The Statewide Committee for Research honors Alaska's

Northern Innovators

Dennis Nottingham

The Bridge Builder

Northern Innovators Hall of Fame Member

With the delicate ring of bamboo wind chimes and the occasional heavy clunk, unimaginable tons of ice raft down the largest river in Alaska.

In late May, spring breakup has arrived at the longest bridge in the state. Swallows plaster mud nests to its dry underside. Below, the swollen Yukon feeds rotting sheets of ice at six miles per hour into the bridge's five concrete footers. Standing on the vibrating bridge above these piers, each pointed like a ship's hull, is like standing on deck of an icebreaker.

Forty years after Dennis Nottingham drew them on an engineering table, the metal-plated legs of the bridge cleave ice sheets that subfreezing air thickened during the past seven months. A few hundred feet above on the canted bridge surface, truck drivers gun their engines on the 414-mile road from Fairbanks to the Arctic Ocean.

Nottingham, 75, is a retired engineer who designed more than 300 Alaska bridges, including this one. With designs from Hurricane Gulch to Sitka on his resume, Nottingham's bridges have carried thousands of Alaskans across glacial rivers and have guided Iditarod mushers over six lanes of speeding traffic above Tudor Road in Anchorage. He faced glacial rivers, giant earthquakes, killer cold, spills of toxins into giant rivers and so many other variables that make working in Alaska different from anywhere else.

Nottingham, who now lives in Carter, Montana, arrived in Alaska more than a half century ago. It was a perfect time for a creative young man; the early 1960s was a frenzy of anticipatory development in a state soon to be swimming in oil money.

Educated at Montana State College, Nottingham specialized in designing bridges around Montana for a few years after he graduated. That's when, in a local newspaper, he saw an ad for bridge engineers needed for Alaska's expanding road system.

Nottingham drove his 1960 Ford Falcon up the Alaska Highway and onto the ferry to Juneau, where he started his career with the Alaska State Highway Department. Shortly after he arrived, the Good Friday earthquake rocked Southcentral Alaska.

At magnitude 9.2 one of the largest events in the history of seismic monitoring, the 1964 earthquake destroyed some Alaska roads and bridges and shook the reliability out of others. With the drama in mind as he sat at his drafting table, Nottingham redesigned wrecked bridges so the rebuilt ones could resist minutes of shaking. Then state officials announced a 1968 discovery in northern Alaska.

"No sooner had we got (the earthquake-damaged bridges) done, along came the trans-Alaska pipeline," Nottingham said.

Stretching from Valdez to Prudhoe Bay, the 800-mile pipeline crosses about the same number of rivers and creeks. The consortium of oil companies building the pipeline needed bridges to carry the pipe across waterways and to allow access for vehicles that built and serviced the pipeline. In rare cases, the four-foot diameter steel pipe would cross rivers on the same bridge as trucks.

On tight deadlines, the young engineer executed on project after project. The surprise discovery of permafrost in a Copper River valley location late in the pipeline-building process threatened to stall construction and cost millions per day in lost revenue. Oil executives called on RNM Consultants, for whom Nottingham then worked, to complete the bridge that carries the trans-Alaska pipeline over the Gulkana River. Nottingham chose a "slant leg tied arch" design for the bridge, which is attractive and still functional.

"In six months (from design to construction), that bridge was ready to go," Nottingham says.

As a ready critic of government delays and excessive spending, Nottingham's ethics meshed well with results-driven oil companies. He drew up plans for bridges from the Tsina, near Valdez, to the Sagavanirktok, which empties into the Arctic Ocean; Alyeska Pipeline Service Company had them built soon afterward.

"They just let you do it," he says, "because nobody really knew how to do it or was qualified to say no."

One of the biggest challenges of pipeline construction was the crossing of the Yukon River about 50 miles south of the Arctic Circle; there, the river oozes 2,000 feet from bank to bank.

In 1972, when he was 34, Nottingham designed the Yukon River Bridge while he was working for the Alaska State Department of Highways. A year later, Alyeska Pipeline Service Company hired Nottingham to oversee the design and construction of the structure that would replace an ice bridge on the surface of the Yukon that melted every April.

Thinking of giant earthquakes, great local temperature extremes (Alaska's all-time low of minus 80 Fahrenheit was recorded at Prospect Creek, not far from the Yukon) and of the most dramatic river breakups in the world, Nottingham knew he needed to create something different. The bridge would carry not only truck traffic, but also the oil pipeline and natural gas pipeline (should it ever be built) in sleeves on either side of the roadway.

"With the pipeline running over that bridge, (the oil companies) could not afford to have that break and have oil go into the river," Nottingham says.

Brainstorming with structural engineer Nathan Newmark of the University of Illinois, Nottingham designed the bridge to endure Alaska-style earthquakes. His seismic design was decades ahead of its time.

"California has 30-second earthquakes, but they're nothing compared to subduction earthquakes," Nottingham says. "Alaska has long-period earthquakes with up to five minutes of shaking."

In addition to the unprecedented earthquake resistance of the bridge, Nottingham worked with Japanese steel mill executives who provided a fine grained, cold-resistant steel not available in the United States.

To absorb the stunning blows of breakup, when sheets of ice five feet thick grind downriver, Nottingham designed the bridge's concrete piers to crush the thickest ice floes the river shoves into them. Five of the piers protrude from the surface of the Yukon, attached to pre-stressed rock anchors in the riverbed. Nottingham designed the bridge to withstand a "project design flood."

"If the world was to end, that would be the flood," he says.

Nottingham further engineered the bridge to resist the crash of a small plane.

"We designed it so that if an aircraft flew into it and cut one girder in half, it would still stand," Nottingham says.

The bridge, almost one half mile long and rising 200 feet above the swirling brown surface of the river, stands today like a ramp (with a 6 percent grade) connecting northern Alaska to the rest of the state. Nottingham designed it in just three months, but Alaska's iconic bridge will last a long time.

"After the 2002 (Denali Fault magnitude 7.9) earthquake, everybody ran up to the Yukon River Bridge to see the damage," Nottingham says. "None. That bridge will be there 200 years from now."