

EXPANDING THE REALM OF POSSIBILITY

## Magnetic Imaging Technology

2005 Virginia Concrete Conference




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An International Concrete Company

### State of the Practice

- The importance of proper dowel alignment is widely recognized, but it could not be verified effectively
- Many agencies specify strict alignment tolerances
  - Tolerance on rotation ranges from 3 mm (1/8 in) to 13 mm (1/2 in) for 457-mm (18-in) dowels
  - Typical tolerance is 10 mm (3/8 in)
- Acceptance is based on limited number of cores




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### MIT Scan-2 Stirs Up All Kinds of Trouble

- MIT Scan-2 measures dowel alignment with unparalleled level of efficiency and accuracy
  - What to do with all the data generated
  - Problems that went unnoticed in the past are being detected – How bad is bad?
- Limitations of existing specifications on dowel placement tolerances:
  - Based on limited laboratory testing and analytical evaluation
  - Not verified with field performance




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### MIT Scan-2




- Device designed specifically for the measurement of dowel bar position and alignment
  - Developed by Magnetic Imaging Tools, GmbH
  - Based on the principles of pulse induction



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### Advantages

- Works on fresh or hardened concrete
- Real-time, automated data analysis
- Very accurate and reliable
- Efficient (1-2 min per joint)
  - 200 or more joints can be tested in an 8-hr workday
  - Up to 3 lanes can be tested in a single pass



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**Test track at MIT GmbH**




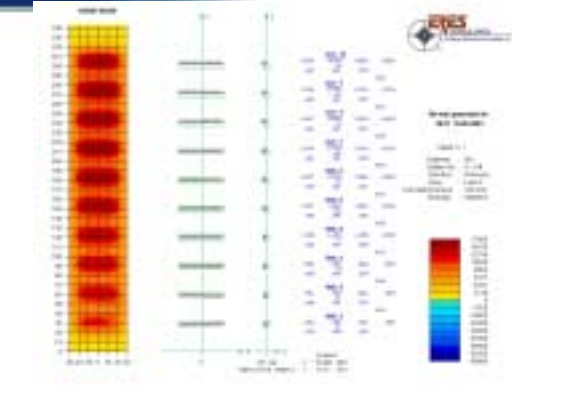
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The image shows a test track on a boat deck. The track is made of metal rails and is set up on a yellow surface. The text "Test track at MIT GmbH" is at the top. The ARA logo and tagline "Expanding the Realm of Possibility" are at the bottom.






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### Accuracy


- Conditions for best results
  - Depth: 150±40 mm
  - Horizontal & vertical misalignment: ±20 mm
  - Lateral placement error (side shift): ±50 mm
- Reported accuracy
  - Depth: ±4 mm
  - Rotation: ±4 mm
  - Side shift: ±8 mm
  - Repeatability: ±2 mm



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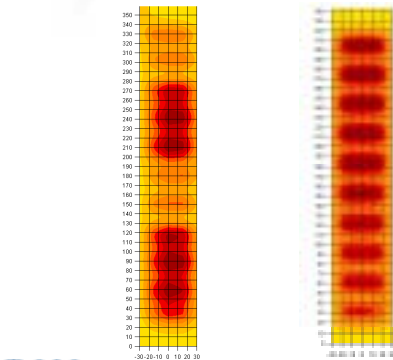

### Evaluation Results

- MIT specified accuracy was verified
- Overall standard deviation of measurement errors is estimated to be about 3 mm on rotation
  - Accurate to about ±5 mm at 95% confidence level



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### Dowels Placed in a Basket

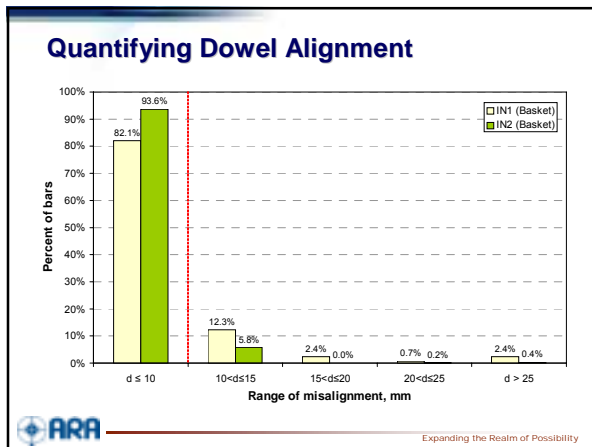
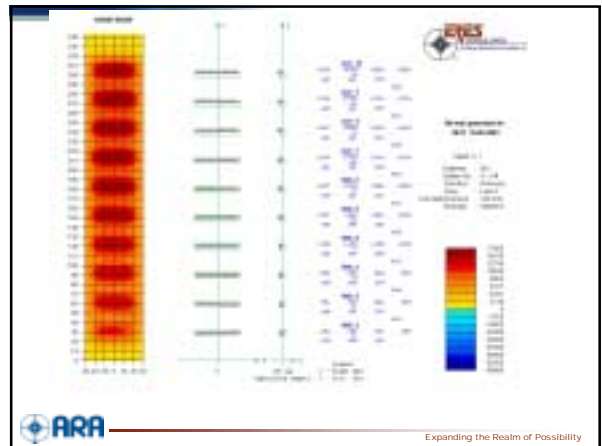
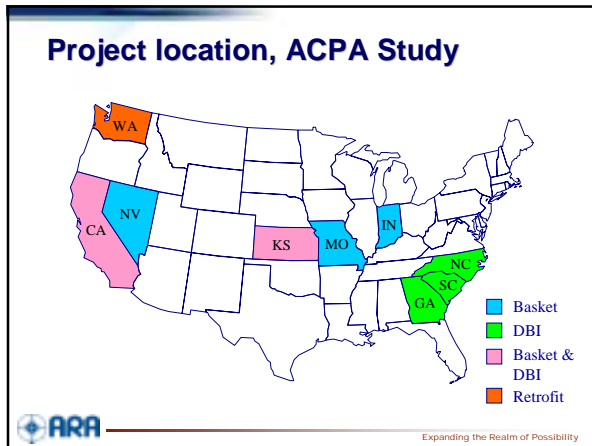
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### Dowel Bar Alignment in Typical Concrete Pavements

- Sponsored by American Concrete Pavement Association (ACPA)
- Objective – evaluate and document the dowel bar alignment in typical concrete pavements
  - Evaluated typical-construction projects with no reported construction-related problems
  - Both DBI and basket sections were included
- MIT Scan-2 was used to measure dowel alignment



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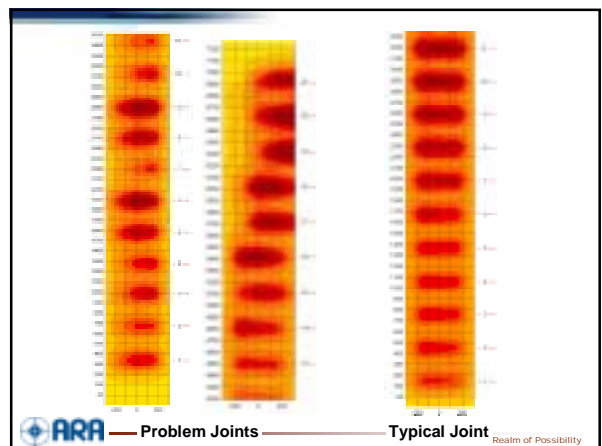
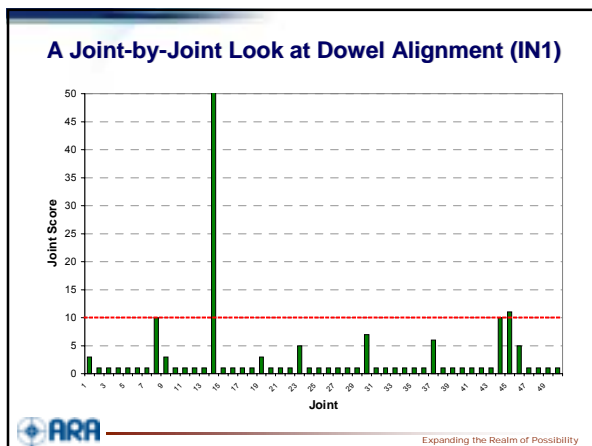


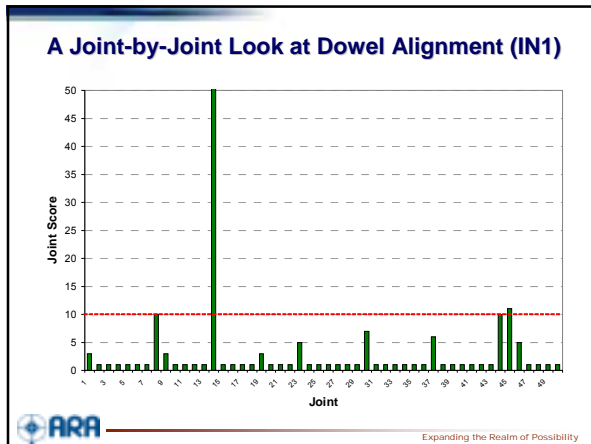
### Joint Score

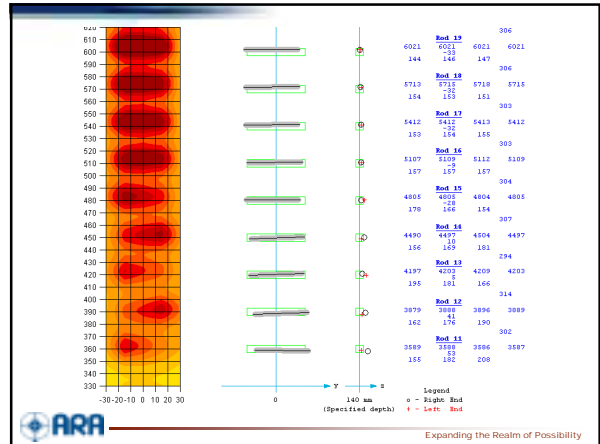
- Developed to assess the risk of joint locking – the higher the Joint Score, the higher the risk
- Determined as a sum of product of number of bars at each level of misalignment and weighting factors that reflect the relative adverse effect
- Further research is needed to refine Joint Score

Range of misalignment, mm	Weight
10 < d ≤ 15	0
15 < d ≤ 20	2
20 < d ≤ 25	4
25 < d ≤ 38	5
38 < d	10

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## Conclusions

- Dowel bar alignment can be determined very accurately and efficiently using MIT Scan
- There is a critical need to improve specifications on dowel placement tolerance
  - Must be consistent with field performance and pavement behavior
  - Consideration should be given to joint-by-joint evaluation
  - Identify conditions that will cause a joint to lock up
  - Determine the allowable number of locked joints
- With care good alignments can be obtained using either baskets or inserters



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