Indianapolis Math and Science Academy

An Honors Thesis

by

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April 2008

Graduation: May 2008
Abstract:

The Indianapolis Math and Science Academy design project represents a comprehensive capstone project that was originally part of a design competition. The project included all aspects of the design process, including preliminary site visits and meetings with the client, as well as full schematic and technical design development. This project allowed for students to fully produce a comprehensive design that not only represents a great level of detail and thinking, but exposed the numerous layers of information that must be gathered to produce such a design. I have included all documentation of the design process, the final product that was entered into the competition and a personal reflection on the project.

Acknowledgements:

I would like to thank my studio professor and Honors Thesis Advisor, Andrea Swartz for all her help and advise throughout the design process this year, as well as overseeing my work on this project.
The Indianapolis Math and Science Academy design project is located along 38th Street in Indianapolis Indiana. The program for this design was intended to be the addition of a high school learning facility to an existing retrofitted middle school. The original use of the middle school was actually a Toys R Us store which made for an interesting backdrop for a well designed charter high school. We were able to approach this project from any angle and the unlimited original guidelines allowed me to investigate the impact of specific formal moves in the environment. The project was taken in many different paths by students; however, my intention was to utilize the existing framework of the site and develop my design strategy around it.

The concept I derived for my building is directly related to the first site visit for the project. Immediately upon arrival I was aware of the harshness of the manmade landscape while approaching the existing middle school. The surrounding site consisted of shopping centers, strip malls, and fast food restaurants, which is not the best environment for a learning facility in my opinion. What I found most interesting about the site arose after passing the existing middle school building. It acted like a buffer zone from 38th Street for the beautiful natural site condition behind it. What existed currently was a large parking lot with a dense natural barrier to the south. Once in this parking lot, I immediately felt enclosed and privatized as compared to the initial feeling of exposure and overwhelming noise and pollution. I thought it was very interesting that a site as calm as this could exist in such an urban landscape. I continued this thinking while developing a concept for the project. The high school would further enhance the feelings of safety, privacy and movement into a new landscape by becoming the transition from the harsh commercial district, described by hard manmade surfaces, to the under-utilized natural environment to the south. The school would create a sense of ownership and pride in the students and faculty as its protection and separation from the outside world would place privilege on them as charter students.
Numerous site visits and analysis, along with meeting with faculty of the middle school aided in the development of this project greatly. Rather than a fictional site and client, this capstone project pushed us to examine some factors that can easily affect the design that are out of our hands. After my initial site visits and project concept, I began by examining precedent studies and decided what avenue to take with the building. The final product became something quite bold but through material and form it can easily be seen to transition from the north of the site to the south. I designed a structural system that consists of tradition steel section combined with unique custom sections to create a very dynamic formal system. The building skin has two main components; the lower half consists of reclaimed wood siding and shingles that reference the natural southern edge and the upper portion consists of a tightly wrapped metal skin that begins to unfold and lift away from the lower element to allow access to numerous views to the south and west, while providing northern light into each lab space, and allowing vertical movement and inhabitancy of the lofted space. This skin acts as a transition in itself, as the northern portion of it is completely solid, with slight perforations for light, and the southern edge lifts away enough to provide a third level and roof access, becoming increasingly perforated to let light deep into the building. The program within the building reflects the formal moves of the exterior and the transition to the south. Traditional class rooms and administration are located to the north as a first experience by visitors and users, while interactive lab spaces, interior-exterior dining areas, and the resource center are reserved for the southern end.

The Indianapolis Math and Science Academy was my most comprehensive design project at CAP and not only was it beneficial for me as a designer, it allowed me to express some of the ideas I have not had a chance to experiment with thus far. I feel like it was a successful project and I think for this competition it contained a level of detail that exceeded satisfactory, yet I can not help feeling like I would take it further if I had had the time. Upon reflection on the project, there
are many layers of information that I would be able to further develop including interior work, and connection details. Imbedded in the design are some sustainable issues, yet I still feel like this agenda could have been pushed much further in the design. Rethinking this project with that concept as a driving force might produce an interesting additional layer. Overall, I feel like this project was an immense success for me, as I was able to combine the schematic design phase with technical thinking and the site and client into one comprehensive studio design project. Ultimately, I think any good designer will inevitably find things within a project that could be bettered upon and the same is evident here, yet this project did provide the framework for me to express some remaining design ideas into real site and acted as a completion point for my undergraduate design work. I plan on bettering upon and developing all of these ideas and design decisions in graduate school, as well as professionally in the coming years.
1 2" dia. steel tube
2 pre-oxidized COR-TEN steel panels
3 curved l-beam (beyond)
4 curved l-beam (secondary structure)
5 curved-top open web steel joist
6 insulated double glazing (clerestory)
7 l-beam (primary structure)
8 steel channel
9 wood siding
10 operable double glazing
11 8" dia. steel tube
12 metal panel system
13 raised floor system
14 floor construction
   pre-cast concrete
   rigid insulation
   poured concrete
15 pre-fab facade element
   fibre-cement sheathing
   insulation
   vapor barrier
   plasterboard
1. 2' dia. steel tube
2. pre-oxidized COR-TEN steel panels
3. I-beam (primary structure)
4. open web steel joist
5. steel channel
6. wood siding
7. operable double glazing
8. 8' dia. steel tube
9. metal panel system
10. raised floor system
11. floor construction
   - pre-cast concrete
   - rigid insulation
   - poured concrete
12. pre-fab facade element
    - fibre-cement sheeting
    - insulation
    - vapor barrier
    - plasterboard
COR-TEN STEEL PANEL

STAINLESS STEEL BRACKET

THREADED EXTENSION

STAINLESS STEEL CABLE

2" STEEL TUBE

RIVITED TO BRACKET

STAINLESS STEEL BRACKET

COR-TEN STEEL PANEL

RIVITED TO BRACKET
COR-TEN STEEL PANEL
STAINLESS STEEL BRACKET
RIVITED TO BRACKET
INSULATION
ROOF MEMBRANE
THREADED EXTENSION (WELDED)
METAL DECKING
CURVED-TOP OPEN WEB STEEL JOIST
A copper alloy, which sheathes the exterior walls, patinates to a reddish-brown hue. The west and south walls (right) have few openings since the labs require low levels of light.

and biologists would collaborate on research in geometrical, physical, quantum, and mathematical optics. Most labs required low to almost nonexistent light levels with no vibrations, and the floors needed to align with those of the building on the east—a reason why Richárd and Bauer depressed the building 7 feet below grade. In addition, the college wanted to provide informal gathering spaces, conference rooms, offices, and a lecture hall, elements not in full supply in the adjacent building.

The architects strategically placed the windowless labs behind solid walls facing west and south, where heat loads can be punitively high in the warm months. The walls, clad in a copper alloy that turns a reddish bronze as it patinates, conform in color to the redbrick buildings blanketting the campus. Since the shimmering skin stands at a remove from the inner core of poured-in-place concrete, heat from the sun rises behind the walls to the roof. This crisp outer carapace also acts as a rain screen, owing to the fact that rainwater leaders and lab exhaust can be tucked into the interstitial space, reducing the presence of surface joints.

With regard to the particular needs of the labs, the architects installed a low-velocity laminar system to bring in outside air on a distribution path that hugs the perimeter spaces. Because optical-scientific experiments and research demand very stable work surfaces, the architects tied the edges of the concrete floor plates together to create structural lattice that would help prevent vibrations.

Arranging the labs along the perimeter of the building presented a problem with the central spaces, however, where the college hoped to encourage students and professors to interact casually near the labs; these inner areas would look a bit gloomy without daylight. To brighten things up, the architects came up with the idea of light wells. Since fire codes demanded that the light wells could open on no more than two vertically connecting floors, Richárd and Bauer ingeniously decided to gang three shafts together: The main light well begins at the ground-floor lobby, known as Level 3, and connects to Level 4. While the skylit shaft is walled-in for the floors above, its hand-notched plaster finish creates a spectacularly luminous element visible from the lobby.
One level down from the planted entry terrace, the central courtyard (this page and opposite two) provides access to the art center’s bookshop and three lobbies. LED strips at the tops and bottoms of translucent glass panels illuminate them. The museum affixes exhibition posters to the exterior surfaces of these glowing rectangles. Some panes, but not all, admit light to the interior.
1. Lobby
2. Light well with fire stair
3. Plaza/entrance
4. Classroom
5. Lecture hall
6. Elevator
7. Mechanical room
8. Restroom
9. Bridge to existing building

10. Light well
11. Open to below
12. Conference room
13. Offices
14. Labs
15. Electronic/data

The wire-frame drawing (left) indicates placement of the three light wells. An enclosed terrace on the northwest corner of the building (above right) provides views of the Santa Catalina mountains. The walls of the 75-seat lecture hall (right) are sheathed in foamed aluminum panels.
hologically, occupants of naturally ventilated buildings grow accustomed to less consistency in temperature, eventually coming to expect interior conditions that more closely hew to outdoor weather.

These shifts in perception undoubtedly encouraged SCB’s architects to take advantage of Chicago’s more temperate weather periods for natural ventilation. “A weather vane on the roof can open the facades and induce ventilation when outdoor temperatures fall within a range of 55 to 5 degrees,” Patterson says, noting that the building’s fullest potential lies in spring and fall. Still, he estimates that’s enough time averaged across the year for the building to beat ASHRAE’s 90.1 Energy Standard by 50 percent.

**Green for open, red for closed**

For architects and engineers, this sort of mixed-mode design probably presents the future direction of passive ventilation schemes. For risk-averse developers, mixed-mode designs offer flexibility—tenants who refer air-conditioning can choose to ignore the windows—as well as a bulwark against the unrelenting onslaught of humidity. At NBBJ’s new offices in Seattle [RECORD, January 2007, page 110], Allan Montpellier, a mechanical engineer with the local office of Flack+Kurtz, developed a fixed-mode approach for an underfloor HVAC system that depends on occupants to operate windows when the air-conditioning is off. Green and red indicator lights, tied to the building’s HVAC control system, alert staff to when they can open windows. The approach can also backfire. “If you put a desk up against a window, that person will then ‘own’ that window,” Montpellier says. “You really need space between desks and windows—you have to think psychologically about the space.”

But before Montpellier could get to this point, he undertook a comprehensive review of what he terms a “typical meteorological year” in Seattle. He developed a chart for NBBJ that showed the number of hours in a year when the temperature would stay in a specific range; ever the jargonists, many engineers call this “binning up” temperatures. For example, the chart indicated 432 hours annually for a bin of 60 to 62 degrees, but Montpellier mainly focuses on the values above 80 degrees. “You really start to get uncomfortable around 80 to 85 degrees, even with a ceiling fan,” Montpellier says. “Above that, people will complain.” He found there were only 64 working hours per year where the temperature exceeded 80 degrees, which helped convince NBBJ to go with the mixed-mode design, though he notes each client tolerates different environmental conditions.

Having established a case for natural ventilation, Montpellier then had to determine if he could secure enough openings in exterior...
Canada's National Ballet School:  
Project Grand Jeté,  
Stage 1: The Jarvis Street Campus  
Toronto, Canada  
Architect: Kuyabara Payne McKenna Blumberg Architects/  
Goldsmith Borgal & Company Limited

This ballet school is the only institution in North America to offer an integrated program of professional dance training, advanced-level academic education, and residential living all on one site. This project completes the first stage of the school's plan to create a student-centered facility. Conceived as a vertical campus of three transparent buildings, the total project included 180,000 square feet of new construction and the adaptive reuse of two buildings. The tallest building fuses architecture, dance, movement, and spectacle in a series of stacked, horizontal platforms ("stages") that project the building's program out to the city. A fully glazed curtain wall on its east facade offers views of the dancers, who in turn have the city as both backdrop and audience.
Bird's-eye View

Rural Studio students turn an abandoned fire tower into the tallest avian lookout in the United States.

At Auburn University's renowned architecture program, the Rural Studio, students turn trash into treasure as a matter of course. In their buildings for residents of Alabama's Black Belt, glass bottles become windows and stacked carpet tiles serve as insulated walls. But a recent project—part of the school's collaboration with Perry County to revitalize a historic park—takes the tradition of using reclaimed materials to vertiginous new heights.

The idea to build a birding tower had been brewing among students since 2001, when the Rural Studio began working with Perry Lakes Park, built by FDR's Civilian Conservation Corps in 1935. It wasn't until 2004—once separate teams had completed a pavilion, outhouses, and a bridge that provided access to the proposed tower site—that the park was ready for a student team to take on the project. "We had been working on the trails," team leader Paul Howard says. "When the bridge to the park was done, we knew the next step was a tall structure that could give birders and naturalists a place to observe the more than 200 species that live there."

But financial concerns loomed. A previous budget had funded a boardwalk leading to the park, and while the financial concerns were met by big ideas because of the former president of the County Commission (Brady, Paul Howard's father), "I believe they'd give us one footprint," says Howard. "And we sold alonk to erect the structure, including individual stairs and platforms, a handrail, and the rare opportunity to generate funds. "The top platform says, "And we sold a rare opportunity to generate funds."" Small community projects are-and to have the example of thinking big ideas because of accepting that challenge is a rare opportunity to do something." "But I believe they'd give us one footprint," says Howard. "And we sold..."
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AWARD WINNERS

Heifer International
Headquarters
CITY Little Rock, Ark.
ARCHITECT Polk Stanley
Rowland Curzon Porter
Architects

PORTFOLIO
CELEBRATING THE TOP TEN GREEN PROJECTS AROUND THE COUNTRY.
Text Gideon Fink Shapiro
The project was initially intended to be a remodel of an existing brutalist building, but SOM suggested it be torn down. Many expected it to be a copy of the neo-classical mansion adjacent to the school. Part of a ten year plan to expand and update the school, the new facility serves 250 students of the upper school. This addition acts as a connection between the lower school to the north and the gymnasium to the south.
In terms of area, Greenwich is twice the size of Manhattan. The town is bordered to the west and north by Westchester County, New York, to the east by the city of Stamford, and to the south by Long Island Sound. The median income for a household in town is $99,086, and the median income for a family is $122,719. The average temperature is between 30 and 75 degrees F.

Surrounding buildings include the Lower building to the north (1970s).
4575 West 38th Street: CONTEXTUAL ANALYSIS

FIGURE-GROUND ANALYSIS

CONTEXT IMAGES

Sept. 17, 2007
PROGRAM ANALYSIS

Sept. 26, 2007

4575 West 38th Street: PROGRAM ANALYSIS

PROGRAM DIAGRAM

PROGRAM

- Class Rooms (15) : 900 sq.ft.
- Alt. Class Room (3) : 700 sq.ft.
  - Exterior
  - Interior Lounge
- Labs (4) : 1000 sq.ft.
  - Multipurpose
  - Computer
  - Science
  - Storage
- Administration : 3000 sq.ft.
  - Director
  - Deans of Academics
  - Dean of Students
  - Disciplinary