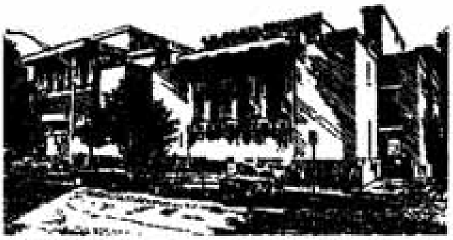
ARCHITECTURE

EHLINGER & ASSOCAITES SECOND QUARTER 1995



UNITY TEMPLE
Oak Park, Illinois

Lao Tse, or Lao-Tzu as some translations interpret the name, was an ancient Chinese poet - philosopher who lived contemporaneously with Confucius. Some say he was a follower of Confucius. He wrote the ***Tao Te Ching*** (The Book of the Way) in the 5th century B.C. in which he said:

We join spokes together with a rim to make a wheel, but the essence of rotation lies in the space between the axle and the hub;

We shape clay into a vase, but it is the emptiness inside that holds what we want held;

We hammer wood together for a house, but the reality is the space within;

What is unseen is more important than what is seen.

Frank Lloyd Wright wrote that he was crestfallen to the degree of being severely depressed when he first read those words of Lao Tse shortly after he had completed the design and construction of Unity Temple in Oak Park, Illinois in 1906. He had previously thought that he, and he alone, had had the creative genius to have first dreamed of such a profound idea, and here he discovered that Lao Tse had done so two and one half millennia earlier. He was not the first after all: he was a "johnny-come-lately" - what a letdown!

Then Wright related that he thought about it some more for a few days, and with his characteristic arrogance and egocentricity, he remarked: "Perhaps Lao Tse was the first to think of the reality of space, but I, and I alone, was the first to consciously design it in a building in the real world!" Wright felt that the Unity Temple was the first building he designed where he was fully conscious of the reality of the spatial expression the whole time he designed it, not merely intuiting what he was doing.

This issue's limited edition signed print, by Ladd P. Ehlinger, is of the south facade of Unity Temple. Here we can see the building as two masses connected in the middle by the entry lobby that one can't see from the street. The lower mass closest to the viewer is the parish hall, whereas the taller mass is the sanctuary. One approaches the entry lobby from the front (west) of the building on either side of the sanctuary.

Spatially the sanctuary is a cube, being subdivided into two levels of balconies on three sides by massive corner columns flanked by square corner stair towers, all lighted by a huge skylight with the exquisite stained glass of Wrightian artistry. The fourth side is devoted to the minister's pulpit, seats for the elders, and the organ. One enters the sanctuary indirectly from the corners, from below in the dressing and choir areas, but one exits past the minister's pulpit into the lobby.

After exiting into the lobby, one enters a similar spatial expression in the parish hall, where there are classrooms on the second level and a large communal space on the ground level with a kitchen.

This building was one of the first buildings built in the U.S. of reinforced concrete. One of the determinants of the shapes used in the building was the reusability of the forms for casting the concrete. The sanctuary and the parish hall were built in quarters to save money. The texture of the concrete was designed to be exposed aggregate after the forms were stripped from the cured concrete.

Oak Park is a suburb adjacent to and west of Chicago that was developed from the mid 1880's through 1914 or so. It was suburban sprawl that was made possible by the inter urban railroad - the EL. Wright developed as an architect along with the community, having built his home there first in the late 1880's and his attached studio after he left Adler & Sullivan's employ in the early 1890's. Wright's family were Unitarians, with a long association. This particular church commission came to Wright through his Uncle Lloyd's influence as a Unitarian Minister.

Oak Park today is a virtual museum of Wright's buildings, and of those of other architects of the Prairie School of Architecture, as it was called at the time. Most all of these buildings, like Unity Temple, have been restored and are in active use. It is well worth a visit when seeing Chicago.

BUILDING CODES

Building Codes shape our environment as instruments that all Architects and Engineers utilize as criteria for designing our buildings. Building Codes address and establish criteria in two basic areas of concern: Fire Safety, and Design Standards for materials and systems.

To regulate fire safety, Building Codes define the types of occupancy, the level of occupation of each type of occupancy, how one must design the exiting of each type of occupancy, and how one must design for maximum size and rated fire separation of each type of Occupancy from other types of Occupancy and the public way.

Types of occupancy are derived from the usage to which the spaces will be put along with the number of people intended to be in the spaces. For instance, schools from kindergarten through high school are classed as educational occupancy, while college buildings are classed as business occupancy under the Standard

Building Code, right along with office buildings. The Code recognizes that young adults do not need the type of protection that small children through teenagers do.

The most stringent type of occupancy is Assembly, where large numbers of people congregate in a small space. A school may have an Assembly occupancy within it, in which case the building is said to be a Mixed Occupancy. The Code will require that the two types of Occupancy be separated by a fire resistive wall of a particular rating which reflects the severity of the risk of the two types of occupancy.

The Code will also limit the square footage of space that can be built for a particular Occupancy within a type of construction that is unsprinklered or sprinklered. This also tries to balance the risk of the type of Occupancy against the risk of the amount of square footage of the type of construction.

The number of people that occupy a given space within a given occupancy is defined in the Codes by the square footage occupied per the type of Occupancy. This number of people is then used to determine the number of exits and exit ways. The Code specifies exits per the type of Occupancy, population, and fire separation ratings within each Occupancy and between Mixed Occupancies. One interesting type of exit that is defined and permitted in the Codes is the Horizontal Exit.

A Horizontal Exit isn't really an exit at all - yet it is. It is a device whereby the building is divided into two or more compartments per floor that are separated by a two hour rated fire wall. A percentage of the population (usually 50%) of one compartment is allowed to exit into an adjoining compartment rather than to fire stairs to the public way. The adjoining compartment is allowed to do likewise. This reduces the total number of stairs required in multi-floor buildings. Stairs are expensive elements of the building. The thinking is that one has two or more buildings for purposes of refuge by exit from a fire, and that one will be as safe exiting into the adjoining building as exiting into a fire stair.

The final area governed by Building Codes has to do with the performance of individual materials and systems of materials. Engineering standards are written into the Codes or referenced into the Codes. Waterproofing; structural properties and performance; fire resistivity, plumbing performance; heating, ventilation and air conditioning; power and lighting; are all regulated by Building Codes to satisfy the other criteria previously mentioned.

DOPPLER RADAR AND INADEQUATE BUILDING CODES

The knowledge that we are gaining about climatic phenomena because of Doppler radar is astounding. The data is also indicative of the fact that we should rethink the wind loading requirements of the building code for coastal as well as inland areas.

In the case of south Louisiana and other coastal areas, the data tells us that ordinary T-storms frequently produce microbursts of winds whereby there are downdrafts of the magnitude of 100 to 140 MPH that are deflected by the ground into a lateral stream. Buildings directly under the vertical portion of the micro burst are subjected to pressure loadings in excess of the vertical loads required to be resisted by the building code. Buildings facing the deflected microburst winds that are lateral in nature (horizontal) are generally all right if they are code compliant (designed to resist 100 MPH with factored increases). The frequencies of these storms are greater than hurricanes. The possibility is high but the probability is low.

In the case of north Alabama, most of the dangerous storms are tornadoes that arise out of T-storms associated with weather fronts. Most of these tornadoes that frequent the area look like no other anywhere else - these are **not** the classic funnel shaped clouds. The shapes are that of a huge cylinder with walls straight up and down, 1/4 mile to 3/4 mile in diameter, with lateral winds in the range of 90 to 140 MPH. There may also be updrafts and downdrafts like the microbursts as well. The bottom of the storm walls may touch the ground or hover anywhere from 20 to 40 feet above the ground as the storm traverses its path. Here again, the possibility is high, but the probability is low. The swath of the storm covers only a small area.

In both instances, even though the probability is low of being hit by one of these storms, it is still high enough to warrant changes in the building code to protect life and property, and changes in design criteria in the meantime.

The coastal areas of the U.S. are required by building codes to design to resist hurricane force winds - derated to satisfy some of the affected segments of the construction industry and society - of 100 MPH in the Gulf of Mexico region. The codes also require that the design of the building be tied together to resist tensile forces, uplift and the like. Wind clips, for instance, are required to be installed at the connection of the wood rafters to the top of the wood stud wall in residential and light commercial construction. These clips are fabricated of sheet metal with punched holes for nailing to make the nails work or resist the wind forces in shear, rather than in tension, which is how a toe nail on a rafter works when subjected to uplift wind forces.

Had wind clips been used on the roof construction of the houses that lost their roofs in the recent north Alabama storms, they would have added only $150 to $200 extra cost to each house. This is a lot cheaper than losing the entire roof and exposing the interior of the house to the weather in the middle of the storm.

We each pay for these losses in our insurance premiums. Lower premiums would result if the building code were changed to require designs to resist winds up to 140 MPH.

Wind pressure varies with the square of the wind's velocity given by the formula: $\mathbf{P = 0.00256V^2}$ Where P = Wind Pressure, and V = Wind Velocity.

The graphed pressure curve is a parabola. The economics of the design to resist the pressure change when the wind speed reaches the "break point" of the curve is between 130 MPH and 140 MPH. Over 140 MPH it is cheaper to let the structure blow down than to design to resist these high pressures.

The current Standard Building Code was revised from earlier versions to reflect the subtleties of how the wind actually acts upon the structure. There are now formulas that take into account the importance of the structure (which would include whether or not it was intended to be a shelter), its location, its shape, and the member of the structure (main or secondary, and windward or leeward side).

Now that we know so much more about these types of storms, we can design structures that can better resist winds of these magnitudes.