



Lusail Real Estate Development Company

Health, Safety, Security, Environment, Logistics & Quality Department

Lusail Construction Safety Management Procedure – Steel Erection

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1. Description

This element of the LCSMP provides basic health, safety and environment (HSE) guidelines for personnel conducting steel erection activities at Lusail. This element applies to all Lusail personnel, Contractors, Developers, Consultants and subcontractors working on the Lusail project.

As the qualified authority on steel erection and the hazards associated with steel erection, the Contractor's Steel Erection Plan and site-specific Health and Safety Plan for steel erection shall be viewed as the authoritative guidelines for safe steel erection activities. This Lusail HSE Procedure shall be not used by the Contractor in lieu of the above mentioned required documents/plans for steel erection activities.

2. Responsibilities

The Contractor is fully responsible for the pre-planning, development of Method Statements, Job Hazard Analysis, overall safe work planning and implementation. Project Management is responsible for the assurance that all work is planned and conducted according to the pre-planning documents; Contractor and Lusail Health Safety & Environment (HSE) procedures and the Qatar Construction Specifications 2010. Should a conflict occur between procedures/standards or requirements the more stringent shall apply.

3. Definitions

Term	Description
Job Hazard Analysis (JHA)	A process used to identify the hazards or potential hazards associated with each step of a particular job or work plan in order to uncover hazards and then eliminate, control, or remove them before the work is started.
Construction Load (for joist erection)	Any load other than the weight of the employee(s), the joists, and the bridging bundle.
Hoisting Equipment	Commercially manufactured lifting equipment designed to lift and position a load of known weight to a location at some known elevation and horizontal distance from the equipment's center of rotation.
Permanent Floor	A structurally completed floor at any level or elevation (including slab on grade).
Personal Fall Arrest System	A system used to stop an employee in a fall from a working level, in accordance with LUS-HSE-WG3-446-022 , Fall Protection.
Steel Erection	The construction, alteration or repair of steel buildings, bridges, and other structures, including the installation of metal decking and all planking used during the process of erection.
Structural Steel	A steel member or a member made of a substitute material (e.g., fiberglass, aluminum, or composite members). These members include steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold-formed metal framing that is integrated with the structural steel framing of a building.

4. Project Steel Erection Plan

The Project Manager oversees the development and implementation of the Project Steel Erection Plan (Plan) by a qualified person, including specific provisions for compliance with this Procedure. The Project Manager designates employees to conduct activities within the plan.

The Plan includes the following components at a minimum:

- Planning documents (Risk Assessment/ Job Hazard Analysis (JHA)/ Method Statements/ Two-Week Look-ahead)
- Requirements for verification of structural load capacity/ compressive strength reports

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- Site layout; including access roads, drainage, fabrication, and storage areas
 - Fall protection program, in accordance with [LUS-HSE-WG3-446-022](#), Fall Protection
 - Hoisting and critical lift plans, in accordance with [LUS-HSE-WG3-446-026](#), Cranes, Hoists, and Lifts
 - Method of steel erection
 - Erection schedules

The Plan shall be reviewed and authorized by a registered professional engineer. The Plan shall be the primary guideline used by the Contractor for day to day erection activities. All personnel involved in steel erection duties shall be fully trained on the Plan components and requirements.

5. Fall Protection

Lusail [LUS-HSE-WG3-446-022](#), Fall Protection Policy requires that personnel exposed to falls in excess of 1.8 meters (6') be provided with and use an approved form of fall protection.

The Contractor shall ensure that all personnel involved in steel erection activities (connecting, plumb-up, bolting, welding, decking) are provided with personal fall arrest, fall restraint, guard railings, or safety net protection when exposed to falls in excess of 1.8 meters.

Contractor use of "Safety Monitors" as a fall protection method is prohibited at Lusail.

The Contractor shall prepare and submit a detailed Fall Protection Plan when the use of approved fall protection methods is infeasible or creates a greater hazard to workers. Fall Protection Plans shall be submitted to the Supervising Consultant and Lusail HSE Department for approval. The Contractor shall not implement their Fall Protection Plan until approved by both the Consultant and Lusail.

Contractors shall ensure adequate temporary work platforms at all steel erection sites, per [LUS-HSE-WG3-446-018](#), Walking & Working Surfaces. During steel erection, temporary flooring is required to limit worker exposure to falls as well as the risk of tools and materials falling on personnel below. In line with this, the Contractor shall ensure the following:

- Ensure that the derrick or working floor of every building under construction is solidly decked over its entire surface. Planking or decking of equivalent strength must be thick enough to carry the calculated working load. Planking must not be less than 2 inches thick, full size undressed, laid tight, and secured to prevent shifting under moving weight.
- On buildings or structures not adaptable to temporary flooring, and where scaffolding is not used, the Contractor must install and maintain safety nets if the potential fall distance is the lesser of two stories or 7.6 meters (25'). The nets must be installed with sufficient clearance to prevent contact with any surface structure below.
- During structural steel assembly, install temporary safety perimeter cable of 3/8-inch wire rope (or equivalent) approximately 42" above the deck or floor height around the periphery of all temporary-planked or temporary metal-decked floors of buildings and other multi-floored structures. Wire rope perimeter cables must remain appropriately tensioned to ensure that ropes do not deflect greater than 3" in any direction.
- When erecting flooring skeleton steel, a substantial, tightly planked floor must be maintained at the lesser of two stories or 9.1 meters (30') directly under that portion of each tier of beams on which any work is being performed. The exception is when temporary floor planks on a lower floor are being gathered and stacked ready for transfer to an upper floor. Where such a floor is not practicable, use safety nets.
- Gather and stack temporary floor planks successively, working toward the last panel of a temporary floor. This process ensures that the workers have the support of a planked floor at all times.
- Access to decks under construction shall be provided onto areas where temporary flooring is complete, rather than onto exposed steel beams where unprotected workers would be exposed to falls upon departing ladders.
- Any openings in temporary flooring greater than 12" must be provided with perimeter cabling as described above, or workers exposed to falls through floor openings shall be provided with personal fall arrest or fall restraint and approved anchorage

Install permanent floors for skeleton steel construction in accordance with the following standards:

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- Install permanent floors as the erection of structural steel progresses. The uppermost permanent floor must be in place at the lesser of eight (8) floors or 36 meters (120') under the erection floor, except for cases in which flooring affects the structural integrity of the building.
 - The number of floors having unfinished bolting and/or welding must never exceed four (4) floors or 14.6 meters (48'), whichever is less, above the foundation or uppermost permanently secured floor.

6. Floor/ Hole Covers

- Protect floor openings or holes in decking/planking by using approved guardrails or hole covers, in accordance with [LUS-HSE-WG3-446-018](#), Walking & Working Surfaces.
- Covers for roof and floor openings must be capable of supporting, without failure, twice the weight of the employees, equipment, and materials that may be imposed on the cover at any one time.
- Plywood covers shall be a minimum ¾ inch thickness.
- Secure all covers when installed to prevent accidental displacement by the wind, equipment, or employees.
- Paint all covers with high-visibility paint and mark covers with "DANGER OPEN HOLE" to provide warning of the hazard.
- Smoke dome or skylight fixtures that have been installed are not considered covers for the purpose of this LCSMP element unless they capable of withstanding a load of at least 200 pounds (91kg) applied perpendicularly at any one area on the screen. Such fixtures shall be appropriately marked to indicate this.
- Install wire mesh, exterior plywood, or equivalent, around columns where planks or metal decking do not fit tightly. The materials used must be of sufficient size and strength to prevent objects from falling through.

7. Structural Steel Assembly

When erecting structural steel members, Contractors are advised to use the following guidelines to ensure safety and structural integrity:

- Do not place open web steel joints on any structural steel framework unless that framework is safely bolted or welded.
- Do not place any load on open web steel joints until the following safety actions are met:
 - When bar joists are used in steel framing, and columns are not framed in at least two directions with structural steel members, field-bolt a bar joist at appropriate columns to provide lateral stability during construction.
 - Where long-span joists or trusses 12.2 meters (40') or longer are used, install a center row of bolted bridging to provide lateral stability during construction before any hoisting lines are slackened.

If planking or safety nets might interfere with the safe erection of steel members, workers should be provided with personal fall arrest or fall restraint systems.

Do not weaken any structural member by cutting, holding, or other means, except in accordance with the revised structural steel drawings issued by the contractual engineering designer.

7.1 Multistory Structures

Install the permanent floors as the erection of structural steel progresses. No more than eight (8) stories are allowed between the erection floor and the uppermost permanent floor, except where the structural integrity is maintained as a result of the design.

No more than four (4) floors or 14.6 meters (48'), whichever is less, of unfinished bolting and/or welding is allowed above the foundation or uppermost permanently secured floor, except where the structural integrity is maintained as a result of the design.

Maintain a fully planked or decked floor or safety nets within two stories or 9.1 meters (30'), whichever is less, directly under any erection work being performed.

7.2 Shear Connectors

Do not attach shear connectors (e.g., headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors, or threaded studs to the top flanges of beams, joists, or beam attachments so that they project vertically from or

horizontally across the top flange of the member until after the metal decking, or other walking/working surface has been installed.

When shear connectors are used in construction of composite floors, roofs, and bridge decks, lay out and install the shear connectors after the metal decking has been installed, using the metal decking as a working platform. Do not install shear connectors from within a controlled decking zone (CDZ).

Workers are not permitted to walk on the top surface of any structural steel member that has been coated with paint or similar material unless documentation or certification that the coating has achieved a minimum average slip resistance of 0.50 when measured with an English XL tribometer or equivalent tester on a wetted surface at a testing laboratory is provided.

Such documentation or certification must be based on appropriate international consensus standards and conducted by a laboratory capable of performing the test. The results must be made available at the project site and to the steel erector.

7.3 Plumbing-Up

When deemed necessary by a competent person, install plumbing-up equipment in conjunction with the steel erection process to ensure the stability of the structure. When using plumbing-up equipment, ensure that it is in place and properly installed before the structure is loaded with construction material such as loads of joist, bundles of decking, or bundles of bridging. Remove plumbing-up equipment only with the approval of a competent person.

When a turnbuckle is stressed during plumbing up, Contractors must use a safety device to keep the turnbuckle from unwinding while under the load. Place guys used to support plumbing-up equipment so that employees have access to all connection points.

Contractors shall provide a minimum of three (3) guys on initial or free standing columns. All guys shall remain in place until adequate bolting/welding has been completed, as determined by a competent person.

7.4 Metal Decking

- Do not use bundle packaging and strapping for hoisting unless it is specifically designed for that purpose.
- If loose items such as dunnage, flashing, or other materials are placed on the top of metal decking bundles to be hoisted, secure them to the bundles or remove them.
- Land decking bundles on framing members so that enough support is provided to allow the bundles to be unbanded without dislodging the bundles from the supports.
- During initial placement, place metal decking panels to ensure full support by structural members.
- Workers must verify that metal decking is supported on both sides of proposed cuts. Where this is not feasible, workers shall stand only on decking that is fully supported while performing cuts.
- At the end of the shift or when environmental or jobsite conditions require, secure metal decking against displacement/blowing.
- Install metal decking at roof and floor holes and openings in accordance with the following:
 - Framed metal deck openings must have structural members turned down to allow continuous deck installation except where not allowed by structural design constraints or constructibility.
 - Roof and floor holes and openings must be decked over. Where large size, configuration, or other structural design does not allow openings to be decked over (e.g., elevator shafts, stair wells).
 - Holes in metal decking must not be cut until immediately prior to being permanently filled with the equipment or structure intended to fulfill its specific use.

7.5 General

Observe the following safety precautions at all times during bolting, fitting-up drilling, reaming, and plumbing up:

- ◆ Provide approved eye protection in accordance with [LUS-HSE-WG3-446-006](#), Personal Protective Equipment.
- ◆ Ensure that containers for storing or carrying bolts, drift pins, and other loose objects are in accordance with [LUS-HSE-WG3-446-029](#), Tools. Bolt buckets and other loose items shall not be left aloft between shifts unless properly secured.

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- ◆ At no time may an employee ride a headache ball, hook, or load, in accordance with [LUS-HSE-WG3-446-026](#), Cranes, Hoists, and Lifts.
 - ◆ Use and maintain pneumatic hand tools in accordance with [LUS-HSE-WG3-446-029](#), Tools. When bolts or drift pins are being knocked out, provide a means to prevent the bolts or drift pins from falling.
 - ◆ Do not throw bolts, nuts, washers, and pins; place them in bolt buckets or other approved containers and raise or lower buckets using a line. All impact wrenches must have locking devices for retaining sockets.
 - ◆ Two (2) employees must operate drilling and reaming machines unless the handles are firmly secured to resist the torque reaction of the machine if the reaming or drilling bit freezes.

8. Training

Contractors shall train their employees in requirements for safe steel erection work. The Contractor shall arrange training before employees begin work and when a new hazard is introduced to the jobsite.

Contractors shall ensure that all steel workers are trained on the specifics of the Steel Erection Plan, Method Statements, and JHAs associated with steel erection activities.

Using an acceptable training form, the HSE Representative maintains a record of all training or instruction given to employees.

9. Documentation

Structural load capacity, compressive strength, design and engineering records associated with structural steel erection shall be maintained on site in the Contractor site office for the duration of the project.

Steel Erection Plan shall be made available on site. Copies of the Plan or sections thereof may be copied and taken into the field to assist erectors in meeting design specifications.

The Contractor maintains testing and inspection records at the site for the duration of the project and archives them at a minimum of 10 years from creation date.

10. References

Qatar Construction Specifications 2010 Section 1 Part 10.3.13 “Working at Height”

Qatar Construction Specifications 2010 Section 11 Part 1.3.8 “Safety with Steelwork”

Qatar Construction Specifications 2010 Section 16 Part 8 “Erection”