Félix Candela's Concrete Shells: An Engineered Architecture for Mexico
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Gallery 400, University of Illinois at Chicago

Expanded Exhibition Checklist

PABELLÓN DE RAYOS CÓSMICOS
(COSMIC RAYS PAVILION)
Ciudad Universitaria (University City), Mexico City, Mexico, 1951
Collaborator: Jorge González Reyna
Photographs: Erwin Lang (left) and Armando Salas Portugal (above)
Model: Facultad de Arquitectura, Universidad Nacional Autónoma de México (FA-UNAM)

At the end of the 1940s, Candela constructed several prototypes to test the structural limits of concrete shells and began to experiment with hyperbolic paraboloid (hypar) geometries. He realized his first building using hypar curves at the new campus of the Universidad Nacional Autónoma de México (UNAM). It is one of the thinnest concrete structures ever built with a surface that is in most places only 5/8 inch thick. As the name of the pavilion suggests, the enclosure houses instruments for the measurement of cosmic radiation. In its initial use, the super-thin shell protected the measurement devices while simultaneously allowing for cosmic rays to pass through the concrete.

DEFINITION OF A HYPERBOLIC PARABOLOID (HYPAR)
A hyperbolic paraboloid, referred to as a hypar, is a doubly-curved surface that resembles the shape of a saddle. It has a convex form along one axis, and a concave form along the other. Horizontal sections taken through the surface are hyperbolic in format and vertical sections are parabolic. It is also a doubly-ruled surface; that is, every point on its surface lies on two straight lines across the surface and can, therefore, be constructed with straight segments of wood.
Félix Candela, diagram of a hypar, 1966 (published in *Casabella* #306, 1966, 28)

BOLSA MEXICANA DE VALORES
(MEXICAN STOCK EXCHANGE BUILDING)
Centro Histórico (Historic Center), Mexico City, Mexico, 1953-55
Collaborators: Enrique de la Mora and Fernando López Carmona
Photograph: Erwin Lang
Model: FA-UNAM

Upon its completion the Stock Exchange's bidding room ceiling became the first hypar groined vault in the world. Candela later recalled: "… it was with the Stock Exchange Hall… that I

discovered how to really work with hypars." Fernando López Carmona had designed an intersecting groined vault for the ceiling, located on the third-floor extension of an office building. Yet he and the chief architect, Enrique de la Mora, had difficulties finding a structural engineer willing to build it, since the design eliminated the reinforcing ribs that would normally be placed on the undersides of the groins for support.

The duo eventually turned to Candela, who solved the reinforcement problem by using V-shaped ribs in the folds where the two vaults meet, hidden out of view even on the outside of the shell structure. Out of this collaboration, the three architects developing a working relationship that continued for many productive years.

CABARET LA JACARANDA, HOTEL EL PRESIDENTE
(LA JACARANDA NIGHTCLUB, EL PRESIDENTE HOTEL)
Acapulco, Guerrero, Mexico, 1957
Collaborator: Juan Sordo Madaleno
Photograph: Antonio Candela, courtesy Félix & Dorothy Candela Archive, Princeton University
Model: FA-UNAM

Now demolished, the shell of La Jacaranda was constructed during Acapulco's burgeoning tourist development. Facing the Pacific Ocean and part of a hotel nightclub, the shell's flying curves contrasted with the rectilinear form of the hotel tower adjacent to it and suggested connections to wind and the sea. The form blends three hypars that cantilever far beyond its foundations. Like a billowing sail on land, the shell connected to the ground at only three points, covering a triangular 3,200 square-feet site and protecting visitors from the sun.

CASETA DE VENTAS VERDE VALLE
(VERDE VALLE SALES STAND)
Guadalajara, Jalisco, Mexico, 1960
Collaborator: Alfredo Terrazas de la Peña
Photograph: Antonio Candela, courtesy Félix & Dorothy Candela Archive, Princeton University
Model: FA-UNAM

This structure was built as a location to sell land and houses for the new residential development of Verde Valle in Guadalajara, Mexico. The stand closely mimics the groined vaults at the Bacardí Bottling Plant, which Candela had designed one year prior. Yet at half the size of the Bacardí vaults, the hypars at the Verde Valle Sales Stand required no structural reinforcements at its edges (an aesthetic problem that had upset Candela at Bacardí) and allowed him to conceive a free-edged concrete shell as he had pioneered at the Parish of Saint Anthony of the Orchards in 1959.

PALACIO DE LOS DEPORTES
(PALACE OF SPORTS)
Magdalena Mixhuca, Mexico City, Mexico, 1968
Collaborators: Enrique Castañeda Tamborell and Antoni Peyrí i Macià
Photographs: Courtesy Félix & Dorothy Candela Archive, Princeton University (above and right)
Model: FA-UNAM

The sports stadium is a milestone in Candela's career, for it was his largest and last major work in Mexico City. Built in only eighteen months, the Palace of Sports is a massive arena constructed for the 1968 Summer Olympics, the first Olympics to take place in Latin America. The form and material qualities of the stadium became a fixture in the official image of Mexico's Games. Constrained by the lack of time and funding, Candela moved away from concrete and instead designed a roof of individual copper sheets, each in the shape of a hypar and attached to an arched grid of steel piping. The apparent lightness of the dome is so striking that the V-shaped concrete buttresses along its perimeter seem to prevent the shell structure from taking off rather than support it weight. In the same year in which the Palace of Sports was built, Candela ended his partnership in Cubiertas Ala (the company that he had co-founded) and in 1971, permanently moved to the US to teach at the University of Illinois at Chicago Circle (today UIC).

PARROQUIA SAN ANTONIO DE LAS HUERTAS
(PARISH OF SAINT ANTHONY OF THE ORCHARDS)
Tlaxpana, Mexico City, Mexico, 1956-59
Collaborators: Enrique de la Mora and Fernando López Carmona
Photograph: Guillermo Zamora, courtesy Félix & Dorothy Candela Archive, Princeton University
Model: FA-UNAM

This project is a landmark in the develop concrete shell construction since it was the first to incorporate shells with "free" edges, edges without reinforcements. Using the knowledge that he had previously gained during the construction of Mexico's Stock Exchange Building, Candela designed a hypar that required no additional stiffening system along its boundaries and, therefore, allowed the concrete membranes to be extraordinarily thin. The stained-glass windows placed between the arched surfaces draw attention to the shell's thinness.

PLANTA EMBOTELLADORA BACARDÍ
(BACARDÍ BOTTLING PLANT)
Tultitlán, Estado de México, Mexico, 1958-60 (first stage), 1971 (second stage)
Collaborator: Juan Antonio Tonda
Photograph: Antonio Candela, courtesy Archivo Bacardí-México

Model: FA-UNAM

In 1958, Bacardí & Co. commissioned Candela to design its production hall while Mies van der Rohe was asked to design the office buildings for the company. The bottling plant was initially constructed with three hypar groined vaults with stiffening ribs at the edges. Inspired by Minoru Yamasaki and Anton Tedesko's 1956 Lambert-St. Louis Airport Terminal, Candela vowed that his next structure would "demonstrate that [the St. Louis airport terminal] could be done in a simple, more elegant form." At the bottling plant, three adjacent vaults span 100 feet while large glass surfaces cap the ends of each vault and skylights between the adjacent shells add to the spatial and atmospheric effects. Candela's design anticipated the expansion of the building and in 1971 a second row of three identical vaults was added. By then Candela was based in Chicago, leaving the construction under the supervision of his brother Antonio and the architect Juan Antonio Tonda.

IGLESIA DE LA VIRGEN DE LA MEDALLA MILAGROSA
(CHURCH OF OUR LADY OF THE MIRACULOUS MEDAL)
Vértiz Narvarte, Mexico City, Mexico, 1953-57
Collaborators: José Luis Benlliure Galán and Fernando Fernández Rangel
Photograph: Lola Alvarez Bravo, courtesy Félix & Dorothy Candela Archive, Princeton University
Model: FA-UNAM

The Church of Our Lady of the Miraculous Medal was Candela's first commission for a religious edifice, a typology in which he saw a unique opportunity to experiment with form. The spatial and structural complexity of the building, and its interior in particular, can hardly be overlooked. Reportedly, more than twenty-one different hypars where deployed in the church. Yet its basic component, the pronounced bays along each side, derives from a single asymmetrical umbrella form that Candela had previously developed. This earlier shape was modulated in order to form one bay of the church, which then was repeated four times in order to enclose the nave.*

CAPILLA DE PALMIRA
(CHAPEL OF PALMYRA)
Lomas de Cuernavaca, Morelos, Mexico, 1958-59
Collaborators: Guillermo Rossell and Manuel Larrosa
Photographs: Alberto Moreno Guzmán (left) and Antonio Candela (above)
Model: FA-UNAM

Despite its relatively small footprint, the open-air chapel of Palmyra is one of Candela's most iconic, arresting, and straightforward works—a single architectural form that seems to reach far above the collective space that it shelters. Measuring sixty feet at its tallest point, the

uninterrupted shape dramatically swerves down towards its lowest point before projecting upwards again to reach a height of twenty-eight feet—a sweeping movement that is reinforced by the linear texture left on the concrete by the formwork. The saddle-type hypar that Candela had previously deployed at the Cosmic Rays Pavilion is here pushed to its spatial and material limits. The challenging and experimental nature of his work was made evident when in the first attempt to construct the shell, the structure collapsed during the formwork's removal.

CAPILLA DE NUESTRA SEÑORA DE LA SOLEDAD, "EL ALTILLO"
(CHAPEL OF OUR LADY OF SOLITUDE, "THE ATTIC")
Coyoacán, Mexico City, Mexico, 1955-57
Collaborators: Enrique de la Mora and Fernando López Carmona
Photograph: Erwing Lang, courtesy Félix & Dorothy Candela Archive, Princeton University
Model: FA-UNAM

The architect Richard Neutra once commented on the Chapel by noting "Here only four centimeters separate us from God," alluding both to the predominant element of the structure (its sweeping roof) and the thinness of it. Known colloquially as "The Attic" because it is located slightly above the surrounding elevation, the outer walls of dark volcanic stone from the region follow the slope, while the roof lifts up to form a large opening for the Chapel's main light source. The simplicity of scheme is revealing and points towards the programmatic implications of Candela's hypar geometries. While the open rhombus-shaped plan has no dividing walls, the curvature of the ceiling differentiates the interior space through smooth transitions between room-heights and lighting conditions.

IGLESIA DE SANTA MÓNICA
(CHURCH OF SANTA MONICA)
Del Valle, Mexico City, Mexico, 1960-63
Collaborator: Fernando López Carmona
Photograph: Juan Guzmán
Model: FA-UNAM

In order to accommodate the placement of the building on a compact urban lot, the architect on record (López Carmona) developed a semicircular plan and positioned it on the corner of the site. For this particular urban condition, Candela designed a structural form that begins at the edge, fans out over the site, and opens into large stained-glass windows. Visitors to the church witness the most remarkable moment in the interior, where a slanted column leans into the space to support all the concrete arches that form the enclosure.

CAPILLA DE SAN VICENTE DE PAUL
(CHAPEL OF SAINT VINCENT DE PAUL)
Coyoacán, Mexico City, Mexico, 1958-60
Collaborators: Enrique de la Mora and Fernando López Carmona
Photograph: Guillermo Zamora
Model: FA-UNAM

Candela was responsible for the structural design and roof of this chapel, when collaborating once again with the architects de la Mora and López Carmona. The roof is comprised of three identical hypar concrete shells with straight edges that connect towards the top via steel rods. Each shell is grounded on only two posts and cantilevers almost fifty-eight feet. The result is a structure in equilibrium, where the weight of each concrete shell contributes to the balancing act of the overall form.

PARROQUIA DE NUESTRA SEÑORA DE GUADALUPE
(PARISH OF OUR LADY OF GUADALUPE)
Madrid, Spain, 1963
Collaborators: Enrique de la Mora, José Ramón Aspiazu, and José Antonio Torroja
Photograph: Pablo Lines
Model: Facultad de Arquitectura, Universidad Nacional Autónoma de México (FA-UNAM)

This was Candela's first project in Spain, the country he had left in 1939, after Franco's Civil War. It was also the first major Spanish building by a team of Mexican designers (Enrique de la Mora as architect and Candela as engineer, who had collaborated on many occasions). Candela designed a roof with a highly complex geometry that bends and folds in order to differentiate spatial and lighting conditions. Over the 1950s, Candela had perfected the use of hyperbolic paraboloids (hypars) in concrete, and for the Parish assembled several hypars that balance each other and create a perplexing interior. While the floor plan is basic and symmetrical, the ceiling undulates and, in turn, distinguishes different locations within the space. In the center, the warped surfaces rise up and are held together by a metal framework similar to that used by Candela in the San Vicente de Paul Chapel three years prior.

CANDELA'S DRAWINGS
1) Detail section study drawings of Parroquia de Nuestra Señora de Guadelupe (Parish of Our Lady of Guadalupe)
2) Plan, elevation, and section drawing of Capilla de San Vicente de Paul (Chapel of Saint Vincent de Paul)
3) Building section and column detail drawings of Iglesia de Santa Mónica (Church of Santa Mónica)

4) Plan and section drawing of Capilla de Nuestra Señora de la Soledad, "El Altillo" (Chapel of Our Lady of Solitude, "The Attic")
5) Plan drawing of Capilla de Palmira (Chapel of Palmyra)
6) Exterior and interior elevation drawings of Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal)
7) Plan and elevation drawings of Planta Embotelladora Bacardí (Bacardí Bottling Plant)
8) Plan and elevation drawings of Parroquia San Antonio de las Huertas (Parish of Saint Anthony of the Orchards)
9) Elevation and section drawings of Palacio de los Deportes (Palace of Sports)
10) Interior perspective drawing of Palacio de los Deportes (Palace of Sports)
11) Plan and section drawings of Caseta de ventas Verde Valle (Verde Valle Sales Stand)
12) Plan and section drawings of Cabaret La Jacaranda, Hotel El Presidente (La Jacaranda Nightclub, El Presidente Hotel)
13) Section drawings of Bolsa Mexicana de Valores (Mexican Stock Exchange Building)
14) Plan drawing of Restaurante Los Manantiales (Los Manantiales Restaurant)

Pages 1-6 and 8-12, courtesy Avery Drawings and Archives Collection, Columbia University
Pages 7 and 13-14, courtesy Archivo de Arquitectos Mexicanos, Universidad Nacional Autónoma de México (UNAM)

Workers load-testing experimental umbrella-shaped hypar, Vallejo, Mexico City, 1953
Courtesy Félix and Dorothy Candela Archive, Princeton University

FÉLIX CANDELA
Map of Locations of his Work in Mexico City, 1969
Courtesy Avery Drawings and Archives Collection, Columbia University

Poster for "Architecture Faculty Exhibition"
April, 1975
Courtesy Steven Reardon

"Polémica Sobre La Arquitectura: Diálogo Con El Arq. Félix Candela En Chicago, Illinois"
("Polemics on Architecture: Dialogue with Architect Félix Candela in Chicago, Illinois")
from Calli International Nueva Época: Revista analítica de arquitectura contemporánea, #65, 1975, 11-16

FÉLIX CANDELA
Pencil Drawings, Chicago, 1975-78
Photographs of original drawings
Hypar Surface Condition, Chicago, ca. 1975 (top left); Plaza Pavilion, unknown location, Chicago, 1976 (bottom left); Park Shell, unknown location, Chicago, 1978 (right)

GRUPO TYPSA (Félix Candela as consultant)
Elevation of Stadium Roof for The Islamic University, Riyadh, Saudi Arabia Section, 1986
Photograph of original drawings
Courtesy Archivo de Arquitectos Mexicanos, Universidad Nacional Autónoma de México (UNAM)

FÉLIX CANDELA
Interior Perspective
Drawing of Stadium Santiago Bernabeu
Project, Madrid, 1975
Photograph of original drawings
Courtesy Archivo de Arquitectos Mexicanos, Universidad Nacional Autónoma de México (UNAM)

STEVEN REARDON
Drawings for Kuwait Swimming Arena #1-4, Student Project for Candela Studio at the School of Architecture, University of Illinois Chicago Circle, 1976
Courtesy Steven Reardon

Ferro-Cement Sculpture at the University of Illinois at Chicago Campus, Built by Civil Engineering Student Under the Supervision of Professor Surendra Shah in 1977
Photograph: Christopher Markin

Personal accounts of meetings with Candela

Included are discussions of Candela during his time in Chicago (1971-78). Accounts by William Baker, Stuart Cohen, Geoff Goldberg, Steven Reardon, Ken Schroeder, Surendra Shah, and Stanley Tigerman.

Two tables with materials focusing on Candela's time in Chicago, the city in which he lectured and exhibited multiple times before arriving to teach as a full professor in the School of Architecture at the University of Illinois at Chicago Circle (today UIC) in 1971.

TABLE 1

1) "Candela's Work at Pier," *Daily Illini*, Oct. 29, 1958 (reproduction of newspaper clipping)
2) "Architects Plan Confab on Design," *Daily Illini*, Oct. 18, 1956 (reproduction of newspaper clipping)
3) University Gallery, "Concrete Shells by Felix Candela," Mar. 17, 1961 (reproduction of expense notice for exhibition at University of Illinois at Navy Pier)
* No. 1-3, courtesy UIC Library, Special Collections and University Archives
4) "Felix Candela," invitation for lecture by Candela at the Graham Foundation, Oct. 6, 1964 and, letter from Leonard J. Currie (Dean, College of Architecture and Art, UICC) to George E. Danforth (Director, School of Architecture and Planning, IIT), Sep. 30, 1964, discusses a guided tour for Candela of UICC campus by Walter Netsch
5) Letter from Leonard J. Currie to John Entenza (Director, Graham Foundation), March 15, 1971, funding request to bring Candela to Chicago for a visit
6) "Sangría -- Fiesta with Candela," Apr. 21, 1971, invitation to a reception/party for Candela at UICC with note from Leonard J. Currie to John Entenza, accompanied by promotional flyer for Graham Seminar lecture by Candela on the same day at noon at UICC
* No. 4-6, courtesy Graham Foundation for Advanced Studies in the Fine Arts, Chicago
7) Letter from George E. Dunforth to John Entenza, Apr. 8, 1971, notifying of Candela lecture on Apr. 22, 1971, courtesy Graham Foundation for Advanced Studies in the Fine Arts, Chicago
8) "Shell Structures in Mexico," announcement for Candela lecture at the Graham Foundation, presented by the Society of Architectural Historians, Chicago Chapter, March 7, 1972) (reproduction), courtesy UIC College of Architecture, Design, and the Arts Archive
9) Memorandum from UICC Board of Trustees meeting, approval of Candela's appointment to professor at UICC, July 21, 1971 (reproduction), courtesy UIC Library, Special Collections and University Archives
10) Carol Olmsted, "Discuss environment oriented school here," unknown paper, Feb. 28, 1974 (reproduction of newspaper clipping), courtesy UIC College of Architecture, Design, and the Arts Archive
11) *Calli Internacional Nueva Época: Revista analítica de arquitectura contemporánea*, #65, 1975, contains Candela interview reproduced on the wall here, courtesy Alexander Eisenschmidt
12) Felix Candela, "Shell Structures and Climatic Influences," abstract for conference talk, courtesy UIC College of Architecture, Design, and the Arts Archive

13) Felix Candela, letter to Andrew S. Messick of Messick Construction & Development Co. about Chicago tennis court roof project, July 12, 1974 (photograph of original letter)
14) *Contemporary Architects Series: Pier Luigi Nervi, Felix Candela* (Tokyo: Bijutsu Shuppan-sha, 1974), courtesy Alexander Eisenschmidt
15) Letter from Academic Vice-Rector of Universidad Nacional Federico Villareal, Lima, Peru, Feb. 21, 1977, notification for Candela's appointment as an honorary professor (reproduction), courtesy UIC Library, Special Collections and University Archives
16) Letter from Norman F. Cantor (Vice Chancellor for Academic Affairs, UICC), May 17, 1977, congratulates Candela for his appointment as an honorary professor
17) Letter from Alan M. Voorhees (Dean, College of Architecture, Art, and Urban Science at UICC), Jan. 5, 1978, congratulates Candela on his award from the Illinois Council of the American Institute of Architects
18) "Town Talk," *Downtown News*, Nov. 29, 1977, Candela mentioned as award recipient from the Illinois Council of the American Institute of Architects (reproduction of newspaper clipping)
19) *News: University of Illinois at Chicago Circle*, May 12, 1977, press release about a panel discussion on the work of Luis Barragán (misspelled in document), led by Candela, May 25, 1977
* No. 16-19 courtesy UIC College of Architecture, Design, and the Arts Archive
20) Felix Candela, *En defensa del formalismo y otros escrito*s (Xarait, 1985), two copies of Candela's book, one closed and one opened to the title page, showing Candela's handwritten dedication to UICC, courtesy Alexander Eisenschmidt and UIC Library
21) "Felix Candela," *The News & Observer,* obituary for Candela, Dec. 9, 1997 (newspaper clipping), courtesy Alexander Eisenschmidt

TABLE 2

Reyner Banham, "Simplified Vaulting Practices," *Architectural Review*, vol. 114 (September 1953), 199- 202

"Wizard of the Shells," *Architectural Forum*, vol. 3, #5 (November 1959), 154-159

Arts & Architecture, vol. 73, #5 (May 1956), Candela structure featured on cover, interior article: Colin Faber, "Structure by Felix Candela," 20-25

"Four Great Pours," *Architectural Forum*, vol. 115, #3 (September 1961), 104-115

"Candela," *Zodiac*, vol. 21/22, #22, 70-87

Burton Holmes and Thomas Creighton, "Can a Man Be Architect, Engineer, and Builder?" *Progressive Architecture*, vol. 40 (February 1959), 140-141

Ester McCoy, *Felix Candela: Shell Forms* (1957), courtesy Graham Foundation for Advanced Studies in the Fine Arts, Chicago

Colin Faber, *Las Estructuras de Candela* (Mexico City: Continental, 1970), showing Candela's handwritten dedication to UICC

Unless otherwise indicated, all bound journal volumes courtesy UIC Library

Candela en el cine mexicano (*Candela in Mexican Cinema*) by Aurelie Semichon and Elisa Lozano, 2010
This video compiles film excerpts focusing on moments during which Candela's structures become the movie set.

El aviso inoportuno by Rafael Baledón, 1969
Palacio de los Deportes (Palace of Sports), 1968

La montaña sagrada by Alejandro Jodorowsky, 1973
Palacio de los Deportes (Palace of Sports), 1968

Cuernavaca en primavera by Julio Bracho, 1965
Escultura *Las Alas* de Tequesquitengo (Sculpture *Las Alas*, at Tequesquitengo), 1958 and Casino de la Selva (Hotel Casino de la Selva), 1960

Sí quiero by Raúl de Anda, 1965
Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal), 1955

Cruz de amor by Federico Curiel, 1969
Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal), 1955

Solo para ti by Ícaro Cisneros, 1966
Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal), 1955

Domingo salvaje by Francisco del Villar, 1966
Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal), 1955

Espiritismo by Benito Alazraki, 1961
Iglesia de la Virgen de la Medalla Milagrosa (Church of Our Lady of the Miraculous Medal), 1955

RESTAURANTE LOS MANANTIALES
(LOS MANANTIALES RESTAURANT)
Xochimilco, Mexico City, Mexico, 1958
Collaborators: Fernando and Joaquín Álvarez Ordóñez

Photograph: Juan Guzmán, courtesy Archivo Fotográfico Manuel Toussaint, IIE-UNAM
Model: FA-UNAM

The structure is located amongst the meandering canals and floating gardens of Xochimilco that date back to pre-colonial times and today can be explored via trajinera (a traditional wooden boat). Seemingly composed of only two elements—a base and a thin, undulating sheet of concrete—the structure maximizes material efficiency and formal expression. The four intersecting hypar vaults that span the 1,000-seat restaurant create an interior of eight folds that meet in the center at a height of 20 feet. Candela was determined to deploy no edge reinforcement, which results in a mysteriously thin structural surface that defies gravity.

Construction of Los Manantiales Restaurant
Xochimilco, Mexico City, Mexico, 1958
Collaborators: Fernando and Joaquín Álvarez Ordóñez
Photographs: Juan Guzmán, courtesy Archivo Fotográfico Manuel Toussaint, Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México (IIE-UNAM)

Candela's concrete shells combine advanced geometries with relatively simple construction techniques. During the construction of Los Manantiales, as in all of Candela's other hyperbolic paraboloid (hypar) concrete shells, the formwork for each double-curved surface was entirely created with straight pieces of timber board, before the rebar was placed and concrete poured by hand. Once the concrete cured, the three-dimensional scaffolding (that held the formwork in place) was removed and a vaulted space revealed. This technique, on the one hand, enabled the proliferation of speculative forms and, on the other, relied on large teams of workers. By the mid-1960s, however, labor and construction material became more expensive in Mexico, which, in turn, affected the appeal of Candela's concrete shells.

Workers constructing the concrete shell at Restaurante Los Manantiales (Los Manantiales Restaurant), Xochimilco, Mexico City, Mexico, 1958
Photograph: Juan Guzmán, courtesy Archivo Fotográfico Fundación Televisa, México