality responibility

Data quality responsibility

Professional engineer

- Certified and insured

As-builts and SUE surveys

Assigning ASCE 38 and CSA S-250 quality standards

Professional land surveyor

- Certified and insured

Above ground surveys, surveys of exposed below ground utilities

- Locator

Routine locates in response to one call requests

Comprehensive program involving all stakeholders required to reduce underground utility damage

Reducing underground infrastructure damage in Japan

- High level of collaboration between highway agencies and utility network operators
- All road and utility location network data contained in single repository (ROADIS)

Japan
(2016)

134
Japan Construction Industry Association

- Construction culture produces as-builts accurate to ± 10-20 cm
- Excavators routinely exercise extreme caution when digging near (± 50 cm) underground utilities
- Mandatory reporting of incidents of utility/telecom damage

Key takeaways

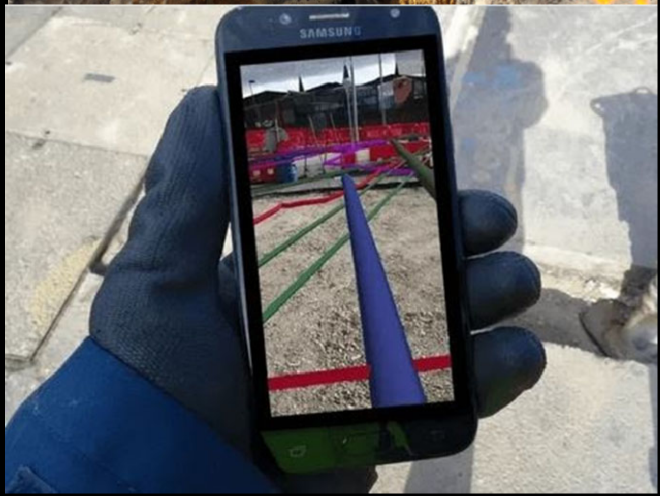
Unreliable information about location of underground infrastructure is expensive

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

▪New legislation and regulations for capturing, protecting and sharing accurate data about underground infrastructure

Technical innovations enable rapid, accurate locating and mapping of subsurface utilities

Requires trusted, centralized organization to provide governance for sharing underground data



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