



**Subsurface
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**SUBSURFACE SENSING LAB
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Project Summary Report

Project 0-4882-S: Develop Pushcart and Vehicle-mount Laser
Thickness-Measuring Devices for Thermoplastic Pavement
Marking Material

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**Develop Pushcart and Vehicle-Mount Laser
Thickness-Measuring Devices for Thermoplastic
Pavement Marking Material:
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PROJECT SUMMARY REPORT

Based on the research results in Projects 0-4282, lightweight in compact size pushcart and vehicle-mount laser thickness-measurement devices have been successfully developed. The Length, Width, and Height, which are 42.5 inches, 29 inches, and 47 inches in the old pushcart version, were reduced to 28 inches, 15 inches and 37 inches in the new pushcart version, respectively. The weight is only half of the old version. The new pushcart is easy to be handled by one person to do routine project monitoring practice.

To increase the TPMM thickness measurement speed, a prototype of vehicle-mount laser thickness measurement system is also developed. Two synchronized laser devices are installed onto a golf cart. The tape thickness is obtained by processing the output signals from the two laser devices. The results of the



Figure 1. Pushcart version of TPPM device in filed application on FM 2761





Figure 2. Mobile version of TPMM device in filed tests on Spur 5 near I45 in Houston



Figure 3. TPMM material over aggregates on FM 2761.

lab and field tests of the vehicle-mount devices are very close to real thickness of thermoplastic.

An auto-synchronized laser scanning for the 3D measurement of the TPMM thickness is also pursued. The

optical simulation and some initial tests show that this new method with high speed laser scanning makes a highway speed vehicle-mount TPMM thickness measurement feasible.

What We Did ...

The pushcart version of the TPPM thickness measurement devices is shown in Figure 1 and Figure 2 shows the vehicle mount version.

The new pushcart TPMM thickness measurement device is composed of three subsystem: the laser scanning subsystem, laser range finder subsystem, and power supply subsystem. The vehicle-mount device can operate up to 15 miles/hr to measure TPPM thickness. Thickness measurement accuracy of both devices can reach 5 mils.

What We Found...

The pushcart TPMM thickness measurement device was tested on FM2761 near Sealy off I10 West several times.

The pavement surface of FM2761 is rather rough as shown in Figure 3. It can be clearly seen that the TPMM materials are partially flowed into the porous aggregates resulting in the reduction in overall thickness over the pavement. Figure 4a shows the measured thickness data over the pavement before processing in one cross-sectional scan over the tape. Due to the size of aggregates, the TPMM are not reflected in the measured clearly. Figure 4b is the results after processing. The shape of the tape can be clearly seen and the thickness of the TPMM can be easily found. Using the reflectivity indicator signal, the computer program can easily identify TPPM tape covered areas from pavement aggregates. By applying data processing, the TPMM thickness are found to be 85 mils on the section of FM2761.



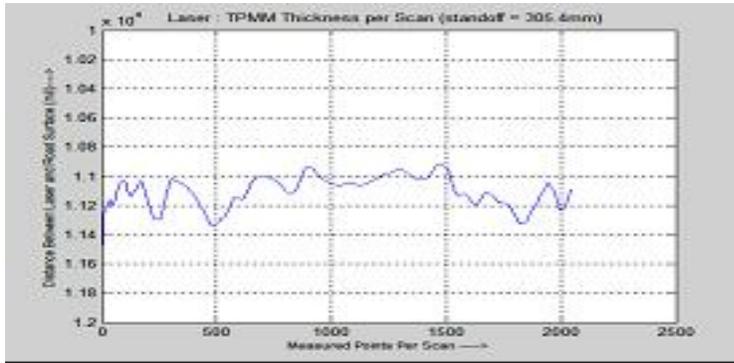


Figure 4a. Measured thermoplastic thickness data on FM2761 before data processing

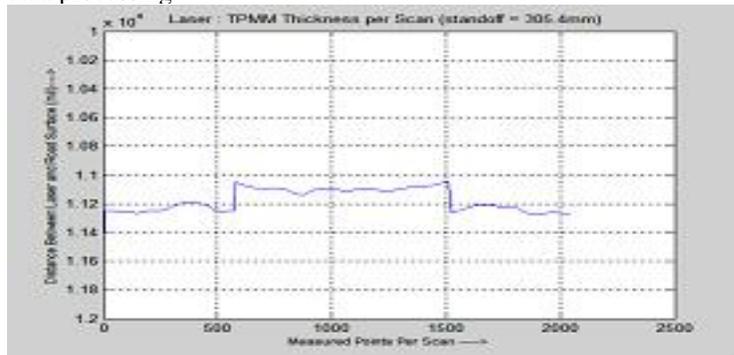


Figure 4b. Measured thermoplastic thickness data on FM2761 after data processing

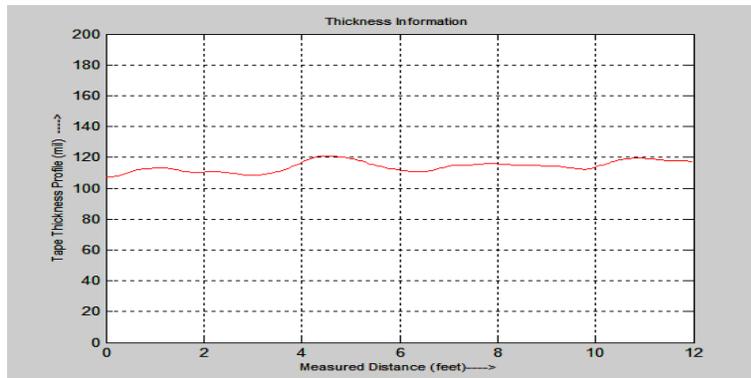


Figure 5a. Measured TPMM thickness of 100 mils yellow tape by mobile device

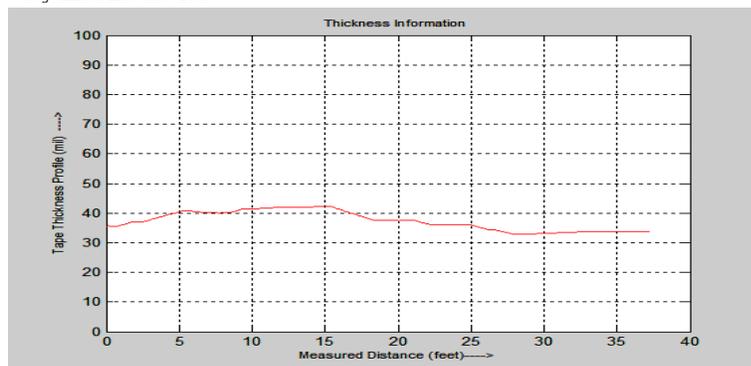


Figure 5b. Measured FLEX_O_LINE thickness of 30 mils tape by mobile device

The field-test of the vehicle-mount TPPM thickness measurement device were conducted on Spur 5, off I45 near Houston Downtown on October 17, 2004. Self-attachable TPMM tapes were used for the tests. Two types of TPMM tapes were used: 12 feet long, 100 mil thick regular tape and 30 feet long FLEX_O_LINE thin tape. After data processing, the thickness profile of the normal thermoplastic tape is plotted in Figure 5a. Figure 5b is the thickness profile of FLEX_O_LINE. Note that the measured thickness a bit over the tape thickness due to the partial contact of the tape to the pavement surface.

The Researchers Recommend...

- Lightweight in compact size pushcart version is easy to use, but it is suitable for heavy duty use;
- Successfully developed golf cart mount version verifies the vehicle-mount, non-contact TPPM thickness measurement concept;
- Further tests should be done to improve the operation speed;
- Further research on auto-synchronized laser scanning for 3D measurement of the TPPM thickness will make the highway speed vehicle-mount device feasible;



For More Details...

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