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CONSTRUCTION LEAFLET NO. 15
THE ASPHALT INSTITUTE
 ASPHALT INSTITUTE BUILDING
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MAINTENANCE AND REPAIR OF ASPHALT PARKING LOTS

INTRODUCTION

All pavements require maintenance. They need this attention because stresses producing minor defects are constantly at work. These stresses may be caused by such things as traffic loads, temperature fluctuations, and changes in moisture content. Regardless of the cause, the result is the same—without timely maintenance the pavement ultimately deteriorates.

Because parking lots are usually provided as adjuncts to primary facilities—such as shopping centers, office buildings and bus stations—the importance of their being properly designed and constructed is sometimes minimized, and a frequently overlooked fact is that often they have to carry traffic loadings equivalent to those on arterial streets.

It is easy to determine when a parking lot is in need of repair. But, without experience in pavement maintenance, it is sometimes difficult to decide just what should be done. The information contained in this Construction Leaflet is designed to help with those decisions. Also it provides a basis for a continuing program of timely and efficient maintenance.

PROPER DRAINAGE

Laboratory testing and practical experience have demonstrated the dramatic reduction in the ability of a soil to resist stresses in the presence of excess moisture. For this reason, one of the most important functions of a pavement is to provide a seal over the underlying soil.

Although the pavement itself absorbs much of the traffic-induced stress, invariably some of this pressure is ultimately transmitted to the foundation layers of soil. If there is an excess of moisture in this soil, it may be unable to resist the applied loads. The resulting deformation will eventually exceed that which the pavement can tolerate, and a local failure will result.

Excess moisture can be prevented by proper drainage. Properly designed inlets and culverts should efficiently conduct stormwater from the parking lot surface to a convenient outlet. Where necessary, subsurface drains should be employed to collect and dispose of groundwater before it can reach the foundation soil of the parking lot.

In terms of the maintenance of parking lots, this very brief discussion of moisture and drainage has three implications: First, a properly-functioning drainage system can eliminate a number of future maintenance problems. Second, surface repair of a pavement defect caused by poor drainage will merely be a temporary solution, since it treats only the symptom, not the cause of distress. Third, the most important kind of repairs are those that will stop water from getting beneath the pavement surface. These are the repairs that can prevent even larger maintenance expenditures in the future.

INSPECTION AND EVALUATION

The key to successful maintenance is careful planning and programming of the work to be done. The first step in planning is an evaluation of all parking areas and access roads in the system with respect to surface condition, structural strength, and drainage.

The parking lot should be thoroughly inspected. Usually, this means that the inspection be made by walking rather than from a slow-moving vehicle. This enables the inspector to notice very small cracks and defects. He also becomes more aware of the sometimes subtle signs of future trouble, such as mud or water on the pavement.

In all cases of pavement distress, it is important to determine the cause or causes of the difficulty. This determination will facilitate repairs that will both correct the defect and prevent its recurrence. Time and money spent for such repairs are well invested, since the same repairs will not have to be repeated in the future.

When the inspection has been completed, there should be a record of problem areas, and also an idea of the general condition of the pavement.

WHAT TO LOOK FOR

Pavements in need of maintenance or repair can exhibit any or all of the following conditions:

Raveling. This is the progressive separation of aggregate particles in a pavement from the surface downward. Usually, the fine aggregate comes off first and leaves little "pock marks" in the pavement surface. As the process continues, larger and larger particles are broken free, and the pavement soon has the rough and jagged appearance typical of surface erosion. Raveling can result from lack of compaction during construction, construction during wet or cold weather, dirty or disintegrating aggregate, poor mix design, or extrinsic damage to the pavement.

Alligator Cracks. These are interconnected cracks forming a series of small blocks resembling an alligator's skin or chicken-wire. In most cases, alligator cracking is caused by excessive deflection of the surface over unstable subgrade or lower courses of the pavement. The unstable support usually is the result of saturated granular bases or subgrade. The affected areas in most cases are not large; sometimes, however, they will cover entire sections of a pavement, and when this happens, it usually is due to repeated loadings exceeding the load-carrying capacity of the pavement.

Upheaval. Upheaval is the localized upward displacement of a pavement due to swelling of the subgrade or some portion of the pavement structure. In colder climates, upheaval is commonly caused by expansion of ice in the lower courses of the pavement or the subgrade. It may also be caused by the swelling effect of moisture on expansive soils.

Pot Holes. These are bowl-shaped holes of various sizes in the pavement, resulting from localized disintegration of the pavement under traffic. Contributory factors can be improper asphalt mix design, insufficient pavement thickness, or poor drainage. Also, pot holes may simply be the result of neglecting other types of pavement distress.

Grade Depressions. Depressions are localized low areas of limited size which may or may not be accompanied by cracking. They may be caused by traffic heavier than that for which the pavement was designed, by settlement of the lower pavement layers, or by poor construction methods. A depressed cracked area frequently denotes a plastic failure in the base or subgrade. A cracked area without permanent deformation often indicates an elastic movement in the pavement structure.

WHAT TO DO

The following are examples of some typical cases of pavements requiring maintenance, and the proper methods of correcting the deficiencies.

Pavement in Good Condition. Typically, a pavement in good condition might exhibit fine cracking, and some raveling of the fine aggregate; the ordinary effects of some wear and tear.

The remedy for this condition is the application of a light seal coat, such as a fog seal or an emulsified asphalt slurry seal.

A seal coat is a thin asphalt surface treatment used to waterproof and improve the texture of an asphalt wearing surface. Depending on the purpose, seal coats may or may not be covered with aggregate. The main types of seal coats are aggregate seals, fog seals, emulsion slurry seals, and sand seals.

An asphalt fog seal, a type of seal coat, is a light application of slow-setting emulsified asphalt diluted with water. It is used to renew old asphalt surfaces and to seal small cracks and surface voids. The emulsion is diluted with an equal amount of water and sprayed at the rate of 0.45 to 0.7 litre/m² (0.1 to 0.15 gal/yd²). This rate of application is particularly important, since the amount of fog seal that can be absorbed depends on the dryness and texture of the existing surface. Too light an application will not seal the small cracks and surface voids; however, too heavy an application can impair the pavement's skid resistance.

Another important consideration in applying fog seals to parking lots is curing time. Since the emulsified asphalt does require a few hours to cure, alternative parking should be available during the construction and curing period, so that those using the facility will not be inconvenienced by the temporary tackiness of the surface.

Care should be exercised when spraying liquid asphalt or emulsified asphalt near building walls and portland cement concrete curbs. In some cases, it may be advisable to use a movable shield or building paper to protect these structures. Also, when using a distributor spray bar, the height of the bar should be no more than that necessary for adequate coverage; as the spray-bar height increases, control over the asphalt spray decreases.

“Emulsified asphalt slurry, another type of seal coat, is a mixture of emulsified asphalt, fine aggregate, mineral filler, and water. It is mixed in a slurry machine that both mixes and spreads the material. Emulsified asphalts SS-1, SS-1h, CSS-1, and CSS-1h* are used in slurry seals. On some small jobs, where the quantity of slurry does not warrant the use of a machine, prepared asphalt slurry may be applied by squeegee. This material is available in 19 to 38 litre (5 to 10 gal) containers at many hardware and department stores.”

Asphalt, since it is a petroleum product, can be dissolved by many other petroleum-derived products. Therefore, in localized areas where extensive fuel spillage is likely, it may be advisable to seal the pavement with a commercially-available proprietary sealer that is impervious to petroleum solvents. However, since experience has shown that these proprietary sealers often develop small surface cracks soon after being placed, they should be used judiciously.

Pavement in Fair Condition. Such a pavement might be characterized by random cracks of up to 13 mm (1/2 in.) in width, and raveled aggregate.

The random cracks should be filled with emulsified asphalt slurry, or a light grade of liquid asphalt mixed with fine sand. The cracks should be prepared for filling by removing vegetation, cleaning with a broom or a stream of compressed air, and the application of a soil sterilant if weed growth is anticipated. The cracks are then filled using a hand squeegee and a broom.

Also,

- A hand torch or weed killer can be used to destroy existing vegetation.
- Fine cracks, up to 3 mm (1/8 in.) wide, are too small to effectively fill, and can usually be ignored, especially when an overlay or slurry seal is to follow.
- A fine sand-asphalt hot mix can also be used for filling very large cracks.

After the cracks have been filled, the parking lot should be covered with an asphalt overlay or a seal coat.

Pavement in Poor Condition. This pavement may display random cracks, raveled aggregate, depressions, local alligatored areas, pot holes, and perhaps upheaval.

First, the areas of local distress—that is the alligatored areas, pot holes, and upheavals—should be repaired. This is accomplished by constructing a Full-Depth asphalt patch†. Here's how it's done:

- Remove the surface and base for as deep as necessary, a minimum of 100 mm (4 in.), to reach firm support, extending at least a foot into good pavement outside the cracked area. Make the cut square or rectangular, with faces straight and vertical.
- If water is a cause of failure, install drainage if necessary. Then compact the subgrade until it is firm and unyielding.
- Apply a tack coat to the vertical faces. This is a light application of liquid asphalt or emulsion used to ensure a bond between the existing pavement and the patch.
- Backfill the hole with a dense-graded hot asphalt plant-mix.

*Although not yet recognized by the American Society for Testing and Materials (ASTM), or the American Association of State Highway and Transportation Officials (AASHTO), quick setting emulsified asphalts especially designed for slurry-seal applications, have been successfully used.

†See Full-Depth Asphalt Patching, CL-19, The Asphalt Institute.

- Compact in layers if the hole is more than 150 mm (6 in.) deep. Compact each layer thoroughly. Compaction should be done with equipment most suited to the size of the job: A vibratory plate compactor is excellent for small patches; a roller may be more practical for larger areas.
- Use a straightedge or a stringline to check the riding quality of the patch.

Following the repair of local distress, the cracks should be filled.

Depressed areas should be restored to the proper cross-section by applying a leveling or wedge course. This is an asphalt layer of variable thickness, specifically intended to eliminate irregularities in the contour of an existing surface prior to an overlay.

An asphalt overlay or an asphalt seal coat should then be applied.

These suggested repair procedures are not the only effective maintenance techniques. Some parking lots will develop problems other than the more common pavement defects discussed in this publication. Additionally, alternative methods and materials are commonly used in some areas to adapt to local conditions. The preceding examples should, however, serve as a useful guide to the types of repairs generally required to maintain a parking lot, as nearly as possible, in its as-constructed condition.

PREVENTIVE MAINTENANCE IS THE KEY

Preventive maintenance means the early detection and repair of minor defects, before major corrective action is necessary; it is the only proper way to care for a parking lot.

Preventive maintenance makes sense when one considers that cracks and other surface breaks, which in their first stages are almost unnoticeable, may develop into serious defects if not soon repaired. Cracks and surface breaks may occur in a very few days in an under-designed pavement under heavy traffic, especially in the presence of water. For this reason, qualified individuals should perform frequent, close inspections of the parking-lot pavement. When these inspections reveal minor defects they should be repaired immediately, before they deteriorate into pavement failures requiring major maintenance expenditures.

A parking lot is an investment, as is a building or any other capital structure. Just as a building must be maintained to ensure its maximum utility, so must a parking lot be properly cared-for. When this care is taken, the parking-lot users will be provided with an attractive and useful facility. Moreover, proper maintenance will serve to carefully protect and preserve the facility for the many years necessary to justify the initial substantial investment.