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WALKER
RESTORATION CONSULTANTS

CONDITION APPRAISAL REPORT

**CITY OF SANTA ROSA
PARKING STRUCTURES**

SANTA ROSA, CALIFORNIA

Prepared for:
THE CITY OF SANTA ROSA
PARKING DIVISION

WALKER #33-1453.00

MARCH 2007



CITY OF SANTA ROSA PARKING STRUCTURES

CONDITION APPRAISAL REPORT



PROJECT #33-1453.00

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EXECUTIVE SUMMARY

Walker Restoration Consultants completed observations and limited materials testing of the City of Santa Rosa’s five (5) parking structures noting the observed condition of the structural members, floor surfaces, ceiling surfaces, joints, walls, façade, waterproofing materials, and other features. Visual observations were also conducted of the exposed mechanical and electrical systems. The review included select materials testing, review for compliance with ADA, review of structural drawings and previous reports, and presents budgetary cost for repair and maintenance recommendations. Our objective with these services was to:

- Evaluate the overall condition of the structures.
- Present findings and recommendations for work items that require repair.
- Evaluate the impact of the noted deterioration on long-term durability and service life of the facility.
- Identify and prioritize repair and maintenance items required for maintaining the structures through their respective remaining service life.
- Present a recommended repair program and associated probable cost.

This report also identifies any areas in need of immediate corrective repair for safety of the patrons.

Walker compiled the condition appraisal information and developed a budgetary plan for recommended repairs (including maintenance items) and/or possible enhancements. The associated costs of this plan are listed in Table I.

TABLE I - COST SUMMARY
Condition Assessment of Parking Garages

Parking Garage	Immediate Repairs	Base Repairs
Garage 1		\$455,000
Garage 3		\$248,000
Garage 5		\$992,000
Garage 9	\$ 15,000	\$1,530,000
Garage 12		\$245,000
Subtotal	\$ 15,000	\$3,470,000
Mobilization 7%	\$ 1,050	\$242,900
Contingency 10%	\$ 1,605	\$371,290
Design Fee 10%	\$ 1,500	\$347,000
Total	\$ 19,155	\$4,431,190
Combined Immediate and Base Recommended Repairs		\$4,450,345



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CONCLUSIONS

The parking structures range from fair condition to good condition for their respective service lives; however, we recommend implementation of a structured maintenance plan, including selective concrete repair and waterproofing systems to protect structural components, reduce future repair costs and effectively extend the useful service life of each of the parking structures for another 8 - 10 years before substantial restoration repairs are required.

The conditions observed in the parking structures include deterioration we consider typical in exposed parking structures with over 15-40 years of service. The items are often related to replacement of materials at the end of the expected service life.

GARAGE #1 PARKING STRUCTURE

The Garage #1 Parking Structure includes a slab-on-grade parking level and four supported concrete levels. The major conditions observed include cracking of the concrete slabs, moisture infiltration of electrical room, sealant failures of control joints, failure of expansion joint seals and moisture infiltration of the brick façade with staining and efflorescence present.

Recommended repairs would include concrete floor repairs, restoration of the waterproofing systems and cleaning and sealing of the façade. Maintenance repairs to the mechanical and electrical systems of the structure are required as part of our recommended repair program.

GARAGE #3 PARKING STRUCTURE

The Garage #3 Parking Structure includes a slab-on-grade parking level and five support levels. The major conditions observed include concrete cracking of the slab and sealant failures of control joints at pour strips.

Recommended repairs would include concrete, waterproofing, and maintenance repairs.

GARAGE #5 PARKING STRUCTURE

The Garage #5 Parking Structure includes a slab-on-grade parking level and two structural supported levels. The major conditions observed



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include floor slab cracks, delamination, concrete spalls, and sealant and waterproofing deterioration.

Recommended repairs would include concrete repairs to the floor slabs, waterproofing, and maintenance repairs.

GARAGE #9 PARKING STRUCTURE

The Garage #9 Parking Structure includes a slab-on-grade parking level and three structural supported levels. The major conditions observed include floor slab cracks and delaminations, poor drainage in select locations, and sealant and waterproofing deterioration.

Immediate repairs required are the installation of a steel barrier on the top deck to prevent a vehicle from driving off the west end of the garage. The existing curb and railing are not adequate to provide restraint of a vehicle impact.

Recommended repairs would include concrete repairs to the floor slabs, waterproofing, supplemental drainage, and maintenance repairs.

GARAGE #12 PARKING STRUCTURE

The Garage #12 Parking Structure includes a slab-on-grade parking level and seven structural supported levels. The major conditions observed include floor slab cracks and delamination, sealant and waterproofing deterioration and drainage problems at the lower level electrical room.

Recommended repairs would include concrete repairs to the floor slabs, waterproofing, and maintenance repairs.

Our review of the five parking structures included limited materials testing, select sounding of concrete surfaces, examination of typical spalling, cracking, corrosion, exposed reinforcing, efflorescence, and moisture infiltration. Visual observations were also conducted of the façade, stair towers, railings, and barrier cables, mechanical and electrical systems.

This report is based on observations of existing conditions on each of the structures and selective testing and sampling of concrete materials.

Planning for the repair and maintenance of parking structures requires the selection of a repair approach. The report presents the systematic approach in the recommendations section of the Condition Appraisal



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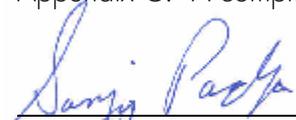
Report and an estimate of the overall costs in the summary cost tables. The report Summary Discussion Section includes a discussion of the recommended repair approach with our conclusions and interpretation of the testing. The Appendices include additional details, photographs, and support material.

IMPLEMENTATION/PHASING

Implementing the recommended repairs can be phased and scheduled around the City's parking needs to least impact patrons of the parking structures.

Phasing the work over multiple construction seasons will increase the costs shown in Table I. Most of the increases will be from inflation, wage increases, and costs from contractor constraints in phased work areas or time frames.

A complete list of observed conditions for each structure may be found in Appendix C. A complete cost breakdown can be found in Appendix A.



Signature

March 21, 2007
Date



Signature

March 21, 2007
Date

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OBJECTIVE

This appraisal is intended to provide a professional opinion of the general condition of the City of Santa Rosa’s five (5) parking structures. The opinion is based upon our visual examination, limited materials testing and selective chain dragging of the structures. In particular the appraisal:

- Evaluates the location and extent of apparent deterioration in the parking structures.
- Evaluates the impact of the deterioration noted on long-term durability and service life of the facilities.
- Recommends necessary corrective measures.
- Presents a recommended repair program and associated probable cost.

FACILITY DESCRIPTIONS

We understand that the original structures were built between 1965 and 1985. The structural configurations of the parking structures are as follows:

Garage #1 Parking Structure

This facility has one slab-on-grade parking level and four supported parking levels constructed of cast-in-place post-tensioned concrete slabs and beams supported with conventionally reinforced columns.

The structure is a 2-bays wide structure configured with an end-to-end helix ramping system with one-way traffic and with the center ramp being a “jump ramp.” The in-bound loop is on the south end of the garage and the out-bound loop is on the north end. Garage # 1 provides parking for 750 vehicles.

Pedestrian ingress/egress is provided through stair towers on the four corners of the structure along with one stair located at mid deck on the east side with an elevator and one other elevator located on the southeast corner of the structure.

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Garage #3 Parking Structure

This facility has one slab-on-grade parking level and five supported parking levels constructed of cast-in-place post-tensioned concrete beams and slabs supported with conventional reinforced cast-in-place columns. The exterior spandrel panels are ribbed precast concrete panels.

The structure is a 3-bay wide structure that is configured with a single treaded helix ramp with one way traffic. Garage #3 provides parking for 680 vehicles.

Pedestrian ingress/egress is provided through stair towers on the four corners of the structure with an elevator located on the south end of the structure.

Garage #5 Parking Structure

This facility has one slab-on-grade parking level and two supported parking levels constructed of cast-in-place (CIP) conventionally reinforced slabs referred to as "waffle slabs" that are supported with CIP columns. The structure is 2 bays wide and configured with a single threaded-helix ramp with two-way traffic. Garage #5 provides parking for 208 vehicles.

Pedestrian ingress/egress is provided through stair towers on the four corners of the structure with entrances to the adjacent office building at the middle of the west elevation.

Garage #9 Parking Structure

This facility has one slab-on-grade parking level and three supported parking levels and is constructed of cast-in-place (CIP) conventionally reinforced slabs referred to as "waffle slabs" that are supported with CIP columns.

The structure is 3-bays of flat floors with a spiral helix ramp located on the west end of the structure. Garage #9 provides parking for 440 vehicles.

Pedestrian ingress/egress is provided through stair towers on the four corners of the structure with an elevator tower located adjacent to the stairs on the northwest corner.

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Garage #12 Parking Structure

This facility has one slab-on-grade parking level and six supported parking levels which are constructed of cast-in-place post-tensioned concrete with the first level serving the bus station.

The structure is a 3-bay wide structure with the ramp in the center bay that is configured as a single threaded helix with one way traffic. Garage #12 provides parking for 720 vehicles. The bus station is located on the north side of the lower level.

Pedestrian ingress/egress is provided through stair towers on three corners of the structure. Elevators are located at the midpoint of the east elevation of the structure. This structure is closed off to traffic on the upper two levels to mitigate vandalism on the upper levels, at times when demand does not require use of the parking spaces.

PREVIOUS REPAIRS

Previous repairs or restoration projects have been reported on all of the structures; however, repair documents were not available for review. The construction repairs observed are noted as follows:

Garage #1 Parking Structure

- Select cracks in the structural slab were routed and sealed with a urethane sealant.
- Expansion joints were replaced on the top level.
- Repair to a spandrel and released PT tendon on the first supported level after a vehicle accident.

Garage #3 Parking Structure

- Select cracks were routed and sealed with a urethane sealant.
- Pour strips were sealed with an asphalted type sealer.
- Stair tower landings were replaced and stairs and railing repainted.
- Exterior spandrel repair on the east side.

Garage #5 Parking Structure

- Select cracks were routed and sealed with a urethane sealant.
- Exterior metal façade and railing were installed/upgraded.

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Garage #9 Parking Structure

- Select cracks were routed and sealed with a urethane sealant.
- Traffic coating was installed on the east end bay and on the stairs in the northeast section.

Garage #12 Parking Structure

- Select cracks were routed and sealed with a urethane sealant.

As with all repair projects, the previous repairs have an expected service life. Some of the factors that can influence the service life of the repairs include:

- Extent of original deterioration.
- Quality of material specified for the original construction and for the repairs.
- Quality of the preparation and installation of the repair materials.
- Adverse conditions or severe exposure.
- Lack of protection and/or maintenance of the repaired area.

Planning and budgeting for replacement of these previously repaired areas and items should be anticipated in the future through a maintenance repair program.

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Walker Restoration Consultants recommends a repair and protective maintenance program appropriate for the age and existing condition of the parking structures. We reviewed repair options, protective systems and products for the repair program and associated work items and recommend the following:

SUMMARY OF IMMEDIATE REPAIRS

There was a condition observed on Garage # 9 that requires immediate repair to help prevent a vehicle from driving off the west end of the structure. There are parking spaces available at the west end of the top level that do not have a spandrel wall or other device to absorb the vehicle bumper impact load centered at a height of 18" above finished floor as required by the building code. Existing conditions are a 12" curb with hand railing attached to the curb. Walker recommends installation of a steel barrier along this edge of the garage.

SUMMARY OF RECOMMENDED BASE REPAIRS

The recommended Base Repair program concentrates on repairs to the deteriorated sections of the structures and protection applications to the garage façades. With proper maintenance, this repair program will effectively extend the service life of the structures for another 8-10 years before substantial restoration repairs would be required again.

Garage #1 Parking Structure

A number of repair items need to be addressed for this garage. These include the following:

Concrete repairs are required on structural members such as columns, and floor slabs. Recommended concrete repairs include:

- Patch Repair of the delamination and spalls in select locations of the structure with the application of a latex modified concrete patching material.
- Repair of cracks on Level 3.
- Patch repair of concrete spalling on the exterior columns in select locations.

RECOMMENDATIONS



Garage #9

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Waterproofing repairs are required on the supported floor slabs and at joints between the walls and concrete curbs. Recommended waterproofing repairs include:

- Replacement of failed expansion joints on all supported levels.
- Routing and sealing of selected cracks with urethane sealant.
- Installation of traffic topping on the end bay (south) of Level 3.
- Routing and sealing of selected cracks with urethane sealant and installation traffic topping membrane on the southeast stair tower to help mitigate water intrusion of the electrical room located below the stairs.
- Application of water repellent sealer on the brick façade.
- Repair failed vertical control joint sealant in the brick façade.
- Installation of vertical sealant on the electrical room brick façade.

Recommended mechanical repairs include:

- Installation of supplemental drains on the upper level to improve drainage.
- Cleaning of the existing drains and leaders to remove dirt, laitance, and debris.

Electrical repairs are required throughout the structure for safe operation of the structure and patron comfort.

Electrical repair recommendations are:

- Repairs to non-functioning lamps and exit signs.
- Repairs to corroding conduit and any damaged or unfastened conduit in the electrical room.

Architectural and miscellaneous repairs are required throughout the structure to maintain the aesthetics of the structure and enhance patron comfort.

- Brick masonry repair of the damaged wall area on the elevator tower on Level 1.
- Installation of a vertical joint in brick parapet walls at cantilevered slab section on south end of roof level. These joints will also need to have urethane sealant installed.
- Power washing and cleaning of the brick façade to remove efflorescence and staining.
- Repainting of the handrails on the top of the spandrel and the stair tower railings.

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- Removal of dirt and vegetation in the exterior planter on the perimeter of the garage and re-waterproofing of the planters.
- Re-application of the pavement traffic markings to assist in wayfinding and restriping of stalls to maximize stall utilization.

Garage #3 Parking Structure

A number of repair items need to be addressed for this garage. These include the following:

Concrete repairs are required on structural members such as columns, spandrels and floor slabs. Recommended concrete repairs:

- Patch Repair of the delamination and spalls in select locations of the floor slabs with the application of a latex modified concrete patching material.

Waterproofing repairs are required on the supported concrete slabs. Recommended waterproofing repairs include:

- Installation of traffic coating membrane over the pour strips to help protect the post-tension tendon anchorages.
- Replacement of control joint sealants at pour strips on all levels.
- Application of a high solids silane sealer on the supported floor slabs to minimize moisture infiltration and chloride intrusion.
- Routing and sealing of selected cracking on the supported levels.
- Installation of cove sealant as required.

Recommended mechanical repairs include:

- Installation of supplemental drains and piping to improve drainage of the floor slab.
- Cleaning of the existing drains and leaders to remove dirt, laitance, and debris.

Electrical repairs are required throughout the structure for safe operation of the structure and patron comfort.

- Repairs to non-functioning lamps and exit signs.
- Repairs to corroding conduit and any damaged or unfastened conduit.



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Architectural and miscellaneous repairs are required throughout the structure to maintain the aesthetics of the structure and enhance patron comfort.

- Power wash and cleaning of staining on the exterior façade.
- Re-application of the pavement traffic markings to assist in wayfinding and restriping of stalls to maximize stall utilization.
- Inspect, re-tension, and maintenance of interior barrier post-tension cables and anchor systems on all supported levels.

Garage #5 Parking Structure

Garage #5 was constructed with a light weight topping slab over a buried membrane on the structural slab on the top level.

Concrete repairs are required at topping slab locations. Recommended concrete repairs:

- Concrete repair of the topping slab in block sections along the deteriorated control joints on the upper level.
- Concrete repair to delaminated or spalled floor slabs (waffle slabs) in select locations of the structure.

Waterproofing repairs are required on the supported floor slabs in select locations.

- Repairs to buried waterproofing membrane at slab repair areas.
- Routing and sealing of select cracking in the slabs.
- Installation of cove sealant in select locations.
- Replacement of failed control joint sealant.
- Re-installation of traffic coating membrane on exterior stairs.

Recommended mechanical repairs include:

- Resetting existing drain on the top level at the bottom of the ramp.
- Cleaning of the existing drains and leaders to remove dirt, laitance, and debris including trench drain at Level 2.
- Install sealant around drains on the supported levels.

Electrical repairs are required throughout the structure for safe operation of the structure and patron comfort.

- Repairs to non-functioning lamps.
- Repairs to corroding conduit and any damaged or unfastened conduit.

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Miscellaneous repairs:

- Re-application of the pavement traffic markings to assist in wayfinding and restriping of stalls to maximize stall utilization.

Garage #9 Parking Structure

Garage #9 was constructed with a light weight topping slab over a buried membrane on the structural slab on the top level.

Concrete repairs are required at selective locations. Recommended concrete repairs:

- Concrete repair of the topping slab in block sections along the deteriorated control joints on the upper level.
- Concrete repairs over column tops where required on the top level.
- Concrete repairs to delaminated or spalled floor slabs (waffle slabs) in select locations of the supported levels in the structure.

Waterproofing repairs are required on the supported floor slabs.

- Routing and sealing of select cracking in the topping slab.
- Install cove sealant at exterior ramps and select locations.
- Repair failed vertical sealant on spandrels and stair towers.
- Installation of top coat of traffic topping on Level 2 east side over the parking office.

Recommended mechanical repairs include:

- Installation of supplemental drains and piping.
- Cleaning of the existing drains and leaders to remove dirt, laitance, and debris.
- Install sealant around drains on the supported levels.
- Replace damaged drainage pipe adjacent to the ramp on Level 1.

Electrical repairs are required throughout the structure for safe operation of the structure and patron comfort.

- Repairs to non-functioning lamps and exit signs.
- Repairs to corroding conduit and any damaged or unfastened conduit.

Miscellaneous repairs:

- Re-application of worn anti-slip surface in the stair tower treads and landings.

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- Painting of the stairwell walls and elevator tower exterior walls to improve and provide uniform aesthetics.

Garage #12 Parking Structure

Concrete repairs are required on structural members such as columns, spandrels and floor slabs.

Recommended concrete repairs:

- Partial depth concrete repairs of spalled or delaminated slab sections in select locations with the application of a latex modified concrete patching material.
- Concrete repairs of the slab at the corners of the stair towers which have cracked.

Waterproofing repairs are required on the supported concrete slabs.

Recommended waterproofing repairs include:

- Installation of traffic coating membrane over the pour strips to help protect the post-tension tendon anchorages.
- Replacement of control joint sealants at pour strips on all levels.
- Application of a high solids silane sealer on the top supported floor slab to minimize chloride intrusion.
- Routing and sealing of cracking on the supported levels.
- Installation of cove sealant as required.

Recommended mechanical repairs include:

- Installation of supplemental drains adjacent to the electrical room on the lower level.
- Installation of concrete curb (waterproofed) around mechanical equipment in the electrical room lower level.
- Cleaning of the existing drains and leaders to remove dirt, laitance, and debris.

Electrical repairs are required throughout the structure for safe operation of the structure and patron comfort.

- Repairs to non-functioning lamps and exit signs.
- Repairs to corroding conduit and any damaged or unfastened conduit.

Architectural and miscellaneous repairs are required throughout the

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structure to maintain the aesthetics of the structure and enhance patron comfort.

- Power wash and cleaning of staining on the exterior façade.
- Re-application of the pavement traffic markings to assist in wayfinding and restriping of stalls to maximize stall utilization.
- Replacement of the ornamental hand railing at the interior ramp.

OPINION OF PROBABLE COST

The repairs presented below will identify the basic repair approach to extend the service life of the structure. Please refer to Table II - VI for a summary estimate of probable construction cost for the structure. For a detailed cost breakdown please refer to Appendix A.

TABLE II – SUMMARY OF ESTIMATED COSTS

Garage # 1 Parking Structure

	Base Repairs
Concrete Repairs	\$20,000
Waterproofing / Protection	\$275,000
Mechanical Systems/ Electrical Systems	\$15,000
Architectural	\$145,000
Subtotal	\$455,000
Mobilization 7%	\$32,000
Contingency 10%	\$48,000
Total	\$535,000

TABLE III – SUMMARY OF ESTIMATED COSTS

Garage # 3 Parking Structure

	Base Repairs
Concrete Repairs	\$20,000
Waterproofing / Protection	\$180,000
Mechanical Systems/ Electrical Systems	\$18,000
Architectural	\$30,000
Subtotal	\$248,000
Mobilization 7%	\$17,000
Contingency 10%	\$26,000
Total	\$291,000

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TABLE IV – SUMMARY OF ESTIMATED COSTS

Garage # 5 Parking Structure

	Base Repairs
Concrete Repairs	\$935,000
Waterproofing / Protection	\$45,000
Mechanical Systems/ Electrical Systems	\$7,000
Architectural	\$5,000
Subtotal	\$992,000
Mobilization 7%	\$69,000
Contingency 10%	\$99,000
Total	\$1,160,000

TABLE V – SUMMARY OF ESTIMATED COSTS

Garage # 9 Parking Structure

Immediate Repairs	\$15,000
	Base Repairs
Concrete Repairs	\$1,335,000
Waterproofing / Protection	\$155,000
Mechanical Systems/ Electrical Systems	\$15,000
Architectural	\$25,000
Subtotal	\$1,545,000
Mobilization 7%	\$108,000
Contingency 10%	\$154,000
Total	\$1,807,000

TABLE VI – SUMMARY OF ESTIMATED COSTS

Garage # 12 Parking Structure

	Base Repairs
Concrete Repairs	\$15,000
Waterproofing / Protection	\$160,000
Mechanical Systems/ Electrical Systems	\$20,000
Architectural	\$50,000
Subtotal	\$245,000
Mobilization 7%	\$17,000
Contingency 10%	\$26,000
Total	\$288,000



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DISCUSSION AND CONCLUSION

The observed condition of the structures range between fair to good condition. Generally, the original construction specifications, maintenance, and upgrade efforts have provided for the initial service life of the various systems in each structure. At this time, recommended restoration programs are required in all five structures to maintain the structures in serviceable condition, prevent further deterioration and, as a result, extend the service life of these structures.

The following conditions were observed throughout the five structures:

- Full depth cracked concrete slabs in post-tension garages.
- Surface spalling of the supported concrete topping slabs.
- Delaminated concrete in the supported slabs in select locations.
- Spalled/cracked concrete columns, beams, and walls.
- Deteriorated and failed control joint sealants.
- Failed pre-molded expansion joints.
- Drainage problems and obstructed floor drains.
- Stained exterior façades.
- Moisture infiltration through brick façade.

CONCRETE SLABS

Concrete topping slabs on the top level of Garage 5, and 9 are delaminated and spalled in select locations. Garage 5 and 9 were constructed with a buried waterproofing membrane. The membrane protects the structural slab and was still in good condition with limited areas where the membrane is breached and moisture infiltrates the structural member.

Repair to the topping slabs are required to help mitigate moisture infiltration to the buried membrane. Block areas of the deteriorated topping slab should be removed and repaired using a latex modified concrete. These repairs are designed to help extend the life of the membrane another 8-10 years with proper maintenance of the existing topping slab. At that time, consideration should be given to the long term repair option of removing the topping slab and installing a new waterproofing membrane and installing a complete new topping slab.

Post-tension tendons were observed during our site work through concrete excavations. The post-tension systems in Garages 1,3,12 were in good condition with no distress observed. The tendons were observed to be

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wrapped in sheathing and grease was present in the sheathing. Grout pockets ends of the tendons did exhibit signs of efflorescences in select locations and the grout ends should be removed, the anchors inspected and installation of new non-shrink grout should be completed.

Protection of the grout pockets and tendons anchorages at the pour strips should be provided by installation of new control joint sealant and waterproofing traffic coating membrane installed over the pour strip.

Protection of the post-tension tendons and anchorages is critical to prolonging the service life of the post-tension reinforced garages. Inspection of the post-tension system should be conducted by a structural engineer on a regular basis.

Cracking of the post-tension floor slabs and beam members was observed in several locations of Garages 1, 3 and 12. They include:

- Restraint cracking at the corners of the structure; this cracking can be seen at 45-degree angles from the two intersecting corners.
- Restraint and shrinkage cracking between the columns in select locations of the structures supported slabs.
- Flexural cracking of select columns.

Although a portion of the slab cracks propagate full depth of the slab section and thus can be attributed to restraint to volume change. These types of cracks are non-structural in nature. These types of cracks are not uncommon in post-tensioned concrete slabs. Repairs to the cracks are necessary to help prevent moisture infiltration of the slabs which in turn helps prevent corrosion of post-tension reinforcement and mild reinforcement. Moisture infiltration of the concrete can lead to corrosion of the embedded reinforcement, which in turn cause concrete cracking and spalling.

The supported floor slabs were non-destructively tested with a chain-drag device in select locations. The chain drag can locate most shallow depth delamination. Other than the quantities noted in our cost estimate, widespread delamination was not observed.

Concrete cover over the reinforcing steel was verified using a pachometer. Cover of 1/2 inch or less was recorded in localized areas of the structures. There were isolated locations where the reinforcement was visible and the concrete provided zero cover. These areas require repair and protection from exposure to and infiltration of moisture. Laboratory tests indicated levels of chlorides in the post-tensioned supported concrete slabs are below the threshold for corrosion of the reinforcing steel to begin.

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After these areas are repaired, the areas should be identified for future chloride ion testing to monitor the condition of both the concrete and steel.

WATERPROOFING

Waterproofing systems consisting of expansion joints, control joints, traffic coating membranes and clear sealers on all structures have provided the intended waterproofing, but are now nearing the end of their respective service lives. Replacement of these various waterproofing systems are required to protect the concrete from moisture infiltration and subsequent concrete deterioration.

Waterproofing repairs are recommended, which include re-application of traffic topping membrane and urethane sealants in cracks, control joints, and along coves. This will improve protection of the concrete and embedded reinforcement from water intrusion, which in turn will minimize further concrete deterioration.

Waterproofing membrane was installed in Garage #9 over the parking office and maintenance areas. The membrane over these occupied spaces appeared to be well adhered and only minor damaged areas were observed. The membrane was worn, however, and in a wet environment the membrane can become slick and pose a slip hazard to patrons. Waterproofing membrane in these areas require close monitoring of the surfaces and must be maintained. Additional applications of top coat will be needed to provide additional service life of the system and improve slip resistance.

Premolded expansion joints on Garage #1 have failed. Replacement of expansion joints with an elastomeric concrete edge expansion joint is recommended to accommodate the movement and traffic impact of the joint.

FAÇADE

The selected areas of façades of all structures showed signs of staining resulting from moisture infiltration, leaching, efflorescence and deterioration.

Cleaning and power washing the exterior façades to remove efflorescence's, leaching and environmental staining is recommended for all structures except Garage #5.



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An application of a penetrating sealer to the façades will help protect from moisture infiltration and subsequent staining. The penetrating sealer is a water repellent that will require re-application every 5-7 years but is a cost effective method to help protect the façade.

Additional waterproofing applications to the horizontal stairs above the electrical room on Garage #1 along with installation of water repellents on the façade will help prevent moisture infiltration into the electrical room and equipment.

SEISMIC PERFORMANCE CONSIDERATIONS

It is recognized that structures constructed prior to early 1980s can have seismic performance deficiencies related to meeting current code prescribed detailing and ductility requirements. Therefore, Garage #5 (designed in 1965), Garage #9 (designed in 1970) and Garage #3 (designed under the 1979 Building Code) may have concerns related to seismic performance.

In the process of addressing seismic performance concerns the City and their consulting structural engineer will first need to define seismic rehabilitation objectives and target structure performance levels for these garages. Based on the criteria adopted, seismic evaluations will need to be performed to see if the as-built garage structures can satisfy the criteria and, if not, then a program for seismic retrofit will need to be developed.

Rehabilitation objectives are based on a target structure performance level and an earthquake hazard level. Engineers and Owners often will reference the FEMA 356/November 2000, "Prestandard and Commentary for the Seismic Rehabilitation of Buildings" document to guide them through this process. Target performance levels include:

- Immediate Occupancy Structure Performance Level
 - Remains safe to occupy
- Damage Control Structure Performance Level
 - Minimize repair time and operation interruption
- Life Safety Structure Performance Level
 - Significant damage but not imminent collapse
- Collapse Prevention Structural Performance Level
 - Substantial structural damage, verge of partial or total collapse. However, structure continues to carry gravity load but without any safety margin.



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Performance of a seismic evaluation to determine seismic performance characteristics of the as-built garage structures was beyond the scope of this condition appraisal.

MISCELLANEOUS

There is a crack in the brick parapet at the south end of the top level of Garage #1 where the floor slab cantilevers out over the column line. This type of crack is attributed to effects of long term deflection of the cantilevered section of the floor slab under the influence of gravity loads.

Walker used the cover meter on site to locate the post-tension tendons in the cantilever section and noted the length of the supplemental tendons installed to reinforce the cantilever slab.

Walker reviewed the original construction drawings to compare the existing conditions to details and slab design requirements in these areas. We also performed independent calculation to evaluate if the original design of the cantilevered slab was appropriate for gravity loading being applied. Review of design details of this area indicated that the brick parapet is anchored to the floor along all edges of the floor slab.

Our calculations and field observations showed that the magnitude of post-tensioning reinforcement specified in the original design was adequate. However, the effects of creep on long-term deflections of the cantilevered slab section resulted in a magnitude of deflection which caused the observed cracking of the brick parapet. A vertical joint in the brick parapet at the column line location would have allowed the section of parapet to move with the cantilevered slab section as it deflected and since this joint was not provided, the brick cracked at this location.

Walker also used the cover meter at selected locations to define the as-built layout of column reinforcement and spandrel wall reinforcement. The as-built layout of reinforcement in the locations tested was in general conformance with the layout specified in design drawings.

Flooding of the electric room on the lower level of Garage 12 occurs during heavy rain storms. The water is deep enough to reach the electrical equipment in the room. Additional drainage and waterproofing measure or relocation of the electrical equipment is required to alleviate the problem.

Barrier strand cables are loose in Garage 3 interior ramps. Barrier cable must be properly maintained and tensioned as not to allow a 4" sphere to

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pass between cables.

Timely implementation of the recommended repairs and preventive maintenance programs will extend the useful operation of the structures.

As with all facilities, continued observation, durability enhancements, and future maintenance are critical in the continued safe and cost effective operation of the facilities. Yearly maintenance if reasonably budgeted and completed will reduce future repair costs and provide long-term serviceability of the structures.

TESTING

Results from both our testing performed in the field and results from laboratory testing by UCT, indicate that the parking structures are experiencing low levels of corrosion and deterioration for their age and construction type. This can be attributed to very little chloride contamination of the supported concrete slabs due to the minimal airborne and surface applied chlorides (salt) in the Santa Rosa area.

Chloride levels retrieved from samples taken from the supported floor slabs are as follows:

TABLE VII – CHLORIDE DATA SUMMARY		
Garage	Range of Chloride Data	Typical Chloride Level for Corrosion to Initiate
1	20 – 90 (ppm)	280 - 410 (ppm)
3	20 – 30 (ppm)	280 - 410 (ppm)
5	20 – 140 (ppm)	280 - 410 (ppm)
9	20 – 130 (ppm)	280 - 410 (ppm)
12	20 - 60 (ppm)	280 - 410 (ppm)

Refer to the testing report in Appendix E for additional information.

ADA ASSESSMENT

A review of the five structures for ADA compliance requirements was completed and a report is located in Appendix F.

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SUMMARY OF MAINTENANCE

The purpose of parking structure facility maintenance is to assure proper and timely preventive actions to reduce premature deterioration of structural elements and equipment failures. The maintenance requirements outlined in this report have been adapted from the book titled "Parking Structures¹" written by Walker professionals and from the maintenance manual "Parking Garage Maintenance Manual, First Edition²," published by the National Parking Association (^{1,2} see references in Appendix I).

An important objective in restoring existing structures is to reduce future operating and maintenance costs. This report addresses maintenance actions required to extend the life of the parking structure. Maintenance must be performed at regular intervals if the full benefit of the effort is to be realized. Irregular or incomplete maintenance will provide a marginal return on investment. To ensure that a maintenance program is functional, establish a schedule and follow appropriate maintenance procedures. Maintenance actions include:

- **Preventive Maintenance** – Preventive maintenance includes actions that tend to extend the facility service life. These items include reapplication of surface sealers, pedestrian membrane, joint sealants and expansion joints. Preventive maintenance does not usually include the capital expenditures associated with structural repairs.
- **Replacement** – Replacement actions include replacement of structural and operational items at the end of their service lives. Items such as lighting, elevators, plumbing are included. Replacement maintenance includes the capital expenditures associated with structural repairs.
- **Routine Maintenance** – Routine maintenance includes aesthetic and other housekeeping actions such as cleaning and washing down floor surfaces. Routine maintenance can also include annual or ongoing repairs to structural and operational elements in the parking structure. This could include repairs to portions of a preventive or replacement maintenance system such as: repairing leaking joint sealant, clearing plugged drain lines, replacing damaged light fixtures, small area repairs to spalled or delaminated concrete, replacing expansion joint seals and other similar work.

We have evaluated the maintenance requirements based on our walk-through review or visual inspection of the facilities and limited nondestructive and laboratory testing to qualify construction materials and as-built conditions. The walk-through review assists in developing the conceptual maintenance program based on factors such as:

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- Age and geographic location.
- Structural system and the design details involved.
- Quality of construction material specified.
- Construction quality or deficiencies.
- Existing distress in structural elements, such as spalling, cracking, scaling, or excessive deformations.
- Corrosion-protection system specified or implemented.
- Operational elements.

The cost tables have identified relevant maintenance elements, procedures and schedules for maintaining the structure. The cost tables include costs for preventive and replacement maintenance. Routine maintenance is not included in the cost tables because these items involve details of the daily operation that are beyond the scope of this overall maintenance evaluation. Regularly scheduled walk-through inspections would monitor the effectiveness of the maintenance programs.

The purpose of facility maintenance is to assure proper and timely preventive actions to reduce premature deterioration of structural elements and equipment failures. Routine maintenance actions that include periodic repairs and/or corrective actions are necessary to maintain serviceability and facility operations.

GENERAL

- Regular inspections of the structure by a restoration engineer to determine if progressing deterioration poses a life safety risk to the patrons or compromises the structural integrity of the garage.
- Regular maintenance of the floor surfaces including sweeping and wash downs will help keep dirt and latent salts from collecting.
- Continued structural and non-structural concrete repair with routing and sealing of cracks throughout the structure to minimize chloride and moisture migration through the floor slabs and structural elements.
- Periodic cleaning of floor drains and stand pipes to ensure proper drainage of the slabs.
- Maintenance and replacement of light fixtures and elements as required.

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Garage #1 Parking Structure

The Garage #1 Parking Structure will continue to need scheduled repair to the concrete members, reapplication of the silane sealer, and replacement of sealants and expansion joints. Continued maintenance of the exterior water repellent sealer will minimize water migration into the brick façade, stair towers and mechanical rooms. Waterproofing systems on the southeast stairs must be maintained to mitigate water intrusion of the electrical rooms.

Garage #3 Parking Structure

The Garage #3 Parking Structure will continue to need scheduled repair to the concrete slabs and concrete structural members, replacement of sealants, routing of cracks and ongoing tracking of the chloride ion content of floor slabs. Waterproofing systems to protect the post-tension ends in the pour strip will require maintenance and replacement on a scheduled maintenance program.

Garage #5 Parking Structure

The Garage #5 Parking Structure will continue to need scheduled repair to the concrete slab, replacement of sealants and ongoing tracking of the chloride ion content of floor slabs. Full topping slab replacement and buried membrane replacement may be required in the future to restore waterproofing integrity of the top level.

Garage #9 Parking Structure

The Garage #9 Parking Structure will continue to need scheduled repair to the concrete slab, replacement of sealants and ongoing tracking of the chloride ion content of floor slabs. Full topping slab replacement and buried membrane replacement may be required in the future to restore waterproofing integrity of the top level.

Garage #12 Parking Structure

The Garage #12 Parking Structure will continue to need scheduled repair to the concrete slabs, replacement of sealants, routing and sealing of cracks and ongoing tracking of the chloride ion content of floor slabs.



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SUPPORTED SLABS FUTURE MAINTENANCE REPAIRS

Installation of sealants and the existing waterproofing membrane system will require future maintained repairs. Sealants typically have a service life of 5-7 years. Yearly maintenance is required for the sealant application and complete replacement of the sealants is recommended at the end of the service life.

Traffic topping membranes require yearly maintenance of cleaning and repair to worn or damage surfaces. Many manufacturers of traffic topping membrane will extend the warranty of the traffic topping membrane if the system is properly maintained and an additional top coat is reapplied at the fifth year of service. Traffic topping membranes typically have a service life of 10-12 years and removal and replacement of the membrane is recommended at the end of the service life.

Cracked concrete slabs may spall and delaminated in select locations and concrete slab repairs should be anticipated. Removal of the delaminated or unsound concrete is completed with the application of a latex modified concrete patching material. Budgeting for patching concrete slab areas every 3-5 years is recommended as part of a maintenance repair program.

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LIMITATIONS

Walker Restoration Consultants prepared this plan to assist The City of Santa Rosa in planning for the repair and maintenance of their parking structures. We have summarized the evaluation and recommendations for use with additional fiscal and technical judgment. This report is not for the benefit of others without the permission of Walker Restoration Consultants.

The purpose of this plan is to bring to the attention of the Owner, items that are in need of repair and/or maintenance and to provide a conceptual plan. This plan provides budgeting information based on professional judgment and the experience of Walker Restoration Consultants, this plan does not provide specific repair details, or methods, construction contract documents, material specifications, or details to develop the construction cost from a contractor. We have estimated the work item cost from visual observations and limited field survey work. There is no warranty to the accuracy of such cost opinions as compared to bids or actual costs.

The evaluation required that certain assumptions be made regarding existing conditions, and some of these assumptions cannot be verified without expending additional sums of money or destroying otherwise adequate or serviceable portions of the buildings. Since these facilities are currently functioning without evidence of shortcomings in the original design of the parking structures, we did not include a review of the design, detailed inspection for concealed conditions, or detailed analysis.

The report is not a warranty or guarantee of the items noted. The extent of our evaluation was limited, and we cannot guarantee that the appraisal discovered or disclosed possible latent conditions.

The recommendations outlined represent current technology for parking structure renovation and maintenance. We have assumed the garages will continue in their present use and will require appropriate repairs and maintenance for this use. Parking structures undergo harsh exposure to various environmental elements and further deterioration will take place with continued service related exposure. Appropriate design and installation of effective repairs and maintenance can significantly reduce further deterioration and the associated costs.



APPENDIX A

ESTIMATE IN PROBABLE CONSTRUCTION COST

SANTA ROSA PARKING STRUCTURES

APPENDIX A - ESTIMATE IN PROBABLE CONSTRUCTION COST

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Table VIII - Opinion of Probable Costs
Recommended Base Repair - Garage 1

WORK ITEM	DESCRIPTION	EXTENSION	YEAR
1.0 Concrete Repairs			
1.1	Floor Repair - Partial Depth/ Shallow	\$5,000	2
1.2	Floor Repair - Partial Depth/ Deep	\$8,000	2
1.3	Column Repair - Partial Depth /Deep	\$7,000	2
2.0 Waterproofing /Protection			
2.1	Expansion Joints - Blockouts	\$8,000	2
2.2	Expansion Joints	\$58,000	2
2.2	Rout and Seal Cracks	\$6,000	2
2.3	Control Joints - Sealants	\$5,000	2
2.6	Cove Sealant	\$6,000	2
2.7	Exterior Façade Clean and Seal	\$150,000	6
2.8	Traffic Coating - Pedestrian	\$42,000	2
3.0 Mechanical Systems			
3.1	Supplemental Drains & Pipe	\$5,000	2
3.2	Clean Existing Drains	\$5,000	2
4.0 Electrical			
4.1	Electrical Allowance	\$5,000	2
5.0 Architectural and Misc. Repair			
5.1	Brick Façade Repairs	\$5,000	2
5.2	SandBlast and Paint Railings	\$120,000	5
5.3	Sandblast and Paint Standpipes	\$5,000	5
5.4	Stair Tower Roofing Repairs	\$5,000	5
5.5	Traffic Markings	\$10,000	5
Base Repair Subtotal		\$455,000	
Mobilization @ 7% (approx.)		\$32,000	
Contingency @ 10% (approx.)		\$48,000	
Base Repair Total		\$535,000	

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Table IX - Opinion of Probable Costs
Recommended Base Repair - Garage 3

WORK ITEM	DESCRIPTION	EXTENSION	YEAR
1.0 Concrete Repairs			
1.1	Floor Repair - Partial Depth/ Shallow	\$6,000	1
1.2	Floor Repair - Partial Depth/ Deep	\$8,000	1
1.3	Ceiling Repair	\$1,000	1
1.4	Miscellaneous Concrete Repairs	\$5,000	1
2.0 Waterproofing /Protection			
2.1	Rout and Seal Cracks	\$20,000	1
2.2	Control Joints - Sealants	\$9,000	1
2.3	Cove Sealant	\$3,000	1
2.4	Silicone Sealant	\$1,000	1
2.4	Concrete Sealer	\$39,000	1
2.5	Exterior Façade Clean and Seal	\$63,000	7
2.6	Traffic Coating - Pedestrian	\$45,000	1
3.0 Mechanical Systems			
3.1	Mechanical Allowance	\$5,000	1
3.2	Supplemental Drains and Pipe	\$10,000	1
3.3	Clean Existing Drains	\$2,000	1
4.0 Electrical			
4.1	Electrical Allowance	\$1,000	1
5.0 Architectural and Misc. Repair			
5.1	Retension Barrier Strands	\$15,000	1
5.2	Sandblast and paint Pipe Bollards	\$2,000	1
5.3	Paint Columns - Upper Level	\$5,000	1
5.4	Traffic Markings	\$8,000	1
Base Repair Subtotal		\$248,000	
Mobilization @ 7% (approx.)		\$17,000	
Contingency @ 10% (approx.)		\$26,000	
Base Repair Total		\$291,000	

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APPENDIX A - ESTIMATE IN PROBABLE CONSTRUCTION COST

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Table X - Opinion of Probable Costs
Recommended Base Repair - Garage 5

WORK ITEM	DESCRIPTION	EXTENSION	YEAR
1.0 Concrete Repairs			
1.1	Floor Repair - Partial Depth/ Shallow	\$7,500	3
1.2	Floor Repair - Partial Depth/ Deep	\$130,000	3
1.3	Miscellaneous Concrete Repairs	\$2,500	3
1.4	New Concrete Topping Slab	\$795,000	10
2.0 Waterproofing /Protection			
2.1	Rout and Seal Cracks	\$4,000	3
2.2	Control Joints - Sealants	\$1,000	3
2.4	Epoxy Injection	\$4,000	3
2.6	Cove Sealant	\$3,000	3
2.7	Concrete Sealer	\$18,000	3
2.8	Traffic Coating - Pedestrian	\$15,000	3
3.0 Mechanical Systems			
3.1	Mechanical Allowance	\$5,000	3
3.3	Clean Existing Drains	\$1,000	3
4.0 Electrical			
4.1	Electrical Allowance	\$1,000	3
5.0 Architectural and Misc. Repair			
5.1	Traffic Markings	\$5,000	3
Base Repair Subtotal		\$992,000	
Mobilization @ 7% (approx.)		\$69,000	
Contingency @ 10% (approx.)		\$99,000	
Base Repair Total		\$1,160,000	

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APPENDIX A - ESTIMATE IN PROBABLE CONSTRUCTION COST

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Table XI - Opinion of Probable Costs
Recommended Base Repair - Garage 9

WORK ITEM	DESCRIPTION	EXTENSION	YEAR
	Immediate Repairs	\$15,000	1
1.0	Concrete Repairs		
1.1	Floor Repair - Partial Depth/ Shallow	\$3,000	2
1.2	Floor Repair - Partial Depth/ Deep	\$22,000	2
1.3	Miscellaneous Concrete Repairs	\$5,000	2
1.4	New Concrete Topping Slab	\$1,305,000	10
2.0	Waterproofing /Protection		
2.1	Rout and Seal Cracks	\$15,000	2
2.2	Control Joints - Sealants	\$12,000	2
2.3	Gravity Feed Epoxy	\$4,000	2
2.4	Cove Sealant	\$14,000	2
2.5	Concrete Sealer	\$35,000	2
2.6	Exterior Clean and Seal	\$50,000	8
2.7	Traffic Coating - Pedestrian	\$25,000	2
3.0	Mechanical Systems		
3.1	Mechanical Allowance	\$5,000	2
3.2	Supplemental Drains	\$7,000	2
3.3	Clean Existing Drains	\$2,000	2
4.0	Electrical		
4.1	Electrical Allowance	\$1,000	2
5.0	Architectural and Misc. Repair		
5.1	Remove Precast Planters	\$6,000	2
5.2	Paint Stair Towers	\$12,000	2
5.3	Traffic Markings	\$5,000	2
5.4	Miscellaneous	\$2,000	2
	Base Repair Subtotal	\$1,545,000	
	Mobilization @ 7% (approx.)	\$108,000	
	Contingency @ 10% (approx.)	\$154,000	
	Base Repair Total	\$1,807,000	

SANTA ROSA PARKING STRUCTURES

APPENDIX A - ESTIMATE IN PROBABLE CONSTRUCTION COST

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Table XII - Opinion of Probable Costs
Recommended Base Repair - Garage 12

WORK ITEM	DESCRIPTION	EXTENSION	YEAR
1.0	Concrete Repairs		
1.1	Floor Repair - Partial Depth/ Shallow	\$4,000	4
1.2	Floor Repair - Partial Depth/ Deep	\$5,000	4
1.3	Wall Repair - Partial Depth/ Shallow	\$1,000	4
1.4	Miscellaneous Concrete Repair	\$5,000	4
2.0	Waterproofing /Protection		
2.1	Expansion Joints	\$10,000	4
2.2	Rout and Seal Cracks	\$45,000	4
2.3	Control Joints - Sealants	\$6,000	4
2.4	Cove Sealant	\$2,000	4
2.5	Concrete Sealer	\$27,000	4
2.6	Exterior Façade Clean and Seal	\$62,000	9
2.7	Traffic Coating - Pour Strips	\$8,000	4
3.0	Mechanical Systems		
3.1	Mechanical Allowance	\$10,000	1
3.2	Supplemental Drains	\$5,000	1
3.3	Clean Existing Drains	\$4,000	4
4.0	Electrical		
4.1	Electrical Allowance	\$1,000	4
5.0	Architectural and Misc. Repair		
5.1	Railing Replacement	\$15,000	4
5.2	Curb/Waterproof Electrical Room	\$12,000	1
5.3	Planters - Repair Waterproofing	\$10,000	4
5.4	Traffic Markings	\$8,000	4
5.5	Miscellaneous Repairs	\$5,000	4
	Base Repair Subtotal	\$245,000	
	Mobilization @ 7% (approx.)	\$17,000	
	Contingency @ 10% (approx.)	\$26,000	
	Base Repair Total	\$288,000	

CITY OF SANTA ROSA PARKING STRUCTURES

APPENDIX B – PHASING & ASSET MANAGEMENT PLAN



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TABLE XIII: PRELIMINARY PHASING PLAN

Description	Phasing Year										Total	
	1	2	3	4	5	6	7	8	9	10		
Repairs												
Garage #1	-	165,000	-	-	140,000	150,000	-	-	-	-	-	455,000
Garage #3	185,000	-	-	-	-	-	63,000	-	-	-	-	248,000
Garage #5	-	-	197,000	-	-	-	-	-	-	-	795,000	992,000
Garage #9	15,000	175,000	-	-	-	-	-	50,000	-	-	1,305,000	1,545,000
Garage #12	27,000	-	-	156,000	-	-	-	-	-	62,000	-	245,000
Subtotal	227,000	340,000	197,000	156,000	140,000	150,000	63,000	50,000	62,000	2,100,000		3,485,000
Mobilization 7%	15,890	23,800	13,790	10,920	9,800	10,500	4,410	3,500	4,340	147,000		243,950
Contingency 10%	24,289	36,380	21,079	16,692	14,980	16,050	6,741	5,350	6,634	224,700		372,895
Design Fee (10%-Subtotal)	22,700	34,000	19,700	15,600	14,000	15,000	6,300	5,000	6,200	210,000		348,500
Total - 2006 Dollars	289,879	434,180	251,569	199,212	178,780	191,550	80,451	63,850	79,174	2,681,700		4,450,345
Future Value (4% Inflation)	301,500	469,700	283,000	233,100	217,600	242,400	105,900	87,400	112,700	3,969,600		6,022,900

Notes:

1. Estimated costs are based on historical data and experience with similar types of work and are in 2006 dollars.
2. Estimated costs may vary due to time of year, local economy, or other factors.
3. Estimated costs do not include costs for inflation, financing, operating, general housekeeping, and other owner requirements or contingency for bidding conditions.
4. Repairs include recommended repairs or renovations for existing structural systems in the garages.
5. Cost Estimate in year 10 (for Garage 5 and 9) is for full topping slab replacement.
6. Inflated Future Value accounts for general inflation of the U.S. Dollar and does not include an increase for material or labor.
7. Immediate Repairs for Garage #9 are shown in Year 1.