



BIM + CM-AT-RISK = SAVES YOU TIME & \$\$\$
ESPECIALLY ON RENOVATION PROJECTS

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Learning Objectives

1. Participants will be able to **identify the benefits of using Building Information Modeling software (REVIT 2012) during the design process** through observation and discussion of several design coordination examples presented in the two JHS renovation projects (examples = mechanical, structural, plumbing, architecture).
2. Participants will be able to **identify the benefits of using Building Information Modeling software (REVIT 2012) during the construction process** through observation and discussion of several construction coordination examples presented in the two JHS renovation projects (examples = clash detection meetings between construction trades - mechanical, structural, plumbing, architecture).
3. Participants will be able to **discuss the benefits the Owner can obtain by integrating BIM into their design and construction process** through the presentation and participating in the 15 minute Q&A portion of this session.
4. Participants will be able to **discuss the cost and time benefits of using BIM technology and CMaR delivery method** to maximize the construction dollars identified for the two comprehensive JHS renovation projects presented, by participating in the 15 minute Q&A portion of this session.



Integrated Project Team

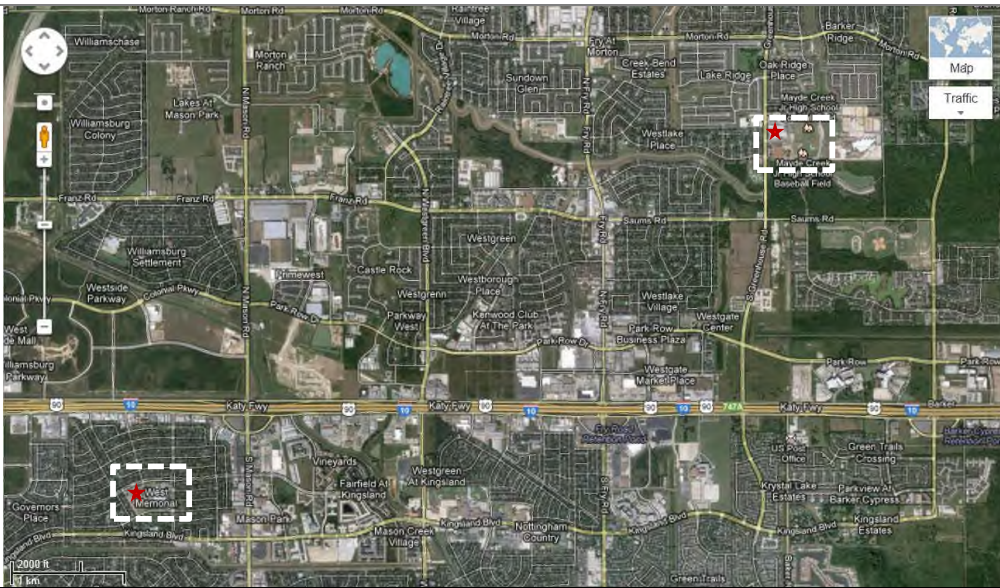
Owner

GC/CM

A/E Team



Project Overview

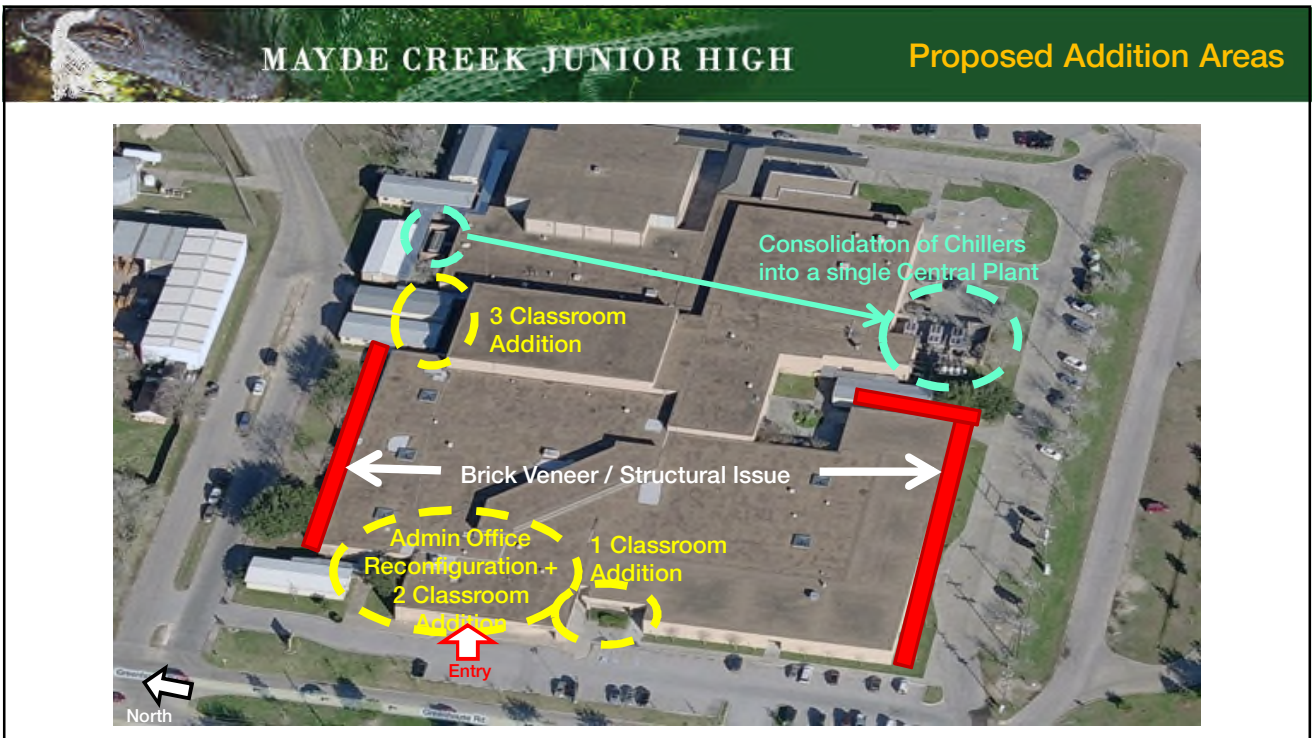


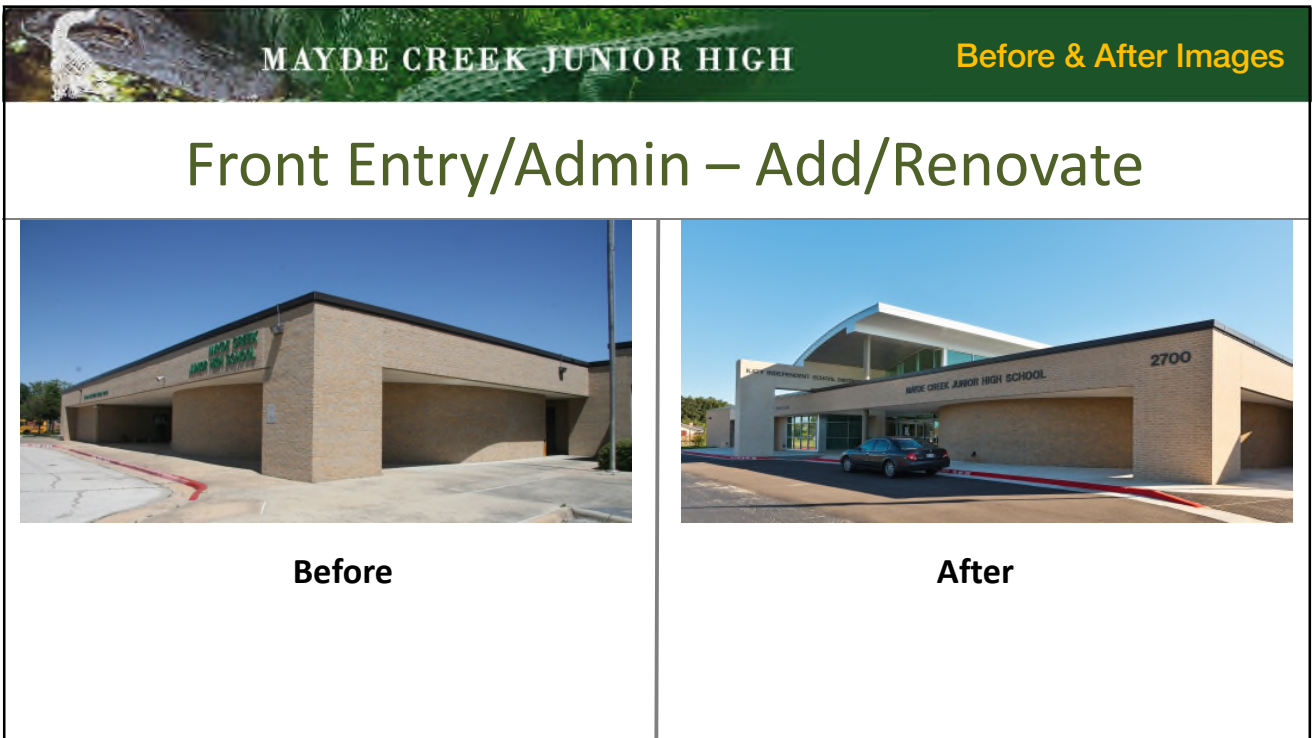
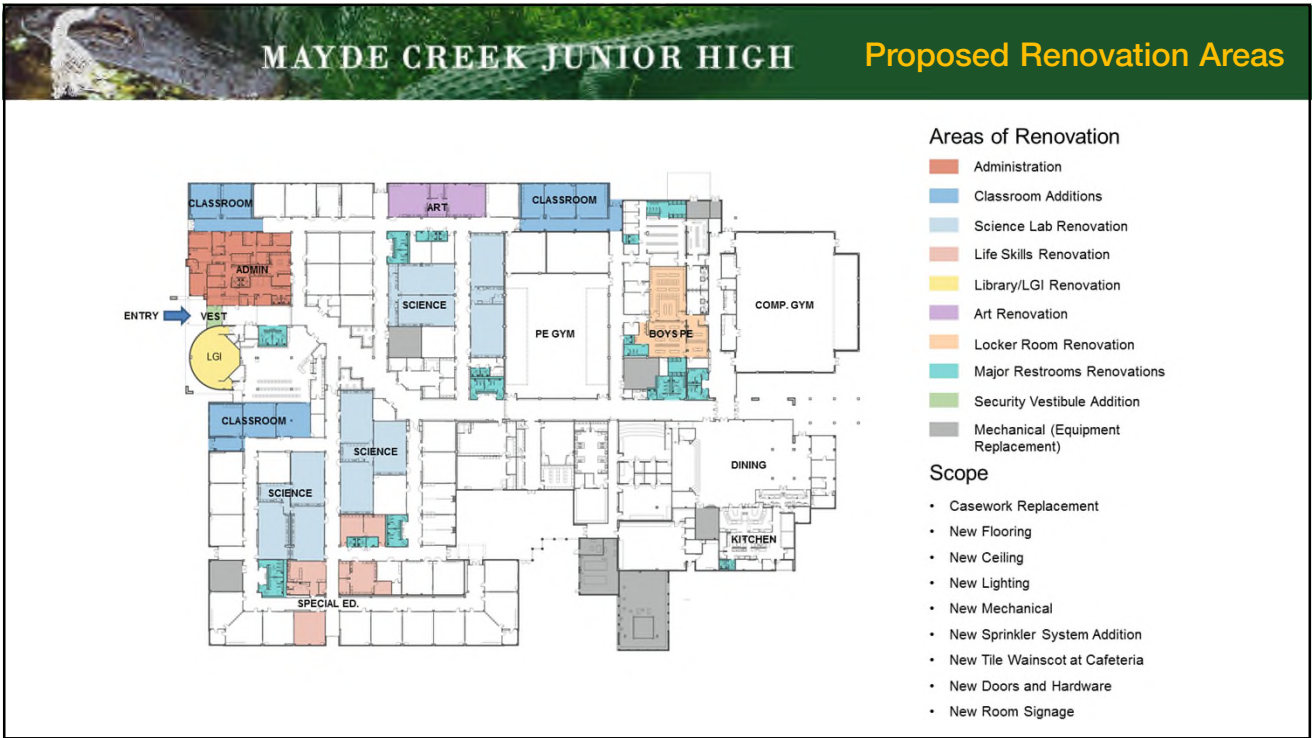
MAYDE CREEK JUNIOR HIGH



Project Overview

- MCJHS Comprehensive Renovation
- Addition/Renovation
- Mech. + Elect. + Plumb. Upgrades
- Safety & Security
- Interior Finishes
- Budget: \$18,35,661
- Completed: August 2012





MAYDE CREEK JUNIOR HIGH Before & After Images

Front Office – Renovation/Consolidation



Before



After



MAYDE CREEK JUNIOR HIGH Before & After Images

Main Corridor – Renovation



Before



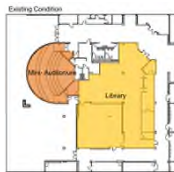
After

MAYDE CREEK JUNIOR HIGH Before & After Images

Large Group Instruction - Renovation



Before



After



MAYDE CREEK JUNIOR HIGH Before & After Images

Science - Relocation



Before

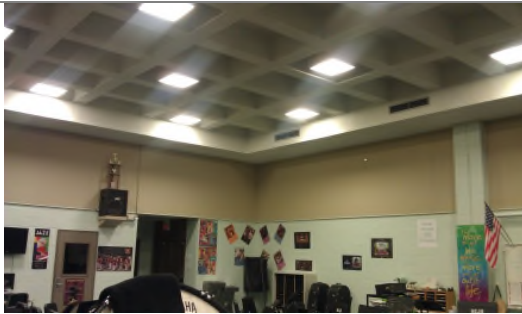


After



MAYDE CREEK JUNIOR HIGH Before & After Images

Band Hall - Renovation



Before



After

MAYDE CREEK JUNIOR HIGH Before & After Images

Home Economics - Renovation



Before



After

MAYDE CREEK JUNIOR HIGH Before & After Images

Restroom - Renovation



Before



After

West Memorial Junior High



Project Overview

- WMJHS Comprehensive Renovation
- Addition/Renovation
- Mech. + Elect. + Plumb. Upgrades
- Safety & Security
- Interior Finishes
- Budget: \$19,756,257
- Completed: August 2012

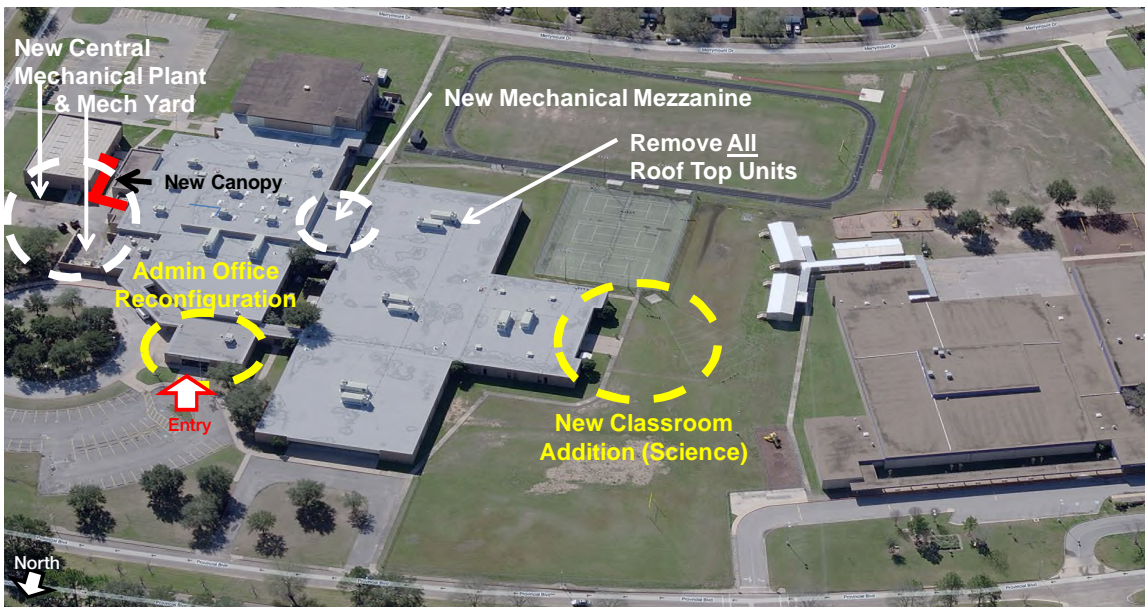
West Memorial Junior High

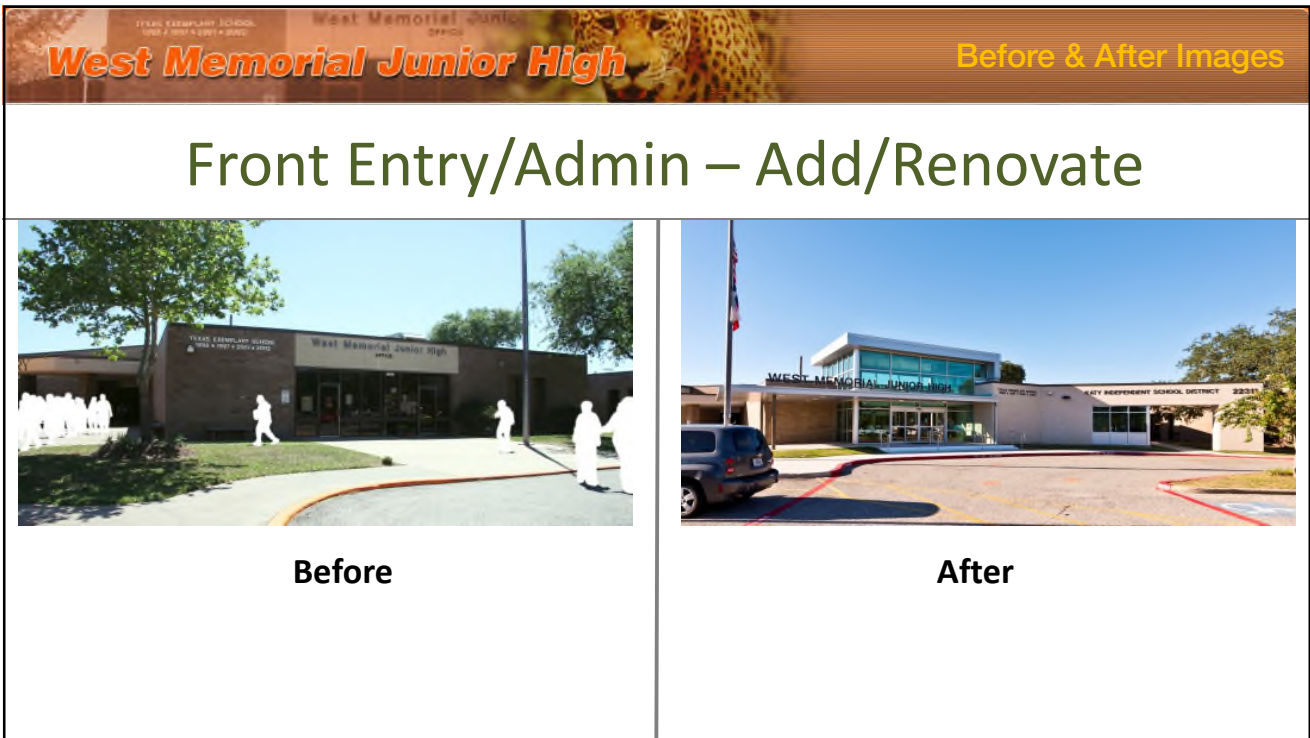
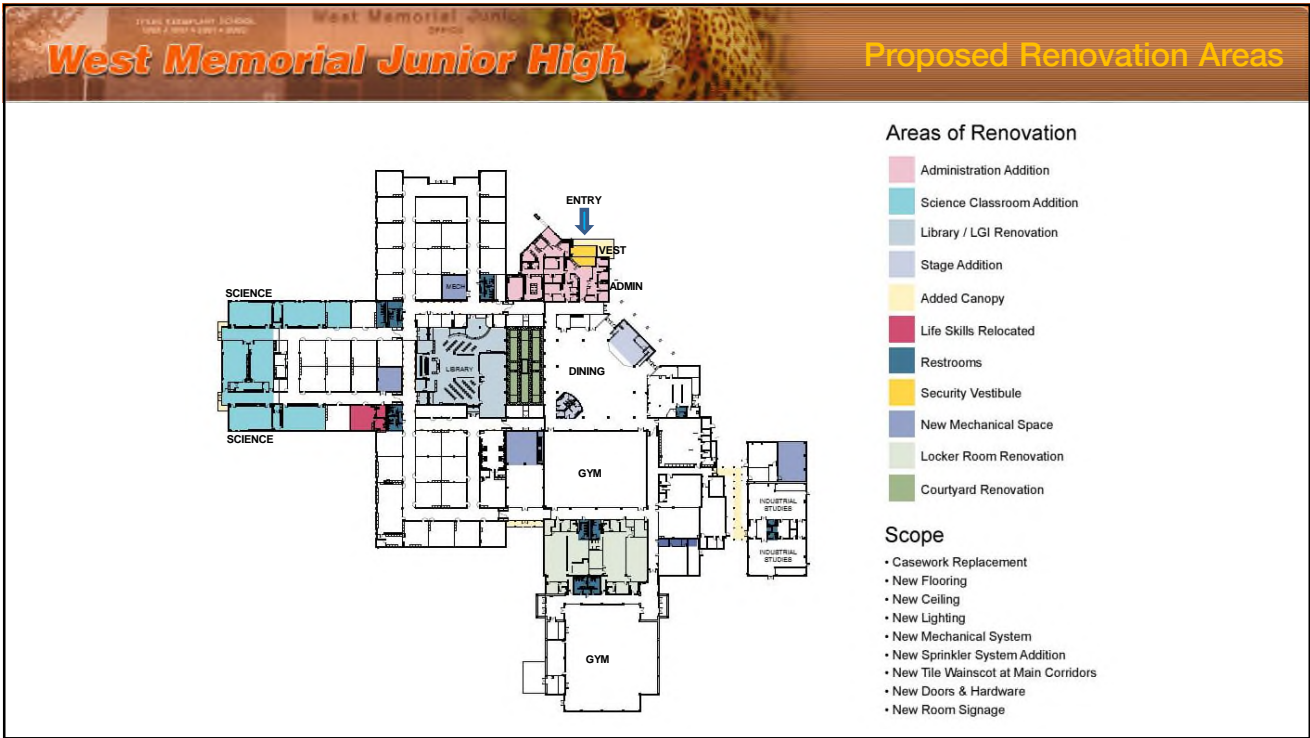
Existing Context - Site Plan



West Memorial Junior High

Proposed Addition Areas





West Memorial Junior High

Before & After Images

Front Office – Renovation/Consolidation



Before



After

West Memorial Junior High

Before & After Images

Science – Addition/Relocation



Before



After



West Memorial Junior High

Before & After Images

Library - Renovation



Before



After



West Memorial Junior High

Before & After Images

Cafeteria Stage - Relocation



Before



After



West Memorial Junior High

Before & After Images

Cafeteria Dining - Renovation



Before



After



West Memorial Junior High

Before & After Images

Home Economics - Renovation



Before



After

West Memorial Junior High

Before & After Images

Exterior Courtyard - Renovate

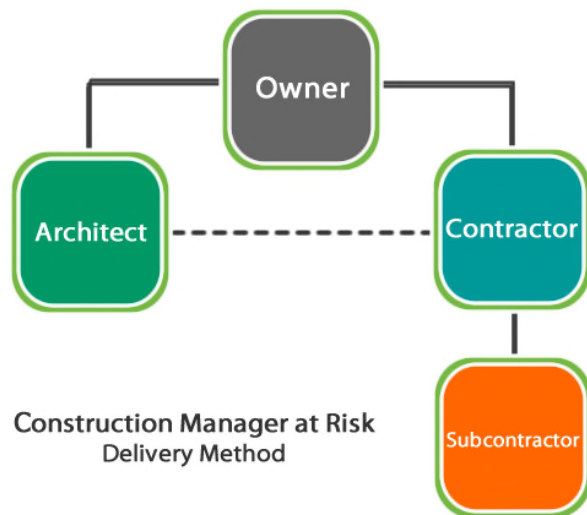


Before



After

Delivery Method: CM-at-Risk





Benefits of CM-at-Risk

Budget Control

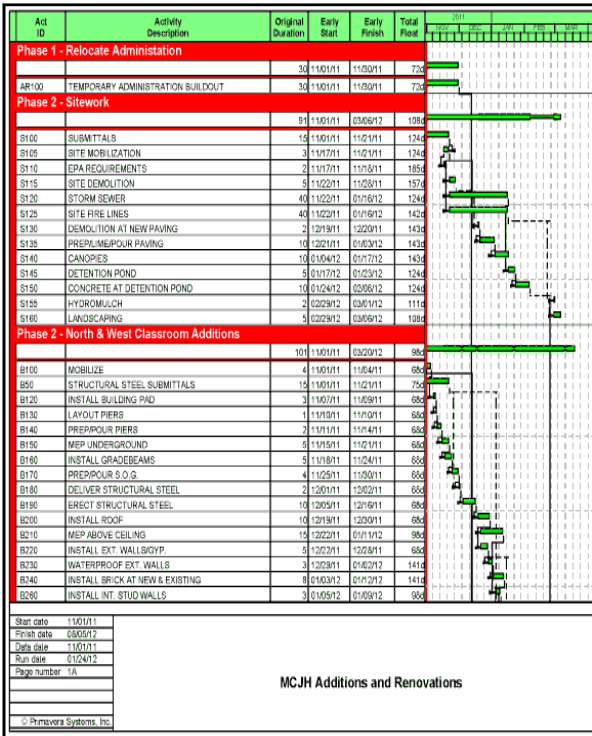
- Mechanical
- Electrical
- Plumbing
- Fire Sprinkler
- Structural Steel
- Interior Finishes
- Interior Furnishings



Benefits of CM-at-Risk

Constructability Review

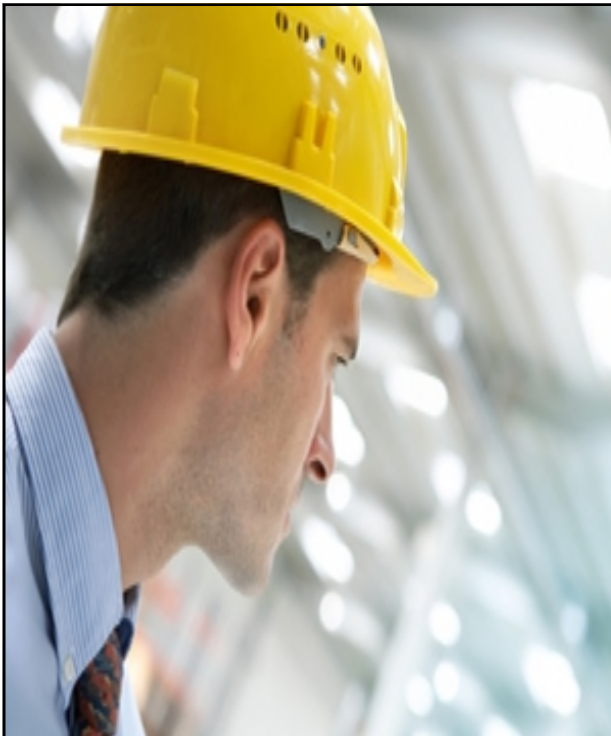
- Building Envelope
- Structural Systems
- MEP Systems
- Site Utilities
- Foundation
- Construction Details
- Discipline Coordination



Benefits of CM-at-Risk

Planned Scheduling

- Abatement
- Demolition
- New Construction Activities
- Renovation Activities
- Phasing / Sequencing
- Punch List
- Occupancy

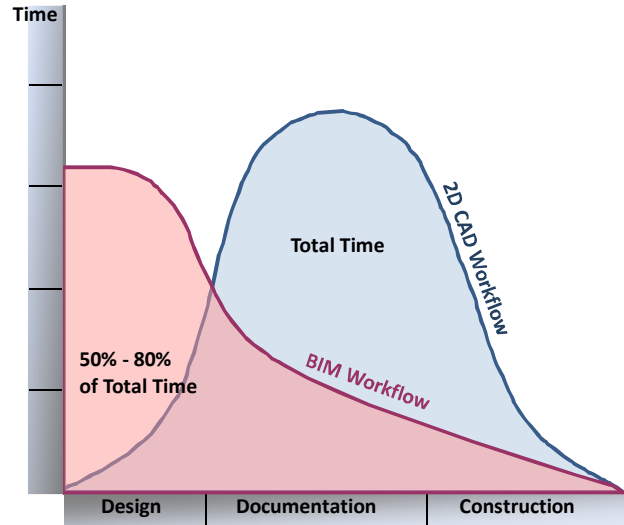
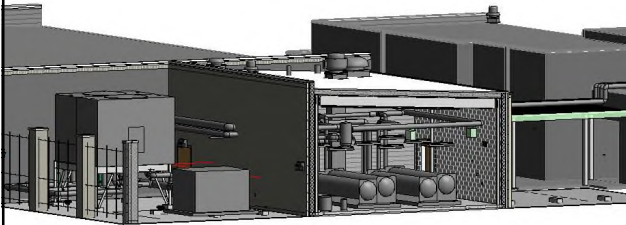


Benefits of CM-at-Risk

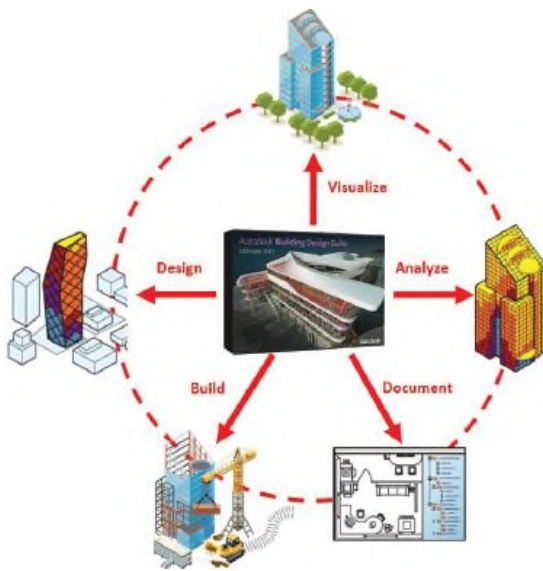
Minimize Surprises

- Design Input – *Explore Options*
- Contract Documents – *Provide Input*
- Construction Phasing – *Plan Early*
- Renovation Activities – *Plan Early*
- Sub Contactor Buy-in – *Critical Subs*
- Market Pricing – *Understand Risks*

Building Information Modeling



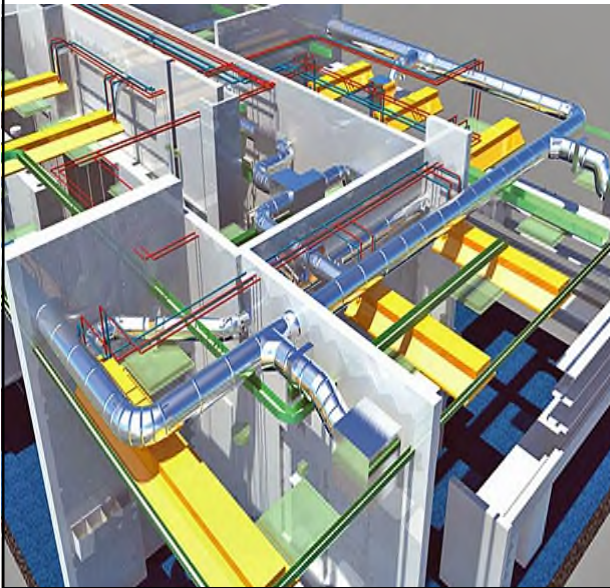
Benefits of BIM



Virtual Construction

- Architects
- Structural Engineers
- MEP Engineers
- Food Service Consultants
- Civil Engineers
- Construction Manager
- Owner

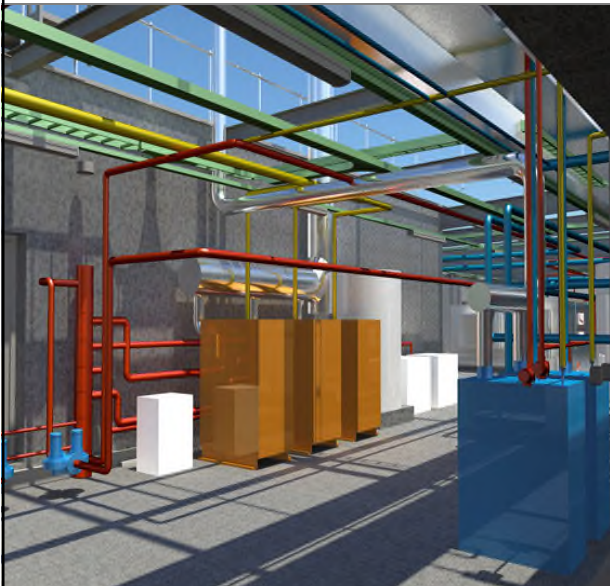
Benefits of BIM



3-Dimensional Design

- Architect + Major Consultants
 - Structural
 - Mechanical
 - Electrical
 - Plumbing
 - Food Service

Benefits of BIM



Design Coordination

- Inter-discipline Coordination
 - Structural
 - Mechanical
 - Electrical
 - Plumbing
- Tricky Transitions
- Complex Designs

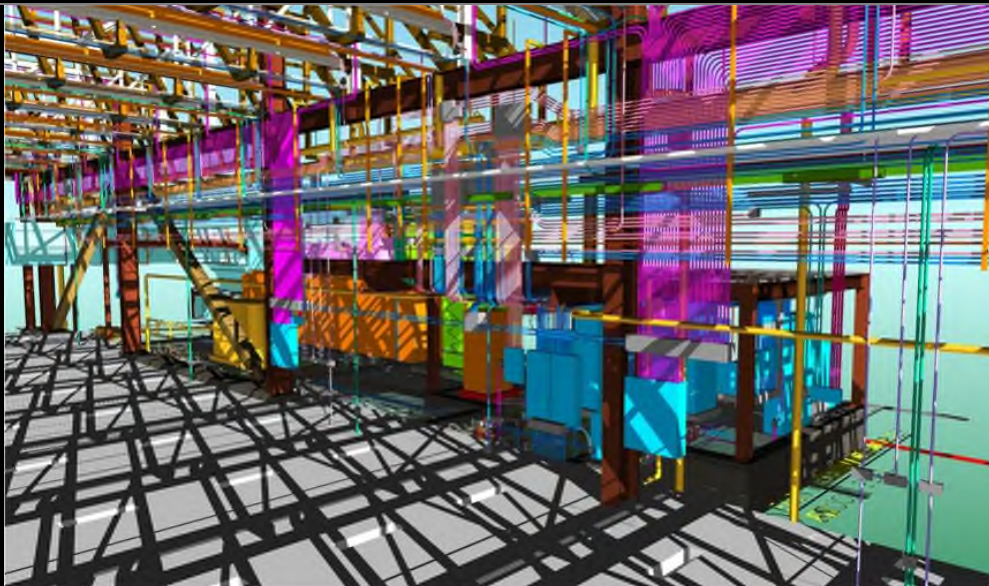
Benefits of BIM



Field Coordination

- Clash Detection / Resolution
 - Structural
 - Mechanical
 - Electrical
 - Plumbing
- Tricky Transitions
- Complex Designs
- Phased/Complicated Renovation

Planning / Design Phase

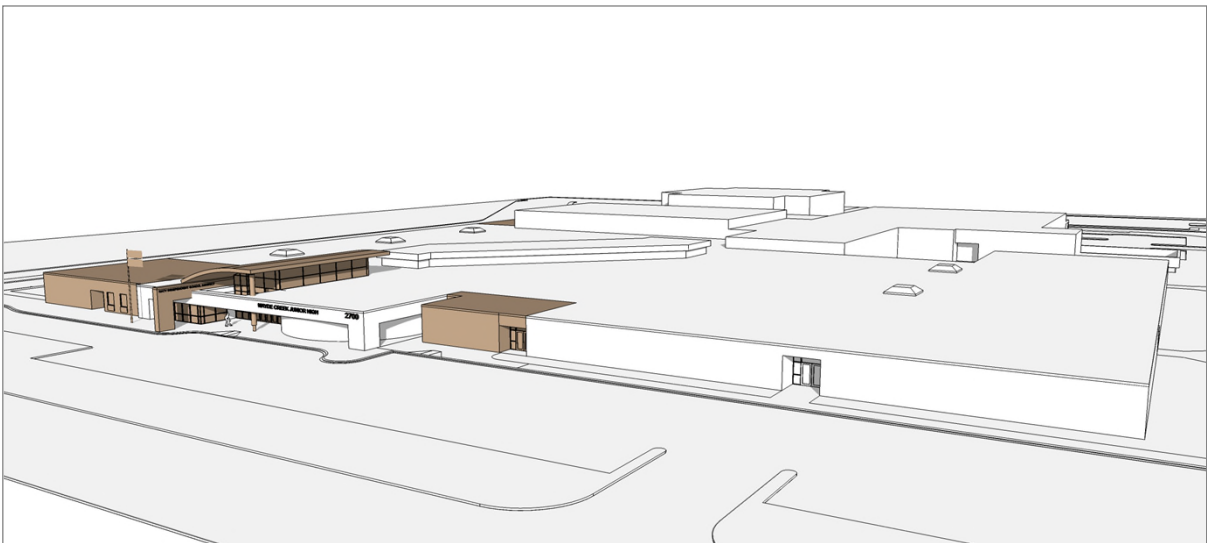


BIM/REVIT = Communicate Design



Owner Communication

- DD = Board Approval of Design
- DD = Explore Front Entry Options
- DD/CD = Casework Layout – 3D



Proposed Condition – 3D Overall View

Mayde Creek Junior High School



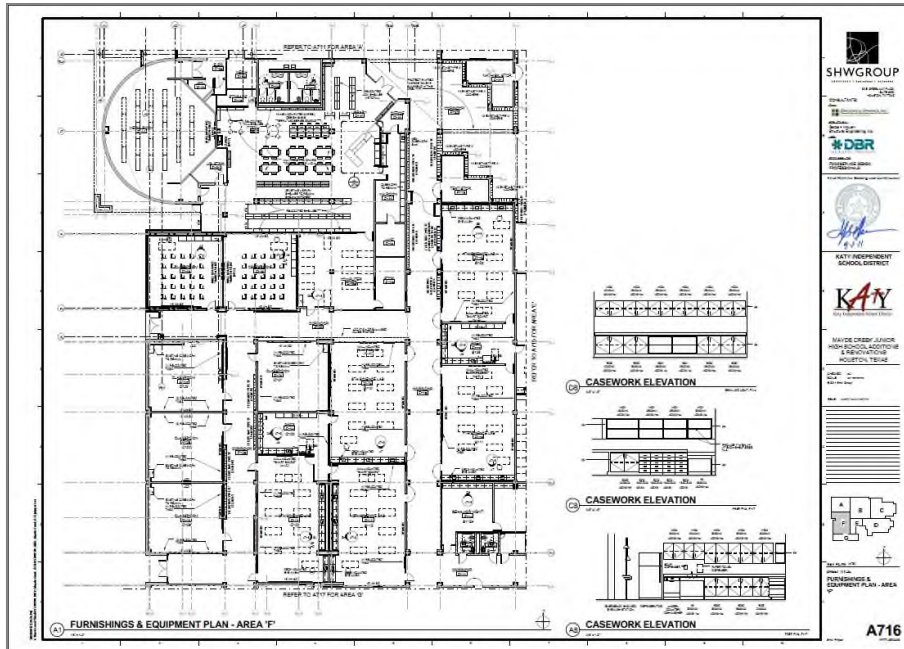
Proposed Condition – Admin / Classroom Addition
Mayde Creek Junior High School



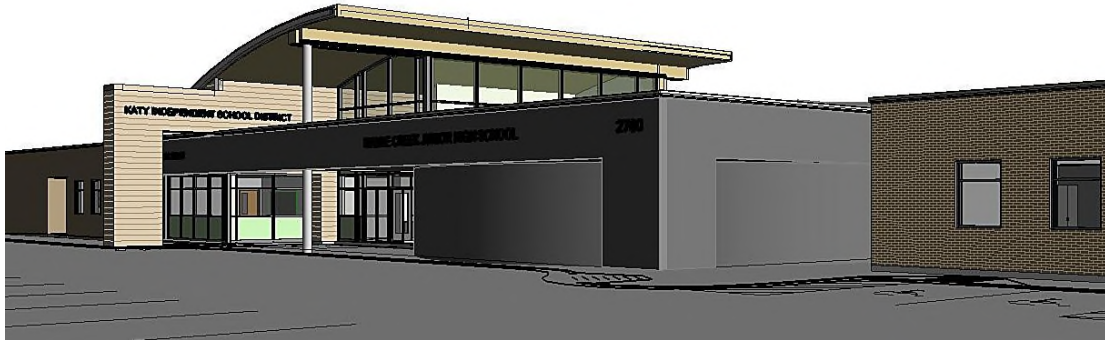
Existing Condition – Main Entry
Mayde Creek Junior High School



Proposed Condition – Main Entry
Mayde Creek Junior High School



Communicate Design – Various 3D Views
Mayde Creek Junior High School



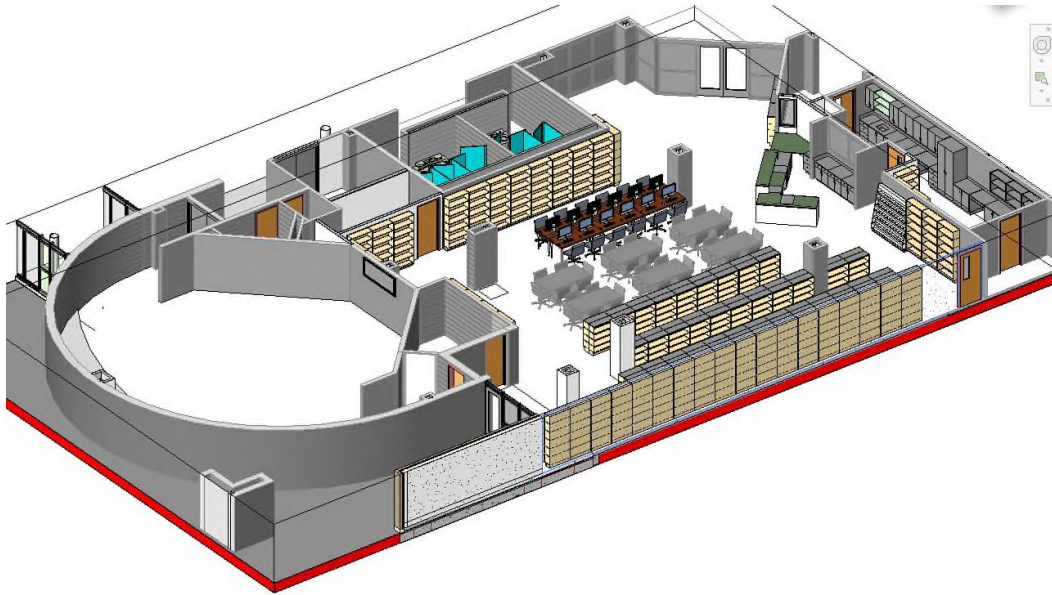
Exterior Addition/Renovation - Front Entry View

Mayde Creek Junior High School



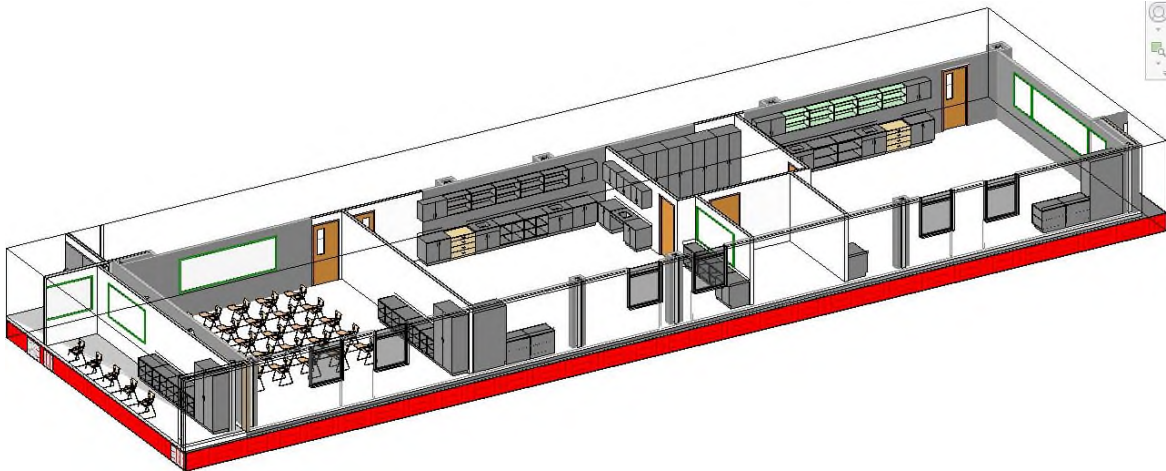
Casework Plans/Elevations – Admin Area Casework

Mayde Creek Junior High School



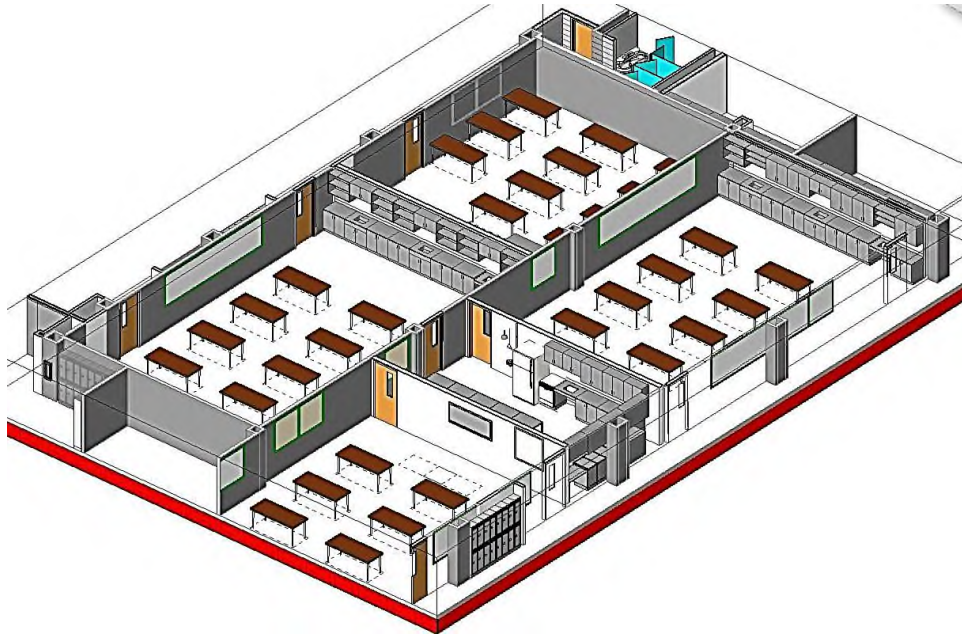
Casework Plans/Elevations – Library Renovations

Mayde Creek Junior High School

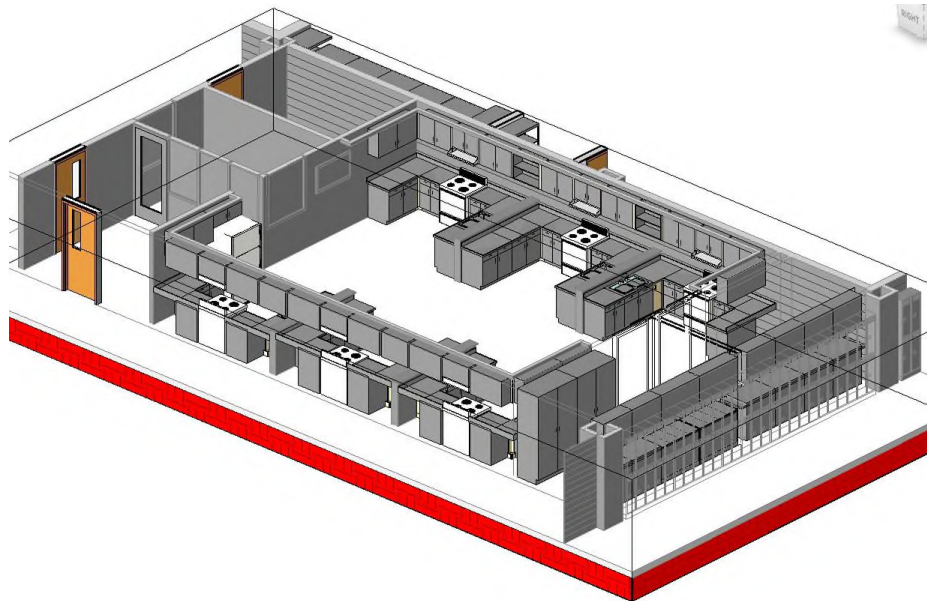


Casework Plans/Elevations – Art / Classroom Addition

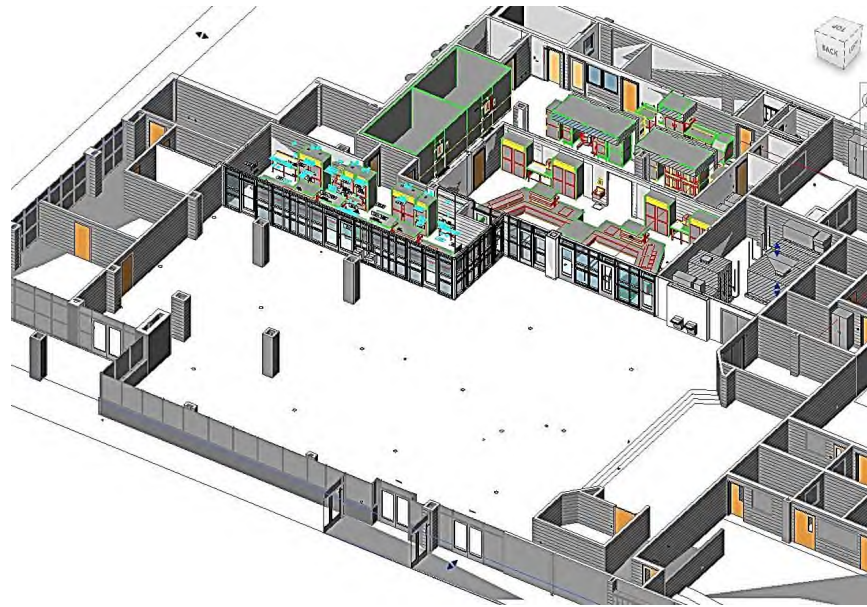
Mayde Creek Junior High School



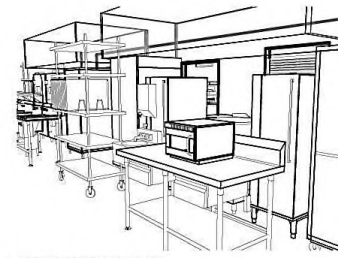
Casework Plans/Elevations – **Science Classroom Renovations**
Mayde Creek Junior High School



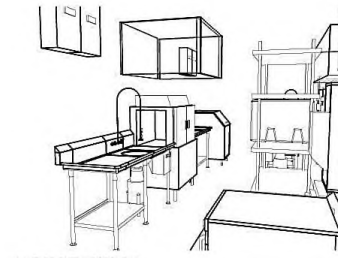
Casework Plans/Elevations – **Home Economics Renovations**
Mayde Creek Junior High School



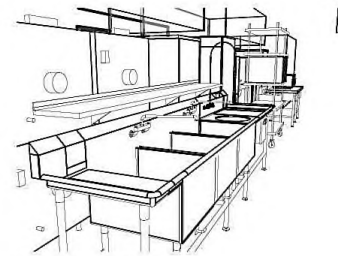
Casework Plans/Elevations – Dining / Kitchen Renovations
Mayde Creek Junior High School



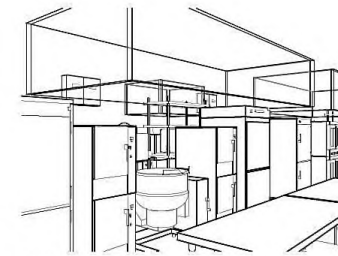
② WORKTABLE - UTENSIL SHELF



④ WAREWASH EQUIPMENT



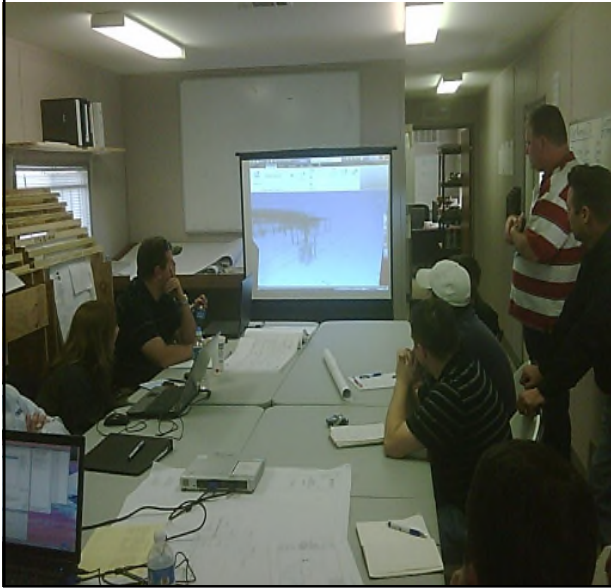
③ THREE COMPARTMENT SINK



⑤ PRODUCTION 1

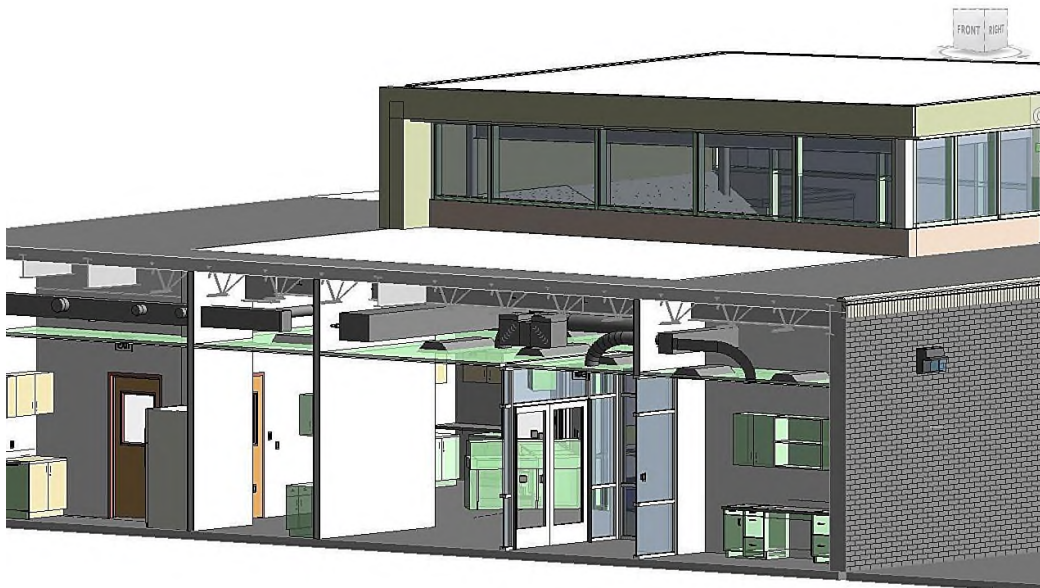
Casework Plans/Elevations – Kitchen Equipment
Mayde Creek Junior High School

BIM/REVIT = Design Coordination



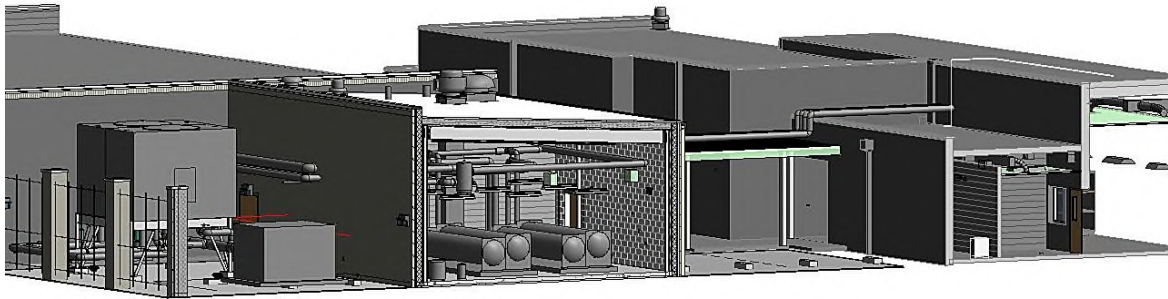
Team 3D Coordination

- Regular Coordination Meetings
 - Structural
 - Mechanical
 - Electrical
 - Plumbing
- Tricky Transitions
- Complex Design Areas



Discipline Coordination

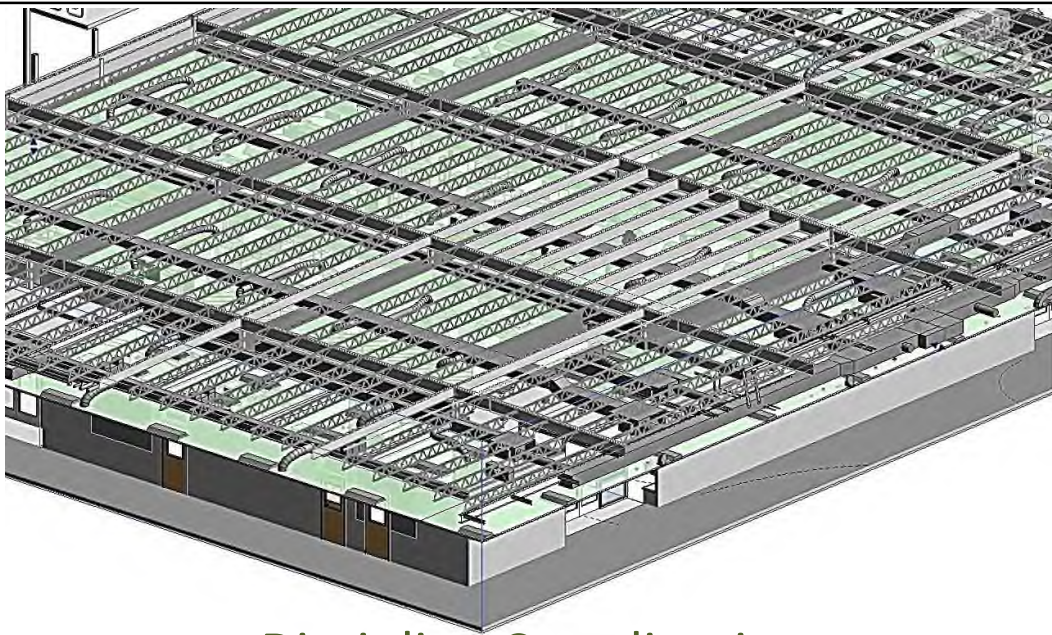
(Existing Bldg. w/ New Construction – Administration Area)



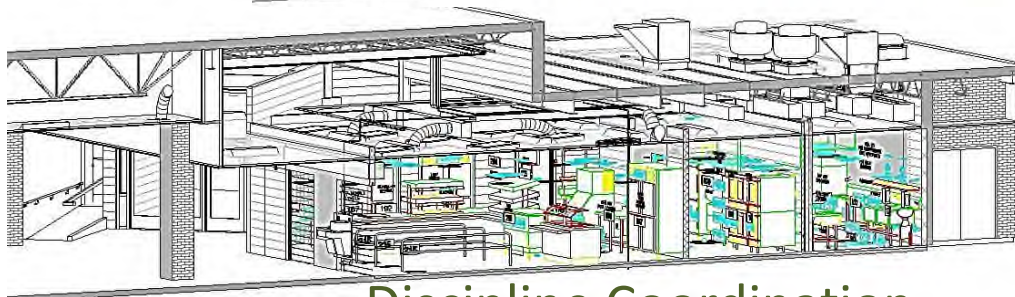
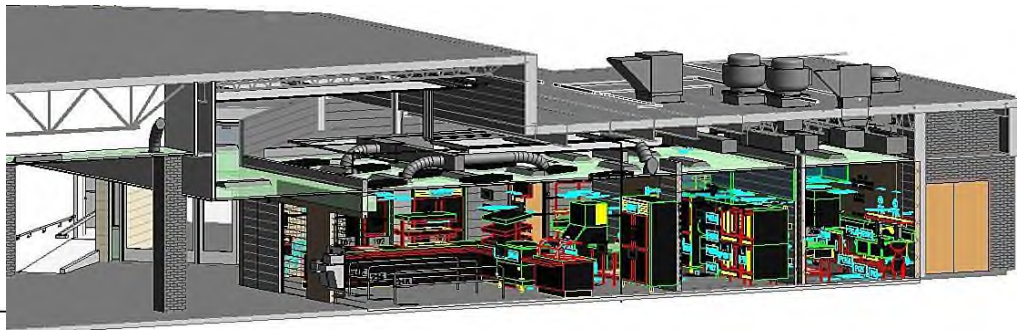
Discipline Coordination
(Existing Bldg. w/ New Construction – Central Plant)



Discipline Coordination
(Existing Bldg. w/ New Construction – Science Area)



Discipline Coordination
(Existing Bldg. - Library + Hall Plenum)



Discipline Coordination
(Existing Bldg. Renovation – Kitchen Section)

Construction Phase

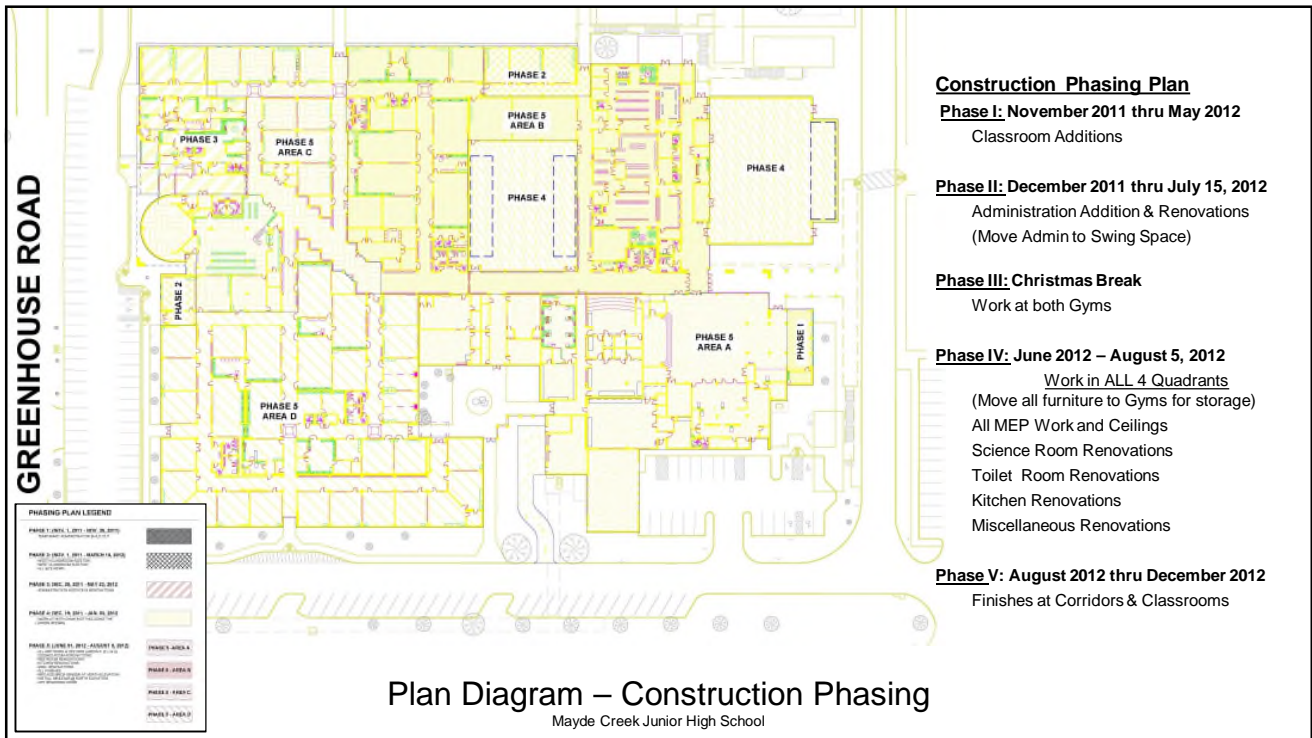
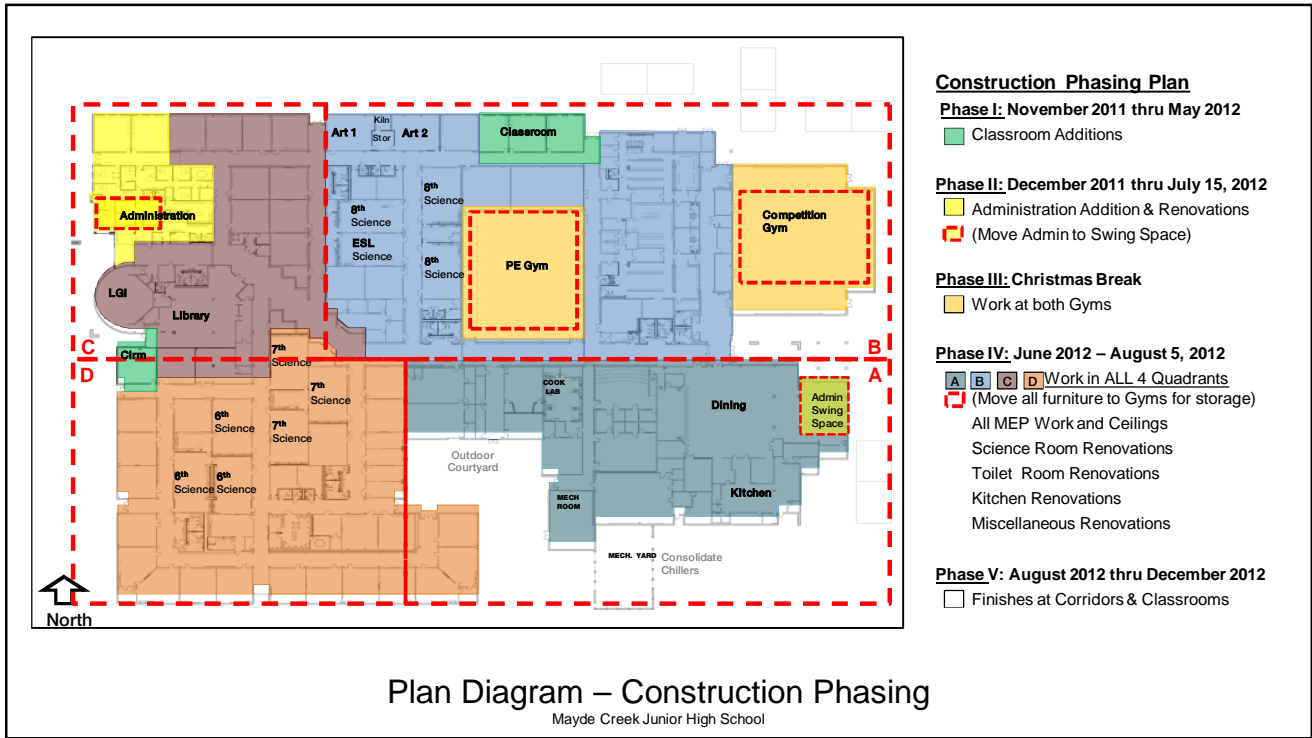


Phased/Comprehensive Renovation

Act ID	Activity Description	Original Duration	Early Start	Early Finish	Total Float
Phase 1 - Relocate Administration					
AR100	TEMPORARY ADMINISTRATION BUILDOUT	30	11/01/11	11/20/11	720
Phase 2 - Sitework					
8100	SUBMITTALS	15	11/01/11	03/02/12	1080
8105	SITE MOBILIZATION	3	11/17/11	11/21/11	1240
8110	EPA REQUIREMENTS	2	11/17/11	11/21/11	1350
8115	SITE DEMOLITION	5	11/22/11	11/28/11	1570
8120	STORM SEWER	40	11/22/11	01/16/12	1240
8125	SITE FIRE LINES	40	11/22/11	01/16/12	1420
8130	DEMOLITION AT NEW PAVING	2	11/21/11	12/01/11	1430
8135	PREP/IMP/POUR PAVING	10	12/21/11	01/03/12	1430
8140	CANOPIES	10	01/04/12	01/17/12	1430
8145	DETENTION POND	5	01/17/12	01/23/12	1240
8150	CONCRETE AT DETENTION POND	2	01/24/12	02/05/12	1240
8155	HYDROMULCH	7	02/28/12	03/01/12	1110
8160	LANDSCAPING	5	02/28/12	03/06/12	1080
Phase 2 - North & West Classroom Additions					
		101	11/01/11	09/20/12	800
8160	MOBILIZE	4	11/01/11	11/04/11	600
850	STRUCTURAL STEEL SUBMITTALS	15	11/01/11	11/21/11	750
8120	INSTALL BUILDING PAD	3	11/07/11	11/08/11	600
8130	LAYOUT PIERS	1	11/10/11	11/10/11	600
8140	PREP/POUR PIERS	2	11/11/11	11/14/11	600
8150	MEP UNDERGROUND	5	11/15/11	11/21/11	600
8160	INSTALL GRADEBEAMS	5	11/18/11	11/24/11	600
8170	PREP/POUR S.O.G.	4	11/25/11	11/29/11	600
8180	DELIVER STRUCTURAL STEEL	2	12/01/11	12/02/11	600
8190	ERECT STRUCTURAL STEEL	10	12/09/11	12/16/11	600
8200	INSTALL ROOF	10	12/16/11	12/26/11	600
8210	MEP ABOVE CEILING	15	12/22/11	01/11/12	800
8220	INSTALL EXT. WALLS/GYP.	5	12/22/11	12/28/11	600
8230	WATERPROOF EXT. WALLS	3	12/28/11	01/02/12	1410
8240	INSTALL BRICK AT NEW & EXISTING	8	01/03/12	01/12/12	1410

Schedule: Why 1 Summer vs. 2 Summers?

- Start New Construction Early
- 10-Week Extreme Makeover
- Design = Plan/Create Schedule
- GMP = Subs \$\$ based on Schedule
- Construction = Phased by Quadrants





Project Implementation

- Start New Construction Early
- 10-Week Summer Renovation
- Team Commitment to Schedule
 - GC Mobilized = One Time
 - End User Impacted = One Summer only
 - Team = Fast Submittal / RFI process



Coordinate Construction

- Submittal Review
- RFI Responses
- Existing Structure
- MEP Coordination
- Team Efficiency / Discipline
- Owner Move-Out & Move-In



No Margin for Error

- 10-Week Extreme Makeover
- Abatement
- Demolition
- Infrastructure Rough-in
- Interior Finish-out
- Occupancy



No Margin for Error

- 10-Week Extreme Makeover
- **Abatement**
- Demolition
- Infrastructure Rough-in
- Interior Finish-out
- Occupancy



No Margin for Error

- 10-Week Extreme Makeover
- Abatement
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No Margin for Error

- 10-Week Extreme Makeover
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No Margin for Error

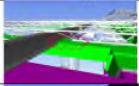
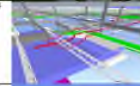
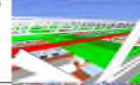
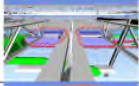
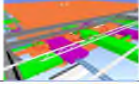
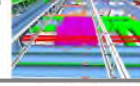
- 10-Week Extreme Makeover
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No Margin for Error

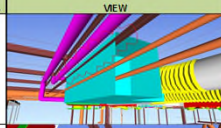
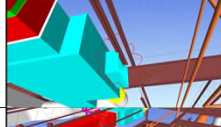
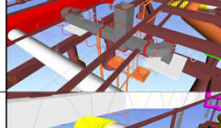
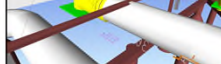
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BIM – Clash Detection Process

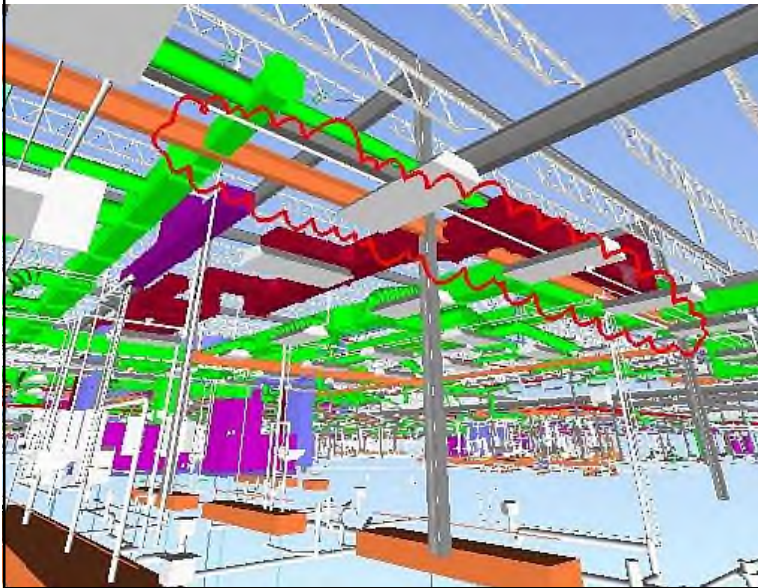
13-Apr-12 KATY ISD MAYOR CREEK 11-529 2012-4-12_MCHS_Federated Model MWB All Areas		CLASH DETECTION REPORT			
View No.	VIEW	CATEGORY	View No.	VIEW	CATEGORY
DS1		HVAC Duct - Existing Steel	DC4		HVAC Duct - Elec Condt.
DS2		HVAC Duct - Existing Steel	DE8		HVAC Duct - Elec Condt.
DS3		HVAC Duct - Existing Steel	DE8		HVAC Duct - Elec Condt.
DnS1		HVAC Duct - New Structure	DE7		HVAC Duct - Elec Condt.
			DE8		HVAC Duct - Elec Condt.

- GC ‘merged’ the REVIT files
 - Architectural
 - Structural
 - Mechanical + Electrical + Plumbing
 - Food Service
- Ran “clash detection” software
- Generated “clash report”
- Conducted meetings at project with the Owner + A/E + GC subs
- Worked through each clash and made decision of what to do – assigned tasks
- Repeated 2-3 times for each project

BIM – Clash Detection Report

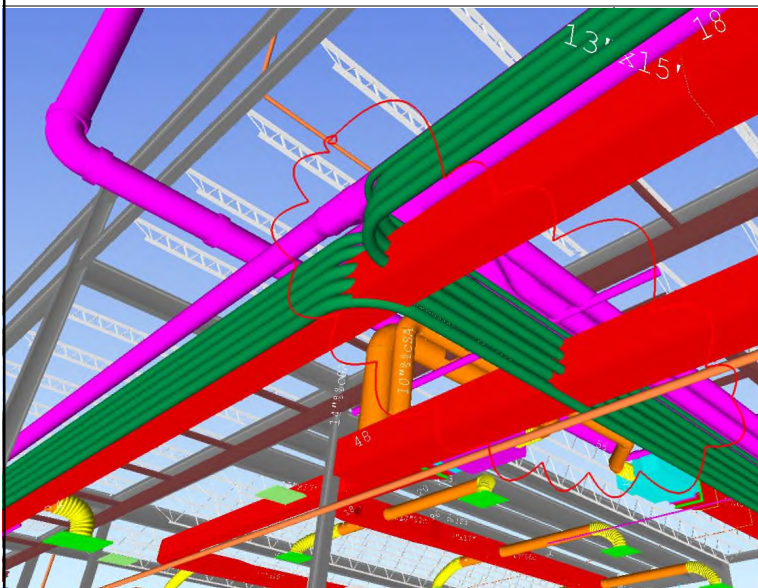
DATE: 28-Jan-12		CLASH DETECTION REPORT						
PROJECT NAME: KATY ISD WEST MEMORIAL RIS								
PROJECT NUMBER: 11-529								
FILE NAME: 011312_WMBIS_Federated Area-RLand								
REPORT MODELS: ANEA - J (Revised) & ANEA_A_B_C_D_F_G								
NOTE:								
No.	LOCATION	DATE	View No.	VIEW	CATEGORY	DESCRIPTION	RE SPONSE	STATUS
1	B134	20-Jan-2012	HDPR1		Area B Duct - Struc PE1			Open
2	B124, B130	20-Jan-2012	HDPR2		Area B Duct - Struc PE1			Open
3	B124, B130	20-Jan-2012	HDPR3		Area B Duct - Struc PE1			Open
4	B130	20-Jan-2012	HDPR4		Area B Duct - Struc PE1			Open

MCJH – Clash Detection Example



- HVAC Duct & New Steel PR-1.**
- DnS1 - Description: HVAC duct running into Steel beam.
Location: A123
Assigned to: Southern Mechanical will look into it. Check the structural drawings if the beam is there.
 - DnS2 - Description: HVAC transfer boot hitting steel beam.
Location: A131
Assigned to: Southern Mechanical will move the transfer boot as required.
 - DnS3 - Description: HVAC duct running into Steel beam.
Location: D-132
Assigned to: Southern Mechanical will look into it. Check the structural drawings if the beam is there.

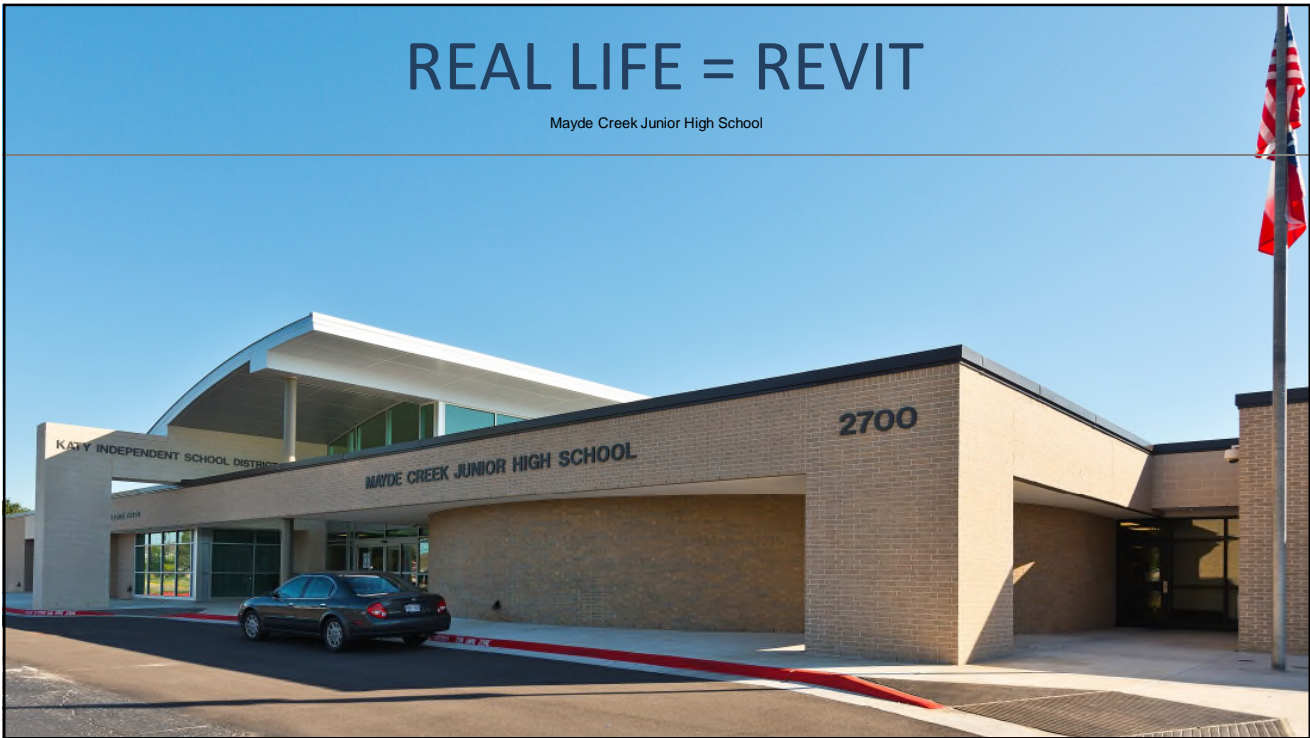
WMJH – Clash Detection Example



- Electrical Conduit & HVAC Duct.**
- ECD1 Description: Electrical conduit hitting HVAC duct.
Location: G139
Assigned to: Pieper Houston Electric will move the conduits up. TNT mechanical to flatten duct and provide transitions
 - ECD2 Description: Electrical conduit hitting HVAC duct
Location: G139 near G100
Assigned to: Pieper Houston Electric will look into it.
 - ECD3 Description: Electrical conduit hitting HVAC duct
Location: G139 near G125
Assigned to: Pieper Houston Electric will look into it.

REAL LIFE = REVIT

Mayde Creek Junior High School



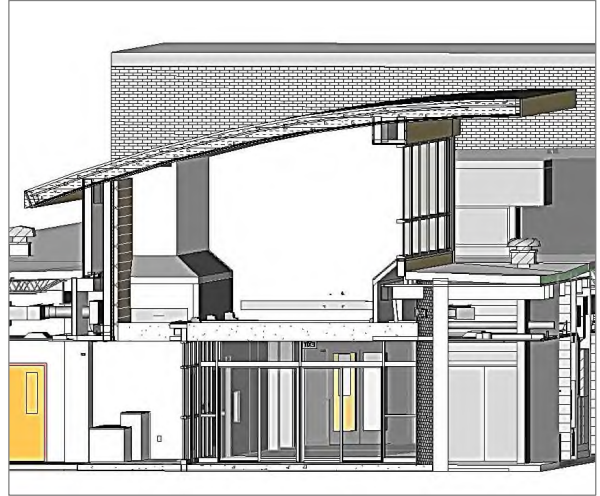
REAL LIFE = REVIT

Mayde Creek Junior High School



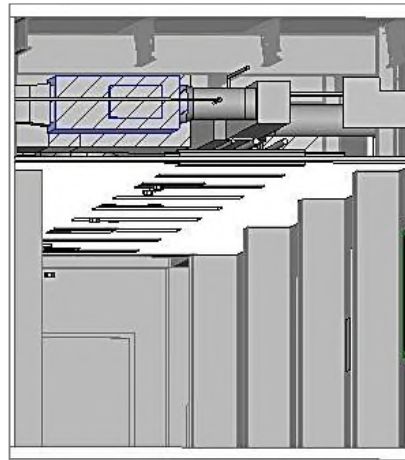
REAL LIFE = REVIT

Mayde Creek Junior High School



REAL LIFE = REVIT

Mayde Creek Junior High School



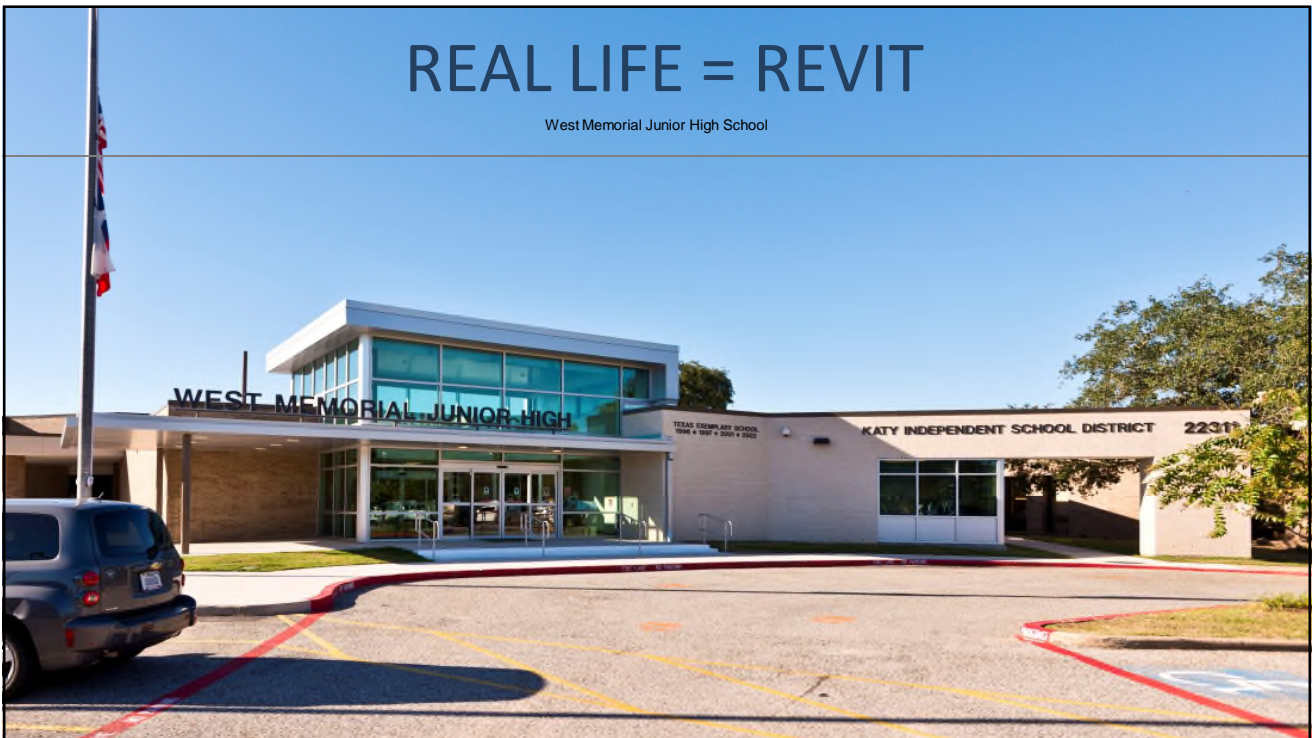
REAL LIFE = REVIT

Mayde Creek Junior High School



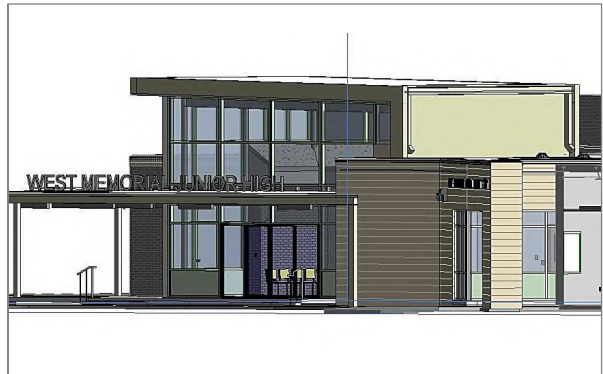
REAL LIFE = REVIT

West Memorial Junior High School



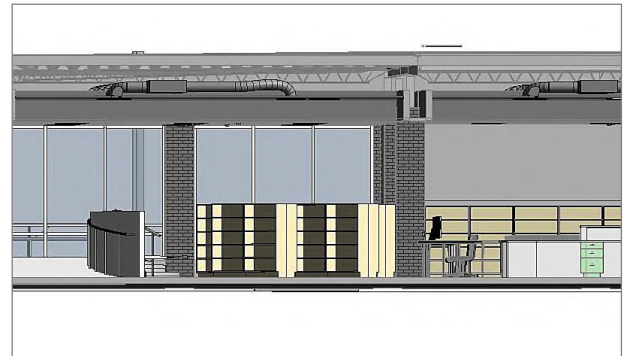
REAL LIFE = REVIT

West Memorial Junior High School



REAL LIFE = REVIT

West Memorial Junior High School



REAL LIFE = REVIT

West Memorial Junior High School



REAL LIFE = REVIT

West Memorial Junior High School



Real Results

THE BENEFITS OF BIM

VISUALIZATION 



DECREASED COST

INCREASED ACCURACY 



EFFICIENCY

SITE LOGISTICS 



CLASH DETECTION

PREFABRICATION 



CLOSE OUT

BIM = Min. Guesswork

- Virtual Construction – Exist/New SF
- Worked out the “Kinks” in Design
- Better Coordination
 - Structural
 - Mechanical
 - Electrical
 - Interior Construction

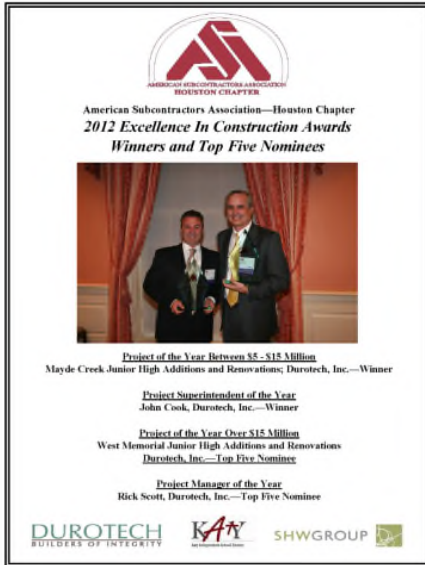
Real Results



CMaR = Added Value

- Design Pricing / Options
- 10-Week Summer Renovation
- Team Commitment to Schedule
 - GC Mobilized One Time
 - End User Impacted One Summer only
 - Fast Submittal / RFI process

Real Results



2012 Construction Awards

Excellence in Construction Awards

- American Subcontractor Association
Houston Chapter

Winners

- Project of the Year – Mayde Creek JHS (\$5-15 million)
- Project Superintendent of the Year - John Cook

Top 5 Nominees

- Project of the Year – West Memorial JHS (\$5-15 million)
- Project Manager of the Year – Rick Scott

Real Results = Save Time + \$\$



Minimized Impact to Campus

- Campus occupied space at early start
- Single Move-out / Move-in at summer

Construction Savings / Added Scope

- **Included within GMP @ both schools**
 - Fire Sprinkler System (+/- \$500K unplanned)
 - Security Vestibule + New Entry
 - New Kitchen Serving Lines (*alternate*)
 - All new doors + hardware @ 2 JHS (*alternate*)
- **Added Scope Examples during CA**
 - Home Economics improvements @ 2 JHS
 - All new casework vs. partial replacement @ 2 JHS
 - New tile wainscot to reduce on-going maintenance \$
 - Exterior courtyard improvements at WMJH

This concludes The American Institute of Architects
Continuing Education Systems Program

QUESTIONS??

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