National Occupational Skill Standard (NOSS)

Occupational Title : **Shuttering Carpenter**

Level : **1**

Sector : **Construction**

Sub - Sector : **Construction Work**

NOSS ID/NSCO ID :

ISCO NO :

Council for Technical Education and Vocational Training

NATIONAL SKILL TESTING BOARD

Madhyapur Thimi-17, Sanothimi, Bhaktapur, Nepal

Developed: 30-05-2025 (16-02-2082)

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Developed jointly by National Skill Testing Board
And
F- SKILL

Recommended by Construction Technical Sub Committee
August. 2006

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Recommended by Construction Technical Sub Committee: 30 May 2025 (16 Jestha 2082)

1	**Occupational Title: Shuttering Carpenter** **Level: 1**
2	**Job Description:** Shuttering Carpenter, L-1, fabricates and erects formwork for foundation, fabricates and erects formwork for column, fabricates and erects formwork for staircase and simple slope roof, fabricates and erects formwork for beam and slab, and fabricates and erects formwork for shear wall.
	UNITS OF COMPETENCY: 1. Fabricate and erect formwork for foundation 2. Fabricate and erect formwork for column 3. Fabricate and erect formwork for staircase and simple slope roof 4. Fabricate and erect formwork for beam and slab 5. Fabricate and erect formwork for shear wall 6. Perform communication 7. Develop professionalism ***Note: Units 6 and 7 are not for testing purpose.***
4	**Qualifying Notes/Prerequisites:** • Physical Requirements: Sound health • Entry Requirements: As per NSTB rules. **Additional Information:** • Assessment Types: Performance test only • Assessment Duration: 4 to 5 Hours (Full competency) • Recommended Group Size: 8 to 10 Candidates

5	**Unit No: 1** **Unit Title: Fabricate and erect formwork for foundation**	**Unit code:**

Elements of competency	Performance standards
1.1 Prepare worksite for formwork installation	1.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 1.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 1.1.3 Worksite inspected, cleaned, and levelled for foundation work. 1.1.4 Worksite barricaded and safety signs placed as per safety requirements.
1.2 Perform base layout	1.2.1 Foundation base and the required peripheral levelled, measured, and checked. 1.2.2 Foundation alignment and centerline marked and checked based on reference points. 1.2.3 Periphery of ***foundation elements*** marked and checked based on centerlines and dimensions.
1.3 Fabricate foundation formwork components	1.3.1 ***Requirements*** for foundation formwork determined from drawing and site conditions. 1.3.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 1.3.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 1.3.4 Plywood/timber joined using ***appropriate joints.*** 1.3.5 Formwork components assembled to required dimension. 1.3.6 Fabricated components inspected for measurement, alignment, and stacked at designated area near worksite.
1.4 Erect formwork	1.4.1 Base plate placed on levelled firm surface. 1.4.2 Pegs and studs installed as per site conditions.

		1.4.3 Form oil applied evenly on formwork surfaces coming in contact with concrete. 1.4.4 Side panels installed with required ***supporting elements.*** 1.4.5 Additional supporting elements installed to secure and strengthen the formwork. 1.4.6 Gaps and joints sealed to prevent leakage.
	1.5 Perform de-shuttering	1.5.1 Supporting elements removed carefully in sequential order. 1.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 1.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 1.5.4 Formwork components stacked in designated area.
	1.6 Clean workplace	1.6.1 Unused materials collected and stored in designated area. 1.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 1.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Formwork materials (plywood, timber, steel), props, binding wire, GI wire, spacer, cover block, measuring tape, spirit level, plumb bob, level pipe, hammer, claw hammer, chisel, rammer, mason thread, try square, combination square, marking gauge, marking tool (chalk, marker, marking scriber), adjustable wrench, spanner, pliers, screwdrivers, hand saw, cutter, drill machine, file, wire cutter, paint brush, nails, screws, bolts, clamps, supporting elements, bracing, form oil, scraper, crowbar, magnet, dust pan, dust bin, broom, brush, first aid kit and personal protective equipment.	

7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Hazards involved in sharpening tools. • Isolate electric and fire hazards (tripping, electric shock, burns). • Hazards involved in lifting tools, equipment and materials. • Safe handling of debris.

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools and equipment
	  ○ Type
	  ○ Use
	  ○ Safe handling and storage
	• Foundation
	  ○ Introduction
	  ○ Types and their formwork requirements
	  ○ Dimension
	• Formwork
	  ○ Introduction
	  ○ Types
	  ○ Importance
	• Fabricating formwork components
	  ○ Foundation formwork components and their functions
	  ○ Materials used in formwork (Timber, plywood, steel, fiber)
	  ○ Measuring, marking, cutting, and shaping technique
	  ○ Types of timber joint and joining technique
	  ○ Assembling methods and technique
	• Foundation formwork erection
		• Convert metric unit to imperial and vice versa
		• Calculate area
			• Read and interpret drawing
			• Read and interpret manufacturer's instruction

	○ Site inspection and preparation ○ Foundation layout and marking ○ Types and application of release agent (form oil, cream emulsion, chemical agent) ○ Foundation formwork erection process and techniques ○ Foundation formwork leveling, alignment, and plumb setting ○ Bracing and support systems ○ Formwork securing techniques ○ Clear cover between formwork and reinforcement ○ Cover block and its use ○ Joints sealing ○ Formwork inspection and adjustment • De-shuttering ○ Formwork removal timing ○ Formwork removal sequence and methods ○ Handling and protecting formwork ○ Cleaning and stacking formwork • Recordkeeping and reporting • Waste management • Occupational health and safety (OHS) • Use of first aid kit		

9	**Assessment of Competency**					
	Unit: 1 **Unit Title: Fabricate and erect formwork for foundations**					
	Candidate Details			**Assessors Detail**		
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:			Assessors' Name 1. 2. 3.		ID/License No:
Element of competency	**Performance Standards**			**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
1.1 Prepare worksite for formwork installation	1.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 1.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 1.1.3 Worksite inspected, cleaned, and levelled for foundation work. 1.1.4 Worksite barricaded and safety signs placed as per safety requirements.						
1.2 Perform base layout	1.2.1 Foundation base and the required peripheral levelled, measured, and checked. 1.2.2 Foundation alignment and centerline marked and checked						

	based on reference points. 1.2.3 Periphery of ***foundation elements*** marked and checked based on centerlines and dimensions.				
1.3 Fabricate foundation formwork components	1.3.1 ***Requirements*** for foundation formwork determined from drawing and site conditions. 1.3.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 1.3.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 1.3.4 Plywood/timber joined using ***appropriate joints.*** 1.3.5 Formwork components assembled to required dimension. 1.3.6 Fabricated components inspected for measurement, alignment, and stacked at designated area near worksite. 1.3.7 Form oil applied evenly on formwork surfaces coming in contact with concrete.				
1.4 Erect formwork	1.4.1 Base plate placed on levelled firm surface. 1.4.2 Pegs and studs installed as per site conditions. 1.4.3 Form oil applied evenly on formwork surfaces coming in contact with concrete. 1.4.4 Side panels installed with required ***supporting elements.*** 1.4.5 Additional supporting elements installed to secure and strengthen the formwork.				

	1.4.6 Gaps and joints sealed to prevent leakage.				
1.5 Perform de-shuttering	1.5.1 Supporting elements removed carefully in sequential order. 1.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 1.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 1.5.4 Formwork components stacked in designated area.				
1.6 Clean workplace	1.6.1 Unused materials collected and stored in designated area. 1.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 1.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation
RP- Role Play **PG** –Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced
CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Safety jacket • Goggles • Gloves • Safety shoes • Mask • Ear plug
Foundation elements	*May include but not limited to:* • Isolated footing • Combined footing • Raft/Mat • Strap beam • Strip foundation
Requirements	*May include but not limited to:* • Dimension/size • Shape • Quantity
Appropriate joints	*May include but not limited to:* • Butt joint • Half lap joint • Lap joint

Supporting elements	*May include but not limited to:* • Studs • Walers • Bracers • Cleats • Spacer • Clamps • Props • Ties
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No: 2** **Unit Title: Fabricate and erect formwork for column**	**Unit code:**

Elements of competency	Performance standards
2.1 Prepare worksite for formwork installation	2.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 2.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 2.1.3 Worksite inspected, cleaned, and levelled for column work. 2.1.4 Worksite barricaded and safety signs placed as per safety requirements.
2.2 Fabricate column formwork components	2.2.1 ***Requirements*** for column formwork determined from drawing and site conditions. 2.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 2.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 2.2.4 Plywood/timber joined using ***appropriate joints***. 2.2.5 Column ***formwork components*** assembled to required dimension. 2.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.
2.3 Construct column kicker/starter	2.3.1 Centerlines of columns checked and adjusted as per drawing. 2.3.2 Column perimeter measured and marked with respect to centerline based on column dimension. 2.3.3 Form oil applied evenly on surfaces coming in contact with concrete. 2.3.4 Kicker panels installed on marked line to kicker height of 75 - 150 mm in line, level and plumb maintaining clear cover.

		2.3.5 Formwork joints and gaps sealed to prevent leakage. 2.3.6 Concrete mixture prepared in required ratio and poured into column kicker to required column height. 2.3.7 Concrete mixture compacted and rough surface created on the top. 2.3.8 Kicker formwork removed after setting of concrete.
	2.4 Erect column formwork	2.4.1 Debris is removed from surface. 2.4.2 Form oil applied evenly on surfaces coming in contact with concrete. 2.4.3 Column formwork base prepared as per dimension of column. 2.4.4 Column bars held upright with binding wires or rope maintaining clear cover by placing cover blocks at required intervals. 2.4.5 Column panels erected and positioned vertically resting against kicker or on column base. 2.4.6 ***Supporting elements*** installed to secure formwork and ties placed at intervals of 450 - 750 mm depending on formwork type and dimension. 2.4.7 Internal clear dimension and verticality checked on two directions and adjusted as per task requirements. 2.4.8 Gaps and joints sealed to prevent leakage.
	2.5 Perform de-shuttering	2.5.1 Supporting elements removed carefully in sequential order. 2.5.2 Column panels loosened gently and removed without damaging concrete surface and formwork. 2.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical

		damage. 2.5.4 Formwork components stacked in designated area.
	2.6 Clean workplace	2.6.1 Unused materials collected and stored in designated area. 2.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 2.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Formwork materials (plywood, timber, steel), props, clamps, nails, binding wire, GI wire, spacer, cover block, sand, cement, aggregate, pan, trowel, shovel, measuring tape, spirit level, plumb bob, level pipe, hammer, claw hammer, chisel, mason thread, try square, combination square, awl, marking gauge, marking tool (chalk, marker, marking scriber), adjustable wrench, spanner, pliers, screwdrivers, hand saw, cutter, drill machine, file, wire cutter, paint brush, screws, bolts, supporting elements, bracing, form oil, scraper, crowbar, magnet, dust pan, dust bin, broom, brush, first aid kit and personal protective equipment.	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Safe lifting of formwork materials. • Isolate electric and fire hazards. • Safe handling of debris.	

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools and equipment
	  ○ Type
	  ○ Use
	  ○ Safe handling
	  ○ Basic maintenance
	  ○ Storage
	• Column
	  ○ Introduction
	  ○ Types (Square, rectangular, circular)
	  ○ Dimension
	• Formwork
	  ○ Introduction
	  ○ Types
	  ○ Importance
	• Fabricating column formwork components
	  ○ Column formwork components and their functions
	  ○ Materials used in column formwork (Timber, plywood, steel, fiber)
	  ○ Measuring, marking, cutting, and shaping technique
		• Convert metric unit to imperial and vice versa
		• Calculate area
			• Read and interpret drawing
			• Read and interpret manufacturer's instruction

	○ Types of timber joint and joining technique ○ Assembling methods and technique • Column kicker/starter ○ Introduction ○ Dimension ○ Column layout and placement of column kicker ○ Column kicker installation, setting, and levelling technique ○ Use of shear key • Concrete mix ○ Introduction ○ Ratio ○ Concrete setting time • Column formwork erection ○ Site inspection and preparation ○ Column layout and marking ○ Types and application of release agent (form oil, cream emulsion, chemical agent) ○ Formwork base for column ○ Column formwork erection process and techniques ○ Column formwork levelling, alignment and plumb setting ○ Bracing and support systems		

	○ Formwork securing techniques ○ Clear cover between formwork and reinforcement ○ Cover block and its use ○ Joint sealing ○ Formwork inspection and adjustment • De-shuttering ○ Formwork removal timing ○ Formwork removal sequence and methods ○ Handling and protecting formwork ○ Cleaning and stacking formwork • Recordkeeping and reporting • Waste management • Occupational health and safety (OHS) • Use of first aid kit		

9	**Assessment of Competency**					
	Unit: 2 **Unit Title: Fabricate and erect formwork for column**					
	Candidate Details			**Assessors Detail**		
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:			Assessors' Name 1. 2. 3.		ID/License No:

Element of competency	**Performance Standards**	**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
2.1 Prepare worksite for formwork installation	2.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 2.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 2.1.3 Worksite inspected, cleaned, and levelled for column work. 2.1.4 Worksite barricaded and safety signs placed as per safety requirements.				
2.2 Fabricate column formwork components	2.2.1 ***Requirements*** for column formwork determined from drawing and site conditions. 2.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked.				

	2.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 2.2.4 Plywood/timber joined using ***appropriate joints***. 2.2.5 Column ***formwork components*** assembled to required dimension. 2.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.				
2.3 Construct column kicker/starter	2.3.1 Centerlines of columns checked and adjusted as per drawing. 2.3.2 Column perimeter measured and marked with respect to centerline based on column dimension. 2.3.3 Form oil applied evenly on surfaces coming in contact with concrete. 2.3.4 Kicker panels installed on marked line to kicker height of 75 - 150 mm in line, level and plumb maintaining clear cover. 2.3.5 Formwork joints and gaps sealed to prevent leakage. 2.3.6 Concrete mixture prepared in required ratio and poured into column kicker to required column height. 2.3.7 Concrete mixture compacted and rough surface created on the top.				

	2.3.8 Kicker formwork removed after setting of concrete.				
2.4 Erect column formwork	2.4.1 Debris is removed from surface. 2.4.2 Form oil applied evenly on surfaces coming in contact with concrete. 2.4.3 Column formwork base prepared as per dimension of column. 2.4.4 Column bars held upright with binding wires or rope maintaining clear cover by placing cover blocks at required intervals. 2.4.5 Column panels erected and positioned vertically resting against kicker or on column base. 2.4.6 ***Supporting elements*** installed to secure formwork and ties placed at intervals of 450 - 750 mm depending on formwork type and dimension. 2.4.7 Internal clear dimension and verticality checked on two directions and adjusted as per task requirements. 2.4.8 Gaps and joints sealed to prevent leakage.				
2.5 Perform de-shuttering	2.5.1 Supporting elements removed carefully in sequential order. 2.5.2 Column panels loosened gently and removed without damaging concrete surface and formwork.				

	2.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 2.5.4 Formwork components stacked in designated area.				
2.6 Clean workplace	2.6.1 Unused materials collected and stored in designated area. 2.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 2.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Safety jacket • Goggles • Gloves • Safety shoes • Mask • Ear plug
Requirements	*May include but not limited to:* • Dimension/size • Shape • Quantity
Appropriate joints	*May include but not limited to:* • Butt joint • Half lap joint • Lap joint
Formwork components	*May include but not limited to:* • Column panel: side and end panel • Kicker panel

Supporting elements	*May include but not limited to:* • Studs • Bracers • Spacer • Clamps • Props • Ties
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No: 3** **Unit Title: Fabricate and erect formwork for staircase and simple slope roof**	**Unit code:**
	Elements of competency	**Performance standards**
	3.1 Prepare worksite for formwork installation	3.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 3.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 3.1.3 Worksite inspected, cleaned, and levelled for column work. 3.1.4 Worksite barricaded and safety signs placed as per safety requirements.
	3.2 Fabricate formwork components	3.2.1 ***Requirements*** for column formwork determined from drawing or site conditions. 3.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 3.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 3.2.4 Plywood/timber joined using ***appropriate joints***. 3.2.5 ***Formwork components*** assembled to required dimension. 3.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.
	3.3 Erect staircase formwork	3.3.1 Formwork installation site checked and prepared as per site requirements. 3.3.2 ***Staircase layout*** marked accurately as per drawing. 3.3.3 Formwork ***supporting elements*** installed firmly as per marked layout. 3.3.4 Bottom form/soffit for staircase flight and landing installed at correct angle and height. 3.3.5 Side formwork/stringers installed at the edge and aligned as per staircase profile

		maintaining required slope and width. 3.3.6 Riser formwork placed and fixed to soffit at required intervals in line, level, and plumb. 3.3.7 Additional supporting elements installed to secure and strengthen trade and riser. 3.3.8 Level, alignment, dimensions, and stability of erected formwork is inspected and adjusted as per drawing. 3.3.9 Gaps and joints sealed to prevent leakage. 3.3.10 Form oil applied evenly on surfaces coming in contact with concrete.
	3.4 Erect formwork for slope roof	3.4.1 Formwork installation site checked and prepared as per site requirements. 3.4.2 Roof slope layout marked accurately as per drawing. 3.4.3 Formwork supporting elements installed firmly at designated points to required height in line, level, and plumb. 3.4.4 Bottom form/soffit installed along the roof slope at correct angle, height, and alignment. 3.4.5 Side formwork fixed at the edge and aligned maintaining required thickness, slope, and shape of roof. 3.4.6 Additional supporting elements installed to secure and strengthen the formwork. 3.4.7 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 3.4.8 Gaps and joints sealed to prevent leakage. 3.4.9 Form oil applied evenly on formwork surfaces coming in contact with concrete.

	3.5 Perform de-shuttering	3.5.1 Supporting elements removed carefully in sequence. 3.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 3.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 3.5.4 Formwork components stacked in designated area.
	3.6 Clean workplace	3.6.1 Unused materials collected and stored in designated area. 3.6.2 Tools and equipment cleaned and stored in designated area 3.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Formwork materials (plywood, timber, steel), props, clamps, nails, binding wire, GI wire, spacer, cover block, measuring tape, spirit level, plumb bob, level pipe, hammer, claw hammer, chisel, mason thread, try square, combination square, marking gauge, marking tool (chalk, marker, marking scriber), adjustable wrench, spanner, pliers, screwdrivers, shuttering seal tape, hand saw, cutter, drill machine, chisel, file, wire cutter, paint brush, screws, bolts, supporting elements, bracing, form oil, scraper, crowbar, dust pan, dust bin, broom, brush, first aid kit and personal protective equipment.	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Hazards involved in handling cutting tools. • Isolate electric and fire hazards (tripping, electric shock, burns).	

	• Hazards involved in lifting tools, equipment and materials. • Safe handling of debris.

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools and equipment
	  ○ Type
	  ○ Use
	  ○ Safe handling
	  ○ Basic maintenance
	  ○ Storage
	• Formwork
	  ○ Introduction
	  ○ Types
	  ○ Importance
	• Staircase
	  ○ Introduction
	  ○ Types
	  ○ Dimension
	  ○ Staircase components
	• Roof
	  ○ Introduction
	  ○ Types
	  ○ Dimension
		• Convert metric unit to imperial and vice versa
		• Calculate area
			• Read and interpret drawing
			• Read and interpret manufacturer's instruction

	• Fabricating staircase and roof formwork components
	  ○ Staircase and roof formwork components and their functions
	  ○ Materials used in formwork (Timber, plywood, steel, aluminum)
	  ○ Measuring, marking, cutting, and shaping technique
	  ○ Types of timber joint and joining technique
	  ○ Assembling methods and technique
	• Staircase and roof formwork erection
	  ○ Site inspection and preparation
	  ○ Layout and marking
	  ○ Staircase and roof formwork erection process and techniques
	  ○ Formwork alignment and plumb setting
	  ○ Bracing and support systems
	  ○ Formwork securing techniques
	  ○ Use of cover block and spacer
	  ○ Joints sealing
	  ○ Types and application of releasing agent (form oil, cream emulsion, chemical agent)
	  ○ Formwork inspection and adjustment		

	• Dismantle shear wall formwork
	  ○ Formwork removal timing/period
	  ○ Formwork removal sequence and methods
	  ○ Handling and protecting formwork
	  ○ Cleaning and stacking formwork
	• Recordkeeping and reporting
	• Waste management
	• Occupational health and safety (OHS)
	• Use of first aid kit		

9	Assessment of Competency					
	Unit: 3 **Unit Title: Fabricate and erect formwork for staircase and simple slope roof**					
	Candidate Details			**Assessors Detail**		
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:			Assessors' Name 1. 2. 3.		ID/License No:

Element of competency	Performance Standards	Standard Met	Standard Not Met	Evidence Type	Comments
3.1 Prepare worksite for formwork installation	3.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 3.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 3.1.3 Worksite inspected, cleaned, and levelled for column work. 3.1.4 Worksite barricaded and safety signs placed as per safety requirements.				
3.2 Fabricate formwork components	3.2.1 ***Requirements*** for column formwork determined from drawing or site conditions. 3.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked.				

	3.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 3.2.4 Plywood/timber joined using ***appropriate joints***. 3.2.5 ***Formwork components*** assembled to required dimension. 3.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.				
3.3 Erect staircase formwork	3.3.1 Formwork installation site checked and prepared as per site requirements. 3.3.2 ***Staircase layout*** marked accurately as per drawing. 3.3.3 Formwork ***supporting elements*** installed firmly as per marked layout. 3.3.4 Bottom form/soffit for staircase flight and landing installed at correct angle and height. 3.3.5 Side formwork/stringers installed at the edge and aligned as per staircase profile maintaining required slope and width. 3.3.6 Riser formwork placed and fixed to soffit at required intervals in line, level, and plumb. 3.3.7 Additional supporting elements installed to secure and strengthen trade and riser. 3.3.8 Level, alignment, dimensions, and stability of erected				

	formwork is inspected and adjusted as per drawing. 3.3.9 Gaps and joints sealed to prevent leakage. 3.3.10 Form oil applied evenly on surfaces coming in contact with concrete.				
3.4 Erect formwork for slope roof	3.4.1 Formwork installation site checked and prepared as per site requirements. 3.4.2 Roof slope layout marked accurately as per drawing. 3.4.3 Formwork supporting elements installed firmly at designated points to required height in line, level, and plumb. 3.4.4 Bottom form/soffit installed along the roof slope at correct angle, height, and alignment. 3.4.5 Side formwork fixed at the edge and aligned maintaining required thickness, slope, and shape of roof. 3.4.6 Additional supporting elements installed to secure and strengthen the formwork. 3.4.7 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 3.4.8 Gaps and joints sealed to prevent leakage. 3.4.9 Form oil applied evenly on formwork surfaces coming in contact with concrete.				

3.5 Perform de-shuttering	3.5.1 Supporting elements removed carefully in sequence. 3.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 3.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 3.5.4 Formwork components stacked in designated area.				
3.6 Clean workplace	3.6.1 Unused materials collected and stored in designated area. 3.6.2 Tools and equipment cleaned and stored in designated area. 3.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation
RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced
CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Safety jacket • Goggles • Gloves • Safety shoes • Mask • Ear plug
Requirements	*May include but not limited to:* • Dimension/size • Shape • Quantity
Appropriate joints	*May include but not limited to:* • Butt joint • Half lap joint • Lap joint
Formwork components	*May include but not limited to:* • Stringers • Soffit panels • Side forms • Riser boards

Staircase layout	*May include but not limited to:* • Start point • End point • Flight • Tread • Riser • Landing position • Slope lines
Supporting elements	*May include but not limited to:* • Base plate • Sole board • Vertical support/props • Bearer • Brace • Walers • Cleats • Spacer • Clamps • Ties • Struts
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No:4** **Unit Title: Fabricate and erect formwork for beam and slab**	**Unit code:**

Elements of competency	Performance standards
4.1 Prepare worksite for formwork installation	4.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 4.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 4.1.3 Worksite inspected, cleaned, and levelled for shear wall layout. 4.1.4 Worksite is barricaded and safety signs placed as per safety requirements.
4.2 Fabricate formwork components	4.2.1 ***Requirements*** for formwork component determined from drawing or site conditions. 4.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 4.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 4.2.4 Plywood/timber joined using ***appropriate joints***. 4.2.5 ***Beam and slab formwork components*** assembled to required dimensions. 4.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.
4.3 Erect beam formwork	4.3.1 Formwork installation site checked and prepared as per site requirements. 4.3.2 Beam layout marked accurately as per drawing. 4.3.3 Beam soffit/bottom is fixed along with ***supporting elements*** at required interval to required elevation/height in line, level, and plumb. 4.3.4 Side panels of required height installed and aligned as per drawing. 4.3.5 Additional supporting elements installed to secure and strengthen the formwork.

		4.3.6 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 4.3.7 Gaps and joints sealed to prevent leakage. 4.3.8 Form oil applied evenly on surfaces coming in contact with concrete.
	4.4 Lay/erect slab formwork	4.4.1 Formwork installation site checked and prepared as per site requirements. 4.4.2 Slab layout marked accurately as per drawing. 4.4.3 Formwork supporting elements installed firmly at designated points to required elevation/height in line, level, and plumb. 4.4.4 Bottom form/soffit installed at required height in line and level. 4.4.5 Side formwork fixed at the edge and aligned maintaining required thickness, and shape of slab 4.4.6 Additional supporting elements installed to secure and strengthen the formwork. 4.4.7 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 4.4.8 Gaps and joints sealed to prevent leakage. 4.4.9 Form oil applied evenly on surfaces coming in contact with concrete.
	4.5 Perform de-shuttering	4.5.1 Supporting elements removed carefully in sequence. 4.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 4.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage.

		4.5.4 Formwork components stacked in designated area.
	4.6 Clean workplace	4.6.1 Unused materials collected and stored in designated area. 4.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 4.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Formwork materials (plywood, timber, steel), props, clamps, nails, binding wire, GI wire, spacer, cover block, measuring tape, spirit level, plumb bob, level pipe, hammer, claw hammer, chisel, mason thread, try square, combination square, marking gauge, marking tool (chalk, marker, marking scriber), adjustable wrench, spanner, pliers, screwdrivers, shuttering seal tape, hand saw, cutter, drill machine, chisel, file, wire cutter, paint brush, screws, bolts, supporting elements, bracing, form oil, scraper, crowbar, dust pan, dust bin, broom, brush, first aid kit and personal protective equipment.	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Safe lifting of formwork materials. • Isolate electric and fire hazards. • Safe handling of debris.	

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools and equipment
	  ○ Type
	  ○ Use
	  ○ Safe handling
	  ○ Basic maintenance
	  ○ Storage
	• Formwork
	  ○ Introduction
	  ○ Types
	  ○ Importance
	• Beam and slab
	  ○ Introduction
	  ○ Functions
	  ○ Types
	  ○ Dimension
	• Fabricating beam and slab formwork components
	  ○ Beam and slab formwork components and their functions
	  ○ Materials used in shear wall formwork (Timber, plywood, steel, fiber)
		• Convert metric unit to imperial and vice versa
		• Calculate area
			• Read and interpret drawing
			• Read and interpret manufacturer's instruction

	○ Measuring, marking, cutting, and shaping technique ○ Types of timber joint and joining technique ○ Assembling methods and technique • Beam and slab formwork erection ○ Site inspection and preparation ○ Layout and marking ○ Beam and slab formwork erection process and techniques ○ Formwork alignment and plumb setting ○ Bracing and support systems ○ Formwork securing techniques ○ Use of cover block and spacer ○ Joints sealing ○ Types and application of releasing agent (form oil, cream emulsion, chemical agent) ○ Formwork inspection and adjustment • Dismantle beam and slab formwork ○ Formwork removal timing/period ○ Formwork removal sequence and methods ○ Handling and protecting formwork ○ Cleaning and stacking formwork • Recordkeeping and reporting		

	• Waste management • Occupational health and safety (OHS) • Use of first aid kit		

9	Assessment of Competency					
	Unit: 4 **Unit Title: Fabricate and erect formwork for beam and slab**					
	Candidate Details		**Assessors Detail**			
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:		Assessors' Name 1. 2. 3.		ID/License No:	
Element of competency	**Performance Standards**		**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
4.1 Prepare worksite for formwork installation	4.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 4.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 4.1.3 Worksite inspected, cleaned, and levelled for shear wall layout. 4.1.4 Worksite is barricaded and safety signs placed as per safety requirements.					
4.2 Fabricate formwork components	4.2.1 ***Requirements*** for formwork component determined from drawing or site conditions. 4.2.2 Plywood/timber measured as per required dimensions and					

	cutting lines clearly marked. 4.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 4.2.4 Plywood/timber joined using ***appropriate joints***. 4.2.5 ***Beam and slab formwork components*** assembled to required dimensions. 4.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.				
4.3 Erect beam formwork	4.3.1 Formwork installation site checked and prepared as per site requirements. 4.3.2 Beam layout marked accurately as per drawing. 4.3.3 Beam soffit/bottom is fixed along with ***supporting elements*** at required interval to required elevation/height in line, level, and plumb. 4.3.4 Side panels of required height installed and aligned as per drawing. 4.3.5 Additional supporting elements installed to secure and strengthen the formwork. 4.3.6 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 4.3.7 Gaps and joints sealed to prevent leakage.				

	4.3.8 Form oil applied evenly on surfaces coming in contact with concrete.				
4.4 Lay/erect slab formwork	4.4.1 Formwork installation site checked and prepared as per site requirements. 4.4.2 Slab layout marked accurately as per drawing. 4.4.3 Formwork supporting elements installed firmly at designated points to required elevation/height in line, level, and plumb. 4.4.4 Bottom form/soffit installed at required height in line and level. 4.4.5 Side formwork fixed at the edge and aligned maintaining required thickness, and shape of slab 4.4.6 Additional supporting elements installed to secure and strengthen the formwork. 4.4.7 Alignment, dimensions, and stability of erected formwork inspected and adjusted as per drawing. 4.4.8 Gaps and joints sealed to prevent leakage. 4.4.9 Form oil applied evenly on surfaces coming in contact with concrete.				
4.5 Perform de-shuttering	4.5.1 Supporting elements removed carefully in sequence. 4.5.2 Formwork panels loosened gently and removed without				

	damaging concrete surface and formwork. 4.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage. 4.5.4 Formwork components stacked in designated area.				
4.6 Clean workplace	4.6.1 Unused materials collected and stored in designated area. 4.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 4.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Safety jacket • Goggles • Gloves • Safety shoes • Mask • Ear plug
Requirements	*May include but not limited to:* • Dimension/size • Shape • Quantity
Appropriate joints	*May include but not limited to:* • Butt joint • Half lap joint • Lap joint
Beam and slab formwork components	*May include but not limited to:* • Beam side and bottom panels • Slab side and bottom panels

Supporting elements	*May include but not limited to:* • Base plate • Sole board • Vertical support/props • Bearer • Brace • Walers • Cleats • Spacer • Clamps • Ties • Joist
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No:5** **Unit Title: Fabricate and erect formwork for shear wall**	**Unit code:**

Elements of competency	Performance standards
5.1 Prepare worksite for formwork installation	5.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 5.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 5.1.3 Worksite inspected, cleaned, and levelled for shear wall layout. 5.1.4 Worksite is barricaded and safety signs placed as per safety requirements.
5.2 Fabricate shear wall formwork components	5.2.1 ***Requirements*** for shear wall formwork components determined from drawing or site conditions. 5.2.2 Plywood/timber measured as per required dimensions and cutting lines clearly marked. 5.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 5.2.4 Plywood/timber joined using ***appropriate joints***. 5.2.5 ***Shear wall formwork components*** assembled at right angle to each other. 5.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.
5.3 Construct column kicker/starter for shear wall	5.3.1 Centerlines of shear wall checked and adjusted as per drawing. 5.3.2 Formwork layout marked on the base with respect to reference line as per wall dimension. 5.3.3 Kicker panels installed on marked line to kicker height of 75 - 150 mm in line, level and plumb maintaining clear cover.

		5.3.4 Formwork joints and gaps sealed to prevent leakage. 5.3.5 Concrete mixture prepared in required ratio and poured into kicker to required height. 5.3.6 Concrete mixture compacted with rough surface on the top. 5.3.7 Kicker formwork removed after setting of concrete.
	5.4 Erect shear wall formwork	5.4.1 Debris is removed from surface. 5.4.2 Form oil applied evenly to entire inner surface. 5.4.3 Formwork base prepared as per dimension of shear wall. 5.4.4 Shear wall bars held upright with binding wires or rope maintaining clear cover by placing cover blocks at required intervals. 5.4.5 Spacer placed at required intervals as per drawing. 5.4.6 Formwork panels erected and positioned vertically resting against kicker or on shear wall base. 5.4.7 ***Supporting elements*** installed to secure formwork at intervals of 450 - 750 mm depending on formwork type and dimension. 5.4.8 Internal clear dimension and verticality checked on adjacent surface and adjusted as per task requirements. 5.4.9 Gaps and joints sealed to prevent leakage.
	5.5 Perform de-shuttering	5.5.1 Supporting elements removed carefully in sequential order. 5.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 5.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical

		damage. 5.5.4 Formwork components stacked in designated area.
	5.6 Clean workplace	5.6.1 Unused materials collected and stored in designated area. 5.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 5.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Formwork materials (plywood, timber, steel), props, clamps, nails, binding wire, GI wire, spacer, cover block, measuring tape, spirit level, plumb bob, level pipe, hammer, claw hammer, chisel, mason thread, try square, combination square, marking gauge, marking tool (chalk, marker, marking scriber), adjustable wrench, spanner, pliers, screwdrivers, shuttering seal tape, hand saw, cutter, drill machine, chisel, file, wire cutter, paint brush, screws, bolts, supporting elements, bracing, form oil, scraper, crowbar, dust pan, dust bin, broom, brush, first aid kit and personal protective equipment.	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Safe lifting of formwork materials. • Isolate electric and fire hazards. • Safe handling of debris.	

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools and equipment
	  ○ Type
	  ○ Use
	  ○ Safe handling
	  ○ Basic maintenance
	  ○ Storage
	• Formwork
	  ○ Introduction
	  ○ Types
	  ○ Importance
	• Shear wall
	  ○ Introduction
	  ○ Functions
	  ○ Types
	  ○ Dimension
	• Fabricating shear wall formwork components
	  ○ Shear wall formwork components and their functions
	  ○ Materials used in shear wall formwork (Timber, plywood, steel, fiber)
		• Convert metric unit to imperial and vice versa
		• Calculate area
			• Read and interpret drawing
			• Read and interpret manufacturer's instruction

	○ Measuring, marking, cutting, and shaping technique ○ Types of timber joint and joining technique ○ Assembling methods and technique • Shear wall kicker/starter ○ Introduction ○ Dimension ○ Shear wall layout and placement of shear wall kicker ○ Shear wall kicker installation, setting, and levelling technique • Concrete mix ○ Introduction ○ Ratio and grade of concrete ○ Concrete setting time/duration • Shear wall formwork erection ○ Types and application of releasing agent (form oil, cream emulsion, chemical agent) ○ Site preparation ○ Layout and marking ○ Shear wall formwork erection process and techniques ○ Shear wall formwork alignment and plumb setting ○ Bracing and support systems		

	○ Formwork securing techniques ○ Clear cover between formwork and reinforcement ○ Use of cover block and spacer ○ Formwork inspection and adjustment • Dismantle shear wall formwork ○ Formwork removal timing/period ○ Formwork removal sequence and methods ○ Handling and protecting formwork ○ Cleaning and stacking formwork • Recordkeeping and reporting • Waste management • Occupational health and safety (OHS) • Use of first aid kit		

9	**Assessment of Competency**					
	Unit: 5 **Unit Title: Fabricate and erect formwork for shear walls**					
	Candidate Details		**Assessors Detail**			
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:		Assessors' Name 1. 2. 3.		ID/License No:	
Element of competency	**Performance Standards**		**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
5.1 Prepare worksite for formwork installation	5.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 5.1.2 Tools, equipment, and materials collected, checked for serviceability, and arranged in designated area. 5.1.3 Worksite inspected, cleaned, and levelled for shear wall layout. 5.1.4 Worksite is barricaded and safety signs placed as per safety requirements.					
5.2 Fabricate shear wall formwork components	5.2.1 ***Requirements*** for shear wall formwork components determined from drawing or site conditions. 5.2.2 Plywood/timber measured as per required dimensions and					

	cutting lines clearly marked. 5.2.3 Plywood/timber cut along the marked line and cut surface smoothened and shaped as required. 5.2.4 Plywood/timber joined using ***appropriate joints***. 5.2.5 ***Shear wall formwork components*** assembled at right angle to each other. 5.2.6 Fabricated components inspected for measurement, alignment and stacked at designated area near worksite.				
5.3 Construct column kicker/starter for shear wall	5.3.1 Centerlines of shear wall checked and adjusted as per drawing. 5.3.2 Formwork layout marked on the base with respect to reference line as per wall dimension. 5.3.3 Kicker panels installed on marked line to kicker height of 75 - 150 mm in line, level and plumb maintaining clear cover. 5.3.4 Formwork joints and gaps sealed to prevent leakage. 5.3.5 Concrete mixture prepared in required ratio and poured into kicker to required height. 5.3.6 Concrete mixture compacted with rough surface on the top. 5.3.7 Kicker formwork removed after setting of concrete.				

5.4 Erect shear wall formwork	5.4.1 Debris is removed from surface. 5.4.2 Form oil applied evenly to entire inner surface. 5.4.3 Formwork base prepared as per dimension of shear wall. 5.4.4 Shear wall bars held upright with binding wires or rope maintaining clear cover by placing cover blocks at required intervals. 5.4.5 Spacer placed at required intervals as per drawing. 5.4.6 Formwork panels erected and positioned vertically resting against kicker or on shear wall base. 5.4.7 ***Supporting elements*** installed to secure formwork at intervals of 450 - 750 mm depending on formwork type and dimension. 5.4.8 Internal clear dimension and verticality checked on adjacent surface and adjusted as per task requirements. 5.4.9 Gaps and joints sealed to prevent leakage.				
5.5 Perform de-shuttering	5.5.1 Supporting elements removed carefully in sequential order. 5.5.2 Formwork panels loosened gently and removed without damaging concrete surface and formwork. 5.5.3 Concrete residue, mortar, and dirt removed from formwork and inspected for physical damage.				

	5.5.4 Formwork components stacked in designated area.				
5.6 Clean workplace	5.6.1 Unused materials collected and stored in designated area. 5.6.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 5.6.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Safety jacket • Goggles • Gloves • Safety shoes • Mask • Ear plug
Requirements	*May include but not limited to:* • Dimension/size • Shape • Quantity
Appropriate joints	*May include but not limited to:* • Butt joint • Half lap joint • Lap joint
Shear wall formwork components	*May include but not limited to:* • Wall panel • Kicker panel
Supporting elements	*May include but not limited to:* • Studs

	• Bracers • Spacer • Clamps • Walers • Vertical supports/props • Ties
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle