CE 444
Highway Laboratory
Course Syllabus, Grading, Procedures, and Policies
Spring 2011

Department of Civil Engineering
Jordan University of Science and Technology

Department of Civil Engineering
Jordan University of Science and Technology

| Lecture | Sec #4: Wed 2:15PM-5:15PM-Highway Lab
|---------|----------------------------------|
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Assistant Professor of Civil Engineering |
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| Office Hours | Sun, Tue, Thu 9:15AM-12:15PM
Office visits outside office hours are allowed by appointments. |

I. Course Objectives:

The main objectives to be achieved after the completion of this course are summarized below:

1. To study the physical consensus and source properties of aggregate materials using the SUPERPAVE and the traditional test methods.
2. To present the SUPERPAVE requirements and criteria for aggregate materials.
3. To measure and study the physical properties of asphalt binders using the SUPERPAVE and the traditional test methods.
4. To present the SUPERPAVE specifications for asphalt binders.
5. To evaluate and design asphalt paving mixtures prepared from available aggregates and asphalt binders using Marshall Mixture Design Method as well as SUPERPAVE Mixture Design Procedure.
II. Course Outline:

Aggregate Tests

A. Traditional Tests:

1. Specific Gravity and Absorption of Coarse Aggregate Test
2. Specific Gravity and Absorption of Fine Aggregate Test
3. Los Angeles (LA) Abrasion Test
4. California Bearing Ratio (CBR) Test

B. SUPERPAVE Tests:

5. Coarse Aggregate Angularity (CAA) Test
6. Fine Aggregate Angularity (FAA) Test
7. Flat and Elongated (F&E) Particles Test
8. Sand Equivalent (SE) Test

Asphalt Binder Tests

A. Traditional Tests:

1. Penetration Test
2. Ring and Ball Softening Point Test
3. Ductility Test
4. Flash and Fire Points Test
5. Specific Gravity Test
6. Solubility Test

B. SUPERPAVE Tests:

7. Test Method for Aging Asphalt Binders Using a Rolling Thin Film Oven (RTFO).
8. Test Method for Aging Asphalt Binders Using a Pressure Aging Vessel (PAV).
10. Test Method for Measuring Complex Shear Modulus ($G^*$) and Phase Angle ($\delta$) of Asphalt Binders Using a Dynamic Shear Rheometer (DSR).
11. Test Method for Measuring Creep Stiffness ($S$) and Slope ($m$) of the Log Stiffness versus Log Time of Asphalt Binders at Low Temperatures Using the Bending Beam Rheometer (BBR).
12. Test Method for Measuring Tensile Strain at Failure of Asphalt Binders at Low Temperatures Using a Direct Tension (DT) Tester.
Marshall Mixture Design Method:

1. Aggregate and Asphalt Preparation and Evaluation
2. Preparation of Marshall Specimens
3. Bulk Specific Gravity of Compacted Asphalt Mixtures (G_{mb})
4. Theoretical Maximum Specific Gravity of Asphalt Mixtures (G_{mm})
5. Marshall Stability and Flow Test
6. Volumetric (Density and Voids) Analysis
7. Selection of Design Asphalt Content

SUPERPAVE Mixture Design Method:

1. Materials
2. Selection of Aggregate Blend
3. SUPERPAVE Gyratory Compactor
4. Compaction of Samples
8. Bulk Specific Gravity of Compacted Asphalt Mixtures (G_{mb})
9. Theoretical Maximum Specific Gravity of Asphalt Mixtures (G_{mm})
10. Volumetric (Density and Voids) Analysis
11. Selection of Design Asphalt Content

III. Grading:

Course grades will be based upon the following breakdown:

<table>
<thead>
<tr>
<th>Item</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Reports</td>
<td>25%</td>
</tr>
<tr>
<td>Participation and Lab Work</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40%</td>
</tr>
</tbody>
</table>

IV. Submission of Laboratory Reports:

Laboratory reports are due one week from the time of the experimental work of each corresponding test. However, reports turned in after this time will be considered late and will be subjected to the deduction policy shown below:
0-1 day = 15%, 1-2 days = 30% and so on. If you cannot submit your laboratory report on time and you have a strong valid excuse, please see me to make other arrangements for new date of report submission.

V. Formatting Requirements for Laboratory Reports:

Laboratory reports should be submitted and presented in a professional manner by following the points below:
It is strongly encouraged to use Microsoft Word or other convenient word processors in writing and Microsoft Excel (spreadsheets) or other graphical/data analysis software/program for analysis and plotting.

Writing should be only on one side of the sheet.

Use a cover sheet for each laboratory report and include on the cover sheet your name, university, faculty, department, course number (CE444), laboratory number, name of the experimental test, submitted to:, submitted by:, and the date of submission.

Pay attention to consistency, neatness, page layout, and page numbering. Consistency in graphs/charts should be considered particularly in units, chart size, numbering, axis, and titles.

For graphs/charts, use proper titles, proper font and type for the text inside the graph, and a legend and different symbols for different data series.

Use black and white coloring in your graphs/charts, as this color type is the standard one used for most professional and academic communications, technical reports, proposals, and publications. However, if you feel you still need to use colored graphs/charts, use it only when it has stronger advantages over black and white coloring or/and when it provides clearer idea and picture of what you need to present.

VI. Grade Distribution per Laboratory Report:

<table>
<thead>
<tr>
<th>Category</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Letter</td>
<td>15</td>
</tr>
<tr>
<td>Response to Client Questions</td>
<td>15</td>
</tr>
<tr>
<td>Lab Descriptions and Procedures</td>
<td>15</td>
</tr>
<tr>
<td>Analysis of Results</td>
<td>20</td>
</tr>
<tr>
<td>Presentation of Results</td>
<td>20</td>
</tr>
<tr>
<td>Overall Appearance</td>
<td>15</td>
</tr>
</tbody>
</table>

VII. Grading Criteria:

<table>
<thead>
<tr>
<th>Cover Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important points “up front”</td>
</tr>
<tr>
<td>Professional</td>
</tr>
<tr>
<td>Well-written</td>
</tr>
<tr>
<td>Clear and attractive page layout</td>
</tr>
<tr>
<td>Clear Addresses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response to Client’s Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-written</td>
</tr>
<tr>
<td>Accurate answers and straight forward</td>
</tr>
<tr>
<td>Priorities of answers from most to less important</td>
</tr>
<tr>
<td>Brief and complete responses</td>
</tr>
</tbody>
</table>
### Lab Descriptions and Procedures
- Well-written
- AASHTO/ASTM references
- Brief
- Complete and clear

### Presentation of Results
- Proper presentation of results
- Make key findings emphasized
- Organize thoughts and results
- Proper tables and summary of results

### Analysis of Results
- Well-written
- Accurate analysis
- Clear and complete conclusions
- Use supporting charts/histograms/plots/figures...etc
- Precision and accuracy of interpretation

### Overall Appearance
- Computer-typed writing
- Page layout and numbering
- Cover sheet
- Table of contents
- References
- Neatness and general appearance
- Organizing different parts of the report

### VIII. Exams:

There will be two exams during the semester: midterm exam and final exam. The midterm exam will be done in week no. 8. The exam will be scheduled later and announced in class. The final exam will be scheduled by the office of admissions and records and conducted at the end of the semester. Midterm exam will be typically written exam and cover what students have learned about test equipment, test procedures, test specifications and conditions, class notes and lectures, and all the analysis and calculation covered in the test methods. The final exam will be written exam as well and it will cover all tests conducted in the laboratory, class notes and lectures, laboratory reports and analysis.
IX. Manners in the Laboratory:

Laboratory lectures will be informal to the extent that you are encouraged to ask questions and participate in any discussion at any time. However, side discussions between students during lectures will not be tolerated due to the fact that this kind of discussions distract other students. Good conduct of students is very important and include: attending all classes, being on-time, not doing other tasks, not responding to cellular phones (turning off cellular phones is alternatively recommended), respecting other students, …etc. All these behaviors will provide a healthy and comfortable environment to all students. Although good manners in the laboratory do not affect your grade, providing a favorable impression during laboratory lectures and work may impact a pass/fail grade.

X. References:

5. The AI Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types, 1996.