Building a Memorial to Match the Battle

by Barbara Eaves

On April 21, 1937, "with a heartfelt speech of tribute and a trowel full of mortar," Jesse H. Jones laid the cornerstone for a soaring monument to commemorate a small battle with huge consequences.[1] The memorial to that battle is as breathtaking as the battle itself. Not only is the obelisk beautiful, it set structural precedents that are still used today in constructing tall buildings in the area.[2]

The octagonal shaft is faced with Texas Cordova shell stone quarried near Austin. It rises 570 feet above the battleground.[3] The museum proper, which forms the building's base, is 124 feet square. It is decorated by eight engraved panels that relate the history of Texas. The six flags of Texas decorate the building's bronze doors. Above the panels, at the base of the shaft, is a frieze depicting events in the Anglo-American colonization of Texas. The shaft tapers from forty-eight feet square at its foundation to thirty feet square at the observation tower. The building is crowned by a thirty-four-foot star that symbolizes the "lone star" of Texas.[4]

At its dedication, on San Jacinto Day in 1939, it was the largest masonry construction project ever built.[5] In 1960, the battlefield, including the monument, was designated a National Historic Landmark by the U.S. Department of Interior.[6] The 1984 Guinness Book of World Records listed the San Jacinto Monument as the "Tallest Monumental Column" in the world. In 1992, the American Society of Civil Engineers declared the San Jacinto Monument a National Historic Civil Engineering Landmark.[7] This memorial to Texas heroes cost "more than $1.5 million," reported Jones to President Harry S. Truman in 1946. "Of this amount about $250,000 was contributed by the State of Texas; $400,000 came from the $3,000,000 appropriated by Congress for the celebration of the Texas Centennial; a modest amount was furnished at Houston; the balance by PWA and WPA. All with the approval of President Roosevelt, who went with me to the battleground prior to selecting the exact location for the monument."[8] As Jim Steely wrote in *Texas Highways* in 1993: "On his way to open the Centennial Exposition in Dallas (in 1936), Roosevelt detrained in Houston, sailed down Buffalo Bayou to the San Jacinto project, and delivered a hearty speech from the backseat of a Rolls-Royce limousine. 'I have in my office… a model of the beautiful memorial you are to erect here…Jesse Jones gave it to me,' he grinned."[9] Jones added to President Truman: "President Roosevelt never saw the monument, but had planned to."[10]

Bellows built the base and tower. WPA built out the museum and constructed the reflection pool. Courtesy San Jacinto Museum of History.

The players

Jones, lumberman, financier, philanthropist, publisher of the *Houston Chronicle* and, at the time, chairman of the Reconstruction Finance Corporation in Washington and the Centennial Celebration in Texas, was a powerful force in marshalling the financial and political capital it took to bring this structure out of the ground.[11] Alfred C. Finn was Jones' choice as architect; the engineer was Robert J. Cummins, and W.S. Bellows Construction Company was the contractor. C.A. "Deke" Bullen was Bellows' superintendent on the job.[12] Jones has been credited as the monument's designer. He wrote to President Truman: "I called to mind all of the monuments I had ever seen. Of these, the Washington Monument

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Jesse Jones with a model of the monument. Courtesy San Jacinto Museum of History.

Ground was broken on April 21, 1936, with oxen straining to pull a 100-year-old plow guided by Andrew Jackson Houston, Sam Houston's youngest son. Jesse Jones stands to his right. Courtesy San Jacinto Museum of History.

and the Lincoln Memorial are two that are always inspiring. Hence, I drew a design of a shaft growing out of a base on the order of, but smaller than, the Lincoln Memorial with a large star on top symbolizing the Lone Star State. The architects perfected the plans accordingly."[13]

The $400,000 grant Jones obtained from the Federal government came with the implied understanding that the Texas structure would not exceed the height of the Washington Monument—555 feet. Jones agreed, but he didn't say how it was to be measured. "The plans we sent to Washington show the height of the San Jacinto Monument as 549 feet—measuring from the first floor," said Charles C. Kubin, vice president and architectural engineer, W. S. Bellows Construction Corporation. "However, the first floor was fifteen feet above grade. From the ground up, the monument is 564 feet high, about nine feet higher than the Washington Monument."[14] In a 1938 letter to Jones, Finn explained: "San Jacinto, which has now reached its full height, is actually 552 feet from the first floor to the top of the beacon."[15]

That argument was still going on in 1945, when columnist George Dixon wrote in the *Seattle Post-Intelligencer:* "…at San Jacinto, I saw one of the great scientific marvels of the age – a monument which does not measure as high as it actually is." According to Dixon, the monument was 563 feet high. But "one of the great government brains came up with the solution to the discrepancy: 'That monument will sink twenty feet in the next twenty years.' Therefore it is not actually as high as it is. And, by golly, those are now the official measurements—even though there are still no symptoms of the monument sinking."[16]

George Dixon, in his column in the Seattle Post-Intelligencer*, explained why the San Jacinto Monument couldn't possibly be taller than the Washington Monument. Courtesy San Jacinto Museum of History.*

Finally, in 1991, Paul Gervais Bell, then-president of the San Jacinto Board of Trustees, and J. C. Martin, then-director of the museum, hired Cotton Surveying Company to actually measure the monument. Their findings? The base, from its footing to the top of the roadway pavement, was 1.41 feet. The distance from the roadway to the top of the star was 562.29 feet. From the top of the star to the top of the beacon was 3.61 feet. So, the total height of the San Jacinto Monument was 567.31 feet – still taller than the Washington Monument.[17] And so it goes. Round it off. Today's "official" measurement is 570 feet.

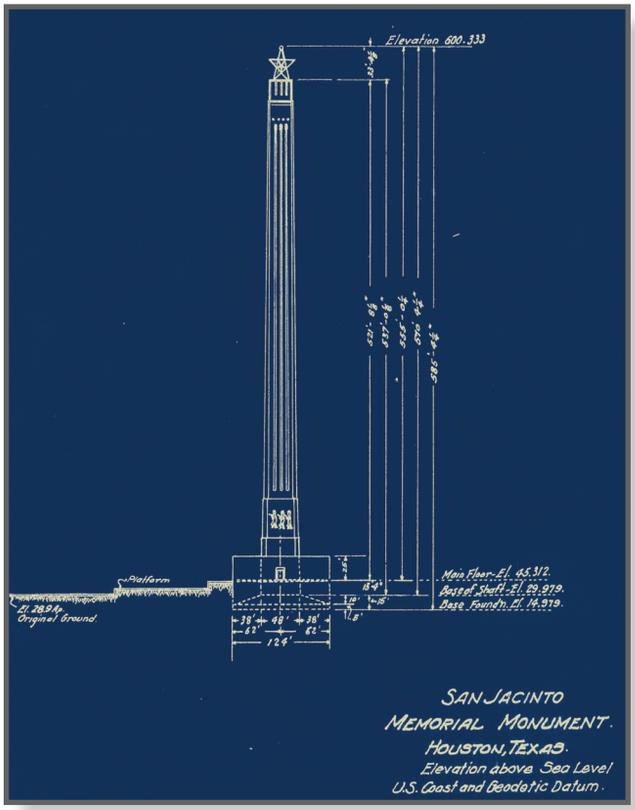
The unique ideas

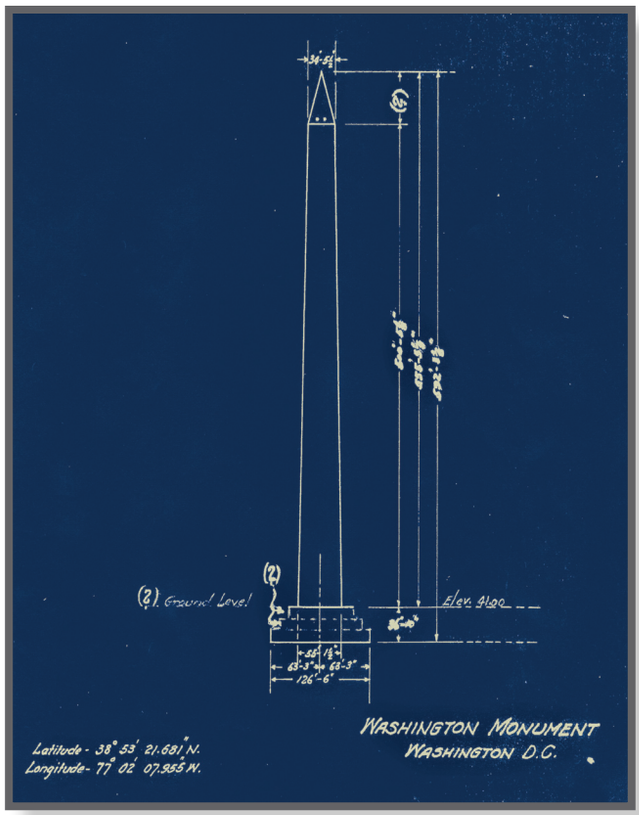
In 1992, the American Society of Civil Engineers stated: "As no comparable project had ever been built, state-of-the-art techniques were developed and pioneered directly at the site."[18] Specifically:

- The spread footing foundation of the base became a prototype for foundations of tall buildings built on strong clay soil even today; [19]
- The unique construction scaffolding saved time by permitting work to be done inside and outside at the same time;
- Using the stone facing as formwork for the structural concrete greatly improved construction efficiency.

About the foundation

The foundation was *not* the simplest issue.[20] Engineers designed a 124-foot-square mat, five feet thick at the outside and fifteen feet thick in





In 1939, H. L. Richardson, engineer for the Port of Houston, made careful measurements of the San Jacinto Monument to compare with the Washington Monument. The answer? From ground level, the Washington Monument is 555' 5 1/8"; from ground level, the San Jacinto Monument is 570' 4 ¼". Courtesy Houston Metropolitan Research Center, Houston Public Library, Box 61, 1939, MSS 1436 Robert J. Cummins Collection.

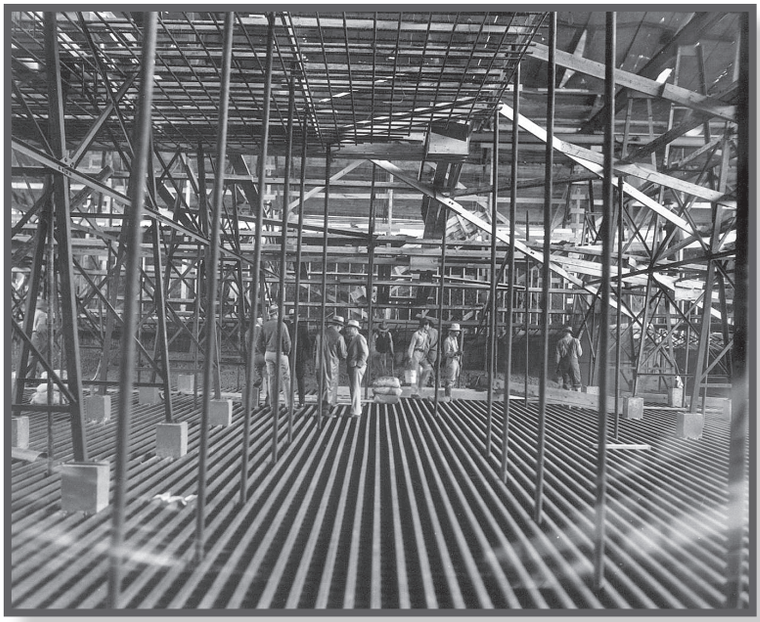
the center.[21] The fifteen-foot-thick portion of the foundation supported the shaft, which made the mat look like a truncated pyramid.[22] At completion, the base was capable of sustaining 146,208,000 pounds.[23]

This huge size was necessary because of the nature of the strong, wet, red clay soil—*not* bedrock, by any means. This soil calls for a foundation large enough (vertically or horizontally) to safely support the structure and resist the wind pressure of a hurricane. The moisture in the soil also must be considered because, over time, a heavy load will squeeze moisture out of clay and the load will sink.[24]

University of Texas professors, Raymond F. Dawson and S. P. Finch, offered their services from the beginning to take occasional settlement readings to check on the behavior of the foundation. In a letter to Jones, Finn said he cooperated in establishing permanent bench marks as reference points from which readings could be made. "It is well for an institution like Texas University to have charge of such an undertaking," Finn said, "for the reason that these readings will probably continue over a period of more than 25 years and their findings may be of value to future engineers interested in soil mechanics, to say nothing of having the satisfaction of knowing whether or not the monument is settling uniformly, and further if seasonal winds which prevail from one direction over a long period of time have any material effect on the settlement."[25]

According to a 2006 study led by Texas A&M civil engineering professor Jean-Louis Briaud, Dawson kept the original data and read the settlement points twenty-six times between 1937 and 1966. Then in 1980, Walter P. Moore & Associates and McClelland Engineers were retained by Texas Parks & Wildlife Department to assess the current condition of the monument. This study found that the San Jacinto Monument had settled a total of 8.3 feet (2.526 m) over the past seventy years, including subsidence in the area. If you ignore movement due to subsidence, then the monument has settled 1.08 feet (0.329 m).[26] "These records are a major source of information…for the design of major … structures in the Gulf Coast area," the study concludes.[27]

In addition to Finn, architect, and Cummins, engineer, the Bellows' construction sign lists thirty sub contractors, including Jones Lumber Company. The imprint of Jones' lumber can still be seen on the inside walls of the monument, according to San Jacinto Museum librarian, Lisa Struthers. Courtesy W. S. Bellows Construction, Inc



All photos courtesy W. S. Bellows Construction, Inc.

Two-inch bar grill awaiting foundation concrete.

Pouring the slab: labor, back-ups, dress rehearsals, and the fifty-seven-hour pour

As soon as excavation reached the planned depth, a thin concrete seal slab was poured to prevent the clay from drying out. This slab also served as a floor for placing the reinforcing steel.[28] The reinforcing steel bars, two inches square by 110 feet long, were rolled in Alabama, shipped by barge, and unloaded on the Houston Ship Channel about a mile from the job site. Their extreme length made them easy to bend, so Bellows rigged up a structural cradle to pick up the bars at two points, sixty-five feet apart. Then workers lashed them to eighty-five foot poles for moving. Two forty-five-foot boom cranes placed the bars on the mat. Those that did bend were run through a standard rail straightener with a truck.[29] The architect and engineer specified that the footing had to be constructed using a continuous pour because "cold joints" could cause the mat to pull apart. The continuous pour was so critical that, if interrupted, the entire foundation would have to be broken out and begun again.[30] At the time, this was the largest single pouring of concrete ever reported.[31] Not surprisingly, everything that could be thought of had a back-up – and, in some cases, a second back-up.[32]

The pour began at 8:27 a.m., reported the *Houston Chronicle* on Monday, October 27, 1936. "The modern battle of San Jacinto will be 'fought' for eighty hours. Sam Houston's men in a quarter-hour battle a century ago were able to…set free this mighty imperial state." The reporter added that workmen would "fight" in eight-hour shifts; three shifts a day.

The job called for two cement mixers with a potential capacity of one hundred cubic yards per hour. Two spares were on hand. One batching plant stocked with sand and gravel was required; two plants were set up, each with its own crane—plus two spare cranes. The concrete was deposited by two-wheeled buckets that were set on rollers and moved out from either side of the excavation on a track. Two hoisting engines to propel the buckets were on hand in case of a break-down. Electric motors pumped water from a lake 3,000 feet away. Gasoline pumps were hooked onto the line in case electricity failed. Several tanks were filled with four-hour supplies of water that could be gravitated to the mixers. Extra pipe and fittings were nearby. It took fourteen trucks to supply the mixers and haul the cement. Four more were on call as well as a mechanic with spare parts and tires. Floodlights were installed for night work. Carbide lights were nearby in case of electrical failure. A large circus tent was pitched over the excavation in case of rain; drainage ditches were dug in case of a flood.

Then there was the labor. This was a Public Works Administration (PWA) project, which meant all labor came from relief roles within a twenty-mile radius of the site. "Of the 150 men working on this very critical pour, not more than thirty-five had ever been on a construction job—including this job, because pouring the foundation was one of our first tasks," said Bullen.[33] "Since most of the men had been selected by looks alone, we held several dress rehearsals," he added.[34]

The precautions paid off when the 5,700 cubic yard of concrete pour

The fifty-seven-hour foundation pour had to be done non-stop. Here, the tent covers the site of the pour (in case of rain). In the foreground, trucks deliver sand and gravel. This was loaded (according to a carefully calculated formula) into the hopper, mixed, then poured into the drum with cement and water and mixed to become concrete. A spigot then transferred the concrete into the buckets that traveled by rail and dumped it into the pit.

All photos courtesy W. S. Bellows Construction.

Four of the five levels of Bellows' unique scaffold are shown in this picture of the twin steel towers inside the monument. The solid floor just above the museum is the storage level. One more inside level and two outside levels are also shown.

Here, placing natural stone for the outside form. Note, the man at right wears a telephone for communicating with the hoist operator.

The rebar and wooden form are at the left in this picture, and the stone has been set on the right. All that's missing is the concrete.

was completed in a speedy fifty-seven hours (versus the eighty hours reported by the *Chronicle)* without a major incident.[35] "Needless to say, the architect, engineer, contractor and 150 workmen were much relieved when that job was finished."[36]

About the scaffold

"There are several stories about why Bellows was low bidder on this job," said George F. Bellows, president, W. S. Bellows Construction Corporation, who, along with Kubin, made a presentation to the Houston Associated General Contractors on October 17, 1991. (The two begged the indulgence of the audience because they were twelve and five years old, respectively, when their fathers began work on the monument.)

> The conventional way to build this structure would be to use outside scaffolding from the ground to build the concrete shaft and set the stone," said Bellows. "We knew the guy who built the Washington monument, and one of our estimates was based on renting his scaffolding. He wanted an outrageous price. But a very ingenious Bellows engineer, James Melton, had a better idea. He suggested using an interior structural tower with climbing construction platforms that let us do everything in one trip.[37]

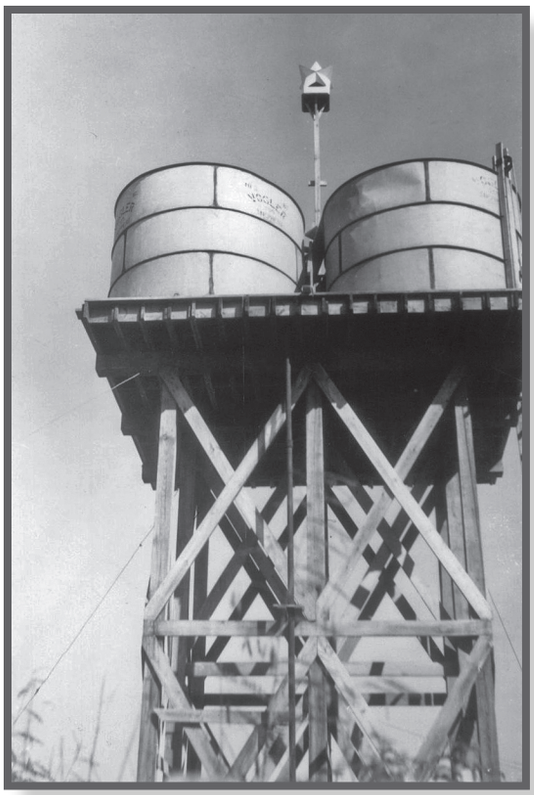
Kubin explained that the scaffold had five work platforms. The top outside platform was used to store the stone and provide overhead protection. One inside platform was used to place the reinforcing steel; the other—the main one—was used to set the wooden forms, pour the concrete, then strip out the wooden forms. The two other outside platforms were used to set the stone, remove the wall ties, clean the stone and fill the joints. Its weight—the five hanging scaffolds, a load of two courses of stone stocked ahead, and seventy-five workmen—was approximately sixty-five tons.[38] The platform was raised and lowered by eight five-ton hand winches.[39] "As you can imagine, Mr. Melton's scheme was much cheaper and efficient," said Bellows.[40] The W. S. Bellows Construction Company won the contract for the job with a low bid of $888,300. [41]

The first sixty feet of the tower is clad in large blocks of stone that were to be sculptured—each weighed about 8,000 pounds. The remainder was set in courses two feet high, with stones weighing about 500 pounds each. These were loaded onto the top working platform, then lowered through trap-doors (with mobile hand-operated stone derricks) to the wall below, where they were set by the masons. In brief, the operation consisted of placing the steel, setting a course of stone, building two feet of forms, cranking up the working platform two feet, then pouring the concrete. This operation was repeated three, sometimes four, times a day.[42] This made possible a schedule of building twenty-four feet of tower per week, with three days of wall construction and two days "consumed in building the formwork for the strut beams coming at twenty-five foot intervals and setting the steel therein preparatory to pouring concrete."[43] With the help of excellent weather, this schedule was maintained for fifteen consecutive weeks.[44]

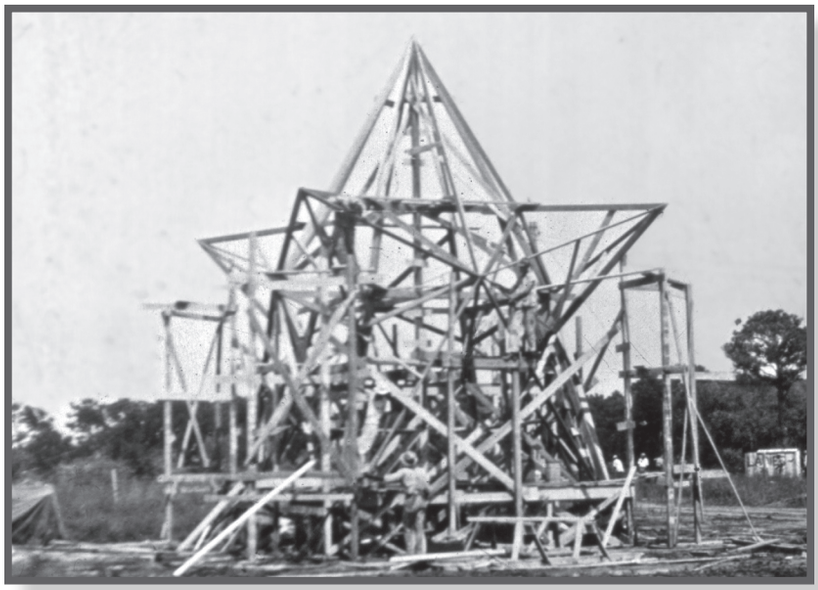
Kubin's dad, carpenter Karel Kubin, said that his workday started when he reached the scaffold. "He had to walk up in the morning and down in the evening on his own time," said the younger Kubin. "But, he told me, 'work during the Depression was hard to come by, and if you didn't want to walk up and down each day, fifty or one-hundred men were waiting at the gate for your job.'" Wages were between $2.00 and $2.50 a day.[45]

Building the star

"My dad said the original plans called for a two-dimensional star, but no one liked it," said Kubin. "Consideration was given, at an early stage, to replacing that star with a soldier, but that didn't solve the 360-degree view problem, either." Finally, Finn experimented with a three-dimensional star. "My dad built several one-inch scale plywood models and set them on a post on top of a water tower, 564 inches above ground, for



Here, the one inch scale model of the three-dimensional, nine-point star is hoisted up the water tower 570 inches for the architect to check. Courtesy W.S. Bellows Construction, Inc.



Carpenter Karol Kubin is shown in this photo of the full-sized wooden model of the star. Courtesy San Jacinto Museum of History.

Setting stone on the star. Courtesy W.S. Bellows Construction, Inc.

Mr. Finn to view," said Kubin. "After everyone agreed on the shape and size, Kubin and two other carpenters built a full-sized wooden model. From this model, Mr. Melton drew a set of plans that were used to detail the structural steel and develop a stone layout for construction." Kubin added that his dad received permission to take one of the small models home – "which he mounted on top of our garage. That stirred up quite a bit of conversation with the neighbors!"[46] Due to the star's odd shape, not one piece of stone was either plum or level. The stone was brought to the top in twelve-inch-by-twelve-inch blocks, three inches thick, and cut to fit there. As was done in the tower, concrete was poured against the stone. It took twenty working days to set the stone and pour the concrete. As there were only two carloads of stone in the star, one can readily see how much cutting and fitting was necessary.[47] "The fact that the thirty-four-foot star overhung its nineteen foot wide base made construction 537 feet in the air difficult," said Bullen.[48]

Conclusion

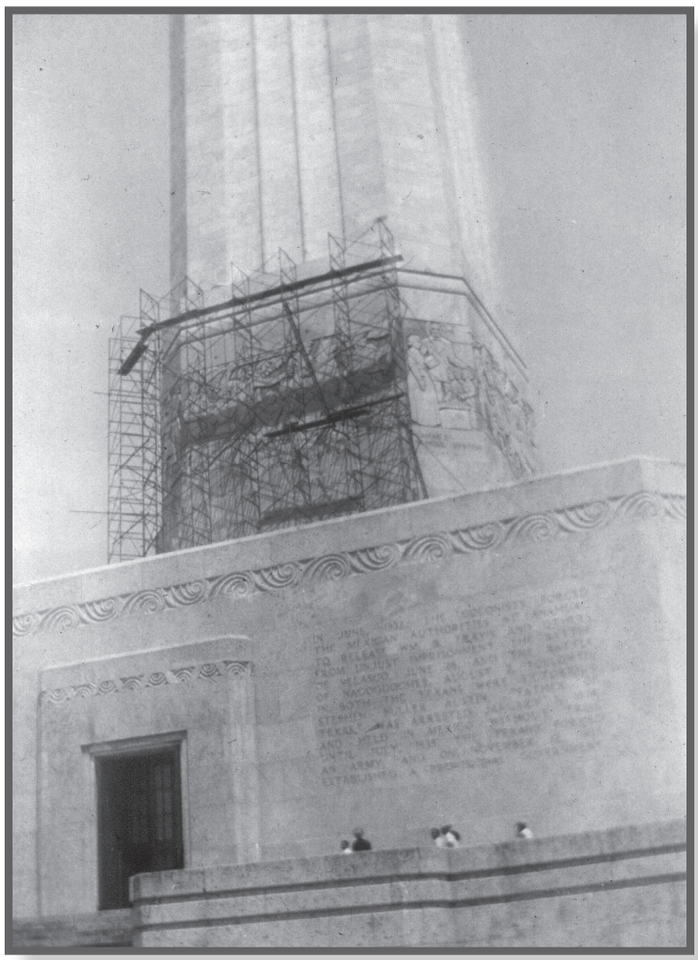
"By March 1938, Finn and Bellows had solved all of the monument's odd construction challenges and completed the exterior structure. Rice University instructor and noted sculptor, William McVey, carved the shallow relief scenes of Texas history in the frieze."[49] Texas historian, L. W. Kemp, supplied the names of San Jacinto participants for bronze tablets inside the monument and drafted a 600-word summary of Texas history that is carved on the base pavilion.[50] Landscapers groomed the old battlefield; a WPA team completed the formal terrace, stairsteps and amphitheater. Roadways were a joint project of the WPA and the state highway department. The WPA also built the 200-by-1,800-foot-long reflection pool laid over the route the Texas Army took to the battle. And, in late 1938, the San Jacinto Museum of History was formed to create a museum in the base of the monument.[51] On April 21, 1939, the 570-foot monument was dedicated to the heroes who fought there and elsewhere to gain Texas' independence.

In 1942, Jones reported to President Roosevelt that more than

Here, Architect Alfred Finn inspects the star. Courtesy San Jacinto Museum of History.

one million people had visited the monument in four years; traffic had averaged more than 1,000 people per day in 1941.[52] And today, the structure is honored by historians of the battle, by others who stand awestruck by its sheer beauty, and by engineers who understand that "this towering symbol of Texas' freedom laid the groundwork for many future high-rise structures along the Gulf Coast, particularly those built on expansive soils and subject to heavy wind loads caused by severe tropical storms."[53] "Through the use of safety precautions and safety education, together with a lot of good luck, no one was seriously injured in the construction of the monument – an unusual record in so high and dangerous a structure," said Bullen. "Undoubtedly enough lives had been lost on the same site one hundred years before."[54]

"George Bellows and I were curious about what the Monument might cost if work were started today," said Kubin in 1991. "Using the *Engineering News Record*'s building cost index, the original construction cost would be a minimum of $15 million in 1991 (versus the $888,300 Bellows bid in 1936)." He calculated costs again in 2006. The results? $32 million – more than twice as much.[55] Or, as Bob Tutt wrote in the *Houston Chronicle* on October 3, 1992: "costs would be so high that maybe even Jones couldn't swing it."



Rice University instructor and sculptor, William McVey, carved the scenes of Texas history on the frieze. Courtesy San Jacinto Museum of History.