SECTION II EQUIPMENT RESEARCH

SHRP'S EQUIPMENT RESEARCH FOR MAINTENANCE COST-EFFECTIVENESS

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MAINTENANCE COST-EFFECTIVENESS

The major objective of the Strategic Highway Research Program (SHRP) research in the maintenance cost-effectiveness (MCE) area is to make technological improvements in equipment, materials and processes by increasing pavement service life, productivity and worker/motorist safety. This will improve the capabilities of the states for developing budgets, administering programs and allocating resources.

Figure 1 lays out the 10 contracts that constitute the MCE portion of the Highway Operations research program. The figure shows the interrelationships of the contracts. The solid lines denote the progression toward follow-on contracts. The dashed lines indicate the need for coordinated effort between separate contracts. The equipment development contracts are identified as H-104 and H-107. Both these contracts are geared towards development of new equipment for:

Pavement Condition Evaluation

Two separate equipment units are under development under H-104, one at the network level and the other at the project level. These automated equipment units will make it easier for maintenance technicians to keep track of the condition of a road network. The equipment units will assist in both the network-level and project-level decision-making about preventive maintenance.

Pavement Repair

A crack filling robot and an automated pothole repair machine are under development under the category of pavement surface repair equipment, contract H-107. Both equipment units, when operational, will reduce labor costs, provide quality repair and reduce the exposure of maintenance workers to risks.

MAINTENANCE MEASURING EQUIPMENT - NETWORK-LEVEL

The network-level equipment units for pavement condition evaluation uses ground penetrating radar (GPR) to collect data quickly on subsurface conditions that can lead to pavement distress. This includes potential distress caused by moisture in asphalt subbase, voids or loss of support under concrete slabs, and overlay delamination. Figure 2 is a sketch of the equipment unit.

The trailer mounted radar equipment can be operated at speeds of up to 25 mph (40 kilometers per hour). The data acquisition and interpretation is rapid and accurate due to the high resolution radar system and enhanced data interpretation software.

MAINTENANCE MEASURING EQUIPMENT - PROJECT-LEVEL

The project level equipment for early detection of subsurface conditions uses seismic wave analysis techniques to measure localized pavement conditions. This trailer-mounted (Figure 3), low-cost equipment is designed for maintenance technicians to measure moisture in foundation layers of flexible pavements and under rigid pavement joints, fine cracking, voids under rigid pavement joints, and overlay delamination. With this equipment, early symptoms of pavement distress can be identified, measured and diagnosed to take timely action to prolong pavement life.

Innovative Equipment for Surface Repairs - Crack Filling Robot

A robotic crack filling machine is being developed to seal/fill pavement cracks in less time than what is done manually at the present. The robotic truck is highly automated and will require only two operators to accomplish the job that currently requires from six to eight workers.

The equipment unit will fill and seal both longitudinal and transverse cracks using vision sensors and mechanical robots (see Figure 4). When operational, the automated vehicle will repair cracks faster and more consistently than do typical repair crews. One of the major benefits will be increase in worker safety because all operations will be from inside the vehicle.

Innovative Equipment for Surface Repairs - Pothole Patcher

Another equipment unit being developed is a one person operated pothole patching machine that will perform all patching operations that normally require from four to

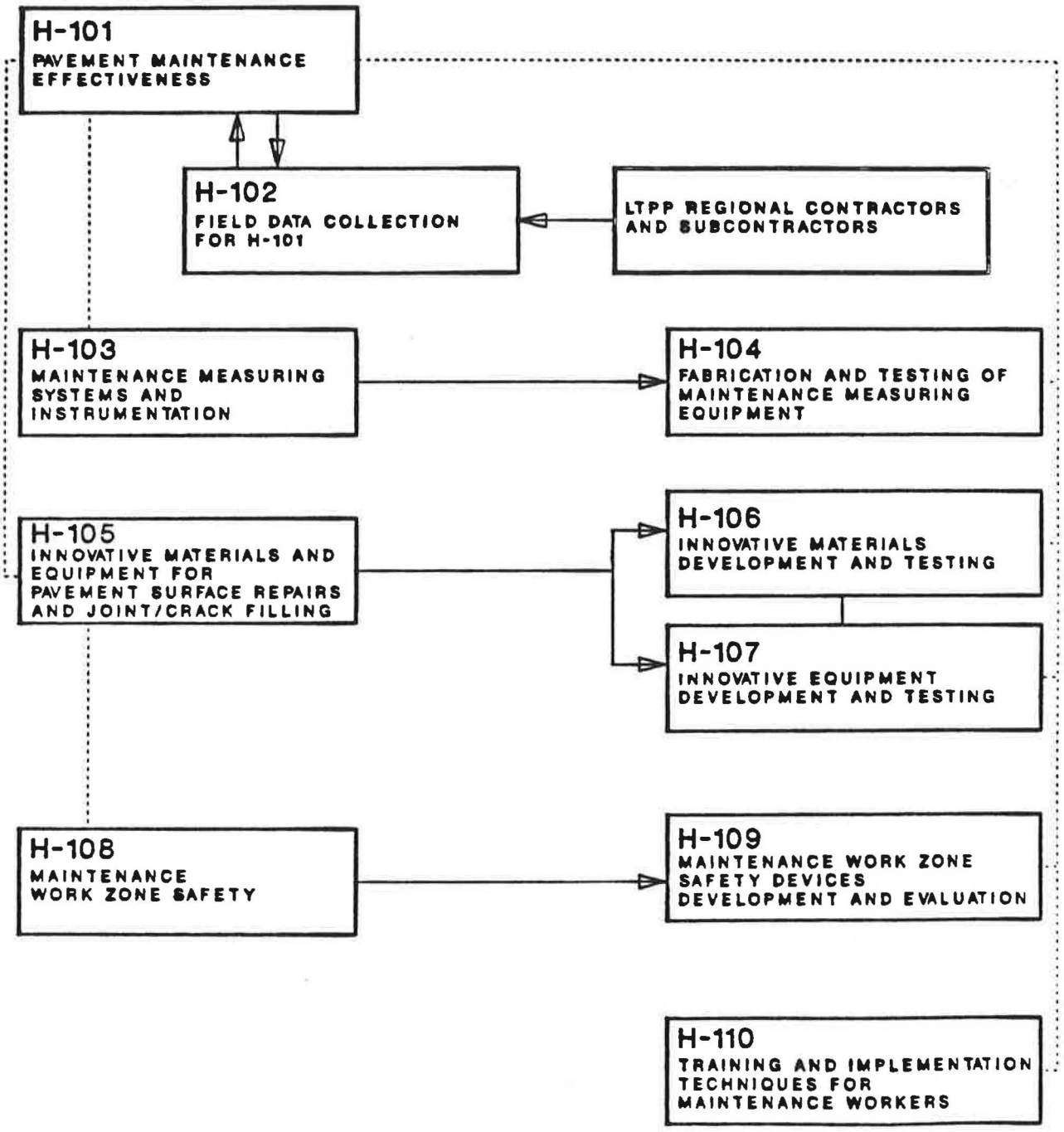

Figure 1 Contracting Plan for SHRP Maintenance Cost-Effectiveness.

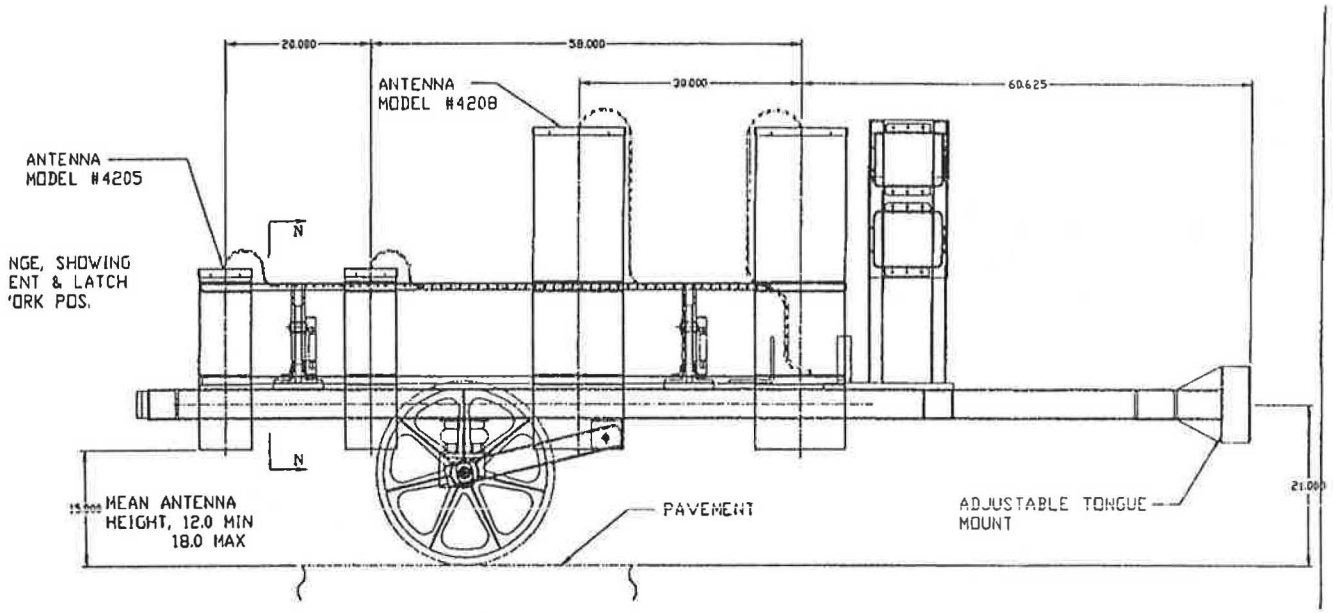

Figure 2 Network Level Maintenance Measurement Equipment (Subsurface Interface Radar).

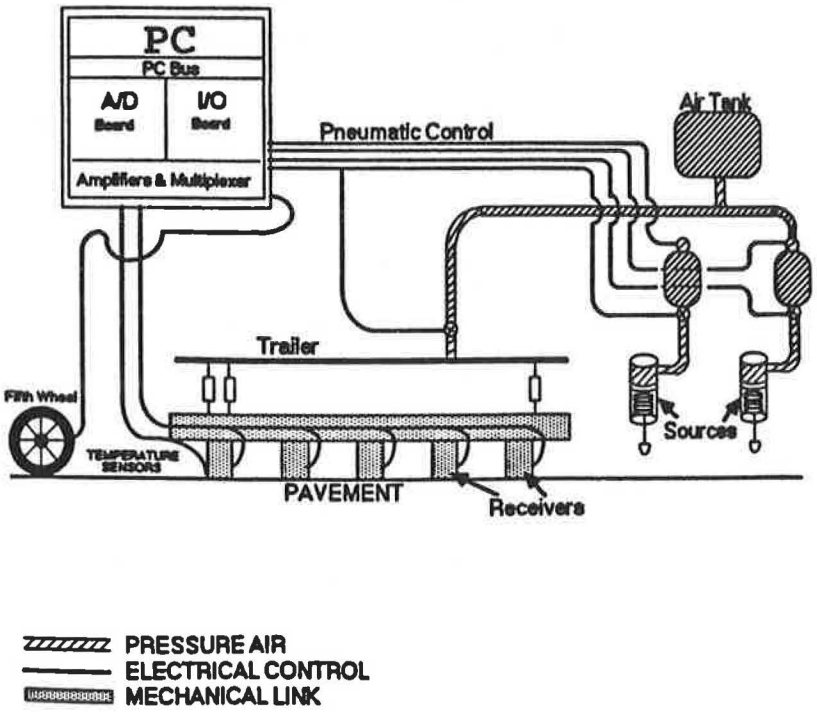

Figure 3 Project Level Maintenance Measurement Equipment (Seismic Surface Analyzer).

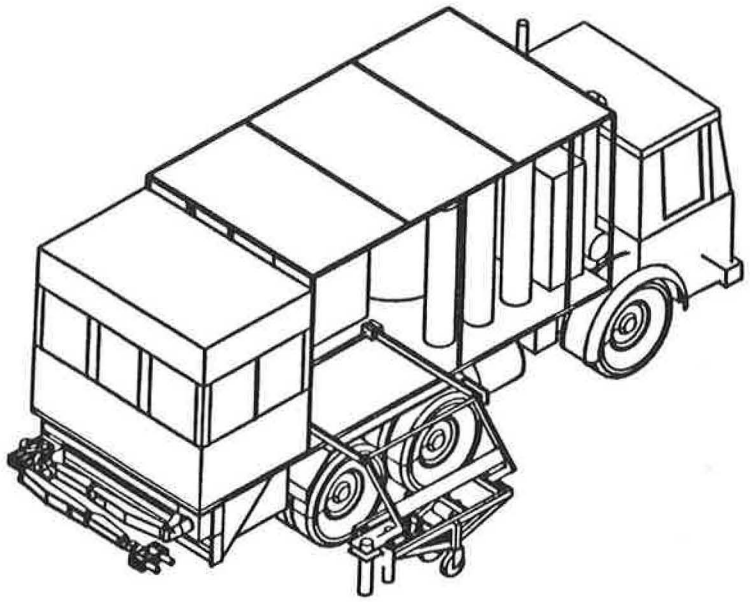

Figure 4 Integrated Crack Sealing Machine.

six workers. This robotic machine will cut the edges of the pothole, vacuum up the loose materials, dry and heat the hole surface and fill the hole with material at high enough velocity that it does not require additional compaction.

The truck is designed to accommodate two aggregate hoppers, asphalt emulsion tanks and all other mechanical and hydraulic systems. The repair system is housed in the repair box at the end of the truck. Within the repair box, a stereo-vision system will determine the outline and depth contour of the pothole. This will assist the operator to spray the exact quantity of patch material into the cavity. The automated equipment will not only increase the quality, consistency and life of the patch but also will increase the safety of workers. Figure 5 is the sketch of the prototype pothole patcher.

CURRENT STATUS

All of the above equipment will be available for demonstration sometime in 1993. The prototype equipment may require extensive testing and evaluation. It is expected to lead to commercially available units sometime in 1995.

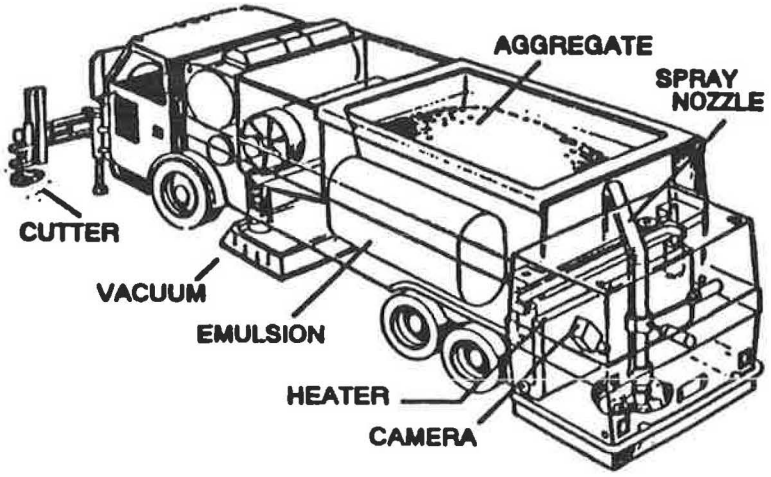

Figure 5 Cutaway View of the Pothole Patcher.