



**Universitas Negeri Surabaya  
Vocational Faculty,  
D4 Transportation Study Program**

Document Code

**SEMESTER LEARNING PLAN**

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Earthworks and Heavy Equipment Management	99993940103032	Compulsory Study Program Subjects	T=2	P=1	ECTS=4.77	4	April 27, 2023
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator	
	Ir. Mas Suryanto HS., S.T., M.T.		.....			Dr. Anita Susanti, S.Pd., M.T.	

Learning model	Case Studies
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Program Learning Outcomes (PLO)	PLO study program that is charged to the course	
	Program Objectives (PO)	
	PO - 1	Mastering the principles, applications, technical references, procedures and work standards (SOP) for earthworks and heavy equipment management.
	PO - 2	Able to carry out work and entrepreneurship in the field of land transportation engineering technology related to earthworks and heavy equipment management.
	PO - 3	Able to apply the principles of mechanics, mathematics and engineering concepts in the technical design process and design of earthworks and heavy equipment management in the field of land transportation engineering technology in a professional manner.
PO - 4	Able to carry out work on design, implementation, supervision and documentation of work in the field of land transportation engineering technology for earthworks and heavy equipment management in accordance with applicable standards by prioritizing the principles of occupational and environmental safety and health management systems (SMK3L).	

**PLO-PO Matrix**

	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>P.O</td></tr> <tr><td>PO-1</td></tr> <tr><td>PO-2</td></tr> <tr><td>PO-3</td></tr> <tr><td>PO-4</td></tr> </table>	P.O	PO-1	PO-2	PO-3	PO-4
P.O						
PO-1						
PO-2						
PO-3						
PO-4						

**PO Matrix at the end of each learning stage (Sub-PO)**

	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th rowspan="2">P.O</th> <th colspan="16">Week</th> </tr> <tr> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th> </tr> <tr><td>PO-1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>PO-4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	P.O	Week																1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PO-1																	PO-2																	PO-3																	PO-4																
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PO-4																																																																																																						

Short Course Description	This course will contain material about various types of earthworks based on the 2018 General Bina Marga Specifications for Road and Bridge Construction Work (Revision 2) as well as how to use heavy equipment for this work. The heavy equipment taught in this course will focus on function and productivity when carrying out work, consisting of: field cleaning equipment, digging and lifting equipment, loader and transport equipment, compaction equipment, stone crushing equipment, concreting equipment, asphaltting equipment, cars cranes, tower cranes, pile driving equipment, compressors, water pumps, generators, hand power tools. Calculation of heavy equipment costs in the context of heavy equipment management will be given in this course.
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References	Main :
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1. Rochmanhadi. 1985. Alat-alat Berat dan Penggunaannya. Jakarta: Badan Penerbit Pekerjaan Umum.
2. Susy Fatena Rostiyanti. 2008. Alat Berat untuk Proyek Konstruksi. Jakarta: Rineka Cipta.
3. Asianto. 2008. Manajemen Alat Berat untuk Konstruksi. Jakarta: Pradnya Paramita.
4. Kementerian Pekerjaan Umum. 2016. Permen PU No. 28/PRT/M/2016 tentang Analisis Harga Satuan Pekerjaan Bidang Pekerjaan Umum. Jakarta: Kementerian Pekerjaan Umum.
5. Kementerian Pekerjaan Umum dan Perumahan Rakyat Direktorat Jenderal Bina Marga. 2020. Surat Edaran No. 16.1/SE/Db/2020 tentang Spesifikasi Umum Bina Marga 2018 untuk Pekerjaan Konstruksi Jalan dan Jembatan (Revisi 2). Jakarta: Direktorat Jenderal Bina Marga

**Supporters:**

1. Anonimus. 2008. Caterpillar Performance Handbook. Peoria Illionis USA: Caterpillar Inc.

**Supporting lecturer**  
 Ir. Mas Suryanto H.S., S.T., M.T.  
 Dr. Ari Widayanti, S.T., M.T.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [ Estimated time ]		Learning materials [ References ]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline ( offline )	Online ( online )		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Students understand the basics of earthworks and heavy equipment.	<ol style="list-style-type: none"> <li>1. Students can name the properties and types of soil.</li> <li>2. Students can name the types of earthworks.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Basics of Earthworks and Heavy Equipment Management  <b>Library:</b> Susy Fatena Rostiyanti. 2008. Heavy Equipment for Construction Projects. Jakarta: Rineka Cipta.</p>	5%
2	Students are able to explain earth excavation work.	<ol style="list-style-type: none"> <li>1. Students are able to explain the various types of earth excavation work.</li> <li>2. Students are able to explain the dimensional tolerances of soil excavation.</li> <li>3. Students are able to prepare work readiness applications and record land excavation work.</li> <li>4. Students are able to explain soil excavation procedures.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Soil Excavation Work  <b>Literature:</b> Ministry of Public Works and Public Housing, Directorate General of Highways. 2020. Circular No. 16.1/SE/Db/2020 concerning 2018 General Bina Marga Specifications for Road and Bridge Construction Works (Revision 2). Jakarta: Directorate General of Highways</p>	5%

3	Students are able to explain earth embankment work.	<ol style="list-style-type: none"> <li>1. Students are able to explain the various types of earth embankment work.</li> <li>2. Students are able to explain the tolerance of soil embankment dimensions.</li> <li>3. Students are able to prepare work readiness applications and record land filling work.</li> <li>4. Students are able to explain soil embankment materials.</li> <li>5. Students are able to explain the spreading and compaction of earth embankment materials.</li> <li>6. Students are able to explain quality assurance of earth embankment work.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Landfill Works <b>Literature:</b> Ministry of Public Works and Public Housing, Directorate General of Highways. 2020. Circular No. 16.1/SE/Db/2020 concerning 2018 General Bina Marga Specifications for Road and Bridge Construction Works (Revision 2). Jakarta: Directorate General of Highways</p>	5%
4	Students are able to explain road preparation work as well as cleaning, stripping and felling trees.	<ol style="list-style-type: none"> <li>1. Students are able to explain the work of preparing road bodies, dimensional tolerances, submission of work readiness, materials, implementation of road body preparation.</li> <li>2. Students are able to explain the work of cleaning, stripping and felling trees, submitting work readiness and recording, and carrying out cleaning, stripping and cutting trees.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Road Body Preparation. <b>References:</b> Ministry of Public Works and Public Housing, Directorate General of Highways. 2020. Circular No. 16.1/SE/Db/2020 concerning General Specifications for Highways 2018 for Road and Bridge Construction Works (Revision 2). Jakarta: Directorate General of Highways</p> <p><b>Material:</b> Cleaning, Stripping and Felling Trees <b>Reference:</b> Ministry of Public Works and Public Housing Directorate General of Highways. 2020. Circular No. 16.1/SE/Db/2020 concerning General Specifications for Highways 2018 for Road and Bridge Construction Works (Revision 2). Jakarta: Directorate General of Highways</p>	5%

5	Students are familiar with various types of heavy equipment and understand field cleaning equipment.	<ol style="list-style-type: none"> <li>1. Students can name various types of heavy equipment based on their classification.</li> <li>2. Students can calculate the productivity of field cleaning equipment.</li> </ol>	<p><b>Criteria:</b> Good marks if the practice questions can be done correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, discussions, practice questions. 2 X 50	Lectures, practice questions. 2 X 50	<p><b>Material:</b> Various Heavy Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p> <hr/> <p><b>Material:</b> Heavy Equipment Classification <b>Library:</b> Rochmanhadi. 1985. <i>Heavy Equipment and Their Use.</i> Jakarta: Public Works Publishing Agency.</p> <hr/> <p><b>Material:</b> Field Cleaning Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p>	10%
6	Students are able to explain the types, functions, working methods and calculate the productivity of digging equipment, lifting equipment and loading equipment.	<ol style="list-style-type: none"> <li>1. Students are able to explain the types, functions, how they work and calculate the productivity of digging equipment.</li> <li>2. Students are able to explain the types, functions, how they work, and calculate the productivity of lifting equipment.</li> <li>3. Students are able to explain the types, functions, how they work, and calculate the productivity of loading equipment.</li> </ol>	<p><b>Criteria:</b> Good marks if the practice questions can be done correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, questions and answers, and practice questions. 2 X 50	Lectures, practice questions. 2 X 50	<p><b>Material:</b> Digging Equipment <b>Library:</b> Rochmanhadi. 1985. <i>Heavy Equipment and Their Use.</i> Jakarta: Public Works Publishing Agency.</p> <hr/> <p><b>Material:</b> Lifting Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p> <hr/> <p><b>Material:</b> Loading Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p>	10%

7	Students are able to explain the types, functions, working methods and calculate the productivity of transport, surface forming and compaction equipment.	<ol style="list-style-type: none"> <li>1. Students are able to explain the types, functions, how they work, and calculate the productivity of transport equipment.</li> <li>2. Students are able to explain the types, functions, working methods, and calculate the productivity of surface forming equipment.</li> <li>3. Students are able to explain the types, functions, how they work, and calculate the productivity of compaction equipment.</li> </ol>	<p><b>Criteria:</b> Good marks if the practice questions can be done correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, questions and answers, and practice questions. 2 X 50	Lectures, practice questions. 2 X 50	<p><b>Material:</b> Transport Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p> <hr/> <p><b>Material:</b> Equipment Unit Price Analysis <b>Library:</b> Ministry of Public Works. 2016. PU Ministerial Decree No. 28/PRT/M/2016 concerning Unit Price Analysis of Public Works Sector. Jakarta: Ministry of Public Works.</p> <hr/> <p><b>Material:</b> Surface Forming Equipment <b>Reference:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p> <hr/> <p><b>Material:</b> Compaction Equipment <b>Library:</b> Rochmanhadi. 1985. <i>Heavy Equipment and Their Use.</i> Jakarta: Public Works Publishing Agency.</p>	10%
8	Midterm Exam (UTS)						0%
9	Able to explain the purpose, types and how dredging equipment works, as well as being able to calculate the productivity of the equipment.	<ol style="list-style-type: none"> <li>1. Students are able to explain the purpose of dredging work.</li> <li>2. Students are able to explain the various types of dredging equipment.</li> <li>3. Students are able to calculate the productivity of dredging equipment.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, questions and answers, practice questions. 2 X 50	Lectures, practice questions. 2 X 50	<p><b>Material:</b> Dredging Equipment <b>Reference:</b> Rochmanhadi. 1985. <i>Heavy Equipment and Their Use.</i> Jakarta: Public Works Publishing Agency.</p> <hr/> <p><b>Material:</b> Dredging Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. <i>Heavy Equipment for Construction Projects.</i> Jakarta: Rineka Cipta.</p>	5%

10	Students are able to explain the function, capacity and workings of Mobile Crane and Tower Crane equipment.	<ol style="list-style-type: none"> <li>Students are able to explain the function, capacity and how a Mobile Crane works.</li> <li>Students are able to explain the function, capacity and how tower cranes work.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Crane <b>Reader:</b> Susy Fatena Rostiyanti. 2008. Heavy Equipment for Construction Projects. Jakarta: Rineka Cipta.</p>	5%
11	Students are able to explain the function, capacity and workings of Pile Driving Equipment and Rock Breaking Equipment.	<ol style="list-style-type: none"> <li>Students are able to explain the function, capacity and how Pile Driving Equipment works.</li> <li>Students are able to explain the function, capacity and workings of Rock Breaking Equipment.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Project Results Assessment / Product Assessment</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Pile Driving Equipment <b>Library:</b> Rochmanhadi. 1985. Heavy Equipment and Their Use. Jakarta: Public Works Publishing Agency.</p> <p><b>Material:</b> Stone Breaking Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. Heavy Equipment for Construction Projects. Jakarta: Rineka Cipta.</p>	5%
12	Students are able to explain the function, capacity and workings of Concreting Equipment and Paving Equipment.	<ol style="list-style-type: none"> <li>Students are able to explain the function, capacity and how concreting equipment works.</li> <li>Students are able to explain the function, capacity and how asphaltting equipment works.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Concreting Equipment <b>Library:</b> Susy Fatena Rostiyanti. 2008. Heavy Equipment for Construction Projects. Jakarta: Rineka Cipta.</p> <p><b>Material:</b> Paving Equipment <b>Library:</b> Rochmanhadi. 1985. Heavy Equipment and Their Use. Jakarta: Public Works Publishing Agency.</p>	10%
13	Students are able to explain the function, capacity and workings of work support equipment (compressors, water pumps, generators and hand power tools).	<ol style="list-style-type: none"> <li>Students are able to explain the function of compressors, water pumps, generators, and hand power tools.</li> <li>Students are able to explain how compressors, water pumps, generators and hand power tools work.</li> <li>Students are able to explain the capacity of compressors, water pumps, generators and hand power tools.</li> </ol>	<p><b>Criteria:</b> Good marks if questions are answered correctly.</p> <p><b>Form of Assessment :</b> Participatory Activities</p>	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<p><b>Material:</b> Work Support Equipment <b>Library:</b> Rochmanhadi. 1985. Heavy Equipment and Their Use. Jakarta: Public Works Publishing Agency.</p> <p><b>Material:</b> Hand Power Tools <b>Reader:</b> Susy Fatena Rostiyanti. 2008. Heavy Equipment for Construction Projects. Jakarta: Rineka Cipta.</p>	5%

14	Students are able to explain the costs of heavy equipment.	1. Students are able to explain the exact costs of heavy equipment. 2. Students are able to explain the operational costs of heavy equipment.	<b>Criteria:</b> Good marks if the questions are answered correctly.  <b>Form of Assessment :</b> Participatory Activities	Lectures, discussions, questions and answers. 2 X 50	Lectures, questions and answers. 2 X 50	<b>Material:</b> Heavy Equipment Costs <b>Library:</b> <i>Asianto. 2008. Heavy Equipment Management for Construction. Jakarta: Pradnya Paramita.</i>	10%
15	Students are able to calculate the cost of heavy equipment.	1. Students are able to calculate the exact cost of heavy equipment. 2. Students are able to calculate the operational costs of heavy equipment.	<b>Criteria:</b> Good marks if the practice questions can be done correctly.  <b>Form of Assessment :</b> Project Results Assessment / Product Assessment	Lectures, questions and answers, practice questions. 2 X 50	Lectures, practice questions. 2 X 50	<b>Material:</b> Heavy Equipment Costs <b>Library:</b> <i>Asianto. 2008. Heavy Equipment Management for Construction. Jakarta: Pradnya Paramita.</i>	10%
16	Final Semester Examination (UAS)						0%

#### Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	45%
2.	Project Results Assessment / Product Assessment	55%
		100%

#### Notes

- Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
- The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
- Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
- Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
- Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
- Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
- Forms of assessment:** test and non-test.
- Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
- Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
- Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
- TM=Face to face, PT=Structured assignments, BM=Independent study.