Project Controls Expo, Australia – 26th November 2019

Melbourne Cricket Ground, Melbourne

Why 4D is the New Standard for Project Planning?

Nishant Gujarati

Director | Setu Projects

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About the Speaker

Nishant Gujarati – Director | Setu Projects

Nishant is a qualified **project manager, engineer and planner** with over **20 years** of experience on projects of total value exceeding **$ 9.52 billion** delivering services of project management, project planning & program interrogation; program delivery strategy formulation and contractual claim assessment/ defense. His work exposure covers **large and complex multi-disciplined building & infrastructure works**; with varied forms of procurement from Managing Contractor and Early Contactor Involvement, design & construct and construct only forms; covering project delivery phases: master planning & feasibility programs, design program management, procurement advisory, delivery & controls, handover and transition to operations. He has represented the interests of **clients and contractors on public and private sector projects**.

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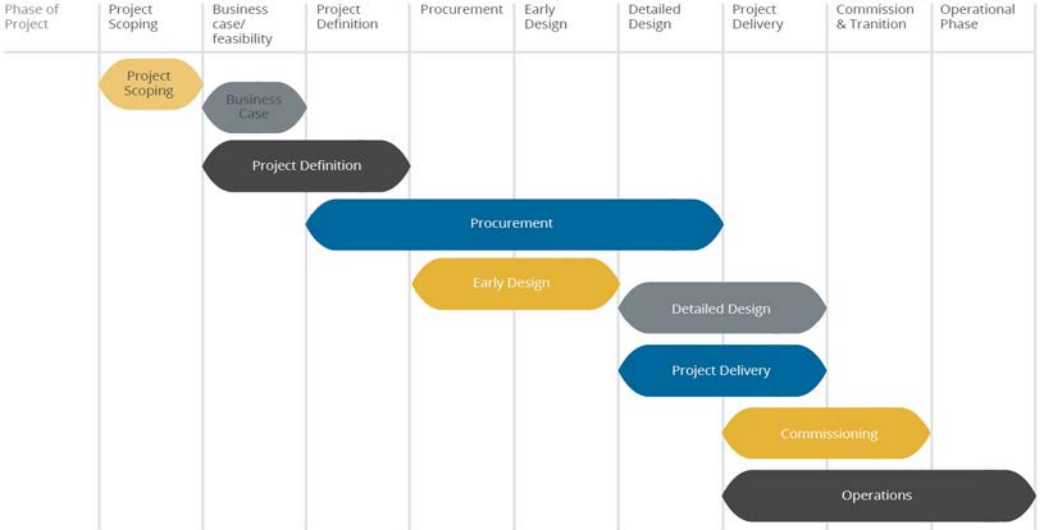
What do we do?



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The context of Technological advancement

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Where does Australia stand in the advance adaption of BIM?

Continent	North America	Europe	Asia	Australia
3D Modelling	81.8%	60.7%	67.6%	88.9%
4D Scheduling	54.4%	57.1%	18.9%	33.3%

Jung and Lee, 2015

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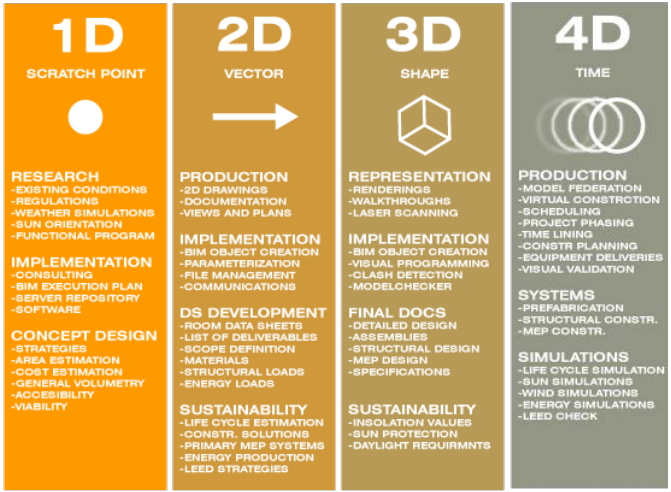
What are the Dimensions of BIM Adaption in AEC Industry?



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AEC Industry in Transition

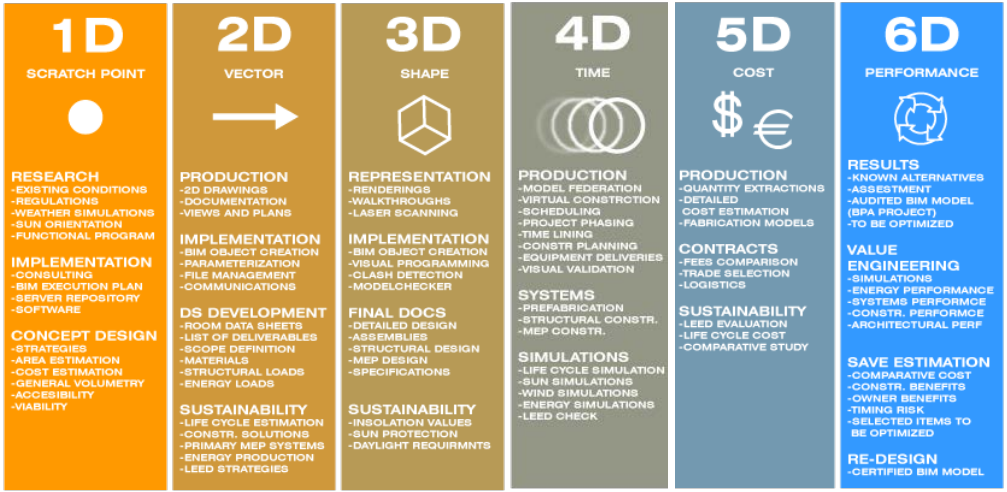
- 2D drawings
- Slow internet
- Poor hardware

- 3D drawings
- Fast internet
- Powerful hardware
- BIM
- Cloud computing

- 5D BIM end-to-end solution
- Smart/Mobile/Apps
- Collaboration along the value chain

since 1985 → Today → Tomorrow

What are the Dimensions of BIM Adoption in AEC Industry?



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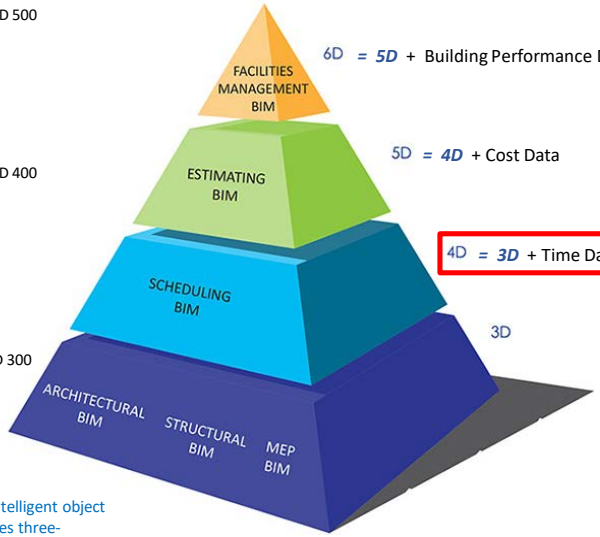
4D Simulation is a Data Visualization Tool

LOD - Level of Development (LOD) reflecting accuracy and reliability of model elements and their authorized uses.

PROJECT — LOD 500

CONTRACTOR & CONSULTANT — LOD 400

ARCHITECTS & ENGINEERS — LOD 300



6D = ***5D*** + Building Performance Data

5D = ***4D*** + Cost Data

4D = ***3D*** + Time Data (MSP/Prima Vera)

1000's of Tasks/Activities

One Combined Model to Views the Project and Program

1000's of Technical Drawings

3D Model – An intelligent object Model that includes three-dimensional (3D) shape information and attached attribute data (Material type, specifications etc)

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Benefit of 4D

in Construction project continuum

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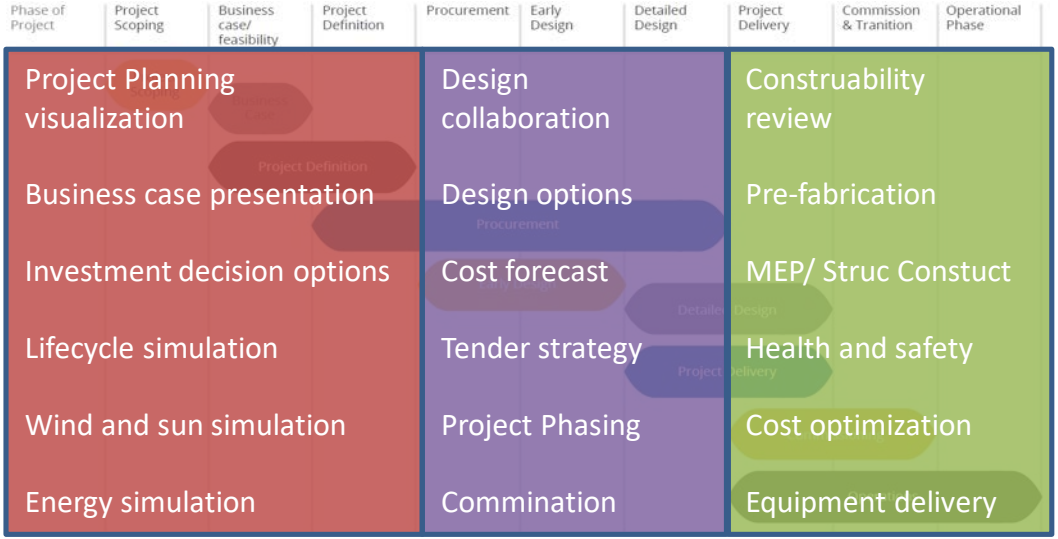
Why should we consider 4D modelling?



4D models help you …

- Confirm your own project plans at the strategic and tactical level
- Optimize and manage risks by involving other project stakeholders early, often, and as needed
- Capitalize on learning curve effects by practicing the project virtually
- Track and monitor project progress
- Respond to changed conditions and new opportunities

4D life cycle

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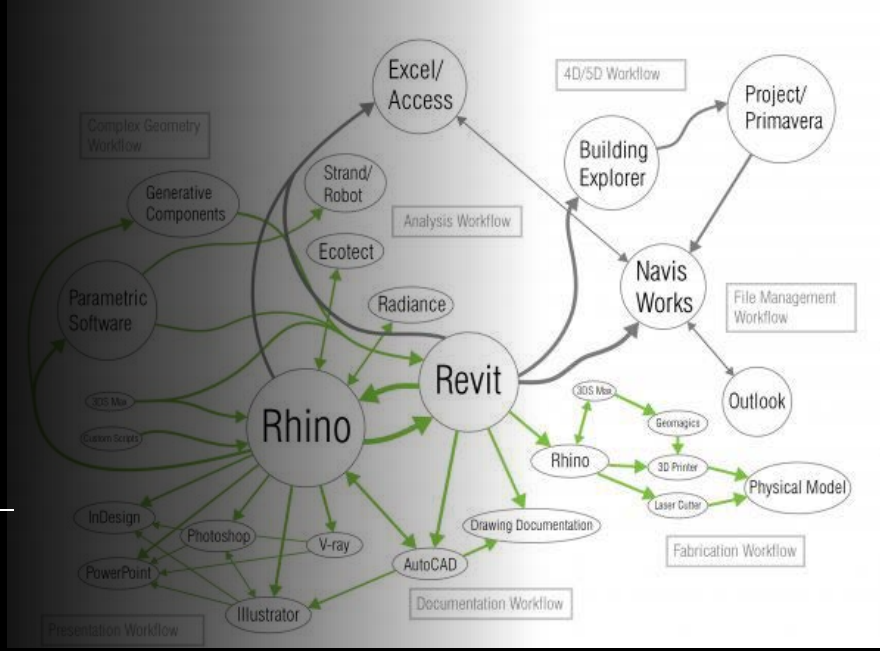
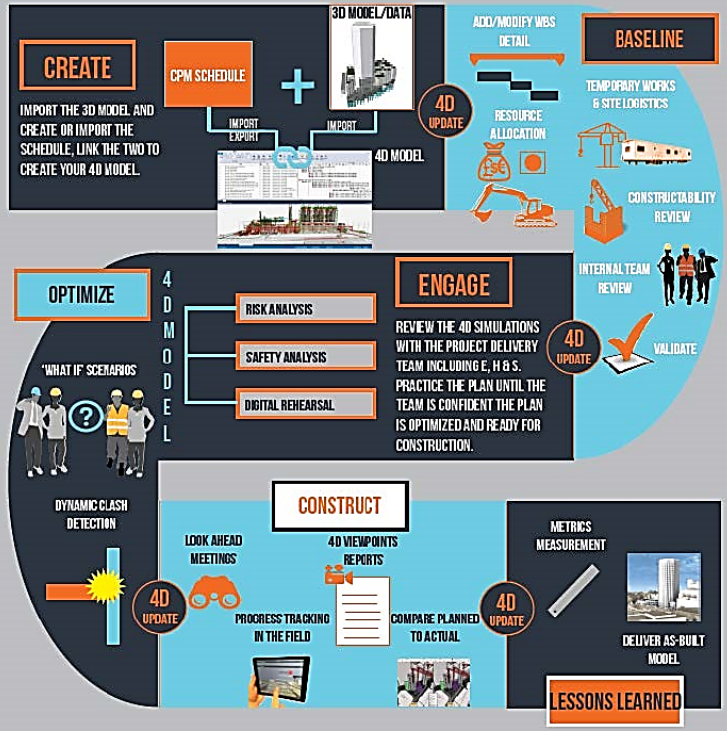
Complexity of the data flow in the 4D modeling…





4D lifecycle

From Creation to Construction

and Beyond

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Use the complexity to your advantage

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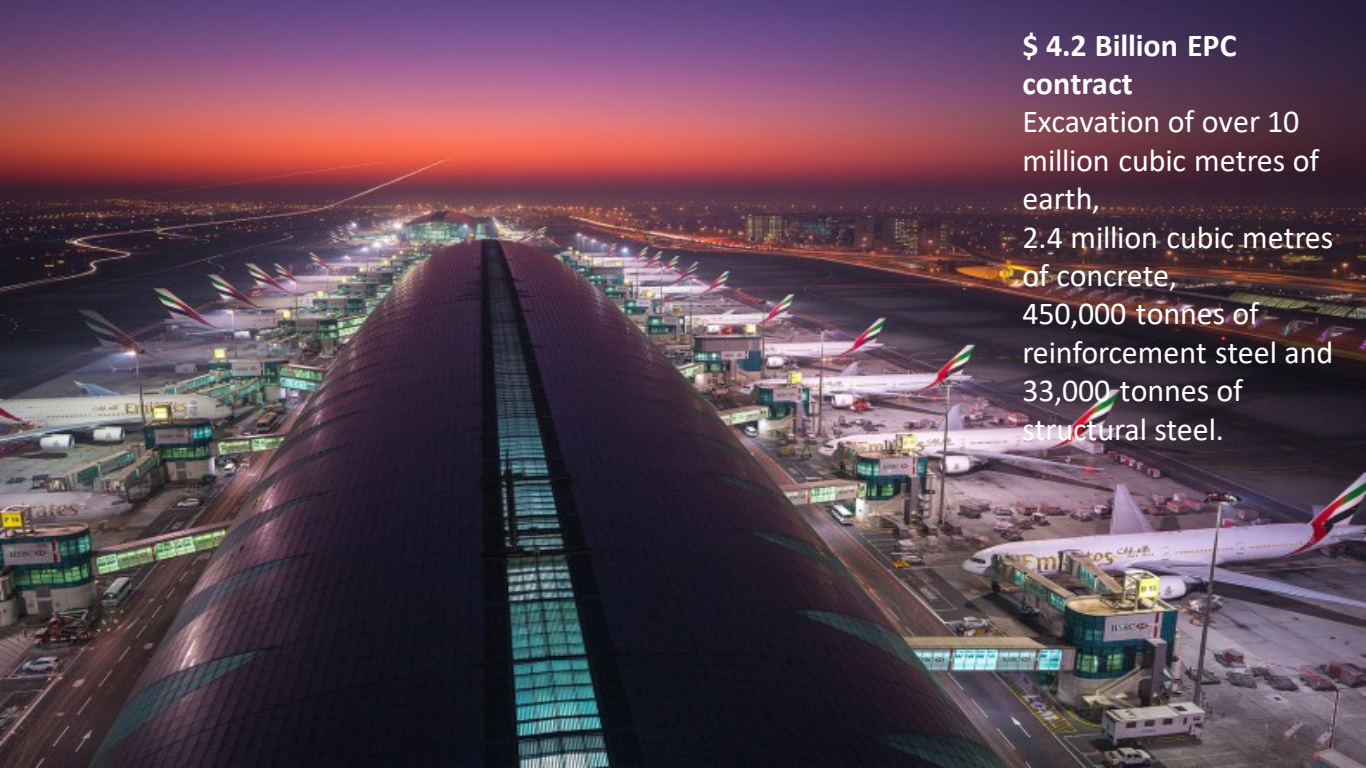


$ 4.2 Billion EPC contract

Excavation of over 10 million cubic metres of earth,
2.4 million cubic metres of concrete,
450,000 tonnes of reinforcement steel and
33,000 tonnes of structural steel.

Planning Phase "what if" scenarios

Early Project Planning: $450M Water front project

Determine overall construction strategy

Communicate strategy to key stakeholders

-> get owner b

-> pu **ent work**

P **contracts optimally**

S **for the project from the start**

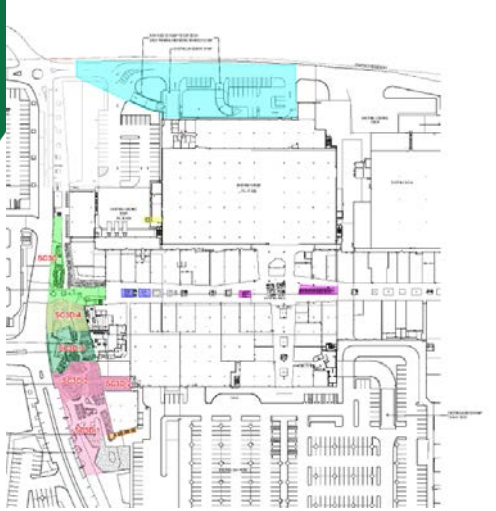
Establish project management framework

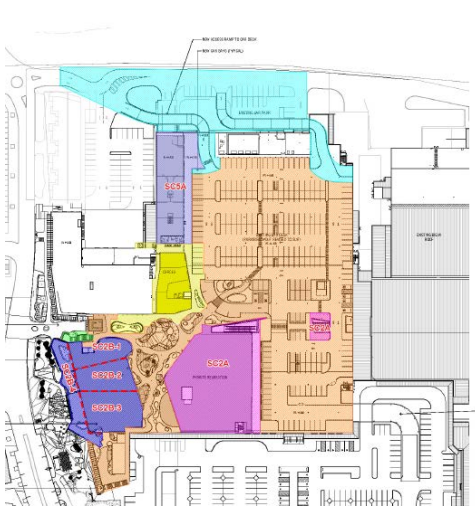
Win the project

$1x,000 per day

4D model snapshot courtesy of Mortenson, Seattle, WA 2005

Tender Program - Construction Strategy





		Duration
Stage 1	Commercial Centre	134 days
Stage 2A	Entertainment Tenancy	239 days
Stage 2B	Lvl 1 Dining Tenancy, Alfresco and Facade	200 days
Stage 2C	Lvl 1 External Works & Travelator	170 days
Stage 3	Entry & Piazza	165 days
Stage 4	New Car Ramps	115 days
Stage 5	Childcare	190 days

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Site logistics & traffic management in the urban environment

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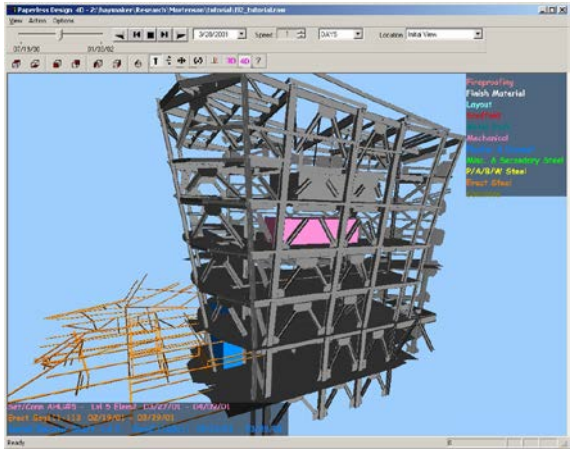
4D models align work throughout supply chains

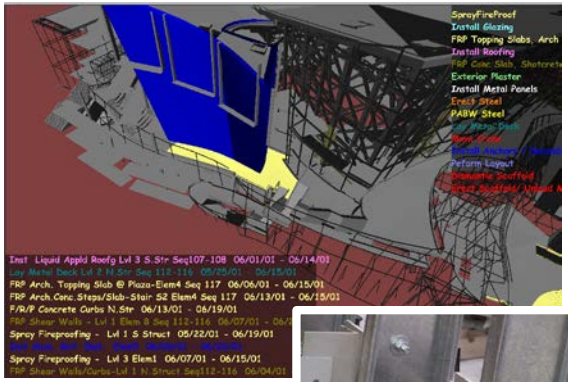
"The 4D model clearly revealed issues ordinarily resulting in rework."



AHU cannot be installed at this time.

4D models identify critical interactions between design and construction sequence

"4D models helped create reliable sequences of work that optimize use of resources."



Architectural concrete is too late for curtain wall

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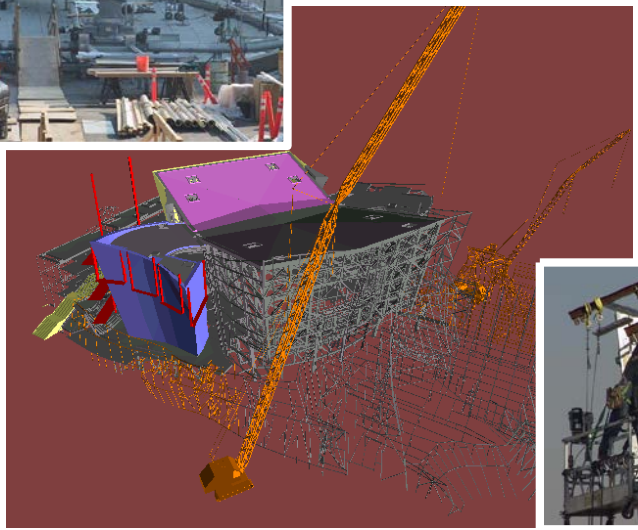
4D Models help plan construction methods



Exploration of different hoisting methods

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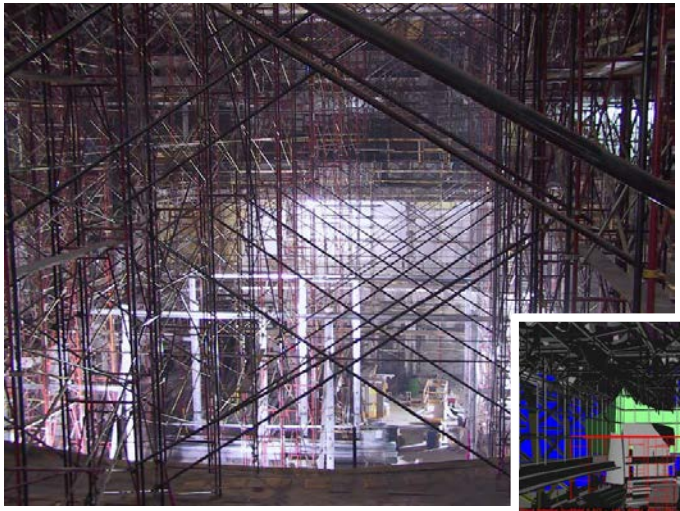
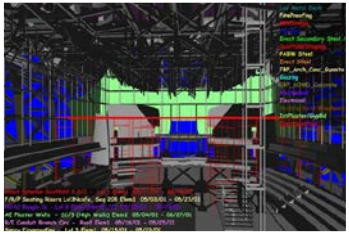
4D models helped redesign scaffolding to shorten schedule



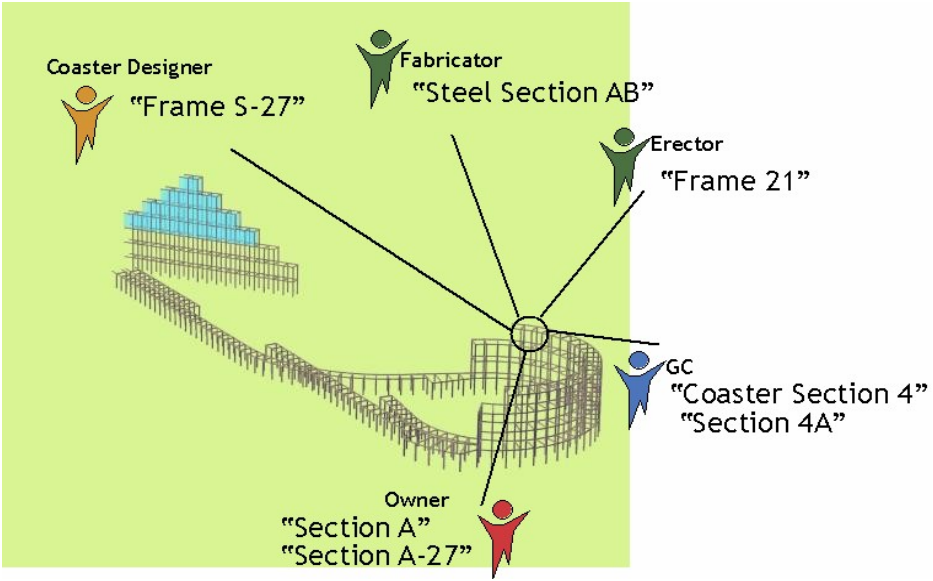
Scaffolds collided in the original plan



Benefits of 4D models

- Better designs and better schedules
- Improved schedule and cost predictability
- Reduced change orders (90% reduction in some cases)
- Fewer requests for information (RFIs) during construction (up to 60% reduction observed so far)
- Increased productivity and less rework
- Improved communication from owner to subcontractors and suppliers

Ahhh, I see, you have been talking about that part



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Use and implementation issues

- Schedule pressures increasing
  - 4D coordination and communication is valuable for everybody
- 4D models have a profound effect on the team to recognize where the major project risks will manifest themselves
- Validate thinking of team of real critical path
- Begin 4D modeling at time of capital expenditure authorization
- Validate early on that thinking of overall sequencing is correct

Health and Safety

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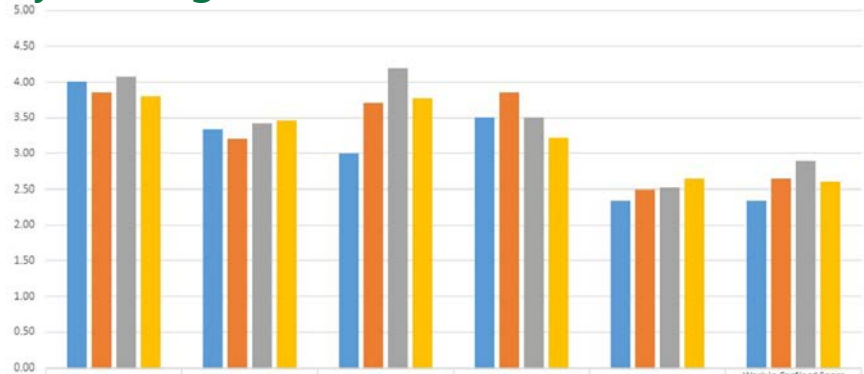
Benefits of 4D Modeling for Construction Health and Safety Management

Site Logistic planning
Work at height
Plant location movement
Pedestrian segregation
Manual Handeling
Work in confined space



	Site logistic planning	Work at Height	Plant location and movement	Pedestrian segrigation	Manual Handling	Work in Confined Space planning
Director/manager using 4D	4.00	3.33	3.00	3.50	2.33	2.33
Director/manager not using 4D	3.86	3.21	3.71	3.86	2.50	2.64
Professional using 4D	4.08	3.42	4.18	3.50	2.53	2.89
Professional not using 4D	3.79	3.46	3.77	3.22	2.64	2.60

Advance BIM & 4D Adaption

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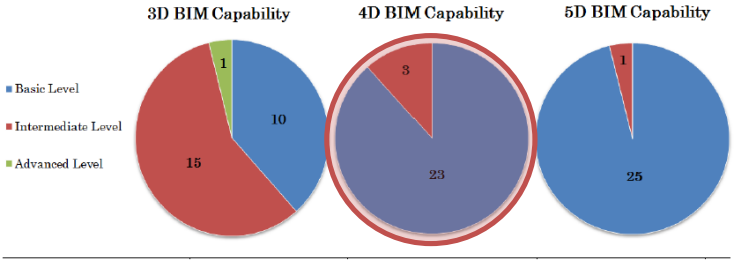
How does the Organizational Capability numbers stack up?



BIM Adoption Level	Basic Level	Intermediate Level	Advanced Level
3D BIM	10	15	1
4D BIM	23	3	None
5D BIM	25	1	None

Pyung, Ki & Tony, Ma & Baryah, Amanjot & Zhang, Chujun & Hui, Ka., 2016

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What are the challenges?

What is bothering us for implementation?

Categories	Description
Business and Legal Barrier	- Ambiguity in data ownership and legal risks - Lack of clarity on roles and responsibilities - Lack of clients/market demands - High investment cost and low incentives - Return on Investment
Technical Barrier	- Lack of standards - Interoperability - BIM Library/Dataset
Organizational Barrier	- Lack of initiative and training - Resistance to changing current practices - Lack of knowledge/data library

Are you ready for 4D?

Is 4D right for your project?

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Litmus test to On-board the 4D Journey…….

1. Do you believe a **validated and reliable schedule provides a foundation for successful project** delivery?

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2. Does your **schedule identify safety issues, congestion, and no work zones** to minimize risks and hazardous conditions? Does the **safety team understand and participate in early review** of the plan?
3. Are **temporary works, resources and equipment included and optimized** in your schedule? There are significant potential savings here.
4. Can you easily **identify space/time conflicts early in the planning stage;** so they can be resolved when costs are at their lowest?
5. Does the **project delivery team engage and share knowledge to optimize the plan** for the overall project rather than protecting their silos?

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Litmus test to On-board the 4D Journey…….

6. Are your **subcontractors** and specialty suppliers **receiving up to date progress reports** to ensure maximum productivity and cost efficiency on site?
7. Do you communicate clearly and efficiently ensuring the entire **delivery team has a shared understanding** of the project approach?
8. Are you confident that you can **deliver every project on time**?
9. Have you reviewed **“what if” scenarios to enable informed and proactive decisions** if things don’t go as planned?
10. Are **you innovating at every stage to ensure peak performance**?

Some misconceptions about 4D models

I need to have a detailed 3D model for 4D modeling

- Don't have to do everything in 3D to do 4D
- 4D modeling is not a 3D initiative, it is a scheduling initiative

4D modeling is very time-consuming

- RFP model in 1 week but possible in 24 hours, project model in 30-60 days

Learning curve is high

- for scheduler: a couple of weeks to understand relationships between schedule and 3D model and to learn 4D software
- project management: a few days
- clients/audience: quick education on what they are looking at

3D coordination is good enough

- every project comes down to construction sequencing to make the project feasible or economical

Global Construction Market to Reach $15 Trillion by 2025

Acknowledgement

- Synchro
- V5D
- Swallow M and Zulu S (2019) Benefits and Barriers to the Adoption of 4D Modeling for Site Health and Safety Management. Front. Built Environ. 4:86. doi: 10.3389/fbuil.2018.00086
- Pyung, Ki & Tony, Ma & Baryah, Amanjot & Zhang, Chujun & Hui, Ka. (2016). Investigation of Readiness for 4D and 5D BIM Adoption in the Australian Construction Industry
- Jung, W. and Lee, G. (2015) The status of BIM adoption on six continents, International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering, 9(5), 512-517.
- Martin Fischer; 4D Modeling: Applications and Benefits

Don’t wait!

Just get started with a pilot project; to ripe benefits of the New Standard of planning; 4D modelling

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