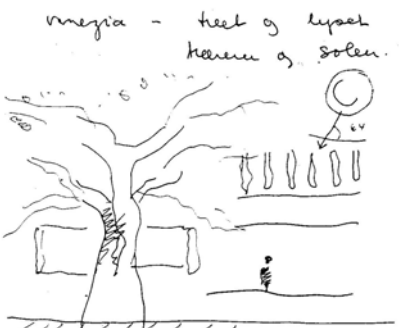
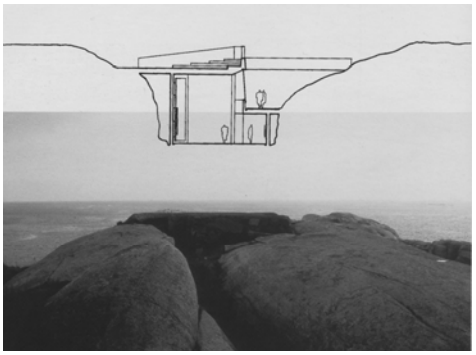
ARCH 5516•LUMINOUS AND THERMAL DESIGN
ECOLOGICAL DESIGN FOR THE 21ST C

"Architecture has the task of discovering and preserving these [site] memories, interpreting and manifesting them, making them comprehensible to the inhabitants."

-Sverre Fehn



Sverre Fehn, Concept Sketch for Nordic Pavilion, Tree and Sun



Sverre Fehn, Proposal for an Art Gallery Verden Ends (the end of the Earth)

PROJECT ONE:
Site & Bioclimatic Design Charette: Between Earth and Sky

Friday, January 25, 10:00 a.m.: Phase 1 pin-up on mezzanines
Monday, January 29, 10:00 a.m.: Phase 2 due: pin-up in the courtyard

Time period: 1 week; estimated minimum 18 hours
Grade weighting: To be submitted and graded with Project One: Daylighting (15% of Project One)
Electronic Reading:

- Knowles, Ralph. *Ritual House*, Washington: Island Press, 2006, pp. 3-73 (Chapters on Sheltering, Migration, Transformation, and Metabolism).

Design Charette Objectives:

The objectives of charette are to:

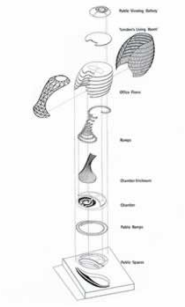
- *Explore site and bioclimatic forces as they influence daylighting, thermal, and architectural design.*
- *Investigate poetic and pragmatic daylighting and thermal design opportunities and considerations related to site, bioclimatic, and ecological forces.*
- *Consider the architectural and environmental implications of site, climate, and place.*
- *Investigate processes and tools for site and bioclimatic analysis and design.*

Problem Statement

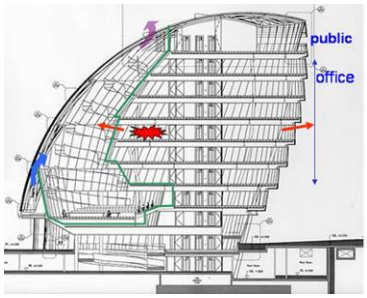
In his essay, "Between Earth and Sky," Gennaro Postiglione states that: *"Every site constitutes a kind of archive in which the different stories intertwined in its evolution are conserved. Every site holds a key that guarantees the preservation of its meaning, even when the transformations caused by humankind tend to erase the traces and memories.* Norwegian architect Sverre Fehn, suggests that it is the role of the designer to "preserve, interpret, and manifest" the story of a given place or site. A "bioregional" approach to daylighting and thermal design celebrates the ecological characteristics and history of a given place.

In this design charette you are asked to evaluate Rapson Hall at the site and building scales and develop preliminary design proposals that explore the bioclimatic "story" or "narrative" of your site and program for the "Minnesota Zero-Emission/Zero-Energy Design Lab" at the College of Design (see mnZED program brief for details).

Greater London City Hall
Arch: Norman Foster



Exploded Axonometric



Annotated Section Drawing

PROJECT SIX: mnZED Lab Optimized Design Proposal
Integrated Design and Evaluation

- **In-process team critique: Monday, March 3, 2008:**
  sign-up for one 30 minute team critique "in studio" between 10:00 am-12:00 pm
- **In-process team critique: Wednesday, March 5, 2008:**
  sign-up for one 30 minute team critique "in studio" between 10:00 am-12:00 pm
- **Phase 3.0 Due on Friday, March 7; 8:45 a.m.:** All teams please pin-up by 9:00 in Rapson Hall Courtyard (class critiques from 9:00-11:30 am)

Introduction

In the final phase of Project Six, teams will complete the design and evaluation of their project. You will propose your final recommended design solution for the mnZED Lab Addition to Rapson Hall and compare the performance to the Baseline Case. This Baseline Case should be the initial concept that was presented in Project Two and analyzed as the Baseline Case in Project Three. Your final design should be informed by the analysis of your incremental design improvements made during Projects Two - Five. In Project Six you will integrate passive thermal and luminous design considerations as well as the key building systems including *Lighting, Heating, Cooling, Ventilation and Circulation*. The building solution should respond adequately to the program provided at the outset and it should meet the energy, daylighting and other relevant goals set by your team. You will analyze the final design and compare the results to the original Baseline Case showing the estimated improvements in energy use, greenhouse gas (carbon dioxide) emissions, thermal comfort, daylighting performance, life-cycle cost and other metrics (performance measurement) of your choice. To do this you will make the necessary modifications to your building model, using ECOTECT, and determine the resulting change in performance. You will present your findings through charts, graphs, annotated plans, sections or axonometric diagrams as appropriate and as outlined in the *Presentation Checklist* at the end of this assignment. In addition you will also be asked to show graphically how the various design strategies and related systems are integrated into your design.

STEP 1: DESIGN REFINEMENT

i Incorporate the preferred explorations in "Ecological Envelope" Design and "The Room" into your final design. Ask the questions:

- *Does the design, as a whole, integrate effective daylighting, heating, cooling and ventilation with other ecological opportunities?*
- *Does it foster a fivefold approach to ecological form and functionality?*
- *Does the design balance poetics and pragmatics*
- *Does the design positively impact the existing Rapson Hall facility in terms of environmental quality, energy use and aesthetics?*

ii Problem resolution: address potential problems or unresolved design issues in your design (e.g., unresolved circulation issues, building infrastructure connectivity and alignment, excessive floor area values with respect to program requirements, etc.).

iii Systems Integration: Holistically integrate all major systems including daylighting, passive and active heating, passive and active cooling, passive and active ventilation, renewable energy systems and related controls strategies.

iv Eco-effective Design: Using an eco-effective approach, optimize benefits resulting from your design proposal not only to the immediate building occupants, but also to external communities and ecosystems. (e.g., urban heat island effect, wildlife habitat, carbon emissions, etc.)

STEP 2: ECOTECT MODEL REFINEMENT: UPDATE YOUR FINAL ECOTECT MODEL

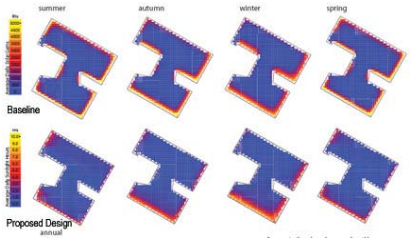
i Incorporate the necessary modifications reflecting all possible proposed design refinements from "Step 1: Design Refinements" into your ECOTECT model and save it as a "Final Design Case" for comparison to your preliminary design "Baseline Case" from previous projects.

ii Investigate problems and troubleshoot simulation errors and model construction problems (e.g., see "Error Messages" topic in the ECOTECT HELP!)

iii Check to see that all appropriate values for object materials, HVAC system mode, occupancy load and schedules, internal loads for lighting and equipment and establish the appropriate operating schedules are included.

STEP 3: PERFORMANCE ANALYSIS: FINAL DESIGN CASE

Simulate your "Final Design Case" using ECOTECT. Use the same time and seasons for all daylight and thermal studies as used in past studies (e.g. summer solstice - June 21, winter solstice - December 21 and Equinox (March/September 21).



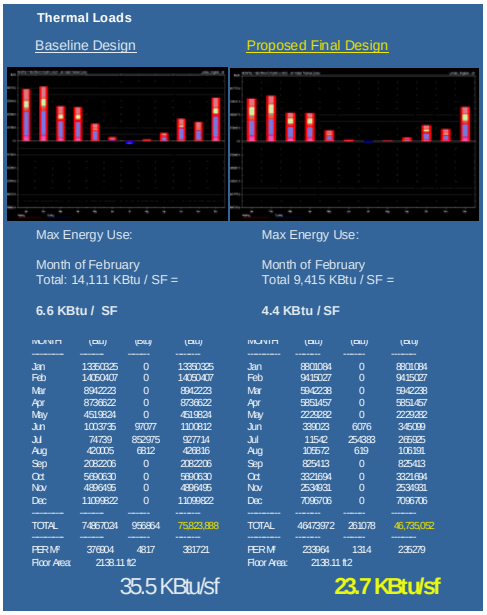
i <u>Daylight Studies</u>: perform a typical daylight illuminance analysis *(in lux)* of your final design proposal illustrating the diurnal and seasonal light levels.

ii <u>Thermal Studies</u>: perform the following thermal analysis:

a) Hourly Temperatures: Chart the hourly temperature profile for all Zones in your final design (select the same times of day and seasons as your Ecotect daylighting study – see above).

b) Passive Gains: Chart the passive gains breakdown preferably for selected zones where passive strategies are being employed or for all zones to evaluate the improved effectiveness of your passive design approach.

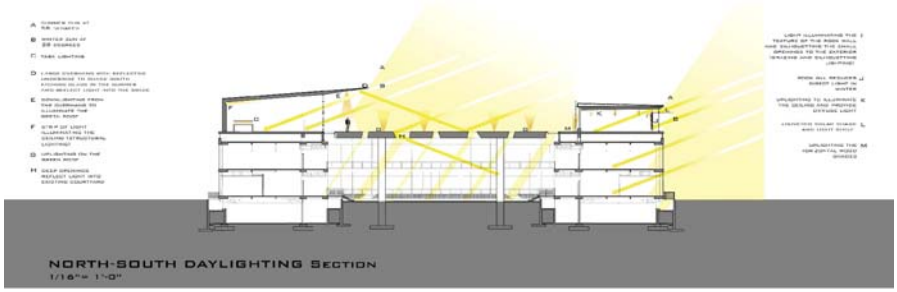
c) Average Monthly Heating and Cooling Loads for all zones – include both a loads Chart and Data Table similar to that required for Project Two. Indicate the thermal performance of your proposed final design in KBtu/sf as compared to Baseline design case?

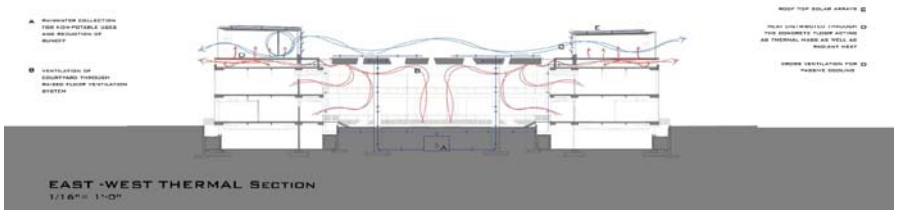


Note: You are asked to also include your original "Baseline Case" for daylighting and thermal in your final presentation.

STEP 4: MODEL AND GRAPHIC INTEGRATION STUDIES

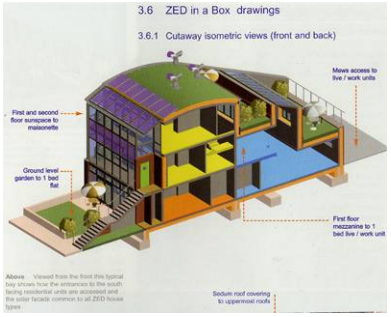
i 1/16" Massing Model: Develop a physical model of your final design project at 1/16 scale. You may update the massing mode from an earlier project based on your final design or you may fabricate a new model, whichever is more expedient.





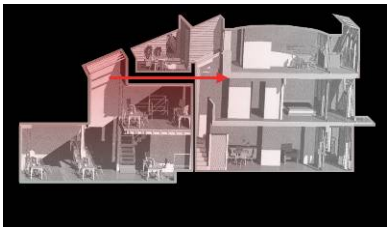
ii Graphical Systems Integration Studies: Use sections or sectional axonometric drawings to illustrate your approach to the following systems integration:

a) Daylight, electric lighting, and solar control systems integration. Include conceptual control strategies.
b) Passive/active solar and conventional heating systems integration.
c) Passive/active cooling and ventilation systems integration.
d) Renewable energy systems and proposed building integration concepts.



iii Plans and Other Renderings: Provide drawings representing how your design meets the program requirements:

a) Provide a site plan and area map for your project at an appropriate scale.
b) Floor Plans an appropriate scale (consider including room labels and area in s.f. Indicate zoning and circulation paths, etc.).
c) Provide perspective renderings of your building in full and/or partial views graphically representing the design details, materials and integration with the existing.

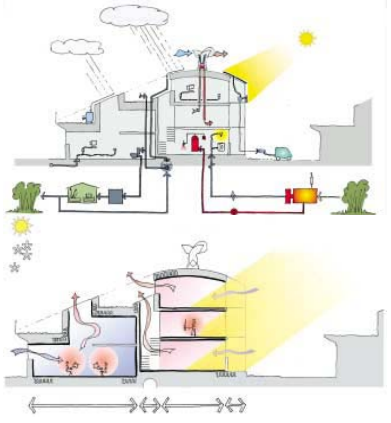


STEP 5: WRITTEN FINDINGS AND CONCLUSIONS

Develop a brief written summary of the findings and conclusions of your analysis and your design explorations.

Please include the following in your presentation:

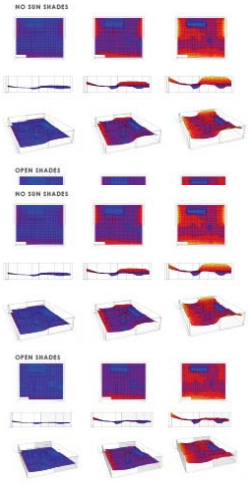
i. Design Intentions and Strategies: Summarize the critical design intentions and strategies related to daylight, thermal, and zero-energy design.
ii. ZED Performance: State clearly how well your final design meets your ZERO energy performance goal using written and/or graphic means.
iii. Carbon Emissions: State clearly how well your final design performs in terms of annual carbon emissions using written and/or graphic means.
iv. Ecological Summary: Summarize the Eco-effective benefits of your final design to the community and surrounding eco-systems.
v. Strengths and Weaknesses: List the major strengths and weaknesses of your design proposal?



PRESENTATION CHECKLIST: PROJECT SIX

FINAL REVIEW: FRIDAY, MARCH 7; 9:00-12:00; Pin up completed by 8:45 a.m.
Required format: 2 or more boards at 24"x 36" (vertical format). *Label all charts, tables, graphs, sections and other diagrams.*

1. ***Project Six: Phase 1.0:*** *Envelope study models and annotated wall sections- minimum 3 strategies (see Project Three – Phase 1.0 assignment)*
2. ***Project Six: Phase 2.0:*** *Room study model, lighting photostudies and Ecotect parametric analysis studies (see Project Three – Phase 2.0 assignment)*
3. ***Project Six: Phase 3:0***
   - ***a) ECOTECT Comparative Analyses – Proposed Final Design compared to Baseline Case from previous projects:***
     - *a. Daylight Illuminance Studies for final design (noon for June 21, Dec. 21, and March/Sept. 21)*
     - *b. Thermal Studies for final design*
       - Hourly Temperature Profile Chart for all Zones (same days as daylighting)
       - Average Monthly Heating and Cooling Loads Chart
       - Monthly Heating and Cooling Loads Data Table showing Peak Heating and Cooling Loads and times
       - Passive Gains Breakdown Chart (same days as daylighting studies)
     - *c. Baseline Cases for Daylight and Thermal from previous projects: include your earlier quantitative analyses to compare to your "Final Design Case":*
   - ***b) Model and Graphical Systems Integration Studies:***
     - *i) Updated Massing Model at 1/16" = 1'-0" scale*
     - *ii) Graphical Systems Integration Studies (building section or cutaway axonometric)*
       - Annotated study explaining your daylight and electric lighting systems integration (including solar control).
       - Annotated study explaining your passive and/or active solar heating systems integration.
       - Annotated study explaining your passive and active mechanical cooling and ventilation systems integration.
       - Annotated study explaining your renewable energy systems integration.
   - c) ***Written Findings and Conclusions - Include a brief written summary of the following:***
     - Design Intentions and Strategies
     - ZED Performance
     - Carbon Emissions
     - Ecological Summary
     - Strengths and Weaknesses



GRADING CRITERIA: Project Six: 40% total

Phase 1.0: Grading Criteria: 15%
Phase 1.0 Final due for grading on Friday, March 7: integrate with Final Project Three Presentation
- 60%: Clarity and execution of design intention demonstrated in the models
- 30%: Clarity and execution of design intentions demonstrated in the annotated sections
- 10%: Clarity and execution of precedent studies

Phase 2.0: Grading Criteria: 20%
Phase 2.0 Final due for grading on Friday, March 7: integrate with Final Project Three Presentation
- 60%: Clarity and execution of design intention demonstrated in the physical and Ecotect models
- 20%: Clarity and accuracy of parametric studies
- 20%: Clarity of intentions demonstrated in summaries, drawings, diagrams, and photographs

Phase 3.0: Grading Criteria: 15%
Phase 3.0 Final due for grading on Friday, March 7: integrate all Project Three Phases
- 50%: Completeness, clarity, and quality of final presentation
- 25%: Demonstration of understanding of analysis methods
- 10%: Clarity of findings and conclusions

NOTE: Please also submit 2 – 11"x17" color copy of your boards and a CD with all of your projects from the semester.


"…a lovable energy hog is more sustainable than an unloved building that uses no energy. The goal was to create a beautiful, low-maintenance; high-quality building that is also sustainable." - Pugh + Scarpa, Solar Umbrella House

Poetics

Inventive, ingenious…A treatise on or study of poetry or aesthetics

Pragmatics

Dealing with facts or actual occurrences; practical. The study of phenomena…with an emphasis on their practical outcomes

PROJECT FIVE:

THE ROOM: Experiencing Sustainability: Balancing Poetics + Pragmatics

Grade weighting: 10%

Mon, February 25: In-Process team critique on mezzanine with instructors and TAs
Friday, February 29: Project due; Informal exhibition on mezzanine for class discussion
Friday, March 7: Project integrated into Final Project Three Presentation

INTRODUCTION

Objective: To explore the poetic and pragmatic implications and integration of daylighting and thermal design at the scale of the room and to explore a serial (or parametric) procedure of design development and testing.

For Project Five you will be working at the scale of the room. You are asked to select a "typical room" or an "important room" within your project. Over the next week you will be developing and testing both poetic + pragmatic design intentions through serial studies (also know as parametric studies). These studies will enable you to gain a better sense of the experience of sustainability in your project while also exploring the qualitative and quantitative implications of your design investigations. This phase will also introduce an ecological design method that incrementally compares and tests design intentions and strategies. You will be asked to bring the lessons from the room study into the overall design of your project.

Before beginning, please take time to reflect on the concepts and lessons from Projects Three and Four. Consider design revisions to the overall proposal based on feedback.

METHOD: THE SERIAL PROCEDURE: on parametric studies

On Seriality:

"…serialism is a cross-disciplinary movement that uses a process of repetition and variation to direct a unified, non-hierarchical body of work… an iterative design process; taking the position that its value as a heuristic tool is in conceiving and critiquing an architecture that is temporal, relational but also spatial, informed by use and the logic of construction…Artists have often worked in series: think of Claude Monet's haystacks, painted at different times of the day and year, or Andy Warhol's varieties of soup cans. LeWitt's use of seriality is different, however, as it is deployed as an internal logic that will produce, once its parameters are set, a precisely incremental series of variations. Each variation has thus been determined objectively. The series could not have been arrived at solely through an act of subjective imagination." - Jennifer Yoos and John Ross, GDII Studio, Fall 2007

Step 1 *Select One Room to Study and Develop Intentions and Goals for the Series (Parametric) Studies*: Your team is asked to select one "typical or important room" to study over the coming week. Once you have selected your room you are asked to define the design intentions and strategies that you will qualitatively and quantitatively test in your "series or parametric studies" of the room. Work as a team to establish the issues that you will investigate over the next week. The goal is to explore the poetic and pragmatic ecological design implications of your qualitative and quantitative testing. Pay particular attention to the window form, materials, and structure.

You are asked to test a minimum of three different design intentions and strategies. Before beginning please develop a brief written outline of your three explorations: 1) define your intentions (analysis goal) and 2) the design strategies (physical design features) that you will test. You might consider comparing and contrasting the poetic and pragmatic implications of the:

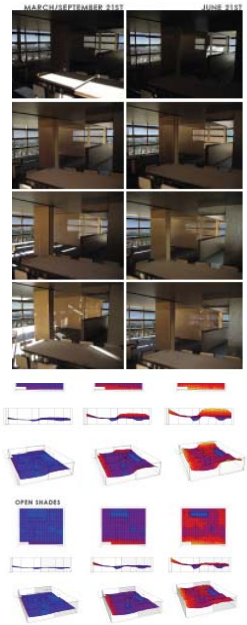
- *Room height*
- *Window size and form*
- *Window location*
- *Window detailing*
- *Exterior shading devices and layering*
- *Interior shading elements*
- *Room materials and finishes*
- *Room color*
- *Interior shading elements*
- *Enclosure systems*
- *Spatial configuration*
- *Interior and borrow light strategies*
- *Daylighting strategies (e.g. top vs. sidelight)*
- *Depth of the room*
- *Material properties (thermal qualities)*
- *Material finishes (reflective, matte, specular)*
- *Glazing characteristics (clear, transparent, etc.)*
- *Others…*

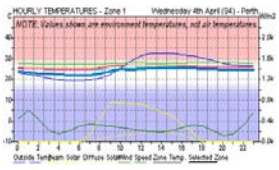
Step 2 *Develop A Physical Model of the Room to Test the Qualitative Design Intentions and Goals:* Develop a physical model at an appropriate scale to study your room of choice (e.g. ¼ or ½" scales are usually large enough). Please keep the model no larger than 18"-24" as a maximum dimension. Review the "daylight model handout" for suggestions on model construction methods that make it easy to adapt and change your model. Use the design intentions and goals developed in Step 1 to inform the model testing and documentation phase. You will need a "base model" or "control" to compare your series studies. The "base model" can be your selected room design as it is currently proposed in your Project Two.

Step 3 *Develop Ecotect Models of the Room to Test the Quantitative Daylighting and Thermal Design Intentions and Goals:* Use Ecotect to develop daylighting and thermal models of your room to test the design intentions and strategies. Develop your "base model" as a "control" for your series studies.

Step 4 *Methodically Document Your Serial Studies Using Qualitative and Quantitative Methods:* Define a clear method to assess and document the series of design studies using your physical model(s) and Ecotect studies. Make only one change per serial study to compare and contrast the quantitative and qualitative implications of your design alterations. Develop photographs and graphics materials to illustrate the qualitative and quantitative implications of your three serial studies:

- Photo-documentation of the Quality of Space and Sun Penetration Studies: Use a sunpeg for 44ºNL to photo-document the quality of light and sun penetration for the interior of your physical model at chosen seasons and times of day (use the same views and times for all studies). Provide a diurnal and seasonal understanding of the room.
- Ecotect Quantitative Studies: Use Ecotect to evaluate the quantitative light levels (in lux) and the thermal performance of your room for the three series studies (use the same time of day and season for the light and thermal studies).
    - Daylight Studies: perform a typical daylight analysis of the room to evaluate the illumination levels (in lux) to illustrate the diurnal and seasonal light levels for your three studies (times and seasons of your choice – use the same time and seasons for all daylight and thermal studies in Ecotect).
    - Thermal Studies: Hourly Temperatures and Passive Gains: Use Ecotect to study the hourly temperatures in your three rooms (select the same times of day and seasons as your Ecotect daylighting study). You are also asked to look at your passive gains breakdown to determine the impact of solar radiation (both direct and absorbed through a wall).





- ***NOTE ON Ecotect and Hourly temperatures****: Using the* ***Highlight Zone*** *section below the graph in the analysis tab, select the zone containing your room. Ecotect then highlights the selected zone in bold, and overlays color gradient bands to indicate relative comfort (ideally, the graph should fall within the white band of the color gradient). The dashed and dotted orange lines represent Beam and Diffuse solar radiation. Beam Solar refers to the direct component of radiation from the Sun itself, whereas Diffuse Solar refers to radiation that occurs due to reflections from clouds, moisture vapour and other atmospheric particles. Wind speed is indicated by the green dashed line, and is shown to indicate its relative influence upon the temperature patterns within zones being analyzed.*

Step 5 *Summarize the Findings of Your Serial Studies (Poetics + Pragmatics):* Develop a Brief Written Summary of Your Serial Studies: 1) qualitative and quantitative design intentions (analysis goal), 2) design strategies, 3) strengths and weaknesses, and 4) design lessons and implications.

Extra Credit: Due Feb 29 (20 points): Building elevations of the façade of the important room and old Rapson.

In-Process Deadlines: In-Process Critique and Informal Exhibition

Please prepare in-process work for your "Room Studies" for the following dates:

- Mon, February 25: In-Process team critique on mezzanine with instructors and TAs
    - Please sign-up for a team critique for Monday between 10-12; crit whatever work the team has completed
- Friday, February 29: Project due; Informal exhibition on mezzanine for class discussion
    - Please pin-up your completed Phase 2.0 studies on Friday for an informal exhibition on the mezzanine by 9:45 a.m.
- Friday, March 7: Project integrated into Final Project Three Presentation

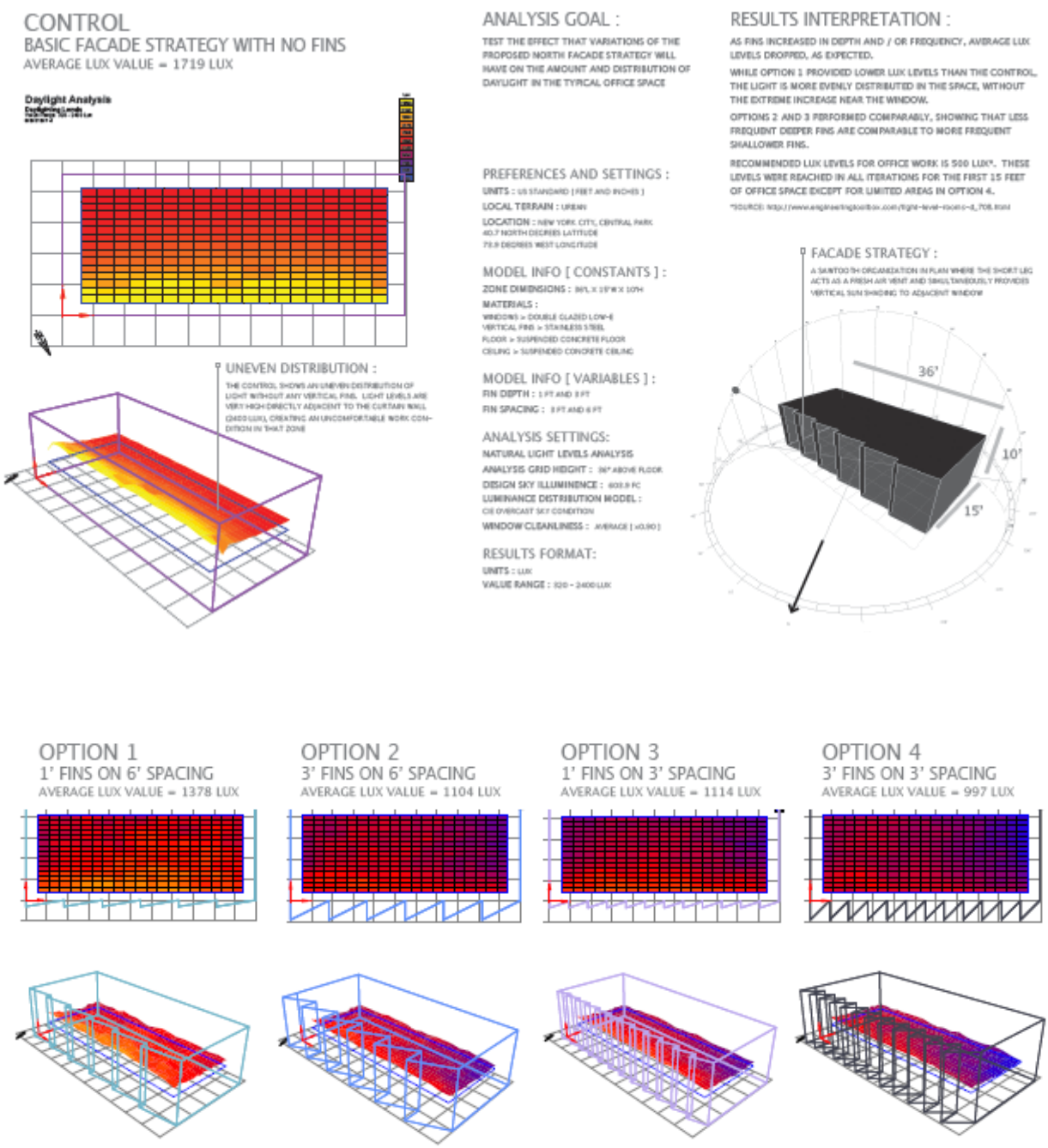
Project Five: Grading Criteria: 10% total

Project Five: Final due for grading on Friday, March 7: integrate with Final Project Three Presentation

- 60%: Clarity and execution of design intention demonstrated in the physical and Ecotect models
- 20%: Clarity and accuracy of parametric studies
- 20%: Clarity of intentions demonstrated in summaries, drawings, diagrams, and photographs

SERIAL STUDIES – QUANTITATIVE PARAMETRIC STUDIES EXAMPLE

From Jenny Lovell, University of Virginia

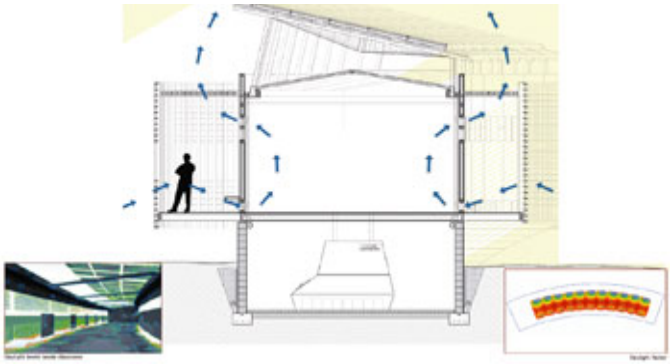


"Thermal analysis basically means using a manual calculation or computer program to mathematically model the interplay of thermal processes within a building. There are a wide range of mathematical models used for this purpose, all of which vary significantly in both in ease of implementation and comprehensive.

_Source: Ecotect website

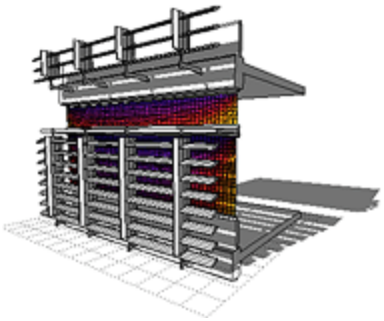
The useful practice of the 'ancients' should be employed on the site so that loggias should be filled with winter sun, but shaded in the summer.

-Leone Battista Alberti, De Re Aedificatoria, 1452



PROJECT THREE: Phase 2
ASSESSING THERMAL PERFORMANCE: Temperature, Loads and Comfort

Phase 2.0: Final Thermal Design with Whole Building Thermal Analysis



- **In-process team critique: Friday, February 15:** sign-up for one 30 minute team critique "in studio" between 10:00 am-12:00 pm
- **Phase 2.0 Due on Monday, February 18; 8:45 a.m.:** All teams please pin-up by 9:00 in Rapson Hall Courtyard (class critiques from 9:00-11:30 am)

Objectives

- To demonstrate competence in thermal design refinement of the initial project design.
- To understand and compare the metrics of thermal design performance and the related impact on lighting quality and energy use in buildings.
- To develop the knowledge and skills needed to evaluate thermal envelope and passive solar design strategies for a given climate and to begin to optimize performance through an iterative analysis approach.
- To demonstrate the application of whole building analysis of the proposed addition to Rapson Hall as a design intervention and it's impact on the thermal performance of the building as a whole.
- To better understand how to apply an "eco-effective" approach to thermal design. This will be further explored in Project 3.

Introduction

In this phase of Project Three, teams will explore the process of design evaluation and incremental improvement through hypothesis, and testing using the ECOTECT thermal simulation tool. Teams will begin optimizing thermal design parameters based on the findings of your Phase 1.0 analysis and trial and error testing of strategies intended to improve thermal performance. In other words you will make modifications to your building model, using Ecotect, testing your hypotheses and examining the resulting impacts on building loads and other performance criteria. You will also be receiving a thermal model of the existing Rapson Hall. You will be asked to run simulations of your project combined with the Rapson Hall model to determine the impact of your design (if any) on the existing facility. In addition you will be evaluating the overall synthesis of the existing and new in terms of relative energy use and environmental impacts.

STEP 1: MODEL REFINEMENT

i Make corrections and/or simplify your ECOTECT Model for better or quicker thermal simulation results.

ii Investigate problems and troubleshoot simulation errors and model construction problems. E.g., see "Error Messages" topic in the ECOTECT HELP!

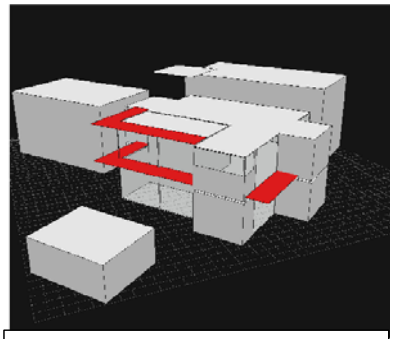
iii Set appropriate values for object materials, HVAC system mode, occupancy load and schedules, internal loads for lighting and equipment and establish the appropriate operating schedules.

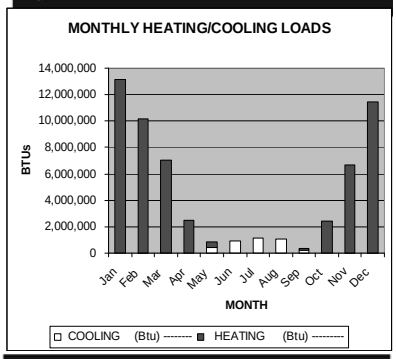
STEP 2: HYPOTHESIS FORMULATION

i *As a group:* review your Phase One precedent research and thermal analysis results and formulate several (4-6) hypotheses that you suspect to be true about your building regarding its thermal performance. In other words, what changes in the design do you think would improve thermal performance. Select the 3 best hypotheses for testing – one to be tested by each team member.

ii *As individuals:* begin to work with ECOTECT and your building model if you have not already done so. Become a "champion" for one of (preferably your favorite) the hypotheses.

iii *Optional results from Phase 1:* If your team performed either of the optional analyses tasks outlined in Phase 1, you may use these results for your hypothesis tests required in this phase. Or you may use those results to formulate new hypotheses for additional testing.





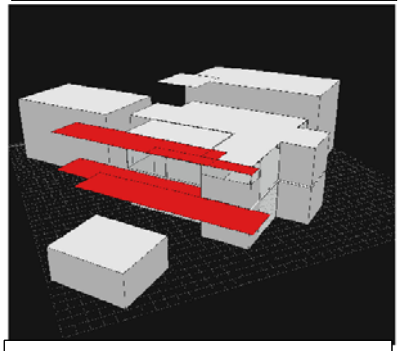
STEP 3: RESEARCH

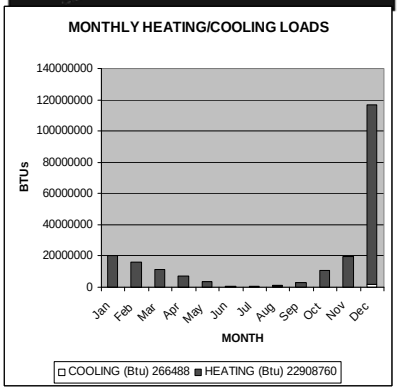
As a "Champion" for one hypothesis: each team member will investigate the data relating to that specific hypothesis in order to modify your model and test the hypothesis. *i.e., what are the appropriate materials choices and related properties: such as thermal insulation u-values, specific heat, glazing visible light transmittance or solar heat gain coefficients?*

STEP 4: TESTING AND EVALUATION

i As a "Champion" each team member will need to make the necessary modifications to the ECOTECT model that your hypothesis test involves. Copy and paste the MONTHLY HEATING/COOLING LOADS data from the Analysis page of your ECOTECT model into an Excel Workbook or *other data analysis tool* and analyze the data to determine the optimal design. An Excel Spreadsheet for that purpose has been provided (see folder labeled "Assignments " on Webvista in Week Four.)

ii As a team you should review the results of the various optimization exercises to determine:
- Was your original hypothesis correct?
- Which of your hypotheses had the greatest impact on building loads or performance?
- For each hypothesis tested what do you feel is the optimal design condition or material property for your particular building?...and why?
- What were the limitations of the ECOTECT software that hindered your analysis?
- Based on your overall findings, what other design elements would you consider for further analysis?





STEP 5: CONCLUSIONS FOR PRESENTATION

Prepare a graphic presentation to present and discuss the findings of your analysis. Please include the following in your presentation:

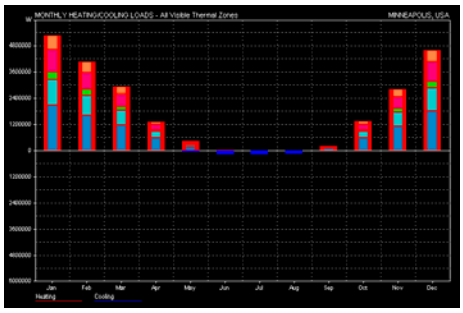
1. State clearly each hypothesis considered by your group and the primary reasons(s) why it was chosen for testing.
2. Review the test method for each hypothesis and the design conditions modeled in the analysis. Use diagrams where appropriate.
4. Provide the appropriate graphs, charts or tables showing the results of your analysis including the range and types of data collected. Be clear about the scale of data and the units being presented.
5. Conclusions – what conclusions can be drawn from the results of your analyses?

PRESENTATION CHECKLIST: PROJECT THREE - Phase 2.0

PINUP MONDAY, FEBRUARY 18

Required format: 2 or more boards 24"W x 36"H (vertical format.)

Label all charts, tables, graphs, sections and other diagrams. Include graphical scale where appropriate.



MONTHLY HEATING/COOLING LOADS

All Visible Thermal Zones
Comfort: Zonal Bands

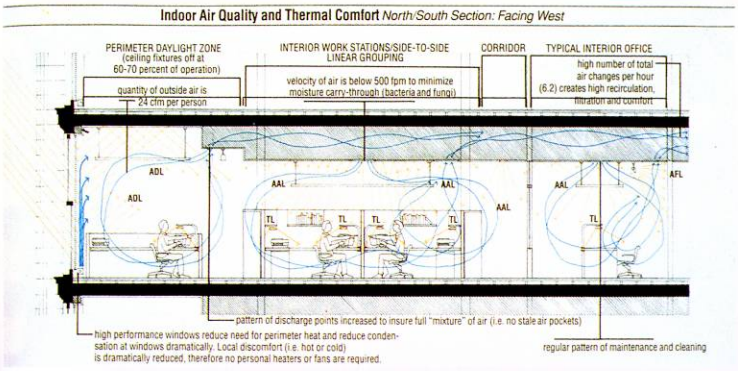
Max Heating: 39224.4 Btu/hr at 05:00 on 31st December
Max Cooling: 10706.2 Btu/hr at 14:00 on 28th May

MONTH	HEATING (Btu)	COOLING (Btu)	TOTAL (Btu)
Jan	17911208	0	17911208
Feb	13847516	0	13847516
Mar	9948593	0	9948593
Apr	4544896	0	4544896
May	1370772	236687	1607459
Jun	74218	612719	686937
Jul	0	663750	663750
Aug	0	474338	474338
Sep	702927	1628	704554
Oct	4613660	0	4613660
Nov	9527052	0	9527052
Dec	15650158	0	15650158
TOTAL	78191000	1989122	80180120
PER M²	1404797	35737	1440534
Floor Area:	599.12 ft2		

1. ***Results of precedent Study from Phase one - minimum 3 strategies or concepts***

2. ***ECOTECT Thermal Analysis Phase 1 (and Phase 2 where indicated):***
   a. ***Temperature Profile Study (Phase 1):***
      - Temperature Profile Chart from Ecotect for Hottest Day
      - Temperature Profile Chart from Ecotect for Coldest Day
   b. ***Heating and Cooling Loads Studies for original design (phase 1) and for modified design (Phase 2):***
   - Average Monthly Heating and Cooling Loads Chart from Ecotect
   - Monthly Heating and Cooling Loads Data Table showing Peak Heating and Cooling Loads and days - Exported from Ecotect in spreadsheet format
   - Passive Gains Breakdown Chart from Ecotect (optional for Phase 2.)
   - Label all charts and provide diagrams or annotated sections to indicate the design condition being tested for each result.

3. ***Graphical studies and a brief written narrative highlighting the key concepts and describing the thermal design intent and Passive Solar Integration:***
   - Annotated building wall sections at an appropriate scale (e.g. ¼" – ½"=1'0") explaining your passive design integration strategies. Indicate integration of both lighting and thermal strategies.
   - At least 1 additional diagram to explain your passive integration, e.g., exploded view diagrams, cutaway perspective or axonometric studies. Include sufficient annotation to convey design intentions clearly.



Section drawing illustrates air ventilation and circulation with light and heat source patterns. In order to minimize moisture carry-through (which increases the potential for bacteria and fungi), the air velocity is below 500 FPM. Drawing: Croxton Collaborative Architect.

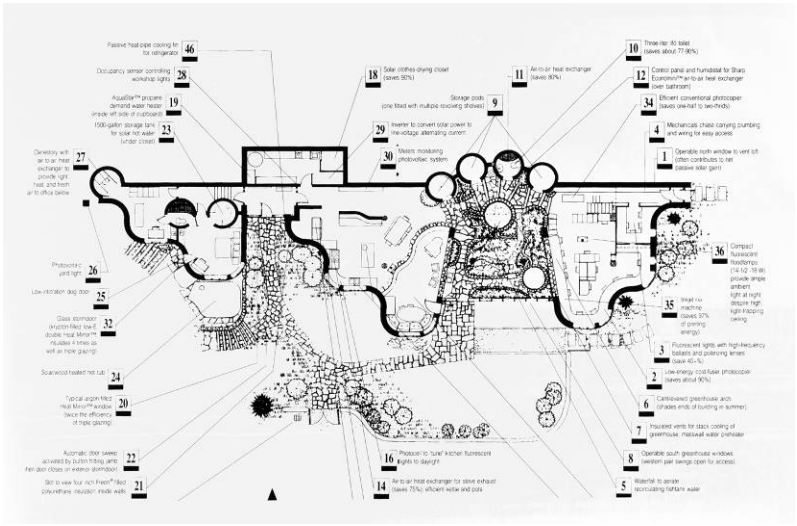
   - Written narrative – 2-4 paragraphs to describe basic design concept, key strategies and conclusions of your analyses. In clued any caveats or explain any strategies which could not be modeled in ECOTECT.

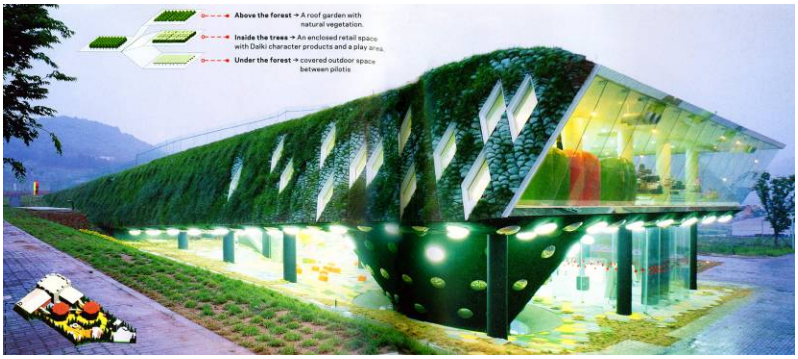
GRADING CRITERIA - Project THREE: *25% total*
Phases 1 and 2 combined:

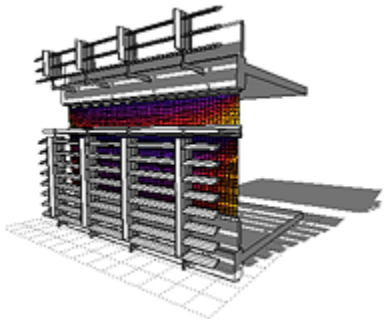
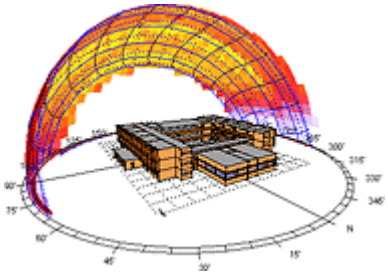
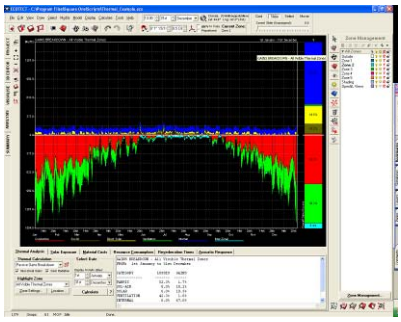
1. ***Final Presentation 50%)***
   - ***Completeness, clarity and intelligibility of presentation***
   - ***Graphic and design quality***

2. Demonstration of understanding of analysis methods 25%

3. Credibility and reasonableness of findings & conclusions 25%





"Thermal analysis basically means using a manual calculation or computer program to mathematically model the interplay of thermal processes within a building. There are a wide range of mathematical models used for this purpose, all of which vary significantly in both in ease of implementation and comprehensive. _Source: Ecotect website

The useful practice of the 'ancients' should be employed on the site so that loggias should be filled with winter sun, but shaded in the summer. -Leone Battista Alberti, De Re Aedificatoria, 1452

PROJECT THREE: Phase 1:

ASSESSING THERMAL PERFORMANCE: Temperature, Loads and Comfort

Overview of Project Schedule

Phase 1: Precedent Study and Passive Solar + Loads Analysis	Due 9:45 AM Wed Feb. 13
Phase 2: Final Thermal Design Whole Building Thermal Analysis	Due 9:00 AM Monday Feb. 18

Phase 1.0: Passive Design and Ecotect analysis of thermal performance

Suggested time limit: 4 days; minimum 16 hours; Phase 1.0 Grading: 20%; 200 points total
Phase 1.0 Due on Wednesday, February 13; 9:45 a.m.: All teams please pin-up by 9:45 on mezzanine (class critiques from 10:00-11:30)

Objectives

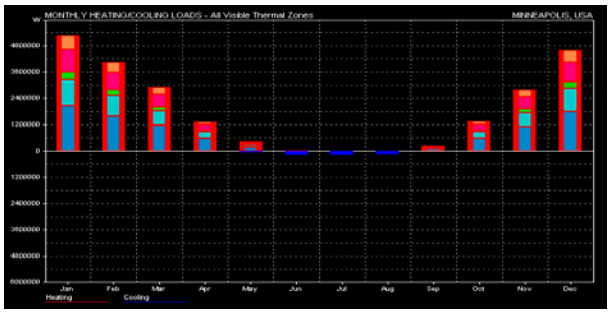
- To study the relationships between solar exposure, envelope design and thermal loads.
- To develop the knowledge and skills needed to conduct thermal design assessments in architectural design.
- To better understand heat flow in buildings, human thermal comfort & thermo-regulation, and the effects of thermal mass.
- To be able to calculate passive gains, temperatures & heating and cooling loads and to interpret results.

Buildings are complex in that they respond to both internal and external fluctuations in heat gains and losses. In the recent past buildings have tended to ignore solar radiation both when desirable and sometimes when undesirable. Architectural form dictates to a large extent a building's ability to benefit from solar flux. Proper orientation of glazed openings, adequate thermal mass and summer shading are the primary factors determining the efficacy of a "passive" building design, however, placement of operating windows and wind shaping through intelligent roof and building form also play a significant role. In Project Two you will explore critical questions concerning thermal comfort and building loads in your designs for a mnZED Lab addition to Rapson Hall. Please consider the following process:

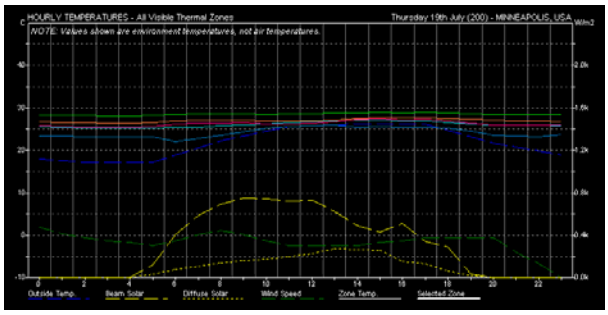
1. **<u>Define the design intent with respect to energy and thermal design goals</u>:** As a team, take time to discuss the results of Project One and how well it responds to the regional and micro-climatic context of your project. Review your energy and thermal design goals. Consider how you can improve the use of passive design strategies to capture and store thermal energy in winter and to reject unwanted thermal gains in the summer. You might consider:
   - *Climate data (changing temperature, wind, sun, and humidity)*
   - *Massing and orientation strategies*
   - *Building program and relative need for thermal comfort*
   - *Surrounding buildings that block sun and wind*
   - *Building envelope materials and resistance to thermal conductivity*
   - *Daylighting and thermal design integration*
   - *Existing building systems integration*
   - *Circulation vs. continually occupied spaces*
   - *Strengths and weaknesses …*

2. **<u>Thermal Strategies Precedent study</u> :** Assign at least 1 precedent research task to each individual in your team pertaining to the various strategies included in your Project One/Two design proposal and as modified by Step 1 (above.) The research assignments should include all critical strategies which will impact the thermal performance of your building. You might consider:
   - *Solar control strategies active and passive*
   - *Glazing materials, technologies and systems*
   - *Thermal envelope materials and insulating methods*
   - *Living Walls, arbors and trellises*
   - *Intelligent Skin concepts*
   - *Phase change thermal storage systems*
   - *Superinsulated Envelope*
   - *Thermal mass materials and configuration*
   - *Natural ventilation strategy*
   - *Cool roof and Green roof strategies*
   - *Passive solar heating strategy*
   - *Passive and Active Solar integration*
   - *Double Envelope Concepts*
   - *Other innovative Thermal Approach*

3. **<u>Thermal Computer Model Preparation</u>**
   Construct a thermal model of your proposed design using ECOTECT. You should be able to use the model constructed for your daylighting studies for Project One. This model will be used to study the various performance aspects of your thermal design. At this stage it is advisable to simplify the model in order to get quicker results. Follow the *Thermal Analysis* tutorials provided (see Course Website: Ecotect) to ensure that you have constructed the model correctly in order to do the prescribed thermal analysis.



Average Monthly heating and cooling loads



Hourly Temperature Distribution by zone

4. **ECOTECT Thermal Analysis:** As a group, you will investigate the climate responsiveness and overall thermal performance for your building. ECOTECT will calculate internal temperatures, spatial comfort and heating and cooling loads for models with any number of zones or type of geometry. You will need to assign material choices to all objects. You will also need to assign HVAC mode and operational schedules for occupancy.
   a. Temperature Profile Study: Calculate the hourly temperatures for all your zones for the hottest and coldest days of the year. Check the Average Hottest and Coldest Days Are they the same? How about the windiest and sunniest days? When do they occur?
   b. Heating and Cooling Loads Studies: Calculate the average monthly heating and cooling loads for your project and create a graph showing the monthly heating and cooling loads for your building for a typical year. Export (or copy) the data table showing the monthly heating and cooling loads values and the peak loads conditions to a table in Word or Excel or another suitable application. Create a diagram showing the passive gains breakdown of your design using the Thermal Analysis Wizard.

c. Optional Passive Solar Study: Vary the size or shading of some south facing window(s) of your model or the overhang depth and evaluate the impact on thermal loads and on daylight contours (you should have produced these graphs for your Project One.) Report your findings.

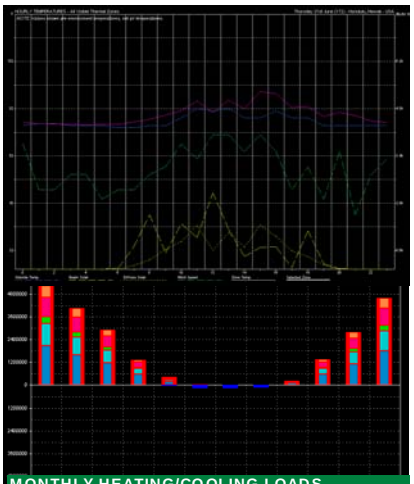
d. Optional Thermal Mass Study: Vary the thermal mass of some element(s) of your model and evaluate the impact on your calculated building loads. Report your findings.

5. Graphical Study of Passive Solar Integration:

Develop an annotated building wall section at an appropriate scale (e.g. ¼" – ½"=1'0") and at least one other detailed diagrammatic study explaining the passive solar heating and cooling strategies integrated into your thermal design.

PRESENTATION CHECKLIST: PROJECT THREE
Phase 1.0 Submission: PINUP FRIDAY, FEBRUARY 8

Work as a team to create an informal presentation.
Suggested format: informal collage in an area no more than 72" W x 36" H. *Label all charts, tables, graphs, sections and other diagrams. Include graphical scale where appropriate.*



MONTHLY HEATING/COOLING LOADS

All Visible Thermal Zones
Comfort: Zonal Bands

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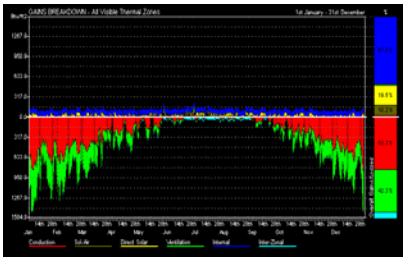


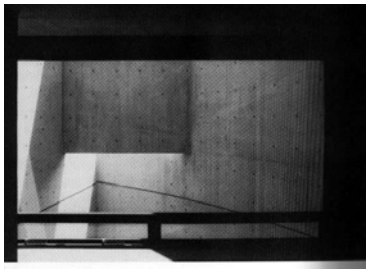
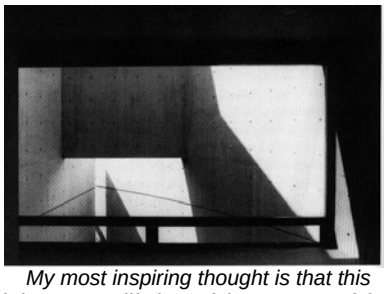
1. ***Results of precedent Study - minimum 3 strategies or concepts***
2. ***ECOTECT Thermal Analysis:***
   - ***a. Temperature Profile Study:***
     - Temperature Profile Chart from Ecotect for Hottest Day
     - Temperature Profile Chart from Ecotect for Coldest Day
   - ***b. Heating and Cooling Loads Studies:***
     - Average Monthly Heating and Cooling Loads Chart from Ecotect
     - Monthly Heating and Cooling Loads Data Table showing Peak Heating and Cooling Loads and days - Exported from Ecotect in spreadsheet format
     - Passive Gains Breakdown Chart from Ecotect
   - *c.* ***Optional Passive (South Window) Study:***
     - Recalculate and plot the Average Monthly Heating and Cooling Loads
     - Recalculate and plot the Passive Gains Breakdown Chart from Ecotect
     - Any other Charts that show the before and after condition.
     - Please include other diagrams clarifying your design variation (e.g. increased south window area, increased or decreased overhang depth, etc.)
     - Brief Written Critique:
       - Did it change the results – in what way?
       - Include a brief written summary of your "quantitative analysis"
       - Design Conclusions: Does the strategy help or hurt the design?
   - *d.* ***Optional Thermal Mass Study:***
     - Recalculate and plot the Average Monthly Heating and Cooling Loads
     - Recalculate and plot the Passive Gains Breakdown Chart from Ecotect
     - Recalculate and plot the Daylight Illuminance studies from Project One for the affected area.
     - Please include other diagrams clarifying your design variation (e.g. added CMU walls, Thermal storage objects, etc.)
     - Brief Written Critique:
       - Did it change the results – in what way?
       - Include a brief written summary of your "quantitative analysis"
       - Design Conclusions: Does the strategy help or hurt the design?

3. ***Graphical studies and a brief written narrative highlighting the key concepts and describing the thermal design intent and Passive Solar Integration:***
    - Annotated building wall sections at an appropriate scale (e.g. ¼" – ½"=1'0") explaining your passive design integration strategies.
    - Or include other diagrams to explain your passive integration, e.g., exploded view diagrams, cutaway perspective or axonometric studies. Include sufficient annotation to convey design intentions clearly.
    - Written narrative – 2-4 paragraphs

GRADING CRITERIA Project Three: *25% total Phases 1 and 2 combined*

1. **Phase 1.0: Exploratory Studies:**
    - Overall clarity, accuracy and execution of thermal analysis methods
    - Demonstrated understanding of findings and results

2. **Phase 2.0: TBA**

My most inspiring thought is that this place, if I am to live well in it, requires and deserves a lifetime of the most careful attention. -- Wendell Berry

During the four perilous days of solar transition, each household in San Juan Pueblo shares in a period of rest and spiritual retreat within their home as an expression of collective awe and respect for the Sun. --The Tewa, Southwest U.S., Days of the Sun Ritual

PROJECT ONE – Phase 2

LIGHTSCAPES: Light in Place and Time

Final Project One Due: Wednesday, February 6, pin-up by 8:45 on the courtyard (reviews at 9:00)

(Phase 2 total: suggested time limit: minimum 24 hours)

- **Friday, February 1: In-Process Pin-up-Phase 2.1 Due:** pin-up on mezzanine at 9:45
- **Monday, February 4: In-Process Pin-up for Phase 2.2 Due:** sign-up for team critique (between 10-12:00
- **Wednesday, February 6: Final Presentation for Phase 1 and Phases 2 Due:** reviews at 9:00 in courtyard

Phase 2.1: Design Proposals: 1/16" site/massing physical models

Due: Friday, February 1: In-Process Pin-up for Phase 2.1: pin-up on mezzanine at 9:45 (in-process reviews start at 10:00); *(Phase 2 Feb 1 studies: suggested time limit: 1/2 day)*

Objective: To investigate the relationship between the quality and character of the luminous experience and the massing, section, envelope, and window form.

Daylight is a dynamic and constantly changing force. It is always in a process of transition, varying from hour to hour and season to season. Each moment offers new colors, positions, and qualities of light which are particular to a given place and geographic location. In The *Poetics of Light*, Henry Plummer states: "...living structures can *be* only if they *become*, they can *exist* only if they *change*. Change and growth are inherent qualities of the life process." Daylight provides an opportunity to explore the changing and evolving qualities of architectural experience. In Project One you will explore the ecological, experiential, and aesthetic opportunities of light, place, and time in the mnZED Lab addition. Each team member is asked to develop at least ONE 1/16" site/massing model to communicate your daylighting proposals for the mnZED Lab. The model should reveal "an experience of place and time".

1. Define What Aspect of "Place and Time" to Express: Reflect on the site and bioclimatic lessons from the charette. Take time to reconsider your project in a way that reveals some character or quality of the "light in place and time". You are asked to focus on the ***building massing and envelope***. Consider what characteristics or qualities of place/site your want to capture and express in Phase 1:
   - Seasonal phenomena
   - Geographic location
   - A particular view(s) (near or far)
   - A particular time of day (morning, mid-day, afternoon…)
   - Site materials or features (snowfall, water, topo, etc.)
   - Sky conditions (clear, overcast, etc.)
   - A mood or feeling of the site
   - Colors of light (morning, mid-day, evening)
   - Luminous phenomena on the site
   - Connection to earth or sky? Others…
2. Develop New Exploratory Studies (1-2 hours suggested): Use sketches, computer models, or physical models to reconsider the overall site/massing of your design from the Bioclimatic Charette (including the old part of Rapson). Develop new site/massing proposals to consider how "place and time' can be revealed in architecture. Generate as many ideas as you can before selecting proposals to further develop using 1/16" scale physical models (see step 3 below). Document your explorations to include in your *Final Project One Presentation*. Select an exploratory study to develop in a 1/16" physical model.

3. Develop at Least One 1/16" Physical Site/Massing Model (3-4 hours minimum): Each team member is asked to develop at least ONE 1/16" design proposal for the mnZED Lab. Use materials of your choice to construct a 1/16" physical site/massing model to express your chosen aspect(s) or qualities of "light in time and place" (balsa wood, wire, mesh, screen, transluscent materials, metal, etc. Use a sunpeg for 44°NL and a digital camera to document the daylighting on the inside of your model. You will need to include a "peep hole" to see inside your model at select locations to photograph the inside. Also consider if there are any reflective surfaces outside the windows or objects that block or influence the daylight that should be modeled (e.g. is there a ground plane adjacent to a window? Do you need to consider seasonal light changes with snow or vegetation? Document your explorations to include in your *Final Project One Presentation*.

4. Annotated 1/16" Sections and Daylighting Concept Diagrams (1 hour minimum): Each team member is asked to develop annotated plans and sections (at 1/16" scale) and daylighting concept diagrams to communicate your 1/16" design proposals. Document your explorations to include in your *Final Project One Presentation*.

5. Friday, February 1: In-Process Pin-up-Phase 2.1 Due: pin-up on mezzanine at 9:45 (in-process reviews start at 10:00). Please include: exploratory studies, 1/16" physical models, and annotated sections.

Phase 2.2: Integration into a Team Proposal: Daylight Program: Qualitative and Quantitative Analysis

Due: Monday, February 4: In-Process Pin-up for Phase 2.2: sign-up for a review on Monday between 10-12 (Daylight Program and 1/16" models are due on Monday, February 4).

1. Weekend Design Integration: Develop ONE Team Proposal: Physical Model at 1/16" (4 hours minimum): Over the weekend you are asked to integrate the best of your design thinking into ONE TEAM PROPOSAL using a 1/16" physical site/massing model. Based on the design critique on Friday, revise your proposal to further develop, clarify, and refine your daylighting design. Leave time to conduct a quantitative Ecotect analysis and Photo-documentation of the new 1/16" team proposal.

2. Define the Team's Daylighting Program and Goals (1-2 hours estimated): As a team, use the *"Program Narrative Handout"* (who, what, when, where, how, etc.) and the *IESNA Lighting Handbook* (on reserve in the library) to define your team's daylighting program goals (qualitatively and quantitatively). Prepare a brief written description of your "Daylighting Program Goals" (including answers to the "Program Narrative: who, what, when, where, how" and the target illuminance levels in different spaces). Develop an Ecotect study model of the team proposal to assess the illumination levels and distribution of light. Use qualitative photo-documentation of the team proposal to assess the character of the light and whether you have issues for solar control and heat gain.

3. Develop a Quantitative Analysis of the Team's Proposal Using Ecotect (4 hours estimated): On Monday, February 4, the team is asked to present a quantitative analysis of their combined "team proposal" using Ecotect (mnZED Lab addition only). You should evaluate the illuminance level in lux (1 footcandle = 10 lux) for 3 times of the year: *Noon for June 21, March/September 21, and December 21* (this is the maximum, average, and minimum illumination seasonally). Include plans, sections, and 3-D Axonometric for each of the specified times and seasons (e.g. this is a total of 3 times of the year with 3 drawings for each time). Take time to critique your Ecotect study: what is it telling you about the amount of light, distribution, and program needs? Do you have sufficient light? Experiment with the Ecotect model to see how design modification impact the quantity and distribution of light. *If you run into problems move back to design explorations and troubleshoot with Mary and the TAs on Monday. You will be asked to develop a written critique of your Ecotect Analysis for the final presentation on Wednesday, February 6.*

4. Develop a Qualitative Analysis of the Team's Proposal Using Photo-Documentation of 1/16" Model (1-2 hours estimated): After constructing the team model, use a sunpeg to photograph the model on the actual (yes – real) site. *Leave plenty of time to get a sunny day!* Please use a digital camera to document the following nine times of day for each of the 1/16" models (a sunpeg for 44º NL is in the climate data handout).
    - MARCH/SEPT. at 9:00, noon, and 3:00 (or 3 other times for the same day).
    - JUNE at 9:00, noon, and 3:00 (or 3 other times for the same day).
    - DECEMBER at 9:00, noon, and 3:00 (or 3 other times for the same day).

2. Monday, February 4: In-Process Pin-up for Phase 2.2 Due: sign-up for team critique (between 10-12:00 and in the afternoon); Please include: Daylight Program and Goals, Ecotect Study, and Qualitative Photos of the Team's Proposal.

FINAL PRESENTATION REQUIREMENTS FOR PROJECT TWO:
Final Submissions for Phase 2.1 and Phase 2.2

- **Due: Wednesday, February 6: Final Phase 2.1 and Phase 2.2 :** pin-up by 8:45 on the courtyard (reviews at 9:00); All final materials are due on February 6.

Written Submission & Graphic Presentation Checklist for Project Two: Phase 1, Phase 2.1, and 2.2

Work as a team to prepare a graphic presentation using a vertical 24x36" format. *Please identify the name of the team member who developed the 1/32" and 1/16" design proposals. Label all plans, elevations, sections and other diagrams. Include graphical scale and indicate "north" direction on all plans.*

1. ***Phase 1: Nature of Light*:** Please include a graphic summary with all the investigations from Phase 1: The Nature of Light, include the following for each team member:
   - images and words from nature
   - 1/16" physical section models
   - photos of the models in the presentation
   - annotated 1/16" sections
2. ***Phase 2.1: Light in Place and Time:*** Please include a graphic summary with all the investigations from individual team members (identify team member's projects):
   - Exploratory studies (sketches, computer studies, photos, etc.)
   - 1/16" site/massing model (one per team member)
   - Annotated 1/16" Sections and Daylighting Concept Diagrams (one per team member)
3. ***Phase 2.2: Light in Place and Time:*** include the following for the team model:
   - Daylighting Program and Goals (written summary – team only for all work listed below)
   - Team Model: 1/16" Physical Site/Massing Model
   - Ecotect Study of the Team Model (noon for 3 designated seasons; 9 images: plan, section, axon)
   - Qualitative Photo-Documentation of 1/16" Model (9 times of the year)
   - Annotated 1/16" Sections and Daylighting Concept Diagrams
   - Written Critique: assess the Ecotect analysis and the photo-documentation to evaluate the strengths and weakenesses of the team proposal: 1) Ecotect: do you have enough light based on your program and goals? Critique the distribution of light pros and cons? 2) Photo-documentation of Model: evaluate the seasonal images from the 1/16" Photo-Documentation: what did you observe in the photographs? Evaluate whether the quality of light and patterns of light meet your daylighting goals and objectives. 3) Discuss whether there are any problems with solar control, comfort, glare, and heat gain? Discuss the strengths and weaknesses and identify any changes you would make to the team design.

   PIN-UP: Bioclimatic Charette Boards: Please also pin up your Site and Bioclimatic Charette presentation

Grading Criteria: Project Two: *25% total grade*

1. Bioclimatic Charette: 15% (150 points – team grade only)

- 50 points: Clarity and craft of "Site & Bioclimatic Analysis" (team grade)
- 50 points: Clarity, craft, and execution of design intentions demonstrated in the models and drawings (individual grade)
- 50 points: Overall craft of presentation boards and drawings (team grade)

2. Phase 1: Nature of Light: 10% (100 points – team and individual grade)

- 70 points: Clarity, craft, and execution of design intentions demonstrated in the models and drawings (individual grade)
- 30 points: Overall craft of presentation boards and drawings (team grade)

3. Phase 2: Light in Place and Time: 25% (250 points – team grade only)

- 125 points: Clarity, craft, and execution of design intentions demonstrated in the models and drawings (team grade)
- 50 points: Clarity and accuracy of quantitative and qualitative analysis (team grade)
- 75 points: Overall craft of presentation boards and drawings (team grade)

Goldsworthy, Schoorl, Provincie Noord-Holland, March 1999.

Movement, change, light, growth and decay are the lifeblood of nature, the energies that I try to tap through my work. I need the shock of touch, the resistance of place, materials and weather, the earth as my source. Nature is in a state of change and that change is the key to understanding. I want my art to be sensitive and alert to changes in material, season and weather. Each work grows, stays, decays. Process and decay are implicit. Transience in my work reflects what I find in nature. - Andy Goldsworthy




"Nature has been for me, for as long as I can remember a source of solace, inspiration, and delight; a home, a teacher, a companion."
- Lorraine Anderson, Sisters of the Earth (1991)

For the artist, communication with nature remains the most essential condition. The artist is human ... part of nature within natural space.
- Paul Klee

"I have stopped sleeping inside. A house is too small, too confining. I want the whole world, and the stars too." - Sue Hubbell, A Country Year (1986)

PROJECT TWO: PHASE 1:
LIGHTSCAPES: The Nature of Light

Due: Wednesday, January 30, pin-up by 9:45 on the mezzanine (reviews begin at 10:00)
(Phase 1 studies: suggested time limit: 1/2 day)

"Nature is everywhere. It affects and can be found in every inquiry of creativity. Many of the emotions generated by nature are intangible: the changes of the hour, the passage of time as seen through the colors of the elements, the filtering of light through the clouds, the moon and the sunset. Nature influences many channels of architectural creativity. It is ever-present and unclassifiable, powerful inspirationally and as a tool."
-- Anthony Antoniades, The Poetics of Architecture

Procedure: Defining a Desired Quality of Light: 1/16" sectional physical study models

Objective: To investigate the relationship between the quality and character of the luminous experience and the section, envelope, and window form.

In Phase 1 we will use visual images from nature to explore the mood, feelings, and character of light in space. Each member of the team is asked to find ONE image from nature, which captures a powerful or meaningful luminous experience appropriate for your current design concept(s). This image (or images) will be used as a point of departure for your first daylighting study. You are asked to develop THREE different 1/16" physical models that interpret the quality of light into the "building section/envelope." Use the luminous phenomenon found in the image to inspire your design thinking in section. Please include a base model with old Rapson Hall to study the relationship between your new design intervention and the old. These will be 1/16" sectional study models (select a sectional cut of the building to reveal the power of light in space).

1. Define a desired quality of light that could inform your design concept(s): In this study you will be exploring the qualitative effects of light in space. Work together as a team to select one (or a few) evocative image of a luminous phenomena in nature that could inform the quality and character of light in your proposed addition. What character and quality of light do you want to create? Consider the mood, emotional response, essential character of the light, and what physical factors create the luminous experience (i.e. the direction of light, how it is filtered, the pattern, color, or intensity, etc.). Identify words to define the quality of light (e.g. brilliant, soft, filtered, mysterious, quiet, exuberant, etc.) Please use the image and word(s) to inform your design explorations in section.

2. Sectional Experimentations: 1/16" physical study models: Each team member is asked to develop at least THREE "sectional interpretations" for your "addition" which are inspired by the essential luminous qualities of the image from nature and the corresponding words to define the quality of light. *Photograph your models for your final Project One Presentation.*

   In this exercise focus on the *quality of light and the attributes of the section and envelope*, including the size, position, shape, and detailing of the building skin and "window(s)." *Use appropriate model materials to explore the section and building envelope (balsa, wire, mesh, translucent materials, metal, etc.). Please consider:*
   a. Spatial volumes and sequencing of volumes inside to outside
   b. Layering and/or character of the envelope and materials inside, at the window, or outside.
   c. Position of windows and size and distribution of windows.
   d. Window form and detailing to influence the quality of light (i.e. 2-D, 3-D, slots, slivers, walls of glazing, punched opening, deep reveals, etc.).
   e. Role of shadow as well as light

3. Annotated 1/16" Sections and Critique: Please develop one annotated section (at 1/16" scale) for each of your three design proposals to illustrate your design concepts, desired qualities of light, and intentions (what did you do and why?). Include a brief bulleted summary of your design intentions and lessons (strengths, weaknesses, what you would like to develop further).

4. Informal Pin-up: Please pin-up the following by 9:45 on Wednesday, January 30:
   - your images of nature, related words
   - annotated sections and critique
   - section models

Grading Criteria:
Project One: Phase 1: 10% total grade (100 points)
60%: Clarity and execution of design intention
40%: Craft and quality of design proposal

Mystery
Celebration
Silence
Joy
Calm
Compassion
Clarity
Wisdom
Reflection
Connection
Renewal
Meditation
Rest
Inspiration
Balance
Community
Clarity
Reverence
Time
Seasons
Cosmos

PHASE 1: Pin-up Due: Friday, January 27, 10:00 on mezzanine (pin-up by 9:45)

Site and Bioclimatic Analysis: A Story of "Place"

(Site and bioclimatic study: suggested time limit: 1/2 day)

Before beginning, please complete the reading for the charette. Take time visit the site under varying conditions (clear vs. overcast conditions; morning vs. afternoon; calm vs. windy day; etc.). After you have become familiar with the "moods" and qualities of the site, develop a graphic analysis of the site and bioclimatic design opportunities. Your team is asked to use words, images, collage, sketches, or other graphic or media to create an analysis and to define your interpretation of the "narrative" or "story" of the site and building. *Prepare an "informal" graphic presentation for January 27.* Divide the workload between your team members. Please consider:

1. *Site and Bioclimatic Forces and Features: Prepare an analysis of the physical forces and features of the site and building (e.g. annotated photos, Ecotect weather data, site/building diagrams, and/or mapping overlays to consider the site and building phenomena and building metabolism). You should consider:*
   - Context: *Google Earth* photos: adjacent buildings impacts; optional Ecotect Solar Tool studies of site
   - Seasonal changes for your climate (sky conditions, temperatures, relative humidity, weather patterns)
   - Sun path for your climate and site
   - Prevailing wind patterns for your climatic and site
   - Views into and out of the site (existing or proposed)
   - Noise and other sources of pollution (existing or mitigated)
   - Impacts of adjacent buildings (existing or proposed)
   - Contours. drainage, water features; phase change of water and seasonal issues (existing or proposed)
   - Vegetation, landscape issues, wildlife habitat (existing or proposed)
   - Pedestrian and vehicular circulation (existing or proposed)
   - Other: identify any other factors that may influence the ecological site and building design response.
2. *Site and Luminous and Thermal Phenomena: Use annotated photographs to capture the quality and character of the luminous, and thermal experiences and phenomena on the site; consider the opportunities to celebrate diurnal or seasonal phenomena (sun, wind, water, rain, snow, landscape, habitat, day/night, etc.).*
3. *Indoor Environmental Quality Assessment: Assess the existence of lighting, thermal, acoustical, indoor air pollution or other environmental quality problems that could be mitigated as a result of the proposed project.*
4. *Site/Building Journey: Use photographs or annotated diagrams to assess the movement and experience through the site and building; consider the sequence of luminous, thermal, and site events (inside/outside).*
5. *Construction & Enclosure: Use photos or diagrams to assess the relationship between the inside/outside; consider materiality, degree of enclosure, elevations and skin, and connection to site and place. Develop an inventory, written or graphic, of the existing materials, structural systems, and other building systems that may impact the proposed project.*
6. *Experiential and Poetic Opportunities: Use text, images, or diagrams to consider the experiential and poetic ecological opportunities of the site and building.*
7. *CONCLUSIONS: Site and Bioclimatic Design Interpretation and Story?: Develop a summary of the bioclimatic and ecological design opportunites have you found on the site and at the building scales,What do you want to elevate and reveal through design? How would you decribe the story of the site and building?*

PHASE 2: Due: Monday, January 28, 10:00 in the courtyard (pin-up by 9:45)

Site & Bioclimatic Design "Charette"

You are asked to develop concept studies and *at least* THREE design proposals exploring the building siting and massing based on your "Site & Bioclimatic Analysis" and related "design concepts" for the mnZED Lab. Keep in mind that this is a "charette," which is intended to open ideas.

PART A: 1/32" Site/Massing Physical Concept Models (study models):

(suggested time limit: ½ day)

1. 1/32" Concept Models: Based on your site analysis and conclusions develop at least SIX different concept studies using physical models at 1=32" that interpret the design opportunities of "place" and "site" for the "mnZED Lab" (minimum of 2 for each team member). Use balsa wood, cardboard, or other modeling materials. Feel free to generate as many ideas as possible. Include the new portion of Rapson in the 1/32" study models (consider using one base model of Rapson with alternative additions). Be mindful of the impact of adjacent surfaces and buildings (e.g. plan and sectional sketches are useful to explore relationships to adjacent buildings and spaces inside and outside). Photo-document your studies and related concepts to integrate into your graphic presentation.

PART B: 1/16" Scale Proposals: 1/16" Computer Studies and Drawings

(suggested time limit: ½ day)

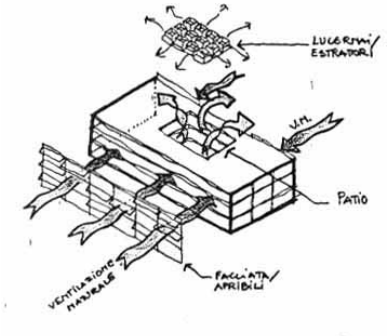
You are asked to select THREE of your "concept models" for further development via drawings and computer renderings at the scale of 1"=16' (at least one per team member).

1. Site/Building Plan and Section Drawings: Develop annotated plans and section drawings (include the earth/site) at 1"=16' to illustrate your site and bioclimatic design concepts related to daylighting and thermal design to illustrate three of your selected concept models (one per team member).
2. Concept Diagrams and/or Isometrics (see diagram below): Develop annotated concept diagrams to illustrate your site and bioclimatic design concepts for the 1/16" proposals (one per team member).
3. Ecotect Data: Include your bioclimatic data from Ecotect. Include a brief summary of the climatic design implication for the data (team only).
4. Qualitative experience: Include words, images, writing, etc. or other media that capture the quality of light and thermal experience for each 1/16" proposal (one per team member).
5. Optional: Please add any additional images or studies that would be useful to explain your design investigations:
   - Optional 1/16" study models: build the study models from balsa wood with a chipboard site. You can focus only on the "old Rapson" portion of the building at the 1/16" scale.
   - Optional Time Sequence Studies: Photograph your 1/16" models outside to study the diurnal and seasonal transitions (e.g. use a 45ºNL sunpeg to photo models at June, Sept/Mar., and Dec. 21 at 9:00, noon, and 3:00).
   - Solar Path Studies: use the Solar Tool from Ecotect at the building massing scale (e.g. morning, noon, and afternoon for June, March/Sept, and Dec. 21).
   - Time sequence photographs of the 1/16" study models (see #2 above).
   - Other relevant issues.

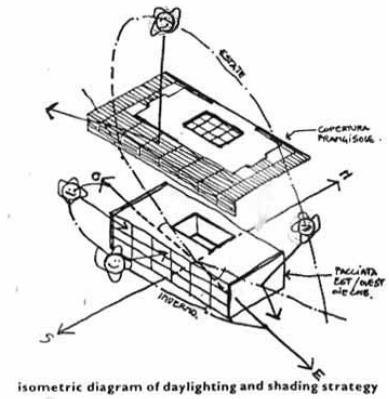
Submission Requirements: Design Charette

The design proposals should include models and graphic representations using a 24"x36" vertical presentation format. Keep in mind that this is a "charette"; sketches are acceptable. *Please identify the name of the team member who developed the 1/32" and 1/16" design proposals. Label all plans, elevations, sections and other diagrams. Include graphical scale and indicate "north" direction on all plans.*

1. *Phase 1: Site and Bioclimatic Analysis*: include a graphic summary with all site and bioclimatic analyses from Phase 1 (team)
2. *Phase 2: Physical Concept Models at 1/32"*
   - SIX Site/Massing Concept Models: 1"=32'-0" (minimum of two studies per team member)
   - Photo-documentation of 1/32" models for graphic presentation
3. *Phase 2: Graphic Presentation for each 1/16" proposal*
   - Site/building plans: 1"=16'-0" (one per team member)
   - Site/building sections: 1"=16'-0" (one per team member)
   - Site/building concept diagram(s) and/or isometrics of design proposal (see right; one per team member)
   - Supporting photos, sketches, text as useful (team)
   - Ecotect weather data (team)
4. *Phase 2: Optional*
   - 1/16" physical models
   - Time sequence studies of models
   - Ecotect Solar studies at the site/building massing scale



isometric diagram of ventilation strategy


isometric diagram of daylighting and shading strategy

Grading Criteria: To be submitted for grading with Project One

(the Charette will be 15% total grade for Project One: Daylighting)

Grading Criteria

- Clarity and craft of "Site & Bioclimatic Analysis"
- Overall craft of presentation boards and drawings
- Clarity, craft, and execution of design intentions demonstrated in the models and drawings