Memorandum
City of Lawrence
Public Works

TO: Chuck Soules
FROM: Mark Thiel
CC: Tom Orzulak, Steve Stewart
Date: 7/14/2010
RE: Authorization to Purchase of a Truck Mounted Spray Injection Patcher, Truck Chassis, and Oil Storage Tank with Trailer

I am requesting authorization for the addition of a truck mounted spray injection patcher, truck chassis for the patcher, and an oil storage tank with trailer to our equipment inventory to assist with the efficiency of patching streets. (See Figure 1 and 2)

Figure 1 - Truck Mounted Patcher


Figure 2 – Oil Storage Tank

The Street Division has one traditional pothole patching truck. During a surge in patching efforts additional flatbed trucks are deployed with cold or hot mix to perform patching from the back of the truck. This is a very inefficient method for patching that proves to not last. The injection spray patching technology has been in existence for many years and much research has been done to support its use in this process. It is one of the most efficient methods for making long lasting patches to potholes under less than desirable conditions. Attached are excerpts from a study that was performed by Oregon Department of Transportation highlighting some of the benefits found from using this form of patching. Additionally, KDOT – all locations, Johnson County, City of Overland Park, City of Olathe, City of Gardner, Labette County, City of McPherson, City of Topeka as well as many others in the region have deployed this technology with effective results.

Comparatively, a spray injection patcher can be used year round when more traditional methods cannot due to lack of availability of materials, such as hot mix asphalt. The spray injection patcher is a self contained unit that actually mixes the raw materials within its configuration to produce the patching materials. The attached study provides a basic description of the injection patching method.

Costs associated with a traditional patching unit versus a spray injection unit are comparable. The spray injection patcher configuration that we are recommending will cost:

Injection patcher	$ 76,000,
Truck chassis	$ 68,000
Oil storage tank	$ 20,000
Total	$164,000

A traditional patch truck will cost on average $160,000 to $180,000.

However, application cost is significantly lower with a spray injection patcher. A traditional cold patch repair is estimated to cost $151 per ton of material including labor and equipment. With an estimated failure rate of 50%. Whereas, injection patching has an estimated cost of $87 per ton of material with a very low failure rate.

We believe that the truck chassis and patcher are available on government procurement contracts (Patcher and oil storage tank – Huston / Galveston Mid America Region and the truck chassis – Kansas City Metro Contract) and readily available for delivery. We have coordinated with the Finance Department and they have indicated that this would be an appropriate method for procurement in accordance with City of Lawrence purchasing policies.

There are three basic spray injection patching configurations: trailer mounted, truck mounted and self-contained truck. We are recommending the truck mounted unit because it will provide the most flexibility. The self-contained truck unit is rather large and would be hard to maneuver in residential areas limiting our capability. The trailer mounted unit, while the least expensive option, would not be preferable because it would require a dedicated dump truck to haul the aggregate used while patching. During winter operations that would mean we would have one less plow / spreader truck available. The trailer mounted units also requires a larger number of staff and creates more on street safety issues.

Action Requested

Approve purchase of a truck mounted spray injection patcher and oil storage tank in the amount of $164,000.

Oregon Department of Transportation – Study OR-RD-99-10

IMPROVED WINTER POTHOLE PATCHING

State Planing And Research
Project Number 538

by

Andrew Griffith, P.E.

for

Oregon Department of Transportation
Research Unit
200 Hawthorne SE, Suite B-240
Salem OR 97301-5192

1.0 INTRODUCTION

1.1 PROBLEM

During the winter months, asphalt pavements are subjected to traffic, moisture penetration and in many areas of Oregon, repetitive freeze-thaw cycles. Under traffic loads, the more brittle colder pavement and the moisture trapped in the pavement base often lead to the formation of potholes.

Methods for repair of a pothole vary. They include:

a) Throw and roll -- the hole is filled with a cold mix material and compacted using the tires of the maintenance truck.
b) Edge seal -- the cold mix throw-and-roll patch is sealed around the edges with an asphalt based sealant material.
c) Semi-permanent -- the pothole is properly milled to square edges and is patched with cold mix, or in some cases, hot mix. It is compacted using a steel drum or rubber tired roller.

Even with a properly constructed cold mix patch, a pothole is likely to fail before the pavement is resurfaced or rehabilitated. Further exacerbating the problem, is limited manpower availability to do the patching and the impacts to the traveling public when the highway is partially closed for pothole patching. To maintain an acceptable pavement ride quality, ensure motorist safety and to minimize vehicle damage, potholes must be filled more efficiently and effectively.

Alternate methods are available to quickly, safely and permanently patch potholes in the late fall, winter, and early spring months. Although not employed in Oregon, a successful method used in many other states is spray injection. Spray injection is a process where using specialized equipment, aggregate is simultaneously premixed with a heated asphalt emulsion and sprayed through a hose and nozzle into the pothole. Specifically, the steps taken to fill the pothole when using this equipment include:

1) Blowing water and debris from the pothole.
2) Applying a tack coat of asphalt emulsion on the sides and bottom of the pothole.
3) Spraying the emulsion and aggregate mixture into the pothole.
4) Covering the repaired area with a thin layer of uncoated aggregate.
5) Opening the repair to traffic as soon as workers and equipment are clear.

Figure 1.1 illustrates the process. The spray injection method requires no compacting after the cover aggregate is placed.

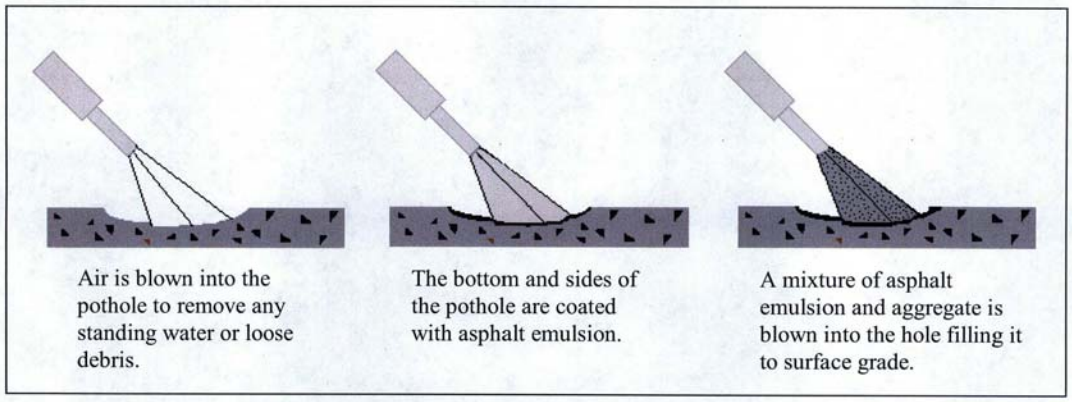

Figure 1.1: Spray Injection Pothole Patching Procedures

The spray injection equipment offers potential for much greater productivity and efficiency and can operate in extreme cold weather. Effective road repair operations are possible in the winter months when adverse weather prevents traditional pothole repairs from lasting through the season.

Oregon continues to use the throw-and-roll technique as the primary method for temporary road repairs. This process is labor intensive and repairs can easily fail if the repair is not done correctly or if the repair must be made in wet conditions. Proven specialized spray injection patching equipment is available to improve road repair capability in Oregon. This report presents results from recent studies of pothole patching equipment as well as relevant information obtained from other states that are using spray injection patching equipment. The report can be used by the Oregon Department of Transportation (ODOT) and local agencies as a basis for making operational decisions about the type and make of patching equipment available to best meet the agencies' needs.

1.2 PROJECT OBJECTIVES

This project involved information gathering and a literature search to determine the feasibility of employing spray injection patching equipment for road repairs in Oregon. The literature search consisted of reviewing current publications on pothole repair methods and contacting other state departments of transportation (DOT) who are using spray injection equipment. It also involved contacting manufacturers for information about costs, equipment types and their operating characteristics. The objective of the search was to provide ODOT Maintenance Managers and local agencies information about the spray injection process, including:

- Previous study results regarding automated pothole patching;
- Manufacturers of the equipment and costs;

- Features and characteristics of different equipment types; and
- Names of DOT representatives from other states using the equipment and the extent of their usage.

ODOT Maintenance Managers and local agencies can use this information to make decisions on obtaining spray patching equipment to improve their highway maintenance program efficiency and effectiveness.

1.3 TYPES OF SPRAY INJECTION EQUIPMENT

There are three types of units that are widely used by DOTs and local agencies for spray injection pothole patching. These include:

- Trailer type unit;
- Modified truck unit; and
- Self-contained unit.

In the trailer type unit, a dump truck pulls the trailer and feeds the aggregate through a modified tailgate into the trailer unit. At least two people, the truck driver and a person to operate the patching spray injector hose and nozzle are required. The spray injection operator works behind the trailer to control a delivery hose suspended from a boom on the rear of the unit.

With the modified truck unit, the patching equipment is reconfigured so that it can be mounted on the chassis or dump truck bed of an existing DOT truck. This eliminates the need for pulling a trailer, although the spray injection hose and boom are still operated from the rear of the truck.

In the self-contained unit, only one person is required to patch the pothole. The spray injection equipment is factory built onto a truck chassis. The patching is done by the truck operator inside the truck's cab using a joystick to remotely control the spraying operations. The boom and attached hose extend from the front of the truck.

2.0 LITERATURE SEARCH

2.1 TRANSPORTATION RESEARCH BOARD (TRB) REPORT

A previous Strategic Highway Research Program (SHRP) study, H-106, evaluated the effectiveness of several pothole patching materials and techniques at eight sites in the United States and Canada. One of the sites was in Oregon on U.S. 97 in Modoc Point. All sites except Oregon used a spray injection method for pothole patching. The results of the study indicated that the most productive method in terms of tons/person-day was the spray injection method (*Wilson, 1993*). Additionally, the study demonstrated that spray injection pothole patches were more durable when compared to those made using the throw-and-roll, edge seal and semi-permanent methods.

2.2 SHRP INFORMATION

The Federal Highway Administration (FHWA) has published news bulletins highlighting actual case studies regarding the use of spray injection pothole equipment in various locations throughout the United States. Overall, these reports indicate that the spray injection method is highly efficient, productive, and effective (*FHWA, 1996*).

2.3 OTHER STUDIES

Northwestern University

In 1991, The Basic Industries Research Laboratory (BIRL) at Northwestern University received a $1.2 million grant from the National Research Council to develop an Automated Pavement Repair Vehicle (APRV). The APRV research attempted to solve the pothole repair problem through complete automation of the repair procedure. The APRV uses a more advanced process than spray injection in that the APRV is fully automated using a computerized vision system and robotics to perform the repair operations under complete computer control. The APRV was designed to cut and shape a pothole, vacuum the hole, heat and dry the bonding surfaces and spray an asphalt emulsion and aggregate patch material into the hole. The end result is a flat and dense patch requiring no additional roller compaction. Repairs with an APRV were expected to last several years (*Blaha, 1993*).

The Northwestern University BIRL study has not achieved the anticipated results. The prototype machine was not effective in field trials. The APRV was used on the streets of Evanston, Illinois. It operated slowly and was costly to use. Jim Dorava, the supervisor for Evanston's Department of Streets and Sanitation commented about the APRV, "It's so