


BIM for Civil Engineering

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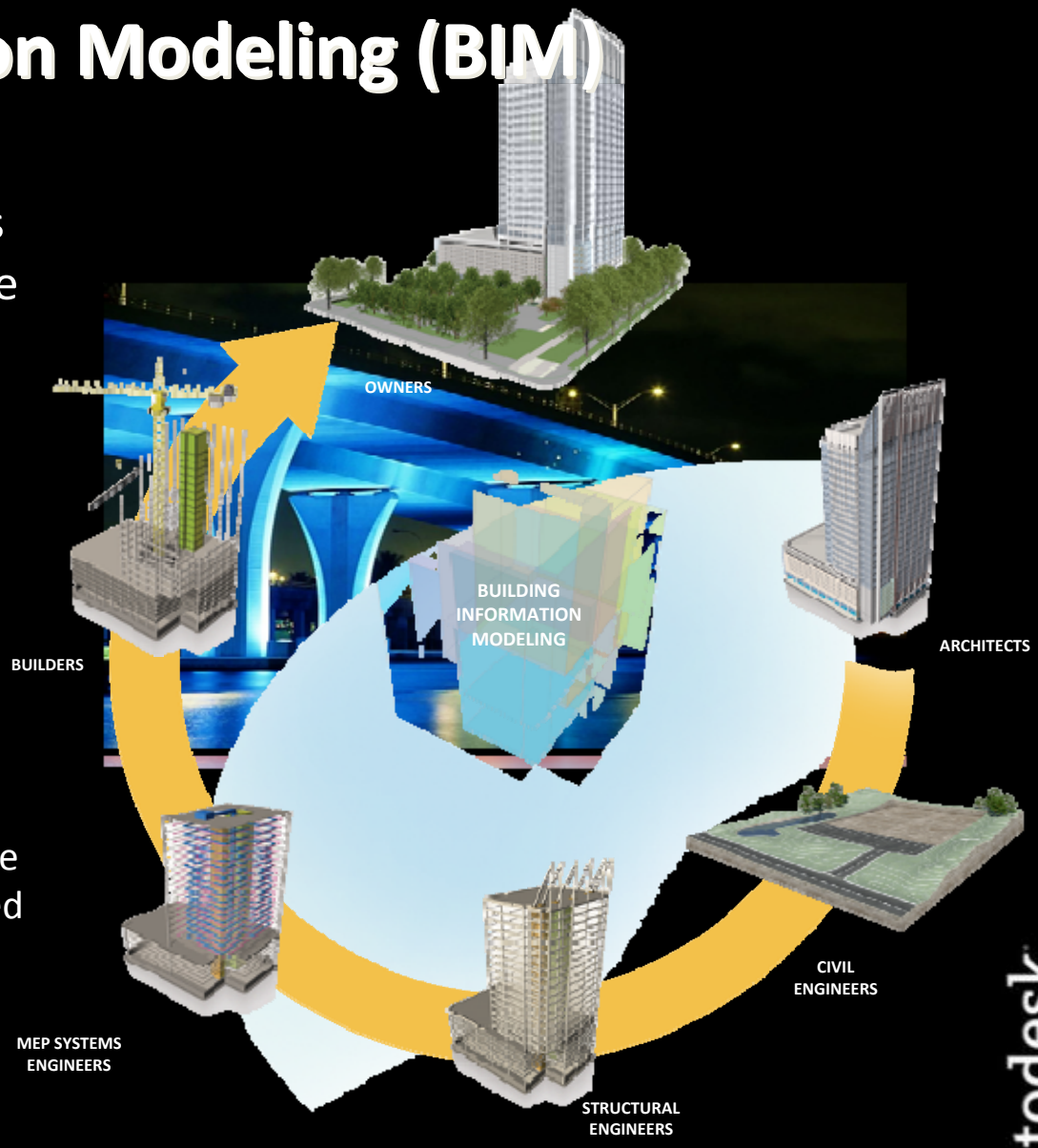
Building Information Modeling (BIM)

BIM is an integrated process built on coordinated, reliable information about a project from design through construction and into operations.

- Create coordinated, digital design information and documentation.
- Predict performance, appearance, and cost.
- Deliver the project faster, more economically, and with reduced environmental impact.



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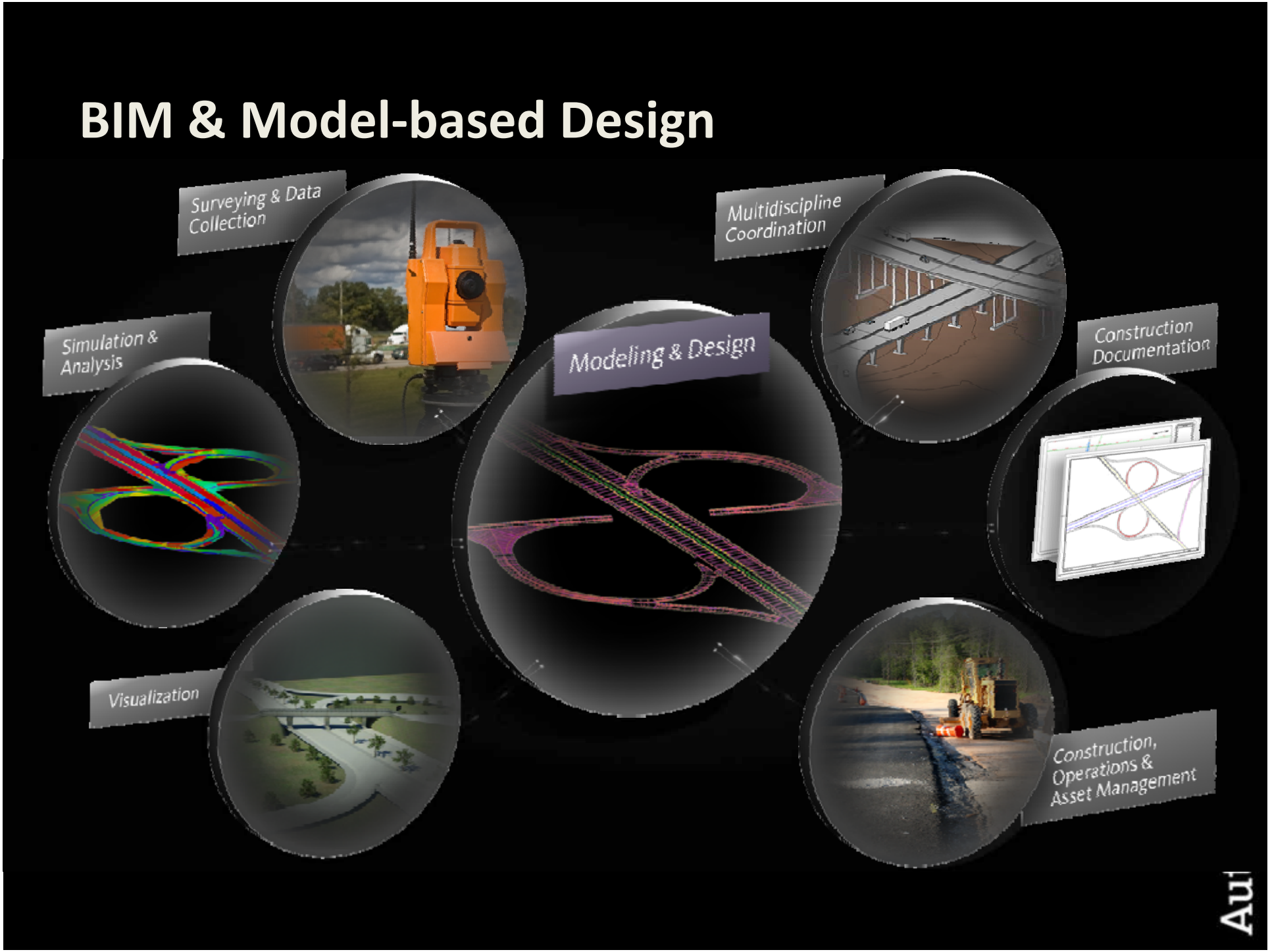
BIM & Model-based Design



Benefits of BIM for Civil Engineering

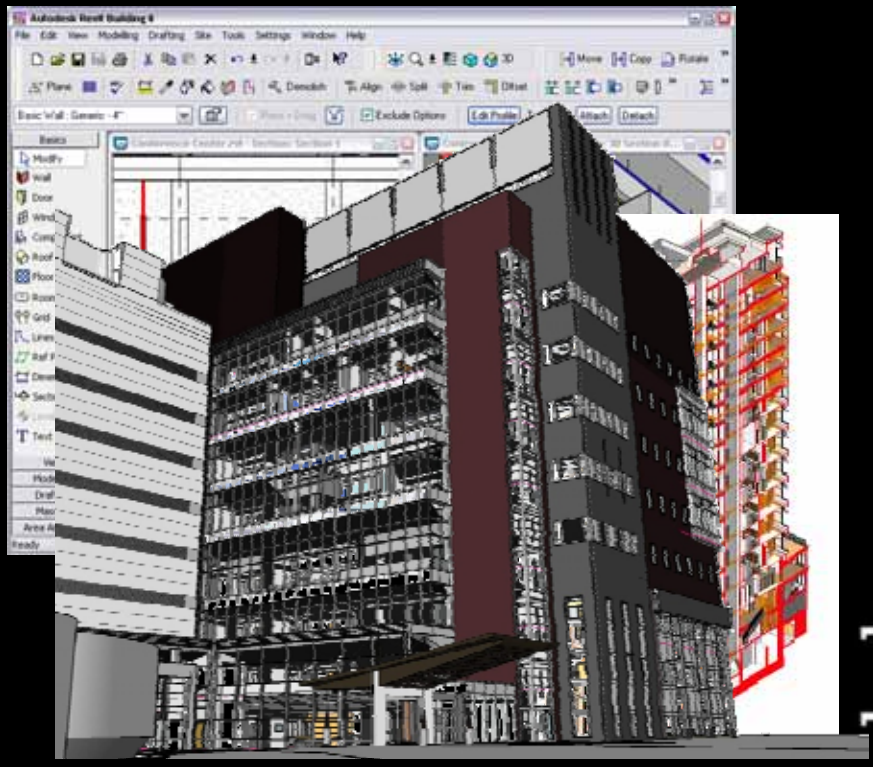
Model-based Process

Model-centric Process

Accuracy

- Ability to speed up design to construction process
- Quantities/Takeoff – more accurate takeoff of materials and components versus manual counting
- Reduction of errors, omissions, collisions – reducing risk and liability as mistakes found in office not field
- Rapid reset should design need to change – production of plans, or updated information

This is CAD



This is BIM

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Visualization

- Reduced time converting 2D to 3D for Visualization
- Uses of Visualization
  - Agency/Owner presentation
  - Marketing
  - Public Meetings/Google Earth

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Machine Control

- Export of Design data to Machine Control
  - *Time to construction – from weeks to hours for machines to begin rolling, changes mid stream rationalized in hours not weeks*
- Export of Design Data to GPS/Robotics
  - *Inspection*
  - *XYZ coordinates for construction layout and control*
  - *Construction project progress tracking, material tracking, daily QA/QC of construction to design model*
- Risk Mgmt
  - Performance verification

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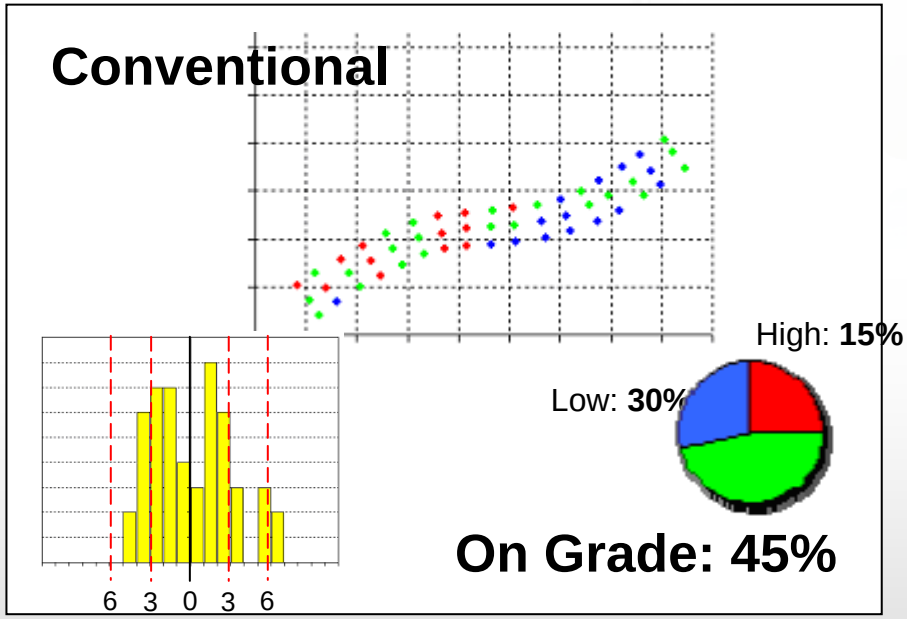
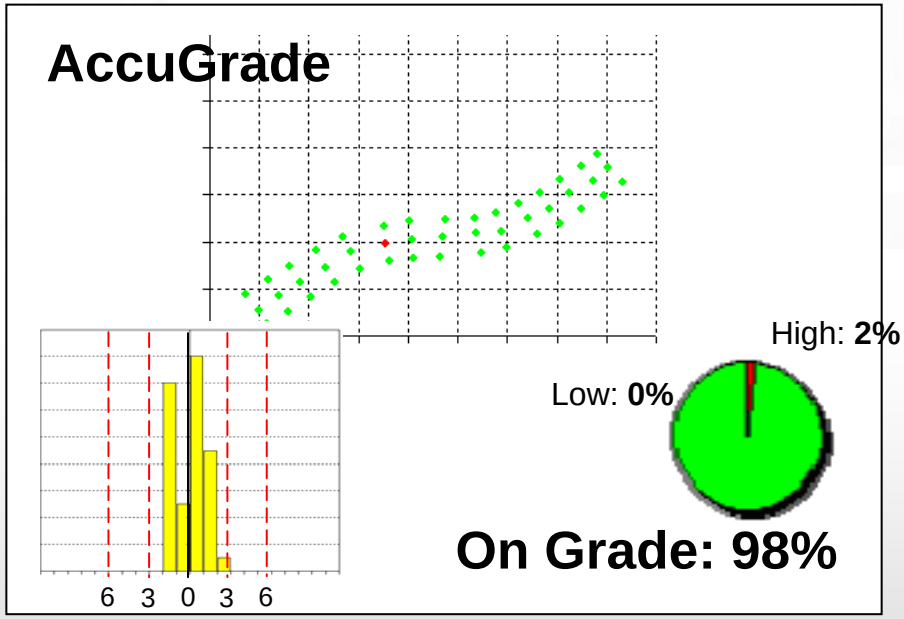
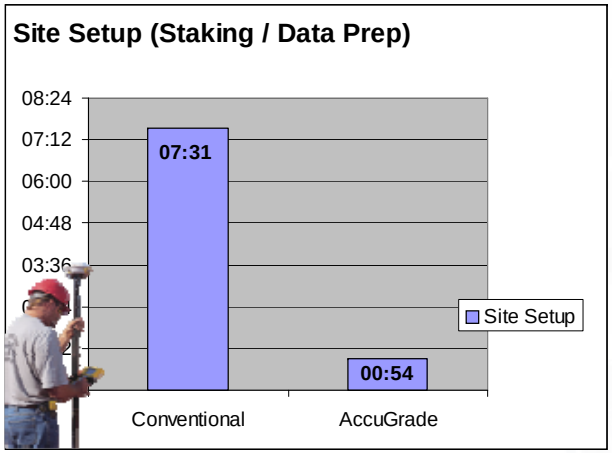
Grade Checking of Base Course

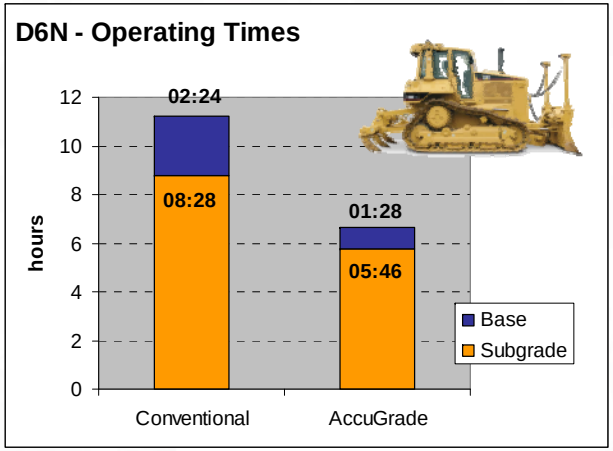
- Three points every 5m were surveyed
- A tolerance of ± 2cm was applied

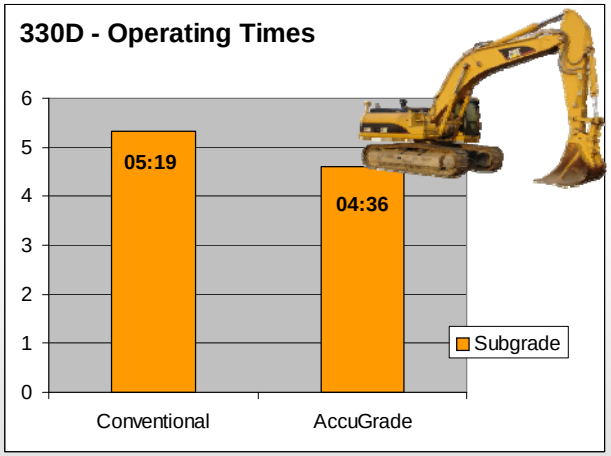


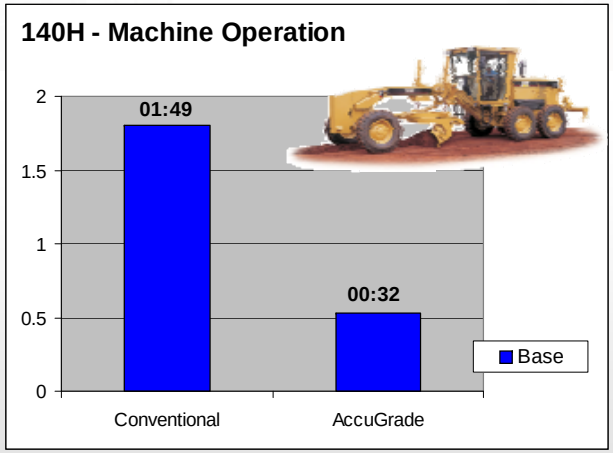


Summary of Results







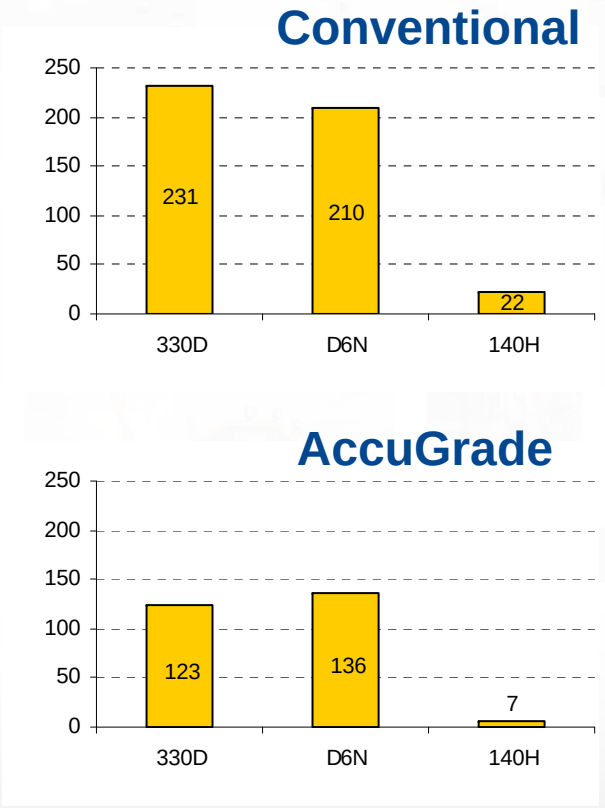


Conventional
24:32 hrs

AccuGrade
11:50 hrs

Summary of Results

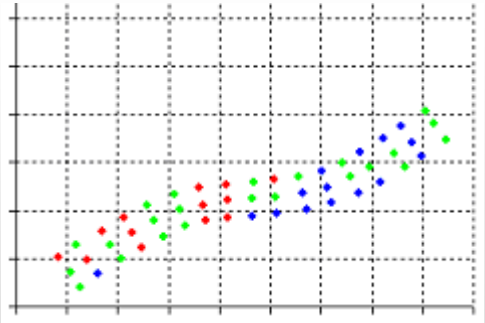
- **100% Increase in Productivity**
  - 3,0 days vs. 1,5 days
- **Increased Machine Utilization**
  - Less waiting time
  - Longer passes
- **Savings in Operating Cost**
  - 43% less Fuel consumption



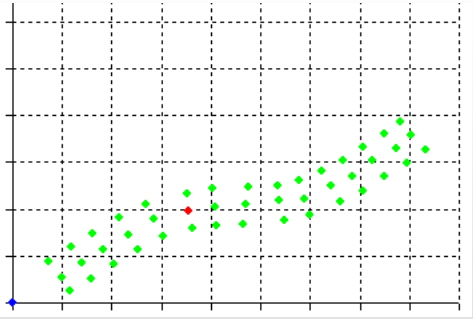
43% fuel savings

Summary of Results

- **Reduction in Surveying Cost**
  - 18 hrs & 14 min. X 2 people (Old way) vs.. 54 min. for 1 person (New way): 95% time saved and 1 person less.
- **Increased quality / potential for material saving**
  - 45% in tolerance vs.. 98% in tolerance & much more consistent
  - Verges and side slopes visually looked much better with AccuGrade
  - 9 Trucks vs.. 8 Trucks over 80M – 11% savings



Conventional



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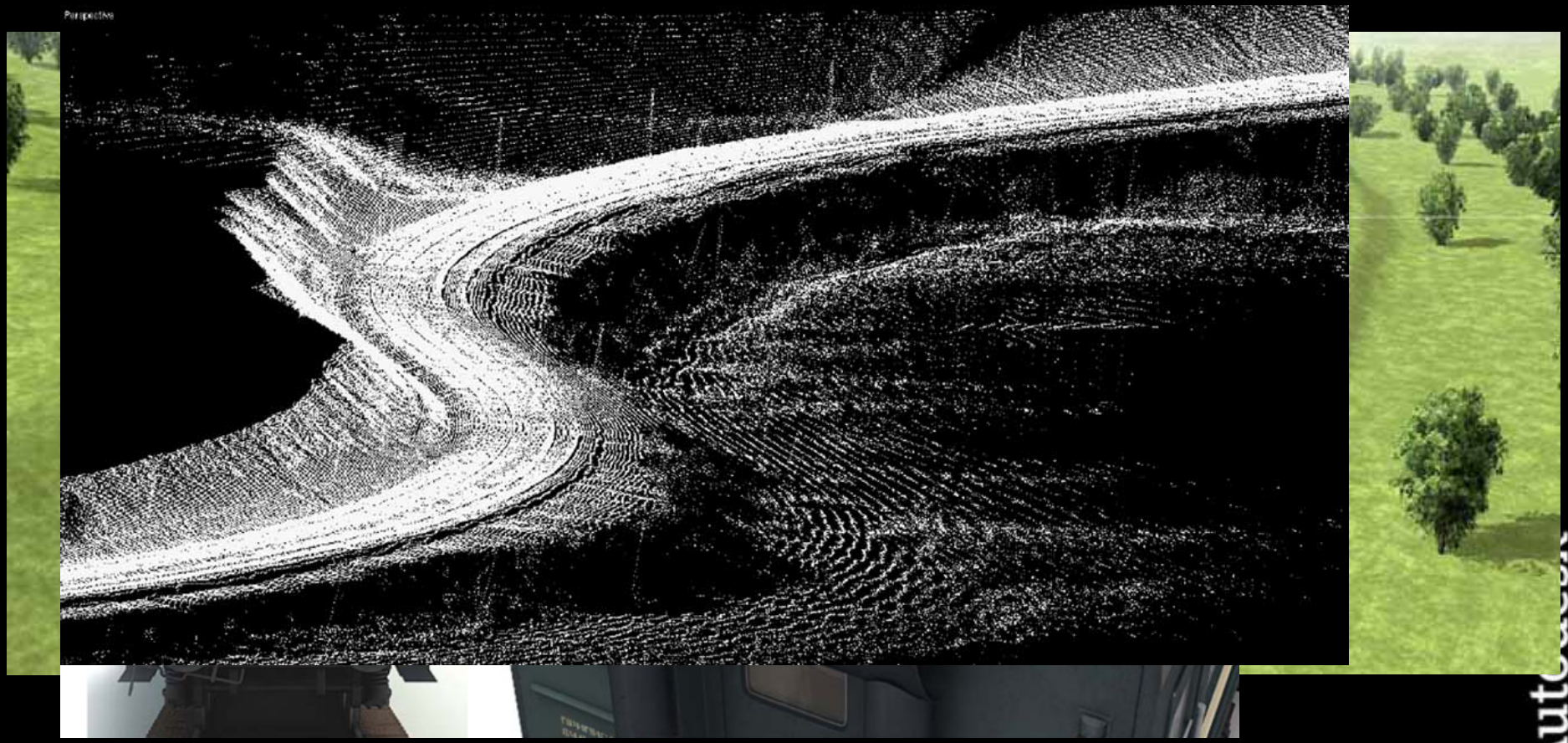
Laser Scanning (LIDAR)

- Scan existing conditions for Design parameters/As-builts
- *Safety paramount (performed from safe location)*
- *Scanning during construction to verify progress to model for % complete*
- *Scanning during construction for verification of as-built vs. as design*



Quantities for Estimating and Production /Cost Control

- Optimization of Cut/Fill
- Haul Road analysis
- Wetland/Environmental mitigation
- Quantity extraction of materials (concrete/rebar/rock/guardrail/walls/etc.)
- *More sustainable – wiser use and less material waste when ordering*

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Construction Simulation

- Sequencing
- Lane closures
- 4D Planning
- Equipment and Material schedule optimization

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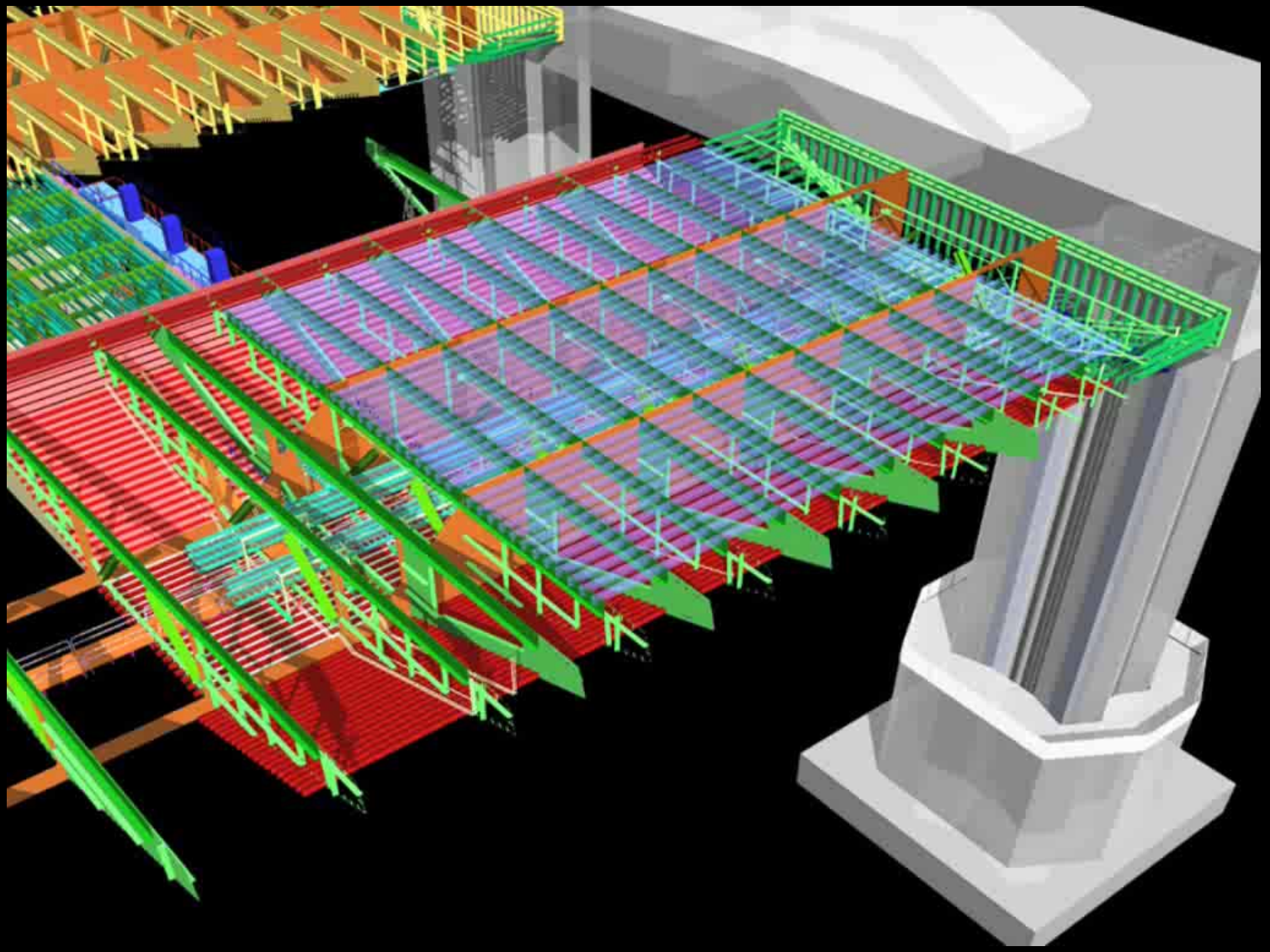
Bay Bridge - 4D Planning Equipment and Material schedule optimization



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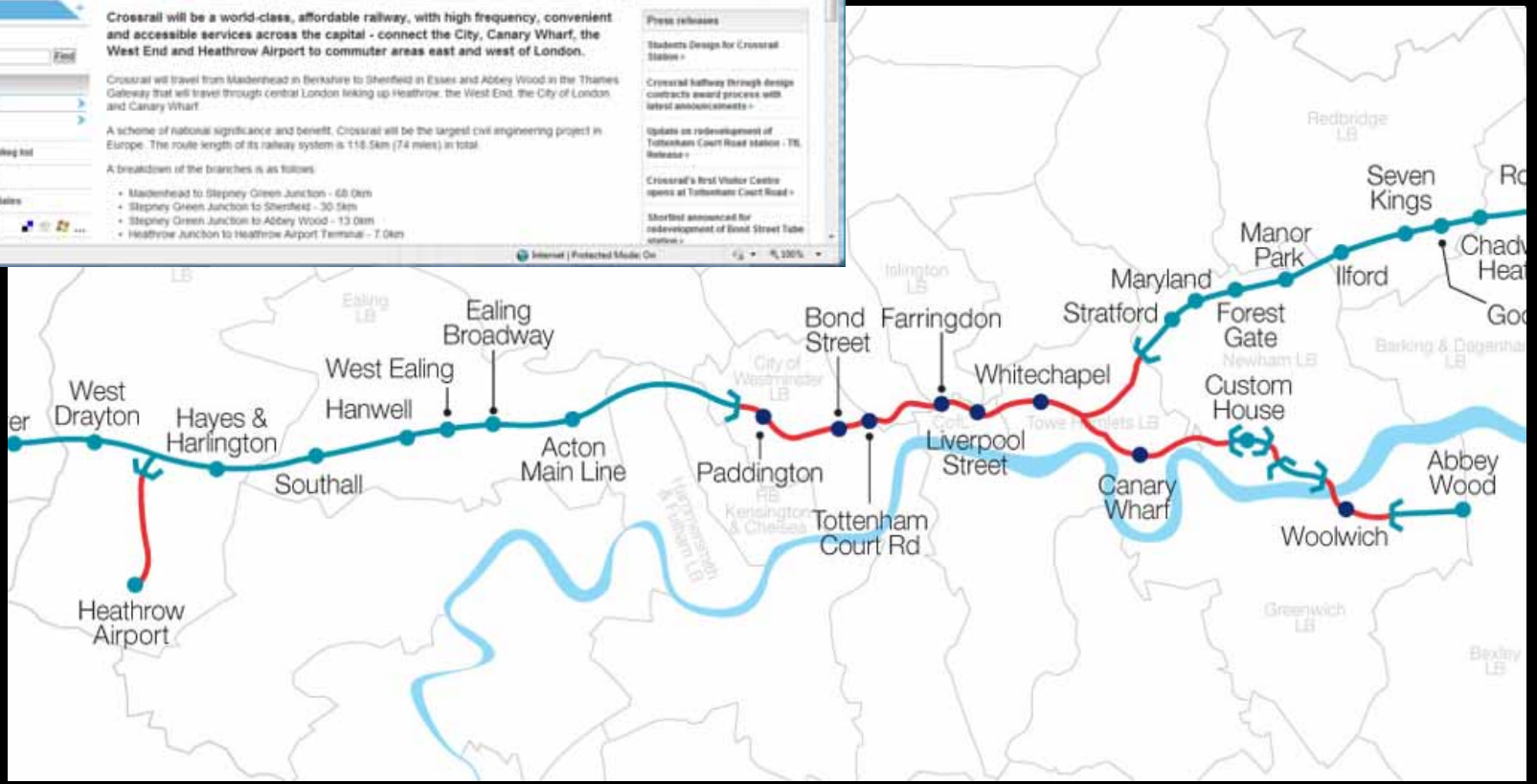
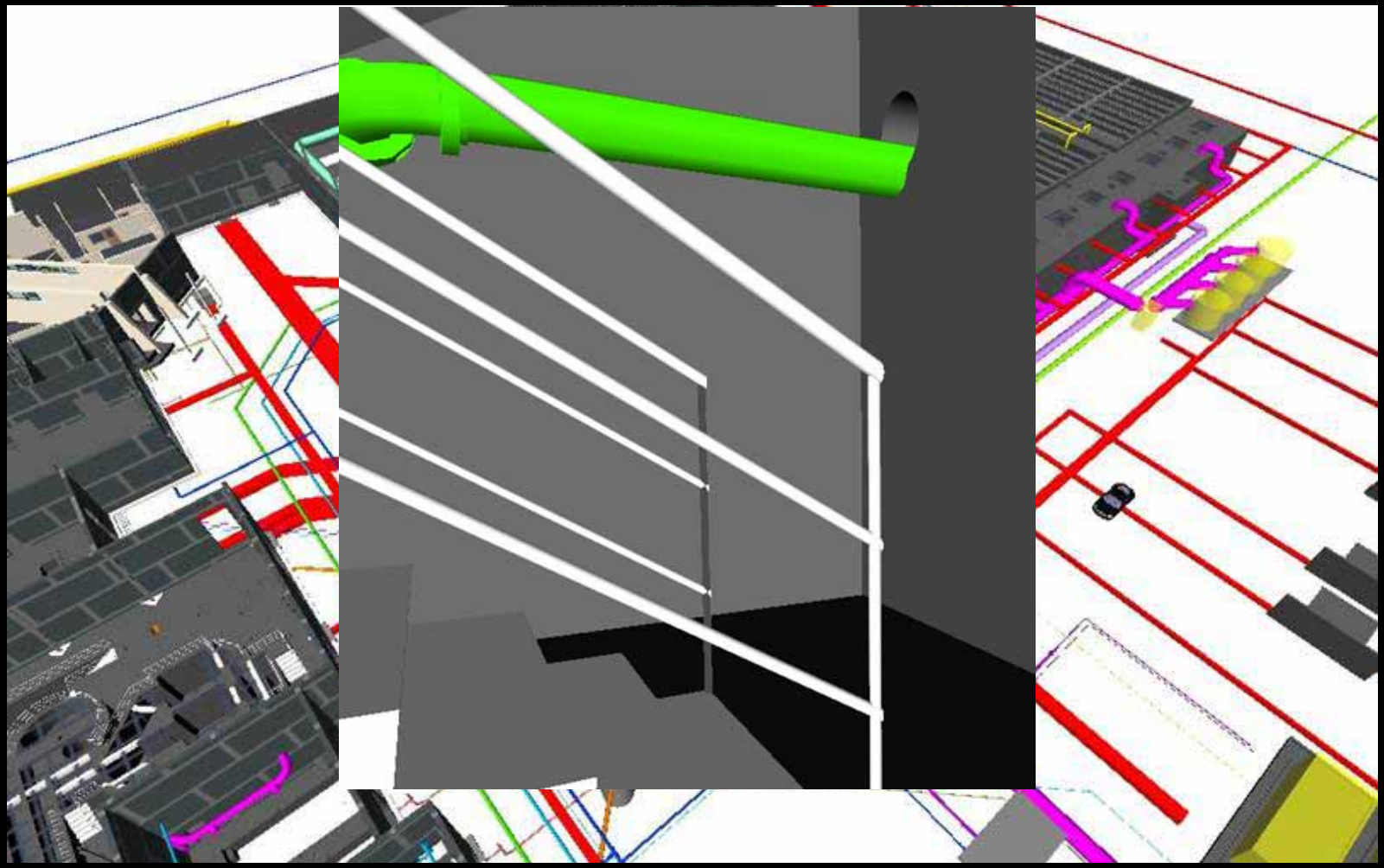
Tottenham Court Road Station, London



Tottenham Court Road Station- 4D Planning Sequencing

Collaboration:

- Project team sharing of model
  - *Currency of the model*
- Clash Avoidance
- Utility/Contractor information sharing



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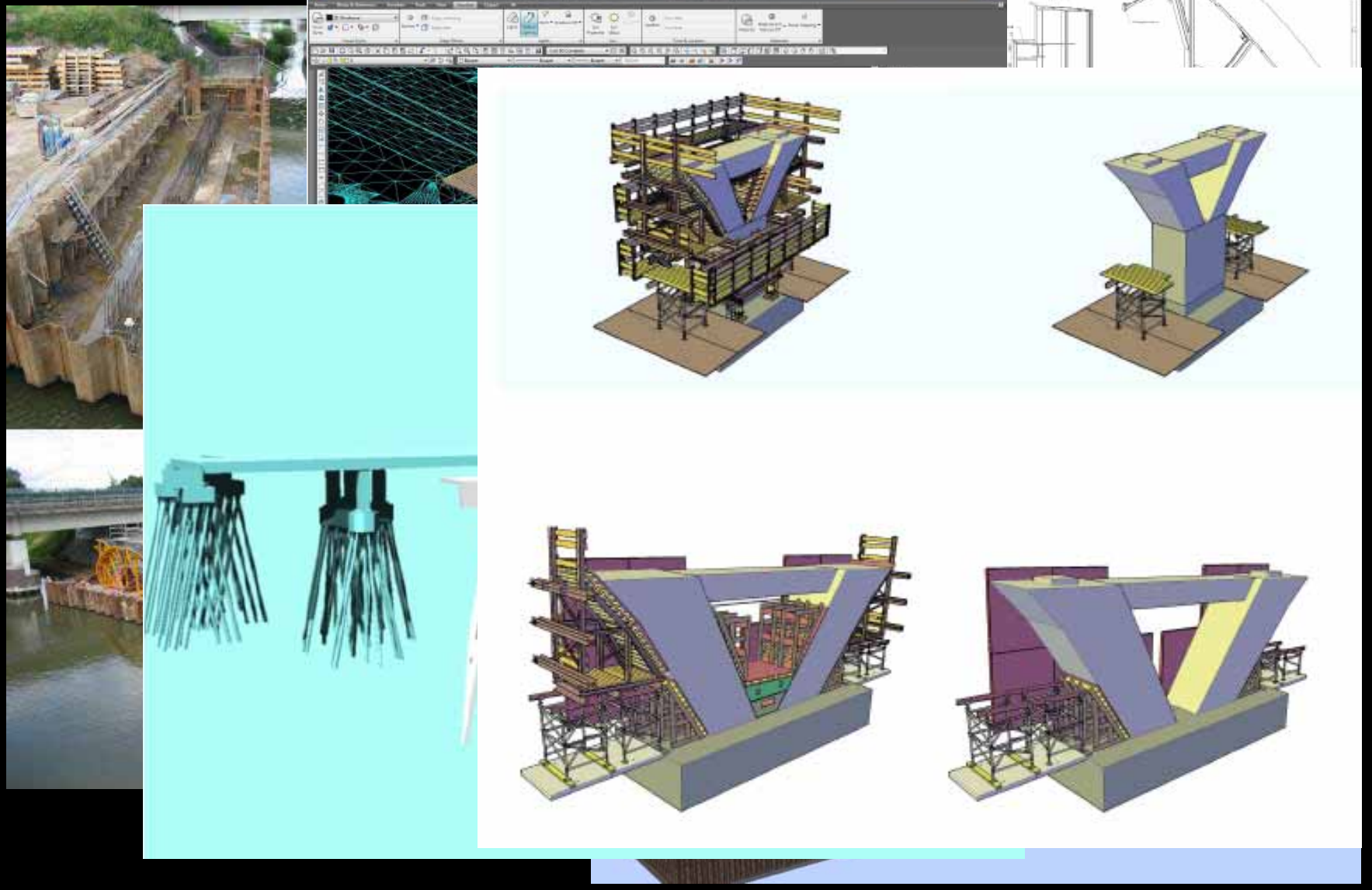
Results – Savings from Clash Detection

Butler Treatment Plant Clash Savings		
CLASH #	**DESCRIPTION**	**POTENTIAL COSTS**
1	Grid dimensions were wrong	$10,000.00
2	A-Basin - Shortened Corbel along side wall	$2,000.00
3	A-Basin - Beam pockets sizes	
4	A-Basin + Membrane - being able to see the section at the channel deck and wall joints.	Priceless!
5	Headworks - Grit Chambers ftgs./eliminated underslab	$5,000.00
6	Headworks - Sluice Gates blockout sizes and location	
7	Admin. - Battered walls needed to be elongated due to clash with Curtain Walls	$10,000.00
8	Admin. - Columns in the middle of the 2 main center walls were in the wrong place	$5,000.00
9	Admin. - Chase blockouts on plans were not big enough for all HVACs and Electrical to go through.	$5,000.00
10	Admin. - By putting in steel beams we were able to see what size blockout and plates were needed, caught	$5,000.00
	mistake from Able Steel in the process.	
11	Admin - Eliminated steel beam	?
12	Admin. - Ftgs and stems were layed out incorrectly on plans and were wrong size.	$25,000.00
13	By modeling the masonry we were able to lay out all the door and louver openings.	
14	Modeling piping & ductbanks	$150,000.00
	TOTAL SAVINGS	**$217,000.00**

Detailing & Prefabrication:

- Concrete lift drawings
- Rebar detailing



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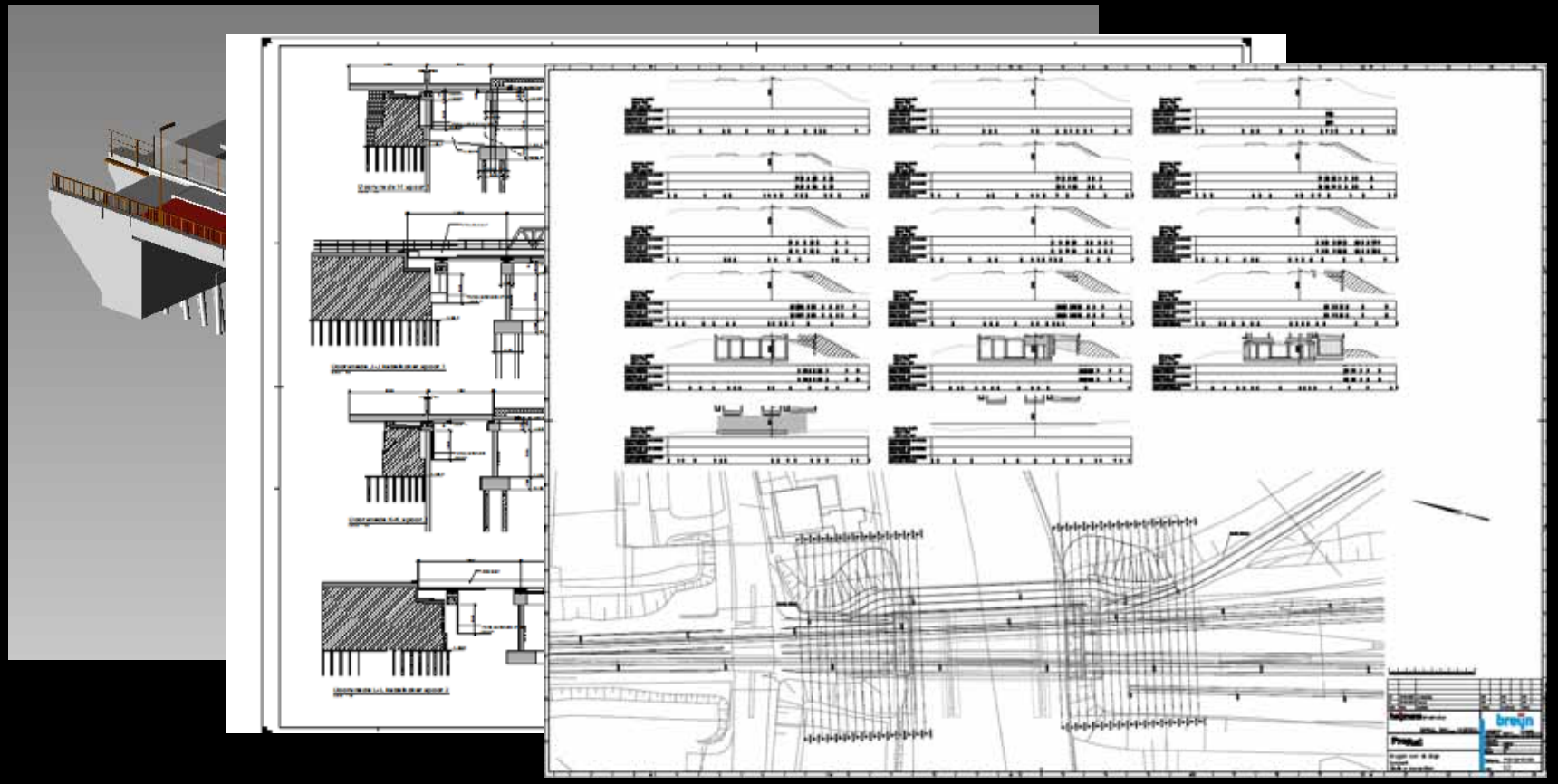
Errors and Omissions:

- Reduced errors on labeling and design
- Better design
- "What you see is what you get"
  - *Data derived from the model*
  - *Construction Docs derived from model*
  - *No "tricking" model to get desired results*



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