



RAWstudio
an unaltered natural state

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Key Concepts to Sustainable Building Enclosures

Sustainable Timeline

- 1962 Rachel Carson's book *Silent Spring*
- 1970 1st Earth Day (recycling symbol born)
 - Boy enters symbol in contest by Container Corporation of America (CCA)
- 1970 OSHA Requirements
- 1970 EPA Formed
- 1971 GreenPeace
- 1973 Oil Embargo/Oil Crisis

Sustainable Timeline Con't

- 1977 DEP Created
- 1980 Superfund
- 1986 OSHA requires MSDS Sheets
- 1988 ECP est. in Canada
- 1989 Green Seal in U.S.
- 1990 Pollution Prevention Act

Top 10 Environmental Concerns

- Climate Change
- Energy
- Water
- Biodiversity & Land Use
- Chemicals, Toxics, and Heavy Metals
- Air Pollution
- Waste Management
- Ozone Layer Depletion
- Oceans and Fisheries
- Deforestation

(Source: Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage, by Daniel C. Esty and Andrew S. Winston)

What is Sustainability?

- Green?
- LEED®?
- Just “Sustainable”?

Sustainability

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

(Source: Grundtland Commission)

Sustainability

The practice of

- increasing the efficiency with which buildings and their sites use energy, water and materials, and
- reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal – the complete building lifecycle.

Green Rating Systems

- LEED® - USGBC
- Green Globes - GBI
- SPiRiT
- CHPS
- ENERGY STAR - DOE
- Sustainable Building Industry Council (SBIC)



What Matters?

- Does a project need to be LEED® certified?
- Does it require any certification to be sustainable?
- How do WE create Sustainable Projects?

Sustainable Building Enclosures

6 Fundamental Principals for Sustainable Building Design

- Optimize Site
- Minimize Energy Consumption
- Protect and Conserve
- Use Environmentally Preferred
- Enhance Indoor Environmental Quality (IEQ)
- Optimize Operational and Maintenance Practices

Sustainable Building Enclosures

Sustainability has become an increasing priority for projects. For the design and construction of buildings, there is an importance in the interface between the indoor and outdoor environments...this is the Building Envelope. The building envelope consists the foundation, walls, roof, windows, doors and floors.

Functions of a Building Envelope:

- Provide shelter, security, solar and thermal comfort, moisture control, indoor air quality, access to daylight, views to the outside, fire resistance, acoustics, cost effectiveness, and aesthetics.

Based on the idea of meeting all of these functions of a Building Enclosure, a synergistic Whole Building Approach is required.

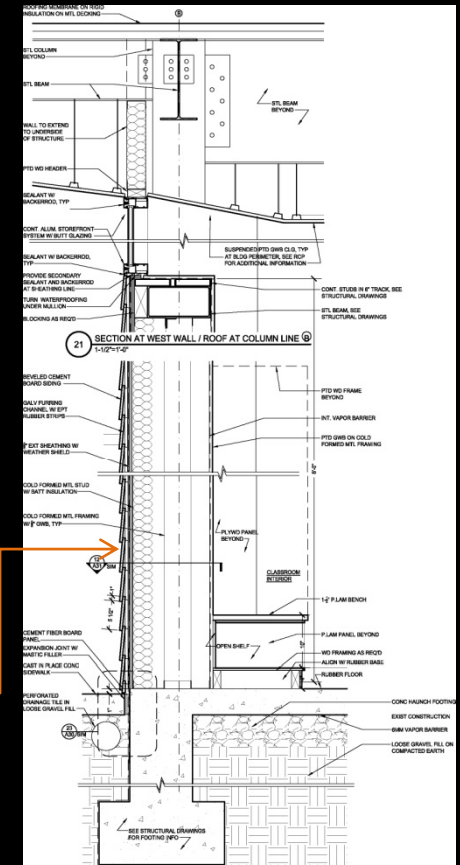
Sustainable Building Enclosures



Moisture Migration Priorities
Significantly more water vapor travels through a wall by air leakage than by diffusion.

Vapor diffusion – 2/3 pint of water per heating season

Yet air leakage through a 1/2" hole – 50 pints of water per heating season



Sustainable Building Enclosures

Environmental Hazards

Much of the US contains environmental hazards. Only through proper detailing of building enclosures, can this be prevented.



Sustainable Building Enclosures

Design Approaches

- Daylighting
- Renewable Energy: Solar, Integrated PhotoVoltaic (IPV) Curtainwalls
- Building Shape, Orientation, and Size
- Local Climate
- Thermal Efficiency

System Approaches

- Glass Curtainwalls
- Double Skin Facades
- Green Roofs
- Rainscreen Systems
- Experimental Enclosures

Daylighting

“Daylighting is the practice of bringing light into a building interior and distributing it in a way that provides more desirable and better quality illumination than artificial light sources.” - Loren Abraham



Clinton Presidential Library – Polshek Partnership



NY Times Building – Renzo Piano

Daylighting

Daylighting Practices

Programming Phase

- Establish daylighting performance objectives
- Analyze lighting performance needs

Preliminary Design

- Establish basic daylighting parameters as part of building design

Design Development

- Specify details for lighting systems and products

Construction

- Confirm that specified practices and materials are installed properly.

Post Occupancy

- Ensure that the buildings daylighting features are in place and maintained for optimum performance

Daylighting

Lighting Principles and Strategies

- Avoid direct sunlight on critical tasks and excessive brightness
- Bring the daylight in at a high location
- Filter the daylight
- Bounce daylight off of surrounding surfaces
- Integrate daylight with other building systems and strategies
- Use curved or sloped ceiling planes
- Optimize overhangs based on window height
- Incorporate light shelves with windows
- Integrate daylighting with lighting controls
- Consider selective glazings
- Consider switchable glazings



Renewable Energy

Renewable Engery

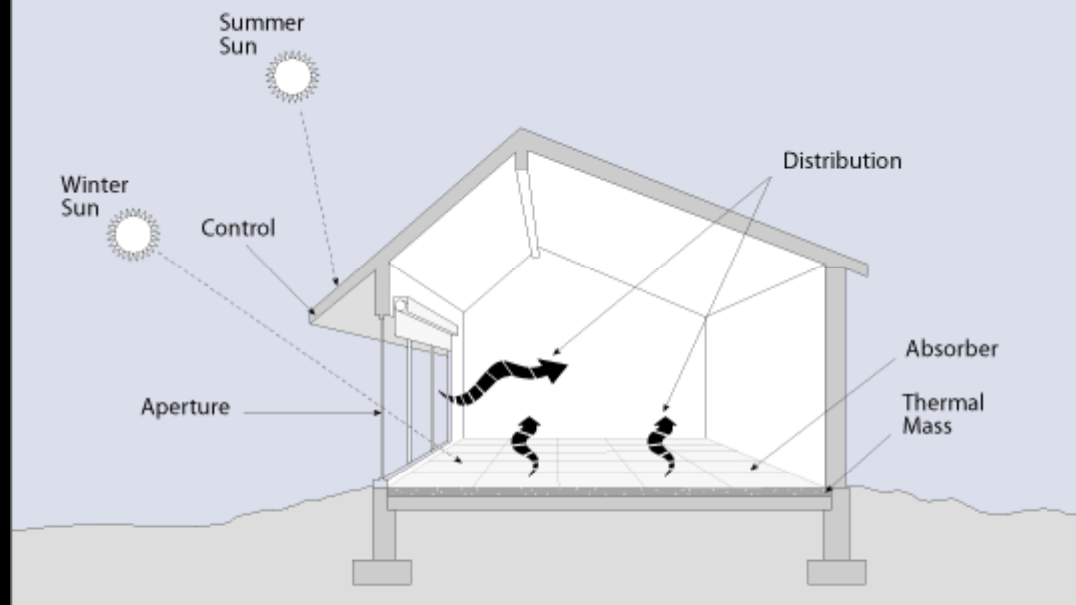
Passive Solar Energy

Windmill Energy

Solar Power



Five Elements of Passive Solar Design



Renewable Energy

- Integrating Solar Panels into building enclosure and roofs
- Building Integrated PhotoVoltaic Glass Curtainwall



Building Shape, Orientation, & Size

- Choose the most compact building footprint and shape that works with the requirements for daylighting, solar heating and cooling, and function.
- Site and orient the building so as to minimize the effects of winter wind turbulence upon the envelope.



Local Climate

- Asses the local climate to determine the appropriate envelope materials and building design.
- Assess the site's solar geometry.



Thermal Efficiency

- Determine the building function and amount of equipment that will be used.
- Build walls, roofs, and floors of adequate thermal resistance to provide human comfort and energy efficiency.
- Consider the reflectivity of the building envelope.
- Prevent moisture buildup within the envelope.
- Specify construction materials and details that reduce heat transfer.
- Consider earth berms to reduce heat transmission and radiant loads on building envelope.



Potential LEED® Points

Sustainable Sites

- SS Credit 5.1, Site Development: Restore Habitat (Green Roof)
- SS Credit 5.2, Site Development: Maximize Open Space (Green Roof)
- SS Credit 7.2, Heat Island Effect, Roof (White Roofs)

Material and Resources Category

- MR Credit 3.1, Material reuse 5% (1 point)
- MR Credit 3.2, Material reuse 10% (1 point)
- MR Credit 4.1, Recycled content 10% (1 point)

Environmental Quality

- EQ 1 – Energy performance
- EQ 6.2, Controllability of Systems: Thermal Comfort (Operable Windows)
- EQ 7.1, Thermal Comfort Design (HVAC & Building Enclosures)
- EQ 7.2, Thermal Comfort Verification (Survey 6-18 months Post Occupancy)
- EQ 8.1 Daylight and views, 75% of spaces (1 point)
- EQ 8.2 – Daylight and views, 90% of spaces (1 point)

Innovative Design

- ID credits 1-1.4 (1-4 points)

Sustainable Building Enclosures

- Curtainwalls & Double Skin – NY Times Building
- Double Skin Facades – Clinton Presidential Library
- Green Roofs – Clinton Presidential Library
- Rainscreens – Boy's Club of NW New Jersey
- Experimental Enclosures – Sam Mockbee, Rural Studio

Glass Curtainwall

NY Times Building – Renzo Piano Building Workshop



Double skin facades of any form include an outer façade, an intermediate space, and an inner façade.

Glass Curtainwall

NY Times Building – Renzo Piano Building Workshop



A double skin building enclosure clads a steel framework. The first layer of skin is a glass curtainwall allowing for a transparent appearance. The second skin consists of ceramic white tubes on an aluminum frame to shield the glass from direct sunlight. The irregularly spaced tubes bounce daylight up to the ceiling, throwing it into the tower's interior.

NY Times Building Mock-up – Renzo Piano

Glass Curtainwall

NY Times Building – Renzo Piano Building Workshop



Glass Curtainwall

NY Times Building – Renzo Piano Building Workshop



Double Skin Facade

Clinton Presidential Library – Polshek Partnership



Double Skin Facade

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Double Skin Facade

Clinton Presidential Library – Polshek Partnership



High performance curtainwall glass reduces heat gain by the use of ceramic frit, double skin technology and a double glazed high performance inner assembly. The building uses 34% less energy than a similar building designed to meet the energy code.

The buildings west screen wall, which is separated from the curtainwall by an exterior walkway, acts as a sunscreen for the museum, protecting museum objects and substantially reducing the air condition required to cool this space.

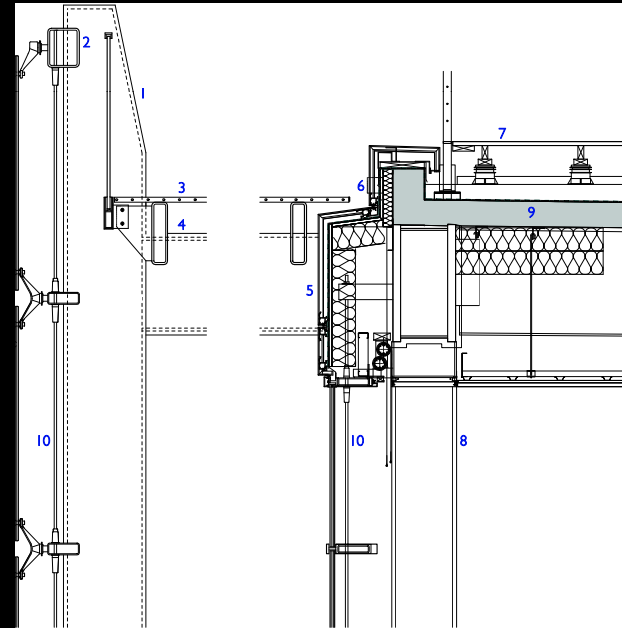
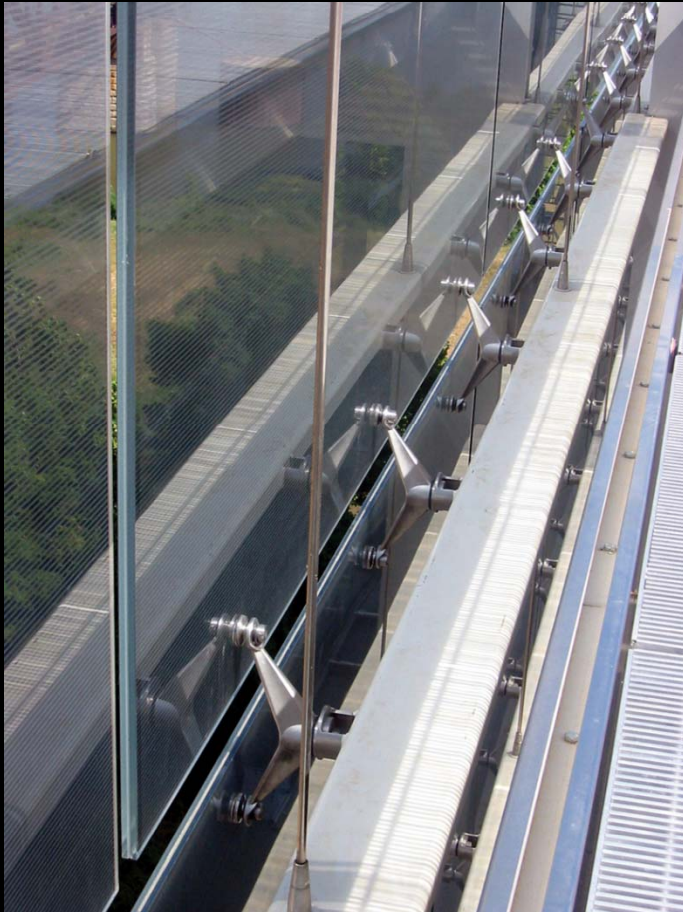
Double Skin Facade

Clinton Presidential Library – Polshek Partnership



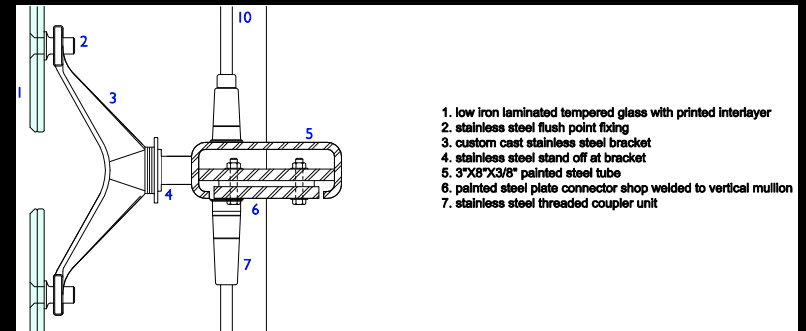
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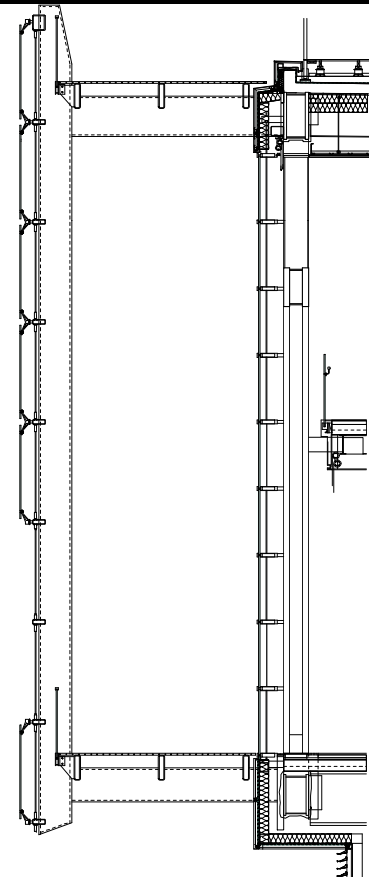
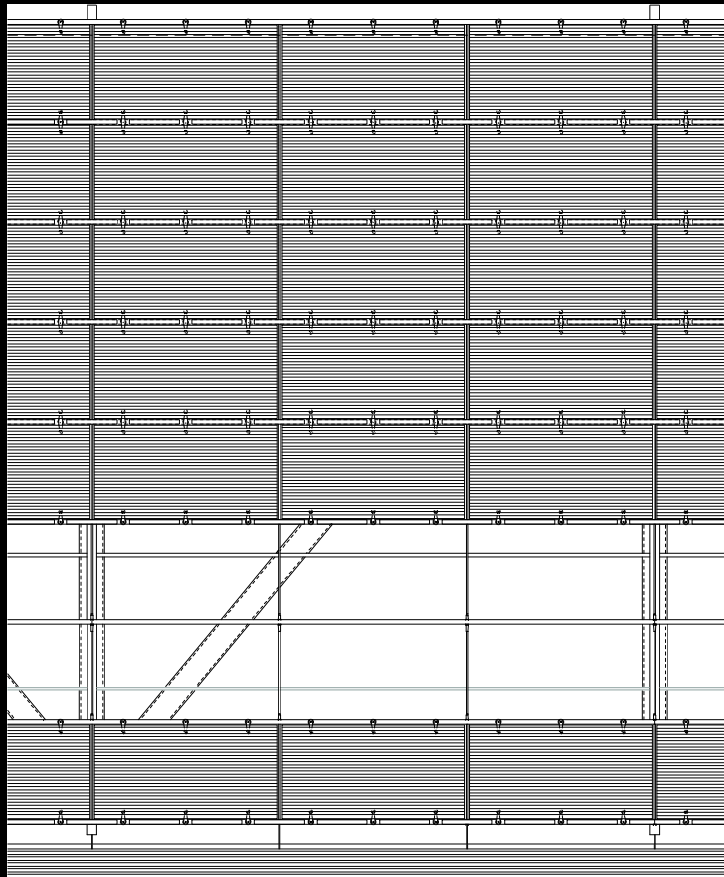
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Green Roofs

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Rain Screen Systems

Boy's & Girl's Club of NWNJ – RAWstudio



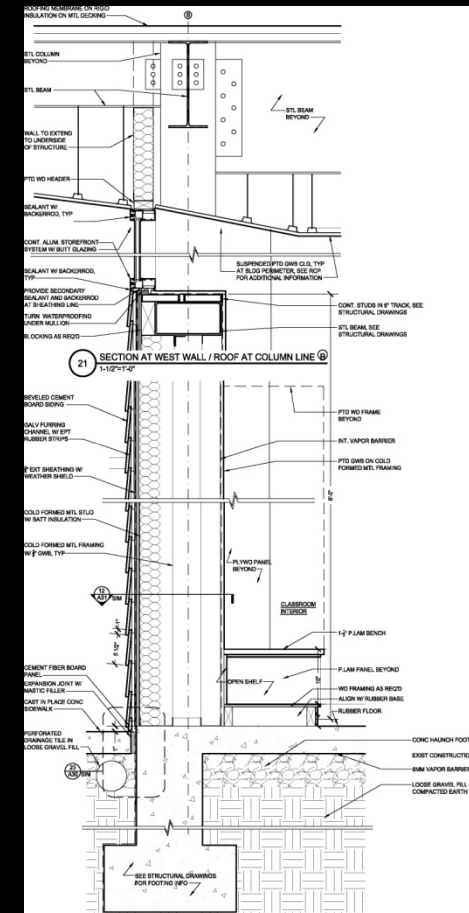
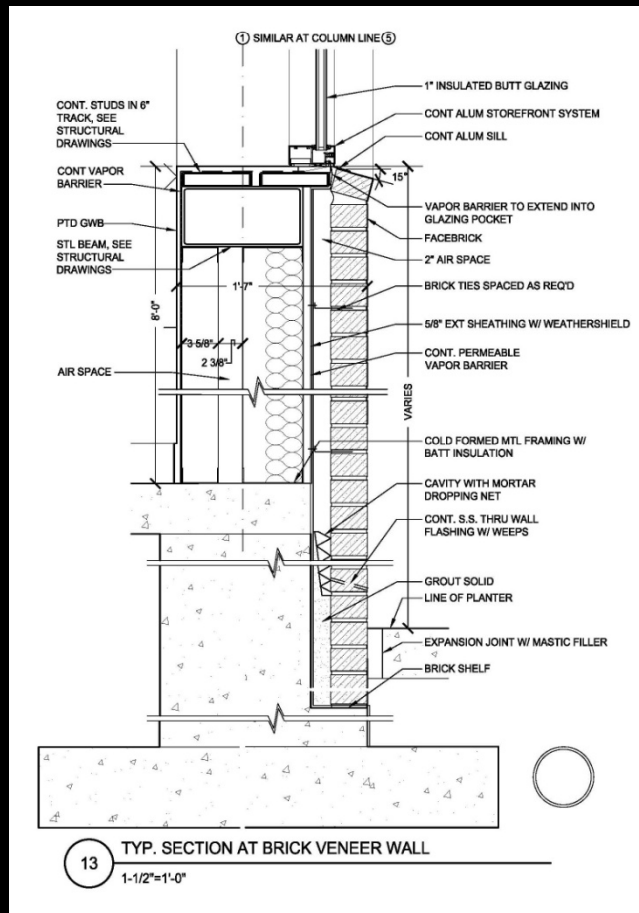
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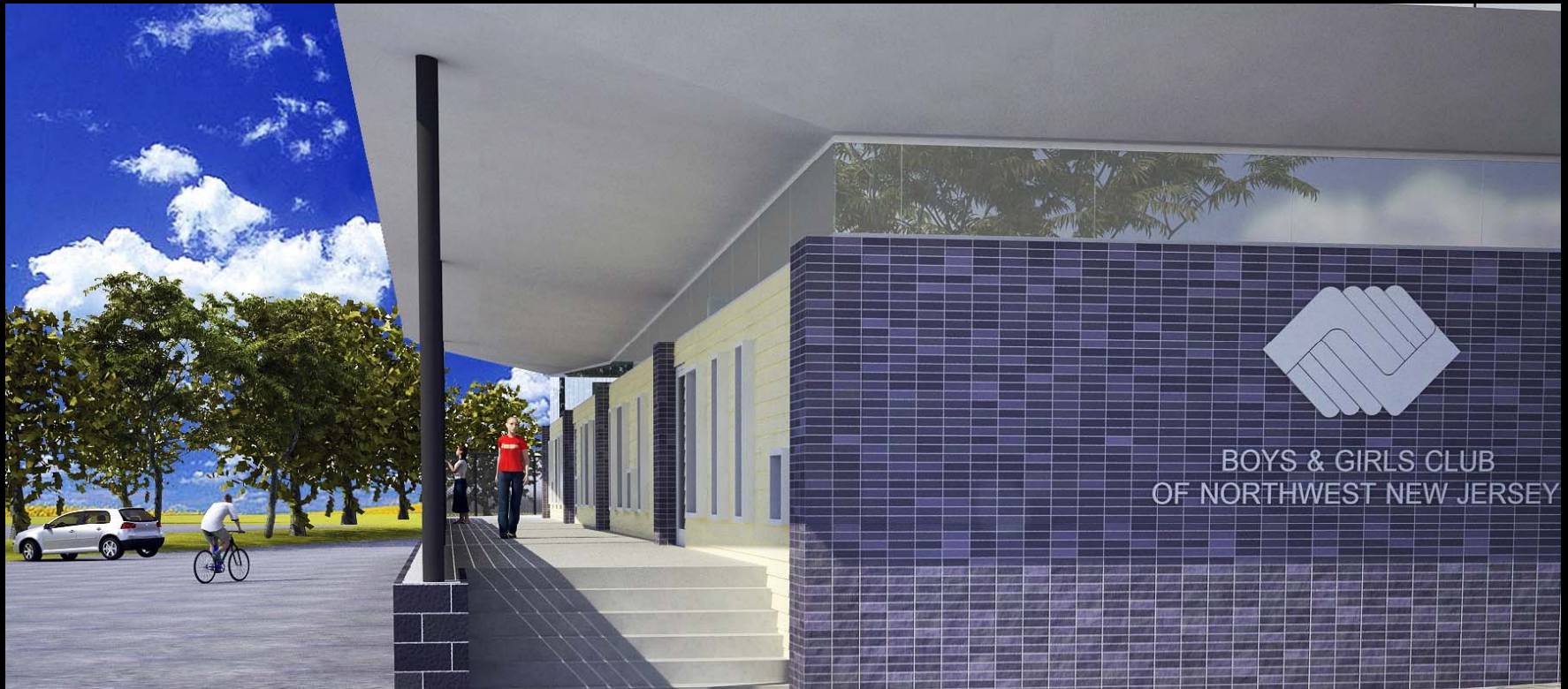
Rain Screen Systems

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Experimental Enclosures

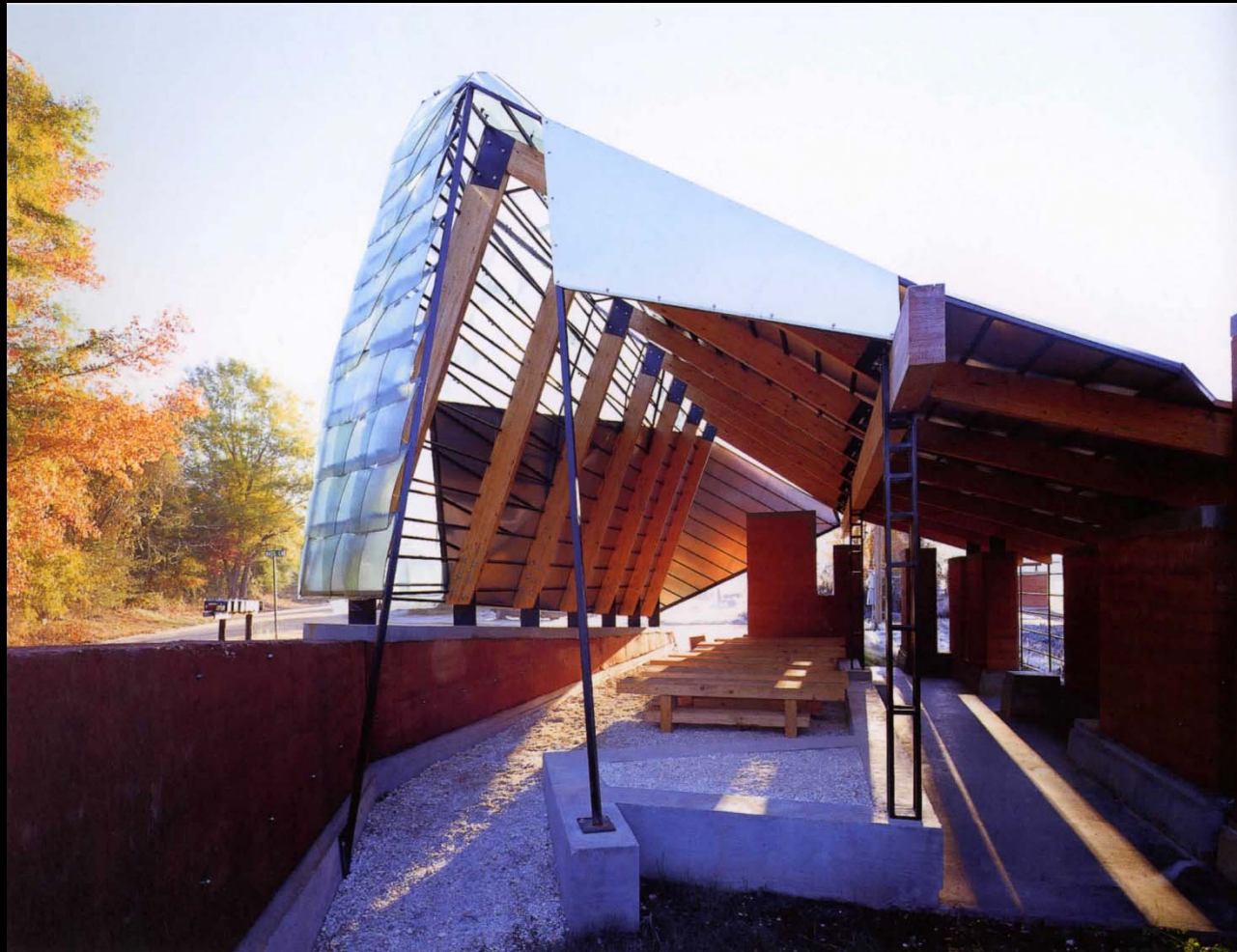
Rural Studio



Masons Bend Community Center – Rural Studio

Experimental Enclosures

Rural Studio



Experimental Enclosures

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Experimental Enclosures

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Experimental Enclosures

Rural Studios



Lucy's House – Rural Studio

Experimental Enclosures

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