
 VirginiaTech
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Building Information Modeling Curriculum at Virginia Tech

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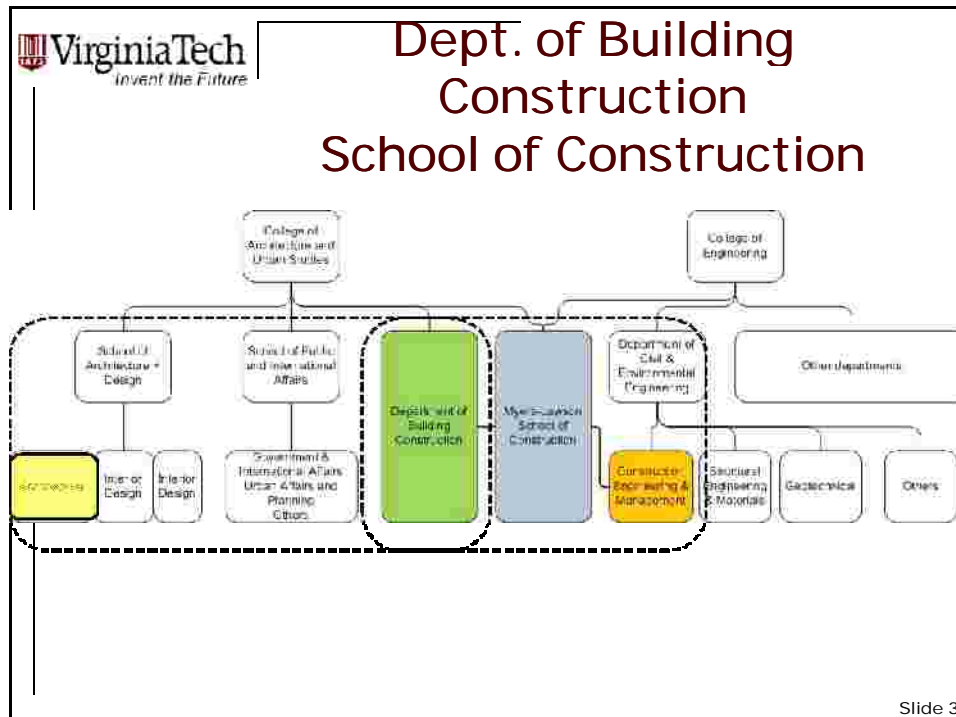
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Structure of Presentation

- Department of Building Construction & School of Construction
- BIM in the Undergraduate Curriculum
- BIM in the Graduate Curriculum
- Pedagogy for tomorrow's Construction Professionals

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Building Construction Undergraduate

- 4 year program, ACCE accredited
- Technical and managerial
- Construction and Design track
- Development, Real Estate, and Construction track
- Vertically integrated lab (2nd, 3rd, 4th year)
- Integration with architecture

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Construction Engineering & Management Undergraduate

- 4 year program, ABET accredited (in progress)
- Engineering, construction theory and business management
- Integrated lab with BC

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Digital Craft and Collaboration

in Today's Architectural Practice

September 7-8, 2007

Global Conference Center/Venue at Virginia Tech, Blacksburg, VA


Earn Up to 10 AIA/CES Learning Units!





This conference will focus on the rapidly changing digital design, construction and fabrication process. With a series of presentations, workshops, demonstrations, keynote lectures and hands-on architectural exercises, we'll explore the latest in digital design, construction and fabrication. This conference is a must-attend for anyone involved in the digital design and construction process.

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2008 B.I.M. Convergence: Some collaboration required

February 14-15, 2008
Virginia Tech Campus
Blacksburg, Virginia

[General Information](#)
[Schedule](#)
[Registration](#)

General Information

Myers-Jensen School of Construction
Building Construction Department, College of Architecture and Urban Studies and Virginia Construction Management Program,
Department of Civil and Environmental Engineering

2008 B.I.M. Convergence:
Some collaboration required

Building Information Modeling (BIM) continues to intrude industry professionals, academics, and students as they look to the future process of construction transactions. This event will bring leading minds together to discuss and debate the future implications of BIM.

Invited panels are asked to answer the following questions:

1. How do you see the future of BIM from your perspective?
2. How can students be better prepared to deal with this in the future?

Dates:
February 14-15, 2008

Location:
George Mason Hall (on the Virginia Tech Campus)


Who Should Attend:

All are invited to attend this converging of the minds and to contribute to the discussion. The format of the event will be made up of 1-hour discussion sessions. The first 30 minutes will be used for panels to answer the above mentioned questions. The second half of the session will be a Q&A and discussion moderated by a Virginia Tech faculty member.

Costs:
Sponsorship: \$25
Scholarship: \$500

Registration fee includes social on February 14th, breakfast & lunch February 15th, food will be provided all day in the main lobby of George Mason Hall.

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Traditional vs. VT Construction Education

•Yr 4

•Yr 3

•Yr 2

•Yr 1

•ESTIMATING

•SCHEDULING

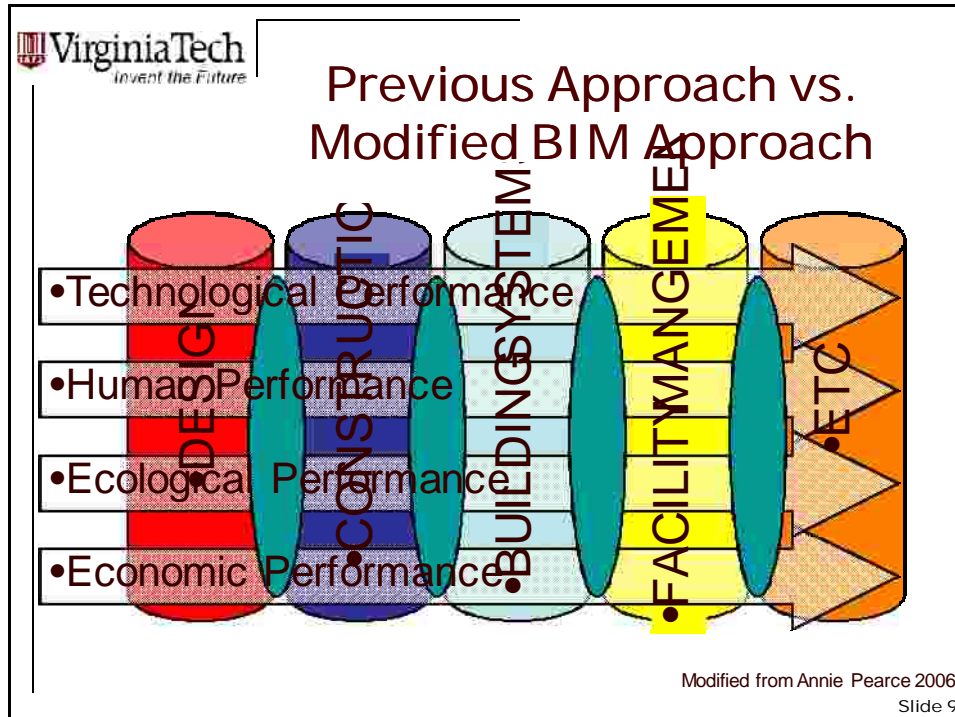
•PLANNING
•MANAGEMENT

•MATERIAL
•METHOD

•EQUIPMENT

Modified from Annie Pearce 2006

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BC BIM Curriculum (Undergraduate)

- Start in 2006 as online tutorial/workshop at 1st year: construction, structural components, quantification, pricing, scheduling
- 4th year: modeling from existing project documents, structure, mechanical clash detection, 4D scheduling
- Goal to comprehension and operational fluency in manipulations of the data, including inputs/exports during procurement/performance area
- Software: Revit, Navisworks (Commonpoint)

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CEM BIM Curriculum (Undergraduate)

- Intro at 2nd year focus on CAD, schedule impact analysis
- 4th year: modeling from existing project documents, structure, mechanical clash detection, 4D scheduling
- Goal to comprehension and operational fluency in manipulations of the data, including inputs/exports during procurement/performance area


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Crane Coordination

Student Project Example




•(S team Crane Location Illustration)

- Location
 - From S team
- Integrated Schedule
 - Input Crane location into overall schedule

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Student Project Example

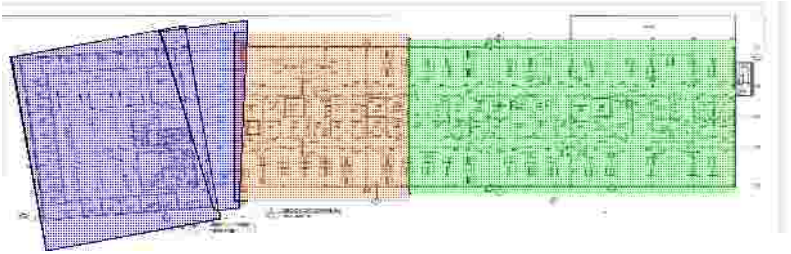


Structural Schedule

- 3 Phases
 - Col Line 17-9
 - Col Line 9-5
 - Col Line 5-1


Logic

- Columns
- Beams
- Metal Deck
- Concrete



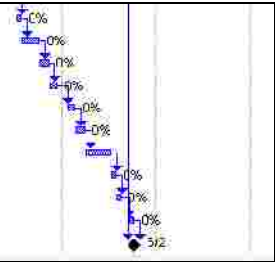
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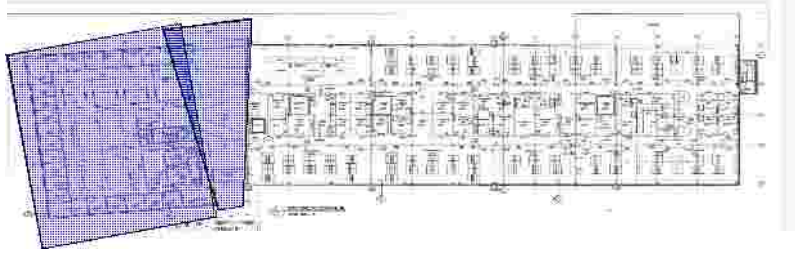
Student Project Example



Structural Phase 3

Columns 5-1	1 day
Steel Beams (2nd fl)	2 days
Steel Beams (main)	2 days
Steel Beams (attic)	2 days
Metal Decking (2nd)	2 days
Metal Decking (main)	2 days
Metal Decking (attic)	1 day
Slab on Grade (1st fl)	1 day
Slab on Deck (2nd fl)	1 day
Slab on Deck (main)	1 day
Structural Finish	0 days





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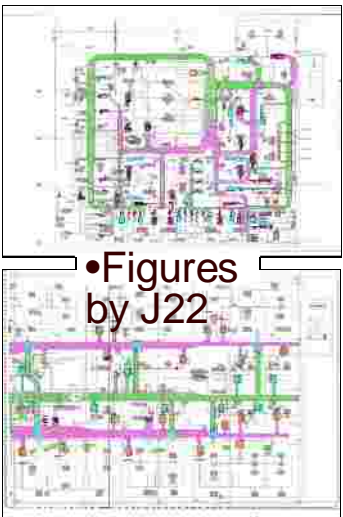
Student Project Example

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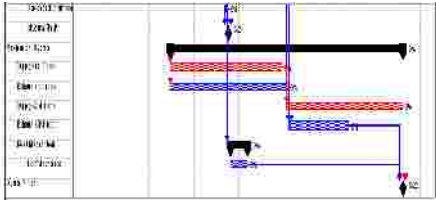
Mechanical Logic Per Floor

n Floor Logic

- Ductwork
- Machines (HX, Hydronic Pipes, etc.)
- Attenuators, Diffusers
- Filters, Hoods



•Figures by J22

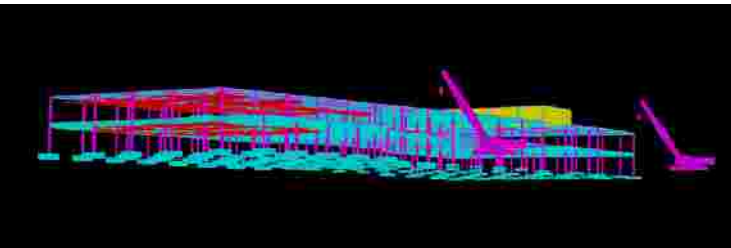
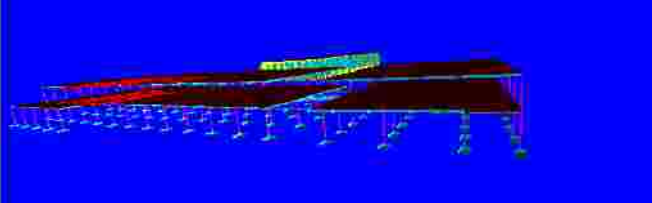


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3 D Model

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Student Project Example



Overall Coordination Strategy

•Coordination Based on S and J given Schedule:

1. Structural sequence
2. Mechanical sequence
3. Matching schedule
4. Items being brought on site

•Start S team structural on section D

↓

•Coordinate construction sequence in 3D model

↓

•Commence 4D simulation


•Start J team Mechanical schedule

←

•4D model coordination

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Student Project Example



Original Schedules

A) Schedule Coordination


Schedule Coordination of G21 will be based on selected J and S team's structural and mechanical report

B) AON Analysis

Part of creating a uniform G team schedule for the 4D model is through the analysis of J and S teams' AON

C) Total Derived Duration

Steel Duration: 70 days
HVAC Duration: 109 days



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G21's Schedule

A) Schedule Modification

Steel Duration: 98 days
 Added 28 days
 Concrete Curing
 No weekend work

HVAC Duration: 88 days
 -21 day difference
 Non-modeled components/activities



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Student Project Example

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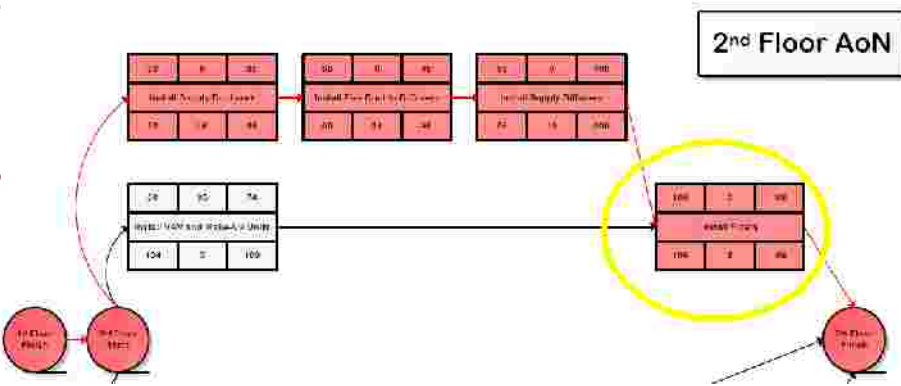
HVAC Non-modeled Components

•Other Examples

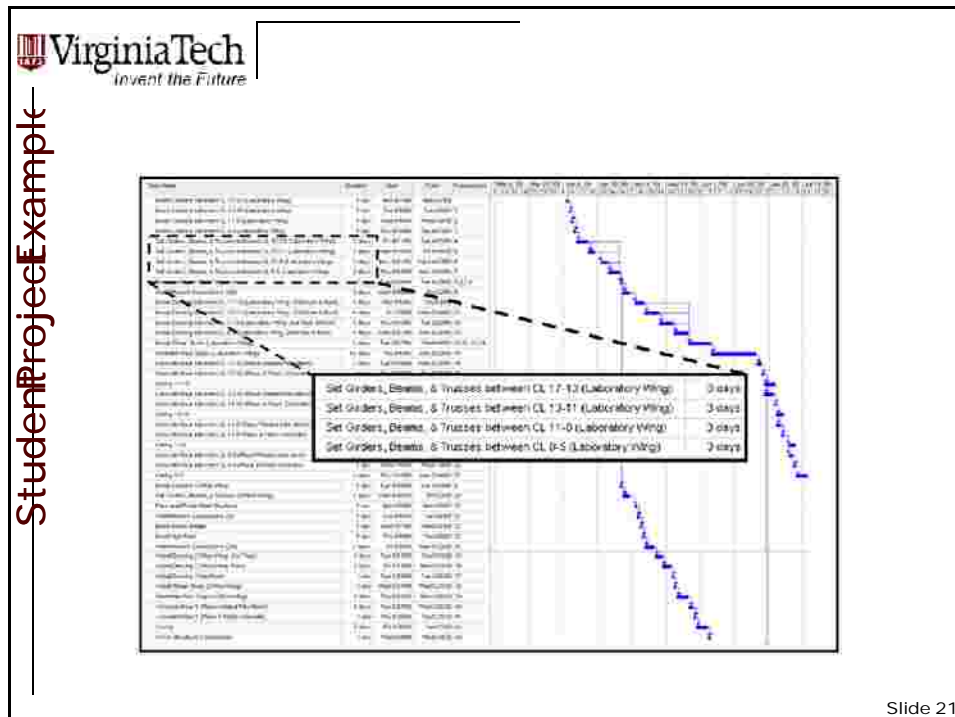
•Heat Exchangers

•Sound Attenuators

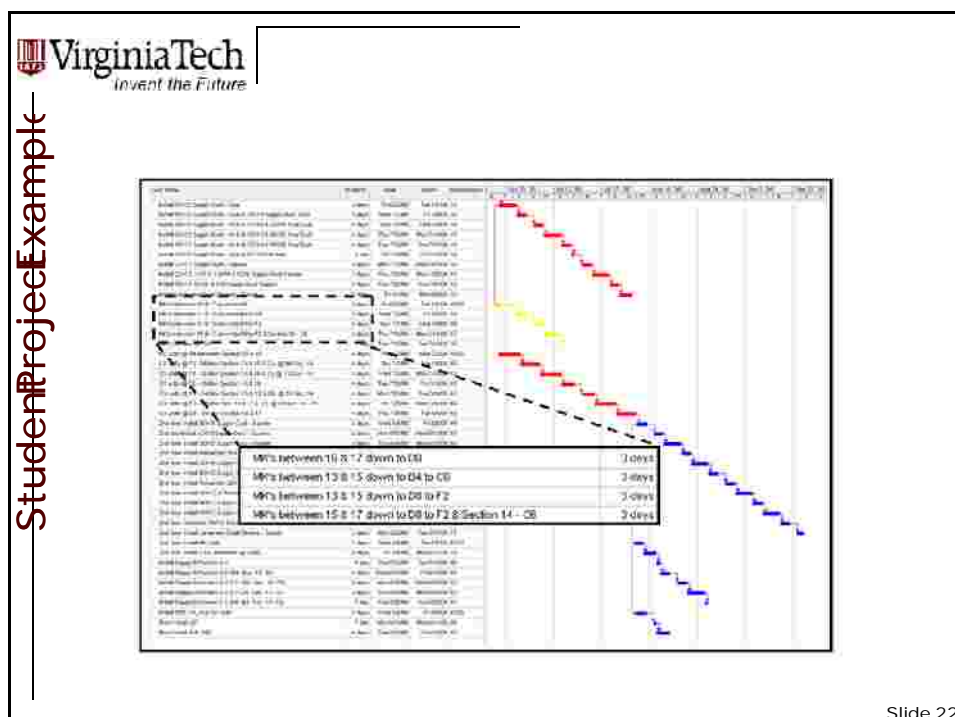
•Exhaust Hoods



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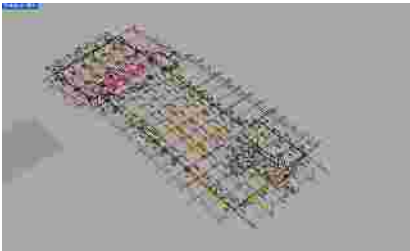

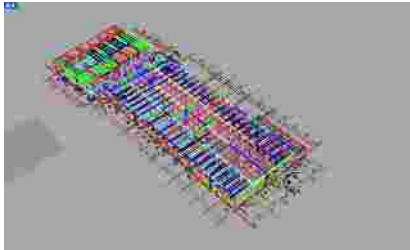
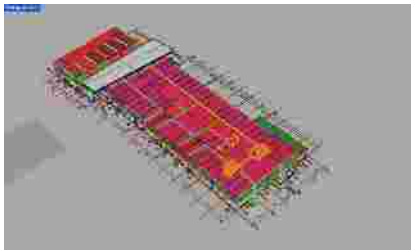
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4D-Sequencing- Phase 1


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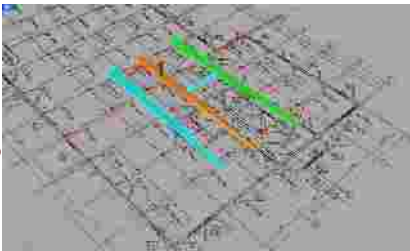
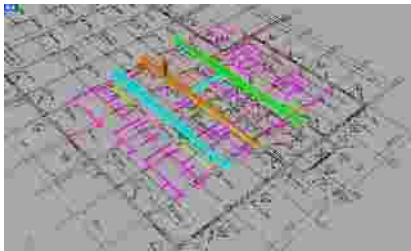
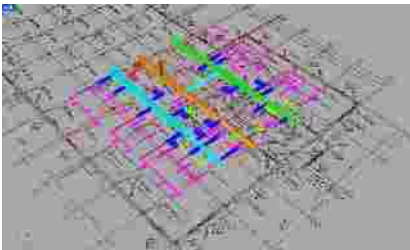
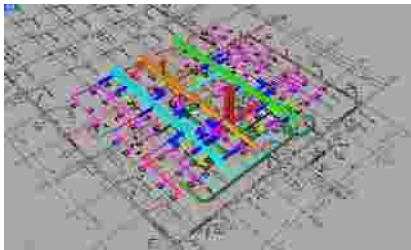
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4D-Sequencing- Phase 1


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Student Project Example




4D Simulation Issues

- Areas of Concern
 - **Software Compatibility**
 - Layering of Objects
 - Rhino to Common Point
 - Schedule
 - MS Project to Common Point
 - **Visual Restrictions**
 - Structural Obstruction of HVAC Installation




•Project 4D™

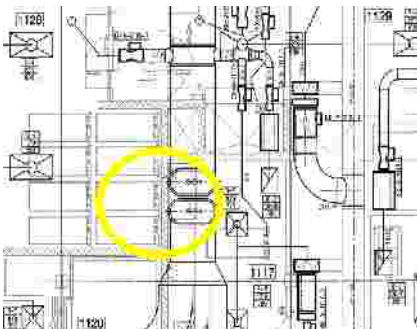
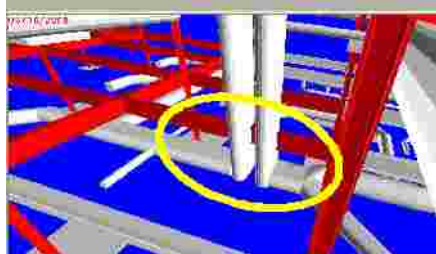


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Collision Detection

- Areas of Concern :
 1. 1st floor; page M1.4
 2. Clash detection indicated in 4D model.

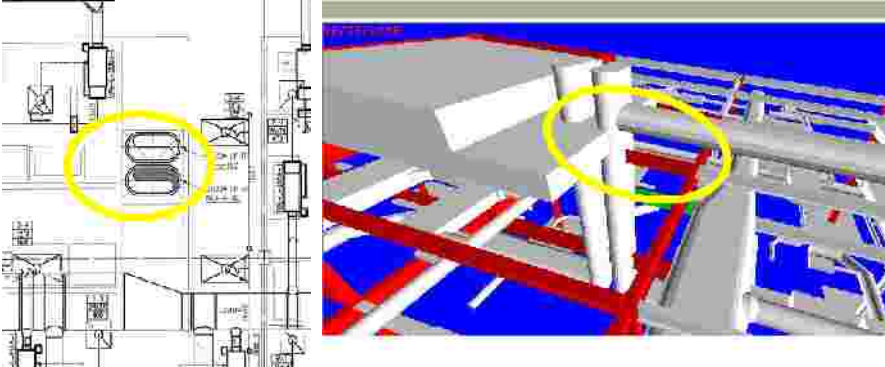
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Collision Detection


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•Areas of Concern:

1. 2nd floor; page M1.8
2. Clash detection indicated in 4D model.



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Architecture BIM Curriculum (Undergraduate)

- 5 year program, NAAB accredited
- BIM curriculum by spring 2010
- Modeling/rendering course and Building structures course
- Application at 3rd year for building assemblies, environmental systems analysis
- Digital fabrication & 3D imaging
- Solar Decathlon

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Graduate Courses incorporating BIM

- Construction Integration I, II
- Information technologies in Construction
- Facilities Integration
- Building Systems integration


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Student Project Example

- **CYBERTECTURE EGG, MUMBAI, INDIA**
- 32,000 sq.m. Egg-shaped building
- 13 floors of office spaces
- James Law Cybertecture International
- Vision
 - Cybertecture Egg will combine "iconic architecture, environmental design, intelligent systems, and new engineering to create a landmark in the city."



- The egg is orientated and skewed at an angle to create a strong visual impact

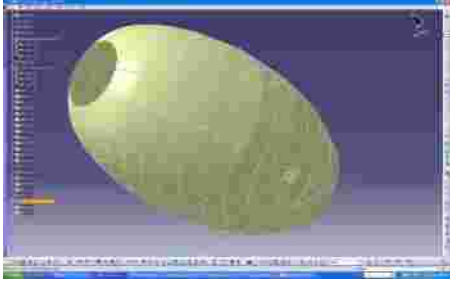
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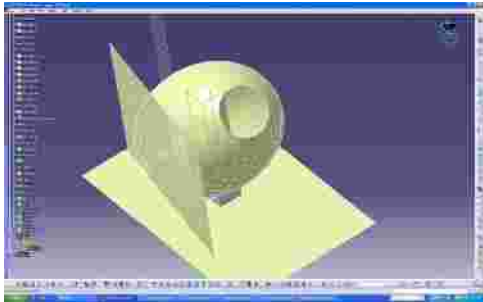
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MODEL DEVELOPMENT

- Visualization of the building envelope as a 'cucoon'
- Array of parametrically increasing circles
- Formation of a multi-section surface





- Intersecting surfaces cutting through the multi-section surface
- Formation of the base surface and the sliced profile

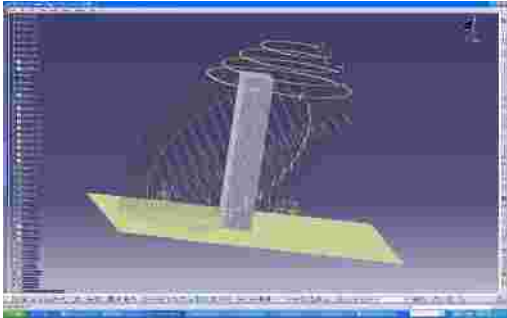
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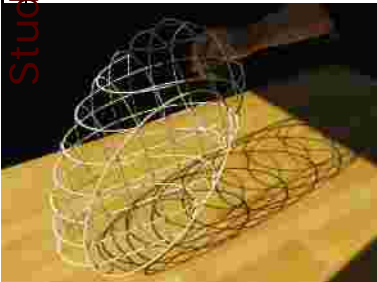
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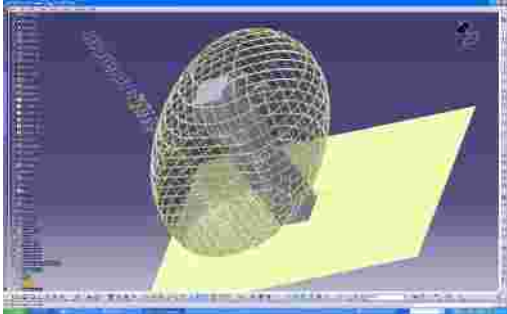
STRUCTURAL SYSTEM

- Initial structural system thought as the circular profiles used to model the surface
- The shaft as the main support to floors and the glass envelope



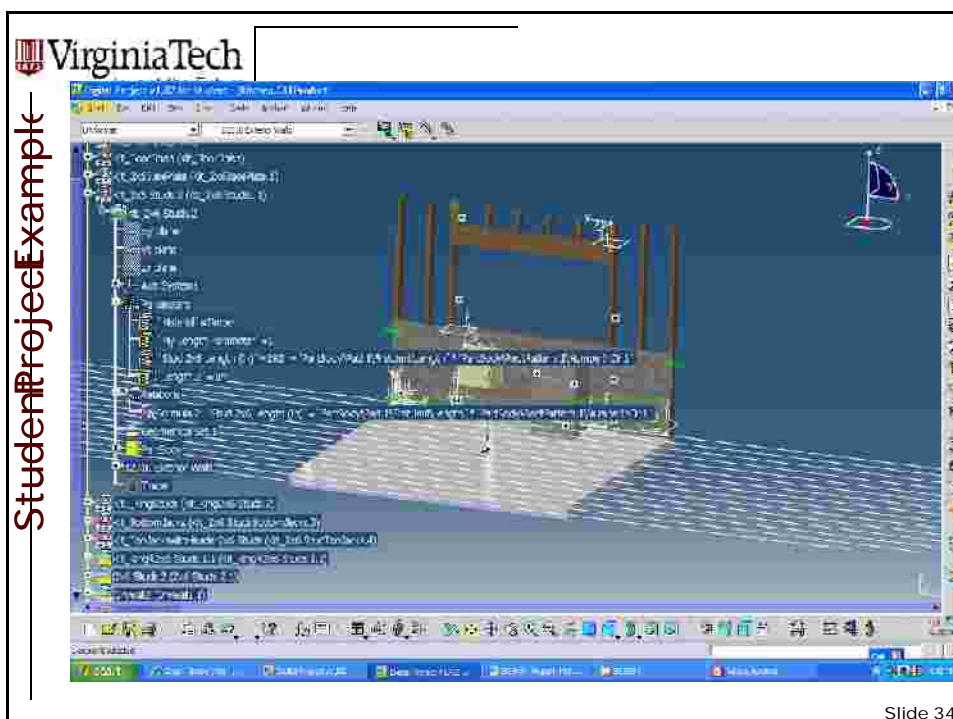
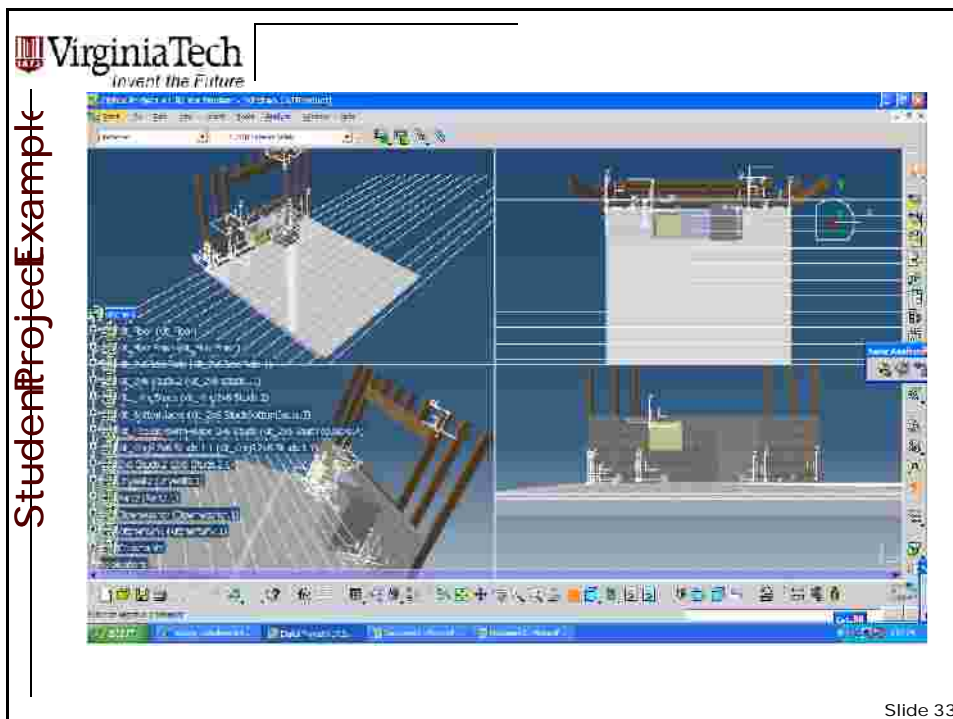



- Primary structural system aligned to the floors of the building
- Secondary ribs running perpendicular to the horizontal ribs



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Project Purpose

- Troubleshoot post-processing software to produce as-built documentation of the Catawba Hospital Farm



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Introduction

- Catawba Hospital Farm

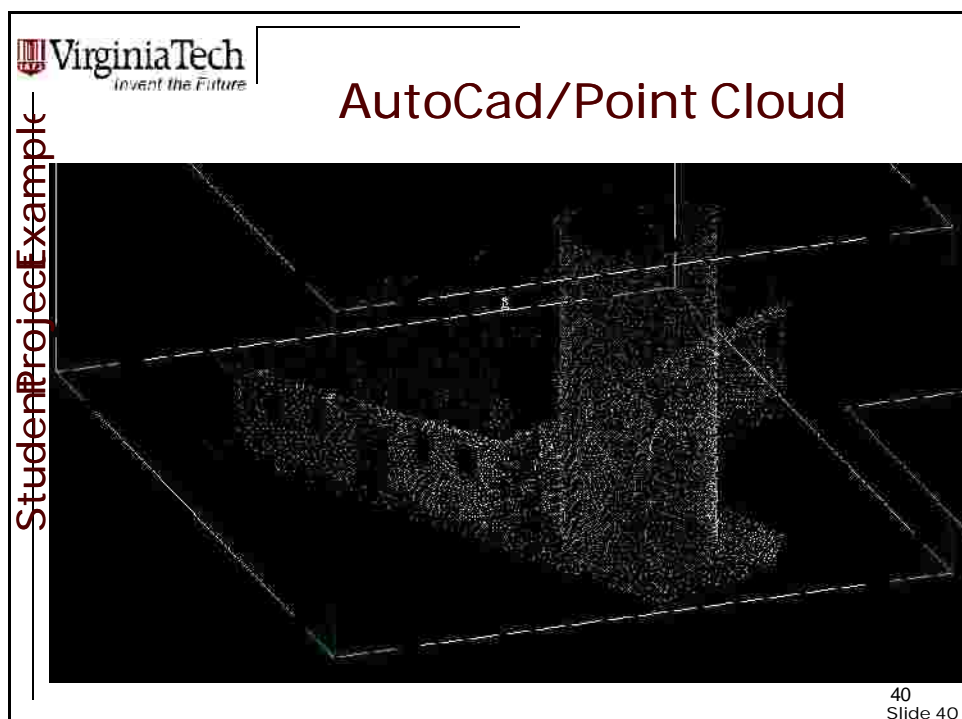


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Slice



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Bishop-Farrar Hall Construction Simulation in SL

- Scenarios are developed by creating virtual model in SL.



AC3D Model

AC3D B3X Builder








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Safetytrainingin Secondlife


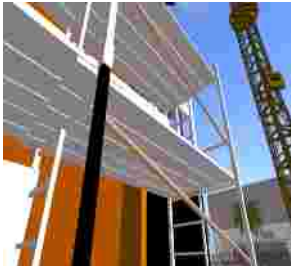

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•Proposed Scaffold Safety Prototype in SL

↳ Scaffold Erection scenario

↳ Trainees will be provided with planks, brackets, supports etc.

↳ Users need Install scaffold

↳ Follow proper installation sequence

•Safety training in Secondlife

Slide 3

Student Project Example



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•Tower Crane Safety training

↳ Optimization of crane usage can reduce cost, safety issues and scheduling delays

↳ Training operators can reduce fatalities



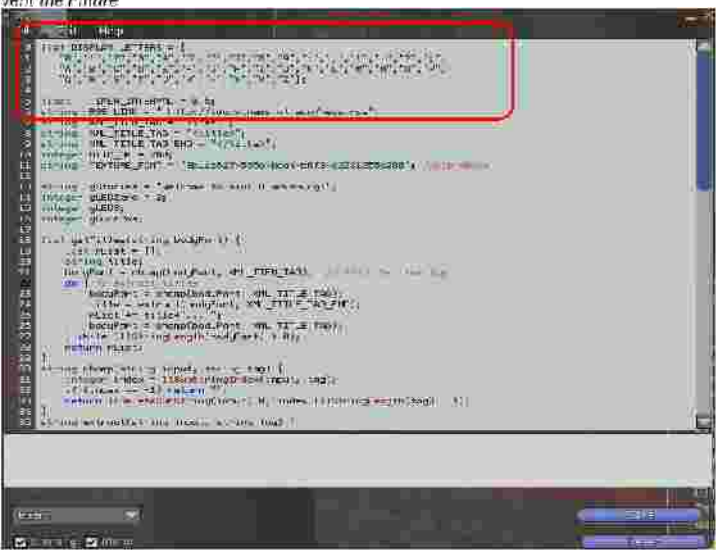

•Safety training in Secondlife

•*Craneaccidents.com ,

•*Toward Fully Automated Robotic Crane for Construction Erection, SHIHCHUNG KANG and EDUARDO MIRANDA, Stanford University


Slide 4

Student Project Example



• RSS Scripting- Methodology


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BIM Pedagogy

- Goal: Cultivate an environment for creative team-based problem solving
- Focus on process innovation and digital documentation
- Learn cross-cutting analytical tools & methods such as life cycle costing, construction & building simulation, process modeling, etc.
- Provide opportunities and guidance for immersion with real world stakeholders

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Core Competencies

- Systems-based conceptualization and analysis of built facilities (integrated practice)
- Evaluation of contextual sensitivity / appropriateness of solutions and tools
- Identification, comparison, and evaluation of goals, metrics, project value, design options, etc.)
- Understanding the interaction of multidisciplinary knowledge domain including architecture, engineering, construction, computing, sustainability, etc.

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Essential Skills

- Cross-functional process modeling
- Ability to...
 - Collaborate and control processes
 - Integrate and validate models
 - Specify levels of detail and/or development
 - Articulate costs and benefits from multiple perspectives
- Parametric modeling and data specification skills
- Experience in interacting with real world stakeholders, and sensitivity to their needs

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Discussion

- Gaps in the current approach
- Learning/pedagogy evaluation opportunities
- Sequencing of curriculum

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