

Pat Allen | Rachel Barrow | Alex Byard | Melanie Fonner | Brad Frederick | Brian LaChance | Mike Palmer

BIM Thesis | AEI Team 5 | Presentation #1 | 14 September 2012



## **Mission Statement**

Mission

BIM Ex. Plan

Structural

Mechanical

Lighting

Construction

Precedents

Modeling

The mission for this project is to engineer an Elementary School that meets the needs of both the school district and community. The building design will address safety, functionality, and sustainability. These criteria will be met while providing the most costefficient building over its lifecycle. To achieve these goals, all building systems will be seamlessly integrated.



# **Project Information**

| Mission      | <i>Client</i> : Rea        |
|--------------|----------------------------|
| BIM Ex. Plan | <i>Name</i> : Ele          |
|              | Location:                  |
| Structural   | Descriptio                 |
| Mechanical   | state-of-th                |
| Lighting     | classroom<br>and additi    |
| Construction | Focus Poir                 |
| Precedents   | efficient; s<br>adaptabili |
| Modeling     |                            |

ading School District ementary School 13<sup>th</sup> and Park Streets on: Three-story elementary school with he-art classrooms; special education ns; library, gymnasium, swimming pool, ional recreational facilities *nts*: High performance and energy security; safety; durability; functionality; ty; community connections



# **Project Milestones**

#### Mission

BIM Ex. Plan

Structural

Mechanical

Lighting

Construction

Precedents

| Project Phase         | Start Date        | Completion Date   |
|-----------------------|-------------------|-------------------|
| Presentation #1       | 29 August 2012    | 14 September 2012 |
| Presentation #2       | 15 September 2012 | 3 October 2012    |
| Presentation #3       | 4 October 2012    | 24 October 2012   |
| Proposal Presentation | 25 October 2012   | 12 November 2012  |
| Written Submission    | 13 November 2012  | 22 February 2013  |
| Final Presentation    | 25 February 2013  | 3-5 April 2013    |



# **Team Meeting Procedures**

#### Mission

#### **COLLABORATION STRATEGY:**

- Weekly meeting schedule
- Team communication group text messaging, Google Docs, common file storage
- · Continual interdisciplinary interaction for building systems' integration
- Team leaders selected based on project phase

#### BIM Ex. Plan

- Mechanical
- Lighting
- Construction
- Precedents
- Modeling

| Richel Barrow     official Vessis team meeting, and agee to being held responsible for any tasks, and their successful completion b       Richel Barrow     stated date, suspeed duing this meeting.       Alex Dyrad     Takes meeting minute scrutter while white coursed duing the specified time of the official Neum meeting.       Melanie Fonner     Takes meeting minute scrutter while white coursed duing the specified time of the official Neum meeting.                                       |                                      |                                                                |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------|-------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Patick Allen Rachel Barow Alex Byrd Mehaie Fonner Bid Fedrick Mehaie Fonner Hitting Conett() pretent: Name  I.1 Old Buniness I.2.1 I.2 New Buniness I.2.1 I.3 Team Schedule I.3.1 I.4 Team Deliverables I.4.1 I.5 Construction Management I.5.1 I.5 Construction Management I.5.1 I.5 Construction Management I.5.1 I.5 Construction Engineering I.7.1 I.5 Lighting / Electrical Engineering I.7.1 I.5 Lighting / Electrical Engineering I.5.1 I.5 Further Bunines I.5 | Location:<br>Time:                   |                                                                |       | _ | Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Gnet(i) present:     Name       1.1 Old Ennices       1.1.1       1.2 New Business       1.2.1       1.3 Team Schedule       1.3.1       1.4 Team Deliverables       1.4.1       1.4 Team Deliverables       1.5 Construction Management       1.5.1       1.6 Structural Engineering       1.7 Mechanical Engineering       1.8 Lighting / Electrical Engineering       1.8 Jepting / Electrical Engineering       1.9 Furture Business                                                                   | Nexus team members pres              | Patrick Allen<br>Rachel Barrow<br>Alex Byard<br>Melanie Fonner | <br>_ |   | By initialing and dating above, all Nexus team members present, and any guests prevent, agree to being present at<br>official Nexus team meeting, and agree to being held serpositivle for any task, and their successful completion by<br>stated date, suspared during this meeting.<br>Takes meeting minutes accurately necessive that occurated during the specified sum of the official Nexus meeting<br>team meeting emission specified and the state of the state of the official Nexus meeting. |
| 1.1.       1.2 New Duniess       1.2.1       1.3 Team Schedule       1.3.1       1.4 Team Deliverables       1.4.1       1.5.1       1.5 Constructual Engineering       1.6 Structual Engineering       1.7.1       1.8 Lighting / Electrical Engineering       1.8 Lighting / Electrical Engineering       1.9 Furuse Business                                                                                                                                                                            |                                      | Michael Palmer                                                 | <br>  | _ | these meeting minutes within 45 hours to discuss sertinions and a republication of amended meeting minutes.                                                                                                                                                                                                                                                                                                                                                                                            |
| 1.3.1       1.4 Team Deliverables       1.4 Team Deliverables       1.4.1       1.5.1       1.5 Construction Management       1.5.1       1.6 Structural Engineering       1.7.1       1.8 Lighting / Electrical Engineering       1.8 Lighting / Electrical Engineering       1.9 Furture Business                                                                                                                                                                                                        | 1.1.1<br>1.2 New Business            |                                                                |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1.5 Construction Management<br>1.5 1<br>1.6 Structural Engineering<br>1.7 Mechanical Engineering<br>1.7.1<br>1.8 Lighting / Electrical Engineering<br>1.8.1<br>1.9 Funce Businees                                                                                                                                                                                                                                                                                                                          | 1.3.1<br>1.4 Team Deliverables       |                                                                |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1.6.1<br>1.7 Mechanical Engineering<br>1.8 Lighting / Electrical Engineering<br>1.8.1<br>1.9 Future Business                                                                                                                                                                                                                                                                                                                                                                                               | 1.5 Construction Managen             | nent                                                           |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1.7.1<br>1.8 Lighting / Electrical Engineering<br>1.8.1<br>1.9 Future Business                                                                                                                                                                                                                                                                                                                                                                                                                             | 1.6.1                                |                                                                |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.7.1<br>1.8 Lighting / Electrical E | ~                                                              |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                      |                                                                |       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



# **Team Meeting Schedule**

|                     |       | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday           |
|---------------------|-------|--------|--------|---------|-----------|----------|--------|--------------------|
| Mission             | 8:00  |        |        |         |           |          |        |                    |
|                     | 8:30  |        |        |         |           |          |        |                    |
|                     | 9:00  |        |        |         |           |          |        |                    |
| <b>BIM Ex. Plan</b> | 9:30  |        |        |         |           |          |        |                    |
|                     | 10:00 |        |        |         |           |          |        |                    |
|                     | 10:30 |        |        |         |           |          |        |                    |
| Structural          | 11:00 |        |        |         |           |          |        |                    |
|                     | 11:30 |        |        |         |           |          |        |                    |
|                     | 12:00 |        |        |         |           |          |        |                    |
| Mechanical          | 12:30 |        |        |         |           |          |        |                    |
| IVIECHAIIICAI       | 1:00  |        |        |         |           |          |        |                    |
|                     | 1:30  |        |        |         |           |          |        |                    |
| t talette a         | 2:00  |        |        |         |           |          |        |                    |
| Lighting            | 2:30  |        |        |         |           |          |        |                    |
|                     | 3:00  |        |        |         |           |          |        |                    |
| • · · · ·           | 3:30  |        |        |         |           |          |        |                    |
| Construction        | 4:00  |        |        |         |           |          |        |                    |
|                     | 4:30  |        |        |         |           |          |        |                    |
|                     | 5:00  |        |        |         |           |          |        |                    |
| Precedents          | 5:30  |        |        |         |           |          |        |                    |
|                     | 6:00  |        |        |         |           |          |        | NEXU               |
|                     | 6:30  |        |        |         |           |          | Cor    | nstruction Manag   |
| Modeling            | 7:00  |        |        |         |           |          | Stru   | ctural Engineers   |
|                     | 7:30  |        |        |         |           |          |        | chanical Enginee   |
|                     | 8:00  |        |        |         |           |          |        | nting / Electrical |



# Meeting Types

| Mission      | Meeting Type                     | Project Stage         | Frequency | Participants | Location    |
|--------------|----------------------------------|-----------------------|-----------|--------------|-------------|
|              | BIM Execution Plan               | Presentation #1       | 5x / week | All          | 333 Sackett |
| BIM Ex. Plan | 3D Coordination                  | Presentation #3       | 3x / week | All          | 334 Sackett |
|              | Structural Analysis              | Presentation #3       | 3x / week | All          | 335 Sackett |
| Structural   | Lighting Analysis                | Presentation #3       | 3x / week | All          | 336 Sackett |
|              | Mechanical Analysis              | Presentation #3       | 3x / week | All          | 337 Sackett |
| Machanical   | Energy Analysis                  | Proposal Presentation | 1x / week | All          | 338 Sackett |
| Mechanical   | Sustainability (LEED) Evaluation | Presentation #3       | 2x / week | All          | 339 Sackett |
|              | Phase Planning (4D Modeling)     | Proposal Presentation | 3x / week | All          | 340 Sackett |
| Lighting     | S.F. / Detailed Cost Estimation  | Presentation #2       | 3x / week | All          | 341 Sackett |
|              | Existing Conditions              | Presentation #1       | 3x / week | All          | 342 Sackett |
| Construction | Record Modeling                  | Proposal Presentation | 1x / week | All          | 343 Sackett |
|              | Site Utilization Planning        | Presentation #1       | 2x / week | All          | 344 Sackett |
| Precedents   |                                  |                       |           |              |             |

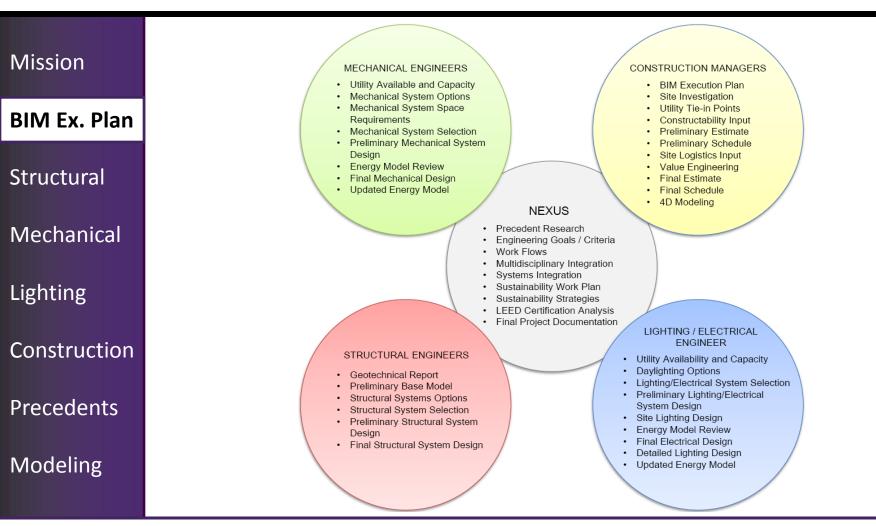


## **BIM Goals**

| Mission      |          |                                                 |                           |
|--------------|----------|-------------------------------------------------|---------------------------|
| BIM Ex. Plan | Priority | GOAL DESCRIPTION                                | POTENTIAL BIM USES        |
|              | High     | Engineering integration through multi-          | Design Reviews            |
| Structural   |          | disciplinary collaboration                      |                           |
| Structurar   | High     | Whole-building constructability and operation   | 3D Coordination           |
| Mechanical   | High     | Fluid transfer and comprehension of information | Phase Planning            |
|              | High     | Short term and lifecycle cost benefits          | Cost Estimation           |
| Lighting     | Medium   | LEED certification                              | Sustainability Evaluation |
| Construction |          |                                                 |                           |
| Precedents   |          |                                                 |                           |
| Modeling     |          |                                                 |                           |



#### **BIM Roles**





#### **BIM Uses**

| Mission      | Presentation #1       | Presentation #2      | Presentation #3                                             | Proposal Presentation                      | Written Submission | Final Presentation |
|--------------|-----------------------|----------------------|-------------------------------------------------------------|--------------------------------------------|--------------------|--------------------|
|              | 14 September 2012     | 3 October 2012       | 24 October 2012                                             | 12 November 2012                           | 22 February 2012   | 3-5 April 2012     |
| BIM Ex. Plan | Design Review         |                      |                                                             |                                            |                    | Į                  |
| Structural   |                       |                      | 3D Coordination<br>Structural Analysis<br>Lighting Analysis |                                            |                    | <br>[<br>_         |
| Mechanical   |                       |                      | Mechanical Analysis                                         | Energy Analysis                            |                    |                    |
| Lighting     |                       |                      | Sustainability (LEEI                                        | D) Evaluation<br>Phase Planning (4D Modeli | ng)                | I                  |
| Construction | Existing Conditions   | S.F. / Detailed Cost | Estimation                                                  |                                            |                    | I                  |
| Precedents   | Site Utilization Plan | ning                 |                                                             |                                            |                    | Record Modeling    |
| Modeling     |                       |                      |                                                             |                                            |                    |                    |



# **BIM Uses Analysis**

|                       |                         |                                                                                                                                                                                                                                                                          | BIM Goa     | l Use Analys                        | sis Worksheet                                                    |  |  |
|-----------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------|------------------------------------------------------------------|--|--|
|                       | BIM Us                  | Project                                                                                                                                                                                                                                                                  | Disciplines | Discipline                          | Neccostry Dete                                                   |  |  |
| /lission              | BIM Us                  | Importance                                                                                                                                                                                                                                                               | Involved    | Importance                          | Necessary Data                                                   |  |  |
|                       |                         | High / Med /<br>Low                                                                                                                                                                                                                                                      |             | High / Med /<br>Low                 |                                                                  |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          |             | Design Pha                          | se                                                               |  |  |
| BIM Ex. Plan          |                         |                                                                                                                                                                                                                                                                          | CM          | High                                | Constructability input to design models                          |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          | SE          | High                                | Structural design models                                         |  |  |
|                       | Design Ke               | view High                                                                                                                                                                                                                                                                | ME          | High                                | Mechanical design models                                         |  |  |
|                       |                         | LE       3D Coordination       High       Ket       High       Structural Analysis       High       LE       Structural Analysis       High       LE                                                                                                                     | High        | Lighting / Electrical design models |                                                                  |  |  |
| المسلود بيريس الشميسي |                         |                                                                                                                                                                                                                                                                          | CM          | High                                | Design models                                                    |  |  |
| tructural             |                         | TTet                                                                                                                                                                                                                                                                     | SE          | High                                | Design models, ETABS and SAP models                              |  |  |
|                       | 3D Coordin              | lation High                                                                                                                                                                                                                                                              | ME          | High                                | Design models                                                    |  |  |
|                       |                         | 3D Coordination     High     1       3D Coordination     High     1       Structural Analysis     High     1       Lighting Analysis     High     1       Mechanical<br>Analysis     High     1       Energy Analysis     High     1       Sustainability     High     1 | LE          | High                                | Design models, ceiling plans                                     |  |  |
| /lechanical           | Structural Ar           | nalysis High                                                                                                                                                                                                                                                             | SE          | High                                | Local codes, ETABS and SAP models                                |  |  |
| viechanicai           | Lighting An             | alysis High                                                                                                                                                                                                                                                              | LE          | High                                | AGI and Daysim models                                            |  |  |
|                       | Mechanic                | cal High                                                                                                                                                                                                                                                                 | ME          | High                                | Energy model and equipment sizing and selection                  |  |  |
| ighting               | Energy Ana              | alysis High                                                                                                                                                                                                                                                              | ME          | High                                | Preliminary Vasari model and later more accurate<br>energy model |  |  |
|                       | 07                      |                                                                                                                                                                                                                                                                          | LE          | High                                | AGI - lighting power density information                         |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          | CM          | High                                | Materials and energy data                                        |  |  |
|                       | Sustainabi              | ility                                                                                                                                                                                                                                                                    | SE          | High                                | Material efficiency data                                         |  |  |
|                       | (LEED) Eval             | luation High                                                                                                                                                                                                                                                             | ME          | High                                | Energy model and IAQ information                                 |  |  |
| onstruction           |                         | Design ReviewHighSE<br>ME<br>ME<br>LEHigh<br>HighStructural design models<br>Mechanical design models3D CoordinationHighCM<br>SE<br>ME<br>HighDesign models<br>Lighting / Electrical design models3D CoordinationHighCM<br>SE<br>ME<br>LEHigh<br>                        |             |                                     |                                                                  |  |  |
|                       |                         | C High                                                                                                                                                                                                                                                                   | СМ          | Ū                                   |                                                                  |  |  |
| Precedents            |                         | l Hundh                                                                                                                                                                                                                                                                  | СМ          | High                                | Materials, building statistics                                   |  |  |
| receuents             | E La C                  | Alter Mat                                                                                                                                                                                                                                                                | CM          | Med                                 | Site data                                                        |  |  |
|                       | Existing Con            | ditions Med                                                                                                                                                                                                                                                              | SE          | Med                                 | Ggeotechnical report                                             |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          | CM          | Med                                 | <u> </u>                                                         |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          | SE          | Med                                 | Structural and ETABS model                                       |  |  |
| lodeling              | Record Mod              | ieiing Med                                                                                                                                                                                                                                                               | ME          | Med                                 | Model and equipment selection                                    |  |  |
|                       |                         |                                                                                                                                                                                                                                                                          | LE          | Med                                 | Analyses and models                                              |  |  |
|                       | Site Utiliza<br>Plannin | High                                                                                                                                                                                                                                                                     | СМ          | High                                | Site layout, equipment, material laydown, project<br>schedule    |  |  |

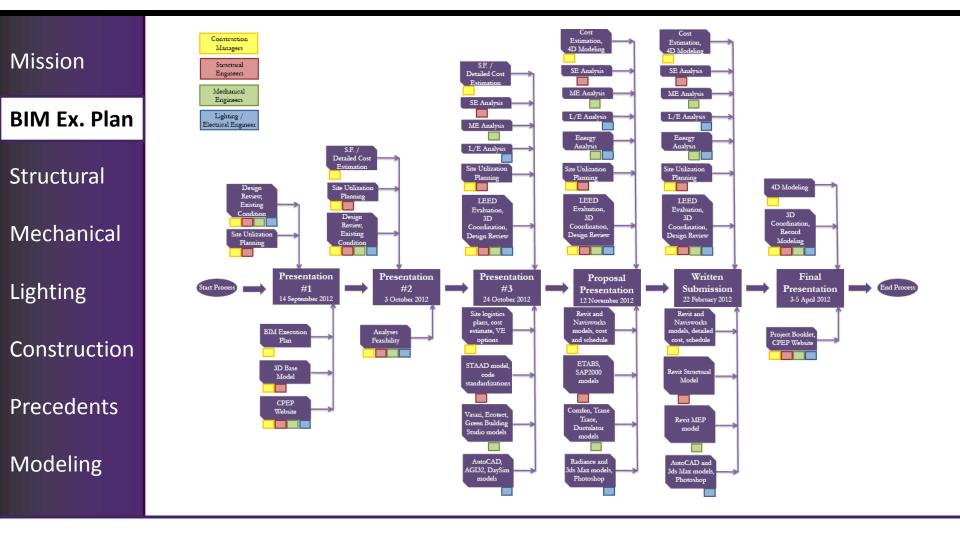


# **Information Exchanges**

#### Mission 1. Vasari / Ecotect / Green Building Studio -1. MSWord - BIM Execution Plan updates, meeting preliminary energy analysis using basic Revit models minutes to determine: internal loads, solar heat gain; 2. MSProject - scheduling opportunities for energy savings and sustainable **BIM Ex. Plan** 3. MS Visio - BIM Execution Plan maps practices 4. MS Excel - spreadsheets 2. Comfen - used for glazing analysis / selection 5. MS PowerPoint - presentations 3. Trane Trace / Carrier - HAP - energy model to CONSTRUCTION MECHANICAL 6. AutoCAD - constructability and value engineering design conceptual building to analyze building loads ENGINEERS MANAGERS input; site logistics layout and total energy usage 7. Revit Architecture - modeling; constructability and Structural 4. Trane Topps - equipment sizing / selection value engineering input; quantity takeoff 5. Ductulator - use loads to size ducts 8. RSMeans - cost and schedule data 6. AutoCAD - floor, wall, and window areas for future 9. Navisworks - import Revit models: clash detection: models 4D schedule model 7. Revit MEP - exterior wall R-values; layout mechanical room; duct installation Mechanical **NEXUS** Revit Central Model Lighting 1. AutoCAD - model areas based on floor and ceiling plans: used to import into other softwares 1. ASCE 07-10 - wind and earthquake load 2. AGI32 - import AutoCAD drawings; assign reflectance to provisions Construction surfaces; import IES file from internet; analyze footcandle 2. AISC Steel Manual - member load calculations calculations 3. ACI 318-11 - concrete member design DaySim – import AutoCAD drawings; import material, 4. STAAD / SAP2000 - analyze individual systems STRUCTURAL LIGHT. / ELEC. occupancy, and weather files; analyze footcandle levels, and components (2D); remodel systems from ENGINEER ENGINEERS energy savings through incorporation of luminaire IES files; Revit; load calculations performed daylighting calculations Precedents 5. ETABS - analyze global structural systems and 4. Revit Architecture – lighting plans components (3D); load calculations performed 5. Radiance - import AutoCAD drawings; renderings of 6. Revit Structural - simultaneous design with all daylighting other disciplines 6. 3ds Max - import Revit and IES files; interior renderings 7. Photoshop - lighting and building schemes analyzed Modeling

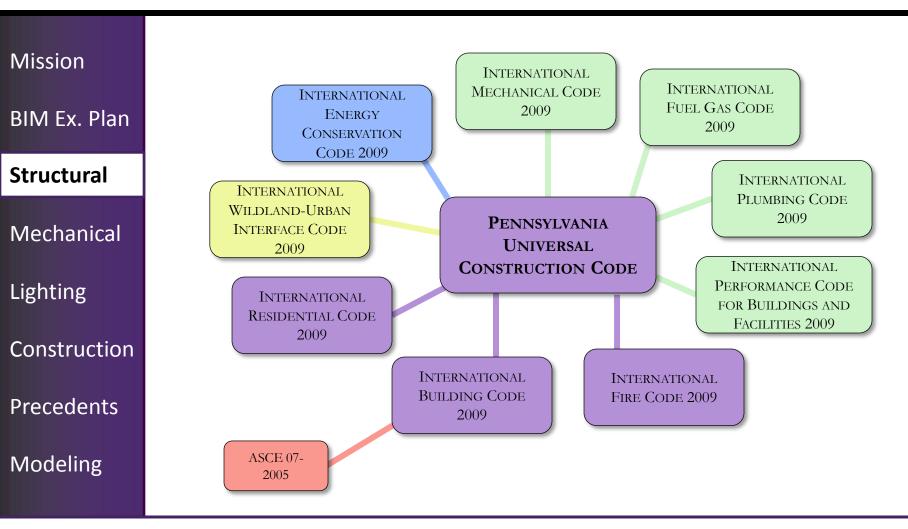


## Team Overall Process Map



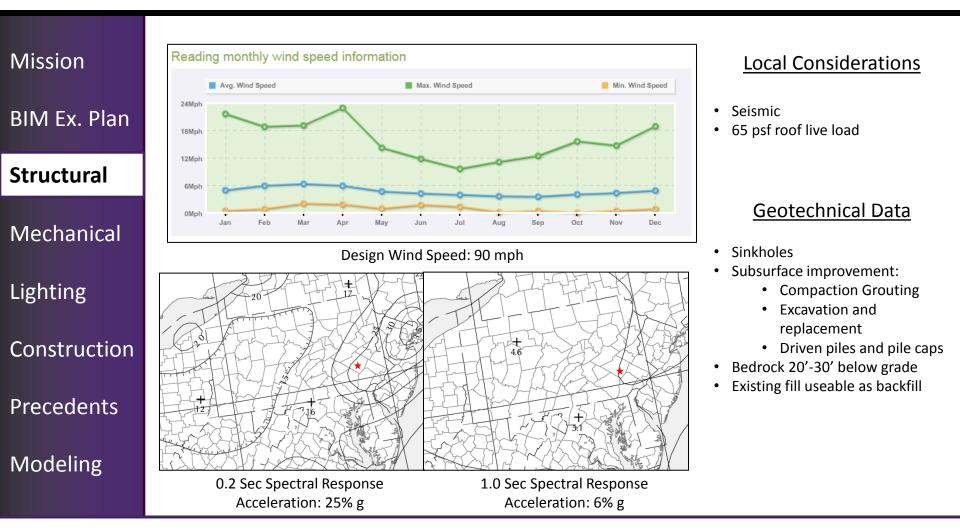


#### **Code Structure**





#### Structural





#### Structural

#### Mission

BIM Ex. Plan

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Mount Nittany Elementary School State College, PA

Millmont Elementary School

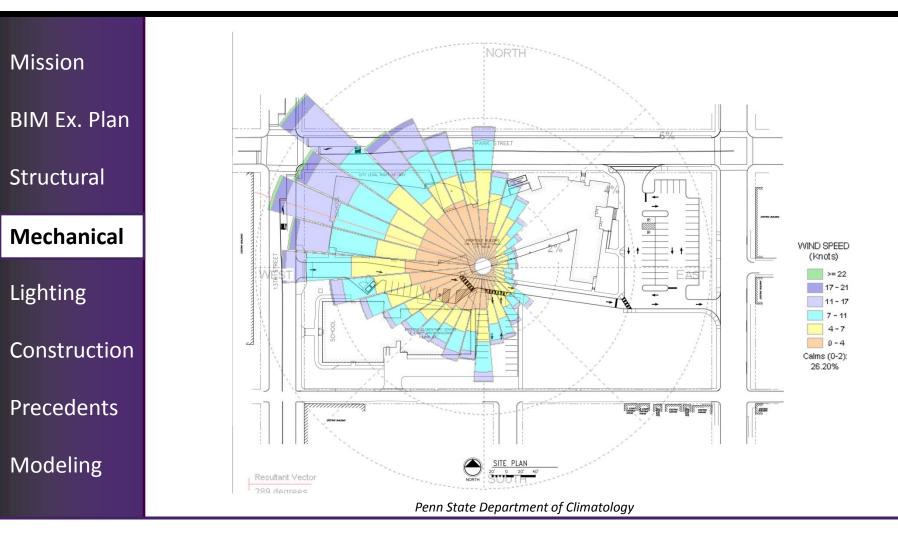
Millmont Elementary School Reading, PA

#### **Structural Framing**

- Structural steel framing is the most common framing method for elementary schools in Pennsylvania
- A small number of schools are also constructed using reinforced concrete, wood, or masonry structural framing

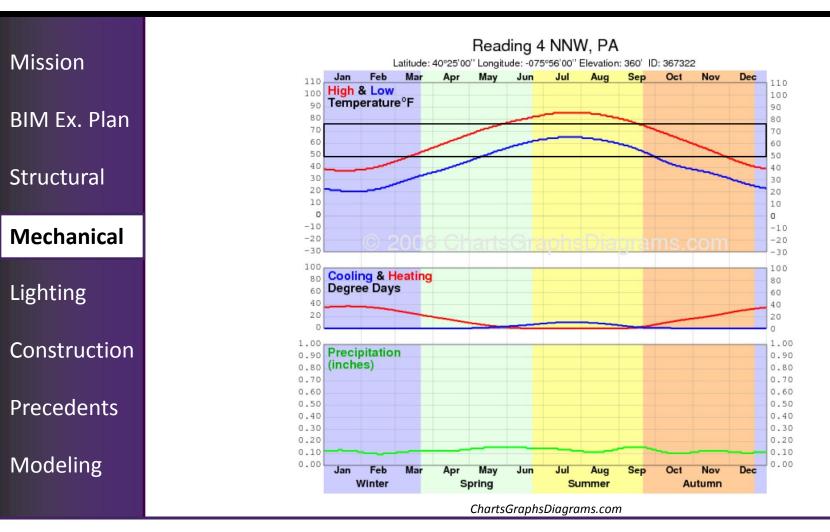


## Mechanical





## Mechanical





# Lighting / Electrical

Mission

BIM Ex. Plan

Structural

Mechanical

Lighting

Construction

Precedents

Modeling



http://www.boora.com/files/64961232133930Clackamas-High-School--Daylighting-Skylights-Hallway.jpg



http://www.gauinc.com/wp-content/uploads/2012/06/LED-classroom.jpg



http://www.zigersnead.com/blog/wp-content/uploads/2010/02/ZigerSnead\_Friends-School-of-Baltimore-Dining-Hall\_Image-04.jpg



http://www.finelite.com/images/sustainable-hprled2x2.jpg



## **Construction Management**



BIM Ex. Plan

Structural

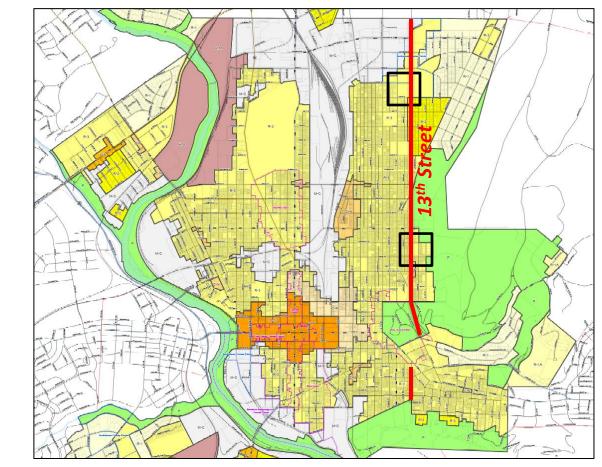
Mechanical

Lighting

Construction

Precedents

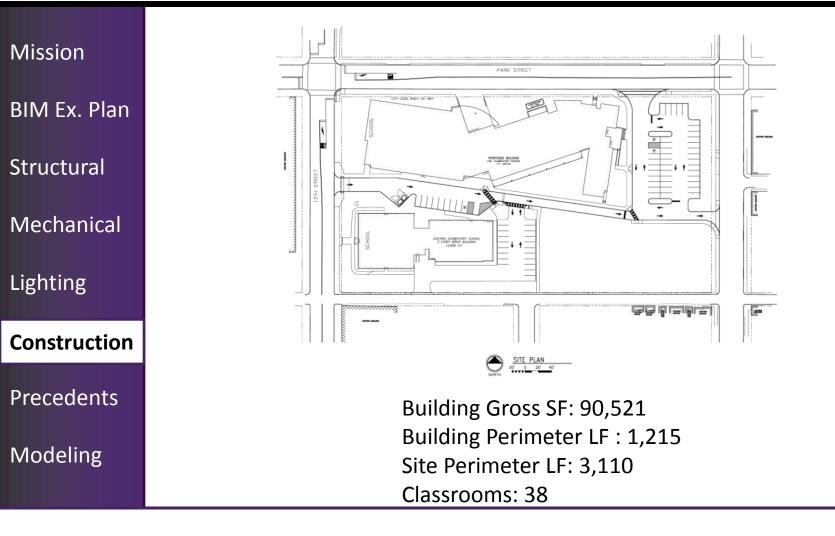
Modeling



City of Reading Zoning Map



## **Construction Management**





## **Construction Management**

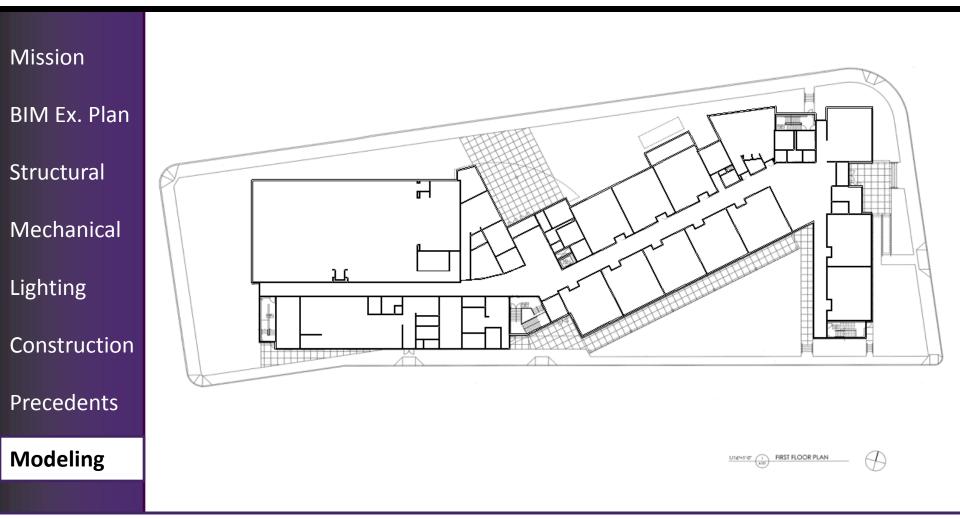
| Mission      |                                                               |                             |                       |                      |                |                      |                                        |                              |                                  |
|--------------|---------------------------------------------------------------|-----------------------------|-----------------------|----------------------|----------------|----------------------|----------------------------------------|------------------------------|----------------------------------|
| BIM Ex. Plan | §27-804. R-3. Residential District                            |                             |                       |                      |                |                      |                                        |                              | ]                                |
|              | 1. Dimensional Requirements.                                  |                             |                       |                      |                |                      |                                        |                              |                                  |
| Structural   | Uses                                                          | Min. Lot<br>Size<br>Sq. Ft. | Max.<br>Bldg.<br>Cov. | Max.<br>Imp.<br>Cov. | Max.<br>Height | Min.<br>Lot<br>Width | Min.<br>Front Yard<br>Setback<br>***** | Min. Rear<br>Yard<br>Setback | Min. Side Yard<br>Setback (each) |
| Mechanical   | Place of Worship, Cemeteries and<br>Private or Public Schools | 20,000                      | 50%                   | 75%                  | 60             | 125                  | 5                                      | 30                           | 10                               |
| Lighting     |                                                               |                             | City of               | Reading Z            | oning Ordin    | ance                 |                                        |                              |                                  |
| Construction |                                                               |                             |                       |                      |                |                      |                                        |                              |                                  |
| Precedents   |                                                               |                             |                       |                      |                |                      |                                        |                              |                                  |
| Modeling     |                                                               |                             |                       |                      |                |                      |                                        |                              |                                  |
|              |                                                               |                             |                       |                      |                |                      |                                        |                              |                                  |



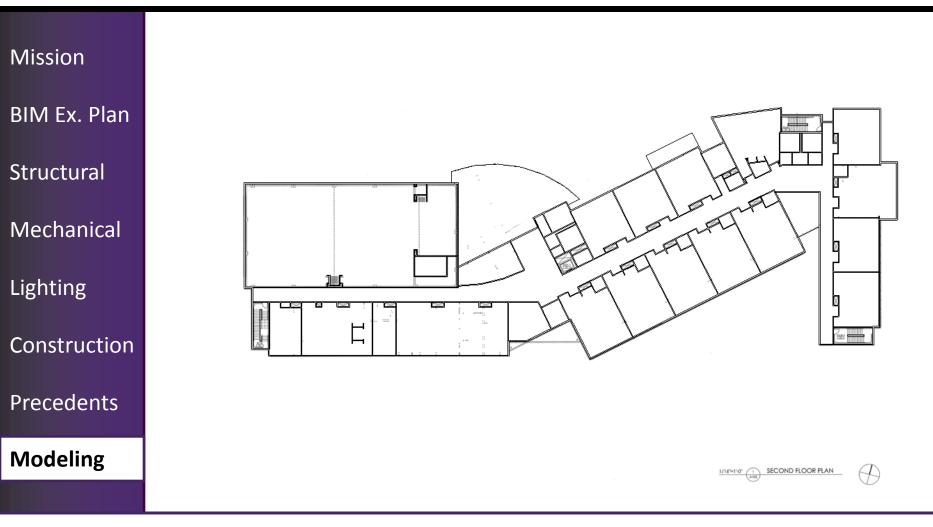
#### **Precedent Buildings**



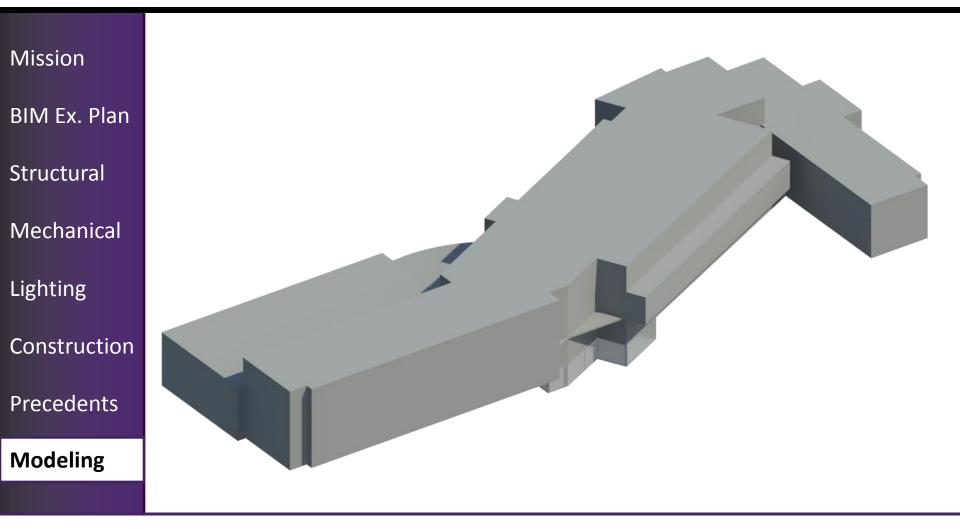














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