



**The Experts in Design Build Operate Solutions**



# Using BIM for Construction Layout

“Where BIM meets the real world”

February 2015



## Who is Mark Forrest?



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- Managing Director of BuildingPoint Australia
  - BuildingPoint Australia represents Trimble Buildings products throughout Australia
- 20+ years experience introducing technologies to the Construction industry
- Pioneered 3D machine control solutions with Trimble

## The high cost of Rework!

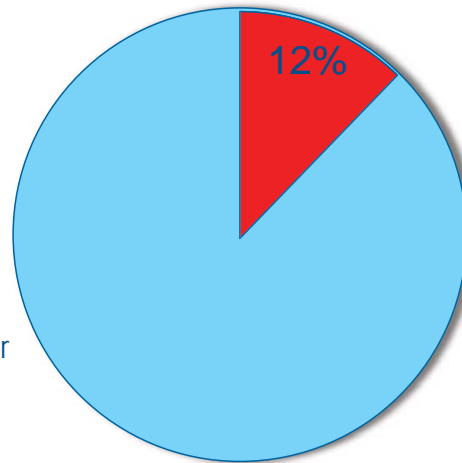


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### "Rework in Civil Infrastructure Projects: Determination of Cost Predictors"

- 161 Australian construction projects
- Direct cost 6.4%
- Indirect costs 5.6%

Total **12%** of contract value!



(A Rework Reduction Model for Construction by Peter E D Love, Zahir Irani and David Edwards)

## Factors that lead to rework



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30% design error

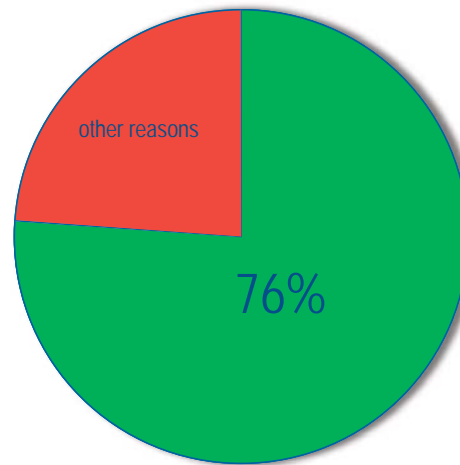
46% construction execution

### 1. Setting out errors

2. Inadequate supervision
3. Staff turnover
4. Low skill level

24% other reasons

1. poor or incompatible materials
2. damage to other trades
3. Weather



Modern Design Tools have provided unprecedented design freedom...



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...yet many Layout techniques have changed little since the Pyramids...



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- Manually scaling distances and calculating angles from plans
- Turning angles with theodolites
- Pulling tapes to measure distance & 90 degree angles





# Trimble Layout System Components



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**Trimble RTS Series  
Robotic Total Station**



**Inverted  
Layout Rod**



**Trimble Field Tablet with  
Trimble Field Link for MEP**



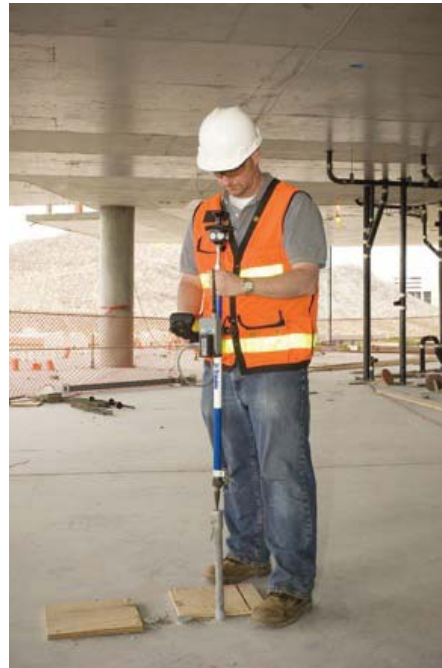


# Laying Out with a Robotic Total Station



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- Instrument is set up and referenced to the job by measuring known reference points
- A location to lay out is identified
- The horizontal and vertical angles that the instrument must turn to are calculated
- The distance from the instrument to the point is calculated
- The user is given guidance to desired location



# Trimble RTS Robotic Total Stations

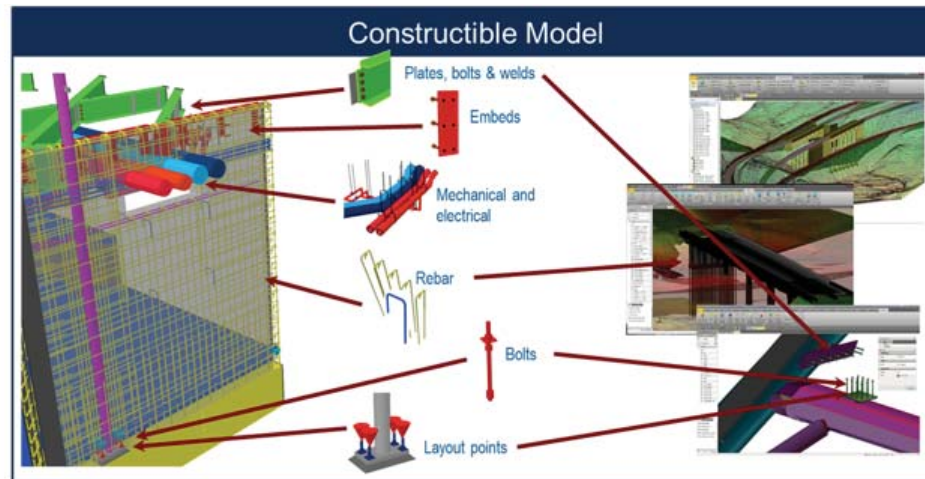
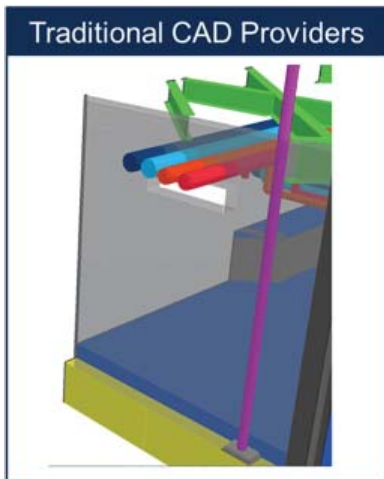


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- Highly accurate measurement  $\pm 2$  mm
- Range of up to 700 meters
- Measurement without prism
- Optional integrated camera in the robotic total station
- Bright Red or Green Laser Pointer used for visual layout
- Used in conjunction with Trimble tablets



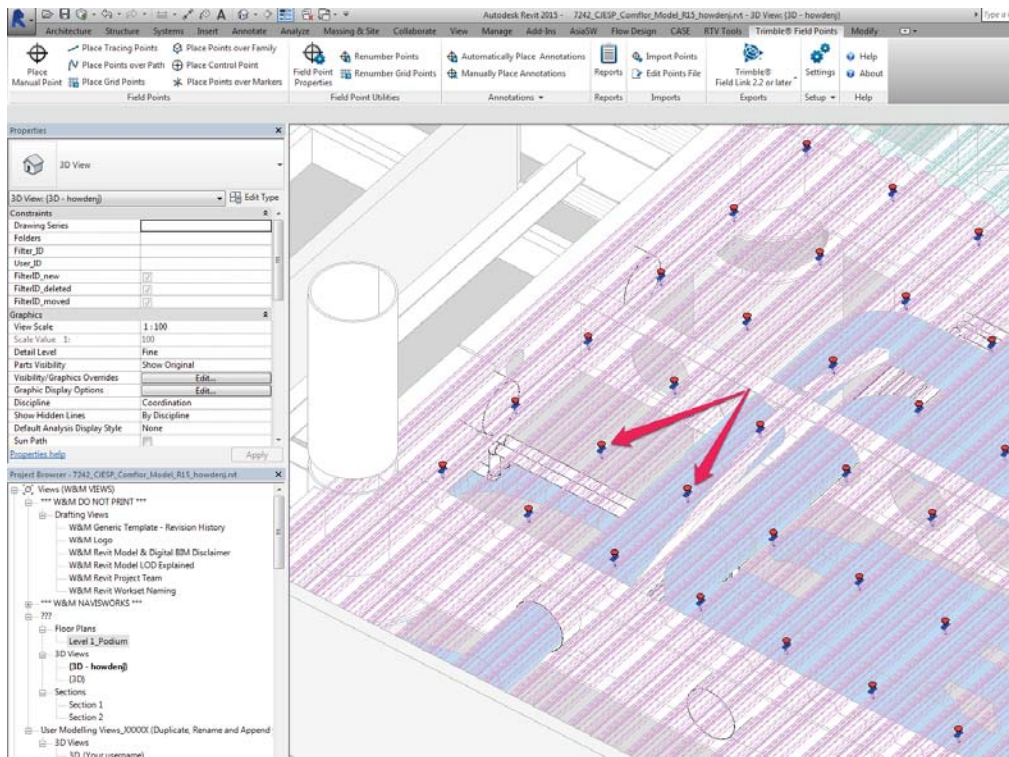
# The Constructible Model



# Direct export from the model to the controller



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# User Interface - Trimble Field Link for MEP



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Trimble Field Link: Level 1\_Mechanical Layout

Back: 3' 9 3/8" Left: 6' 10 7/8" Up: 1/4"

Point Lay Out

75 HP

☒ Visual Layout Aim Stake

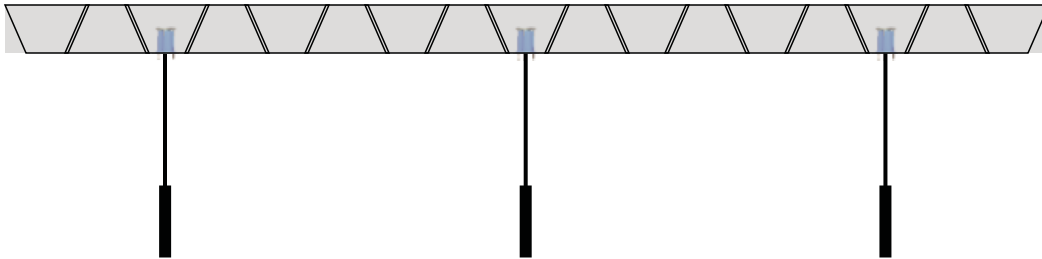
70	HP	○ +
71	HP	○ +
72	HP	○ +
73	HP	○ +
74	HP	✓ +
75	HP	○ +

Total: 30 Remaining: 29

## On The Deck From Above



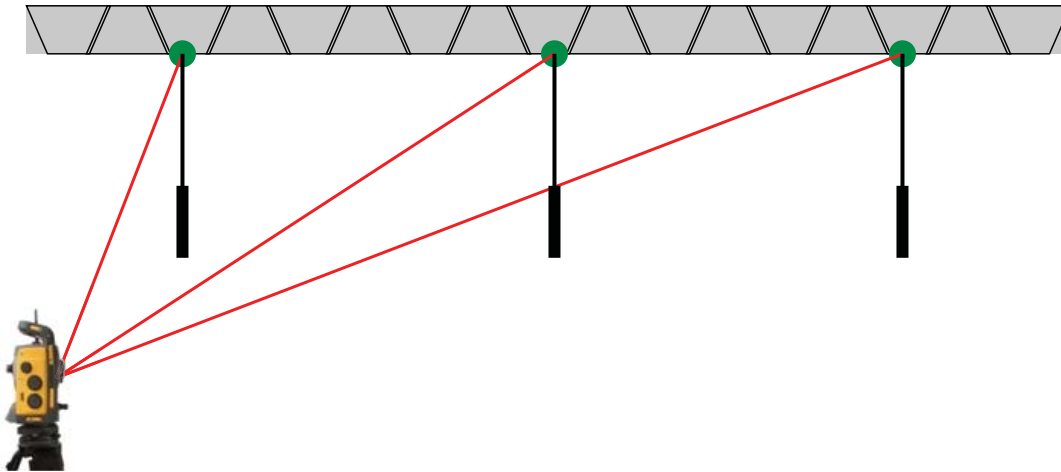
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## On The Ceiling From Below



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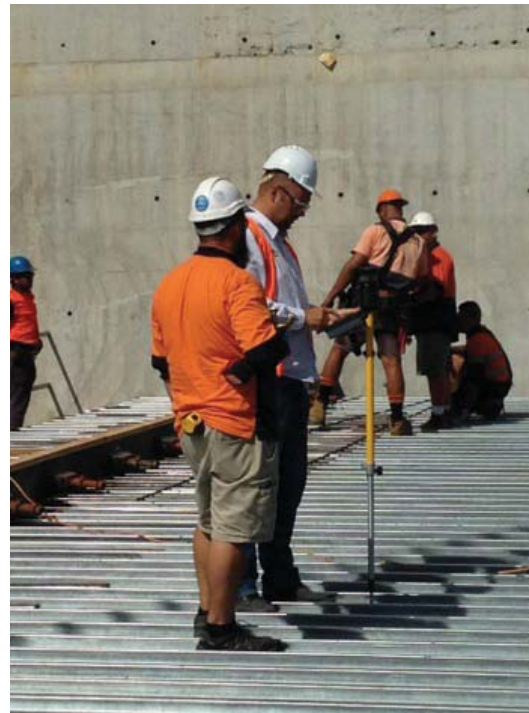


# Common Applications



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- **Lay out of points**
  - Equipment bolt down locations
  - Underground piping stub-ups
  - Floor penetrations for piping
  - Anchor and hanger locations for suspended systems
- **Lay out of lines and arcs**
  - Underground piping
  - Wall penetrations for piping & duct
  - Anchor and hanger locations for suspended systems
- **Measure points**
  - Locate existing floor penetrations
  - Locate existing anchor and hanger locations for suspended systems
- **Measure lines and arcs**
  - Locate existing structure & spatial utilization
  - Locate existing equipment boundaries
  - Locate existing piping & duct



# Some times it takes more than one!



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- Deck with four robots working at a new hospital wing in PA
- Not as uncommon as you may think



# Local success! – 111 Eagle Street



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- Fifty-six floor building
- Six “Green Star” Project
- Separate runs of ductwork for both heating and cooling
- Most floors requiring over 500 duct hanger points per floor.
- Layout Productivity
  - Able to layout over 500 pts. per day
  - Saving on this job alone, \$70k. Real saving is 2 men over 12 months, \$140k
  - Months ahead of schedule



## Advice for BIM Managers...



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- Learn and understand the field requirements and be able to effectively communicate the benefits
- Ensure you have Constructible models
- Reduce the BIM intimidation
  - Limit the use of BIM words & acronyms...
- Encourage the contractors to embrace new technologies and processes and generate real \$ savings



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**For a copy of this presentation and our  
Transforming BIM to Field whitepaper...**

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**[whitepaper@buildingpoint.com.au](mailto:whitepaper@buildingpoint.com.au)**



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Thank you!