YHEM012

YTMM12

Board Authority Authorized – Heavy Equipment Operator ACE IT

District Name: Abbotsford

District Number: 34

Developed By: Patrick Henman

Date Developed: November, 2008

School Name: District Program

Principal's Name: Patricia Tebbutt, Vice Principal - Career Programs

Board/Authority Approval Date:

Board/Authority Signature:

Course Name: Heavy Equipment Operator ACE IT Training

Grade Level of Course: 12

Number of Course Credits: 4

Hours of Instruction: 120 hours

Special Training, Facilities or Equipment Required:
Training Curriculum based on ITA program outline
BC Road Builders & Heavy Construction Association
Equipment to be provided by BC Road Builders & Heavy Construction Association at Operator training Site (OTS) in Aldergrove.

Course Synopsis:

The program is intended to provide a logical order of study so that students will receive the training to safely carry out the duties and responsibilities of the Machine Operator apprentice program that will occur in Grade 12. Graduates of the program will have entry-level employability skills appropriate to work in the road building industry.

Rationale:

The Machine Operator course is targeted at individuals who are interested in starting a career in the road construction trades. It is designed to enhance secondary school curriculum for students. The program will motivate and encourage students to make successful transition to post-secondary education related to road construction and/or employment. It will also develop knowledge, skills and attitudes particular to the machine operator trade.

The program will encourage students to:

- identify potential employment opportunities specific to Machine Operator
- identify and use safe workplace procedures
- experience the Machine Operator workplace setting
- develop inter-personal skills, career awareness and maturity
- experience the roles and responsibilities of a trades training environment/curriculum
- appreciate the time constraints imposed in terms of attendance at both school and work
- relate classroom skills and knowledge to an employment context
- make transition to employment

Organizational Structure:

Unit/Topic	Title	Time - Hours
Unit 1	Industry Orientation & Overview	3
Unit 2	Identify Health & Safety Excellence	20
Unit 3	Environmental Issues	3
Unit 4	Hand & Power Tools	8
Unit 5	Ladders & Scaffolds	3
Unit 6	Rigging and Material Handling	6
Unit 7	Basic Road Building and Heavy Construction Equipment Operation and Maintenance	8
Unit 8	Small Road Building & Construction Equipment	3
Unit 9	Surveying & Construction	8
Unit 10	Drainage	3
Unit 11	Basic Soil Mechanics/Geology	3
Unit 12	Principles of Excavation and Shoring	3
Unit 13	Aggregates	3
Unit 14	Asphalt Pavement	3
Unit 15	Concrete	3
Unit 16	Employment Skills	6
Unit 17	Worksite Employee Roles	2
Unit 18	Construction Worksite Team & Communication Skills	2
Unit 19	Communication Skills	2
Unit 20	Essential Heavy Equipment Knowledge	6
Unit 21	Job Control and Engineering Basics	6
Unit 22	Operate Articulating Haul Truck	6
Unit 23	Operate Loader (choose one)	12
Unit 24	Operate Backhoe(choose one)	12
Unit 25	Operate Dozer(choose one)	12
Unit 26	Operate Excavator(choose one)	12
Unit 27	Operate Grader(choose one)	12
Total		120

Unit/Topic/Module Descriptions:

Unit 1: Industry Orientation & Overview
It is expected that students will be able to:

- Use Road Building and Heavy Construction Terminology
- Describe Types of Road Building and Heavy Construction
- Describe Types of Road Building and Heavy Construction Equipment
- Describe Road Building and Heavy Construction Industry Culture
- Describe Road Building and Heavy Construction Careers
- Describe Road Building and Heavy Construction Technology and Innovation

Unit 2: Identify Health and Safety Excellence
It is expected that students will be able to:

- Occupational Diseases and Injuries
- Complete Road Builders Safety Training System
- Obtain First Aid- Level 1 Certification
- Obtain Construction Safety Network Flagperson Certification

Unit 3: Environmental awareness, protection, and enhancement

It is expected that students will be able to:
• Describe common environmental issues pertaining to heavy construction/excavating
• Demonstrate spill control techniques
• Demonstrate job site techniques to control sediment, and minimize environmental damage

Performance Objective for Competency 'E' Environmental awareness, protection, and Enhancement:
Given information on environmental awareness, protection, and enhancement the learner will correctly answer questions on a quiz covering content from this curriculum (passing grade is 70%), and will describe and apply environmental awareness, protection, and enhancement knowledge during practical training and on the job.

Unit 4: Tools & Equipment Operations & Maintenance
It is expected that students will be able to:

- Describe Environmental Hazards
- Describe Sediment and Drainage Management
- Describe Fuel and Special Procedures
- Describe Handling Spills
- Describe Proper Disposal Methods of Fuels, Oils, Lubricants, Antifreeze, Waste Oil
- Describe Special Protection Methods
- Describe Excavation and Disposal of Contaminated Soil
- Demonstrate Safe Use of Basic Hand Tools
- Demonstrate Safe Use of Basic Power Tools

Unit 5: Ladders and Scaffolds

It is expected that students will be able to:

- Describe WCB Regulations and Scaffold Erection Procedures
- Describe WCB Regulations for Portable and Fixed Ladders
- Describe Swing Staging Operations and Safety
- Describe Scissor Lift and Zoom Boom Operations and Safety

Unit 6: Rigging and Material Handling

It is expected that students will be able to:

- Describe WCB Regulations and Procedures for Rigging
- Identify Signals for Crane and Hoisting Operations
- Describe Safe Use of Ropes, Chains, Slings and Blocking Equipment

Unit 7: Basic Road Building and Heavy Construction Equipment Operation and Maintenance

It is expected that students will be able to:

- Describe Types and Functions of Common Large Pieces of Equipment
- Describe Large Equipment Operation Safety Procedures
- Describe Walk Around Procedures
- Describe Common Engine Parts and Functions
- Perform Checks and Maintain and Engine Lubrication Systems
- Perform Checks and Maintain and Engine Cooling Systems
- Perform Checks and Maintain and Engine Induction Systems
- Describe Basics of Drive Systems and Brakes
- Describe Basics of Electrical Systems
- Describe Basics of Air Breaks and Air Systems
- Describe Basics of Hydraulic Systems
- Describe Basics of Hitches and Mechanical Linkages

Unit 8: Small Road Building and Constriction Equipment

It is expected that students will be able to:

- Describe Types and Functions of Common Small Pieces of Equipment
- Describe Small Equipment Operation Safety Procedures

Unit 9: Surveying and Construction

It is expected that students will be able to:

- Interpret drawings and plans
- Demonstrate Differential Levelling
- Demonstrate Distance and Angular Measurement
- Demonstrate Slope Staking
- Demonstrate Grade Staking from Survey Stakes, Hub Stakes and Offset Stakes
- Describe Use of Hand Levels and Lasers
- Describe GPS Principles

Unit 10: Drainage

It is expected that students will be able to:

- Describe the Importance of Drainage

- Describe Drainage Systems

Unit 11: **Basic Soil Mechanics/Geology**

It is expected that students will be able to:

- Describe Types of Soils
- Describe Soil Compaction
- Describe Soil Density Testing

Unit 12: **Principles of Excavation and Shoring**

It is expected that students will be able to:

- Describe Principles of Excavation and Shoring
- Describe Principles of Dewatering
- Describe Principles of Utilities

Unit 13: **Aggregates**

It is expected that students will be able to:

- Describe Use of Aggregates in Asphalt and Concrete
- Describe Use of Base Course
- Describe Aggregate Standard Specifications and Quality Control Systems

Unit 14: **Asphalt Paving**

It is expected that students will be able to:

- Describe Asphalt Technology
- Describe Hot Mix Asphalt Concrete Laydown (HMAC)
- Describe HMAC Testing
- Describe Asphalt Plant Operations
- Describe the Effects of Transporting Aggregates

Unit 15: **Concrete**

It is expected that students will be able to:

- Describe Concrete Properties and Technology
- Describe Concrete Formwork
- Describe Concrete Placement and Curing
- Describe Quality Control and Testing
- Describe Production and Supply of Concrete
- Describe Reinforcement of Concrete
- Describe Soil Cement and Roller Compacted Concrete

Unit 16: **Employment Skills**

It is expected that students will be able to:

- Set Personal Career Goals

- Prepare a Resume
- Use Job Search Skills
- Use Interviewing Skills
- Use Road Builder Internet Job Board

Unit 17: Worksite Employee Roles

It is expected that students will be able to:

- Employee Responsibilities
- Project Management
- Quality Management
- Demonstrate Job Site Clean Up and Housekeeping Procedures

Unit 18: Construction Worksite Team & Communication Skills

It is expected that students will be able to:

- Describe Positive Worksite Attitudes
- Describe Conflict Resolution Principles
- Describe Teamwork Practices

Unit 19: Communication Skills

It is expected that students will be able to:

- Speak and Listen Effectively
- Use Documentation

Unit 20: Essential Heavy Equipment Knowledge

It is expected that students will be able to:
• Describe common types of heavy equipment and their respective capabilities, advantages, limitations
• Describe common attachments for heavy equipment and their purposes and capabilities
• Describe basic tools, supplies, and lubricants associated with heavy equipment
• Define terminology common to the heavy equipment industry
• Describe heavy equipment mechanical systems (general)
• Demonstrate heavy equipment inspection and maintenance (general)

Performance Objective for Competency 'B' Essential Heavy Equipment Knowledge:
Given information on essential heavy equipment knowledge, the learner will correctly answer questions on a quiz covering content from this curriculum (passing grade is 70%), and will describe and apply common heavy equipment knowledge during practical training and on the job.

Unit 21: Job Control and Engineering Basics

It is expected that students will be able to:
• Define engineering and survey terminology
• Use simple grade checking instruments and techniques
• Describe expressions of slopes and grade
• Use job control and layout (grade stakes)

• Describe utilities
• Describe soils
• Describe common aggregates
• Describe bulking and settlement of materials
• Describe compaction practices and equipment
• Interpret drawings and plans

Performance Objective for Competency 'D' Job control and engineering basics:
Given information on job control and engineering basics, the learner will correctly answer questions on a quiz covering content from this curriculum (passing grade is 70%), and will demonstrate these skills during practical training and on the job.

Unit 22: Operate HAUL TRUCK

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up/shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Haul and dump materials

1. The practical lab component for F5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from F6. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (F2, D4), and sediment control (E2, E3).
*Operators having previous experience operating the articulated haul truck need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution.

3. To complete the in school practical lab requirement for the articulated haul truck the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including observation of surroundings.
- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.
- Perform basic moves with equipment including:
    - Move forward, stop, back up, stop (flat elevation).

- Apply park brake, lock out transmission.
- Raise and lower box (making sure to observe for wires and/or overhead objects).
- Shift transmission.
- Shift from 2 to 4 to 6 wheel drive.
- Back up into a simulated and marked loading area without hitting pylons. Apprentice must back up within 1.5 meters of the back pylon without driving over the pylon or hitting the side pylons. (Pylons must be set to have a tolerance of 1.5 meters on each side of the articulated haul truck. Pylons must also be placed so they are visible to the driver).

Unit 23: Operate LOADER

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up and shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Dig, carry (tram) and stockpile materials
• Place, spread, and grade material in lifts
• Backfill trenches and excavations
• Load trucks
• Service aggregate processing plants (screening and crushing systems) • *Optional*
• Install and use attachments • *Optional*
• Remove snow and ice • *Optional*

1. The practical lab component for G5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from G6 to G12. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (D2, D4), and sediment control (E2, E3).
*Operators having previous experience operating the loader need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution.

3. To complete the in school practical lab requirement for the loader the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including observation of surroundings.

- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.

Perform basic moves with equipment including:

- Move forward, stop, back up, stop (flat elevation).
- Apply park brake, lock out transmission.
- Shift transmission.
- Raise and lower bucket (making sure to observe for wires).
- Maintain bucket angle in scrape position not the gouge position (flat smooth to the surface).
- Load bucket and tram with minimal spillage to dump location 50 meters away.

Unit 24: Operate Backhoe

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up and shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Dig, carry (tram) and stockpile materials
• Place, spread, and grade material in lifts
• Excavate trenches, ditches
• Backfill trenches, excavations
• Service pipe crew • (place bedding, hoist objects, backfill in lifts, hoe pack, etc.)
• Load trucks
• Drive on public roads
• Handle debris, brush, cleanup tasks with 4-in-one bucket • *Optional*
• Install and use attachments • *Optional*

Although the theory for the Grader remains within the Heavy Equipment Operator course the practical component remains as an option.

1. The practical lab component for H5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from H6 to H14. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (D2, D4), and sediment control (E2, E3).

*Operators having previous experience operating the backhoe need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution.

3. To complete the in school practical lab requirement for the backhoe the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including observation of surroundings.
- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.

Perform basic moves with equipment including:

- Move forward, stop, back up, stop (flat elevation).
- Apply park brake, lock out transmission.
- Shift transmission.
- Raise and lower loader bucket (making sure to observe for wires).
- Maintain loader bucket angle in scrape position not the gouge position (flat smooth to the surface).
- Load bucket and tram with minimal spillage to dump location 50 meters away.
- Position stabilizers and loader buckets for dig positions
- Raise and lower boom (making sure to observe for wires).
- Extend and retract stick.
- Curl and dump bucket.
- Swing left and right.
- Lower bucket to the ground for lock out procedures.
- Know that you must call before you dig (Check for underground utilities).
- Excavate simple trench. Place materials from dig no less than 2' from edge of dig area.
- Backfill trench using the materials taken from the excavated site.
- Use bucket to flatten and compress the dig site.

Unit 25: Operate DOZER

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up and shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Strip and stockpile surface materials/ organics
• Cut and fill material
• Create slopes
• Create ditches

• Spread ballast
• Place aggregates to specified elevations ("finish grading")
• Rips dense materials • *Optional*
• Clear land • *Optional*
• Push scraper • *Optional*

1. The practical lab component for I5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from I6 to I14. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (D2, D4), and sediment control (E2, E3).
*Operators having previous experience operating the dozer need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution.

3. To complete the in school practical lab requirement for the dozer the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including observation of surroundings.
- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.

Perform basic moves with equipment including:

- Move forward, stop, back up, stop, turn left and right stop (flat elevation).
- Apply park brake, lock out transmission.
- Shift transmission.
- Demonstrate control of blade by raising, lowering and changing the angle of the blade.
- Maintain blade angle in flat position (flat smooth to the surface).
- Move dozer into a simulated and marked parking area without hitting pylons. Apprentice must move dozer within 1 meter of the back pylon without driving over the pylon or hitting the side pylons. (Pylons must be set to have a tolerance of 1.5 meters on each side of the dozer. One 90 degree turn must be made on route to parking area. (Pylons must be placed so they are visible to the driver).
- Push tire 25 meters without loosing the tire either under the blade or off the side of the blade.

Unit 26: Operate Excavator

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up and shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Excavate and backfill trenches

• Cut and fill material
• Strip and stockpile surface materials/ organics
• Create mass excavation
• Create slopes
• Load trucks
• Create side cast road • (road building on sloping terrain)
• Service pipe crew (e.g., Place bedding, hoist objects, backfill in lifts, hoe pack, shoring cages)
• Place riprap *Optional*
• Clear land *Optional*
• Perform demolition tasks *Optional*
• Use attachments *Optional*

1. The practical lab component for J5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from J6 to J17. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (D2, D4), and sediment control (E2, E3).
*Operators having previous experience operating the excavator need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution.

3. To complete the in school practical lab requirement for the excavator the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including observation of surroundings.
- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.

Perform basic moves with equipment including:

- Move forward, stop, back up, stop (flat elevation).
- Apply park brake, lock out transmission.
- Shift transmission.
- Raise and lower boom (making sure to observe for wires).
- Extend and retract stick.
- Curl and dump bucket.
- Swing left and right.
- Lower bucket to the ground for lock out procedures.
- Know that you must call before you dig (Check for underground utilities).
- Excavate simple trench. Place materials from dig no less than 2' from edge of dig area.
- Backfill trench using the materials taken from the excavated site.
- Use bucket to flatten and compress the dig site.
- Shows ability to split functions to operate tracks and digging functions simultaneously i.e. pulling up steep grades, clearing obstacles, push up turns, etc.
- Change buckets (quick change) in 10 minutes or less

Unit 27: Operate grader

It is expected that students will be able to:
• Describe and comply with safety requirements
• Perform pre start checks, start up and shutdown procedures, monitor performance of equipment
• Perform daily maintenance tasks
• Describe mechanical components, perform troubleshooting, basic repairs and maintenance
• Perform basic operator functions
• Describe and apply grading fundamentals
• Form and handle windrows
• Strip surface materials
• Cut and fill material
• Maintain construction access roads, logging roads
• Maintain public roads
• Create slopes
• Create ditches
• Shouldering
• Form road base (sub-grade)
• Place aggregates to specified elevations ("finish grading")
• Clear snow and ice
• Use common attachments

Although the theory for the Grader remains within the Heavy Equipment Operator course the practical component remains as an option.

1. The practical lab component for K5 will include a minimum of 3 hours of "seat time". The remaining lab time should be used for demonstrations, and observation of working equipment to instruct additional operating tips and fundamentals, and to introduce content from K6 to K18. At the discretion of instructors, this time could also be used to reinforce the practical 'hands on' content from grade stakes and instruments (D2, D4), and sediment control (E2, E3).
*Operators having previous experience operating the grader need only demonstrate the competency skills listed below in order to complete the lab portion of this module.

2. The hours listed in the endorsement column are suggested minimum hours for each task to address the need for experience and training for a variety of applications. The remaining hours required for endorsement can be completed on the tasks appropriate for the employer or training institution

3. To complete the in school practical lab requirement for the grader the learner must be able to demonstrate the following practical skills:

- Demonstrate the safe operation of equipment including visual checks, constant awareness of space, position, clearance and safe movement of machine.

- Perform pre-start checks, start-up/shutdown procedures and monitor performance of the equipment.
- Perform daily maintenance tasks.

Perform basic moves with equipment including:

- Move forward, stop, back up, stop (flat elevation).
- Apply park brake, lock out transmission.
- Operates with smooth and precise control of drive train, appropriate gear and engine speed.
- Maneuver through a prescribed path without running over pylons. The course will see the apprentice maintain a straight line of 100 meters moving forward and backward and a 90 degree turn to the left and to the right.
- Push tire 200 meters using the grader blade without losing it
- Create a windrow of 100 meters without gouging or driving over it.

Instructional Component:

- Direct Instruction
- Modelling/Demonstration
- Guided Practice
- Guided Research and Analysis
- Independent Research

Assessment Component:
An educator with BC Certificate of Qualification as a Machine Operator and BC Provincial Instructor's Diploma will evaluate the student. Assessment will be based on:

- Technical training curriculum and tests
- Hands on practical skills
- Apprenticeship Logbook for on-the job competencies

Assessment will be based on the following topics. Both theory and practical learning will be evaluated.

	Title	
Theory	Course Theory Weighting	70%
	Units 1- 21	
	Course Practical Weighting	30%
	Units 22-27	
	Total	100%

ITA standards require that students achieve a minimum of 70% for successful completion of ACE IT Machine Operator.

Learning Resources:

- BC Roadbuilders training modules for Apprenticeship Level 1 Machine Operator
- WorkSafeBC Industrial Health and Safety Regulations
- Safety courses (contact BC Roadbuilders)
- Videos (contact BC Roadbuilders)