UNT UNIVERSITY OF NORTH TEXAS

PROJECT SUMMARY

Texas Department of Transportation

0-7084: Develop Improved Methods for Eliminating Striping on Roadway Surfaces

Background

Eliminating existing roadway pavement markings is a real challenge. The stripes must be ideally completely removed without causing damage to the road surface.

The most-used techniques for striping removal are flailing and hydro-blasting. These techniques result in damage to the road that can create problems for drivers, as scars of the old markings remain (ghost stripes). These scars could confuse drivers, especially at night and/or in wet weather conditions.

What the Researchers Did

The project aimed to investigate current removal techniques and to put together and test a pulsed solid state fiber laser system as an alternative method for road markings removal. Figure 1 shows the system in operation, with the laser scanner in use during a white thermo stripe ablation.

Figure 1. Laser system in operation: white thermo stripe removal from a concrete surface.

Firstly, a literature review and a national survey were conducted to understand the current state-of-the-art and industry standards regarding the removal of road stripes. The survey was prepared and disseminated to various DOT districts from different states.

Questions were focused on the following:

- pavement marking removal methods,
- frequency of use,
- removal effectiveness,
- problems of scarring and ghost marking,
- removal efficiency in terms of marking materials, pavement surfaces, and marking thickness,
- removal speed,
- cost,
- environmental and health impact,
- skill level required.

Secondly, a laser system was put together consisting of a pulsed fiber laser with a wavelength of 1064 nm and 200 W average output power, a chiller, a laser scanner, air knives, a generator, and a compressor. The system was tested in both a laboratory environment and in the field. Concrete samples made using three different white stripes types (i.e. thermo, hot tape, and paint) were tested in the lab. In addition, paint stripes were ablated

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Project Completed:
12-31-2022

from asphalt core samples.

The research team tested different laser and scanner parameters with the goal of minimizing the removal time and of optimizing the removal quality. The removal quality was evaluated by using photographs taken from samples before and after the stripe's removal and with the aid of algorithms written in Matlab.

What They Found

From both literature and survey responses it was found that flailing and water blasting methods are commonly used for road stripes removal, with flailing used more frequently than the water blasting. In general, both methods damaged more thermo stripes, which exhibited the most severe scarring, followed by paint, epoxy, and then tape. The flailing method was found to be effective for removing thick markings (over 100 mil), was cheaper, and required low level equipment and expertise compared to the water blasting method. On the other hand, the water blasting method was found to be more effective in removing stripes (on Portand cement concrete), exhibited lower scarring and ghosting, and perceived as environmental & health friendly when compared to the flailing method. However, water blasting was found to be less effective for removing thick markings, more expensive, and required higher level of equipment and expertise.

Tests conducted in laboratory and in the field using the laser equipment showed that the technique was effective to remove road markings without causing damages to the road surface. Moreover, white thermo (by truck) stripes were the easiest to be removed, followed by paint, and hot tape stripes. The removal speeds for stripes with standard width (4 inches) were 1.7 ft/min (0.0193182 miles/hr) for thermo by truck stripes, 0.065 ft/min (0.0007386 miles/hr) for paint stripes, and 0.31 ft/min (0.0035227 miles/hr) for hot tape stripes.

What This Means

The laser technique was tested as alternative techniques for removing road markings to try limiting/eliminating scars. In all tests performed, it was found that the 200W average power laser was not sufficient to produce high removal rates.

Therefore, to meet stripe removal speeds, the research team suggests that additional tests are required using hybrid methods (i.e., mechanical/ laser) and using higher power lasers. A higher power laser system (e.g., 1000W) can potentially achieve (based on initial calculations) removal speeds of ~53 ft/min (0.60 miles/hr) for thermoplastic stripes and 44.6 ft/min (0.51 miles/hr) for the hot tape stripe. These are removal speeds similar to those of the flailing and water blasting methods. Moreover, a calculated speed of 158 ft/min (1.79 miles/hr) for the paint stripe could be reached, which is three times the current speed from the aforementioned methods. On the other hand, the potential pitfall of using a higher power laser would be higher light scattering from the embedded glass beads, and further studies should be performed.

For More Information

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Keyword: Research