CONCRETE

TIME EQUITIES INC.

ANNUAL PREVENTATIVE MAINTENANCE MANUAL

FOR PARKING GARAGES

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SECTION 1

CONCRETE CLEANING AND MAINTENANCE (ANNUALLY)

The elements of parking structures, more than any other building type, require routine cleaning.

Unlike other buildings, the structural components of parking structures are exposed directly to weather and other environmental conditions. Extreme temperature changes, rain, snow, deicing salts, road grime, leaves and dampness directly influence the durability of parking structures and have the potential to create performance problems.

It is essential for a preventative maintenance program to be a major phase in the operation of all parking structures. All parking structures require a diligent maintenance program to ensure long-term durable performance. Maintenance involves those items that enhance the aesthetic appeal and functional performance of the parking facility.

Preventative maintenance should include a yearly checkup of structural, architectural, and mechanical components to verify proper performance. For the structural system, the checkup should include a visual inspection of all structural components, preferably by a structural engineer experienced in the design and construction of precast parking structures. Of particular importance in structural system maintenance is the drainage and sealants. Over time, poor performance of these elements can lead to serious structural problems.

The annual checkup involves the following tasks:

- General Cleaning
- Floor Wash
- Stain Removal
- Cleaning and Filling of Expansion Joints and Control Joints

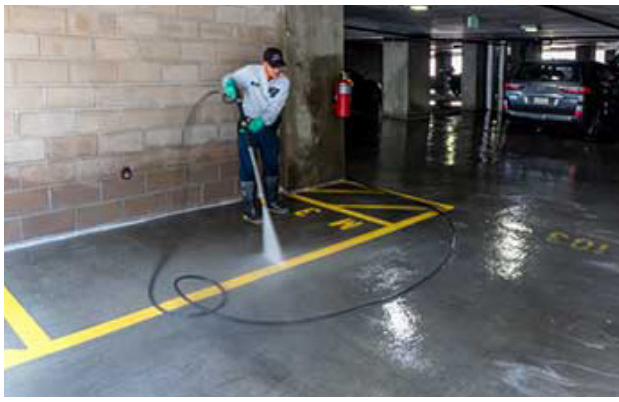
A. GENERAL CLEANING:
TRASH REMOVAL, DRAIN CLEANING, SWEEPING

B. FLOOR WASH: ANNUAL HIGH PRESSURE WASH DOWN

1. Flush all floor surfaces (use a fire hose or 1 1/4 in. hose or larger; garden hose water volumes are not sufficient). Where 1 1/4 in. hose pressure is not available, an outside pressure washer company should be engaged. Start from the roof and work down. In deicing salt areas, a spring flushing should be done immediately after the spring thaw. Flushing should be done with all drains protected by screens or burlap to prevent clogging. Care should be taken to avoid damage of sealants and coatings with high pressure water jets.

2. Inspect and clean floor drains, repair downspouts, and remove barriers that prevent proper water flow to drains. Cleaning should include removal of drain grates and cleaning of pipes at bends and joints.

C. STAIN REMOVAL: GREASE AND OIL REMOVER



D. EXPANSION JOINTS AND CONTROL JOINTS: CLEANING OF DEBRIS AND FILLING

1. Inspect floor surfaces for excessive wear and cracking. An increase in the number and severity of cracks, or any other surface deterioration such as potholes, should be brought to the attention of a structural engineer.

2. Potholes should be patched and worn spots leveled with appropriate materials having compatible thermal expansion properties as the concrete. If reinforcing steel or steel plates are exposed in the pothole, the reinforcement should be cleaned of rust down to bright metal by sand blasting, hydro blasting, or power wire brushing. A qualified engineer should then specify patch materials and additional coatings.

3. Cracking should be noted during periodic inspections in order to ascertain whether cracks are “moving”. Moving cracks will open and close as the structure contracts and expands through seasonal temperature changes. Such cracks are readily sealed with a two-part polyurethane or a silicone sealant after routing of the crack. A crack that extends through the deck surface is typically filled with epoxy if it is not moving.

4. Studies have shown that fine cracks (0.007 in. or less) are typically regarded as non-detrimental to the serviceability of the deck and have little influence on the corrosion process. This is due to the dense matrix of the concrete and the shallow depth of the crack. Also, studies have shown that where cracking is perpendicular to the reinforcement the possibility of corrosion is greatly diminished. The presence of an applied penetrating silane sealer, typical on many deck surfaces, creates a thin hydrophobic protective layer on the surface and provides additional protection against possible corrosion. It should be noted that reapplication is required periodically and manufacturer’s recommendations must always be followed.

5. Inspect floor expansion and control joints for deterioration, wear, and/or abuse (from snow plows and other cleaning equipment). Repair as required. Expansion joints are particularly susceptible to snow plow damage. Many expansion joint manufacturers void their warranties unless the snowplow is lifted over the expansion joint. Even those that allow plowing over the expansion joint require the blade to be perpendicular to the joint only. Each manufacturer has specific requirements that should be followed.

SECTION 2

SNOW AND ICE REMOVAL

Removal of snow and ice is necessary for functional performance, the public's safety, and the long-term durability of the structure. Snow and ice removal can be difficult depending on the size, timing, and type of storm, and also the area to be maintained.

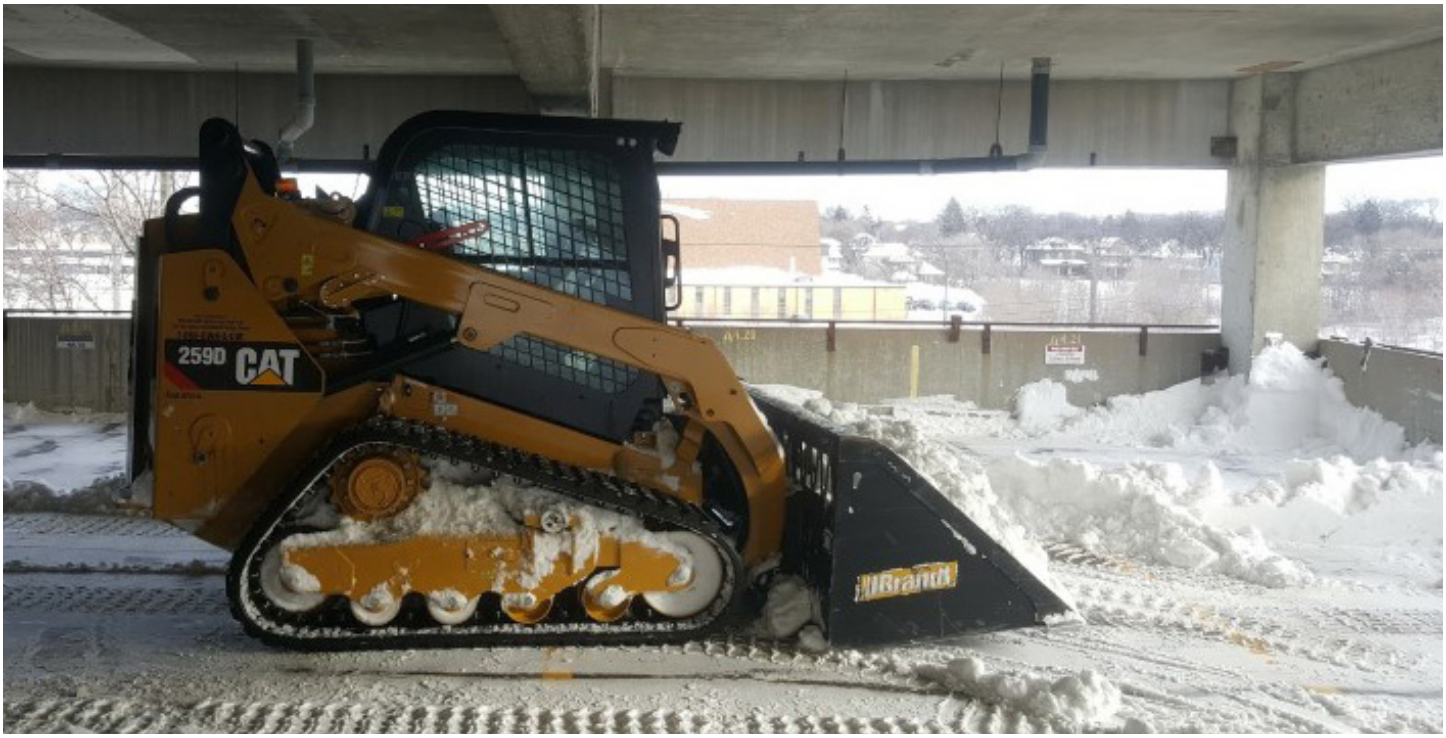
CHEMICAL DEICERS FOR SNOW REMOVAL

The use of chemical deicers can affect the structure's efficiency, life safety, and longevity. Deicers must be chosen prudently because of their chemical potency, availability, and cost. Improper use of deicers may be deleterious to surfaces to which they are applied.

When using deicers, it is necessary to wash-down deck surfaces immediately following the winter season. The use of a high water volume from a 11/4 in. or larger hose is recommended. During the initial design phase, consideration for sufficient water to clean all surfaces (i.e., floor levels in addition to the roof level) contacted by deicers is important. It should be remembered that chemical deicers are also deposited by vehicles parking in the parking structure, so cleaning of all levels is important even if deicers were not directly applied to lower floor levels.

There are many types of chemicals deicers. Some, like chlorides, are relatively inexpensive but are much more harmful to the structure than urea's or calcium magnesium acetate. It is recommended that sodium or calcium chloride (rock salt) deicers not be used. Deicing chemicals should not be used until the parking structure is at least one-year-old.

Stairs, landings, and other areas of pedestrian egress must also be clear of snow and ice.



SECTION 3

CONCRETE STRUCTURAL REPAIRS

If required, structural repairs must be designed and specified by a structural engineer experienced in parking structure repair techniques. Repairs that may be required for older precast structures include the following:

A. CONCRETE DETERIORATION

More common in cast-in-place portions of the structure such as field placed toppings and pour strips than in precast concrete components. Deterioration mechanisms include:

1. **Scaling:** The shallow disintegration of cement paste at the concrete surface. Usually associated with freeze-thaw cycles, scaling produces an unsightly rough surface that poses a tripping hazard and recesses for water ponding. Repairing with a surface overlay or topping is common.

2. **Spalling**: Fracturing of the outer surface of concrete from rebar corrosion or isolated impact loads. Spalls tend to have a surface area of several inches and depths of 1 in. or more. Repairing of spalled areas should include a structural assessment to determine the cause of the spall along with a specification of proper repair materials that are compatible with the base concrete properties.

3. **Cracking:** Well distributed fine cracks are typical and normal for non-prestressed concrete elements. A typical cracking can occur from mishandling precast units, improper placement, finishing or curing of cast-in-place toppings, thermal movements, corrosion of embedded metal, structural overload, or from foundation settlement.

   Minor non-moving cracks in deck surfaces are non- structural and need only a surface seal to prevent water intrusion. (See Section 2.3, Section C, Paragraph B.)

   Structural cracking requires an engineering appraisal to determine the origin of structural degradation and proper repair specifications.

4. **Delaminations:** Fractures which occur below and parallel to a concrete surface. In precast parking structures, these typically occur in field placed toppings due to corrosion of reinforcing steel or due to improper placement (surface preparation) of the cast-in-place topping. Extensive delamination requires engineering evaluation and significant remedial repair to stop the deterioration process.

B. EXPANSION JOINTS

Expansion joints are typically installed on structures with lengths greater than 300 ft., structures with irregular shapes, or to isolate stair and elevator towers. Their purpose is to limit the build-up of stresses in structural members or connections due to volume change movements created by seasonal temperature variations and customary drying-shrinkage of concrete. Expansion joints work by providing a flexible link between two separate portions of the structure. Typical movements will range from 1 to 3 in. which can be accommodated by a variety of joint styles and brands.

When expansion joints deteriorate or malfunction, water leakage through the joints may lead to deterioration of the concrete structure. Frequent monitoring, cleaning and repair of local damage will extend service life, but frequent problems require a specialist to evaluate and resolve.

C. CONNECTION DISTRESS

Thermal movements or structural overload can occasionally create cracking or distress in connections between precast members. Connections, which can consist of welded plates, bolted plates, bolts through members or bearing pads between members serve a variety of functions during and after construction of the structure. For this reason, it is recommended that an experienced engineer familiar with precast concrete construction investigate any sign of connection distress.