

# Maynard Street Parking Structure Renovation and Restoration

2000

Award of Excellence Winner,  
Municipal Category



Renovated structure—Maynard Street view

**T**he Maynard Street Parking Structure is located in Ann Arbor, Michigan, in a commercial area near the Central Campus of the University of Michigan. Patrons of this 811 space parking structure include approximately 200 permit parkers who work in the area, with the remaining spaces used for short term parking for shoppers and students.

The Maynard Street parking structure was built in 3 phases. In 1954, the structure was started as a 3-level, single helix on a surface lot. In 1956, the structure was expanded vertically two additional levels. In 1967, the structure was expanded horizontally extending over Maynard Street and above the commercial space formerly housing a Jacobson's department store. In 1967, an exit speed ramp was also installed within the footprint of the original structure in order to facilitate exiting traffic from the now expanded structure.

The well-used parking structure is a major asset to both the University of Michigan and the surrounding commercial district. The City of Ann Arbor would actually have preferred to demolish and

replace the aging structure versus restoration. The restoration project was estimated to cost approximately \$9.5 million and to be completed in 12 months. The structure replacement was estimated at \$20 million and was to be completed in 24 months. It was determined that the high cost and longer schedule of a new structure on the very tight site would have a major negative impact on the parking needs of the community and the financial livelihood of the surrounding businesses.

With the decision made to restore the structure, it became apparent that the restoration needed to be well-planned, well-phased, and complete. The repairs and protection options chosen needed to extend the service life of the 45-year old structure at least 30 additional years. It was also apparent that the city of Ann Arbor, the neighboring businesses, and the patrons of the facility did not want to spend millions on renovating the structure and have it look like a 1950's vintage parking structure. Therefore, in addition to major structural restoration, the project needed a significant renovation component.

The typical structural restoration work included full slab replacement, beam/column repair, masonry repair, expansion joint replacement, sealant work, and deck coating.

The renovation items included:

- Addition of a parking operator office
- Addition of a community police office
- Façade coating
- Brick façade replacement
- Complete parking equipment system and booth replacement
- Complete electrical system upgrade including the refurbishment of 1967 switchgear and new transformers
- Complete lighting upgrade
- New speed ramps
- New vehicular and pedestrian signage
- Major painting and aesthetic improvements
- Elevator replacement
- Emergency phone system
- New exterior signage
- Relocation of pedestrian stair
- Fire protection system
- New mechanical drainage system under slab-on-grade

## Structural Characteristics

The two-bay structure consists of eight parking levels providing approximately 285,000 square feet of parking for 811 vehicles. The parking structure footprint is approximately 140 feet in the north/south direction by 465 feet in the east/west direction. Vehicular access to the structure is provided by two entry/exits on opposite ends of the parking structure (Figure 1).

The 1954 and 1956 construction consisted of a cast-in-place conventionally reinforced one-way slab system supported on conventionally reinforced concrete beams. The 1967 addition over the former Jacobson's department store consists of cast-in-place conventionally reinforced two-way flat slab construction.

## Problems That Prompted Repair

Corrosion-induced deterioration was so severe that the structural integrity of the floor system was compromised. The deterioration resulted in concrete spalls on the underside of the slabs becoming a safety hazard to pedestrians. At various times prior to the restoration, the city hired a contractor to literally remove dump trucks of concrete debris from the structure. In the most severe areas, supplemental steel beams were added to buy time until a full restoration could be completed or the decision was made to close and demolish the structure. Along with falling concrete, water leaking through failed membranes and cracked concrete slabs also resulted in damage to vehicles and complaints from patrons. The exterior façade had also deteriorated to the point of mortar and bricks being dislodged from the face of the structure.

The small 1967 elevator had numerous breakdowns, causing people to walk up to eight flights of stairs. In addition, the size of the elevator cab prohibited wheelchair use and limited the occupancy to a maximum of 3-4 people. The area surrounding the elevator was also poorly lit.

## Inspection/Evaluation Methods

Numerous studies, tests, and reports programs were completed throughout the life of this parking structure. The evaluation included a complete review of all past documentation and testing as well as our own in-depth field investigation and materials testing. The evaluation included:

- *Supported Floor Survey* – A chain drag was completed on all supported slab surfaces. The chain drag revealed that in areas not restored in 1991, 27% of the floor area was delaminated on the top side of the floor surface.
- *Ceiling Survey* – A detailed visual review and selective sounding of the underside of the floor slab and beams were completed. Approximately 5% of the underside of the floor slab was

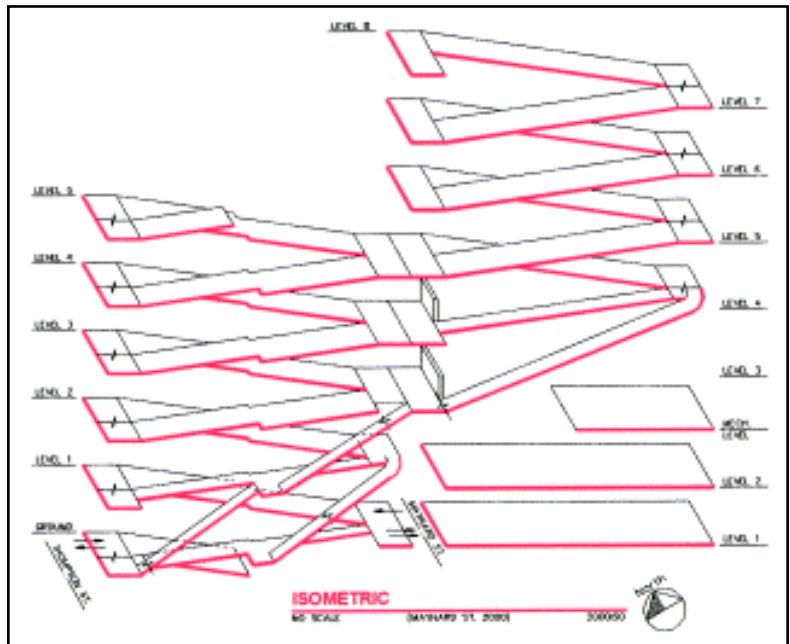


Figure 1: Isometric view of complex Maynard Street Parking Garage



Spalled floor surface



Ceiling spalls

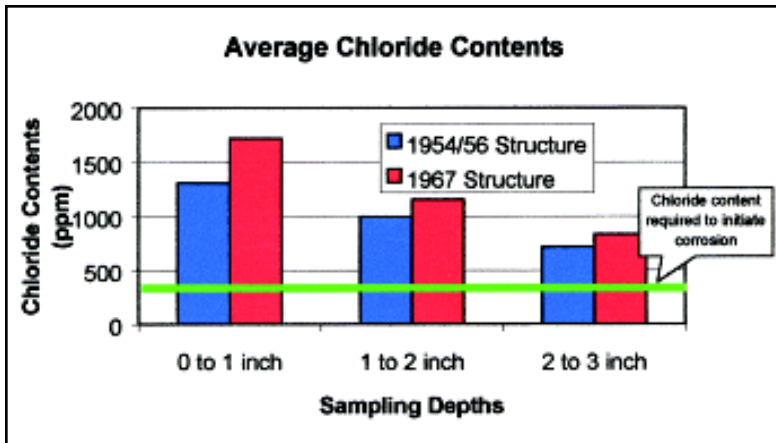


Figure 2: Chloride ion concentrations

delaminated along with over 500 square feet of beam delamination. There were also found to be approximately 2,000 square feet of column delamination and 500 square feet of wall delamination.

- *Slab Drainage* – An elevation survey of the supported parking levels was completed to evaluate the existing drainage in the structure.
- *Waterproofing Systems Review* – The condition of the deck coating, protected waterproofing membrane, expansion joints, and sealants was reviewed.
- *Stairs/Elevators* – Deterioration and renovation ideas were reviewed in the 3 stair towers and 2 existing elevators.
- *Exterior Façade* – A complete visual review of the exterior of the structure was completed.
- *Lighting Review* – Light levels were measured at key areas of the structure to compare the existing light levels to recommended light levels for parking structures by the Illuminating Engineering Society (IES). The existing high-pressure sodium lighting was inadequate at cross-overs, entry/exit areas, and in the stair towers.
- *ADA Compliance Review* – The entire structure was reviewed for compliance with the requirements of the Americans with Disabilities Act (ADA) and the Michigan Barrier Free Code. Several areas required significant modification.

## Test Results

Testing completed on this structure included:

- *Compressive strength testing* – The average concrete compressive strength of the 1967 portion of the structure was 3,583 psi. The average concrete compressive strength of the 1954/56 portion of the structure was 5,830 psi.
- *Petrographic analysis* – Testing on cores revealed that the concrete in the structure was of marginal to poor quality with relatively low air contents and high water/cement ratios.
- *Chloride Ion Analysis* – Chloride concentrations of approximately 300 to 400 parts per million (ppm) along with the presence of moisture and

oxygen are needed to support corrosion of mild steel reinforcement in concrete. The chloride ion concentrations are shown in Figure 2.

## Causes of Deterioration

The structure was subjected to years of exposure to road salts and moisture from the harsh Michigan environment. Direct salting of the parking structure for ice control also contributed to the deterioration. Relatively early in the life of the structure, a waterproofing membrane/asphalt wearing course was installed. As this membrane aged and started to fail, the rate of concrete deterioration increased rapidly. In the early 1990's, a 3 million dollar repair program was implemented that included a concrete overlay and deck coating on portions of the structure and partial slab repairs and deck coating to the roof level of the 1956 structure expansion. The extent of deterioration and quality of concrete in the upper level necessitated the partial slab repairs from the early 90's to turn into full-depth replacement in 1999.

## Repair System Selection

There are several basic repair system options that can be considered for parking structures, including conventional patching and sealing, slab replacement and deck coating, and even cathodic protection. For this structure, few options were considered feasible and in accordance with the owner's requirements. The options were to replace the remainder of the deteriorated floor slabs' full depth and deck coat, or to demolish and replace the entire structure. Because of monetary and site conditions, the City of Ann Arbor chose not to demolish the structure, but instead to implement an aggressive repair alternative.

The City determined that the structure had received significant repair in the past and that the proposed repairs should bring the structure to a relatively low-maintenance condition for about 30 years. The City agreed that the repair alternative would include not only aggressive concrete restoration, but significant functional, operational, and security upgrades.

Several restoration methods were needed to achieve the required 30 years of service life. These included:

- Full-depth slab replacement on 135,000 square feet of the deck surface. New state-of-the-art concrete slab specifications called out for two inches of concrete cover, low-permeability concrete, corrosion-inhibiting admixtures, and crack-controlling fibers.
- Microsilica concrete overlay on 20,000 square feet.
- Deck areas that were not replaced were repaired with conventional patches.
- The drainage in the entire structure was improved by providing increased sloping of the decks and replacing the drainage system.

- The entire 250,000 square feet of deck surface received a waterproofing membrane.
- Deterioration in the columns and walls was repaired.

## Site Preparation Issues

The parking structure is located adjacent to numerous commercial buildings and residential housing, so there were critical site preparation issues to consider. A portion of the parking structure was directly above offices housing 200 University of Michigan staff members. Site preparation issues included communication with the community, project phasing, and dust/noise control.

Noise was a major concern of the adjacent residents. The city hired a testing agency to complete noise decibel testing prior to and during construction. The testing was completed around the facility as well as in the adjacent buildings. All work was completed in accordance with the City of Ann Arbor Noise Ordinance.

## Demolition Methods

For the slab replacement areas, bobcats with hoe ram attachments and jackhammers were the main method of demolition used. Hydro-demolition methods were considered, but were not chosen due to noise concerns and lack of physical space for the equipment. Also, portions of the structure were to remain open during the project, and the debris from the water would have interfered with garage operation. Jackhammers were used on the remainder of the concrete to be repaired. Also, one of the stair towers was removed so that safer, glass-enclosed stairs could be constructed. Finally, the brick façade was removed.

## Surface Preparation

For the concrete overlay areas, scabblers mounted on bobcats were used to remove the existing waterproofing membrane prior to the overlay installation. In areas where the slab was to undergo full-depth replacement, concrete was removed around all existing exposed reinforcing steel. The remaining concrete surfaces and the reinforcing steel were then abrasive blasted. Finally, shotblasting was used in all areas receiving a traffic-bearing membrane (deck coating).

## Application Methods

Because of the complexity of the restoration, several different application methods were used. Shotcrete was used for most ceiling repairs of reasonable size. Smaller ceiling areas were completed with trowel-applied repair mortars. For the beam/column repairs, a combination of form-and-pour shotcrete and trowel-applied mortars were used, depending on the size and the location of the



*Completed rooftop deckcoating*

repair element. Ready-mixed concrete was used for the full-depth slab replacement, and pumped to the above grade replacement areas.

## Repair Process Execution

The restoration was completed in five distinct phases. The phasing enabled portions of the structure to remain open during some of the repairs. Closure of the entire structure only took place during the summer, when there were fewer university students in the city. Construction began in April of 1999 and was substantially completed by December 31, 1999. Punchlist items and some deck coating operations were completed in the first part of 2000.

## Renovation

A significant investment was made to extend the structural concrete service life by another 30 years. The City of Ann Arbor felt strongly about implementing other renovation options to improve the user comfort of the parking structure by improving the parking facility's functionality, aesthetic appeal, and security.

## Functionality

The functionality of the existing structure was deficient because patrons entering the Thompson Street entrance were required to cross over existing traffic and merge with traffic from the Maynard Street entrance. With the high turnover of patrons using this facility, this crossover created an inconvenient, unsafe condition. The renovation included the creation of a new entry ramp that brought vehicles directly to the second level, thus bypassing the conflict with the other entry/exit areas.

The parking layout was also redesigned, which increased available parking spaces from 785 to 811 spaces. There were also new entry/exit facilities and revenue control equipment added during renovation, designed with emphasis on aesthetic appeal. New exterior signage at both entry/exit locations, designed



*New elevator/stair area with new signage*



*New interior lighting makes brighter driving and parking areas*

to blend with the new architecture, were added to improve patron flow. The interior signage was also completely replaced to improve both vehicular "trailblazing" signage and pedestrian "way-finding" signage.

Finally, the 1967 vintage electric traction elevator was replaced with a large ADA-compliant stainless steel elevator. Installation of the new elevator required enlargements and structural modifications to the elevator shaft. The elevator shaft also had to be extended vertically by 10 feet to accommodate the new elevator machine room.

## Aesthetics

Because the structure needed extensive masonry repairs, the entire brick masonry veneer was removed and replaced with new masonry brick, capstones, and hot-dipped galvanized pedestrian railings. To improve the natural light and ventilation into the ends of the structure, the existing wall heights were lowered and pedestrian railings were installed to provide the code-required pedestrian railing heights.

The lighting was also improved in all full slab replacement areas, which received new metal halide



*Renovation complete—Thompson Street view*

lights. Lighting in the remaining areas of the structure remained the previous high-pressure sodium type, but was supplemented with salvaged fixtures from the full slab replacement areas.

## Security

The security of the parking facility was also upgraded in several ways. First, the existing stairwells were replaced or modified to provide openings for windows and additional lighting. New emergency phones were also installed at all three stair/elevator towers to replace the outdated video monitoring system. Finally, a new parking operator office that serves the entire City of Ann Arbor system was placed at grade level next to one of the entrances, and a new, enlarged community police office was placed in a visible location near the street and sidewalk access.

This total restoration of the Maynard Street Garage was a complete success. This 45-year old structure was not only renovated to update and brighten the parking for its patrons, but the structure itself now has an estimated additional 30-year service life.

## Maynard St. Parking Structure

### Owner

City of Ann Arbor  
Ann Arbor, Michigan

### Designer

Carl Walker, Inc.  
Kalamazoo, Michigan

### Repair Contractor

Western Waterproofing  
Livonia, Michigan

### Material Supplier

Neogard  
Dallas, Texas

### Project Architect

Luckenbach Ziegelman Architects  
Ann Arbor, Michigan