CS124943

SBG Successful BIM Implementation Case Study: General Contractor

Youssry Salman
SBG-PBAD

Mohammad Saleh
SBG-PBAD

Learning Objectives

- Best practice BIM implementation plan in large firms.
- Evaluate different BIM tools and select the best for firm and projects.
- Learn about how to implement an effective BIM workflow for huge construction projects.
- Learn about BIM goals and model uses as value-added objectives at the project levels.

Description

In this class, SBG will share how it builds its own formula of conversion from a self-execution engineering 2D firm to a construction engineering management BIM model firm. SBG innovation setup changed in year 2012.

It is imperative that efficiency in project delivery is maximized and the commitment is to safe and sustainable construction. Traditional methods have been replaced by more efficient, transparent processes and technologies that require different project planning and different data exchange platforms. SBG has chosen Autodesk BIM solutions release 2013/2017 as the foundation of building a dedicated BIM platform for SBG megaprojects and developing a BIM Execution Plan (BIM charter).

Speaker(s)

Youssry Salman is Building Information Modeling and Building Information Management (BIMM) senior manager with an extensive multi-faced experience in architecture, engineering & construction (AEC) industry. He has more than 20 years of in depth experience in design and business development, demonstrating core competencies in BIMM including 5 years of construction industry experience with a vital mix of construction companies. Since 2008, Youssry has been leading, planning, designing, and executing different types of project standards from inception to completion, and he has demonstrated effective leadership, communication, coordination, motivation, and team building. As a BIMM senior manager for Saudi Binladin Group (SBG), Youssry is involved in the process of design review and design validation using modeling and documentation to identify, customize, and apply BIM tool software such as Autodesk® AutoCAD®, Building Design Suite Ultimate®.

YSALMAN@PBAD.SBG.COM.SA

Mohammad A. Saleh, holding Masters in Construction Management, American University in Cairo and 14 Years of experience between Site Works and Technical Office, BIM Coordinator and Head of C&A Departments at SBG's Cairo Office.

M.LATTIF@EDO-CAIRO.COM

Introduction

Traditionally, information such as 2D IFC Design drawings, Bill of Quantities, and Specs that are transferred to owners for the construction phase and General Contractors (GC) during the construction process include interpretation of two dimensional (2D) drawings and information retrieval. In this 2D process most of the GCs' technical offices' time is spent on non-value added tasks such as developing mental models as well as searching for and validating information and the final results is new set of 2D shop drawing. By year 2012 SBG study in depth the interpretation and information retrieval challenges faced by GCs can be addressed by providing access to linked information through 3D models. This can be accomplished by using Building Information Models (BIM) in the construction phase. Accessing the information using BIM is a two-steps process. The first step includes the identification and selection of the appropriate 3D elements from the digital model. The second step is by enhanced construction Existing Condition model by integrating 3D Scan technology with BIM. SBG as a GC is willing to share successful BIM implementation during challenged period of rush project and the gained benefits from BIM done in projects.

BIM at Saudi Arabia

For years, many existing standardized contracts used in Saudi Arabia's (AEC) industry based on 2D construction contracts. During the Construction phase, the General Contractor is required to refer to unlinked 2D Issued for Construction Drawings (IFC) for:

- Dimensional Details and Documentation for other information.
- Issue new set of detailed 2D shop drawings and Fabrication.
- It's not considerable amount of time is spent in performing non-value added tasks such as searching, accessing and validating the massive information.

Recent study by <u>DODGE</u> "Business Value of BIM in Middle East SMR_2017"

Saudi Arabia currently has the fewest users at the heavy level of implementation (21%) and, although forecasting strong growth, is still projected to lag the other regions in heavy implementation in two years.
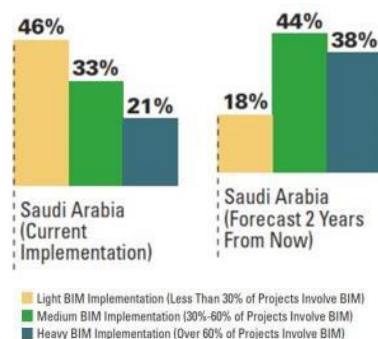
Before BIM at SBG

Previously, in 2D tender project and due the shortage of understanding design package at Tender Stage, when project awarded, Project manager and Site Team governs all processes of Engineering, Procurement, Commissioning and Handover, Engineering team to finish 2D shop drawings and fabrication sheets during the first 5% of project schedule, while Construction Team processing the Logistics & Mobilization.

The Result:

- Huge effort spent thousands of RFIs and approved 2D shop drawings, mostly not constructible.
- During Coordination process with site issues, new lots of RFIs, and RFIs affecting shop drawing for consultant approval, loop never end.
- Material wastes and abortive works reserve a good place in any process execution regardless the tight QA/QC followed by Project control teams
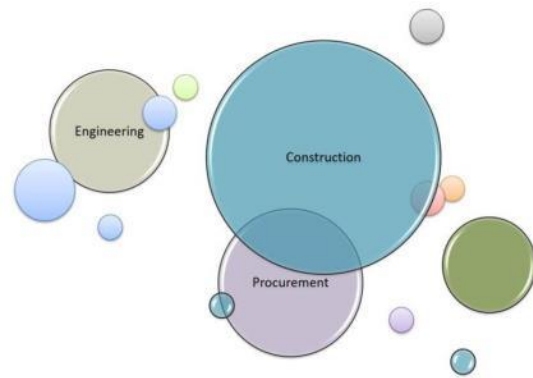
Why change to BIM?

It is Booming era and positive economy forecasts, SBG found it is necessary to re-think the way things are done:

- Economy gross and rush in projects while tenders are 2D IFC Design Packages were not 100% complete.
- Traditional methods that have previously met industry needs have been replaced by more efficient.
- Client Design Changes and Missing Data were challenging 2D drafting process

SBG studied several improvement methods and developed own understanding of Engineer/ Procure/Construct (EPC).moreover, in-depth studies all possible ways to enhance existing processes/progress in current and future projects with huge Built-up areas by deploying (EPC): BIM, Enterprise resource planning (ERP) and Project Data Collaboration.

The challenge of Implementing BIM in unaccompanied environment and Identify a number of changes including:

- Periodical Assessment.
- Reward mechanisms.
- Customized Training for Modeling Standardization and new information exchange platform.

BIM Implementation Challenges

At the day of starting BIM Implementation, SBG celebrating 80 years' experience, having long heritage of 2D works and executed very successful land mark project, and apply Implementation during running most strategic projects. In addition to Maintain Cost and Technology challenges. The key # 1 problem with BIM Implementation:

- Behavioral
- Temperamental
- Emotional
- Mental

BIM Implementation

SBG started convert to BIM and evaluate several BIM implementation proposals between 2010 and 2011, final approved, BIM Implementation Kick-off meeting- July 2011 with milestones:

- Hire BIM Consultant- August 2011.
- Implementation Period 9 months:
  - o Per- Implementation – 1month.
    - Hire BIM Consultant
    - Define BIM Strategy
    - Status Assessment
    - Implementation Planning
    - BIM Expertise Recruitment Policies
    - IT Infrastructure Consultancy
  - o Core Implementation- 4 months.
    - Select Platform
    - Modular Training
    - BIM Infrastructure Development
    - Test Project
    - BIM Standards Development and Documentation
  - o Rollout training- 4 months.
    - *Project Activities Planning*
    - *Modelling Methodologies*
    - *Technical Support and Supplementary Training Sessions*
- Success made partners.
  - o Autodesk®
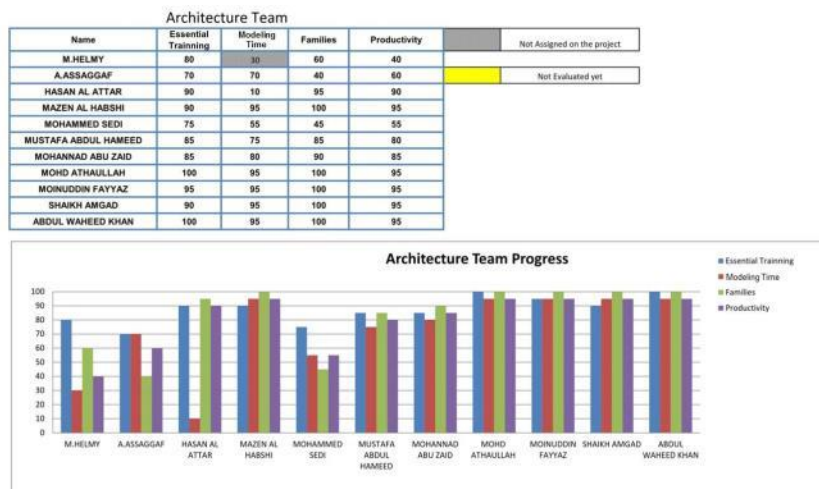 - o Kemet Egypt®

Pre Implementation key of success

"You can't clap with one hand only." Chinese proverb.

- Involve ever player of process and Assemble the right team by Identifies individuals skills.
- Select a suitable starting Project with limits of BIM scope and clear BIM deliverables with tangible Success measuring scale of "Time, Quality and Process".
- Identify Concerns and Challenges in current work process by understand Workflow and Methodology.
- Evaluate BIM Expertise (Consultant) who can utilize the maximum of your resource.
  - o Conduct Expert interviews with various BIM Outsourcing service providers.

- IT infrastructure is very important, assess the Software and Hardware, determine Network needs and what is additional Software required completing the puzzle.
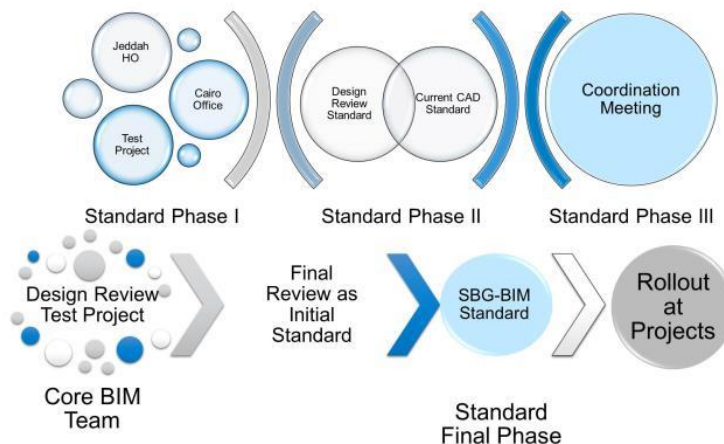
Core Implementation

Interview key members of departments for prioritization the BIM goals:

- Reduce 2D Drafting Processes.
- Improve construction workflow.
- Design review vs Constructability.
- Improve communication.
- Eliminate abortive works.
- Improve competitiveness

- Autodesk Suite® 2013 was selected as foundation of BIM Implementation.
- Conduct Several Modular Training Levels to build Modeling Team capable.

Architecture Team

Name	Essential Trainning	Modeling Time	Families	Productivity		Not Assigned on the project
M.HELMY	80	30	60	40		
A.ASSAGGAF	70	70	40	60		Not Evaluated yet
HASAN AL ATTAR	90	10	95	90		
MAZEN AL HABSHI	90	95	100	95		
MOHAMMED SEDI	75	55	45	55		
MUSTAFA ABDUL HAMEED	85	75	85	80		
MOHANNAD ABU ZAID	85	80	90	85		
MOHD ATHAULLAH	100	95	100	95		
MOINUDDIN FAYYAZ	95	95	100	95		
SHAIKH AMGAD	90	95	100	95		
ABDUL WAHEED KHAN	100	95	100	95		

Architecture Team Progress

- Boost team to receive Autodesk Professional Certificates
- Select BIM Modeling Outsources and Test and Validate new Procedure with Team.
- Develop and Document standard requirements to facilitate the Test Projects (Templates, Families & Model Workflow), Review Previous & ongoing quality control initiatives.

Implementation- Test Project*

Selected Test Project is part of ongoing project with area 24,000m^2. Apply one tangible Goal and Use: "MEPF Coordination Model" by trained Core Team of 30 Modelers and use Autodesk® out of box products that allowed us to:

- Test training and standard.
- Apply success measurement.
- Develop rollout training.
- Compare outputs.
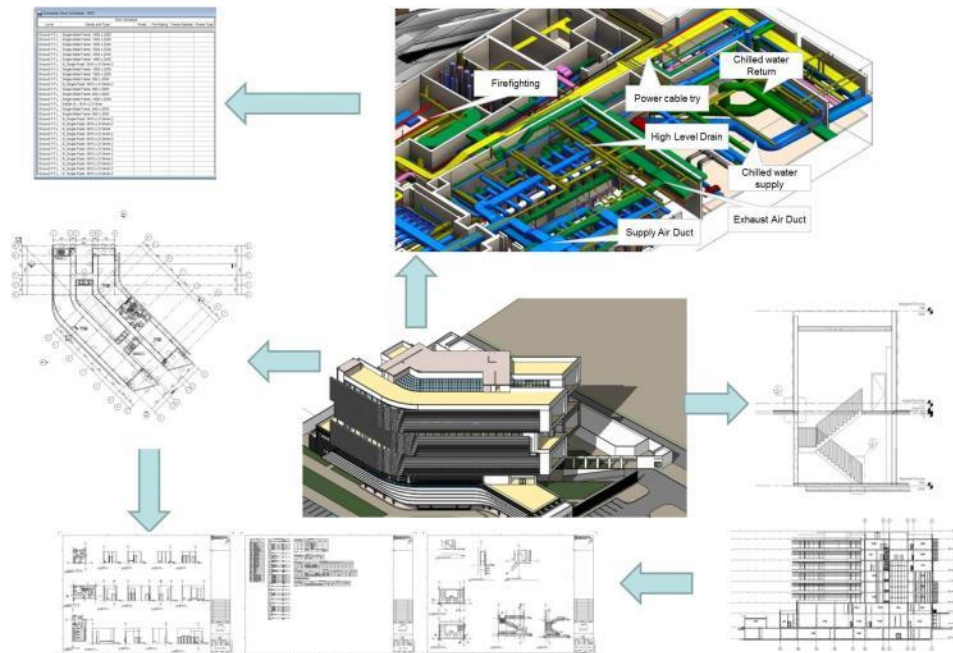
Video and compression at the CS124934 presentation

SBG BIM Charter (Execution Plan)
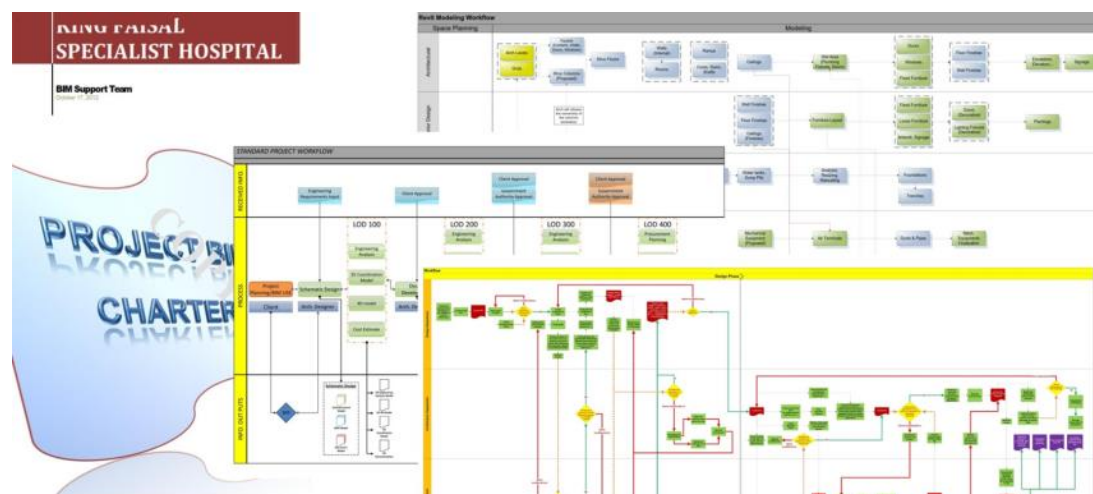
BIM Charter is a document issued by the project BIM Manager that formally authorizes the existence of every project, and support project manager with BIM protocols to apply resources to project BIM Goals.

- Establish BIM each model uses and Model structure Breakdown.
- Information exchanges and Matrix of responsibilities.
- Model Minimum requirements and LODs.
- Collaborative Workflow.
- Requirements for the Project technical standards.
- Team assessment.
- Technology maturity.

Example defined Goal.

	BIM Goals and Uses	Priority	Barrier to Entry	BIM Technology Competency	Advantage
1	Increase Design Effectiveness	High	Low	Very High	High

BIM Uses:
- MEPF Coordination Model
    - Split each trade in one model.
    - Model LOD 200 to 300.
- Initial Object Coordination Matrix

Publish and share

Test project with all parties to start rollout training and develop more BIM Goals. That led to Build BIM capacity for potential BIM projects ended by build our own formula:
- Apply transparent processes and technologies (BIM).
- Self-Execution Engineering 60% at the project.
- Outsource Engineering 40%, under SBG management.
- Develop different projects customized BIM charter (planning, Moreover, different Data and Information exchange platforms).

BIM Modeling Platform Autodesk Revit® add-on APIs

Quotation of why Add-ons and extra expanses challenge every implementation, in our situation:
- BIM is not client request as much as it is in-house self-improvement, challenged by 2D environment.
- In absence of time leverage to convert thousands of 2D IFC A0 sheets in to 3D Models, processes were very complicated and time consumption.
- Using Autodesk® BIM products with Product enhancement and service pack provide good stable platform.
- Using out of shelf 3rd parties API provide great enhancement. However, it is not a complete solution especially it is not design for Gulf Region.
- SBG acquire different "Subject Matter Experts" services or Outsource partner to develop customized API add-ins to reduce time consumption.
    - Each APIs enhance different projects and different BIM Goals or Model Uses.
        - AutoM for converting MEP 2D to Model.
        - Fabrication to create fabrication Assembly in Rivet 2015.

Successful BIM Implementation- by Project

Public Project 260,000m^2

Project Execution started at December 2011, it is Multi-use spaces, it's renovation of existing building complicated MEPF design and strategic by the client, challenges in execution due natural of site with different constrain access levels.

Applied BIM Goals, Value added objectives:

- Increase effectiveness of Design:
    - Validate Design Constructability.
    - MEPF Coordination.
- Increase Field Productivity:
    - Detailed Shop Drawing from Coordinated Model.
    - Assembly Structure Models.
- Interface Management between old-new buildings.
    - 3D scan coordination Model.

Validate Design Constructability

When a weak communication between Engineering Team and Site Team to exchange data properly.

Overlap between Design Review and Design Constructability is gray.

- "Constructability & Coordination Model" vs "Clash Free Models" :
    - Wrong thought of Revit® as replacement of AutoCAD®.
    - Use Revit® for Clash Detection only resulted in nice looking Models but are un-constructible.
    - Use NaviesWorks® and BIM Field® to achieve constructability.

Constructability as BIM Development

- Develop detailed Coordination Matrix showing the Clashes Level of Severity.
- Use NavisWorks® tools of Clearance and Tolerance to implement Field requirement of right installation.

DISCIPLINE				Electrical-CR								
				ELEMENT								
				Cable Trays		Cable Tray Fittings		Electrical Fixtures		Electrical Equipment	
				Tolerance	Clearance	Tolerance	Clearance	Tolerance	Clearance	Tolerance	Clearance
STRUCTURAL	ELEMENT	Columns	Tolerance	3 mm		3 mm		-		-	
			Clearance		50 mm		E.D		-		300 mm ˮˮˮ
		Beams	Tolerance	2 mm		2 mm		-		-	
			Clearance		50 mm		50 mm		-		-
		Floors	Tolerance	3 mm		3 mm		2 mm		2 mm	
			Clearance		150 mm		150 mm		-		-
		Walls	Tolerance	2 mm		2 mm		-		-	
			Clearance		50 mm		50 mm		-		300 mm ˮˮˮ
		Foundation	Tolerance	-		-		-		-	
			Clearance		-		-		-		-

-	no need for clash Test
E.D	Engineering Define
ˮ	: unless floor electrical fixtures are used.
ˮˮ	: unless the electrical equipment is floor mounted type; for instance: transformer, RMU, etc.
ˮˮˮ	: in case the electrical equipment is floor mounted type; for instance: transformer, RMU, etc.
ˮˮˮˮ	: in case the floor electrical fixtures are used.

CR Electrical Fixtures: Disconnecting Switches.
CR Electrical Equipment: Panel Boards, Tranformers, Generartors... etc.
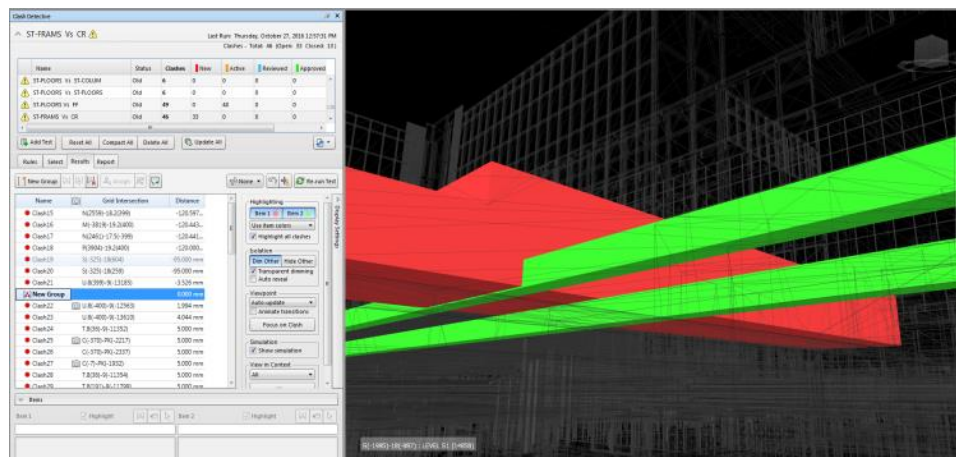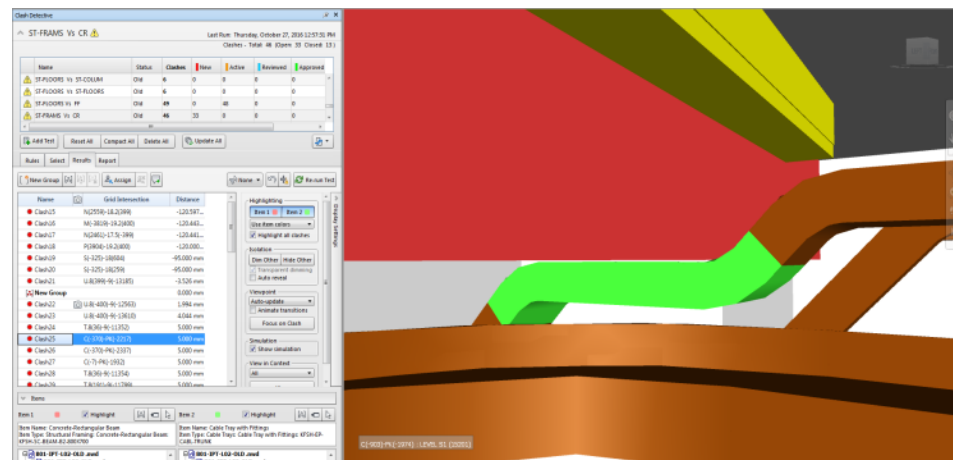
**Detailed Shop Drawing from Coordinated Model**

After apply coordination as constructability aspect, adding annotations to saved sheets views will generate a set of workable clash free set of shop drawing
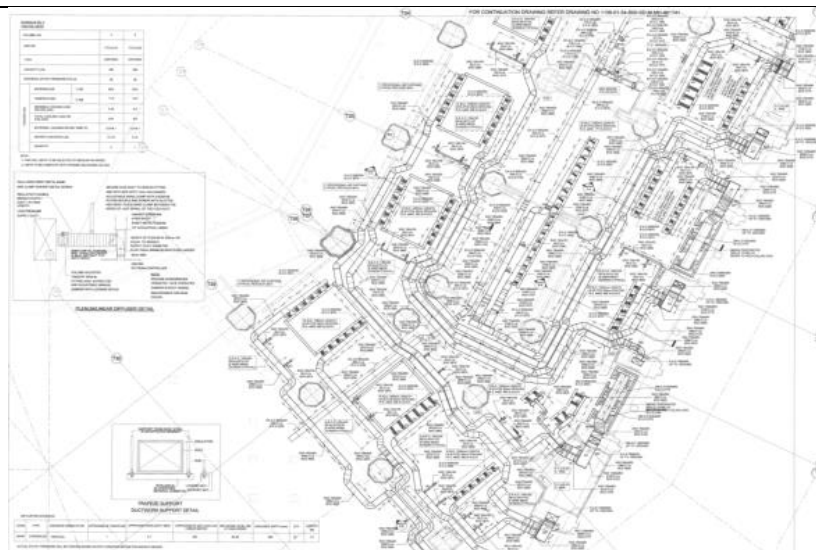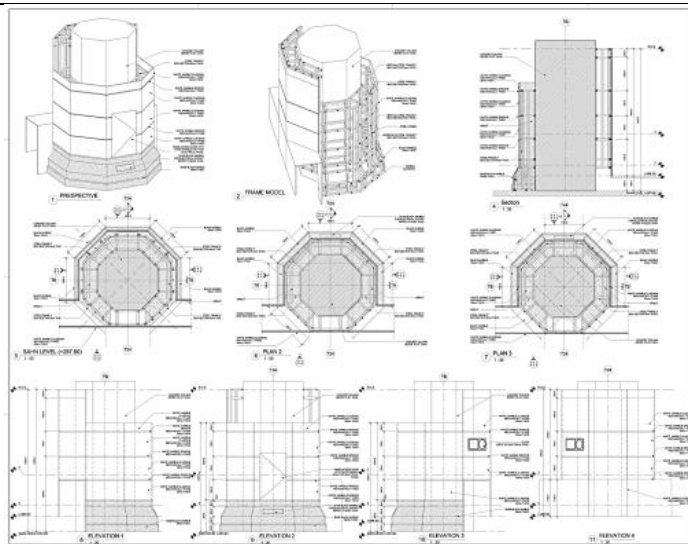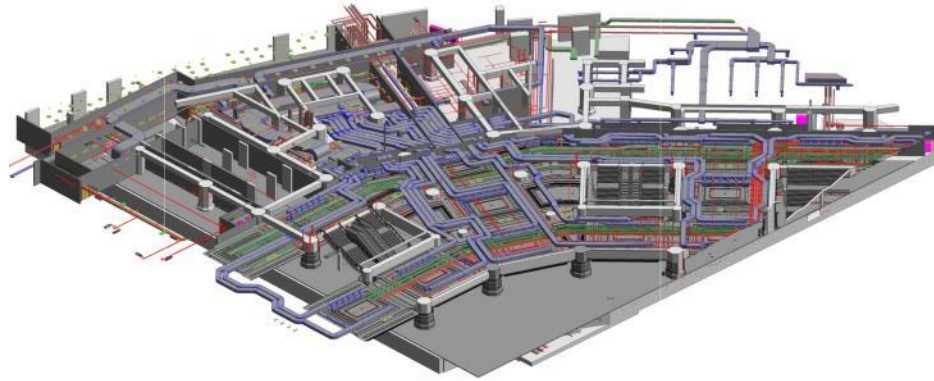
Assembly Structure Models

By Nature of project design and interface between exist and new building relation between structure members and type of reinforcement force to study up to assembly level. Even the nature of structure members shapes and sizes.
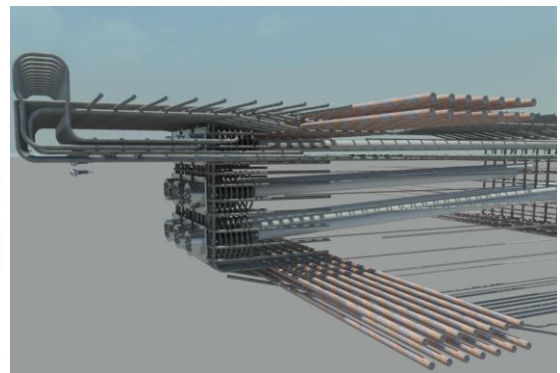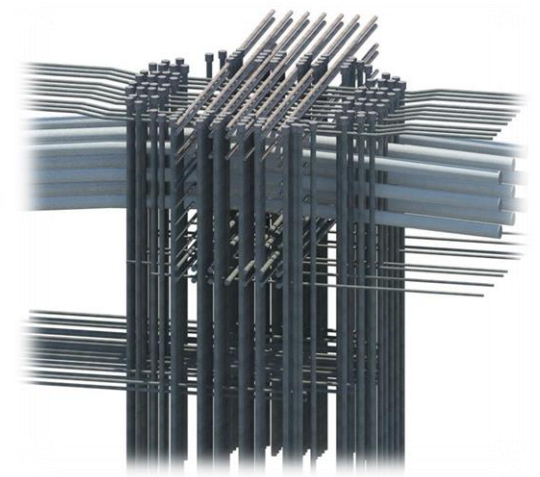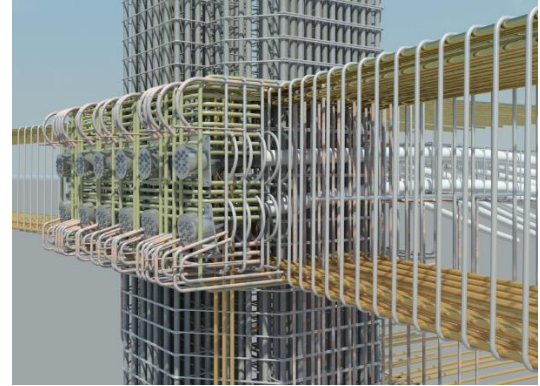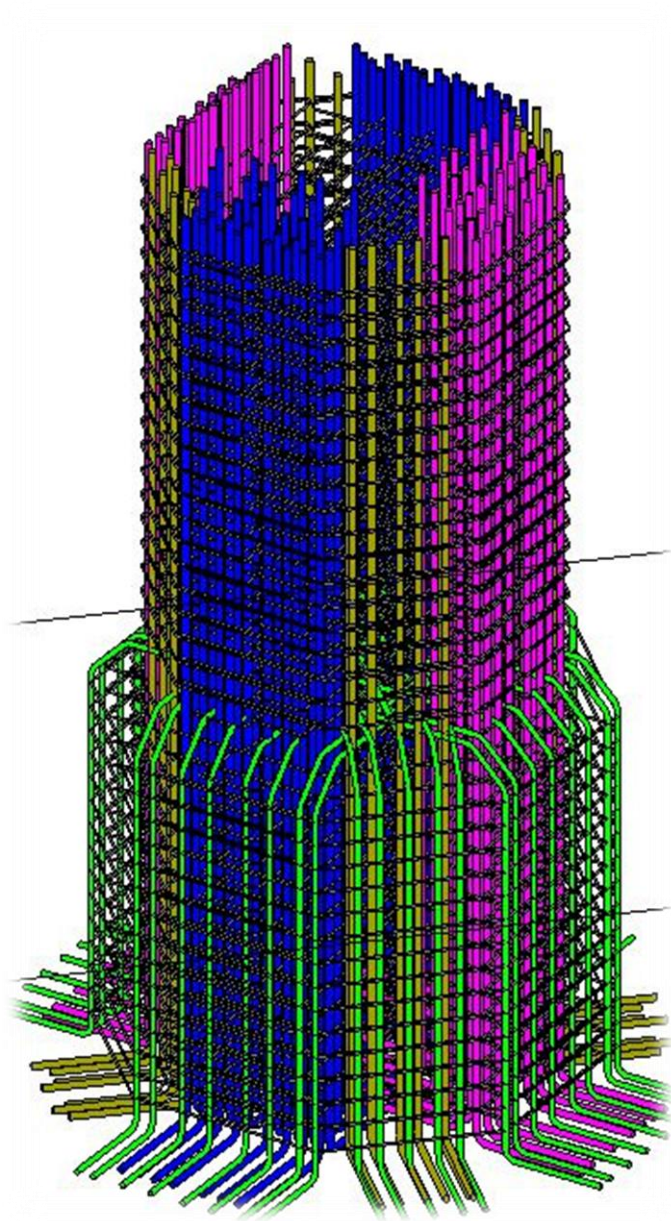
3D Scan Coordination Model

As per execution plan the relation between existing and new utilities have to be record and coordinated with minimal tolerance, the best tool is 3D scan capture reality.

SBG apply 3D scan process to flex the coordination between new design BIM model and existing point Cloud.
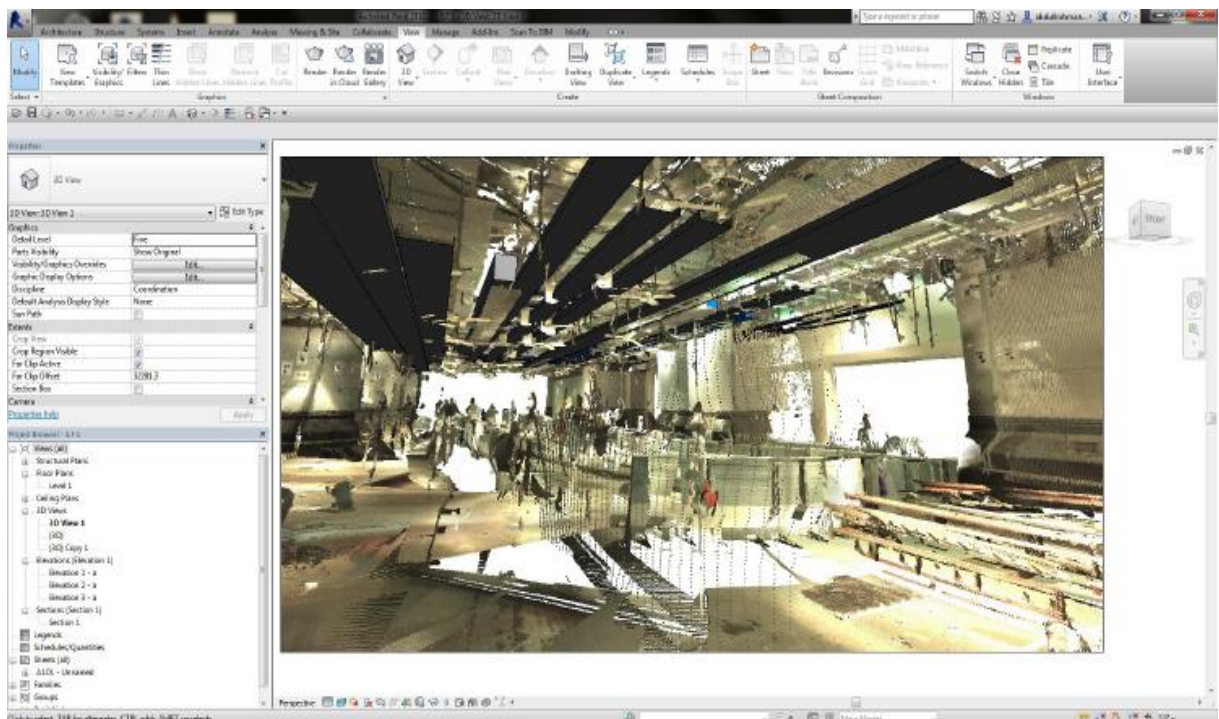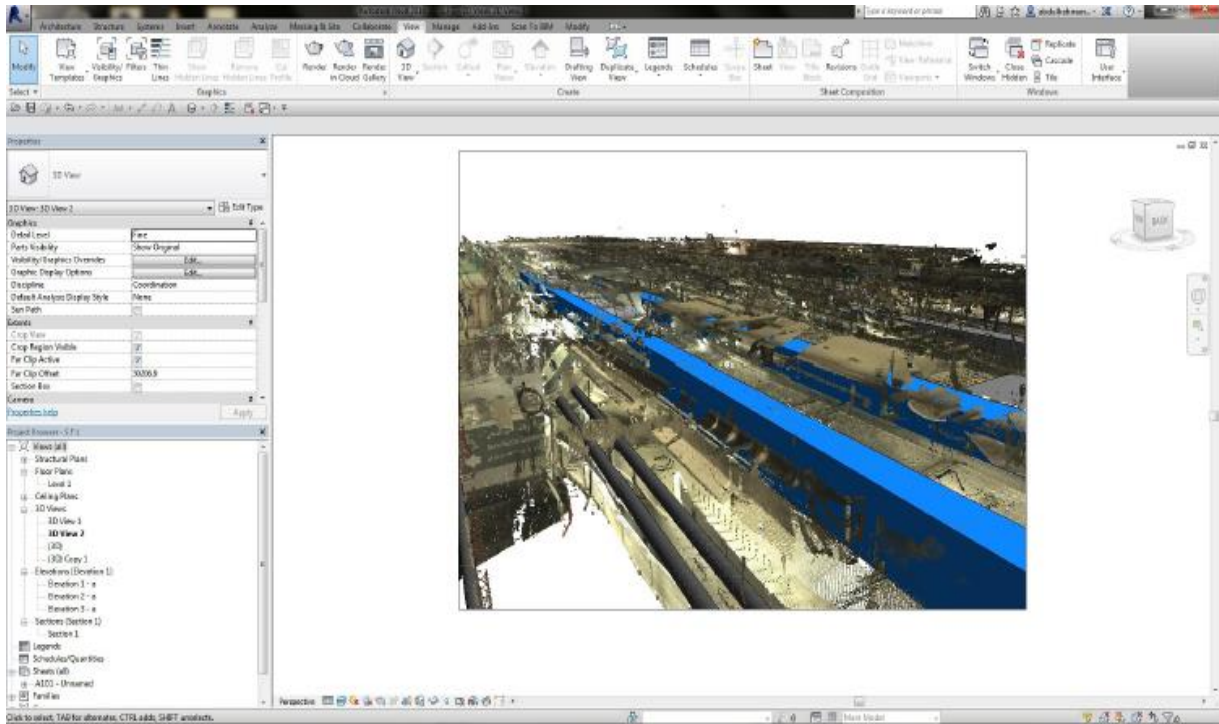
Healthcare Project 540,000m^2

Project execution started February 2013, it is complex facility and SNG to deliver project at budget on time based on Design, Bid and Build (DBB) 100% 2D packages of Issued for Construction (IFC) Design Drawings managed by the client, some challenges of having Design Package defined as 100% IFC documentation in 2D drafting process and suffered a lot. Then project converted at year 2014 to BIM process with the following goals:

- Increase effectiveness of Design:
  - Better Design understanding.
  - MEPF Coordination.
- Increase Field Productivity:
  - Detailed Shop Drawing from Coordinated model.
  - 4D Simulation of Accessibility and Safety.
- Accurate Quantities take-off

Better Design understanding

When Project Run in traditional process revealed that actual problems, then convert to BIM processes as following:

- [Design Validation (DV)] is responsible for the development initial Design Model. [Detailing (SD)] is responsible for the initial Means & Methods Revit® Model.

- [DV] to provide the coordinated Design Intent Model to [SD] to be used for the creation of LOD 400 Detailed Model and extract shop drawing sheets.

Using BIM Comparing to 2D IFC Project RFIs. Design/Construction relate RFIs were drastically reduced to critical Design issues:
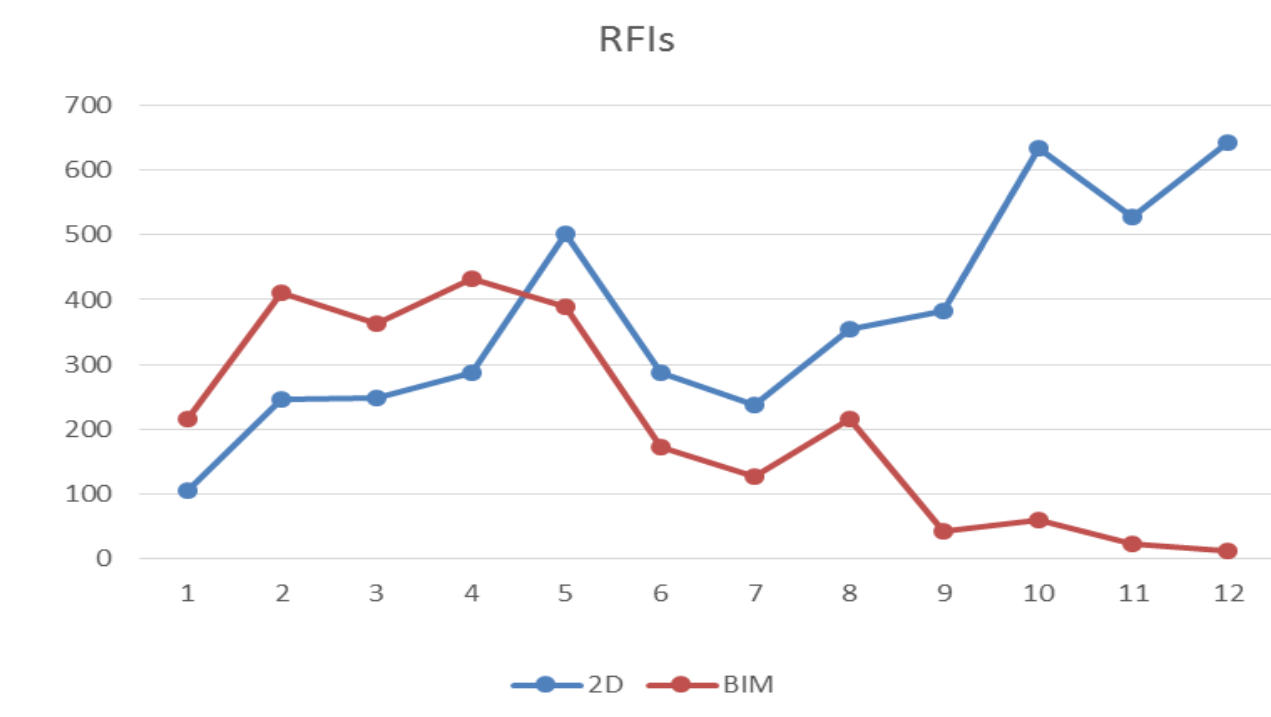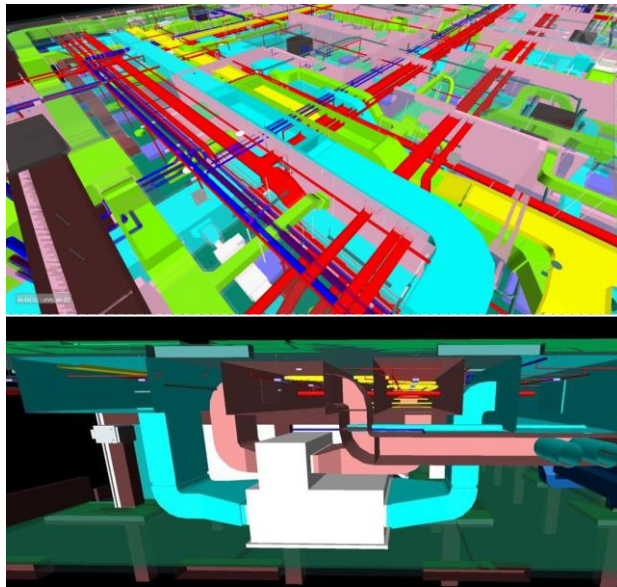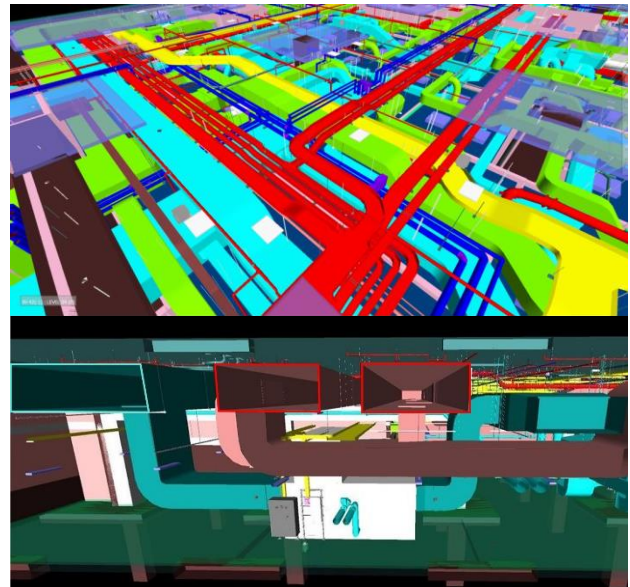
MEPF Coordination

To able to deal with multi-layer of MEPF systems and Medical Gases, SBG Engineered General Arrangement section of MEPF Systems. To allow better installation sequence and ordering material.
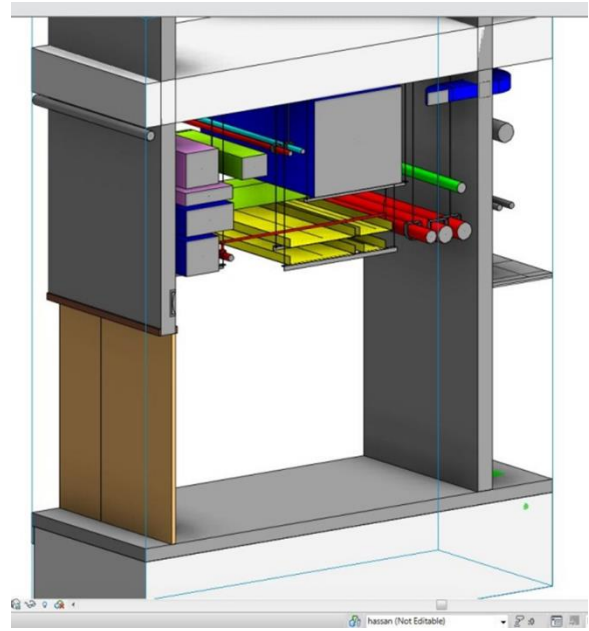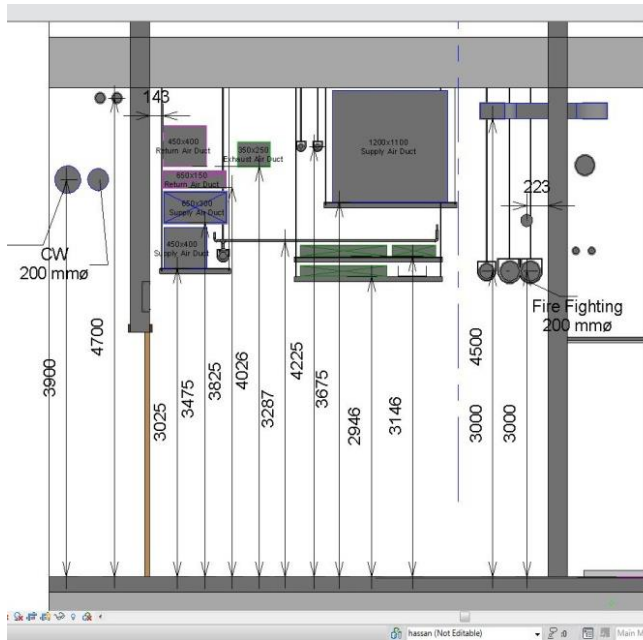
Before

After

Develop Shared Parameters to allow Quantity Take-off

Develop Revit Families and shared parameters in addition to Customize CSI keynotes and project special QS parameters to aloe extract Quantities from Revit Model and verify it from NavisWorks.

Conclusion

BIM implementation possible to success regardless organizations sizes, the successor achieved in my previous firm (Design Consultant) with 100+ architect and engineers is not different the current success with General Contractor which is totally different environment and business goals.

The key success is killing People fears and finding right short period achievable BIM goals.

Elements made implementation Success

- Implementation is the best practice can copy, you have to customize something can fit your firm environment.

- Select right people and award system, peoples follow the winners.

- Right BIM consultant, who can utilize the maximum of your resource.

- Revolutionary solution does not mean "Expansive". Don't rush with change IT infrastructure unless it is needed, rent a Cloud solution.

- Autodesk® Revit out of box solution enough to make good start, some third parties API or software can boost.

- Test project with measurable Goal easy to achieve in short period.

- Model structure divided by Trade or Floor, model size not more 300 MB.

- Small units 5-10 uses access one file under one modeling leader.

- Do not split your team in two groups, Technical and Modelers, who know the information better to model it.

- BIM coordinator is your system examiner and have to audit models and correct team diversion.

- BIM execution plan is a datum of each project understanding to build early, its BIM manager responsibility to develop and monitor.

- Autodesk Building and Infra Suites are very helpful but focus on Revit+ NavisWorks or Civil 3D+ NavisWorks, achieve your implementation then implement other ones after to improve implantation.

- Revit® is not replacement of AutoCAD® and AutoCAD® is BIM player do not eliminate, find for it the right location in your execution map.

SBG BIM Implementation ROI

- SBG received direct value added and it is mandatory to apply BIM for all future projects.

- Current Project Sponsors acknowledge the existence of a Model or BIM specific deliverables.

- Importance of Software Application interacts with the BIM database Information through the BIM Application Program Interface (API).

- There are punitive measures for non-performance of relays on 2D design IFC packages, providing the positive reinforcement for using BIM in design as part of the Contractor Performance Reporting System.

- SBG support extra researches in other BIM fields and ERP integration.

Successful make partners

Kemet Egypt	www.kemet.com.eg
Sanveo	www.sanveo.com
VirtualProjects	www.virtualprojects.build