

MATES

MICHIGAN DEPARTMENT OF TRANSPORTATION



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SAND BLASTING—It's a dirty job, but... It's gotta be done right!

Michigan's steel bridge beams are protected from rust caused by water, snow, and salt, by multiple coats of paint. This protection needs to be renewed periodically, requiring paint removal, steel cleaning, and repainting after years of service. Although the process has proven satisfactory, some new concerns have arisen that have greatly complicated repainting in these environmentally conscious times. Until the midseventies, our bridge paints contained red lead. Zinc has since replaced the lead, and is only about 1 percent as toxic. The problem facing MDOT today is how to safely remove and dispose of the old lead-based paint residue while adhering to all of the recent environmental regulations.

Abrasive ('sand') blasting is the most common method for removing old bridge paint. The blast cleaning operation is regulated by a large number of worker safety, environmental, and hazardous waste laws.

Worker Safety and Environmental Regulations

Worker safety laws are designed to protect maintenance personnel from the lead dust. Environmental laws are designed to protect both the public and the environment near the bridge blast cleaning operation. Even more extensive control measures are instituted if the bridge is near a residential area or over water. Although very expensive, bridges can be completely enclosed, under vacuum, to ensure maximum dust recovery. These enclosures are used on bridges within 200 ft of residential or commercial buildings. Although this complete enclosure prevents lead dust from escaping, it increases the lead concentration and potential worker exposure within the enclosure.

Hazardous Waste Regulations

Hazardous waste laws govern the collection, handling, labeling, transportation, disposal and documentation of all hazardous wastes. The remainder of this article will deal with the developments concerning hazardous waste laws and their effects on MDOT blast cleaning operations. Under the Federal Resource Conservation and Recovery Act and the State Hazardous Waste Management Act, a waste material is classified as 'hazardous' or 'non-hazardous.' Handling and disposal laws for hazardous wastes are extensive, and require waste disposal in a licensed hazardous waste (Type I) landfill. There is only one such landfill in Michigan, located in Wayne County.

A waste is classified as hazardous if it is either ignitable, corrosive, reactive, or toxic. Spent abrasives from blast cleaning operations have tested negative for the first three hazardous classifications; however, the fourth category, toxicity, is the problem. A waste is considered toxic if it contains more than specified maximum amounts of chemicals identified on extensive regulatory lists. A waste is also considered toxic if the chemicals could leach from the waste into the environment when exposed to acid rain.

The U. S. Environmental Protection Agency (EPA) developed a test to simulate a landfill with acid rain perco-

lating through the buried wastes. This test procedure was called the Extraction Procedure Toxicity Characteristic (EP Tox) test. A sample of a waste was mixed with a simulated acid rain solution for 24 hours, and the liquid was extracted and tested for listed chemicals. A waste tested by EP Tox would be considered toxic, and therefore hazardous, if the concentration of the extracted chemicals exceeded 100 times the EPA drinking water limits.

Lead-Based Painted Bridges

When blast cleaning lead-based painted structures, lead is the metal of primary concern because of its toxicity and leachability. During 1989 and 1990 approximately 60 percent of the lead-based paint/abrasive blast wastes tested by MDOT exceeded the 5.0 parts per million (ppm) limit for leachable lead, and therefore were classified as hazardous waste.

The EPA replaced the EP Tox test in August 1990 with the new Toxicity Characteristic Leachate Procedure (TCLP) which simulates harsher conditions (using a more acidic solution to simulate acid rain). Since August 1, 1990, when MDOT implemented the TCLP test, nearly all of the wastes from blast cleaning lead-based painted bridges have tested hazardous for lead (i.e., in excess of 5.0 ppm).

How have the law and testing procedure changes affected the way MDOT handles its bridge cleaning operations? Under the old system, contracts for bridge cleaning were bid and let on the basis of the abrasive blast waste qualifying for non-hazardous disposal. If the waste tested exceeded the non-hazardous limits, the additional hazardous waste disposal costs were added to the contract. Under the new system, MDOT contracts for cleaning bridges with lead-based paint are bid under the presupposition that the waste will be hazardous, with hazardous waste handling and disposal costs to be included in the contractor's bid item for blast cleaning the structure.

With this bidding procedure, it is expected that contractors will investigate and implement ways of reducing the quantity of waste generated. Recycling the abrasive during the blast operation, for example, reduces the amount of hazardous waste by a factor of about 30. Other techniques are being investigated that could render the lead non-leachable and thus non-hazardous. Contractors using recycled abrasive or generating non-hazardous blast wastes could save considerable amounts of money and reduce hazardous waste quantities to a minimum.

Legal Requirements for Hazardous Wastes

The hazardous waste laws are strict and extremely detailed (based on Act 64, a Michigan law). The requirements appear limitless. Not only must the hazardous waste be disposed of in a hazardous waste (Type I) landfill, but as of August 1990 the waste must be treated by the disposal agency to non-hazardous levels before being buried. Each bridge site must have an EPA identification number. The workers handling the waste must be trained by a certified instructor in proper hazardous waste management techniques. Each container of waste must immediately be labeled with all pertinent information. Spill contingency plans must be available and posted. Weekly inspection

of the storage containers is required. The waste can be moved only by a licensed hazardous waste hauler. A multi-copy hazardous waste manifest must accompany the waste at all times. Cradle-to-grave tracking of the waste is required. Owner liability for the hazardous waste is endless. Disposal in hazardous waste landfills requires reams of paperwork. Michigan's only hazardous waste treatment facility requires: 1) a Waste Characterization Report, 2) a Toxicity Characterization Report, 3) a sample of the waste, and 4) a laboratory analysis of the waste. All must be submitted before an approval for shipment is granted. When waste is shipped, it must have: 1) the manifest, 2) a land ban form which ensures waste treatment before burial, and, 3) prior landfill approval. All of these must be signed by the Project Engineer on behalf of the Department, which the law defines as the hazardous waste generator.

Zinc-Rich Painted Bridges

Lead is not the only metal regulated under toxicity testing procedures. Other metals listed include arsenic, barium, cadmium, chromium, mercury, selenium, and silver, and Michigan's regulations (Act 64) also include copper and zinc. All testing for these metals, except lead, in blast cleaning wastes using the EP Tox test were negative. Zinc was the only other metal that showed any appreciable leachate concentration. The zinc concentrations were typically about 1/10 of the 500 ppm DNR limit.

Since the concentration of leachable lead increased greatly by changing from EP Tox to TCLP procedures, would the leachable zinc concentrations also increase? For if the zinc exceeded the toxicity limits, the zinc-rich paint that has been applied since the late nineteen seventies could become a hazardous waste problem when those bridges are cleaned and repainted. The zinc-rich painted bridges that have been blast cleaned and tested by the TCLP method have produced results showing the residue to be classifiable as non-hazardous.

Weathering Steel Bridges

Another type of steel beam was used in Michigan's bridges in the early nineteen seventies. Uncoated ASTM A588, or weathering steel, when exposed to the elements, was supposed to form a 'protective' coating of surface rust, which would prevent further corrosion. In fact, this rust did not provide the protective coating anticipated when exposed to deicing salts and these bridges are now being blast cleaned and painted with zinc-rich paint. As anticipated, the rusty blast cleaning wastes have all tested non-hazardous, and thus can be placed in non-hazardous (Type II) landfills.

Recycled Steel Shot Abrasive

Another interesting situation involves recycled steel shot abrasive. The paint is removed using steel shot in the blasting operation and paint residue and steel shot are separated using magnetic and centrifugal methods, and the recycled steel shot is used for further blasting. There are still some problems with this process. One, for example, being the potential for the iron dust reaction with moisture which can cause rust stains on vehicles. Yet there are significant advantages that warrant continued development of the process. First is the reduction in waste quantities. As mentioned previously, by removing the abrasive from the waste, the quantity of waste is reduced by an approximate factor of 30. This greatly reduces the waste volume and disposal costs.

An unexpected situation has arisen with the use of recycled steel blasting abrasive. The iron dust from the steel shot appears to combine with the lead in such a way as to reduce its leachability below regulated values. The

wastes from recycled steel shot blasting are testing non-hazardous. It is therefore possible that iron mixed into other types of blasting abrasives could eliminate the lead leachability as well.

Where Are We Today?

MDOT has responsibilities both as a generator of hazardous waste and as an enforcer of the contract provisions over the contractors we hire to remove the lead-based paint. Our role as enforcer will no doubt continue to increase. We must ensure that the waste is handled "to the letter of the law," or be prepared to pay the fines ourselves (fines of \$25,000 per bridge per violation are common).

In an effort to improve our procedures, MDOT is classifying its bridge painting contracts and handling procedures based on the type of material being removed.

1) A588 weathering steel bridges will be classified and bid as non-hazardous waste jobs. Samples of the waste will still be tested by MDOT for verification and documentation necessary for disposal in a non-hazardous (Type II) landfill.

2) Zinc-rich painted bridges will be classified and bid as non-hazardous waste jobs. MDOT will test samples for verification for disposal in a Type II landfill.

3A) Lead-based painted bridges will be preclassified and bid as hazardous waste jobs. Samples will be tested by MDOT for verification and documentation necessary for disposal in a hazardous waste (Type I) landfill.

3B) Lead-based painted bridges blasted with recycled steel shot will also be preclassified and bid as hazardous waste jobs. Samples of the waste will be tested by MDOT for verification and documentation necessary for waste disposal in the required hazardous waste landfill, or if tested and shown to be non-hazardous, for disposal in a Type II landfill. The difference in disposal costs will be kept by the contractor to encourage development of technology in this area.

As the technology improves, and as more testing information becomes available, MDOT policies and procedures will change. Coordination of all laws, rules, forms, agreements, and information will be a continuing challenge for the Department. It will be the responsibility of jobsite personnel to know the rules or know where to get the answers. They must not guess; they must not ignore it. The price in dollars and potential environmental damage is too high. DO IT RIGHT! If questions arise, or you are unsure of any procedure, the Materials and Technology Division's Geoenvironmental Unit should be contacted by phoning Tom Work, (517) 322-6185, or Judy Ruszkowski, (517) 322-1205.

-Bob Nordlund

MDOT RESEARCH PUBLICATIONS

Evaluation of Tensar Bituminous Pavement Reinforcement: Final Report, Research Report No. R-1307, by J. H. DeFoe. 'Tensar,' a high tensile strength geogrid material for reinforcing bituminous pavements was evaluated as a bituminous overlay reinforcement in Lenawee County on M 50, which was rehabilitated in 1985. The rehabilitation also included several miles of pavement which were cracked and sealed after sawing just prior to overlaying. Five different methods of preparation for the overlay were used on the 5.4 mile section of highway. Tensar reduced reflective cracking more than any other treatment but was one of the least cost effective methods. The most cost effective measure was the conventional joint repair treatment (MDOT Detail 8) which was second to Tensar in reducing reflective cracking.

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Technology Transfer Unit
Materials and Technology Division
Michigan DOT
P.O. Box 30049
Lansing, Michigan 48909
Telephone (517) 322-1637