Ohio Research Institute for Transportation and the Environment

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WAY-30 Instrumentation

US 30 Bypass of Wooster, Ohio
Test Section at Geyer’s Chapel

Test Section at Sta 664+00

West End Tie-In
Test Section at McQuaid Road

Weather Station
Test Section, STA 876+60
McQuaid Rd Overpass
WAY-30 Project Background

Research Objectives for ORITE and OPE

- The WAY-30 bypass consists of 3 research projects:
  - Assessment of the perpetual pavement concept for asphalt concrete.
  - Determination of mechanical properties of materials used.
- These projects, designed by ODOT, will incorporate new and innovative design procedures, specifications, test procedures, and construction techniques.
Project Objectives

- Review design procedures used by ODOT.
- Develop comprehensive instrumentation plans to monitor environmental and load response parameters.
- Monitor dynamic responses of the pavement structure during non-destructive testing and controlled vehicle tests.
- Determine mechanical properties of the pavement materials used during construction and in-service.
- When the projects are completed, the Office of Pavement Engineering (OPE), with information provided by ORITE, will be able to achieve the strategic goals of developing design procedures for these long life pavements.
Benefits of Research

• Data obtained can be used to validate current pavement analysis procedures and develop new design procedures and models.

• Longer lasting pavements will reduce traffic congestion, user delays, and life-cycle costs.

• Mechanical properties and other data can be used on two other ODOT research projects.
Instrumentation Plan

- ORITE’s instrumentation plan will monitor environmental and response parameters in each pavement type.
- Instruments will be purchased and calibrated, then installed during the construction process.
- Environmental parameters to be monitored in only one section of each pavement type.
- Dynamic load responses will be collected in duplicate sections.
Instrumentation Schedule

Environmental Parameters

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>LAYERS</th>
<th>MANUFACTURER</th>
<th>SENSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Pavement, Base and Subgrade</td>
<td>Measurement Research Corp.</td>
<td>MRC Thermistor</td>
</tr>
<tr>
<td>Moisture</td>
<td>Base and Subgrade</td>
<td>Campbell Scientific, Inc.</td>
<td>TDR Probes</td>
</tr>
</tbody>
</table>

Automatic weather station installed to collect data related to air temperature, precipitation (rain and snow), wind speed and direction, relative humidity, and incoming solar radiation.
## Instrumentation Schedule

### Asphalt Concrete Test Sections

### Response Parameters

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>PARAMETERS</th>
<th>MANUFACTURER</th>
<th>SENSOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>Load Response and Seasonal Response</td>
<td>Macro Sensors</td>
<td>Macro Sensors LVDTs (Linear Variable Displacement Transducer)</td>
</tr>
<tr>
<td>Pressure</td>
<td>Load Response and Seasonal Response</td>
<td>Geokon Inc.</td>
<td>Geokon 3500 Pressure Cell</td>
</tr>
<tr>
<td>Strain</td>
<td>Longitudinal and Transverse Strain</td>
<td>Dynatest</td>
<td>Dynatest PAST II Strain Transducer</td>
</tr>
</tbody>
</table>
LVDTs and Pressure Cells

- Shallow LVDTs will monitor displacement above the subgrade.
- Deep LVDTs will monitor the total displacement in the pavement system.
- This combination of LVDTs help distinguish the movement between the subgrade and base.
- Two pressure cells will measure the vertical pressure applied to the base as a measure of support in each section.
- Strain gages are placed in the wheel path of varying layers to measure transverse and longitudinal strain during controlled vehicle testing.
Subgrade Instrumentation

Drilling of Deep LVDT rods and TDRs

TDR Installation
LVDT Preparation

LVDT stakeout after initial survey

Core drilling LVDT pits
TDR Probes and Pressure Cells

TDR Probes at various depths

Pressure cells aligned in AC wheel path
LVDT Preparation

Deep and shallow LVDT references
Strain Gage Installation
Strain Gage Installation
Strain Gauge Installation

Large aggregate is removed by sieve, then asphalt is placed over gages prior to paving.
Strain Gauge Installation
Strain gauge Installation
Strain gauge Installation
Strain Gauge Installation
Strain Gauge Installation
Testing

Asphalt Concrete Sections

- Dynamic Cone Penetration and Falling Weight Deflectometer testing performed on base and subgrade prior to paving. FWD performed twice per year after completion.
- Dynamic strain response and pressure readings collected for speeds of 5 – 50 mph during controlled testing.
- Deflection also monitored during controlled testing.
WAY-30 FRL Strain Response

5 mph Test: ODOT 28.2 Kip Single Axle Truck

Longitudinal Strain

Time (sec)

Strain (ue)
WAY-30 LVDT Response

5 mph Test: ODOT 40 Kip Tandem Axle Truck

Deep References
WAY-30 Pressure Cell Readings

5 mph Test: ODOT 40 Kip Tandem Axle Truck

![Diagram of pressure cell readings showing time (sec) on the x-axis and pressure (PSI) on the y-axis, with sections A and B indicated.]
AC Segregation
AC Segregation
AC Section Removal
AC Section Removal
AC Section Removal
Rutting