ENGINEERING AWARDS of EXCELLENCE

2002

The *Engineering Awards of Excellence* are presented annually to recognize engineering excellence and innovation in steel-framed buildings.

There are three categories—up to $10 million, projects greater than $10 million but less than $25 million, and more than $25 million. In addition to the National Awards presented in each category, two merit awards are given in the greater than $25 million category.

TO BE ELIGIBLE:

- A significant part of the framing system must be steel wide-flange structural shapes or hollow structural sections;
- Building construction must have been completed between January 1, 1998 and December 31, 2001; and
- Projects must be located in the U.S., Canada or Mexico.

JUDGING CRITERIA:

- Creativity in response to the owner's and architect's program;
- Application of new or innovative technology in areas such as connections, gravity systems, lateral load resisting systems and fire protection;
- Structural efficiency; and
- Significance of engineering achievement.

THIS YEAR'S JURY:

- Joe Burns
  Thornton-Tomasetti Engineers, Chicago, IL
- Kevin Wilson
  Tylk Gustafson Rectors Wilson, Chicago, IL
- Tom Harrison
  OWP&P, Chicago, IL

AWARD WINNERS

$100M OR GREATER

NATIONAL WINNER
Kimmel Center for the Performing Arts—Philadelphia, PA
Goldreich Engineering, P.C. in association with Dewhurst Macfarlane and Partners, Inc.

MERIT AWARD
Washington State Convention and Trade Center Expansion—Seattle, WA
Skilling Ward Magnusson Barkshire, Inc.

MERIT AWARD
JFK International Airport , Terminal 4—Jamaica, NY
ARUP

$25M OR GREATER, BUT LESS THAN $100M

NATIONAL WINNER
Peter B. Lewis Building—Cleveland, OH
DeSimone Consulting Engineers, P.L.L.C.

$10M OR GREATER, BUT LESS THAN $25M

NATIONAL WINNER
UCSF Mount Zion Outpatient Cancer Center—San Francisco, CA
Degenkolb Engineers

MERIT AWARD
New York Presbyterian Church—New York, NY
Buro Happold Consulting Engineers PC

LESS THAN $10M

NATIONAL WINNER
Live / Work Lofts—Seattle, WA
Swenson Say Faget

MERIT AWARD
Augen Optical Laboratories—Ensenada, B.C. Mexico
Enrique Martinez Romero, S.A. Consulting Engineers

NATIONAL WINNER

$100M OR GREATER

Kimmel Center for the Performing Arts
PHILADELPHIA, PA

JUROR COMMENTS:

A very strong solution—supports the architectural concept clearly and directly. A striking design that meshes structure with glass.

The Kimmel Center in Philadelphia, PA, contains a 2,500-seat concert hall and a multi-use recital theatre that will accommodate 650 patrons. These two spaces have been designed for a zero noise transmittance. This requires that both be completely isolated from the support and adjacent structure to eliminate any vibration transmittance.

The surrounding spaces are used for offices, classrooms and warm-up spaces. The entire building is covered with a transparent roof and end walls. This transparency invites patrons to feel a part of not only the performance they attend but also the experience of Philadelphia.

The entire structure is built atop a parking basement and mechanical service rooms that require column free spaces to accommodate a dense layout of mechanical equipment.

The Kimmel Center may be split into five engineering design challenges.

CONCERT HALL

The concert hall provides 2,500 seats, cantilevered balconies and member-free reverberation chambers. The superstructure of the concert hall has been developed as a series of trussed-arch shapes springing from a point at the base to provide stiffness to cantilever the balcony support members. This system provided an internal shell that supports all of the loads from the ceiling. The adjacent reverberation chamber is free of structural members passing through it.

RECITAL THEATRE

The recital theatre offers 650 seats and a multipurpose revolving stage. The recital theatre is a conventionally framed box supported away from the sides and the corners creating a difficult transfer path. This accommodates parking underneath and circulation concerns. The theatre also includes a fly gallery and a revolving stage with stage-fixed balcony seating to switch between theatre and recital modes quickly.

GENERAL BUILDING

The general building creates atrium and theatre support and consists of a reinforced concrete basement, parking level and mechanical spaces supported on conventional spread foundations. Large spans are designed for open spaces in both mechanical areas and parking areas, 50′ in most cases.

The reinforced concrete basement forms the support structure for the isolation pads and a shell around the halls, providing additional layers of resistance to sound transmission. The depth of excavation was limited to above the height of the groundwater level, approximately 30′ below the sidewalk grade. The depth of the acoustic isolation space had to be minimized. Upturned beams were used with multiple access points to the space created by the beam pattern.

All concrete areas consist of multiple geometry changes and large accommodations for multiple openings. A plenum structure was used within the concert hall for air distribution.

At grade level the building becomes

STRUCTURAL ENGINEER
Goldreich Engineering PC in association with Dewhurst Macfarlane and Partners Inc., New York, NY

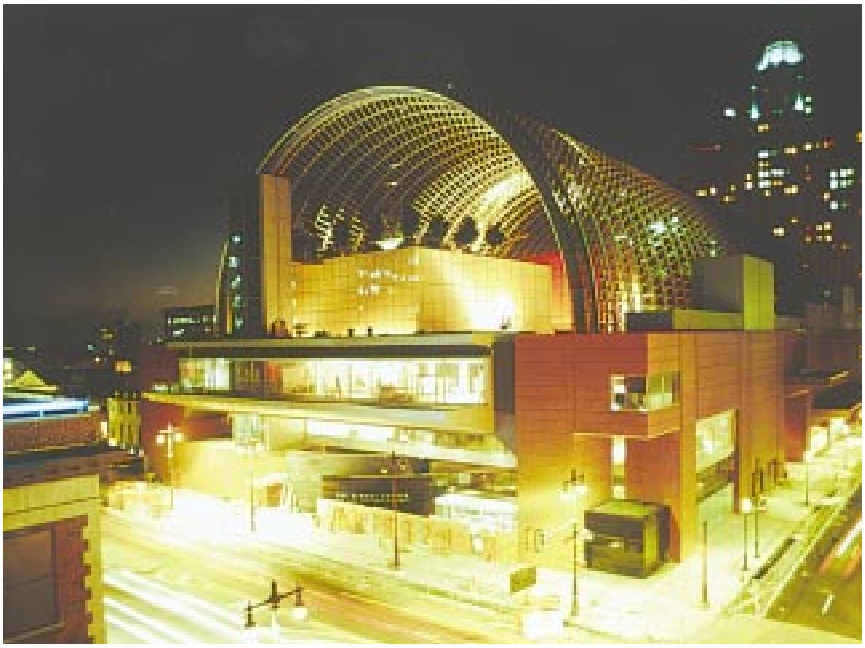
ARCHITECT
Rafael Vinoly Architects PC, New York, NY

STEEL FABRICATOR
Helmark Steel, Wilmington, DE (AISC member)

STEEL DETAILER
Base Line Drafting Services, Concorde, Ontario, Canada (NISD member)

GENERAL CONTRACTOR
LF Driscoll, Philadelphia, PA

SOFTWARE
QSE, ROBOT Millenium



steel. The surrounding building structure is composed of 16 main framed "box-columns" that support each floor as a cantilever. This structure includes a 100′ span bridge framed by vierendeel trusses. At the fourth floor level the cantilevered floor plate supports the load from the vaulted roof.

VAULT

The vault roof provides a transparent atrium roof and spans between cantilevered steel frames above the two theatres. It covers the full length of the building, measuring in plan 350′ by 174′.

The roof structure utilizes the depth of the vaulted section to create Vierendeel trusses that arch across the atrium space and provide vertical and lateral support. Each truss is propped against each other to provide folded plate action to resist longitudinal wind loads. Higher value steel stress material was used to minimize the member size. The spacing of the truss members was modulated to suit an optimal glass panel dimension.

END WALLS

Providing transparent closure for the atrium space, the end walls enclose the vault structure. To maximize transparency, a cable structure was utilized. Typical cable net walls rely on very stiff elements to secure the cable. This calls for a pretension load to be applied to the cable to give it initial stiffness and resist lateral wind loads.

The cable wall resists wind loads by creating a catenary shape. The cable is required to be in a catenary mode before it resists loads, hence the pre-tension to restrict initial movement. The base building has long-span members directly under the wall plan, thus providing little in the way of anything stiff enough to anchor the cables to. Additionally, there is a transparency requirement between the base of the wall and the adjacent support structure. The most significant challenge was to provide a technically stable and financially viable solution.

The arch shape naturally provides stiffness; however, the vault structure moves under wind loads, untensioning the cables. The spanning members under the wall also move under load, affecting the cable geometry and loading.

The cable must maintain stiffness throughout the loading cycle. Since the deflection movement of the vault was problematic, a slip joint was introduced to completely isolate the wall from the roof under considerations of lateral movement. It was resolved that the way to maintain constant loads on a deflecting cable was to provide a weight at the bottom end.

Grey iron, the heaviest material economically available, was used. This allowed the smallest possible profile to be created. Due to the different lengths of each cable and its location on the elevation, each weight is required to be different. To maintain cost effectiveness, the dimensions of the weights were designed to be the same. The weight differentials were obtained by using fixed dimensioned castings with varying sized internal hollow cores.

Each weight was calculated to provide a curvature of the wall deflection such that the edges of the glazed surface deflect very little and can be captured in a simple channel detail.

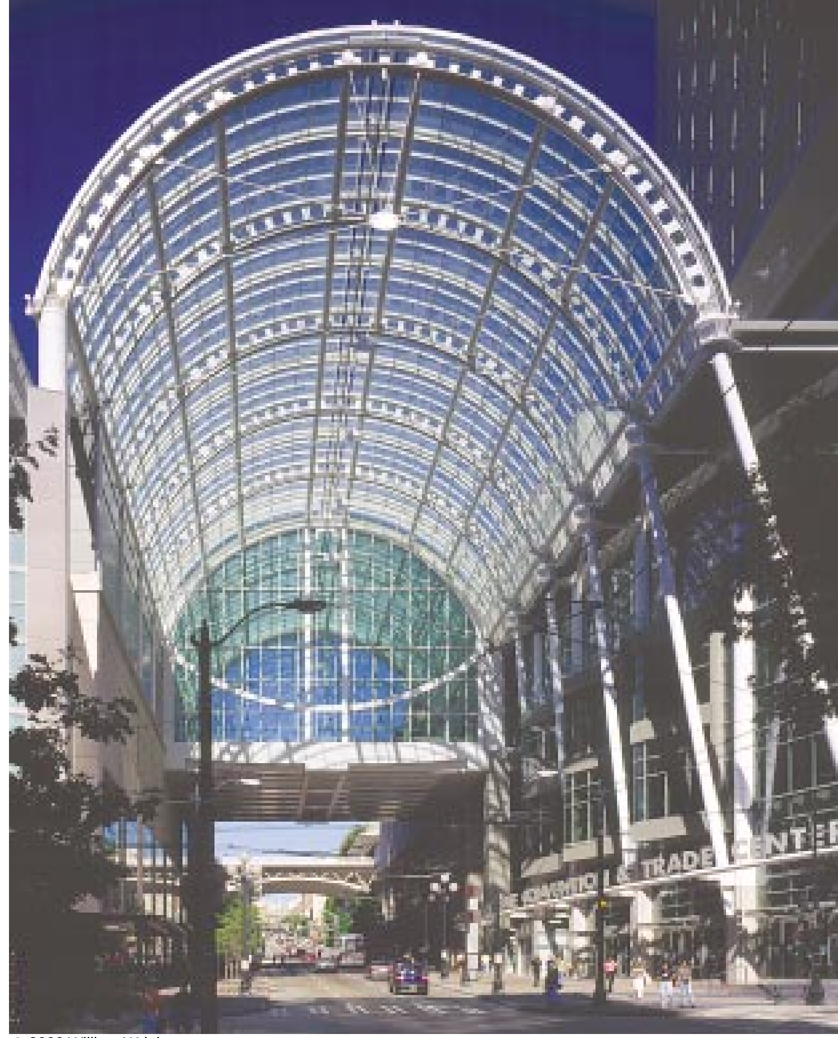
The concept for the total structure is very simple: the box that creates the space of the vestibule carries lateral loads through diaphragm/bracing behavior of the walls and roof. When the box becomes too long to provide diaphragm action, vertical columns provide propped cantilever action. These columns also support horizontal beams that carry the gravity load of the barrel vault trusses.

MERIT AWARD

$100M OR GREATER

Washington State Convention and Trade Center Expansion

SEATTLE, WA



© 2000 William Wright

© 2000 Michael Dickter/Skilling Ward Magnusson Barkshire

JUROR COMMENT:

The design team developed well-thought-out solutions to the complex challenges in this mixed-use facility.

STRUCTURAL ENGINEER
Skilling Ward Magnusson Barkshire Inc., Seattle, WA

ARCHITECTS
Convention Center Expansion and Canopy: LMN Architects, Seattle, WA

One Convention Place Office Building: Callison Architecture, Seattle, WA

Museum of History and Industry: LMN Architects, Seattle, WA

Elliott Grand Hyatt Hotel: Mulvanny/G2 Architects, Bellevue, WA

STRUCTURAL STEEL FABRICATORS
Canron Construction Corporation, Portland, OR (majority of project, AISC member)

STEEL DETAILERS
Steel Systems Engineering, Hollywood, CA (NISD member)

GENERAL CONTRACTORS
Convention Center Expansion and Canopy: Kiewit Construction/ECI Contractors, Seattle, WA

One Convention Place Office Building: Howard S. Wright Construction, Seattle, WA

Museum of History and Industry: Berschauer Phillips Construction

Elliott Grand Hyatt Hotel: Hedreen, LLC, Seattle, WA

DESIGN SOFTWARE
RAM Structural System, ROBOT Millennium

The Washington State Convention and Trade Center (WSCTC) Expansion project, under consideration for more than seven years, could not have become an economic reality without creative engineering—and the strength of steel—to solve the complex urban puzzle of this $425 million development.

The original convention center facility was built by innovatively capturing space in air-rights over Interstate 5 through downtown Seattle, using a unique steel mega-truss design to "bridge" the building over 12 lanes of freeway and city streets. The resulting elevation of the exhibition hall floor is 60′ above street level, and the state mandated that the desired expansion space be contiguous and at the same level. To support the cost of building

© 2000 Michael Dickter/Skilling Ward Magnusson Barkshire

the exhibition hall floor at this high elevation, many appropriate uses had to be found, all able to justify their own construction costs to become part of the development. Private parties ultimately bought development rights above, and beneath, the proposed convention center expansion. The solution was to stack, interlock, layer, hang, bridge, and tunnel these development pieces, and steel is what made it all possible.

Joined together is a challenging—and often conflicting—mix of uses: 105,000 sq. ft. of exhibition space, 319,000 sq. ft. of office space, 425 hotel rooms, a new convention center entrance, retail space, restaurants, a museum, back-of-house and storage areas, parking for 1,247 cars, heavy-truck access, and multiple pedestrian connections. The entire complex had to be built while the existing convention center and busy city streets bisecting the site remained operational. Again, the ease and speed of steel construction was critical to the project's success.

The WSCTC expansion bridges Pike Street with a dramatic canopy and exhibit area to connect the new and existing halls to provide 205,700 sq. ft. of contiguous space. A heavy-load truck bridge also spans the street to connect old to new. The new hall was itself designed as a "bridge building," supported by full-story braced-Vierendeel steel truss. The building spans a second city street and is layered over seven parking levels.

The 22-story Class A One Convention Place office tower employs a steel belt-truss system to cantilever 40' over the existing WSCTC facility. The tower incorporates six stories of the WSCTC expansion area, shares its lobby space with the new WSCTC grand entrance and sits atop shared parking.

The new WSCTC facility contains a portion of space that belongs to the Museum of History and Industry to be used for their new location in three years. In the interim, the main Seattle Public Library is using the space while their new home is built.

The 30-story, Elliott Grand Hyatt Hotel tower connects to and incorporates a layer of WSCTC mechanical and high storage space, then sits atop a layer of shared retail area.

A 15' diameter underground "steel pipe" pedestrian tunnel connects the WSCTC facility with an adjacent historic theater.

The ability to solve this structural "function puzzle" allowed the development to move forward. It has since become the catalyst for hundreds of millions of dollars of development on surrounding blocks—elevating Seattle to a truly vibrant, 24-hour city.

NATIONAL WINNER

$25M OR GREATER, BUT LESS THAN $100M

Peter B. Lewis Building
Case Western Reserve University
CLEVELAND, OH

STRUCTURAL ENGINEER
DeSimone Consulting Engineers, P.L.L.C., San Francisco, CA

ARCHITECT
Gehry Partners, LLP
Santa Monica, CA

CONSTRUCTION MANAGER
Hunt Construction Group
Indianapolis, IN

SOFTWARE
CATIA, RISA 3D, SAP 2000

The Peter B. Lewis Campus of the Weatherhead School of Management is the latest addition to the campus of Case Western Reserve University in Cleveland, OH. Peter B. Lewis, Cleveland entrepreneur and resident, agreed to supply major funding to the project if world-renowned architect Frank O. Gehry of Santa Monica, CA, would design it. Design began in 1997, ground was broken in April 1999, and construction completed in 2002.

The building encloses approximately 145,000 sq. ft. and rises 110′ at its highest point. It will provide offices for the school's professors and graduate students, a library and cafeteria, as well as several state of the art classrooms.

Metal-clad, cloud-like shapes that form portions of the building's roof and walls are characteristic of Mr. Gehry's most recent works. Those shapes, comprising the most noteworthy areas of the building exterior, are framed with structural steel. An underlying cast-in-place concrete structure in turn supports the steel members.

A large atrium space is contained within the building. Covered with over 50,000 sq. ft. of curving drywall, the walls of the atrium define a magnificent space that will provide an inspirational space for future students and faculty of the Weatherhead School.

At a first glance, the Peter B. Lewis Building may look quite like other Frank Gehry projects as portions of the structure are covered with curving, stainless steel clad surfaces. However, a deeper investigation reveals that not only are these surfaces much more wildly undulating than any of Mr. Gehry's previously completed projects,

but the structural steel support structure for these surfaces required the design of two unique and never before used structural systems. The design and construction team referred to these systems as "ladder trusses" and the "stick and pipe" system.

The name "ladder truss" was given to structural members constructed by bending 4" diameter pipes to form interior and exterior chords and welding staggered flat plates to each side of the pipes. The resulting member is a type of Vierendeel truss.

The second structural system, the "stick and pipe" system, is comprised of straight structural HSS, varying in size from HSS8×4s to HSS20×12s, and crossed with 4" diameter pipes bent in 2D to conform to and define the design surfaces.

The desire for a structure covered with pipes arose during schematic design as DeSimone Consulting Engineers and Gehry Partners began to coordinate and prepare documents for the construction of the building. It was decided that a new approach for a Gehry project would be attempted in which the structural steel would completely define the geometry for the steel clad surfaces of the building. In previous Gehry projects the main structural steel system was used either (1) to approximate the design geometry, requiring the use of a secondary system that had to be completely adjusted in the field, or (2) to define the design geometry only at regularly spaced intervals, typically by way of "ribs". This system required the use of specially shaped panels, which finished the definition of the design geometry between rib locations.

Using the computer program CATIA, the design team insured that a 4" pipe was placed no more than 6' apart on each design surface. The pipes were placed in specific locations: perpendicular to "ruled lines," straight lines found on any surface clad with pieces of flat material. (Surfaces without ruled lines, like a sphere, cannot be clad with flat materials). This arrangement allowed the steel pipes to be covered with straight, light gage metal "hat" channels spanning from pipe to pipe along the ruled lines. Since the pieces providing attachment point for the hats were always round pipes, the orientation of the channel to the pipe was not of concern. The "hats" were then covered with flat sheets of light gage metal, a layer of waterproofing and the signature stainless steel shingles.

Implementation of the new structural steel framing systems thus allowed the delivery to the jobsite of a structure that completely defined the

JUROR COMMENT:

Challenging geometry problems—solved beautifully with steel.

curving design surfaces, minimized the need for field adjustment and could be clad with simple materials.

The final structure includes approximately 370 tons of structural steel. Each piece of the two miles of 4" diameter standard pipe was bent to form the direct support for the design surface geometry; no two pieces of pipe are alike, and not one is curved to a single radius.

Contributing significantly to the success of the project was a magnificent level of teamwork between the design and construction teams. Numerous meetings were held with all members of both teams to discuss the layout and location of structural members, connection details, detailing, review of shop drawings, and fabrication and erection concerns.

Further, while shop drawings were eventually produced and reviewed in the traditional manner, the most productive communication between the structural engineers and the fabricators took place electronically. Shop fabrication model files, for the first time produced using CATIA, including all tubes, pipes, plates, bolt holes, and other connection materials as 3D solids, were sent from the fabricator to the structural engineer for review and comments. Comments were made electronically by attaching pieces of text to the 3D element where the comment was applicable. After several rounds of this communication, the shop drawings were produced and reviewed by the engineers along side the final "shop models" on a computer screen, thus accelerating the shop drawings approval process.

From the outset, the design and construction teams realized that the Peter B. Lewis building would require the construction of curving surfaces wild even by the standards of a Frank Gehry project. The construction of these surfaces was completed successfully by opening channels of communication between all parties on the design and construction teams, utilizing communication and detailing review methods never before attempted, and the implementation of innovative and new structural framing solutions made possible only through the use of structural steel.

NATIONAL WINNER

$10M OR GREATER, BUT LESS THAN $25M

UCSF Mount Zion Outpatient Cancer Center

SAN FRANCISCO, CA

JUROR COMMENTS:

Creative use of AESS to form framing for bay windows, canopy and skylights.

STRUCTURAL ENGINEER
Degenkolb Engineers,
San Francisco, CA

ARCHITECT
SmithGroup, San Francisco, CA

STEEL FABRICATOR AND STEEL DETAILER
Gayle Manufacturing,
Woodland, CA (AISC member)

STEEL ERECTOR
California Erectors,
Benicia, CA (NEA member)

GENERAL CONTRACTOR
ProWest PCM, Inc., Temecula, CA

SOFTWARE
ETABS

PHOTOS
Michael O'Callahan 2001

The Mount Zion Outpatient Cancer Center contributes to the University of California San Francisco's (UCSF) goal of uniting renowned cancer scientists, clinical researchers and cancer care specialists in a cooperative and open environment. The new building serves an integral role as part of the Comprehensive Cancer Center, with a goal of facing the challenges posed by cancer through research, care and prevention. The UCSF Comprehensive Cancer Center is the only National Cancer Institute designated center in Northern California, an appointment that acknowledges its broad range of services linking cancer research and patient care.

The building is five stories above grade with two levels below grade. The sub-basement and

basement contain the radiation oncology department, and the first floor provides waiting areas and public amenities. The second floor houses a breast care center, with cancer-related clinics on floors three and four, and an infusion center on the fifth floor.

Designing a building with such an important purpose without intimidating patients created a challenge. The architect desired an "open" building that appeared delicate yet "strong and deliberate" that would be intuitive to use. Another challenge was integrating operating hospitals located on two sides of the site with the new building. A design with steel and glass elements weaving throughout the building, forming bay windows, canopies, trellises, sunshades, skylights, and the main lobby formed the desired solution.

Degenkolb met all challenges, designing each structural element to meet the vision of the architect and owner. Arching glass canopies form the new front entrance, held aloft upon efficient architecturally exposed structural steel pipe with pretensioned stainless steel rod bracing to limit deflection and resist lateral loads. The larger canopy and vestibule at the north end of the drop-off leads the visitor to a two-story garden lobby covered by a skylight supported on slender steel pipe columns and arches. In a subbasement waiting room, an ocular skylight gives views of the sky. A tube steel framework supports this skylight near the main entrance. The cylindrical structure, with its successive rings, and the playful, slanted plane of the glass itself, grant unexpected levity and grace to the building's exterior.

To meet the open space and flexibility desired by the team, the UCSF Mount Zion Outpatient Cancer Center was one of the first buildings to utilize an unreinforced Reduced Beam Section (RBS) Special Moment Frame (SMF) following the 1994 Northridge earthquake. With a structural design based on early FEMA/SAC documents, the 1997 design meets requirements set forth in the newly released documents from 2000/2001. The base of the building contains four Linear Accelerator vaults for patient treatment that required very thick walls and a proper ceiling structure for shielding. In addition, most walls also required the use of thick steel plate for complete radiation shielding between spaces. The layout of the building demanded that the basement step outside (under the sidewalk) of the exterior wall, forcing the design to transfer the perimeter moment frame. Through careful planning and coordination, Degenkolb was able to design and detail a portion of a required shielding element as a transfer beam for over seven levels of SMF columns.

Another desired element of the building was the use of bay windows, a signature feature of many San Francisco Bay Area buildings. The architecture, however, demanded a very thin sandwich in which to place the structure. Instead of the common cantilever steel framing typical of these conditions, Degenkolb designed the metal deck composite slab to cantilever outboard of the framing over 4'. Deflections and vibration performance were controlled by adding a tube steel "tie" column floor to floor, carefully hidden in the mullions of the window system.

Structural work also included the retrofit of the concrete shear wall building (Building B, directly east of the new building) using an exposed special steel concentric braced frame employing zipper columns for enhanced ductile performance. Degenkolb was also retained to design the structural portions of the remodel, shoring and underpinnings of the adjacent, fully functioning acute care facilities. As part of the shoring design, steel soldier beams with tie-backs were placed in cased drilled holes with wood lagging set between adjacent soldier beams. Due to the limited space between the adjacent structures, Degenkolb designed the soldier beams to function as the pile foundation of the exterior steel frame retrofit to the existing hospital. This method saved material, but more importantly, saved time and limited the disruption to the functioning hospital. To phase the multiple stages of work, this "project" was actually comprised of five different projects, with all structural work designed by Degenkolb, and all consisting of significant and innovative structural steel solutions.

MERIT AWARD

$10M OR GREATER,
BUT LESS THAN $25M

New York Presbyterian Church

NEW YORK, NY

JUROR COMMENT:

Exploits the potential of steel to create very interesting geometric forms.

Seeking a new place of worship to accommodate to accomodate their growing congregation, a Korean church in New York decided that renovating a former commercial or industrial building was their most viable option. A two-story, 88,000-sq.-ft., 1930s steel-framed building that had housed the Knickerbocker Laundry factory in Queens was selected for renovation into a new place of worship. This presented the design team with quite a challenge: to respect and exploit what was there while transforming the building to suit a new use and give it a new image. The new church needed to accommodate a 2,500-seat sanctuary, classrooms, cafeteria and wedding chapel, all on a tight budget.

The main challenge was to break out of the constraints imposed by the regular column grid and 10′ ceiling heights of the old factory. In order to provide the 2,500-seat sanctuary, additional space had to be added, but the architects did not want this space to swallow up the existing building. The solution was to place the new sanctuary on top of the existing building. Structural analysis revealed that the existing roof could support the congregants in a new sanctuary if the sanctuary's own roof were independently supported on columns that threaded through the existing building to separate foundations. The load carrying capacity of the existing roof was also strengthened by stripping off the concrete encasement, adding shear studs to the top of the existing beams and then casting a new composite steel-concrete structure. Although this technique is widely used in new buildings, the project shows that it can be effectively applied to renovation projects.

The new sanctuary roof was supported on steel framing separate from the 1930s superstructure that was "dropped through" the existing construction. This secondary framing system included 120′ long trusses to provide a clear span over the auditorium, providing uninterrupted sightlines for the congregation.

The architects also needed to respond to the acoustic requirements of the sanctuary, achieving this by designing a wavy, kinetic ceiling and roof profile and rib-like walls. Instead of varying the beam length to achieve the wavy roof profile, the engineers produced a parametric design for the column bays. Pre-fabricated open-web joists, measuring a constant 22′ long, were used, but set on columns placed at varying distances. The roof beams consequently assumed the sloping an-

STRUCTURAL ENGINEER
FTL—Happold, New York, NY

ARCHITECT
Michael McInturf Architects, Cincinnati, OH

Greg Lynn FORM, CA

Garofalo Architects, Chicago, IL

GENERAL CONTRACTOR
Bethel General Contracting, New Hyde Park, NY

SOFTWARE
Alias Wavefront

PHOTOS
Karen Ludlam/Buro Happold

© Michael McInturf Architects, Greg Lynn, Garafalo Architects

Building section. The new sanctuary is built on top of the existing building.

gles required for the sanctuary but at low cost.

The architects' design specified that the sanctuary be reached by new wide flights of steps and circulation paths that bore little relation to the existing geometry or structural grid. The architects used 3-D geometric modeling packages to sculpt these complex voids and stairways, and the engineers were then quickly able to assess the structural implications of various design options. To create these new staircases, the existing steel structure had to be cut away. A complex transfer structure is often the structural solution used to create new load paths around the existing columns that have to be removed, but this would have been too expensive in this building. The solution was identified using the 3-D geometric modeling packages as they established where on plan new load-bearing block walls could be used to prop the floor structure. Starting from the basement, the walls were built up to the underside of the existing steel beams and concrete floor and dry-packed to be able to take the load imposed from above. The superfluous original structure could then be cut away to create the new voids.

The other area of complex steel framing is the grand covered outdoor walkway, doubling as an emergency exit, viewing platform and "signboard" for the building. It also continues and makes visible from the outside the rib-like forms of the sanctuary ceiling. The rigid bents that comprise it were described for the fabricators using a 3-D model and an extensive set of workpoints, resulting in remarkably few fabrication errors despite their complexity. The series of bents is stabilized longitudinally with diaphragms constructed from light-gage steel joists and plywood panels, clad outside in metal and inside in redwood. These diaphragms are warped out of plane owing to the bents' geometry. The use of light-gage joists permitted them to be formed economically simply by torquing the joists.

The Presbyterian Church shows that the complex geometry required of many contemporary designs can be achieved economically with the assistance of today's sophisticated computer software, adaptive reuse of materials and close dialogue between the architect and engineers.

NATIONAL WINNER

LESS THAN $10M

STRUCTURAL ENGINEER
Swenson Say Faget, Seattle, WA

ARCHITECT
The Miller/Hull Partnership, LLP

STEEL FABRICATOR AND DETAILER
Standard Steel Fabricating, Co., Inc., Seattle, WA (AISC member)

GENERAL CONTRACTOR
Turner Construction Company SPD, Seattle, WA

Photo courtesy Miller/Hull.

Live/Work Lofts
SEATTLE, WA

JUROR COMMENTS:

Progressive design stimulated by steel elements.

Simple direct use of materials inside and out—a modern reinterpretation, in steel, of a traditional loft structure.

Occupying a small 40′ by 80′ urban lot on Seattle's Capitol Hill, this loft-style condominium project maximizes the site's potential. Bounded by buildings on three sides. The architects built up to the 65′ zoning limit, taking advantage of additional natural light and views of the city beyond. The relatively flat site accommodates eight loft-style condominium units plus street level commercial leased space and parking for eight cars. Parking is provided in a stacked configuration using European parking lifts. The residential floors contain two units each varying in size from 700 sq. ft. to 1,600 sq. ft. The top two floors each contain side-by-side two story condominiums with west

Photo courtesy James F. Housel.

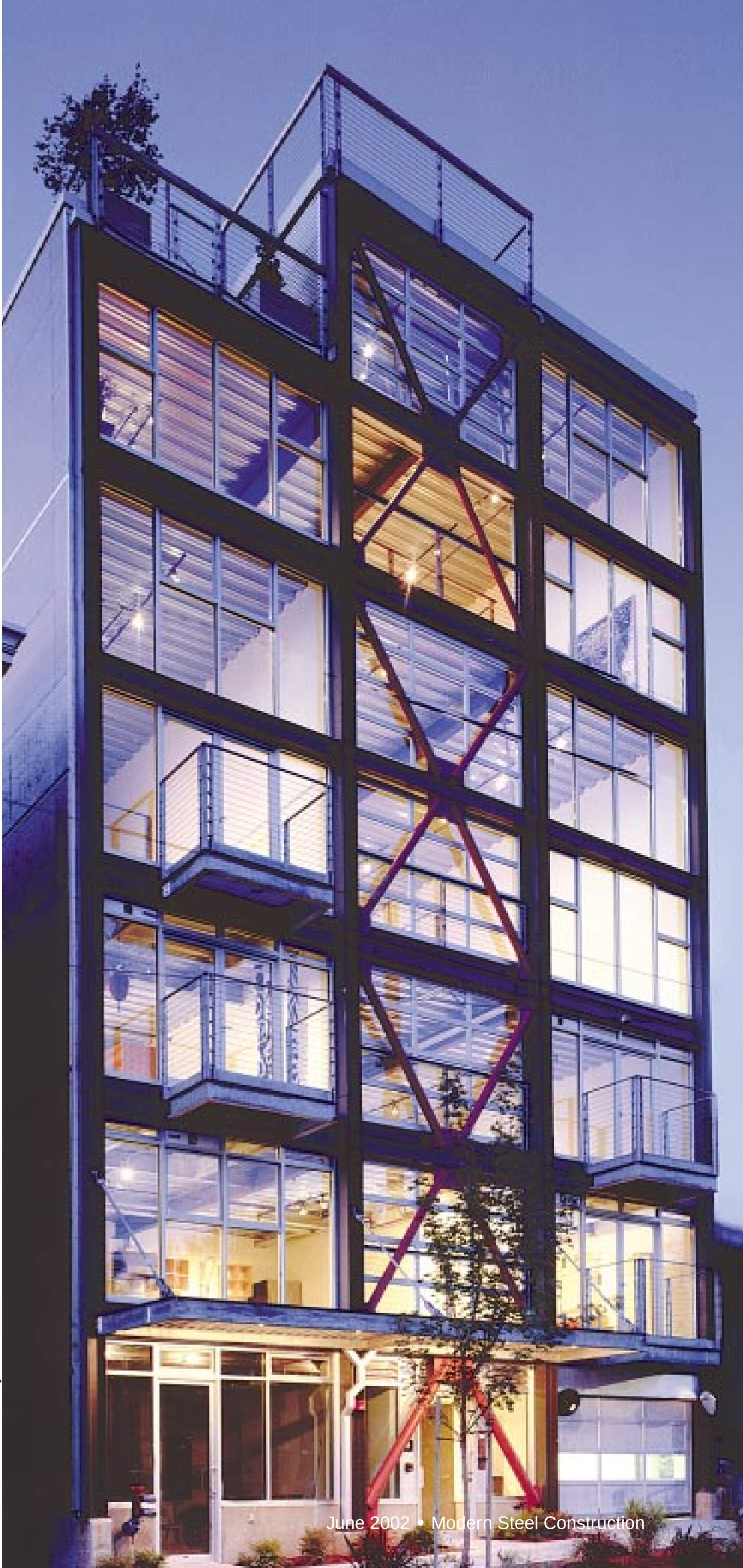


Photo courtesy Benjamin Benschneider.

facing balconies, mezzanines and shared access to a private rooftop garden.

The building solution is simple: a seven-story steel-framed glass box flanked by solid party walls. The steel structure conveys a sense of lightness and transparency. Given the small site with virtually no lay-down area, the steel structure provided the contractor with a rapid erection sequence. It also facilitated off-site fabrication of many structural elements. The primary gravity load system was coated with fire retardant intumescent paint where the diagonal bracing and mezzanine structure is exposed steel.

The north and south facades, fully glazed floor to ceiling, maximize light transmission and preserve the connection to the outdoors, vital to Seattle residents.

Glass and aluminum-frame garage doors roll up converting the living and dining spaces to exterior balconies. Plans of the loft-style units are completely open with only the bathrooms enclosed. The units on floors two through four run front to back, wrapping around a compact core housing an elevator, stair and shafts. These units are provided south light and decks overlooking the street. The fifth floor units have private roof terraces off the mezzanine level and a spiral stair to an additional roof deck. A public roof deck is also provided for use by all residents of the building. Interior materials include concrete floors, exposed steel structural elements, steel railings, steel plate baseboards and modular metal kitchen casework supporting butcher-block counters. All units are heated with radiant slabs.

The building is meant to invest an image of structural architecture, conveying a sense of economy, efficiency, discipline and order: essential characteristics of urban loft living.

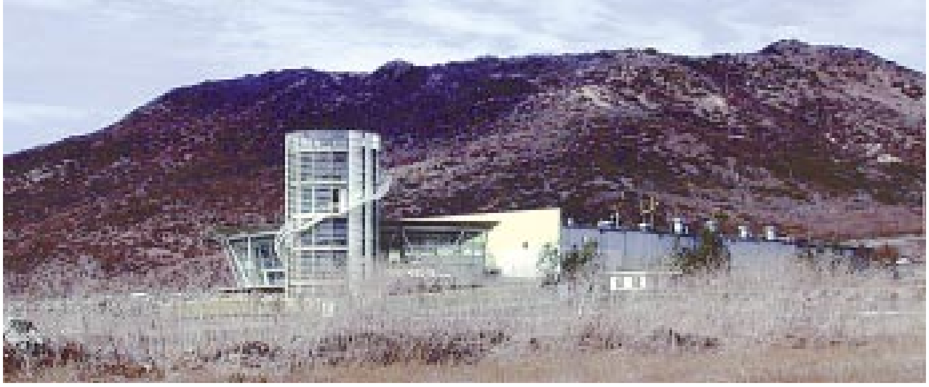
Photo courtesy Benjamin Benschneider.

MERIT AWARD

LESS THAN $10M

Augen Optical Laboratories

ENSENADA, B.C. MEXICO



JUROR COMMENT:

Beautiful integration of structure and architecture—the cylindrical shell has a fantastic sculptural quality.

Augen Optical Laboratories is a wholly Mexican-owned company established for research and development of technologies for the fabrication of plastic optical lenses. This project consisted of an expansion of a currently existing facility producing plastic optical lenses formerly imported from the U.S.

Two principal buildings were designed for this expansion: one circular-shaped four-story research building and an office and laboratory building completely separate from the tower yet operationally integrated with it.

The tower is comprised of a cylindrical steel shell, 10 m (33′) in diameter, serving the two-fold purpose of carrying the vertical gravity loads as well providing the necessary strength to resist the horizontal seismic and wind forces. The city of Ensenada is located in a high-wind/seismic zone similar to the San Diego area, which lies about 65 miles north of Ensenada.

The structure of the cylindrical shell contains 16 W10×26 perimeter columns supporting wall panels made out of $^3/_8$″ plate which is curved and stiffened in order to provide interesting openings for natural light and ventilation, as well as the necessary strength.

Each floor consists of a series of radial horizontal beams meeting at the center of the circle and running in radial form, simply supported by the perimeter columns. All beams meet at

STRUCTURAL ENGINEER
Enrique Martinez Romero, S.A. Consulting Engineers, Colonia Condesa, Mexico

ARCHITECT
Taller de Arquitectura X, Mexico, D.F., Mexico

GENERAL CONTRACTOR
ABSA Coonstrucciones, Mexico, D.F., Mexico

SOFTWARE
SAP 2000

the center in a circular plate supporting a king post from which tension rods connect with clevises, forming a series of radial post-and-beam trusses.

A concrete slab was poured on top of these beams and acts compositely with the beams through the use of shear-connectors.

An external stairway provides the access to each floor, surrounding the building like a graceful spiral.

The natural ventilation and illumination of the tower was attained through the very ingenious architectural shape of the external steel shell in combination with horizontal plate-stiffeners, providing the necessary structural strength to support the horizontal and gravity forces. A SAP2000 model of the tower was used in its structural design.

The office and laboratory building has a semi-circular shape and consists of a concrete-roof supported by radial rigid frames incorporating lean-to columns. The external columns consist of circular tubes in a "V" arrangement.

The first high mezzanine is suspended from the roof-beams through tension rods creating large column-free areas. Likewise, the main floor is also structured with steel radial beams receiving secondary curved joist beams. The floor consists of steel metal deck with 5 cm (2") of concrete topping. A second lower mezzanine is suspended as well from the main floor beams, creating a partial-underground level.

Advantages of this structural system include:

- Meets the owner's need for large column-free areas with excellent natural lighting and ventilation to accommodate the special research laboratories and offices.
- Integrates the skin steel plates and vertical columns of the tower perimeter to give the necessary strength and stiffness to resist a high earthquake and wind loads of the region.
- Provides the necessary strength and serviceability (vibration, drift-control).
- Reduces construction cost due to the avoidance of special architectural finishes (floor, false ceilings, cladding, HVAC ducts, etc.)