

# **FREEZE-THAW DURABILITY TESTING OF OVERSANDED BRIDGE FLOOR CONCRETE**

**Final Report  
For  
MLR-95-5**

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**Project Development Division**



**Iowa Department  
of Transportation**

Final Report for MLR 95-5

**FREEZE-THAW DURABILITY TESTING OF  
OVERSANDED BRIDGE FLOOR CONCRETE**

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8. ABSTRACT

Due to an equipment malfunction, too much sand was used in the concrete on the bridge floor placed on August 9, 1994 in Washington County, project No. BRF-22-2(36)38-92. Freeze-thaw durability testing of cores taken from the concrete in question and the other two concretes not in question was performed. The experimental results indicate that the concrete in question is considered at least as durable and resistant to freeze-thaw damage as the concretes which are not in question. The concrete in question can be expected to function properly for the regular service life of the bridge.

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**Freeze Thaw Durability Testing of Oversanded Bridge Floor Concrete**

*(BRF-22-2(36)--38-92, Design 1692, Washington County)*

by Chengsheng Ouyang

May 22, 1995

**INTRODUCTION**

Due to an equipment malfunction too much sand was used in the concrete on the bridge floor placed on August 9, 1994 in Washington County, project No. BRF-22-2(36)38-92. Contractor for the project was Iowa Bridge & Culvert, and the concrete was supplied by Wilson Concrete in Washington. To check whether or not the presence of the excessive sand in concrete may affect durability of the bridge, four beam samples listed in Table 1 were sent to the Central Materials Laboratory for durability test. Samples SDL4-468 and SDL4-478 were taken when the concrete in question was being placed. The 9-day modulus of rupture is 695 psi for SDL4-468. For control, two samples were also taken when concrete not in question was being placed. Those placements were from the same concrete source as the concrete in question using all the same material ingredients and in close time proximity to the placement of the concrete in question. Sample SDL4-479 was from a bridge constructed by Iowa Bridge & Culvert placed on August 21, 1994. Sample 5SD4-24 was from a bridge constructed by Division Contractors Co. placed on September 8, 1994.

To test durability of the concrete, two 4 in. cores were taken from each beam. These cores were then subjected to ASTM C 666 freeze and thaw cycling after soaking in room temperature water for 90 days. Both expansion and pulse velocity were measured during the cycling.

## **RESULTS**

The obtained results are listed in Table 1 and plotted in Figures 1-4.

The measured expansion and pulse velocity for the concrete in question, samples SDL4-468 and SDL4-478 are plotted in Figures 1 and 2 against the number of freeze-thaw cycles. The cores taken from the beams failed after 350 cycles for SDL4-468 and 410 cycles for SDL4-478. Here the failure of the cores was characterized by the fact that no stable reading can be made for the pulse velocity measurement. Additionally, visible cracking is readily apparent. The average freeze-thaw life of the cores taken from two concretes in question is 380 cycles.

The results for the concrete not in question, samples SDL4-479 and 5SG4-24 are shown in Figures 3 and 4, respectively. The cores from SDL4-479 failed after 221 cycles, whereas the cores from 5SG4-24 failed after 499 cycles. As previously discussed, the average freeze-thaw life of the cores taken from the concrete in question is 380 cycles. This is in the range of 221 and 499 cycles for the concretes not in question.

## CONCLUSIONS AND RECOMMENDATIONS

Based on these results and on the limitations of the testing, the concrete in question is considered at least as durable and resistant to freeze-thaw damage as the concretes which are not in question. The concrete in question can be expected to function properly for the regular service life of the bridge.

We suggest that the concrete in question be considered reasonably acceptable in accordance with 1105.04 based on results of these tests, and that an appropriate price reduction be determined to compensate the project for the reduced cement factor.

**Table 1 List of Samples and Results**

Sender No.	In question?	Contractor	Concrete supplier	Core No.	Freeze-thaw life (cycles)
SDL4-468	Yes, too much sand	Iowa Bridge & Culvert	Wilson Ready-Mix	1	350
				2	350
SDL4-478	Yes, too much sand	Iowa Bridge & Culvert	Wilson Ready-Mix	3	410
				4	410
SDL4-479	No	Iowa Bridge & Culvert	Wilson Ready-Mix	5	221
				6	221
5SG4-24	No	Division Contractors	Wilson Ready-Mix	7	499
				8	499

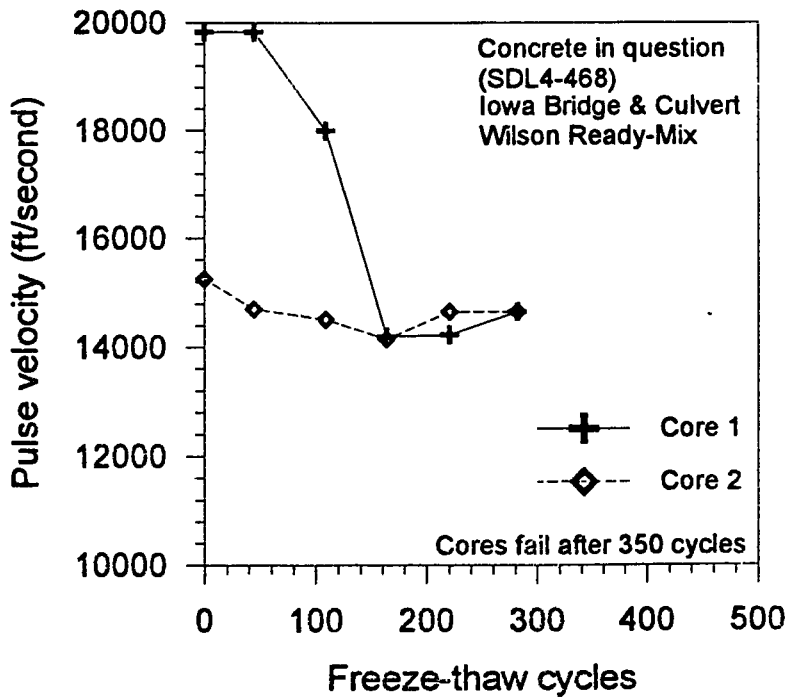
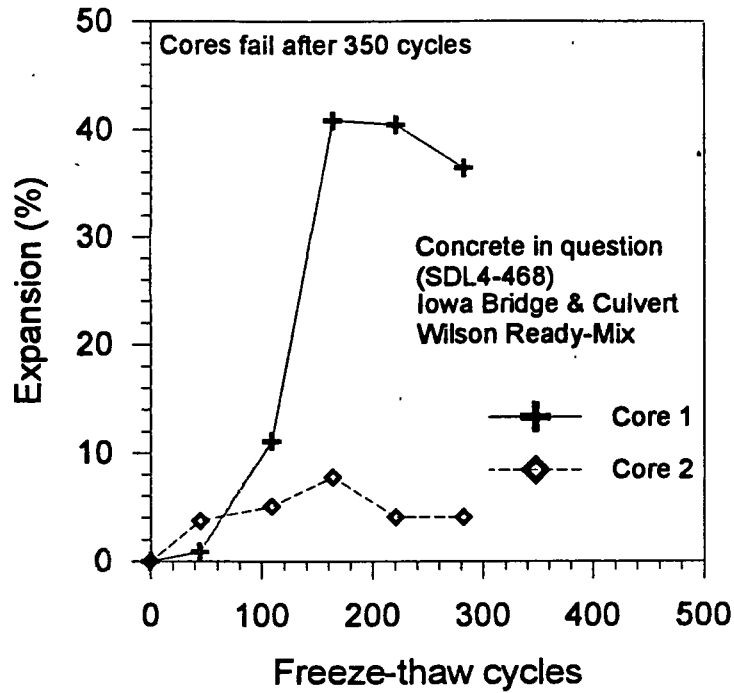


Fig. 1 Concrete in question, Iowa Bridge & Culvert, Wilson Ready-Mix  
Project No. BRF-22-2(36)--38-92



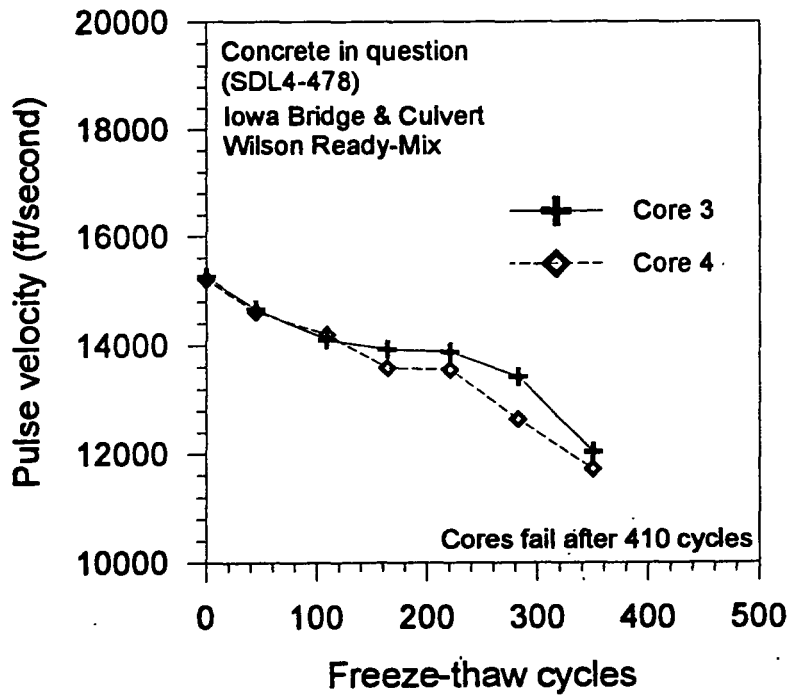
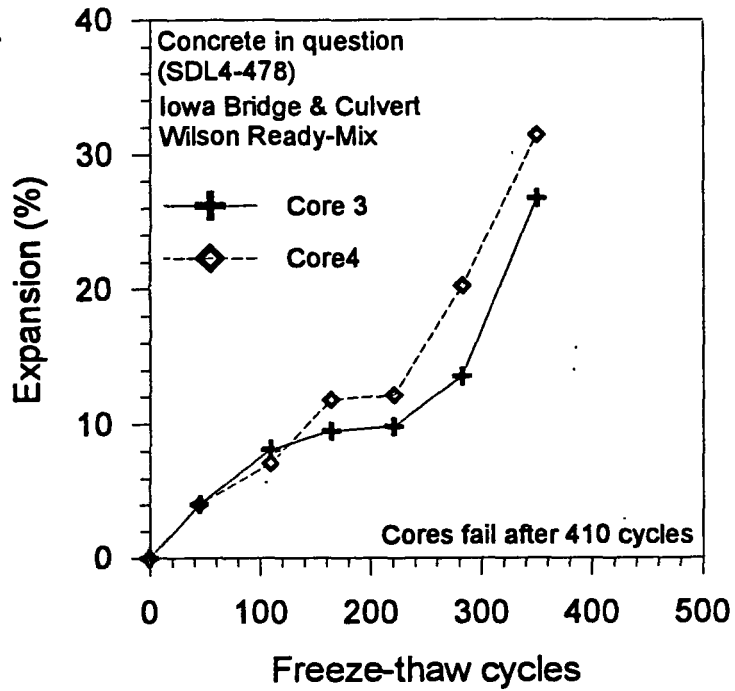


Fig. 2 Concrete in question, Iowa Bridge & Culvert, Wilson Ready-Mix  
Project No. BRF-22-2(36)--38-92

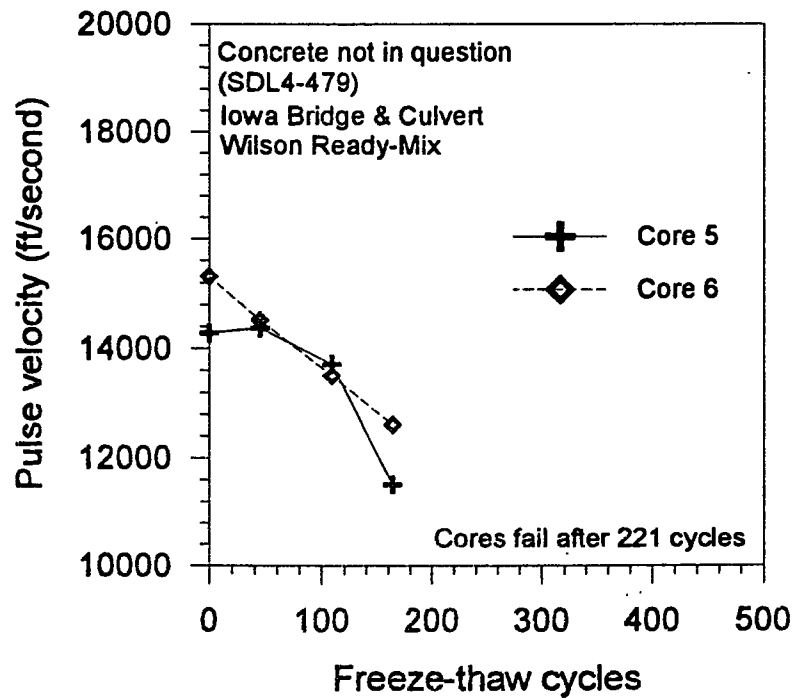
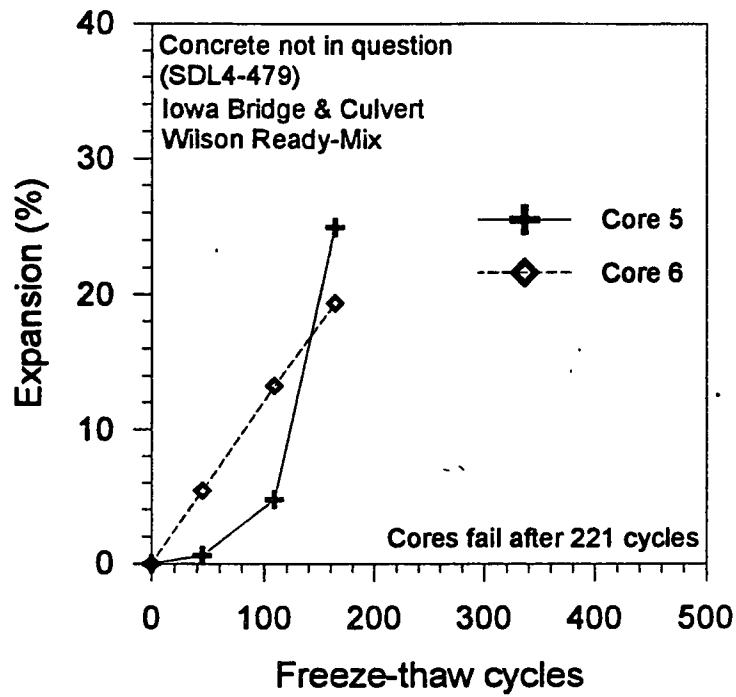


Fig. 3 Concrete not in question, Iowa Bridge & Culvert, Wilson Ready-Mix  
Project No. BRF-22-2(35)--38-92

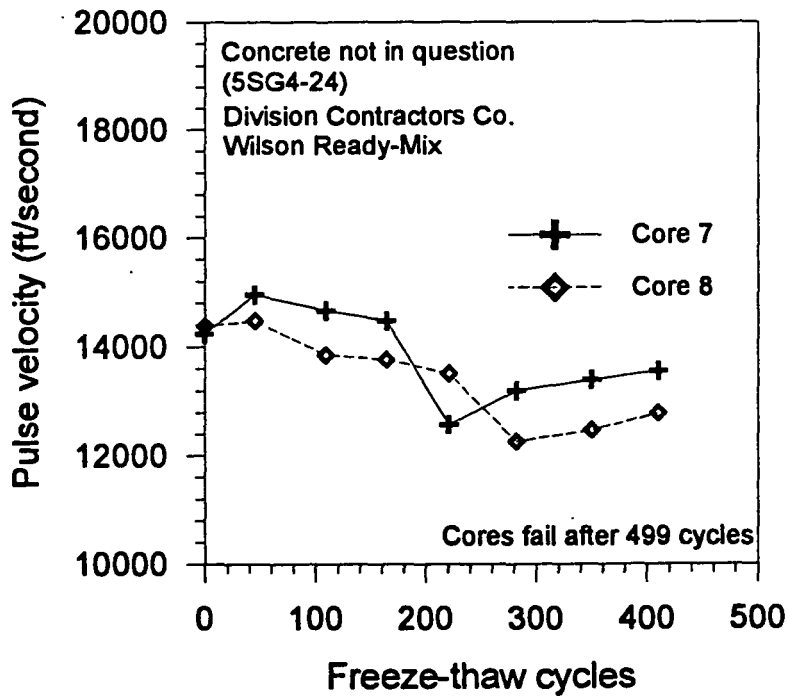
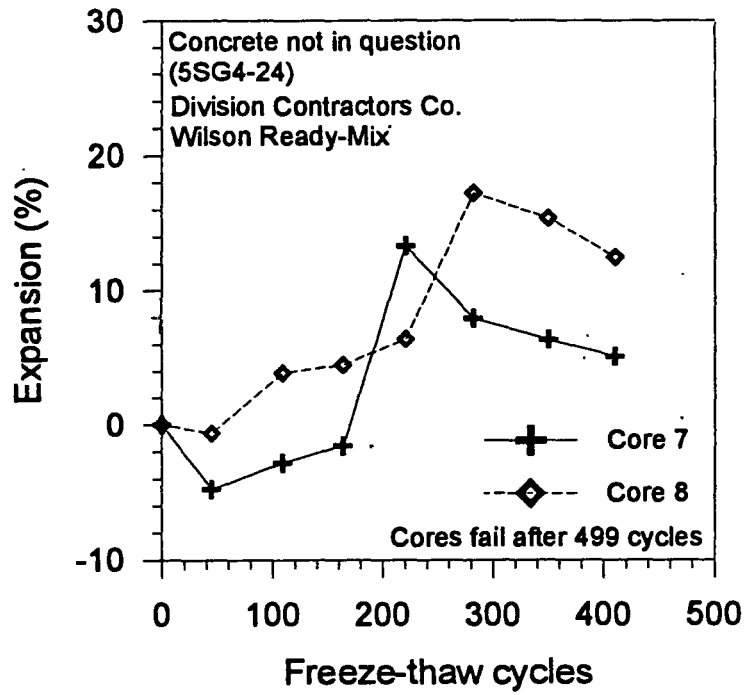


Fig. 4 Concrete not in question, Division Contractors Co., Wilson Ready-Mix  
Project No. BRF-218-3(32)-38-92