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British Precast Architectural and Structural Code of Practice for:

THE SAFE INSTALLATION OF ARCHITECTURAL AND STRUCTURAL PRECAST CONCRETE

2020

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PREFACE

The British Precast Architectural and Structural Code of Practice for the safe installation of architectural and structural precast concrete and associated components is designed to replace the now dated separate codes from the Architectural Cladding Association (ACA) and Structural Precast Association (SPA).

British Precast Architectural and Structural is the new identity of the old Architectural and Structural Precast Association (ASPA) which was in turn an amalgamation of the ACA and SPA.

The Code gives a guide to the current good practice for the installation of all types of architectural and structural precast concrete. Health and Safety is an ever-changing discipline, therefore this document is only up-to-date at the time of publication.

British Precast Architectural and Structural is committed to putting health & safety of the workforce at the forefront of production and installation activities. The health and safety of our employees and customers, as well as the general public, is our primary concern.

Installation of architectural and structural precast concrete components is acknowledged to be a potentially high-risk activity, as it involves the use of heavy plant, cranes and personnel working at height. This Code of Practice is, therefore, used as the basis for the training of installers and supervisors to ensure that all have the skills and competence to carry out their roles in a safe manner.

The council of British Precast Architectural and Structural gratefully acknowledges the help and guidance provided by the Health and Safety Executive in the preparation of this Code.

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FOREWORD

Falls have historically been, and remain, the biggest cause of death and serious injury in construction. Incidents involving the movement and lifting of heavy items also form a significant proportion of annual construction incident statistics. If material movement, lifting and work at height is correctly planned - including selecting suitable plant and equipment and using it properly - then accidents involving falls of people, plant and materials can be prevented.

I am pleased to acknowledge the work of British Precast Architectural and Structural and those involved in revising this code of practice. It brings together good practice at a time where the use of offsite production is increasing the use of pre-cast components. It will guide those involved in the specification, design, installation and use of precast products. It is only by the industry showing leadership, working in partnership, and taking ownership of the management of risk that improvements will be made.

The HSE continues to work closely with the industry and endorses this guidance which follows a sensible and proportionate approach to managing health and safety. Please read this guidance and take the appropriate steps to turn the advice into action.

Sarah Jardine

Acting Chief Inspector of Construction

Message from BPAS Chairman Andrew Tyrrell

This code of practice brings together, as a single revised and updated document, two historic codes relating to the safe installation of both architectural precast cladding and structural precast elements. We advise you take a detailed look at the content whenever you are involved in an offsite precast concrete project. Each member of British Precast Architectural and Structural pledges to work to the Code both through their in-house construction teams and in partnership with all appointed subcontractors.

This code represents an important step in reducing the risks of accidents and injuries during the installation of architectural cladding and structural precast elements. The increasingly wide and exciting variety of applications for precast concrete in buildings, alongside the bespoke nature of our products means that the guidance provided in this code of practice is crucial to its installation. With construction trends continuing to move towards offsite manufacture in recognition of its associated benefits in terms of quality, speed of delivery and site safety, we see this code of practice as increasingly important.

Whether you are a client, a designer or a contractor, by working with British Precast Architectural and Structural members you can help to improve safety on your sites. In addition to adherence to this Code, British Precast members make a number of further commitments as signatories to the Health and Safety Charter which can be viewed on the British Precast website: www.britishprecast.org

Our members pledge to reduce accidents, both in terms of number and severity, to improve the overall health and safety of all those involved in our industry and to work towards the long-term aim of causing zero harm.

A copy of this Code of Practice is available to download at either www.architecturalprecast.org or www.structuralprecast.org.

Acknowledgements

TThe members of British Precast Architectural and Structural and stakeholders have made this publication possible. Whilst many individuals have contributed, the following are amongst those who deserve particular mention:

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Special thanks to Matt Adcock, for his work on the document, who is sadly no longer with us.

Code of Practice for:
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0.1 INTRODUCTION: The Procurement Process

This Code of Practice is designed to cover the safe installation of all architectural and structural precast concrete ranging from the installation of a few small elements up to the erection of a major structural frame and cladding. This wide range of scenarios could therefore involve an equally wide range of contractual arrangements. This means that some of the information in this guide may involve more complex arrangements than are legally necessary on a small, simple, short duration job. The principles of planning the work and selecting the right people, equipment and systems of work still apply to simple jobs but the level of paperwork will often be less. An apparently easy job in a busy area that involves awkward delivery, unloading, lifting, work at height, etc, can be as problematic as more complex work and much of this guide will need to be applied. This Code of Practice does not cover post-stressing of precast elements as this is a specialist area. Typically the principal parties involved in a precast installation project will be:

Client
Principal Designer
Principal Contractor
Contractor
Precast Designer
Precast Manufacturer
Precast Installer

Some of these parties may, on occasions, be one and the same. Frequently, the Precast Manufacturer may also be the Precast Designer (often employing a sub-contract structural engineer and/or detailer) and the Precast Installer (often employing a sub-contract installer) but this procurement model can sometimes vary. In some instances, the Precast Manufacturer may not have responsibility for installation and the Principal Contractor may act as the Precast Installer or employ its own subcontract Precast Installer. In other instances, the Precast Installer may also be the Precast Designer, procuring the precast units from an independent Precast Manufacturer.

This Code of Practice seeks to define the roles and responsibilities for the principal parties whilst recognising that there may be overlap in the contractual relationships and arrangements. Definitions of these parties are provided in the subsequent section.

In addition to the principal parties to the installation process, there may also be involvement from other parties and individuals, often employed by the principal parties, such as:

Temporary Works Coordinator
Temporary Works Designer
Temporary Works Supervisor
Installation Supervisor
Crane Supervisor
Appointed Person

Definitions of these titles are provided in the following section and the Code seeks to further define their roles and responsibilities as they relate to the safe installation of architectural and structural precast concrete.

0.2 DEFINITIONS

Most of the terms used in this document are in common use. However, the following definitions are intended to remove any ambiguity:

Appointed Person: The person employed by the Precast Installer to have overall control of the lifting operation and to act on behalf of the Precast Installer. The Appointed Person must have adequate training and experience and be Certificated to ensure the implementation of a safe system of work.

As Installed Drawing: The layout drawings confirming actually 'as installed' positions of precast component positions, issued for the client's safety file.

Attendances: The Health, Safety and Welfare Attendances, the provision of which should be agreed between the Contractor and the Precast Installer at pre-subcontract stage.

Banksman: A person who has been suitably trained in giving signals to control plant movement and operations on a construction site.

Certificated: Having been trained and qualified to fulfil a particular role. Generally, holding a valid licence/certificate of training gained by attending a recognised course of instruction for the task in question.

Company Representative: A Supervisor/Contracts Manager (usually travelling) in the Precast Installer's employ with a responsibility for a number of contracts. A 'Competent Person' trained to assess all health, safety and welfare arrangements in relation to company operations.

Competent Person: The person is regarded as competent if they have 'sufficient skills, knowledge, experience, training and other qualities to properly assist the employer to meet his safety obligations'.

Components: Any member, article, or item comprised of precast concrete or ancillary metalwork.

Contractor: "The 'Contractor', as defined in this code of practice, shall mean the Precast Manufacturer's or Precast Installer's client, who is responsible for coordinating all Principal Contractor requirements and attendances for the contract. Where the Contractor has overall responsibility for the Construction Phase of the project the 'Contractor' shall also mean the 'Principal Contractor'."

It should be noted that in the CDM Regulations 2015 a Contractor is defined as: "Anyone who directly employs or engages construction workers or manages construction is a contractor. Contractors include sub-contractors, any individual, sole trader, self-employed worker, or business that carries out, manages or controls construction work as part of their business. This also includes companies that use their own workforce to do construction work on their own premises. The duties on contractors apply whether the workers under their control are employees, self employed or agency workers."

This carries its own set of duties under the CDM Regulations 2015.

Crane Coordinator: The person who plans and directs the sequence of operations of cranes to ensure that they do not collide with other cranes, loads and other equipment.

Crane Driver: A competent and trained person responsible for the correct operation of the crane in accordance with the Manufacturer's Operating Instructions, the Safe Working Method Statement and directions from the nominated Slinger/Signaller. The Crane Driver is also known as the Crane Operator.

Crane Supervisor: Also known as 'Crane Lift Supervisor'. The person designated by the Appointed Person to supervise the lifting operations, where the Appointed Person has deemed the operations as basic or standard, as defined by BS 7121–3: 2000 Section 4.8.

Duty Holder: Someone who has duties under CDM Regulations 2015.

Employing Organisation: The person or organisation requiring a lifting operation to be carried out and who has responsibility for safe use of the crane.

Flooring: The precast concrete components that form the structural element of a floor and may include associated precast components.

Installation Supervisor: The Precast Installer's senior representative on site in charge of all precast installation operations. A Competent Person trained in precast concrete installation and responsible for ensuring installation in accordance with the Working Drawings, Safe Working Method Statement and specifications.

Installer: A person who, after suitable training, is competent to carry out all functions of Slinger and Signaller, as well as to hoist, place and secure precast concrete components, including all plumbing/levelling and lining up, and who has the ability and training to work safely, and has a general understanding of structural stability issues. An Installer may be employed by the Precast Installer, a specialist installation company or be self-employed.

Operatives: All other site personnel involved with the precast works, not including Installers.

Precast Designer: The person or persons who produces specifications, drawings, details, designs or calculations for the Components, usually working for or on behalf of the Precast Manufacturer.

Precast Installer: The organisation employed by either the Principal Contractor, Contractor or Precast Manufacturer to install the precast concrete components

Precast Manufacturer: The manufacturer and supplier of the precast components, usually engaged by the Contractor usually also with responsibility for design of the Components. The Precast Manufacturer may also have responsibility for installation in which case they would act as Precast Installer or employ a sub-contract Precast Installer.

Principal Contractor: The contractor with control over the construction phase of a project involving more than one contractor. The role of Principal Contractor is defined within the CDM regulations - refer to the regulations for a full definition of duties.

Principal Contractor's Site Representative: The person in charge of the day-to-day running of a particular site or project, i.e. Site Manager, Site Agent, General Foreman, Project/ Contracts Manager.

Principal Designer: The designer of the building or structure incorporating the precast components. Usually, the organisation or individual (on smaller projects) appointed by the client to take control of the pre-construction phase of a project. A Principal Designer is only required when there is more than one contractor. The role of Principal Designer is defined within the CDM regulations - refer to the regulations for a full definition of duties.

Site Representative: See Company Representative.

Slinger/Signaller: A person who has been suitably trained in the proper selection of lifting tackle, the slinging of loads to the crane attachment, while taking into account the capabilities of the crane employed and has the responsibilities, after suitable certificated training, for directing the safe movement of a load attached to a crane, and for the movement of the crane on site.

Temporary Works Coordinator: On larger projects, the individual, usually employed by the Principal Contractor or Contractor, to plan and coordinate all temporary works on the site. This will include responsibility for ensuring that they are correctly installed, used, checked and maintained. On smaller projects these duties are usually taken on by the site manager.

Temporary Works Designer: The organisation or individual with responsibility for design of any temporary works. In the context of precast installation, this may include any access scaffolds, props, falsework, crane platforms etc.

Temporary Works Supervisor: The competent person responsible for ensuring the correct installation, maintenance and use of any temporary works.

Vehicle Marshal: A person who has been suitably trained to control traffic on a construction site.

Work Area: The area on a site or building where precast components are being erected. This generally but not exclusively includes the areas where mobile cranes, tower cranes or other lifting equipment is being used to lift precast components from lorries (or stacks) to the final position.

Work at Height: Work where there is a significant risk of injury due to falling.

Working Drawings: The layout drawings, section and details, produced by the Precast Designer and issued for client approval, production and installation purposes.

Please note that where the term 'he' or 'his' is used this should also be taken to include 'she' or 'her' as appropriate.

0.3 BIBLIOGRAPHY

This list is not exhaustive, but provides a helpful pointer to useful publications.
Note: Please ensure that you refer to the latest edition of these references.

Her Majesty's Government

Health and Safety at Work etc. Act 1974
The Management of Health and Safety at Work Regulations 1999
The Work at Height Regulations 2005
The Health and Safety (First Aid) Regulations 1981
The Control of Noise at Work Regulations 2005
The Electricity at Work Regulations 1989
The Personal Protective Equipment at Work Regulations 1992
The Provision and Use of Work Equipment Regulations 1998
The Lifting Operations and Lifting Equipment Regulations 1998
The Manual Handling Operations Regulations 1992
The Control of Substances Hazardous to Health Regulations 2002
The Construction (Design and Management) Regulations 2015
The Construction (Design and Management) Regulations (Northern Ireland) 2016
The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013
The Control of Vibration at Work Regulations 2005
The Road and Streetworks Act 1991
The Control of Asbestos Regulations 2012

Health and Safety Executive

GS 6 Avoidance of danger from overhead electrical lines 2013
HSG 141 Electrical safety on construction sites (no longer available)
HSG 144 The safe use of vehicles on construction sites
HSG 149 Backs for the future – safe manual handling in construction
HSG 150 Health and safety in construction
CIS 10 Tower scaffolds (Rev. 4, 2006)
CIS 37 Handling heavy blocks
CIS 36 Construction dust. (Rev.2 June. 2013)
CIS 54 Dust control on cut-off saws used for stone or concrete cutting (Rev. 1. Feb. 2010)
General Information Sheet No. 6 (GEIS6) The selection, management and use of mobile elevating work platforms
Information Sheet MISC 614 Preventing falls from boom type mobile elevating work platforms
Managing health and safety in construction
Health surveillance for those exposed to respirable crystalline silica (RCS) – Supplementary guidance for occupational health professionals (amended January 2016)
HSE CDM 2015 guidance – http://www.hse.gov.uk/pubns/books/l153.htm

British Standards Institution

British Standards and other guidance notes are issued on a continuing basis and users of this Code of Practice should acquaint themselves with the latest updates and revisions.

BS 5975	Code of Practice for falsework
BS 7121	Code of Practice for safe use of cranes – Parts 1, 2, 3 and 5. BS 5628
	Code of Practice for use of masonry
BS EN 818-4	Guidance for the purchaser and user of mechanically assembled slings
BS EN 1990	Eurocode – Basis of structural design
BS EN 1991–1–1	Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings
BS EN 1992–1–1	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings
PAS 59 2004	Filled collective fall arrest systems

Construction Industry Research and Information Association

CIRIA publication C669 Site Safety Handbook
CIRIA publication C703 Crane stability on site
CIRIA publication C654 Tower crane stability

The National Access & Scaffold Confederation

TG20:13 Guide to good practice for scaffolding with tubes and fittings.
TG20:13 Toolbox talk training videos.

1 MANAGEMENT OF HEALTH AND SAFETY

The Health and Safety at Work etc Act 1974 places general duties on employers, employees and others. Regulations are made under Section 15 of the Act. The Regulations referred to in the introductory notes below are a legal requirement and must be adhered to at all times. For more information, refer to the documents themselves, listed in the bibliography, and where necessary obtain competent, professional advice and approval on safety matters.

Management of health and safety issues needs to be planned, supervised, monitored, reviewed and improved where possible. This needs to be an ongoing process within all organisations and by all employers and the self employed. HSE publication HSG65 Managing for Health and Safety sets out examples and arrangements to make this an effective and efficient process.

See http://www.hse.gov.uk/pubns/priced/hsg65.pdf

1.1 Management of Health and Safety at Work Regulations

The Management of Health and Safety at Work Regulations requires all employers and self-employed Operatives to apply sound risk management principles. This includes assessing the risk to the health and safety of workers and any others who may be affected by the work carried out. Where five or more employees are involved, the conclusions of the risk assessment must be recorded in writing.

Assessments will help to identify all the protective and preventative control measures and arrangements that need to be taken to reduce the risk of incident to an acceptably low level. This document contains information to help with understanding the issues, assessing the site and the task to be achieved and selecting and using appropriate control measures. Further guidance on the procedures for risk management and risk assessment can be found on the HSE website.

Before an assessment of risk can be made it is important to understand the terms used, the two most important being:

Hazard – is something with the potential to cause harm,

Risk – expresses the likelihood that the harm from a particular hazard is realised.

Most employers will be capable of undertaking the risk assessment themselves using expertise within their own organisations. Where there are complex hazards or equipment, it may be necessary to employ the help of external health and safety professionals.

The key actions to be taken can be summarised as below:

- These Regulations require an employer to make a suitable and sufficient assessment of the risks to the health and safety of employees and others who may be exposed to those risks. This includes contractors or temporary staff engaged for specific work. Risk assessments must be signed and dated.
- Risk assessments must be regularly reviewed and altered if they are no longer valid or circumstances/conditions have changed significantly.
- This may be a suitable employee or, for new or unfamiliar types of work or equipment, you may need external support.
- Emergency procedures must be established, and Competent Persons nominated to implement them.
- Information must be provided to the employees on the risks identified, the control measures to be taken, the names of the Competent Persons and information on the risks identified, including risks created by sharing work areas with other trades or employers.
- Training must be given to employees in respect of the duties placed upon them by the Regulations, at induction when first employed, when transferred, or if the job changes. This training must be updated and repeated periodically to take account of any changes.

In addition employees have certain duties under the Regulations:

- To make full and proper use of anything provided by the employer in accordance with the training given. This includes safety equipment, machinery, substances, means of transport, etc.
- Employees must also inform the Employer (or Nominated Persons) of any dangerous work situation or any matter relating to the employer's health and safety arrangements.

1.2 Risk Assessments and Method Statements (RAMS)

1.2.1 General procedure for risk assessment

1. Identify the hazards and activities.
2. Where possible the hazards identified should be removed/minimised by design.
3. Consider who will be affected by the hazard and the likely extent of injuries or damage that could result.
4. Assess existing control measures or precautions for adequacy, and decide if any further measures needed.
5. Consider whether the additional control measures now make the task or activity safe – ie low level of risk. Repeat this thinking process until the risk is low enough.
6. Check for compliance with other legal requirements.
7. Record the findings and arrangements.
8. Issue risk assessment.

NB. Risk assessment is largely a process of thinking through the task that needs to be done and ensuring that suitable control measures are in place and correctly used. Some companies prefer to use a numerical approach - such as the example below. However this is not essential and not a legal requirement. All the legislation calls for is a clearly thought out approach so that no one is doing work that hasn't been assessed and judged safe, have been recorded and implemented and are updated.

Table 1.1
Risk assessment

	Severity of harm to personnel				
Likelihood of harm	Bump/scrape No injury (1)	First aid needed (2)	Reportable injury (3)	Major injury (4)	Fatality/ disability (5)
Unlikely (1)	**1**	**2**	**3**	**4**	**5**
Remotely possible (2)	**2**	**4**	**6**	**8**	**10**
Possible (3)	**3**	**6**	**9**	**12**	**15**
Probable (4)	**4**	**8**	**12**	**16**	**20**
Certain (5)	**5**	**10**	**15**	**20**	**25**

Probability rating

1. There is little or no risk of injury or ill health. Only under rare and unforeseen conditions is there the likelihood of injury or ill health. This should be the aim of all workplace activities.
2. Remote possibility; if other factors were present, that injury or ill health might occur, but the probability is low.
3. Possible; the incident may happen if additional factors precipitate it, but it is unlikely without the other factors.
4. The event is probable; the effects of humans or other factors could cause the event (injury or ill health), but it is unlikely without additional factors
5. If the task continues, then it is certain that an injury or ill health will occur.

Severity rating

1. Minor injury such as a slight laceration or bruising requiring limited medical treatment
2. Injury requiring medical treatment, but unlikely to result in absence from work
3. More serious injury, possibly requiring hospital attendance, which could result in absence from work
4. Fracture, dislocation and attendance or possible attendance at hospital for treatment
5. Serious or fatal injury

Risk Score

9-25 Put controls in place before commencing to reduce risk score

6-8 Prioritise and control as far as reasonably practicable

1-5 No further action required. Review periodically

1.2.2 Complexity of task

For simple tasks that workers carry out regularly in similar locations, risk management can be a simple check that the job will be straightforward using familiar techniques and equipment. If generic procedures are used there must still be a check to ensure the location of the work does not pose additional or unusual problems. This location check should form one of the conclusions of the recorded risk assessment.

Where new systems of work. new equipment, or an unfamiliar work area will be involved the risk assessment must be thought through to ensure all significant hazards have been identified and acted on.

Some clients or major contractors have their own risk assessment style and they may insist that you use their approach. Some of these can involve scoring the hazards in relation to likelihood of occurrence and severity of outcome. Then scoring again with control measures in place. For completeness an example of this type of approach is set out in Table 1.1. In most cases this approach adds little and to the unwary can cause more problems than it solves. Remember that the thinking process to identify hazards and work out which control measure or combination of control measures is best for the task and will make the risk of incident acceptable is the main part of the risk assessment process. Recording the conclusions creates a record to show that the legislation has been followed. It is not a legal requirement to carry out a numerical risk assessment although the approach can be justified in high hazard process industries and environments.

1.2.3 Method Statements

A method statement is used to inform workers about how they are expected to carry out the task. The method statement should be discussed during task planning and at all stages any concerns or additional information that would help should be incorporated. Sometimes this means making quite large changes as the planning work proceeds. The process works most smoothly if supervisors or the workers themselves are involved in early discussion. This ensures they agree with proposals and means they are more likely to follow them.

Safe Working Method Statements form part of the overall Safety Management System, covering hazardous activities such as the installation of precast units and associated

components. They provide the information on the arrangements and, where required, the actual sequence of work necessary to manage health and safety. Basic information must be provided and communicated to all concerned parties at the planning stage, thus allowing time for approval or modification of the Safe Working Method Statements prior to site installation.

Precast units installation is similar in nature on many sites and therefore a Safe Working Method Statement will contain common elements and activities. However, the Safe Working Method Statements must take account of specific site conditions/ requirements, information from the Health and Safety Plan/Design Risk Assessment, and/or contractors requirements in the CDM Construction Phase Plan.

1.2.4 Content of Safe Working Method Statements

Safe Working Method Statements must be concise but informative and should contain the following information as a minimum.

Part 1: Management and control	
Principal Contractor	The name of the main contractor in charge of the site.
Contractor	The contractor or sub-contractor who employs the Precast Manufacturer and/or the Precast Installer
Precast Installer	The name of the company or sub-contractor. (If different from above) responsible for installation of the units
Precast Manufacturer	Concrete precaster and supplier
Precast Designer	The designer of the precast elements if different from the Precast Manufacturer
Site address	The address at which the proposed work is to be carried out.
Site manager or representative	The point of contact at the site.
Part 2: Description and information (contract, site and plant)	
Scope of works	Brief description of the work to be carried out – should include the number of visits that will be necessary to complete the contract and approximate duration of work
Lifting equipment and lift plan	The crane type/other lifting equipment (rating and style, tonnage, mobile, tower, outrigger loadings etc). General location of the crane, the location of any obstructions or nearby hazards including overhead and underground services, voids, tanks etc. This section should also include details of the crane supply arrangements ie. whether it is provided by the Principal Contractor, or on 'contract lift' under the control of the crane supplier or on 'crane hire' to the Precast Installer. This section may also include a schedule of lifts (ie the unit weights and method of attaching and lifting the units) as supplied by the Precast manufacturer.
Method of installation and sequence of work	How the units will be lifted and positioned and other relevant requirements. e.g. where will work commence and how the programme is sequenced in respect of other trades.
Temporary Works	Is there a requirement for temporary propping to any units or areas and who will provide this? Are there any other structural stability issues which need to be taken into account? What are the site handover procedures to ensure that temporary works are signed –off by a competent person and ready for use.
Maximum component weights and crane working radius	The maximum weight/radius' for each component type must be stated and any recommendations from the crane suppliers must be considered.
Deliveries and site access	The method of transport by which the components are to be delivered, offloaded and the access and egress requirements, e.g. hardstanding and lay-down areas and their preparation and maintenance. Marshalling of vehicles onto and off site.

Loading, unloading and storage requirements	Design information to ensure that precast units are correctly supported on bearers and properly lifted using the correct equipment to ensure that each unit is not over-stressed and can be positioned safely without damage.
Part 3: Adequacy of supporting structure and ground conditions	
Adequacy of supporting structure and/or ground conditions	The Principal Contractor, at handover, will usually be responsible for ensuring the adequacy of the supporting structure or ground to accept both the precast units in the temporary and permanent conditions and to support any lifting equipment, delivery vehicles and other installation plant. If not, responsibility should be clearly defined in the sub-contract.
Part 4: Personnel	
Installation Supervisor	Manager/ supervisor is the nominated person to liaise with principle contractor and third parties.
Personnel	Statement to confirm the competence and training of all personnel who will be involved in the installation. These may include the Appointed Person, Crane Supervisor, Crane Operator, Slinger/Signaler (banksman) and other Installers.
Other site operations/ third parties	Where cooperation and coordination with other site operations/ third parties is required, this must be stated and managed by the Principal Contractor.
Part 5: Health and safety management and control measures	
Personal protective equipment	List of PPE requirements at the site and a general statement stating that all Installers and other personnel must comply with site and task-specific requirements
Access to work area	It would usually be the Contractor's responsibility to provide safe access and egress to the work area. The provision and use of scaffolding, temporary access etc.
Positioning of components	Standard and non-standard/unusual methods of positioning and installing components.
Access to and Working at height	Statement regarding the means of access to the work area, provision of handrails and other means of protection and risk reduction measures.
Leading edge protection	The use of fall prevention/arrest equipment, e.g. birdcage scaffolding, decking systems, harnesses, safety nets, airbags and barriers to close off any open edges Means of rescue from the fallen position.
Exclusion zones	Method of creating and maintaining exclusion zones.
Welfare facilities	Provision of facilities, e.g. first aid, restroom and toilets.
Part 6: Amendments and additional information	
Amendments to the Method Statement	Should any part of this Method Statement require amendment or alteration, this must be notified for agreement by all relevant parties prior to it being enforced.

1.2.5 Communication of the Safe Working Method Statement

The Safe Working Method Statement must be submitted to the Contractor for review and approval. Where changes are made these must be recorded and the appropriate amended copy sent to the Contractor. Once approved and signed, the Contractor's copy must be added to the Construction Phase Plan. The current Safe Working Method Statement must be supplied with the Working Drawings for the installation crew to use during the installation phase. The Installation Supervisor must ensure that the Installers understand the Safe Working Method Statement and must monitor its adequacy during the installation phase. Any variations are to be reviewed/approved and recorded following liaison between the Precast Installer and the Principal Contractor. Any variations must be communicated to the personnel undertaking the work.

1.2.6 Additions to the Safe Working Method Statement

The Safe Working Method Statement may be supplemented by attaching and/or referring to other documents, for example:

- Company site safety booklets.
- Company procedures, for example, those regarding handling and storage.
- Crane Planning Schedule and Lift Plan.
- Ground Investigation reports
- Risk assessments.
- Addendums to the Safe Working Method Statement.
- Specifications and certification of plant and equipment, etc.
- The British Precast Architectural and Structural Code of Practice and Information Sheets
- Attendances
- The Health and Safety Plan.
- Construction issue drawings and specifications
- COSHH assessments and safety data sheets

This list is not exhaustive and the level of information/inclusion will vary and depends on the nature of the contract.

1.3 Checks and Briefings

1.3.1 Pre-Start Check by Precast Installer

The Precast Installer must ensure that prior to any work commencing a pre-start check has been completed and signed off by a Competent Person. This covers the following areas:

- Crane and lifting requirements.
- Work at height.
- Structural stability.
- Ground conditions.
- Proximity hazards.
- Welfare facilities.

The Precast Installer should ensure that the Competent Person and the Principal Contractor's Site Representative are made fully aware of the need to check and sign off the above on the day of the visit to site. Any problems found should be reported to the Precast Installer and the Contractor.

1.3.2 Daily Briefing by the Contractor

On a daily basis, the Principal Contractor's Site Representative must ensure, as a minimum requirement, the following daily checks and briefings must be conducted:

A summary of activities include the following:

- Daily Significant H&S risks
- Lifting operations/ slewing zones
- Pedestrian and traffic management plan
- Access and egress
- Offloading areas
- Coordination with other subcontractors

1.3.3 Daily Briefing by the Precast Installer

On a daily basis, the Installation Supervisor must brief his team on the following minimum requirements:

- Daily activity to be completed in relation to the Principal Contractor coordination meeting

- Any H&S issues including specific hazards in daily activities
- Any change in Method Statements
- Work activities to be completed.
- Crane operations
- Deliveries

1.3.4 Daily Checks by the Precast Installer

On a daily basis, a Competent Person or persons appointed by the Installation Contractor must carry out the following minimum checks:

- H&S checks to be completed including LOLER, PUWER, COSHH, PPE
- Work area inspection for any significant risks (slip falls, edge protection, access & egress, etc)

This list is not exhaustive and the level of information. Inclusion will vary and depends on the nature of the contract.

1.4 Supplier Coordination

Prior to and throughout the installation contract, the Precast Installer must maintain contact with the Precast Manufacturer and the Precast Designer to ensure that any safety related issues in respect of unit handling and delivery are properly communicated to all relevant parties.

For example:

- Precast Manufacturer to clarify lifting and handling requirements for all units
- Precast Installer to ensure that delivery drivers are aware of access and egress routes, PPE requirements and any restrictions on delivery times
- Precast Installer to ensure that delivery vehicles have provision for edge protection during off-loading or that fall arrest systems are in place where access to trailer beds is required
- Precast Installer and Precast Manufacturer to agree delivery programme and sequence
- Precast Installer to check with Precast Designer in respect of any remedial works, site cutting or drilling

1.5 Specific Health and Safety Considerations

1.5.1 Work at Height

The Work at Height Regulations 2005 apply to all work at height where there is a risk of a fall liable to cause personal injury.

They place duties on employers and any person that controls the work of others (for example facilities managers or building owners who may contract others to work at height).

As part of the Regulations, Duty Holders must ensure:

- All work at height is properly planned and organised.
- Those involved in work at height are competent.
- The risks from work at height are assessed and appropriate work equipment is selected and used.
- The risks from falling through fragile surfaces are properly controlled.
- Equipment for work at height is properly inspected and maintained.

Work at height is covered further in Section 8 of this publication and further guidance can be found on the HSE website (www.hse.gov.uk/work-at-height) including the publication *"Working at Height"* INDG401(rev2)

1.5.2 Lifting Operations

Lifting operations are governed by the Lifting Operations and Lifting Equipment Regulations (LOLER). The Regulations aim to reduce risks to people's health and safety from lifting equipment provided for use at work. In addition to the requirements of LOLER, lifting equipment is also subject to the requirements of the Provision and Use of Work Equipment Regulations (PUWER).

Generally, the Regulations require that lifting equipment provided for use at work is:

- Strong and stable enough for the particular use and marked to indicate safe working loads.
- Positioned and installed to minimise any risks.
- Used safely, i.e. the work is planned, organised and performed by competent people.
- Subject to ongoing thorough examination and, where appropriate, inspection by competent people.

Further information on lifting operations can be found in Section 6 of this publication and further guidance can be found on the HSE website including the publication *"Lifting Equipment at Work"* INDG290(rev1)

1.5.3 Manual Handling

1.5.3.1 Introduction

The Manual Handling Operations Regulations 1992 must not be considered in isolation, but should be used in conjunction with Regulation 3 (1) of the Management of Health and Safety at Work Regulations and other legislation that applies on site. The construction industry has a history of poor health of which excessive manual handling continues to be a problem. By undertaking suitable and sufficient assessment of the risks to the health and safety of their employees while at work a suitable mix of lifting aids and procedures can be used to minimse manual handling and ensure that remaining tasks involving manual handling are safe to carry out.

1.5.3.2 The working environment

The roads and routes around the site should be prepared in advance of the delivery of the precast units. If they are not to be off-loaded into their laying position, suitable stacking areas should be prepared.

Areas where units are moved or handled should be kept clear of obstacles and tripping hazards. Uneven, slippery or unstable ground conditions increase the risk of injury.

1.5.3.3 Training

Installers and Operatives must be given information and training on manual handling risks, their prevention and the systems of work to be used on that site to ensure safe manual handling. Suitable training will also be necessary for designers, specifiers and those managing contracts.

1.5.3.4 Individual capability

Particular consideration must be given to employees who are known to have a history of back trouble, hernia or other health problems that could affect their manual handling capability.

1.5.3.5 Health surveillance

Employers should conduct appropriate health surveillance in order to identify at an early stage any indications that the employee is suffering injury due to the manual handling, thereby enabling further harm to be prevented.

Note: Further guidance and a manual handling assessment chart (MAC) can be found at www.hse.gov.uk/msd (search for toolkits).

1.5.4 Noise at work

The Noise at Work Regulations 2005 place certain duties on employers, employees and manufacturers. The noise created by any operation may be excessive and could cause a health hazard that requires assessment and control. Wherever there is noise at work, you should be looking for alternative processes, equipment and/or working methods which would make the work quieter or mean that people are exposed for shorter times. You should also keep up with what is good practice or the standard for noise control within your industry eg. through your trade association or machinery or equipment suppliers.

Action levels (based on daily or weekly average exposure)

Lower exposure action value	80 dB (A)
Upper exposure action value	85 dB (A)
Exposure limit value	87 dB (A)

Employers must:

- Provide employees with suitable hearing protectors if they ask for them, and their noise exposure is between the lower and upper exposure action values;
- Provide employees with suitable hearing protectors and make sure they use them fully and properly when their noise exposure exceeds the upper exposure action values

To make sure protectors are worn fully (all of the time they are needed) and properly (fitted or inserted correctly) will require you to have systems of supervision and training. Also consider the use of spot checks and audits.

Further guidance on noise at work, including a toolkit for estimating noise exposure can be found at www.hse.gov.uk/noise

1.5.5 Vibration at work

Hand-arm vibration is vibration transmitted from work processes into workers' hands and arms. It can typically be caused by operating hand-held power tools such as portable disc cutters and drills.

Regular or frequent exposure to high levels of vibration can lead to permanent injury. This is most likely to occur when contact with a vibrating tool or process is a regular part of a person's job. Occasional exposure is unlikely to cause injury, although it should be avoided by people with medical conditions such as Raynaud's Disease.

Health and safety law requires the company to assess the risk to the health of employees, plan for its control and manage the risk. This will include provision of suitable equipment, correct maintenance of equipment and providing employees with information and training on health risks and safe use of the equipment.

The documentation supplied by the equipment manufacturer should provide data on typical vibration levels for the equipment when set up and used in a defined manner. Regular use of hand-held power tools may give rise to potential risk.

The risks identified following assessment can be controlled in many ways. Advice and approval should be sought from a competent safety professional and the equipment manufacturers.

It is therefore recommended that the Precast Installer should assess the level of vibration generated by hand-held power tools and minimise exposure to this equipment in line with guidance.

Further guidance on vibration at work can be found on the HSE website (www.hse.gov.uk/vibration).

1.5.6 Provision and Use of Work Equipment Regulations

The Provision and Use of Work Equipment Regulations 1998 (PUWER) lay down important health and safety requirements regarding work equipment. The primary

objective of PUWER is to ensure the provision of safe work equipment and its safe use. The PUWER Regulations make more explicit the general duties on employers, the self-employed and persons in control to provide safe plant and equipment. The PUWER Regulations must not be considered in isolation; in particular, they need to be read in conjunction with the Management of Health and Safety at Work Regulations.

Although the prime duty for ensuring health and safety rests with employers, employees also have legal duties, particularly under Sections 7 and 8 of the Health and Safety at Work etc Act. These duties have been supplemented by Regulation 14 of the Management of Health and Safety at Work Regulations, which require that employees must correctly use all work items provided by their employer in accordance with the training and instructions they received to enable them to use the items safely.

Further guidance on PUWER can be found on the HSE website:
www.hse.gov.uk/work-equipment-machinery
www.hse.gov.uk/pubns/books/l22.htm

1.5.7 Welfare facilities

On the majority of sites, the provision of welfare facilities will be on a shared welfare basis, where the Contractor provides the necessary facilities that can be used by Operatives and Installers engaged in the installation of precast concrete units.

When no formal welfare arrangements exist, the Precast Installer should ensure that the necessary facilities are provided by way of an Attendance, agreed pre- sub-contract, or alternatively, the Precast Installer may provide facilities for use by Operatives and Installers.

The ultimate responsibility for ensuring that the facilities are provided, and that they are of a standard equal to that required by the CDM Regulations, remains with the employer, and therefore, the Installation Supervisor must satisfy himself that the facilities provided, from whatever source, are adequate.

1.5.8 Control of Substances Hazardous to Health (COSHH)

1.5.8.1 Introduction

In order to comply with the Control of Substances Hazardous to Health Regulations 2002, the Precast Installer must ensure the collection and issue of up-to-date information on the potential hazards and toxicity of all materials and substances used by the company in carrying out its site activities, and the control measures to be adopted.

Materials and substances including anything workers could encounter, use or generate e.g. contaminated ground, ready-mixed concrete, silica dust from cutting, drilling and grinding operations, etc.

1.5.8.2 General procedure

Assessment sheets for all products used on site are to be issued to the Installation Supervisor.

All Operatives involved in the use of these materials, e.g. cement, ready-mixed concrete, etc. should be instructed on the hazards from the particular material about to be used and be instructed in all necessary precautions including any PPE required to be provided and used. This equipment will be put into use before any substance is used on site.

All substances received on site should be stored in accordance with the instructions contained in the Assessment Sheets, and in the event of any spillage, appropriate action must be taken to retrieve the material, in accordance with instructions contained in the Assessment Sheet. The Installation Supervisor should monitor these procedures.

Empty containers and waste material must be disposed of in accordance with the approved procedures, as noted on the Assessment Sheet for the product or products concerned.

The materials used in the installation of precast concrete units are generally of low toxicity but all Operatives must be made aware of the hazards at all times by the Company. Checks that control measures are being adhered to should be made at periodic intervals by the Installation Supervisor.

Copies of COSHH Assessment sheets may form part of the Precast Installer's Work Method Statement.

The Installation Supervisor should request the Contractor to supply details of any other substances on site that could affect the Precast Installer's employees or their sub-contractors.

1.5.8.3 Silica Dust

Silica dust can be generated during all drilling, cutting and grinding activities on precast concrete units. Breathing in the very fine dust produced during drilling and grinding is known to cause silicosis which permanently impairs breathing function and can lead to lung cancer. The hierarchy of control in the COSHH Regulations must be followed to prevent silica dust affecting all persons in the vicinity.

More information on dust in the workplace can be found at www.hse.gov.uk/dust and specifically, information on controls and protection against the inhalation of silica dust are available in HSE publications CIS36 (Silica dust) and CIS54 (Dust control on cut-off saws used for stone or concrete cutting).

1.5.9 Occupational Health

1.5.9.1 Introduction

The management of health is an important aspect of site practice. The health of those installing precast concrete can be affected if the work is not properly controlled. To assist in monitoring the effectiveness of the controls described in this Code of Practice, the following recommendations are made regarding pre-employment health screening and health surveillance. Please be aware that some contractors are implementing a system of identifying those on-site workers who in receipt of a Fit to Work Certificate for safety critical workers.

1.5.9.2 Pre-employment health screening

Pre-employment health screening is an essential requirement in establishing the fitness of a potential new employee for the tasks that he will perform. It is also necessary to record the health status of the new employee so that any changes can be measured during the course of their employment.

A person applying for a site-based position should be provided with a brief questionnaire to assist the Precast Installer in assessing any potential health problems that could affect their suitability to do the job that they are applying for. The questionnaire should include questions on the following, but is not limited to those listed below:

- Noise and noisy environments.
- Dust and dusty environments.
- Skin complaints such as dermatitis.
- Vibration and work with vibrating tools.

In addition, where a potential employee is to work in an area where they may come into contact with, or be exposed to substances or situations that could affect their health, they should be provided with a pre-employment medical examination.

In any case, it is recommended that all new employees are assessed for the following:

- Audiometry (assessment of hearing where an employee is likely to work with noisy equipment).
- Lung function.
- Hand-arm vibration assessment (where the person has reported suffering from the problem and will use vibrating tools during the course of employment).
- Vision testing

1.5.9.3 Health surveillance

It is recommended that employees undergo general health surveillance, undertaken by a suitably trained, Competent Person, at a frequency to be determined by the employer's risk assessment policy. This will allow the company to identify where a person's health has been affected. The health surveillance should cover the following:

Audiometry

Where noise levels exceed 80 dB(A), those persons exposed should be screened for hearing loss.

Vibration

Where persons are exposed to vibration to their hands and arms, e.g. in the use of drills, cutting equipment etc. then they should be screened for disease related to hand-arm vibration syndrome (HAVS). The initial screening can be carried out using a self-assessment questionnaire, followed up by specialist consultation where the questionnaire results indicate that this is necessary.

Skin conditions

It is recommended that any person who is likely to be exposed to chemicals or substances that are known to be capable of causing occupational dermatitis are subject to regular skin inspections as part of the health screening arrangements and, in addition, are trained to recognise the symptoms related to occupational dermatitis.

Lung function

Where a person is likely to be exposed to dust it is recommended that lung function tests are carried out in accordance with the advice given by an occupational health professional.

Vision

Where a person is operating or controlling mobile plant it is recommended that vision screening is carried out.

The records of the surveillance must be kept strictly confidential in accordance with all current legislation on Data Protection. Access to these records is limited, and the person to whom the records relate must be asked for their permission in writing before any medical report can be requested from Doctors and other medical personnel. The results of the surveillance should be passed to one nominated individual within the company so that they can arrange any changes to work pattern or arrange referral to an occupational health physician or other specialist as required.

More details on health surveillance can be found at www.hse.gov.uk/health-surveillance.

1.5.10 Occupational Health

1.5.10.1 Introduction

The Personal Protective Equipment at Work Regulations place requirements on the use of personal protective equipment (PPE) in the work place.

The Health and Safety Executive (HSE) has prepared specific guidance on the Regulations after widespread consultation with industry. Readers should refer to the guidance on the Regulations produced by the HSE.

The HSE document contains advice on the selection of PPE, considers the different types of PPE available, and identifies some of the processes and activities which may require PPE to be worn.

1.5.10.2 Working clothes and personal protective equipment

The Personal Protective Equipment at Work Regulations (PPE Regs.) require the Employer to provide suitable PPE necessary for the protection of Operatives and Installers engaged in the installation of precast concrete units. The requirements for PPE must be identified on the General Risk Assessment.

All Operatives and Installers, irrespective of the nature of particular site conditions,

must be provided with, and must wear, PPE to meet general needs, in particular safety footwear, high-visibility clothing, abrasion-resistant gloves, weatherproof clothing and suitable head protection. All PPE must be properly stored and maintained in accordance with manufacturers' recommendations.

The distribution and quality of such equipment are matters of individual company policy. However, all protective equipment or clothing must carry the CE Mark, identifying the product as having passed certain European Standards, or be of a standard at least equal to that set by the appropriate British Standard.

Wherever possible, the Precast Installer should consider the views and comments received from their Operatives and Installers when deciding upon particular types of equipment. The physical stature of Operatives and Installers should be matched as closely as is practicable by any equipment. PPE must also be compatible with other PPE worn, e.g. hearing protection worn with head protection.

The company must ensure that all protective clothing and equipment is fit for use and should apply all necessary measures to ensure that their employees are using such items in proper manner. Operatives and Installers issued with such equipment have a duty under the Health and Safety at Work Act to use and look after it. The company must ensure that Operatives and Installers receive adequate instruction and training regarding the proper use, storage, maintenance and replacement of protective equipment and clothing. Employers must not charge employees for the cost of necessary PPE.

On certain sites, the conditions, site rules or method of working will necessitate the use of special protective clothing and equipment. Certain items such as eye protection, respiratory protection, ear protection and safety harnesses should be carried by the installation team at all times and used as the need arises or should be made available to the installation team prior to the commencement of work. The use of specific protective equipment, e.g. safety harnesses, must be identified in Risk Assessment and Method Statement.

The user should conduct daily inspections prior to use of all equipment and clothing and any items found to be missing or defective should be notified to the company for immediate replacement or repair.

1.5.11 Site Safety Audits

It is recommended that a system of regular site safety audits be implemented on any sites where the installation of a significant duration.

These audits should be carried out by a competent, independent, visiting person.

1.6 Training and Certification

1.6.1 Introduction

British Precast Architectural and Structural is committed to ensuring that all Installers involved in installation activities carried out by or on behalf of its member companies are competent. This includes ensuring a good understanding of the objectives of this Code of Practice for the safe installation of Architectural and Structural Precast Concrete. The Precast Installer should determine the level of training an individual has achieved and should provide training, instruction and refresher training as required.

1.6.2 Scope

The training and certification that applies to all personnel involved in the safe installation of architectural and structural precast concrete.

1.6.3 Responsibility

Employers have a responsibility under many regulations to provide appropriate training for their employees and ensure that their sub-contractors have received the appropriate training.

Section 2 of the Health and Safety at Work Act imposes a general duty on every employer to provide as much information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of their employees and sub-contractors.

It is the responsibility of the Company employing the individual(s) to ensure that they have, or are in the process of obtaining the appropriate skills, knowledge, experience and training in the installation of precast concrete products, for them to carry out the tasks allocated to them and for ensuring that full records of any training provided are kept securely. The company should (a) assess the existing health and safety skills, knowledge, training and experience of their personnel, (b) compare these existing attributes with the skills, knowledge, training and experience they will need for the job. Identify any shortfall between (a) and (b); the difference between the two will be the training required.

1.6.4 Responsibility

All personnel must be trained in accordance with a recognized precast concrete training scheme such as L2 NVQ qualifications in erection of architectural and structural precast (Code Ref 600/3654/0 and 600/3745/3).The training of personnel at all levels is to be carried out by Competent Persons or approved training organisations (e.g. CPCS/CITB/Proskills).

Courses may include those in the following list, which is not exclusive:

- Site safety awareness.
- Manual handling.
- Powered cut-off saw and abrasive wheel operation.
- Work at height/work at height equipment.
- This British Precast Architectural and Structural Code of Practice for the safe installation of Architectural and Structural Precast Concrete.
- Slinger, Signaller.
- Banksman
- Crane Supervisor (BS 7121).
- Appointed Person (BS 7121).
- MEWP (mobile elevated work platform) scissor and boom operation.
- Forklift/tele-handler operation.
- Passive fall installation.
- CDM Regulations 2015.
- Tower scaffold.
- Temporary Works Supervisor
- Site Supervisor Safety Training Scheme

In addition it is recommended that each team of Installers has either a suitably qualified person to administer emergency aid or a fully qualified First Aider. The employer's duty to provide first aid is set out in Regulation 3(1) of the Health and Safety (First-Aid) Regulations: "An employer shall provide, or ensure that there are provided, such equipment and facilities as are adequate and appropriate in the circumstances for enabling first aid to be rendered to his employees if they are injured or become ill at work".

Note: The need for refresher and update training must be regularly monitored; no employee can remember everything, especially if it is not an everyday part of the individual's work. The need for re-training is an essential requirement to satisfactorily meet the requirements of the current Regulations. Re-training requirements can be monitored by expiry dates on certificates of achievement or by periodic assessment of individuals followed by refresher training.

Training is the responsibility of the company employing the Installer and other Operatives.

1.6.5 Certification/competency

Trained and competent Operatives should hold the following competency cards in accordance with the construction Skills Competency Scheme (CSCS) and the Construction Plant Competency Scheme (CPCS):

- CSCS Precast Concrete Installer (industry accreditation A) card.
- CPCS Slinger Signaller card.

Operatives who have not achieved these cards should receive appropriate training and carry out the following NVQs, which will enable them to achieve the appropriate competency card:

- NVQ in Precast Concrete Installation.
- NVQ in Slinger Signalling.

2 SAFE WORKING METHOD STATEMENTS AND DAILY PRE-START CHECKS BY A COMPETENT PERSON

2.1 Introduction

Safe Working Method Statements form part of the overall Safety Management System, covering hazardous activities such as the installation of precast flooring and associated components. They provide the information on the arrangements and, where required, the actual sequence of work necessary to manage health and safety. Basic information must be provided and communicated to all concerned parties at the planning stage, thus allowing time for approval or modification of the Safe Working Method Statements prior to site installation.

Precast flooring installation is similar in nature on many sites and therefore a Safe Working Method Statement will contain common elements and activities. However, the Safe Working Method Statements must take account of specific site conditions/ requirements, information from the Health and Safety Plan/Design Risk Assessment, and/or contractor's requirements.

2.2 Content of Safe Working Method Statements

Safe Working Method Statements must be concise but informative and should contain the following information as a minimum.

Part 1 Management and control	
Principal Contractor	The name of the Contractor in charge of the site.
Precast company client	The name of the sub-contractor/client of precast company.
Site address	The address at which the proposed work is to be carried out.
Site manager/agent/ contact	The point of contact at the site.
Part 2 Description and information (contract, site and plant)	
Description of contract	Brief description of the work to be carried out - may include the number of visits that will be necessary to complete the contract.
Method of installation and sequence of work	How the units will be lifted and positioned and other relevant requirements. e.g. will propping be required and where will work commence?
Crane type/position	The crane type (rating and style, tonnage, mobile, tower, outrigger loadings etc). General location of the crane, etc.
Maximum component weights and crane working radius	The maximum weight/radius' for each component type must be stated and any recommendations from the crane suppliers must be considered.
Deliveries and site access	The form of transport by which the components are to be delivered, offloaded and the access and egress requirements, e.g. hardstanding.
Part 3 Stability and bearings	
Stability and bearings	The adequacy of bearings and the Principle Contractor's responsibility for checking them prior to work commencing. The Principle Contractor's responsibility for ensuring stability and the sequence of laying.

2 DESIGN OF BUILDINGS INCORPORATING PRECAST CONCRETE AND THE ROLE OF THE PRECAST DESIGNER

Maximising the use of precast concrete elements within a building can radically change the construction methodology to improve programme quality and safety. However, designers will need to consider all hazards/risks associated with manufacture, transportation and installation of the individual precast concrete units. Site operations usually involve Operatives and Installers working at heights and the use of cranes or other lifting equipment. To assist Engineers, Designers and Contractors in meeting the requirements of the CDM Regulations 2015, the following detailed information is provided to assist in coordinating designs to achieve safe installation. Under CDM there is a strong duty on all designers involved to share information and cooperate with the other designers and those needing additional information. This should be via the Principal Designer who has a legal duty to organise the design work so that the construction drawings and instructions are an integrated package.

In this Code of Practice, the Precast Designer is not the Building Designer. This may not always be the case but the Principal Designer or Building Designer will have additional legal responsibilities which are not within the scope of this Code. The Precast Designer is often also the Precast Manufacturer who may employ a sub-contract engineer for this purpose.

2.1 Site specific constraints

There are a number of site specific constraints that need to be taken into account by the Building Designer.

The following aspects should be investigated as part of the planning procedure:

- The sizes and weights of the components will determine the method and overall strategy of off-loading and placing the units.
- The precast units are usually delivered to site on articulated lorries> Narrow roads or restricted access may necessitate the use of rigid vehicles.
- Pedestrian and traffic management measures need to be considered, especially if the delivery lorries are off-loaded from the public highway. In this case the Principal Contractor must ensure that any actions taken comply with the Highways Act and the New Roads and Streetworks Act. Partial or full road closure (including public footways/pavements) requires liaison with the Local Authority under their licensing scheme which can take several weeks to arrange. The Principal Contractor should plan this in advance.
- The Contractor should consider the Traffic Management Plan, other trades and deliveries, and plan adequate arrangements for offloading positions. Unless it has been possible to pre-sling components during loading to allow ground level hook up. or to design a slinging method that requires no access onto the flatbed or trailer; then fall protection equipment will be required around vehicles.
- Access to the work area must be provided and suitably maintained for cranes and lorries. An adequate design for hardstanding and crane working platforms must be provided. The crane platform will need a temporary works design to either ensure that ground conditions combined with any load spreading mats or grillage is adequate; or will need a design to allow the ground to be improved to safely support the loads imposed by the crane's outriggers. This also applies to lorry loader crane's used to offload and stack components into holding areas.
- Safe access to the work area for site operatives, plant and equipment must be provided and suitably maintained in order to minimise the interaction with site traffic, vehicle movements and to reduce the risk of slips, trips or falls occurring due to ground conditions.
- Excavations, underground services, drains, water attenuation tanks and basements

are a hazard and strengthening may be required if their proven location cannot be avoided. A temporary works design may also be needed to establish the safe distance from the edge of an underground feature including weak ground, uncompacted backfill or made ground, edges, slopes and open excavations.

- The presence of power lines, railway tracks, trees or overhead structural obstructions may hinder the operation of cranes.
- On restricted sites it may be necessary for loads to be lifted over adjacent land and buildings. In these circumstances, permission must be gained to operate within the airspace of third parties in conjunction with a full risk assessment. All site restrictions and partial or full evacuations must be planned and agreed in advance.

2.2 Pre-Tender Design and Planning

The CDMRegulations: 2015 require a designer's competence to be considered to ensure they secure the health and safety of those affected by their design. Members of British Precast Architectural and Structural must conform to the requirements of this code.

To assist the Precast Designer and Precast Manufacturer for the purposes of producing a tender proposal for the Components, the following information should be provided by the Contractor:

- The design deliverables programme
- Pre-tender stage Health and Safety Plan.
- Design specifications, including permanent and variable actions (Dead and live loads). Design life, fire resistance and concrete exposure are also key parameters which must be identified in the specification.
- Applicable design standards being utilised by the design team
- Manufacturing and erection tolerances, e.g. BS8297, BS EN product standards, National Structural Concrete Specification
- Movement and tolerance report.
- Suitably developed Architects and Engineers drawings including M&E requirements and, where appropriate, aesthetic intent.
- Residual Risk register
- Phasing or sequencing of the works.
- Site and services plan.
- If the project is BIM Level 2 as per PAS 1192 – Part 2 the contractor should provide their Employers Information requirements, BIM Execution Plan, both documents form the basis of how the information and models are managed, shared and collaborated between the different design teams.
- Any other limitations on for example component size or weight.

This information should enable the Precast Designer to produce an outline design for the precast units to enable the Precast Manufacturer and Precast Installer to prepare a quotation for the Contractor. The outline design for tender purposes would normally include:-

- Section sizes and reinforcement contents
- Piece weights of units for installation purposes
- Joint details
- Details of any supporting bracketry etc. including material for fixings and supports, e.g. stainless steel, hot dip galvanized, bright zinc plated, primed
- Any special lifting requirements

If required for the tender, the Precast Designer should also be able to provide general arrangement drawings and sufficient information for the Contractor to assist him in preparing his tender to the Principal Contractor and to facilitate any design of the supporting structure. This may include:-

- Loads and moments expected to be imposed by the precast units
- Minimum bearing area and load
- Any special requirements for the supporting structure (eg column pockets or holding down bolts, shelf angles, minimum bearing shelves etc.)

2.3 Post-Order Design and Detailing

2.3.1 Information Required by the Precast Designer

When an order is placed for the precast concrete units, the Contractor should provide the Precast Designer with the following information:

- Any relevant amendments to the Construction Phase Plan.
- Fully dimensioned 'Construction Issue' Architect's and Engineer's drawings and specifications, detailing the supporting structure, if applicable, and any other aspects that may affect the precast unit design and installation.
- Loadings, including type and location of partitions, types of finish, etc.
- The Engineer's "Movement and Tolerance Report"
- Position and sizes of all holes, notches or rebates required in the precast units.
- Site and services plan (if not provided at tender stage).
- Provisional sequencing and programme dates.
- Where working in the vicinity of rail tracks, underground railway lines, or energy supply structures such as power cables, all permissions that are required from the owners or controllers of the relevant infrastructure are to be given in advance along with any special instructions for the safe installation of the works.
- Information on the location of any nearby schools, or other establishments which could place restrictions on delivery times, working times, or could pose issues with access for certain types of delivery vehicles.
- Any pertinent ground conditions e.g. access roads, crane hard standings.

In addition to information provided by the Contractor, the Precast Designer will also need to take account of the following information provided by the Precast Manufacturer:

- Expected orientation and method of casting
- Preferred concrete mix and strength
- Minimum concrete strength at de-moulding
- Preferred supplier and type of lifting anchors
- Expected orientation of unit during factory handling and storage
- Expected orientation of unit during transportation to site and method of transportation (ie flat or on 'A' frames)
- Any storage or stacking requirements if units are not unloaded and installed immediately.

2.3.2 Design Considerations

Precast Designers may have responsibility for design of any aspect of a structure from complete structural frames or just specific elements to be fitted to new or existing frames. In any event, the sub-contract for supply and/or installation of the precast elements should make it clear which party (Building Designer or Precast Designer) is responsible for which elements of design of the structure. The following list should be considered by all parties and agreement reached over who is responsible. There should be close liaison between the Precast Designer and the Building Designer, either directly or through the Contractor, to ensure that all issues have been covered.

- Designers must take into account the stability of the structure during the installation of precast components and must be aware of or determine the sequence of installation to ensure that stability is maintained at every stage. Where progressive

collapse may be an issue, Building Designers and Precast Designers must take account of this and design accordingly.

- When designing structural elements the designer will need to carefully consider details and connections to ensure progressive structural collapse will not occur. Designers should be familiar with the requirements of BS EN 1992-1-1 in this regard. When designing precast façade systems where precast elements are loaded through one another to a lower level (ie stacked), these should be risk assessed to determine whether design for failure of a lower element needs to be considered. Appropriate consideration should be given to the risk(s) of collapse of the façade in extreme circumstances. Undertaking a specific design risk assessment to determine the best mitigation strategy is recommended. In general, it is good practice that the engineer responsible for the overall stability of the structure should ensure the compatibility of the design and details of parts and components, even where some or all of the design and details of those parts and components are not made by this engineer. This is particularly important when it comes to the robustness of the structural frame. In any event, the party responsible for assessing overall stability should be clearly stated in the contract or sub-contract.
- The Building Designer (in cases where precast units are being fitted to an existing structure) or Precast Designer (where they are responsible for design of the complete structure) must ensure all load paths arising from the temporary precast installation process have been examined and suitable factors of safety incorporated into the design.
- The Building Designer and the Precast Designer must give consideration to the proposed sequence of construction and the effects of any temporary removal of parts of the structure to facilitate the safe installation of the precast units.
- Designers must also consider any temporary loading to be applied to the structure during construction such as construction plant and materials.
- Consideration should be given at the planning stage to allow for the removal, prior to the installation of the components, of overhead obstructions, such as purlins, bracings or main beams (where spans change at the level above) that are likely to foul or hinder the crane boom or suspended load.
- Precast components are heavy. Bearings must be adequate and be robust enough to withstand normal unit fixing operations including landing and barring.
- Lintels or steel beams must be securely fixed and have adequate safe bearing at each end to avoid overturning, excessive deflection, or collapse when precast units are placed onto them.
- Consideration must be given to the unequal loading of unrestrained walls, lintels or steel beams when precast units are being placed.
- Where the use of temporary supports are necessary, they must be designed and installed by a Competent Person. The location of temporary supports should be agreed with the Precast Designer.
- Designers must consider the unit exposure in order to determine the concrete mix requirements and cover to reinforcement. This will also determine the finish requirements (stainless, galvanized, BZP etc) and, if appropriate, depth of embedment, for any steel inserts or bracketry.

Precast units should be designed to take account of every load case from de-moulding (when the concrete strength will be at its lowest), through handling and stacking in the storage yard, transportation to site, off-loading and possibly pitching and tilting, site storage and placing of the unit in its final position.

- The type, size and position of lifting inserts should be established for each unit to take account of all expected lifting scenarios during the lifetime of the unit. Inserts should be designed to PD CEN/TR 15728:2016 Design and Use of Inserts for Lifting and Handling of Precast Concrete Elements and must take account of mould adhesion in de-moulding, chain angles and directions of lift and dynamic actions such as crane loading factors during handling and placing as well as just the self-weight of the unit.

Designers should consult supplier's literature for load capacity of inserts, safe edge distances and reinforcement details for all anticipated lifting scenarios.

Consideration must be given to ensuring a safe means of removing lifting tackle after units have been placed.

- Similarly designs for any fixing inserts will need to take account of all temporary and permanent loading and supplier's literature should be consulted to determine load capacities, minimum edge distances and any reinforcing requirements.
- Particular attention must be given to the safe handling and positioning of units including where units may need to be tilted or twisted into position (onto ledger angles or similar). The Building Designer and Precast Designer must assess the suitability and adequacy of supports. Careful consideration must be given to ensure that there is sufficient clearance to place the unit and, where appropriate, to achieve the minimum bearing when the unit is in its final position.
- Thorough consideration of temporary load cases and internal stresses is important where longer precast components have little or no reinforcement in their compression face. This usually means the slinging position must be at or close to the permanent bearing surface. This can necessitate longer lifting chains or a longer lifting beam and in turn may require a larger crane. This must be made clear in the information issued by the precast designer.

Where appropriate, the Precast Designer should ensure that his design is checked by another competent person and is fit for purpose.

2.3.3 Design Deliverables

The submission to the Precast Manufacturer, Precast Installer and Contractor by a Precast Designer for a precast structure or package of precast elements would normally include the following:

- Designer's Risk Assessment detailing residual risks in the precast units and in their handling, storage and installation.
- General arrangement drawings showing setting out of the precast units relative to grid lines and their interfaces with existing structures.
- Structural design calculations for the precast units taking into account all lifting and handling scenarios expected during the life of the element and the stresses imposed during installation. Any temporary conditions once installed must also be considered along with the permanent loading condition.
- Relevant BIM Execution Plan and Employment Information Requirements to outline BIM workflows for the construction cycle of the project. For example, key concerns would be; the level of detail the model is detailed to, Model Information Delivery Plan, clash detection process, shared coordinates, software capabilities and common data environment
- Loads and moments from precast units to be applied to ground or supporting structures
- Fully detailed drawings of the precast units. These drawings should include:-
  - All dimensions required for mould set-up and manufacture and manufacturing tolerances
  - Finishes indicating formed and floated surfaces and casting orientation
  - Reinforcement details with bar marks and spacings and details and positions of any projecting rebar for structural ties.
  - In the case of pre-stressed units, strand patterns and transfer strength
  - Concrete mix type and characteristic strength
  - Minimum de-moulding strength

  - Lifting insert type, size and position
  - Size and position of any holes or penetrations
  - Unit volume and weight (taking into account weight of rebar)
  - Details of any other cast-in items including column base plates and connectors, steel bracketry, well-voids, fixings, propping sockets, dowels etc. (specialist fixings may require separate drawings for fabrication purposes)
  - Positions of bearers for stacking and transportation
- Bending schedules for reinforcing bars
- Joint details between precast units and/or precast units to existing structure
- Details of any in-situ stitches where required
- Concrete mix design
- Method statements or guidance notes for lifting, handling, storage, transportation, off-loading and, where appropriate, pitching and turning. Where possible reference should be made to any special requirements on the drawings but, in an event, designers must provide sufficient detail to allow the Precast Manufacturer and Precast Installer to prepare their own Safe Working Method Statement. This should include:
  - Orientation of the unit in storage and transportation.
  - Maximum chain angles for lifting and/or any requirement for lifting beams or any other specialist lifting equipment
  - Any requirement for temporary bracing or propping and prop loads
  - The sequence of installation of precast units to ensure stability of the structure in both the temporary and permanent conditions
  - Details of any grouting (type and strength) or bedding and the minimum strength to be achieved before the next phase of work can progress or units can be loaded
  - Minimum bearing lengths and shim sizes if required
  - Details of site storage including stability of stacks and maximum stacking height
  - Health and safety information relating to any cutting, drilling or grinding to be carried out on the precast units.

The design of supporting structures including steel or in-situ concrete frames (onto which precast elements are to be fitted), column pads and pockets, support bracketry not supplied by the Precast Manufacturer etc would normally be the responsibility of the Building Designer. Designs may need to be produced or checked on submission of the precast design from the Precast Designer.

2.4 Construction phase

The installation of precast concrete units should be undertaken only by competent† Precast Installers with knowledge of the product and methods of installation. Members of the British Precast Architectural and Structural only employ Precast Installers who have the necessary skills, knowledge, training and experience (or who are in the process of obtaining them).

Where a Precast Installer is in any doubt as to the safe method of lifting, handling, tilting, turning or installing any unit, reference must always be made back to the Precast Designer. If units are to be handled in any way which is different to that envisaged at design stage and indicated on the drawings or designer's method statement, then the Precast Designer must be consulted. It cannot be assumed that lifting inserts are suitable for handling units by any other means than that for which they were expressly designed. The Precast Designer will be able assess suitability by calculation and by reference to the lifting insert supplier.

The sequence of installation of precast units may be critical in ensuring the stability of the structure in the temporary condition. This will have been considered by the Building Designer and Precast Designer at the design stage and should be clearly communicated to the Precast Installer preferably on the drawings or in a designer's method statement. If the Precast Installer is required to deviate from the laid-down sequence for any reason, then reference should be made back to the Building Designer and/or Precast Designer for guidance on how to proceed.

If the Precast Installer or Contractor is required to cut, drill into, core or provide any fixings or penetrations into the precast units which have not been provided for at design stage (and are not therefore shown on the drawings), then reference must be made to the Precast Designer in order that he can assess the suitability and advise of any design implications. In particular prestresed and poststressed tendons must not be cut or interfered with - including ad-hoc attempts to expose them for inserting additional reinforcement for continuity purposes.

Similarly, if any guardrails/handrails or other temporary works are to be fitted to the precast units or the units are to receive any temporary loading (from construction plant or materials etc.) and these have not been identified on the drawings, then the Precast Designer should be consulted to ensure that the unit has sufficient load bearing capacity.

If at any time a unit is found to have incurred significant damage or if significant cracks appear in the unit or if lifting inserts show signs of damage or distress then lifting of the unit must stop immediately and any installation which is affected by the unit should also cease. The Precast Designer must then be consulted and may wish to carry out an assessment of the likely structural implications before work re-commences.

Any cracks found at point of delivery are to be referred to the Precast Designer - including on pretensioned beams/planks in particular longitudinal perpendicular cracks on edge no matter what length or whether they reach an edge. In addition, on pretensioned units cut to reveal the ends of bars or tendons, the designer should be consulted if bond loss and contraction of the reinforcement is evidenced by a hole where the reinforcement should be visible.

† CDM 2015 places duties on Principal Contractors and Contractors to ensure the individuals they employ or appoint to carry out the work have the skills, knowledge, training and experience to carry out the work they will be employed to do in a way that secures the health and safety for anyone working on the site. This duty will also extend to the Precast Company engaged in the supply and/or installation of flooring or precast components.

3 ROLE OF THE CLIENT, PRINCIPAL CONTRACTOR AND CONTRACTOR

Definitions:

Client: The individual or organization employing designers and contractors to carry out a construction project

Principal Contractor: The contractor with control over the construction phase of a project involving more than one contractor.

Principal Designer: The designer of the building or structure incorporating the precast components. Usually, the organisation or individual (on smaller projects) appointed by the client to take control of the pre-construction phase of a project

Contractor: The 'Contractor' shall mean the Precast Manufacturer's or Precast Installer's client, who is responsible for coordinating all Principal Contractor requirements and attendances for the contract. Where the Contractor has overall responsibility for the Construction Phase of the project the 'Contractor' shall also mean the 'Principal Contractor'.

3.1 Introduction

This Code of Practice applies to projects involving only one contractor (who carries out the full build including installation of purchased pre-cast product) and to those with more than one contractor where, under CDM, one of them must be appointed as Principal Contractor. The Principal Contractor is responsible for controlling all work on the site, including control of contractors separately appointed by the client but present during the Principal Contractor's construction phase.

3.2 The Client's Role

The Client on any project has a major role in the management of health and safety. He is responsible for the appointment of competent designers and contractors. On major projects involving more than one contractor the Client must employ a Principal Designer and Principal Contractor and this should be done as early in the project as possible and before the construction phase begins. He may also employ other contractors and designers either directly or indirectly through the Principal Contractor or Principal Designer. In any event, the Client is responsible for ensuring that all contractors and designers have the necessary skills, knowledge, experience and organisational capability to carry out the scope and size of works they have been employed to undertake.

The Client has full contractual control and must ensure that there is sufficient money, time and other resources allowed to carry out the project at every stage. He must appoint contractors and designers in the form of written contracts which must clearly define their roles and responsibilities and, for the duration of the project, must maintain and review the management arrangements and ensure that the Principal Designer and Principal Contractor carry out their duties in managing the contract. He must also ensure that the Principal Contractor prepares a construction phase plan before each phase begins.

The Client should provide pre-construction information to every designer and contractor employed or bidding to be employed on the project. He must make sure that suitable welfare facilities are provided for the duration of the construction work.

The Principal Designer must prepare a health and safety file for the project and revise it as necessary during the project. Where the Principal Designer will depart prior to

completion of the works, the Principal Contractor must be contracted to take over and complete the health and safety file and provide it to the client. The Client must ensure that this is done correctly and is made available to anyone who needs it for subsequent work on the site.

Projects lasting longer than 30 working days and involving more than 20 workers at one time or where work exceeds more than 500 individual worker days are deemed to be *notifiable* projects. In this case, the Client must notify the HSE in writing with details of the project.

3.3 Management of Construction Works

The Principal Contractor must allow time to plan the work of the construction phase and record any details in a construction phase plan. He must liaise closely with the Client and with the Principal Designer and others involved in the project to identify any hazards to health and safety and the control measures which are required to be put in place.

The Contractor should appoint a Precast Manufacturer and Precast Installer who are competent (ie. have the necessary skills, knowledge, experience and organizational capabilities) to carry out the works for which they are engaged. Prior to any appointment and ideally prior to any tender, the Contractor should ensure that the Precast Manufacturer and Precast Designer are provided with all relevant pre-construction information necessary for them to plan, price and undertake the works. The appointment should be in writing and clearly identify the scope of work and the programme for its execution.

Prior to installation of the precast works, the Contractor should arrange a formal pre-installation handover meeting with the Precast Installer and Precast Manufacturer together with any other parties who are likely to have to coordinate with their works.

The Principal Contractor and Contractor must familiarise themselves with the safety aspects of precast concrete installation works by reading this Code of Practice and any drawings, risk assessments and method statements (RAMS) and other documentation provided by the Precast Designer, Precast Manufacturer and Precast Installer. They should also address all agreed issues raised by the Precast Installer at, or subsequent to, the installation pre-start meeting.

The Principal Contractor is responsible for ensuring that guidance within this Code of Practice is incorporated into the works by other trades affected by the precast element and, where necessary, the guidance of the Precast Designer, Precast Manufacturer and other specialist suppliers/sub-contractors is incorporated into the works.

3.4 Attendances

As part of the formal appointment of the Precast Installer, the provision of attendances on the project should be addressed. This should establish which party is responsible for providing the various attendances required on the project. These may include but are not limited to the following:

- Vehicle off-loading and fall protection from vehicles
- Traffic and Pedestrian Management
- Distribution of precast units around the site
- Vehicle haul roads, hardstanding, lay-down areas and car parking areas
- Craneage, other lifting equipment and crane hardstanding
- Wheel washes
- Welfare facilities
- Safe access to the work area

- Guard rails, access scaffolding and other fall prevention systems
- Temporary access platforms, MEWP's etc
- Power and water
- Protection of the works
- General lighting and task lighting
- Dealing with proximity hazards

Where a party is responsible for provision of a facility, this should generally include its up-keep and maintenance for the duration of the requirement.

3.5 Programme

The Contractor shall provide the Precast Manufacturer and Precast Installer with a construction programme and allow within that programme sufficient time for the design, manufacture and installation of the precast elements including procurement time for any long-lead bought-in items. This may require consultation and agreement with the Precast Manufacturer and Precast Installer to understand what the lead times are and where the critical path lies for the supply of information and approval of drawings and calculations.

It is the Contractor's responsibility to ensure that all information required for design and manufacture is provided on time and to ensure that approvals are obtained in a timely manner. Any delays in the provision of information and in getting approvals will inevitably put increased pressure on design, manufacture and installation programmes which can lead to safety being compromised and to delays to the construction project.

3.6 Formal Pre-installation Handover

A formal handover should be given from the Contractor to the authorized representative of the Precast Installer. This will include an as-built survey of any preceding structure, if applicable, agreement of the risk assessments and method statements (RAMS) and details of any remedial works required. Generally, the work area should be structurally sound, completely finished by the preceding trades, and safe for the precast concrete works to commence.

Prior to the precast installation, the Contractor should ensure the suitability of column bases and all bearings in accordance with the construction drawings and this Code of Practice.

3.7 Site and Work Area Access

The Contractor will usually be responsible for access from the public highway onto and within site. They should also consider any requirements for temporary or long-term removal of any fences, walls or other obstructions. Unless agreed otherwise, the Contractor will be responsible for maintaining the condition of agreed access roads to an acceptable standard. The locations of, and access to, stacking areas, stores, temporary buildings and lorry/trailer holding areas should also be agreed.

All agreements on access provisions and other arrangements must be recorded in writing and incorporated into the Safe Working Method Statement in order that all parties have the information readily available and to avoid misunderstandings or confusion when installation commences.

The Contractor must agree with the Precast Installer on means of access into the building(s) as construction progresses. The installation sub-contract should detail who

is responsible for provision of protection on and around the work area during the installation works. Particular attention should be paid to barriers, guardrails/handrails, toe-boards, access, lighting and similar precautions.

3.8 Prevention of damage to precast units

The Precast Installer or Contractor is deemed to accept responsibility for the precast units from damage or interference caused by others from the time of their arrival on site. Notwithstanding that, the Precast Installer may have his own responsibilities for providing defined levels of protection himself and the provision of protection may be passed on to the Precast Manufacturer for fitting prior to delivery.

The Contractor is responsible for ensuring that no cutting, drilling or any other modifications to the precast concrete units occurs without first consulting with the Precast Designer.

3.9 Fall Prevention

Unless otherwise specified in the sub-contract, the Contractor is ultimately responsible for ensuring installation, upkeep, adaptation and final removal of all fall protection measures on site.

If the Precast Installer becomes aware of any area of concern, this must be effectively communicated to the Contractor, who must take the appropriate action.

3.10 Craneage

It is the Contractor's responsibility for ensuring the provision and maintenance of suitable ground bearing conditions for the planned lifting operations.

The Contractor is responsible for ensuring that an Appointed Person is nominated to produce the lift plan and overseeing all lifting operations.

Section 6 of this Code of Practice provides details on the safe use of cranes and other lifting equipment and gives further information on the roles and responsibilities of the various parties.

4 ROLES AND RESPONSIBILITIES OF THE PRECAST MANUFACTURER AND PRECAST INSTALLER

4.1 Introduction

In many cases, the Contractor will appoint a Precast Manufacturer with responsibility for installation of the precast units. In this case, the Precast Manufacturer may then either use an in-house installation team or appoint its own sub-contract Precast Installer. In some cases, the Contractor will appoint a Precast Manufacture for (design and) supply only of the precast units and will appoint a separate sub-contract Precast Installer to install the units. This Code of Practice details separate roles and responsibilities for the Precast Manufacturer and Precast Installer to take account of the case where they are separate organisations.

4.2 Lifting and Handling Precast Units

This section applies to all those who are responsible for lifting and handling precast units. This will usually include both the Precast Manufacturer and Precast Installer. Both parties must also comply with Section 6, (Safe Use of Cranes, Fork Lifts and Other Lifting Equipment) of this Code of Practice.

The Precast Manufacturer and Precast Installer must comply with the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER). This requires that all lifts are properly planned and carried out in a safe manner by competent people who are properly supervised. They should also comply with the Safe Use of Lifting Equipment Approved Code of Practice (ACOP).

All lifting equipment including lifting clutches, shackles, chains, slings, lifting beams and hooks should be marked with its Safe Working Load (SWL) and be subject to a periodic thorough inspection by a competent person. Records must be kept of all thorough examinations and any defects found must be reported to both the person responsible for the equipment and the relevant enforcing authority.

It is recommended that a tagging system is employed to reference each piece of equipment and indicate when it was last inspected and when the next inspection is due. If, at any time between inspections, equipment is found to be damaged or worn, it should be set aside, quarantined and marked as not for use pending a thorough examination by a competent person.

Units should only be lifted and handled using the lifting inserts provided for lifting and turning in each orientation and with the correct lifting clutches, chains etc. Particular attention should be taken to ensure that chain angles do not exceed the maximum safe angle as detailed on the drawings and indicated in the lifting insert supplier's literature. In order to prevent this, it may be necessary to use a spreader beam.

Pitching and turning of units can also be higher risk operations and it is important to properly assess and plan these operations before they are undertaken. Only lifting inserts which are specifically designed for this purpose should be used and units should be adequately protected against damage during the turning operation. Sand beds or old tyres can be useful in this respect. Webbing slings may be used for lifting and turning units where it is not practicable to use cast-in inserts but, in such cases, protective sleeves must be used to prevent damage to the slings and measures must be taken to prevent the slings sliding on the concrete.

Units must only be stored in the orientation in which they were designed to be stored. Stacking should be on firm level ground and bearers should be levelled and placed at the correct positions along their length as indicated on the drawings or other information provided by the Precast Designer. This will generally be below the position of the lifting inserts.

Where components are stacked in rows of more than one high, the bearers to each row should line through vertically to avoid damage [see Figure 4.1]. Stacks must be kept at a safe height to avoid exceeding the bearing capacity of the ground, prevent overloading units and to allow access to the top of the stack for attaching lifting clutches.

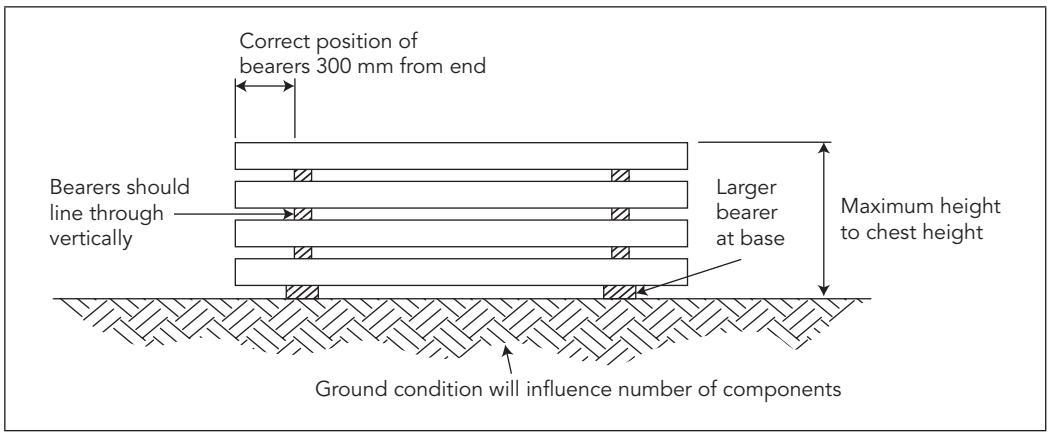

Figure 4.1
Correct Hollowcore stacking method
NB. Bearers must be positioned according to the precast designer's instructions. Failure to do this correctly can result in the compression face of the component going into tension and cracking.

If it is necessary for operatives to access trailer decks to attach or un-attach lifting clutches or crane hooks, then suitable fall prevention and/or fall arrest systems should be employed to prevent injuries due to falls from height.

4.3 The Precast Manufacturer's Role and Responsibilities

This section applies to all those who are responsible for lifting and handling precast units. This will usually include both the Precast Manufacturer and Precast Installer. Both parties must also comply with Section 6, (Safe Use of Cranes, Fork Lifts and Other Lifting Equipment) of this Code of Practice.

4.3.1 Appointment of and Liaison With the Precast Designer

The Precast Manufacturer will normally have contractual responsibility for design of the Components and must therefore either employ in-house, or appoint a sub-contract designer. In either case, he must ensure that the designer has the necessary skills, knowledge, experience and resources to undertake design of the Components on the scope, type and scale of the project in hand.

The Precast Manufacturer may involve the Precast Designer at tender stage to prepare an outline proposal for tender purposes. In order to do this, the Precast Manufacturer must ensure that the Precast Designer has all the pre-tender information (see Section 2.2) required to allow him to prepare an initial design.

Once a contract for manufacture and design has been secured, the Precast Manufacturer should ensure that he obtains all the up-to-date design information from the Contractor (see Section 2.3) and passes this to the designer. In addition he must provide the Precast Designer with as much information as possible on how the precast units will be manufactured handled during their installation and the preferred type and supplier of lifting inserts which should be used. The Precast Manufacturer may also be required to liaise with the Contractor and Precast Installer to establish the proposed sequence of installation and any other construction information which is likely to have an influence on the design.

4.3.2 Programme

The Precast Manufacturer must agree a programme for design, manufacture and delivery of the units with the Contractor and Precast Installer. This should build in sufficient time for activities such as design and drawing approval, mould fabrication or procurement and procurement of any bought-in items.

The programme must ensure that units achieve sufficient maturity in order that they can be delivered, without damage, in time to meet the Precast Installer's programme.

Initially, the manufacturing programme may be based on estimated delivery dates and an outline installation schedule but, as the date for installation gets closer, a more detailed delivery sequence will need to be agreed, down to the level of which Components will be delivered on each load and dates and approximate times for each load.

4.3.3 Manufacture and Storage of Precast Units

The Precast Manufacturer must ensure that units are manufactured strictly in accordance with the approved manufacturing drawings, mix design and bar bending schedules. Achievement of the correct cover to reinforcement and accurate placing of lifting inserts and other cast-in items are particularly important in ensuring safe lifting and handling of the units. Particular attention should be paid to ensure that reinforcement around lifting inserts is correctly placed to suit all directions of lift which the insert may encounter.

If, during the manufacturing phase, any issues arise which prevent strict compliance with the drawings (eg clashes between fittings and rebar), then the matter should be referred back to the Precast Designer in order that an alternative arrangement can be determined. This may involve a revision to the unit drawing and possibly the general arrangement drawing, which the Precast Designer will make and issue to all relevant parties.

The Precast Manufacturer should prepare risk assessments and method statements for the casting, lifting handling and transportation of units throughout their time in the factory and storage yard and during loading and delivery.

Units should only be de-moulded once the concrete strength has reached the minimum cube strength specified by the Precast Designer on the drawings. For new, un-tried mixes, concrete cubes should be taken at the time of casting, match-cured with units and tested just prior to de-moulding to confirm that the strength has been reached. Once sufficient data has been obtained on the strength/maturity properties of the concrete, then it may be acceptable to rely simply on the time from casting and the ambient temperature of the unit to establish an adequate de-moulding strength. In the case of pre-stressed units, it is also important to ensure that the concrete has reached its transfer strength before strands or wires are cut from anchor blocks..

If during the casting of a unit, it becomes apparent that a lifting insert has moved or become unusable, then the Precast Designer should be consulted to advise on any potential alternative lifting solution. Similarly, if at any time during de-moulding, lifting, handling or storage of the unit, any cracking or other damage becomes apparent, particularly around lifting inserts, then the Precast Manufacturer should consult the Precast Designer to establish whether the damage has any structural implications. The Precast Designer may be able to advise on appropriate remedial work to recover the unit or may advise that the unit should be rejected. Units must not be lifted if there is damage to or adjacent to lifting inserts or if lifters have become dislodged during casting unless the Precast Designer advises otherwise.

If units are to be stored on frames or in racks, then these should be designed for that purpose and must ensure that they keep the unit secure and stable at all times. The Precast Manufacturer should ensure that such frames or racks are regularly inspected and that records are kept of these inspections.

Care should be taken to ensure that units are secured in a stable position in all situations. Temporary laying down of units after de-moulding, during transportation around the factory or on site prior to installation can be hazardous situations and unit

stability must be considered at all times. Where a unit is subject to additional finishing or remedial works during storage, then it must be securely fixed or propped to prevent tipping or overturning whilst it is being worked upon.

Manufacturers should ensure that only competent operatives who have been properly trained (or are under-going training and under supervision) in crane operation and as slingers, signalers or banksmen are engaged on these operations.

Prior to delivery, the Precast Manufacturer should satisfy himself that the concrete in the units has reached a strength suitable for handling, transportation and installation. It is expected to reach the design strength by the time the units are subjected to loading. This must be checked and confirmed by cube testing at the appropriate age.

The Precast Manufacturer is responsible for maintaining records in accordance with the specification. This may require a high level of traceability on materials and fittings and extensive manufacturing data but, as a minimum, it should include casting dates for each unit referenced against the unit mark and 7 and 28 day cube strengths. A record should also be kept of the date and load on which each Component is delivered.

4.3.4 Loading and Transportation of Precast Units

The Precast Manufacturer should establish any site rules for delivery vehicles from the Contractor and ensure that the haulier is aware of and complies with these. Where applicable, FORS Silver standard may be adopted for delivery vehicles. Precast Manufacturers and hauliers should also be aware of and comply with the Mineral Products Association Drivers Handbook and the British Precast guidance for loading and delivery of precast products. The Precast Installer should ensure that delivery drivers are equipped with necessary PPE.

In receipt of the call-off from the Precast Installer, the Precast Manufacturer should plan the composition and arrangement of units on each load to ensure that the units can be loaded and transported safely. The fundamental concerns when loading delivery vehicles must be to ensure an even weight distribution and load stability, throughout the loading, transit and offloading stages. Attention should also be paid to the height of loads and the route taken for the delivery.

From the point of view of safety during the installation operation, it is important that components are loaded so that offloading may be carried out in the appropriate sequence. However, this must never be at the expense of the safe transit of the complete load and therefore some double handling may be required at the point of installation. If the off-loading sequence is critical, then the Precast Manufacturer must make sure that this clearly communicated to the Installation Supervisor prior to delivery.

When loaded, the components should be properly and adequately secured to the vehicle to prevent movement during transit, particular attention being paid to loose items, e.g. angles, timber, fixings, pointing materials, etc. It is important when chains or proprietary straps are used to secure loads that some form of protection is provided to prevent damage to the chains or straps and to the edges of the precast components. Small components should have nets or tarpaulins placed over them to prevent individual items falling from the vehicle, and similar measures should also apply to loose items.

The loading arrangement should allow for maximum protection against damage or breakage, as architectural and structural components are particularly vulnerable to damage in transit. Protection should be provided between units to prevent them coming into contact with each other or the trailer deck, headboard or loading frames and causing damage in transit. Softwood, compressible fibre board or old carpet can be useful for this purpose.

Where units are stacked on bearers, these should be kept in line vertically (see Figure 4.1) to ensure that units at the bottom of a stack are not over-loaded. Plastic bubble bearing pads (used to prevent marking of units by bearers) should not be used on delivery vehicles unless special measures have been taken to prevent units sliding on them. Rubber bubble bearing pads are available and may be a preferable solution.

If it is necessary for operatives to stand on trailers for attaching lifting clutches or crane hooks, then suitable fall prevention and/or arrest systems must be utilised to prevent injury due to falls from height.

Where special delivery measures have to be employed e.g. the use of "A" frames or trestles, these should be adequately fixed or secured to the vehicles and the components being transported should be securely and independently affixed to the rack or frame. Any special precautions to be observed whilst the load is in transit, or being offloaded, should be communicated to the vehicle driver and the Installation Supervisor. Special precautions include the sequence of unloading A frames. This must be arranged so that the vehicle remains stable at all times which, in some circumstances, means that PC units must be taken from alternate sides of the A frame. Where possible each PC unit should be separately secured to the A frame - so that releasing one does not leave the others on that side vulnerable to toppling. Consideration should be given to the type and size of the trailer based on the height, stability and width requirements of the load.

Where delivery vehicles are required to reverse in a factory or storage yard, then a signaler should be employed to guide the vehicle and ensure collisions do not occur, particularly with personnel.

Prior to delivery of the units, the Precast Manufacturer should check that the Precast Installer has all the up to date drawings and other information including unit weights, necessary for the safe lifting, handling and installation of the precast elements from the Precast Designer. They should also ensure that they have the required lifting clutches and other lifting equipment necessary for off-loading. Where the Precast Manufacturer is responsible for supplying lifting equipment, they must ensure that the equipment is tested and certified and provide the dated certificates with the delivery notes when the equipment is delivered.

4.4 The Precast Installer's Role and Responsibilities

4.4.1 Site Access

Before a vehicle arrives on site, the access from the highway onto and around the site should have been agreed between the Precast Installer and the Contractor, taking into account the site traffic management plan. The Installation Supervisor should have checked access suitability with the Principal Contractor's Site Representative upon commencement of work on site. Access routes and any rules regarding vehicle access to site should be clearly communicated to the Precast Manufacturer in advance and the Precast Manufacturer or his haulier be afforded the opportunity to check on access prior to delivery.

Reversing manoeuvres should be minimised, where it cannot be avoided a trained signaler should supervise and assist in the positioning of the delivery vehicle both on and off site.

Notwithstanding the above, the final acceptance of the access suitability will remain with the vehicle driver, and in these circumstances the driver must satisfy himself before entering the site that his vehicle can travel safely on the access provided. In all cases the driver must not remove any securing ropes, chains, or tarpaulins until his vehicle is at rest in the area agreed for unloading. For tall narrow loads secured to A frames and for all loads that could slide, it is particularly important not to park the delivery vehicle on a slope or camber that could lead to the load moving or toppling when securing ropes or chains are removed.

4.4.2 Inspection and Off-Loading of Units

Every precast unit must be inspected before lifting from the delivery transport on site for obvious signs of damage, e.g. cracking. Where a unit is deemed to be damaged, the Installation Supervisor must immediately record such damage and notify the Precast Manufacturer or Designer for advice, contacting a person competent to make the decision, on what action should be taken in respect of the damaged unit.

Note that a component that has been structurally damaged in transit can be unstable and may fail completely during removal from the vehicle. The lift plan may need to be reviewed to ensure that injuries will not occur during removal.

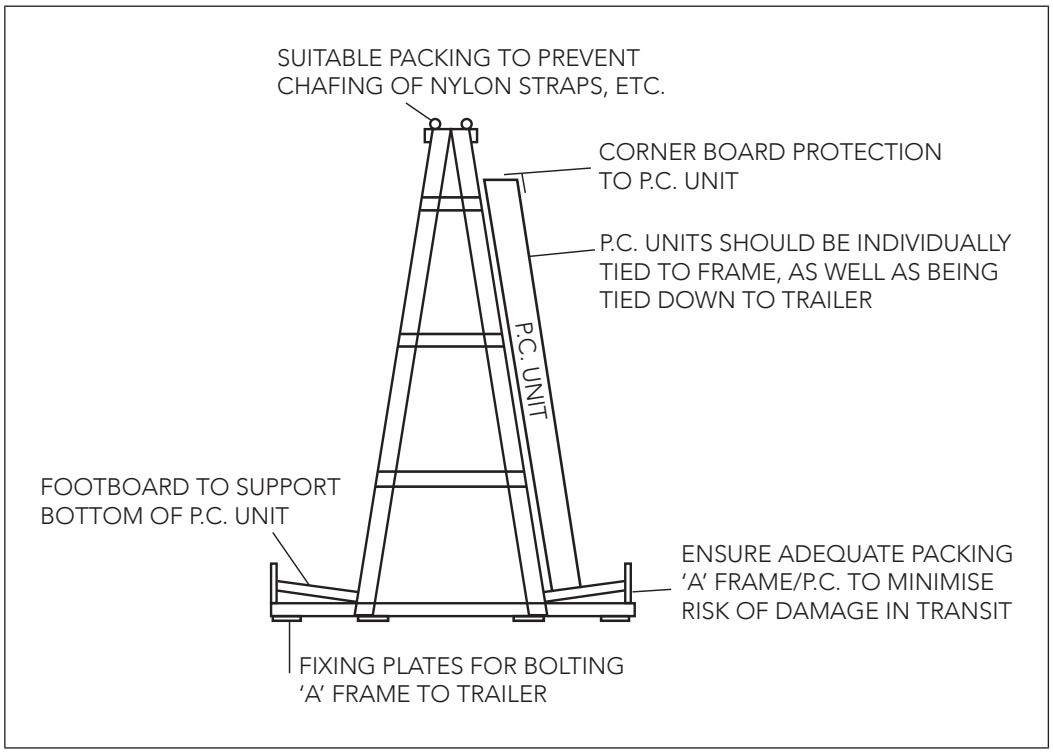

Figure 4.2
'A' Frame for safe transportation of precast units

The Precast Installer must ensure that the correct lifting equipment is available on site to offload Components and must also visually inspect cast-in inserts and Components to ensure that no damage has occurred in transit. Components must be unloaded in such a manner that the stability of the delivery vehicle is not adversely affected. The Precast Installer should, when necessary, liaise with the delivery driver to ascertain the most suitable unloading sequence.

When components are taken straight from the vehicle to their fixing position, care must be taken to ensure that any loose packing or protective materials have been removed and that any fittings are secure.

In rare circumstances where Components may have to be lifted or pass over the cab of a delivery vehicle, the Precast Installer must ensure that the driver leaves the cab and remains in a safe position, until advised that the lifting operations have ended.

Where proprietary cast-in lifting inserts are provided in the units, they must be used strictly in accordance with the manufacturer's recommendations and as detailed on the drawings or other information provided by the Precast Manufacturer or Precast Designer. Any specialist lifting equipment must be used strictly in accordance with the manufacturer's recommendations.

If it is necessary for operatives to stand on trailers for attaching lifting clutches or crane hooks, then suitable fall prevention and/or arrest systems must be utilised to prevent injury due to falls from height.

It is important to ensure that the correct lifting appliances (e.g. fork lift) are used for the offloading of smaller palletised components.

4.4.3 Agreed Sequence of Installation

A sequence of installation is to be agreed, at an appropriate time prior to commencement on site, between the Precast Installer and Contractor. Should it subsequently be necessary for the installation sequence to be varied, for whatever reason, this should be implemented only after liaison with the Principal Contractor, Contractor, Building Designer and Precast Designer after all safety requirements have been satisfied. Where necessary, liaison with the Temporary Works Coordinator may also be needed. If deemed necessary, the Safe Working Method Statement should be amended by an addendum to cover the revision agreed.

Once a sequence and programme has been agreed, a full call-off programme for Component deliveries should be agreed between the Precast Installer and the Precast Manufacturer. This will initially be based on the preferred sequence required by the Precast Installer but will ultimately be dictated by the safe loading and transport of delivery vehicles as advised by the Precast Manufacturer.

4.4.4 Lift Planning

Prior to any installation work, the Precast Installer should attend a pre-start meeting with the Contractor and visit the site to identify any site-specific hazards and establish a safe system of work.

The Precast Installer must ensure that an Appointed Person is employed for the planning of lifting operations. As part of this process relevant information including Components' weights and offloading positions should be provided by the Precast Manufacturer and Designer. The Appointed Person will decide upon the type of lifting plant and equipment to be employed in the installation of each specific contract, taking into account the weight of Components to be lifted, the radius of lifting, and any special handling requirements.

The Precast Installer should liaise with the Contractor and Appointed Person to discuss/advise upon the type and size of delivery lorries and craneage. This will allow the Contractor to make provision for adequate access, lay-down areas and hardstandings, or other facilities that may be required to accommodate delivery and lifting equipment.

The Precast Installer should also consider any factors likely to hinder the lifting operations, e.g. aerial obstructions, proximity hazards, stacked materials or earthworks. Agreement should be reached with the Contractor on how these factors will be removed or mitigated and who will undertake this work.

After reaching a decision about the lifting arrangements, the Appointed Person should draw up a lift plan, including the agreed safe system of work, hardstanding positions, ground bearing pressure requirements, roadways, agreed offloading positions and any storage areas. A copy must be handed over and explained to the Installation Supervisor and Crane Supervisor before work is commenced.

If at any time, changes are made to the precast design causing Component weights to vary from those originally envisaged, the Precast Designer must inform the Precast Installer in order that the Appointed Person can ensure that the crane and lifting equipment are still adequate.

In any instance where the crane or lifting equipment is changed from the original proposal, the Appointed Person must be informed prior to use. In assessing the changes, he must also consider the implications on access, standing areas, or other factors. The Appointed Person must amend the lift plan accordingly and submit to the Contractor.

If the Contractor has responsibility for the provision and maintenance of the craneage (eg. tower cranes) and lift planning, he must also provide an appointed person to plan the lifting operations and a lift supervisor to oversee them (although this may be the same person). In this instance, the Precast Installer must provide the Contractor with all relevant information, e.g. component weights, and agree offloading positions.

4.4.5 Site and Work Area Access

The Precast Installer must agree with the Contractor the access from the public highway onto and within site and locations of, and access to, stacking areas, stores, temporary buildings and lorry/trailer holding areas. The Installation Supervisor should confirm that such agreements are recorded in writing and incorporated into the Safe Working Method Statement in order that all parties have the information readily available and to avoid misunderstandings or confusion when installation commences.

The Precast Installer and Contractor must also agree the means of access into the building(s) as construction progressesand the provision of barriers, guardrails/handrails, toe-boards, access, lighting and similar precautions. The Installation Supervisor must ensure that all suitable protection measures are in place at every stage and, if appropriate, bring any problems to the attention of the Contractor for corrective action.

4.4.6 Supervision of Installation

The level of supervision will vary depending on the complexity of each job but, in all cases, the Precast Installer should appoint an Installation Supervisor, reporting to the Precast Installer's Representative, with day-to-day responsibility for precast installation operations.

Prior to the arrival of the installation team, a sequence for on-site installation must have been agreed, in the form of a Safe Working Method Statement, with records kept on site and a copy handed to the Contractor.

Before commencing the installation of any Components, the Installation Supervisor must satisfy himself that the Attendances agreed for that contract have been provided and are of a satisfactory standard in accordance with the Safe Working Method Statement. This should be part of the pre-start check as detailed in Section 1.3 of this Code of Practice and should, ideally, be conducted jointly with the Contractor. Any item found to be inadequate or missing should be addressed by the Contractor prior to the commencement of installation.

The Installation Supervisor or other nominated competent person should also carry out the daily checks as detailed in Section 1.3.

The Installation Supervisor should carry out the pre-start and daily installation briefings to the installation team and Crane Supervisor, as detailed in Section 1.3 of this Code of Practice, paying particular attention to any special problems or conditions relating to the Safe Working Method Statement. Any area of concern must be communicated to the relevant party. Installation should not proceed until satisfactory corrective action has been taken.

After receiving the formal handover from the Contractor and prior to installation commencing, the Installation Supervisor must ensure that any bearings or receiving structures provided for the precast units (including those on steelwork) are visually satisfactory. Ideally, this should be carried out jointly with the Contractor and any corrective actions required be completed prior to work starting.

The delegation of specific tasks within the team is the responsibility of the Installation Supervisor, who must be satisfied that the person to whom the task is assigned is trained and competent to carry out that work safely.

The Installation Supervisor must also coordinate and monitor other site personnel involved with the precast installation works, such as fall protection operatives and delivery drivers.

The Installation Supervisor must ensure that a qualified and competent Crane Supervisor is present at all times when lifting operations are being performed. Before placing any Components the Installation Supervisor must ensure that the crane (where applicable) is operating in a safe and proper manner, and that the Crane Operator is fully aware of the nature of the work and can identify and understand signals given by the Slinger/Signaler.

In all cases, the Installation Supervisor is responsible for the actual installation of the Components. During the course of the installation, he must check the adequacy of the bearings; any variation or deterioration, from whatever cause, must be brought to the attention of the Contractor. Where the Installation Supervisor has concerns regarding the adequacy of the bearings and/or the structural integrity of the building, he must seek advice and instruction from the Precast Designer and/or Building Designer. Work must be suspended if the bearings are deemed unacceptable.

It is the responsibility of the Installation Supervisor to ensure adherence to the agreed sequence of installation. In circumstances where a deviation is unavoidable, the Installation Supervisor must seek advice and approval from the Precast Designer and/or Building Designer before altering the sequence. If deemed necessary, the Safe Working Method Statement should be amended by an addendum to cover the revision and be agreed by the Contractor.

The Installation Supervisor should ensure any deviation from the Safe Working Method (especially in safety critical areas such as fall protection) is reviewed, approved and documented prior to implementation.

Only where the Appointed Person has determined that the general lifting operations are basic or standard, the Appointed Person's duties can be delegated. The person to whom those duties are delegated will then assume the duties of Lift Supervisor.

4.4.7 Workmanship

The Installation Supervisor should check the dimensional accuracy of the individual Components and the accuracy of setting out of the structure, ensuring that all Components correspond with the Working Drawings.

Components should be fixed strictly in accordance with the Working Drawings and any other information provided by the Precast Designer or Precast Manufacturer. During the installation of the components the Installation Supervisor must ensure that correct handling and placing procedures are being adhered to, and that all aspects of the work are being executed in a safe and proper manner, in accordance with the Safe Working Method Statement and Working Drawings. Work must be suspended if the procedures in place are deemed unacceptable.

Particular attention must be paid where any temporary propping or bracing of Components is required. Props and bracing should be securely fixed and tagged to indicate that they should not be removed until any permanent fixings or conditions are in place and secured. Where the stability of Components in their permanent condition is dependent on grouting of fixings or in-situ stitches, props or bracings should not be removed until the grout, mortar or concrete has gained sufficient strength. Similarly, where follow-on works are dependent on grout or concrete reaching sufficient strength, no work should proceed until it is established that the design strength has been achieved.

Levelling shims and/or packing are usually required on bearings supporting precast elements. The size and type should be specified on the drawings but the Precast Installer should ensure that the correct materials are used and at a size which is appropriate for the load to be imposed upon it. If there is any doubt, the Precast Designer should be consulted to establish the requirements. Where necessary and as detailed on the drawings, joints should then be grouted or dry packed with the specified material.

No 'unspecified' works (eg cutting, drilling, coring, fixing inserts etc) of any type, including remedial works, should be carried out without the prior approval of the Precast Designer, the Building Designer, the Contractor and the Principal Contractor.

Any work which is carried out must be recorded by the Precast Installer.

No variations to the design or design details and no remedial works should be carried out without the prior approval of the Precast Designer and the Building Designer. Full details of any variations must be provided to the Precast Designer and/or Building Designer for incorporation into the as-built drawings.

The Installation Supervisor must ensure that the Work Area is kept clean and tidy, so far as this is reasonably practicable, and at the end of the working day the area should be left free of debris. Materials must be safely and securely stacked.

When the installation of the precast elements (or any section of the working area as defined in the sub-contract) is complete, the Installation Supervisor and the Contractor should jointly inspect the work. Should any damaged or improperly fixed Components be apparent these should be replaced or repaired as soon as is reasonably practicable, having regard for availability of replacement Components from the Precast Manufacturer.

When all works are completed, the Installation Supervisor should advise the Contractor and request a joint inspection prior to leaving site. Provided that everything is satisfactory, a handover certificate should be completed, signed and copies retained by both the Precast Installer and Contractor.

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5 TEMPORARY WORKS' ROLES

Sections 5.1 to 5.4 are primarily derived from Operational Guidance *HSE SIM 02/2010/04* and *BS 5975 "Code of Practice for Temporary Works Procedures and Permissible Stress Design of Falsework"*. Section 5.5 provides an example of how this might work in practice relating to propping of structural precast.

Definitions:

Temporary Works Coordinator: On larger projects, the individual, usually employed by the Principal Contractor or Contractor, to plan and coordinate all temporary works on the site. This will include responsibility for ensuring that they are correctly installed, used, checked and maintained.

Temporary Works Designer: The organisation or individual with responsibility for design of any temporary works. In the context of precast installation, this may include any access scaffolds, props, falsework, crane platforms etc.

Temporary Works Supervisor: The competent person responsible for ensuring the correct installation, maintenance and use of any temporary works.

5.1 Definition of Temporary Works

Temporary works is defined in *BS5975 "Code of practice for temporary works procedures and the permissible stress design of falsework"* as "(those) parts of the works that allow or enable construction of, protect, support or provide access to, the permanent works and which might or might not remain in place at the completion of the works".

Table 5.1 (below) offers examples of Temporary works relevant to the installation of architectural/ structural precast along with complexity/risk classification and BS 5975 categories of design checks.

Table 5.1
Risk classification of Temporary works and associated categories of design check (adapted from BS 5975)

Complexity and Risk (HSE – SIM 02/2010/04)	Examples of Temporary works Activity (HSE – SIM 02/ 2010/ 04)	Categories of Design check	
Simple/ potentially low risk temporary works	Use of standard solutions based on generic equipment assembled in accordance with the manufacturer's instructions and limitations of use. Note that the interface must be assessed.	Category 0 or 1	0
	NASC TG20 compliant scaffold or system scaffold built and used to manufacturer's handbook		
	Simple propping schemes		1
More complex/ potentially medium risk temporary works	Falsework up to 3m high	Category 1 or 2	
	More complex propping schemes – multiple props at single level		
	Safety net systems fixed to robust primary members		2
	Simple designed scaffold		
Complex and/or potentially high risk temporary works	Falsework & formwork over 3m high	Category 2 or 3	
	Working platforms for cranes		
	Tower crane bases		
	Flying & raking shores		
	Complex propping schemes – multiple props and multiple levels		3
	Complex designed scaffold		
	Cofferdams		
	Complex structural steelwork & precast concrete erection schemes		

Note: Other industry guidance documents, including the TWf *"Clients' Guide to Temporary Works"* and PAS8811, offer more detailed classification of design complexity risk categories

Categories' Scope	Comment	Independence of checker
Restricted to standard solutions only, to ensure the site conditions do not conflict with the scope or limitations of the chosen standard solution.	This applies to the use of standard solutions and not the original design, which will require both structural calculations and checking to categories 1, 2, 3 as appropriate.	Because this is a site issue, the check may be carried out by another member of the site or design team.
For simple designs. These may include: formwork; falsework (where top restraint is not assumed); needling and propping to brickwork openings in single storey construction.	Such designs would be undertaken using simple methods of analysis and be in accordance with the relevant standards, supplier's technical literature or other reference publications.	The check may be carried out by another member of the design team.
On more complex or involved designs, designs for excavations, for foundations, for structural steelwork connections, for reinforced concrete.	Category 2 checks would include designs where a considerable degree of interpretation of loading or soils' information is required before the design of the foundation or excavation support or slope.	The check should be carried out by an individual not involved in the design and not consulted by the designer.
For complex or innovative designs, which result in complex sequences of moving and/ or construction of either the temporary works or permanent works.	These designs include unusual designs or where significant departures from standards, novel methods of analysis or considerable exercise of engineering judgment, are involved.	The check should be carried out by another organisation.

5.2 Temporary Works Management

The management of Temporary Works, through correct design and execution, is a fundamental element in risk prevention and risk mitigation in a construction site. Contractors need to demonstrate that sufficient arrangements are in place to control risks associated with the use of temporary works on site.

5.2.1 Temporary Works Coordinator

The Principal Contractor's Temporary Works Coordinator (TWC) is the person responsible for assessing and overseeing the suitability of temporary works design, design checking and temporary works implementation on site in accordance with the Contractor's control procedures and relevant drawings and specifications. Although the TWC and Temporary Works Designer roles could be carried out by the same person (or party), it is essential a TWC is formally named and appointed to carry out this role. The principal activities of a TWC are detailed in BS 5975.

HSE's *SIM 02/2010/04* stresses that a TWC needs to be competent, with relevant up-to-date training, qualification and experience to carry out the role. A TWC's level of experience and training should also be appropriate to the complexity of the project and the required temporary works. The TWC needs to be given sufficient authority to carry out his/her duties: This should include the authority to stop any non-compliant or unsatisfactory works on site.

5.2.2 Temporary Works Supervisor

The Contractor may appoint one or more Temporary Works Supervisors (TWS). A TWS should be responsible to the TWC and assist the TWC in the supervision of the temporary works. TWS responsibilities include:

- Make sure that the temporary works are erected correctly in accordance with the information and based on the drawings and the Method Statement.
- Relay information to the coordinator and liaise with the designer and Contractor
- Responsibility for passing information to the designer to allow him to make the decision for sign-off of procedures.

5.2.3 Temporary Works Register

A temporary works register should be prepared for any project requiring temporary works. It should contain a list of all identified temporary works items associated with the project. These can be set out as a table using appropriate headings, which could include:

- Design brief number (for each item) and date issued
- Short description of temporary works
- Date required
- Category of temporary works
- Designer
- Design Checker
- Date design complete
- Date design checked/approved
- Erection complete and checked or "Permit to Load" "Permit to Dismantle"

5.2.4 Design brief

HSE guidance advises that a design brief should serve as a starting point for subsequent decisions, temporary works design calculations and drawings/ specification. BS 5975 advises that each item of temporary works in a project will need to be

covered by a design brief. The brief should typically include all relevant information to enable the design of temporary works. It is advised that the brief is prepared early enough to allow for all subsequent activities. The level of detail in a design brief will depend on the complexity of the works: A brief for a small scheme may be relatively simple, but a larger project may require more information to be collected and collated prior to design. It is the TWC's responsibility to ensure that a sufficiently clear and comprehensive design brief is provided to the Temporary Works Designer and Design Checker prior to the start of the design work.

5.3 Temporary works design

BS 5975 notes that a designer includes anyone who specifies or alters a design, or who specifies a particular method of work, or material (thereby assuming the responsibilities of a designer under CDM regulations). Temporary works designers could be the manufacturers/ suppliers of proprietary works equipment or those working at the Temporary works department of the Contractor.

The Temporary Works Designer should base his design on the agreed design brief. Where alterations or modifications to the brief are necessary, these should be drawn to the attention of the TWC as soon as possible. The design of temporary works should be based on recognized engineering principles. Any design calculations, drawings or specifications for temporary works should be prepared and checked with the same level of scrutiny and rigour as those needed for permanent works. Even the simplest of temporary works may require careful consideration in their design, construction, commissioning, inspection and loading as even an apparently simple temporary works job can lead to injuries (or even fatalities) if not executed correctly. BS 5975 notes that they should define points such as *"requirements for foundations; positions of components; the nature of connections to other components and limitations for loading and sequence of operations."*. Table 5.1 offers information on the categorization of Temporary Work Designs based on complexity/simplicity of the works structure and potential risk.

5.3.1 Design checks

BS 5975 specifies that prior to the start of erection on site, temporary works design needs to be checked for:

- Design concept
- Strength and structural adequacy (including foundations and lateral stability)
- Compliance with the design brief.

It is essential that design checks are carried out by independent and competent person. The level of competence of a design checker, and his level of independence, will vary significantly based on the complexity of the temporary works and whether new or unfamiliar ideas are incorporated in the design. BS 5975, Table 1, identified four main categories of design check, these are summarised at Table 5.1 of this Code.

The category of design check is not an absolute issue. The category selected may vary between situations and who is conducting the design. For example, a designer carrying out work that they do all the time may not need such a high check category compared to a designer who is less experienced in the type of work in question; and even a simple design may warrant a higher level check where the result of any failure would be catastrophic, such as leading to large scale progressive collapse, or potential for multiple or public casualties.

5.3.2 Temporary works installation

The management, installation, use, maintenance and dismantling of temporary works will need to comply with BS 5975 and in accordance with the agreed design. Installation should be carried out under the supervision of TWS and needs to be checked prior to sign-off (with a copy of the sign-off documentation sent to the Temporary Works Coordinator).

The Contractor is responsible for ensuring that temporary works are not removed, amended or interfered with by any unauthorized persons.

5.3.3 Temporary works release

A Temporary Works Coordinator/ Designer issues a sequence of release of the temporary works. The Release of Temporary Works only takes place following authorization by the Temporary Works Coordinator.

5.4 The role of CDM Principal Designer

CDM requires the client to appoint a Principal Designer to coordinate all design work, including temporary works. The Principle Designer must take reasonable steps to ensure co-operation between permanent and temporary works designers. This is mainly to ensure that all design work is compatible. One part of the role is to ensure that the permanent works information is provided to enable temporary works designers to ensure that loadings from temporary works can be supported. The Principle Designer must also advise the client, prepare pre-construction information, keep the site health and safety file up to date, as well as ensure that the combined designs are both safe to build and meet the overall design brief. This means ensuring that design work and instructions arising from the design are in place so as to ensure site-wide structural stability during the construction phase and of the completed structure/s.

5.5 Example: Safe Procedure for Design, Installation and Removal of Temporary Propping to Precast Units

This procedure applies to Precast Designers, Precast Manufacturers and Precast Installers and its purpose is to ensure design of any temporary site propping is either carried out by the Precast Designer, or in full consultation with them. Also that the method statement for installation, management and removal of props is agreed with the Precast Designer so as to ensure that all propping is carried to a safe and engineered procedure.

Only the Precast Designer should specify propping and only the Precast Designer should authorise the removal of propping. The Precast Designer is therefore the Temporary Works Designer and should either directly act as Temporary Works Coordinator (TWC) in respect of propping, or advise the site TWC regarding requirements. The Temporary Works Supervisor (TWS) should therefore be a member of the Precast Installer's team. He may also be the Installation Supervisor but, if not, should work in close liaison with him.

5.5.1 Prop Design

All propping should be designed by the Precast Designer and each prop must have a prop procedure and a prop release procedure. This will form part of the project method statement. The Precast Designer and the Precast Installer must ensure all correspondence regarding installation is routed via the Principal Contractor. Usually this will involve the site TWC but, as a minimum, the Precast Designer and Installer must ensure that the other parties are fully informed of arrangements and are able to agree these to the extent that they are affected.

The Precast Designer should produce a propping drawing for each and every project where propping in the temporary condition is required. The propping drawing will include component mark numbers, details of props, prop length, details of prop fixings, including length and size, site hazard warning notice and prop procedure.

Where required, the Precast Designer/TWC should specify minimum ground bearing pressures or bearing plates. He should also design any inserts for fixing props to the precast and prop anchor points on the existing structure or any temporary kentledge blocks. All temporary works design should be checked by a suitably trained and competent engineer.

Temporary propping should only be released on written authorisation of the Precast Designer/TWC.

5.5.2 Procurement

The Precast Installer should procure all props in accordance with the propping drawing. This should also include all fixings (noting size and length), washers, double nuts, backing plates and "Do Not Release" signage. Suitable signage must be made available on site on first delivery of precast on the project. No deviations from the Precast Designer's/TWC requirements are permitted without written authorisation of the Precast Designer/TWC. This includes any change in manufacturer or supplier.

5.5.3 Construction

It is the responsibility of the Precast Installer to appoint a Temporary Works Supervisor (TWS). The TWS should ensure all aspects of site propping procedure are implemented as detailed within the Safety Method statement and that props and prop fixings conform to prop drawing and procedure.

All site personnel should receive and sign on receiving a toolbox talk on temporary propping requirements as shown on the propping drawing and detailed in the safe working method statement. Props should be installed for each precast unit where they are required as noted on the propping drawing. Crane attachments to the precast unit must not be released until props are firmly in place and bolts suitably tensioned. Concrete screws or knock in fixings/inserts may be used only under instruction from the Precast Designer/TWC and by workers training in their use.

Hazard warning notices should be placed on each prop stating:

DANGER

STRUCTURAL PROPPING

DO NOT REMOVE

Propping must be checked and adjusted daily and the TWS should inspect and maintain all propping. A record of all inspections should be kept on site.

5.5.4 Prop Release

Following installation of precast units and when all the conditions of the prop release statement have been satisfied the Installation Supervisor should contact the Precast Designer/TWC, confirming that all the conditions have been met and requesting permission to release props. Where possible, photographs should be included and the Contractor copied in. The request for release should be in writing and should, as a minimum, include drawing number, grid reference and precast component ID mark.

Conditions for prop release will often include grouting of connections. In such cases, it should be established that the grouting has been properly carried out and the grout has reached its design strength before it can be confirmed that the prop release conditions have been met. Confirmation of grout strength may be determined by cube testing or by calculation where the Precast Designer/TWC is satisfied that sufficient maturity data exists.

Following review and confirmation that all criteria have been met the Precast Designer/ TWC should authorise in writing that props may be released. This should again include drawing number, grid line and component ID marks. Using this information the TWS or his representative should physically mark props to be removed and remove the hazard warning notices on each prop. Only then ma emoved.

NB. In all cases the Precast Designer's instructions must be followed. In some cases props must be removed prior to structural topping being placed, and in other situations propping must be maintained until the structural topping has cured.

5.5.5 Unplanned Propping Requirements

As is the case with even the most well designed construction activities circumstances can arise when temporary propping may be required that has not formed part of the pre-project design and planning. This could be the need for anti-rotation or minimum bearing propping to units. In such cases, all the above conditions for prop design, procurement, construction and release, still apply. Propping must be specified by Precast Designer/TWC and not by the Precast Installer. It is the responsibility of the Precast Installer to get the relevant information to the Precast Designer/TWC for an engineering solution and then to implement requirements on site.

Ad hoc propping must not be used in an attempt to get round poor fit issues or unexpected changes to build sequence - eg where other contractors' work is not as advanced as expected. Where such situations occur, whoever is at fault, the work must halt unless the Precast Designer is provided with the full facts and is able to provide a formal design as a safe workaround. In some circumstances this will not be possible and work cannot proceed.

6 SAFE USE OF CRANES, FORK LIFTS AND OTHER LIFTING EQUIPMENT

6.1 Introduction

The Lifting Operations and Lifting Equipment Regulations (LOLER) require that lifting equipment provided for use at work is:

- Strong, stable and marked with safe working loads.
- Correctly used.
- Used safely.
- Subject to on-going review.

The Regulations also require that lifting operations are:

- Planned, supervised and carried out safely by people who are competent.
- Controlled, i.e. all documents are checked and in order.

The Lifting Operations and Lifting Equipment Regulations 1998 Approved Code of Practice (ACoP) refer to BS 7121 *Code of Practice for the safe use of cranes:* Part 1 *General* and Part 3 *Mobile cranes* as the standard that should be adopted. It is in the interests of all parties involved in lifting operations that they are carried out efficiently and safely. The ACoP was published to help ensure that everyone involved in a lifting operation is aware of their responsibilities. This Architectural and Structural Precast Association Code of Practice covers all the work involved in handling and positioning concrete products.

6.2 Management of the lifting operation

During preliminary site visit(s) a safe system of work must be established by the Appointed Person, and recorded in the form of a Safe Working Method Statement. This must be followed for every lifting operation or a group of repetitive operations. This principle applies to all lifting operations.

Lifting equipment must be positioned or installed in such a way as to reduce, to as low a level as is reasonably practicable, the risk of the equipment or load striking a person and the risk of the load drifting, falling freely or being released unintentionally.

The safe system of work for crane operations must include the following:

- Planning of the operation including risk assessments must be carried out by a Competent Person. This should include ensuring that the lifting operation is adequately supervised and carried out in a safe manner.
- Selection, provision and use of suitable crane(s) and equipment.
- Ground conditions must be examined, including access, working and adjacent areas.
- Particular attention must be paid to:
  - Trenches, cellars and basements. Underground services.
  - Ramps, slopes, edges, shrinkage voids beneath ground bearing slabs and uneven ground
  - Water attenuation tanks and high void soakaways
  - Use of suspended slabs for supporting lifting equipment
- Liaison with the CDM Principal Designer and Principal Contractor in order to obtain information and an assessment of ground conditions
- Positioning of the lifting equipment to ensure the safety of those working with the equipment and those who may be affected by its operation. This includes eliminating trapping points or preventing access to them by persons.
- Verifying that crane(s) and ancillary equipment are properly inspected and certificated.

- Provision of properly trained and Competent Personnel with the necessary authority who have been made aware of their relevant responsibilities under the Health and Safety at Work Act. BS 7121 defines roles and responsibilities.
- Effective communications between all relevant parties.
- Preventing unauthorised use or movement of the crane.
- The safety of persons not involved in the lifting operation, including eliminating the need to lift the load over people.

The lifting operation must be taken to include any necessary preparation, as well as installation and dismantling of the crane(s).

The Safe Working Method Statement must be effectively communicated to all parties concerned.

6.3 Control of the lifting operation

To ensure the implementation of the safe system of work, one person must be appointed to have overall control and responsibility of the lifting operation and to act on behalf of the Precast Installer.

The appointment of this person does not remove any legal responsibility from the Employing Organisation but enables them to use his expertise to better fulfil their responsibilities. The person appointed may have other duties and need not be an employee of the Company.

The Appointed Person must have adequate training and experience to enable these duties to be carried out competently.

The duties of Appointed Persons for crane operations can vary in accordance with the complexity of the operation. The duties for a 'basic lift' are considerably fewer and less demanding than for a lift at a hazardous location. Hence, an Appointed Person employed for a 'basic lift' may not be suitably trained or experienced for a more complicated operation. Therefore, 'complex lifts' should be planned and supervised by a suitably competent Appointed Person in consultation with the crane hire company and the Contractor. The types of lift are defined below.

- Basic lift

  Lifting operation where the weight of the load(s) can be simply established and there are no significant hazards within the area of the operation or on the access route to the working area.
- Standard lift

  Lifting operation where there are significant hazards either within the working area of the crane or access route of the crane.
- Complex lift

  Lifting operation which includes cranes used for lifting complex loads, the lifting of persons, lifting the load with two or more cranes or where the lifting operation is at a location with exceptional hazards.

  Note: An example of a location with exceptional hazards is a chemical plant, or an area where a relatively minor event could lead to multiple casualties or have major cost implications. This may cause even apparently simple lifts to need more rigorous planning and control..

Where the Appointed Person has determined that the General Lifting Operations are basic or standard, the duties, but not the responsibility for the lifting operation, can be delegated to a Competent Person who will then assume the duties of the Crane Supervisor.

The Crane Supervisor, having been delegated as being in control, will have the authority to stop the lifting operation if it is considered to be unsafe to continue and refer to the Appointed Person.

Where the Contractor provides the crane and the services of an Appointed Person, they must provide details of the lifting equipment that will be used, including configuration, duty charts, location relative to installation area, etc. The Precast Installer will provide details to the Contractor's Appointed Person of the weights of the units to be installed and agree an off-loading position. The Appointed Person and Crane Supervisor must be identified in the Method Statement. Prior to commencement of the works, the Principal Contractor's Site Representative must demonstrate to the Precast Installer that the lifting operations have been adequately planned.

6.4 Crane hire or contract lift

6.4.1 General

Given the wide variety of contractual arrangements used in the construction industry, it is important to ensure that the planning, organisation, control and management of lifting operations is not compromised. In general, any organisation requiring a load to be moved by crane, which does not have its own craneage, has two basic options:

hiring a crane (Hired Crane) or employing a contractor to carry out the lifting operation (Contract Lift). The difference between the two options is summarised in Figure 6.1

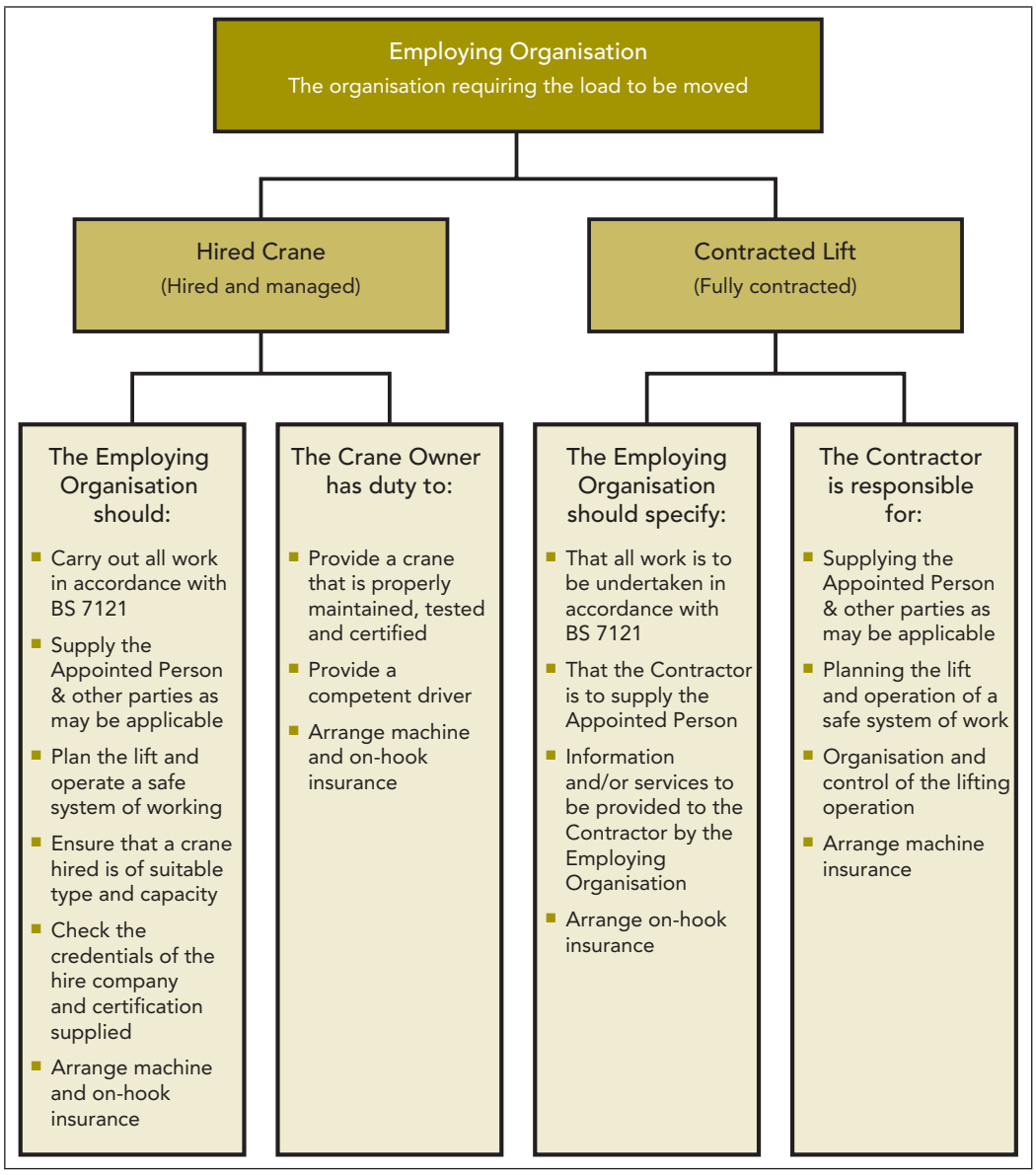


Figure 6.1
Organisation of hired/contracted lifting operations

If an individual or organisation does not have the expertise in lifting operations they should not hire cranes but should opt instead for a contract lift. Before entering into a contract, Employing Organisations should satisfy themselves that the Lifting Contractor has the necessary competence to carry out the work.

Note: Responsibilities for insurance of the crane, personnel, the load and third parties may also need to be clarified.

Note: Responsibility for ground conditions, ie. survey and assessment of the ground bearing capacity, remains with the parties in control of the site information (usually the Principal Designer and Principal Contractor). The crane owner is expected to provide information on maximum outrigger loads (in tonnes or kN per m2). Combining this information allows the Employing Organisation to make decisions about which crane to request and, as needed, how to ensure that ground loadings are reduced or ground capacity is increased. Organising this information may involve the Appointed Person working with the site engineer, or the information may be obtained early and passed to the Appointed Person to help them plan the lift.

6.4.2 Employing Organisation's duties when hiring cranes

When a crane is hired out together with an Operator to the Employing Organisation, the crane owner should provide a Competent Operator and a crane that is properly maintained, inspected and tested in accordance with BS 7121-2, and has a current report of thorough examination (12 monthly for lifting materials; 6 monthly for lifting persons). The Employing Organisation retains the responsibility for nominating the Appointed Person and for following the recommendations given in the BS 7121 series. Despite any advice the Crane Owner might have offered concerning the selection of a particular crane or any other relevant matter, for example clearances or ground conditions, the responsibility for ensuring that the crane is of a suitable type, size and capacity for the task being undertaken and for planning the operation remains with the Employing Organisation. Therefore if an individual or organisation does not have expertise in lifting operations, they should not hire cranes but should opt for a contract lift.

6.4.3 Contract lifting operations

The Employing Organisation may enter into a contract with a lifting contractor who undertakes work on their behalf.

The parties to the contract should ensure that:

- All work is carried out in accordance with BS 7121 series.
- The lifting contractor appoints a competent Appointed Person to the satisfaction of the Employing Organisation.
- All information or services provided by the Employing Organisation to facilitate compliance with the BS 7121 series are notified to the lifting contractor in writing.

The lifting contractor should carry out lifting operations in accordance with the BS 7121 series. The lifting contractor should be given full authority by the Employing Organisation to work in accordance with the BS 7121 series including, where appropriate, authority to control and instruct the Employing Organisation's personnel.

Before entering into a contract, Employing Organisations should ensure that the lifting contractor has the necessary competence to carry out the work in accordance with the BS 7121 series.

6.5 Planning the lifting operation

6.5.1 General

All lifting operations should be planned to ensure that they are carried out safely and that all foreseeable risks have been taken into account. Planning should be carried out by an Appointed Person who has the appropriate knowledge for the lift being undertaken. In cases of repetitive or routine basic lifting operations, this planning might only be necessary in the first instance, with periodic reviews to ensure that no factors have changed.

Planning of the lifting operation should take into account:

- The load, its characteristics and the method of lifting.
- The selection of a suitable crane(s) appropriate to the operation ensuring that adequate clearances are maintained between the load(s) and the crane structure.
- The selection of accessories for lifting/lifting attachments, their weight to be taken into account when assessing the total load on the crane(s).
- The position of the crane(s) and of the load before, during and after the operation.
- The site of the operation including space availability and suitability of ground conditions or foundations should be determined by the Principal Designer and/or Principal Contractor based on sound information.
- Any ground improvement - such as a crane platform must be designed by a temporary works engineer.
- Any load spreading pads or grillage must also be designed with engineering input from the crane supplier's engineer or the site temporary works engineer. Lift supervisors are not responsible for assessing the ground conditions without specialist support.
- Any necessary installation and dismantling of the crane(s).
- Any further planning requirements and management for multiple cranes on site.
- The environmental conditions that exist or might occur at the site of the operation or the effect of the load on the crane.

6.5.2 Risk assessment

As part of the planning process a risk assessment should be carried out by the Appointed Person to identify the hazards associated with the proposed lifting operation. The assessment should consider each hazard involved and the extent of any control measures required to ensure the risk of incident is acceptably low. The assessment should also take into account the existing general site risk assessment and whether this may need revising in the light of the work and control measures now proposed.

The results of the risk assessment should be recorded in writing and used in the preparation of the method statement for that site.

6.5.3 Method Statements

Once the risk assessment has been carried out, the Appointed Person should ensure that a full Method Statement is prepared, detailing the safe system of work for the lifting operation and including the risk assessment.

When necessary, the Appointed Person should consult with others with specialised knowledge and experience.

The Method Statement should include:

- The tasks to be achieved, together with the configuration of the crane at the end of each day's work.
- Details of the steps to be taken to eliminate danger to personnel not involved in the lifting operation, and where necessary, prevent their entry into danger zones, e.g. by organising for road closures if necessary.
- The requirement for pre-use checks to be completed.
- A clear statement of the allocation of tasks to all parties involved in the lifting operation.

The lifting operation will be under the control of a Crane Supervisor who has the authority to stop the work if local conditions are unsatisfactory.

The Crane Supervisor should ensure that the team is inducted at the start of the job in the general site precautions and the specific features of the method statement.

A copy of the method statement and associated work instructions should be sufficient to provide the basis for a briefing or induction and should be clearly communicated to all those involved in the lifting operation.

The Crane Supervisor or Contractor's representative should normally take the opportunity during the site induction to seek the views of the team about any arrangements for health and safety that might be relevant to them.

To be effective, the Method Statement needs to specify clear roles for each member of the team. Arrangements for effective communication among the team (and if necessary with adjacent Crane Drivers in case of danger) should be agreed. Components requiring special lifting arrangements may require separate Method Statements.

6.6 Selection and duties of personnel

6.6.1 Selection of personnel

Safe lifting operations depend upon the selection of suitable personnel who are competent to carry out the required duties. Records of training and experience of persons such as the Crane Driver assist in the selection of suitable personnel.

Those responsible for the selection of personnel should ensure that the personnel involved in the operation are efficiently organised in order to ensure good team-work in the working situation.

Work associated with lifting operations should not be carried out by personnel whose efficiency is impaired by alcohol, drugs or other influences. It is essential that all personnel in the team are made aware of both this fact and their other duties.

Where personnel are undergoing training, they should be supervised by appropriate personnel.

6.6.2 Duties of personnel

Crane Supervisor

The Crane Supervisor should direct and supervise the lifting operation, ensuring that these are carried out in accordance with the method statement. The Crane Supervisor should be competent and suitably trained and should have sufficient experience to carry out all relevant duties. The Crane Supervisor should have sufficient authority to stop the lifting operation if they consider it dangerous to proceed.

Crane Coordinator

The Crane Coordinator should plan and direct the sequence of operations of cranes to ensure that they do not collide with other cranes, loads and other equipment.

Crane Driver

The Crane Driver should be responsible for the correct operation of the crane in accordance with the manufacturer's instructions and within the safe system of work.

The Crane Driver should only respond to a signal from the slinger to carry out the initial lifting of the load, and then only to signals from one slinger/signaller who should be easily identified during the remainder of the lifting operation.

In an emergency, a commonly recognised stop signal may be given by any person observing a situation that could lead to danger and the Crane Driver should respond to that signal.

Slinger

The Slinger should be responsible for attaching and detaching the load to and from the crane load lifting attachment and for the use of the correct accessories for lifting and other equipment in accordance with the planning of the operation.

The Slinger should direct the initial movement of the crane. If there is more than one Slinger, only one of them should have this responsibility at any one time, depending on

their positions relative to the crane.

Where continuity of signalling is required and this Slinger is not visible to the Crane Driver, another Slinger or signaller may be necessary to relay signals to the Crane Driver. Alternatively, other audio or visual methods may be used.

Where audio or visual methods are used, the equipment or its means of use should be such that the operator of the equipment is immediately aware of failure of the equipment, to enable them to stop crane movements.

If, during the lifting operation, responsibility for directing the crane and load is to be transferred to another person trained and competent to act as Slinger, the first Slinger should clearly indicate to the Crane Driver that this responsibility is being transferred and to whom, and he should clearly indicate to the new person that this transfer is taking place.

Furthermore, the Crane Driver and the new person should clearly indicate that they accept the transfer of responsibility.

Signaller

The Signaller should be responsible for relaying the signal from the Slinger to the Crane Driver. The Signaller may be given the responsibility for directing movement of the crane and load instead of the Slinger, provided that only one person has the responsibility at any one time.

6.6.3 Minimum attributes of personnel

All personnel should:

- Have the necessary skills, knowledge, experience and training to perform the tasks required of them.
- Be able to present a record of training and assessment.
- Be physically able to carry out the work.

6.7 Selection of cranes

Note: See the appropriate part of BS 7121 for details of the different types of crane and their operational characteristics.

Cranes are available in a number of forms and the characteristics of the various machines should be considered in relation to the job requirements. Having decided upon the type of crane and knowing the overall requirements involved, a crane that can carry out the planned lift safely should be selected.

Points to be taken into account when making the selection of the crane include the following:

- Weights, dimensions and characteristics of loads.
- Operational speeds, radii, heights of lifts and areas of movement of the crane and its load.
- Number, frequency and types of lifting operations.
- Length of time for which the crane is required.
- Site, ground and environmental conditions, or restrictions arising from the use of existing buildings.
- Space available for crane access, installation, travelling, operation and dismantling.
- The shape of the units to be lifted as this may lead to changes in orientation during transport, lifting and installation.
- Any special operational requirements or limitations imposed.

Particular care is needed when considering lifting operations around, over or into part completed structures. The state of play often needs to be considered in 3 dimensions to ensure there is room for the load to be moved from lifting to landing point with sufficient clearance of adjacent or projecting parts of the structure at all times.

6.8 Safety

6.8.1 General

The person or organisation having overall control of the place of work and the employers of personnel involved in the lifting operation have the responsibility for safety during lifting operations. In order that this responsibility can be effectively discharged, the Appointed Person should be given the necessary authority to ensure that adequate systems to achieve safety are in operation. Safety matters relating to lifting operations include the use, maintenance, repair and renewal of safety equipment and the instruction of, and allocation of responsibilities to, the various personnel in relation to the equipment.

6.8.2 Weather restrictions

Irrespective of the type of equipment used in lifting operations, inclement weather has an effect on the safety of the lifting operations. The amount of influence will vary with the contract and the type of equipment used.

The most common problem presented by inclement weather is that caused by wind, which can seriously increase the dangers involved in lifting operations.

Information on wind speed restrictions related to tower cranes is readily available and, as most tower cranes are fitted with wind speed indicators, the application of these restrictions should be enforced.

In the case of mobile cranes, fixed wind speed indicators are not a statutory requirement but the lift plan must establish the maximum operational wind speed (ie manufacturer's limits based on the configuration in question, plus any downrating due to the shape of the load - eg high sail effect or low weight) and they must be able to compare this to the prevailing conditions. In most cases this means an anemometer should be used otherwise the operator may justifiably wind-off the crane earlier than may be necessary. Reference can be made to the Manufacturer's Operating Manual and Duty Chart or to the Crane Owner for specific restrictions which allow for 'wind sail' area and make reference to wind speed (expressed in miles per hour, knots, metres per second, kilometres per hour, or by reference to the Beaufort scale). Note that wind conditions can vary considerably within a local area. The presence of buildings can reduce wind but can also lead to wind funnel and higher speeds than surrounding areas. Wind is generally much stronger at height than at ground level. In all cases the decision about whether to halt lifting operations due to local weather conditions ultimately rests with the crane driver and site management should respect the crane driver's decision.

6.8.3 Identification of person directing crane movements

The person directing crane movements (Slinger or Signaller) should be easily identifiable to the Crane Driver, for example by wearing different coloured high visibility clothing different coloured safety helmet or by using radio call signs. When choosing high visibility clothing, the backgrounds, type of illumination, similarity to other operatives and other relevant factors should be taken into account to ensure mistaken identity does not occur.

6.8.4 Rated Capacity Indicators and Limiters

All cranes with a Safe Working Limit (SWL) of 1 tonne or more must be fitted with a Rated Capacity Indicator and Limiter (RCI/RCL) All RCI/RCL must give the following warnings:

- Warning of approach to SWL. When the load weight approaches the SWL of the crane at that radius, a warning of approach to SWL will be displayed to the Operator. This may take the form of a visual or an audible warning within the cab.
- Warning of overload. When the load weight exceeds the SWL of the crane, a visual and audible warning of overload will be given to the Crane Driver. The audible warning will also be sufficiently loud to be heard by those persons working in the vicinity of the crane.

Note that on tower cranes that tend to be rigged with the same hook block for their duration on site the duties chart SWL may apply just to component load and accessories (ie lifting chains, spreader beam, etc). However for mobile cranes where hook block may be changed often, the load weight is the item being lifted, plus the hook block, plus lifting accessories as above UNLESS the duties chart is specifically adapted to cover the use of a particular hook block.

Most cranes are fitted with one or more override key switches. These switches are intended for use during rigging and de-rigging of the crane. They must not be used to override the RCI/RCL in order to lift loads that exceed the rated capacity of the crane.

It is important that the Crane Driver ensures the RCI/RCL is correctly set up for the configuration of the crane.

6.8.5 Documentation – certificates, records and registers

6.8.5.1 Crane Drivers

The Appointed Person, or the Crane Supervisor in charge of the lifting operation, is responsible for checking all documentation for the Crane Driver, and crane and lifting accessories documentation before work commences.

6.8.5.2 Operator training qualifications

All Crane Drivers should be able to demonstrate competence in operating the machine in use.

Within the requirements of legislation and Health and Safety guidance notes, there is a requirement for Crane Drivers to be trained and competent on the cranes that they are to operate.

The Construction Plant Certification Scheme (CPCS) provides for certification of Plant operatives. Systems are in place for operator registration, record management and fast access to an individual's summary achievements and status in order to check the validity of a presented training card. Most cards and training are valid for a period of 5 years and renewal needs to be planned ahead with proof of current awareness of health and safety issues, ongoing training and a log book of work associated with each card category held.

Under the CPCS, all Operatives registered are issued with a CPCS Red Card (new entrant) or CPCS Blue Card (experienced operative), an example of which can be seen in Figure 6.2.

Although a voluntary scheme, most crane hire companies have adopted the CPCS. On most sites there is a requirement for all Operators to hold a CPCS card. However, the driver should also be able to demonstrate his competency on the crane he is operating.

The Crane Supervisor should check the Crane Driver, and other personnel, have the correct CPCS category and also the expiry date for the machine he is operating (see Figure 6.2).

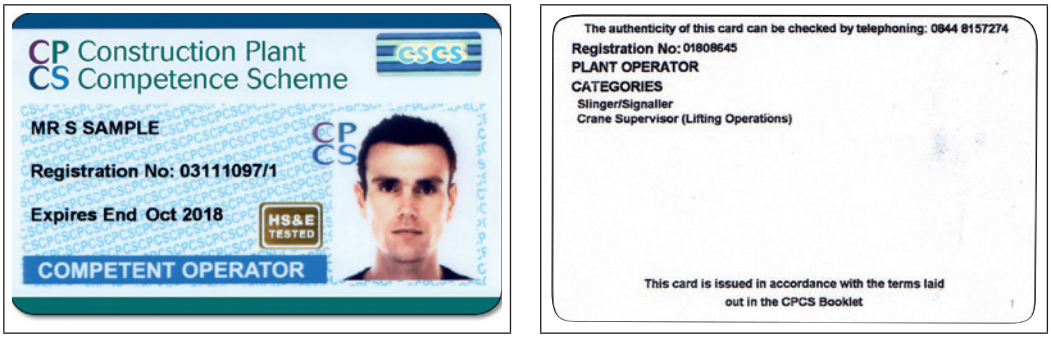


Figure 6.2
Card issued by Construction Plant Certification Scheme

6.8.5.3 Documentation

LOLER and PUWER require Crane Owners to nominate a Competent Person who has appropriate practical and theoretical engineering knowledge and experience of the lifting equipment to carry out the Thorough Examination. This will enable them to detect defects or weaknesses and to assess their importance in relation to the safety and continued use of the lifting equipment. The Competent Person should be sufficiently

independent to be able to take decisions without fear or favour. Where the Competent Person is employed by the Crane Owner, measures should be in place to ensure that the person is not involved in any maintenance activity with the crane or in examining his own work.

All cranes must carry documentation that provides:

- A record of Daily and Weekly Inspections – All cranes must be inspected by the Crane Driver on a daily and weekly basis and the results must be properly recorded on an inspection sheet.
- A record of Thorough Examinations – All cranes must be thoroughly examined by a Competent Person every 12 months (six months if crane is for lifting persons).

Information (Prescribed Particulars) to be contained in a report of Thorough Examination is listed below:

- The name and address of the Employer for whom the Thorough Examination was made.
- The address of the premises at which the Thorough Examination was made.
- Particulars sufficient to identify the equipment including, where known, its date of manufacture.
- The date of the last Thorough Examination.
- The safe working load of the lifting equipment or, where its safe working load depends on the configuration of the lifting equipment, its safe working load for the last configuration in which it was thoroughly examined.

The Thorough Examination must take place:

- For lifting equipment for lifting persons or an accessory for lifting persons or equipment, at least every 6 months.
- For lifting accessories, at least every 6 months.
- For cranes, every 12 months or every 6 months if used for lifting persons.

Every Thorough Examination of Lifting Equipment Report should include:

- Identification of any part found to have a defect which is, or could become, a danger to persons, and a description of the defect.
- Particulars of any repair, renewal or alteration required to remedy a defect found to be a danger to persons.
- In the case of a defect which is not yet, but could become, a danger to persons:
  - The time by which it could become such a danger.
  - Particulars of any repair, renewal or alteration required to remedy it.
  - The latest date by which the next Thorough Examination must be carried out.
- Where the Thorough Examination included testing, particulars of any test:
  - The date of the Thorough Examination.
  - The name, address and qualifications of the person making the report, if he is self-employed or, if employed, the name and address of his employer.
  - The name and address of a person signing or authenticating the report on behalf of its author.
  - The date of the report.

The above list is an extract from Regulation 10(1) from LOLER.

6.8.5.4 Lifting accessory test records

When purchased, lifting accessories should be supplied with a Declaration of Conformity (DOC) to the Machinery Directive and be accompanied by a Test Certificate. The DOC may be used in lieu of a Report of Thorough Examination for the first six months after purchase.

There may be times when more than one item of lifting accessory is displayed on the record, particularly when accessories are purchased in batch order quantities.

6.8.5.5 Lifting accessory examination records

The following key points should be identified:

- Record number or letter.
- Description of accessory.
- Identification number on item.
- Examination date.
- Owner of accessory.
- Condition of accessory, e.g. 'In good order and safe to use'.
- Signature of examiner.
- Last examination date.
- Latest date of next examination.

When examinations have been carried out by an independent organisation, the examination report should be made on that organisation's headed record.

6.9 Siting of cranes

6.9.1 General

Siting of the crane should take account of all the factors that could affect its safe operation, particularly the following:

- The crane standing and support conditions.
- The presence and proximity of other hazards.
- The effect of wind during in-service and out-of-service conditions, the adequacy of access to allow the placing or installation of the crane in its working position and for dismantling and removing the crane following completion of lifting operations.

Note: Further details regarding the siting of mobile and tower cranes are given in CIRIA publication C703 which also provides information that may be relevant to other types of crane.

6.9.2 Stability of cranes

Unless otherwise agreed, the suitability of ground conditions is the responsibility of the CDM Principal Contractor, who must ensure that the crane standing position(s) is prepared in accordance with the loading provided by the Appointed Person.

The stability of mobile cranes relies on the following factors:

- That the ground is suitably compacted and levelled. Underground services or constructions may suffer damage or collapse due to a crane passing over or nearby, which in turn may lead to the crane overturning. Arrangements must be made to avoid underground services and constructions, and basements.
- That the outrigger beams on the crane are extended to the required lengths or positions in accordance with the crane manufacturer's specified duties and dimensions.
- That the outrigger jacks are extended to raise the crane wheels off the ground and free of weight. Where wheels are not raised off the ground, all or the majority of the weight is carried by the stabilisers.

- That adequate support material has been positioned under the outrigger jacks to prevent them sinking into the ground whilst lifting loads.
- That the crane carries out lifting strictly in accordance with the manufacturer's tables of Safe Working Loads, i.e. Duty Charts.
- Specific outrigger loadings are available from the Crane Owner.
- The Crane Supervisor and Crane Driver must monitor ground conditions during the course of installation, paying attention to deterioration as a result of usage and adverse weather.
- If the operator has any doubt about the actual ground conditions or needs to question the reassurance they've been given by site management, they should decline to rig the crane and seek advice from their own management. A well organised and a good site will have a range of documentation that the operator can be shown. This should include a ground investigation report and assessment; crane platform design plus records showing construction to the design and including hand-over certification on completion;and for any load spreading pads or grillage, a design and proof that the supplied equipment meets the design.
- If the condition of the ground or any crane platform needs to be checked this is best achieved using plate testing and/or cone penetration testing to measure and report on the ground condition and whether it exceeds that needed by the crane for the lift/s in question.

6.9.2.1 Guidance on crane outrigger loadings

Having decided on the location, minimum size and type of crane to be used for the lifting operation, the outrigger loads need to be obtained. Most reputable crane suppliers should be able to provide this information. The crane supplier will need the following information concerning the crane configuration and intended loads to be lifted:

- Crane size and type.
- Boom extension.
- Outrigger spread.
- Length and offset of any fly jib.
- Hook block.
- Total quantity and location of counter weight fitted to the crane for the lift
- Maximum load to be lifted
- Maximum radius the load will be taken to during the lift together with the pick-up and lay-down radii.
- Slew arc for the lifting operations.

This information should be provided to the crane supplier in a written format, generally as a drawing with tabular data. The crane supplier should likewise respond in a written format. Typically the information provided will include maximum and minimum point loadings in tonnes or kN for each individual outrigger.

If information is not available from the crane supplier, it can be obtained from the crane manufacturer. Care must be taken, however, to ensure that the manufacturer is provided with the serial number, exact model and configuration of the crane to be used. This information can also be obtained from proprietary software packages or calculations from first principles, but again, extreme care must be taken to ensure that the correct make, model and configuration of crane has been selected.

6.9.2.2 Access and hardstanding

Examination of ground conditions should be thorough, including the condition of ground adjacent to the access and the working area of the crane. Special attention must be paid to:

- Trenches may require additional shoring to prevent collapse when a crane stands or passes nearby.

- Cellars and basements must also be considered to present the same risk as trenches.
- Inadequately compacted fill to trenches or excavations can lead to the overturning of a crane passing over or standing on such ground.
- Underground services or constructions may suffer damage or collapse due to a crane passing over or nearby, which in turn may lead to the crane itself overturning.
- Ramps, slopes or uneven ground can seriously affect the stability of a crane and must, therefore, be avoided, made safe or approached with extreme caution.

Following the visit of the Appointed Person, the Contractor must have considered any conditions on site which could have a detrimental effect upon the safe passage and working of a crane. If there is any doubt as to the suitability of any aspect of the site, it must be brought to the attention of the Principal Contractor's Site Representative in order that remedial measures may be implemented. The Crane Supervisor and Crane Driver must continue to monitor ground conditions during the whole operation, paying particular attention to deterioration as a result of usage and adverse weather.

The crane must operate only from the position(s) formally agreed between the Appointed Person and the Principal Contractor's Site Representative or such other position as may be agreed at the time by the Crane Supervisor after consultation with the Appointed Person and the Principal Contractor's Site Representative, provided that the level of safety is not reduced as a result and the Appointed Person has reviewed and approved the method statement amendment.

Unless otherwise agreed, the crane standing should be constructed by the Contractor to take the outrigger loadings or, where a specific type of crane does not utilise outriggers, the ground loading pressure provided by the Appointed Person. The crane standing should be a minimum of 8m x 8m unless otherwise specified by the Appointed Person. The entire pad should be level and constructed to take the outrigger loadings to allow for the final positioning of the crane.

The adequacy of each crane standing position must be confirmed in writing by the Principal Contractor's Site Representative, or other Competent Person on their behalf, prior to the crane working in that position.

6.10 Hardstanding preparation

6.10.1 Principal Contractor confirmation of hardstanding bearing capacity

Before a crane arrives on site, existing information on the nature of the soils should have been studied, any additional site investigations required should have been carried out and warnings of specific hazards should have been identified in the Pre-Construction Information.. The Principal Designer and/or temporary works coordinator should be of assistance to the Contractors' site manager in ensuring adequate provision of such an assessment.

The Contractor must provide adequate information to the Appointed Person regarding the hardstanding capability. In order to achieve this they should ensure an assessment of the proposed crane hardstanding is undertaken by a Competent Person and confirm the bearing capacity in tonnes/m2 to the Appointed Person. Whether using ultimate or maximum allowable/permissible bearing capacities these should be stated within the assessment. The detail and timing of investigative works/assessment (relative to the lifting operations) will help to determine the safety factor applied to the crane planning operations.

Care should be taken to ensure that construction activity and ground water content have not undermined the hardstanding capability since initial assessment. Further investigation and/or additional safety factors may need to be considered by the Contractor's Competent Person and the Appointed Person. The assessment may require input from a geotechnical engineer.

It is vital that supplied information is totally clear about whether data is presented as (unfactored) ultimate strength or (factored) safe working load. The engineer should also be made aware of the integral safety factors built into the crane outrigger load

calculations. This should enable the Appointed Person to make a decision based on appropriate calculations and avoid including additional safety factors upon confirmation of the hardstand bearing capacity. Such overly cautious assessments can result in a "requirement" for impractically large/inefficient outrigger mat thickness.

Appointed Persons and engineers should refer to CIRIA publication C703 or BRE BR470 for more information/guidance on factors of safety.

Note: Ground loadbearing test results for a given area can vary from day to day, as ground moisture content is a major factor in determining its loadbearing characteristics. It is prudent to apply a factor of safety to all calculations where there is any possibility of ground deterioration after tests have been undertaken.

6.10.2 Appointed Person – proposals to adequately spread the outrigger load

Following confirmation of the hardstanding bearing capacity, the Appointed Person will confirm the proposed outrigger mat size to ensure the ground bearing capacity is not exceeded at any time.

In the absence of hardstanding bearing capacity information at the time of initial crane planning, it is acceptable for the Appointed Person to propose in advance outrigger loads (in tonnes/m²) to the Contractor. The Contractor must then ensure a suitable assessment takes place. This should include confirmation that the proposed tonnes/m² outrigger load is acceptable, or whether additional consideration is required prior to finalising the crane planning. If the crane mat size options mean that the maximum allowable bearing pressure is still exceeded the Contractor's Competent Person should contact the Appointed Person without delay to discuss additional assessment/ground preparation/load spread.

6.10.3 Use of outriggers

In order to achieve 'fully rigged, on outrigger duties' all beams have to be fully extended and all wheels off the ground, as shown in Figure 6.3. Some cranes have duties for 'free on wheels' and/or short outrigger base. For more information refer to manufacturer's duty charts.

The difference in level between any two outrigger supports should be less than 300 mm and the ground beneath each pad should be levelled to avoid any risk of the crane sliding off outrigger support pads.

Note: When working, monitor the outriggers frequently. If there is any concern regarding stability of the outrigger or support pads, work should cease immediately to enable further assessment of the crane hardstanding area.

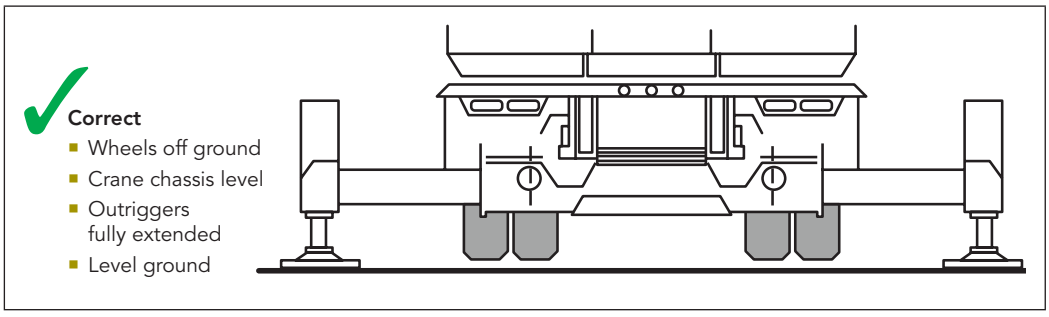


Figure 6.3a
Correct use of outriggers

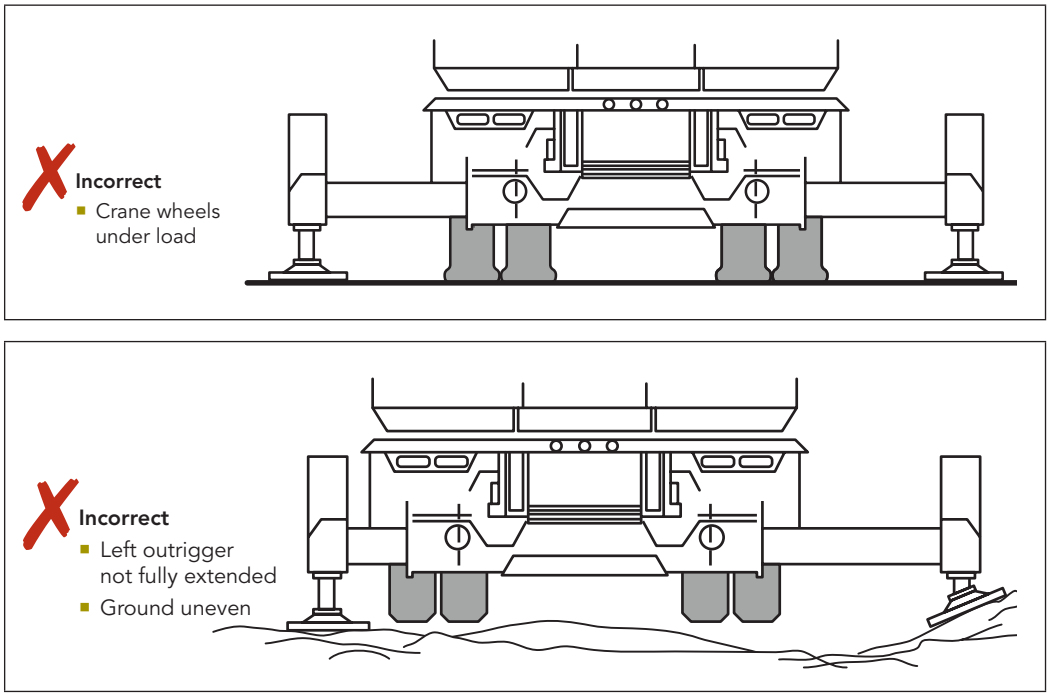


Figure 6.3b
Incorrect use of outriggers

6.11 'Permit to lift' system/confirmation to proceed

Prior to commencing the lifting operations, the Contractor should sign confirmation that:

- The crane is rigged in the anticipated crane stand position as indicated on the Lift Plan.
- The crane hardstanding has been prepared adequately to withstand the load specified on the Lift Plan.
- Full consideration has been given to all factors, including potential ground deterioration due to weather or construction activity since initial investigation or assessment.
- The Principal Contractor should then confirm daily that these conditions are still met by signing off the work. Any concerns regarding the lift operation should be communicated to the Appointed Person, Crane Supervisor and Crane Driver who all have the authority to veto the lift.

6.12 Proximity hazards

6.12.1 General

Consideration should be given to the presence of proximity hazards such as overhead electric lines or cables, nearby structures including earthworks and retaining walls, other cranes, vehicles being loaded or unloaded, stacked goods and public access areas including highways, railways and rivers. Within steel framed buildings, consideration must be given to where there are obstructions such as tie beams, wind posts, sag rods, bracings and purlins etc which may foul or hinder a suspended load.

Where any part of the crane or its load cannot be kept clear of such hazards the appropriate authority should be consulted.

The danger to or from underground services such as gas mains or electric cables should not be overlooked. Precautions should be taken to ensure that the crane foundation is clear of any underground services or, where this is not possible, that the services are adequately protected against damage.

At any place where a crane or its load passes an obstacle, the following apply.

- Where practicable, the crane path should be clearly defined by marking to ensure that it is kept free from obstruction, and a clearance of not less than 600 mm should be arranged between any part of the crane and any obstacle. The signaller needs to have direct line of sight to both load and obstruction with clear view of the clearance gap. Where it is not reasonably practicable to achieve this clearance, effective precautions should be taken to prevent access to any trapping hazards.
- Where goods are regularly stacked near a crane, boundary lines for the stacking of goods should be permanently marked on the ground.

6.12.2 Safety near electricity lines

Whenever possible, work under or close to electricity lines should be avoided. HSE Guidance Note GS6 should be complied with, which requires all work on or near an electrical system to be carried out so as to prevent danger, so far as is reasonably practicable. Also refer to the Energy Networks Association (ENA) publication Look Out Look Up! A Guide to the Safe Use of Mechanical Plant in the Vicinity of Electricity Overhead Lines. This advises establishing exclusion zones around the line and any other equipment that may be fitted to the pole or pylon. The minimum extent of these zones varies according to the voltage of the line, as follows:

- low-voltage line – 1 m;
- kV and 33 kV lines – 3 m;
- 132 kV line – 6 m;
- 275 kV and 400 kV lines – 7 m

Where the safety margins in GS6 cannot be complied with, other methods should be taken to prevent danger. Lower voltage lines can be shrouded by the line operator. Where this is not possible arrangements should be made for the overhead lines to be electrically isolated and proved dead. If this is not possible, then rerouting of the service may be possible. Caution is still needed when working near overhead lines which have long spans, as they tend to swing laterally in the wind and accidental contact could occur.

Consideration should be given to the selection of a crane fitted with zoning systems that can be set to restrict slew angle, hook height and hook radius. Where such a crane is selected it is important that the setting and function of the device is verified by the Appointed Person prior to the crane being set up and the lift commencing.

Warning: All overhead lines and other electrical apparatus must be treated as live unless declared 'dead' and 'safe' by the line operator. If in doubt, seek advice. Cranes or other plant must not be operated within the exclusion zones shown below plus the maximum jib length, as shown in Figures 6.4a, 6.4b and 6.4c. If this is not possible seek advice and clearance from electric supplier/railway company to verify the safe system of work.

Note: 'Maximum jib length' is the length fully telescoped out or to a point of physical restriction, not simply the boom length in use.

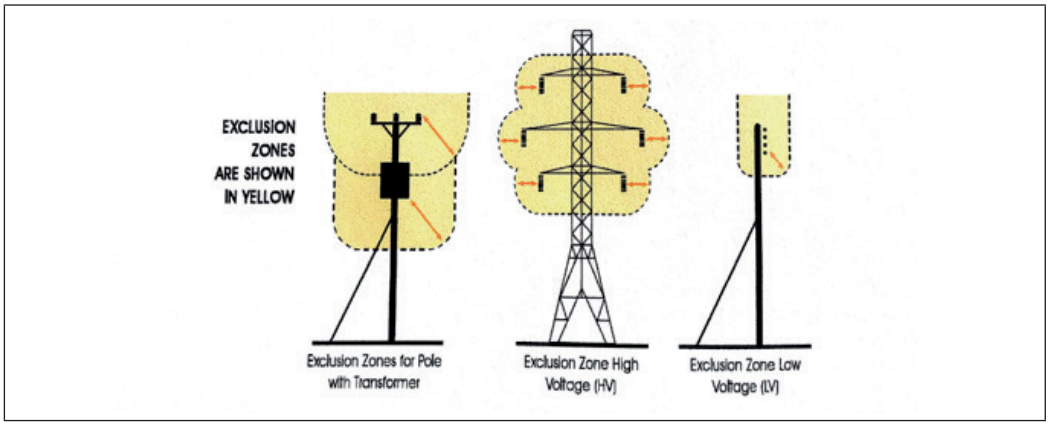


Figure 6.4a
Exclusion zones

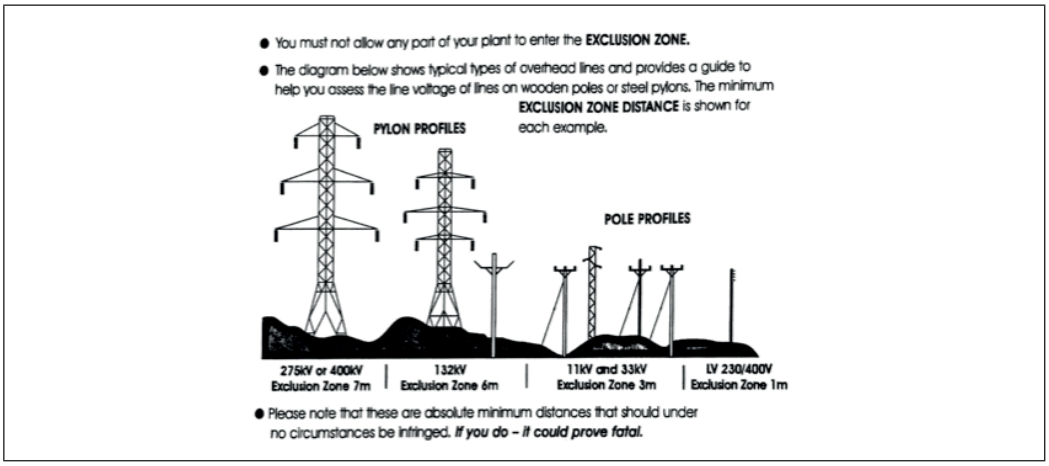


Figure 6.4b
Safety margins near electricity lines

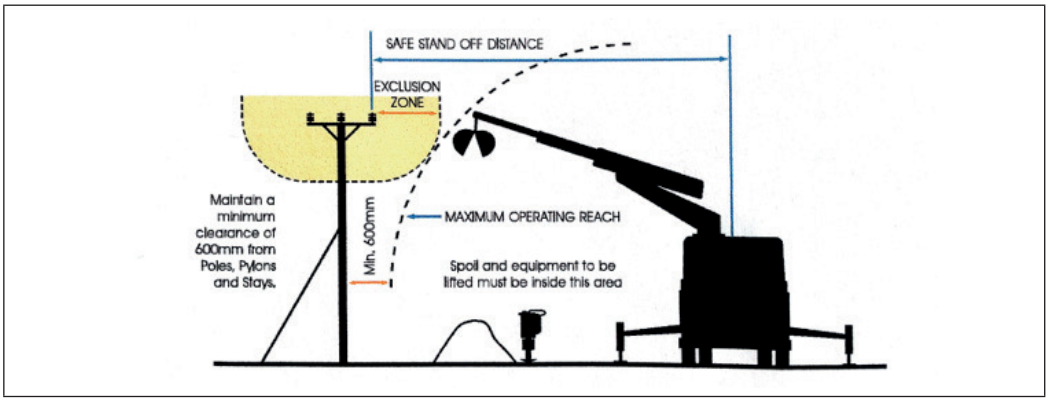


Figure 6.4c
Safe stand off distances

6.12.3 Crane control in the vicinity of aerodromes/airfields

If a crane is to be used within 6 km of an aerodrome/airfield and its height exceeds 10 m or that of surrounding structures or trees, if higher, the Principal Contractor should consult the aerodrome/airfield manager for prior permission to work. Restrictions could be placed on the overall height of the crane and there could be a requirement to fit warning (obstacle) lights to the top of the crane.

6.12.4 Crane control in the vicinity of railways

If a crane is to be used in the vicinity of railways, where there is a risk of the load or part of the crane obstructing the track if the crane fails or overturns, the appointed person should ensure the Principal Contractor consults the appropriate regional Network Rail Asset Protection Manager. Network rail will then assess the work activities being undertaken, and advise what course of action should be taken to ensure lifting operations are carried out as safely as possible.

6.13 Types of crane

6.13.1 Mobile telescopic cranes

General considerations

Mobile telescopic cranes normally operate on 'blocked duties' i.e. supported on outriggers. In such circumstances, all outriggers must be used, and they must be in their extended position and locked, as recommended by the crane manufacturer's operating instruction and duty charts.

Suitable mats must be used under the outriggers to spread the load from the crane, and to give proper firm support on all types of surface. It should be noted that, unless the Appointed Person confirms otherwise, standard outrigger mats will be provided with the crane. Refer to Section 6.9.2.1, Guidance on crane outrigger loadings, for further information. It may be necessary to provide a sand bed to ensure even distribution of the imposed loading beneath each outrigger mat.

The crane must be level, both lengthwise and across the chassis, and wheels lifted enough to be free from the ground before any lifting is attempted. The Crane Operator must check the level as often as is reasonably practicable during the lifting operations.

The Slinger/Signaller is responsible for attaching the load to the crane hook and using the correct lifting accessories and equipment in accordance with the Work Method Statement.

Where audio or visual methods of communication are used, the equipment or its means of use must be such that the Crane Operator will immediately be aware of the instructions. Ensure radios are adequately charged and maintained prior to operation.

When using radio as a means of communication, the Slinger/Signaller must continuously give repeated instruction to the Crane Operator, e.g. "Hoist, Hoist, Hoist","Stop", "Derrick in, Derrick in", "Stop", etc. If the Crane Operator does not receive continuous instruction from the Slinger/Signaller, he should stop the operation. This is a safety measure that compensates for any failure of the radio equipment.

6.13.1.1 Mobile telescopic cranes – 'free on wheels duties'

In some conditions, mobile telescopic cranes may operate on 'free on wheels duties' and may need to travel with a suspended load. When 'free on wheels duties' involving mobile telescopic cranes are unavoidable, specialist cranes must be used and the advice and approval of the crane owner sought. The Precast Installer must check with the Precast Manufacturer and Precast Designer that the Components have been designed and supplied with lifting inserts suitable for dynamic loads resulting from crane movements.

When travelling with a suspended load, great care must be taken and full liaison maintained between Crane Operator, Installation Supervisor and the Principal Contractor's Site Representative.

The crane must operate on level ground and proceed at a crawl pace in accordance with the manufacturer's guidelines. It should be guided by a competent Signaller, who should watch for hazards, slopes and uneven ground, all of which should be avoided.

Before allowing the crane to travel, the Appointed Person or Crane Supervisor must ensure that the Crane Driver and the Signaller are aware of the route to be followed and that the Crane Driver is confident that the operation can be safely undertaken.

Hand lines may be attached to the suspended load whilst the crane is slewing and held by one or more trained Competent Persons, to prevent swinging. At no point should any person stand under a suspended load while holding onto or collecting a hand line. The load should be carried as close to the ground as is reasonably practicable.

6.13.1.2 Mobile cranes - restricted duties

Most mobile cranes have 360° lifting duties, although some are restricted to side lifting and/or rear lifting duties, as shown In Figure 6.5; this must be considered when selecting cranes.

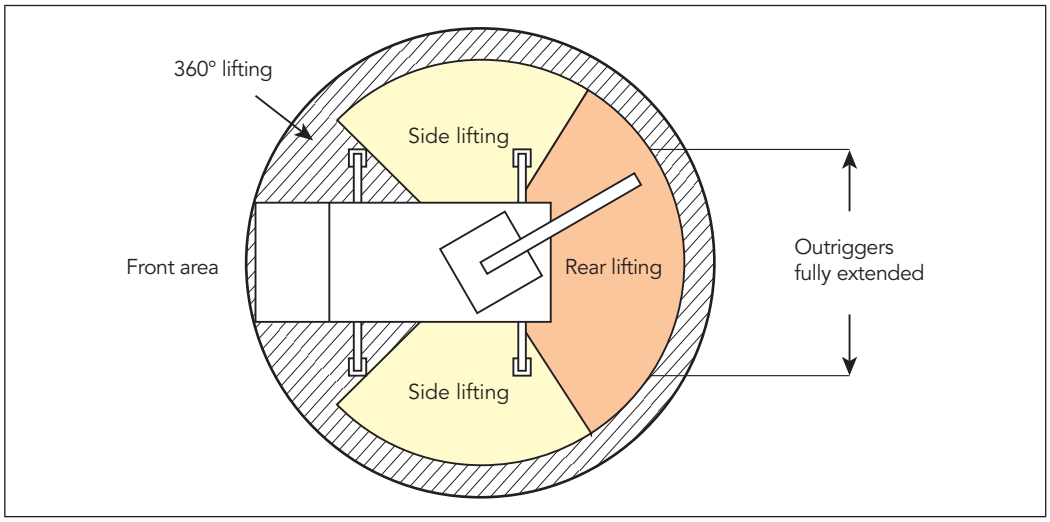


Figure 6.5
Mobile crane with restricted lifting duty

6.13.2 Crawler cranes

Crawler cranes offer an alternative to mobile telescopic cranes. These cranes operate with 360° lifting duties and a fixed or flexible boom, often accompanied by a fly jib for lighter duties with extended reach. They also operate on crawler tracks, which enable the crane to travel with a load. Detailed lifting plans and sketches of routes should be incorporated into the lift plans and safe system of work before a crawler crane is used. The Precast Installer must check with the Precast Manufacturer and Precast Designer that the Components have been designed and supplied with lifting inserts suitable for dynamic loads resulting from crane movements.

When travelling with a suspended load, great care must be taken and full liaison maintained between Crane Driver, Crane Supervisor and Principal Contractor's Site Representative. Dynamic forces and shock loadings exerted on the suspended load must be taken into consideration when lifting precast products with cast-in lifting inserts and when travelling across uneven ground conditions.

The crane must operate on level ground and proceed at a crawl pace. It should be guided by a competent Signaller/Banksman, who should watch for obstructions at ground level and overhead. They should also watch for uneven ground or slopes, both of which should be avoided.

Before allowing the crane to travel, the Crane Supervisor should ensure that the Crane Driver and Signaller/Banksman are aware of the route to be taken and that the Crane Driver is confident that the operation can be undertaken safely.

The suspended load should be carried as close to the ground as possible and hand lines should be attached to it during transit to prevent excessive swinging. At no point should any person stand under a suspended load while holding onto or collecting a hand line.

6.13.3 Tower cranes

The "Lifting Contractor" is responsible for ensuring that the tower crane has been installed and maintained by a Competent Person, in accordance with BS 7121 – Part 5 and the crane manufacturer's recommendations.

The Lifting Contractor is also responsible for ensuring that the lifting operation carried out by the tower crane is properly planned by a Competent Person in accordance with BS 7121 – Part 5. The person planning the lifting operation should have sufficient knowledge and experience of such operations. The plan must address risks identified during risk assessment and must show the resources required, in addition to procedures and responsibilities, so that the lifting operation can be carried out safely. The plan must also ensure that the lifting equipment remains safe for the different lifting operations/load configurations for which it will be used.

The Lifting Contractor is responsible for ensuring that the tower crane is capable of the duties required for lifting and installing the Components.

The Precast Installer is responsible for ensuring that the Lifting Contractor is provided with the weights and positions of the Components to allow the Lifting Contractor to fulfil his duties and adequately plan the lifting operation.

The Contractor must provide the Precast Installer and Lifting Contractor with details of dedicated offloading points for delivery vehicles.

As with other cranes, tower cranes must be properly tested and certificated. They must be operated by trained Certificated persons, unless under the direct supervision of a Certificated person for the purpose of training. The only other persons who should be allowed access to a tower crane are those people authorised by the Crane Owner/hirer, in order that they can carry out their legitimate business, e.g. maintenance workers, inspectors. This should only be done only after work is suspended and the area is cordoned off.

The Lifting Contractor should give special consideration when two or more cranes are being operated in close proximity, to avoid jibs coming into contact with other crane equipment, e.g. lifting ropes.

6.13.4 Lorry Loaders (Hiabs)

Lorry loaders (commercial vehicles or trailers, fitted with loader cranes, which normally have load-carrying capability) are sometimes used for the delivery and off-loading Components, particularly where crane off-loading is not possible or where access to the site is restricted. In general, lorry loaders should only be used for off-loading Components and not for their installation. The selection, operation, inspection, testing and maintenance of lorry loaders should be carried out in accordance with BS7121; *Code of Practice for Safe Use of Cranes*, Part 4; *Lorry Loaders*.

The nature of lorry loader lifts for architectural and structural Components will usually mean that the employing organisation will normally be the Precast Manufacturer under a contract lift arrangement. The Precast manufacturer must therefore ensure that he understands his duties and responsibilities under BS7121; Part 4.

Lifts using a lorry loader must be planned and fully risk assessed as with any other crane lift and a Safe Working Method Statement drawn up for each type of lift. There will need to be close liaison between the Precast Manufacturer, the lorry loader operator and the Precast Installer to ensure that the Safe Working Method Statement addresses all aspects of the safe unloading of the vehicle. This will include maximum chain angles and the use of lifting attachments and spreader beams, if required.

All operatives involved in the lift must have been properly trained and be competent to carry out their duties and have been fully briefed on the Safe Working Method Statement. The lorry loader operator, unless in imminent danger, must remain in control of the lorry loader throughout the lifting operation.

The siting of the lorry loader should take account of all the factors that might affect its safe operation, particularly the following: a) the standing and support conditions; b) the presence and proximity of other hazards; c) the impact of environmental conditions, e.g. the effect of wind; d) the adequacy of access to allow the positioning and set up of the lorry loader for the lifting operation, and for its stowage and egress after completion of lifting operations; e) hazards associated with working on or adjacent to a highway.

Under working conditions, the loads imposed on the tyres and stabilizers arise from the combined effects of: a) the dead weight of the vehicle plus loader crane; b) the lifted load plus any attachments; c) the load carried on the vehicle platform; d) dynamic effects caused by loader crane and lifted load movements. The Appointed Person should obtain confirmation from the Contractor that the loads imposed by lorry loaders can be sustained by the ground.

Care should be taken to ensure that Components are only off-loaded onto firm level ground capable of supporting them and positioned on bearers as detailed in Section 4.2 of this Code of Practice.

6.14 Start of the lifting operation

6.14.1 General

After carrying out the documentation check and having established that all is in order, the Appointed Person or Crane Supervisor can proceed as follows:

- Obtain confirmation in writing from the Principal Contractor's Site Representative (or other Competent Person on their behalf) that the hardstanding has been adequately prepared to receive all ground loadings previously notified and indicated on the Lift Plan.
- Ensure that all personnel involved are familiar with the Safe Working Method Statement/Safe System of Work and are fully briefed on their roles and responsibilities. Discuss with all personnel involved the intended lifting operation and weight of loads being lifted, including information on the heaviest load and maximum radius of operation. Signed acknowledgement of this briefing must be obtained from each person involved.
- Before allowing the crane to enter the work area, the Crane Supervisor and the Crane Driver must ensure, by joint inspection, that the access, working and adjacent areas are safe and suitable. Particular attention should be paid to overhead obstructions, e.g. cables, trees, arches, scaffolding, etc. and underground hazards such as attenuation tanks, trenches, cellars, basements, ramps and slopes, and these should be clearly identified in the Method Statement. Trenches or excavations that have recently been filled and not compacted sufficiently must be avoided. All proximity hazards must be identified and appropriate action taken as detailed in the Safe Working Method Statement.
- Supervise the maneuvering of the crane onto and across site and into the required set up position as indicated on the lift plan, ensuring that the public and other site personnel are not being put at risk.
- Ensure that, before lifting, site personnel have been warned of the lifting operation and have vacated the working radius of the crane.
- Ensure that the Crane Driver can identify and understand those who are to give signals and that all are aware of the code of signals that are to be used, see Figure 6.8 overleaf for recommended crane signals.
- Ensure that the lifting accessory is of adequate Safe Working Load (SWL), of suitable chain leg length for sling angle and that a hand line is available for use if required.
- Ensure that during lifting and placing loads the crane is lifting within safe working load, radius and capacity.
- When lifting from transport off site or with the crane positioned off site, particular attention must be given to segregation of pedestrians and traffic management.
- Ensure that the load/lifting equipment is clear of obstructions at all times.
- Monitor the lifting operation continuously to ensure that it progresses safely.
- Be prepared to stop the operation if personnel or the crane are working unsafely, or for any other reasons.

6.14.2 Safe Working Load Charts – Duty Charts

Each crane has an individual Manufacturer's Duty Chart, which clearly shows the boom length, lifting radius and load for the crane to work safely. These must not be exceeded (Figure 6.6).

These charts are set out in varying ways by the crane manufacturers, depending on the number of lifting configurations and duties in which the crane can work.

During planning, care should be taken to ensure that there is sufficient margin (factor of safety of minimum 10%) between the rated capacity of the crane at the operational radius and the weight of the load to be lifted.

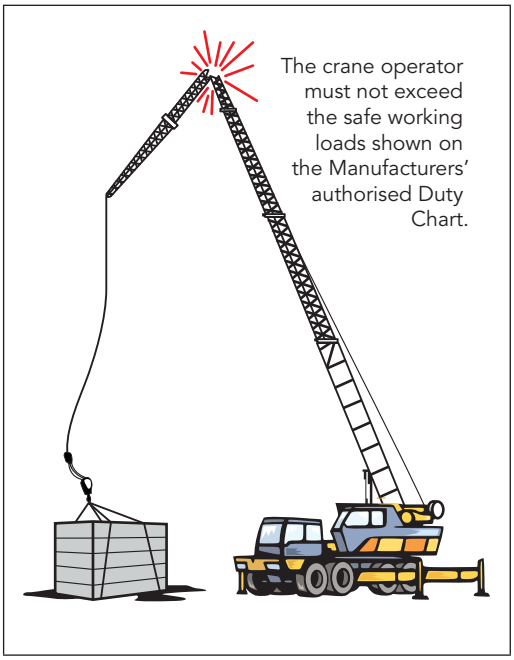


Figure 6.6
Illustration of the crane's capacity being exceeded

6.14.3 Slewing clearance warning

At any place where a crane or its load passes an obstacle, the following applies:

- Where practicable, the crane path should be clearly defined by marking to ensure that it is kept free from obstruction, and a clearance of not less than 600 mm should be arranged between any part of the crane and any obstacle (Figure 6.7).
- Where it is not reasonably practicable to achieve this clearance, effective precautions should be taken to prevent access to any trapping hazards.

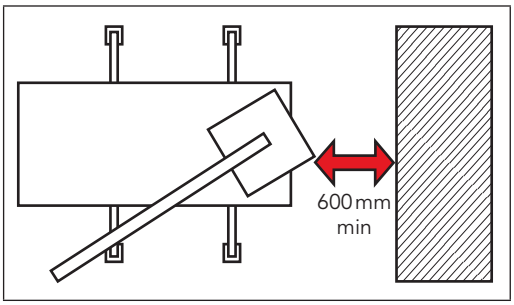


Figure 6.7
Illustration of a situation where site personnel could be trapped between the crane and a barrier when the crane slews

Figure 6.8
Recommended crane signals

6.14.4 Use of on-site equipment

Any equipment used on site must be fully certified and used only by trained and competent personnel.

In some instances the nature of the installation does not allow the load and Slinger/Signaller to be visible to the Crane Driver even in normal weather conditions, and alternative methods of signal relay have to be employed, e.g. radios. Ensure radios are adequately charged and maintained prior to operation.

When the above conditions apply to the installation, then the Slinger/Signaller giving signals to the Crane Operator must have the load in full clear view at all times. Another Slinger/Signaller may be required to ensure that there is control of the load at all times. Where inclement weather interferes with this view, then the lifting operation must be abandoned, and the load left in a stable condition.

6.14.5 Restricted headroom

Detailed planning should take place before attempting any contract where there is restricted crane headroom, for example, within a pre-prepared structure. Preparatory investigation should include, but not be limited to, the following:

- Distance between hook block and crane boom head.
- Over hoist limit switch – distance from head to hook block.
- Critical boom angle – the minimum angle to horizontal at which the crane will operate.

These all vary, depending upon the crane capacity and crane manufacturer (Figure 6.9).

Allowance must be made for deflections of the boom both under load and during movements.

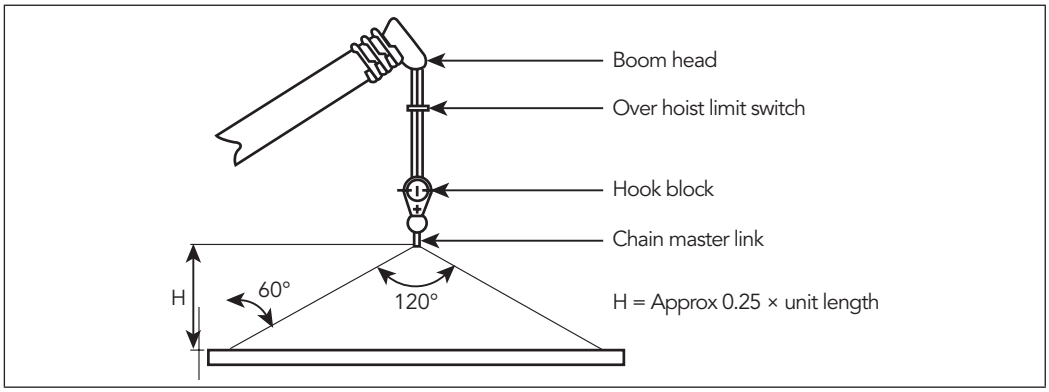


Figure 6.9
Factors to consider where there is restricted headroom

The lifting point centres in the Components will dictate the length of chains required, see Figure 6.10. Patent lifting devices can be used, but these may affect the headroom. The effect of lifting inclined precast units should also be considered.

Chain angles must be checked to confirm that permissible angles are not exceeded in respect of both the chains themselves and of the lifting inserts in the Components. Where chain angles are expected to be exceeded it will be necessary to introduce a spreader beam.

6.14.6 Lifting precast units at an angle

There are a number of reasons why lifting at an angle may be required:

- Feeding components through the structure;
- To clear the top flange of a steel beam where the floor plank will sit on a shelf part way down the beam.

- One end of the plank needs to be inserted fully to allow the other end to clear its support beam;
- Precast stairs are stored flat but often need to be lifted at their installation angle.

Units can be lifted at an angle with the same capacity chains as described below, provided the chain leg is always less than 45° to the vertical. Lifting units at an angle depends upon:

- Unit integrity.
- Unit shape, geometry and centre of gravity
- Suitability of bearings to land angled units
- Grip by choke hitch.
- The nature of cast-in lifting insert/ hook and its suitability for an angled lift (insert and clutch manufacturer's literature to be consulted to determine suitability)

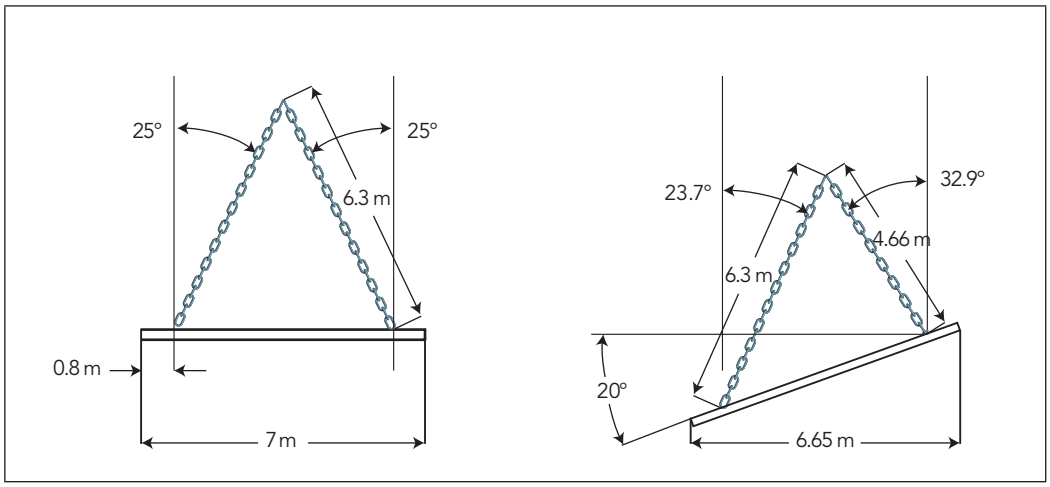


Figure 6.10
Lifting units at an angle (example with a beam at 7m long)

6.15 Examples of safe working practice indicated by use of typical trigonometry

Shortening chains on one side of the precast unit to be lifted enables the chain to maintain an angle of less than 45° from vertical. This is sometimes necessary when lifting precast units into areas where headroom is compromised or through restricted openings (eg stair units where landings are already constructed)

6.15.1 Chain slings

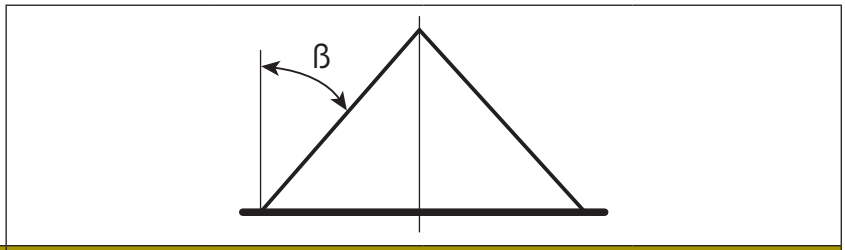
Under the LOLER (Lifting Equipment and Lifting Equipment Regulations), slings are classified as an 'accessory for lifting' i.e. work equipment for attaching loads to machinery for lifting. The more generic term of 'lifting tackle' encompasses chain slings, web slings, eyebolts, shackles, etc.

Under the LOLER Regulations all lifting tackle should be:

- Marked with its SWL (Safe Working Load) or WLL (Working Load Limit).
- Provided with information that indicates its SWL for each configuration.
- Thoroughly examined every 6 months.
- Certified either with a Declaration of Conformity, Thorough Examination Report or Original Test Certificate.

Chain slings used for general lifting purposes should be manufactured to current standards for Grade 8 chain. This standard calls for all slings manufactured for general use to be rated in the Uniform method for ranges of angles from 0° to 45° to the vertical or from 45° up to and including 60° to the vertical as shown in Table 6.3.

Table 6.3
The trigonometry method for rating of slings



Nominal size of chain (mm)	Maximum Safe Working Load for two-leg slings (tonnes)			
	ß = 0° – 44°	Choke Hitch Reduce SWL by 20%	ß = 45° – 60°	Choke Hitch Reduce SWL by 20%
8	2.8	2.24	2.0	1.6
10	4.25	3.4	3.15	2.52
13	7.5	6	5.3	4.24
16	11.2	8.96	8.0	6.4

Each sling should also have relevant information on an affixed tag, showing:

- Number of chain legs.
- Nominal size of chain in mm.
- Lifting capacity at 45° to vertical, angle ß.
- Lifting capacity at 60° to vertical, angle ß.

The capacity of chains marked in the Uniform method cannot be increased by reducing the included angle.

Chain slings rated in the Trigonometrical method are no longer manufactured for general-purpose use within BS EN 818–4.

Although chain slings are manufactured to BS EN 818–4 and rated in the Uniform method, existing slings previously rated in the Trigonometrical method can still be used, provided they are regularly inspected and have the relevant certification.

The Trigonometrical method provides for a variation in the WLL as the angle to the vertical varies and its use was a common practice throughout the UK for multipurpose applications. Care must be taken when using slings rated in the Trigonometrical method as the Slinger must be provided with tables showing the SWL at various angles for each size of chain. There is an inherent danger of overloading the sling if the angles have been misjudged.

6.15.5 Multiple leg slings

Multiple leg slings are comprised of more than one leg, which are connected by intermediate links to the master link.

They are marked with the SWL and identification serial number on the master link or tag. The SWL should be calculated by using either the Uniform or the Trigonometrical method.

When using multiple leg slings, it is important to assess the centre of gravity of a component prior to lifting in order to determine an effective slinging arrangement. If in doubt, the Crane Supervisor must refer back for technical advice and approval on the choice of lifting slings, as multiple leg slings are rated on the assumption there is equal loading in each leg.

Figure 6.11
Examples of multiple leg slings

6.16 Other lifting devices

6.16.1 Proprietary lifting devices

When proprietary lifting devices are used, the Crane Supervisor must ensure that such items are in good condition and of correct size or capacity for the load to be lifted. Proprietary lifting devices must be used in strict accordance with the manufacturer's instructions or recommendations.

The Crane Supervisor must satisfy himself that Operatives and/or Installers involved in the use of proprietary lifting devices understand correct procedures and can identify different types and sizes of equipment.

The Crane Supervisor must conduct an inspection of proprietary lifting devices at regular intervals. Any items that show signs of wear or fatigue must be returned to the company.

Cast-in weight-rated lifting inserts should be used, where possible, for precast concrete components, thus ensuring that only the correct capacity counterpart device is used on site. For example, 'CCL', 'Modform' or 'Frimeda' type devices, which only allow, say, a 5-tonne device to be used with a 5-tonne cast-in fitting, etc.

Information about the component's weight must always be available on site to enable the Crane Supervisor to select the correct lifting equipment. This information must be conveyed in the form of a component schedule, on construction drawings, or the weight of the component may be painted, or otherwise indicated, on the component itself.

Care should be taken to establish which lifting inserts cast into Components are intended for each lift (ie off-loading, pitching turning and installing). If not clearly marked on the drawings or indicated in the Method Statement then the Installation Supervisor should check with the Precast Designer or Precast Manufacturer and ensure that the Slingers use the appropriate inserts.

6.16.2 Lifting grabs

Lifting grabs may be used clamp onto the side profile of certain precast units. Therefore additional vigilance is required before lifting commences to ensure there is no damage to this profile.

Safety chains must be utilised when using a lifting grab. These must be fitted to the unit before it is lifted from the delivery vehicle and removed immediately prior to final placement.

There are two critical factors when selecting a lifting grab: its length in relation to the product to be lifted and its lifting capacity.

The Appointed Person must ensure that the lifting capacity of the grab is adequate for the Component weights to be lifted.

The Appointed Person must obtain advice and approval from the Precast Installer to establish the maximum permitted cantilever (see Figure.6.12) and then select a grab of the correct dimensions to suit the product length.

Holes and notches in the precast unit may affect the allowable cantilever length. The Appointed Person must consult with the Precast Installer, to establish that the proposed lifting grab or other proprietary lifting devices will be suitable for lifting non-standard Components.

The contact area between the clamp and the side of the unit is critical. If the contact area is reduced then the lifting clamp manufacturer's approval must be obtained before lifting continues.

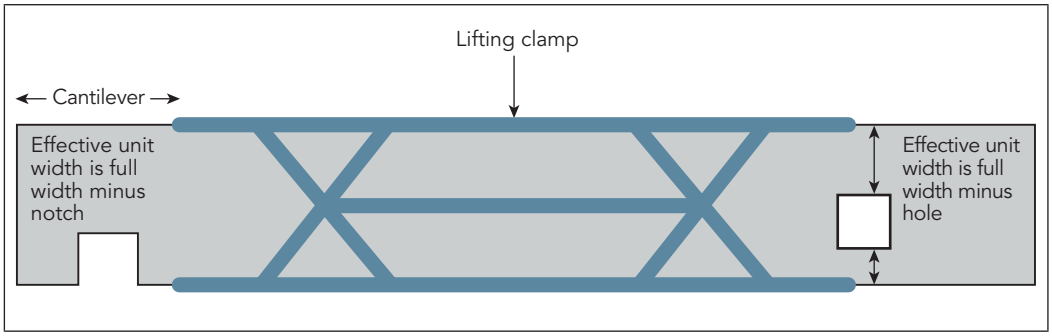


Figure 6.12
Effective unit width for lifting with side grabs

6.16.3 'C' Hooks, Cantilever Beams and Chain Blocks

Occasionally a Precast Installer is required to start installing Components before the structure is complete (where there is projecting decking above the installation) or under an overhead projecting structure or to install under overhead projecting slabs (under slung condition).

Incomplete structure with projecting decking or overhead projecting structure – that is there is projecting decking above the installation, not allowing the crane hook to be directly above the Component to be installed. For this situation a 'C' hook can be used around the projecting decking or a counterbalance beam can be used below the decking. If the structure is sufficiently advanced then it may be possible to utilise a mobile crane below the decking.

Under slung condition – in this case, Components can be installed using a counterbalance beam or pairs of chain blocks through holes in the projecting slabs

above the lift points of the Component to be installed. If the overhanging slab is high enough it may be possible to utilise a mobile crane below the slab.

The presence of obstructions and the use of non-standard lifting equipment can mean that such lifting operations are more hazardous. Therefore, in such circumstances, the operation should be carefully risk assessed and a Safe Working Method Statement prepared. All equipment must be tested and certificated and subject to regular inspection. Only Competent operatives who have been properly trained and instructed in the use of these lifting devices and the Safe Working Method Statement should be used for installation of Components by these means.

6.16.4 Vacuum Lifters

Vaccum lifters may be used where it is not possible or desirable to cast lifting inserts into precast units. This might be the case on certain architectural units where lifting inserts are not acceptable due to aesthetic considerations or on very thin walled units. Vacuum lifters should not be used where Components may be lifted over the heads of people or where a sudden failure of the vacuum lifting equipment may have other dangerous consequences.

In cases where Components are to be lifted by vacuum lifter the Precast Designer must confirm that the Component is suitably designed for lifting with the specific size and configuration of suction pads to be provided.

The design, selection, testing, operation, inspection and maintenance of vacuum lifting equipment should be carried out in accordance with the HSE Guidance Note (**www.hse.gov.uk/work-equipment.../vacuum-lifting-equipment.htm**). The lifting, handling and installation of Components must be subject to a thorough risk assessment and a Safe Working Method Statement specific to the use of the vacuum lifter should be prepared.

The following safe working practices should be considered for inclusion in any Safe Working Method Statement for the use of vacuum lifting equipment.

- Use the right equipment and be aware of the limitations of each device e.g. 'lift only one Component at a time'.
- Always follow the manufacturer's instructions.
- Do not use vacuum lifting devices to handle loads for which it is not designed.
- Vacuum lifting devices are only designed for lifting a single item at a time. Fully assess the risk of items being lifted becoming detached. Do not exceed the SWL. In some cases it may be beneficial to attach safety chains or slings to support the item in the event of detachment - especially if the load will travel some distance from pick up to landing, or where it will be raised to height.
- Ensure that there is good vacuum between the surfaces of the suction pads and the load. Vacuum efficiency could be affected by any damage to the suction pads, or by a rough or porous or channeled surface on the item..
- Prevent unauthorised access into 'lifting zones', especially at automatically controlled processes. Provide operators with safe places of work to ensure that they cannot be struck by displaced loads e.g. guarding.
- Do not transport a vacuum lifted loaded where there is a risk of injury to any person should the load or part of it fall off. All movement of materials should be properly organised and managed to prevent injuries and damage to plant and key services. Travel routes should be clearly defined and maintained.
- Transport loaded vacuum pads at the lowest height possible, where practicable no higher than 1.5m above ground level. Where this is not practicable, other precautions should be considered.
- Prepare arrangements for dealing with emergencies e.g. action to be taken in the event of power/equipment failure, displaced loads, etc.

Vacuum Lifting equipment should be operated only by competent operatives who have been adequately trained in the safe use of the equipment and the Safe Working Method Statement.

6.16.5 Forklifts and telescopic handlers

Forklifts or telescopic handlers are sometimes used to place components in conditions where reduced headroom or limited access makes other forms of lifting impracticable. Liaison with the manufacturer's designer must be sought before planning to use a forklift or telescopic handler to transport precast concrete floor components. Their recommendations may be critical in ensuring the units do not break during installation due to the forces experienced during transit. In particular long units, such as floor planks may have little or no reinforcement on their compression (top) face. If they are picked up other than close to their ends this face will go into tension which is likely to cause the unit to fail.

The Installation Supervisor should ensure that the person delegated to operate the equipment is trained, competent and certificated, and is the only person allowed to operate the vehicle.

When a forklift or telescopic handler is to be used, the Appointed Person should ensure that adequate access and working areas are provided, in the same way as crane access and standing areas are agreed. Likewise, account should be taken of the terrain, height restrictions, noise, working environment, etc.

Should any attachment be used in conjunction with a forklift or telescopic handler, the selection and installation of the attachment should be carried out in consultation with the manufacturer or hirer of the equipment and the rated SWL altered accordingly.

Additional training may be required for the operator where special attachments are to be used.

If it is necessary for the forklift or telescopic handler to travel with units, the route across site should be chosen with care, avoiding adverse gradients and obstructions. Wherever necessary the use of additional hard-core or similar measures should be implemented to minimise the unevenness of the site. Loads must be kept as low as possible to the ground to prevent the equipment becoming unstable.

At all times the operation of a forklift or telescopic handler should be carried out in full conformity with the instructions or recommendations of the hire company and/or the manufacturer, with particular attention being paid to the SWL and weight/height restrictions.

When handling precast components on the forks of a forklift truck or telescopic handler, it will be necessary to ensure that the forks of the vehicle are spaced such that the load is maintained in a stable condition and padded so that no damage is caused to the component being handled.

Travel and lifting using forks of long loads that exceed 3 times the width of the forks should be avoided. In such cases alternative means of transporting and positioning precast items should be used.

6.16.6 Excavators

It is recommended that excavators should not be used to install Components. However in very exceptional circumstances, excavators are sometimes used to place Components in conditions where ground conditions or limited access makes other forms of lifting impracticable. Careful consideration should be given to all aspects of the planning process to ensure the lifting operations are fully risk assessed and can be carried out safely. A detailed Safe Working Method Statement must be developed and all operatives involved must be fully briefed on it.

7 ADDITIONAL ON-SITE WORKS

7.1 Temporary structural support

The practice of installing Components onto temporary supports, whilst not uncommon, should be avoided wherever possible. In cases where such measures are unavoidable, the requirement to install temporary works must be notified to the Principal Contractor at the design stage of the contract, and fixing must not progress until written confirmation has been obtained by the Principal Contractor's Site Representative from a competent technical authority that the temporary works have been suitably designed and checked by a competent person.

7.2 Temporary propping and restraint systems

Should temporary propping or restraint systems be required during the construction phase, this will be indicated on the construction drawings and/or Safe Working Method Statement. All props and restraint systems should be designed, installed, inspected, adjusted and struck by Competent Persons. (See Section 5, Temporary Works Roles). Removal should not occur until the design criteria have been met in accordance with drawings and or Method Statement.

7.3 In-situ concrete and structural toppings

Wet concrete, mould oil and timber treatments are skin irritants and the requirements of the COSHH Assessment and the Personal Protective Equipment at Work Regulations must be complied with.

In-situ concrete work must be executed in accordance with Working Drawings, Risk Assessments and Safe Working Method Statement. All reinforcement must be placed as shown on the drawings, inspected and signed off by a competent person. Particular attention should be paid to the hazard of protruding reinforcement and projecting bar ends should be protected with mushroom caps or other by other means if there is a risk of personal injury.

Unless shown on the drawings, in-situ works should not be carried out without reference to the Building Designer and/or Precast Designer so that any design implications can be assessed and the work recorded.

In-situ concrete can be supported either on permanent shutters, or on formwork. In the case of permanent shutters, these should be tight fitting to one another and their size should be such that the total area of concrete is supported. Precast units acting as permanent formwork must be examined for cracking or other damage before any wet concrete is placed on them. Where the designer specifies additional support - eg propping - during casting of a structural topping, this must be done to a procedure set out by the designer. This should specify the type, position and pre-load to be placed on props prior to pouring. This may need to be altered during curing and the topping strength or curing temperature/time before removal should be set out. Ad-hoc propping should not be carried out as this can affect how the precast and the in-situ works interact in use.

When temporary or permanent formwork is used, this must be of sufficient strength to support its own weight, and that of the concrete, together with reinforcement and the weight of any Operatives or plant engaged in the work. Formwork and steel reinforcement must be designed, constructed and installed by Competent Persons and should be closely examined before, during and after the placing of concrete, in accordance with the requirements of current Standards and Codes.

Safe access to the work area must be provided and maintained in accordance with current guidance.

When using a mobile concrete mixing plant and equipment, care must be taken to ensure that these are operated by competent persons, in accordance with the manufacturer's instructions.

Before commencing any in-situ concrete placement, the Precast Installer or Contractor should ensure that the weather conditions are satisfactory so far as could be reasonably foreseen (as shown in Figure 7.1). Concreting should not commence in conditions likely to cause its failure or displacement, unless adequate measures are implemented to protect it.

If prolonged cold weather is predicted, advice should be sought from the designer regarding the use of additives to aid both workability/flow and frost resistance. In some cases local heating or covering can also be used to avoid the works being unduly delayed. Setting and curing time is temperature dependent and cubes taken for testing need to be representative of actual site conditions. This is a critical aspect if there is a risk of falsework being struck too early or of permanent works being loaded too early as collapse could occur.

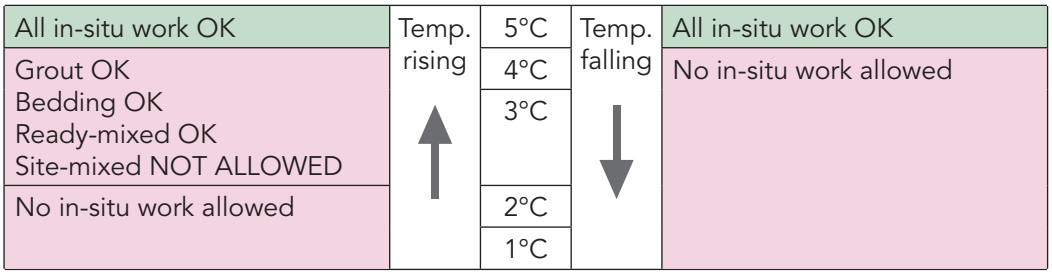


Figure 7.1
Guidance for in-situ concrete work in cold weather

Whilst in-situ concrete work is in progress, the Installation Supervisor and site management team should ensure that the area beneath the work being completed is kept clear of all personnel not engaged in this work.

Concrete can be delivered to the point of placement by various methods, e.g.

- Concrete pump.
- Crane and skips.

Special precautions are required for all operations.

It should be noted that any operative working a concrete pump must hold a certificate of competence.

The use of cranes is covered in Section 6 of this Code of Practice. All concrete skips used must be specifically designed for the purpose and fully supported with current test certificates. Particular care must be taken when passing the concrete skip through other elements of the structure to ensure that it does not accidentally strike them or become entangled.

Excessive heaping of the concrete must be avoided (this is a particular issue with some flooring products). Care should also be taken to prevent impact loading from the concrete, e.g. discharging a skip or pump from a height of more than 0.5 m must be avoided.

Loading out of floors, landings etc must be avoided until the screeds, toppings and grout have cured sufficiently for the design strength to be achieved. The design strength should be stated on the drawings, but if any doubt exists, the Precast Designer should be consulted.

The procedures for grouting are similar to those for in-situ concrete and screeding. The Safe Working Method Statement and drawings must be referred to for the mix specification, joint details, surface preparation and information about responsibility for carrying out the work.

Formwork must be removed only after the concrete has achieved sufficient strength, and the curing time allowed should be as stated by the Precast Designer.

Grouting should be carried out as soon as reasonably practicable after installation of units. Where grouting is delayed, steps should be taken to prevent accidental displacement of units from their supports. Where this situation arises, and before persons are allowed near these units, an inspection of the units' supports by a competent person from a safe area must be undertaken.

7.4 Cutting and forming holes

Normally holes, penetrations and feaures will be formed in Components during manufacture. However, additional modifications may be required on site during or after installation. These must be carried out to an approved method, only after agreement with the Precast Designer. Non- percussion equipment should be used and particular care should be taken when forming holes post-installation using a diamond core-drill. Prestressing tendons should not be cut unless approved by the Designer. The Installation Supervisor and site management team should ensure that the area beneath the drilling operation is kept clear of all personnel not engaged in this work.

Any holes or cuts should be made using the appropriate equipment in accordance with the Safe Working Method Statement and risk assessments. The Installation Supervisor and site management team should ensure that all cutting operations are carried out in a safe manner and the area is kept clear of all personnel not engaged in this work.

Any waste materials should be disposed of in accordance with the Site Waste Management Plan.

Cutting and drilling concrete products tends to produce large quantities of very fine dust. This contains a high percentage of crystalline silica which can cause respiratory damage – including lung cancer. This dust must be controlled – either by extraction equipment or by suppression using water. In addition it is usually necessary for those in the work area to wear face fitted respiratory protective equipment (RPE) with a P3 filter during cutting and drilling.

Damp dust and slurry should be contained and safely disposed of where possible and especially so if inside a building. If it dries out on the ground it will become airborne if disturbed and cause further exposure of anyone in the area. Vacuum tools used to collect this very fine dust usually need to be fitted with a high efficiency (HEPA) filter otherwise the dust simply passes through and back into the atmosphere.

7.5 Structural Fixings

Where possible inserts, voids, channels, couplers or reinforcement continuity systems for attaching fixings will have been cast into each pre-cast component in order to simplify site activity.

These might include any proprietary or bespoke fixings including bracketry, channels, drilled fixings, couplers etc which are fixed to the precast units during or after installation. This would include means of connecting precast units to an existing structure or frame or to adjacent precast units.

All fixings must be fitted strictly in accordance with the drawings, Safe Working Method Statement and manufacturer's guidelines. Where fixings are not shown on drawings, written approval and agreement to the type, size and position of the fixing and to the Method Statement must be obtained from the Precast Designer prior to any work being undertaken.

7.6 Ancillary works

These might include and are not limited to:-

- Sealant/pointing works

- Finishing/washing down
- Protection of works
- Fire-stopping
- Insulation
- Acoustics
- Protective surface treatments (eg. Anti-graffiti)
- Damp-proof membranes and waterproofing

All ancillary works must be executed in accordance with the design, drawings, Safe Working Method Statement, manufacturer's guidelines and relevant COSHH assessments. If not shown on the drawings, written approval and agreement to the details of the works, materials to be used and the Method Statement must be obtained from the Precast Designer, prior to any work being undertaken.

8 ACCESS TO WORKING AREA, WORK AT HEIGHT AND PROTECTION AGAINST FALLS

8.1 Introduction

The Work at Height Regulations 2005 (as amended), gives employers the following hierarchy of precautions to follow when planning work at height:

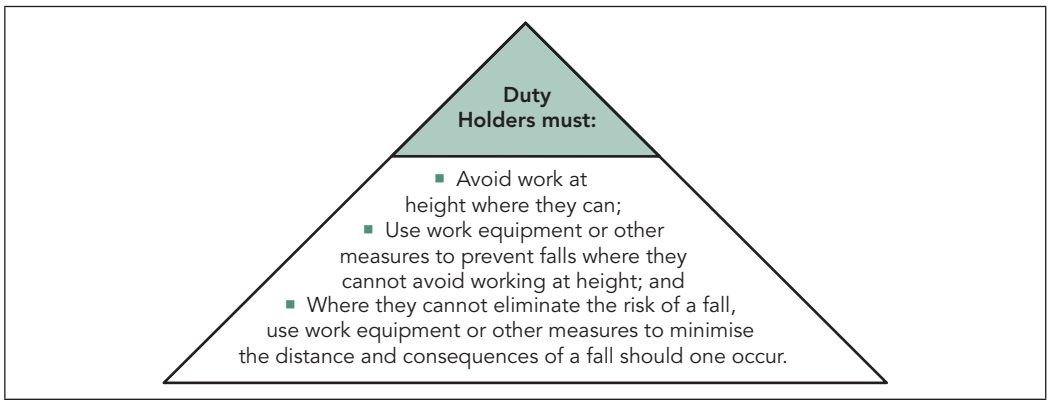


Figure 8.1
The work at height hierarchy of precautions

The following is taken from HSE Document: HSG150: Health and safety in construction. This means that those in control must:

- **Avoid** work at height where they can.
- Use work equipment to **prevent** falls where work at height cannot be avoided.
- Where the risk of a fall cannot be eliminated, use work equipment to **minimise the distance and consequences** of a fall should one occur.
- Always consider measures that protect all those at risk, i.e. **collective protection measures** (scaffolds, nets, soft landing systems) before measures that only protect the individual, i.e. **personal protection measures** (a harness).
- Ensure work is carried out only when weather conditions do not jeopardise the health and safety of the workers.

8.2 General principles for control measures

Generally the installation of Components will require the Operatives to work at height. This work will require careful planning following the hierarchy of controls to reduce the risks of working at height.

There is a range of measures available to protect the perimeter of the building/working area and the leading edge; these include working platforms, handrails, work restraint, safety nets, airbags and fall arrest systems. All of these should be considered within the hierarchy of measures, and their selection will depend upon the type of installation and the structure, if any, which the precast units are being installed onto. The hierarchy of control requires those planning the work to use measures that protect the whole workforce all the time (collective protection) in preference to measures that protect only one worker (individual protection). The system that affords the most suitable reasonably practicable level of protection should be employed.

Precast Installers should endeavor to keep informed of technical innovations and good practice when planning work at height to ensure the most effective control measures are considered.

8.3 Safe access to the working area

Safe means of access to the working area also requires careful planning in advance of site attendance, particularly where work progresses during installation. Safe means of access should be agreed with the Precast Installer's Representative and positioned adjacent to the start point, where reasonably practicable.

Typical methods include:

- Independent scaffolds.
- Suitably protected stairs and ramps.
- Fixed or mobile scaffold towers.
- Mobile access equipment.
- Secured ladders.

More detailed advice on the selection and use of access equipment is given in HSE guidance listed below:

- General Information Sheet No. 6 (GEIS6) *The selection, management and use of mobile elevating work platforms*
- The HSE website includes several pages on work at height.

Additional advice is available from the Prefabricated Access Suppliers and Manufacturers Association (PASMA) website.

8.4 Working at height – control measures

The hierarchy of precautions to be used has been outlined in Sections 8.1.

Unless otherwise agreed, the perimeter of the building should be protected by the Contractor, by means of scaffold/guardrails/working platforms that will prevent a fall. Any edge protection installed by a third party should be checked to ensure it is suitable for use and if it is not then this needs to be rectified before proceeding with precast installation.

The leading edge should be protected using the following hierarchy:

Active work restraint systems	This system prevents a fall. However, it limits access to the leading edge and relies on the operative to act and is therefore active and personal. In the precast flooring industry experience has shown that passive and collective systems are far more effective in preventing injury and are thus preferred (see Section 13.4.2.3 Work restraint systems).
Passive and collective systems	Systems that do not rely on the installer to operate them and are in place prior to the first unit being installed. Passive and collective systems include nets, airbags, decking and many other systems. They minimise the distance and consequence of a fall should one occur.
Active fall arrest systems	Systems for fall arrest rely on the Precast Installer to use them and are therefore active and personal. These systems require the calculation of the maximum drop an installer could suffer to ensure that the arrested drop is sufficiently short to prevent the fallen person coming into contact with the floor. Rescue of the fallen person must also be considered when designing such a system.

Note: All systems mentioned must comply with appropriate schedules given in the Work at Height Regulations.

8.4.1 Scaffold and edge protection

To provide safe access to the working level and access around the edge of the installation area, a scaffold with the required handrails must be in position prior to units being installed. The Contractor and the Precast Installer should agree exactly what is necessary and what will be provided by each party. All scaffolds must be erected by Competent Persons, and must be suitable and safe prior to work commencing. They must comply

with the appropriate schedule in the Work at Height Regulations, i.e. the handrail should have a minimum height of 950 mm, the gap between rails is to be a maximum of 470 mm, and there is to be suitable protection against falling materials.

All scaffolds need to be constructed so as not to adversely affect the installation operation or the operation of the crane. The following recommendations are made for the different circumstances where scaffold and edge protection systems could be used and must be installed to recognised standards such as The National Access & Scaffold Confederation (NASC) Guidance TG20:13

The NASC publication SG4:15 Preventing falls in scaffolding operation – provides detailed advice on systems of work and arrangements for scaffold erection, alteration and dismantling.

8.4.2 Leading edge control measures

8.4.2.1 Working platforms (e.g. scaffold walkways, decking, bird cage)

Several options are available to achieve a working platform, including enhanced lightweight decking systems and scaffolding.

When scaffold systems are used, care should be taken to ensure that scaffold tubes do not extend above the level of the deck, where they could cause injury to a falling person or cause a trip hazard or interfere with the installation of Components.

When lightweight decking systems are used, care should be taken to ensure that the system is designed/installed as a working platform and that the surrounding structure affords adequate lateral restraint where required. Some systems require enhancement over and above the standard 'crash deck only' assembly configuration. Any full bay platform beneath the installation area should not exceed a height and distance from which installers can step down, It should also be in a position which allows lifting chains to be removed. Working platforms are to be installed by Competent Persons in accordance with the relevant schedules in the Work at Height Regulations.

Where limited width access platforms are provided these must have full edge protection.

8.4.2.2 Access platforms, mobile towers and other mobile equipment

A wide range of equipment is available. For some installation operations including mastic sealing and grouting and work of short duration such as inspection and minor maintenance, mobile towers or MEWPs can provide safe access, and the risks associated with scaffold installation can often be avoided.

When power-operated mobile work platforms are used on site these machines must be operated only by a Certificated Operator. The equipment chosen should be appropriate for the ground conditions on the site. The ground must be firm and level and suitable for this type of work. Particular attention must be paid to wind speed when working at height, as this will affect stability. Manufacturers' advice on the maximum wind speed at which it can be safely operated should be followed.

Equipment should be maintained in a safe condition and be operated only by Competent Personnel.

Mobile towers must be used only on a firm level base and should be constructed by competent Installers in strict accordance with the manufacturer's recommendations and HSE Guidance, attention being paid to handrails, bracings, out-riggers and tying to the structure. Mobile towers must be fitted with lockable wheels and should only be moved when unoccupied. Mobile towers need to be taken down or secured in position during high wind as just locking the wheels may not be enough to prevent them being blown over or off the building.

When using tower scaffolds, only those trained in their installation should be given the task of installing this method of access. There are two approved methods

recommended by the Prefabricated Access Suppliers and Manufacturers Association (PASMA), which have been developed in co-operation with HSE: these are the 'through the trap' and 'advanced guardrail system'. Further information is available from www.pasma.co.uk.

The Installation Supervisor must visually inspect all such equipment provided for use during the installation process, and any defects noted must be brought to the attention of the Precast Installer, or where appropriate the Principal Contractor's Site Representative, so that the particular item can be replaced, or repaired, before it is used.

When using mobile towers the Contractor is to ensure that all floor or other bearing surfaces are even and all voids are securely covered.

8.4.2.3 Work restraint systems

Work restraint can prevent a fall by restricting the movement of a person to a safe area. It should not be possible to reach any unprotected edge, hole or fragile material when relying on this system.

This system is based on a minimum of: a safety harness, lanyard and suitable anchorage point. It is imperative that a suitable secure method of fastening the lanyard to an anchor point is provided and that the anchor point is in a suitable location for the arc of movement required. Additional practical measures to achieve sufficient versatility include: running lines attached to at least two suitable anchorage points, which may be incorporated into the precast unit; An inertia reel block attached to a suitable anchor point (must be designed to spool horizontally unless the reel is fixed above the work position); and a rope line anchored at one end and used with a rope grab to adjust the length of travel from the anchor.

The lanyard should be a fixed length or as short as possible whilst allowing the operative to reach the place of work. This prevents them from getting into a fall position, as they are physically unable to get close to the open edge.

In choosing a harness, care must be taken to ensure that it will give the user, as far as is compatible with safety, maximum comfort and freedom of movement. Proper fittings and adjustment are essential to achieve these aims.

Where active work restraint is being considered, adequate training must be provided to Operatives and Installers and the equipment must be inspected by Competent Persons before and after use. Supervision and training are needed to ensure that the system of work adopted is understood by all users and is maintained.

Although, when correctly used, work restraint equipment with a harness, short lanyard and adequate anchor point can prevent a fall, it is more suitable for light, short-duration work and is not always practical to implement when installing Components as the leading edge(s) may constantly move. Similarly, the anchor point may need moving repeatedly. A short lanyard would restrict the movement of the Operative that is required to fix the unit, as they require access close to the leading edge. In this situation it is more practical to use a collective protective system (i.e. safety nets, airbags, etc) that does not restrict the movement of the operative but provides protection to all those at risk (rather than an individual Operative) and minimises the distance and consequence of a fall, should one occur. A fall arrest lanyard incorporates a shock absorber designed to limit the shock loading as the lanyard becomes taut. A restraint lanyard does not incorporate a shock absorber. However, where restraint working is not able to completely remove the risk of an operative falling, it is best to use a lanyard that incorporates a shock absorber (see also section 8.4.2.5). The overall length should still be kept as short as possible. Lanyards are available that can be adjusted in length by the worker to suit the situation.

Alternatively, in some situations a horizontal spooling inertia reel can be used instead of a short lanyard. This will retract to maintain the attachment nearly taut, while allowing movement. It is particularly important to choose a suitable anchor position as the reel may not be moved very often. A pendulum fall situation where the wire is running

almost parallel to the edge the worker falls from must not be allowed to develop. Another option that still requires constant worker vigilance and action is the use of a rope grab with a short lanyard. This allows either a running line or a taut rope from anchor to work area so that the rope grab is adjusted to lock onto the rope to restrict the advance of the worker into the danger area.

Harness systems require a high level of training, understanding and awareness by the user and tight supervision. Errors in use are common and for these reasons passive collective systems are preferred.

8.4.2.4 Passive and collective systems

Lightweight decking systems

Lightweight crash decks usually take the form of plastic platforms, which are suitable for use in most internal areas. The decking provides a safeguard when working at height and can allow full freedom of movement over the working area. Most systems will require the presence of perimeter walls for lateral stability. The floor area on which the platform supports are positioned must be firm and reasonably level. On-site installation of the lightweight decking is usually carried out the day before installation of the precast units and removed on completion of works.

Lightweight crash decks must be installed by Competent Persons to manufacturers' instructions. Suspended loads must not be carried over crash deck installers and the installers must not pass under or work under Components that have not been fully fixed, and adjusted to final position.

Safety nets

Safety nets can be effectively employed to reduce the distance and consequence of falls. They are a passive collective measure and protect everyone working within their boundary, without requiring those workers to act in order to be protected. They allow a broad range of activity to continue with minimum restriction.

Safety nets have high energy absorption capability, and therefore offer a 'soft landing' that minimises injury. They should always be fitted as close as possible to the underside of the working level.

Those who install nets must be aware of the relevant standards, be trained and be competent to carry out the work safely. This will require the use of specialist Installers and riggers. The Installation Supervisor must ensure a handover certificate has been provided and must visually inspect the netting before allowing work to proceed above it.

Should an operative fall into the net, significant sagging could result. To avoid risk of injury the whole area beneath the nets must be kept clear of materials and/or obstructions.

The self-weight of the net and shock loading to anchorage points in the event of a fall should be considered in the design and implementation of the netting system.

Note that some tensioned net systems apply considerable horizontal force into the walls or steelwork they are connected to. These systems are not suitable for use in standard masonry arrangements.

The Building Designer and the Contractor need to confirm that the structure – including components and any connections that will be used as attachment points are suitable to carry the loads likely to result from both rigging and using the safety nets. In general safety nets should not be anchored to slender brick/block walls, especially those newly constructed, as these can be pulled in by self weight/tension from the nets, or under load when a person falls into the net.

Safety Nets should not be supported by any drilled anchor fixed into a masonry or concrete structure unless the Rigging Company can provide evidence that the structure, the anchoring material, and the anchor are capable of taking an applied load of 6kN at 45°. Ref: FASET Bulletin No. 14 (August 2012) Drilled Fixings. Where safety nets are rigged so that the fall is less than 6m, the net must extend a minimum of 3m beyond the leading edge where operatives are working. If the working area is inclined by more than 20 degrees then there must always be 3m minimum beyond the leading edge.

Airbags

Airbag systems comprise bags of varying sizes that are clipped together to effectively form a protection system. The airbags can be individual units with their own integral air pump or can be connected by a system of hoses and connectors, which in turn are connected to an air pump. The air pump is used to inflate the bags and maintain the required pressure.

Installation of airbags must be carried out by trained and competent Installers with adequate access for installation and removal.

Prior to positioning the empty airbags, the whole of the area must be cleared. The airbags are then arranged to cover the desired area, connected together and inflated.

The Contractor or Precast Installer should ensure openings in external walls, such as doors and windows, have been suitably protected, e.g. by scaffold or timber, to prevent Operatives rolling off or falling through the void, should a fall occur. Care should be taken to avoid blocking out all natural daylight if using boarding. Task lighting may be needed to assist in removal of soft landing systems once Components have been installed.

In order to prevent risk of wall collapse, airbag installers should take care to avoid exerting excessive lateral pressure to vulnerable walls. The Contractor or Precast Installer must ensure the temporary stability of the structure and enhance the fall protection or provide an alternative method locally where stability problems are foreseeable. All walls should be adequately fixed or cured before installing airbags.

If the storey height exceeds 4 m the airbag system should be employed with a cover sheet above. Where the distance from the working level to the floor below is over 6.0 m, secondary measures should be used (e.g. clamps and harnesses attached directly to a previously installed precast unit.)

There should be no overhead work in progress above the airbag installation area at any time while airbag modules are being set-up, moved/adjusted or de-rigged.

The absolute minimum airbag coverage should be 4.8 m ahead of the leading edge (direction of installation sequence), 2.4 m behind the leading edge and 2.4 m to each side (these to be increased to 4.8 m if the storey height exceeds 4 m).

This is the absolute minimum area permitted and should not be regarded as target coverage. Bagging installers should whole fill rooms, where practicable, to avoid the need for repeated access to the airbag area to move or adjust the modules. Precast Installers should plan work accordingly to ensure adequate time is allowed for airbag installers to provide adequate fall protection. Operatives and Installers should be instructed that fixing must not commence until this is in place.

The system must be continually monitored during its operation, i.e. to ensure airbags are fully inflated, and work not allowed to start (or be suspended immediately) in situations of non-compliance.

Other proprietary systems

Other systems not listed above may be utilised subject to risk assessment, taking into account fall distance onto the product, and its ability to mitigate the consequences of any fall (by reducing the severity of injury).

8.4.2.5 Active Personal Fall arrest systems

Fall arrest systems do not prevent a fall, are not a collective protection measure and are therefore regarded as a personal protection measure and an active system. They are therefore lower down the hierarchy than the passive systems described at the start of Section 8.4.

These systems consist of a safety harness, lanyard and adequate anchorage point and aim to arrest a fall and minimise injury once a fall has occurred. Specialist advice and approval should be sought from the supplier of the equipment on the provision and location of suitable anchorage points.

A suitable system of rescuing the fallen person in less than 10 minutes must be present before work starts; serious injury or death can occur if the person remains suspended for prolonged periods following an arrested fall (Section 8.8).

Fall arrest systems can provide valuable protection, but they are not a substitute for effective fall prevention measures or collective protection measures. It must be clearly understood that, where practicable, proper working platforms, handrails, safety nets and airbags must be used in preference to fall arrest systems.

It is imperative that a suitable secure method of fastening the lanyard to an anchor point is provided, and that the lanyard length including full extension of the shock absorber will prevent injury by arresting the fall before any part of the body hits the floor or any other part of the structure.

Practical measures to achieve this include running lines and lanyards attached to suitable anchorage points, which may be incorporated into the precast unit

Inertia reels may be used in fall arrest systems but assessments must be based on their design limitations and manufacturers' recommendations. Note that some inertia reels are not suitable for horizontal spooling

In choosing a harness, care must be taken to ensure that it will give the user, as far as is compatible with safety, maximum comfort, freedom of movement and, in the event of a fall, every possible protection to the body from the shock of sudden arrest. Proper fittings and adjustment are essential to achieve these aims. The use of lanyards fitted with shock absorbers is recommended for restraint work where the potential drop height permits the full lanyard deployment, i.e., a lanyard fitted with shock absorber can be used in a fall arrest situation but a restraint lanyard (no shock absorber) must not be used in a situation where a fall could occur, i.e., where restraint working proves inadequate. A fall without a shock absorber incorporated in the lanyard can be fatal as the sudden arrest casuses internal damage.

Where fall arrest devices are being considered, adequate training must be provided to Operatives and Installers and the equipment must be inspected by Competent Persons before and after use. Supervision and training are needed to ensure that the system of work adopted is understood by all users and the equipment is maintained.

8.4.2.6 Use of active and personal work restraint/fall arrest equipment

All persons who will use fall arrest/work restraint equipment must be fully trained in the understanding, inspection and use of that equipment and, in the case of fall arrest, the rescue procedures involved. The training must be provided by a suitably qualified instructor.

The user's life may depend upon the good working order of the fall arrest/work restraint equipment provided and therefore the equipment must be subject to routine inspection, maintenance and, where required, replacement.

The following criteria must be taken into account before using work restraint systems:

- Adequate anchorage points.
- Means of adjustment of lanyard.
- Correct type of body harness.

The following criteria must be taken into account before using active fall arrest systems:

- Anchorage points and position require an adequate margin of strength and stability to withstand the dynamic and static forces.
- Type of lanyard.
- Free fall distance.
- Correct body harness.
- Time taken for rescue procedure.

In practice it is unlikely that active fall arrest systems will be capable of providing a

primary safe system of work when installing precast concrete units. In some situations it may be used as a secondary (back-up) measure in addition to other measures that provide collective protection where installers need additional reassurance. Before it is used, a thorough risk assessment and method statement must be produced, taking into account all of the foregoing.

8.5 Staircases

Layout of flights and landings and the supporting structure differ on all stairwells. Each staircase should be assessed on its own merits and a risk assessment carried out to determine the most adequate and effective way of controlling the hazards.

8.5.1 Planning and co-ordination

When installing precast stairs and landings, it is often a requirement for associated trades to carry out works during the same day of installation, i.e. rigging and de-rigging of safety nets, installation and dismantling of scaffold or other passive fall arrest systems. Full consideration must be given to the planning and co-ordination of all trades, ensuring that all associated trades are fully aware of their requirements and sequence of attendance. It is good practice for precast stair units to be installed after the surrounding flooring units.

It is the Contractor's duty, under the requirements of the CDM Regulations, to co-ordinate the requirements of scaffold protection to the stairwell during the construction phase. This may necessitate a scaffolder being in attendance during the installation of a staircase.

8.5.2 Hazards

The main hazards associated with staircases/stairwells are:

- Work at height whilst installing the flooring product around/close to the stairwell.
- Work at height whilst installing the stair flights/landings.
- Work at height whilst working on the surrounding floor area after the stairs have been installed.

8.5.3 Safety in the working area

8.5.3.1 Installing the floors and stairs in and around the stairwell

Ideally, the surrounding floor should be installed around the stairwell before stair flights / landings are installed. In turn this will form a working platform when installing the top of the stairs. The stairwell void should be protected by the most practicable means, e.g., scaffold handrails or by means of passive fall arrest or a combination of both, before installation of surrounding floor or stairs in that area commences. This will protect against falls into the stairwell during installation of other Components in the vicinity of the stairwell.

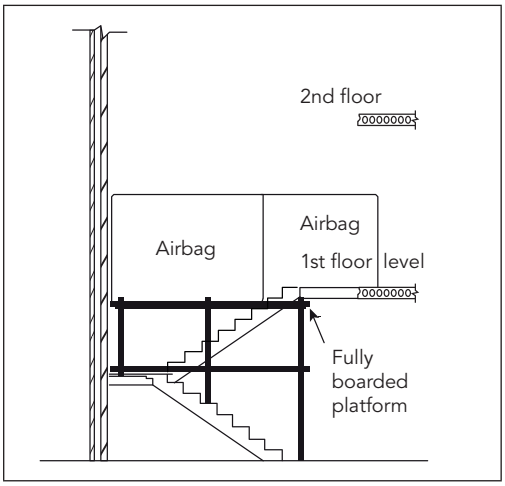


Figure 8.2
When fixing second floor and above

When installing Components at second and upper floor levels, fully boarded platforms should be set immediately below the soffit level at the previous floor level. This platform provides support for the passive fall arrest e.g. airbags during installation works around the stairwell and also allows access to the lower flight and intermediate landing.

Scaffold standards to be kept below or capped off immediately above this platform.

Full consideration must be given to providing adequate access to the upper floor level for the airbag installers. In summary:

- Working platform to be provided.
- Airbags positioned on working platform which provide leading edge protection to stairwell when installing units around the stairwell
- Working platform provides safe access to install intermediate landing and stair flight.
- Work restraint equipment used at floor levels whilst installing flights and landings and removing chains.
- Stairwell to be protected at upper floor level.

8.5.3.2 Installing the stair flights/landings into steel-framed buildings

Access is required to each 'floor' landing level and each intermediate landing level (where the intermediate landing level cannot be reached from the level below). In most instances the access to the 'floor' landing level will be formed by the precast floor units.

Intermediate landings will normally require scaffold provision by the Contractor.

In situations that necessitate stair flights and landings being installed independently of the floor units, access and working platforms must be provided to all intermediate and 'floor' landing levels.

The following diagram gives guidance and some examples of control measures that can be adopted when installing stair flights, landings and adjacent floor units. Each installation must be assessed on its own merits to ensure the most appropriate means of protecting persons from falls from height is achieved. Please refer to section 8.4.2 Leading edge control measures.

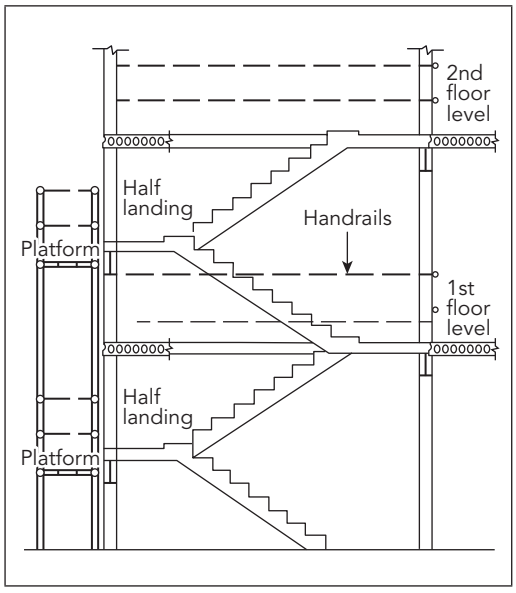


Figure 8.3
Stairs in steel-framed building

Prior to installation of stairs the perimeter of the stairwell should be protected (by scaffold handrails). This will protect against falls into the stairwell during and after the installation of the surrounding floor units.

Where it is not practical to provide the handrails, passive fall protection must be installed to the stairwell area (i.e. safety nets) prior to installation of flooring.

Passive fall protection to be removed after installation of the top landing units, Installers should then use work restraint/ fall arrest equipment attached to the installed product, scaffold handrail or the structure where practicable whilst installing stairs. This should also be used when standing on stair flights to remove chains.

On steel frame structures access/platforms will be required to all bearing positions. Working platforms provide safe access to install intermediate landing and stair flights.

The surrounding floor will normally be installed around the stairwell before stair flights/ landings are installed. In turn this will form a working platform when installing at floor level.

8.5.3.3 Installing stair flights / landings in a masonry structure (upper floor level)

The perimeter of the stairwell void should be protected (by installing scaffold handrails or by means of passive fall arrest or a combination of both), before installation of the stairs.

The protection may need to be adapted to enable stair placement.

The surrounding floor will normally be installed around the stairwell before stair flights/ landings are installed. In turn this will form a working platform when installing the top of the stairs.

The following examples of good practice may assist with decisions about the installation sequence and the type of fall protection needed.

- At all times, consideration must be given to the General principles for control measures when working at height. Refer to section 8.2 for information.
- Ensure surrounding floors are installed prior to installation of stair units as this provides a suitable working platform.
- Where possible a scaffolder should be in attendance throughout the stair installation to modify and adapt working platforms at suitable intervals.
- Restrict access to the working area to essential personnel only involved in the stair installation.

8.5.4 After stairs and surrounding floors have been installed

Immediately after installation of each stairwell is complete, protection must be provided against falls into the formed stairwell whilst working on the surrounding area. In addition, the stairs must not be considered safe for access until handrails and edge protection has been provided by the Contractor (see fig 8.4).

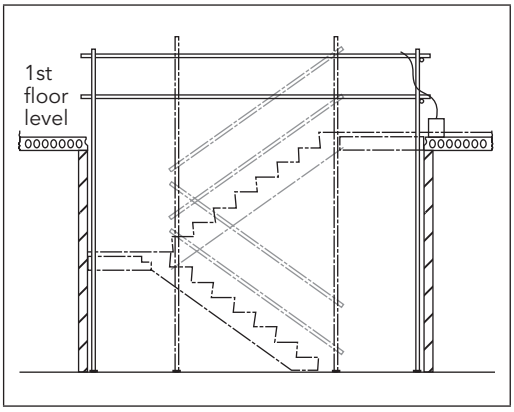


Figure 8.4
Example of protection following installation of stair units

8.5.5 Multi-storey stair cores

Special consideration must be given at design and planning stage to the provision of cast-in anchorage points to aid scaffold arrangements and precast component installation ensuring that components can be installed without the risk to the health and safety of any person.

8.6 Falls from delivery vehicles

The Contractor and Precast Installer have a duty to ensure that all delivery vehicles are offloaded safely.

Where an Operative is required to access the trailer to unload the product there is a significant risk of injury from falls. Work at height on the trailer, and on the load, should therefore be avoided where reasonably practical.

Where work at height on the trailer and load cannot be avoided, then the Contractor should liaise with the Precast Installer and carry out an assessment of the site conditions. The hierarchy of control outlined in the Work at Height Regulations should be applied to reduce the risks of injury due to falls, as far as is reasonably practicable.

Where possible the Precast Manufacturer should ensure that precast units are delivered on vehicles provided with edge protection. If this not possible, other control measures are available ranging from working platform gantries, handrail systems, airbag systems, safety net systems, personal work restraint systems and personal fall arrest systems. A personal fall arrest system is only suitable when the anchor point is above the worker and where it is kept taut (eg by reliance on an inertia reel incorporating a shock absorber). A trailing lanyard or anchor point at low level will result in the worker striking the ground before the shock absorber can start to deploy. Such systems should be adopted where reasonably practicable. The most effective system to be used will largely depend upon the site conditions, the vehicle and the size, height and type of loads being delivered, the location of site and site condition.

All such safety systems will require careful planning. The Contractor should liaise with the Precast Installer and plan the offloading positions. The Contractor should also consider the Site Traffic Management Plan, other trades and deliveries, and ensure that adequate arrangements have been made to accommodate the system being used. Such planning must ensure that the offloading position is within reach of the specified crane, has adequate space for the installation and has adequate ground bearing capacity.

All systems must be examined/inspected by a Competent Person and used in accordance with the manufacturer's recommendations and should be visually inspected before use.

Wherever possible, work at height on the trailer should be avoided. Where it cannot be avoided, safe access to and from the trailer is essential, and suitable in-built steps or secured ladders/handholds should be used.

8.7 Use of ladders

Ladders should be used only as access or for light work of short duration, lasting no more than 15 to 30 minutes where other safer means, such as scaffold towers or Mobile Elevating Work Platforms (MEWPs) have been considered and found not to be reasonably practicable.

Properly constructed and secured ladders, combined with the use of safety harnesses, static lines or anchorage points, may also be practicable in certain conditions where the working space precludes the use of mobile towers.

When ladders are used, they need to be of the correct type, i.e. a suitable grade of industrial ladder. They should be in good condition and effectively secured to prevent movement (Figure. 8.5). Permanent means of securing ladders at identified access points can improve ladder safety. This avoids the need for footing when ladders are tied and untied. Those who use, inspect and secure ladders should be competent to do so.

Ladders may provide safe access, but their use is not always appropriate. Factors to be considered include:

- The length of the ladder required. Very long ladders are heavy to handle and may need staying to reduce flexing in use.
- Correct angle of ladder – for every four up go one out (Figure 8.6).
- There must be an extension of at least 1 m above landing point to provide a secure handhold.
- Ensure the ladder is adequately secured at foot and landing point.
- The need to carry tools, equipment, materials, small components, etc. Both hands should be free when climbing a ladder.
- The Operative must have a secure handhold and at least three points of contact when using the ladder.
- The Operative must not overreach.
- The requirement for records of formal periodic inspections by the Contractor in accordance with the manufacturer's recommendations.

The Installation Supervisor must visually inspect all ladders provided for use during the installation process, and any defects noted must be brought to the attention of the Precast Installer, or where appropriate, the Principal Contractor's Site Representative, so that the particular item can be replaced or repaired before it is used.

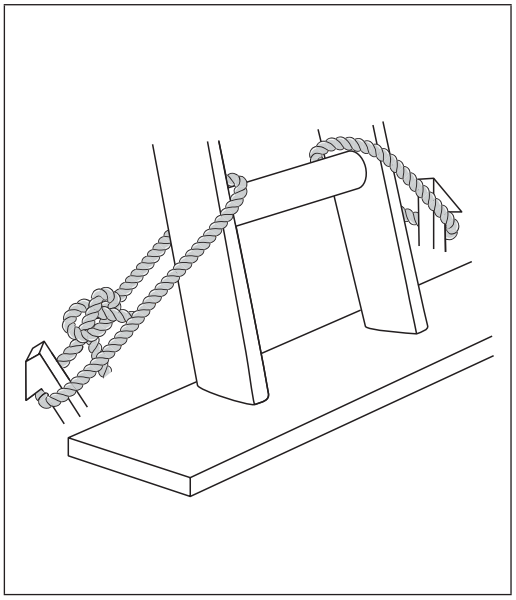


Figure 8.5
Secure ladder fixing

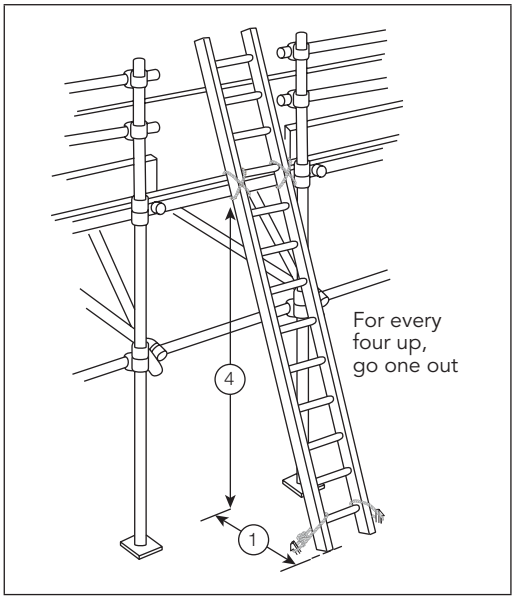


Figure 8.6
Correct ladder angle

8.8 Rescue procedures

A rescue procedure must be in place on all occasions where passive fall arrest or active fall arrest are utilised and where, therefore, a fall is still possible, e.g. fall into airbag, safety net, use of fall arrest safety harness. Any potential rescue procedure must be evaluated at the planning stage of the job and recorded accordingly. When planning for rescue, consideration should be given to the type of situation from which the casualty may need to be recovered, and the type of fall protection equipment that the casualty would be using.

It is essential that individuals undertaking work at height are competent in appropriate rescue techniques and emergency procedures. These should form part of their initial and ongoing training. In addition to this, rescue techniques should be discussed at regular intervals, and at the start of any work situation that is unfamiliar to any of the work team. The rescue procedure must be based on the principle that no other person should be placed at risk of injury while performing or assisting in the rescue. This may require rescue kit to be present at each site. Rescue procedures should be practiced as part of the initial training in rescue techniques and during refresher training.

It must be stressed that reliance upon the Emergency Services to assist with a rescue should not be part of the rescue plan. This is because there is a possible lack of appropriate equipment for the rescue, as well as the likelihood of an extended time period between the onset of the fall and the arrival of the Emergency Services.

It is also important to consider what equipment is going to be suitable for a rescue and whether it will be available on site. Equipment that could be utilised could include:

- A MEWP.
- A proprietary rescue system.
- A system provided by the Contractor.
- A crane with a person riding cage.

Note: Manufacturers provide various types of suspension trauma relief equipment for use by a suspended person. These can delay the effects of suspension trauma, but they only work on conscious and able casualties; they are not an alternative to rescue.

All rescue planning and operations should address the following issues:

- The safety of the persons carrying out or assisting with the rescue.
- The anchor points to be used for the rescue equipment.
- The suitability of equipment (anchors, harnesses, attachments and connectors) that has already arrested the fall of the casualty for use during the rescue.
- The method that will be used to attach the casualty to the rescue system.
- The direction that the casualty needs to be moved to get them to the point of safety, (raising, lowering or lateral).
- The first aid needs the casualty may have with respect to injury or suspension trauma.
- The possible needs of the casualty following the rescue.

8.8.1 Suspension Trauma

Suspension Trauma (Orthostatic intolerance) is a condition in which a person suspended in a harness can experience pallor, cold sweats, nausea, ringing in the ears, blurred vision, dizziness, feeling faint, loss of consciousness and eventually death.

All users of personal fall protection systems, and others involved with work at a height, should be aware of the following precautions that might need to be taken in the event of a casualty being held in a suspended position:

- The longer the casualty is suspended without moving, the greater the chances are of suspension trauma developing and the more serious it is likely to be. Therefore, if an injured person is suspended in a harness, the aim should be to carry out the rescue within 10 minutes. This is particularly important for a casualty who is motionless.
- Unless the suspended person can be immediately retrieved, for assistance call 999 or 112.
- A conscious casualty should be encouraged to mobilise their four limbs, to stimulate circulation of the blood. Frequent 'pumping' of the legs against a firm surface will also activate the muscles and improve blood circulation. Elevation of the legs by the casualty or the rescuer where safely possible may also prolong tolerance of suspension.
- After rescue, providing there are no injuries, there was no medical reason for the fall and the casualty remained conscious throughout the incident, they should be checked by a competent first aider who may advise them to avoid standing and to sit down until satisfied they have fully recovered (maximum 30 minutes).
- After rescue, if the casualty is unconscious or semi-conscious or was unconscious or semi-conscious at any time during the incident, they must be attended to by a competent first aider who must have also contacted the emergency services.
- They must ensure that the patient's airway is open, the patient is breathing and only then place the patient in the traditional recovery position until the emergency services are in attendance. The ambulance service should be advised that the patient needs to be treated for orthostatic shock or intolerance.

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9 PROTECTION OF THIRD PARTIES

9.1 Other trades or persons on site

The Work Area associated with Component installation must be designated a 'prohibited area' to all persons, other than those engaged in the installation of the units. The Contractor must actively enforce this prohibition, and the Precast Installer must co-operate with the Contractor to ensure that fencing, gates and barriers remain secure and that notices are not removed or obscured.

Where possible, the Contractor and Precast Installer should ensure that Components are not hoisted over areas where other persons are working. This may include several levels in multi- storey work.

Operatives and Installers engaged in the installation of Components must, at all times, execute their work with a due regard for the health and safety of other workers or persons. They must observe and comply with the Safe Working Method Statement in force on any particular contract insofar as such rules or requirements affect their operations, and they must also comply with any rules or requirements imposed by the Contractor.

The Installation Supervisor must ensure that the work area is kept clean and tidy so far as this is reasonably practicable and at the end of the working day the area should be left free of debris. Materials must be safely stacked.

9.2 Members of the public

The lifting of Components and materials may present a hazard to the public, especially where the delivery vehicle is unloaded from the public highway.

When unloading from the public highway, the Contractor must obtain the necessary statutory permissions and the area used for offloading must be designated a 'prohibited area' to all persons other than those engaged in the installation of the Components.

The Contractor must provide all necessary traffic cones, warning barriers, notices, traffic signs and lighting to allow the safe passage of pedestrians and road traffic. If deemed necessary, the prohibited area may have to be policed.

On sites where the building operations are in close proximity to public places or highways, additional care must be taken to prevent materials or debris falling from the works. Where the Contractor has provided measures to prevent such falls, or to protect the public, the Operatives and Installers engaged in the installation of the Components must not remove or interfere with these measures in any way.

Any debris or material that falls from delivery vehicles must be removed from the public highway or public area and the area left clean and hazard free.

When the installation involves the operation of a crane in a third party's air space, the Contractor must obtain the necessary permissions and ensure that the appropriate steps are taken to protect third parties and the public in these areas. Components should not be hoisted over occupied buildings. Due consideration should be given when lifting close to any adjacent occupied building. Work may need to be arranged out of hours. Where lifting over an occupied building is unavoidable the entire building, or in some cases the upper floors, may need to be emptied before work can be carried out.

During the course of the lifting operation the Contractor must ensure that members of the public are not in the vicinity of the suspended load or lifting equipment.

The Installation Supervisor must liaise and co-operate in all respects with the Principal Contractor's Site Representative to ensure compliance with any measures, provisions or rules previously agreed with the Contractor or with any statutory provisions for the protection of the public.

In the event that any of the foregoing requirements are not met, lifting should cease immediately.

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