Australian Capital Territory

Work Safety (ACT Code of Practice for Steel Construction) Code of Practice 2010

Disallowable instrument DI 2010 – 231

made under the

***Work Safety Act 2008*, section 18 (Codes of Practice)**

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1 Name of instrument

This instrument is the *Work Safety (ACT Code of Practice for Steel Construction) Code of Practice 2010*.

2 Commencement

This instrument commences on 1 October 2010.

3 Approval of a code of practice

Under section 18 of the *Work Safety Act 2008*, having consulted with the ACT Work Safety Council, I approve the ACT Code of Practice for Steel Construction as a code of practice.

Katy Gallagher
Minister for Industrial Relations
3 September 2010

OFFICE OF REGULATORY SERVICES
DEPARTMENT OF JUSTICE & COMMUNITY SAFETY

STEEL CONSTRUCTION

CODE OF PRACTICE

OCTOBER 2010

Table of Contents

1. INTRODUCTION

1.1 Purpose

The purpose of this Code of Practice for Steel Construction is to provide practical guidance to persons conducting a business or undertaking (including employers), workers and others on meeting the requirements of the *Work Safety Act 2008* (Work Safety Act) with respect to the safe erection of structural steelwork.

The information in this code is primarily for those directly involved in the erection of structural steel buildings, including persons conducting a business or undertaking, whether they are principal contractors, supervisors, clients, professional design advisers such as engineers and architects, as well as designers and manufacturers of components.

1.2 Objectives

The objectives of this code are:-

(a) to provide information which recognises commonly accepted work relationships and work practices in the erection of structural steelwork for the guidance of persons conducting a business or undertaking and workers;

(b) to prevent the occurrence of injury resulting from the erection of structural steel buildings; and

(c) to provide practical guidance for the safe erection of structural steel buildings.

1.3 Scope

Planning and erection guidelines are given to assist in the safe erection of structural steel work.

In providing practical guidance to principal contractors and others, information about recommended responsibilities of designers of steel buildings is also included.

The structural steel components covered in the erection recommendations include:

- columns,
- beams,
- bracing,
- flooring material such as steel decking, and
- other related steelwork.

1.4 Application

This code applies to persons conducting a business or undertaking, persons in control of premises, and workers.

2. DEFINITIONS AND INTERPRETATIONS

"AS" means a standard, rule, code or specification of the Standards Association of Australia.

"BS" means a standard, rule, code or specification of the British Standards Institution.

"competent person" means a person who by reasons of qualifications and/or experience or both is competent to perform a task or function or assume the responsibility in question and is authorised to do so.

"structural engineer" means a person who is eligible for full membership of the Institution of Engineers Australia.

"employer" means a person or entity who engages a worker to perform work under a contract of service.

"erector" means a person who engages in the erection of structural steel components for buildings, and employs persons who are experienced in the erection of structural steel, commonly known as "riggers".

"fabricator" means a person who is engaged in fabricating structural steel components for incorporation in buildings.

"high-rise building" means a building built in a manner consisting of more than two tiers.

"low-rise building" means a single storey structure which may include a mezzanine floor over part of its floor area and which is intended for industrial, commercial, recreational or community use.

"method of work" means a sequence of task related events incorporating appropriate safety measures.

"person in control of premises" means anyone who has control of the premises, including anyone with authority to make decisions about the management of the premises.

"person conducting a business or undertaking" means a person or entity that is conducting a business or undertaking. This includes, but is not limited, to employers, self-employed persons, municipal corporations, sub-contractors and franchisors. A not-for-profit business or activity conducted by local, state or territory government may be a business or undertaking.

"positive restraint" means restraint provided by a guardrail and midrail or other means which limits a fall distance to 600 millimetres when using a safety belt or 2000 millimetres when using a safety harness.

"rigger" means a person who is responsible for the rigging and safety of rigging involved in the erection, positioning or dismantling of any building or structure, or plant that requires the erection of tackle involving the use of wire, fibre rope or other gear for the purpose of lifting, lowering or moving an object.

"static line" means a line extending between two or more anchorages which has been designed to sustain the mass of workers who may be connected to the static line through travelling anchorages.

"worker" means an individual who carries out work in relation to a business or undertaking, whether for reward or otherwise, under an arrangement with the person conducting the business or undertaking. Worker includes but is not limited to employees, independent contractors, outworkers, people doing work experience and volunteers.

"working deck" means the section of decked floor which covers the entire tier of beams and from which the riggers erect steel work.

For the purposes of this code, terms that are defined in the Work Safety Act have the same meaning when used in this code, unless the contrary intention appears.

3. DUTIES OF PERSONS

3.1 Work Safety Duties

This code provides information relevant to the statutory duties of the following persons:

3.1.1 Persons conducting a business or undertaking

Persons conducting a business or undertaking hold a duty to ensure work safety by managing risk under section 21 of the Work Safety Act.

In addition, under Section 28 of the Work Safety Act persons conducting a business or undertaking (including employers, sub-contractors, and self-employed persons) have a duty not to expose others at the workplace to work safety risks because of their conduct.

3.1.2 Persons in control of premises

Persons in control of premises have a duty under section 22 of the Work Safety Act to ensure work safety in relation to the premises by managing risk. This duty includes maintaining the premises in a way that is consistent with work safety; and providing safe entry to, and exit from, the premises.

3.1.3 Worker

Under section 27 of the Work Safety Act, a worker has a duty not to expose the worker, and other people who may be affected by the worker's work, to work safety risks because of the worker's work.

3.2 Other persons

Because of the nature of the work described in this code, information is also provided on the relevant roles of other persons involved such as structural engineers. The information is not based on statutory duties, but on commonly accepted work relationships and work practices that are in place for the erection of structural steelwork. This code, in the interests of safety, sets out the lines of accountability that should be in place between the principal contractor, the

structural engineer, the erector and the person conducting the business or undertaking for the safe erection of structural steelwork.

4. PLANNING

4.1 Criteria for safety

Detailed planning is necessary for the safe erection of structural steel buildings. The structural engineer should include details of how the building has been designed to be erected and the need during the erection to ensure safe working conditions for those engaged in each stage. Failure to plan and design for safety at the earliest stages may encourage or lead to unsafe practices onsite and to structural instability during erection. To ensure that the design will not present any problems during construction, the structural engineer should consult with an erector as to the practicability of the design being constructed safely.

The work safety of workers and members of the public is an integral part of the erection process. At the planning stage, the structural engineer, principal contractor and the erector should agree on the following:

(a) the necessary planning to be carried out to enable safe working practices to be employed at all stages of erection;

(b) the plant, equipment and gear to be used in the erection process be identified and suitable for the intended use;

(c) the training of riggers. Training should include but not be limited to the identification, use and maintenance of suitable personal safety equipment;

(d) the development of a post-fall recovery plan for prompt recovery of riggers in the event of a fall. The rescue support should be provided in a timely manner to avoid long periods of post-fall suspension;

(e) the provision and location of welding screens, fire extinguishers, oxygen and acetylene bottle trolleys etc; and

(f) the provision of temporary access that will be required for the erection of the building.

4.2 Specific requirements for high rise buildings

A protective safety screen system should be erected to envelop the building perimeter to protect persons or objects from falling. The screen should be erected when the building is of sufficient height to allow installation and extend down to a fully decked platform (see Figure 1 -Protective Screens). This requirement does not apply to composite buildings incorporating no more than 1 storey of steel structure, provided the perimeter of this steel storey is no less than 2 metres in from the preceding concrete slab perimeter. If required, the protective safety screen system must be maintained.

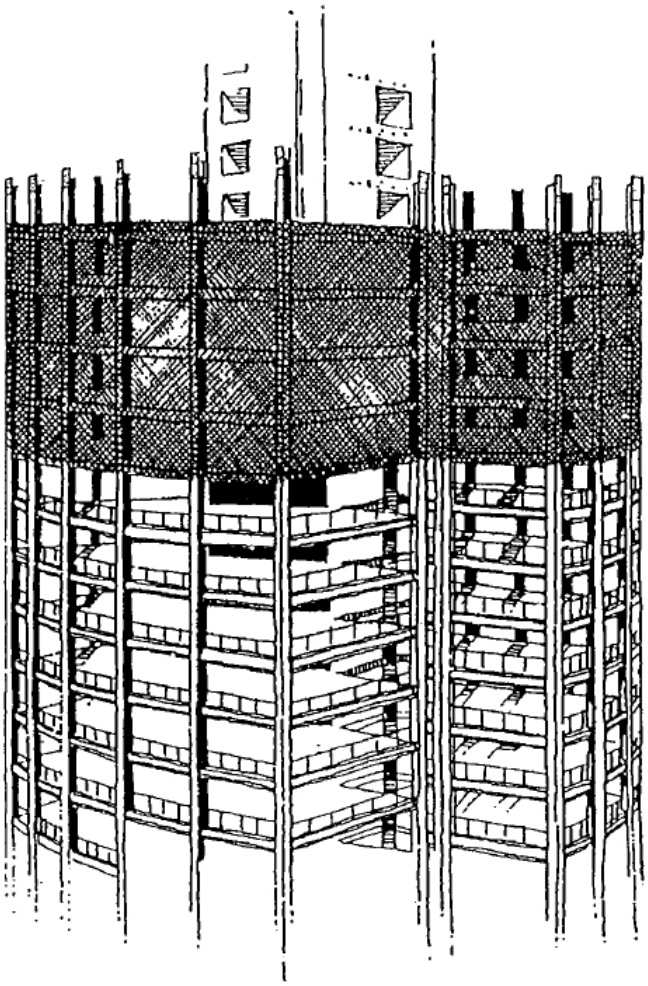

Figure 1 - Protective Screens

4.3 Designers

Designers should take into account the need for, and the practicality of, safe methods of working during erection. Areas to be considered at each design stage include:

(a) stability at all stages of erection of the assembled portions and single components;

(b) the effect of the erection sequence on stability. Where the sequence is critical, the sequence should be stipulated;

(c) realistic assessment of loadings at all stages of construction;

(d) the provisions for safe access and working places, including anchorage points for fall arrest systems;

(e) ease of connecting components, for example the provision of landing cleats;

(f) safe handling, lifting, storing, stacking and transportation of components, depending on their size, shape and/or weight. It is recommended that identifiable lifting points and component weights be detailed. For sub-assemblies it is critical that overall weight and lifting points are identified on all drawings for example, design drawings and as-built drawings;

(g) design specifications should incorporate particular requirements and essential information for the method of erection to be planned and the safe erection of the building. Such information should include any special conditions as well as the phasing of the work, particularly with that of other affected contractors. Special requirements relating to the safe erection of the building should be highlighted at the pre-contract stage, for example, the need for temporary bracing/guying or the use of mobile access platforms;

(h) all materials, for example grades of steel including bolts and means for fabrication of components such as welding, must be in accordance with relevant Standards as specified in the design.

4.4 Method of erection

All contractors and sub-contractors should receive information regarding project planning and erection sequence from the principal contractor or the designer. Once the contract has been awarded and before work commences, the erector should submit to the principal contractor a program which includes a comprehensive method of erection utilising risk management procedures.

This program should have an emphasis on health and safety management, that is, setting out solutions to control identified risks. The extent of detail in a method of erection will depend upon the size and/or complexity of the work and the results of the risk assessment carried out. The whole method of erection should be reviewed and updated as necessary to retain currency.

The following general procedures should be followed:

(a) a safe method of work should be in place;

(b) a person who is employed to erect structural steelwork should have relevant qualifications and experience or be under the supervision of a competent person;

(c) a secure anchorage for lanyards, arresting devices and terminations for static lines should be in place before a rigger works or moves about on steelwork. Supports for lanyards, arresting devices, terminations for static lines etc should be designed and affixed by a competent person;

(d) a rigger should at all times wear the safety harness supplied by the person conducting the business or undertaking when working on a building;

(e) ladders should not be used by riggers when connecting beams or columns unless anchorage for a safety harness has been provided to allow the rigger to be secured and then work from the ladder. Ladders

should project a suitable distance above the working level to allow safe access and egress. Ladders should be bolted to at least one column on each level to allow safe access prior to installation. *BS 4211* and *AS 1657 - Fixed platforms, walkways, stairways and ladders* - provides guidance on size and spacing;

(f) all working decks should be fully decked out. Underneath all rigging work there should be in place a fully decked platform protecting employees working at lower levels from any falling objects;

(g) because of the problems associated with prolonged suspension after a rigger's fall has been arrested, a rigger should not be allowed to work on a building where he can fall, without another person in attendance or in the immediate vicinity. A post-fall recovery plan should be in place to avoid long periods of post-fall suspension of riggers.

4.5 Crane operations

Safety during lifting and handling requires careful consideration of all aspects of the methods and systems to be used.

Factors to be co-ordinated specifically between the principal contractor, the erector, persons in control and crane operator relating to the use of cranes include:

(a) the positioning of a crane on site should take into consideration its reach, the weight of the components to be lifted and the safe working load at the maximum radii;

(b) lifting operations where practical, should not be undertaken above workers. Installation/connection of steel members should not be undertaken directly above workers;

(c) a communication system between the ground, work areas, working deck and the crane operator should be established and the principal contractor should confirm the system's adequacy.

Persons in control should ensure that:

(a) any repairs or modifications carried out on a crane are certified by a competent person;

(b) the safe working load of lifting gear is identified and not exceeded;

(c) the crane is fitted with a load weight indicator in the driver's cabin.

4.5.1 Tower Cranes

When preparing a method of erection that is to use a tower crane during the erection phase, consideration should be given by the erector to the frame of the building. The building at any time during its erection should adequately support the additional load imposed by the normal operation of a tower crane.

4.5.2 Mobile Cranes

Where ground conditions are suspect regarding bearing capacity, the following are strongly recommended:

(a) the principal contractor should supply to the erector all necessary information in writing; for instance, locations of trenches, backfilled services, to enable the crane to be positioned and erected safely;

(b) before "setting up", the crane operator should visually inspect ground conditions to determine the type and amount of packing required under the crane's outriggers to support the proposed loads.

5. WORK RELATIONSHIPS AND ACCOUNTABILITY

5.1 Structural engineer

When the principal contractor has finalised the proposed erection procedure with the erector, the method should be submitted by the principal contractor to a structural engineer for approval. Details of the design erection sequence should be indicated on the drawings by the structural engineer.

5.1.1 Matters to be considered prior to construction

Besides the basic building design, the structural engineer should also:

(a) consult with the fabricator on connection details, taking into consideration allowable manufacturing and fabrication tolerances and erection clearances for welding and bolting;

(b) make provision for:

- the variations which may occur in member dimensions because of temperature change,
- the ability to maintain erection tolerances by the provision of slotted holes, shims or other means,
- the use of landing cleats and standard connections for ease of erection,
- the installation of temporary bracing to be indicated on drawings,
- the concrete strength to be achieved for column footings before being required to support a member should be noted on drawings,
- the ability of column footings and holding down bolt design to accommodate the overturning forces of the first lift of columns once specified concrete strength has been achieved,
- where appropriate the installation of a protective safety screen system,
- the selection and locating at the worksite of suitable cranes to lift components involved in the building,
- the application of an alternative method of work when an existing work operation adversely affects the public,
- the surface texture of components not to be hazardous for riggers to work on, for example smooth painted surfaces,

- the requirement for specific lifting arrangements to be detailed on structural member drawings to facilitate safe lifting,
- the weight for components greater than 2 tonnes to be permanently stamped on the component.

5.2 Principal contractor

The Principal Contractor, as a person conducting a business or undertaking and/or person in control of premises, has a statutory duty to ensure the work safety of all members of the public on or near the workplace. It is the person in control's duty to provide the general public with adequate protection from construction activities and to allow safe access to the site: for both site visitors and workers.

This can be accomplished by overall planning, co-ordination and control of all the site activities for example, the stability and adequacy of the building during its erection.

To help meet this statutory duty, the person in control of securing a safe workplace should apply the following **general** procedures:

(a) ensure that the overall construction planning and/or program enables all contractors and sub-contractors to carry out their functions with sufficient physical or time separation so that the actions of anyone of them does not create hazards for any other;

(b) co-ordinate the activities of all contractors and other parties to ensure that programs for steel erection are integrated into the overall construction scheme, and the erection is safely executed;

(c) conduct regular site meetings to ensure safe working practices are maintained by all contractors and sub-contractors, even with variations of timing and sequencing that may occur during the progress of the works;

(d) ensure that modifications to the structural building layout, or any other additions, substitutions or remedial work considered necessary, are not made without the prior approval of the structural engineer and are adequately monitored and documented. A formal system should be set up to advise all involved parties. This system should include the posting of modifications in a readily accessible place for all involved persons in control and workers;

(e) ensure that the accuracy of each contractor's work is within specified level or position as nominated by the contract documents. Where these are not specifically nominated, the tolerances nominated in appropriate Codes or Standards should apply. This will allow following trades or contractors to successfully complete their work within the level of accuracy demanded of them. Failure to ensure the accuracy of each contractor's work could lead to unsafe working conditions for those following and may even compromise the stability of the building or its component parts especially during erection;

(f) provide at all times and at suitable locations onsite, communication facilities, emergency phone numbers etc.

5.3 Fabricator

The Fabricator should be accountable to the principal contractor for the accurate fabrication of the steelwork to ensure components fit together correctly. During detailing, consideration should be given to the ease of making connections onsite.

In addition, the fabricator should:

(a) ensure that steel members are delivered to site in the required sequence for each stage of erection at the times agreed to by the principal contractor and the erector;

(b) ensure that all locating numbers are clearly and permanently marked on steel components. Consideration should be given to weight and lifting points on steel components; and

(c) ensure that steel members are safely, suitably supported and their ends tied and held as necessary to prevent uncontrolled movement of the steel while it is being loaded, transported, unloaded, moved and located.

5.4 Erector

The Erector should determine and prepare in consultation with the structural engineer, fabricator and principal contractor, a program and method of erection (including risk assessment) which should be followed throughout the project.

In addition, the erector should:

(a) advise his employees of the approved program, the approved method of erection and details of risk indicated in risk assessment and methods of control for same;

(b) erect the building in accordance with the drawings, specification and planned erection procedures as outlined in the method of erection approved by the designer and the principal contractor;

(c) consider how to set out the building in its correct position and level, and maintain accuracy, all within specified requirements, throughout the erection phase;

(d) indicate on a site plan, the type, position and coverage of the proposed erection crane(s). In addition, any other important locations, such as unloading points and storage areas, should be shown. Consideration should be given to the required crane usage in the overall plan including access for mobile cranes where required, and to boom clearances for all cranes;

(e) consider, when preparing a sequence in the method of erection:
   (i) access to work areas,
   (ii) location of workers in respect to other trades,
   (iii) restricted areas,
   (iv) criteria for safety;

(f) consider the stability requirements of all items of the building;

(g) list the ancillary equipment proposed, determine its adequacy for its intended purpose and take such action as may be found necessary;

(h) consider the proposed methods for handling various components for example, the possibility for pre-assembly of members prior to installation and the movement and location of heavy members;

(i) compile a site organisation chart with names, qualifications and experience of key personnel including holders of certificates of competency and present this to the principal contractor prior to commencement of any work on site;

(j) confirm that the training and experience of the riggers is adequate for the tasks to be performed. Workers who are holders of riggers permits and working on the steel erection should be supervised by a certificated rigger;

(k) assist the principal contractor and other contractors onsite to work safely by ensuring sufficient space and clearance to safely manoeuvre the steel work at all stages of the erection process;

(l) ensure that ground conditions are suitable, even after poor weather and sustained traffic, to allow plant and equipment to work safely about the site. The principal contractor or persons in control of the premises should be notified of any areas of concern.

6. CONSIDERATIONS FOR PERSONS INVOLVED IN STEEL ERECTION

6.1 Lighting

Where available lighting at the workplace is not adequate to perform work safely, suitable lighting, including portable lighting where appropriate should be provided.

6.2 Equipment

Safety features built into tools and equipment are only effective if they are properly maintained and regularly inspected.

The persons in control should ensure that all tools and equipment, as well as plant and machinery used in the erection of steel work are regularly inspected and maintained to ensure that these are always in working condition and safe to use. Plant or equipment should only be used as intended and within the limits of its rated capacity.

The worker should be instructed to promptly report all noted defects in plant, equipment and gear to the persons in control.

Where defective equipment is identified, such equipment should be removed from use and tagged or sealed against further use until repaired.

Where there is a requirement for records of maintenance on equipment, such records should be maintained by the persons in control and be available to the principal contractor or persons conducting the business or undertaking if required.

6.3 Personal Protective and Safety Equipment

Appropriate personal protective and safety equipment should be provided by the persons in control. It should fit correctly and be kept in good order. All lanyards, harnesses or similar gear should comply with the appropriate Australian Standards.

As a minimum, some of the following items will be needed during erection work:

(a) safety harnesses with lanyards, tool frogs, and pouches;

(b) safety helmets;

(c) safety footwear;

(d) proprietary girder grip devices or similar;

(e) hearing protection;

(f) eye protection;

(g) protective clothing.

6.3.1 Safety Harnesses

Fall protection may be provided by the use of safety harnesses attached in accordance with the relevant sections of *AS/NZS 1891.4:2009 - Industrial fall-arrest systems and devices – Selection, use and maintenance*.

Safety harnesses, lanyards, static lines and inertia reel systems provide a satisfactory degree of fall protection provided the following points are taken into account:

(a) riggers should be properly trained and supervised in the use of the equipment;

(b) riggers using fall protection such as a safety harness, should not work in isolation;

(c) safety harnesses should comply with *AS/NZS 1891.4:2009*;

(d) lanyards should be selected in accordance with *AS/NZS 1891.4:2009*. When used in conjunction with an inertia reel, the lanyard should not be located between the harness and the harness end of the inertia reel cable;

(e) the total free fall limit for a person wearing a full body harness attached to a safety line or lanyard behind the user's head at the top of

the back, should not exceed 2.0 metres as indicated in *AS/NZS 1891.4:2009*;

(f) the forces associated with a falling person (kinetic energy) are greater than those at a time of static loading. For this reason, the equipment required to restrain a falling person should be able to accommodate this increased loading;

(g) the method by which a person is to be restrained, for example static lines and their associated anchorages, should be designed and documented by a competent person. *AS/NZS 1891.4:2009* provides guidance on anchorage points;

(h) the importance of a minimum of slack in the lanyard or safety line between the person and the anchorage cannot be too strongly emphasised. The location of the anchorage should be as high as the equipment permits. The degree of risk created by working above the point of anchorage is increased because of the additional slack in the lanyard. Inertia reels or other self-locking devices should comply with *AS/NZS 1891.4:2009*;

(i) inertia reels are not designed for continuous support but become effective in the event of a fall. Inertia reels should not be used as working supports by locking the system and allowing it to support the user during work;

j) post-fall recovery for a rigger who is suspended in a safety harness should be trialled, documented and communicated to all relevant parties;

(k) the duration of time that a worker is to be suspended in a harness when working is to be kept at a minimum because of circulation being restricted in the legs.

6.3.2 Pendulum effect

When working with an extended line such as an inertia reel, there is a concern that if a worker fell and was suspended, injuries may result because of the "pendulum effect". Where it can be foreseen that work may have to be undertaken with the use of an inertia reel, planned anchorage points should be in place to help reduce the length of line that is to be connected to the rigger (see Figure 2 - Pendulum Effect).

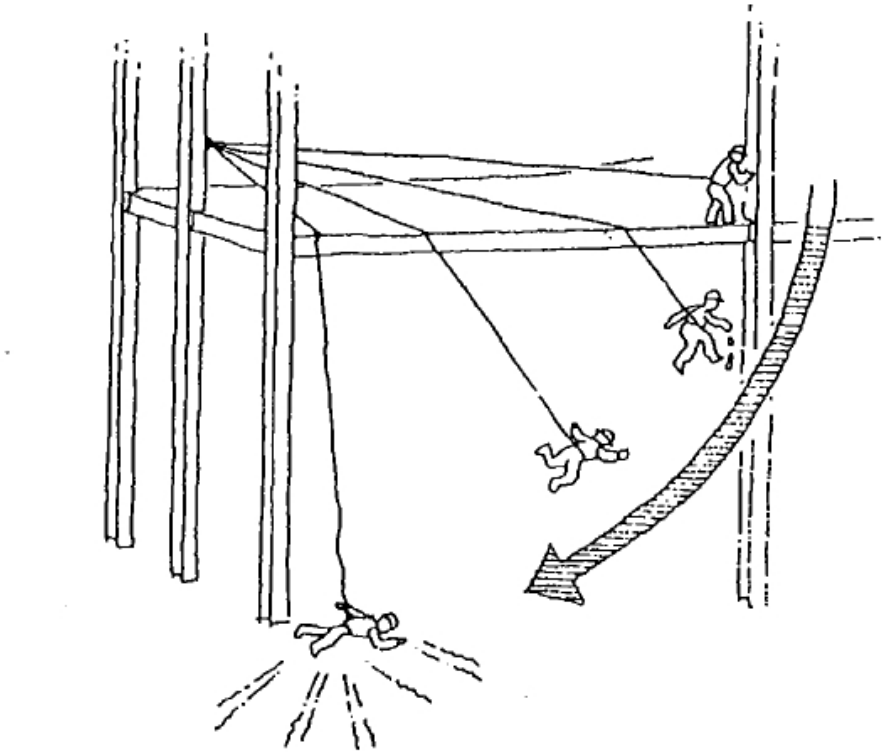

Figure 2 - Pendulum Effect

6.4 Means of access to working places

Safe access to working places should include but not be limited to the following:

(a) walkways and stairways;

(b) inclined ladders;

(c) tower scaffolds;

(d) common scaffolds;

(e) purpose built platforms;

(f) lift boxes;

(g) power operated mobile work platforms.

Note: All the above should comply with the relevant Australian Standards.

The sequence of erection should be planned to allow the permanent building to be used to provide safe and secure access ways and working places as much as possible, with little or no adaptation.

Access to working places should be restricted to persons actually engaged in work in that area and suitable signage should be positioned.

To ensure that all persons can proceed up and down the building with complete safety, access to and egress from all decked floors should be via stairs, either of a permanent or temporary type and/or worker and material hoists.

6.4.1 Movement on steelwork

The compulsory connection to an anchorage point when a rigger is working may in some instances restrict the rigger's movement and result in a hazardous situation arising. The following are recommended:

(a) the persons conducting the business or undertaking should provide the personal protective and safety equipment required, for example, safety harnesses or alternative means of access as identified in paragraph 6.4 above;

(b) the persons in control should provide adequate anchorages for the rigger to use as required;

(c) the rigger should wear the harnesses supplied;

(d) the use of the fall arrest system supplied should be connected to an appropriate anchorage.

The following are means by which access can be gained to work areas:

(a) Vertical movement: Stairs, fixed ladders, hoists, etc. should be used for vertical movement (see Figure 3 - Fixed Ladders).

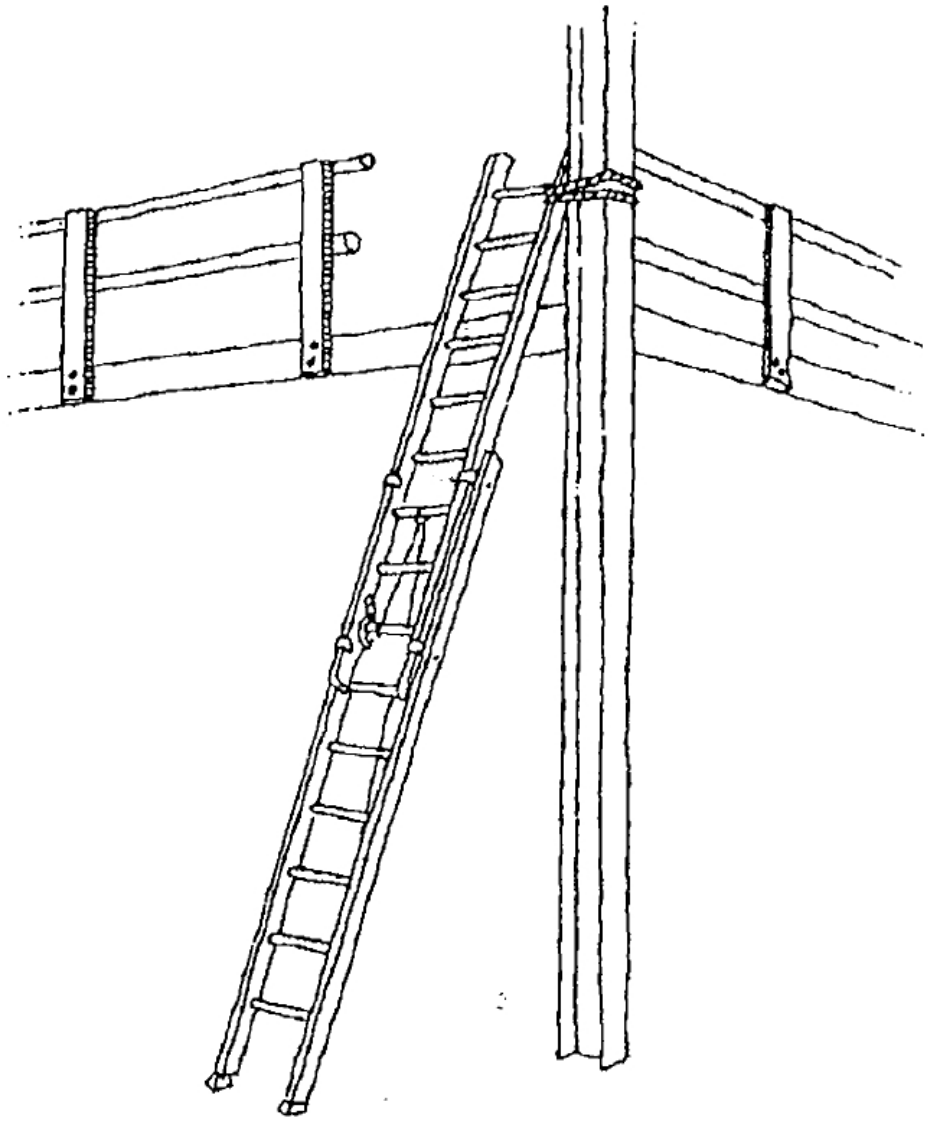

Figure 3 - Fixed Ladders

(b) **Horizontal movement:** Horizontal movement along beams may be required to reach a work area to carry out the erection of the building components. Such horizontal movement may be executed in the following ways:

(i) **Top walking:** Walking along the top surface of a beam by riggers should only be allowed where there is provision for a positive restraint (see Figure 4 - Top Walking).

The beam should be fixed, and sufficiently stable to permit such walking along the top surface.

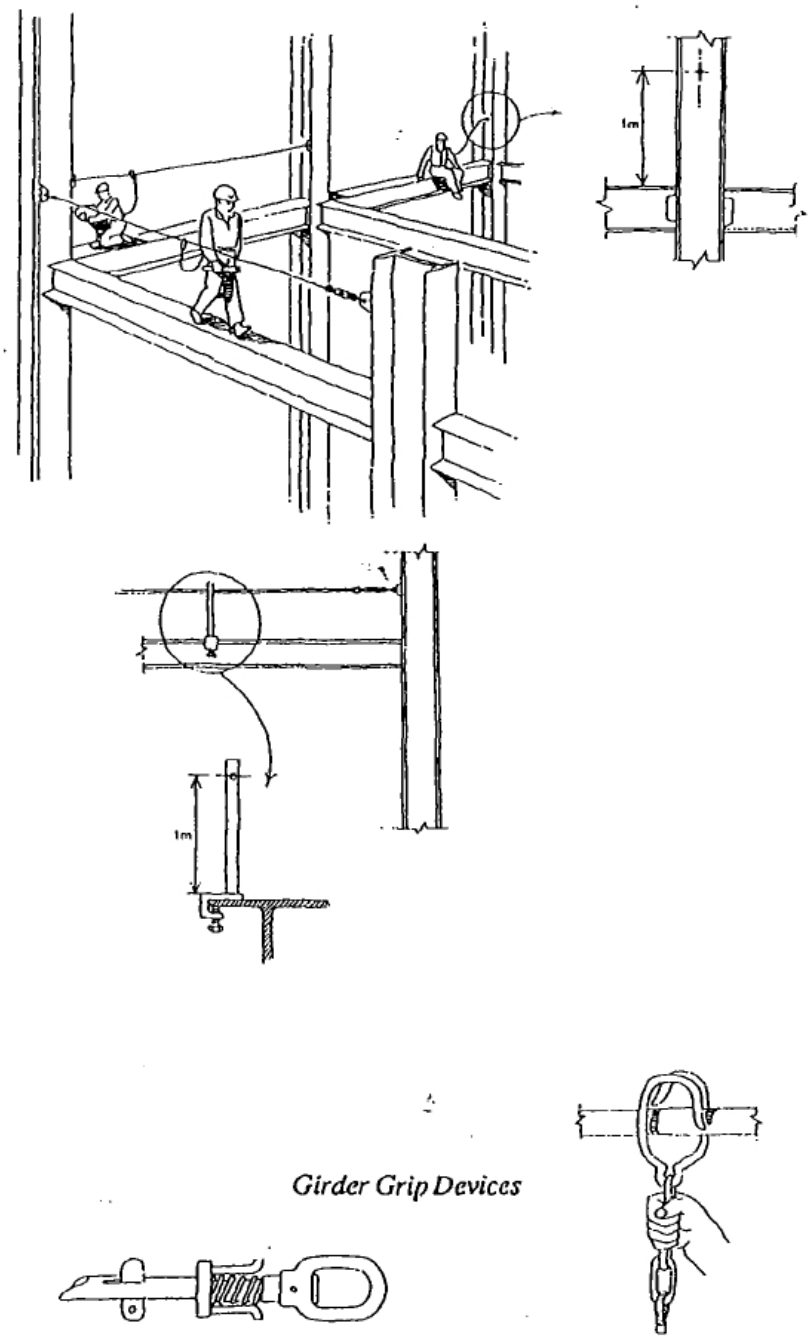

Figure 4 - Top Walking

(ii) **Beam straddling:** Beam straddling (both horizontal and sloping) should only be allowed where the erector has included a risk assessment in the method of work and the size of the beam is adequate (see Figure 5 – Beam Straddling). In such cases, the following conditions should be met:

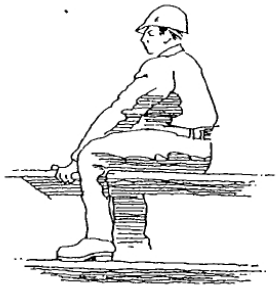

Figure 5 - Beam Straddling

- persons should be able to place each foot firmly on the bottom flange and have both hands gripping each side of the top flange as they move along - this implies that the beam depth should be between 200mm and 700mm;

- upper and lower beam surfaces should be sufficiently free of obstruction so as to allow the above movement to be performed safely;

- for beams including those at an incline, the approved method of work includes a risk assessment component which considers such things as: surface texture, footwear grip, weather conditions, rigidity of the building, health conditions of worker and means of preventing the employee from falling; and

- where a beam is straddled at a working position, a means of preventing a fall should be in place.

(iii) **Walking the bottom flange**: Walking or standing on the bottom flange means working or standing wholly on one side of the beam or rafter and does not imply or include a straddling position (see Figure 6 - Walking on the bottom flange). This is the least preferred option because of the risk of the rigger losing a handhold and falling. Walking the bottom flange of a beam or rafter should only be allowed where there is provision for:

- a secure handhold that can be easily and conveniently reached by the rigger using both hands;

- a secure foothold that is available for both feet and can be used in conjunction with the handhold position without losing co-ordination;

- for beams including those at an incline, the approved method of work includes a risk assessment component which considers such things as: surface texture, footwear grip, weather conditions, rigidity of the building, health conditions of worker and means of preventing the employee from falling; and

- the top flange of the beam not to reach higher than the rigger's waist i.e. the bulk of the rigger's body is located above the beam.

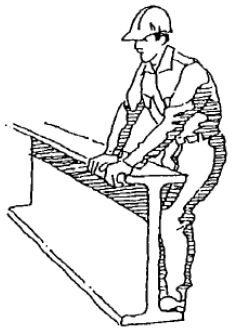

Figure 6 - Walking on the bottom flange

(a) **General:** The working platform should be of a size and strength to carry the required loading of workers, tools and materials. These working platforms should be able to resist other likely induced forces such as impact and environmental conditions such as wind. Working platforms and gangways should be free of protrusions or obstructions. The surface should be finished so as to prevent slips, trips and falls.

(b) **Temporary Working Platforms:** These platforms can be fitted to members at ground level before erection or lifted into position following the erection of steelwork. Design features should include easy and safe dismantling for re-use at other locations.

(c) **Lightweight Fabricated Hanging Working Platforms:** These platforms can be used in many locations if they are designed in such a way to fit a variety of beam widths (see Figure 7 - Lightweight Fabricated Hanging Working Platforms).

NOTE: The design, construction and installation of platforms in (b) and (c) above should be undertaken by, or performed under the supervision of, a competent person.

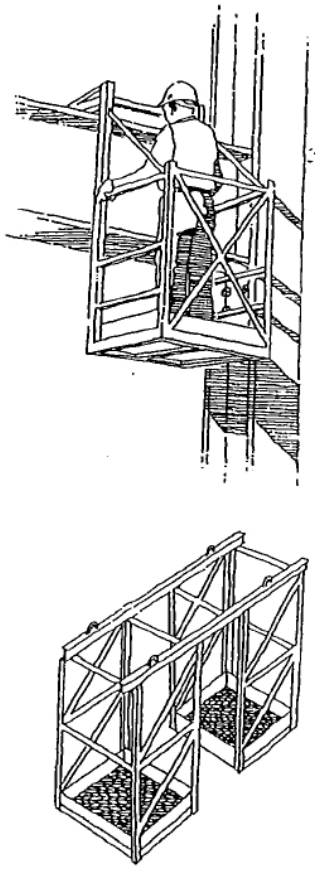

Figure 7 - Lightweight Fabricated Hanging Working Platforms

6.4.2 Working at heights

To reduce the need to work at heights, some alternative means of erection are:

(a) **Connecting:** Connect as much as possible at ground level or from erected floor slabs or decks in the building. This should be planned and included in the erection scheme.

(b) **Unslinging:** Where possible, the lifting sling or device should be released from the decked level by use of long slings, remote release shackles or other suitable devices (see Figure 8 - Unslinging).

(c) **Inspection:** Inspect and test as much as possible at ground level.

(d) **Temporary Access Ways:** The need for temporary access and working at height will be reduced if the methods described above are implemented.

(e) **Fall Protection Strategy:** "On ground" prefabrication should be considered as a fall protection strategy. Other methods available include scaffolding, ladders, scissor hoists, cherry pickers, lift boxes, safety nets, safety harnesses.

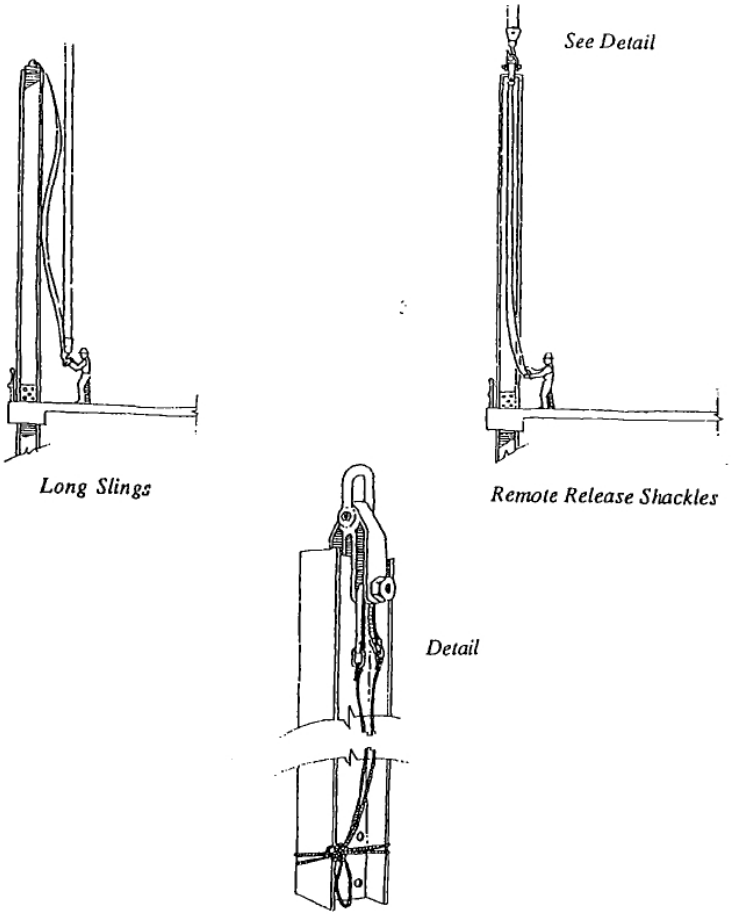

Figure 8 - Unslinging

6.5 Training of all workers

Building and construction sites can be a dangerous environment to the uninitiated. The principal contractor should confirm with each person conducting the business or undertaking the training and induction program of that organisation.

6.5.1 General training considerations

Workers involved in the erection of structural steelwork should undertake safety training and familiarisation with the proposed work before commencing. This safety training should be undertaken by the person conducting the business or undertaking and/or persons in control and can include:

(a) an understanding of the hazards associated with structural steel erection;

(b) the safe use of personal protective and safety equipment;

(c) the safe use of equipment associated with the erection of structural steel;

(d) familiarisation with the risks associated with working at heights;

(e) correct performance of manual tasks.

Training requirements can be split into induction and more specific task-related training, and can be met by a mixture of on-the-job and off-the-job training.

For site personnel, induction training should include the issue and explanation of the company safety policy and procedures, the location of emergency telephones, first aid and medical services, and the use of protective clothing and equipment.

Note: Competent instructors need to be used to carry out the training function.

6.5.2 On-the-job training for riggers

Training of workers should relate to basic health and safety onsite, familiarity with everyday hazards, and the requirements for work health and safety. In general, training for trainee riggers should start at ground level, where basic skills can be acquired and; when riggers are proficient, they may work at increasing heights.

Riggers with limited experience, either as a novice or being absent from this type of work for a considerable time, or riggers in training should work at levels above ground for periods of time related to their experience and level of skill. Variations in time spent at heights by inexperienced riggers should take into consideration not only the level of skill and experience of the erector but also the nature of the work being performed and the environment in which it is being performed and the work safety of the rigger.

Proper supervision should be considered an over-riding requirement. Supervisors should be given full instructions on the work that they are to supervise by the persons in control. Supervisors should be competent to recognise and deal with any potentially dangerous situations.

7. ERECTION OF STEELWORK

7.1 Stability

The requirement for stability at all stages of erection should be clearly understood by all persons dealing with the erection work.

7.1.1 Building stability

In the process of erection, particular care should be taken to verify stability in the following circumstances:

(a) at times of temporary cessation of work or at the end of the workday;

(b) at times when fastenings may be incomplete, for example, during lining up and adjustment of level procedures;

(c) at times of high winds or when high winds are forecast;

(d) when the building or parts of the building may be subject to construction loads, for example due to impact, stacking of parts and lifting or freeing of components which may have become inadvertently wedged in position;

(e) the erection of any element or sub-assembly should start only if all the necessary equipment and tackle is onsite to enable the stability of the building to be maintained at all times. This includes the provision and appropriate use of sufficient temporary guys or bracing to ensure the stability of all parts of the building as well as the building as a whole. Added care should be taken to ensure that all such temporary guys or bracing are always safely anchored. To avoid accidents, guys should be identified by coloured bunting or similar. In areas of plant and vehicle movement, adequate visual barriers are to be located between guys and plant and vehicle movement. The stability of the building and the effectiveness of all temporary guys, bracing and supports should be checked by a competent person at the end and beginning of each shift, or before further erection begins;

(f) the construction of anchor points should be such that they are able to resist any force likely to be imposed upon them. The movement of an anchor should be reported and action taken immediately.

7.1.2 Bracing

Where required by design, erection should start in a braced bay in order that the building can be plumbed and made self-supporting. Such a stable and self-supporting bay can then be used to support subsequently erected steelwork.

If it is not practical to commence erection at a braced bay, the principal contractor should be advised. A competent person should determine the extent of temporary support including the requirement for it, prior to any work being carried out.

7.1.3 Column stability

The erector should be advised in writing by the principal contractor that the footing concrete has reached the specified strength before erecting the columns.

The erector should consider using tightly fitted steel packers and/or steel wedges driven under the edges of the column base plate to provide added stability. No less than four anchor bolts symmetrically placed should be used to anchor the column. Column splices should be capable of supporting the standing column until it is tied together, or the column should have temporary guys attached to ensure its stability at height.

7.1.4 Beam stability

The erector should ensure that all beams are secured by installing no fewer than the minimum of bolts, as determined by a competent person, in a connection before releasing the slings. Where large members are used the number of bolts should increase according to beam mass.

7.2 Lifting steelwork

The weight of all members to be lifted, together with their protective coatings, if any, should be stamped on each member and should be made available to the erector who should ensure that correctly designed lifting gear of appropriate capacity is being used.

Before lifting any steelwork, the rigger/dogger should ensure that members are safely and suitably slung and, when appropriate, tag lines are fixed to their ends. When transferring lifts from a horizontal to a vertical position, care should be taken to avoid unrestrained movement of the lower end. The use of lifting beams may be necessary during lifting and positioning of some members to ensure member stability.

Multiple lifts: The lifting of more than one steel member and/or bundles of steel at the same time or to one or more levels should only be allowed where hazard control measures have been taken. Such control measures include:

- specifically designed lifting slings to avoid steel members becoming entangled;
- cradles for bundles of steel or decking.

The way in which the slings may be released without placing the riggers at risk should be a major consideration when slinging structural steel members. Where possible, the lifting sling or device should be released from the decked level by the use of long slings, remote release shackles or other suitable devices.

7.3 Erection of steel components

7.3.1 Columns

The structural engineer, fabricator and/or erector should consider the following during the design stage:

(a) plumbing and supporting the column at height;

(b) crane capacities;

(c) limitations to column height.

(d) the provision of means to be able to lift column members safely, e.g. lifting "eyes", holes, etc.

Note: No columns should be left freestanding at the end of workday unless completely secured.

7.3.2 Connection of primary beams to columns or concrete core

(a) **Access when Connecting:** When connections are to be made at levels above the working deck, steel members can be initially connected by riggers using a suitably placed, fixed ladder as indicated in section 4.4 (e), scaffold or other working platforms.

(b) **Chemical and Mechanical Anchorages:** This is the last preferred option for connection. There can be a problem in achieving the recommended depth for the anchorage because of the location of steel reinforcement.

Once installed, it is difficult to determine if the anchorage has been installed correctly or incorrectly. Where an anchorage has been installed incorrectly, it is prone to fail without warning. Where practicable, provision for in situ connection, for instance cast in bolts or cast in steel plate to allow a welded connection is the preferred method. If chemical (epoxy resin) and mechanical (expansion shell) type anchorage connections are to be used, they are to be installed in accordance with their manufacturer's recommendations. The erector should be advised in writing by the principal contractor that the concrete core has reached the specified strength into which the chemical or mechanical type anchorage is to be installed.

7.3.3 Connections of secondary and in-fill beams

When connections are to be made at levels above the working deck, the initial bolting of beams can be made from a straddling position. However, final bolting may be made from the straddling position for bolts up to 310 millimetres below the top flange. For bolts over 310 millimetres below the top flange, final bolting will be made from a suitably placed and fixed ladder as indicated in section 4.4 (e), scaffold or other working platform.

7.3.4 Bolting

Approved bolt bags or baskets should be used to transport or distribute bolts from the working deck to the work point. Loose bolts and/or tools should not be left on the steel work at any time. Where riggers are using bolts, they should be passed when required, not thrown.

7.3.5 Purlins

Where conditions allow (normally buildings with a short frame spacing), individual purlins may be carried into position from the purlin bundle previously deposited at the base of the rafter slope. Purlins should always be carried up the slope rather than down as it is both easier and safer. Carrying purlins into position will normally involve two riggers working from adjacent rafters. This activity must comply with the requirements of Clause 6.4.1. Alternatively, where purlins cannot be safely carried into position, individual purlins may be lifted into position by means of a hand line, or with mechanical gear. Where purlins cannot be erected directly from the rafter steelwork, alternate methods such as a crane lifting cradle can be used to raise and place the purlins onto the rafter beams.

7.3.6 Girts

Girts may be erected by a competent rigger from the ground or a safe work platform. The safe work platform includes Elevating Work Platforms, mobile or fixed scaffolds, or ladders. Where a ladder is being used the ladder must be secured. Riggers should not carry the individual girts up ladders, rather the girt should be lifted into position by means of a handline, or with mechanical equipment.

7.4 Metal decking

Landing of metal decking:

(a) Lifting methods should be considered for transporting and lifting of decking material to ensure adequate restraint from fall on landing.

(b) Packs should be landed in correct orientation and location to suit laying. This should be predetermined by the decking contractor. Consideration should be given to loose sheets and windy conditions.

(c) Bundles are to be guided into the final position by the dogger or rigger from his position straddling the beam or on a working platform (see Figure 9 - Landing of Metal Decking). Metal decking should not be landed on sloping surfaces where there is the possibility of slippage.

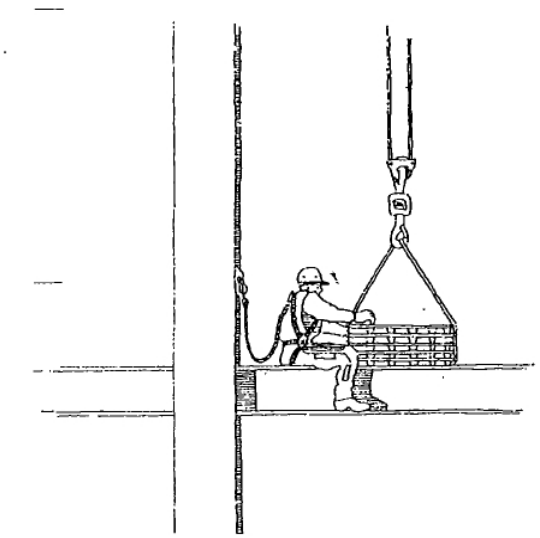

Figure 9 - Landing of Metal Decking

Metal Deck Laying:

(a) Where possible decking should be laid and fixed progressively from the core outwards. Necessary protection should be provided when this work is being carried out.

(b) All loose sheets of decking not interlocked should not be left unattended.

(c) While the deck is being laid, positive fixing should not be greater than three metres behind the laid edge or leading edge. Any pack or single sheets should be secured when work ceases to avoid movement by wind or other means.

(d) All penetrations etc should be protected to prevent a worker from falling.

7.4.1 Decking and openings

Underneath all rigging work there should be in place a fully decked platform protecting workers at lower levels from any falling objects.

All lift wells, stairwells or other similar type openings should be completely decked out with decking material or enclosed by internal protective screens that project at least 900 millimetres past the working floor to prevent persons or objects falling. This decking or protective screen should stay as the work progresses until permanent measures may be taken to prevent persons or objects falling down such openings.

7.4.2 Shear studs

The decked area being shear studded should be enclosed by perimeter screens or meshed handrails along external or atrium edges, handrails and midrails along internal decked edges, or cordoned off along the sides at least 2 metres from internal decked edges (see Figure 10 - Decked Areas).

The area immediately under the area being studded should be flagged off to prevent access because of the danger of hot sparks and adequate signage posted.

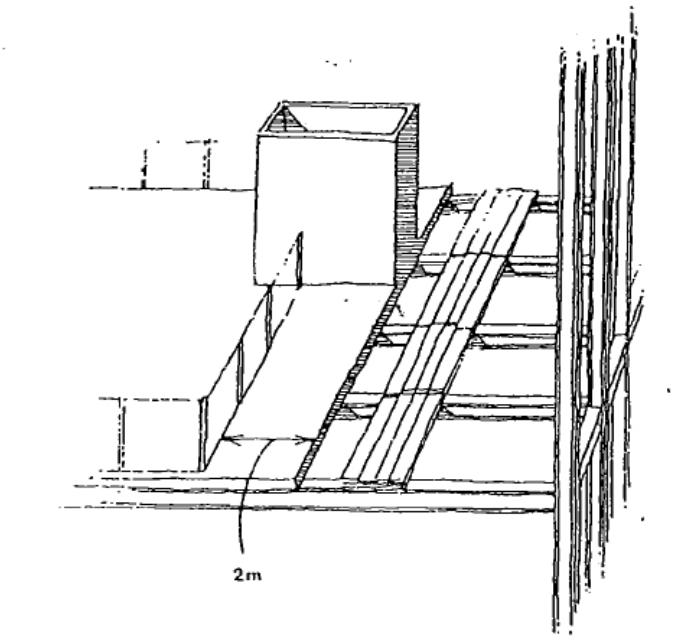

Figure 10 - Decked Areas