



The feasibility laboratory and in-situ study of repairing cracks and potholes by the innovative Asphalt Concrete Bricks



**Materials Testing Institute
Directorate of General Highways
Ministry of Transportation and Communications**

Application for RESEARCH category of IRF 2018 GRAA

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Ministry of Transportation and Communications, Taiwan**

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Outline

1 Introduction

2 Development of
ACB

3 Conclusion

4 Acknowledgement



Introduction

- **Background**

- Moisture susceptibility is a major issue pertaining to Hot Mix Asphalt (HMA) pavement. The moisture can infiltrate and diffuse to the structure of asphalt mixture.
- The excessive moisture causes degradation of cohesive strength of asphalt binder and loss of the adhesion bond between aggregate and binder.



Introduction

- **Background (CONT'D)**

- As such deterioration progress, it results in distresses of stripping, cracks, and potholes.



Cracks

(Photo from Pavement Interactive)



Large Pothole

(Photo taken by DGH)



Introduction

- **Background (CONT'D)**

- In Taiwan, moisture susceptibility is identified as the primary pavement distress, owing to the hot and humid climate in summer.
- Monsoon (Plum) rainfalls, typhoons, and thunder storms provide more than 2000 millimeters in terms of precipitation every year which worsen the moisture damages on the roadways.



Introduction

- **Background (CONT'D)**

- Potholes can be developing after the extensive rainfalls.



Pothole due to moisture susceptibility
(Photo taken by DGH)



Introduction

- **Background (CONT'D)**

- The emergency patching tasks are usually applied quickly by the contractors. However, poor patching can induce more cracks and potholes and it endanger the safety of motorists.



Example of poor patching
(Photo taken by DGH)



Introduction

- **Background (CONT'D)**

- Engineers and professionals in the Directorate of General Highways, MOTC stride to find a better way to repair cracks and potholes effectively.



Severe pothole and good patching
(Photo taken by DGH)



Introduction

- **Background (CONT'D)**

- A research project was commissioned to carry out since 2014 and the research objective was to evaluate the feasibility of utilizing the innovative “Asphalt Concrete Bricks” to be evaluated in the laboratory and in the field.



Asphalt Concrete Bricks, ACB
(Photo taken by DGH)



Development ACB

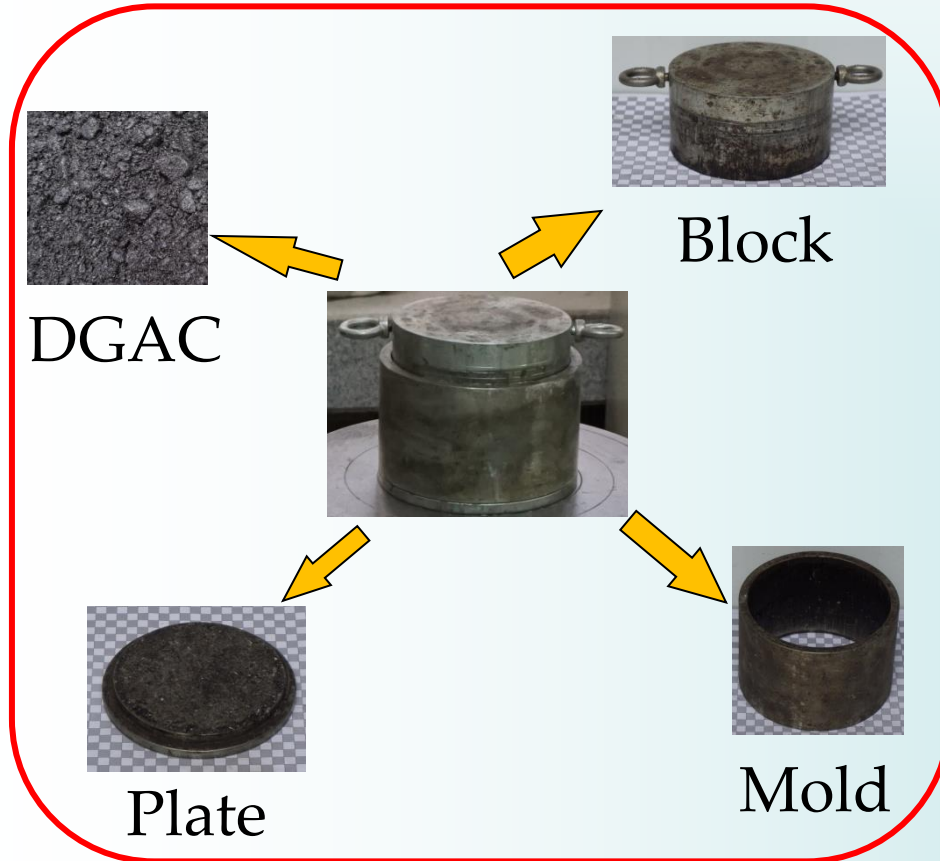
- **Research Scope**

- The development of “Asphalt Concrete Bricks” were divided into three stages:
 - ✓ Process of manufacturing the ACB was investigated;
 - ✓ The laboratory evaluation by the Hamburg Wheel Tracking Test on ACB was performed;
 - ✓ In-Situ evaluations on ACB was studied.



Development ACB

- **Process of manufacturing the ACB**
 - ACB is compacted by concrete compression machine.

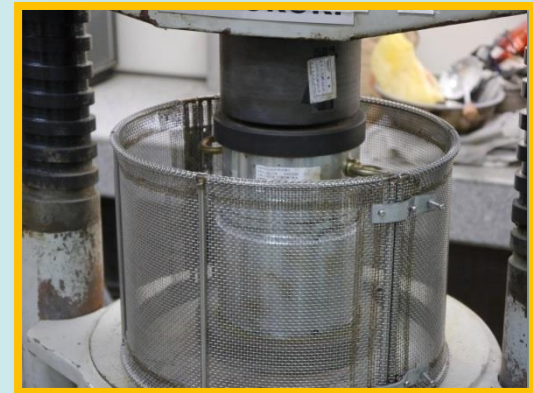
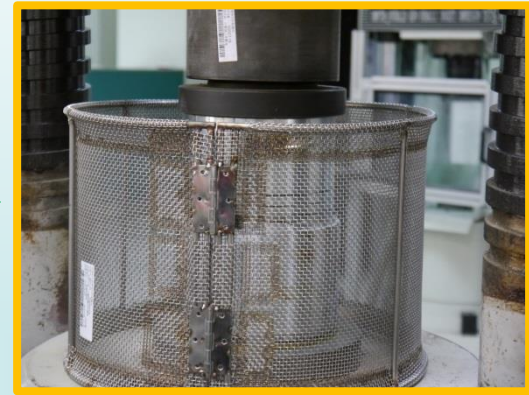




Development ACB

- **Process of manufacturing the ACB (CONT'D)**

➤ It requires to compact both sides of ACB specimen with a fixed rate of 50-mm/min. .





Development ACB

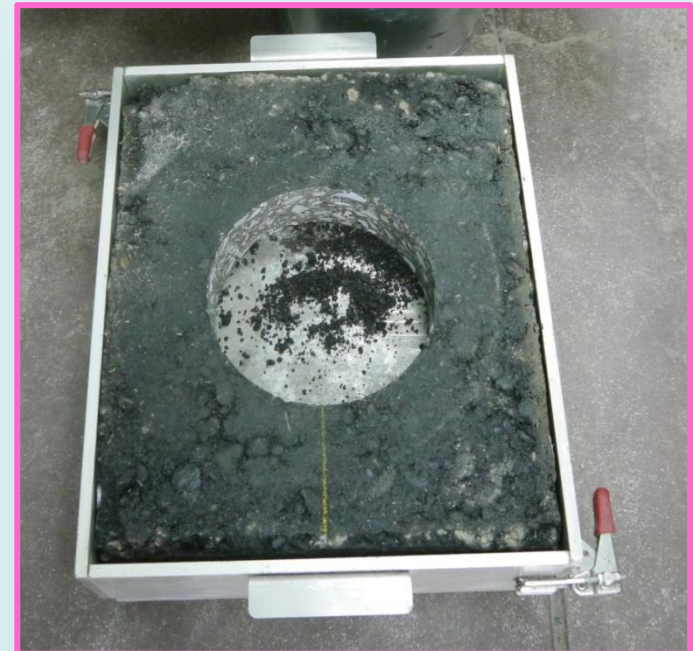
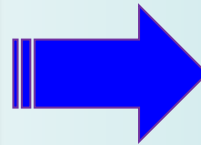
- **Process of manufacturing the ACB (CONT'D)**
 - ACB specimens can be customized with various diameters and thickness.





Development ACB

- The laboratory evaluation
 - Preparing the specimens for Hamburg Wheel Tracking Test rutting test (AASHTO T324).

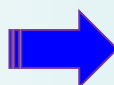
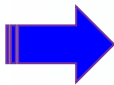
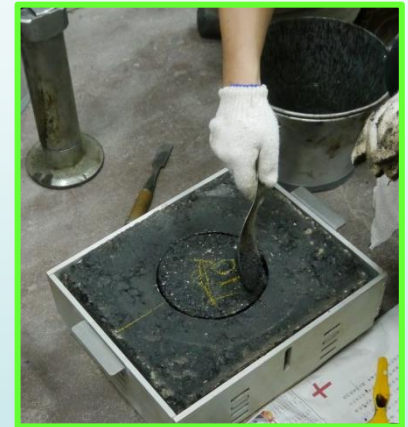
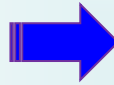
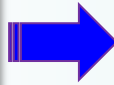




Development ACB

- The laboratory evaluation (CONT'D)

➤ Preparing the specimens for HWTT rutting test.



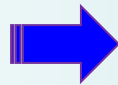
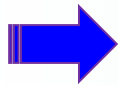
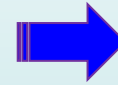
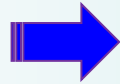
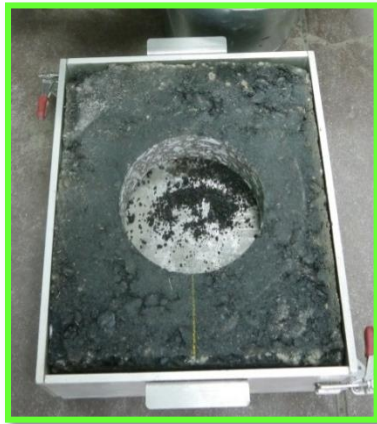
**ACB installed on the specimen for
HWTT test
(Photo taken by DGH)**



Development ACB

- The laboratory evaluation (CONT'D)

- Preparing the specimens for HWTT rutting test.



Regular patching materials prepared on the specimen for HWTT test
(Photo taken by DGH)



Development ACB

- The laboratory evaluation (CONT'D)
 - Preparing the specimens for HWTT rutting test.

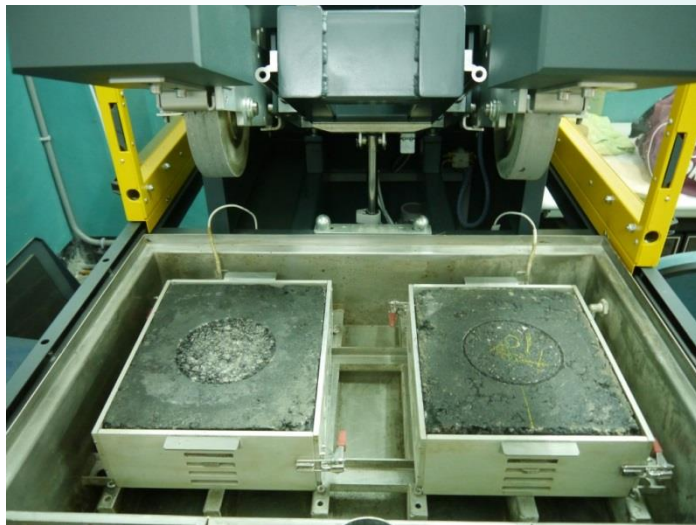


Hamburg Wheel Tracking Test
(Photo taken by DGH)



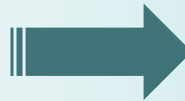
Development ACB

- The laboratory evaluation (CONT'D)
 - The rutting tests unveiled significant rutting resistance for ACB in comparison with that of regular patching materials in the laboratory.



**Patching
Materials**

ACB



ACB

**Patching
Materials**



Development ACB

- In-Situ evaluations on ACB

Remove excessive materials around the pothole



Clean and dry out the pothole





Development ACB

- In-Situ evaluations on ACB (CONT'D)

Leveling the bottom
of the pothole



Padding with the
emulsified binder





Development ACB

- In-Situ evaluations on ACB (CONT'D)

Installing ACB to the
Pothole



Leveling ACB with the
surface layer.





Development ACB

- **In-Situ evaluations on ACB (CONT'D)**

- More than 70 ACB were installed in 2014.

locations	Diameter	Dates	District	No. ACB Installed
Route 15-40k~41k	150 mm	2014-09	Chungli	5
Route 26-21k~24k	150 mm	2015-02	Fenggang	30
Route 27-35k+300~+400	150 mm	2016-01	Chaochou	10
Route 31-7k+050~+460	100 mm	2015-12	Chungli	10
Route 61-77k+100~+240	150 mm	2016-01	Hsinchu	10
Route 68-6k+555~+650	150 mm	2015-12	Hsinchu	5
Route 68-14k+600~+700	100 mm	2015-12	Hsinchu	5



Development ACB

- **In-Situ evaluations on ACB (CONT'D)**

- On March 2017, there were 3651 ACB specimens that have been installed to the DGH district throughout Taiwan.
- All ACB have well performed onsite so far and NONE of them has shown signs of further more moisture damages.



Development ACB



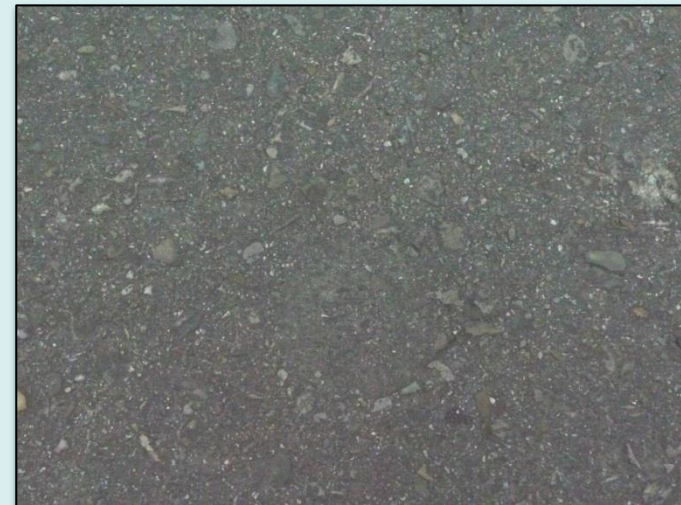
Regular patching materials
(After four months)



ACB
(After one year)



ACB
(After four months)



ACB
(After three years)



Conclusion

- To sum up, the utilization of asphalt concrete brick is an innovative way to repair the potholes and cracks on the roadways which not only improve the serviceability but also safety for the motorists.
 - ACB can be customized to fit and repair various sizes of potholes.
 - ACB is easy to produce in-house and convenient to install on the roadways.
 - ACB warrants durable pothole repairing, saves budgets, and improve the safety of motorists.



Conclusion

- Future work on ACB:
 - ACB can be produced by mixing with other recycled materials, such reclaimed asphalt pavement, crumbed rubber, recycled asphalt shingles, and recycled concrete aggregates...etc..
 - More onsite evaluations where potholes are installed by ACBs can be promoted and monitored.



Acknowledgement

- The engineers of Material Testing Institute of the Directorate of General Highways appreciated of the support and approvals from the Ministry of Transportation and Communications, MOTC, in this study.



Thank you very much!



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