Slab representing cross section through top half of pavement, after treatment to enhance air voids and cracks, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-11, tie marks every half inch.
Slab representing cross section through bottom half of pavement, as polished, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-11, tic marks every half inch.
Slab representing cross section through bottom half of pavement, after sodium cobaltinitrite stain, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-11, tic marks every half inch.
Slab representing cross section through bottom half of pavement, after treatment to enhance air voids and cracks, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-11, tic marks every half inch.
Slabs representing full cross section through pavement, as polished, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every inch.
Slabs representing full cross section through pavement, after sodium cobaltinitrite stain, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every inch.
Slabs representing full cross section through pavement, after treatment to enhance air voids and cracks, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tie marks every inch.
Slab representing cross section through top half of pavement, as polished, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every half inch.
Slab representing cross section through top half of pavement, after sodium cobaltinitrite stain, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every half inch.
Slab representing cross section through top half of pavement, after treatment to enhance air voids and cracks, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tie marks every half inch.
Slab representing cross section through bottom half of pavement, as polished, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every half inch.
Slab representing cross section through bottom half of pavement, after sodium cobaltinitrite stain, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every half inch.
Slab representing cross section through bottom half of pavement, after treatment to enhance air voids and cracks, WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-12, tic marks every half inch.
Appendix A
I-696 Core Site

WB I-696, constructed 1978, at transverse joint, core A, MTU ID 696-05

Data Analysed - 9/19/6 at 12:16
Operator Name - Matt
Sample ID - 696-5

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Results

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WB I-696, constructed 1978, at transverse joint, core B, MTU ID 696-07

Data Analysed - 9/18/6 at 14:34
Operator Name - Matt
Sample ID - 696-7

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WB I-696, constructed 1978, away from transverse joint, core D, MTU ID 696-01

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I-696, constructed 1995, at transverse joint, core A, MTU ID 696-06

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WB I-696, constructed 1995, at transverse joint, core B, MTU ID 696-08

Data Analysed - 9/12/6 at 17:31
Operator Name - Matt
Sample ID - 696-8

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WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-04

Data Analysed - 9/6/6 at 15:3
Operator Name - Matt
Sample ID - 696-4

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I-696, constructed 1995, away from transverse joint, core D, MTU ID 696-03

Data Analyzed - 8/22/6 at 12:9
Operator Name - Matt
Sample ID - 696-3

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| Results                                        |             |          |         |
| Air vol%                                       | 5.8         | 2.6      | 4.2     |
| Paste vol%                                     | 27.4        | 34.8     | 31.1    |
| Aggregate vol%                                 | 66.8        | 62.6     | 64.7    |
| Secondary Phase vol%                           | 0.0         | 0.0      | 0.0     |
| Spacing Factor (mm)                            | 0.252       | 0.185    | 0.229   |
| Paste/Air ratio                                | 4.74        | 13.48    | 7.44    |
| Specific Surface (mm^2/mm^3)                   | 17.9        | 39.1     | 24.3    |
| Void Frequency (voids/m)                       | 256         | 251      | 254     |
| Average Chord Length (mm)                      | 0.223       | 0.102    | 0.165   |
I-696, constructed 1995, at transverse joint, core A, MTU ID 696-09

Data Analysed - 6/5/7 at 16:21
Operator Name - Matt
Sample ID - 696-9

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WB I-696, constructed 1995, away from transverse joint, core C, MTU ID 696-11

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I-696, constructed 1995, away from transverse joint, core D, MTU ID 696-12

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### Results

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Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-06.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrile stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-03.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, top half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Appendix A
I-696 Core Site

Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrile stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09. Note voids in slag aggregate particle filled with alkali-silica reaction product.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, at transverse joint, bottom half of core A, MTU ID 696-09.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitritre stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Appendix A
I-696 Core Site

Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and nearby air void filled with reaction product, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core C, MTU ID 696-11.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and adjacent voids filled with reaction product, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, top half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Alkali silica reaction in fine aggregate and associated cracking, before and after sodium cobaltinitrite stain, polished slab from I-696, constructed 1995, away from transverse joint, bottom half of core D, MTU ID 696-12.
Example of chert particle exhibiting alkali-silica reaction without any associated cracking, from thin section prepared from core from I-696, constructed 1978, at transverse joint, MTU ID 696-07. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting alkali-silica reaction with minor cracking within particle, from thin section prepared from core from I-696, constructed 1978, at transverse joint, MTU ID 696-07. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting deleterious alkali-silica reaction, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-03. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting deleterious alkali-silica reaction, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-03. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting deleterious alkali-silica reaction, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-03. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting deleterious alkali-silica reaction, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-03. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example secondary ettringite in entrained air voids, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-03. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Example of chert particle exhibiting deleterious alkali-silica reaction, from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-12. From top to bottom: transmitted light, crossed-polars, and epifluorescent mode images.
Epifluorescent mode (left) and transmitted light (right) images at transition between zone of abundant entrained air and zone without entrained air at a depth of approximately 3 inches (75 mm). Example from thin section prepared from core taken from I-696, outside lane, away from joint, MTU ID 696-03.
Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1978, away from transverse joint, MTU ID 696-01 (each individual frame measures 2.612 x 1.959 mm).
Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1978, away from transverse joint, MTU ID 696-01, after masking out air voids and fine aggregate to isolate cement paste (each individual frame measures 2.612 x 1.959 mm).
Average cement paste pixel intensities per frame, and equivalent w/c values (as compared to 28-day moist cured mortar samples) from thin section prepared from core from I-696, constructed 1978, away from transverse joint, MTU ID 696-01.

<table>
<thead>
<tr>
<th>cement paste pixel fluorescence measurements (average intensity per frame)</th>
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<tr>
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<table>
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<tr>
<th>equivalent w/c ( y = 0.0044x + 0.0329 )</th>
<th>0.36</th>
<th>0.32</th>
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<td>0.33</td>
<td>0.34</td>
<td>0.34</td>
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Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-08 (each individual frame measures 2.612 x 1.959 mm).
Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-08, after masking out air voids and fine aggregate to isolate cement paste (each individual frame measures 2.612 x 1.959 mm).
Average cement paste pixel intensities per frame, and equivalent w/c values (as compared to 28-day moist cured mortar samples) from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-08.

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</table>

| equivalent w/c \( y = 0.0044x + 0.0329 \) |
|---|---|---|---|
| 0.37 | 0.36 | 0.39 | 0.38 |
| 0.37 | 0.39 | 0.36 | 0.39 |
| 0.36 | 0.35 | 0.36 | 0.36 |
Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-11 (each individual frame measures 2.612 x 1.959 mm).
Mosaic of 12 epifluorescent mode images collected from thin sections prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-11, after masking out air voids and fine aggregate to isolate cement paste (each individual frame measures 2.612 x 1.959 mm).
Average cement paste pixel intensities per frame, and equivalent w/c values (as compared to 28-day moist cured mortar samples) from thin section prepared from core from I-696, constructed 1995, away from transverse joint, MTU ID 696-11.

<table>
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Equivalent w/c ($y = 0.0044x + 0.0329$)

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