

THE DESIGN

- 18 ARCH PROJECT MANAGEMENT WAS A BIG JOB** The builder leases time on McDonnell Aircraft's supercomputer to run a "critical path" algorithm to sequence 2,000 construction tasks. It calculates that the job will take 740 days and prints out 500 pages of plans. The bill for 2 1/2 minutes of processing? \$55,000.
- 19 BUT CONSTRUCTION WAS EVEN BIGGER.** Construction begins February 12, 1963. The Gateway Arch is built by MacDonald Construction Co. of St. Louis, with steel supplied by the Pittsburgh-Des Moines Steel Company. It was delivered right to the Arch's future front door, as it were, via the railroad on the grounds.
- 14 MADE POSSIBLE BY CUSTOM "CREEPER DERRICKS."** Once the Arch hits 70 feet, ingenious cranes "climb" up tracks attached to the Arch's growing legs. A brace stabilizes the freestanding cantilevers. When the legs meet, the derricks crawl down, the track holes are plugged, and the Arch is polished.
- 15 INTERESTINGLY, THE HEIGHT** The Arch stands 630 feet tall and is the tallest structure in St. Louis. It's also the tallest U.S. federal monument. When you compare its height to other famous monuments, it falls right between the Statue of Liberty (305 feet from ground to torch) and the Eiffel Tower (986 feet tall).
- 16 AND THE WIDTH ARE THE SAME—** It's square, but appears more tall than wide because our brains compare the more drastic inside curve to the base width, and the fact that it gets thinner and farther away as it goes up. The original proposal is slightly taller than wide, but Saarinen's affection for clean math evened things out.
- 17 AND YEAH, IT'S PRETTY HEAVY.** There are 43,306 tons of concrete and steel in the Arch. The structural steel (and stairs, ramps, etc.) weighs 4,313 tons and the #3 finish type 304 stainless steel panels that cover the exterior account for 886 tons.

- The finish is load-bearing—every stainless weld gets checked with an X-ray machine. 12,127 tons of concrete are poured between the skins and 25,980 tons set in the foundation.
- 20 THE ORIENTATION IS OFF.** The Gateway Arch appears to be oriented due north-south, but is built at an 18° angle.
- 19 BUT DEEP FOUNDATIONS** They're dug about 60 feet deep—40 into dirt and 20 into bedrock, requiring 300,000 cubic feet of earth to be excavated. 500+ steel tensioning bars extend down from the foundations.
- 20 SUPPORT ITS 142 STACKED SECTIONS.** There are 71 sections, or "cans," in each leg. They're equilateral triangles with a double-wall construction: 1/2-inch stainless steel outside and 3/4-inch structural steel inside. They're filled with reinforced concrete up to 300 feet, which lowers the center of gravity.
- 21 THERE ARE TRAMS INSIDE** Sixteen custom tram cars (eight per leg, holding five people each) take visitors to the top. They travel about three mph during the four minute ride and leave every five minutes. You actually travel 748 feet on the trams as they curve from a horizontal path underground then up the nearly vertical legs.
- 22 (AND SECRET STAIRS)** 1,076 steps, which are used only for emergencies and maintenance, wind up each leg.
- 23 TO TAKE VISITORS TO THE OBSERVATION ROOM** On a clear day you can see 30 miles west into Missouri and east into Illinois. The room is an arched deck just 65x77 feet, and holds 150 people. Its 32 portholes are only 27x7 inches, but they're 3/4 of an inch thick. The intense pressure would crush a larger window.
- 24 AT THE TOP.** On the day the final piece is to be put in place, October 28, 1965, the sun's heat expands the south leg by five inches and the piece won't fit—apparently confirming skeptic's predictions. The leg is doused with water, contracts, and the last section is placed as Vice President Hubert Humphrey circles in a helicopter.
- 25 AMAZINGLY, IT WAS COMPLETED WITH NO DEATHS.** Insurance underwriters estimate that 13 people will die during construction. None do.

THE SCIENCE

- just 1 1/4 inches off center. Contrary to popular belief, it's struck by lightning just once or twice year and has a system of lightning rods grounded directly into bedrock.
- 35 DEATH.** On November 22, 1980, 33-year-old Kenneth W. Swyers of Overland, Missouri attempts to land on the top of the Arch during a parachute jump (some say he was just trying to go through the legs). When he touches down, a wind gust catches his deflating chute and his wife watches as he slides down the north leg to his death.
- 34 NOR DAREDEVILS** On September 14, 1992, 25-year-old daredevil John C. Vincent climbs the exterior using suction cups, then parachutes to the ground. Over the years at least 10 pilots disobey the order to not fly through the legs.
- 35 CAN TARNISH THIS MONUMENT'S REPUTATION.** The U.S. designates the Gateway Arch a National Historic Landmark in 1987. (Today it is, in fact, tarnishing a bit—stainless steel is rust resistant, not rustproof.)
- 36 IT APPEARS ON TV AND IN FILM.** Compared to other national monuments, the Arch gets little screen time. But it does feature prominently in the TV show "Defiance," a post-apocalyptic alien action series on Syfy.
- 37 IS THE SUBJECT OF BOOKS.** We liked *The Gateway Arch: A Biography*.
- 38 ROADSIDE REPLICAS.** There is a not-quite-proportional replica at Neal Auto Parts in Peoria, Illinois. There's another at 1/10 scale at the Economy Inn in Vandalia, Illinois.
- 39 AND EVEN POSTAGE STAMPS.** The Arch appears on at least two U.S. stamps, once in a 2006 series called "Wonders of America," and again in a 2002 "Greetings from..." series featuring the 50 U.S. states. It cost 39¢ to mail a letter in 2006 and 34¢ in 2002—compared to just 3¢ when the memorial project was conceived in the 1930s.



- 1 ONE MAN'S IDEA** During the depression of the 1930s, St. Louis attorney and civic booster Luther Ely Smith decides to revive the dingy downtown riverfront area with a memorial. In 1914 he'd started a pageant-Masques series on Art Hill in Forest Park, which gradually developed into The Muny, America's oldest and largest outdoor musical theatre.
- 2 BECOMES A MEMORIAL.** In 1936 St. Louis voters approve a \$7.5 million bond issue for the project. Twelve years later local architect Louis LaBeaume draws up guidelines for a memorial competition with the requirements that the project be "(a) an architectural memorial or memorials to [U.S. president Thomas] Jefferson; (b) with preservation of the site of Old St. Louis... provision of a Museum interpreting the Westward movement; (c) a living memorial to Jefferson's vision of greater opportunities for men of all races and creeds"; (d) recreational facilities..."
- 3 TO HONOR THOMAS JEFFERSON** Jefferson, a Founding Father and the principal author of the Declaration of Independence, also is known for initiating the Lewis & Clark Expedition, which explored the western lands bought from France in the Louisiana Purchase by navigating the Missouri River all the way to the Pacific Ocean.
- 4 ON A RIVERFRONT LOCATION** In the late 1930s, 40 city acres are leveled. Not even Dr. Joseph Lawrence's offices at 307 Locust Street—where he invented the antiseptic Listerine—are spared. Before the depression, the riverfront was a thriving port for manufacturing, trade, and travel, but had fallen into significant decline. Smith chooses this location partly because Lewis & Clark began their journey here in 1804.
- 5 IN THE CITY OF ST. LOUIS** 170 years earlier, in 1764, St. Louis is founded by Frenchman Pierre Laclède and stepson Auguste Chouteau. The city is named after Louis IX, the only canonized king of France, who reigned 1226–1270.

- 6 WHERE NATIVE AMERICANS** Long before that, a mound-building Mississippian culture inhabited the region, peaking between 1000–1400 A.D. St. Louis is nicknamed "Mound City," though all earthen mounds—save one—are destroyed as the city is developed. Fortunately, about 80 are preserved across the river at nearby Cahokia Mounds.
- 7 HAD LIVED ALONG "THE BIG MUDDY"** The Mississippi River cuts through or along 10 states, from Minnesota to the Gulf of Mexico, flowing 2,820 miles. "Mississippi" is derived from a native Ojibwe word for river. Misizibi, meaning "river spread over a large area." Today the Arch dominates the St. Louis riverfront, standing on the 91 acres that make up the Jefferson National Expansion Memorial, overlooking the "Big Muddy."
- 8 EERO SAARINEN WINS** In 1948 Eero Saarinen's design is selected as the winner, earning him \$50,000 in prize money (plus another \$40,000 for his team) and beating 171 other architects, including his father, the renowned Eliel Saarinen. Born in 1910, sadly Eero dies of a brain tumor in 1961, two years before construction begins.
- 9 WITH HIS INSPIRED ARCH DESIGN.** Part of Saarinen's inspiration for an arch shape came from the Thomas Jefferson Memorial in Washington, D.C., just finished in 1947. The Arch's shape references the Jefferson Memorial's dome, in contrast to the Washington Monument's line, and the Lincoln Memorial's rectangle.
- 10 COLLABORATING WITH MANY** Saarinen collaborates with about a dozen people in order to get the design right. Key players include the German-American engineer Hanns Karl Bandel (engineered the Arch's final curve), Swedish sculptor Carl Milles (suggested a triangular section shape as opposed to the original quadrilaterals), and Norwegian-American engineer Fred Severud (studied the monument's structural feasibility). Saarinen's associates Kevin Roche and John Dinkeloo see the project through after his death.
- 11 TO BRING HIS NEOFUTURISTIC STYLE TO LIFE** Saarinen's "neofuturistic" style—simple, sweeping curves—is more than evident. His other famous projects include the TWA terminal at New York's JFK, the main terminal at Dulles in Washington, D.C., the General Motors Technical Center in Michigan, and many university buildings and furniture designs, including the "Tulip," "Grasshopper," and "Womb" chairs.

- 40 PARK RANGERS** The Jefferson National Expansion Memorial rangers are federal employees. They provide security, assist visitors in and out of the trams, and, of course, answer many questions about the Arch and the city.
- 41 PATROL THE GROUNDS** The landscaping is designed to complement the Arch, not to compete or contrast with it. Saarinen's and landscape architect Dan Kiley's setting has curvilinear concrete staircases at both ends and symmetrical ponds and walkways that reflect the Gateway Arch's huge, graceful curves—all of which combine to become the Jefferson National Expansion Memorial, officially located at 11 North Fourth Street, St. Louis, Missouri 63102 USA.
- 42 (AND THE UNDERGROUND)** There are theaters, shops, and a museum underneath the Arch. The original visitor center opens June 10, 1967, but isn't finished until 1976 due to insufficient funds. Exhibits feature a history of the riverfront, America's westward expansion, and the construction. Tucker Theater shows Charles Guggenheim's 1967 Academy Award nominated Arch documentary, "Monument to the Dream."
- 43 WHILE RIVER TRAFFIC,** The Port of Metropolitan St. Louis stretches 70 miles from Alton, Illinois down to Jefferson County, Missouri, and about a third of the 100 million tons of commodities that float by St. Louis are on- or off-loaded here—\$10 billion worth. Barges are efficient: using one gallon of fuel, a ton of cargo can be moved 60 miles by truck and 200 miles by rail... but more than 500 miles by river barge.
- 44 PERIODIC FLOODING.** On August 1, 1993 the Mississippi crests at 49.58 feet—19.6 feet over flood stage. Water is halfway up the Gateway Arch's riverfront staircase. The peak discharge of the "Great Flood of '93" measures 485 million gallons per minute—a flow that would fill the old Busch Stadium in just 65 seconds. The flood causes about 50 deaths and \$15 billion in damages.
- 45 WORSHIP.** The Basilica of St. Louis, King of France (aka the Old Cathedral, finished in 1834), is the oldest cathedral west of the Mississippi River and one of just a handful of buildings to escape demolition as the grounds are developed around it. It may very well be the only land in St. Louis that's been used for the same purpose since the city's founding—records suggest an itinerant priest set up a tent on that location in 1764.

- 46 AND HISTORY MARCH ON.** In 1847, former slave Dred Scott appears at the Old Courthouse to fight for his freedom. The case ultimately goes before the U.S. Supreme Court which rules that persons of African descent are not citizens under the U.S. Constitution and hence, have no right to file suit. More than 160 years later race relations are still headline news, and a disconnected Arch appears on the cover of *The New Yorker*.
- 47 VISITORS TO THE ARCH** In 2012, the last year we could find exact numbers, 4.6 million people visit in 1966, but this number drops to 1.4 million just four years later. Attendance averages 3.3 million from the mid-90s to the mid-2000s, but has been averaging just over two million since then.
- 48 BOOST ST. LOUIS TOURISM** A 2011 National Park Service report shows that the two million plus visitors to St. Louis' national park units that year spent \$100 million in the area. Overall, tourism in the St. Louis area generates about \$800 million dollars in local, state, and federal taxes every year.
- 49 AND A RENOVATION CONNECTS IT TO DOWNTOWN—** The 2013–15 CityArchRiver project finally enables visitors to walk from downtown to the Arch on a continuous greenway, with no curbs or cars in their way. It expands the museum and includes new trails, play areas, and performance venues.
- 50 THAT IS, UNTIL THE ZOMBIE APOCALYPSE HAPPENS.** If the Arch were unmaintained, some experts think its 300-foot-tall concrete pillar portions might stand for 5,000 years. The rest likely will be destroyed by tornadoes, earthquakes, floods, neglect, government shutdowns, vandals, terrorists, zombies, and/or aliens. Until then, St. Louisans wake up every day to a Midwestern skyline dominated by the incredible, the fantastic, the majestic, the *tremendous* Gateway Arch—a "monument to a dream."

THE HISTORY

THE IMPACT