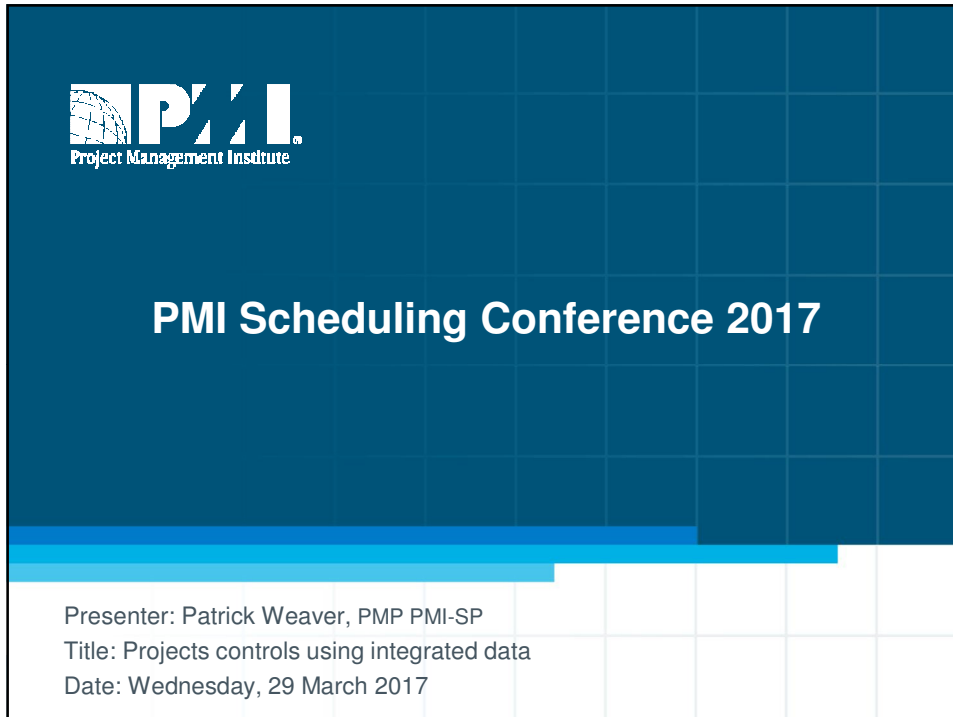


## Projects controls using integrated data – the opportunities and challenges!

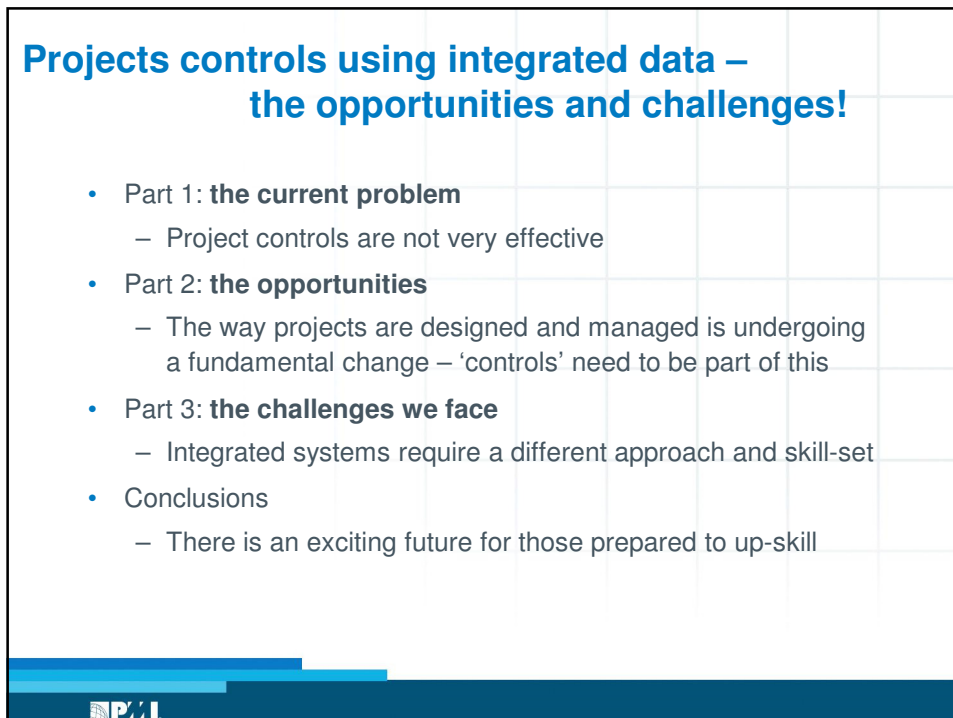


The slide features the PMI logo in the top left corner, consisting of a globe icon and the text 'PMI Project Management Institute'. The main title 'PMI Scheduling Conference 2017' is centered in white text on a dark blue background. Below the title, there is a horizontal bar with a blue-to-white gradient. At the bottom, the presenter's name, title, and date are listed in white text on a light blue background.

**PMI**  
Project Management Institute

### PMI Scheduling Conference 2017

Presenter: Patrick Weaver, PMP PMI-SP  
Title: Projects controls using integrated data  
Date: Wednesday, 29 March 2017



The slide has a light blue grid background. The title is centered at the top in blue text. Below the title is a bulleted list with four main points, each followed by a sub-point. At the bottom left, there is a PMI logo and a blue-to-white gradient bar.

### Projects controls using integrated data – the opportunities and challenges!

- Part 1: **the current problem**
  - Project controls are not very effective
- Part 2: **the opportunities**
  - The way projects are designed and managed is undergoing a fundamental change – ‘controls’ need to be part of this
- Part 3: **the challenges we face**
  - Integrated systems require a different approach and skill-set
- Conclusions
  - There is an exciting future for those prepared to up-skill

**PMI**

# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – current problems

- The current paradigm used for critical path scheduling is a dumbed-down solution to a complex set of problems required to allow software to run on primitive mainframe computers in the late 1950s!



See: **A Brief History of Scheduling**

[http://www.mosaicprojects.com.au/PDF\\_Papers/P042\\_History%20of%20Scheduling.pdf](http://www.mosaicprojects.com.au/PDF_Papers/P042_History%20of%20Scheduling.pdf)



## Projects controls – current problems

- Schedules are isolated 'islands of data'
- The data is complex and difficult to use
- Schedulers are rarely part of the senior management team
- Managers tend to ignore the schedule when making decisions



# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – current problems

- Schedulers are frequently hired based on their scheduling software skills
- They tend work in isolation developing large and complex schedules



## Projects controls – current problems

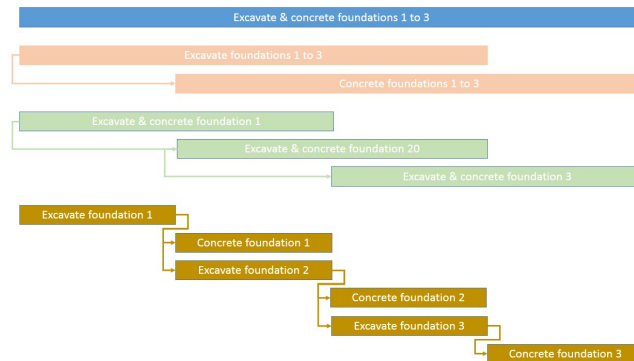
- The primary purpose of most schedules is to meet contractual requirements but there is no 'correct way' of scheduling the excavation and concreting of three foundations like this:



# Projects controls using integrated data – the opportunities and challenges!

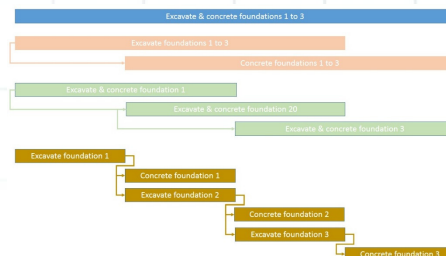
## Projects controls – current problems

- All of these options are correct (and many more complex options are equally viable):



## Projects controls – current problems

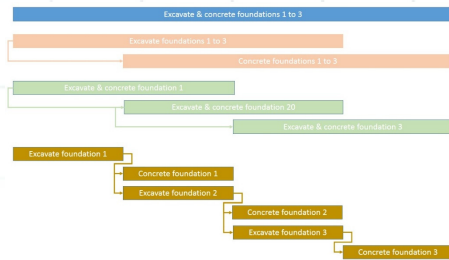
- Contracts typically require highly detailed schedules created early in the project lifecycle and make changing the 'contract program' difficult
  - The primary purpose is to protect the client from claims



# Projects controls using integrated data – the opportunities and challenges!

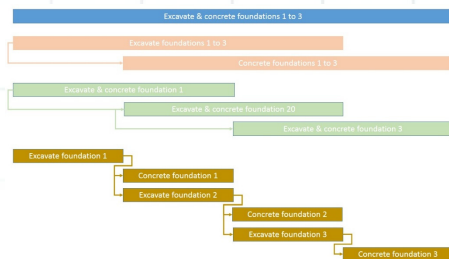
## Projects controls – current problems

- Contractors comply
  - To get paid!
  - With schedules designed to establish the basis for claims in the future
- **But no one can predict the future – EVER**
- The schedule is at best an informed assessment of what might happen!



## Projects controls – current problems

- The consequences are
  - The 'contract program' rarely relates to the construction process
  - Information generated is about the past and used for claims
  - There is little use of the schedule for forward planning and decision making
  - Most project run late
  - Many projects are the subject of disputation
  - 'Claims consultants' are seen as the pinnacle of the controls profession



# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – current problems

- A paradigm shift is required to proactively manage the time available to complete a contract
  - This has been attempted: ‘partnering’, ‘alliancing’, ECI contracts
  - With limited success and limited general acceptance
- But technology is starting to force the need for collaborative working
  - You cannot reap the benefits of ‘BIM’ on your own
- New technologies open up new possibilities for project controls to move back into the center of effective construction / engineering project management – **there are massive opportunities emerging!**



## Projects controls – opportunities

- We will look at a couple of these emerging technologies today
  - 4D BIM
  - Virtual reality
  - Drones and ‘big data’
- And their value as ‘controls tools’



# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- What is (and is not) project controls?
  - An agreed definition:

***Project controls are the data gathering, management and analytical processes used to understand, predict, and constructively influence the time and cost outcomes of a project or program through the communication of information in formats that assist effective governance and management decision making.***

- It is not the use of a scheduling tool or any other software – tools only facilitate a process they do not define it!

Source: [http://www.mosaicprojects.com.au/WhitePapers/WP1093\\_Project\\_Controls.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1093_Project_Controls.pdf)



## Projects controls – opportunities

- BIM as a control tool
  - BIM = Building Information Modelling
  - 3D BIM provides a fully integrated three dimensional model of the structure – allows integrated design and clash detection between components (eg, pipes and ducts)
  - BIM components in the model carry significant data including, dimensions, specifications, and facilities management information
  - Full BIM means the building is designed within an single integrated BIM model (most uses today are 'federated')

For more on BIM see: [http://www.mosaicprojects.com.au/WhitePapers/WP1082\\_BIM\\_Levels.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1082_BIM_Levels.pdf)





# Projects controls using integrated data – the opportunities and challenges!

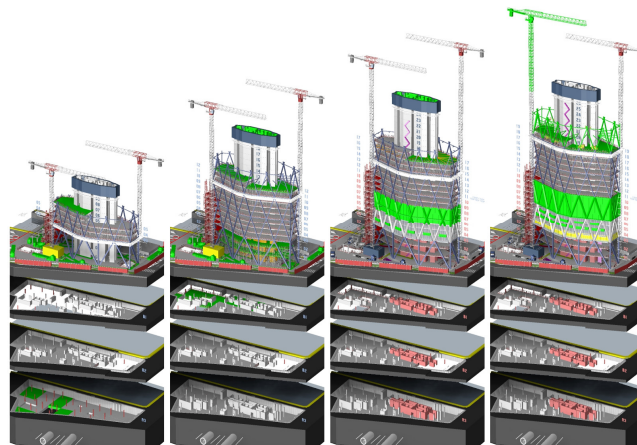
## Projects controls – opportunities

- 4D integrates 'time' as an element in the BIM model
- Current 4D capabilities are federated
  - A 3D BIM model is developed
  - A schedule is developed and mapped to BIM elements
  - The schedule information is incorporated in the model
  - People can 'see' how the construction will progress
  - Observations are fed back into the schedule
  - Repeat as needed



## Projects controls – opportunities

- Current 4D BIM produces some very useful insights:



Source: <http://www.freeform3d.co.uk>



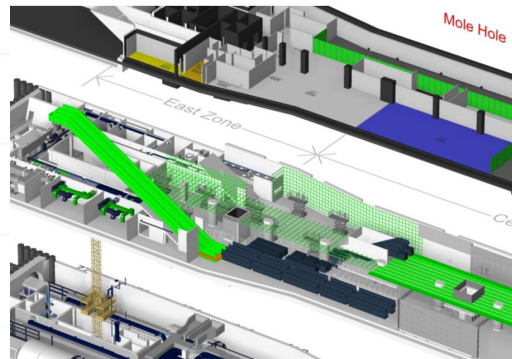


# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- Current 'bleeding edge' capabilities include:

- The ability to model in real time clashes in working space provided the space needed for each crew's work is parameterised. Change the timing of one work crew and the effect on others in a space is highlighted.

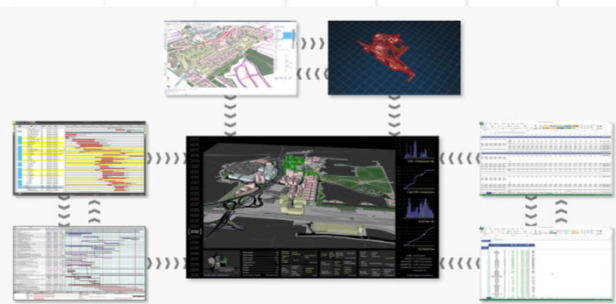


Source: <http://www.freeform3d.co.uk>

## Projects controls – opportunities

- Current 'bleeding edge' capabilities include:

- The ability to import schedule timings from a range of standard tools to animate the building of the model, and to feedback information derived from processes such as the identification of clashes in the use of work space, cash flows (5D), etc.

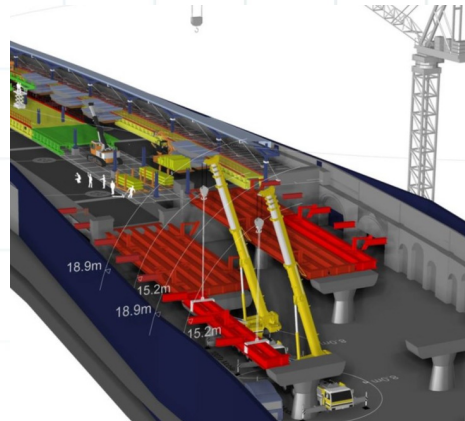


Source: <http://www.freeform3d.co.uk>

# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- Current 'bleeding edge' capabilities include:
  - The space occupied by temporary works and various pieces of equipment can be defined and clashes with permanent works identified over time.



Source: <http://www.freeform3d.co.uk>

## Projects controls – opportunities

- Virtual reality adds to this to include:
  - The ability to view the work from any position at any time in the construction process; allowing things such as a tower crane driver's actual line of sight to be literally 'seen' at different stages of the construction.

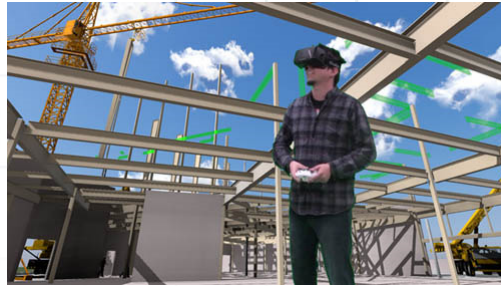


Source: <http://www.freeform3d.co.uk>

# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- Virtual reality adds to this to include:
  - The ability for a person to see and move around within the virtual model using the same type of 3D virtual reality goggles used by many gaming programs. The wearer is literally immersed in the model.



## Projects controls – opportunities

- Opportunities and possibilities for ‘controls’ in a fully integrated 4D BIM environment:
  - To plan the work the ‘planning team’ put on their virtual reality headsets and literally ‘walk’ onto the site. As they start to locate temporary works and begin the building process the model is tracking the use of resources and physical space in real time. Decisions can be made to adjust the size of resource crews and the flow of work can be optimised to balance the competing objectives of cost efficiency, time efficiency and resource optimisation. Different scenarios can be stored, replayed and edited – the ultimate ‘what-if’ experience.



# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- Opportunities and possibilities for 'controls' in a fully integrated 4D BIM environment:
  - BIM objects from standard libraries contain supply chain and work content information
    - Track all off site (supply chain) processes for each object
    - See the effect of decision to make changes in real time
    - Automatically constrain on-site activities based on supply chain constraints



## Projects controls – opportunities

- Opportunities and possibilities for 'controls' in a fully integrated 4D BIM environment:
  - BIM is already used via PDAs to provide information on 'what' to build (replacing paper drawings and specifications) and 'where' to build it
  - Enhance this to include 'when' information. Current work and the intended sequence of future work
  - Automatically track progress, as a job is marked 'complete' in the BIM model (locking it to prevent unnecessary changes) the integrated schedule is updated



# Projects controls using integrated data – the opportunities and challenges!

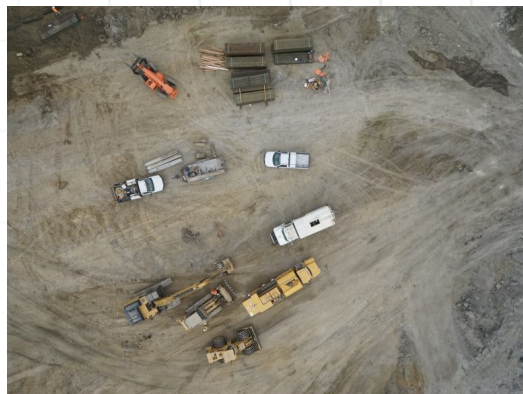
## Projects controls – opportunities

- Opportunities and possibilities for 'controls' in a fully integrated 4D BIM environment:
  - Use the actual data to update the BIM libraries on production rates, etc.
  - This is not 'science fiction' London's Cross Rail project is already using 4D BIM to detect and avoid clashes in the use of working space and to record the status of work on a weekly basis



## Projects controls – opportunities

- Big data – Drones, RFID, etc.
  - The amount of data available for project 'controls' use is exploding
  - Drone images can define the precise amount of material excavated (or placed), monitor stockpiles and help OH&S inspections



# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – opportunities

- Big data – Drones, RFID, etc.
  - Vehicle tracking and remote operation are already used in mining
  - RFID allows the precise location of anything to be tracked
  - **BUT data is not information**



## Projects controls – Challenges

- Integrated 4D BIM will require progressive planning and collaboration:
  - As the overall BIM model is developed the planners work with management to set out an overall approach (strategy) for the work and set the time budgets for the project
  - As the various suppliers are identified their work is incorporated within the schedule in more detail
  - The short term detailed planning of precisely who does what, where and when is done on-site with the work crews based on actual production rates

For more on 'Schedule Density see:

[http://www.mosaicprojects.com.au/WhitePapers/WP1016\\_Schedule\\_Density.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1016_Schedule_Density.pdf)





# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – Challenges

- Integrated 4D BIM will require progressive planning and collaboration:
  - When inevitable problems occur, the project management team have the ideal tool to work through solutions and determine the optimum way forward, as soon as the new schedule is agreed, the BIM model already holds the information
- **But facilitating this type of approach will need a very different contractual approach!**



## Projects controls – Challenges

- Data is not useful management information
  - The challenge for construction professionals using drones and other 'big data' sources is to draw meaning from data they create
  - Care is needed to avoid 'spying' on people. Ethically individuals must be informed of how their personal data (ie their image) is being processed. Covert 'spying' on employees or subcontractors is unethical and is unlawful in many jurisdictions
  - **Controls professionals will need to be able to extract meaningful data quickly and make it available to management for decisions and action**





# Projects controls using integrated data – the opportunities and challenges!

## Projects controls – Conclusions

- This presentation has only 'scratched the surface' of the potential changes being opened up by new technologies
- In a few years the ability to use scheduling software is likely to be as out-of-date as the ability to manually draw and calculate a CPM schedule is today – if you want to stay relevant you will need to start developing completely new skill sets
- **The biggest challenge** – getting project controls professionals embedded in the development of BIM and the other emerging technologies so their development incorporates useful controls processes and functions



## Projects controls – Conclusions

- **The other big challenge** – changing attitudes
  - Collaboration not confrontation
  - Progressive, dynamic management of the project time
  - Problem solving rather than blame placing
  - Generating useful information and advice from masses of data – and having the advice listened to by management
  - Sorting out the ethical and legal issues around ownership, traceability and liability for each data element in an integrated BIM model accessed by many people
- **The future is going to be exciting, but only for those who are willing to embrace the opportunities**

For more on traceability see

<https://mosaicprojects.wordpress.com/2016/12/13/the-yin-and-yang-of-integrated-data-systems/>



## Projects controls using integrated data – the opportunities and challenges!

### Projects controls – Conclusions

*If you don't like change you are  
going to like irrelevance less.*

Gen. Eric Shinseki (US Army retired)



Thank you

Questions?



[www.PMI.org](http://www.PMI.org)