TYPE IL CEMENT CASE STUDY
I-40 PORT OF ENTRY - BECKHAM COUNTY, OKLAHOMA

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Introduction

This case study reviews the impacts of using Type IL cementitious concrete in a port of entry facility built in 2012. The I-40 Port of Entry Facility Project in Beckham County, Oklahoma, was the first known application of Type IL cement for the Oklahoma Department of Transportation. The investigation demonstrated that the concrete pavement utilizing Type IL cement has performed as well as a concrete pavement utilizing Type I cement, with no reported differences in mixing, placing, or finishing.

Pavement Details

The Beckham County port of entry (POE) facility was the second port of entry facility constructed in the state of Oklahoma and the first project to use Type IL cement for the Oklahoma Department of Transportation. It is one of nine facilities currently in service. The facility is located 1.75 miles east of the Texas state line on I-40. The facility houses truck parking and scales, an enclosed inspection bay, a water storage tank, and sewer lagoons. Figures 1 and 2 show the location of the facility.

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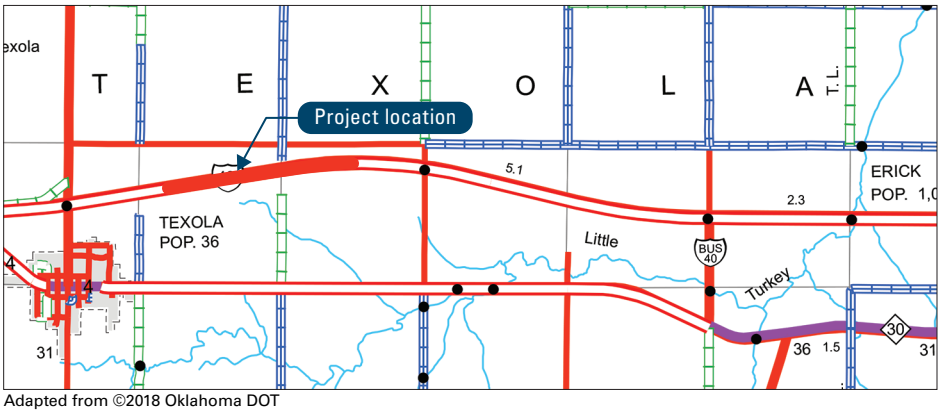
Figure 1. General location map



Adapted from ©2018 Oklahoma DOT

Figure 2. Magnified location map

The Beckham County POE facility was completed in June of 2012. The typical parking and ramp sections consist of a 12.5 in. Type IL portland cement concrete pavement. This pavement was placed on a 4 in. thick cement-treated base separated by a 15 oz nonwoven fabric on top of compacted subgrade. Originally, the project was to include fly ash for soil stabilization. However, high-sulfate soils were discovered on site. Therefore, a change was made to eliminate the fly ash stabilization and add 1 in. thickness to the concrete pavement. Figures 3 through 6 show typical pavement sections.

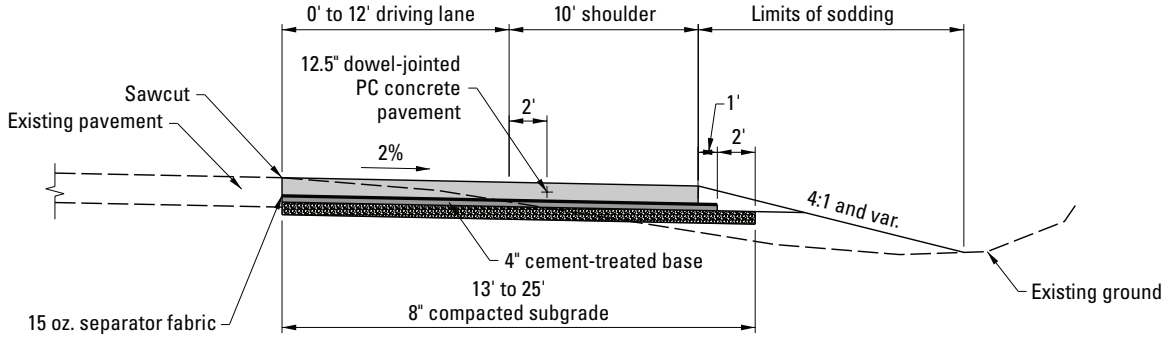


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Figure 3. Pavement typical section no. 1 – ramp section

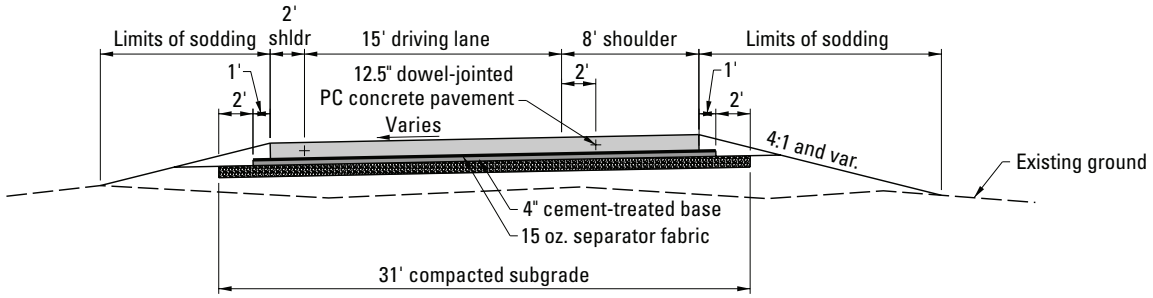

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Figure 4. Pavement typical section no. 2 – ramp section

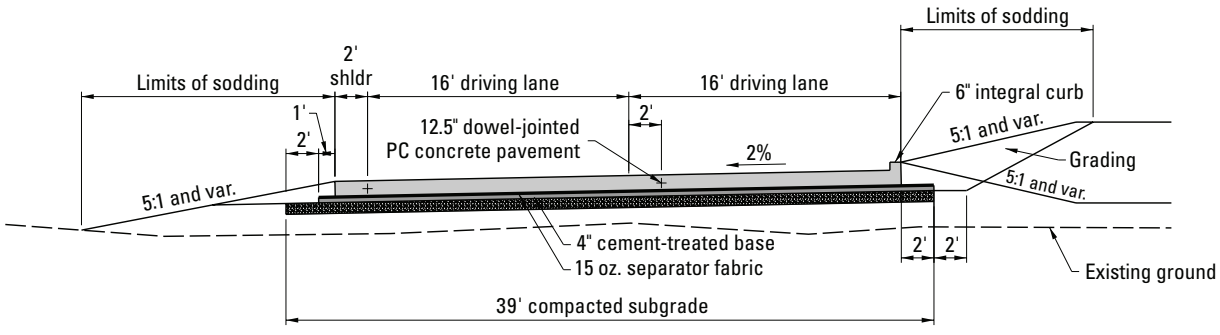

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Figure 5. Pavement typical section no. 3 – ramp section

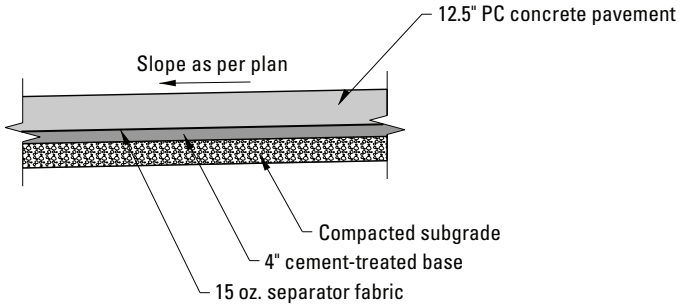

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Figure 6. Pavement typical section no. 4 – parking section

Concrete Mixture

Details of the materials used in the mixture are shown in Table 1.

Table 1. Concrete mix design

Material	Source	Proportions
Type IL cement	Holcim, Ada, OK	439 lb/yd³
Class C fly ash	Lafarge, Amarillo, TX	78 lb/yd³
Coarse aggregate - #57 stone (Figure 7)	Dolese Cooperton Quarry, Mountain View, OK	1,982 lb/yd³ at SSD
Fine aggregate - C33 river sand (Figure 8)	Kline Materials, Woodward, OK	1,285 lb/yd³ at SSD
Water	Local potable water	194 lb/yd³
Admixture (AEA)	Master Builders Solutions	6.8 oz

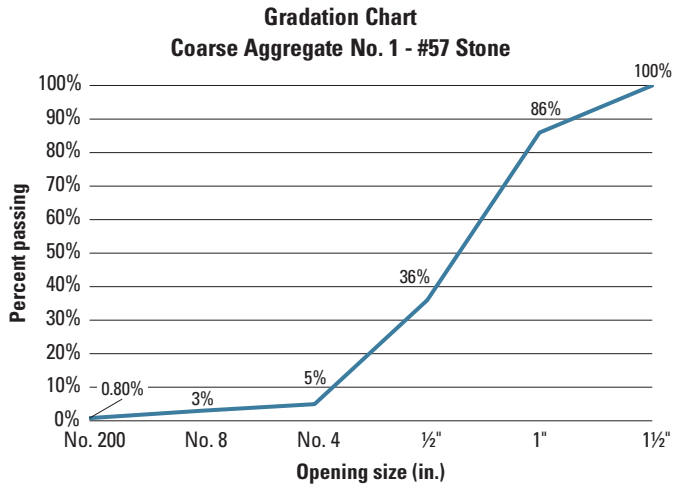

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Figure 7. Coarse aggregate

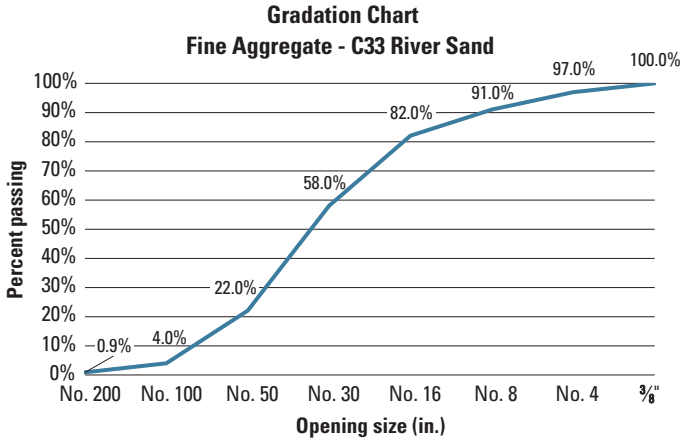

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Figure 8. Fine aggregate

Concrete Placement

Construction of the 50,000 yd² facility occurred in 2012 during the months of March and April.

The subgrade was compacted and covered by a 4 in. layer of cement-treated base (CTB). A nonwoven, 15 oz/yd² separation fabric was placed on top of the CTB with nails. A central plant was used to prepare the concrete, which was delivered to the site by dump truck. Dowel baskets were placed on grade prior to paving. The subgrade was marked with spray paint at the dowel bar basket locations.

Placement of the 12.5 in. thick, plain jointed, dowelled concrete was conducted using a Rex slipform paver (Figures 9 and 10). The curb was placed by a Commander III or slipformed monolithically accompanied by miscellaneous hand-forming.

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Figure 9. Slipform paving – front of paver

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Figure 10. Slipform paving – finishing and hand-floating

The concrete was finished with a burlap drag followed by hand-floating and tining (Figure 11). Curing compound was placed by means of a hand sprayer (Figure 12). Finally, early-entry sawcutting provided ⅛ in. wide and 1½ in. deep saw cuts spaced transversely at 15 ft intervals. Joints were not sealed.

No issues were reported in the placement and workability of the mixture using Type IL cement, and observed hydration and hardening rates were similar to those of Type I cement used in the past.

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Figure 11. Surface tining

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Figure 12. Curing compound application

Testing

Samples for testing were taken every 500 yd³ while thickness was verified by coring. Test data are summarized in Table 2.

Table 2. Average concrete properties during construction

Air	5.5%	
Slump	1.5 in.	
7-day strength	4,400 lb/in.²	Standard deviation – 707 lb/in.²
28-day strength	5,340 lb/in.²	Standard deviation – 754 lb/in.²
Ambient air temperature	50°F–70°F	
Mix temperature	60°F–80°F	

Performance

The facility has received loading from an estimated 70,900 trucks from 2013 through 2022 based on the annual average daily traffic (AADT) of Interstate 40 and using a truck percentage of 53%.

Upon inspection in February of 2024, only minor pavement distress was observed, including minor joint raveling and spalling, corner cracking, and one location with inconsistent surface texture. The distresses accounted for less than 0.5% of the project area (Figures 13 and 14). The only significant repair included a section at the exit of the inspection station caused by a washout from a water leak. Pavement markings are scheduled to be repainted in 2024.

Closing

A port of entry facility was built adjacent to I-40 in Oklahoma in 2012 using Type IL cement. The contractor reported no significant differences in the batching, placement, or finishing of the concrete, and the pavement is performing well under heavy truck traffic (Figures 15 through 17).

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Figure 13. Corner joint spalling

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Figure 14. Surface texture inconsistency

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Figure 15. Finished pavement showing joint condition (2024)

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Figure 16. Completed project showing pavement markings (2012)

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Figure 17. Finished pavement surface (2024)

About the National Concrete Pavement Technology Center

The mission of the National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University is to unite key transportation stakeholders around the central goal of developing and implementing innovative technology and best practices for sustainable concrete pavement construction and maintenance.