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# ***Activity Resource Management Document***

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Grade 11  
**TCJ3E Construction Technology**  
(Workplace Destination)  
**Unit 2, Activity 4:**  
**Let's Build It**



*This Activity Resource Management Document (ARMdoc)  
was produced by the Ontario Council for Technological Education (OCTE)  
to supplement the Ministry of Education's Grade 11 Course Profiles.  
It may be used in its entirety, in part, or adapted.*

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# **Activity Resource Management Document**

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**(Safety sheets to be inserted from separate Safety Resource Pack)**

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*TCJ3E Construction Technology*

## **UNIT 2, ACTIVITY 4: Let's Build It**

### **Activity Description (from Course Profile)**

**Time: 18 hours**

#### **Description**

The students, following their project designs and bill of material plans (Final Proposals), select the appropriate materials and use the proper methods for construction of their specific projects. Specific projects could include; floor, wall, or roof construction, exterior finish, electrical systems, detailed working drawings (site plans, floor plans, assembly drawings, elevations, and details), and project marketing as assigned in Activity 2. The various components of the project are constructed and assembled in the classroom, and/or attached later at the construction site i.e., Activity 5 (depending on classroom size limitations.) The overall structure should be constructed in a modular fashion in order to accommodate transportation to the final site. In addition to skill building and safety, this activity should emphasize teamwork, collaboration, and further develop the student's awareness of the meaning, dignity, and fulfillment of work that contributes to the common good.

### **Resource Management Doc (ARMdoc) Contents**

<b>Teacher Resource Pack (TRP)</b>	Pre-planning Notes, Expectations by Category, Activity Deliverables, Instructional Aid Sheets, Skill Builders, Terminology List, Career Information
<b>Student Project Brief (SPB)</b>	Project Brief, Assessment/Evaluation Checklists and Rubrics, Activity Log
<b>Safety Resource Pack (SRP)</b>	Safety Information (list of pages to be inserted from the separate Safety Resource Pack)

This Activity Resource Document (ARMdoc) was produced to supplement the Ontario Ministry of Education's Grade 11 Course Profiles. These profiles can be found at:

**<http://www.curriculum.org/occ/profiles/profiles.htm>**

ARMdocs for several Technological Education profiles can be found at:

**<http://www.octe.on.ca>**

The Technological Education policy documents can be found at:

**<http://www.edu.gov.on.ca/eng/document/curricul/seccurric.html>**

### ***Pre-activity Planning Notes***

This activity involves the construction of a small residential or urban structure such as out buildings, sheds, playhouses, ice fishing huts, wood shelters, school bus shelters, or decks. This activity follows Activity 1, where the structure is designed and planned, Activity 2, where building materials are investigated, and Activity 3, where the projected cost is estimated. After this activity, the project is constructed on a prepared site. (See the *Grade 11 TCJ3E Construction Course Profile*, Unit 2, pages 22-43).

Teachers should arrange for a project before initiating Unit 2, perhaps arranging for a client who requires a structure and will pay or provide for the materials. Teachers should also ensure all necessary resources for constructing and finishing walls, roofs, floors, exterior cladding and electrical components are ready or will be available before reaching each phase of the project. Teachers need to ensure that all tools, equipment, and machines are in proper working order and all safety guards are in place, and that all facilities are in place for students with special needs. Teachers should ensure all students who require enrichment or additional support are accommodated.

The intention of this activity is to build a modular structure so that it may be transported to the site (Activity 5, see the Course Profile page 36). Depending on the project, students may be required to construct buildings off school property, (garden sheds made from stack-wall cordwood for example must be constructed at the homeowners site). When constructing off school property teachers must ensure proper School Board approval is in place, and that all students working off school property are aware and follow all Ministry of Labour safety guidelines.

This activity is suitable for the student deciding on a career in the house framing or general construction industry, or one who has a general interest in building structures. Before beginning this activity, students should have basic skills in place such as the ability to select the correct tools and equipment; ability to handle construction materials safely; and basic knowledge of concepts in constructing floors, walls, roofs, exterior finishes and electrical components, (from the previous activities in Unit 1 and 2). Students may be prepared for this activity by using the Instructional Skill Builders included in this document.

As in many construction projects, this is a group effort, however, teachers must ensure that each student can demonstrate the expectations of the activity. It is recommended that each student keep a daily log of their specific activities for assessment and evaluation purposes (see Student Project Brief).

General safety procedures and PPE for construction sites and shops should be explained and periodically reinforced to the students. While students should have been instructed in safe procedures previously, safety should be a key component of each stage in this activity. Teachers should refer to the Safety Resource Pack (SRP) document package available at the same source as this document (<http://www.octe.on.ca>).

**Expectations by Category (from Course Profile)**

**Knowledge**

N/A

**Inquiry**

- SPV.01** apply the design process to a variety of construction projects;
- SP2.03** identify suitable materials for a variety of components of a construction project;
- SP2.06** demonstrate an ability to design and, where appropriate, build a stairway for a construction project;
- SP3.02** determine the size of structural members required for a construction project using charts, tables, technical data, and building codes, regulations, and standards;

**Communication**

N/A

**Application**

- SPV.04** demonstrate appropriate technical skills involving the use of construction tools, materials, and equipment;
- SP2.01** use various tools and equipment to calculate the dimensions of and to lay out appropriate structural members for footings, walls, roofs, openings, and other parts of a construction project;
- SP2.02** demonstrate the measurement and layout skills required to build, assemble, erect, and install a variety of components related to construction technology;
- SP2.04** use a variety of appropriate tools, equipment, and materials to complete a construction project;
- SP2.08** complete a construction project using a variety of methods and procedures for laying out, assembling, and joining;
- ICV.02** apply appropriate health and safety legislation; general shop and site safety rules; and rules specific to the use of materials, tools, and equipment.
- IC2.02** demonstrate safe shop and construction site practices for the use of hand and power tools, materials, and equipment.

**Assessment/Evaluation**

Students will be assessed and evaluated on the following deliverables. See the Student Project Brief for assessment/evaluation instruments.

	<b>Deliverable</b>	<b>Notes</b>	<b>Suggested Time (hr)</b>
1	Project Modification Sketches	Team	2
2	Production prototype/end user product	Team	14
4	Written report	Team	2
5	Daily Log	Individual	On-going

### ***Terminology List***

<b>Anchor Bolts:</b>	Bolts used to secure a wooden sill plate to a concrete or masonry wall or floor.
<b>Beam:</b>	A structural member that supports a transverse load.
<b>Bearing Wall:</b>	Any wall that supports a vertical load in addition to itself.
<b>Footing:</b>	A masonry section, most often concrete, in a rectangular shape wider than the bottom of the foundation wall.
<b>Gable:</b>	The part of the roof above the eave line of a double-sloped roof.
<b>Gusset:</b>	A flat piece of wood, plywood or metal member used to provide a strong connection where pieces intersect. It is often used at joints of wood trusses.
<b>Header:</b>	A beam placed perpendicular to joists, to which joists are nailed for framing openings, and wood lintel.
<b>Joist:</b>	One of a series of parallel beams, often 2 inches thick, used to support ceiling and floor loads.
<b>Masonry:</b>	Stone, brick concrete, concrete block and similar building components bonded together with mortar to form mass.
<b>On Centre:</b>	Measurement of spacing for studs, rafters, joists, posts and other members from the centre of one member to the centre of another.
<b>Plywood:</b>	Wood made of three or more layers of veneer joined with glue.
<b>Rafter:</b>	One of a series of structural members for a roof. May also be referred to as roof joists.
<b>Rise:</b>	The vertical height of a step or flight of stairs.
<b>Run:</b>	The horizontal distance covered by a flight of stairs.
<b>Shingles:</b>	Roof covering of asphalt, wood, tile or slate cut to stock lengths, widths and thicknesses.
<b>Sill:</b>	Lowest member of the frame in a structure. The sill rests on the foundation.
<b>Stud:</b>	One of a series of slender wood vertical structural members used as supporting elements in walls and partitions.

**Valley:** An internal angle formed by a junction of two sloping sides of a roof.

## **Reference Resources**

### **Books**

(see the Course Profile for further textbook references)

Algrove Publishing, **Barn Plans and Outbuildings**, Reprint 1999, ISBN0-921335-64-4  
This reprint of the classic book printed originally in 1889 has many barn and shed designs included. It describes the building, its use, and basic construction details.

Monte Burch, **Complete Guide to Building Log Homes**, New York, N.Y., Sterling Publishing Company 1990. ISBN 0-8069-7486-9  
Everything you want to know about log buildings. This book gives details on foundation design, wood and building selection. It give details about roofing materials, ventilation and wiring. Includes 840 different illustrations.

Salvadori, M. **The Art of Construction, Projects and Principles for Beginning Engineers and Architects**. Chicago: Chicago Review Press 1990. ISBN 1-55652-080-8  
Salvadori describes the principles of structures such as the arch, trusses, post and beam, geodesic dome, etc. This is important knowledge when designing display structures and associated joinery that will carry loads.

Gordon, J.E. **The New Science of Strong Materials**. Markham, Ontario: Penguin Books, 1999. ISBN 0-306-80151-5  
Gordon, J.E. **Structures, or Why Things Don't Fall Down**. Markham, Ontario: Penguin Books, 1999. ISBN 0-306-80151-5  
These two books by Gordon describe material, structural properties and the underlying physics and chemistry. Concepts such as stress, strain, mechanical strength and the science of structures are described. This is very important information to have as background knowledge when designing structures and determining materials to use in projects.

### **Websites**

Construction Safety Association of Ontario (CSAO)  
<http://www.csao.org/>  
Important safety site for everything related to construction. Arrange for a free seminar or training session.

Ministry of Labour, Occupational Health and Safety Act  
<http://www.gov.on.ca/LAB/ohs/ohse.htm>  
Important information on the OHSA.

BestToolSites.com (associated with Amazon.com)

**[http://www.besttoolsites.com/SuggestedReading/house\\_plans.htm](http://www.besttoolsites.com/SuggestedReading/house_plans.htm)**

This is a website for buying books or for browsing books on small building construction. Lists the availability of books for the small project builder.

Today's Homeowner

**[http://index.todayshomeowner.com/yard/19980831\\_feature1.html](http://index.todayshomeowner.com/yard/19980831_feature1.html)**

This site gives ideas on various shed designs and hints on how to start. It is from an article in Today's Homeowner magazine. Includes colour pictures.

Ontario Contractors

**[www.ontariocontractors.com](http://www.ontariocontractors.com)**

Gives tips and calculations for building residential structures, including cost estimation charts

### **Video**

(See your school's *Cable in the Classroom* representative, (usually the librarian) for possibilities on recording home building and renovation shows on PBS or The Learning Channel)

Hometime on PBS

**[www.pbs.org/hometime](http://www.pbs.org/hometime)**

Instructional videos on how to build various elements of residential construction

The Learning Channel

**<http://tlc.discovery.com/>**

Shows (and video resources) include Bob Villa's Home Again, Hometime, Trading Spaces, etc.

### **Resource Note:**

*The URLs for the websites were verified by the writers prior to publication. Given the frequency with which these designations change, teachers should always verify the websites prior to assigning them for student use.*

*The ARMdocs make reference to the use of specific texts, magazines, films, videos, and websites. Teachers need to consult their board policies regarding use of any copyrighted materials. Before reproducing materials for student use from printed publications, teachers need to ensure that their board has a Cancopy licence and that this licence covers the resources they wish to use. Before screening videos/films with their students, teachers need to ensure that their board/school has obtained the appropriate public performance videocassette licence from an authorized distributor, e.g., Audio Cine Films Inc. Teachers are reminded that much of the material on the Internet is protected by copyright. The copyright is usually owned by the person or organization that created the work. Reproduction of any work or substantial part of any work on the Internet is not allowed without the permission of the owner.*

**Skill Builder # 1: General Construction Techniques****Topic: Framing****Key Concepts:**

- Identify parts, joinery and structural details from blueprints or technical drawings
- demonstrate knowledge of roof and wall framing
- identify the differences between roof framing and wall framing
- describe framing in of doors and windows

**New learning:**

- Carpentry terminology
- General house framing
- Stud wall designs
- Knee wall designs

**Materials and equipment:**

- Measuring tools
- 2X4 studs
- Nails hammers, saws

**Challenge questions:**

- What is the method for framing a header over a doorway?
- What is meant by “on-centre” when applied to framing a wall?
- Where do floor joist differ from roof rafters?
- What type of lumber is used in framing most houses?

**Notes:**

- Students work off of a floor plan to assemble a stud wall which has a window opening
- Students must wear appropriate PPE (Personal Protective Equipment) when working on this project.

**Skill Builder # 2: General Construction Techniques****Topic: Roofing****Key Concepts**

- identify components of a gable roof
- identify components of a hip roof
- demonstrate an understanding of rafters
- understand various roof coverings

**New learning:**

- rafter design
- roof designs
- truss designs
- personal protective equipment for working on roofs
- types of roof coverings (tiles, shingles, steel, slates)

**Materials and equipment:**

- Lumber for rafters
- Handouts of roof truss designs
- Hammers, nails and gussets

**Challenge questions:**

- Where can problems occur in roof design?
- Why is it important to wear of proper personal protective equipment when working on a roof?
- What are the most common types of roof coverings?
- What are 3 types of truss designs?

**Notes:**

Teachers provide mock roof within shop facility for students to observe and demonstrate skills. Students may also build mock trusses using lath strips to demonstrate their proficiency.

**Skill Builder # 3: General Construction Techniques****Topic: Foundations****Key Concepts:**

- Identify various footing types
- identify the differences between block and poured foundations
- Understand single dwelling and duplex foundation techniques

**New learning:**

- Footing types
- Foundation wall design
- Foundation sizes, block selection
- Anchor bolts
- Windows in foundations
- Special footings

**Challenge questions:**

- What are the reasons for anchor bolts in the foundation?
- Why are rebars used in the footings?
- Why is a key used on a poured foundation footing?

**Notes:**

- Students build footing frame
- Students pour small footing
- Students lay small block wall (next day)

**Skill Builder # 4: General Construction Techniques****Topic: Sub-Floor****Key Concepts:**

- Identify floor joists and hangers
- Identify floor sheathing
- Identify types of screws, nails and adhesives used in sub-floors

**New learning:**

- Sub-floor plywood types
- Sub-floor design
- Bridging
- Basement stair headers
- Joist hangers and main beams

**Challenge questions:**

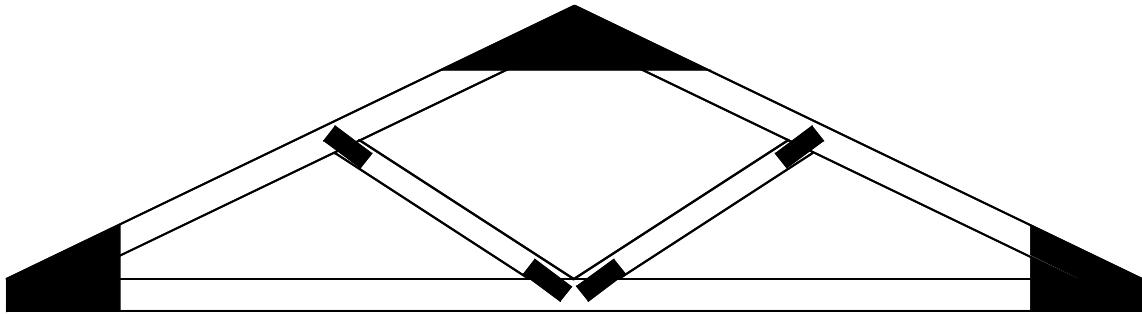
- What are the reasons for using bridging?
- What are beams used for?
- Why is it important to use adhesive in the sub-floor?
- What trades are involved in building the sub-floor?

**Note:**

- Students build 10 x 10 sub-floor for a shed.

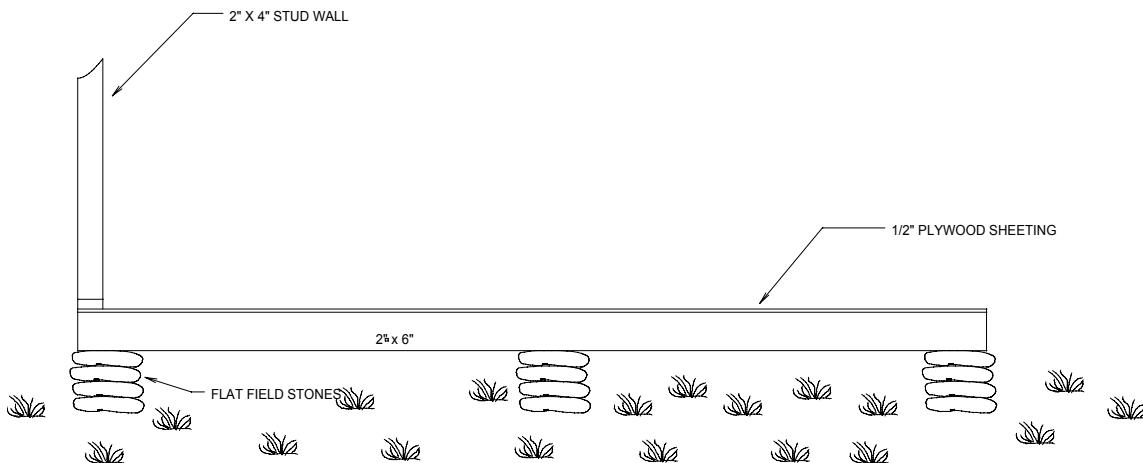
## Roof Truss Design

This design is typical for small sheds and out buildings. Gussets are placed at the heel of the truss and at the peak. Gussets may also be placed at the connecting web members. This truss is built entirely out of 2" x 4" lumber with plywood gussets.



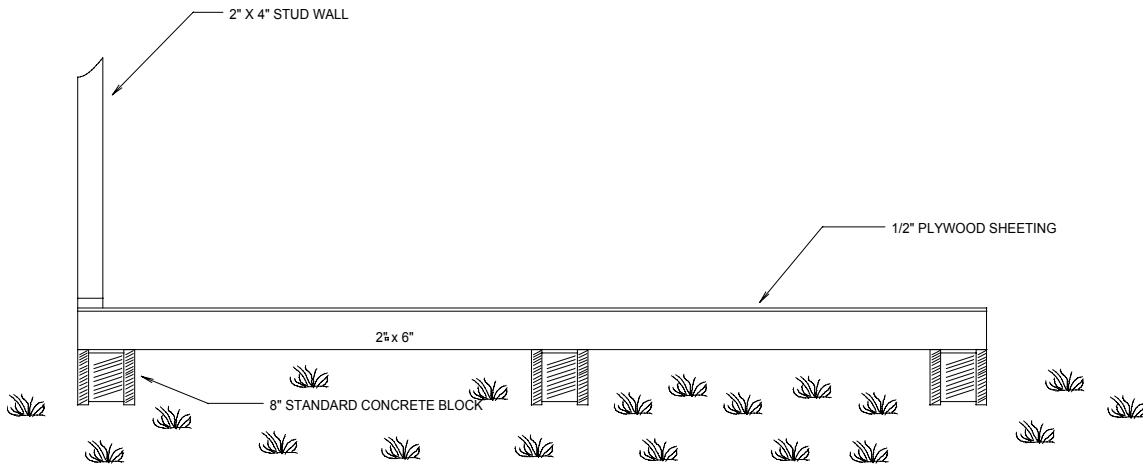
## Foundation Design

Small sheds should never be placed directly on the ground as the wood will be subject to rot. Here are some simple foundation ideas. This design uses flat field stones.



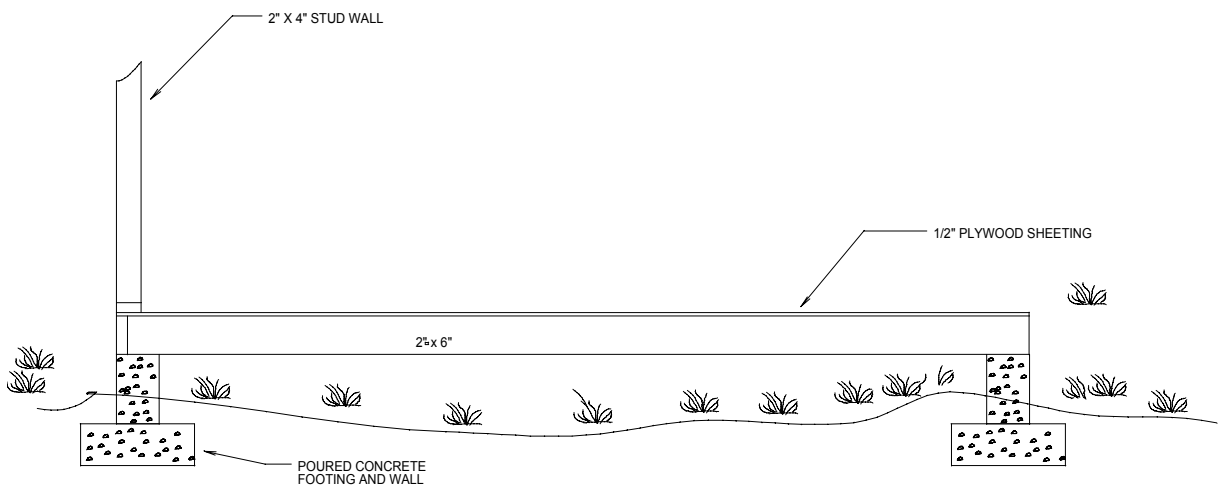
## Foundation designs (cont.)

This design shows a simple foundation using concrete blocks. The floor and wall are supported 8" above the ground.

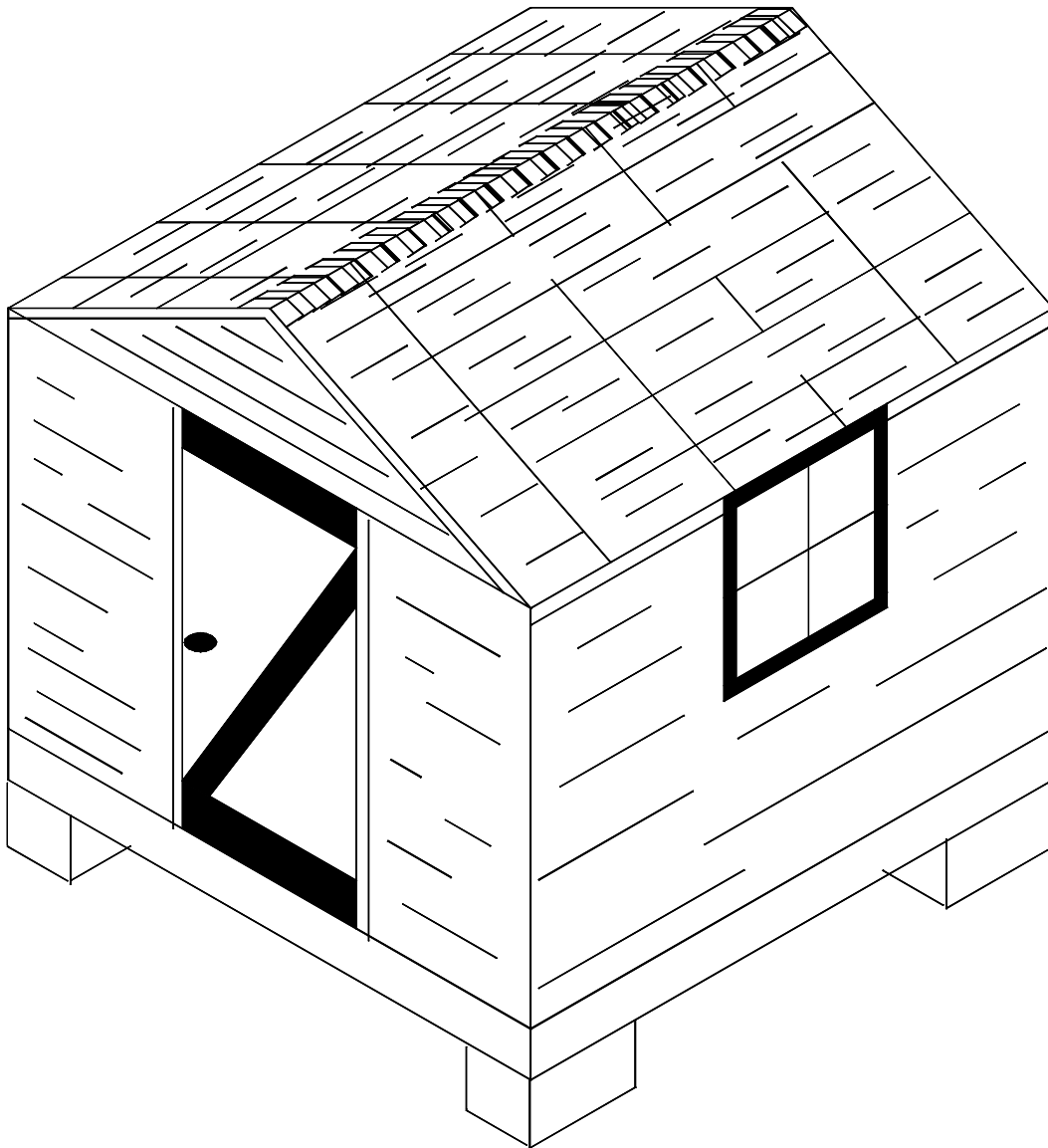


**The builder should note: Use of pour slab foundations may require the owner to acquire a building permit. In most areas a permit is not required if the building is under 100 square feet (10' x 10') and not permanently attached.**

### Poured Foundation



***Sample of a small work shed***



## ***Career Information***

*TCJ3E Construction Technology*

### **UNIT 2, ACTIVITY 4:**

### **Let's Build It**

#### **Career Information Sites:**

Human Resources Development Canada: National Occupational Classification Database-

<http://www.hrdc-drhc.gc.ca/noc>

HRDC NOC Search Engine-

<http://www.worklogic.com:81/noc/Query.htm?lang=e>

Ontario Prospects: geared to young people and students

<http://www.edu.gov.on.ca/eng/general/elemsec/job/prospect/eng/index.html>

Job Futures 2000: what's hot, what's not

<http://www.hrdc-drhc.gc.ca/JobFutures>

Job Profiles: real people profile their jobs

<http://www.jobprofiles.org/index.htm>

Canada WorkInfoNet: national and regional market info

<http://www.workinfonet.ca>

*The following activity related careers are described in the Human Resources Development Canada (HRDC) National Occupational Classification (NOC) database. Use the search engine link above to learn the main duties performed by practitioners of each trade, the education requirements for the position, and related occupations.*

- 0711 Construction Manager
- 0712 Residential Home Builders and Renovators
- 2265 Construction Investigators
- 7215 Contractors and Supervisors, Carpentry Trades
- 7271 Carpenters
- 7294 Painters and Decorators
- 7611 Construction Trade Helpers and Labourers

## ***Student Project Brief***

*TCJ3E Construction Technology*

### **UNIT 2, ACTIVITY 4:**

### **Let's Build It**

#### **Contents:**

1. Project Brief Handout: Storage Shed
2. Checklist
3. Evaluation Rubric
4. Activity Log

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**Project Brief Handout: Lets Build It Storage Shed**

<b>Title:</b>	<b>Let's Build It</b>		
<b>Activity:</b>	Design and build a 10 x 10 storage shed	<b>Course:</b>	<b>TCJ3E Construction Technology</b>
<b>Time Req'd:</b>	14 hours	<b>Date:</b>	
<b>RATIONALE</b>			
<p>Small structures such as out buildings, sheds, playhouses, ice fishing huts, wood shelters, school bus shelters, or decks play important roles in our lives, and designing and building them offers a great learning opportunity since they use many of the same construction techniques as any house. Some of the things you will learn is floor, wall, or roof construction, framing, exterior finish, electrical systems, production of working drawings, and project management. Here we will design and build a storage shed for a local client, considering details in space utilization, protection from the elements, security, lighting and cost.</p>			
<b>THE ASSIGNMENT</b>			
<p>You will build a 10ft x 10ft storage facility to meet specific design criteria.</p>			
<b>LEARNING EXPERIENCE: You will:</b>			
<ol style="list-style-type: none"> <li>1. Document the construction process through daily log sheets.</li> <li>2. Develop a Bill of Materials</li> <li>3. learn to measure and fabricate a structure using a variety of tools and equipment</li> <li>4. Understand framing and roofing</li> <li>5. learn and use safe practices throughout the activity.</li> </ol>			
<b>TOOLS AND MATERIALS</b>			
<p>Saws, power saws, hammers, nails, screws and adhesives. Plywood, 2 x 4 lumber, 2 x 6 lumber, asphalt shingles, roof sheathing.</p>			
<b>NOTES</b>			

<b>EVALUATION</b>				
<b>No.</b>	<b>Deliverable</b>	<b>Time Limit (periods)</b>	<b>% Weight</b>	<b>Notes</b>
1	Bill of materials	2	20	Must be complete
2	Daily log sheets	On-going	10	Complete every day
3	Completed product	14	50	Must meet checklist requirements
4	Written report	2	20	Includes team process with peer evaluations
<b>TOTALS</b>		<b>18</b>	<b>100%</b>	

**NOTES**

This project may take on different needs as the modifications are made to meet customer requirements. The timelines may need to be increased to allow for completion of the project. A team of four is adequate for a project of this size. Team members work on various components as the project continues to evolve.

**SAFETY IS JOB 1 AT ALL TIMES**

**WHEN IN DOUBT, ASK**

**EYE PROTECTION MUST BE WORN AT ALL TIMES**

<b>PROJECT PROCEDURE</b>	
<b>Step</b>	<b>Procedure</b>
1	Review drawing and make appropriate modifications
2	Prepare Bill of Materials
3	Order materials delivered to school or site (depending on style of shed)
4	Ensure all tools are in safe working order and all PPE is ready for use.
5	Layout and build sub-floor
6	Frame walls
7	Fabricate and install roof truss
8	Install roof sheathing and shingles
9	Clean up shop
10	Make a short report using daily logs outlining your contribution

**Checklist for 10' x 10' Shed**

**(Deliverable is the demonstration of your active participation in the safe construction and use of tools in building the completed shed)**

Qualifiers	Yes	No
Applies a systematic process in making design decisions		
Identifies suitable materials for the components of the shed		
Demonstrates how to design and build a stairway (step porch)		
Determines the size of structural members using charts, tables, codes, etc.		
Demonstrates skill in using tools, materials and equipment		
Demonstrates skill in measurement and layout		
Demonstrates knowledge and skill in safe practices		
Demonstrates skill in construction techniques and methods:		
• Understands foundation types		
• Understands and demonstrates the proper use of floor joists		
• Identifies and uses proper sub-floor sheeting		
• Demonstrates proper framing techniques		
• Understand headers and plates		
• Understands various forms of roof trusses		
• Demonstrates an understanding of gussets		
• Demonstrates an understanding of rise and run (roof pitch)		
• Demonstrates proper shingle work		
• Understands squaring up of work		
• Demonstrates the safe and proper use of power saw		
• Demonstrates the proper use of hand tools		
• Demonstrates proper door hanging techniques		

**Marking Rubric For Storage Shed Project**

<b>Criteria</b>	<b>Level 1 (50 - 59%)</b>	<b>Level 2 (60 – 69%)</b>	<b>Level 3 (70 – 79%)</b>	<b>Level 4 (80 – 100%)</b>
<b>Inquiry</b> The student can apply problem solving skills to projects. SPV.01	- minimally applies themselves in this inquiry/design process	- demonstrates some effort and applies some skills involved in this inquiry/design process	- demonstrates quality effort in applying the skills involved in this inquiry/design process	- plays leadership role in managing the inquiry/design process
<b>Inquiry</b> The student identifies and uses suitable materials in the design SP2.03, SP2.06	- demonstrates a limited knowledge of materials in application	- demonstrates good knowledge of materials in application	- demonstrates considerable knowledge of materials in application	- demonstrates thorough and insightful knowledge of materials in application
<b>Inquiry</b> The student uses calculations and references to charts, tables, codes, etc. SP3.02	- demonstrates limited understanding of calculations and layout	- demonstrates some understanding of calculations and layout	- demonstrates considerable understanding of calculations and layout	- demonstrates thorough and insightful understanding of calculations and layout
<b>Application</b> The student can demonstrate skill in the use of tools, materials and processes. SP2.02, SP2.04, SP2.08	- uses equipment, and technology safely and correctly with supervision	- uses equipment, and technology safely and correctly with some supervision	- uses equipment, and technology safely and correctly	- demonstrates and promotes the safe and correct use of equipment and technology
<b>Knowledge/ Understanding</b> The student can recognize and describe the correct safety procedures ICV.02, IC2.2	- describes and practises safe operating procedures throughout the project with direct supervision	- describes and practises safe operating procedures throughout the project with moderate effectiveness	- describes and practises safe operating procedures throughout the project with considerable effectiveness	- describes and demonstrates leadership practises in safe operating procedures throughout the project

**Note:** A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

**Daily Log**

<b>Student:</b>	
<b>Class:</b>	

<b>Date</b>	<b>Project</b>	<b>Function</b>	<b>Hours</b>	<b>Teacher Signature</b>

<b>Total Hours:</b>	
<b>Student Signature:</b>	
<b>Teacher Signature:</b>	

## ***Safety Resource Pack***

*TCJ3E Construction Technology*

### **UNIT 2, ACTIVITY 4:**

### **Let's Build It**

#### **Contents:**

1. Safety Data Sheets:
  - a. Table saw
  - b. Cutoff saw/radial arm saw
  - c. Circular saw
  - d. Jig saw
  - e. Hand tools
  - f. Hammer and/or nail gun
  - g. Air tools (if applicable)
  - h. Paints and solvents
  - i. Personal Protective Equipment
  - j. Others as applicable
2. Safety Passport
3. Safety Test

#### **NOTE:**

**All personnel in a shop environment must be wearing approved safety eyewear at all times.**

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INSERT THE FOLLOWING SHEETS FROM THE SAFETY RESOURCE PACK:

**Contents:**

4. Safety Data Sheets:
  - a. General shop safety
  - b. Power tools
  - c. Hand tools
  - d. Table saw
  - e. Cutoff saw/radial arm saw
  - f. Circular saw
  - g. Jig saw
  - h. Hammer and/or nail gun
  - i. sander
  - j. Air tools (if applicable)
  - k. Paints and solvents
  - l. Personal Protective Equipment
  - m. Others as applicable
5. Safety Passport
6. Safety Test