

Motor Mart Garage



Facade from Stuart St. & Broadway Corner
(before)

2000 National ICRI Concrete Repair Award



Facade from Stuart St. & Broadway Corner (after)

The Motor Mart Garage is a highly visible and well-recognized eight-story building located in Boston's Park Square. Originally constructed in 1929, Motor Mart was at that time the largest garage in the world, capable of holding 2000 vehicles. The futuristic double threaded helix ramp system allowed cars to move up and down the garage simultaneously. Ralph Harrington Doane, the architect, won the 1927 Harleston Parker Award from the Boston Society of Architects for his unique design. Unfortunately, by the late 20th century, the once glorious Motor Mart was in need of major internal and external repairs.

Planning and Design

Results of an in-depth condition appraisal determined that chloride-laden moisture from deicers and road salt combined with water accumulation due to poor drainage had led to a high deterioration rate on the garage's eight supported levels. Large delaminations, spalls, scaling, extensive cracking, leaking and leaching had further caused severe corrosive damage to the steel reinforcement. Unsealed slab cracks and concrete porosity contributed to further deteriorate the concrete beams, columns, and walls. The evaluation methods included petrography and chloride analysis, which were used to assist in the development of options

for a comprehensive restoration program. In addition, a detailed floor delamination survey was performed, along with hammer tapping on all ceilings, beams and columns.

As with the structural frame, the facade of the 76-year-old structure had weathered under harsh exposure conditions and was showing its age in the form of numerous cracks, spalls, and delaminations in the cast stone members. The industrial steel windows and ornamental metal panels above and below the windows were also in serious disrepair. Previous repair attempts had provided minor extensions to the service life. The once sharp detail of the neo-classical motif had been worn to a dull resemblance of its former grandeur.

Based on the condition appraisal and material testing results, the owner was presented with several repair options, ranging in cost from \$1.5 million to \$21 million. The option chosen was a full-depth removal and replacement of deteriorated slab sections, drainage systems installation, and slab protection via traffic bearing membrane. This option also included complete facade removal and replacement.

Design Issues Interior Restoration

The supported floor level framing consists of two-way conventionally reinforced cast concrete waffle



Facade from Stuart St. & Broadway Corner (during)

slab system with concrete girders and beams used to develop large open spans. The structural slab and framing contained the most significant deterioration.

The project dealt with several unique issues in developing the long-term solution to extend service life to this structure. The following issues were considered to have a significant impact:

1. The garage structure was built in 1927 before the standards for concrete quality were defined;
2. The concrete was not air-entrained for freeze/thaw resistance;
3. Over 35% of the supported floor slabs exhibited deterioration in the form of spalls and delaminations;
4. Extensive deterioration into the slabs combined with extensive cracking and leakage caused significant deterioration to beams, joists, and other supporting elements;
5. Considerable shoring would be necessary to support the damaged 12" deep floor sections and 14" deep girders while repairs would be undertaken;
6. Progressive deterioration of the concrete resulted in high repair quantities;
7. Leaking and leaching through the supported slabs caused severe corrosive damage to the steel reinforcement;
8. Internal inclined circulation ramps were found significantly deteriorated to the point of being unsalvageable. Complete replacement of ramps on both the west and east sides of the garage would have to be considered and accomplished as work progressed down through the floors;
9. Steel reinforcement used during the original construction was the "Havermeyer" or square rebar shape and of a lesser tensile grade than that used today; and
10. Poor drainage evident by considerable ponding due to lack of proper floor slope had plagued this garage through its history.

Facade Restoration

Cast stone construction was employed on the original facade. To preserve this cast-stone attribute, architectural precast concrete was utilized. Modern methods and machinery allowed designers to implement larger pieces and effectively maintain the cast-stone appearance through the use of false joints.

Construction Interior Restoration

Interior restoration consisted of the removal of delaminated, spalled, scaled, and unsound concrete from slab, joists, and beams through selective demolition. Full-depth slab replacement required special phasing and construction measures to support the weakened slab and framing through two supported levels below, while maintaining continued occupancy of the garage. Tower shores, steel beams, and timber mats provided the versatile method of accomplishing both objectives.

Demolition work was subject to noise, dust, and fume limitations and required daytime demolition due to adjacent hotels and residences. Manual pneumatic jackhammers and hydrodemolition processes were used to remove the concrete. To minimize environmental concerns, demolition debris was transported through the floor slabs by means of an internal debris chute system, which emptied directly into trucks at ground level. Demolition areas were also dampened to minimize noise and airborne pollution.

Risk control was a critical element during the construction process. The project specifications required construction of full height protective barriers to enclose and secure each work zone. Other requirements included restrictive working hours for demolition, good contractor safety records, and heightened security, all of which proved beneficial in accomplishing the project's goal.

For the slab repair, microsilica concrete with a corrosion inhibitive admixture was specified to provide an added level of protection against chlorides and moisture, especially in the heavily reinforced steel areas. New reinforcing steel was also used extensively in replacement and to supplement areas where full-depth slab replacements occurred. Approximately 4,500 cubic yards of concrete and 80 tons of steel reinforcement were used in this effort. Forming of the slab was complicated because the domed sections of the slab were non-standard in size. A significant number of molds were needed (approximately 1,000 each) to maintain the construction schedule and progress. Foam rubber molds were initially created to replicate the domed sections but were found difficult to secure and reuse. The forming was ultimately accomplished by a combination of fabricated wood

inserts and fiberglass pans to restore the thick slab or waffle sections.

Drainage improvements were made by a combination of floor re-profiling in areas where a significant amount of the slab was being replaced by installing a new drain and riser system on all levels.

Results from the engineering evaluation determined that high chloride and carbonation levels were present on all supported levels. Therefore, a comprehensive waterproofing system became an essential and integral part of the restoration program in order to protect the floor system and minimize the potential of future deterioration over time.

Historic Facade Restoration

As part of the repair process, a series of representative cast-stone and ornamental metal panels were salvaged and shipped to the precast manufacturer for the development of intricate mold work. The precast molds were fabricated to replicate both the original cast-stone and ornamental metal panels.

A repetitive pattern with the facade motif enabled a high level of economy to be achieved, limiting the number of new pieces and mold work required. Once new molds were developed, artisans further refined the molds to sharpen the detail provided by the weathered samples. The handiwork of the artisans was painstakingly slow, thus it was imperative the mold work commence parallel to the removal of the existing facade and repair of the underlying framework to ensure the new precast facade was available once the structure was prepared to receive it.

Following the removal of the cast-stone, windows, and ornamental metal panels, preparation of deteriorated structural frame elements was performed from the same scaffolding platform followed by any necessary cementitious repairs. Four scaffolding platforms were rotated in a leapfrog manner following the sequence of removal, preparation, and repair.

Once the removal and repair program was sufficiently far along, new precast components were shipped to the site and erected on the prepared structure. To minimize site congestion, an offsite holding yard was used to store trailers loaded with precast components. The components were sent to the site for a “just-in-time” erection process, whereby a loaded trailer was scheduled to arrive onsite just as an unloaded trailer was departing.

Non-code compliant operable windows were replaced with a fixed aluminum window system that matched the design of the early industrial window. Vents behind an architectural screening system were introduced into the individual lights of the window frame to provide the code required fresh air/exhaust system, which is controlled by a state-of-the-art carbon monoxide monitoring system.



Facade detail (during)

Two other projects were undertaken in the garage – one to convert the rooftop space to additional parking spaces, and the other to totally renovate the current retail areas on the street level to premiere tenant space. With these multiple projects and contractors active on site, the phasing of the interior restoration, facade restoration, and rooftop activities had to be scrutinized on a nearly daily basis to prevent delays due to site conflicts, interruption of active tenants, and to provide access to parking on over 70% of the garage area.

The Motor Mart Complex was completed and restored over a relatively short time frame of two years, and was conducted with a minimum disruption to the owner’s parking revenue. The building, through extensive repair and protection, has its rich historic value restored, an extended service life, and many other improved features. It now boasts increased vehicle capacity, increased tenant capacity at the street and basement levels, and maximum use of the retail areas by several premiere tenants.

The Motor Mart Garage is a shining example of the reclamation of an historic landmark building after years of deterioration. It has reclaimed its fame as the focal point of the Park Square District in downtown Boston.

Motor Mart Garage

Owner

DeMatteo Realty Corporation
Braintree, Massachusetts

Designer

Walker Parking Consultants
Boston, Massachusetts

Repair Contractor

T Equipment Corporation
Dorchester, Massachusetts