

Architecture, Engineering, and Construction Division

Asphalt Paving Maintenance Strategy and Preservation Guidelines

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All previous versions of this document are obsolete.

A copy of this document is available for download to Church Employees, Consulting Architects and Consulting Engineers on the AEC Website located at:

- <http://aec.ldschurch.org/aec/>
- Select “Design Guidelines” under “Support Documents”
- Select “[Asphalt Paving Maintenance Strategy and Preservation Guidelines](#)” under “Civil” to download the document

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Salt Lake City, Utah

Asphalt Paving Maintenance Strategy and Preservation Guidelines

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Asphalt Paving Maintenance Strategy and Preservation Guidelines

Introduction

The Church spends a substantial amount of money on repairs and replacements of asphalt paving. Implementing the following industry best practices will significantly reduce the total cost of ownership, by delaying or eliminating the need for expensive repairs and premature replacements.

Installation

Asphalt paving systems must be properly designed and installed in order to be able to provide years of service with minimal maintenance. Use a qualified civil engineer with access to a recent, well prepared geotechnical evaluation report. The geotechnical evaluation report should have used the geotechnical evaluation report template. The geotechnical evaluation report will provide paving system recommendations for the civil engineer to evaluate and further site adapt. The civil engineer should always require remediation of unsuitable soils. The standard specifications should be used and be properly site adapted. Whenever possible, a Superpave asphalt mix with asphalt fibers should be used. Thorough testing and inspection of the installation of the asphalt paving system should be required.

If properly designed and installed and then maintained with seals and crack repair to prevent water from getting into the base and the subgrade, the life of the asphalt paving can be extended to 40 years; and even indefinitely. Properly designed, installed and maintained asphalt paving systems will save the Church significant monies by avoiding unnecessary repairs and premature replacement.

Complete replacement of an existing asphalt paving system is seldom required if the asphalt paving system has been properly designed, installed and maintained. Paving systems should be designed, installed and maintained to last 40 years (minimum).

Maintenance

Various studies indicate that for every dollar well spent on maintaining or preserving asphalt paving, about four dollars are saved by not having to do expensive asphalt rehabilitations or replacements. Note that we do not want to do maintenance which is not justified but we do not want to allow our paving to deteriorate because it was not maintained.

A conscientious and consistent program of scheduled preventive maintenance and preservation work will maximize the useful asphalt paving life. We are striving to have paving systems last 40 years (minimum). This may prove difficult or impossible on paving systems that have not been designed and installed correctly or have not been designed and installed to last 40 years.

Facilities managers should implement a preventive maintenance strategy for asphalt paving which includes repairing cracks and applying a combination of penetrating seals, emulsion seals, slurry seals or other appropriate seals at regular intervals. Sometimes, the application of a seal will require the removal of paint stripes and restriping the paving after the seal has been applied, dried and cured.

Facilities managers should develop a maintenance plan for each meetinghouse. *FMAT* can be used to create a maintenance plan as could an excel spreadsheet showing all the meetinghouses for which the facilities manager has responsibility. A sample excel spreadsheet, [Record for Asphalt Parking Lot Maintenance](#), is found on the MFD Resource Library. The spreadsheet visually shows what has been done to the asphalt paving in the past with a proposed maintenance plan for the future.

Carefully inspect each asphalt parking lot annually to determine whether cracks need to be repaired or whether a seal is warranted to seal the surface and hairline cracks. This should be done by a civil engineer, a reputable asphalt paving maintenance contractor or other experienced and qualified personnel. The [Asphalt Maintenance Checklists for Facilities Managers and Contractors](#) was developed such that budgets can be created for work to be performed in the following year (the [Agreement for Asphalt Maintenance Agreement US](#) or the [Agreement for Asphalt Maintenance CN](#) also provides a convenient form for keeping track of this proposed work). The checklists are also intended to be provided to the asphalt maintenance contractors for

them to use to ensure that the site adapted standard specifications are followed and that complete, high quality maintenance has been provided. The checklists can be obtained from the AEC Website (http://aec.ldschurch.org/aec/design_guidelines/).

Preventive maintenance is routine work done to retard deterioration of paving and prolong its useful life. It includes completing the right maintenance activity at the right time and includes the following possible maintenance treatments:

- Asphalt Paving Crack Fill (Section 32 0117.02)
- Asphalt Paving Crack Seal (Section 32 0117.01)
- Asphalt Paving Repair: Full Depth Patch (Section 32 0118.00)
- Bonded Overlay With Fabric: Marshall (Section 32 0113.04)
- Bonded Overlay With Fabric: Superpave (Section 32 0113.05)
- Chip Seal (Section 32 0113.06)
- Emulsion Seal (Section 32 0113.02)
- Fog Seal (Section 32 0113.07)
- Pavement Markings (Section 32 1723.00)
- Penetrating Seal (Section 32 0113.01)
- Slurry Seal (Section 32 0113.03)

Ideally an initial penetrating seal or an emulsion seal should be placed on new asphalt; between 12 to 18 months after the asphalt has been placed. This allows the asphalt paving to “cure” and “stabilize”. However, a compromise with construction schedules has been made and an initial penetrating seal or an emulsion seal is to be used between 1 month and 18 months after the asphalt has been placed. Note that some of the specified penetrating seals should not be used on recently placed asphalt. Verify with the penetrating seal manufacturer that application of the penetrating seal on the new asphalt is acceptable. An advantage that a penetrating seal has over an emulsion seal is that the penetrating seal does not provide a new layer of material that can become unbonded from the newly placed asphalt if it isn’t installed right.

Seals are important because the sun hardens and dries out the pavement, accelerating oxidation, cracking, raveling and erosion of the top layer of the asphalt. Seals also fill cracks 1/8” wide or less. Should larger cracks develop; the cracks need to be repaired as soon as possible to prevent water from getting into and softening the base and subgrade with subsequent paving deterioration.

The frequency for applying seals depends on climatic conditions and the quality of the asphalt paving. Hot, dry climates will require more frequent seals. As a guide, the asphalt paving should be sealed approximately every 3 to 5 years thereafter if emulsion seals are being used and 5 to 7 years thereafter if slurry seals are being used. A penetration seal will last between 4 to 7 years. A combination of different seals will be used over the life of the asphalt paving. Regular maintenance using a combination of penetrating, emulsion and slurry seals will extend the life of the asphalt paving well beyond the current FMAT life expectancy of about 25 years.

Emulsion seals are preferred over slurry seals. Once a pattern is established for how often an emulsion seal needs to be placed, create a maintenance program for applying the emulsion seal, alternating every second or third application with a slurry seal, so that a slurry seal is applied approximately every 9 to 10 years depending on local conditions. A slurry seal should be applied when the asphalt is starting to lose surface aggregate due to raveling.

Asphalt Paving Repair - Crack Repair

Asphalt Paving Crack Seal (Specification Section 32 0117.01)

Asphalt Paving Crack Fill (Specification Section 32 0117.02)

Crack filling is more predominant than crack sealing for crack repair. The primary difference between crack sealing and crack filling is that with crack filling, the cracks are not routed. Routing is performed when cracks are sealed (crack sealing). The routing procedure creates uniform and smooth edges, thus allowing sealant material to better adhere to the asphalt paving.

Crack sealing might or might not use backer rods. Crack filling does not use backer rods. Crack sealing is considered to be a more permanent repair (3 to 8 years) whereas crack filling is considered to be a temporary repair (1 to 2 years).

Crack repair should be done with hot poured asphalt sealant to facilitate the crack being repaired again in the future. This is very likely to be the case. The sealant should be of an asphalt based material, not of a polyurethane or silicone based material. Large cracks should be repaired as directed in the standard specifications.

All types of cracks should be repaired annually (unless crack is less than 1/8 inch (3 mm) wide). They are to be clean and dry prior to being repaired. Cleaning and drying are essential steps, because when a crack is not completely clean and dry, the sealant will not adhere to the sides of crack. Most failures of crack repair occur because of a loss of adhesion between the sealant and the vertical faces of the asphalt paving due to dirt and loose particles.

The best time to repair cracks is in the spring or fall, when ambient temperature is between 45 deg F and 65 deg F (7 deg C and 18 deg C) and when the cracks are open and when the sealant can most easily penetrate into the crack.

Soil sterilant should be used if the cracks contain weed and other live vegetation matter.

Asphalt Paving Repair - Full Depth Patch (Section 32 0118)

Use a full depth patch to replace small areas of asphalt paving that are deteriorated or damaged beyond what seals are capable of repairing. These would include areas of alligator cracking, pavement depressions, wheel track rutting, pavement slippage and corrugations. Alligator cracking is closely spaced cracks resembling alligator skin.

The need to use a full depth patch is often indicative of damage (usually because of water) to the aggregate base and subgrade. The aggregate base and subgrade need to be repaired before the full depth patch is installed. The Owner's Representative should ascertain whether or not the existing aggregate base and subgrade are acceptable. A geotechnical engineer may be needed for this review.

The asphalt mix should be spread carefully into the patch to prevent segregation. If hot-mix is not available, an appropriate cold mix, specialty mix or proprietary mix can be used. State Department of Transportation maintenance divisions are a good source of information regarding specialty and proprietary mixes.

The Owner's Representative is to review any proposed patches over 1,000 sq ft (93 sq m). For new asphalt, Standard Specification Sections 32 1216.01 (Marshall) and 32 1216.03 (Superpave) are excellent references. The requirements of Standard Specification Section(s) 32 1216 can be blended into the requirements of Section 32 0118 to create a more inclusive site adapted specification.

Soil Sterilant should be used if the area of the patch contains weeds and other live vegetation matter.

Asphalt Paving Repair - Overlays

Bonded Overlay With Fabric: Marshall (Section 32 0113.04)

Bonded Overlay With Fabric: Superpave (Section 32 0113.05)

Overlays, or resurfacing, is considered to be corrective maintenance. It is similar to a "maintenance blanket" except that fabric is placed between existing asphalt paving and the new overlay, or resurfacing layer. Overlays are most common in warmer climates.

An overlay is used if extensive maintenance, or even replacement, of asphalt paving would otherwise be required. Overlays are sometimes used to re-level asphalt paving. Often, milling of the existing surface to remove deteriorated asphalt or existing failed seals is performed. Existing structural damage, such as cracks, should first be repaired before installing the overlay.

Reflection cracking can be a problem with resurfacing and may not ultimately be successful if the existing paving has many cracks. When existing paving has many cracks but an overlay will still

be used, consider the use of a multilayer specialty fabric (<http://www.tencate.com/>) on top of the existing paving to create an unbonded overlay system that would resist reflection cracks from telegraphing into the overlay. Also the use of asphalt fibers will help control reflection cracking in the overlay (see Standard Specification Section(s) 32 1216 for information about asphalt fibers).

Asphalt Paving Surface Treatments - Seals

Chip Seal (Section 32 0113.06)

A chip seal should not be used without the approval of the Regional Facilities Manager.

A chip seal is applied as an aggregate overlay and will last between five (5) and seven (7) years. Applying a chip seal is considered to be corrective and restorative maintenance. A chip seal is used to renew, rejuvenate and seal asphalt surface and to also seal hairline cracks. It has a good rate of return on investment and has been a common asphalt maintenance method. It is sometimes used as a “last ditch effort” to avoid asphalt replacement.

A chip seal consists of sprayed application of asphalt binder to the asphalt paving surface immediately covered by single layer of uniform-size aggregate which is then compacted. The goal is to have the aggregate particles approximately 50 to 70 percent embedded in the asphalt binder. A fog seal (flush coat) is installed over the embedded aggregate. A chip seal is used as a wearing and waterproofing course that improves skid resistance. Chip seal is also known as “bituminous surface treatment”. Repeated applications will result in increased thickness.

A fog seal can be applied over an existing chip seal as part of a regular maintenance program.

A portion of the chips will become unbonded from the seal and will need to be swept up. Sometimes, these chips will clog storm water removal systems. Before using a chip seal, thoughtfully consider this possibility.

Emulsion Seal (Section 32 0113.02)

An emulsion seal should be applied every 3 to 5 years to maintain and extend the life of the paving. Emulsion seals must be applied in conditions outlined in the standard specification. If not, the emulsion seal can “flake off” and fail. A few conditions that can lead to failure are:

- Installing the seal without a tack coat (tack coats are generally not needed on “new asphalt”; between 6 and 18 months old).
- Installing the seal on very old, unsuitable asphalt. A tack coat is definitely needed for this.
- Installing the seal on wet asphalt. The asphalt has to be dry.
- Installing the seal on cold asphalt. The asphalt has to be warm.
- Installing the seal on dirty asphalt. The asphalt has to be clean.
- Using “cheap” products. The standard specification lists a few acceptable products but there are other products on the market that meet the standard specification’s product criteria requirements.

An emulsion seal is the preferred surface treatment for asphalt pavement. It should be used before a slurry seal or chip seal is used (depending upon the condition of the asphalt pavement).

Applying an emulsion seal is considered to be preventive maintenance. It is used to renew and seal the asphalt surface and to also seal hairline cracks. For a sealer that provides more corrective maintenance, use a slurry seal or a chip seal. An emulsion seal is emulsified asphalt, and if required by the Owner’s Representative, mixed with sand. The purpose of the sand is to keep the parking surface from becoming slippery. The emulsion seal is intended to seal the surface. It is not intended to provide a new wearing surface. The emulsion seal is applied as two thin coatings of asphalt placed separately at 90 degrees to each other.

Purpose of Emulsion Seal:

- Seals minor cracking, those less than 1/8 inches (3 mm) wide.
- Prevents surface water from penetrating aggregate base and subgrades.
- Fills and plugs small voids and coats and bonds loose aggregate particles.

- Helps prevent oxidation and aging of the asphalt paving which can lead to cracking.
- Enriches, renews and restores the surface of the asphalt paving which has begun to oxidize (turning black to gray) and become dry and brittle with age.
- Inhibits raveling:
 - Raveling is loosening of aggregate in the top surface of the asphalt paving causing a loss of material.
 - Raveling is usually found in the wheel paths while weathering covers the entire pavement surface.

Advantages of Emulsion Seal:

- Usually less expensive than a slurry seal.
- Provides a smooth texture.
- Seals hairline cracks, those less than 1/8 inches (3 mm).
- Relatively long lasting (between three (3) and five (5) years).

Disadvantages of Emulsion Seal:

- Most pavement flaws show through seal.
- Cracks larger than 1/8 inch (3 mm) need to be sealed and repaired before applying emulsion seal.
- Most often an emulsion seal will not last as long as a slurry seal or a chip seal.
- Striping paint does not seem to adhere as well to rougher texture.
- Needs twenty four (24) to forty eight (48) hours of cure time.

Fog Seal (Section 32 0113.07)

A fog seal will last between 1 and 3 years. It is not a substitute for more aggressive treatments such as a penetrating seal, emulsion seal, slurry seal or chip seal. Penetrating seals, emulsion seals, slurry seals or chip seals should be used if more aggressive corrective maintenance is needed.

Applying a fog seal is considered to be preventive maintenance. It is a light spray application of asphalt binder applied to the surface of a chip seal (as part of a regular maintenance program), or an open graded mix, or a weathered hot mix surface or to newly placed hot mix. A fog seal provides some crack sealing, reduces oxidation and raveling, and enriches and seals asphalt surfaces.

Purpose of Fog Seal:

- Seals minor cracking, those less than 1/8 inches (3 mm) wide.
- Prevents surface water from penetrating aggregate base and subgrades.
- Plugs voids and coats and bonds loose aggregate particles.
- Enriches, renews, rejuvenates and restores surface of asphalt paving which has begun to oxidize (turning black to gray) and become dry and brittle with age.
- Inhibits raveling:
 - Raveling is loosening of aggregate in the top surface of the asphalt paving causing loss of material.
 - Raveling is usually found in the wheel paths while weathering covers the entire pavement surface.

Advantages of Fog Seal:

- Less expensive than penetrating seal or emulsion seal.
- Seals hairline cracks, those less than 1/8 inches (3 mm). Flows easily into cracks and surface voids.
- Dries quickly, between one (1) hour in hot, dry conditions and three (3) hours in cool, humid conditions.

Disadvantages of Fog Seal:

- Most pavement flaws show through the seal.
- Cracks larger than 1/8 inch (3 mm) need to be repaired before applying a fog seal.

- Does not replace lost aggregate. Fog seals should not be applied as surface treatment for “medium” or worse raveling.
- Over application can result in asphalt pickup by vehicles and can possibly create a slippery surface.
- Does not provide the same level of preventive treatment as a penetrating seal or emulsion seal.

Penetrating Seal (Section 32 0113.01)

A penetrating seal will last between 4 and 7 years. A penetrating seal is one of the possible initial seals that can be used on new asphalt. It is also used on asphalt paving that has become dry and brittle, to waterproof small cracks, surface voids and to inhibit raveling. It is not a substitute for more aggressive treatments such as an emulsion seal, slurry seal or chip seal. Emulsion seals, slurry seals or chip seals should be used if more aggressive corrective maintenance is needed.

Purpose of penetrating seal:

- Replenish asphalt content in new and old asphalt paving surfaces that are dry and brittle.
- Seal small cracks up to 1/8 inch (3 mm) wide and seal small surface voids.
- Inhibit raveling:
 - Raveling is loosening of the aggregate in the top surface of the asphalt paving causing a loss of material.
 - Raveling is usually found in the wheel paths while weathering covers the entire pavement surface.

Advantages of Penetrating Seal:

- Fills small cracks and voids by penetrating top surface.
- Rejuvenates and waterproofs new and old dry aging asphalt; replenishes asphalt solids.
- Contains equal to/or not less than 50 to 65 percent asphalt solids by weight, more than most slurry and emulsion sealers.
- Oil-based sealer; provides longer service life than water-based sealers such as an emulsion seal or fog seal.
- Seals in one coat.

Disadvantages of Penetrating Seal:

- Obvious pavement flaws may show through the seal.
- Cracks larger than 1/8 inch (3 mm) wide must be filled prior to sealer application.
- Needs about 24 hours of cure time
- In certain weather conditions, sealer can remain “tacky”.
 - To avoid tracking into building, broadcast light layer of sand on top of sealer during application to speed up curing process and create non-skid surface on sealed area.

Slurry Seal (Section 32 0113.03)

The slurry seal is applied as a heavier overlay than an emulsion seal and will last between 5 and 7 years. Slurry seals must be applied in favorable conditions that are outlined in the standard specifications. If not, the slurry seal can “flake off” and fail. A few conditions that can lead to failure are:

- Installing the seal on very old, unsuitable asphalt.
- Installing the seal on wet asphalt. The asphalt has to be dry.
- Installing the seal on cold asphalt. The asphalt has to be warm.
- Installing the seal on dirty asphalt. The asphalt has to be clean.
- Using “cheap” products.
- Not compacting the slurry seal after it has been placed. Compaction aids in creating a bond between the slurry seal and the existing asphalt.

Applying a slurry seal is considered to be corrective maintenance. It is used to renew, rejuvenate and seal the asphalt surface and also to seal hairline cracks. It will help replace missing aggregate at top surface of raveled asphalt paving.

Slurry Seal Types:

- Type I is used for maximum crack penetration and provides a fine textured surface. It also makes an excellent pretreatment for hot-mix overlay or a chip seal. It is usually used in low-density traffic areas such as light-aircraft airfields, parking areas, or shoulders where the primary objective is sealing. It is about 1/8 inch (6 mm) thick.
- Type II is the most widely used gradation and provides a medium textured surface. It is used to seal. It is also used to correct severe raveling and oxidation, loss of matrix, and to improve skid resistance. It is used for moderate (medium) traffic, depending on the quality of the aggregates available and the design. It is about 1/4 inch (6 mm) thick.
- Type III is used to correct surface conditions and provides a highly textured surface. It is used as first course in multicourse applications for heavier traffic, and to provide skid resistance. Use this only on very old and weathered, raveled, oxidized asphalt paving.

Slurry Seal Purpose:

- Seals minor cracking, those less than 1/8 inches (3 mm) wide.
- Prevents surface water from penetrating the aggregate base and subgrades.
- Plugs voids, coats and bonds loose aggregate particles.
- Enriches, renews, rejuvenates and restores the surface of asphalt paving which has begun to oxidize (turning black to gray) and become dry and brittle with age.
- Inhibits raveling:
 - Raveling is loosening of the aggregate in the top surface of the asphalt paving causing a loss of material.
 - Raveling is usually found in the wheel paths while weathering covers the entire pavement surface.
- Provides new rejuvenated wearing surface about 1/8 inch (3 mm) thick for Type I slurry seal, about 1/4 inches (6 mm) thick for Type II slurry seal and 3/8 inches (9 mm) thick for Type III slurry seal.
- Replaces some of lost matrix at surface of asphalt paving.

Advantages of Slurry Seal:

- Rapidly applied.
- Does not have loose cover aggregate.
- Provides excellent surface for paint striping.
- Corrects minor surface irregularities.
- Seals hairline cracks, those less than 1/8 inches (3 mm) wide.
- Lasts longer than an emulsion seal (between five and seven years).

Disadvantages of Slurry Seal:

- More expensive than an emulsion seal.
- Most pavement flaws show and reflect through sealer.
- Cracks larger than 1/8 inch (3 mm) need to be sealed and repaired before applying slurry seal.
- Susceptible to power steering tearing and sometimes loses “chips”, especially when new.
- Needs 24 to 48 hours of cure time.

Miscellaneous:

- Rolling slurry seal is usually not provided but it will improve durability. Rolling is usually not needed unless the thickness of the slurry seal is more than 1/4 inches (6 mm) or if late season work is involved. The standard specification requires rolling unless the Owner’s Representative removes it.

Asphalt Removal and Replacement

If removal and replacement of asphalt paving is being considered, three experienced people should review the paving to verify that the cost of maintenance to extend the life of the paving can no longer be justified. The “don’t do anything until it can no longer be tolerated approach” may be applicable.

- Full depth reclamation should be investigated. The asphalt paving is demolished and mixed into the existing aggregate base and subgrade. Its cost is 2/3 to 3/4 of the cost of full replacement. When combined with cement, it provides additional benefits by strengthening and stabilizing the existing aggregate base and subgrade. Standard specifications for this approach are being developed.

If new expensive detention/retention basins are required that significantly increase the cost of the replacement, evaluate the potential use of pervious concrete. For now, do not use pervious concrete in areas of freeze thaw where aggressive deicers will be used.

Additional References:

- Refer to the [Meetinghouse Replacement and Improvement Standards](#) when evaluating asphalt paving
- Refer to the standard asphalt maintenance specifications found on the AEC Website (<http://aec.ldschurch.org/aec/>). These would be site adapted by the design team for individual projects.
- Refer to Attachment A of the [Agreement for Asphalt Maintenance US](#) or the [Agreement for Asphalt Maintenance CN](#). It can be used for scoping and budgeting for the following year’s work.
- Refer to the [Asphalt Maintenance Checklists for Facility Managers and Contractors](#). It should be required that the contractors use the checklists. It helps ensure that the contractor adheres to the requirements of the asphalt maintenance specifications.
- Different sources for asphalt maintenance guidelines, training materials and miscellaneous information for asphalt maintenance are available on the [MFD Resource Library](#). For instance:
 - PowerPoint Presentation - [Installing, Maintaining, and Avoiding Asphalt Replacement](#)
 - ELearning Course - [Maintaining Asphalt Paving at Church Facilities](#)