The migration from AutoCAD to BIM using REVIT at Ferris State University

Bruce C. Dilg, NCARB
Professor Architectural Technology

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# Curriculum Guide

**FIRST YEAR - FALL SEMESTER (17 semester hours)**
- ARCH 101: Architectural Graphics
- ARCH 108: Intro to Computer Graphics in Architecture
- ARCH 112: Structure Materials, Systems & Codes
- ENGL 150: English 1
- MATH 116: Intro. Algebra/Num. Trigonometry

**FIRST YEAR - WINTER SEMESTER (17 semester hours)**
- ARCH 115: Interior & Exterior Finishes & Systems (ARCH 112)
- ARCH 244: Historical Development of Western Architecture
- COMM 121: Fundamentals of Public Speaking
- PHYS 211: Introductory Physics 1 (MATH 116)

**SECOND YEAR - FALL SEMESTER (17 semester hours)**
- ARCH 203: Architectural Construction Detailing (ARCH 102:112:115)
- ARCH 222: Statics & Structures (ARCH 112, PHYS 211, MATH 116)
- ARCH 241: Design Fundamentals (ARCH 244, or instructor's permission)
- HVAC 337: Math. & Electrical Systems for Bldgs. (PHYS 211, MATH 116)
- ENGL 250: English 2

**SECOND YEAR - WINTER SEMESTER (15 semester hours)**
- ARCH 204: Arch. Const. Documents 2 (ARCH 203:223: or instructor's permission)
- ARCH 216: Professional Practice (junior standing)
- ARCH 230: Systems Cost Estimating (ARCH 102, MATH 116, or instructor's permission)
- PSYC 150: Introduction to Psychology
- ___ Architectural Elective
- ARCH 270: Adv. Usage of CAD in Arch (ARCH 109, or instructor's permission)

**ARCHITECTURAL ELECTIVES**
- ARCH 245: History of Architecture
- ARCH 265: House - The American Evolution (ARCH 102.241.244)

**ARCHITECTURAL ELECTIVES FOR STUDENTS LADDERING INTO FACILITY MANAGEMENT**
- FMN 321: Principles of Facility Management

**ARCHITECTURAL ELECTIVES FOR STUDENTS LADDERING INTO CONSTRUCTION MANAGEMENT**
- COMM 111: Construction Practices
- COMM 122: Construction Surveying
- COMM 212: Soils and Foundations
Curriculum Guide

THIRD YEAR - FALL SEMESTER (15 semester hours)
FMAN 321 Principles of FMAN (tacked in FMAN or instructor's permission)
MGT 301 Applied Management (junior standing or permission)
PSY 326 Industrial/Organizational Psychology (PSY 150)
ENGL 311 Advanced Technical Writing (ENGL 210)
STQM 260 Introductory Statistics (MATH 115)

THIRD YEAR - WINTER SEMESTER (15 semester hours)
FMAN 329 Comp Appl. for FMAN (FMAN 321, ACAD comp., or instructor's permission)
FMAN 332 Project Management (FMAN 321, or instructor's permission)
FMAN 331 Facility Plan & Design Process (FMAN 321)
BLAW 221 Elementary Business Law
ECON 221 Principles of Economics 1 (MATH 110)

THIRD YEAR - SUMMER SEMESTER (4 semester hours)
FMAN 393 FM Internship (completion of 3rd year or instructor's permission)

FOURTH YEAR - FALL SEMESTER (18 semester hours)
FMAN 421 Concepts of Space Planning (FMAN 321)
FMAN 441 Property Development & Planning (FMAN 321, BLAW 221)
FMAN 451 Bldg. Diagnose & Operations (FMAN 221)
ACCT 201 Principles of Accounting (MATH 110)
ECON 222 Principles of Economics 2 (ECON 221)

FOURTH YEAR - WINTER SEMESTER (18 semester hours)
FMAN 432 Interior Design for Facility Managers (FMAN 421)
FMAN 499 Capstone Assessment Thesis (FMAN 393 and prior status)
HVAC 483 HVAC Building Systems
BIOCL 111 Environmental Biology

The list above is a sample class schedule for a student in the Facility Management Program. By clicking this link you will be redirected to the Facility Management Course Catalog page.
Academics

The Construction Technology and Management Department offers two Associate of Applied Science (A.A.S.) degrees and one Bachelor of Science (B.S.) degree appropriately tailored to the needs of the nation's largest industry—construction.

Construction Management Bachelor of Science Degree

Accredited by the American Council for Construction Education (ACCE).

Graduates of the Construction Management program are prepared to manage and supervise the complete construction process from initial considerations through bidding to final completion. Graduates enter the industry as project superintendents, project engineers, project managers, or owner's representatives for a variety of construction related firms such as: general contractors, specialty subcontractors, construction managers, designers, developers, consultants, or owners.

Students may enter the Construction Management program as freshmen or after completion of an approved associate degree. Course content includes management of skilled labor resources, contract administration, estimating, cost and schedule control, quality control and quality assurance, project management, engineering, mathematics, sciences, business, and computer application topics.

There are four paths for the students to obtain their Bachelor of Science in Construction Management, depending on the interest and background of the student.

The primary tracks emphasis either building construction or highway construction.

Within the building construction area, the Mechanical/Electrical/Plumbing (MEP) emphasis is relatively new. New courses will be added as time allows.

The B.S. program also provides an opportunity for A.A.S. graduates of the Architectural Technology program to enter the C.M. program as a Junior.

Click on the degree path for more information:

Bachelor of Science - Construction Management

Building Construction Technology Management
Commercial/Industrial Building Emphasis
Mechanical/Electrical/Plumbing Emphasis
Hills and mountains — with tunnels for your trains — add enormously to the realism of railroading with American Flyer. The first step is to make a suitable frame work. Plywood is excellent for the purpose.

The second step is to cover the frame work with fine wire mesh, shaping it to some interesting and natural-looking contours. Include one or two highways in your plan. Flatten the mesh to a suitable width.

Next, mix asbestos plaster with water and apply it to the mesh, giving hills and mountains the desired shape. When dry, paint with water mix paints, using blends of blue, yellow and brown.

For the finishing touches, trees can be made of twigs dipped in shellac. Green can be simulated by dyeing a paste of green, then sprinkling it over wet paint. You can make a lake by painting glass blue-green on the underside.

THE natural goal of every scale model railroader is to have a mighty railroad empire. Send sleek trains roaring into a dark tunnel... hear the muffled noise of their “choo-choo” beating against the walls... then see the locomotive reappear at the other end engulfed in a cloud of smoke. Have big freight yards where cars are loaded with spectacular automatic equipment — make up trains and hustle them over a maze of tracks to their destination — uncouple and unload cars by remote control.

Here is fun that will last you all the days of your
2D or not 2D?
that is the question

BRUCE C. DILG (with apologies to will shakespeare)
10APR97
Thinking about the Thinking

- Two dimensional
- Know the size of the ball
- Orthographic projection
- Coordination Issues
- Constructibility Issues
- Visualization Issues
- Seeing around a corner

copywrite Bruce C. Dilg
Concept

• What if we build buildings rather than draw lines to represent parts of buildings?
  • can we visualize our spaces more accurately?
  • a client?
  • an engineer?
  • a code official?
  • a contractor?
What if?

- we can put this model through a wind storm
- blow water against it
- load it with snow
- light a fire in it
- play a concert in it
- test lighting ideas
Could a 3D model someday
• be given to code officials to do their analysis?
• be given to a contractor for bidding?
• be used by contractors to decide what details or sections they want?
IMMANUEL LUTHERAN CHURCH

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Big Rapids, MI 49307
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BIG RAPIDS BANDSHELL
ACTUAL BUILDING

BIG RAPIDS BANDSHELL
COMPUTER MODEL ON ACTUAL SITE
<table>
<thead>
<tr>
<th>Mark</th>
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• Architectural Detailing – How do you teach students how a building goes together?

• Can “building the building virtually” help students understand the process?
An example of a model created in AutoCAD and imported into REVIT. However everything in the model is “dumb” because it was done in AutoCAD.
An AutoCAD model imported into REVIT retains its geometry, but as shown here has no Properties (Intelligent Data) associated with it.
FERRIS STUDENT WORK MODELING IN AUTOCAD WITH INTELLIGENCE ADDED THROUGH ATTRIBUTES
A Case Study of why “Dumb” models can add value but have substantial limitations.
The “DUMB” model produced in AutoCAD could produce great renderings and walkthroughs.
The Acoustical Consultants diagnose potential acoustic problems and solve them—before those problems are built into new structures. As acoustical design consultants, we review architectural design plans, research applicable noise ordinances, conduct building site evaluations, and use sophisticated **acoustical modeling software** to deliver the optimal solutions.

**Acoustical Modeling for Architectural Design**

Modeling acoustics before spaces are built can reveal **architectural acoustics** performance issues—arming architects, engineers, facilities managers, and building owners with acoustical modeling data and information to make the optimal design decisions. With sophisticated acoustical modeling software and the experience of our acoustical engineers, you can attain the desired acoustical environment for your clients.

copyright Bruce C. Dilg
What happened?

• All of the data available in the architectural model was imported into a German acoustical modeling software.

• Acoustical modeling was done and an acoustical design report was prepared showing the extent, frequency and design of custom acoustical tuner panels to produce the acoustical ambiance and reverberation time desired.
Implementation of Acoustical Recommendations

Layout of acoustical panels above light is typical for west, north and south gables.

Acoustical panels mounted on mezz rail, west only.

Acoustical wall panel schedule:
- All panels by Kinetico Noise Control
- Panel F-A - Standard panel 4" thick
- Panel F-B - Tapered panel 4" thick fabric wrapped fiberglas with flousboard panel
- All panels to be mounted per manufacturers recommendations

Transverse section through sanctuary - looking west

Scale 1/8" = 1'-0"

Relief air opening as part of brick coursing

Copywrite Bruce C. Dilg
The Reality

• When the building opened after all recommendations had been followed the acoustics were TERRIBLE!

• The Electrical Engineer had placed two lighting dimmer panels on the balcony. Each had three fans which produced 42db per fan.

• This was not accounted for in the model because the model was not “SMART”. It was just geometry.
Designing details

Not neat, linear, or fully logical

Messy complex process

The bad

False starts, wrong turns, mental blocks, dead ends, backtracking, despair.

The good

Purposeful progress, intelligent decisions, creative synthesis, gratification, insight, and triumph

Section 2 - Getting started

The step by step process of detailing a building
- **Step 1**- Clarify your aspirations
  - Determine function, constructability, and aesthetics
- **Step 2**- Set performance standards
  - Identify key details, Put into sketch form
  - Draw given features; skeletal structure, plane of structural wall, ground plane, floor-to-floor dimensions
  - The first ideas for the key details will emerge logically from these elements
- **Step 3**- Access each detail
  - How does it meet the broad goals (function, constructability, and aesthetics)
  - How does each compare to performance standards
  - Look at compositional/spatial complications of first efforts

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**Section 2**

**Getting started**

The step by step process of detailing a building
Section 2
Getting started

The step by step process of detailing a building

- Step 4- refine aesthetic goals-Make more precise
  - Make notes graphically or in writing to summarize important items of each detail
    - Repeat for each detail - ensure common source

- Step 5-test details
  - Look at the less typical conditions
    - How does the detail turn the corner?
    - How is an opening made in it for a horizontal chase?
Use of the internet
BIM Models - Overview

KAWNEER'S BIM MODELS.
DESIGN THE WAY YOU THINK

In support of an emerging trend in architecture, Kawaeeer has adopted Building Information Modeling (BIM) to deliver product specific content to the design community. Kawaeeer's BIM product models help bring your vision to life, providing a virtual tool to help you design the way you think.

Our growing library of BIM models will enable architects to be more efficient in the design process and demonstrates our continued commitment to providing valuable products and tools to architects and customers.

To deliver the library of BIM models to a broad audience, Kawaeeer has partnered with one of the leading developers of manufacturer specific BIM content in the construction marketplace, BIMWorld.

Our models are offered in Autodesk® Revit®, as well as a variety of applications, including, Graphisoft® ArchiCAD®, Bentley Architecture, and Google™ SketchUp.

DOWNLOADS AND LINKS

Click on the links below to download Kawaeeer BIM product models:
- Curtain Wall
- Entrances - Sliding
- Entrances - Swing
- Storefronts - Framing
- Sun Control Products
- Windows - In/Out Projecting

OR

Click on the link below to view, browse, download and manage BIM models via the BIMWorld website:
- bimworld.com
Kawneer

1600 SS™ (Screw Spline) - (2-1/2” x 68"

Based on the popular tried and true design of 1600 Wall System®1 and 2, the 1600 SS’s screw spline joinery allows 1600 SS to be sealed in more controlled shop conditions than the job site provides. By pre-assembling and then delivering “ready to install” time and effort required in the field is minimized.

Key Features Include:
- glazed captured or SSG curtain wall system
- 1600 SS™ has 2-1/2” (63.5) sightlines
- Standard 6” (152.4) or 7-1/2” (190.5) depth systems
- Infill options up to 1-1/8” (28.6)
- Perimeter seal can be installed at the pressure plate or mullion shoulder
- 1600 SS™ can be supplied fabricated and knocked down (KD) or in stock lengths
- Interlocking mullion design to eliminate need for anti-buckling clips
- Concealed fastener joinery creates smooth, monolithic appearance
- EPDM gaskets and thermal break
- Screw spline joinery method allowing for shop assembly
- Corners available with shear block fabrication method
- Offers integrated entrance framing systems
- Silicone compatible glazing materials for long-lasting seals
- Two color option
- Permanodic® anodized finishes in 7 choices
- Painted finishes in standard and custom choices

Optional Features
- Captured system thermal separator can be pre-installed into pressure plate
- Captured and SSG systems integrate with concealed GLASSvent™
- Profit$Maker® Plus die sets available
- Captured system Integrates with standard Kawneer windows
- Deep and bullnose covers available

Product Applications
- A wide variety of applications where high performance is desired
File Description
1600 SS™ (Screw Spline) Spec.
SSG with Pressure Plate - 6” Deep Mullion (1” and 1/4” infill)
3D Revit Family
3D Autocad Model
3D Bentley Model
3D Sketchup Model
3D Archicad Model
APPLY SILICONE SEALANT TO ENDS OF HORIZONTALS AS SHOWN

WW-110 FACE CAP

5/16" WEEP HOLES @ 1/4 POINTS

HP-17 (MOD.) SETTING BLOCK

GP-103 EPDM EXTERIOR GASKET

WW-149 GLAZED PANEL

WW-186-01 SHEAR BLOCK
ATTACH TO MULLION WALL
ATTACH TO HORIZ W (2)
Interfacing AutoCAD and REVIT
STUDENT COMMENTS ON THE USE OF BIM

• Using REVIT forced me to understand how the building was put together and what was behind every wall.

• REVIT is a complex program to learn but a great way to force yourself to think like a contractor and examine the buildings details.
  • The way changes are so easily fixed makes learning a new program well worth it.

• It’s hard to explain the simplicity of REVIT compared to AutoCAD, it just is. It took me only half the time to be as far on the Rankin Center model in REVIT compared to AutoCAD.

• When I heard Professor Dilg announce he was switching to a new program it made me extremely nervous because of my past experiences. When I saw how much easier REVIT was than CAD it was like an answer to my prayers. REVIT allows you to be a builder without the hard hat. This building program makes designing goals so much clearer and you really get a chance to challenge your knowledge and go to the next step of how a building is really built.
Comments from the Ferris Physical Plant on the use of BIM

We have investigated BIM but have not used it to date. There seems to be two primary reasons as to why we have not gotten involved to date:

• Cost - BIM is not currently a universal tool in the A/E world. It seems to be growing and more prevalent in the last two years. I can think of only one or two firms that we have interviewed in the last 3-4 years that have this as a basic service. There may be another 2-5 firms that would offer it as an additional service but I think we would be their guinea pig.

• The other issue is that there seems to be very little participation from the construction industry in BIM. I am aware of one firm that has gone after our projects that is very familiar with BIM. Several are indicating that they are looking at it but to date have not gone in that direction.

I think this is the way of the future. Especially as the next generation takes over for us old guys in the industry.

Michael J. Hughes
Associate Vice President for Physical Plant
What’s Next?

• Expand use of BIM into Advanced Construction Documents, add mass modeling.
• Bring BIM into HVAC program to replace AutoCAD.
• Bring BIM into FM program.
• Bring BIM into CM program.
• Develop cross university virtual course with the University of Oklahoma.