Activity Hazard Analysis (AHA) — Rebar and Formwork Installation

Overall RAC: **M** · SAMPLE formatted to EM 385-1-1 (15 March 2024) and ENG Form 6206 (SEP 2024) conventions. Adapt every step, hazard and control to actual site conditions; requires competent-person preparation, SSHO review and Government acceptance before the definable feature of work begins (EM 385-1-1 2024, para 2-6). Contracts solicited before 15 March 2024 remain governed by the 2014 edition — verify which edition your contract cites.

JOB STEPS	HAZARDS	CONTROLS	RESIDUAL RAC
Mobilization, material delivery, and staging of rebar and form materials	Struck-by or crushed-by during offloading of rebar bundles and form panels	• Establish an exclusion zone around the offloading area and keep all non-essential personnel clear of suspended loads; no one works under bundled material loads (27-8.a(4)(a)). • Use tag lines to control rebar bundles and form panels during hoisting, and rig loads under the direction of a qualified rigger (Ch 15). • Unload cylindrical and bundled material using a method that keeps workers off the unloading side of the carrier after tie wires are cut (14-8.b(20)(d)).	L
	Trip, laceration, and toppling hazards from disorderly material storage	• Store reinforcing steel in orderly piles located away from walkways and roadways (14-8.b(19)(a)). • Stack and block form lumber and cylindrical materials to prevent spreading, tilting, or sliding, and securely pile steel so members cannot slide off (14-8.b(19)–(20)). • Follow the material delivery, storage, and staging procedures in the QP's formwork erection and removal plan (27-7.a(3)).	L
	Manual handling injuries (strains, pinch points) moving rebar and panels	• Use mechanical means (forklift, crane, buggies) for bundles and panels instead of manual carrying wherever the site layout allows. • Assign team lifts for long bar and awkward panels and pre-plan carry routes to keep them clear of debris and grade changes. • Wear cut-resistant gloves, safety-toe boots, hard hats, and eye protection selected for the task per Ch 5 (27-8.a(5)).	L
Pre-work planning: formwork/shoring design verification and plan review	Shoring erected to an unverified or deviated design, leading to later collapse	• Obtain the QP-developed erection and removal plan required for all formwork other than slab on grade, and confirm it is accepted by the KO/COR before work begins (27-7.a). • Have an RPE qualified in structural design inspect shoring equipment prior to erection to verify it matches the shoring design, and remove damaged equipment from service (27-5.a(1)). • Keep the fabricated shoring system manufacturer's specifications on site during planning and execution, and do not exceed the manufacturer's safe working load (27-8.e(3), 27-8.e(5)(g)). • Design and plan formwork and shoring according to ACI 347R-14 (27-8.e(1), 27-1.a).	L
	Crew unaware of sequence, hazards, or stop-work triggers	• Review this AHA at the preparatory meeting; every involved employee reviews and signs it before starting work (2-6.d(2)). • Designate in writing, by name, the CP for formwork/shoring, the QP who prepared the plan, and the CP for fall protection (2-6.d(4)(g)). • Update the AHA when site conditions or the shoring system change, and resubmit if the RAC increases (2-6.d(5)(a)).	L

JOB STEPS	HAZARDS	CONTROLS	RESIDUAL RAC
Erect and brace formwork and shoring	Formwork/shoring collapse during erection from inadequate base support or bracing	• Verify supporting ground or completed construction has adequate strength for the applied vertical and lateral loads, and that sills are sound, rigid, and capable of carrying the maximum intended load (27-8.e(5)(a)-(b)). • Keep base plates, shore heads, extension devices, and adjustment screws in firm contact with the footing sill and form material, secured where necessary (27-8.e(5)(c)). • Provide diagonal bracing in vertical and horizontal planes, and brace single post shores in both longitudinal and transverse directions, installing bracing as the shores are erected (27-8.e(5)(e), 27-8.e(6)(f), 27-8.e(6)(f-3)). • Reject fabricated single post shores or adjusting devices that are heavily rusted, bent, dented, re-welded, or have broken welds, and timber that is split, cut, or rotted (27-8.e(4)). • Have a structural engineer design and inspect the layout wherever single post shores are used in more than one tier (27-5.a(3), 27-8.e(6)(a)).	M
	Falls from elevation while setting wall forms and deck formwork	• Provide fall protection at 6 feet (1.8 m) for all Chapter 27 work using guardrails, work platforms, or personal fall protection systems (27-8.a(1), Ch 21). • Have the CP for fall protection select the system, and ensure Authorized Persons are trained by a CP before using personal fall protection equipment (21-4.c, 21-3.d). • Inspect personal fall protection equipment before each use and remove from service anything damaged or subjected to a fall (21-5.a).	L
	Struck-by and pinch-point injuries handling panels and shore frames	• Verify all locking devices on frames and braces are in good working order, coupling pins align frame legs, and pivoted cross braces have their center pivot in place before assembly (27-8.e(8)(a)). • Secure posts located near the slab perimeter during assembly to prevent post fall-out (27-8.e(6)(f-4)). • Keep hands clear of closing surfaces when landing panels; use tag lines on hoisted forms.	L
Install and tie reinforcing steel	Impalement on protruding rebar and fasteners	• Guard all protruding reinforcing steel onto which workers could fall with impalement protection (OSHA-compliant rebar caps or troughs) before exposure is created; do not allow employees to work above or in positions exposed to impalement hazards until the hazard is controlled (27-8.a(3), 1926.701(b)). • Provide fall protection regardless of height wherever a fall onto an impalement hazard is possible (21-8.a(3)(a)). • Inspect impalement protection daily and replace displaced or damaged caps immediately.	L
	Collapse of vertical rebar assemblies (walls, piers, columns)	• Brace, guy, weld, or otherwise support reinforcing steel for walls, piers, columns, and similar vertical structures to prevent overturning or collapse (27-8.c(1)). • Use an RPE-designed support system for any reinforcing steel supports that are independent of other shoring support systems (27-8.c(1)). • Secure turnbuckles against unwinding under stress and place plumbing-up guys so workers can reach connection points; the CP oversees removal of plumb-up guys (27-8.c(2)-(4), 27-4.a(1)).	M
	Wire mesh recoil and tie-wire lacerations	• Secure unrolled wire mesh to prevent recoiling before cutting bands (27-8.c(5)). • Wear cut-resistant gloves and eye protection for tying and cutting operations (Ch 5). • Turn tie-wire tails down or cap them where they create snag or laceration exposure on walking/working surfaces.	L
	Falls while working from rebar mats and formwork at elevation	• Provide guardrails, work platforms, or personal fall protection at 6 feet and above; formwork and rebar assembly are listed fall-protection exposures (27-8.a(1), 21-8.a(3)(b)). • Have the CP for fall protection verify anchorage and system selection for workers tying steel above the 6-foot threshold (21-4.c). • Maintain clear access routes onto the mat and prohibit climbing formwork bracing as access.	L

JOB STEPS	HAZARDS	CONTROLS	RESIDUAL RAC
Pre-pour inspection and support during concrete placement	Shoring failure under fluid concrete load during the pour	• Inspect erected shoring equipment immediately prior to, during, and immediately after concrete placement; immediately reinforce or re-shore any shoring found damaged, displaced, or weakened (27-5.a(2)). • Place concrete following the sequence and rate assumed in the approved formwork design so lateral pressures are not exceeded (27-8.e(2), 27-7.a). • Do not adjust single post shores to raise formwork after concrete is in place (27-8.e(6)(d)). • Do not place construction loads on the structure unless a person qualified in structural design confirms it can support them (27-8.a(2)).	M
	Struck-by from concrete buckets and pump discharge lines	• Keep all employees, including vibrator crews, out from under concrete buckets and other suspended loads, and route elevated buckets to minimize worker exposure (27-8.a(4)). • Verify bucket gates have positive safety latches to prevent accidental dumping (27-8.b(1)(e)). • Support pump discharge pipes on supports designed for 100% overload and secure tremie sections with wire rope in addition to couplings (27-8.b(1)(f), 27-8.b(1)(h)).	L
Strip formwork and shoring; install reshores	Structural collapse from premature formwork or shoring removal	• Do not remove forms or shores (except slab on grade and slip forms) until the CP for forming/shoring determines the concrete has gained sufficient strength to support its weight and all superimposed loads (27-8.e(10), 27-4.a(2)). • Base the CP's determination on the plans-and-specifications removal conditions or on concrete testing, per the strength-determination procedures in the erection and removal plan (27-8.e(10)(a)-(b), 27-7.a(4)). • Provide reshoring to safely support slabs and beams after stripping or where members carry superimposed construction loads (27-8.e(5)(f)). • Follow the removal sequence in the QP's erection and removal plan (27-7.a(1)).	M
	Struck-by falling panels and shores during stripping	• Establish a controlled access zone below and around the stripping operation and keep other trades out until stripped material is landed and stacked. • Secure perimeter posts during dismantling and reshoring to prevent post fall-out (27-8.e(6)(f-4)). • Lower panels and shores in a controlled manner; do not drop them to the deck or ground.	L
	Puncture wounds and impalement from protruding nails in stripped lumber	• Pull or bend over protruding nails as lumber is stripped and before stacking; do not allow work in positions exposed to protruding fasteners until controlled (27-8.a(3)). • Stack stripped material in orderly piles away from walkways as it is generated (14-8.b). • Wear puncture-resistant footwear and gloves per the PPE assessment (Ch 5).	L
Demobilization, housekeeping, and material disposal	Trips, lacerations, and public exposure from accumulated debris and stored material	• Remove form debris and cut rebar from work areas daily and dispose of material per the site plan (14-8.c). • Restack reusable shores, panels, and remaining rebar in orderly, blocked piles clear of walkways and roadways (14-8.b(19)-(20)). • Where the work presents a hazard to the public, maintain barricades and postings per MUTCD and ANSI/ASSP A10.34 until the area is cleared (27-8.a(6)).	L
	Struck-by during load-out of stripped materials	• Rig and hoist banded loads of stripped panels and shores with tag lines and an exclusion zone; no workers under suspended loads (27-8.a(4)(a)). • Verify banding and pallet integrity before hoisting stripped material that may contain loose pieces.	L

Equipment To Be Used

• Fabricated shoring system (frames, single post shores, tube-and-coupler) with manufacturer's specifications on site (27-8.e(3))

• Form panels, walers, sills, base plates, and diagonal bracing materials

• Reinforcing steel, tie wire, tying tools, and rebar benders/cutters

• OSHA-compliant impalement protection (rebar caps/troughs) (27-8.a(3), 1926.701(b))

• Crane/forklift, rigging hardware, and tag lines for bundles and panels (Ch 15/16)

• Personal fall protection systems, guardrails, and work platforms (Ch 21)

• Concrete buckets with positive safety latches, pump lines with rated supports (27-8.b(1))

• PPE: hard hats (ANSI Z89.1), safety glasses, cut-resistant gloves, safety-toe boots, high-visibility apparel (Ch 5)

Training Requirements

• AHA review and signature by every involved employee before starting work (2-6.d(2))

• Fall protection training for Authorized Persons conducted by a qualified CP before using personal fall protection equipment (21-3.d)

• CP for Fall Protection: minimum 24 hours of initial coursework with performance assessment (21-3.c)

• Rigger and signal person qualification for crews hoisting rebar bundles and form panels (Ch 15)

• Operator training/certification for forklifts and load handling equipment used in staging (Ch 14/16/18)

• Task-specific PPE selection and use training per the Ch 5 hazard assessment

Inspection Requirements

• RPE inspection of shoring equipment prior to erection to verify conformance with the shoring design; damaged equipment removed from service (27-5.a(1))

• Inspection of erected shoring immediately prior to, during, and immediately after concrete placement, with immediate reinforcement or re-shoring of damaged, displaced, or weakened members (27-5.a(2))

• Structural engineer inspection of the layout wherever single post shores are used in more than one tier (27-5.a(3))

• CP strength determination (per plans/specs or concrete testing) before any formwork or shoring removal (27-8.e(10))

• Pre-use inspection of personal fall protection equipment by each Authorized Person; documented CP inspection at least semi-annually and after any fall (21-5.a)

• Daily walkdown of rebar impalement protection, material storage piles, and housekeeping (14-8.b, 27-8.a(3))

Competent / Qualified Person Requirements

• Competent Person for formwork/shoring — determines the concrete has gained sufficient strength before formwork and shoring removal and oversees removal of plumb-up guys (27-4.a(1)-(2), 27-8.e(10))

• Qualified Person — develops the formwork and shoring erection and removal plan from the approved design and updates it as conditions change (27-4.b(1), 27-7.a)

• Registered Professional Engineer — inspects shoring equipment prior to erection and designs any independent reinforcing steel support systems and single post shores (27-5.a(1), 27-8.c(1), 27-8.e(5))

• Competent Person for Fall Protection — selects and inspects fall protection systems and has stop-work authority (21-4.c, 21-3.c(4), 21-5.a)

• AHA preparer — the AHA must be prepared by the Competent Person(s) for the activity, with required CP(s) and QP(s) designated in writing by name by the employer (2-6.d(1), 2-6.d(4)(g))

References

- EM 385-1-1 (2024) Ch 27 — Concrete, Masonry, Roofing, and Wood Construction
- EM 385-1-1 (2024) 27-5.a — Inspection Requirements — Formwork and Shoring
- EM 385-1-1 (2024) 27-7.a — Erection and Removal Plan for Formwork and Shoring
- EM 385-1-1 (2024) 27-8.a — General (fall protection threshold, impalement, working under loads)
- EM 385-1-1 (2024) 27-8.c — Structural and Reinforcing Steel
- EM 385-1-1 (2024) 27-8.e — Formwork and Shoring (design, erection, removal)
- EM 385-1-1 (2024) Ch 21 — Fall Protection
- EM 385-1-1 (2024) Ch 14 — Material Handling, Storage, Disposal, and Conveyors
- EM 385-1-1 (2024) Ch 5 — Personal Protective and Lifesaving Equipment
- 29 CFR 1926 Subpart Q (1926.700–.706) — Concrete and Masonry Construction
- 29 CFR 1926.701(b) — Reinforcing steel — protection from impalement
- 29 CFR 1926.703 — Requirements for cast-in-place concrete (formwork and shoring)