La Guardia Airport parking structure, New York (USA)

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Objekttyp: **Article**

Zeitschrift: **IABSE structures = Constructions AIPC = IVBH Bauwerke**

Band (Jahr): **1 (1977)**

Heft C-2: **Parking structures**

PDF erstellt am: **22.09.2024**

Persistenter Link: https://doi.org/10.5169/seals-14521

8. La Guardia Airport Parking Structure, New York (USA)

Owner: The Port Authority of New York and New Jersey
Architect: The Port Authority of New York and New Jersey
Engineer: The Port Authority of New York and New Jersey
Contractor: D. Fortunato, Inc. Floral Park, New York

Dimensions and arrangements:

Total surface, including ramps: 110'000 m2
Floor surface: 103'000 m2
Number of floors: 5
Total number of parking units: 2792; 36.9 m2/parking unit
Space built: 290'000 m3; 104 m3/parking unit
Column spacing: 17.7 x 8.2 m
Clear ceiling height: 2.44 m
Floor thickness: 0.75 m
Ramp's grade: 5.53 o/o
Ramp's width: 6.1 m
Parking arrangements: Skew
Lane's width: 5.5 m
Parking unit's dimensions: 5.5 x 2.6 m
Live load (excluding permanent load): 2.4 kN/m2

Materials used:

Concrete: 3.6 m3/parking unit
Steel for concrete: 166 kg/parking unit
Structural steel: 1520 kg/parking unit

Work's duration: 36 months
Service date: 1976

Introduction

In the last decade, passenger volume at La Guardia Airport has quadrupled to over 14'000'000 travelers annually and it is expected to reach 17'000'000 by 1980. To alleviate parking and traffic problems a five level parking facility providing space for 2792 cars has been built in front of the Central Terminal Building. In addition to the 142 by 161 m garage, the project also includes four helical ramps; an elevated roadway entering the third level of the buildings; and two fully enclosed pedestrian bridges connecting the fourth level of the garage with the Central Terminal Building.

Fire Protection

Fire tests on simulated parking structures and survey of fire damage in actual parking structures showed that an outbreak of fire in a car in an open parking garage was unlikely to result in uncontrolled fire spread and would not cause serious damage to the structure.
Some of the special features providing for adequate fire protection are:

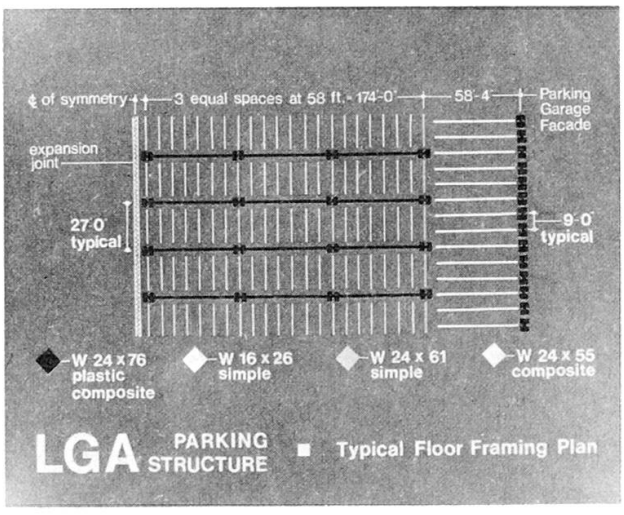
- A mechanical exhaust shaft to aid in dissipating heat and smoke near the center of the structure
- Fire detectors to activate the exhaust system
- Over 50 o/o of the exterior wall open to the air
- Fire-rated egress stairs at a maximum distance of 30.5 m
- A dry fire standpipe system located in each stair enclosure
- Manually operated alarm boxes and phones at 30.5 m intervals
- Exterior fire protection by means of a complete fire hydrant system
- Four sides of the building accessible for fire fighting
- Full time surveillance by Port Authority Police and other personnel

Materials Selection

A structural steel framing scheme resulted in considerable savings over a concrete scheme because of the significant reduction in dead load and the elimination of exterior architectural finishing due to an architecturally expressive steel framing system. Weathering steel (A588) was chosen because of the reduction of member sizes and weights due to 50 ksi strength, elimination of initial painting and future maintenance cost and aesthetic quality of exposed steel.

Design

A system of braced main frames combining the benefits of plastic and composite design was chosen as the most economical framing system. Column spacing of 17.7 m was required to accomodate two angle-parked cars and an unobstructed traffic lane. The typical 8.2 m spacing between frames was selected after analysis showed it to be optimum.
The building facade consists of a four story high weathering steel Vierendeel truss which serves as the main architectural feature while also providing structural support for the interior members. The truss is unique in that the beam and column flanges on the front side of the joints do not continue through the connection.
To achieve uniformity in deck section, slab thickness and reinforcement, spans were kept in the range of 2.4 to 2.7 m. Welded wire fabrics was used as typical reinforcement for the 102 mm light-weight concrete slab, which was poured on a 38 mm stay-in-place galvanized metal deck.



The building was divided into four approximately equal areas by means of expansion joints. A bracing system using stairwells as shear walls was designed to resist all lateral forces including wind, temperature and loads caused by lateral displacement. This system made it possible to relieve the steel frame of all horizontal forces.

At La Guardia Airport, 9 to 18 m of thick, soft organic layers make it necessary to install pile foundations for all major structures. Pipe piles 254 mm in diameter were driven close-ended approximately 25 to 54.4 Mg capacity and then concrete filled. Batter piles were used to provide for all lateral loads. Approximately 2000 piles were required for the entire project.

Access

Four concrete helical ramps with an outside diameter of 24.4 m serve as the main entrances and exits to the building. The ramps have no exterior columns. Slabs are cantilevered 5.2 m from a continuous helical girder 165 m long that runs the entire height of the building and is supported by six interior columns.

In addition to the helical ramps, a roadway system connecting the existing elevated and at-grade roadways to the third level of the garage provides additional access and 305 m of curbside to be utilized for unloading departing passengers.

Construction

To minimize interference with airport operations, the structure was constructed in stages. During the first stage which began in November 1973 only the eastern half of the existing lot was closed for construction purposes. By July 1975 the first two levels were open to the public and construction began in the western half. In December, 1976 the entire structure was available for parking.

(E.J. Fasullo)