The Salt Lake City mixed-use development covers two city blocks, each with a is 240 ft long and 58 ft wide S-shaped retractable roof, that follows the curve of the creek below. The precision-sculpted steel and glass transparently shields patrons when closed, and disappears from sight when open; connecting nature with the areas below. For each block, the retractable roof is comprised of three pairs of glass-covered, arching panels that cantilever 33 ft. from the adjacent structures over the retail concourse. When closed, all six panels seal together and create an air and water-tight barrier. To open, the panels part in the middle and retract onto the building structure as the panels bow down out of sight from below. Each roof panel is comprised of three parallel whalebones made of curved and tapered welded steel box girders that run from the tip of each panel's arch to the end of its backspan. The glazed portion of the three whalebone arches are joined by four purlins. The purlins are designed with concealed connections that are invisible from below, and provide attachment points for 6-ft,-4-in.-sq. panes of glass. A typical roof panel is glazed with 72 panes of glass, each weighing approximately 300 lb, although the size of each panel varies because of the roof's curvature. The three whalebone backspans are connected with K-braces that provide shear stiffness between whalebones.

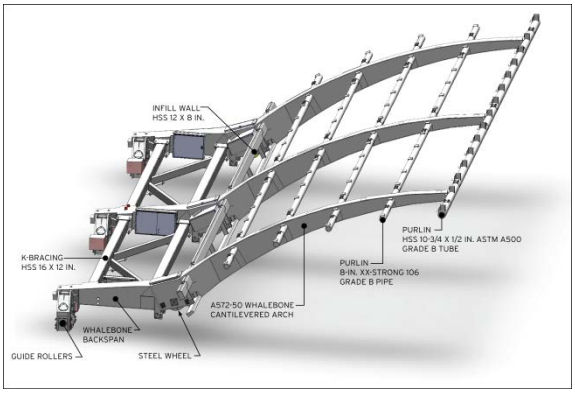
The whalebones were built in two sections using custom-designed fixtures and joined with a plate-welded connection to accommodate the unique geometry. The preassembled rail girders and whalebones were hoisted onto the roof, and the panels were assembled in place, stick framing whalebones, purlins, and K-braces.

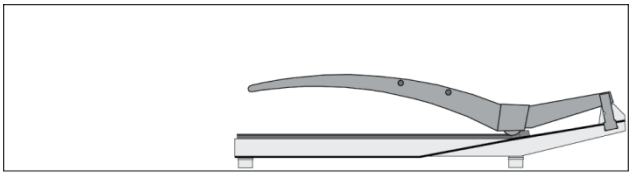
Each 10.5-ton whalebone is supported by a 27-in. double-flanged steel wheel located at the bottom of the arch and two guide rollers located at the end of the backspan. The wheel follows one geometric path on top of the rail girder, and the guide rollers ride an inclined track along the bottom of the rail girder. As the guide rollers travel up the incline, the roof's cantilevered front edge dips down, causing the roof to bow down, with the wheel as the vertical rotation point.

The guide roller track surface is a heat-treated, hardened plate welded to the A572 Grade 50 steel rail girder. A custom welding procedure was developed to join the two elements to avoid damaging the hardened plate.

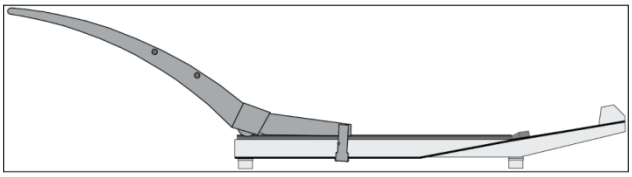
The flanges on the center wheel closely surround the center rail and act as wheel guides. The flanges on the two outer wheels leave a slight gap around the rails to accommodate lateral movement between the three rails caused by construction tolerances, and structural and thermal movement. Locking pins mounted to the whalebones automatically engage the rail girders when the panels reach the open or closed end of travel. With the pins engaged, the roof panels can accommodate differential movement from potential seismic activity .

An industrial computer located in a remote control room operates the retractable roof, which travels up to 8 ft per minute and opens or closes in approximately 6 minutes. Each panel has a unique operating sequence to prevent the panels from interfering with one another as the seals engage and disengage. Because the S-shaped curve of the roof causes the three panels on one side to converge when opening, the center panel on that side remains in the raised position when opening, rather than bowing down , to prevent collisions. The roof's curvature, along with the complex seals and intersecting panels, made the control system the most complicated ever developed by Uni-Systems.





Panel open: bowed down.



Panel closed: tilted up.