

AASHTO TIG Project

Implementation of Ground Penetrating Radar Technology for Pavement Evaluation

Proposed by: TxDOT

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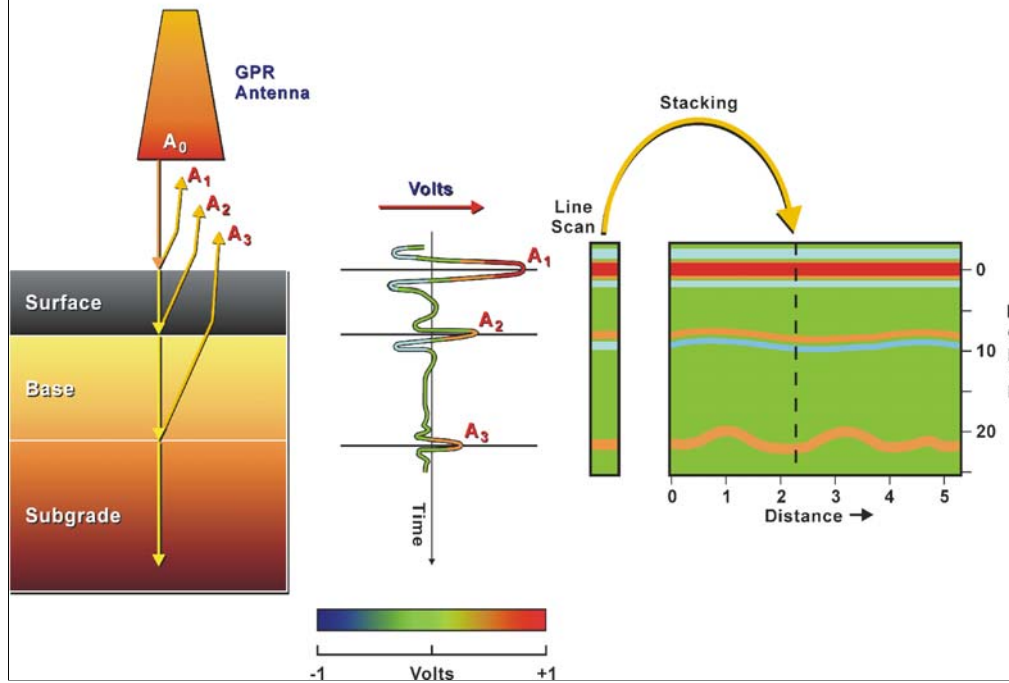
TxDOT's Ground Penetrating Radar Unit

- Research started 1989
- Implementation 1995
- Data collection and processing systems developed by TxDOT
- Integrated Video
- Data collected at highway speed (60 mph)
- Effective depth of penetration 20 ins
- TxDOT has 5 available units (Austin, FW, TTI, 2 under development)



TxDOT vehicle with Pulse Radar antenna -- Camera also video tapes highway. During processing it is possible to look at both surface distresses (video) and subsurface causes (GPR).

Principles of Ground Penetrating Radar



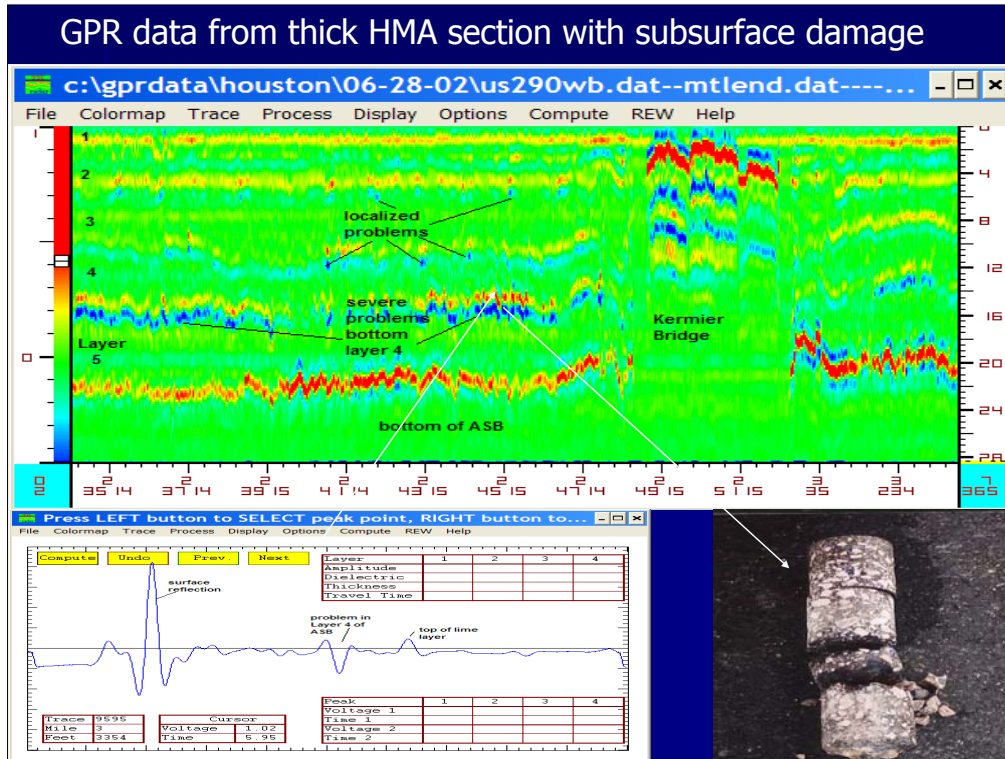
GPR transmits and receives up to 50 pulses per second. Transmitted wave is reflected at each layer interface, the amount of the energy reflected is primarily a function of moisture content and density. The captured data is an X-Y plot of amplitude against arrival time. To conveniently display many of these traces a color coding scheme is used to convert this into a color display. This is analogous to looking at an X-Ray of the pavement section.

Successful GPR Applications for Flexible Pavements

- Thickness of Pavement Layers
- Defects in Hot Mix layers (stripping, trapped moisture)
- Defects in Base (Wet areas)
- Pavement Rehabilitation studies (identifying changes in structure)
- Identifying areas of segregation and poor joint density

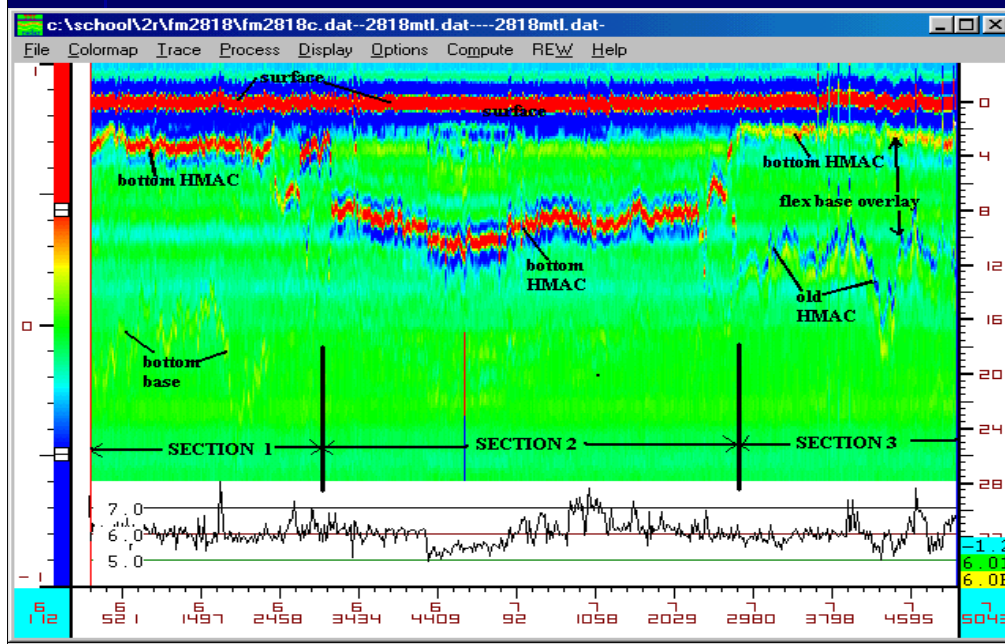
Limited success on concrete pavements

Does not work everywhere - oversold in some cases



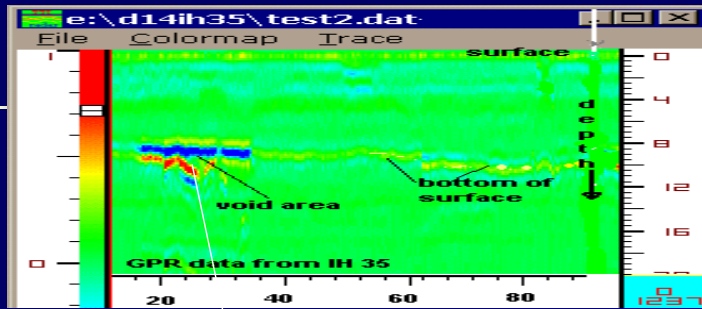
Case study from a thick hot mix pavement in Texas with severe problems withing the hot mix layer. This is shown in the GPR trace as a negative reflection, and in the color display as blue areas. GPR can locate this problem and say how deep is it beneath the surface.

Identifying section breaks with GPR



This is an important application of GPR within TxDOT. Finding changes in section within a rehabilitation project. On the surface of this everything looked identical. But from the GPR it is clear that there are 3 different structures. To summarize GPR is used to get NO SURPRISES in our projects.

Use of GPR to detect major washout on IH 35 Austin Texas, March 2002



SAFETY
APPLICATION

WATER MAIN BREAK UNDER INTERSTATE

GPR was used to test this section after a major water main break. Traffic was driving over the section. However the GPR showed major problems as indicated by the upper figure. The blue areas indicate areas where the base has been washed out. This section was closed and collapsed itself overnight. No one was hurt.

Keys to TxDOT success

Long term support of both development and implementation efforts

1. what works and what does not
2. equipment specifications
3. data acquisition software
4. data processing software
5. training programs

Long term funding through TxDOT's research program has been key to the successful implementation of this technology.

Objectives of TIG project

- Expand use of GPR to other DOT's
 - Non contact (high speed) systems
 - Pavement Rehab applications
 - Via in-house or consultant efforts
- Convince upper management of benefits (videos/CD's)
- Provide training for pavement specialists (workshops/demo projects)

TIG Panel Members

- Carl Bertrand TxDOT Chairman
- Bouzid Choubane FDOT
- Marc Loken MnDOT
- Bruce Vandre UDOT
- Jack Springer FHWA
- Tom Scullion TTI

All of these DOT's have active interest in GPR. Florida and Minnesota have purchased their own equipment.

Elements of Proposed Work Plan

- Technology Transfer
 - Videos
 - Brochures
 - Workshops
- Procurement specifications
- Operating Protocols
- Training and Certification programs

Schedule (Approved)

- Panel Coordination meeting
 - March 2003 in Austin Texas
 - Finalized/revised work plan based on AASHTO comments
- Presentations at Conferences
- Preparation of presentation materials

Details to be resolved

- Executive Level Videos
- Executive level Brochures
- Engineering level CDs
- Workshop development
- How to overcome barriers to implementation

These will be discussed at the meeting in Texas.

Barriers to Implementation

- FCC/NTIA Restrictions
 - GPR classed as UWB transmitter
 - Concerns from DOD and FAA
 - Rules are being reviewed by Congress
 - Action by AASHTO
- Negative Image within many DOT's
 - Tried it – doesn't work

Imitating Ken Fults (5 golden rules from East Texas)

- Don't kick cow chips on a hot day.
- Don't slap a man chewing tobacco.
- Don't squat with your spurs on.
- When you are out ahead of the herd, look back occasionally to make sure they are still following.
- Don't ever miss a chance to shut up.