

## The Knowledge Bank at The Ohio State University

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# ENGINEERING AT N. Y. WORLD'S FAIR

By ROBERT DERRENBERGER

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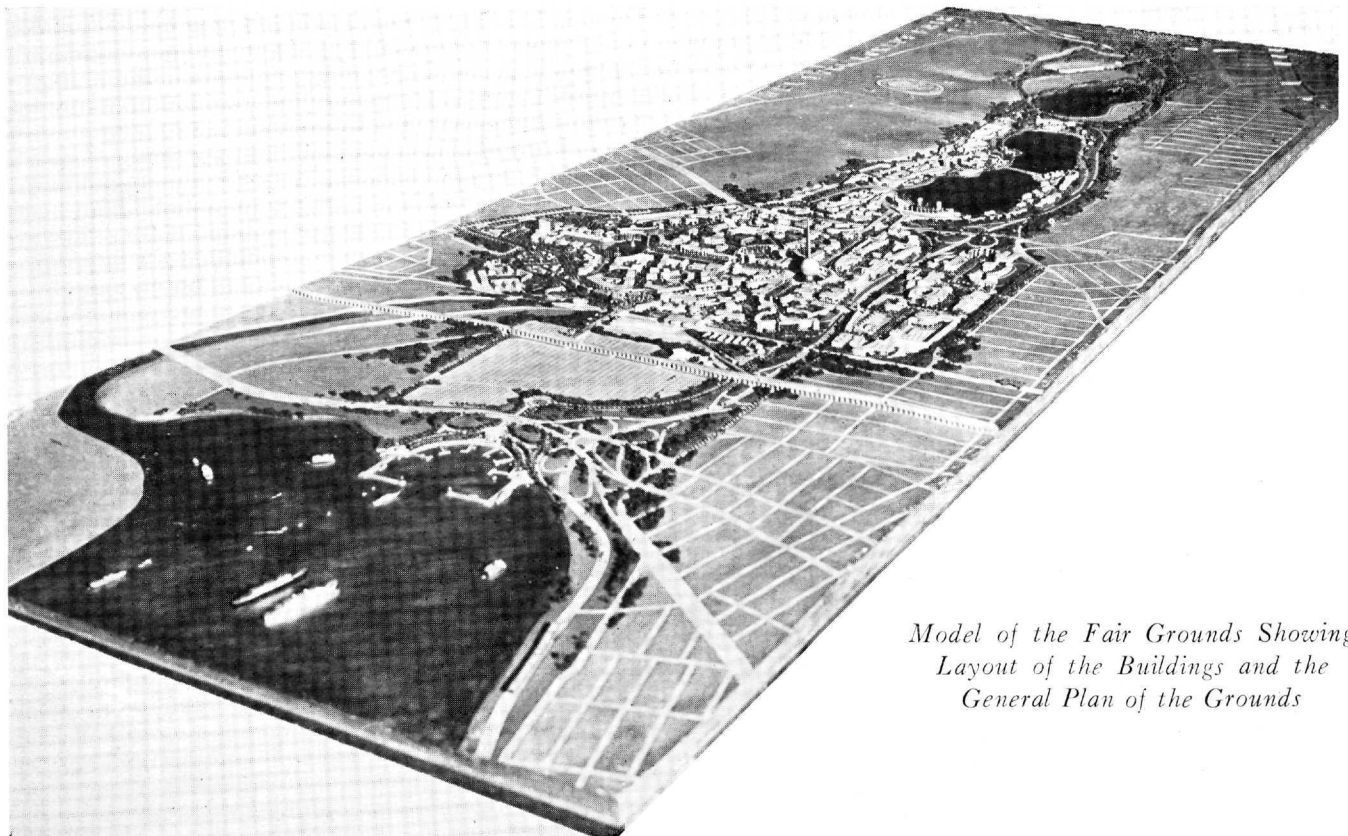
THE dominant architectural feature of the New York World's Fair of 1939 will be a white sphere 200 feet high poised on a cluster of fountains and flanked by a slender 700-foot triangular obelisk.

Although both sphere and triangle are among geometry's simplest most fundamental forms, neither has ever before been employed in formal architecture. Their use for the key buildings of the Fair—the Theme Building and Tower—resulted from a determination to strike a new note in design, yet one that was simple in form yet beautiful and structurally sound, to exemplify in architecture the theme of the Fair—Building the World of Tomorrow.

So new is the triangular motif to architecture that fair technicians were unable to find a word which would adequately describe the obelisk-like structure.

"Acute triangular pyramid" was the best they could do. Geometricians at Columbia University could only suggest "tall tetrahedron." Finally, it was decided to coin a new word, and "trylon" was selected—a combination of "tri," referring to its three sides, and "pylon," indicating its use as a monumental gateway to the Theme Building. To describe this Theme structure, the word "perisphere" was coined. It was felt that the prefix "peri," signifying "beyond, all round, about," conveyed perfectly the underlying idea of the Fair.

The Perisphere, which will house the Exposition's Theme Exhibit—a spectacular portrayal of the basic structure of the World of Tomorrow—will rise eigh-



*Model of the Fair Grounds Showing  
Layout of the Buildings and the  
General Plan of the Grounds*

teen stories above the Fair grounds. It will be broader than a city block. Except for the Trylon it will be the highest structure in the Fair. Its interior will be more than twice the size of Radio City Music Hall.

A single entrance high up on its side, fifty feet from the ground will be reached by glass enclosed escalators. Stepping within, the visitor will seemingly find himself suspended in space on a moving platform gazing down on a vast panorama dramatizing the all-important role of cooperation in modern civilization, showing all the elements of society coordinated in a better World of Tomorrow.

A bridge will link the sphere to the obelisk, while from the latter a ramp 900 feet long will slope gently to the ground curving around the fountain basin beneath the sphere in a huge three-quarter circle. This ramp is described as the "helicline." Since it will be 50 feet high at the top—higher than any other vantage point to which visitors will be admitted—it will command a view of the entire Fair.

A spectacular night illumination of the sphere has been promised by Fair engineers, who are working on lighting effects never before attempted on such a scale. Batteries of powerful projectors mounted on distant buildings will spot the globe in color. At the same time other projectors will superimpose on this color moving patterns of light which may take the form of clouds, geometric patterns and even moving panoramas. These moving lights will create the optical illusion that the sphere itself is slowly rotating.

The great Trylon or Obelisk—half again as tall as the 555 foot Washington Monument—will not be illuminated at night except by reflected light. In contrast to the brilliant surface of the Theme Spheroid, its sloping sides will fade away into the night, giving the effect of a tower reaching to infinity.

A unique feature of the Trylon will be its utilization as the source of all broadcasts to Fair visitors. From it the "Voice of the Fair" will issue announcements at regular intervals. New types of long range sound projectors, some of them still in the experimental stage, will make it possible to blanket the entire grounds with beams of sound, thus eliminating both overlapping and unpleasant variations in volume.

The Perisphere will be of articulated steel frame construction. Both longitudinal and latitudinal trusses will be large and heavy at the bottom and will get progressively smaller and lighter as the top is neared. The entire surface will be covered with some white substance. Experiments are now being made to determine what substance will be most suitable.

The Perisphere also will have an inner shell, perforated to absorb sound and prevent reverberations. Insulation will be applied to the interior surface of the outer shell to deaden further all sounds and to protect against exterior heat. The chamber between the two shells will be four feet wide at the top and sixteen feet

wide at the bottom. Emergency exits from the interior platform will open into it, and temperature will be kept as low as possible by means of a huge fan which will draw air out of the top.

The shape of a sphere is said to be the most perfect attainable from the point of view of technical construction. Surface stresses and strains are so balanced that it would be theoretically possible to build a ball this size out of steel plates only one-half inch thick with bracing only at the top and bottom and without girders. The cost of scaffolding for this method of construction, however, led to the decision to use an articulated steel frame.

The Perisphere will weigh, exclusive of exhibit material, 5,760,000 pounds, it is estimated. It will be supported on eight columns spaced around a circle of eighty-one feet diameter. Each column will be twelve feet high and four feet thick and will be covered with a cylindrical jacket.

The spectator will not see these supports but only a gigantic bubble floating on a cluster of fountains. This effect will be obtained by encasing the columns in glass and sheathing each in a jet of water pumped up from the inside. The water will fall back into the circular pool, which will be eight feet below the bottom of the sphere.

Because of its unique design careful experiments had to be made to determine the effect of wind pressure on the sphere and of unbalanced loads, such as spectators crowded on one side. It was found that the natural streamlining of the building would greatly reduce wind pressure. A wind velocity of 88 miles an hour, for example, produces a pressure of 30 pounds per square foot on a bridge truss. On a sphere a similar velocity produces a pressure of only 2.5 pounds per square foot.

Originally it had been proposed to support the building on a circular collar, but aside from the appearance, it was found that this would have resulted in a much greater wind pressure on one side and wind vacuums on the other. As a corollary to abandoning this plan it was found necessary to increase from six inches to three feet the depth of the pool, which will measure 325 feet across. Otherwise a heavy wind sweeping under the sphere would suck all the water out of the basin.

Final reports of consulting engineers stated that the building was "a safe and practical structure" and stable "beyond a doubt." Its construction, it was said, "should furnish an exemplification of the advancements made in scientific design and the possibilities in the use of modern methods and construction." Among these modern methods will be its air conditioning and lighting systems, studies for which are now being made.

The Trylon, rising from the east bank of the pool, also will have a steel frame and a light outer covering.

It will have a triangular base measuring sixty-eight feet on a side, and each of its three sides will be triangles, tapering to a point about 700 feet in the air. One of the sides may be colored to give it sufficient depth when seen from a distance.

From its base two escalators will mount the sixty-five feet to the sphere entrance. They will be the longest moving stairways in the world, and each will carry a double file of passengers. Their maximum capacity will be 16,000 persons per hour.

A movable platform, on which the spectator will be carried slowly around the Perisphere, may be compared to a gigantic washer fourteen feet wide and 450 feet in circumference suspended in the globe. It will be hung at least twelve feet from the walls so that a view may be had from the railing on either side.

The platform will have a capacity of about 1,200 persons at any one time. Moving at the rate of thirty feet a minute it will take fifteen minutes for it to carry a visitor from the entrance around to the adjacent exhibit. From here a bridge will lead across to the Trylon, from which the visitor can descend either by stairs within the structure or on the Helicline, which starts at this point.

The lights thrown on the Perisphere at night will have their source in projectors at least 400 feet away from the globe. They will be mounted in batteries on the roofs of various exhibit buildings, and their beams will envelope the sphere in cones of light. On misty nights these cones will be visible and will of themselves create interesting patterns.

The illumination experts state that the total amount of light thrown on the Perisphere will equal 850,000 watts. The projectors will be either of the incandescent or arc type, depending on their function. Some will be used to bathe the surface in solid color, while others will superimpose on this color moving patterns, either abstract or depicting actual scenes and pictures.

The illumination of the sphere will differ from flood lighting because of the distance the beams will travel. Furthermore, the beams will just fit the globe so that no light will spill over on the sides. Additional lighting effects will be provided by throwing white light up through the fountains, making them emit a glow against the bottom of the sphere.

No illumination will be directed at the Trylon. Its lower part will receive reflected light from other buildings, but the rest of the tower will fade into the night.

The sound projectors will be mounted near its top. Each will be directed at a particular section of the grounds, and sound from it will hit that section and no other. This method of broadcasting, which is still in process of development, is expected to be far more satisfactory than the present one of spotting loudspeakers around the grounds or of having one great amplifier. Maximum amplification will be used to

reach distant sections without deafening listeners nearby. We are assured that there will be no overlapping of sound waves at borderline points. Another advantage will be that announcements can be sent to one section, if necessary, without disturbing those in other zones.

The broadcasting system will be used only to disseminate news and announcements by what will be known as the "voice of the fair." There will be no music, and such announcements as are made will probably come at pre-arranged intervals when all other noise will cease.

These structures and their auxiliaries are to exemplify the theme of the fair—Building the World of Tomorrow—a forward working philosophy of universal appeal.

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