

Industry standard

Safe erection of structural steel for buildings

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Acknowledgements

This industry standard was prepared on behalf of Foundations for Safety Victoria by a working group comprising industry practitioners, employers, industry employer groups, unions, and WorkSafe Victoria.

The working group was chaired by WorkSafe Victoria, and included representatives from:

AMWU Associated Rigging Australia Aus Truestyle Australand Industrial Construction CFMEU Contexx Housing Industry Association Master Builders Association of Victoria National Association of Steel Housing Salta Constructions P/L Structural Steel Fabricators Association (Vic) United Engineering Australia P/L Victorian Construction Safety Alliance WorkSafe Victoria.

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Developing industry standards in partnership

Foundations for Safety Victoria is Victoria's primary forum for dealing with occupational health and safety issues in the construction industry.

Foundations for Safety brings together regulatory agencies, construction unions and employer associations representing principle contractors and specialist trade sub-contractors.

Chaired by WorkSafe Victoria, it meets every three months to progress OHS issues relating to the construction industry. One of its initiatives is establishing working parties to develop industry standards which provide practical guidance to the industry on particular issues.

The organisations represented on Foundations for Safety Victoria are:

Air Conditioning and Mechanical Contractors Association Association of Wall and Ceiling Industries Australian Industry Group Australian Manufacturing Workers Union Australian Workers Union Building Commission Victoria CEPU Electrical Trades Union **CEPU** Plumbing Division CFMEU Construction and General Division **Civil Contractors Federation** Energy Safe Victoria Finishing Trades Association of Australia Housing Industry Association Master Builders Association of Victoria Master Plumbers and Mechanical Services Association of Australia National Electrical and Communications Association National Federation of Bricklayers and Masonry Employers Plumbing Industry Commission Royal Australian Institute of Architects Victorian Construction Safety Alliance Victorian Crane Association Victorian Employers Chamber of Commerce and Industry Victorian Volume Home Builders Safety Alliance Victorian Trades Hall Council WorkSafe Victoria

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1.

Introduction

1.1 Purpose

Under the Occupational Health and Safety Act 2004 employers have a general duty to ensure the health and safety of employees at work. Employers involved in construction work also have specific duties under the construction part of the OHS regulations to control any risk associated with construction work as far as reasonably practicable.

This industry standard provides practical guidance for the design, fabrication, transportation and erection of steel members for buildings, to eliminate or reduce the risk to the health and safety of:

- employees and contractors involved in structural steel erection
- the public in the vicinity.

The main hazards risking the health and safety of workers in structural steel erection are:

- falls from heights
- · falling objects
- collapse of the structure
- plant used in the work.

1.2 Scope

This industry standard applies to the construction of:

- portal framed buildings
- residential and other buildings where steel frames provide structural strength and stability to the whole building.

Generally, the structural steel members covered include:

- portal and other frames
- columns, beams, rafters, purlins, girts and bracings.

The industry standard does not apply to the construction of:

- buildings that have steel members such as lintels, posts or frames that are not part of the complete steel structure providing stability
- light-gauge, cold-formed metal stud wall, floor and roof systems for structures such as villa housing and those homes, garages and sheds which come in a "kit" style.

Parties, who are excluded in the list above, are encouraged to use this industry standard, regardless, as a guide for the safe erection of their steel framed structures.

WorkSafe Victoria

1.3 What is the status of this industry standard?

1.

The guidance in this industry standard should be followed. An alternative method may be followed if it will achieve an equivalent or better level of health and safety.

Where this industry standard reflects the OHS Act and OHS Regulations (including the construction regulations), this is indicated by the use of the word "must". In such cases, this guidance must be followed.

Steel structures should be designed in accordance with the key Australian standards dealing with the design, fabrication and erection of steel structures:

AS 3828:1998, Guidelines for the erection of building steelwork

AS 4100:1998, Steel structures.

These documents, and other relevant Australian standards, provide detailed technical guidance.

Where any technical conflict arises between a provision of this industry standard and a technical provision of the Australian standard, the Australian standard provision should be followed. However, where the guidance in this industry standard reflects a legal requirement in Victoria, this industry standard should be followed.

See Appendix 1 for a list of relevant Australian standards and other guidance information.

1.4 How to read this industry standard

This standard deals separately with each stage of structural steelwork in sequence. Section 2 provides an overview of the key roles in the whole process for safe erection of structural steel, their responsibilities and methods of work to ensure an efficient, co-operative and safe working environment.

The sections that deal with the stages in the process are:

Section 3: Design

Section 4: Fabrication

Section 5: Transportation

Section 6: Erection.

Each of these sections describes the key responsibilities of that stage in the process, and provides a table of common hazards and risk control measures.

2.

Overview

2.1 Management and control

Erecting structural steelwork for building construction takes place in a dynamic, changing environment where there are many hazards and risks.

Proper and timely planning and coordination are the most effective ways to manage those hazards and risks.

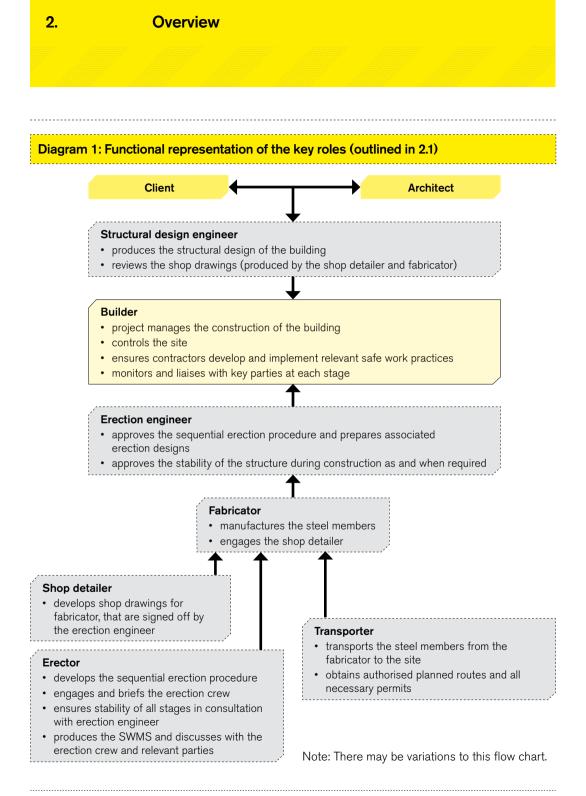
Projects involving structural steel construction have four main stages (dealt with in sections 3 to 6) where risks to health and safety need to be considered:

- design
- fabrication
- transport
- erection.

The parties with roles and responsibilities at the various stages of projects are:

Structural design engineer	The engineer, with experience in structural steel, who is responsible for the engineering design of the overall building.
Builder	The party responsible for project managing the construction of the building and who has control of the building site.
Erection engineer	The engineer who is responsible for the engineering design and stability aspects of the erection of the steel structure. This role requires the person to have a sound knowledge of the structure and its capacity in a temporary state.
Fabricator	The party responsible for making the steelwork.
Shop detailer	Engaged (usually by the fabricator) to produce the shop drawings.
Transporter	The person who delivers the steel to the building site.
Erector	The employer responsible for engaging the erection crew and erecting the structure.

Note: On some projects, one person may perform more than one role, or parts of different roles. This industry standard assumes that each role is carried out by a different person.



The functional relationship between each party is outlined in Diagram 1, on the previous page.

Each party is responsible for the matters that are under its management and control. Managing risks arising from these matters is more effective when parties regularly consult one another and review how the next part of the process will proceed.

For example, close co-operation between all parties is essential to ensure that the procedure for the erection of steel work is safe. They should:

- ensure the procedure is acceptable to all
 parties and signed off by the erection engineer
- review the procedure before activities begin.

2.2 Health and safety representatives

Planning and coordination must involve consultation with those engaged in the work and the health and safety representatives (if any).

A health and safety representative (HSR) is elected by the workers to represent their health and safety issues at work. HSRs must be consulted alongside employees and contractors on issues relating to health and safety, including when processes are reviewed.

For further information, see publication, *Employee Representation*.

2.3 Key planning tools

There are six key documents which help ensure safe work in structural steel erection. These are:

- construction drawings architectural and structural
- shop drawings drawn up by the shop detailer, who is engaged by the fabricator, in consultation with the erection engineer, and detail what steel members are to be manufactured. Shop drawings are reviewed by

the structural design engineer before fabrication (see Section 4 – Fabrication)

- marking plans developed by the fabricator and detail where steel members will be positioned in the erection process (see Section 6 – Erection)
- sequential erection procedure usually developed by the erector and approved by the erection engineer. The sequential erection procedure sets out the steps for the work in the correct order of erection (see Section 6 – Erection)
- safe work method statement (SWMS) developed by the erector in consultation with the crew and the builder, and identifies the hazards and risk controls for each step of the erection sequence (see Section 6.3.3, as well as Appendix 1 for an example)
- erection design developed by the erection engineer based on the sequential erection procedures prepared by the erector.

The responsibility for completing and endorsing these documents in each stage is discussed in the relevant stage sections.

2.4 Licences for high risk work

The erection of structural steel is "high risk work", involving the operation of a variety of plant and the use of certain skills. Those workers operating cranes and other particular plant must have the appropriate licence before anyone can perform high risk work (see Table 1).

Anyone who is being trained, in order to obtain a licence, must be directly supervised if operating the relevant equipment or carrying out specific works without a licence, to ensure that the work is carried out safely.

The arrangements for issuing licences to operators of industrial equipment are set out in the OHS Regulations 2007.

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Table 1: Licences required for high risk work used in steel erection

Licence code	High risk work
LF	Forklift truck operation
DG	Dogging
	A licence is required if:
	 there is a need to apply slinging techniques that require judgement to be exercised
	 there is a need to direct a crane or hoist operator in the movement of a load when the load is out of the operator's view.
RB	Basic rigging
	Work involving:
	movement of plant and equipment
	steel erection
	• particular hoists
	placement of pre-cast concrete
	safety nets and static lines
	mast climbers
	perimeter safety screens and shutters
	cantilevered crane loading platforms.
RI	Intermediate rigging
	In addition to the work associated with basic rigging, this work involves the rigging of:
	cranes, conveyors, dredges and excavators
	all hoists
	• tilt slabs
	demolition
	• dual lifts.
RA	Advanced rigging
	In addition to the work associated with intermediate rigging, this work involves:
	 the rigging of gin poles and sheerlegs
	flying foxes and cableways
	guyed derricks and structures
	 suspended scaffolds and fabricated hung scaffolds.

СТ	Tower crane operation
CN	Non-slewing mobile crane operation (greater than 3 tonnes)
CV	Vehicle loading, crane operation (greater than 10 metre tons; the operation of crane trucks will usually be limited to the delivery of steel members to site)
C2	Slewing mobile crane operation (up to 20 tonnes)
C6	Slewing mobile crane operation (up to 60 tonnes)
C1	Slewing mobile crane operation (up to 100 tonnes)
C 0	Slewing mobile crane operation (over 100 tonnes)
WP	Boom-type elevating work platform operation (boom length greater than 11 metres)

2.5 Competency and training

In addition to the licences listed above, employers must also ensure that their employees have completed:

- construction induction training (such as a 'construction induction card' or equivalent)
- training in the use of plant that does not require a licence for high risk work to operate for example, a boom-type elevating work platform (boom length 11 metres or less), telehandler or non-slewing mobile crane less than 3 tonnes
- a site-specific induction
- training on how to work in accordance with the SWMS developed for the task
- training on how to eliminate or control specific hazards and risks involved in the work which are not covered by an SWMS, for example, manual handling and UV-protection.

Where relevant, training for harnessed-based work positioning and fall protection systems may also be required.

Design stage

3.1 General

There are two separate phases of design in structural steel erection:

i) Structural design

The first phase involves the structural design of the building, for in-service condition, which is carried out by the structural design engineer.

The structural steel design should be produced according to AS 4100, *Steel structures* and AS 3828, *Guidelines for the erection of building steelwork*, which detail how risks can be eliminated or reduced in the design stage. Any associated concrete design, such as building foundations, should comply with AS 3600 *Concrete Structures*.

ii) Erection

The second phase, the design for erection, is for the handling, transportation and erection of the individual members and structure. It may be produced independently of the structural design of the building.

Ideally, planning for the safe erection of structural steel work should be considered at the design stage. Structural design engineers should consider the safe working conditions for those involved in the erection stage, and eliminate as many of the hazards as possible at this stage.

3.2 Roles during the design stage

The structural design engineer is responsible for the structural design of the building.

3.3 Managing risk at the design stage

Failure to plan and design for safety, from the outset, can result in unsafe practices onsite and in structural instability during erection. Accidents in the erection of structural steelwork are not restricted to falls. They can also occur because of structural instability during erection, and while handling, lifting and transporting material.

The stability of the building should be checked by the erection engineer at agreed times with the builder during erection.

Special care should be taken in design and during construction to guard against progressive collapse. Progressive collapse means a continuous sequence of failures initiated by the local failure of one part of the structure.

Progressive collapse may be prevented by providing:

- adequate structural strength and continuity of the structure and its parts, or
- · temporary bracing, shoring or ties, or
- alternative load paths that cause applied forces to be safely transmitted through the structure

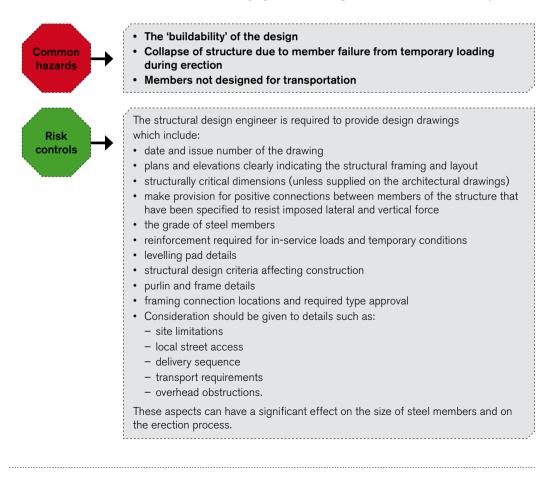
The failure of a single member should not lead to the complete collapse of the structure. This is

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particularly important where structural stability is provided by steel roof and wall bracing systems. In addition, consideration should be given to the effects of abnormal loads on the building, such as gas explosions or vehicle impacts.

- As part of the structural design process the structural design engineer must provide sufficient details to allow the shop detailer to prepare shop drawings and the erection engineer to prepare the erection design
- The shop drawings and erection design should be submitted to the structural design engineer for review to ensure that they comply with the requirements of the structural design
- Before the shop drawings are produced, the parties involved in the design, fabrication, transport and erection process should liaise to plan the complete construction and erection sequence.

The following table lists what hazards may arise if the design does not adequately provide for safety in the erection of the structure. Methods for managing and controlling the risk of hazards are also provided.



Fabrication stage

4.1 General

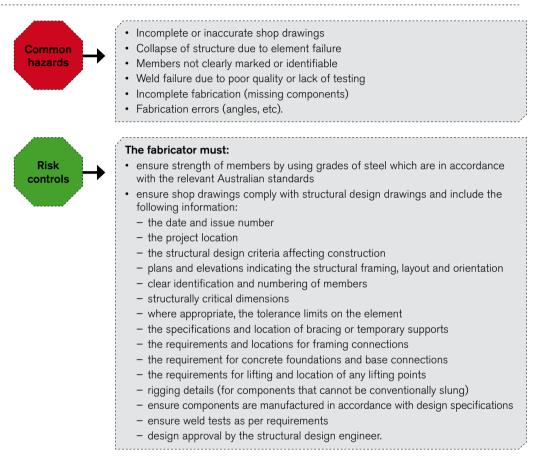
In consultation with the erection engineer, the shop detailer produces the shop drawings, and the fabricator works from these drawings to produce the steel members.

The structural design engineer should ensure that the shop drawings comply with the structural design. The drawings are reviewed by the structural design engineer before fabrication of the steel members.

4.2 Roles during the fabrication stage

The fabricator is responsible for the accurate detailing and fabrication of the steelwork to ensure members fit together correctly. Detailing should include the ease of making connections on site.

4.3 Managing risk at the fabrication stage



Transportation stage

5.1 General

Workers can be exposed to the risk of injury when loading, transporting and unloading steel from transport vehicles. Delivery of steel onto the site requires co-operation between the fabricator, builder, transporter and erector so that the steel is delivered in a timely and efficient manner, and that it does not overload the delivery area or the construction zone.

5.2 Roles during the transportation stage

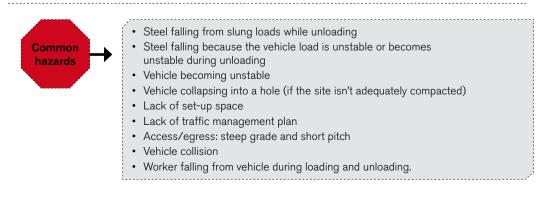
The transporter should have planned the routes and obtained all necessary permits and authorisation — for oversize or wide loads, restricted routes, etc. The transporter should be familiar with the builder's traffic management plan that includes, where necessary, traffic controllers, barricades and road closure permits to allow unimpeded access to the site.

The builder should also provide a safe and adequate unloading and lay-down area on the site and ensure that the transporter has detailed instructions on how to enter the site.

For information on the restraint of steel loads for safety during transportation, see the VicRoads publication *A Guide to Restraining Steel*.

For information on traffic management see the VicRoads Code of Practice for Worksite Safety – Traffic Management and AS 1742.3, Manual of uniform traffic control devices, Part 3: Traffic control devices for works on roads.

5.3 Managing risk at the transportation stage



Transportation stage



Before loading vehicle

The Fabricator should check that:

- the sequence of loading is agreed between the fabricator and the builder
- each member is clearly marked (together with its mass where it is over 1.5 tonnes) before loading.

The Transporter should check that:

- · trucks have restraining spikes in place
- steel is supported and secured, so that there is no uncontrolled movement of the steel until it is ready to lift
- sufficient hardwood bearers, or equivalent, have been provided for loading.

The Builder should check that:

- the sequence of loading is agreed between the builder and the erector
- · a crane of the required type and capacity is at the site
- the area for unloading is firm and level and checked for load capacity and where applicable or necessary, ground computations
- · there is an adequate set-up area
- there is a traffic management plan
- the grade and pitch of access/egress is suitable and safe for the vehicles and their loads.

When loading the vehicle

The Transporter should check that:

• the vehicle and load is stable and load will remain stable during unloading.

On vehicle's arrival at site

The Transporter should check that:

- · securing chains or straps are not removed until restraining spikes in place
- · the steel has not shifted into a dangerous position
- the vehicle is positioned as directed by the erector and stabilised before the steel restraints are released
- if the unloading sequence can lead to the instability of loads, the steel is individually restrained and the loading configuration checked so that unloading does not result in the load or the vehicle becoming unstable
- the vehicle is not moved without the steel being properly secured.

The Erector should check that:

- · loads are lifted in a level manner
- · loads are not lifted vertically or at a slope
- loads are sufficiently secured to prevent inside lengths from falling out if the bundle is at an angle
- there is fall protection for workers and doggers on the truck.

Erection stage

6.1 General

Safe erection of structural steel work depends on proper and timely planning. All personnel should be aware that erection of any structural steel is potentially hazardous and that planning must control any risk from these hazards.

6.2 Roles in the erection stage

6.2.1 Builder

The builder has overall management and control of the building site and should ensure that:

- the building construction is in accordance with the project schedule
- a traffic management plan is developed and implemented (which includes safe access / egress points and delivery areas)
- a marking plan has been submitted
- a delivery schedule submitted by the fabricator is agreed upon
- the activities of all contractors are being coordinated and supervised
- the ground surface or supporting structure is suitable for plant (such as EWP, mobile scaffolds and cranes) to operate safely
- holding-down bolts, cast in concrete footing, pedestals or slabs, are within tolerance
- shop drawings (prepared by the shop detailer)

have a signed statement from the structural design engineer that the shop drawings comply with the structural design

- the erection engineer provides clear advice on how to achieve stability for each stage of the structure's erection
- weather conditions are continually monitored, particularly potentially hazardous situations like high or strong winds and electrical storms, and that a contingency plan has been developed for severe weather
- at least one of the erection crew or another person who remains on site throughout erection should hold a current qualification as a Level 2 first aider
- a safe work method statement has been developed and work is undertaken in accordance with the SWMS.

These tasks are also contained in a checklist. See Appendix 2 – Builder's checklist.

The builder must also provide to contractors a detailed site plan, which includes information on:

- site location
- · access points
- structure location
- suitable ground bearing locations for crane operations
- · uploading areas
- storage areas.

The builder should ensure that the accuracy of each contractor's work is within the tolerance of the level or position nominated by the erection engineer or relevant standard. Any modifications to the building layout also need to be checked by the builder for approval by the erection engineer.

As principal contractor, the builder prepares the Health and Safety Coordination Plan according to section 5.1.16 of the Occupational Health and Safety Regulations 2007 see handbook *Working safely in the general construction industry*.

6.2.2 Erection engineer

The erection engineer approves the sequential erection procedure which includes how the structure is stabilised at each stage and signs any modifications, and is required to provide guidance to the builder and erection crew on matters including:

- · joints and additional erection cleats
- structural design criteria affecting construction
- temporary bracing
- · lifting points
- loads and conditions likely to be experienced during the lifting and erection
- any wind load limitations on the integrity of the structure as it is being erected according to the signed-off sequential erection procedure
- wind load on the braced members.
- joint positions (as they affect erection sequences)
- · accessibility of connections
- fixings for working platforms, hand rails etc
- preferred method of connecting steel members
- preferred type and number of cranes to erect members of particular size and shape, and for vertical and horizontal bracing requirements
- instructions on how to stabilise the structure at each stage of erection which involves:

- verifying the adequacy of the base connections (steel to foundations)
- checking stability under construction load conditions
- capacity to withstand accidental vehicle impact.

The fabricator can also provide guidance in this area.

6.2.3 Erector

The erector ensures that:

- the structure is erected in accordance with the sequential erection procedure
- an SWMS is developed in consultation with the erection crew (see the sample SWMS in Appendix 1)
- · work proceeds in accordance with the SWMS
- confirms with the builder's representative that the ground or supporting surface is suitable for mobile plant to safely operate
- pre-assembly of members and the movement and location of heavy members are considered prior to installation
- weather conditions are continually monitored, and in particular, potentially hazardous situations like high or strong winds and electrical storms for which a contingency plan should be developed and implemented as required.

These tasks are also contained in a checklist. See Appendix 3 – Erector's checklist.

6.2.4 Erection crew

An erection crew consists of:

- an experienced structural steel supervisor
- riggers
- doggers
- · crane operator.

The erection supervisor is responsible for directing and coordinating the agreed sequential erection procedure (see 6.3.1). They should hold a high risk work licence for rigging in either the Intermediate Rigging or Advanced Rigging classes (class codes RI or RA) as appropriate (see Table 1).

6.

The crane operator must hold a licence to perform high risk work appropriate for the type of crane and, in the case of a slewing mobile crane, the crane's capacity (WLL) (or be under the direct supervision of the holder of the appropriate licence).

The size and make-up of the remainder of the erection crew will vary depending upon the nature of the site and the particular circumstances. All members of the crew must hold the basic rigging licence (class code RB) as a minimum. Anyone who is being trained, in order to obtain a licence, must be directly supervised to ensure that the work is carried out safely.

6.3 Documentation in the erection stage

6.3.1 Sequential erection procedure

The erector, in consultation with the builder, erection engineer and other parties involved in the work, needs to plan the process for lifting and erecting individual members.

The process is set out in the sequential erection procedure which is used by the erection crew. The erector is responsible for ensuring that a sequential erection procedure is in place and that it has been approved by the erection engineer.

The sequential erection procedure includes:

- site limitations
- member sizes
- · access for positioning and lifting of members
- crane size, mobility and access, and use of other large plant

- the erection sequence
- the stability requirements of the structure at all stages during erection
- · requirements for working at height
- overhead obstructions, including overhead power lines
- weather restrictions
- specialty bolting or site welding requirements, included on the marking plan.

6.3.2 Marking plan

The marking plan shows the erector where each member will be placed on the site. It is prepared by the shop detailer for the fabricator, and approved by the structural design engineer.

The marking plan includes:

- · location of each element
- configuration of braces and any temporary bracing/supports
- clear markings to identify each member.

6.3.3 Safe work method statement

Any erection of structural steel will require a site specific SWMS (see Appendix 1). The SWMS must list the high risk construction work, as a minimum, and describe how the risks are to be controlled.

The SWMS is prepared by the erector in consultation with the erection crew and reviewed by the builder.

High risk construction work in steel erection may include:

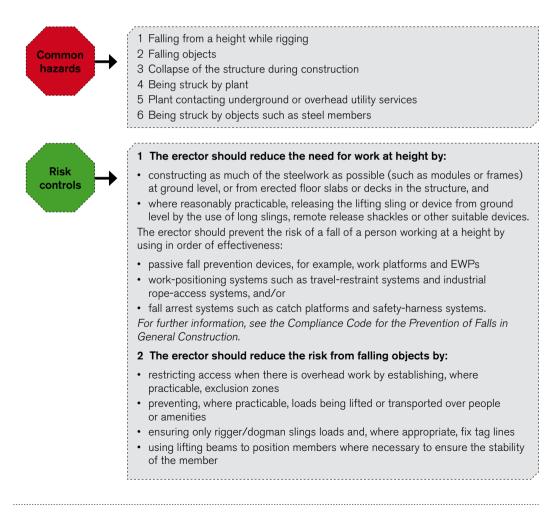
- · a risk of falling more than two metres
- structural alterations that may require temporary support to prevent collapse
- working near live power lines
- tilt-up or precast concrete (which may be part of the project).

- working on or adjacent to roadways or railways used by road or rail traffic
- any movement of powered mobile plant, for example, the use of EWPs.

This particular information must be identified and provided by the builder to the person preparing the SWMS. The SWMS should also identify any other hazards associated with the work and state the measures necessary to control them. For more information, see handbook *Working safely in the general construction industry – A handbook for the construction regulations*.

6.4 Managing risk at the erection stage

The key risks involved in steel erection, and the controls for each of these are outlined below.





- considering perimeter screens, guardrails with integral toe-boards and wire mesh, debris nets, cantilever work platforms, scaffolding sheathed with protective material and/or lanyards to secure tools and equipment
- · using materials boxes which are fully sheeted to enclose the load
- ensuring safety helmets are worn at all times.

3 a) Before erection, to avoid collapse, the erector should:

- ensure a sequential erection procedure is prepared, which has been approved by the erection engineer and is consistent with the marking plans
- ensure that an experienced steel erection supervisor is present at all times to oversee the implementation of the sequential erection procedure
- ensure an adequate exclusion zone to prevent risk to other people not involved in the erection
- only start the erection of a member or sub-assembly when equipment to ensure the structure's stability is available and being used
- · ensure temporary guys or bracing are securely anchored
- place adequate visual barriers between guys and plant/vehicle movement areas.

b) During erection, to avoid collapse, the erection supervisor must:

- verify the stability of the structure in accordance with the erection engineer's specifications:
 - at the end of each work day
 - when fastenings may be incomplete
 - during strong winds or when strong winds are forecast
- seek approval from the builder (or erection engineer where appropriate) to cease work at unscheduled points where the structure has not been completed to the specifications of the erection engineer's design
- Obtain, from the builder, the erection engineer's written approval before loads are
 placed onto the structure
- where possible, start erection in a nominated braced bay (if this is not possible, make sure that the erection engineer is involved in developing an alternative site-specific sequential erection procedure)
- check the fittings for the support of columns during erection, to ensure adequate structural capacity for the erection conditions
- · make sure that all beams are secured before releasing the slings
- make sure that all bolted connections are effective to ensure the stability of the steel structure.
- 4 To avoid being struck by plant and before the use of a crane or any other powered mobile equipment, the erector should consider:
- crane selection, access and siting in accordance with AS 2550 Parts 1, 4 and 5 (cranes, hoists and winches)
- · protection of the public



- the location of any excavations or underground services that may affect a crane load
- the proximity of overhead power lines
- · the capacity of the ground or supporting surface to bear the load
- check the type and amount of packing required under the crane's outriggers to support the proposed loads
- written procedures for setting up and dismantling of the crane and the lifting method
- · the composition of the rigging crew suits the job
- procedures for visual and audible signals between the crane operator and the erection crew
- ground support conditions
- · selection of lifting gear
- emergency procedures
- prevailing or forecast weather conditions
- the need to avoid lifting loads over people.

The use, of two or more cranes to move and position loads, is hazardous and should be avoided if a single crane is capable of doing the job. Where it is necessary to use two cranes to «dual lift» members, the following controls are to be implemented:

- the weight of the load and its centre of gravity as well as the weight of the lifting gear must be carefully calculated.
- cranes of similar characteristics should be selected.
- the position of each crane should minimise movement and slewing.
- the lifting capacity of each crane must be 20% greater than the share of the load.

For further advice on multiple crane lifting, see A Guide to Rigging, chapter 18.

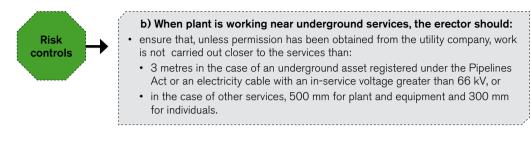
5 a) Where plant is working near overhead lines, the erector should:

 identify all powerlines services before permitting any crane or other mobile plant on site

 check that material and plant is moved or operated outside the "No Go Zone" of 3000 mm from an overhead electrical cable on a pole or 8000 mm if the electricity cable is on a tower line (If erecting scaffolding, the "No Go Zone" during this process is 4.6m distant and 5m below from the nearest power line)

• if work or plant is able to encroach on this clearance, the erector must obtain permission from the electricity company or develop a SWMS and work in accordance with it.

Note: Tiger battens do not protect from risk of electrocution or electric shock. They provide a visual warning only.



6.5 Other hazards

Consideration should be given to other hazards associated with steel work. Any risks posed by these hazards must be controlled. They may include:

noise

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- manual handling
- hot work
- · exposure to hazardous substances
- · dangerous goods
- · electrical work
- sun (UV) exposure.

Appendix 1

Note: This is a sample only. The purpose of a legislatively required SWMS is to include what has been described in the document proper regarding hazards and risk controls.

Safe Work Method Statement – Structural steel erection (sample)

This SWMS is a site-specific statement that must be prepared before any structural steel erection has begun.	l
Work must be performed only in accordance with this SWMS.	l

Erection superviso (RI licence) respons for ensuring complia with this SWMS	ible			Date: Company:	
High-risk job:				Location:	
Think about the wor	ksite	and each stage of the	e projec	t, including prep	paration and clean-up.
What are the tasks involved?		at are the hazards risks?	How will hazards and risks be controlled? (describ control measures and how they will be used)		
1. Site planning	W	<i>l</i> orkers unfamiliar ith the site and ot inducted V	 Each worker must have a: site induction Cl card and correct licence for high risk work long sleeved shirt, safety boots, hard hat, riggers glove safety glasses and ear plugs. 		
	W	rew unfamiliar ith sequential rection procedure	• Each worker must be briefed on the procedure and their duties.		
2. Prepare work area	 O th C ar El 	lips, trips, falls ther workers in le vicinity ollapse of work rea/hard standing lectric shock from ower lines	 Inspect site and clear area of any obstructing materia or debris Isolate work zone; erect barricading and signage Stabilise/compact ground where required Identify all electrical lines in work area. Confirm electric current is disconnected to those lines. 		erect barricading and signage ground where required Il lines in work area. Confirm electrical

Appendix 1

Safe Work Method Statement – Structural steel erection (sample)

What are the tasks involved?	What are the hazards and risks?	How will hazards and risks be controlled? (describe the control measures and how they will be used)
3. Erecting stage	Weather makes erection hazardous	 Supervisor to check weather forecast and monitor on a continual basis and have a contingency plan in place in the event of extreme weather.
	 Mobile crane/EWP injury through unsafe use overloading / uncontrolled loads 	 Operator must: have a current licence (or be a supervised trainee) perform a daily check of crane and complete a log check ground for stability check overhead for electrical lines wear and attach a safety harness if operating a boom lift use crane only within known wind tolerances not operate the crane outside its load charts know the weight of each lift use tag lines where appropriate (minimum 16 mm diameter).
	 Incorrect or poorly maintained slings 	 Riggers / doggers must: be licenced only sling load with Grade 80 lifting chain check that lifting chains are inspected and tagged not stand under the load.
	 Not following the sequential erection procedure 	 The sequential erection procedures must be followed unless authorisation has been approved by both the builder and the erection engineer Steel frame to be inspected daily for stability and results documented
	Electrical hazards	 Do not use electrical equipment that does not have a current tag Keep leads elevated or adequately protected and away from sharp edges and water hazards Check that power supply is RCD protected and undamaged.
	 Injury from releasing load too soon 	 The riggers and doggers are the only people permitted to release the load Load is only to be released when adequately fixed and supported.
	 Loading incomplete bays with panels and roofing 	 Check that the erection engineer has approved placement load Check that the placement load is within constraints Check that columns have been grouted prior to loading.

Appendix 1

Safe Work Method Statement – Structural steel erection (sample)

What are the tasks involved?	What are the hazards and risks?	How will hazards and risks be controlled? (describe the control measures and how they will be used)
3. Erecting stage (continued)	Unstable structure	 Builder or builder's representative and erection supervisor to inspect the frame to ensure it meets the erection engineer's specifications Check that bolts have been tensioned to specified torques.
4. End of shift	Unsecured site	Secure all plant and equipmentInspect site and clean up area.

Please ensure you have completed this SWMS correctly by checking the following.

\blacksquare I have completed the form with the following information:

- □ I have discussed with relevant employees, contractors and HSRs what work will be high risk, the tasks involved, and associated hazards, risks and controls.
- □ I have listed, in the first column 'What are the tasks involved?' the main stages for the tasks involved.
- □ I have listed, in the second column 'What are the hazards and risks?' the hazards and risks for each work task under the relevant stage of construction.
- □ I have listed, in the third column 'How will the hazards and risks be controlled?' control measures for the hazards and risks, based on the hierarchy of control levels 1 to 4 (listed below). I have chosen a control measure (and how it is to be used) that is as close to level 1 as is reasonably practicable.

Control levels 1 to 4:

- 1. Eliminate risk to health or safety associated with construction work.
- 2. Reduce risk to health or safety by any one or any combination of the following:
- · substituting a new activity, procedure, plant, process or substance
- isolating people from the hazard, such as barricading, fencing or guardrailing, or
- using engineering controls, such as mechanical or electrical devices.
- 3. Use administrative controls, such as changing the way the work is done.
- 4. Provide appropriate personal protective equipment (PPE).
- □ The crew has been inducted to this SWMS, and briefed to stop work immediately if the SWMS is not being followed.
- □ I will monitor the work and, if controls are not adequate, I will stop the work, review the SWMS, adjust it as required and re-brief the team.
- □ I will retain this SWMS, and its amended form if applicable, for the duration of the project.

Appendix 2 Builder's checklist

Builder's checklist - Structural steel erection

Project:			Date:
What are the tasks involved?	√ X n/a	Comme	nt
1. Marking plans: Shop detailer has provided a marking plan.			
2. Delivery schedule: fabricator has provided, and has been agreed.			
3. Ground or supporting surface: suitable for plant (cranes, EWPs) to operate safely.			
4. Shop drawings: Fabricator has provided. Structural design engineer has reviewed and approved. Erection engineer has certified.			
5. Sequential erection procedure: Erection engineer has provided a certified sequential erection procedure which is understood and agreed.			
6. Supports tolerance: Holding-down bolts, cast-in concrete footing and pedestals or slabs are within tolerance.			
7. Traffic management plan: implemented (which includes safe access, egress and delivery areas).			
8. Health and safety coordination plan: is current and available for inspection by all workers.			
9. Weather conditions: are monitored for potentially hazardous conditions such as strong winds and/or electrical storms, and that a contingency plan can be activated as required.			

Erector's representative: _

Signature: _

Appendix 3 Erector's checklist

Erector's checklist - Structural steel erection

Project:				Date:	
What are the tasks involved?	1	X n/a	Comme	nt	
1. Sequential erection procedure: Erection engineer has provided a sequential erection procedure which is understood and agreed.					
2. Sequential erection procedure: Erection crew has been inducted into sequential erection procedure.					
3. SWMS: Erection crew has been inducted into the safe work method statement.					
4. Pre-planning: Confirms with the builder's representative that the ground or supporting surface is suitable for mobile plant to safely operate.					
5. Pre-planning: Pre-assembly of members, and the movement and location of heavy members have been considered before installation.					
6. Sequential erection: Structure has been erected in accordance with the sequential erection procedure.					
7. SWMS: Work has progressed in accordance with the safe work method statement.					
8. Weather conditions: Are monitored for potentially hazardous conditions such as strong winds and / or electrical storms and that a contingency plan can be activated as required.					

Erector's representative: ____

Signature: ____

Definition of terms

General definitions

AS	Australian standard (produced by Standards Australia)
AS/NZS	Australian Standard/New Zealand Standard (a joint standard)
BOM	Bureau of Meteorology
Builder	The company or person responsible for the construction of the building and who has control of the building site. The builder may also be the client or a company or person responsible to the client. (The builder may also be the principal contractor.)
CI card	Construction Induction card. A person carrying out construction work in Victoria must have a Construction Induction Card, or recognised equivalent, which provides evidence that they have received construction induction training.
Client	The owner of the building or the company or person responsible for developing the building.
Structural design engineer	An experienced structural steel engineer who is responsible for the engineering design of the building. Should be a person eligible for membership of the Institution of Engineers Australia, be a registered building practitioner and be competent to practise in the structural engineering field. Where necessary the structural design engineer will need to consult with other persons who have specific expertise and experience. The structural design engineer will usually be responsible to the client.
Erection supervisor	An experienced person with an Intermediate or Advanced Rigging licence who is appointed by the erector to supervise the erection of the structural steel.
Erector	The company or person responsible for erecting the steel work. The erector may be responsible either to the builder, fabricator or client.
Fabricator	The company or person responsible for manufacturing the steel work.

Definition of terms

High risk work	Any work set out in schedule 3 of the OHS regulations which requires a WorkSafe licence to perform this work.
High risk construction work	High risk construction work is types of construction work listed in the construction part of the OHS regulations (part 5.1.3). Before any of this work commences, a SWMS must be prepared if anyone's health or safety is at risk because of this work.
HSR	Health and safety representative
OHS	Occupational health and safety
OHS Act	Occupational Health and Safety Act 2004
OHS regulations	Occupational Health and Safety Regulations 2007
Erection engineer	An experienced structural steel engineer who is responsible for the engineering design for the erection of the building. The erection engineer should be a person eligible for membership of the Institution of Engineers Australia, be a registered building practitioner and be competent to practise in the structural engineering field. Where necessary the erection engineer will need to consult with other persons who have specific expertise and experience. The erection engineer will usually be responsible to the builder, the fabricator or the erector, or may also be the structural design engineer.
SWMS	Safe work method statement, which:
	 lists the type of high risk construction work being done
	states the health and safety hazards and risks arising from that work
	 describes how the risks will be controlled
	 describes how the risk control measures will be put in place.
Technical definitions	
Dogging	The application of slinging techniques, including the selection or inspection of lifting gear, or the directing of a crane or hoist operator in the movement of a load when the load is out of the operator's view.
EWP	Elevating work platform. A telescoping device, scissor device or articulating device used to support a working platform.
Flying fox	An arrangement where a rope is suspended between two tower structures and which supports a carriage (or 'fox') from which a load may be raised, traversed or lowered.
Gin pole	A guyed derrick without a pivoted strut-boom. It can raise and lower a load and a limited amount of slewing can be achieved by adjusting the guys.
Girt	A horizontal structural member in a wall of a steel structure which supports the wall cladding sheets.

Definition of terms

Guy	A tensioned rope fixed at one end to a mast, tower or structure and anchored some distance from the base to stabilise the structure.
PPE	Personal protective equipment
Purlin	A longitudinal member spanning between roof trusses or beams and to which roofing sheets are fixed.
RCD	Residual current device
Rigging	The use of mechanical load shifting equipment and associated gear to move, place or secure a load including plant, equipment or members of a building or structure and to ensure the stability of those members, and for the setting up and dismantling of cranes and hoists, other than the setting up of a crane or hoist which only requires the positioning of integral outriggers or stabilisers.
Shop detailer	Engaged by the fabricator to develop the shop drawings.
Shop drawing	A detailed drawing of an element used in the construction process.
Slinging techniques	(In relation to dogging) refer to techniques that require judgement to be exercised in relation to the suitability and condition of lifting gear, and the method of slinging, by consideration of the nature of the load, its mass and centre of gravity.
Tagline	A fibre rope attached to a suspended load to control the load during lifting.
Tower crane	A boom or jib crane mounted on a tower structure.

References

Australian standards

AS/NZS 1576.1:1996, Scaffolding – General requirements AS/NZS 1891.1:2007, Industrial fall-arrest systems and services – Harness and ancillary equipment AS/NZS 1892.1:1996. Portable ladders – Metal AS 2550.1, Cranes, hoists and winches - Safe use - General requirements AS 2550.4, Cranes, hoists and winches - Safe use - Tower cranes AS 2550.5:2002, Cranes, hoists and winches – Safe use – Mobile cranes AS 2550.10, Cranes, hoists and winches – Safe use – Mobile elevating work platforms AS 3600:2001. Concrete structures AS 3828:1998, Guidelines for the erection of building steelwork AS 4100:1998. Steel structures AS/NZS 4576:1995, Guidelines for scaffolding AS/NZS 4994, Roof edge protection equipment AS/NZS 4389:1996, Safety mesh AS/NZS 4360:2004, Risk management AS/NZS 1554.1:2004/Amdt 1:2005, Structural steel welding Copies of standards can be obtained from Standards Australia at: 1300 654 646 or: standards.com.au

Legislation

Occupational Health and Safety Act 2004 Occupational Health and Safety Regulations 2007 View the legislation at: legislation.vic.gov.au Acts and regulations are available from Information Victoria at: 1300 366 356 or: bookshop.vic.gov.au.

References

WorkSafe publications

Compliance Code for the Prevention of Falls in General Construction Working safely in the general construction Industry: A handbook for the construction regulations A guide to safety in the metal fabrication industry Prevention of falls in the transport of steel Employee Representation Framework for Undertaking Work near Overhead and Underground Assets: A guide to the No Go Zones A Guide to Rigging, available from WorkCover NSW: workcover.nsw.gov.au

Energy Safe Victoria

Phone: (03) 9203 9700, esv.vic.gov.au

Other publications

A Guide to Restraining Steel (VicRoads, December 1998) Code of Practice for Worksite Safety – Traffic Management (VicRoads, December 2004)

Other information

Dial Before you Dig Phone: 1100, dialbeforeyoudig.com.au



Further information

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