

# Risk Analysis using 4D Visualization Models

## PC Expo Melbourne - November 2018



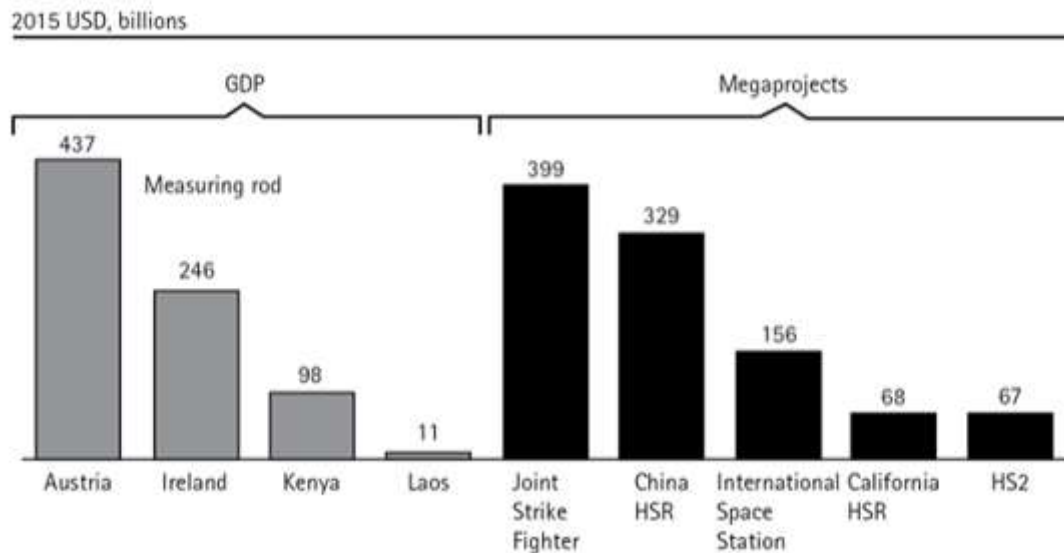
Household Bay Drive Interchange - Aerial view of proposed tunnel portals (Artists impression only)



# Mega Projects

Megaprojects are a different breed of projects due to their complex characteristics. They are not just larger projects. Mega projects are large-scale, complex ventures that typically cost \$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, transformational, and impact millions of people

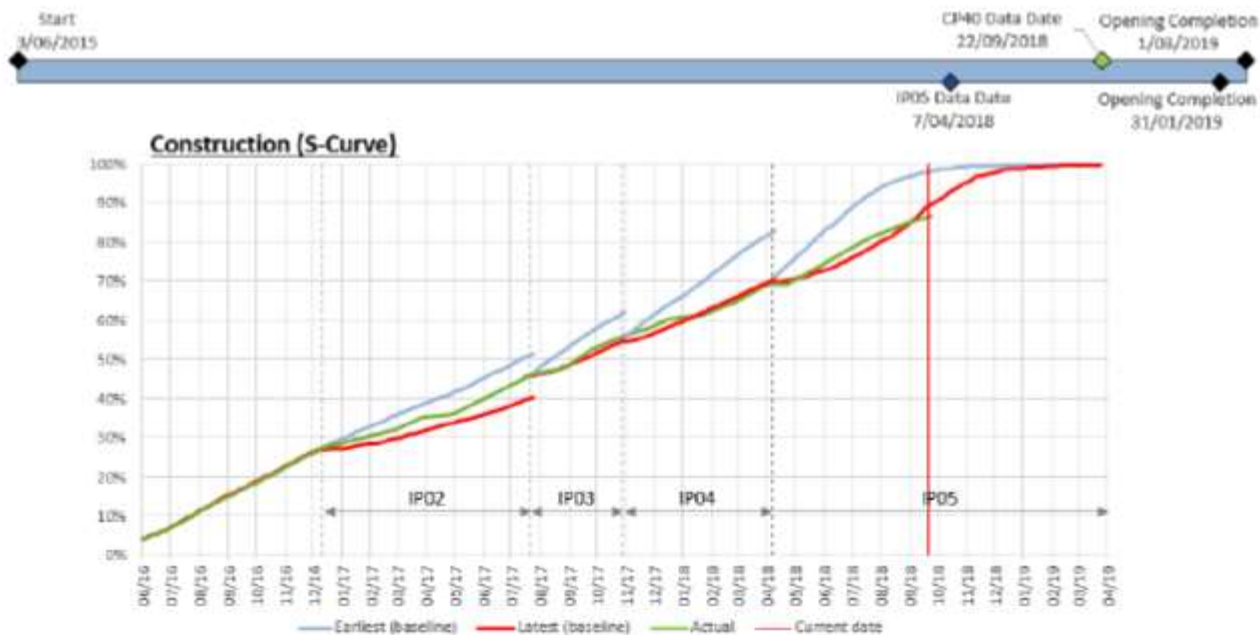
## Mega Projects vs GDPs



# Optimism Bias

Megaprojects suffer from optimism bias as its project team consistently underestimate costs and overestimates benefits.

They fail to learn from their mistakes despite the increased number of projects and researchers claiming the presence of optimism bias leading to a 'performance paradox.'



# Optimism Bias and other fallacies

## Misconceptions of chance

- HHHTTT or HTHHTH ?

## •The Conjunction Fallacy

- Air travel insurance covering terrorism only closer to a flight vs insurance of all sorts including terrorism

## •Disregarding variance in a small sample

- Likelihood of an average of 6 feet being the average height of 10 randomly selected people vs 1000 randomly selected people

## •Insensitivity to prior probabilities

- A 99% reliable test gave you a positive result on a rare medical condition (1 in 1000 have the condition)

## Three reasons for failure of Mega Project

- ▶ Underestimation or refusal to acknowledge uncertainty
- ▶ Stakeholder neglect or mismanagement
- ▶ Inflexible contractor management

# Knowing Doing Gap – Knowledge to Action



Gap between Knowing and doing is greater than the gap between ignorance and knowledge.

This emphasizes the importance of measuring performance at each project stage

The first step towards addressing the knowing-doing gap is to acknowledge that the gap is real. The knowledge-doing gap is evident in the case of megaprojects as they suffer from a performance paradox where the project team fails to learn despite many opportunities to do so.

# Optimism bias – a political reality



System engineering and technical complexity are well understood, but uncertainty and stakeholder complexity are still big challenges for mega projects.

# Government's Role



- ▶ Only party capable and potentially willing to stand behind delivery of an integrated project is Government
- ▶ Contract aggregator
- ▶ De-risking – site conditions, utilities, community
- ▶ Pressure on governance and management



## Optimism Bias

- ▶ One way to deal with the effects of optimism bias is to innovate during the project to manage overruns and preserve benefits
- ▶ For this we need to increase the capability of client and contractors and provide opportunities for innovation One way to increase the capability of the client is to be able to predict issues before they arise and be able to mitigate those risks.
- ▶ In complex projects risk tend to grow exponentially due to the interactions of the various parties involved if their efforts are not coordinated

## Risk Identification

- ▶ Risk identification is the most important phase in risk management and the advantages of risk management hinges to a large extent on the approach used for risk identification
- ▶ Client's project team did not think that it was a realistic forecast (internal assessment showed a delay to the project completion date) and wanted to assess the risks to the project schedule (project timeline and logic). – ([Research in Project Governance : Trust and outcome](#))

Schedule risk analysis is a powerful tool to address this challenge. Thus, it was agreed that the board needed to have the Schedule risk analysis outputs while appreciating the complexity of the structure.

# Road Ventilation Facility – July 2018



# Road Ventilation Facility (PRVF)

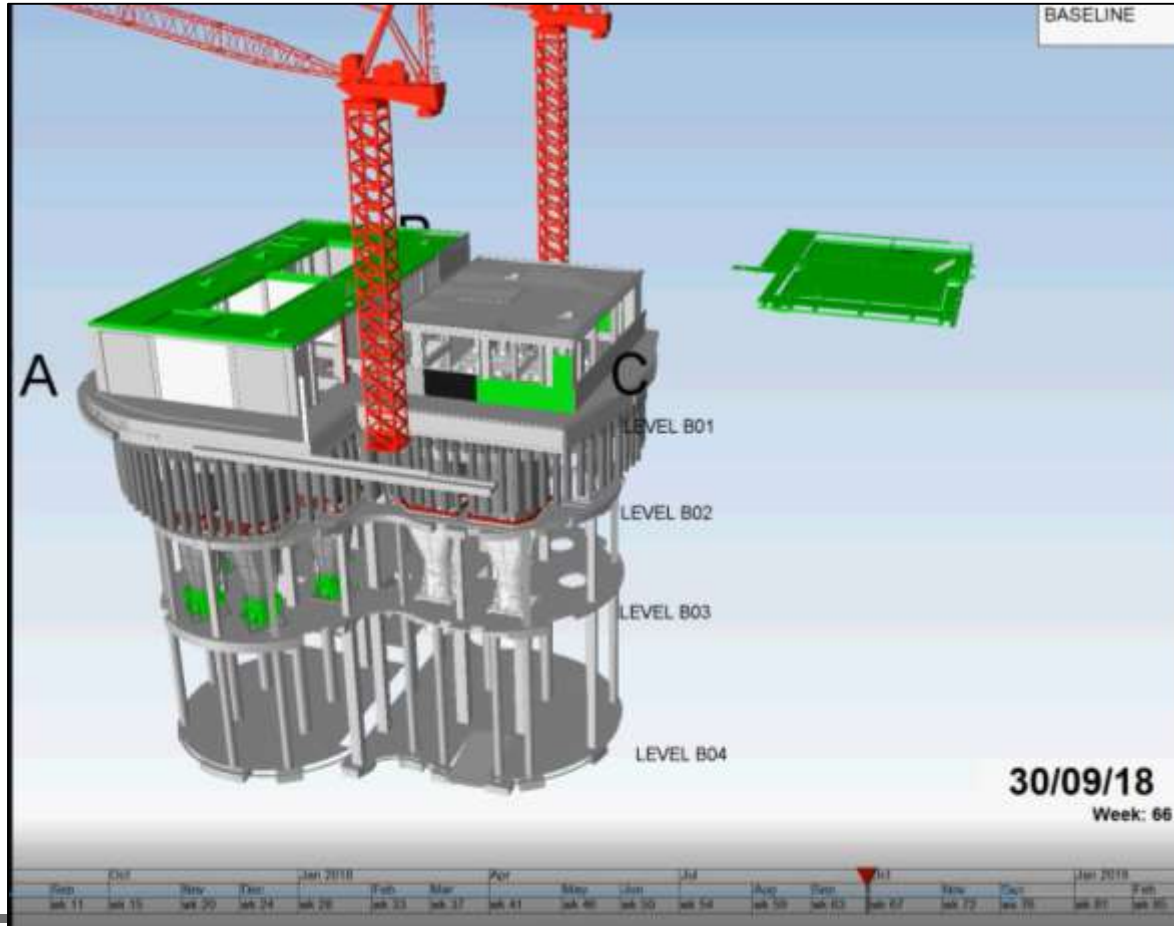
- 4D modelling used by SMC to track Contractor methodology and program. Syncho© for clash detection.
- Contractor using full 3D Revit model of RVF for building structure and M&E installation.





# Road Ventilation Facility – July 2018

- Full parallel program developed to provide certainty in Contractor's program using more conservative program assumptions and sequencing



# RVF excavation

- 45m deep clover-leaf shaft, 80,000 m<sup>3</sup> rock removed

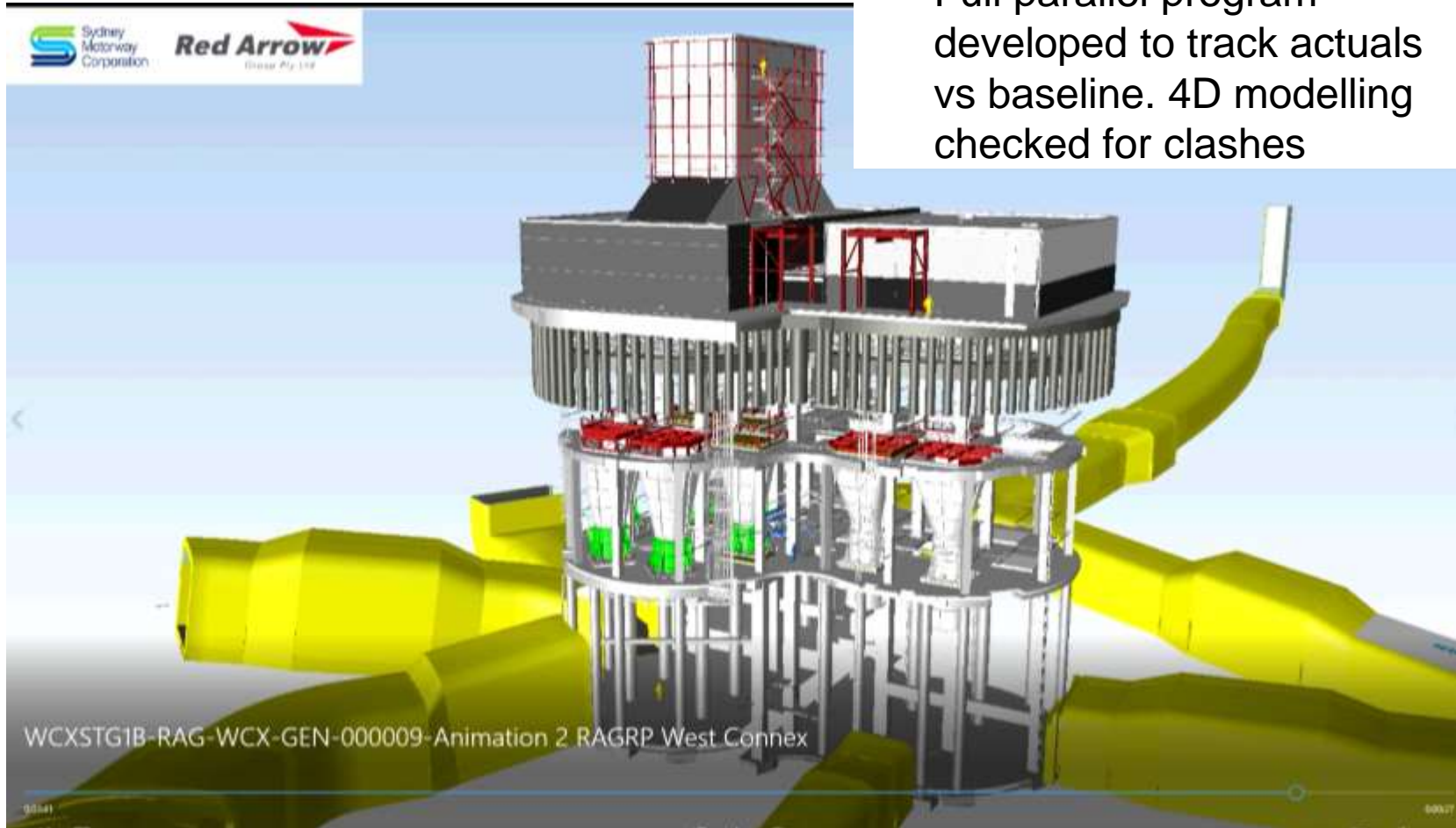


# RVF Temporary Props

- RVF props to support capping beam during excavation



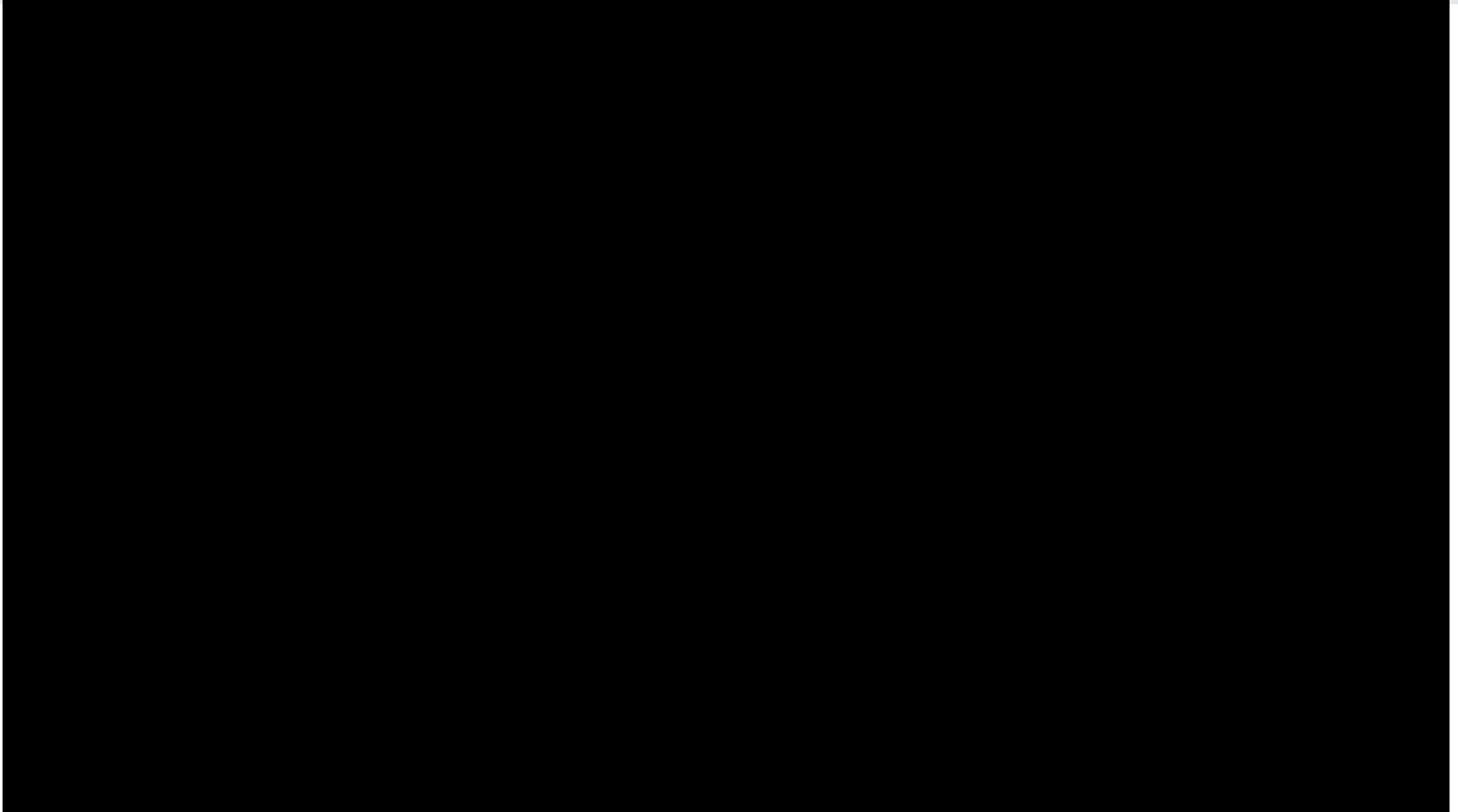
# RVF final configuration – 6 vent tunnel openings into shaft



- Full parallel program developed to track actuals vs baseline. 4D modelling checked for clashes

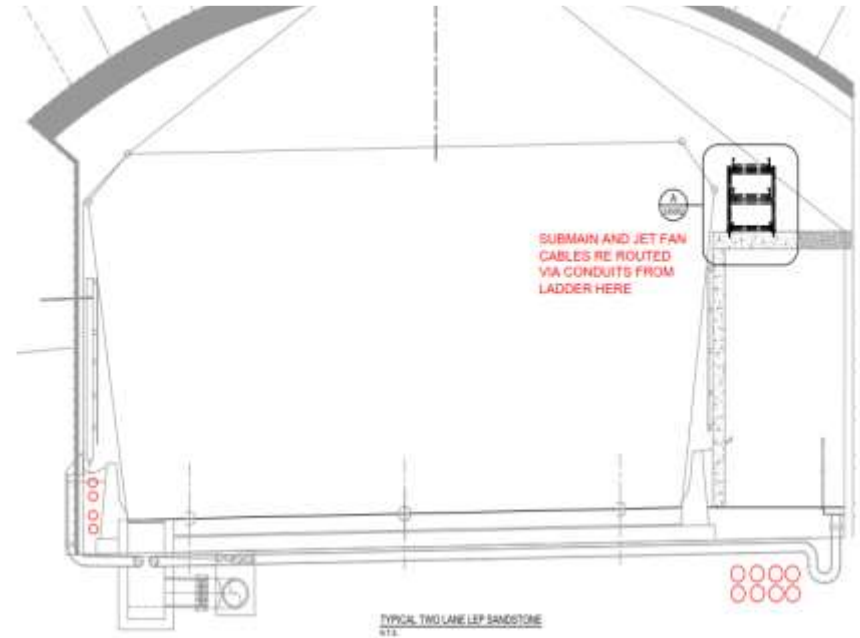
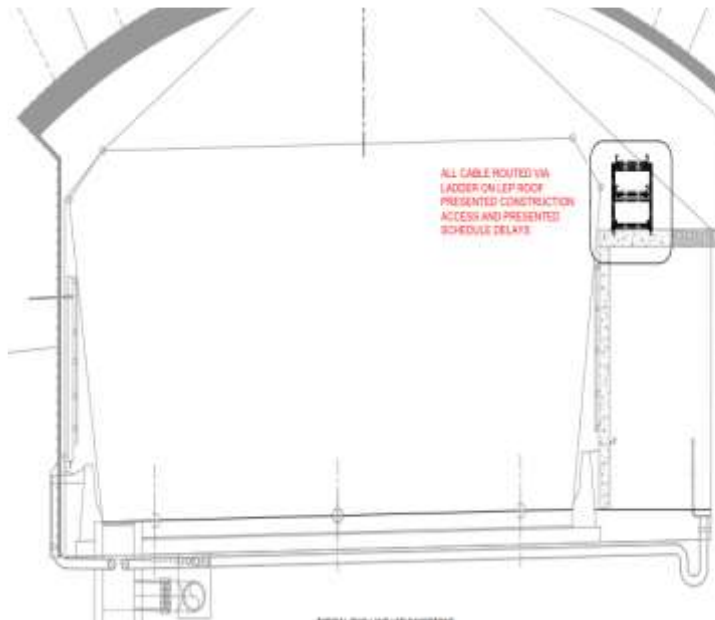


# A flavour of the animation



# Substation 8 Zone cable path design and installation

Change in design for cable path between Sub 8 and ramps via PRVF



# Cable path design and installation

**Change in design for cable path between Sub 8 and ramps via PRVF**

**Move the services into the trench rather than in roof of LEPs to install faster**

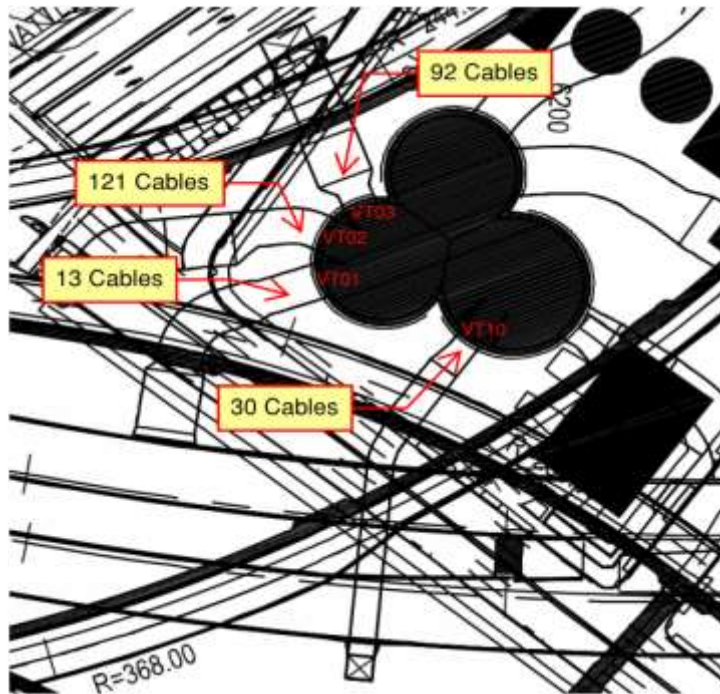
**Moved cable path from suspended under B03 to be in Basement floor.**

The re-routing of the submain cables allows the cables to be hauled earlier in the program because the M&E team does not need to wait for the BEW team to finish constructing the LEP.

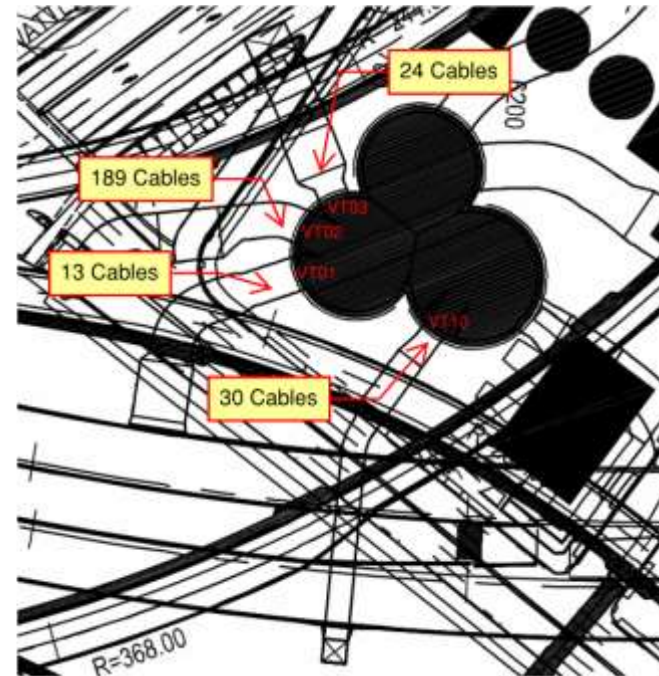
# Cable path design and installation

Change in design for cable path between Sub 8 and ramps via PRVF

Old Design



New Design



# Hidden Innovation in construction

- **Sector-level innovation**

Sector-level innovation is very visible and often produces radical or step change. It takes two principal forms. First, regulations and standards which prescribe new sector-wide product or material attributes (for example, structural integrity) or new behaviours (for example, health and safety regulation) forces 'compliance'

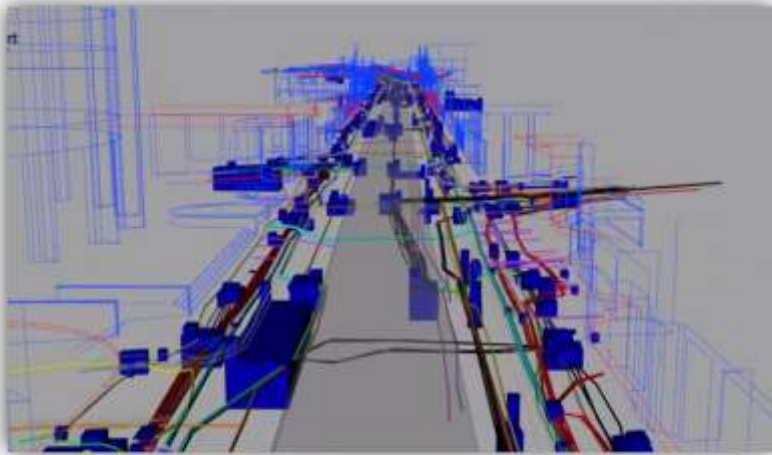
- **Business-level innovation**

Business-level innovation tends to be more obscure than sector-level, and can produce either radical or incremental innovation. The innovation focus is on general resource and capability development, rather than being project specific

- **Project-level innovation**

Project-level innovation activity is the most hidden, but arguably has the greatest impact on sector performance, and is generally incremental in nature.

# Still there's a GAP





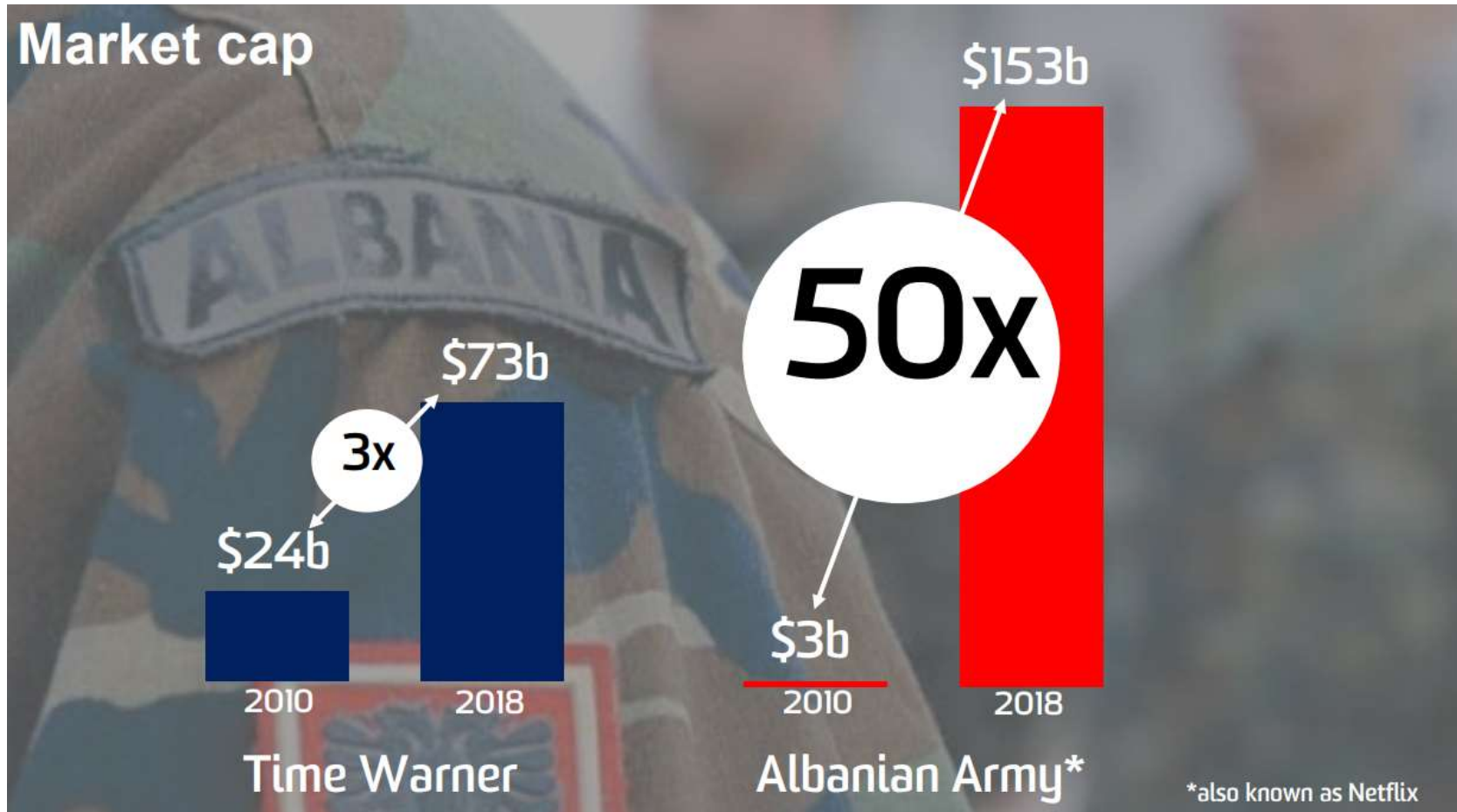
## Catastrophic Overconfidence

Is Netflix a threat?

“Is the Albanian army going to take over the world?”

Jeffery Bewkes, CEO Time Warner, 2010

# Catastrophic Overconfidence





Thank you



Homeshush Bay Drive Interchange - Aerial view of proposed tunnel portals (Artists impression only)