



NATIONAL STEEL BRIDGE ALLIANCE

**2001** Prize Bridge Award

**WINNER:**  
GRADE SEPARATION

**I-55 / Damen  
Avenue Interchange**

Chicago, IL



Limited-access highways have been a boon to travelers but the interchanges needed for access to and from them consume enormous amounts of land—an acute problem in urban areas where land resources are limited. One solution to this problem is the Single Point Urban Diamond Interchange (SPUDI), which can be contained almost entirely within the normal rights of way of the intersecting highways and requires little additional land.

A feature of the SPUDI that has important structural consequences is the large flare at the top of each ramp. The flares are needed to permit two simultaneous left



turns onto and off the ramps. Uniquely among SPUDI structures, the I-55 / Damen Avenue design conforms closely to the “minimum” structure needed to accommodate the functional requirements of a SPUDI, minimizing the amount of superstructure required and maximizing the natural light available to the expressway below the interchange.

These benefits of the SPUDI concept (compared to the conventional design) come at the cost of much greater structural design complexity. This design complexity, however, is transparent to the owner, operator and user of the structure.

### Basic Superstructure Design Concept

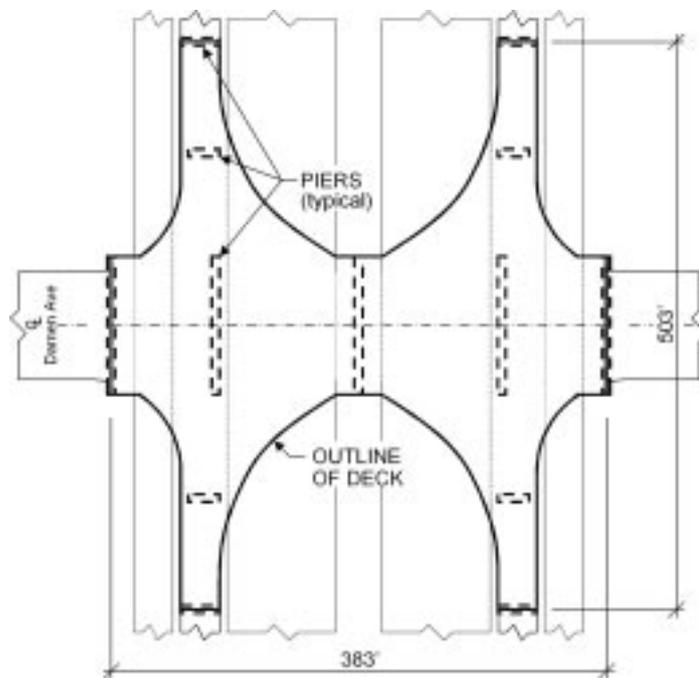
The basic superstructure design consists of a reinforced concrete deck supported on straight steel girders parallel to the Damen Avenue centerline and straight and curved steel girders for the ramps. The upper, flared ends of the ramp structures are framed into the fascia girders of the Damen Avenue bridge structure; these are welded plate girders about 6'-0" deep. The other girders at Damen Avenue and at the ramps are also welded plate girders, about 4'-0" deep.

### Piers and Foundations

The typical piers are concrete hammerhead-type units supported on drilled caissons. A steel crosshead within the depth of the girders was required to support the overhanging superstructure at locations where vertical clearance above the expressway was insufficient to accommodate a hammerhead below the girders.

### Expansion Joints and Bearings

There are no expansion joints in the 383' x 503' H-shaped structure indicated in the figure. The concrete deck and steel framing are continuous over this large area. This eliminates the maintenance and durability problems associated with expansion joints, but it created complications in the design of the bridge bearings, which had to be designed for movement.



### Special Condition at Damen Fascia Girders

The steel structure and the concrete deck are continuous across the Damen Avenue fascia girders. There is no expansion joint between the ramp structure on one side of the girder and the Damen Avenue bridge structure on the other side. The cross frames and diaphragms are configured to permit the fascia girder to rotate about its top to accommodate rotations caused by the deflection of the ramp spans. The deck slab has sufficient flexibility to accommodate this rotation without cracking.

#### Owner

Illinois Department of Transportation, Schaumburg, IL

#### Structural Engineer

Teng & Associates, Inc., Chicago, IL

#### Steel Fabricator

PDM Bridge, Wausau, WI (AISC member)

#### Steel Detailer

Tensor Engineering Company, Indian Harbor Beach, FL (AISC & NISD members)

#### General Contractor

Walsh Construction Company, Chicago, IL

#### Software

GT Strudl

