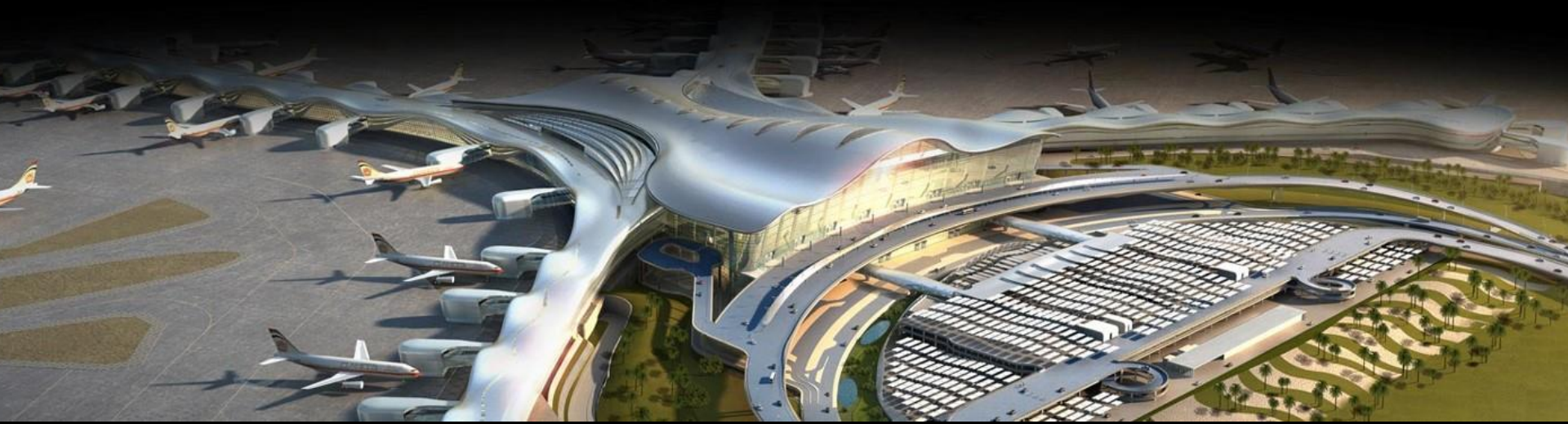
BIM AND DIGITAL CONSTRUCTION WORKFLOWS WITHIN THE CONSTRUCTION INDUSTRY

PROPER AND PRACTICAL APPLICATION OF BIM IN A MEGA AIRPORT PROJECT

ADDING VALUE AND MAXIMIZING ROI ACROSS THE SUPPLY CHAIN

01/APR/2025 ISSAM ELABSI

MEGA AIRPORT PROJECT

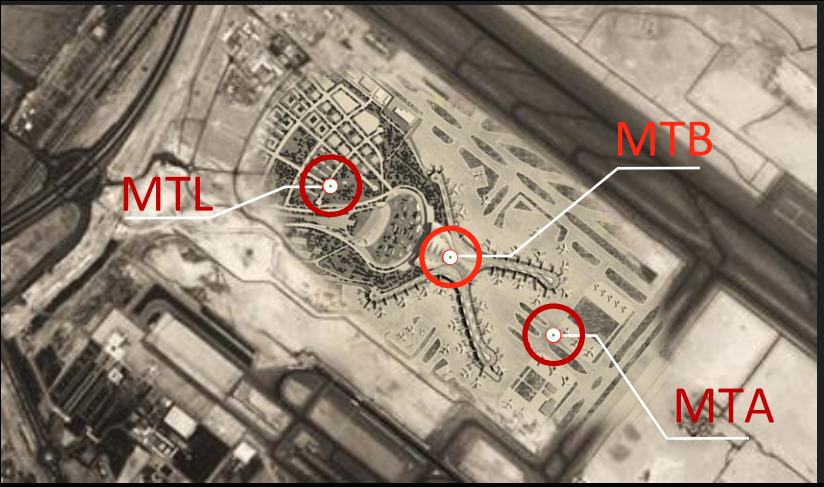




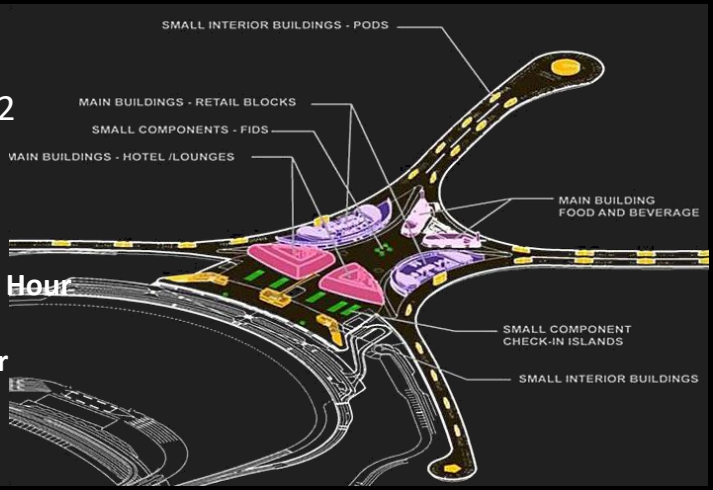

Midfield Terminal Building




General Figures



Built Up Area : 700 000 m2
Project Value : $ 3 Billion
Piers Aircraft Capacity : 65
Number of Gates : 106
Passenger Capacity : **8500 / Hour**
Check in Counters : **165**
BHS Capacity : **19000 / Hour**
BHS Length : **22 Kilometers**



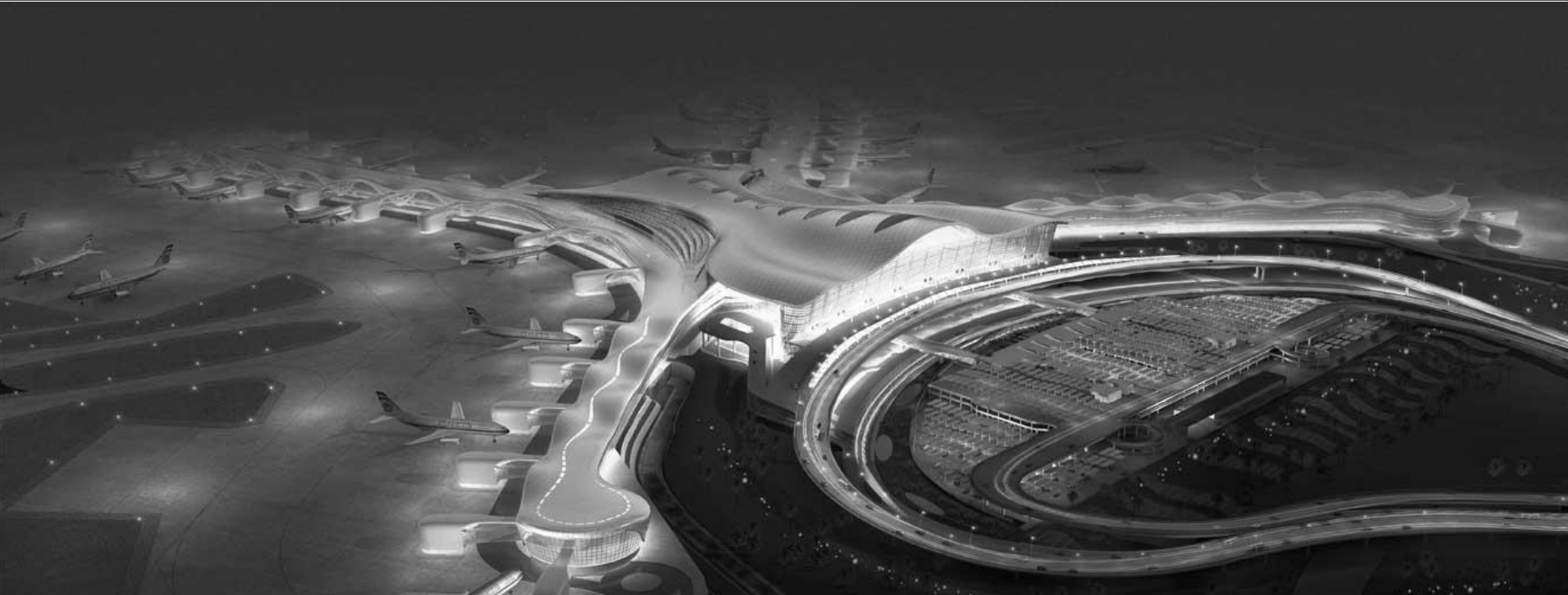
General Figures

Structural

- In situ Concrete Volume : **560,000 m³**
- Pre-Cast Concrete Volume : **312,000 m³**
- Steel Rebar Tonnage : **135,000 tns**
- Structural Steel Tonnage : **45,000 tns**

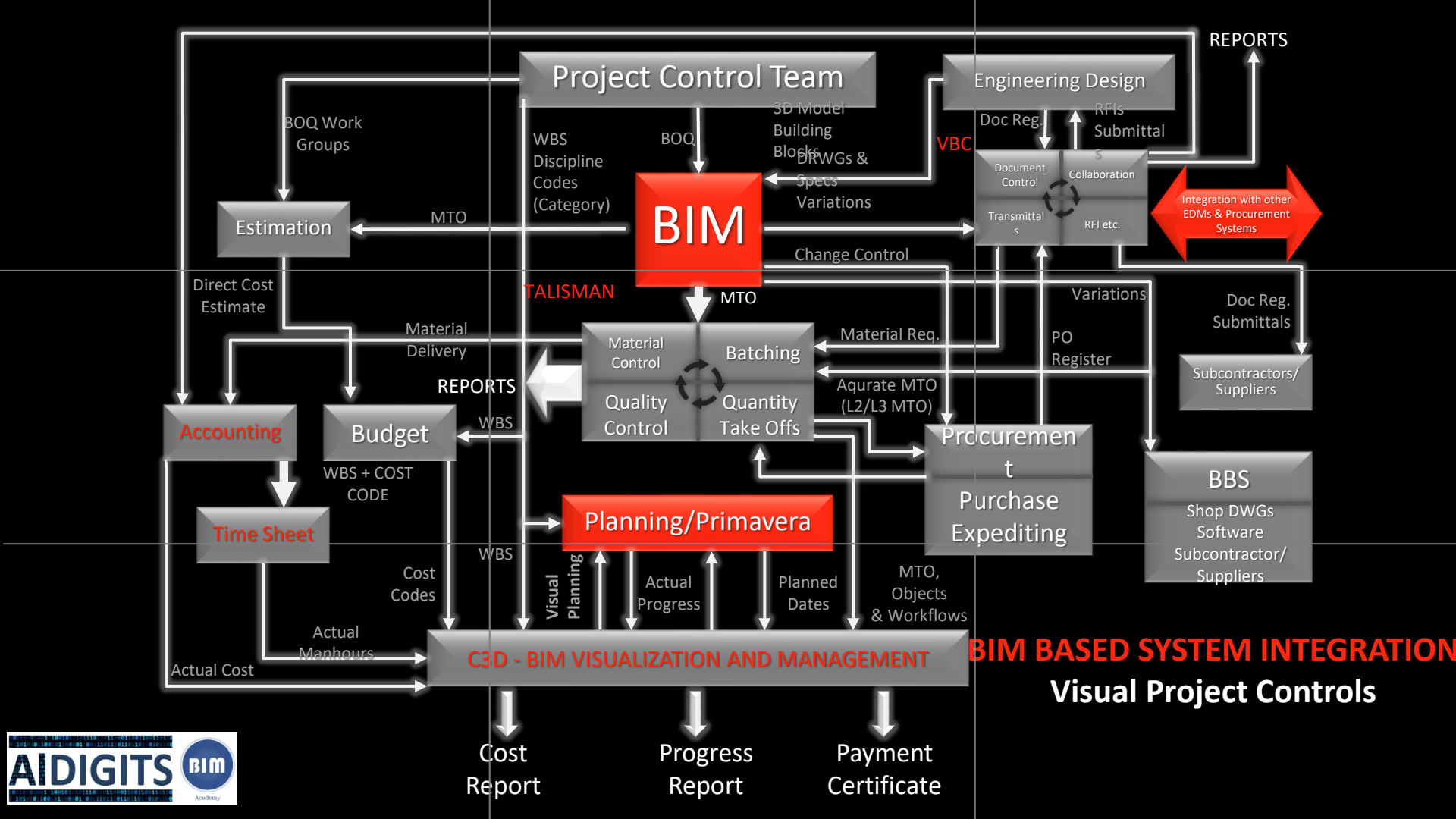
Architectural

- In Blockwork : **230 000 m²**
- Roof Cladding : **260 000 m²**



REQUIREMENTS

- Engineering
  - Clash Mitigation and Design Coordination
  - Develop and Implement an RFI system
  - Extract and Support the development of Shop drawings
  - Realistic digital mock-ups
- Project Controls / Planning
  - Cost Estimation
  - 4D studies, link to Primavera, Optimize Construction Schedule
  - Show Project resources (labor, material and equipment)
  - Progress monitoring and control
  - What if scenarios
- Contractual & Quantity Surveying
  - Quantity take-off and measurements
  - Variation orders management and visualization
- Manufacturing
  - Digital fabrication
- Handing over :
  - As – Built
  - FM / AM Integration
  - O&M Integration


REPORTS
Project Control Team
Engineering Design
BOQ Work Groups
WBS Discipline Codes (Category)
BOQ
3D Model Building Blocks
DRWGs & Specs
VBC
Doc Reg.
RFIs
Submittals
Document Control
Collaboration
Transmittals
RFI etc.
Integration with other EDMs & Procurement Systems
BIM
Estimation
MTO
Variations
Change Control
Direct Cost Estimate
TALISMAN
MTO
Material Delivery
Material Req.
Material Control
Batching
Quality Control
Quantity Take Offs
PO Register
Doc Reg. Submittals
Subcontractors/ Suppliers
REPORTS
Aqurate MTO (L2/L3 MTO)
Accounting
Budget
WBS
WBS + COST CODE
Prccuremen t Purchase Expediting
BBS
Shop DWGs Software Subcontractor/ Suppliers
Time Sheet
Planning/Primavera
WBS
Cost Codes
Visual Planning
Actual Progress
Planned Dates
MTO, Objects & Workflows
Actual Manhours
Actual Cost
C3D - BIM VISUALIZATION AND MANAGEMENT
Cost Report
Progress Report
Payment Certificate
BIM BASED SYSTEM INTEGRATION
Visual Project Controls
AIDIGITS
BIM
Academy

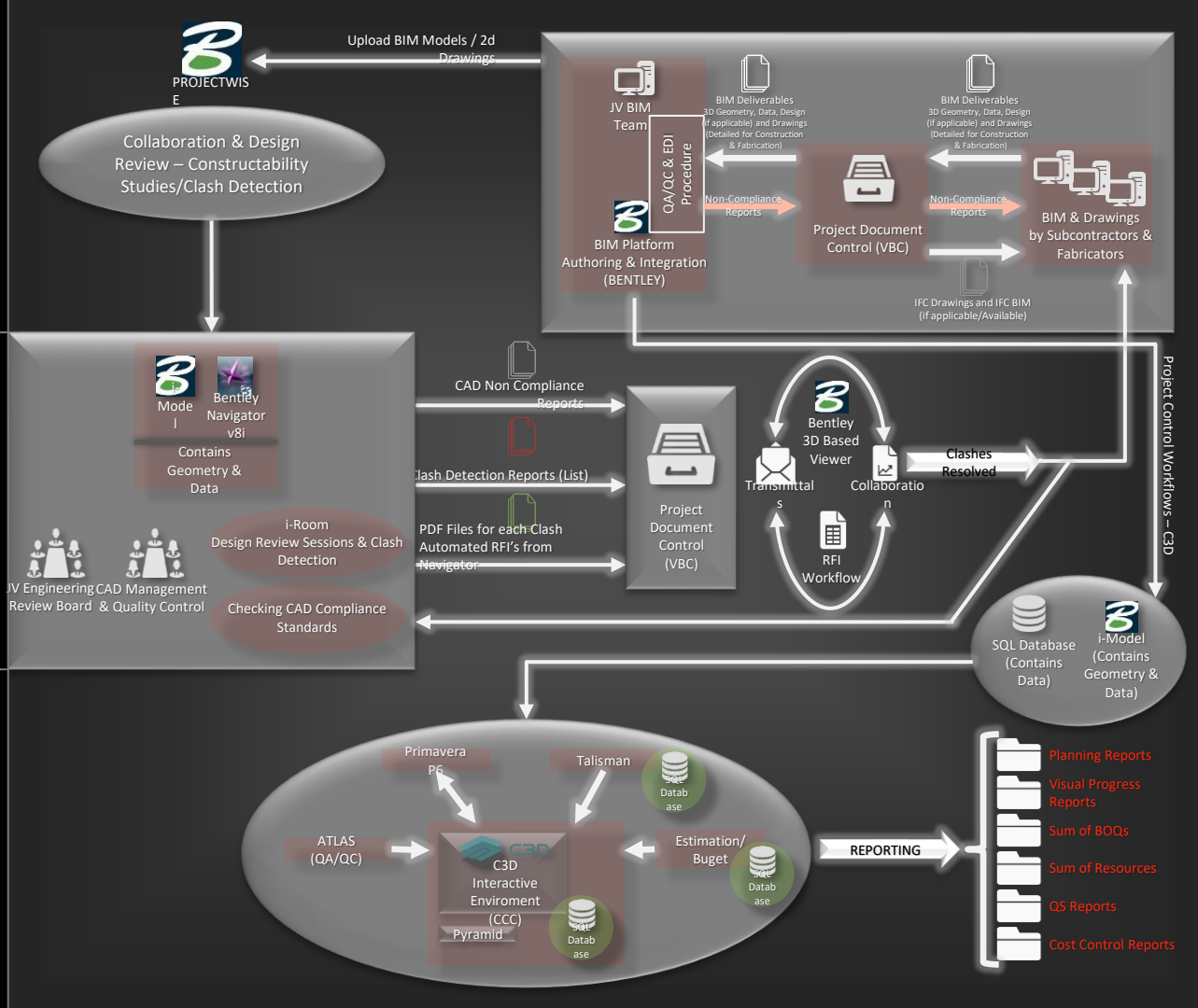
E D I
(INTEROPERABILITY)
Electronic Data Interchange

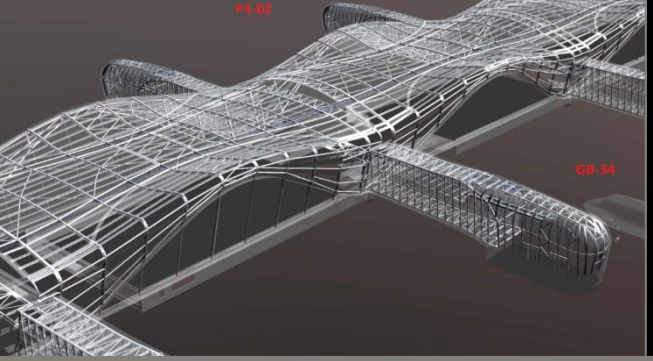
Aim

Arrangement and transformation of the BIM CAD files and information created by the JV & Subcontractors to project (TCAJV) BIM platform

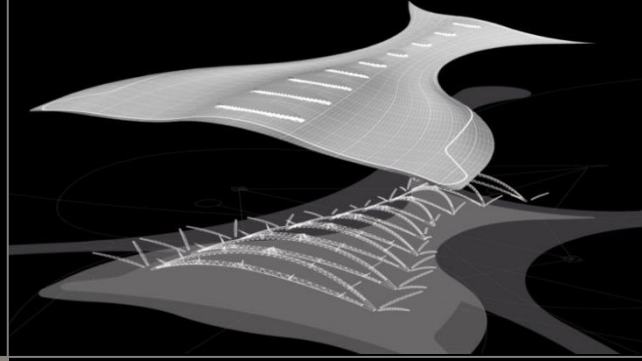
Benefits

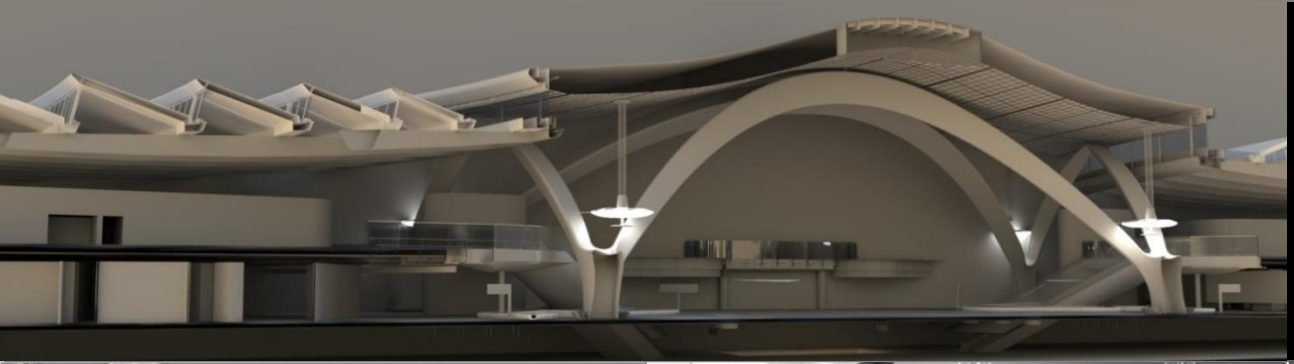
- Common language for graphical and textual data exchange
- Interoperability
- Integration of all BIM information from all disciplines
- Data integrity and lifecycle management





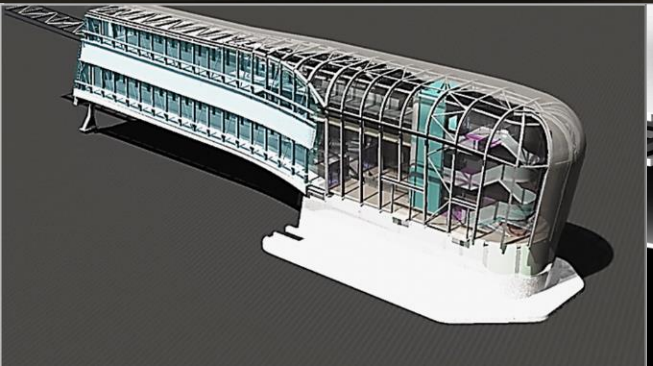
3D Modeling

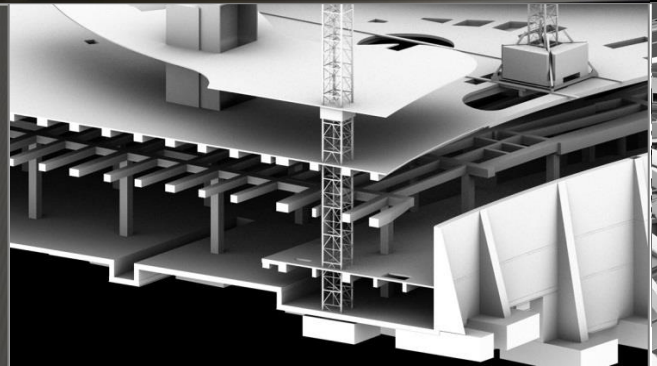


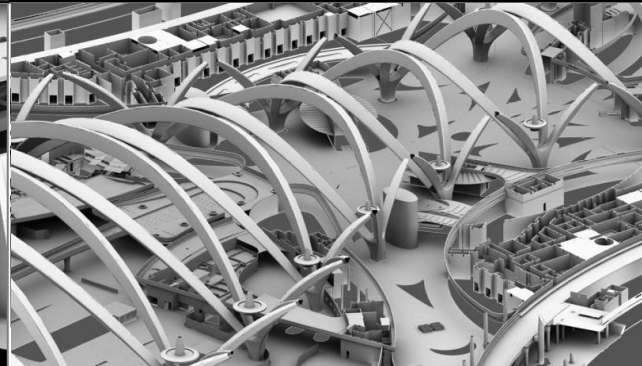


Bentley Tools allowed for :

- Intelligent models generation
- Addressed the complex design
- Visualized engineering situation through all construction phases







BIM Based Material Take Off – Scope Management

Schedule Table

Project Name	Building	Level	System	Activity	Sector	Description-1	Description-2	Handle	Length	Room
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15174	375.	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15173	?	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15164	375.	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15163	?	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15154	375.	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15153	?	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15144	375.	
MTB	CP	LB.2	ELE-SP		5.16D	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15143	?	
MTB	CP	LB.2	ELE-SP		5.16D	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	1512D	659.021	
MTB	CP	LB.2	ELE-SP		5.16D	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	1511E	659.021	
MTB	CP	LB.2	ELE-SP		5.16D	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	1510F	659.021	
MTB	CP	LB.2	ELE-SP		5.16D	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	15100	659.021	
MTB	CP	LB.2	ELE-SP		5.12A	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15075	375.	
MTB	CP	LB.2	ELE-SP		5.12A	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15074	?	
MTB	CP	LB.2	ELE-SP		5.12A	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	15065	375.	
MTB	CP	LB.2	ELE-SP		5.12A	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15064	?	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	15055	1045.734	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15054	?	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	15053	629.218	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	15044	945.734	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	15043	?	
MTB	CP	LB.2	ELE-SP		5.12A	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	15042	529.218	
MTB	CP	LB.2	ELE-SP		5.12C	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	1502D	375.	
MTB	CP	LB.2	ELE-SP		5.12C	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	1502C	?	
MTB	CP	LB.2	ELE-SP		5.12C	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	1501D	375.	
MTB	CP	LB.2	ELE-SP		5.12C	RGS	25.00 MM DIAMETER 90.0 DEGREE CONDUIT ELBOW EMT SET SCREW US METRIC	1501C	?	
MTB	CP	LB.2	ELE-SP		5.12C	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	1500D	986.974	
MTB	CP	LB.2	ELE-SP		5.12C	PVC	25.00 MM CONDUIT EMT SET SCREW US METRIC	14FFE	987.694	
MTB	CP	LB.2	ELE-SP		5.11D	RGS	25.00 MM CONDUIT EMT SET SCREW US METRIC	14FE0	375.	

	A	B	C	D	E
1	Code	Description	Unit	Sum of Sum of Quantity IFC	Sum of Sum of Quantity B06
2	03-R-28-095-A	Pre-action system manual station points	pc	291	292
3	03-R-28-095-B	Manual fire alarm pull station points	pc	744	744
4	03-R-28-095-C	Smoke detector points U.O.N type	pc	3342	3356
5	03-R-28-095-D	Smoke detector points U.O.N type, Duct	pc	36	26
6	03-R-28-095-E	Air sampling smoke detector points U.O.N	pc	3509	3515
7	03-R-28-095-F	Elevator recall smoke detector points	pc	540	540
8	03-R-28-095-G	Smoke/heat detector points	pc	785	785
9	03-R-28-095-H	Heat detector points	pc	573	546
10	03-R-28-095-I	Addressable input module points	pc	2146	2148
11	03-R-28-095-J	Addressable output module points (Control)	pc	1622	1622
12	03-R-28-095-K	Output relay points	pc	121	121
13	03-R-28-095-L	Flow detector/switch points	pc	413	413
14	03-R-28-095-M	Tamper detector/switch points	pc	857	859
15	03-R-28-095-N	Low air pressure detector/switch points	pc	119	119
16	03-R-28-095-O	Horn; strobe assembly points; wall/ceiling	pc	1846	2050
17	03-R-28-095-P	Strobe points wall/ceiling mounted	pc	4816	4781

ROI : BIM Methods Reduced The Number of Quantity Surveying Team

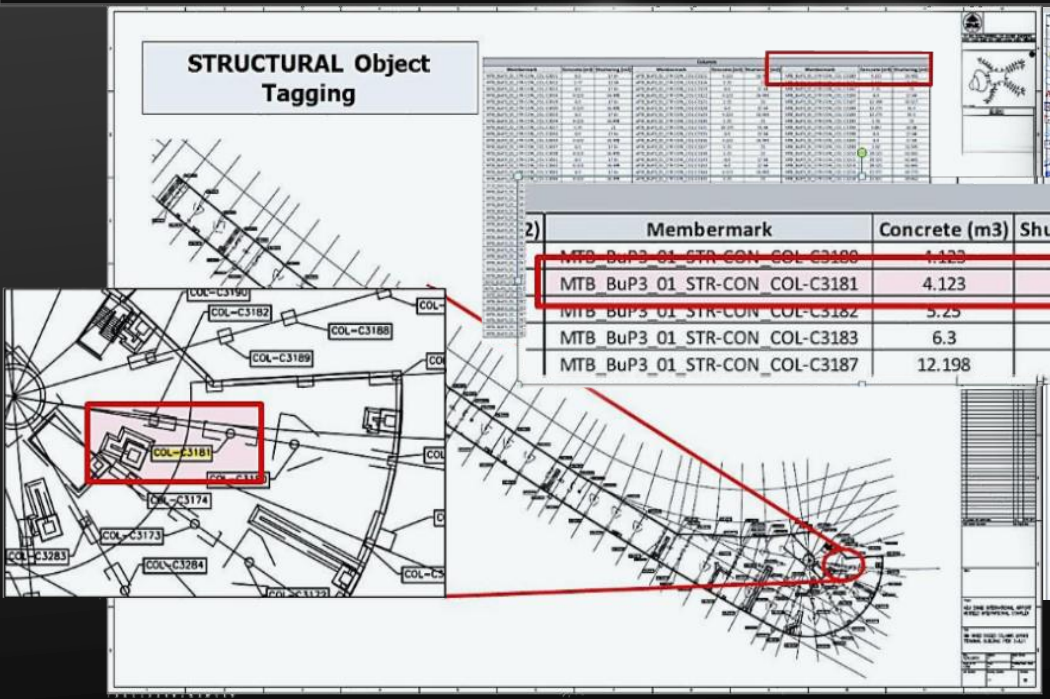
from 60 to 6 - 90% Saving in Direct Cost

AIDIGITS BIM Academy

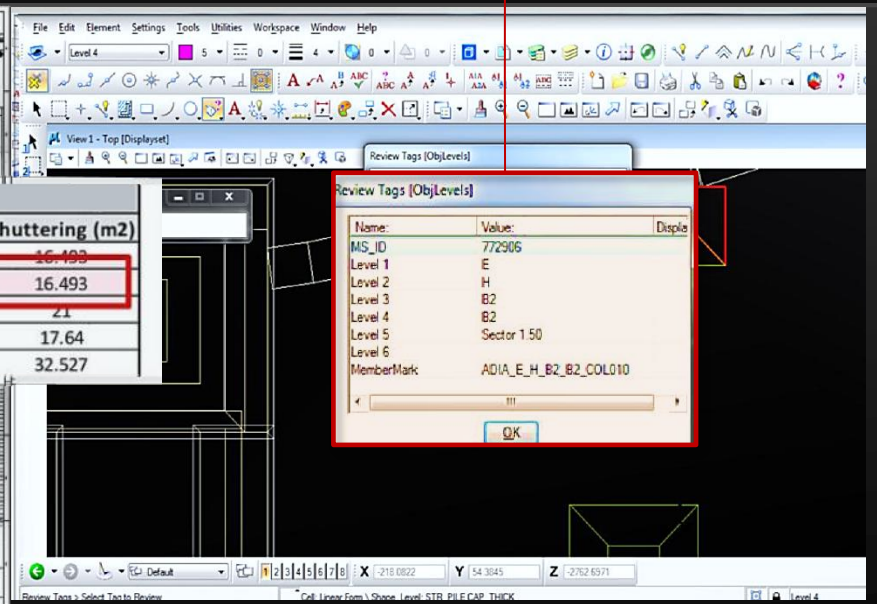
Object Naming: Asset Tagging

Asset / Object Tagging (Structural)

Objects are tagged based on agreed WBS ensuring uniqueness of each element.



Membermark	Concrete (m3)	Shuttering (m2)
MTB_BuP3_01_STR-CON_COL-C3180	4.123	16.493
MTB_BuP3_01_STR-CON_COL-C3181	4.123	16.493
MTB_BuP3_01_STR-CON_COL-C3182	5.25	21
MTB_BuP3_01_STR-CON_COL-C3183	6.3	17.64
MTB_BuP3_01_STR-CON_COL-C3187	12.198	32.527



Collaboration
Project Wise

Name	Out to	State
Clash1_Mech vs Struc.pdf		Published
Clash2_Mech vs Struct.pdf		Review
Clash4_Mech vs Struct.pdf		WIP

Enforced Workflow

Workflow in PW Explorer

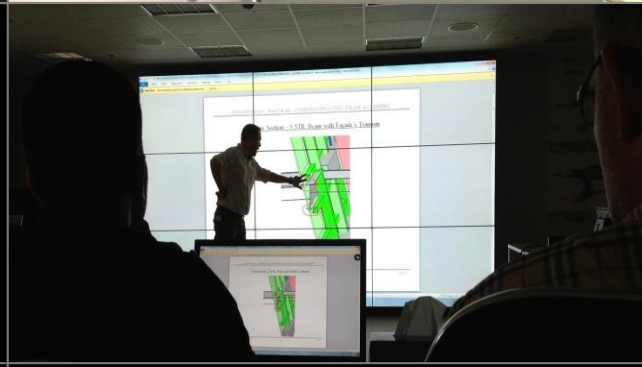
- Model created by WIP Team
- Review by QC Team
- Others can see but not change
- Accessible to Third Party (S/Cs, Client, Engineering)
- Model Ready For Coordination (LOD400)
- Model locked as Final Version (LOD400/500)

ROI :

- Automatic Versions/Revisions
- Automatic Notifications
- Better Performance By Working Locally
- File Tracking
- File Information from within Explorer
- Custom File Attributes
- Number File Check-Out Window
- File Check-In Window
- Powerful and Fast Search Capability

Collaboration

i - Room

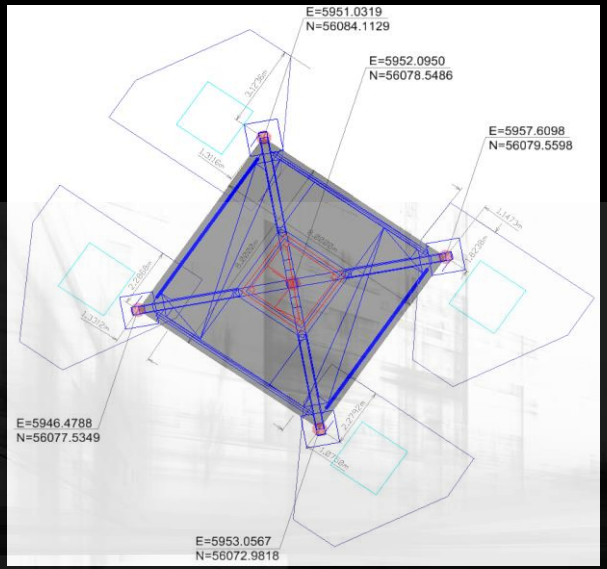


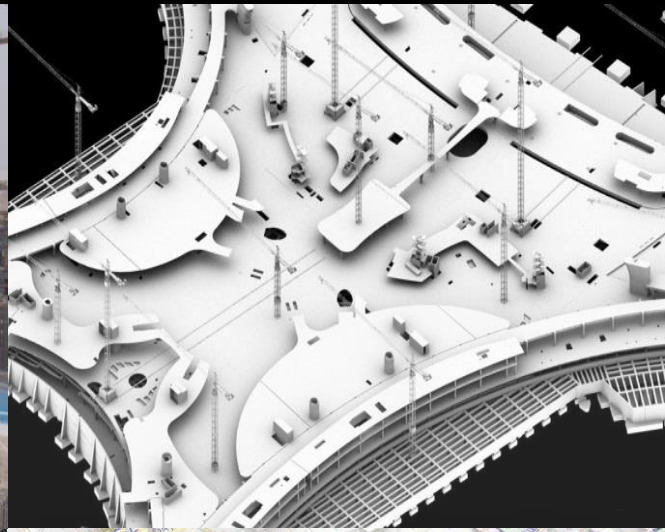
ROI

Innovative Methods For BIM Based Collaboration

Reduced The Cycle Of Critical RFI'S From 28 Days Down to (7 to 2) days

BIM Site Logistics





BIM AIDIGITS

Construction Sequence
Internal Logistics

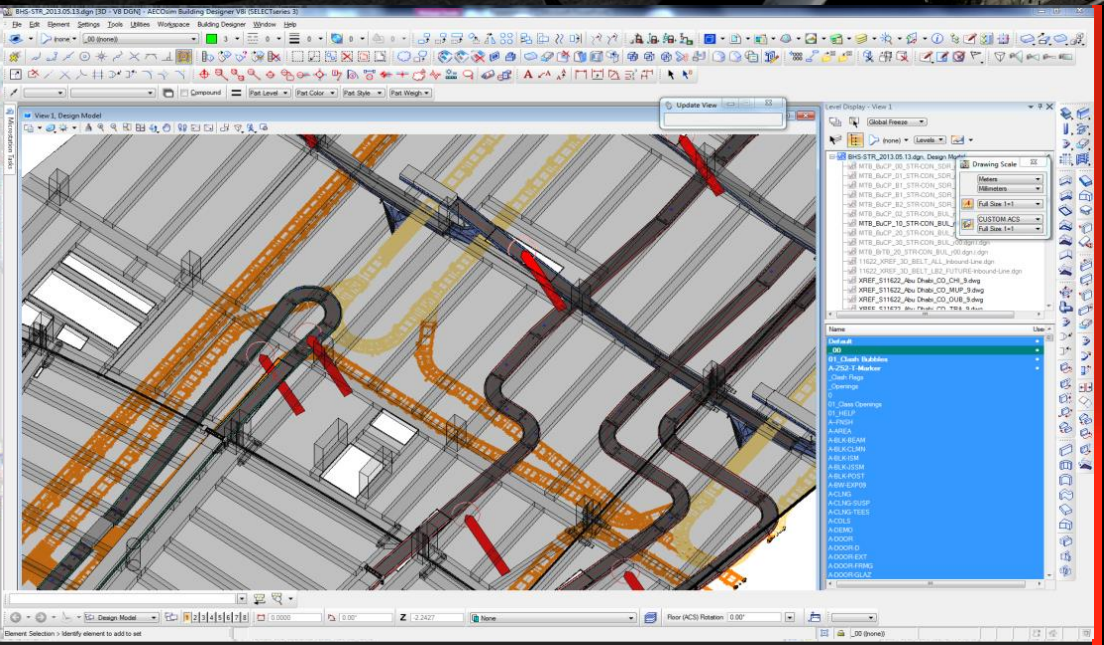
Site Condition on October 10th

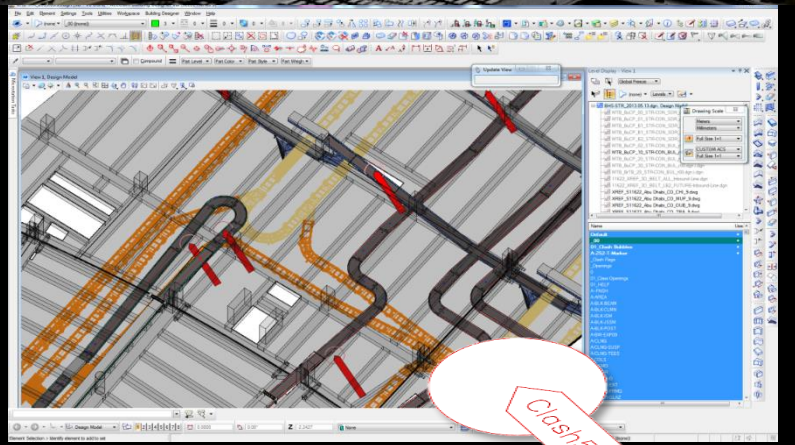
ROI:

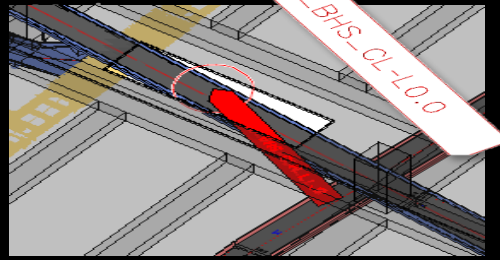
- BIM Methods Eliminated the Acquisition of 5 New Tower Cranes
- 4D Simulation Proved less than 20% of Effective Utilization
- Cancelled Costly Non Feasible Investment

Clash Detection

- Reduction Of Costly On-Site Errors
- Time Saving
- Quality Improvement Of The Design
- Making Reliable Decisions
- Reducing Risks





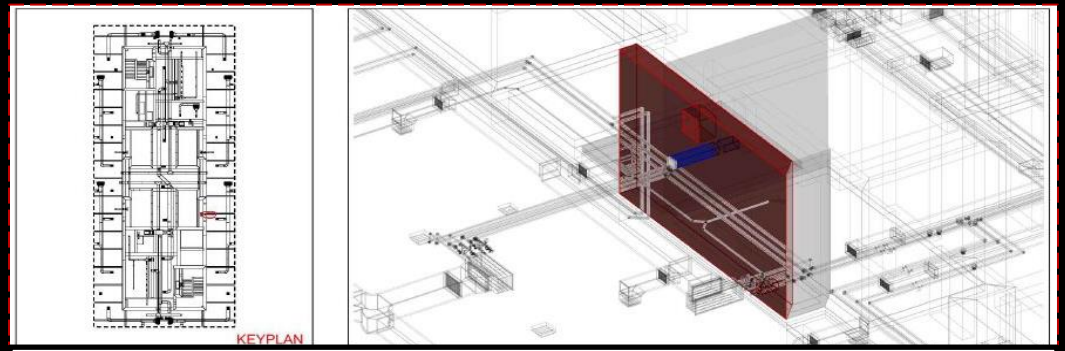


Clash Detection With Bentley

Clashes Tags Navigator

Clash Detection

Report Markup/Resolve Clashes (RFI)



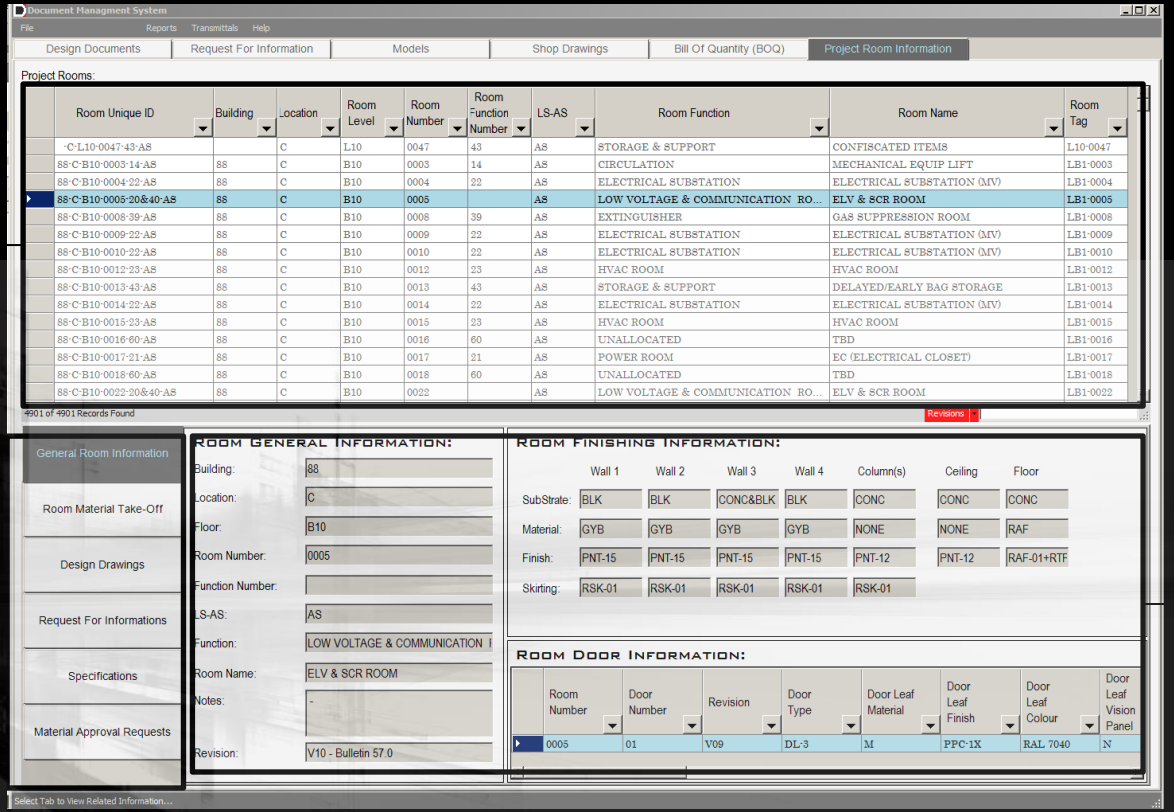
Markup: HVA to 1Wall-0002_STR L11 - MEC L11	
Description: STR L11 - MEC L11	Approved By: ####
Review Model: Default	Status: Not started
Creator: pmlaiou	Priority: Normal
Date Created: 30-Dec-14 9:25:17 AM	Due Date: 02-Jan-15
Assigned To: AKaradimas	Reviewed By: PMLaiou
Users: BIM Department	

BIM FINISHES SCHEDULE

BIM
Updatable Room Schedule

Other Room Specific Linked Information

Detailed Finish Schedule per Room

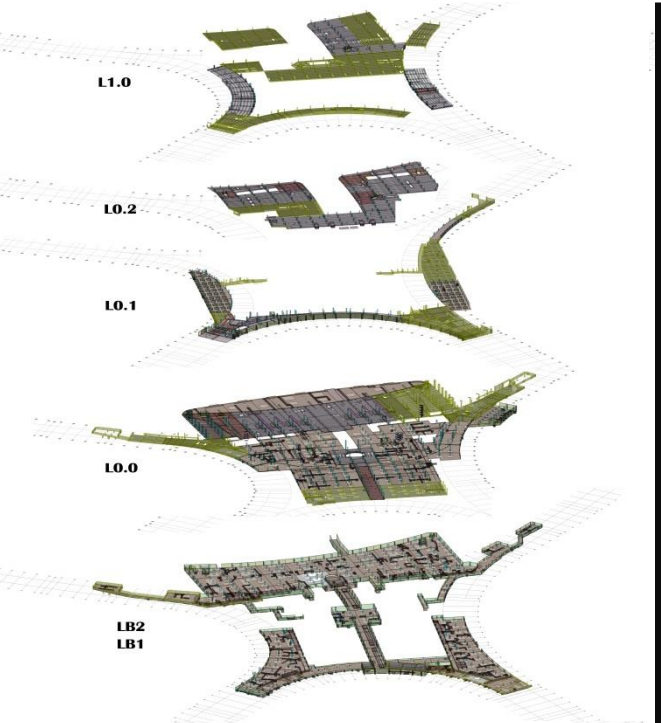


4D Simulation

4D Simulation

BIM Workflows Eliminated the Need for Lengthy Approval Cycles for the Construction Schedules

- Validate the Construction Methodology
- Resolution of Constructability Concerns
- Produce ‘ WHAT IFS ’ Scenarios to enhance Construction Efficiency
- Visualization of Schedule to augment Cost Effective Scenarios

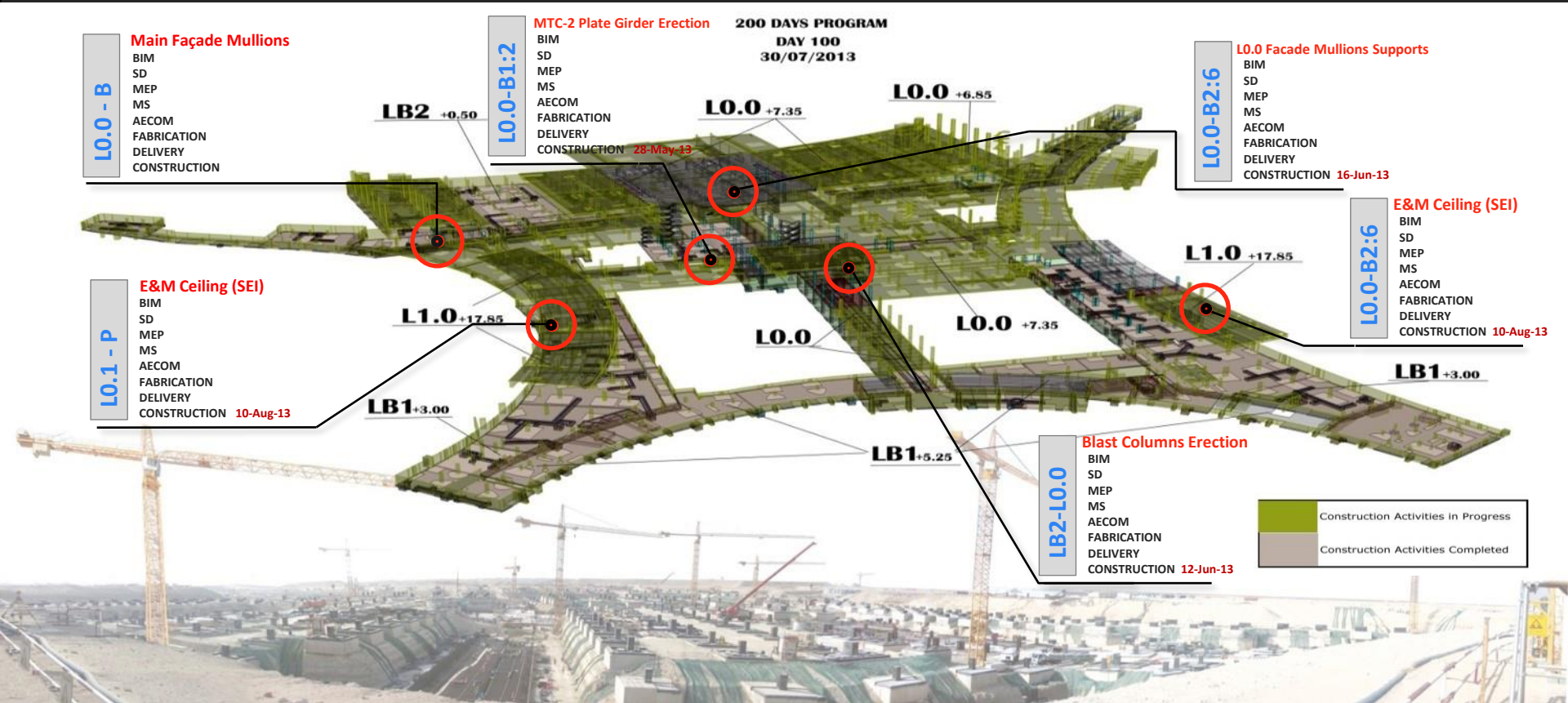


200 DAYS PROGRAM

SCHEDULED ANIMATION

VIRTUAL CONSTRUCTION SEQUENCE

4D Simulation



BIM VE – VO Commercial Reports

VE'S & PROVISIONAL VE'S *(FAÇADE CASE STUDIES)*

29 October 2012

Reference: MTB/TCA/AECOM/L/000070

ISSUED 30 OCT 2012 TCA JV DCG

RECEIVED 30 OCT 2012

AECOM MIDDLE EAST LIMITED
P. O. Box 38811
Abu Dhabi
United Arab Emirates

Attention: **Alan Stevens, Construction Manager**

Contract Number: AUH.06.10.0401
Project Name: Midfield Terminal Building - General Contractor
Reference: TCA JV Letter ref. MTB/TCA/AECOM/L/0004 dated 19 September 2012
Subject: **Provisional Value Engineering Savings - Arch 12, 30, 35 and 38**

Dear Sir,

With reference to your letter ref. MTB/TCA/AECOM/L/0004 dated 19 September 2012 regarding the Employer's selection of Arch 12, 30, 35, 38 and Arch 122 for definition and cost estimation. This letter responds to Arch. 12, 30, 35 and 38 only.

Our proposals for the above referenced Provisional Value Engineer Items are as follows:

ADAC

PRICING DOCUMENTS - VALUE ENGINEERING

BILL NO. VE 1
Alternate Arch-35B - Glazing

ITEM	DESCRIPTION	QUANTITY	UNIT	RATE	DIRHAMS
					Bill VE/Arch-35/1
	Arch- 35 Item B: Replace bi-colored frit at Wall types P & CG with single colored frit. All other current specifications pertaining to glazing to remain. Reference Specification 084401				
	OMIT Glazing to Piers (Bi-Colored Frit)				
A	Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PT1, PT2 and PT3, securing back to horizontal and vertical steel members as described, including circular local clip detail	-14,550	m²	2,043.48	(29,732,634.00)
B	Design, supply and install specialist steel and panellized glazing, inclined to 14.75				

Quantity Comparison for VE-35&38 and Extension

SN	BOQ Ref	System	Unit	BOQ QTY	Actual QTY
1. For Arch-35					
1	3/H/24-B	PT1/PT2/PT3	M2	18,150.00	18,187.00
2	3/H/24-E	PN1/PN2/PN3	M2	3,295.00	3,304.00
3	3/H/25-A	PG1/PG2/PG3	M2	3,105.00	3,110.00
4	3/H/25-F	PS1/PS2/PS3	M2	2,265.00	2,310.00
5	3/H/26-A	PE1/PE2	M2	3,940.00	3,806.00
6	3/H/26-I	PE3/PE4	M2	2,104.00	1,920.00
7	3/H/26-E	CG	M2	2,080.00	1,897.00
2. For Arch-38					
1	3/H/28-A	PrD Inclined	M2	10,745.00	10,969.00
2	3/H/28-B	PrD Curved Inclined	M2	1,215.00	1,288.00
3	3/H/28-C	PrD Vertical	M2	5,130.00	5,134.00
4	3/H/28-D	PrD Vertical Inclined	M2	1,362.00	1,369.00
5	3/H/28-E	Terminal Foot Bridge	M2	2,670.00	2,632.00
6	3/H/28-F	Ditto curved on plan	M2	185.00	207.00
7	3/H/28-G	PrA Vertical	M2	4,664.00	4,554.00
8	3/H/29-A	PrA Vertical Inclined	M2	1,122.00	1,139.00
3. For Extension of Arch-35&38					
1	3/H/11-G	Gatehouse	M2	25,685.00	28,704.00
2	3/H/12-A	Gatehouse FR	M2	3,725.00	4,146.00
3	3/H/12-G	PC	M2	4,995.00	7,680.00
4	3/H/30-G	MTB Footbridge Fritted Glass	M2	860.00	845.00
5	3/H/30-I	CPLB Extra over fritted Glass	M2	64.00	64.00

SCs

Commercial

Client

BIM

Arch 35 & 38:
Alternative A > Replace low iron glass with clear glass

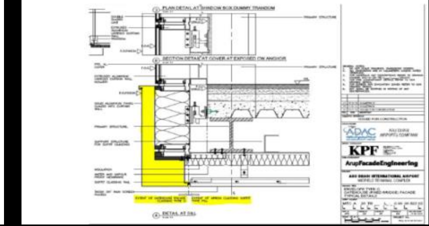
Alternative B > Replace bi-colored frit glass with single colored glass

BOQ Codes	Description	BIM Total Quantity	BoQ Quantity	Unit	Rate	Amount (AED)
03-H-08-024-B	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PT1, PT2 and PT3, securing back to horizontal and vertical steel members as described, including circular local clip detail	-17,985.45	18,150	m2		
03-H-08-024-E	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PN1, PN2 and PN3, securing back to horizontal and vertical steel members as described	-3,289.36	3,295	m2		
03-H-08-025-A	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PG1, PG2 and PG3, securing back to horizontal and vertical steel members as described	-3,095.68	3,105	m2		
03-H-08-025-F	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PS1, PS2 and PS3, securing back to horizontal and vertical steel members as described	-2,277.28	2,265	m2		
03-H-08-026-A	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier and Garden glazing; As PE1 and PE2, securing back to horizontal and vertical steel members as described	-3,969.42	3,940	m2		
03-H-08-026-I	OMIT Design, supply and install specialist steel and panellized glazing, inclined to 14.75 degrees, facetted on plan; includes metallic powder coated aluminium frame to glass; to lowest level of Pier glazing; As PE3 and PE4, securing back to horizontal and vertical steel members as described	-2,170.40	2,104	m2		
03-H-08-026-E	OMIT Design, supply and install aluminium and panellized fritted (bi-colour patterned screen printing with 40% density) glazing, facetted on plan; as type CG, securing back to horizontal and steel members as described	-2,119.82	2,080	m2		

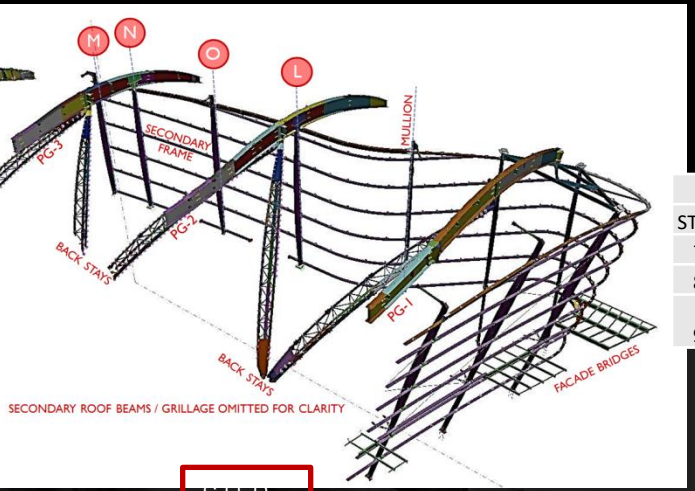
BoQ Codes	Description	Quantity	BoQ Quantity	Unit	Rate	(AED)
03-H-07-011-G	OMIT Gatehouse Facade; As Envelope Type G Design, supply and install support brackets, fixed back to primary steel structure, including double glazed unitised curtain walling to fixed link bridge and external pressure caps	-32,200.27	25,685.00	m2		
03-H-07-012-A	OMIT Proprietary fire rated double glazed curtain wall; glazing with bi-colour patterned screen printing 75% density	-4,140.84	3,725.00	m2		
03-H-07-012-G	OMIT Design, supply and install aluminium carrier frame curtain wall system, including fritted glass panels securing back to primary structure; As Façade Type PC	-7,252.27	9,989.00	m2		
03-H-08-030-G	OMIT Extra over for fritted glass	[illegible]	860.00	m2		
03-H-08-030-I	OMIT Extra over for fritted glass	-82.81	64.00	m2		

p.2/4 Date: 22.04.2014

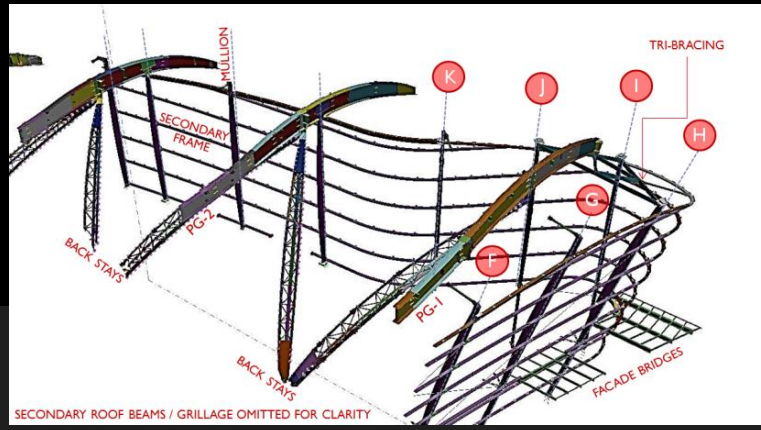
Note: Cill detail (highlighted below/extracted from dwg. A30-522) is included in BoQ item 03-H-07-011-G for BIM Quantities.
*BIM total Quantity for Gatehouse Glass only (cill detail excluded) is **28876.472 m2**.*



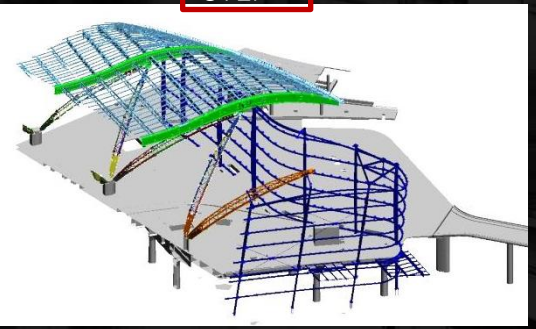
BIM & Construction Methodology



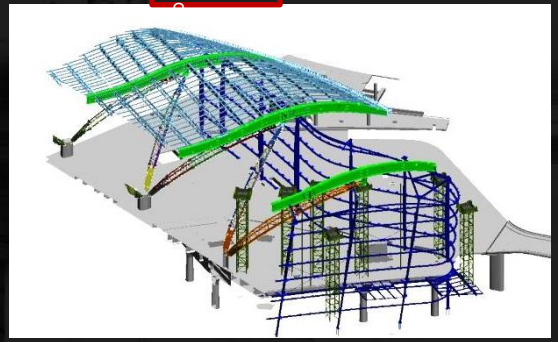
STEP	STEEL ROOF/ FAÇADE SEQUENCE
7	ERECT MULLION G, H, SECONDARY FRAME
8	ERECT PG1
9	SG12 SECONDARY ROOF BEAMS (TFGs) AND GRILLAGE



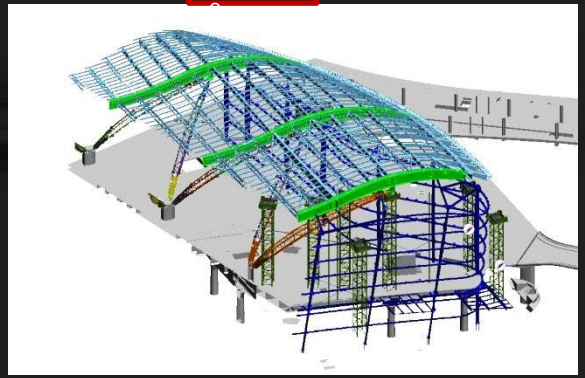
STEP



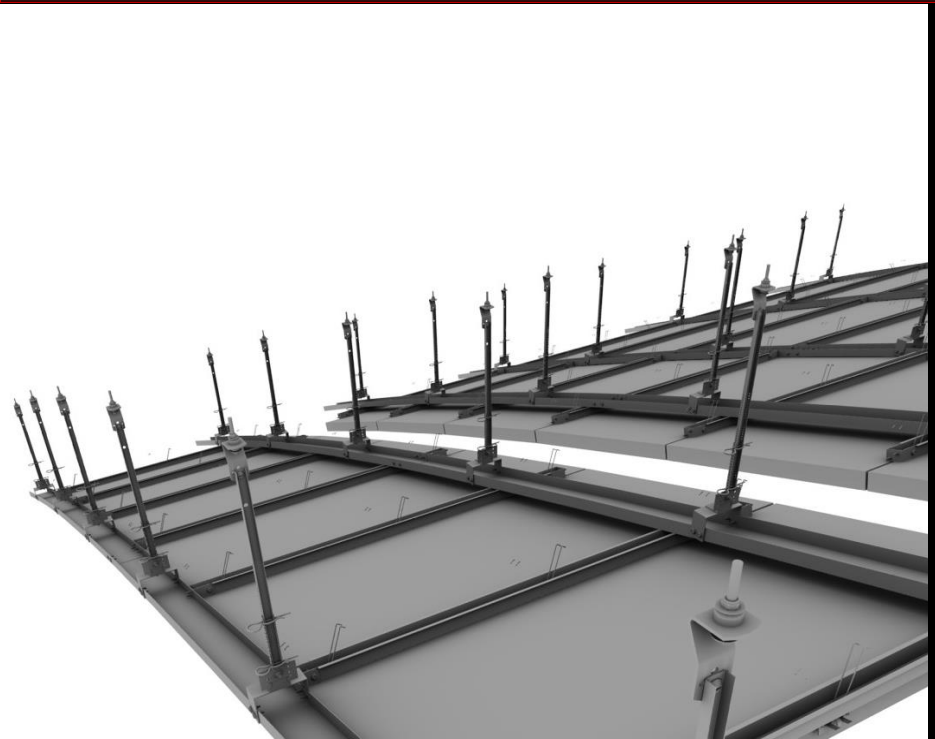
STEP

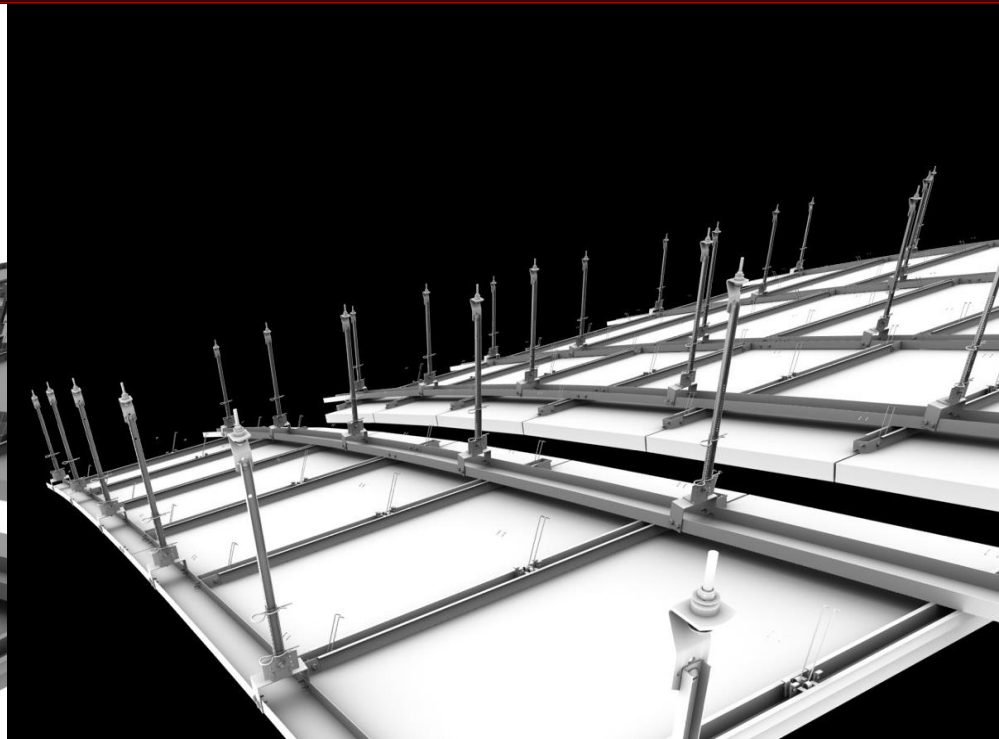


STEP



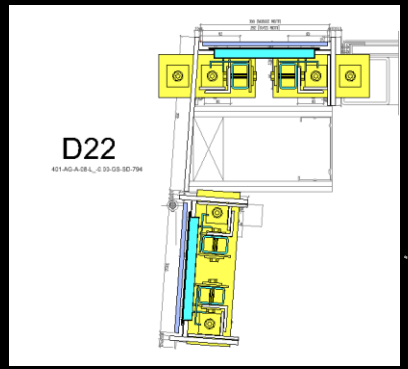
Fabrication

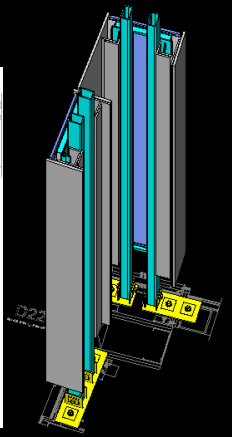


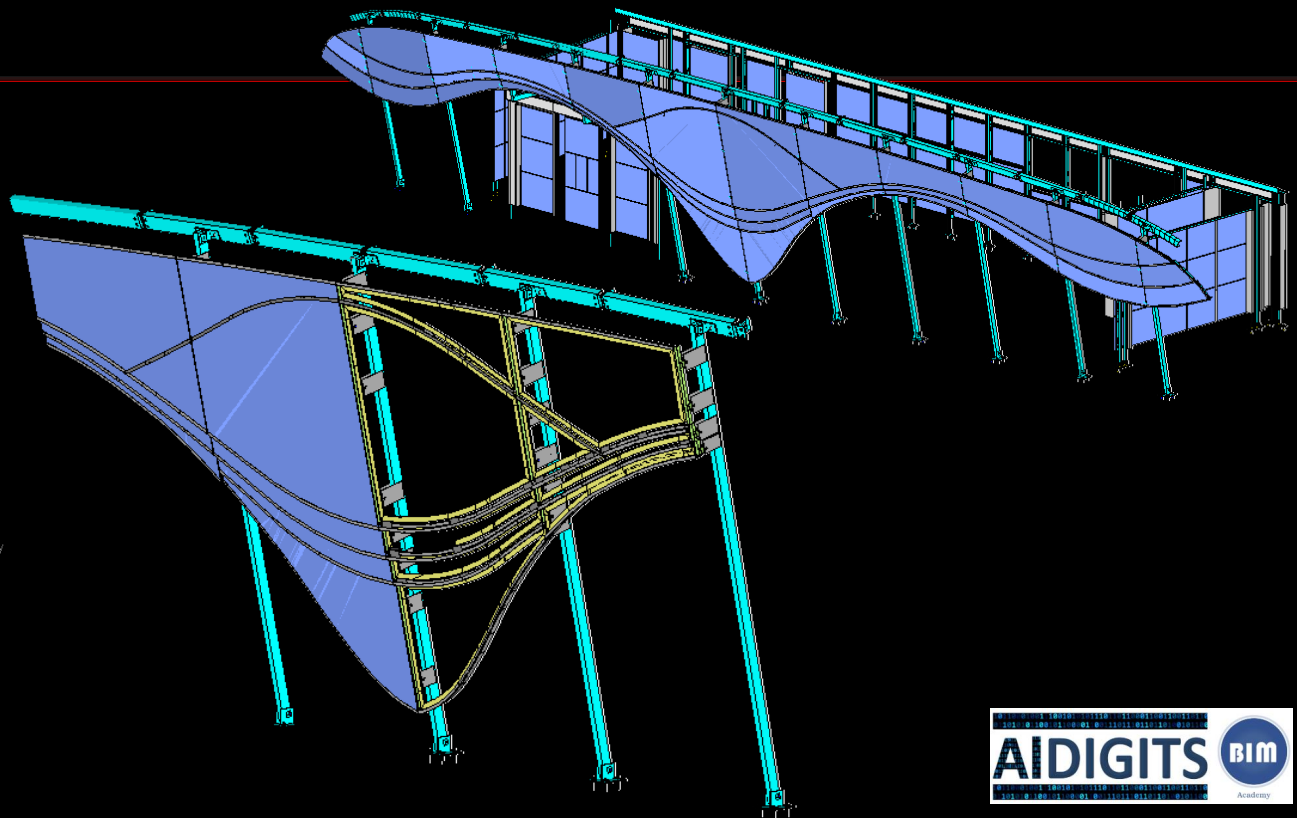


Fabrication

P1, P2 P3







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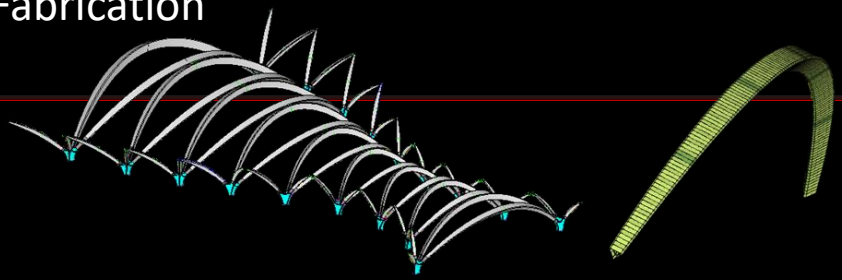
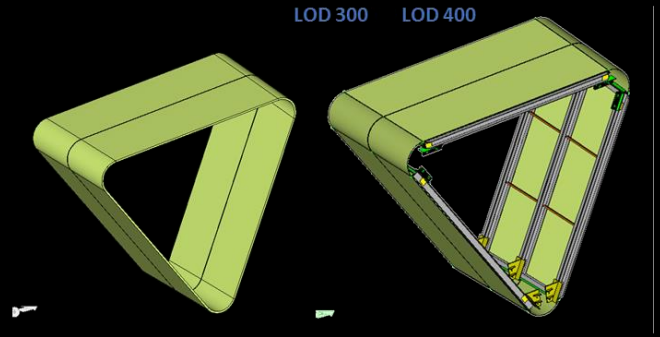
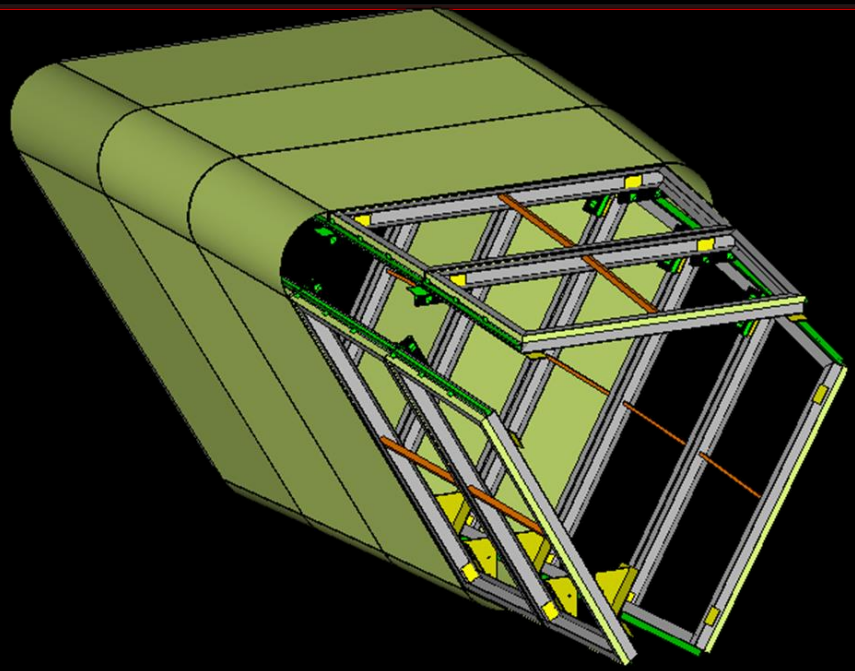


CENRE SPACE STRUCTURE

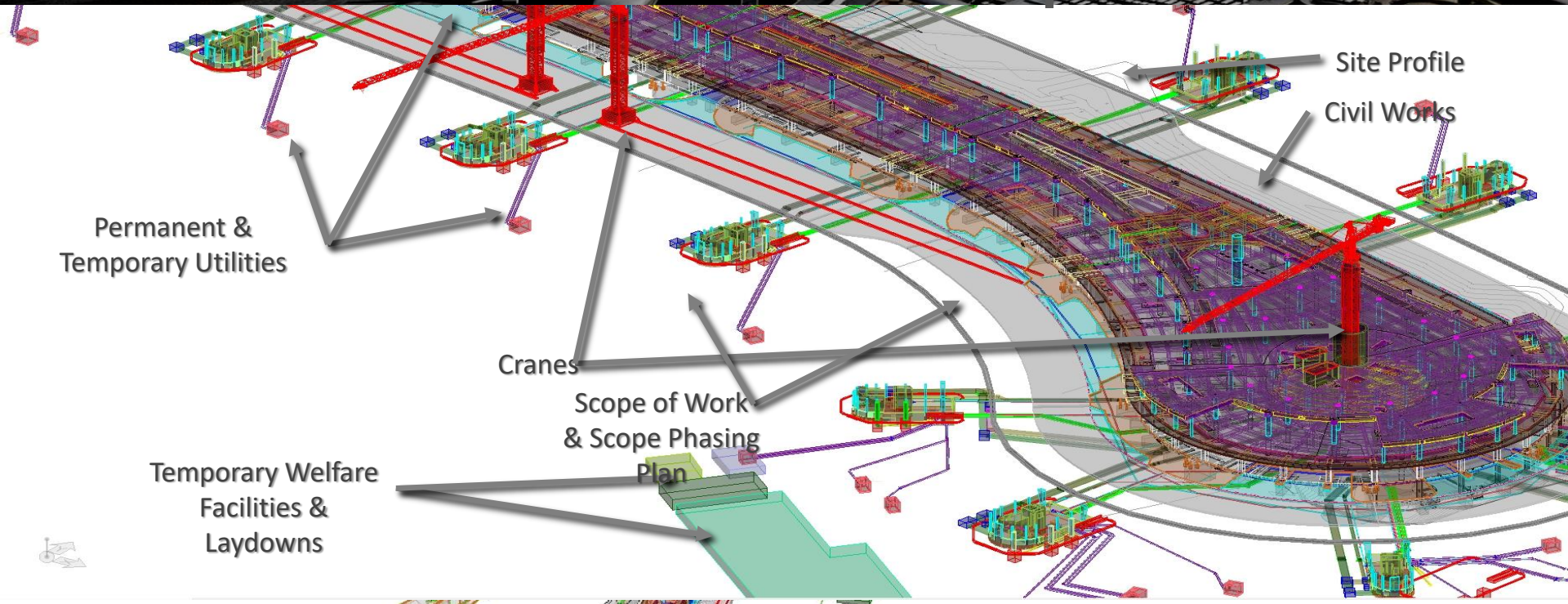
MAIN ARCHES AND BACKSTAYS



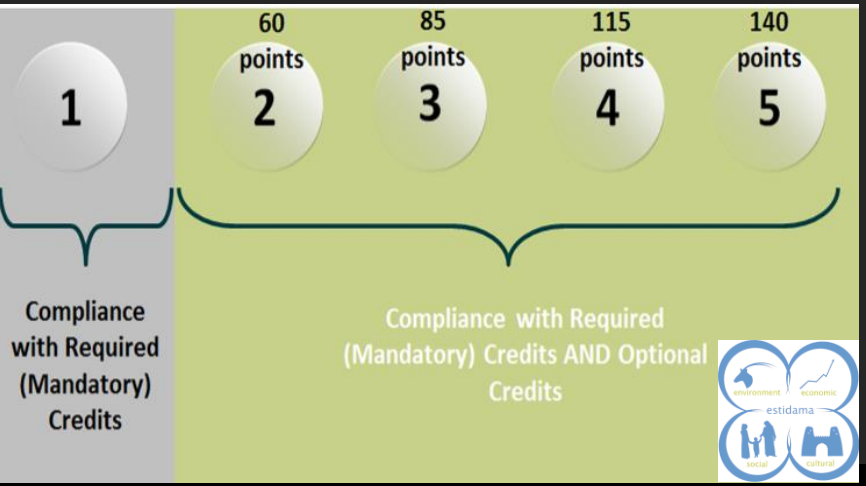


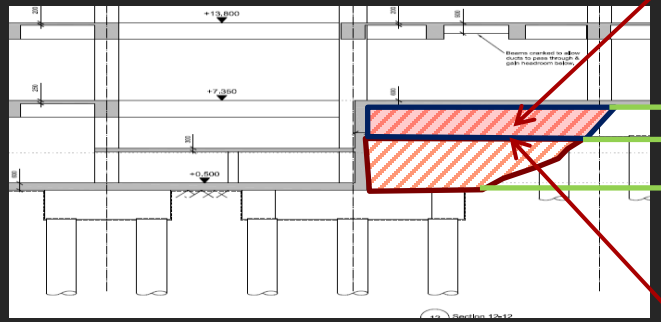
Progressive Interface Infrastructure Master Plan

ROI : BIM Workflows facilitated and managed the complex **Interface Coordination Process** eliminating Costly Delays, rework and Claims between Stakeholders



Sustainability in Construction



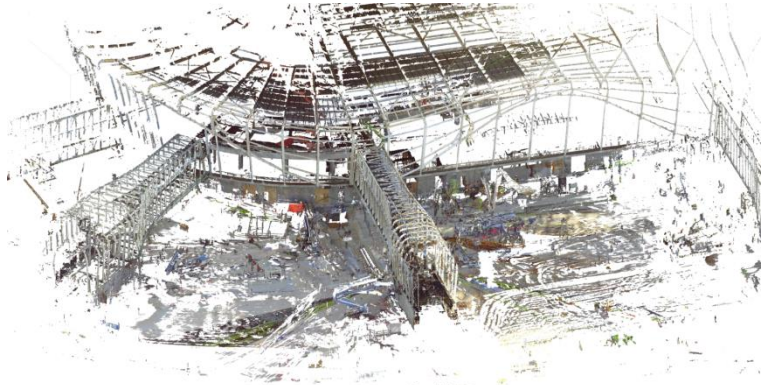


Filling for Suspended Slabs and Slabs on grade

- Better utilization of existing stock piles
- Eliminating purchase and transportation on site of backfilling material.
- Better coordination of earthwork and maximum use of existing temporary access ramps and equipment for filling.
- Facilitating reporting for QC due to clear and exact tagged areas
- Achieve 2 Credit Points

ROI : Use of 1,040,437 m3 recycled aggregates

BIM LASER SCANNING – AS BUILD

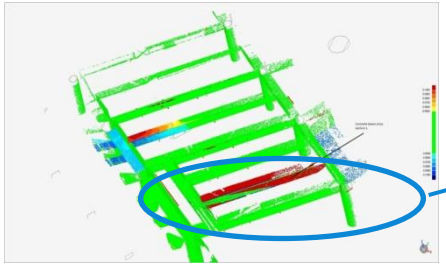


BIM LASER SCANNING – AS BUILD

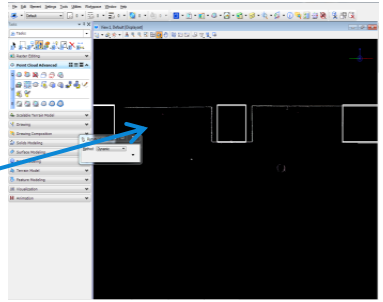
SCOPE OF THE PROJECT:
Updating BIM model using laser scanning.

QUALITY CONTROL

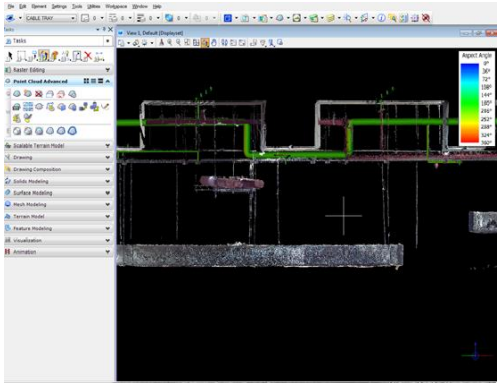
Color based deviation map

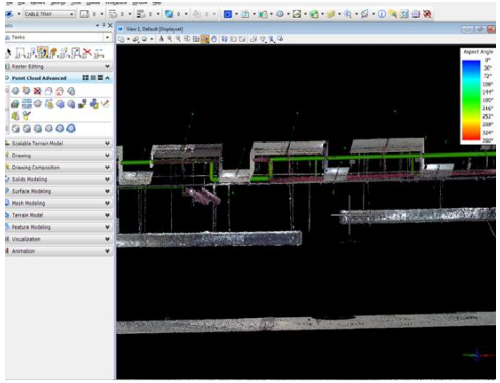


Cross section view



AS BUILT COMPARISON WITH MEP



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