Executing with BIM in the field

The next wave of productivity improvement and benefits awaits

Ragnar Wessman
Director of Product Architecture
Trimble Engineering & Construction Sector

Trimble: A Global Partner

Engineering and Construction Segment
>50%
Of Total Revenue

Customers in over
150
Countries

$2.5B+ in Revenue

6,000+ Employees

Over
2,000
Trimble Patents Issued

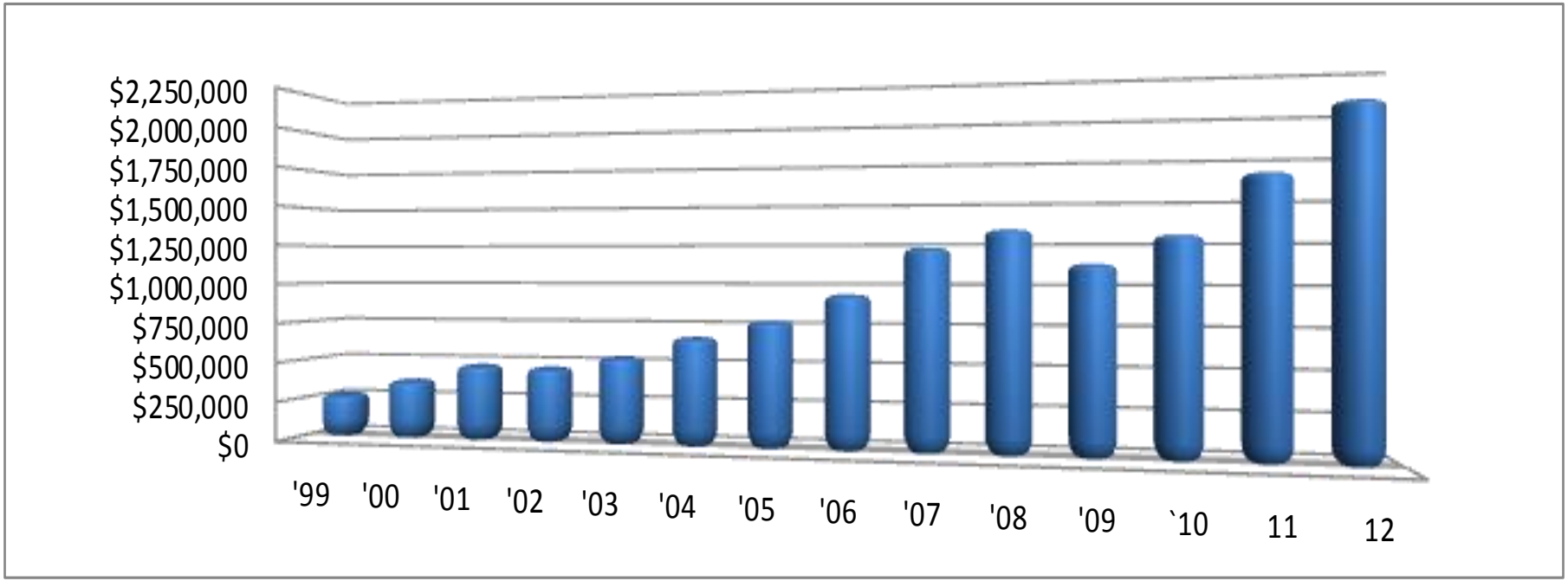
Trimble Facilities in
33
Countries

Global R & D:
36 Sites 36
11 Countries 11
12 Time Zones 12

64%
of Technical Personnel are in Software

Strong History of Financial Progression

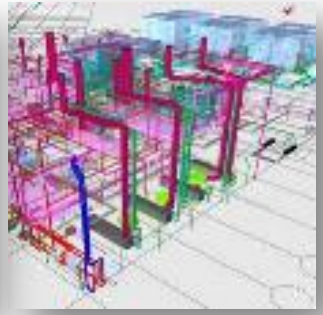
Compound annual growth since 1999 **16.4%**



Core industry focus

Agriculture

Heavy Civil Construction



Building Construction

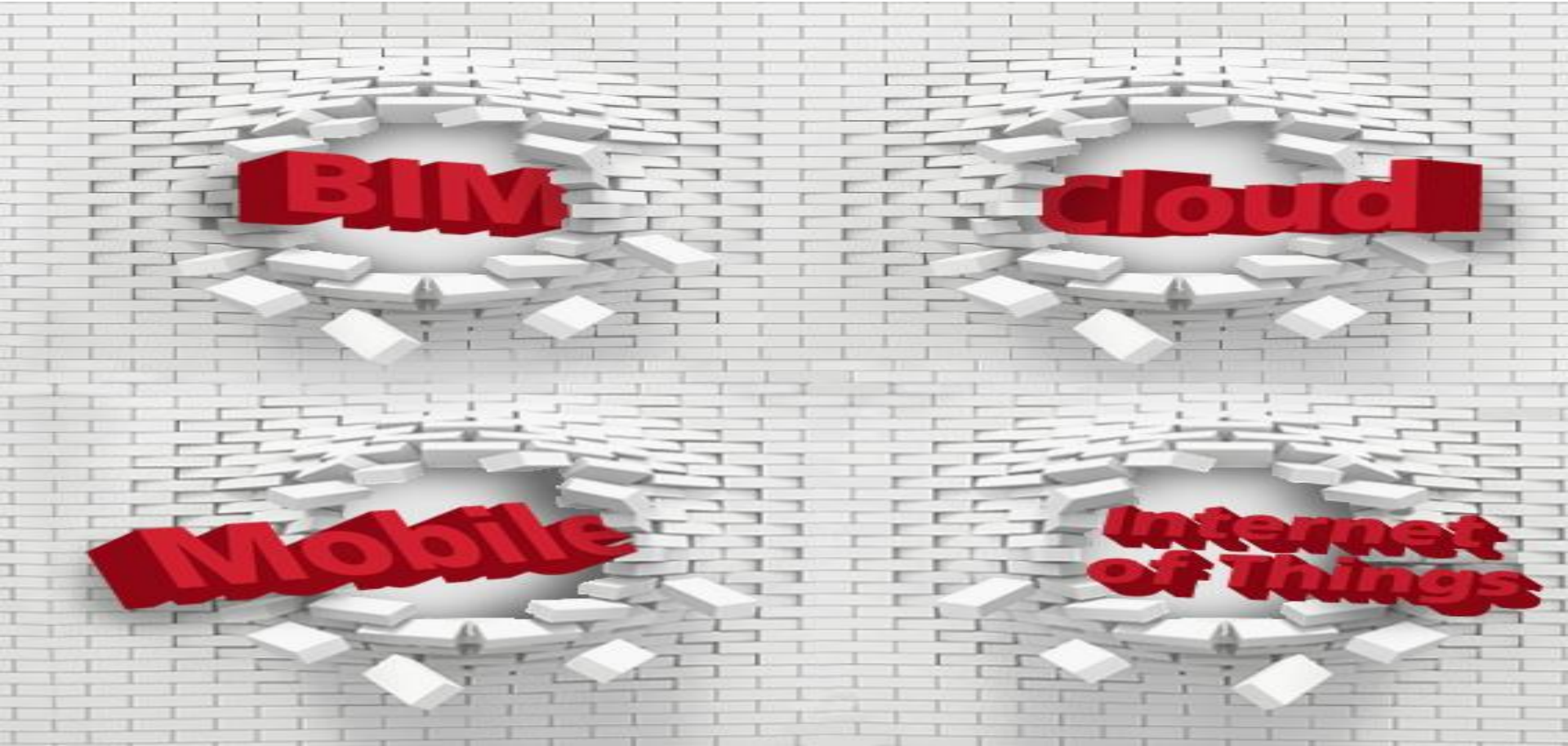
Geospatial

Transportation & Logistics

Our core industries are global trillion $ industries which operate in demanding environments, with technology adoption in the early phases

THE CONSTRUCTION WORLD IS CHANGING

New Technologies – New Opportunities

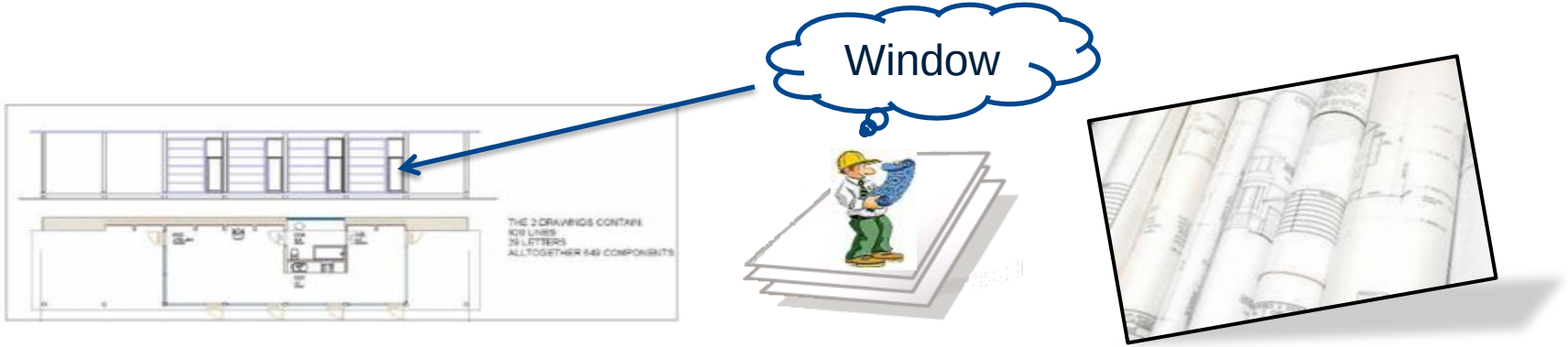


What is BIM?

What are drawings?

- Drawings are an inconsistent, ambiguous, and human only readable description of a building

- Information content = Lines and text



What is Building Information ?

- **A Building Information Model is a virtual description of a facility**
  - a virtual model
- **Information Content = Building objects with geometry & properties**
  (semantic information)
  - Wall, Floor, Column, Beam
  - Duct, Pipe, Cooler, Heater
  - Door, Window, Chair, Table

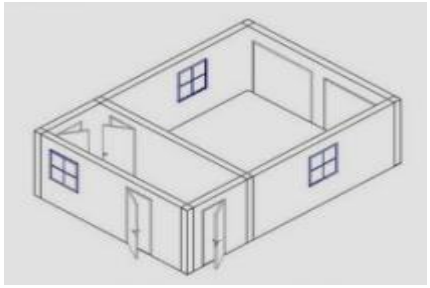
Window:
Type: Fenestra A206
Size: 1200x600
Glass: opaque
Open: left
…

Building Information

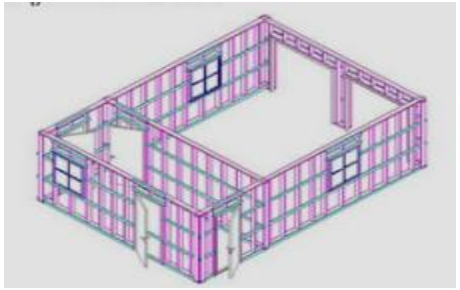
What to build? - objects describing the building – the end result

Abstract objects

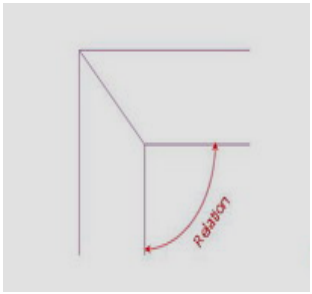
Functional objects



Physical objects



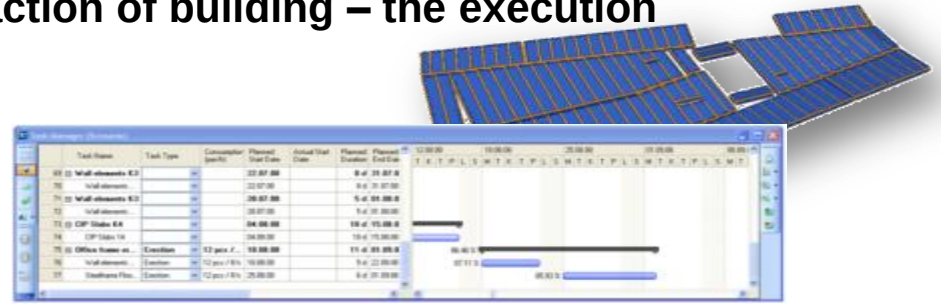
Logical objects



How to build? - objects describing the action of building – the execution

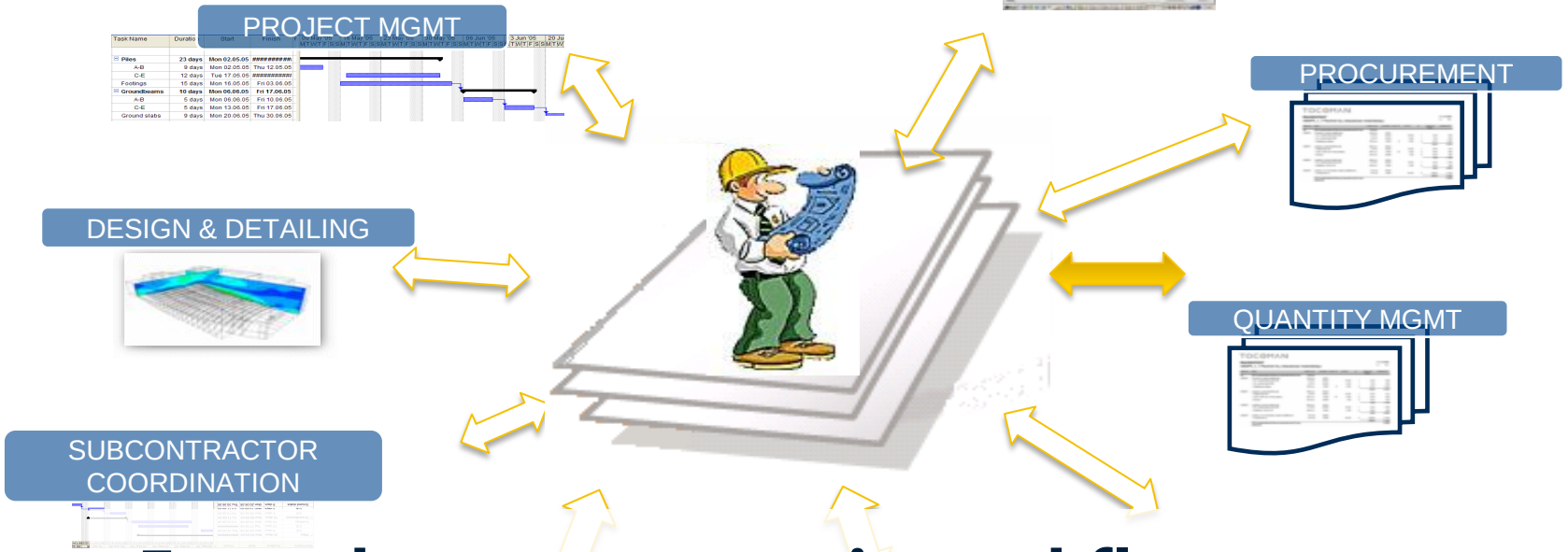
- Schedules
- Resources
- Costs
- Quality assurance
- Project controls

- Tasks
- Work
- Approvals
- RFI:s
- Submittals
- …



DRUM - Distributed information management

From human readable to machine readable



From document centric workflows to data centric workflows

From modeling to consuming information

Human consumption

- Viewing the virtual thing as opposed to drawings of it
- Augumented reality

Software consumption

Software combining input from various sources and with the help of human beings producing new information to be used in the workflow

Machine consumption

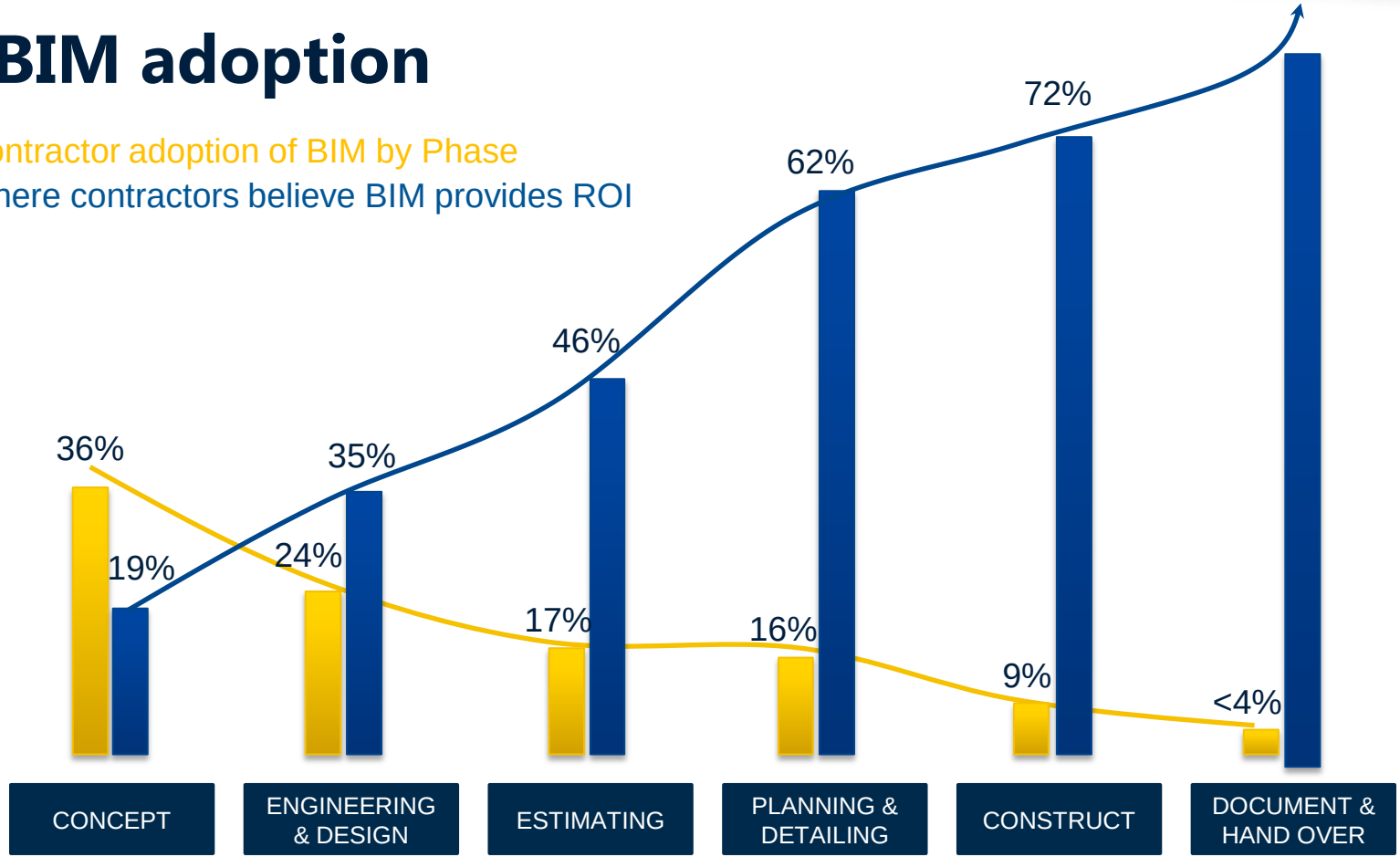
Machines, robots, fabrication equipment, on site equipment

FROM DESIGN BIM TO CONSTRUCTION BIM

BIM adoption

% contractor adoption of BIM by Phase

% where contractors believe BIM provides ROI

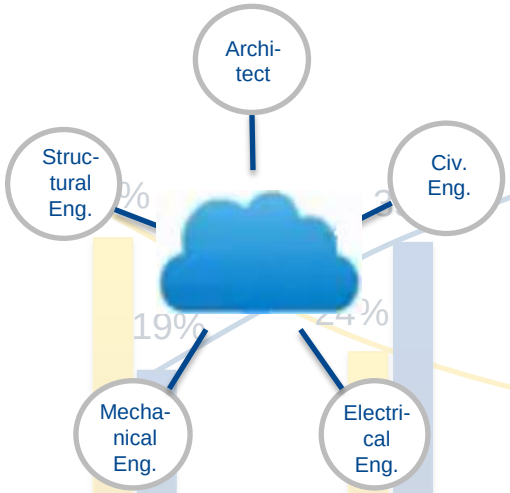


Sources: (1) McGrawHill SmartMarket Report; The Business Value of BIM in North America (2) McGrawHill SmartMarket Report; The Business Value of BIM for Construction in Global Markets, (3) Internal Trimble market estimate

% contractor adoption of BIM by Phase

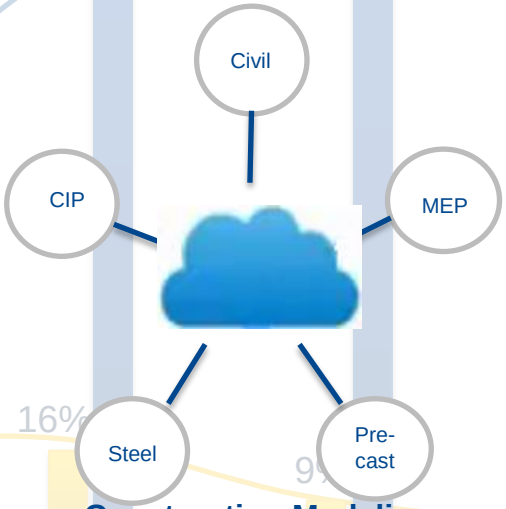
% where c… BIM provides ROI

Design BIM



Drawings and/or models

Construction BIM



72%
62%
46%
24%
19%
17%
16%
9%
<4%

Design Modeling & Design Coordination

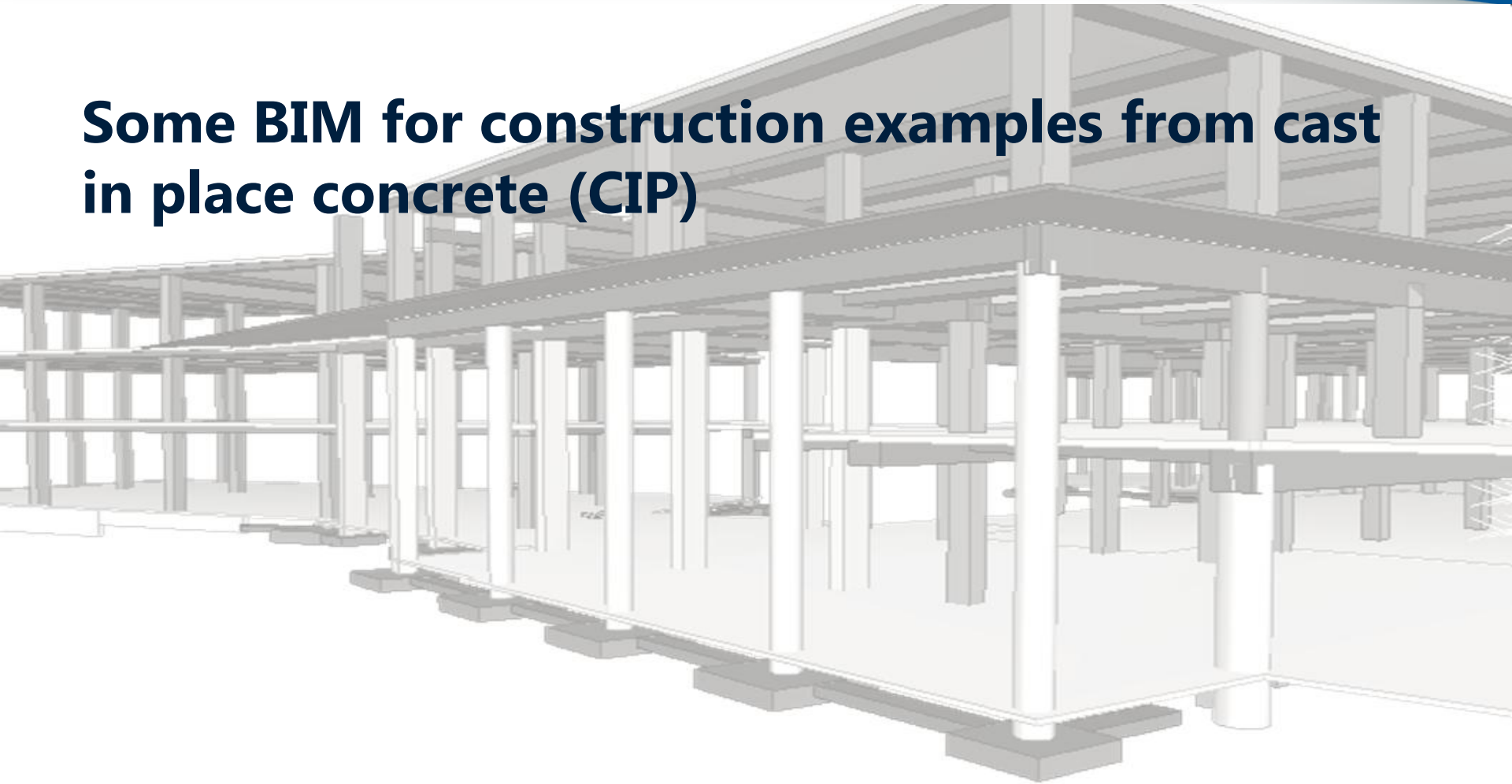
Construction Modeling, Estimating, Procurement, Fabrication, Logistics, Site excecution, Project Controls

CONCEPT | ENGINEERING & DESIGN | ESTIMATING | PLANNING & DETAILING | CONSTRUCT | DOCUMENT & HAND OVER

Sources: (1) McGrawHill S… The Business Value of BIM in North America (2) McGrawHill S… Report: The Business Value of BIM for Construction in Global Markets, (3) Internal Trimble market estimate

BIM TO CONSTRUCTION - BIM TO FIELD

Some BIM for construction examples from cast in place concrete (CIP)



Construction BIM – BIM to Field

Estimators, Quantity Surveyors

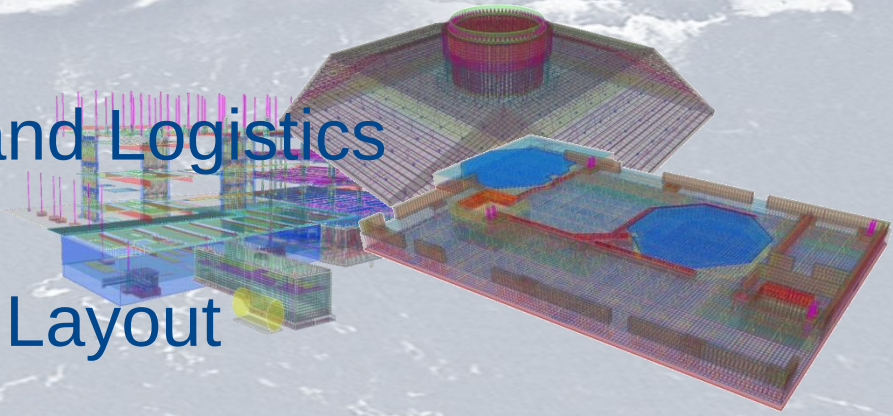
Structural Detailers/ Engineers

Project Managers, Site Engineers, Superintendents, Foremen, Site crews

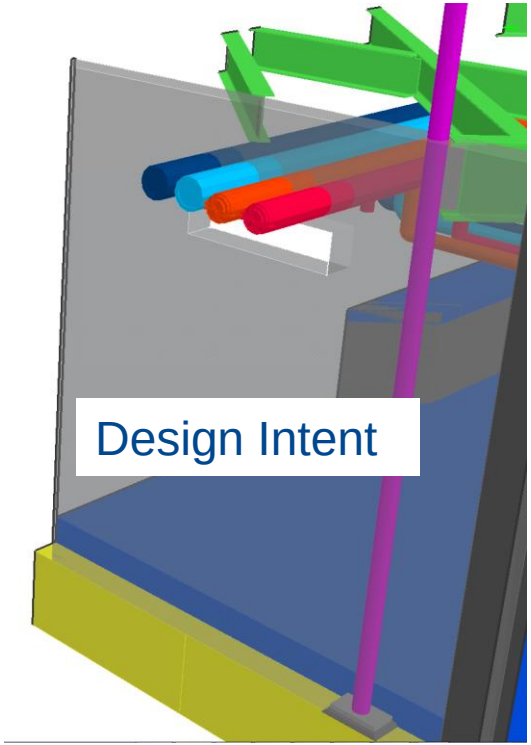
Rebar Detailers

Some model based workflows

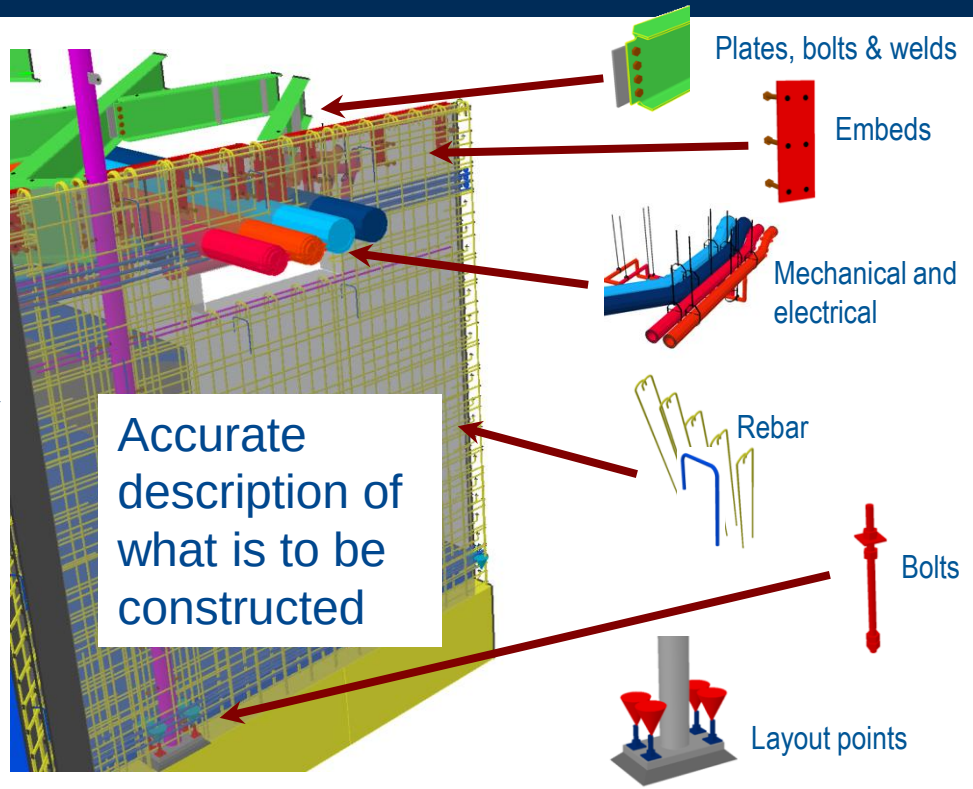
1. Construction Modeling
2. Quantity Take-Off
3. Coordination & Communication
4. Planning and Logistics
5. Field Layout



Design Model

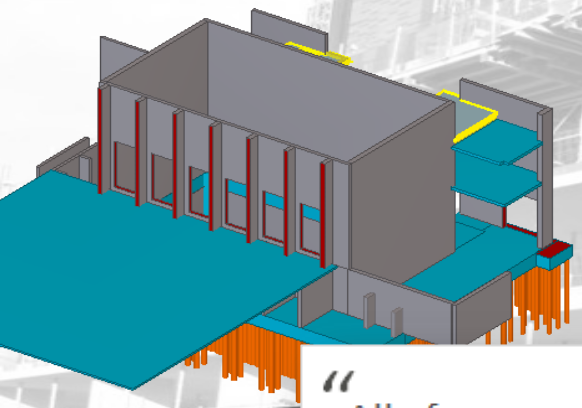


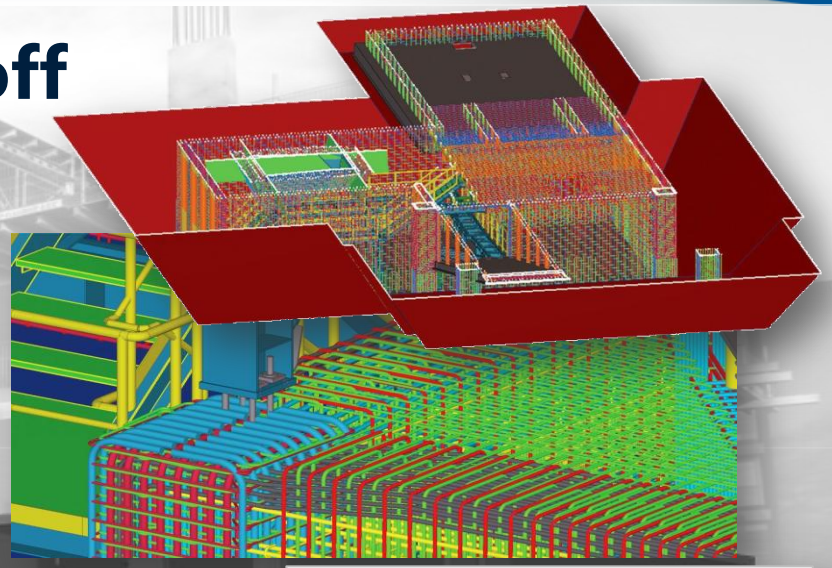
Constructible Model



CONCEPT | ENGINEERING & DESIGN | ESTIMATING | PLANNING & DETAILING | CONSTRUCT | DOCUMENT & HAND OVER

Model based quantity takeoff





"All of our tenders are now completed with Tekla. The quantities are **accurate** and we get them **50% faster**."

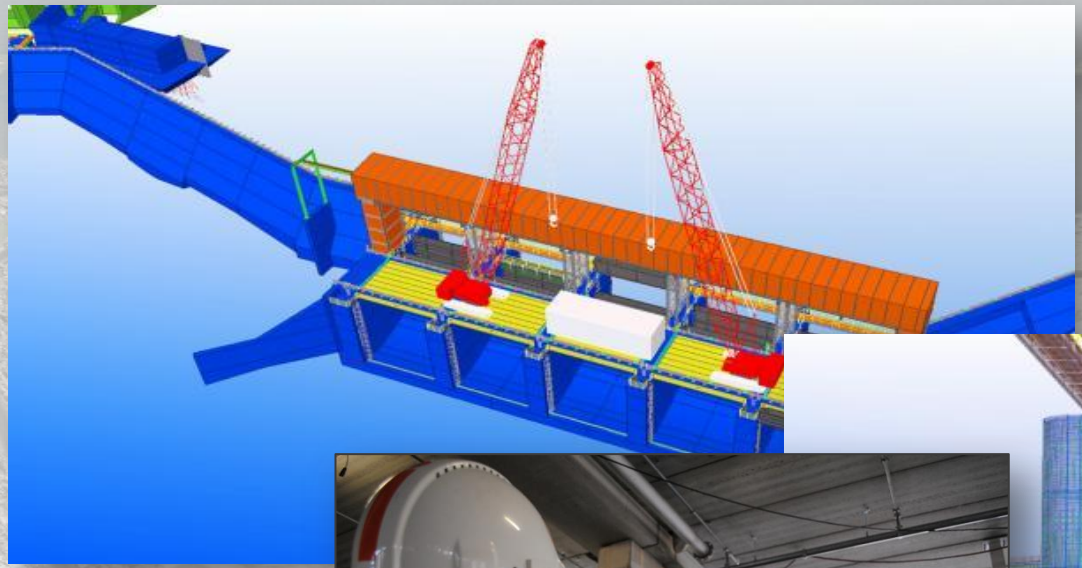
Rob Smith, Director

CIDON CONSTRUCTION

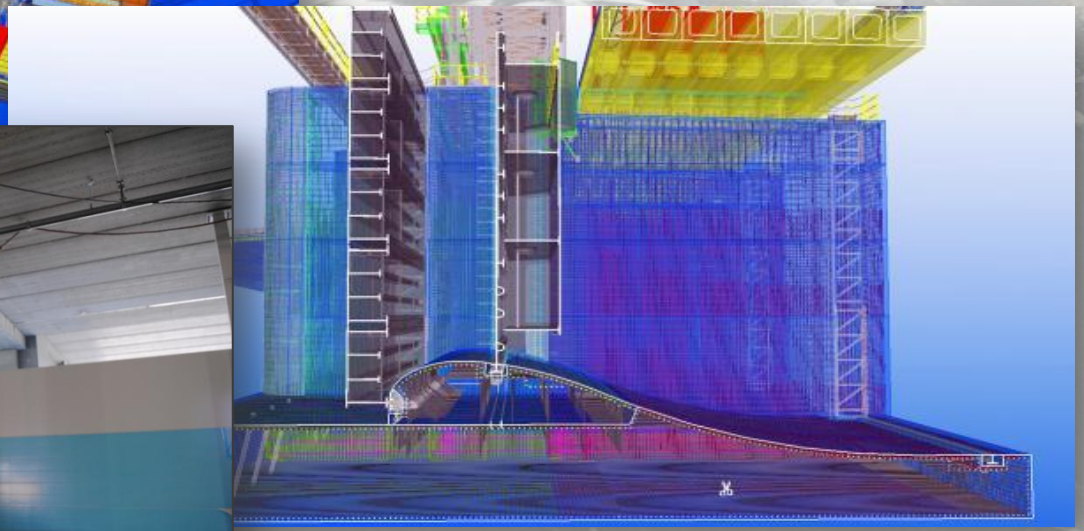
"Tekla reduces the time and manpower required to do the quantity take-off and allows us to come up with bids quickly, accurately and competitively."

Mr Nguyen Dinh Quan, Head of the Engineering Department, Polysius Vietnam

Construction coordination

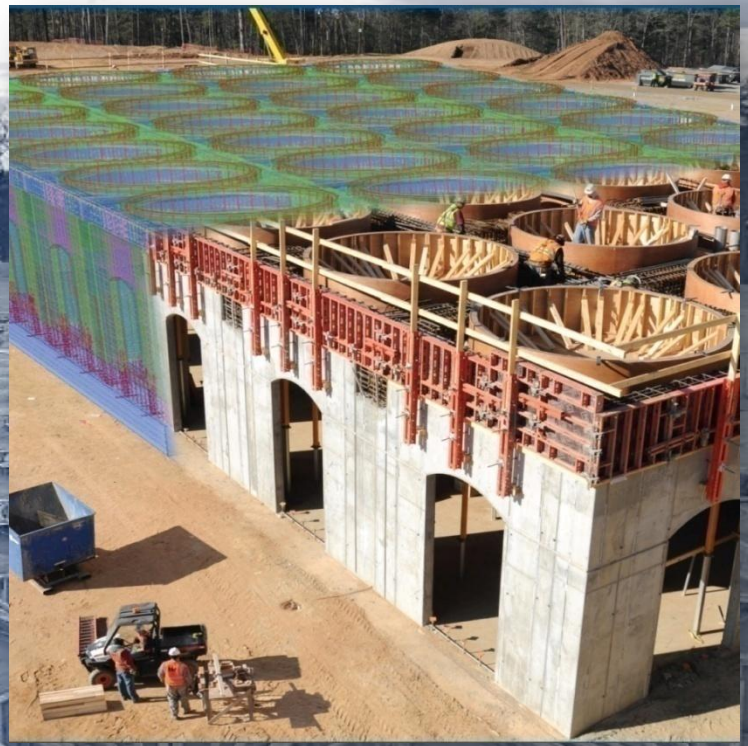


> "Tekla was actually much simpler and user friendly solution than I expected, I am certainly a fan of Tekla Structures for CIP and steel design work."
>
> *Donovan Kroeker, SeniorStructural Engineer, KGS Group*



KGS GROUP
CONSULTING ENGINEERS

Construction and logistics planning



"With Tekla, we've reduced the time from the award to the first rebar submittal by 50 percent, allowing us to meet the most demanding schedules. This gives us a clear competitive edge because we can respond quicker with more accuracy and provide a higher level of support to our clients."

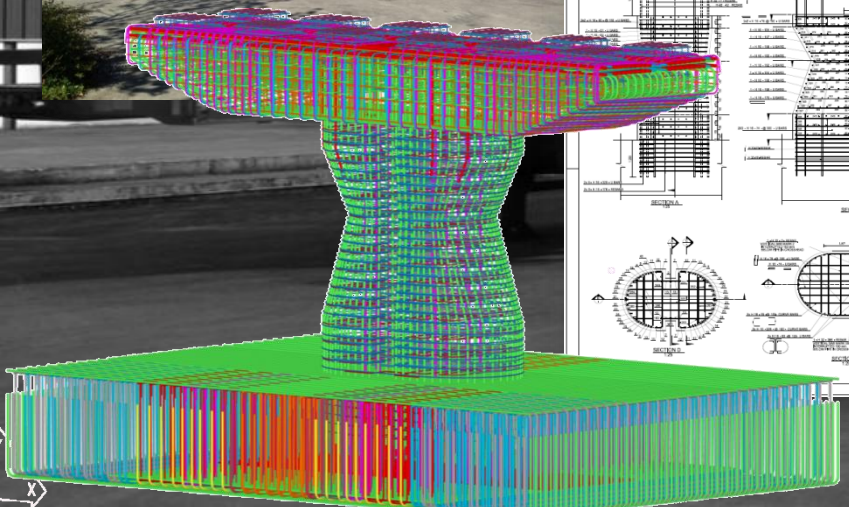
Daniel Wayne, Director of Technology, Wayne Brothers

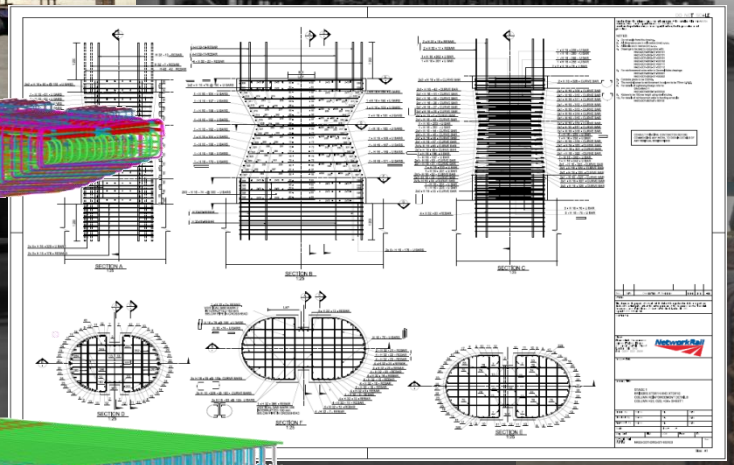
Wayne Brothers INCORPORATED

Automated rebar fabrication

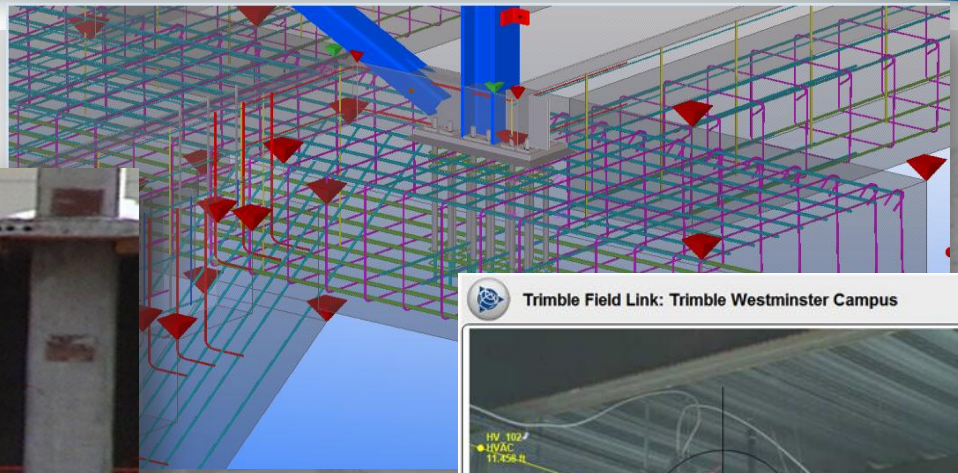
Fabricating and producing reinforcing from the model ensure seamless projection and fit-up.

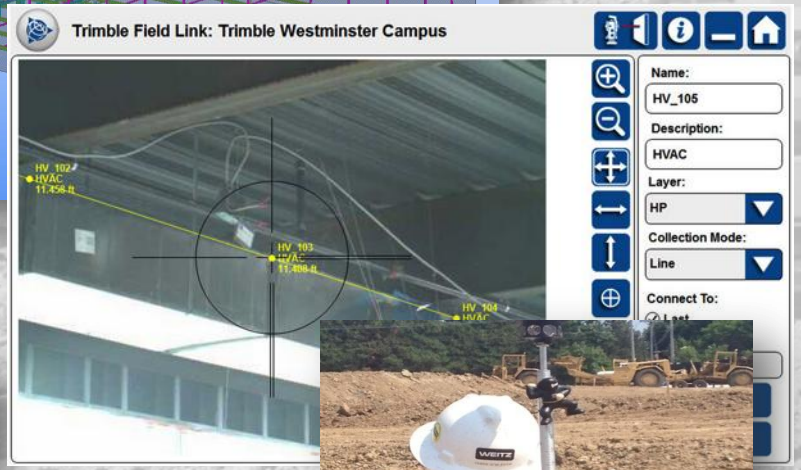
Midland Steel
Reinforcement Supplies





Point Layout



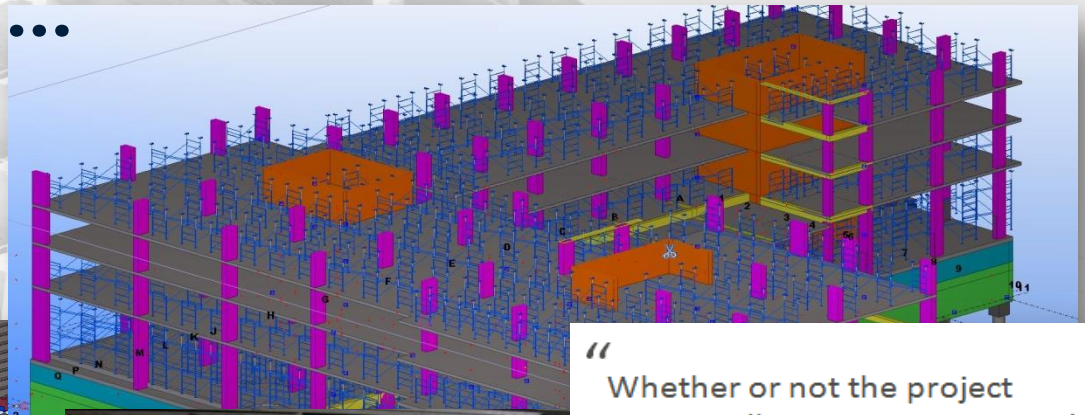


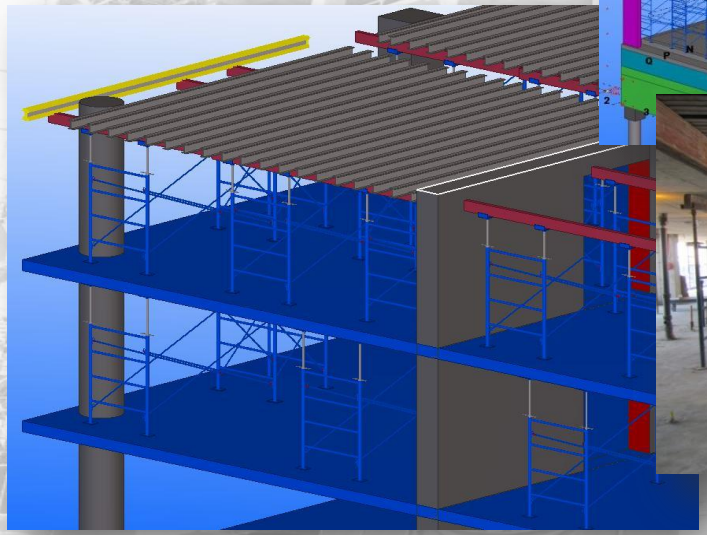
"We do this to ensure the model intelligence reaches the field. Coordinated model data paired with robotic total stations results in increased productivity and quality."

Jared Schleifer
Construction Model Manager

WEITZ

And much more …





"Whether or not the project contractually requires a BIM model, there are too many benefits to ignore for any member of the design or construction team."

Eric Lindquist, Project Manager

ADJUSTABLE FORMS
CONCRETE CONSTRUCTION

Robotic welding of assemblies

Standardization of ÏFC fabrication view going on

WHERE IS TRIMBLE HEADING?

Transforming construction

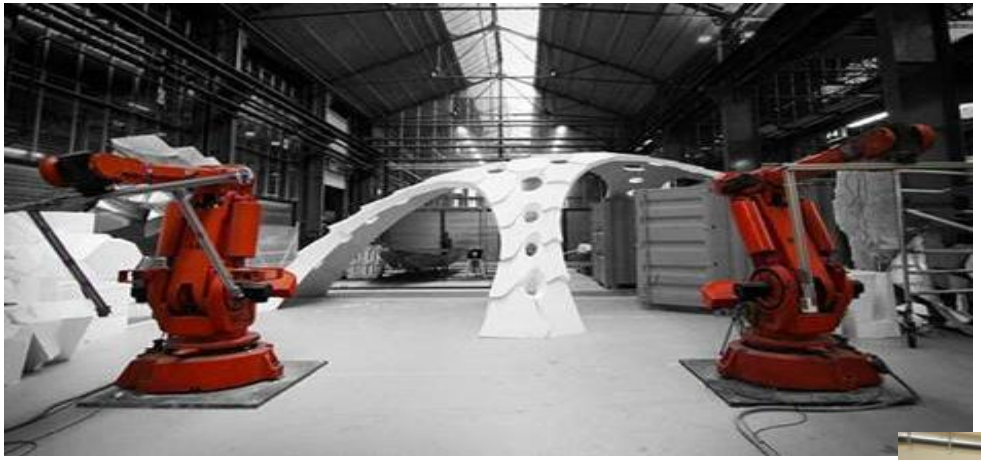
Trimble uses technology to change the way people work;
improving productivity, quality and safety while reducing waste

Open and interoperable workflow from concept to operation

WHERE IS BIM HEADING?


From Document centric ->
Data Centric workflows

Robots in production…

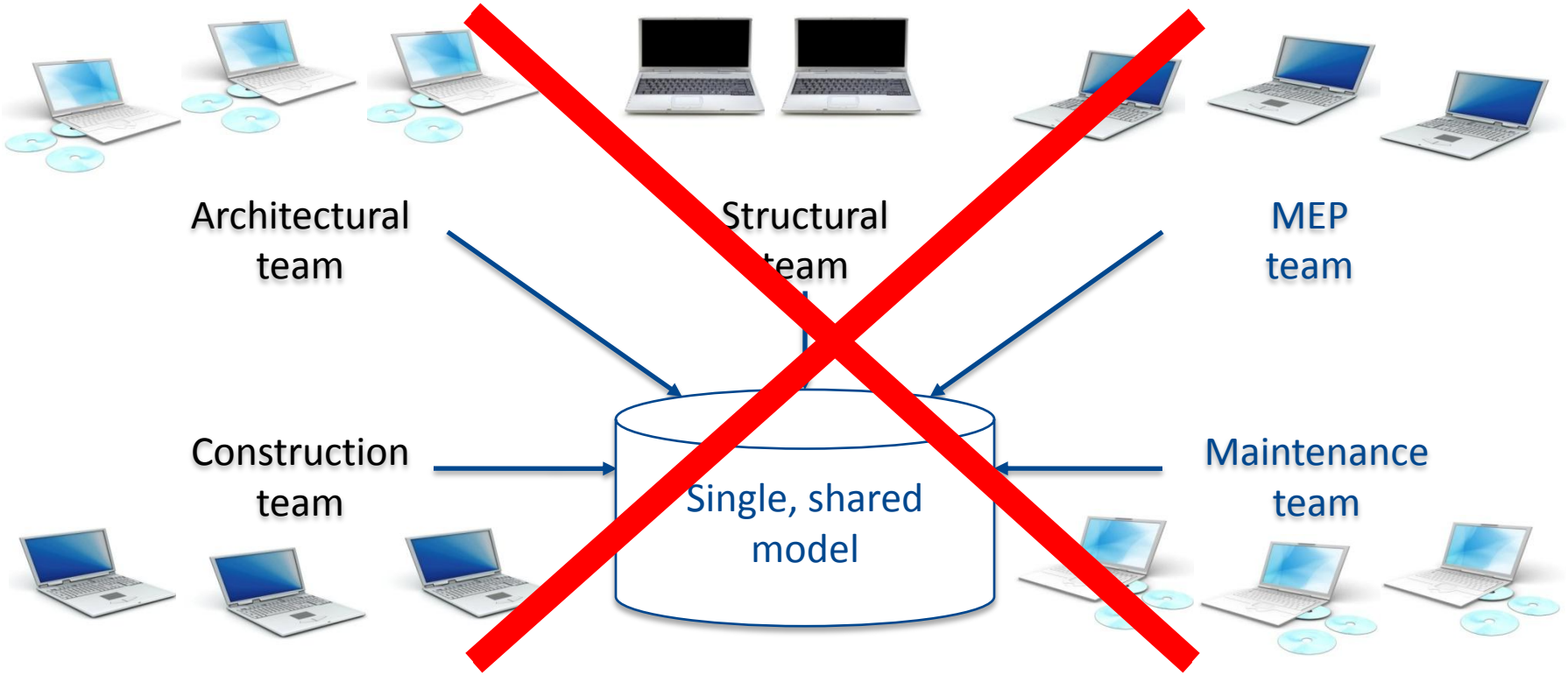


The sky is the limit

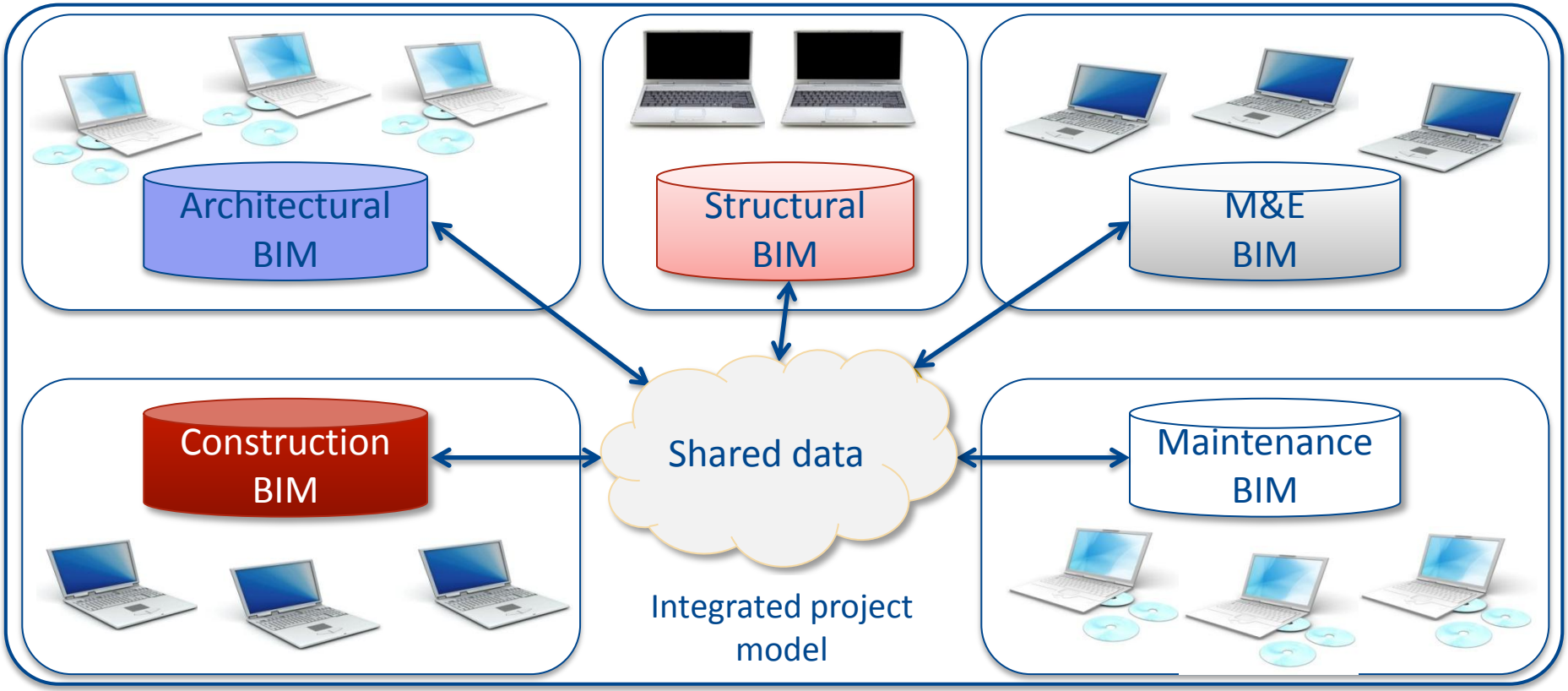
We cannot today imagine all places where sharing and consuming structured machine readable information anywhere and everywhere will take us

Thank You

Common (mis)conception of integrated BIM



Domain specific & integrated BIM



BIM linked to internal and external information