

國立成功大學土木工程學系  
**N680300 鋪面估與維修/ Pavement Evaluation and Rehabilitation**

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**Class Hour** : Wed 13:00 ~16:00pm  
**Office Hour** : Wed 09:30~10:30pm or By email Appointment

**Objective:**

This course has been developed to address the urgent needs of the deteriorating roadway infrastructure. The objective of this course is to educate graduate engineering students about deterioration, rehabilitation, and cost effectiveness of rehabilitation techniques of roadway structures with emphasis on pavement rehabilitation and new technologies. The course presents different types of rehabilitation techniques and the selection of the most efficient and cost-effective approaches.

**TextBook** : Rehabilitation Strategies for Highway Pavements  
Class Distributed Materials

**Course Outline**

1. Identify the different deterioration aspects of roadway infrastructure.
2. Identify methods of pavement evaluation.
3. Identify new rehabilitation materials and different pavement rehabilitation techniques.
4. Define different rehabilitation and implementation approaches.
5. Define the most cost-effective rehabilitation techniques.
6. Identify methods of estimating service life improvement due to rehabilitation

**Policy and Procedures:**

- The course outline will serve as a general guide for the order of the work. However, it is subject to change at the discretion of the instructor at any time during the semester.
- Class attendance is expected, and participation is encouraged.
- The important issues will be discussed in class; however, the student should be cognizant of the material in the reading assignments. Students are encouraged to ask questions in the class.
- Required homework will be due at the beginning of the period on the due date. On the cover page, write the course number and semester, homework title and number, your name, and the date. If the assignment is to be completed in groups, one solution set per group is due. For group assignments, the cover page should include the name of the group leader followed by the names of other *participating* group members. *If a student's name appears on a solution set, it certifies that he/she has participated in solving some of the problems and understands all the solutions.* If this turns out to be not the case, both the group leader and student in question will be considered to have violated NCKU's Honor Code.
- Late homework will be accepted up to one week after the due date and will receive a maximum grade of 50%. This privilege will be withdrawn if any individual abuses it.
- If you miss a test without approval or certified medical excuse, you may take a makeup exam at a designated time near the end of the semester. Only one such exam will be given. If you miss the final without a valid excuse, a zero will be averaged into your grade.
- All submitted work shall be considered graded work, unless otherwise noted. The NCKU STUDENT CODE will be strictly enforced in this class. All aspects of your course work are covered by the STUDENT CODE. Honesty in your academic work will develop into

**N680300 鋪面估與維修/ Pavement Evaluation and Rehabilitation**

professional integrity.

- There will be two exams, a final report, and an oral presentation. Grades are distributed as follows:

Exam1 .....	20%
Exam2.....	20%
Homework .....	30%
Final Project & Presentations .....	30%

**COURSE OUTLINE**

Week	Date	Lecture Topic
1	02/20	Introduction
2	02/27	Pavement Types/ Pavement and Rehabilitation Management
3	03/06	Material Characterization
4	03/13	Flexible Pavement Deterioration
5	03/20	Rigid Pavement Deterioration
6	03/27	Ground Penetration Radar
7	04/03	Stress Wave Propagation: Methods and Applications/ Roughness, Friction, and Noise
8	04/10	Falling Weight Deflectometer – Theory and Measurement
9	04/17	<b>Exam I</b>
10	04/24	Preventive Maintenance/ Drainage Survey, Evaluation, and Design
11	05/01	Cold Milling and In-Place Recycling of HMA/ HMA Recycling and Rubblization
12	05/08	Use of RAP in HMA and HMA Overlay/ Special Overlays: OGFC, Rubberized Asphalt, and SMA
13	05/15	Full Depth Repair of PCC/ Slab Stabilization/ Load Transfer Restoration
14	05/22	PCC Pavement Recycling/ Edge Drainage Retrofitting
15	05/29	Reflection Cracking Mechanisms and Treatment/
16	06/05	<b>Exam II</b>
17	06/12	Identification and Selection of Feasible Alternatives Based on Life Cycle Concept
18	01/16	<b>Project Presentation</b>

**REFERENCE LIST****Rehab Guide and Manual**

Hall, K., C. Correa, S. H. Carpenter, and R. P. Elliott, *Pavement Evaluation Maintenance and Rehabilitation Rehab Guide*, Final Report, National Cooperative Research Program, Transportation Research Board, National Research Council, Washington, D.C., 2001.  
*Pavement Evaluation Maintenance and Rehabilitation Manual.*

**Introduction and Pavement Distresses**

U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration, Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance, Report to Congress Executive Summary, 2006.

Grigg, N. S., *Infrastructure Engineering and Management*, John Wiley and Sons, New York, NY, 1988, pp 8-12.

Federal Highway Administration, *LTTP Distress Identification Manual*, RD 03-31, 2003. National Research Council, *Durability of Concrete*, Transportation Research Circular No. 494, Transportation Research Board, Washington D.C., Dec 1999.

### **Pavement NDT&E**

- Al-Qadi, I. L. and S. Lahouar, "Measuring Layer Thickness with GPR-Theory to Practice," *Construction and Building Materials*, Vol. 19, 2005, pp. 763-772.
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- Malhotra, V. M. and N. J. Carino, *Handbook on Nondestructive Testing of Concrete*, CRC Press, Inc., 1991, pp. 275-304.
- Sansalone, M. J. and W. B. Streett, *Impact-Echo Nondestructive Evaluation of Concrete and Masonry*, Bullbrier Press, Ithaca, NY, 1997, pp 29-60.
- McGhee, K. K. and G. Flintsch, *High Speed Texture Measurement of Pavements*, Final Report, Virginia Transportation Research Council, Virginia Department of Transportation, Charlottesville, VA, 2003.
- Hall, J. W. et al., *Guide for Pavement Friction, Final Guide*, National Cooperative Highway Research Program, Transportation Research Board, National Research Council, Washington, D.C., 2006.
- Sayers, M. W., and S. M. Karamihas, *The Little Book of Profiling*, The Regent of the University of Michigan, Ann Arbor, MI, Sep 1998.
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- Molenaar, A. A. A., *Structural Evaluation and Strengthening of Flexible Pavements Using Deflection Measurements and Visual Condition Surveys*, Lecture Notes, 2002.
- Lytton, R. L., *Backcalculation of Pavement Layer Properties*, Nondestructive Testing of Pavement and Backcalculation of Moduli, American Society of Testing and Materials Standard Technical Publication 1026, A. J. Bush III and G. Y. Baladi, Eds., Philadelphia, PA, 1989, pp. 7-38.

### **Pavement Instrumentation and Accelerated Testing Facilities**

- Al-Qadi, I. L., A. Loulizi, M. Elseifi, and S. Lahouar, "The Virginia Smart Road: The Impact of Pavement Instrumentation on Understanding Pavement Performance," *Journal of the Association of Asphalt Paving Technologists*, Vol. 73, 2004, pp. 427-466.
- Saeed, A., and J. W. Hall, *Accelerated Pavement Testing Data Guidelines*, National Cooperative Highway Research Program Report 512, Transportation Research Board, Washington, D.C., 2003.

### **Recycling and Overlays**

- Al-Qadi, I. L., M. Elseifi, and S. H. Carpenter, *Reclaimed Asphalt Pavement: A Literature Review*, Research Report FHWA-ICT-07-001, 2007.
- Cooley, L. A., and E. R. Brown, *Potential of Using Stone Matrix Asphalt (SMA) for Thin Overlays*, National Center for Asphalt Technology Report 03-01, Auburn, AL, Apr 2003.
- Huddleston, I. J., H. Zhou, and R. G. Hicks, "Performance Evaluation of Open-Graded Asphalt Concrete Mixtures Used in Oregon," *Journal of the Association of Asphalt Paving Technologists*, Vol. 60, 1991, pp. 19-42.
- Brown, E. R., R. B. Mallick, J. E. Haddock, and J. Bukowski, "Performance of Stone Matrix Asphalt (SMA) Mixtures in the United States," *Journal of the Association of Asphalt Paving Technologists*, Vol. 66, 1997, pp. 426-428.
- McDaniel, R. S., and W. D. Thornton, "Field Evaluation of a Porous Friction Course for Noise Control," Annual Meeting of the Transportation Research Board, CD-ROM, Washington D.C., Jan 2005.
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### **Reflective Cracking**

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**N680300 鋪面估與維修/ Pavement Evaluation and Rehabilitation**

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Baek, J., and I. L. Al-Qadi, "Finite Element Method Modeling of Reflective Cracking Initiation and Propagation," Transportation Research Record: Journal of the Transportation Research Board, No.1949, Transportation Research Board of the National Academies, Washington D.C., 2006, pp 32-42.

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Song, S. H., G. H. Paulino, and W. G. Buttlar, Simulation of Mode I and Mode II Crack Propagation in Asphalt Concrete Using a Bilinear Cohesive Zone Model, Presented at 84th Annual Meeting of the Transportation Research Board, Washington D.C., Jan 2005.

**Life Cycle Cost Analysis**

Walls, J. III, and M. R. Smith, Life-Cycle Cost Analysis in Pavement Design—Interim Technical Bulletin, Federal Highway Administration Report FHWA-SA-98-079, Sep 1998, 107 p.