The Study of Developing Asphalt Patch Slabs on Repairing Pavement Potholes (ID#805)

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Outline

- Introduction
- Objective
- Experimental Program
- Results and Analysis

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Introduction

- The recent climate change has caused various effects to weather patterns observed in Taiwan, especially the fact that storm rainfalls hves become stronger.

- The sustained surface run-off penetrating through cracks cause damages such as stripping, potholes, or other pavement distresses.

Introduction

- The field distresses, evaluated by the Institute of Materials Testing of the Directorate General of Highways (DGH), revealed that potholes could be induced by taking cores for QC/QA, poor patching job, and materials aging on the surface layer.

Courtesy of DGH

Introduction

- The patching job has found to fail very often in practice, due to the difficulties in controlling appropriate field compaction level.
  - The size of pot holes, reported by DGH, range from 100- to 200-mm (4-8“) in diameter and 30- to 70-mm (2-3“) in depth in Taiwan.
- There is a need to develop a suitable technique to repair potholes and maintain the serviceability of pavement for the safety concern.

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Objective

- The objective of this study was to develop and evaluate the circular asphalt patch slabs in the laboratory.

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Experimental Program

- One dense graded asphalt concrete (DGAC) mix design was selected to produce asphalt slabs.
  - Slabs were produced compaction method by Marshall compactor or compression method by UTM machine.
  - Targeted thickness: 50- and 60-mm
  - Targeted voids: 3-5% or 6-8%

Experimental Program

- The asphalt slabs were brought to examine in the laboratory including the bulk specific gravity, voids, thickness, slab-producing time, and rutting depth.

- The mix design and the following tests were performed at the certified asphalt laboratory of the Institute of Materials Testing of DGH at Shin-Chuang, New Taipei, Taiwan.

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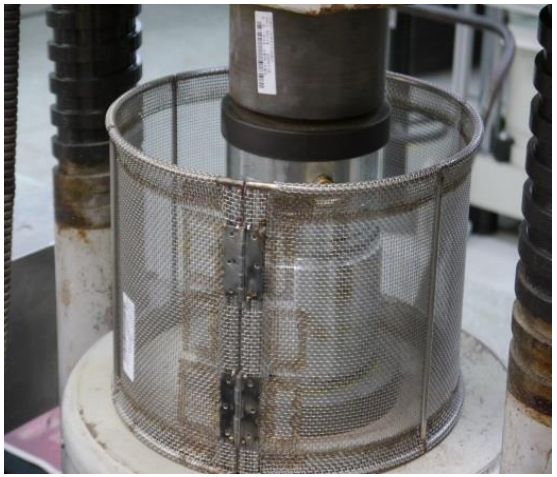
Results and Analysis

- Comparisons of compaction and compression methods.
  - When it came to make slabs with 50- or 60- mm in thickness, it was found that the asphalt patch slab with 3-5% or 6-8% of voids requires about 70 or 21 hammer drops, respectively

Drops	7	14	21	28	42	56	84	112
Voids (%)	8.7	8.2	7.3	6.7	5.4	4.3	3.1	2.7

Results and Analysis

- Comparisons of compaction and compression methods.
  - The compression method through UTM machine, either one-side or double-side approach, reached to 6.8% or 6.45%.


(Photos taken by DGH)

Results and Analysis

- Comparisons of compaction and compression methods.

Production Method	Compaction		Compression	
	70 drops	21 drops	One-side	Double-side
Target Voids (%)	3-5	6-8	6-8	6-8
Bulk Specific Gravity	2.32	2.25	2.27	2.26
Slab Thickness (mm)	60.4	61.0	59.9	59.4
Voids (%)	4.53	7.40	6.80	6.45
Time for production (min)	5-8	3-5	3-5	3-5

Results and Analysis

- Laboratory rutting test (AASHTO T324)
  - It is a Hamburg wheel tracking device and the testing temperature was set at 50±1 ˚C with the presence of water.

Production method	Compaction		Compression	
	70 drops	21 drops	One-side	Double-side
Target voids (%)	3-5	6-8	6-8	6-8
Rut depth at 20mm (Number of wheel passes)	21595	12704	7110	14204
Rut depth at 12.5mm (Number of wheel passes)	16320	8867	5000	8775
Stripping inflection point, SIP (Number of wheel passes)	10939	7738	3920	6972

Conclusions

- The asphalt patch slab is feasible to manufacture through either compaction methods by the Marshall hammer drops or compression method by the UTM machine.
  - It was found that 70-drop and 21 drop of Marshall hammer can produce either 50- or 60-mm of asphalt patch slab with 3-5% and 6-8% voids, respectively.
  - It was found that one-side and double-side of compression method can manufacture 50- or 60-mm of asphalt patch slab with 6-8% voids, respectively.

Conclusions

- The production time of slab with 70-drop compaction was the most time consuming for five to eight minutes.
  - The rest of production methods, including 21-drop compaction, one-side, and double-side of compression, consumed about three to five minutes to fabricate one patch slab..

Conclusions

- The slab of 3-5% voids made through compaction method was the best performance in wet rutting test performed by the Hamburg wheel tracking device.
  - The slabs of 6-8% made either compaction or double-side compression were seemingly equal in performance of rutting test. However, the slab of 6-8% made through one-side compression was not as good as that made through double-side compression..

Conclusions

- The future work aim to evaluate the field performance and the asphalt patch slabs have been installed on the field in comparison with difference field maintenance approaches.
  - More details will be reported in the near future..

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Thanks for your attentions!

- **Questions?**