CSIC Cambridge Centre for Smart Infrastructure and Construction

Intelligent Infrastructural Assets?

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Overview

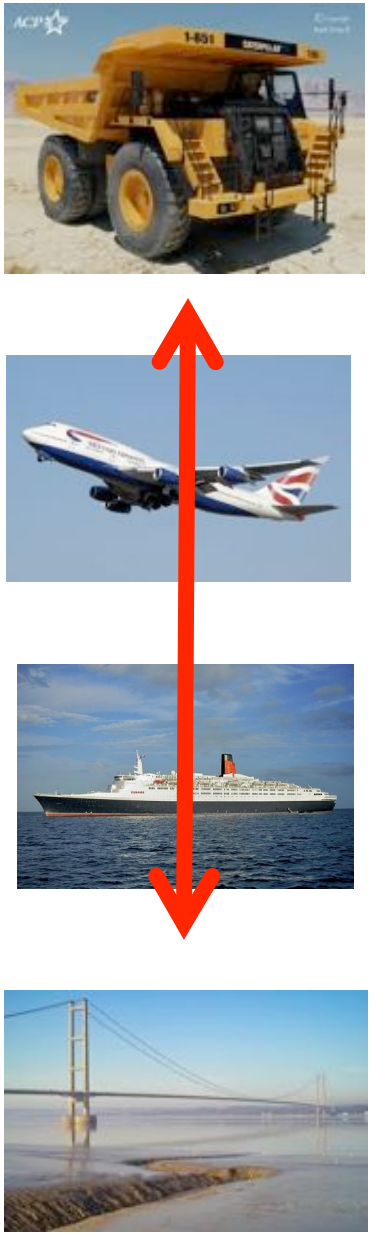
- Asset Management for Key Infrastructural Assets
- A Vision for Intelligent Infrastructural Asset Management
- CSIC Activities: Towards More Intelligent Infrastructural Assets
- Wrap Up

Infrastructural Assets?

Characteristic	Equipment
Life	10-20 years
Number Off	Many
Maintenance focus	Part Replacement
Standardisation	Standard design and usage
Lifecycle complexity	Replaceable components, Technology upgrades
Performance Measure	Operational performance dominant factor for maintenance
Value proposition	Most costs and values generated and enjoyed by the asset owner

Infrastructural Assets?

Characteristic	Equipment	Infrastructure
Life	10-20	60-200 years
Number Off	Many	Few
Maintenance focus	Part Replacement	Life extension, repair
Standardisation	Standard design and usage	Unique design and usage life
Lifecycle complexity	Replaceable components	Mixture of replaceable and indefinite life components
Performance Measure	Operational performance dominant factor for maintenance	Structural reliability and operational availability
Value proposition	Most costs and values generated and enjoyed by the asset owner	Values enjoyed and costs borne by different stakeholders



… Some Infrastructural AM Challenges

- Huge numbers of assets
  => management of key assets can often be limited, superficial
  ⇒ Committing to monitoring key assets is a major undertaking
  ⇒ Some very old ….
- IAs contain interacting civil infrastructure, mechanical and electrical systems
  => In many organisations asset management decisions are separate
- Difficult to predict value/cost/risk of asset over long life
- Asset changes ownership, usage, state many times over life

The Times
Tuesday 25 March

Implications for Infrastructural Asset Management approaches?

- Involve low cost, easy to maintain sensing, data gathering & management
- Prioritse all assets within a single integrated portfolio
- Examine value of the use of the asset in conjunction with cost of maintaining
- Be robust to future ownership, usage changes

- *Centralised management of individual assets is challenging*

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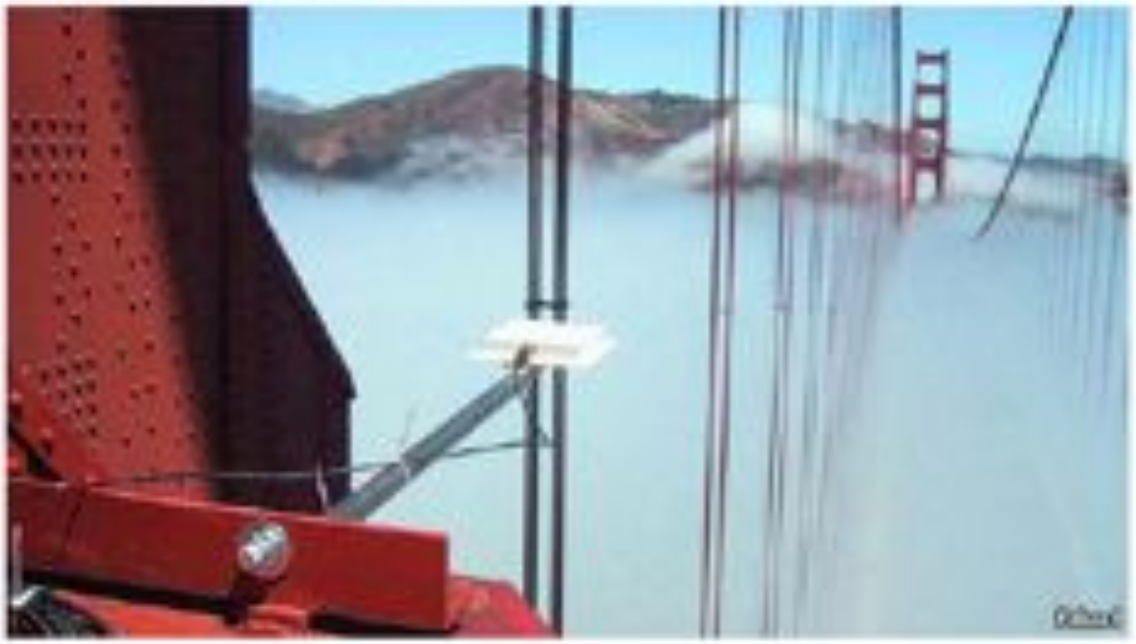
The Economist

Inside story

Superstructures

Engineering: Adding sensors and other devices to bridges, tunnels and buildings can turn them into "smart structures" capable of sensing and, in some cases, even responding to problems

Dec 9th 2010 | from PRINT EDITION



"If a car can be made smart enough to spot when the oil is low or a brake light has failed, why not do the same for bridges, tunnels and buildings?"

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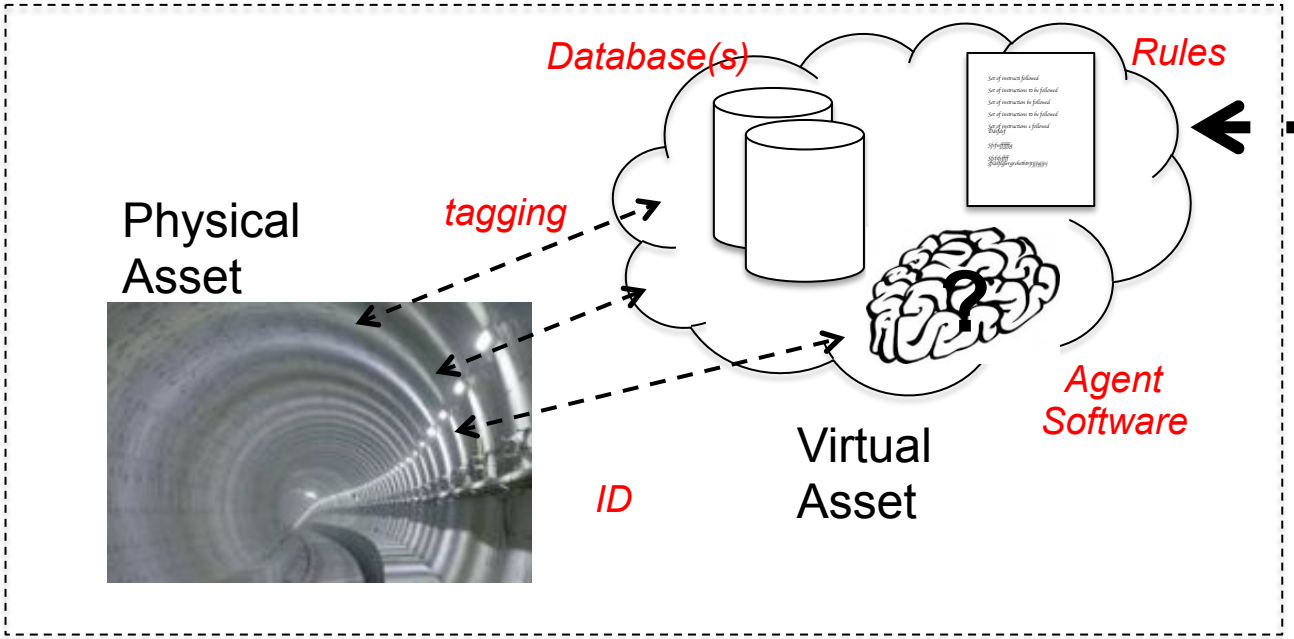
Intelligent Infrastructural Asset?

A self-contained infrastructural element linked to its own monitoring, diagnostic and maintenance strategy and with the ability to guide, influence or direct its own use, maintenance & support.



Functionality of An Intelligent Infrastructural Asset?

1. *Identity*.
2. *State Awareness*
3. *Communication:*
4. *Data Management:*
5. *Language:*
6. Decision *[support]:*
7. *Value system:*

=>

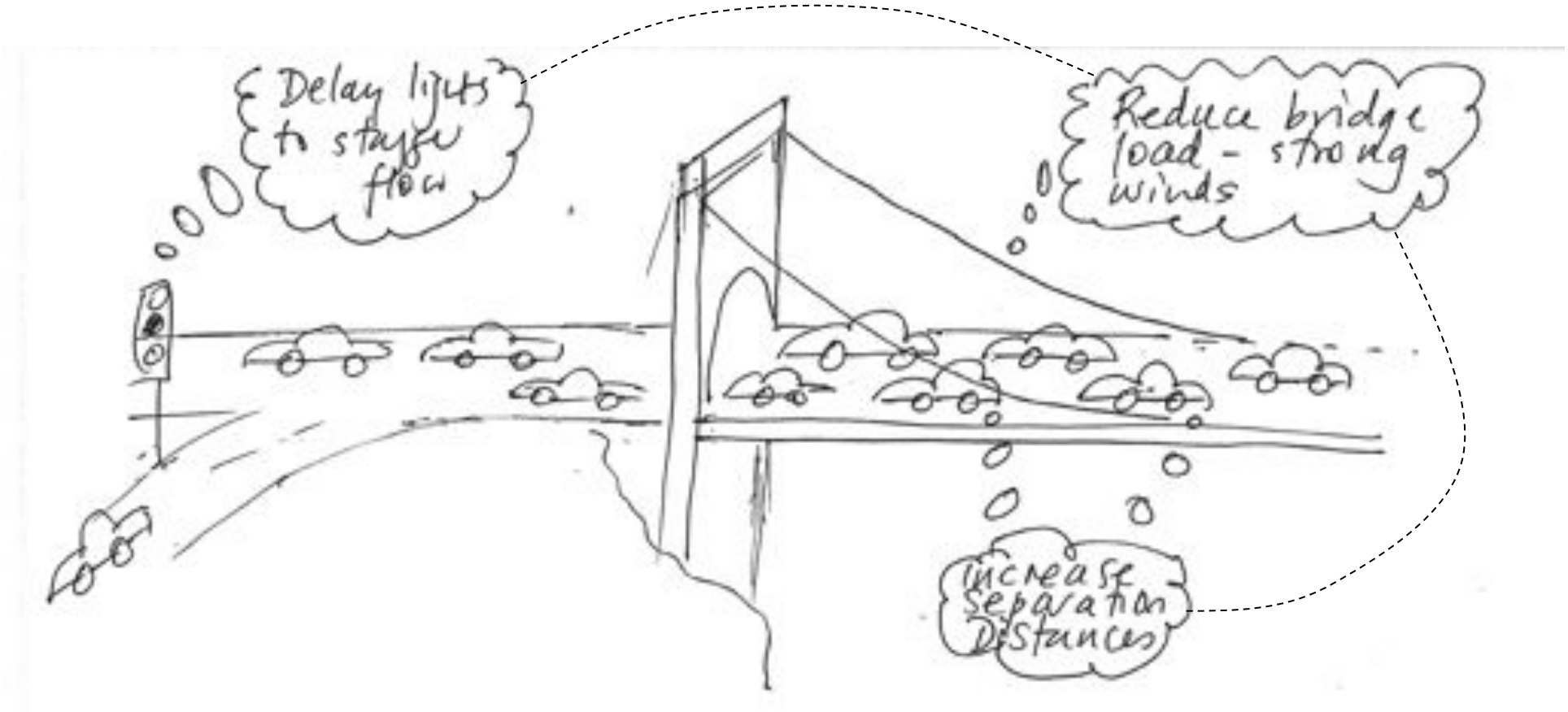
Information tightly "bound" to the asset it represents [not owner, user, operator]

Asset has a virtual counterpart holding data and also rules, guidelines

Asset (via virtual counterpart) can trigger new decisions/actions

Intelligent Assets?

Intelligent Assets?



Intelligent Assets?

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CSIC - The Future of Infrastructure

MISSION

Transforming the future of infrastructure through smarter information

VISION

- **Enable** step changes in construction practice
- **Establish** a world-leading sensing and monitoring industry
- **Extend** asset life & reduce management costs

Construction Sector:

Halcrow, LAING O'ROURKE, ARUP, SKANSKA, COSTAIN, ATKINS, WSP, SOLDATA, itm, CAPITA SYMONDS, Mott MacDonald, bre

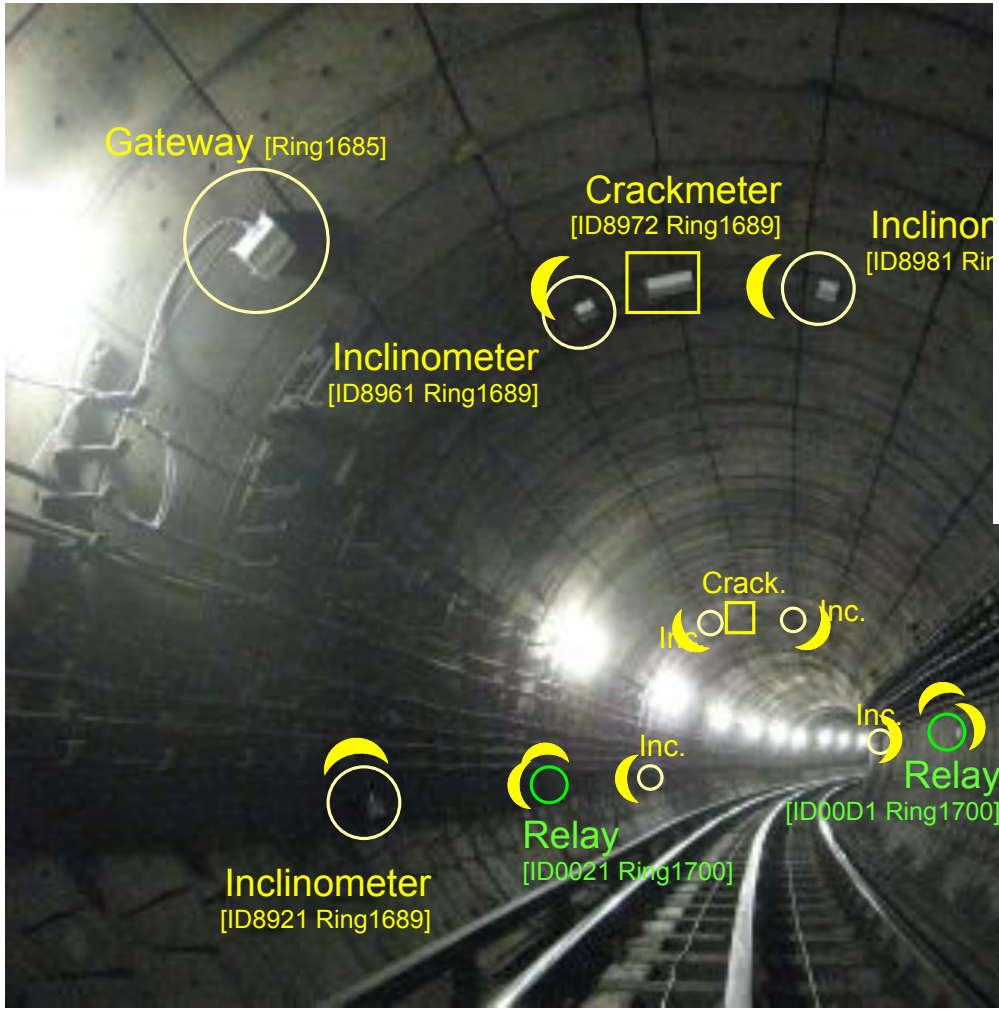
Infrastructure Owners/Operators:

TRL, nationalgrid, HIGHWAYS AGENCY, Tube Lines, Thames Water, Transport for London, NetworkRail, Crossrail, UNDERGROUND, Infrastructure UK, HUMBERBRIDGEBOARD, TRANSPORT SCOTLAND

Systems / Solution Providers:

TOSHIBA Leading Innovation, RedBite, Omnisense, THALES, iMETRUM, geothermal international, IBM, Senceive, GE Aviation, zühlke, horizon DIGITAL ECONOMY RESEARCH, AEROFLEX, RolaTube™

Self Sustaining Sensor Networks



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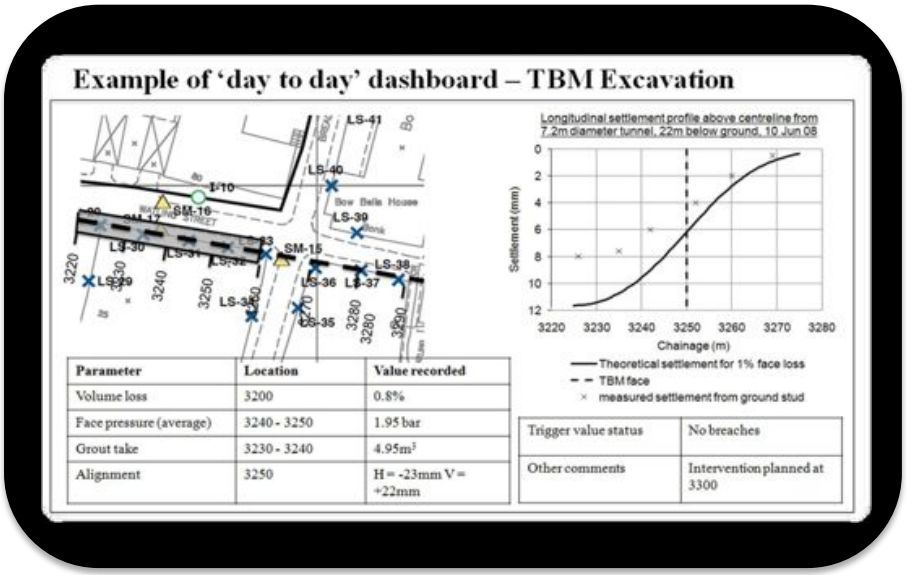
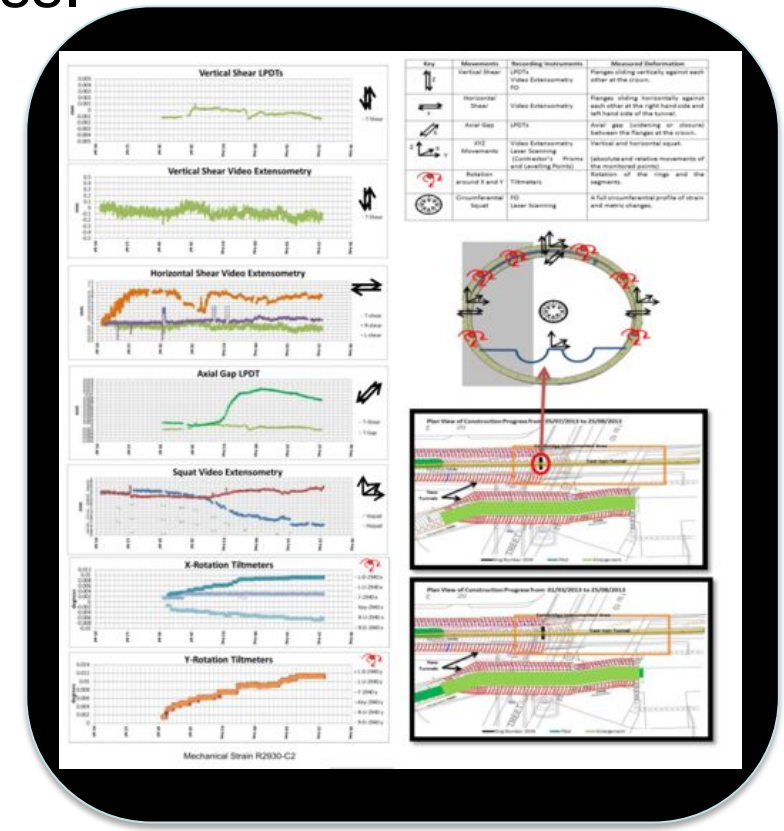
Asset Data Visualisation

Unified Dashboard of real time sensed, scheduled and manually gathered data – e.g. to predict movement against the construction progress.





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Decision Support Systems

Infrastructural Asset Futureproofing

City Level, Asset Interaction Planning

Visioning master plans	Scenario planning	Whole life cost analysis	Ecosystem services valuation	Real options analysis	Horizon scanning

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Whole Life Valuing of Key Assets

Model the condition and degradation of infrastructure

↓

Model the impact of interventions on degradation

↓

Model the impact of interventions on the value elements

↓

Calculate the yearly value for each element

↓

Calculate the WLV for each intervention option

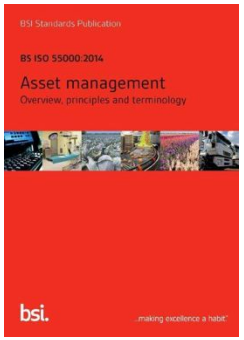
↓

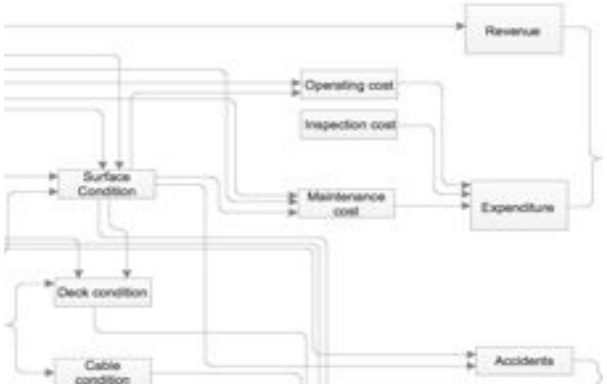
Conduct sensitivity and risk analysis of the options

↓

Choose the best WLV option

Asset-related factors | Components of value drivers | Value drivers





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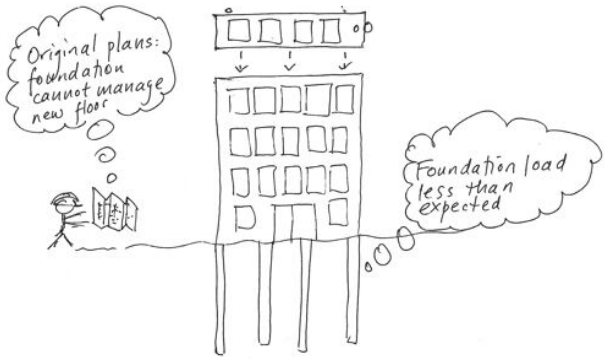
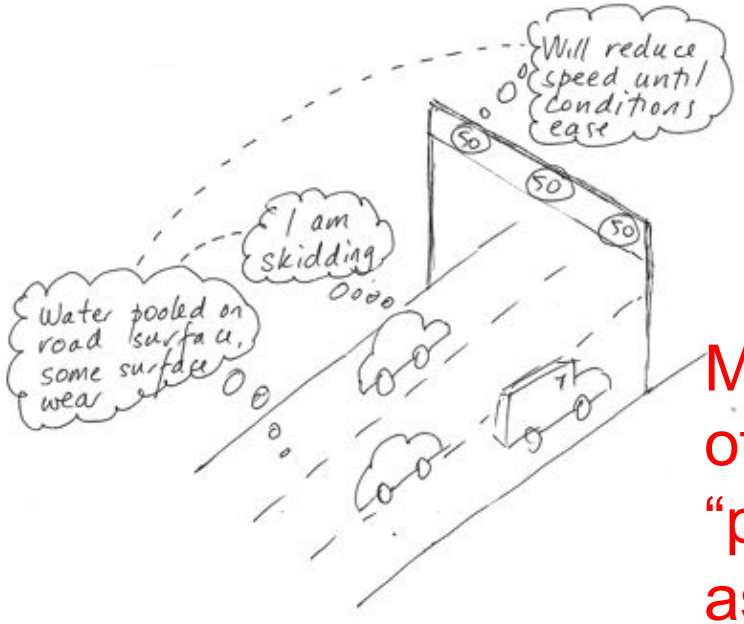
Wrap Up

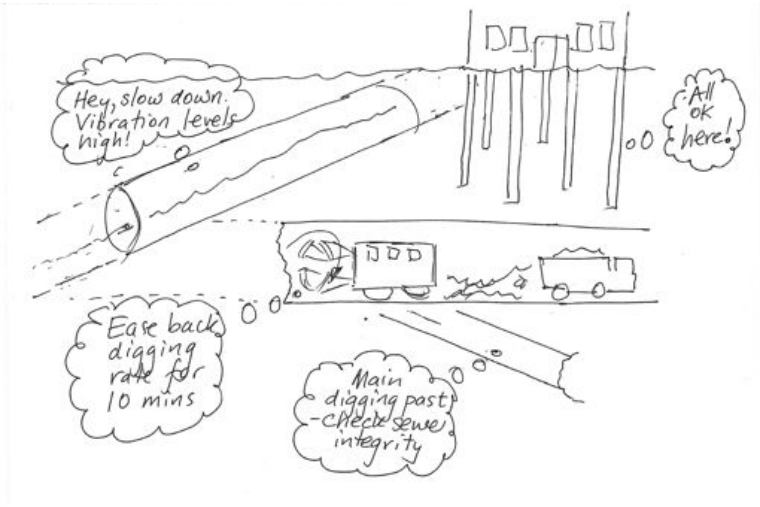
More assets, less money => new approach to infrastructural asset management needed





Assets as value providers not cost generators

Management of asset "provided" by asset itself



Smart technologies already embedded in equipment that infrastructure interacts with

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