Orness Plaza: Integrating Health & Sustainability

Charrette to Grand Opening and Beyond– Integrated Design for Health and Environmental Improvement in Green Buildings—The Orness Plaza Study

Duluth Energy Design Conference

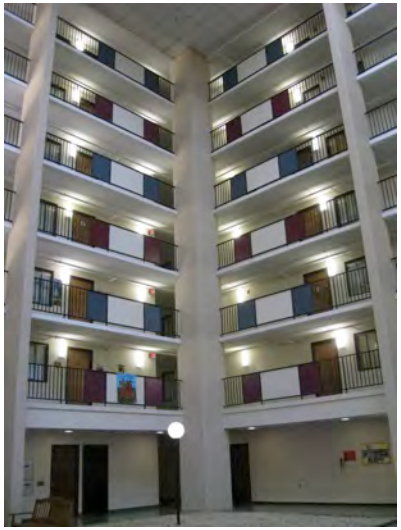
Matthew Casavant
Blumentals Architecture

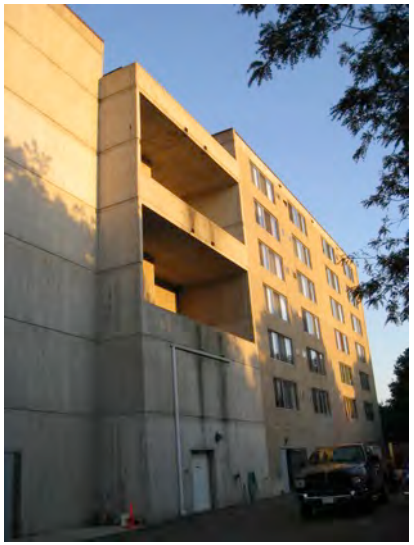
Jorge Lopez
Southwest Minnesota Housing Partnership

William Weber
Center for Sustainable Building Research, UMN

OBJECTIVES

1. Attendees will understand the make-up and importance of an integrated design team and a process to activate the expertise of the team including public health and building science experts
2. Attendees will gain awareness of the principles of sustainable design and design for health
3. Attendees will understand the process of goal setting and outcome metrics in project decisions making incorporating basic building science principles
4. Attendees will understand design and construction challenges of renovating a 1970s era apartment building while meeting sustainable goals in affordable housing—improving energy performance, durability and indoor air quality
5. Attendees will gain awareness of the building assessment process for environmental quality including TVOC and formaldehyde sampling
6. Attendees will gain awareness of the relationship of residential environments and health
7. Attendees will gain a fundamental understanding of health outcomes related to sustainable renovation





SESSION OUTLINE

Orness Plaza Project Overview (Jorge)

Building the Integrated Team/Charrette Process

Identifying key issues –envelope and mechanical systems
Working groups for key areas
Qualitative and quantitative factors in decision making

Design and Construction (Matt)

Enclosure of the balconies (simplifying the building envelope)
Exterior envelope details (increasing insulation)
Geothermal system (heating & cooling)
Building ventilation (indoor air quality)
Plumbing fixtures (water conservation)

Testing Outcomes (Billy)

Ventilation and exhaust systems
Energy and water use and cost (pre and post)
TVOC and Formaldehyde testing
Temperature and Rh monitoring outcomes
CO2 monitoring

Health Study Outcomes (Billy)

Q and A

ORNESS PLAZA





ORNESS PLAZA OPTIONS

Do nothing?

Rehabilitate Existing Structure

Before

After

Demolition

Financial Options

Three to Four Options

Fannie Mae Mod Express Program

HOPE 6 Funding through HUD

Low Income Housing Tax Credit Program (LIHTC)

American Recovery and Re-Investment Act (ARRA) Grant

Funding for Orness Plaza

American Recovery and Re-Investment Act (ARRA)

Mankato EDA

SWMHP

Greater Minnesota Housing Fund (GMHF)

Minnesota Department of Employment and Economic Development (DEED)

TDC 9,862,985.62

Charrette

Intense Discussion
and Planning for Solving Design Challenges

Goals for the Project

Energy Conservation

Modeling/Commissioning/Testing

Water Conservation

LEED, or Leadership in Energy & Environmental Design with the U.S. Green Building Council

Minnesota Green Communities

Health Impacts

Buying American

Team Creation/ The First Team

Center for Sustainable Research from the University of Minnesota

National Center for Healthy Housing

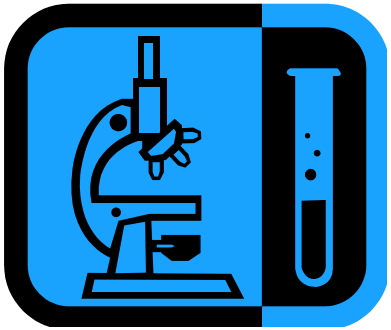
Questions and Solutions

SWMHP

The Mankato Economic Development Authority/Public Housing Authority

Funding for Charrette and Studies

Blue Cross/Blue Shield



Kresge Foundation

HUD – Evaluating Health Impact Through Pre- and Post- Health Testing

Selecting the Rest of the Team

Request for Proposal – Architects

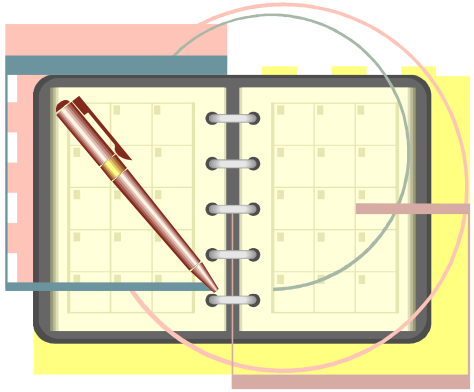
Request for Proposal - Contractor

Pre - Charrette Decisions

Exterior Remodeling System Options

- Concrete Panels vs
- Metal Panels vs
- Exterior Insulation and Finishing System (*EIFS*)

Construction Phases



Pre - Charrette Decisions

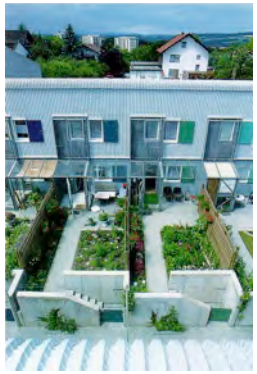
Topics for the During Charrette

Type of Heating and Cooling

More Topics for Discussion

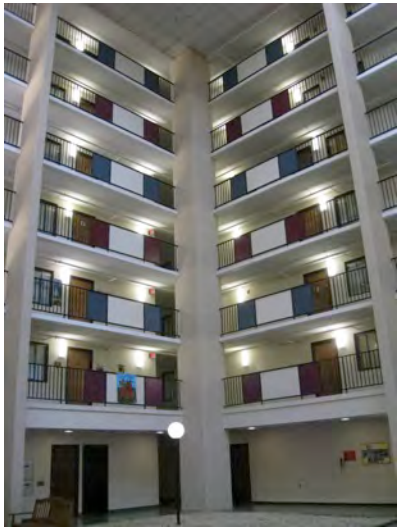
More Topics

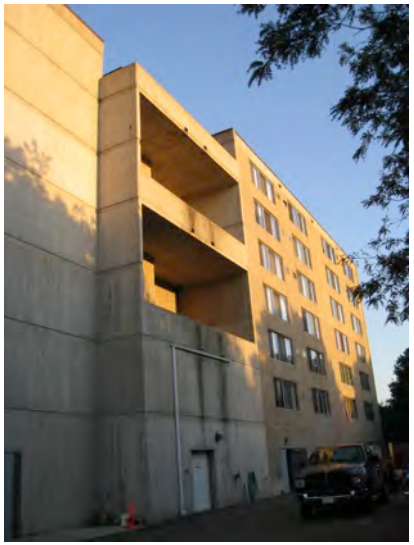





Orness Charette
Focus on Health: Integrated Solutions

2009 - 2010





CHARRETTE FORMAT

Pre-meet: Understand Project Intent

Full Day Charrette

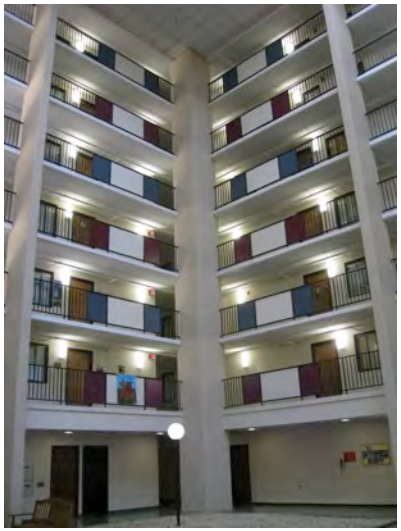
Follow-up:

- Working Group 1
  - Task Meetings
- Working Group 2
  - Task Meetings
- Ownership Meeting

Half Day Charrette - Integration Meeting

- Working Group Reports

PEOPLE



ownership team

owner - Mankato EDA

site staff – manager and maintenance sup.

developer – SWMHP

design/build team

architect – Blumentals Architecture, Inc

mechanical engineer – Steen Engineering, Inc

structural engineer – Ulteig

commissioning agent – Questions & Solutions

funders

Minnesota Housing

Greater Minnesota Housing Fund

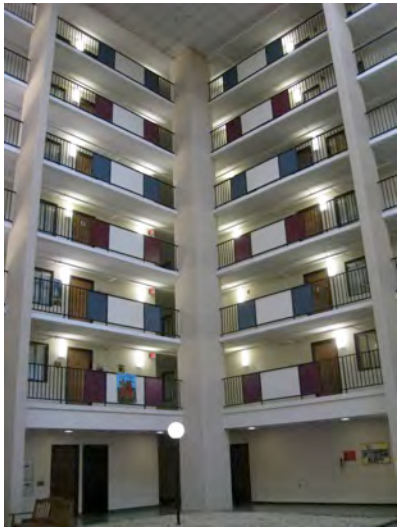
funders

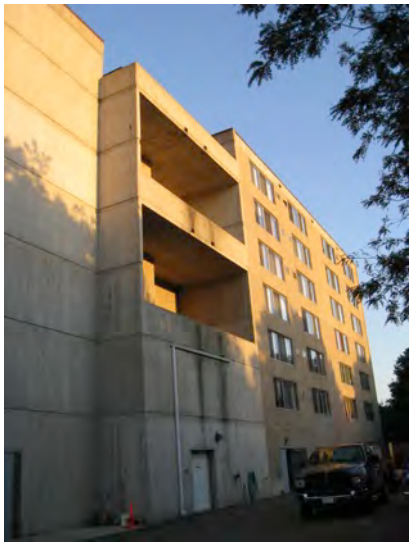
National Center for Healthy Housing

Building Envelope Council

Cold Climate Housing

Center for Sustainable Building Research





CHARRETTE OVERVIEW

Kick-off of the design stage for Orness

Gain understanding between building and health

Set Project Goals

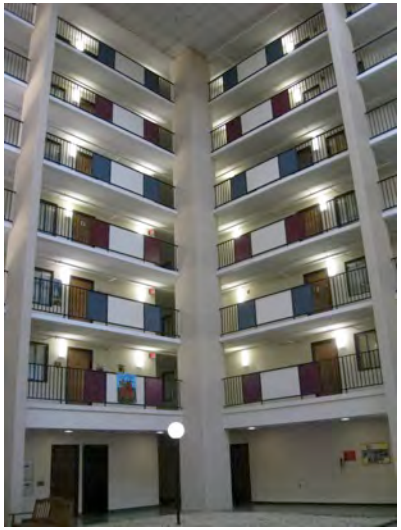
Work the Checklist.

- review criteria
- set performance goals

Introduce and outline critical issues.

- envelope
- mechanical systems
  - heating/cooling
  - solar hot water

Design Options



CHARRETTE AGENDA

9:00 Introductions

9:20 Project Introduction/tour (Jorge Lopez)

Overview – including intended scope; budget brief; etc.

10:00 Sustainability/Health (Dave Jacobs, NCHH)

10:30 Project Goals

Lunch

1:00 Working Session (All)

Mechanical System Options

Wall system Options

3:00 Next Steps

charette outcomes

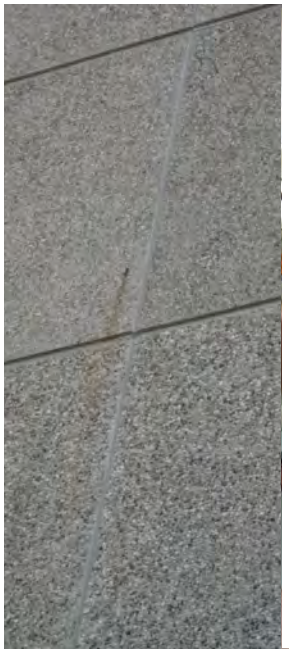
A better understanding between building and health

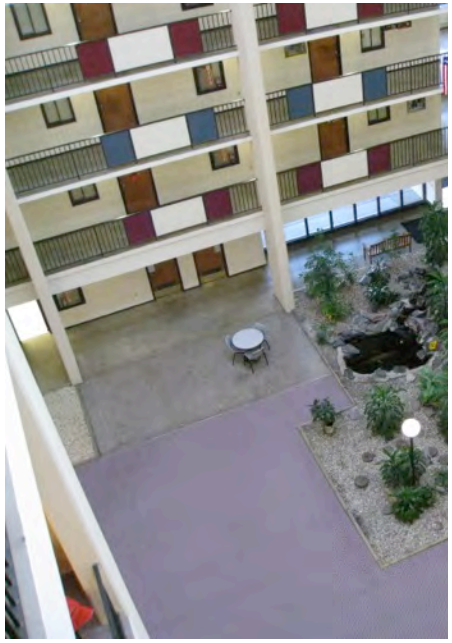
Updated Checklist.

Goals

Criteria for evaluating design options

Design Options to be investigated further.







Green Communities Criteria Checklist
Integrated Design Process
Location and Neighborhood Fabric
Site Improvement
Water Conservation
Energy Efficiency
Healthy Living Environment
green communities
Green Communities Criteria

2. Location and Neighborhood Fabric

2.1a Smart Site Location: Proximity to Existing Development

2.1b Smart Site Location: Protecting Environmental Resources

2.1c Smart Site Location: Proximity to Services

2.2 Compact Development

2.3 Walkable Neighborhoods

2.4a Smart Site Location: Make use of passive solar heating/cooling

2.4b Smart Site Location: Grayfield, Brownfield, or Adaptive Reuse Site

2.5 Compact Development

2.6 Walkable Neighborhoods

2.7 Transportation Choices

Site Improvements

3.1 Environmental Remediation

3.2 Erosion and Sedimentation Control

3.3 Landscaping

3.4 Surface Water Management

3.5 Storm Drain Labels

Water Conservation

4.1a Water Conserving Appliances and Fixtures

4.1b Water-Conserving Appliances and Fixtures

4.2 Efficient Irrigation

Energy Efficiency

5.1b Efficient Energy Use

5.2 ENERGY STAR Appliances

5.3a Efficient Lighting-Interior

5.3b Efficient Lighting-Exterior

5.4 Electricity Meter

5.5b Additional Reductions in Energy Use for Moderate Rehab

5.6a Photovoltaic Panels

5.6b Photovoltaic Ready

5.X Solar Hot Water

Materials Beneficial to the Environment

6.1 Construction Waste Management

6.2 Recycled Content Material

6.3 Certified, Salvaged and Engineered Wood

6.4a Water-Permeable Walkways

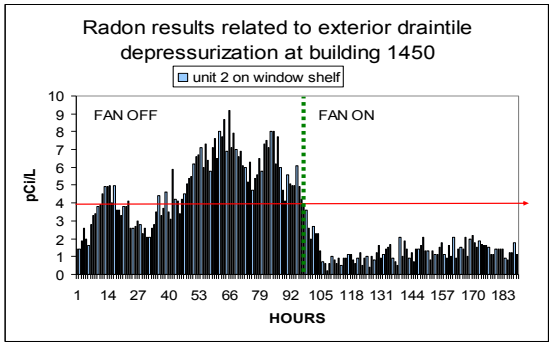
6.4b Water-Permeable Parking Areas

6.5a Reduce Heat-Island Effect-Roofing

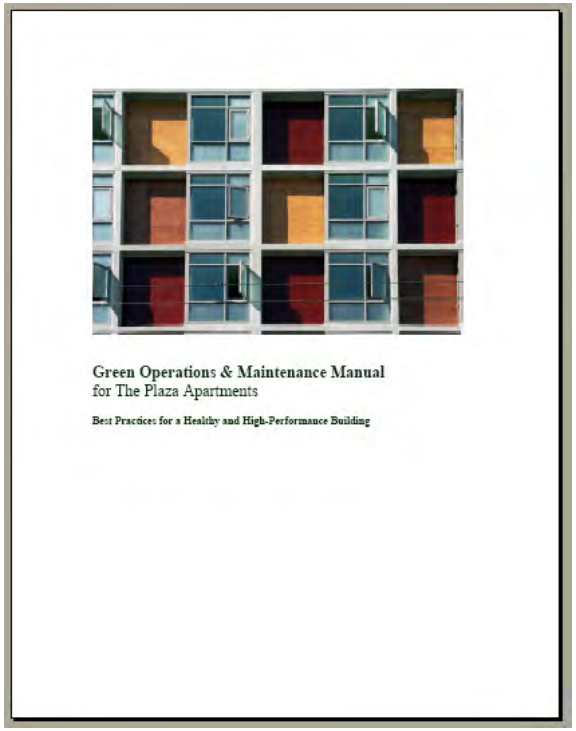
6.5b Reduce Heat-Island Effect-Paving

Healthy Living Environment

7.1 Low/No-VOC Paints and Primers
7.2 Low/No-VOC Adhesives and Sealants
7.3 Formaldehyde-free Composite Wood
7.4 Green Label Certified Floor Covering
7.5a Exhaust Fans-Bathroom
7.5b Exhaust Fans-Kitchen
7.6 Ventilation
7.7 HVAC Sizing
7.8a Water Heaters-Mold Prevention
7.8b Water Heaters-Minimizing CO
7.9 Cold Water Pipe Insulation



- 7.10a Materials in Wet Areas-Surfaces
- 7.10b Materials in Wet Areas-Tub and Shower Enclosures
- 7.11a Basements and Concrete Slabs-Vapor Barrier
- 7.11b Basements and Concrete Slabs-Radon
- 7.12 Water Drainage
- 7.13 Garage Isolation
- 7.14 Clothes Dryer Exhaust
- 7.15 Integrated Pest Management
- 7.16 Lead-Safe Work Practices
- 7.17a Healthy Flooring Materials-Alternative Sources
- 7.17b Healthy Flooring Materials-Reducing Dust

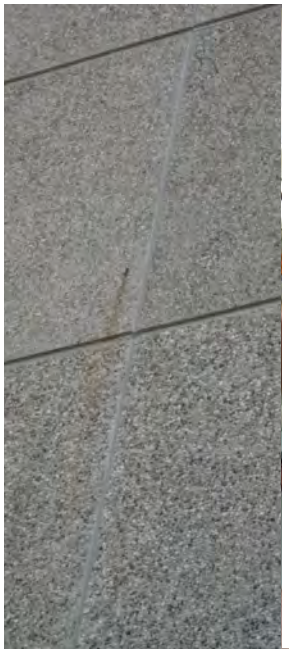


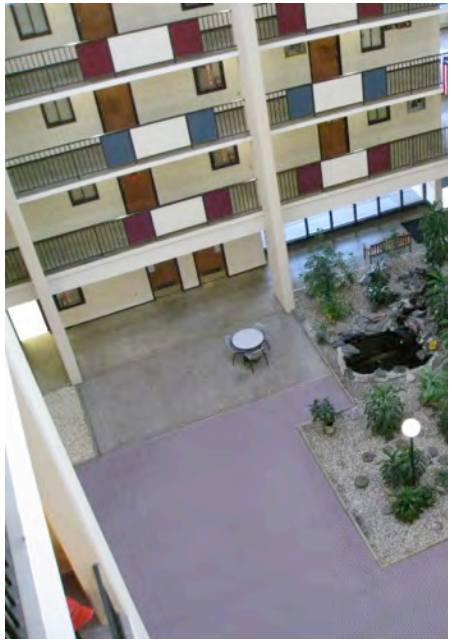
Operations and Management

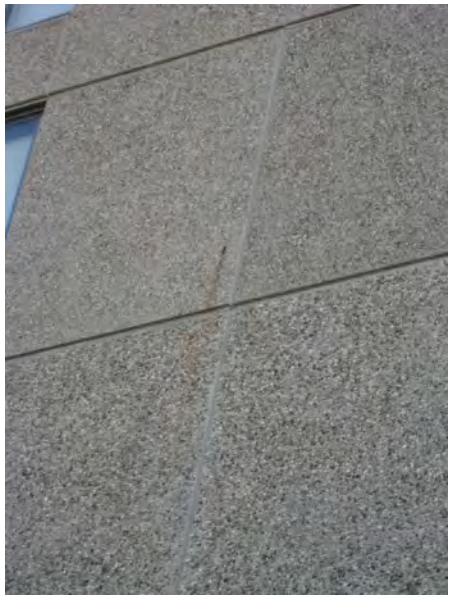
8.1 Building Maintenance Manual

8.2 Occupant's Manual

8.3 Homeowner and New Resident Orientation





brainstorming

What are the critical issues in the re-design of Orness Plaza?

What are the broad impacts?

What are the metrics to measure success?

Brainstorming - Outcomes

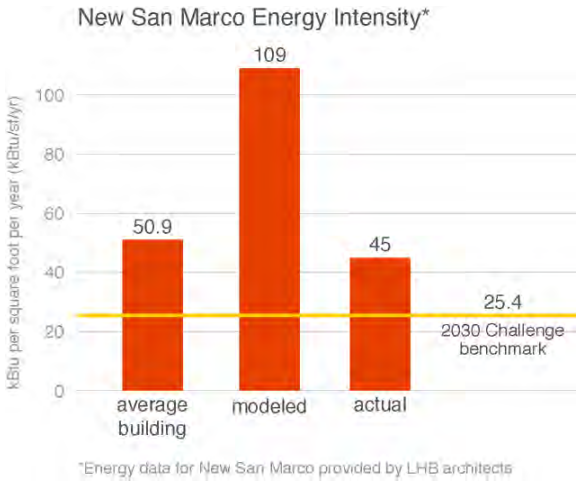
Preserve the housing stock

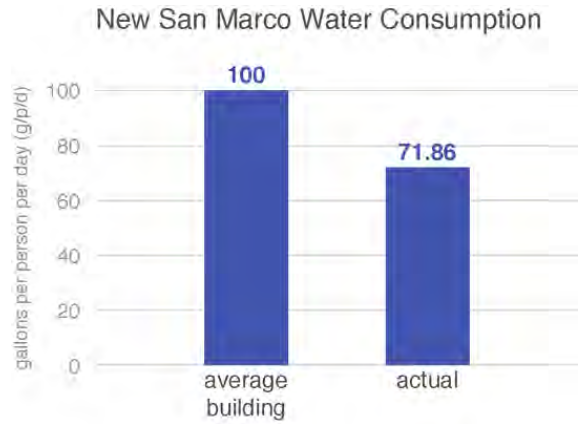
Improve energy consumption by 50% while improving living environments, resident health, and durability

Apply building science principles

Establish criteria for evaluation on outcomes

Divining information from utility bills





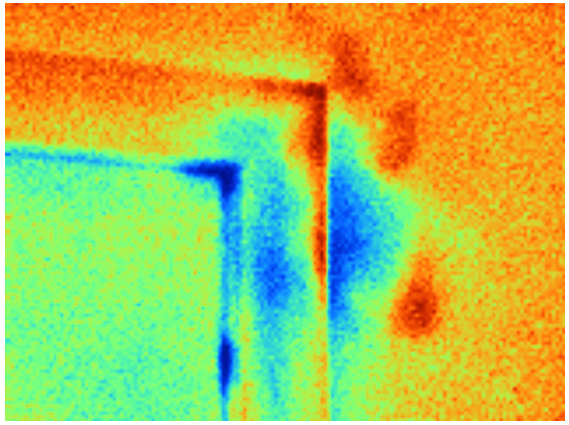
ENERGY – kBtu/SF Year
2030 Targets
Modeled/Predicted
Utility Bills

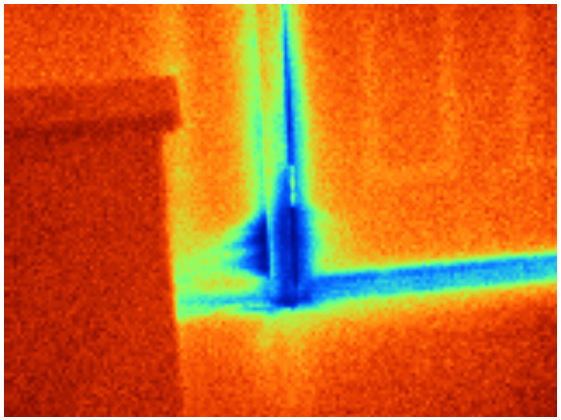
WATER – Gallons/Person/Day
Utility Bills

STORMWATER

TRANSPORATION/
VEHICLE MILES TRAVELED

COST
incremental costs
simple payback
typical projects





brainstorming

What are the design opportunities?

Energy

Thermal Comfort

Health (humidity control, mold)

Durability

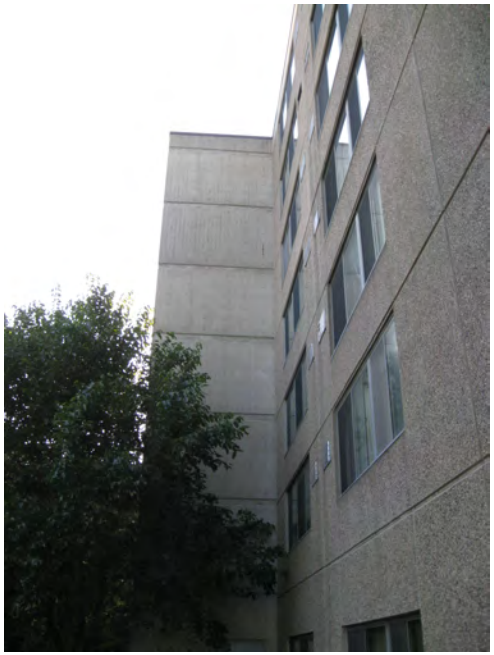
brainstorming

What are the critical issues in the design of the envelope?

…the heating and cooling.

…the ventilation system.

…how are the systems integrated.



Envelop options

remove replace existing concrete

1. insulated panel;
2. un-insulated panel with insulation on the interior

retrofit existing exterior without removal of concrete panels

1. EFIS over existing
2. metal pan finish over existing

Envelop Matrix

O - Optional; S - Somewhat; **Bold** - Integrated

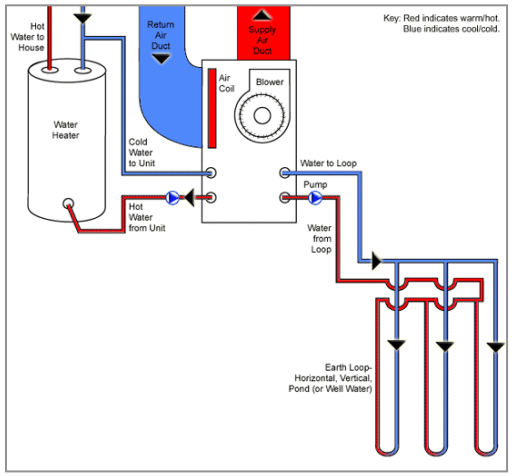
envelope options	continuous insulation	continuous air barrier	enclosed structure		thermal bridges	insulation levels (bld) R-value	fastener type	rain screen	recyclable	cost (budget)	Total Cost with increments	option description	insulation depth	Expected R-Value	panel size	warranty
EIFS	Y	Y	Y		N		bonded	N	N			Includes rolled water stop, aqua flash, 2" eps, mesh reinforcement to 6' above grade, 2 color finish - includes scaffold	2"	Summer R-7.7 at R-3.85/in; Winter R-8.7 at 4.35/in	Control joint location varies	10yr renewable, based on repairs as noted
												4" EPS in lieu of 2" EPS	4"	Assumed R-15.4 summer; R-17.4 winter		
												Additional insulation	12" maximum	?		
												Additional Panzer 20; est. $1.75-2.25/sf		Impact resistent upgrade on baseball facing side		
Metal Panel	Y	Y	Y		Yes - at points where panel attached to hat or z channel or other furring/support, which bridges to structure		clipped to z-channel / channel anchored to panel	O	Y			Furnish and install 2" insulation, framing and metal panel system, includes installation of ice and water shield at wall panel locations	2"	Between R-7.7 for eps and R-12.5 for polyiso	Max - 58" high by 192" long	Installers may have warranty, kynar finish (if specified) may carry warranty, panel manufacturer has 2-year workmanship warranty
												Additional insulation / Possible?	Depends on furring/design of z-channels and structure under panel	?		

Performance

r-value, continuous insulation, enclose structure, constuctability

Cost

Warranty



Mechanical systems options

heating/cooling

1. geothermal full system
2. conventional system
3. hybrid - piggyback geothermal on to existing system

ventilation

1. exhaust only
2. supply/exhaust

Mechanical Matrix

Orness Plaza Mechanical System Options

System Type	System Description	Pros	Cons	Efficiency Htg/Clg	Maintenance / Life Expectancy (LE)	HVAC Cost/Unit **
4-Pipe Fan Coil	Requires both chiller and boiler plant. Existing Boiler plant can be used as is. Chillers are located on the roof or on grade. This system has a double loop, one carrying cold water and one carrying hot water. Hi-efficiency 90+% condensing boiler sized at 30% load could be added for shoulder seasons.	365 days of comfort with the best comfort control can be heating and cooling on the same day in different parts of the building. Very quiet. Existing fin-tube radiation can be re-used. Concealed horizontal or vertical stacking fan coils available. Most widely used system for high-rise condominiums or apartments	Space needed for central chiller, which may require additional structural support and vibration isolation. Separate metering is difficult and expensive if required.	85% htg / 14 EER clg	Fan coils are relatively low maintenance. Filters Clean Coils Chiller is relatively low maintenance LE chiller = 25 yr LE fan coil = 20	$6500
VRF DX Split-System with HW Baseboard	Console type indoor cooling fan coils with HW heat. Ductless Fan coils are hung on wall. Multiple indoor units are piped to single condensers (up to 10 or 12 to 1). The DX lines capable of 300 feet distance from fan coil. Heat pump heat good to about 30 degrees F. Requires supplemental heat (HW baseboard).	16 SEER Cooling, 4+ COP heating (above 30 F). No FC closet necessary. No through-wall louver. Significantly reduces number of outdoor condensers. Good individual comfort control. Existing fin-tube radiation can be re-used.	Console wall unit is not concealed. Larger outdoor condensers required. Estimated 8 required; 4 on roof and 4 on grade. Heating only functions above 25 Deg F. Overall equivalent efficiency is about 2.5 COP	80% and 2.5 COP 16 SEER	Verify refrigerant charge Indoor wall units are relatively low maintenance Filters Outdoor condensers require routine service and cleaning LE = 15-20 yr	$7000
Geothermal Hybrid Heat Pump System	Geothermal vertical heat exchanger well field augmented with High efficiency boiler plant and Cooling Tower. A compressor then either runs forwards or backwards depending on whether you need cold or hot air. Like the old freezer defrost button.	Very good control, can be heating and cooling on the same day in different parts of the building.	Requires more maintenance due to refrigeration in each heat pump. Heat pumps with compressors can be noise concerns. Heat pumps require more access and are slightly larger than fan coils thus requiring larger closets. Heat pump heat is forced air and delivered at a cooler temp (~85 deg)	80% and 4+ COP 18 SEER	Heat pumps: verify refrigerant charge, filters, require routine service Supplemental cooling tower requires routine service and chemical treatment LE geo field = 50 yr LE heat pumps = 15-20 yr	$9,000

* Central duct system for make-up air ventilation is recommended for any chosen system and are not included in unit prices.

** Cost estimates are approximate and do not include plumbing, common amenity space heating/cooling and assumes boiler and heating distribution piping may be reused.

COP (Coefficient of Performance) -
A ratio calculated by dividing the total heating capacity provided by the refrigeration system, including circulatory fan heat (BTU's per hour), by the total electric input (watts) X 3.412 (Btuh/watt). By definition the COP of electric heat is 1.0.

EER (Energy Efficiency Ratio) -
A ratio of cooling capacity in Btu's per hour (Btuh) divided by Power input (watts) at any given set of rating conditions, expressed in Btuh per watt.

SEER (Seasonal Energy Efficiency Ratio) -
The total cooling of an air conditioner or heat pump in Btu's during its normal annual usage period for cooling divided by the total electric energy input watt-hours during the same period. Takes into account cycling as well as the electricity used by the indoor blower motor, outdoor fan motor, and compressor. Used in systems producing up to 65,000 Btu's of cooling (1-5 tons).

Orness Plaza
Design & Construction

- **Remedy exterior wall issues**
- **Increase energy efficiency**
- **Update building finishes**
- **Update building services**
  - **Mechanical, Electrical, Plumbing**
- **Provide more indoor activities**
- **Re-purpose unused spaces**

Orness Plaza
Design & Construction

- Design requirement from funding sources
  - ARRA Funds (American Recovery & Reinvestment Act
  - Enterprise Green Communities
- Building and zoning codes
- Accessibility requirements
- Self-imposed requirements
  - LEED (Leadership in Energy & Environmental Design

Orness Plaza
Design & Construction

1. Integrated Design
2. Site, Location, and Neighborhood Fabric
3. Site Improvements
4. Water Conservation
5. Energy Efficiency
6. Materials Beneficial to the Environment
7. Healthy Living Environment
8. Operations and Maintenance

Orness Plaza
Design & Construction

Sustainable Sites
Water Efficiency
Energy & Atmosphere
Material & Resources
Indoor Environmental Quality
Innovation
Regional Priority

Orness Plaza
Design & Construction

- **Occupancy during construction**
- **Existing building construction**
- **Spending deadlines**
- **Unforeseen conditions**

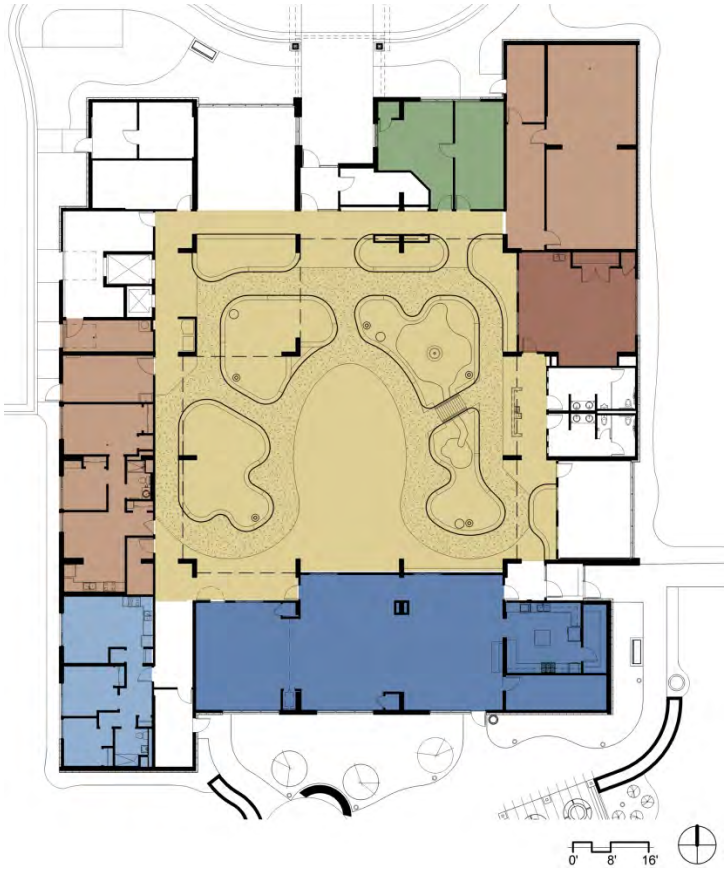
Orness Plaza
Design & Construction

Now that we have created goals, identified our requirements, and explored some of our challenges - what do we do now?

...more collaboration.

- **Engineers**
- **Consultants**
- **Owner**
- **City Officials**

Orness Plaza
Design & Construction

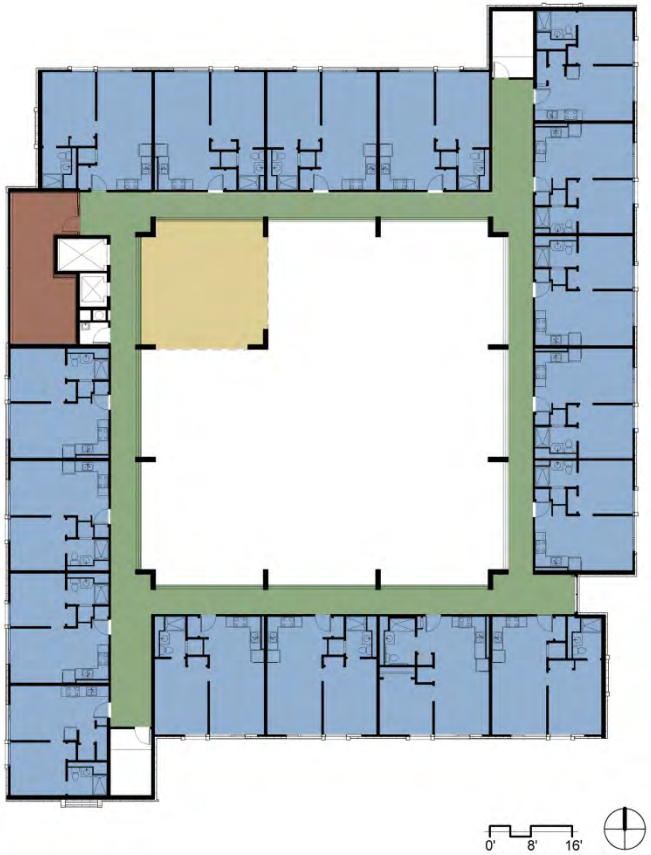


First Floor

Atrium
Community Room
Game Room
Office
Mechanical/
Maintenance

Building Section

Orness Plaza
Design & Construction



Upper Level Plans

Building Section

Orness Plaza
Design & Construction

Before construction starts, we have a few things to take care of…

Relocating residents, Construction screening, Recycling

Orness Plaza

Building Commons – Atrium Before Construction

Empty space

Dated color scheme

Uninspired landscaping

Orness Plaza

Building Commons – Atrium During Construction