

**LIFE CYCLE ASSESSMENT OF ASPHALT: A FOCUS ON END OF LIFE
AND RECLAIMED ASPHALT PAVEMENT (RAP)**


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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University and Institut Français du Pétrole
2014

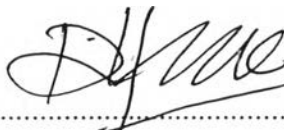
I 28369828


Thesis Title: Life Cycle Assessment of Asphalt: A Focus on End of Life and Reclaimed Asphalt Pavement (RAP)
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Program: Petroleum Technology
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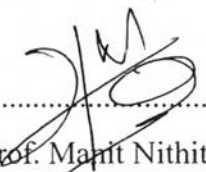
Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

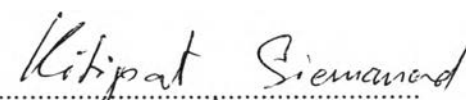

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ABSTRACT

5573027063: Petroleum Technology Program

Pongtorn Naiyaboot: Life Cycle Assessment of Asphalt: A Focus on End of Life and Reclaimed Asphalt Pavement (RAP)

Thesis Advisors: Asst. Prof. Pomthong Malakul and Dr. Thawach Chatchupong, 140 pp.

Keywords: Hot-mixed asphalt (HMA)/ Warm-mixed asphalt (WMA) / Life cycle assessment (LCA)/ Reclaim Asphalt Pavement (RAP)

Asphalt is an important product of oil refineries that is extensively used for road pavement. When an asphalt concrete pavement reaches the end of its designed life, the road surfacing is milled, creating a milling waste material known as reclaimed asphalt pavement (RAP) containing aggregate and asphalt binder. In this study, a cradle-to-grave life cycle assessment (LCA) was performed to evaluate the environmental impacts of hot-mixed asphalt (HMA) and warm-mixed asphalt (WMA) in terms of global warming potential (GWP) and energy input, with a focus on different end-of-life management scenarios of the asphalt pavement and the use of RAP. The study scope covered the entire life cycle of asphalt including raw materials, production, pavement (use) and end of life. The studied end-of-life processes were reuse (cold in-place recycling), recycle (hot in-place and in-plant recycling) and landfill (disposal). The functional unit was set to be 7 m x 1 km x 0.05 m of road pavement. The inventory data were collected from both primary and secondary data and analyzed by using commercial LCA software, SimaPro 7.3. The results show that recycling is the best end-of-life management for asphalt pavement. WMA has better performance than HMA in both GWP and energy consumption, but the benefits are not significant (<5 %). The comparison between the BAU (business as usual) case and the best case of HMA and WMA revealed a reduction of energy consumption by ~8 % and GHG emission by ~22 %.

บทคัดย่อ

พงศธร นัยบุตร : การประเมินผลกระทบต่อสิ่งแวดล้อมและพลังงานตลอดวัฏจักรชีวิตของแอสฟัลต์คอนกรีตโดยเน้นศึกษาการจัดการแอสฟัลต์ที่ถูกรื้อแล้วและการนำกลับมาใช้ใหม่ (Life Cycle Assessment of Asphalt: A Focus on End of Life and Reclaimed Asphalt Pavement (RAP)) อ. ที่ปรึกษา: ผศ. ดร. ปมทอง มาลากุล ณ อยุธยา และ ดร. ธวัช วัชรชูพงษ์ 140 หน้า

งานวิจัยนี้ทำการประเมินผลกระทบต่อสิ่งแวดล้อมและพลังงานของแอสฟัลต์คอนกรีต โดยเน้นศึกษาการจัดการแอสฟัลต์ที่ถูกรื้อแล้วและการนำกลับมาใช้ใหม่ โดยมีการเปรียบเทียบผลกระทบระหว่างแอสฟัลต์คอนกรีตแบบใช้ความร้อนต่ำกับแอสฟัลต์คอนกรีตแบบใช้ความร้อนปกติแบบเดิม โดยใช้กระบวนการประเมินผลกระทบต่อสิ่งแวดล้อมตลอดวัฏจักรชีวิตในการวิเคราะห์ การศึกษานี้จะทำการวิเคราะห์ผลกระทบโดยจะเน้นศึกษาในส่วนของแอสฟัลต์ที่สิ้นสุดอายุการใช้งาน และเทคโนโลยีในการจัดการแอสฟัลต์ที่ถูกรื้อแล้ว รวมไปถึงเทคโนโลยีในการนำแอสฟัลต์กลับมาใช้ใหม่ ทั้งนี้การศึกษายังครอบคลุมไปถึงการวิเคราะห์สัดส่วนในการจัดการแอสฟัลต์ที่ถูกรื้อแล้วในประเทศไทย และนำเสนอแผนของสัดส่วนในการจัดการแอสฟัลต์ที่ถูกรื้อแล้วที่ช่วยลดการใช้พลังงานและผลกระทบต่อสิ่งแวดล้อมในอนาคต โดยในการศึกษาจะนำแอสฟัลต์แบบใช้ความร้อนต่ำและแอสฟัลต์คอนกรีตแบบใช้ความร้อนปกติมาเปรียบเทียบกัน ขอบเขตของการศึกษาคครอบคลุมตลอดวัฏจักรตั้งแต่วัตถุดิบ การผลิตแอสฟัลต์ การขนส่ง การปูถนน จนถึงการจัดและการนำกลับมาใช้ใหม่ของแอสฟัลต์คอนกรีต โดยการศึกษาครั้งนี้ มีหน่วยของการศึกษา คือถนนขนาดความกว้าง 7 เมตร ความยาว 1 กิโลเมตรและความหนา 5 เซนติเมตร ข้อมูลต่างๆ ที่เก็บรวบรวมจะถูกนำมาวิเคราะห์โดยใช้โปรแกรม SimaPro 7.3 ด้วยวิธี Eco-Indicator 95 และ CML baseline 2000 เพื่อประเมินภาวะด้านสิ่งแวดล้อมด้านต่างๆ โดยเน้นที่ผลกระทบด้านภาวะโลกร้อนและพลังงานที่ใช้ จากผลการศึกษาแสดงให้เห็นว่า หากมีการนำแอสฟัลต์กลับมาใช้ใหม่ในกระบวนการใช้ความร้อน ทั้งแบบผลิตที่โรงงานและแบบผลิต ณ จุดรื้อถอนจะสามารถลดการใช้พลังงานและผลกระทบต่อสิ่งแวดล้อมได้ดีกว่าการนำกลับไปใช้ใหม่ในรูปแบบพื้นถนนและการนำไปฝังกลบ นอกจากนี้แอสฟัลต์คอนกรีตแบบใช้ความร้อนต่ำมีผลกระทบด้านภาวะโลกร้อนและพลังงานที่ใช้ในกระบวนการต่ำกว่าแอสฟัลต์คอนกรีตแบบใช้ความร้อนปกติแต่ต่ำกว่าไม่มาก ซึ่งคาดว่า การลดอุณหภูมิในการผลิตมากขึ้นจะช่วยลดผลกระทบต่อสิ่งแวดล้อมมากขึ้นด้วย

ACKNOWLEDGEMENTS

This work would not have been possible without the assistance of the following individuals:

First and foremost, I sincerely appreciate Asst. Prof. Pomthong Malakul, my advisor, and Dr. Thawach Chatchupong, my co-advisor, for providing invaluable knowledge, creative comments, untouchable experience in classroom, and kind support throughout this research work.

I would like to thank Asst. Prof. Manit Nithitanakul and Asst. Prof. Kitipat Siemanond for being my thesis committee. Their suggestions and comments are very beneficial for me and this work.

I also thank Mr. Seksan Paping for your kind suggestion and kind support throughout this research work.

This thesis work is funded by the Petroleum and Petrochemical College and PTT Research and Technology Institute of PTT Public Company Limited, Thailand

I greatly appreciate all PPC staffs and my friends who gave me support and encouragement.

Finally, I am deeply indebted to my family for their love, understanding, encouragement, and support for me at all time.

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