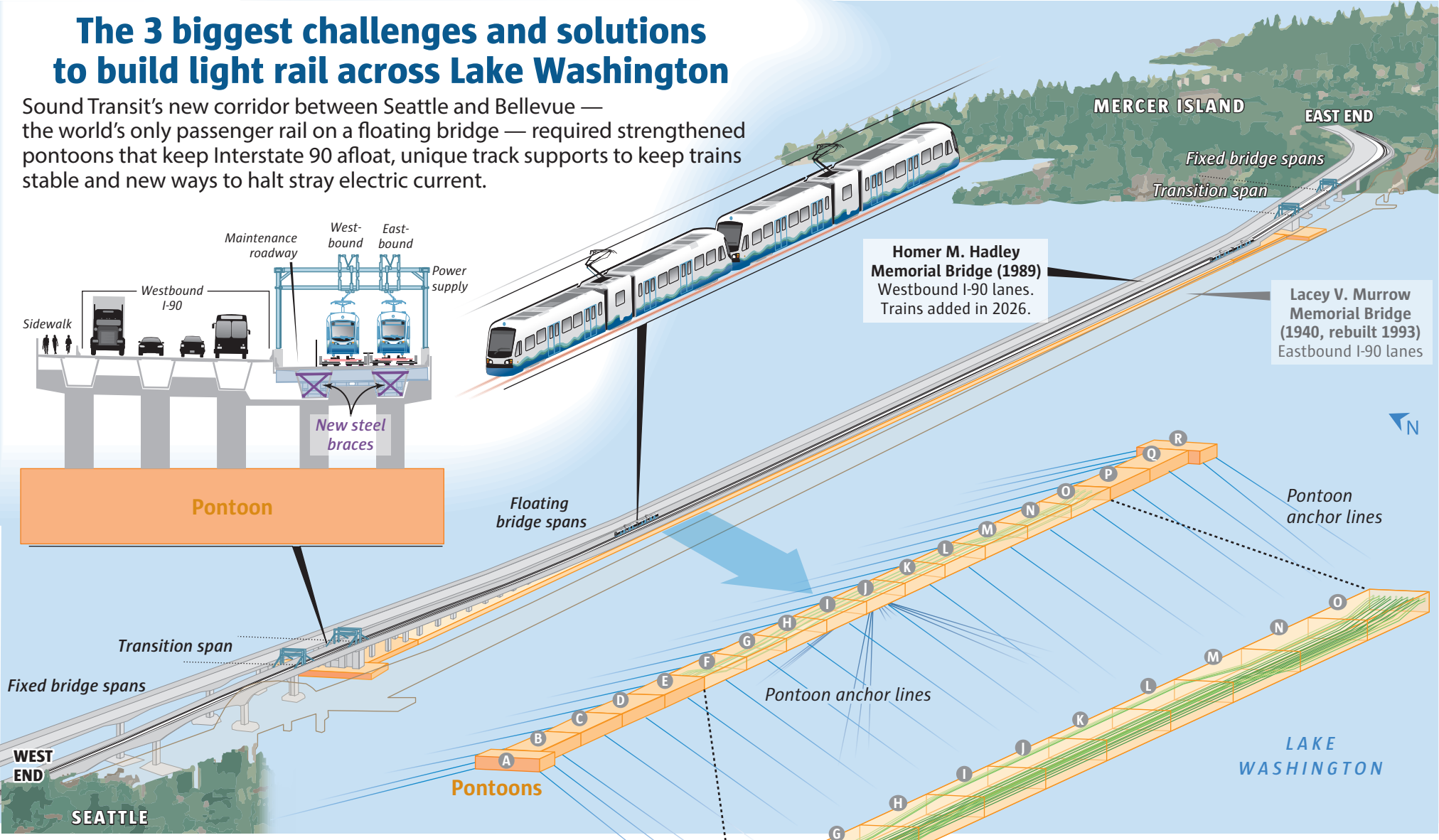
The 3 biggest challenges and solutions to build light rail across Lake Washington

Sound Transit's new corridor between Seattle and Bellevue — the world's only passenger rail on a floating bridge — required strengthened pontoons that keep Interstate 90 afloat, unique track supports to keep trains stable and new ways to halt stray electric current.

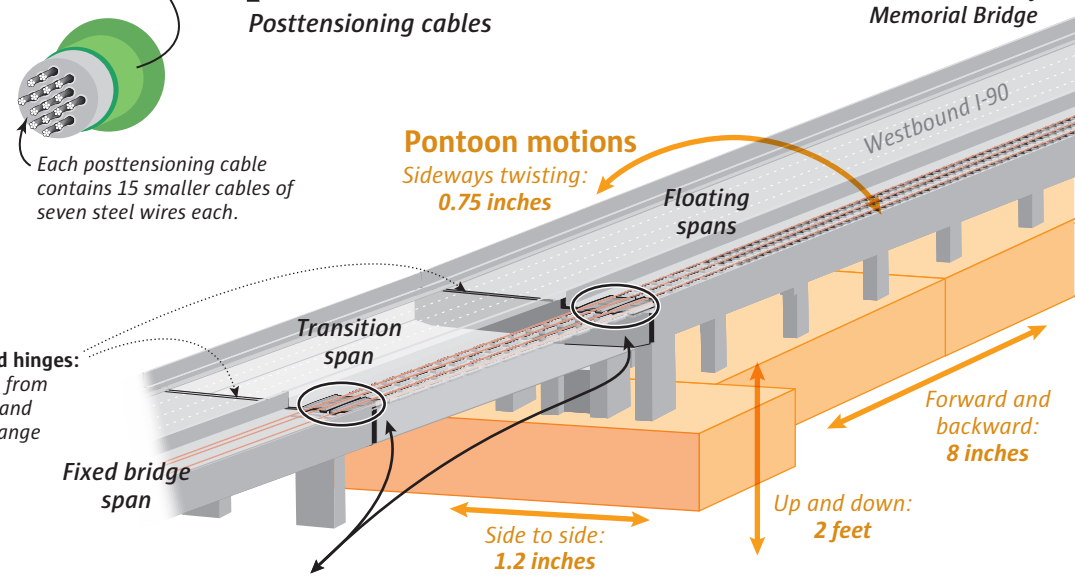


1 MAKING A STRONGER BRIDGE

To help the bridge withstand 600,000-pound trains, contractors added high-tension steel cables that tighten the pontoons. They removed some of the gravel ballast within the pontoons to add buoyancy.

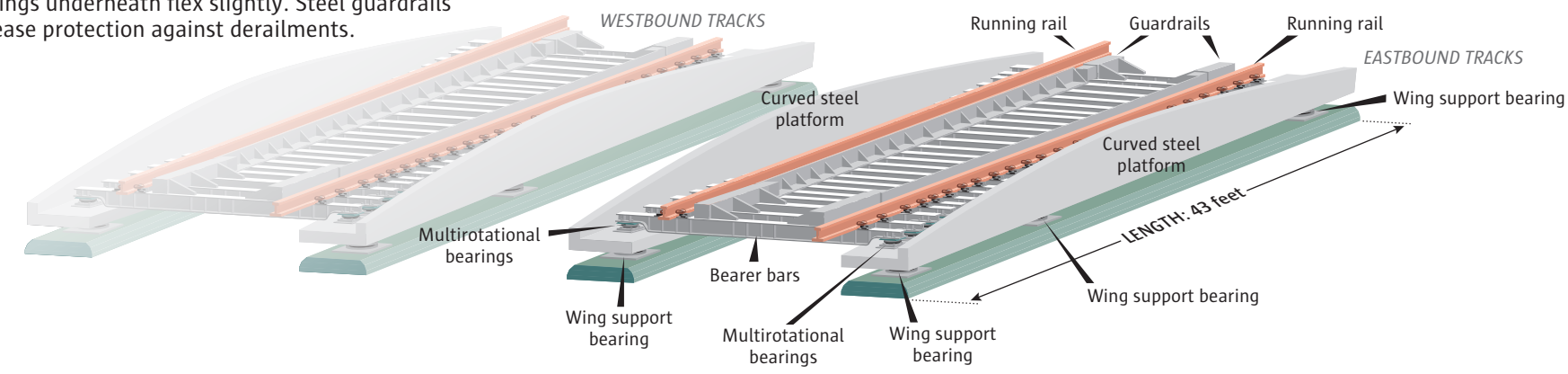
Floating bridge span: A total of 52 anchor cables fasten the Hadley bridge to the deep lake bottom and keep the 18 hollow pontoons from drifting.

Tighter pontoons: Workers strung 20 giant cables through pontoons F through O and tightened them. Those pontoons behave like a single barge, stiff enough so they don't bob separately beneath a passing train. This compression, known as posttensioning, shrunk the concrete bridge 3 inches.



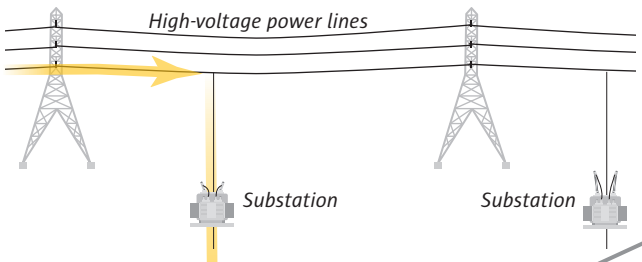
2 KEEPING RAILS STRAIGHT

Lake Washington rises and falls 2 feet seasonally, while trains, heat, wind and waves make the bridge twist, shift sideways or change geometry. To absorb all that motion, eight platforms pass over I-90's hinges where fixed and floating spans meet near shore. The rails are held parallel by rigid bearer bars, while rows of wafer-shaped bearings underneath flex slightly. Steel guardrails increase protection against derailments.

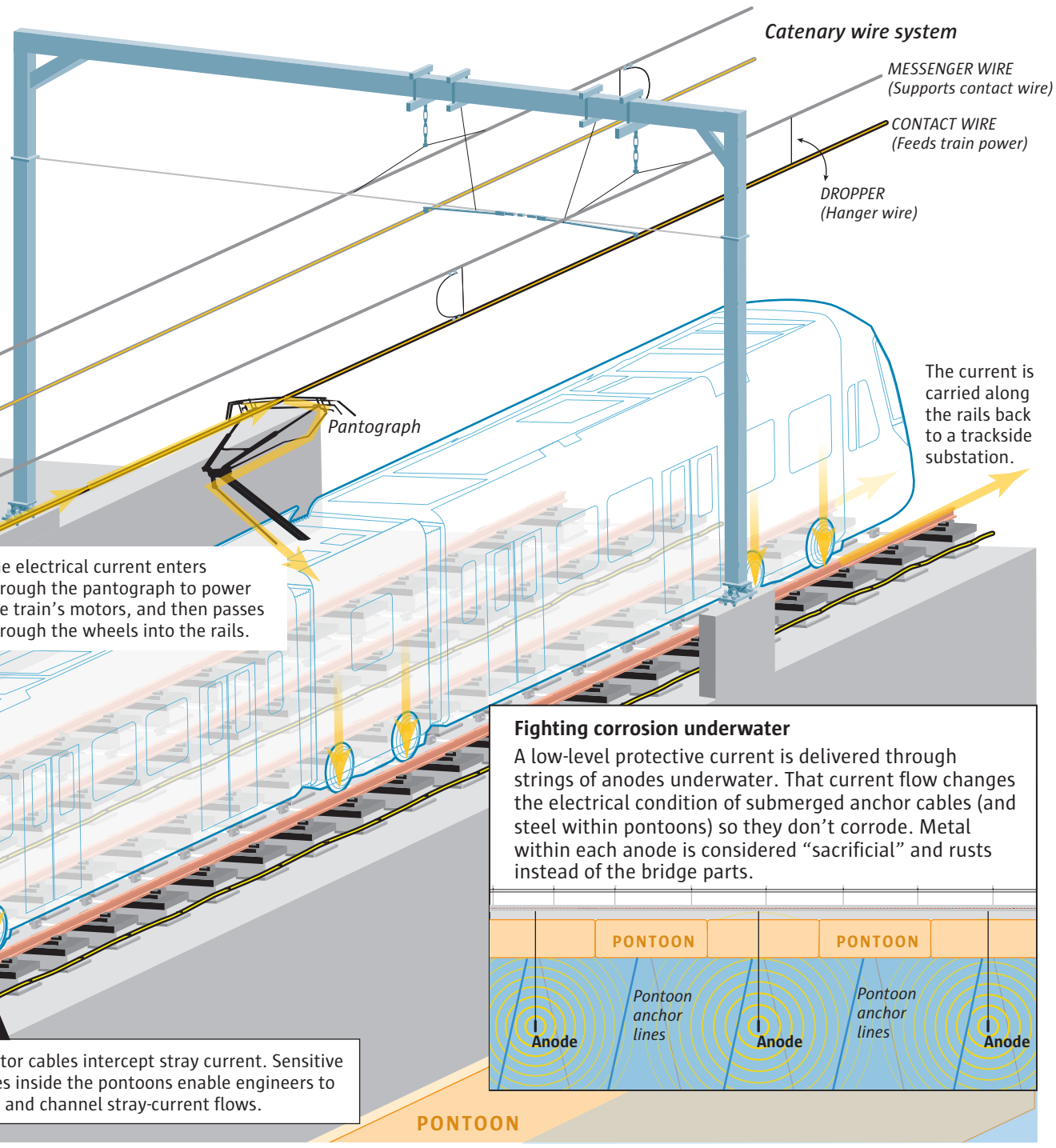


3 THWARTING STRAY CURRENT

Stray current can corrode steel rebar and eventually crack trackway ties or bridge pontoons. Stray current is harder to control on a floating bridge than on land, and left unsolved, might shorten the bridge's 70-year remaining life.



Electricity travels through high-voltage wires to train-power substations onshore. The substations deliver 1,500-volt DC current to the overhead catenary wires.



Fighting corrosion underwater

A low-level protective current is delivered through strings of anodes underwater. That current flow changes the electrical condition of submerged anchor cables (and steel within pontoons) so they don't corrode. Metal within each anode is considered "sacrificial" and rusts instead of the bridge parts.

Sources: Sound Transit, state Department of Transportation, University of Washington Mobility Innovation Center, Seattle Times reporting

Reporting by MIKE LINDBLOM, graphic by MARK NOWLIN / THE SEATTLE TIMES