NSSP
NEPAL SAFER SCHOOLS PROJECT

UKaid
from the British people

SCHOOL RETROFIT CONSTRUCTION GUIDELINES

CROWN AGENTS
ACCELERATING SELF-SUFFICIENCY & PROSPERITY

ARUP

NSET
Earthquake Safe Communities in Nepal

Save the Children

Cover Image reference: NSET

Image reference: NSET

ACKNOWLEDGEMENTS

This is Version 2.2 of the NSSP Construction Guidelines issued on 16th July 2021.

This construction manual was written for the purpose of the Nepal Safer Schools Project (NSSP) that took place from 2018-2021. For use outside this programme, it should be used for information only and does not negate the need to develop specific technical design information by an appropriately qualified person.

This manual is guidance that has been developed by Arup, with invaluable input from Crown Agents and NSET. We are grateful to all the stakeholders that contributed to the production of this guidance, their suggestions, input and critiques have been appreciated and incorporated in this document.

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Authors:

ARUP

Emma Warren	International Development Consultant
Vita Sanderson	Senior International Development Consultant
Lottie McCarthy	International Development Consultant
Roman Svidran	Senior Designer
Lauren Walter	International Development Consultant

Key Contributors:

CROWN AGENTS

Yucca Aurovillian
Eliot Stephens
Sanju Neupane
Leela Mulukutla

NSET

Narayan Marasini
Rajani Prajapati
Dev Maharjan
Pramod Khatiwada
Deepak Shrestha
Hima Shreshtha

ARUP

Jorge Lopez
Hayley Gryc
Timurhan Timur
Danielle Antonellis
Laura Elbourne-Binns

CHAPTER 1

INTRODUCTION

BACKGROUND

This manual was developed for the Nepal Safer Schools Project (NSSP), which will increase the safety of vulnerable schools infrastructure in Nepal, increasing protection for tens-of-thousands of children and building resilience throughout their communities.

This work was funded by Foreign Commonwealth and Development Office (FCDO) and delivered by a consortium of private-sector and NGO partners. The NSSP is integrated with the Government of Nepal's School Sector Development Plan which has a focus on school safety and disaster risk reduction.

Many schools in Nepal, and the children attending them, are recognised as being vulnerable to disasters, particularly earthquakes, floods and landslides. It is estimated that more than 4 million children in Nepal attend schools in unsafe buildings; in the 2015 earthquakes almost 7,000 schools were significantly damaged or destroyed. Fortunately the largest Gorkha earthquake struck on a Saturday (25th April 2015) when most schools were closed, limiting casualties.

The Nepal Safer School Project has three aims:

1. To make schools' infrastructure safer and more resistant to earthquakes.

2. To enhance skills and knowledge at the local level enabling schools, their pupils, staff and the wider community to be more resilient to natural disasters.

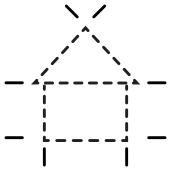
3. To increase capacity at a national level to support safer schools and disaster risk reduction.

PURPOSE

This Construction Manual is designed to assist the field technical team (the Construction Technician, the Sub-Engineer and the District Engineer) in the construction process.

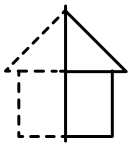
It has been developed in order to help teams at each school deliver the highest quality of construction by providing advice on Quality Assurance, Health and Safety, Material Specification and also by enhancing the Engineering Construction Drawings through the provision of additional drawings, diagrams, step-by-step construction processes and checklists to be read in conjunction with the Engineering Construction Drawings.

IT IS COMPRISED OF:



Construction Advice

Chapters on Quality Assurance (Chapter 2), Health and Safety (Chapter 3) and Materials Specification (Chapter 4) apply to all constuction projects and should be read in full before starting any works on site.



Retrofit Solutions

The methodology for how to undertake the relevant retrofit techniques are contained in Chapter 5.

Scope of the Manual

There are four key stages of implementation for school infrastructure which include; Planning, Design, Construction and Operation and Maintenance (O&M). At each stage there are a variety of activities and responsible stakeholders. This manual addresses the activities within the Construction phase providing construction advice and retrofit solutions for school infrastructure.

Planning	Design	Construction	Operation and Maintenance
• Needs assessment • Site Identification • Hazard assessment and site investigations • Site Feasibility • Site Masterplan	• Project Requirements • Concept Design • Construction Documentation • Bill of Quantities • Approvals and permits	• Construction Management • Site Quality Assurance (QA) including material testing • Health & Safety • Material Specification • Construction Methodology	• Budget for O&M • O&M manual including definition of roles and responsibilities • Regular maintenance • Design and implementation of repair work and required modifications

Four key stages of implementation with key activities to highlight scope of this manual (not an exhaustive list)

USING THE MANUAL

WHAT IS IN EACH CHAPTER OF THE MANUAL?

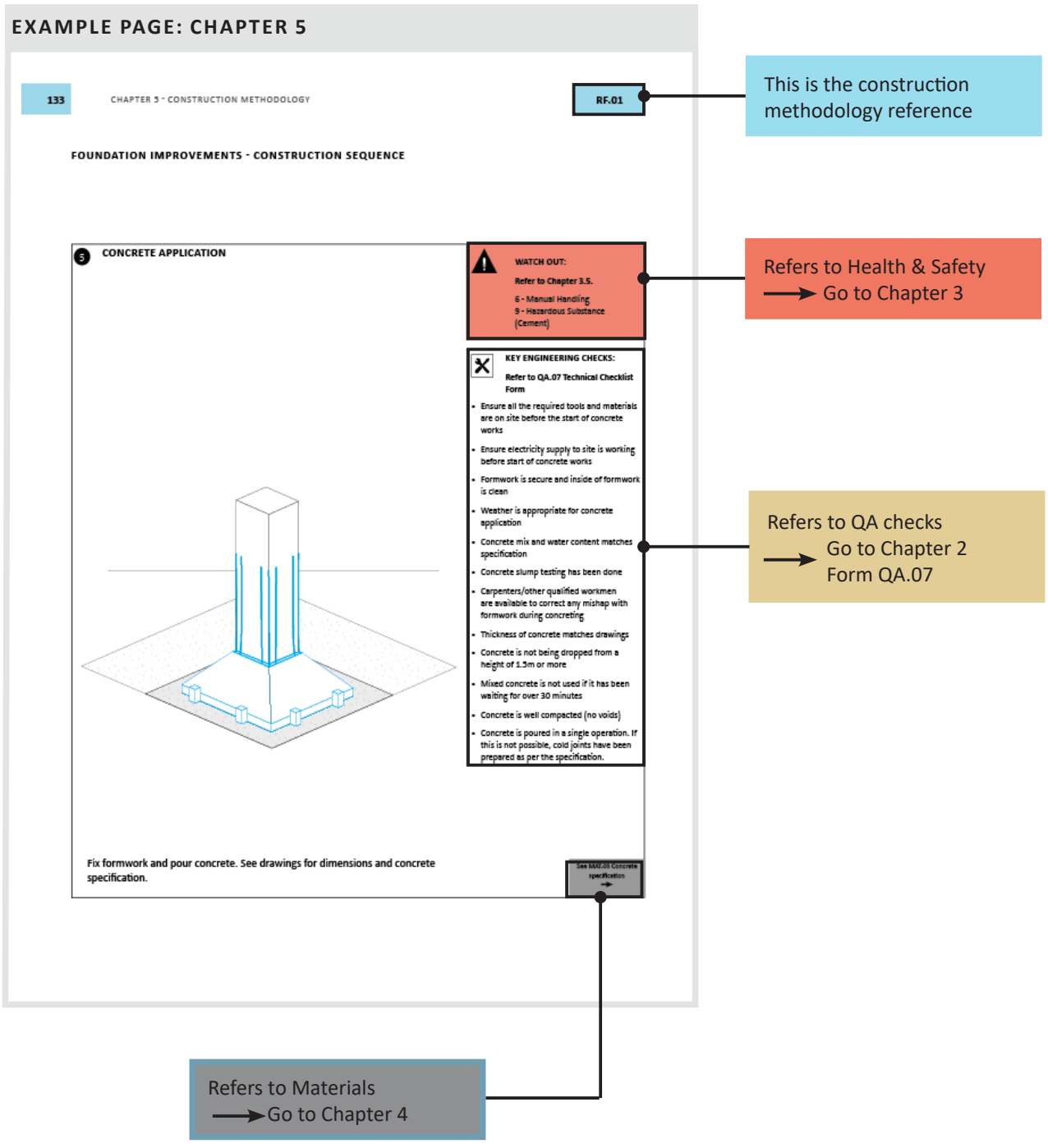
CHAPTER	SUMMARY
1. Introduction	This chapter contains an explanation of the purpose of the manual along with information on how to use it.
2. QA & Site Management	This chapter contains all the information about Quality Assurance processes for construction works and associated forms.
3. Health & Safety	This chapter covers all the relevant information and checklists to ensure the site is run safely during construction.
4. Material Specification	This chapters covers information on the different materials which will be used in the construction works and provides guidance on quality and standards.
5. Construction Methodology	This chapter provides guidance on the different retrofitting techniques and provides step-by-step instructions for construction for each.

HOW TO READ IT?

Chapters 1 to 4 should be read in full at the start of each project as these give important construction information for the whole of the retrofitting works.

Chapter 5 must be read as shown below, it refers back to sections of Chapters 2, 3 and 4 to remind you where relevant information can be found.

EXAMPLE PAGE: CHAPTER 5



ICONOGRAPHY


Do / good example


Don't / bad example


Watch out, health and safety


Construction Check


Sign off required

ACRONYMS

NSSP - Nepal Safer Schools Project

QA - Quality Assurance

PIU - Project Implementation Unit

SMC - School Management Committee

MOU - Memorandum of Understanding

NSET - National Society for Earthquake Technology Nepal

PPE - Personal Protective Equipment

CHAPTER 2

QA AND SITE MANAGEMENT

This chapter covers the Quality Assurance and site management protocols and forms to provide the field teams (District Engineer, Sub-Engineer and Construction Technician) with the framework and tools to ensure that construction quality can be maintained across the scale of the project.

The following topics are covered:

SECTION		ASSOCIATED FORMS	
2.1	Quality Assurance Strategy		
2.2	Site Monitoring	QA.01	Monthly Progress Report
		QA.02	Weekly Site Visit Record
		QA.03	Site Diary
		QA.04	Material Log - Materials Received
		QA.05	Stock Card
2.3	Change Control	QA.06	Change Control Form
2.4	Sign Off Procedures	QA.07	Technical Sign-Off Form
2.5	HR and Site Personnel	QA.08	Training Records
		QA.09	Daily Worker Register
2.6	Handover Process	QA.10	Post-Completion Inspection Form
		QA.11	Inspection Certificate

2.1 QUALITY ASSURANCE STRATEGY

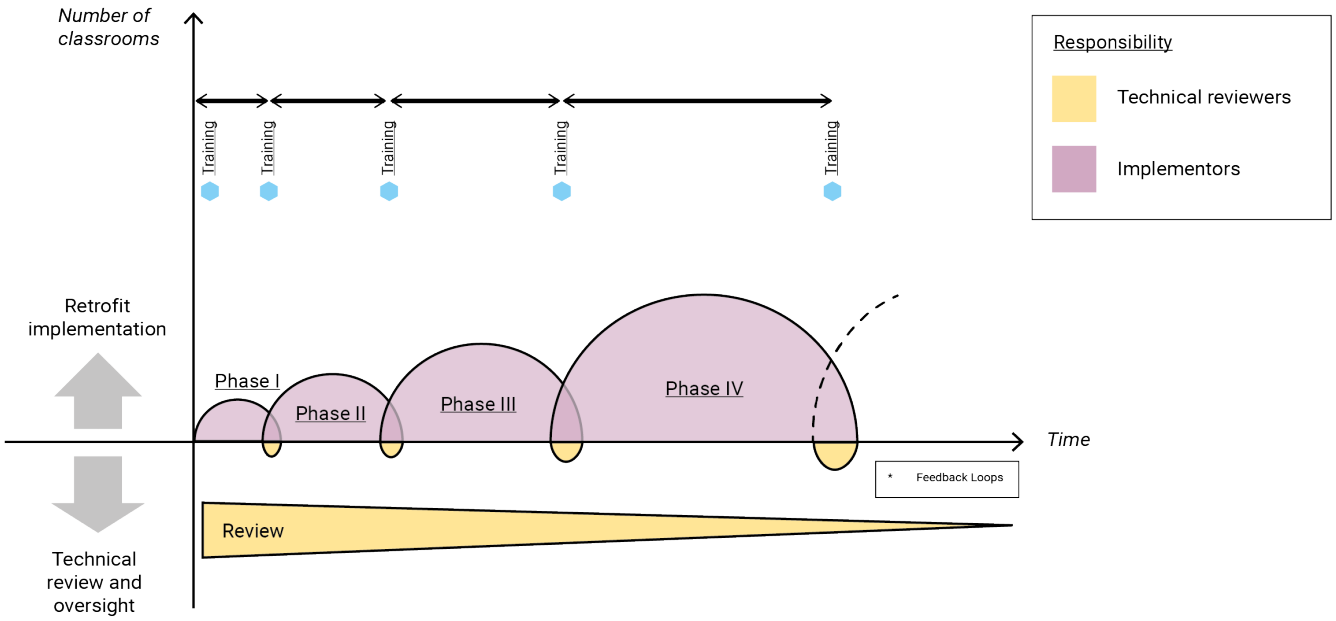
How to achieve quality assurance at scale?

Taking a systematic, replicable and scalable approach is required to produce good quality, functional and safer schools. The strategy sets out a phased approach that increases in scale of construction as the programme progresses. The first phase starts with a small number of schools in a pilot, which is then replicated and scaled by increasing the number of schools in each subsequent phase. This allows for feedback loops based on previous phases to continually improve the process at each phase of construction.

During each phase, the Technical Reviewer acts to ensure that the retrofitting works are carried out in line with the agreed methodology, are consistent, and identify key strengths as well as any weaknesses and gaps that may exist. This will form part of the learning that is incorporated in the subsequent phase.

The feedback loops at the end of every phase serve the purpose of identifying issues early on and rectifying design and construction approaches based on the feedback from both the Implementers and Technical Reviewers.

Addressing changes as the programme progresses improves the QA at each phase and prevents poor methodologies from being enacted at scale, helping to control risks in the implementation of large scale retrofitting programmes, maximising the impact of the programme.



Roles and Responsibility

Technical Reviewers	The Technical Reviewer oversees and provides technical feedback on the work implemented during the NSSP programme
Implementers	Implementers put the NSSP programme into practice through executing the retrofitting techniques for each individual school

A PHASED APPROACH

Phase 1: Pilot Design And Construction

The initial design criteria and assumptions are put into practice through the design and construction of a small number of retrofits. The purpose of this stage is to test both the applicability of the criteria in the design stage and subsequently the design in the construction stage. The learning outcomes should be clearly defined at this stage to aid the evaluation for the subsequent phases.

Phase 2: Optimise Design and Construction

The purpose of the optimisation phase is to adjust the implementation approach following the evaluation of the pilot phase to address key issues identified.

For example, this could take the form of:

- Alterations to the design approach to address challenges faced during construction.
- Inclusion of additional guidance, drawings or details to more effectively communicate the design where repeated issues in construction quality are identified.
- Improved quality and progress reporting processes.
- Further capacity building either for designers or constructors to address gaps in capabilities required.
- Adjustments due to material cost or availability considerations.
- Adjustments to programme to account for time to achieve external approvals.

This optimised design is then implemented for another set of buildings, usually slightly larger than the pilot, depending on the number of adjustments that have been required from the pilot phase. If significant adjustments have been required, it may be prudent to repeat the sample size of the pilot for the optimisation phase to ensure the adjustments made have been effective.

Phase 3: Replicate

Following a successful optimisation phase, this should be replicated in a larger number of buildings to ensure the approach continues to be effective and there are not additional considerations which arise from implementation in increased numbers. If so, these should be incorporated into adjustments in preparation for the next, larger, phases.

Phase 4 onwards: Scale

Benefiting from the learning from the previous phases, the project can then roll out the design and construction approach at a larger scale, confident that it has been well tested and therefore that the quality will be reflective of the learning from the phased approach.

As scale increases, learning outcomes should identify challenges in communication and management which may affect quality arising from increasing numbers of schools under construction .

SITE PERSONNEL ROLES AND RESPONSIBILITIES

This page describes the case study of NSSP and how a cluster approach was implemented to achieve quality assurance at scale.

Who is responsible for what?

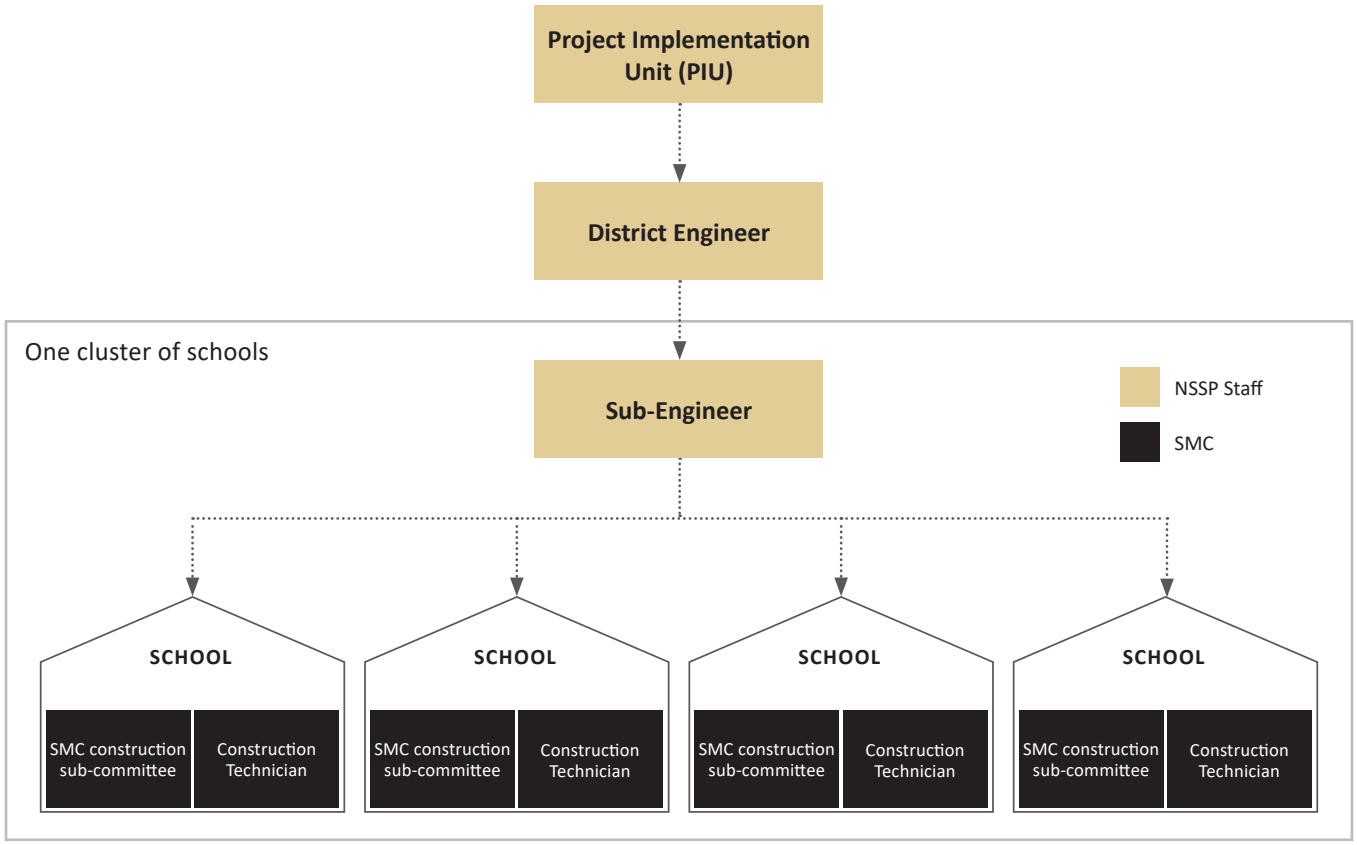
The Quality Assurance strategy consists of different levels of monitoring.

Firstly, the SMC Construction Sub-Committee will be taught what good construction looks like, and empowered to question what they see on-site. Each school will have a ***Construction Technician*** who will oversee all stages on construction. The ***Construction Technician*** will be hired by the SMC. Each school cluster will have a ***Sub-Engineer*** who works directly for NSSP and will oversee key construction stages and monitor works regularly.

There will also be a ***District Engineer*** who oversees all the school clusters in each of the four districts, they will also be NSSP staff.

Lastly the ***Project Implementation Unit (PIU)*** will make site visits to monitor construction, and be available to solve problems on site and facilitate any necessary design changes. Municipal engineers will be invited to site to inspect construction milestones where required.

Responsibility for QA sits with the ***Sub-Engineer***, as the technical person who is closest to site. The ***Construction Technician***, as the 'eyes and ears' on-site, are responsible for ensuring QA checks are carried out at the correct stages of construction.



SUMMARY OF QA RESPONSIBILITIES BY ROLE

	Topic	Contents	District Engineer	Sub Engineer	Construction Technician
2.2 Site Monitoring	Reporting on Progress	Responsibility	To report to PIU	To report to District Engineer	To report to Sub-Engineer
		Relevant Forms	District Progress Report (QA.02)	Site Visit Record (QA.03)	Site Diary (QA.04)
		Frequency	Monthly	Sub Engineer to visit site every other day - Site Visit Record to be completed weekly	Daily
	Programme Management	Responsibility	Main Person Responsible	To report problems and delays to the District Engineer	To report problems and delays to the Sub-Engineer
		Relevant Forms	District Progress Report (QA.02)	Site Visit Record (QA.03)	Site Diary (QA.04)
		Frequency	Monthly	Weekly	Daily
	Quality of Materials	Responsibility		Spot checks	Main Person Responsible
		Relevant Forms			Update and maintain Stock Card (QA.06) and Materials Log (QA.05)
		Frequency		Spot checks at least once a month	At every delivery and when materials are used in construction
2.3 Change Control	Change Control	Responsibility	To review to give to PIU for approval	To prepare relevant forms and submit to District Engineer	To notify Sub-Engineer when changes are required
		Relevant Forms		Change Control Form (QA.06)	
		Frequency		Every time there is a need to deviate from the design drawings.	
	Health and Safety on Site	See Chapter 3			
2.4 Sign Off Procedures	Quality of Workmanship	Responsibility	Spot Checks and review of Sign Off Forms	Main Person Responsible	Notifying Sub-Engineer when there are sign off points coming up
		Relevant Forms		Completing the site Sign Off Form (QA.07)	
		Frequency	Spot checks at least once a month	At relevant times as noted on the construction sequence drawings	
	Building Permits (New Build only)	Responsibility	Responsible for ensuring approval from Municipality through SMC	Responsible for requesting approval from Municipal Engineer	Responsible for notifying Sub-Engineer
		Relevant Forms			
		Frequency		At commencement, plinth level and at completion	

All forms noted above are included in this chapter

SUMMARY OF QA RESPONSIBILITIES BY ROLE (CONTINUED)

	Topic	Contents	District Engineer	Sub Engineer	Construction Technician
2.5 HR and Site Personnel	HR	Responsibility		To support SMC with labour issues. To review and sign Daily Worker Register	To maintain registers and other records.
		Relevant Forms		Sign Daily Worker Register (QA.09)	Maintain Training Records (QA.08) Maintain Daily Worker Register (QA.09)
		Frequency		Weekly	Daily
2.6 Handover Process	Handover	Responsibility	To review evidence of completion of corrective works and call for final inspection from Inspection Committee	Notification of completion and final (internal NSSP) inspection	Implementation of any corrective work required prior to Inspection
		Relevant Forms	To prepare the Inspection Certificate (QA.11) for signing by Inspection Committee Chair	Prepare Post-Completion Inspection Form (QA.10)	
		Frequency	At the end of the construction		

All forms noted above are included in this chapter

CONSTRUCTION TECHNICIAN RECRUITMENT

The Construction Technician will be recruited and employed by the SMC however they will be responsible for reporting to the Sub-Engineer on technical matters as detailed in the Roles and Responsibilities table on the previous pages.

This person is vital to ensuring the quality of the works undertaken by NSSP as they will be on site at all times.

Therefore, in order to make sure that a person who can manage the role is recruited, suitable support will need to be provided to the SMC during recruitment and the appropriate documentation included in the SMC MOU.

The final form will need to be agreed by NSET but as a minimum, any candidates should be tested on the following topics:

Understanding of construction drawings: the candidates should be able to draw a plan building from the school based on their observations with basic information including layout, dimensions, key features.

Setting out: the candidates should be able to complete a basic setting out exercise with pegs and string off a provided drawing.

Reporting: the candidates should be able to fill in a site diary clearly and accurately based on a provided narrative.

Construction materials: the candidates should be tested on their knowledge of key construction materials.

The Construction Technicians should all participate in a training programme before they commence work which should familiarise them with the following:

Retrofitting techniques: the candidates should be trained on the different retrofitting techniques and given a basic understanding of how they are improving the structure of the buildings.

Construction Drawings and Manual: a basic training on the engineering drawings they are likely to be working with and how the manual and the drawings should be read together.

Roles and responsibilities: the Construction Technician has a key role in both Quality Assurance and Health and Safety as detailed by this manual, and these should be clearly set out before work starts on site.

Construction materials: training on key materials including how to manage deliveries and check materials on arrival to preparation and use on site.

2.2 SITE MONITORING

Site monitoring is undertaken to provide Quality Assurance during construction.

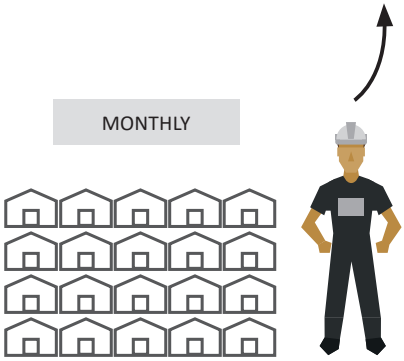
Site monitoring is to be carried out by all field staff, the following pages detail how and when QA activities for NSSP were organised and sets out the roles and responsibilities.

In NSSP, the **KoBoCollect™** app (see information on following page) was used where internet connectivity allowed. All NSSP staff were trained on the application prior to the start of construction. Otherwise, the paper forms provided in the following pages could be used and scanned and sent via email when possible for the recipient to input the information via KoBo so it be stored on the database.

SPOT CHECK

Project Implementation Unit (PIU)

MONTHLY



District Engineer

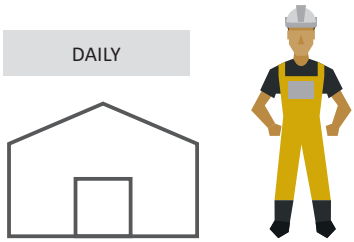
- Overall responsibility for the delivery of the projects within their **district**.
- Reports to the PIU with **Construction Progress Reports**.
- Should visit each site **monthly**.
- Based in the District Headquarters.

WEEKLY

Sub Engineer

- Responsible for the delivery of the projects within their **cluster**.
- Reports to the District Engineer with **Site Visit Records.**
- Should visit each site **every second day** and **at key points** for sign off.
- Based centrally **within their cluster**.

DAILY



Construction Technician

- Responsible for the delivery of their **school**.
- Reports to the Sub Engineer with a **Site Diary.**
- Based **on the school site** for the duration of the construction.

MOBILE DATA COLLECTION

The way data is collected affects the quality of the information received. Mobile data collection is used for the NSSP programme to further aid the scale implementation of the retrofitting works.

Potential Uses

- Assessments e.g. site access, building condition assessment and risk assessments
- Surveys e.g. existing buildings, land surveys including geological and geotechnical surveys
- Analysis of secondary information e.g. EMIS (national school information database)
- Monitoring progress and quality of construction work on site
- Disaggregate data in reports and maps: data dashboards, modelling and web maps

Benefits

- Improved data quality: control inputs, no need for manual transcribing from paper forms, reducing errors
- Design forms quickly and easily, build complex forms with skip logic and validation
- Reduced administration: no need to transcribe/type up data or input into Excel
- GPS geotagging possible
- Easier to integrate with other systems

Considerations

There are multiple tools available for mobile data collection. Kobo Collect is one tool available and has been selected due to its suitability for the NSSP programme, but there are others available that have similar capabilities.

Key considerations for choice of tool:

- Licencing
- Fee
- Ease of use and integration
- Online/ offline use
- Access with internal/ external organisations

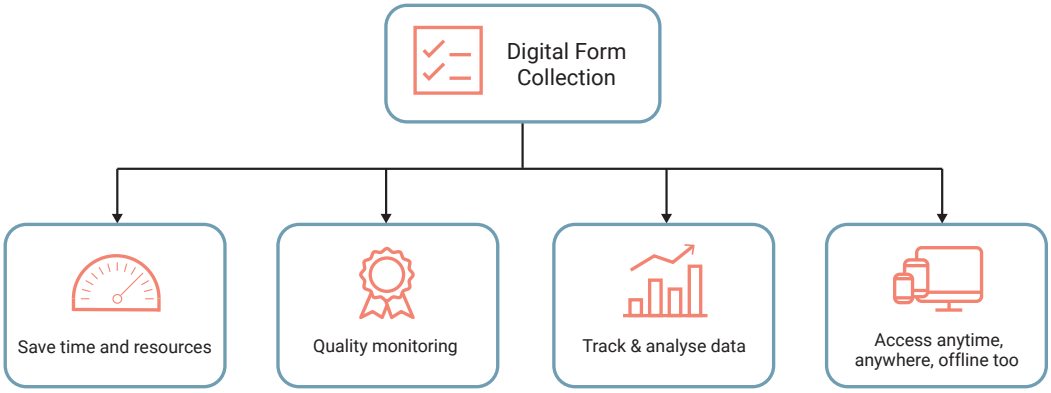


Image reference: Adapted from *The 4 Key Advantages of Digital Data Collection* (Progressly 2017)

MOBILE MONITORING ON SITE

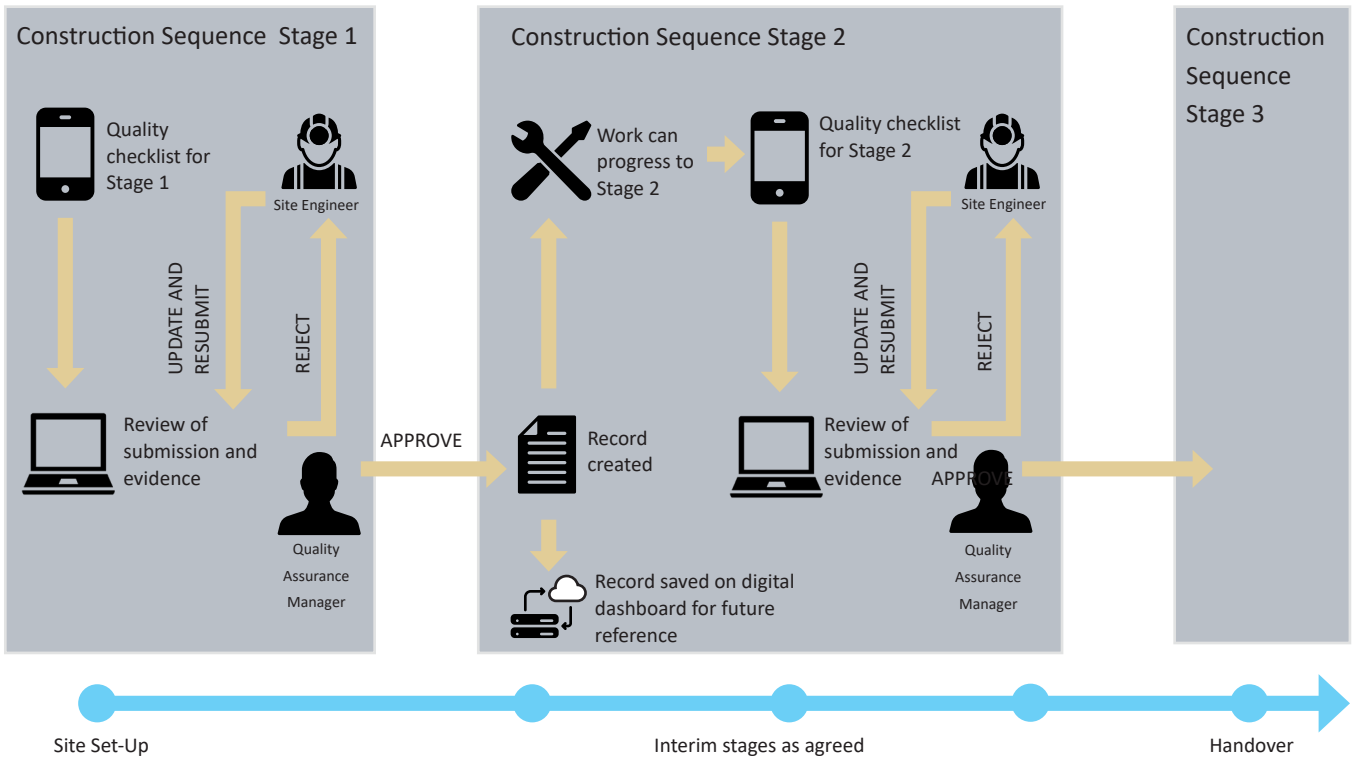
Using mobile data collection that links to a database on site automatically helps with the quality control on site and gives you the ability to remotely monitor project progress whilst reducing reporting time and improves accuracy (e.g. for change orders for site work).

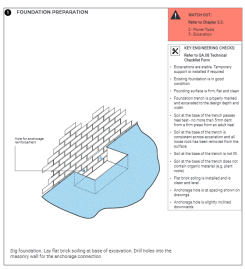
Questions to be considered:

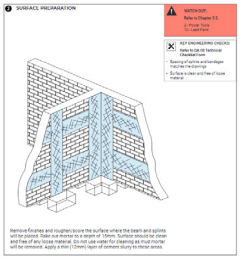
- Who needs to see what information?
- Who needs to input information?
- What is the purpose of collecting information?
- What verification is required and who provides and approves this?
- Are any other outcomes required?

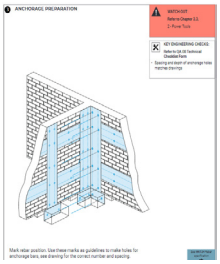
Quality Assurance Forms

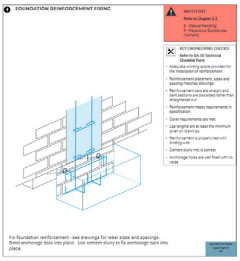
The use of a mobile database allows for early detection of quality assurance issues on site enabling avoidance of errors and maximises value from the existing school selection database.







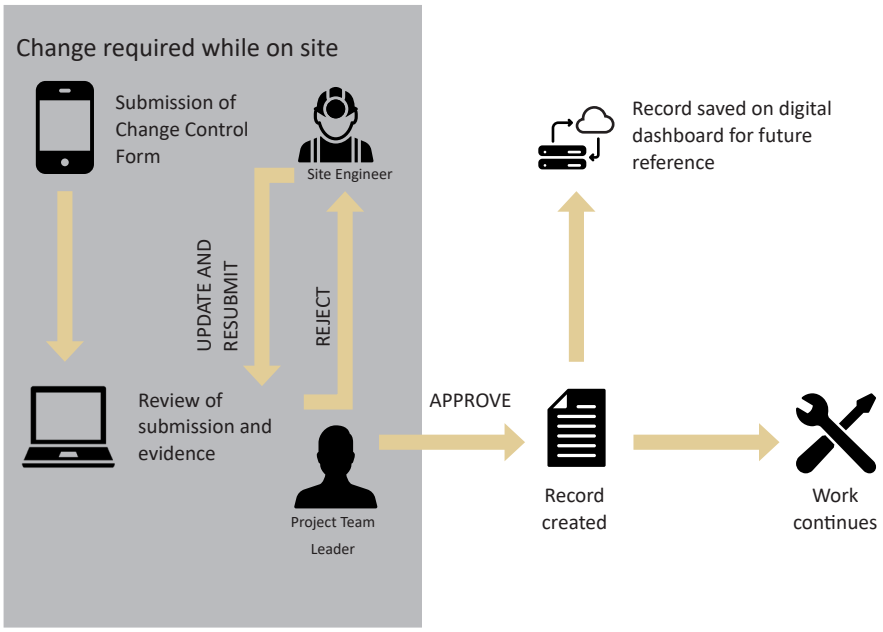




MOBILE MONITORING ON SITE

Change Control Forms

The use of a database for change control forms aids transparency and improves approval times on site. Forms are automatically saved on database platform for future reference.



COVID-19 Response Applications and Benefits

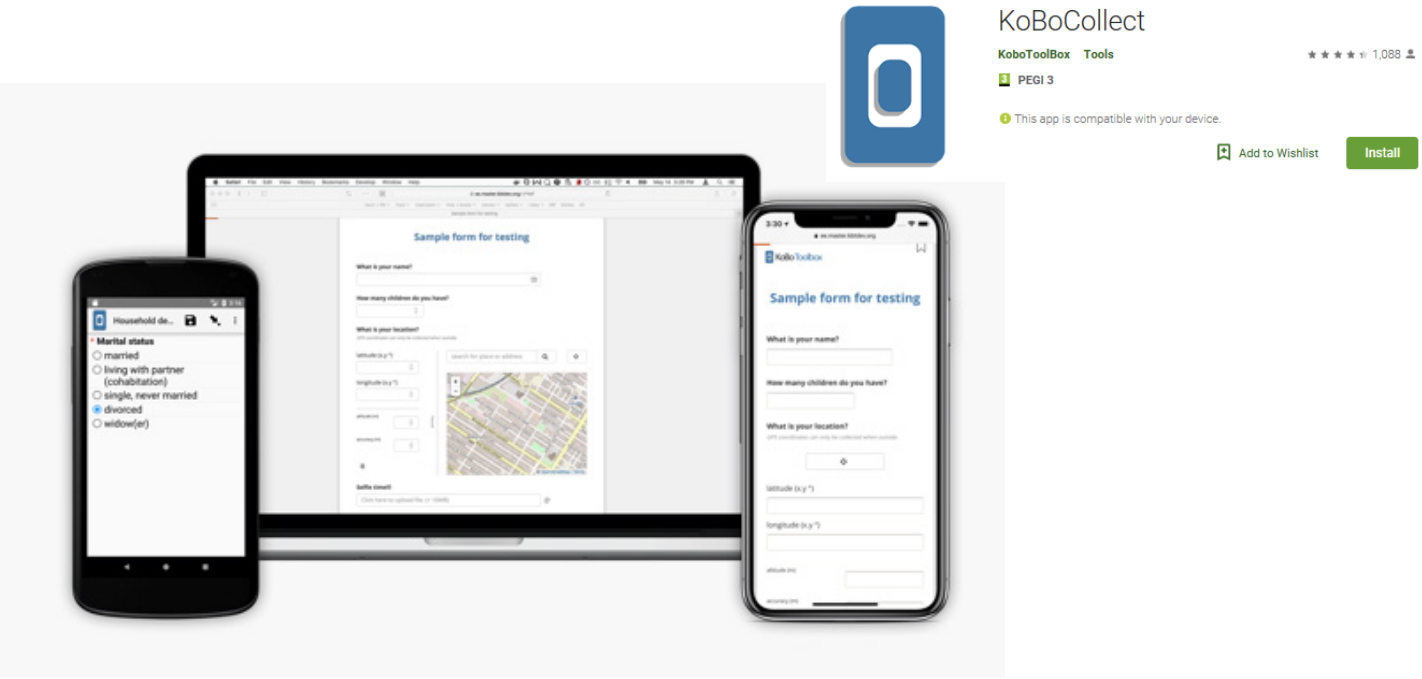
- Enable **remote construction oversight** during periods of extensive national and international travel restrictions.
- **Reduced exposure** for staff by reducing need for unnecessary travel to oversee site works.
- Ability to pull data from screening survey to report on existing WASH facilities in NSSP schools and undertake analysis to aide **decision making on additional hygiene interventions** around COVID-19.
- Collection of **evidence of impact** of any of these additional interventions.

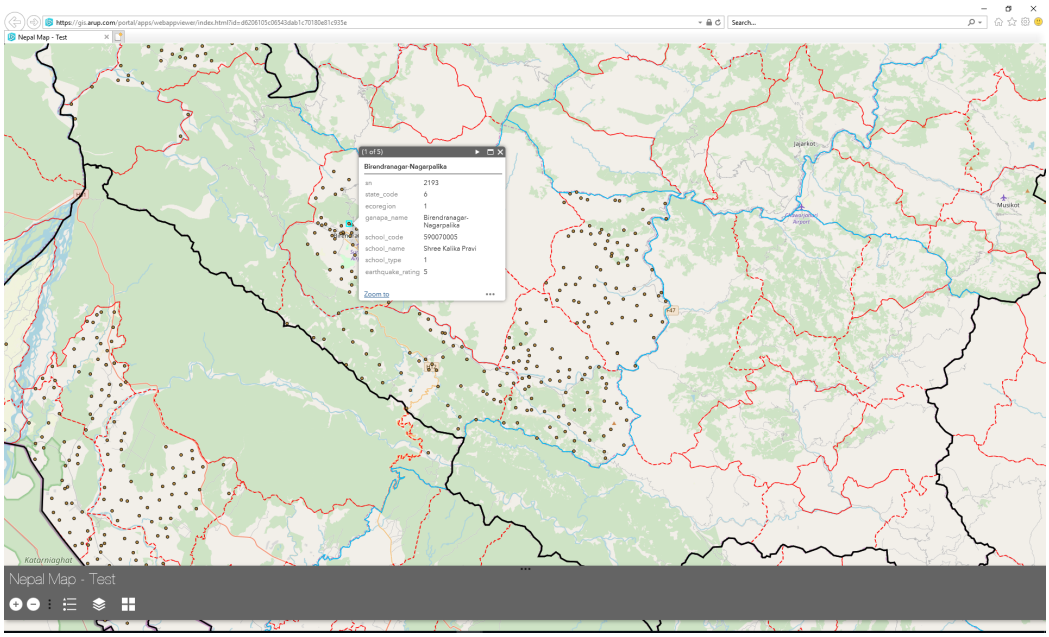
KOBOCOLLECT ™ AND THE NSSP DATABASE

Technology is key to making this process consistent and efficient. During the pilot phase KoBoCollect will be trialled and all Field Staff (District Engineers, Sub Engineers and Construction Technicians) will be trained in the platform.

The information in the forms from each stage of the quality assurance process, as detailed in this chapter of the manual will be collected into a central database hosted on a web-platform from where it will be possible to monitor remotely what the progress on site is and highlight if the correct procedures are not being followed. It will also improve the response time and transparency of the NSSP construction.

The app will work offline and save the forms for submission later for use in remote school sites but if needed the forms are provided on the following pages to be printed as paper version to be scanned and emailed later and then inputted into KoBoCollect.





QA.01 | MONTHLY DISTRICT PROGRESS REPORT (PAGE 1)

Time	Week		Date	
District name				
Progress				
Last month	Number of school blocks in district completed: Number of school blocks in district in progress: Number of school blocks in district not yet started:			
Next month				
Looking ahead				
Procurement				
Last month				
Next month				
Looking ahead				
Labour				
Who/what skills were present onsite last month				
Who/what skills will be needed on site next month				
Who/what skills will be needed on site looking forward				

QA.01 | MONTHLY DISTRICT PROGRESS REPORT (PAGE 2)

Plant/Tools (any issues)
Programme (ahead/behind schedule)
Finance (update on spend so far)
Health and Safety Issues on sites - Mitigation measures taken
Queries: Has there been anything queried to the PIU? Has there been any queries resolved?
Any other business?

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 1)

Location	EMIS number		School name	
	Municipality			
	Building reference			

Visit Information	
Prepared by	
Role	
Date	
Supervisor name	
Construction Technician Name	
Activities completed during visit (Orientations, briefings, stock checks etc.)	
Meetings held during visit	
Instructions given during meetings	
Site Information	
Personnel on site - Site supervisors	
Personnel on site - Skilled workers *(Mason, electrician, mechanic, painter, bar bender, plumber, carpenter welder)*	
Personnel on site - Semi-skilled workers *(Mason helper, bar bender helper, carpenter helper)*	
Personnel on site - Unskilled workers *(Labourer)*	
Materials on site	
Materials received this week? *Site stock card to be updated, issues to be noted in next question.*	☐ Yes - received as planned ☐ No - none planned ☐ Yes but there are some errors or other issues ☐ No but there should have been a delivery
Materials on site - description of any issues *Include any materials not received*	
Materials on site - photos of any issues *Include any materials not received*	
Describe any material testing being carried out over the week *Include type of testing, frequency (e.g. 20 blocks from every delivery), summary of results*	
Plant and tools on site	
Any issues with plant and tools on site? *If yes, fill in following questions to describe*	☐ Yes ☐ No
Plant and tools on site - description of any issues	
Plant and tools on site - photos of any issues	
Any issues with fund flow or procurement?	☐ Yes ☐ No
Fund flow and procurement - description of any issues	
Have there been any health and safety incidents on site this week? *Accidents or near misses - both should be noted* *Include the type of testing, how often it is carried out (e.g. every delivery)*	☐ Yes ☐ No
Ensure an accident or near miss report has been completed for any health and safety incidents	

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 2)

Block Information	
Block nunber *Plase enter B plus one number, e.g. B1*	
Description of weekly progress on block	

Which QA checks have been done for block this week?	
☐	Site Setup
☐	Site Management
☐	Groundworks
☐	Materials Delivery
☐	Materials Storage
☐	Foundation Improvements
☐	RC Jacketing - Masonry
☐	RC Jacketing - RC Frame
☐	Splint and Bandage
☐	Addition of Crosswall
☐	Diaphragm Stiffening
☐	Addition of Horizontal Bracing
☐	Replacement Slab
☐	Parapet Strengthening
☐	Gable Alterations
☐	None
Which stage of foundation improvement are you checking this week?	
☐	Foundation Preparation
☐	Surface Preparation
☐	Anchorage Preparation
☐	Reinforcement Fixing
☐	Concrete Application
☐	Concrete Curing
Which stage of RJ Jacketing - Masonry are you checking this week?	
☐	Foundation Preparation
☐	Surface Preparation
☐	Anchorage Preparation
☐	Reinforcement Fixing
☐	Slab Connection Preparation
☐	Slab Connection
☐	Concrete Application for Footing
☐	Concrete Application for Bottom Section of Column
☐	Concrete Application for Top Section of Column
☐	Concrete Curing
Which stage of Splint and Bandage are you checking this week?	
☐	Foundation Preparation
☐	Surface Preparation
☐	Anchorage Preparation
☐	Foundation Reinforcement Fixing
☐	Reinforcement Fixing
☐	Foundation Concrete Pour
☐	Concrete Application
☐	Concrete Curing

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 3)

Which stage of Addition of Crosswall are you checking this week?	
☐	Foundation Preparation
☐	Foundation Anchorage
☐	Foundation Reinforcement Fixing
☐	Foundation Concrete Pour
☐	Stitching Bars Preparation
☐	Bricklaying - to underside of first holes
☐	Stitching Bars
☐	Bricklaying - to complete crosswall
☐	Splint and Bandages
Which stage of Diaphragm Stiffening are you checking this week?	
☐	Surface Preparation
☐	Wall-Floor Connection
☐	Anchorage Preparation
☐	Reinforcement Fixing
☐	Concrete Pour
☐	Concrete Curing
Which stage of Addition of Horizontal Bracing are you checking this week?	
☐	Preparation and Drilling
☐	Fix Connection and Collector Plates
☐	Fix Bracing
☐	Finishing
Which stage of Addition of Replacement Slab are you checking this week?	
☐	Demolition of Existing Structure
☐	Breaking Out of Existing Wall
☐	Formwork and Falsework
☐	Reinforcment Fixing
☐	Concrete Pour
☐	Concrete Curing
Which stage of Parapet Strengthening are you checking this week?	
☐	Surface Preparation
☐	Anchorage Preparation
☐	Reinforcement Fixing
☐	Concrete Application
☐	Concrete Curing
Which stage of Gable Alterations are you checking this week?	
☐	Stability of Existing Structure
☐	Demolition
☐	Bandage Construction
☐	Replace Gable
Which stage of Gable Alterations are you checking this week?	
☐	Surface Preparation
☐	Anchorage Preparation
☐	Reinforcement Fixing
☐	Concrete Application
☐	Concrete Curing
Which stage of Alterations of Existing Openings are you checking this week?	
☐	Remove Alternate Edge Bricks
☐	Fill Existing Opening

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 4)

Which stage of Repair Works - Masonry Damage are you checking this week?		
	☐	Cement Grouting
	☐	Rebuilding
	☐	Exposed Reinforcement
Ensure a Milestone Checklist form has been completed for each QA check.		
Plan for week ahead for block		
Challenges for block		
Instructions given on site for block		
Issues for the PIU for block		
Has a change been requested regarding this block this week?	☐	Yes
Ensure a change control form is completed for any change requests.	☐	No

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 5)

Works Completed					
Block Ref					
SN	Description	Unit	Total Quantity	Quantity Used to Date	Percentage Used (%)
1.00	*Site Preparation/ Protection Works*				
1.10	Labor for removing & safe storage	LS			
1.20	Providing and fixing the 500 gauge polythene sheet with adhesive tape and nail for protection of door/ window frame with its fixtures of (on which shutter has removed) by covering it, including removing it after completion of the work and cleaning thoroughly all complete as original condition or as per instruction by the Engineer.	sqm			
2.00	*Reinstatement Works*				
2.10	Removing of existing door or window shutters and its fixtures (not frame) and its safe storage before construction including cleaning and fixing, all complete as original condition or drawing and as per instruction by the Engineer.	Nos			
2.20	Removing of existing door or window shutters and its fixtures (not frame) , its safe storage before construction and ***reinstate it*** after retrofitting including cleaning and fixing, all complete as original condition or drawing and as per instruction by the Engineer.	Nos			
3.00	*Demolition Works*				
3.10	Demolition of the existing brick masonry wall in cement mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.	cum			
3.20	Demolition of the existing brick masonry wall in mud mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.	cum			
3.30	Demolition of existing P.C.C. in perfect line, level and disposing the debris including transportation of debris, cleaning the site all complete as per drawing, specification and instruction by the Engineer.	cum			
3.40	Demolition of existing R.C.C. slab in perfect line, level and disposing the debris including transportation of debris, cleaning the site all complete as per drawing, specification and instruction by the Engineer.	cum			
3.50	Stripping off the existing cement plaster on the wall, raking out the cement mortar to a depth of 10 mm at joint, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.	sqm			
3.60	Stripping off the existing cement plaster on the mud mortar masonry wall, raking out the mud mortar to a depth of 10 mm at joint, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.	sqm			
3.70	Dismantle of existing roof truss with CGI sheet, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.	sqm			
3.80	Demolition of the existing stone masonry wall in cement mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.	cum			
3.90	Demolition of the existing stone masonry wall in mud mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.	cum			
4.00	*Excavation Works*				
4.10	Earthwork in excavation in ordinary to mixed/hard soil in foundation including dressing of sides and proper compaction to trench bed, disposing of excess soil all complete as per drawing, specification and instructions by the Engineer.	cum			
4.20	Backfilling Works	cum			

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 6)

Works Completed					
SN	Description	Unit	Total Quantity	Quantity Used to Date	Percentage Used (%)
5.00	*Masonry Works*				
5.10	Good quality local chimney made brick work in cement sand mortar (1:4) in perfect line, level and finishing including , curing, raking out green mortar from joints and cleaning the brick face before stopping the work and proper bonding with existing masonry all complete as per drawing, specification and instruction by the Engineer.	cum			
5.20	Providing and laying flat brick soling with voids filled with sand in foundation in line and level all complete as per drawing, specification and instruction by the Engineer.	sqm			
5.30	Providing and laying Stone soling with voids filled with sand in foundation in line and level all complete as per drawing, specification and instruction by the Engineer.	cum			
5.40	Stone Masonary work in cement sand mortar (1:6) in perfect line, level and finishing including , curing, raking out green mortar from joints and cleaning the Stone face before stopping the work and proper bonding with existing masonry all complete as per drawing, specification and instruction by the Engineer.	cum			
6.00	*Concrete / Micro-Concrete Works*				
6.10	Providing, mixing and laying P.C.C. in 1:1.5:3 ratio for foundation, flooring, beam with stone aggregate 20mm down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.	cum			
6.20	Providing, mixing and laying P.C.C. in 1:1.5:3 ratio for 75 mm thick micro concrete jacketing on wall surface with stone aggregate 4.75mm down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.	cum			
6.30	Providing, mixing and laying P.C.C. in 1:1.5:3 ratio for 40 mm thick micro concrete jacketing on wall surface with stone aggregate 4.75mm with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.	sqm			
6.40	Providing, mixing and laying P.C.C. in 1:3:6 ratio for concreting on foundation with stone aggregate 40 mm down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.	cum			
7.00	*FormWorks*				
7.10	Providing, fitting and fixing standard formwork of shuttering local wood including all necessary metal/wooden props, bracing, wedges and nails etc. and careful removal of form works at approved time for all type of R.C.C. works all complete as per specification and instruction by the Engineer.	sqm			
7.20	Providing and fixing the scaffolding works for more than one storey and all complete as original condition or as per instruction by the Engineer.	sqm			
8.00	*GI Wire Works*				
8.10	Providing, cutting and laying galvanized wire mesh of prescribed diameter and mesh size including anchoring it on the wall with stainless screw with G.I washer by drilling and fixing grip all complete as per drawing details, specification and instruction by the Engineer.	kg			
8.20	Providing, cutting and laying galvanized ***welded*** wire mesh of prescribed diameter and ***mesh size*** including anchoring it on the wall with stainless screw of length 64mm with G.I washer by drilling and fixing grip all complete as per drawing details, specification and instruction by the Engineer.	sqm			
9.00	*Steel Works*				
9.10	Providing high strength deformed bars (HYSD) of grade Fe:500 approved reinforcement confirming to IS: 1786 - 1985 for R.C.C work and approved bar bending schedule including straightening, cutting, bending, placing and binding in position by binding wires all complete as per drawing, specification and instruction by the Engineer.	kg			
9.20	Providing and fixing black pipe of all sizes and bars for bracing, tie up and restrengthing of roof structure including welding, making hole for nut & bolt, two times primer coating and nailing in perfect line, level and plumb as per drawing details, specification and instruction by the Engineer.	kg			
9.30	Providing and fixing 16mm dia nut and bolts of maximum length 150mm long as per drawing details, specification and instruction by the Engineer.	nos			

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 7)

Works Completed					
SN	Description	Unit	Total Quantity	Quantity Used to Date	Percentage Used (%)
10.00	*Anchorage Works*				
10.10	Providing, cutting, bending and laying 2mm dia GI wire in a hole of dia 12mm throughout the wall to anchor the G.I wire jacketing including drilling the holes with rotary drill, cleaning it with blow air and filling the hole by cement slurry upto finished level all complete as per drawing, specification and instruction by the Engineer.	nos			
10.20	Providing, cutting , bending and laying 4.75mm dia bar in a hole of dia 16mm on the wall to anchor the tie beam including drilling the holes with rotary drill, cleaning it with blow air and filling by cement slurry by gravity flow all complete as per drawing, specification and instruction by the Engineer.	nos			
10.30	Drilling the holes with rotary drill, cleaning it with air blower to insert the jacketed rebar throught the existing slab and filling the hole with cement slurry by gravity flow/ epoxy groute whereever necessary all complete as per drawing, specification and instruction by the Engineer.	nos			
10.40	Drilling Holes in Slab for Insertion of Vertical Bars and Filling with Cement Slurry	Nos			
11.00	*Plaster Works*				
11.10	Cement plaster works over GI wire mesh / chicken wire mesh on walls, with cement sand mix (1:3) and 20 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.	sqm			
11.20	Cement plaster works over on walls, with cement sand mix (1:4) and 12.5 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.	sqm			
11.30	Cement plaster works over GI wire mesh / chicken wire mesh on walls, with cement sand mix (1:3) and 30 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.	sqm			
12.00	*Rectrification works*				
12.10	Rectrification of doors	nos			
13.00	*Painting Works*				
13.10	Applying two coats white cement paint	sqm			
13.20	Applying two or more coats of enamel paint of approved colour and quality on existing wooden member without primer in properly sanded surfaces for high class finish all complete as per specification and satisfaction of Engineer. All enamel paint will be provide by Engineer.	sqm			
13.30	Applying one coat of primer and one weather coat paint in properly sanded outsided wall surfaces for high class finish all complete as per specification and satisfaction of Engineer. All enamel paint will be provide by Engineer.	sqm			
13.40	Applying one coat of primer and one coat of distemper paint in properly sanded inside wall surfaces for high class finish all complete as per specification and satisfaction of Engineer. All enamel paint will be provide by Engineer.	sqm			
14.00	*Flooring Works*				
14.10	Providing and laying 3 mm thick cement sand punning (1:1) on floor including mixing laying and rubbing with steel trowel to a hard, smooth and shining surface and curing all complete as per specification and instruction nett.	sqm			
14.20	75 mm thick screeding (1:2:4)	cum			
14.30	Skerting of cement plaster including supply of materials, mixing, placing and pouring, compaction and curing etc. of specified thickness all complete.	RM			
15.00	*CGI works*				
15.10	CGI sheet	sqm			
15.20	Metal work	Kg			
15.30	U- Bolt of 10 mm diameter bolt	Nos			

QA.02 | WEEKLY SITE VISIT RECORD FORM (PAGE 8)

Works Completed					
SN	Description	Unit	Total Quantity	Quantity Used to Date	Percentage Used (%)
16.00	*Ramp Works*				
16.10	Excavation in foundation	cum			
16.20	Soil Filling and Compaction	cum			
16.30	Brick Soling	sqm			
16.40	PCC	cum			
16.50	Masonry Works	cum			
16.60	Screeding	cum			
16.70	Steel Railings (40 mm square hollow pipe)	rm			
17.00	*Additional Works*				
17.10	Roof Bracing	Cum			
17.20	Supply, making and fixing of sal wood frame of good quality sal wood for doors frame size 75mm x 100 mm finished size as per drawing and specification all complete.	Cum			
Total Works Completed of block (%)					

Total Works Completed	
Block	**Total works completed of block (%)**
Total Works Completed of school (%)	

QA.03 | SITE DIARY

Location	EMIS number		School name	
	Municipality			
Time	Week		Date	
Weather				

Site Activities.

Personel on site	
Skill set (eg carpenter, mason, unskilled labour)	Number
Site Supervisor	
Skilled - Mason	
Skilled - Operator	
Skilled - Bar bender	
Skilled - Carpenter	
Skilled - Electrician	
Skilled - Plumber	
Skilled - Mechanic	
Skilled - Welder	
Skilled - Painter	
Semi-skilled - Mason Helper	
Semi-skilled - Bar bender Helper	
Semi-skilled - Carpenter Helper	
Unskilled - Labourer	
Other	

Vistors to site

Machinery on site

Quality Assurance checks performed

H&S Incidents

Meetings and general notes

Completed by	
Signature	
Witnessed by	(SMC Construction Committee Member)
Signature	

QA.04 | MATERIAL LOG - MATERIALS RECEIVED

Insert from BoQ												
Material	**Type / size**	**Total Quantity**	**Cost per unit**	**Total Cost**	**Supply notes**	**Quality Assurance**	**Logistics to site**	**Transport cost**	**Request Date**	**Delivery Date**	**Material quality check**	**Material quantity check**
	Eg grade, mix, strength, etc		Nepali Rupees/unit	Nepali Rupees	eg. lead in time, reliability of supply	eg. certifications, tags, proof of material grade/type	eg. Transport, lead in, ordering time, access	Nepali Rupees	When were the materials ordered?	When did materials arrive?	Did materials pass quality check (see CH. 4 for checks)?	Does quantity recieved match quantity ordered?

QA.05 | STOCK CARD

For tracking the movement of materials into and around the site. Must be used for all materials.

Material	Quantity taken out	Quantity remaining in	By	Purpose	Signature
			Name		

2.3 CHANGE CONTROL FORMS

WHAT

What are they?

They are forms which communicate any changes that are needed to the design while the works are on site.

WHO

Who prepares the forms?

They are prepared by the Sub-Engineer and reviewed by the District Engineer before being sent to the PIU for signing.

WHEN

When do they need to be used?

When there is any variation to what is shown on the design drawings or specifications.

WHY

Why are they needed?

Things on site are not always as envisaged and so there needs to be a way to make sure that any changes that are needed are correctly approved.

Good reasons to request a change might include:

- lack of availability of certain materials
- the conditions on site do not allow the design to be constructed as drawn
- there is no safe way to construct what has been drawn

There cannot be any change from the construction drawings without a signed change control form.

QA.06 | CHANGE CONTROL FORM

Sub-Engineer to advise SMC regarding rules on what changes may be applied for based on the guidance, particularly in regards to applications for cost increases.

Time	Week		Date		
Description of Change					
Reasons for change					
Corrective action	☐	Design Development	☐	Other Reason (please specify)	☐
Site Condition Requirement	☐	End-user Request	☐		
Cost					
Total estimated cost/saving of proposed change					
Details of costing assumptions and exclusions					
Source of additional funding if required					
Design					
Expected design impact (to be confirmed by District Engineer)					
Programme					
Total estimated programme implication of proposed change					
Assessment of impact of not implementing proposed change					
Completed by					
Signature					
Approved by (Team Leader)					
Signature					

2.4 SIGN OFF PROCEDURES

To ensure the quality of the construction, the works must be inspected at key points to make sure the works are progressing in line with the design.

PROCESS

The **Construction Technician** notifies the Sub-Engineer when an area is ready for sign off

The **Sub-Engineer** inspects the area and completes a **Sign Off Form**

Work can only continue after signing off.

The **Sub-Engineer** submits the form to the **District Engineer**.

A hard copy of the form is retained on site.

The Sub-Engineer is responsible for ensuring all the correct checks have been done

WHEN

At each stage of the construction sequence drawings (Chapter 5), the checks noted must be completed before moving onto the next stage.

Construction cannot continue past the key points without sign off.

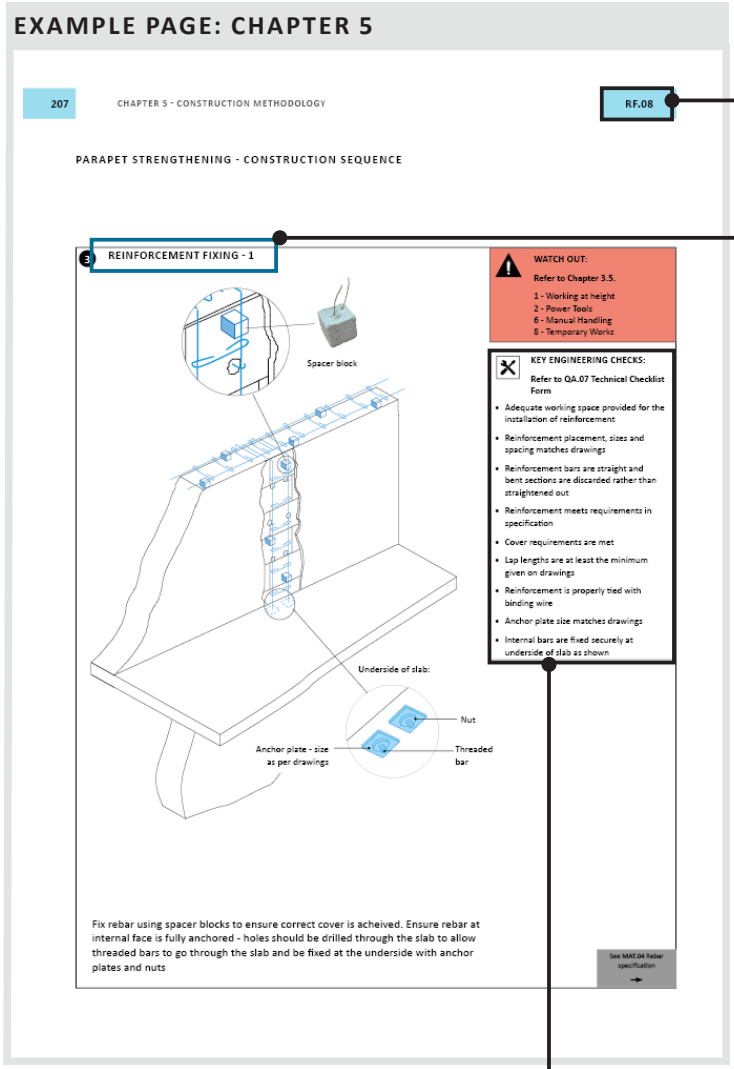
Checks are shown at each stage on the Construction Sequence drawings in Chapter 5 - see next page.

HOW TO USE QA.07 TECHNICAL SIGN OFF FORM

QA.07 Technical Sign Off Form needs to be used alongside the construction sequences detailed for each retrofitting technique in Chapter 5.

Each step in the construction sequences detailed in Chapter 5 has a corresponding list of checks that need to be carried out before progressing to the next step. This list of checks is duplicated in form QA.08 in order to record the sign-off process.

EXAMPLE PAGE: CHAPTER 5



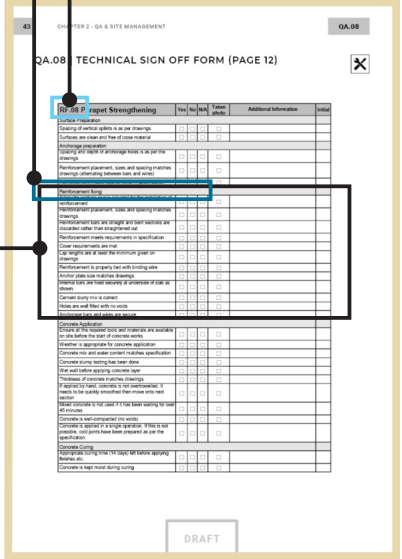
This is the construction methodology reference

This is the construction step reference

List of QA checks

→ Go to relevant section of Form QA.07

EXAMPLE PAGE: QA.07



QA.07 | TECHNICAL SIGN OFF FORM (PAGE 1)

To be updated regularly by Sub Engineer during site visits.

Site Setup	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Fence or caution tape is installed in correct place, surrounding site extents.	☐	☐	☐	☐			
If used, fence is stable, not swaying or wavy. If used, caution tape is secure and taut.	☐	☐	☐	☐			
Adequate allowance made for site access and egress	☐	☐	☐	☐			
There is a reliable electricity supply to site (mains or generator)	☐	☐	☐	☐			

Site Management	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
All materials are removed and disposed of safely	☐	☐	☐	☐			
Ensure egress routes are clear and available at all times	☐	☐	☐	☐			
Ensure storage of ignition risks (e.g. welding equipment) is away from fuel and combustible materials	☐	☐	☐	☐			
Ensure provision of fire fighting equipment	☐	☐	☐	☐			

Ground works	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Setting out done to specification	☐	☐	☐	☐			
Site mitigation measures are completed in line with the drawings.	☐	☐	☐	☐			
Site drainage control: there are no areas of ponding water, water can safely drain away from site	☐	☐	☐	☐			

Materials delivery	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
There is adequate space on site to accommodate materials delivery.	☐	☐	☐	☐			
Materials that are delivered in bulk are measured (volume) on the truck before unloading.	☐	☐	☐	☐			
Materials are recorded in the stock card on delivery.	☐	☐	☐	☐			
There is a signed delivery note for every delivery.	☐	☐	☐	☐			

Materials storage	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
There is adequate space to store materials on site.	☐	☐	☐	☐			
Valuable materials can be secured to prevent theft.	☐	☐	☐	☐			
Items which are stacked must be stable to ensure they do not fall on workers.	☐	☐	☐	☐			
Stored materials do not block access routes.	☐	☐	☐	☐			
Manufacturer's instructions for storage are followed for all items, particularly for hazardous substances.	☐	☐	☐	☐			
Workers must not walk or stand on stacked materials.	☐	☐	☐	☐			
Bricks are stacked on level, well drained ground and protected from rain with a polythene sheet. They are stacked on edge to a maximum height of 2.4m.	☐	☐	☐	☐			
Blocks are stacked in columns up to 8 blocks high and protected from rain with a polythene sheet.	☐	☐	☐	☐			
Roof sheets are stored flat on a level surface and covered with a polythene sheet.	☐	☐	☐	☐			
Timber should be stacked horizontally, maintaining free airflow. Different sizes should be stored separately. Timber must be covered to be protected from rain.	☐	☐	☐	☐			
Cement is stacked to a height no more than 1m on a raised dry platform such as a pallet. It is covered with a polythene sheet weighed down at the edges to ensure the cement remains dry.	☐	☐	☐	☐			
Different aggregate types and sizes must be kept separate. Store on a clean, hard, free-draining surface.	☐	☐	☐	☐			
Rebar should be stacked off the ground and protected from the rain. Different sizes should be stored separately.	☐	☐	☐	☐			
Structural steel should be stored at least 150mm off the ground and protected from the rain. Different sizes and strength classes should be stored separately.	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 2)

RF.01 Foundation Improvements	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Foundation Preparation							
Excavations are stable. Temporary support is installed if required	☐	☐	☐	☐			
Existing foundation is in good condition	☐	☐	☐	☐			
Top surface of footing is clean and free of loose material	☐	☐	☐	☐			
New founding surface is firm, flat and clean	☐	☐	☐	☐			
Foundation trench is properly marked and excavated to the design depth and width	☐	☐	☐	☐			
Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel.	☐	☐	☐	☐			
Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface	☐	☐	☐	☐			
Soil at the base of trench is not fill	☐	☐	☐	☐			
Soil at the base of the trench does not contain organic material (e.g. plant roots)	☐	☐	☐	☐			
Flat brick soling is installed and is clean and level.	☐	☐	☐	☐			
Surface Preparation							
Surface is clean and free of loose material	☐	☐	☐	☐			
Anchorage preparation							
Spacing and depth of holes matches drawing	☐	☐	☐	☐			
Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Concrete Application							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Formwork is secure and inside of formwork is clean	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time left before backfill etc.	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			
Backfill is properly compacted before reinstating floor	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 3)

RF.02 RC Jacketing - Masonry	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Foundation Preparation							
Excavations are stable. Temporary support is installed if required	☐	☐	☐	☐			
Existing foundation is in good condition	☐	☐	☐	☐			
Founding surface is firm, flat and clean	☐	☐	☐	☐			
Foundation trench is properly marked and excavated to the design depth and width	☐	☐	☐	☐			
Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel.	☐	☐	☐	☐			
Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface	☐	☐	☐	☐			
Soil at the base of trench is not fill	☐	☐	☐	☐			
Soil at the base of the trench does not contain organic material (e.g. plant roots)	☐	☐	☐	☐			
Flat brick soling is installed and is clean and level.	☐	☐	☐	☐			
Surface Preparation							
Surface is clean and free of loose material	☐	☐	☐	☐			
Anchorage preparation							
Spacing and depth of holes matches drawing	☐	☐	☐	☐			
Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Anchorage bars and wires are secure.	☐	☐	☐	☐			
Concrete Application							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Formwork is secure and inside of formwork is clean	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Wet wall and apply cement slurry before applying concrete layers	☐	☐	☐	☐			
Dimensions of tie beam and thickness of concrete match drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
If applied by hand, concrete is not overtrowelled. It needs to be quickly smoothed then move onto next section	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time (14 days) left before striking formwork/applying finishes	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 4)

RF.03 RC Jacketing - RC Frame	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Foundation Preparation							
Excavations are stable. Temporary support is installed if required	☐	☐	☐	☐			
Existing foundation is in good condition	☐	☐	☐	☐			
Founding surface is firm, flat and clean	☐	☐	☐	☐			
Foundation trench is properly marked and excavated to the design depth and width	☐	☐	☐	☐			
Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel.	☐	☐	☐	☐			
Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface	☐	☐	☐	☐			
Soil at the base of trench is not fill	☐	☐	☐	☐			
Soil at the base of the trench does not contain organic material (e.g. plant roots)	☐	☐	☐	☐			
Flat brick soling is installed and is clean and level.	☐	☐	☐	☐			
Surface Preparation							
Surface is clean and free of loose material	☐	☐	☐	☐			
Anchorage Preparation							
Spacing and depth of holes matches drawing	☐	☐	☐	☐			
Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Anchorage bars are secure.	☐	☐	☐	☐			
Slab Connection Preparation							
Adequate working space provided for safe breaking out of holes	☐	☐	☐	☐			
Holes are to dimensions and placement as given on drawings	☐	☐	☐	☐			
Existing beams are not damaged	☐	☐	☐	☐			
Waste/rubble is removed and site is clean	☐	☐	☐	☐			
Slab Connection							
Adequate working space provided for the fixing of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 5)

RC Jacketing - RC Frame continued

Concrete Application for Footing							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Application for Bottom Section of Column							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Application for Top Section of Column							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time left (14 days) before applying finishes etc.	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			
Backfill is properly compacted before reinstating floor	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 6)

RF.04 Splint and Bandage	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Foundation Preparation							
Excavations are stable. Temporary support is installed if required	☐	☐	☐	☐			
Existing foundation is in good condition	☐	☐	☐	☐			
Founding surface is firm, flat and clean	☐	☐	☐	☐			
Foundation trench is properly marked and excavated to the design depth and width	☐	☐	☐	☐			
Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel.	☐	☐	☐	☐			
Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface	☐	☐	☐	☐			
Soil at the base of trench is not fill	☐	☐	☐	☐			
Soil at the base of the trench does not contain organic material (e.g. plant roots)	☐	☐	☐	☐			
Flat brick soling is installed and is clean and level.	☐	☐	☐	☐			
Anchorage hole is at spacing shown on drawing	☐	☐	☐	☐			
Anchorage hole is slightly inclined downwards	☐	☐	☐	☐			
Surface Preparation							
Spacing of splints and bandages matches the drawings	☐	☐	☐	☐			
Surface is clean and free of loose material	☐	☐	☐	☐			
Anchorage preparation							
Spacing and depth of anchorage holes matches drawing	☐	☐	☐	☐			
Foundation Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 7)

Splint and Bandage continued

Foundation Concrete Pour							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Formwork is secure and inside of formwork is clean	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Dimensions of foundation matches drawings	☐	☐	☐	☐			
If poured, concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Appropriate curing time left (14 days) before striking formwork/backfilling around new footing	☐	☐	☐	☐			
Concrete Application							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Wet wall and apply cement slurry before applying concrete layer	☐	☐	☐	☐			
Dimensions of concrete matches drawings	☐	☐	☐	☐			
If applied by hand, concrete is not overtrowelled. It needs to be quickly smoothed then move onto next section	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is applied in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Once concrete is applied check level of bandage and verticality of splint with plumb bob.	☐	☐	☐	☐			
Cement slurry has been cleaned from areas where concrete has not been applied.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time (14 days) is allowed	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 8)

RF.05 Addition of crosswall	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Foundation Preparation							
Existing foundations are in good condition where exposed	☐	☐	☐	☐			
Founding surface is firm and flat	☐	☐	☐	☐			
Foundation trench is properly marked and excavated to the design depth and width	☐	☐	☐	☐			
Excavations are stable. Temporary support is installed if required	☐	☐	☐	☐			
Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel.	☐	☐	☐	☐			
Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface	☐	☐	☐	☐			
Soil at the base of trench is not fill	☐	☐	☐	☐			
Soil at the base of the trench does not contain organic material (e.g. plant roots)	☐	☐	☐	☐			
Flat brick soling is installed and is clean and level.	☐	☐	☐	☐			
Foundation Anchorage							
Holes drilled to depth and placement as given on drawings	☐	☐	☐	☐			
Anchorage bars to size and specification as given on drawings	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Foundation Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Foundation Concrete Pour							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Formwork is secure and inside of formwork is clean	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Dimensions of foundations matches drawings	☐	☐	☐	☐			
Concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Appropriate curing time (14 days) is allowed before continuing adjacent work	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 9)

Addition of Crosswall continued

Stitching Bars Preparation							
Holes drilled to depth and placement as given on drawings	☐	☐	☐	☐			
Finishes are removed locally where new crosswall will abut existing wall and surface is clean and free of loose material.	☐	☐	☐	☐			
Bricklaying - to underside of first holes							
Mortar joints do not exceed 10mm	☐	☐	☐	☐			
Mortar matches specification	☐	☐	☐	☐			
Bricks match specification and pass field test requirements	☐	☐	☐	☐			
Brickwork is laid as shown in chapter 3	☐	☐	☐	☐			
No slush joints - mortar is applied to vertical face of brick before laying not after.	☐	☐	☐	☐			
Mortar is not laid for more than 3-5 bricks in advance	☐	☐	☐	☐			
Mortar is used within 30 minutes from mixing	☐	☐	☐	☐			
Wall line is set out with string and checked that it is plumb	☐	☐	☐	☐			
No more than half height of the wall is laid in a day	☐	☐	☐	☐			
Stitching Bars							
Reinforcement length, diameter and placement matches drawings	☐	☐	☐	☐			
Reinforcement matches requirements in specification	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Bar installation does not disrupt masonry layout	☐	☐	☐	☐			
Bricklaying - to complete crosswall							
Mortar joints do not exceed 10mm	☐	☐	☐	☐			
Mortar matches specification	☐	☐	☐	☐			
Bricks match specification and pass field test requirements	☐	☐	☐	☐			
Brickwork is laid as shown in chapter 3	☐	☐	☐	☐			
No slush joints - mortar is applied to vertical face of brick before laying not after.	☐	☐	☐	☐			
Mortar is not laid for more than 3-5 bricks in advance	☐	☐	☐	☐			
Mortar is used within 30 minutes from mixing	☐	☐	☐	☐			
Wall line is set out with string and checked that it is plumb	☐	☐	☐	☐			
No more than half height of the wall is laid in a day	☐	☐	☐	☐			
Reinforcement length, diameter and placement of stitching bars and bandage bars matches drawings	☐	☐	☐	☐			
Reinforcement matches requirements in specification	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Bar installation does not disrupt masonry layout	☐	☐	☐	☐			
Splints and Bandages							
Splints and bandages have been installed in line with the drawings (as per RF.04). A separate QA.08 is completed for splints and bandages.	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 10)

RF.06 Diaphragm Stiffening	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Surface Preparation							
Surfaces are clean and free of loose material	☐	☐	☐	☐			
Existing floor is fully connected e.g. no loose planks etc.	☐	☐	☐	☐			
Wall-floor connection							
Floor is properly connected to the walls. If repair is required, the connection detail matches drawings	☐	☐	☐	☐			
Anchorage preparation and fixing							
Spacing and depth of holes matches drawings	☐	☐	☐	☐			
Holes are clear of debris	☐	☐	☐	☐			
Size and length of anchorage bars matches drawings	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Reinforcement fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Connection nails protrude half of the proposed concrete thickness	☐	☐	☐	☐			
Concrete Pour							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Floor surface is clean and free of loose material	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
Concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time (14 days) left before applying finishes etc.	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			
Seal up around penetrations through the floor	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 11)

RF.06A - Addition of Horizontal Bracing	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Preparation and Drilling							
Wall surface is flat and in good condition	☐	☐	☐	☐			
Wall surface is clear of finishes and loose material	☐	☐	☐	☐			
Anchorage holes are at size and locations as shown on drawings	☐	☐	☐	☐			
Fix connection and collectors plates							
Steel is as per the specification	☐	☐	☐	☐			
Connection plates are as shown on the drawings (dimensions, holes, welds etc.)	☐	☐	☐	☐			
Collectors are installed at this level (ringbeam or bandage) or a collector plate as shown on the drawings is installed.	☐	☐	☐	☐			
Welds are in good condition, continuous and to the sie given on the drawings	☐	☐	☐	☐			
Anchorage plates are to the size shown on the drawings	☐	☐	☐	☐			
Bolts are to the size and strength shown on the drawings	☐	☐	☐	☐			
Connections are fully tightened	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Fix bracing							
Steel is as per the specification	☐	☐	☐	☐			
Bracing rods are as per drawings (dimensions etc.)	☐	☐	☐	☐			
Connections are as per drawings (bolt size, strength, spacings, edge and end distances)	☐	☐	☐	☐			
Washers are in place	☐	☐	☐	☐			
A minimum of two threads protrude through each nut	☐	☐	☐	☐			
There are bolts in every hole of the connection	☐	☐	☐	☐			
Rods are in tension	☐	☐	☐	☐			
There is no visible sag in the rods.	☐	☐	☐	☐			
Finishing							
Steel is fully corrosion protected	☐	☐	☐	☐			
Any minor damage to walls caused by drilling is repaired	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 12)

RF.07 Replacement Slab	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Demolition of existing structure							
Temporary stability and propping is installed in line with temporary works drawings	☐	☐	☐	☐			
Extent of demolition is marked	☐	☐	☐	☐			
Demolition is carried out safely	☐	☐	☐	☐			
Waste/rubble is removed and site is clean	☐	☐	☐	☐			
Breaking Out of Existing Wall							
Channel dimensions match drawings	☐	☐	☐	☐			
Key dimensions and spacings match drawings	☐	☐	☐	☐			
Waste/rubble is removed and site is clean	☐	☐	☐	☐			
Formwork and Falsework							
Formwork and falsework is properly installed and well braced in line with temporary works drawings	☐	☐	☐	☐			
Formwork is properly aligned vertically and/or horizontally and is placed such that the concrete element will be straight and plumb	☐	☐	☐	☐			
Inside of formwork is clean	☐	☐	☐	☐			
Reinforcement Fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Concrete Pour							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting	☐	☐	☐	☐			
Thickness of concrete matches drawings	☐	☐	☐	☐			
Concrete is not being dropped from a height of 1.5m or more.	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time (14 days) left before formwork is struck	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			
Seal up around penetrations through the floor	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 13)

RF.08 Parapet Strengthening	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Surface Preparation							
Spacing of vertical splints is as per drawings	☐	☐	☐	☐			
Surfaces are clean and free of loose material	☐	☐	☐	☐			
Anchorage preparation							
Spacing and depth of anchorage holes is as per the drawings	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings (alternating between bars and wires)	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Reinforcement fixing							
Adequate working space provided for the installation of reinforcement	☐	☐	☐	☐			
Reinforcement placement, sizes and spacing matches drawings	☐	☐	☐	☐			
Reinforcement bars are straight and bent sections are discarded rather than straightened out	☐	☐	☐	☐			
Reinforcement meets requirements in specification	☐	☐	☐	☐			
Cover requirements are met	☐	☐	☐	☐			
Lap lengths are at least the minimum given on drawings	☐	☐	☐	☐			
Reinforcement is properly tied with binding wire	☐	☐	☐	☐			
Anchor plate size matches drawings	☐	☐	☐	☐			
Internal bars are fixed securely at underside of slab as shown.	☐	☐	☐	☐			
Cement slurry mix is correct	☐	☐	☐	☐			
Holes are well filled with no voids	☐	☐	☐	☐			
Anchorage bars and wires are secure.	☐	☐	☐	☐			
Concrete Application							
Ensure all the required tools and materials are available on site before the start of concrete works	☐	☐	☐	☐			
Ensure electricity supply to site is working before start of concrete works.	☐	☐	☐	☐			
Weather is appropriate for concrete application	☐	☐	☐	☐			
Concrete mix and water content matches specification	☐	☐	☐	☐			
Concrete slump testing has been done	☐	☐	☐	☐			
Wet wall and apply cement slurry before applying concrete layer	☐	☐	☐	☐			
Dimensions of concrete matches drawings	☐	☐	☐	☐			
If applied by hand, concrete is not overtrowelled. It needs to be quickly smoothed then move onto next section	☐	☐	☐	☐			
Mixed concrete is not used if it has been waiting for over 30 minutes	☐	☐	☐	☐			
Concrete is well-compacted (no voids)	☐	☐	☐	☐			
Concrete is applied in a single operation. If this is not possible, cold joints have been prepared as per the specification.	☐	☐	☐	☐			
Cement slurry has been cleaned from areas where concrete has not been applied.	☐	☐	☐	☐			
Concrete Curing							
Appropriate curing time (14 days) left before applying finishes etc.	☐	☐	☐	☐			
Concrete is kept moist during curing	☐	☐	☐	☐			

QA.07 | TECHNICAL SIGN OFF FORM (PAGE 14)

RF.09 Gable Alterations	Yes	No	N/A	Taken photo	Additional Information	Initial	Date
Stability of existing structure							
Existing structure is stable	☐	☐	☐	☐			
Temporary stability and propping is installed in line with temporary works drawings	☐	☐	☐	☐			
Demolition							
Extent of demolition is marked	☐	☐	☐	☐			
Demolition is carried out safely	☐	☐	☐	☐			
Waste/rubble is removed and site is clean	☐	☐	☐	☐			
Bandage Construction							
Bandage is installed in line with drawings (as per RF.04)	☐	☐	☐	☐			
Reinforcement is continuous around corners and junctions	☐	☐	☐	☐			
Wall plate is installed in line with drawings. Wall plate is securely tied into bandage	☐	☐	☐	☐			
Replace gable							
Material specification in line with drawings	☐	☐	☐	☐			
Fixings match with drawings	☐	☐	☐	☐			
Gable material is fixed securely into wall plate and into roof structure.	☐	☐	☐	☐			

2.5 HR AND SITE PERSONNEL

Making sure that the people working on the site know what is going on is important to ensure that works are completed to a high standard. It is also important to make sure everyone is well trained, that you know when people are on site so that you can make sure they are safe and paid correctly.

The following forms should be used by the Sub Engineer and the Construction Technician to help manage the construction site and make sure that the correct records are being kept.

QA.08 | TRAINING RECORDS

Training subject:

Delivered By:

Job Title:

I, the undersigned, confirm that I have received and understood the above training.

No.	NAME	JOB TITLE	SIGNATURE
1.			
2.			
3.			
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29.			
30.			

I confirm that I have delivered the above training

Name: Signature: Date:

This form should be filled out for each training which is carried out on site and the records kept in a safe location on the site for future reference.

QA.09 | DAILY WORKER REGISTER

This document is for recording staff present on site. It should be completed daily by the Construction Technician and the records from past weeks kept somewhere safe on site.

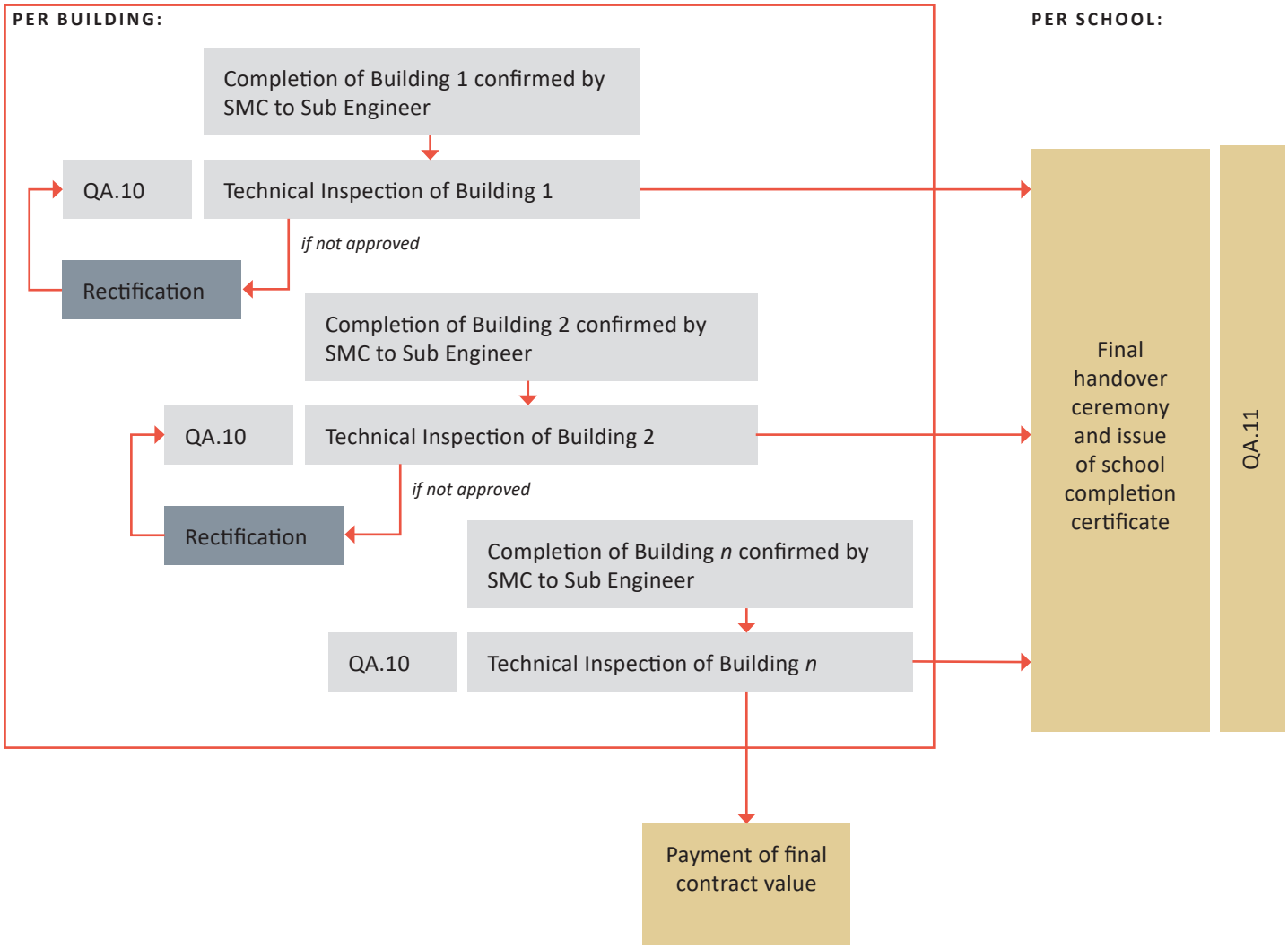
WEEK #: _____

EMPLOYEE NAME	EMPLOYEE CITIZEN NUMBER	JOB TITLE	DATE: Site Supervisor:			DATE: Site Supervisor:			DATE: Site Supervisor:			DATE: Site Supervisor:			DATE: Site Supervisor:			DATE: Site Supervisor:			TOTAL HOURS	COMMENT
			TIME IN	TIME OUT	SIGNED	TIME IN	TIME OUT	SIGNED	TIME IN	TIME OUT	SIGNED	TIME IN	TIME OUT	SIGNED	TIME IN	TIME OUT	SIGNED	TIME IN	TIME OUT	SIGNED		

CERTIFIED BY: _____
Sub Engineer

2.6 HANDOVER PROCESS

The handover process described here is as per the NSSP Post Completion Inspection and Rectification Policy issued 20th December 2018, updated following workshop at NSET 26th February 2019.



GLOSSARY OF TERMS - HANDOVER

Technical Inspection Committee

- NSSP District Engineer
- NSSP Sub Engineer
- SMC chair (or representative)
- Palika Engineer (if said person exists)
- Ward Chair (if available)
- Ward Technical Person (if said person exists)

Completion Ceremony Invitees

- Mayor or Deputy Mayor of Palika (Chair)
- Palika Engineer (if said person exists)
- Ward Chair
- NSSP District and Sub-Engineers
- SMC Chair
- PIU

This page reflects the document issued by Crown Agents 20th December 2018 and does not reflect any legal advice or commentary by Arup on this document. As previously advised, this means the project effectively self-insuring against defect claims and Arup cannot give legal advice as to how much cover this policy provides to this aspect of exposure. We do note that it does not cover any of the other risks and liabilities which the Project may be exposed to and independent legal advice on this and other liabilities should be sought.

QA.10 | POST COMPLETION INSPECTION FORM (PAGE 1)

One form to be completed per building, Inspection team to be led by the NSSP District Engineer.

Location	**EMIS number**		**School name**	
	District		**Municipality/ Rural Municipality**	
	Ward		**Tole**	
Construction	**Construction start date**		**Completion date**	
	Construction type/ design type			
	No. of storeys		**No. of classrooms**	

Inspection	**Date of visit**	
	Building number	

Inspection Team				
School No.	**Name of monitoring team member**	**Institution**	**Designation**	**Signature**

NSSP Engineer Declaration [to be completed by the District Engineer]

I, _____, confirm that I have reviewed and verified that:

1. The completed construction of this building has been reviewed against design drawings (including any approved change orders) and any discrepancies have been noted in the attached checklist.
2. Technical sign forms (QA.07) have been completed and submitted to PIU for all stages of the retrofitting works with accompanying photos.

Signed: _____

Date: _____

QA.10 | POST COMPLETION INSPECTION CHECKLIST (PAGE 2)

Block Ref	

Exterior General	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
All rebar has sufficient concrete cover and no steel is exposed	☐	☐			
The area is clean and tidy and access is safe for people to use the building. If other blocks still have ongoing construction, the site line has been moved and these areas have been clearly demarcated from the school site.	☐	☐			
Exterior Paint	☐	☐			
The ground around any excavation work is fully compacted and levelled	☐	☐			
Cleaning incomplete in areas	☐	☐			

Roof Exterior	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Some metal roof sheets have dents or scratches	☐	☐			
All steelwork has smooth continuous welding and is fully painted	☐	☐			
All fixings (bolts, screw, nails) are fully fixed and tightened – do spot check of tightness of at least 3 fixings.	☐	☐			
Roof sheeting has fixings as per the structural drawing of truss	☐	☐			
Other items	☐	☐			

External Wall	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Added Brickwork has motar missing in sections	☐	☐			
Added Brickwork not adequately cleaned	☐	☐			
Added Brickwork mortar joints not consistent	☐	☐			
Loose bricks at top of wall/s	☐	☐			
Render finish is inconsistent	☐	☐			
Other items	☐	☐			

Exterior Windows	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Windows not cleaned	☐	☐			
Windows chipped/cracked	☐	☐			
Frames damaged	☐	☐			
Gaps around windows are excessive	☐	☐			
Other items	☐	☐			

External Door	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Door hardware missing	☐	☐			
Door is not a solid core door	☐	☐			
Door wrong Type	☐	☐			
Gaps around doors are excessive	☐	☐			
Door lock not installed	☐	☐			
Other items	☐	☐			

QA.10 | POST COMPLETION INSPECTION CHECKLIST (PAGE 3)

Block Ref	

Interior General	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Painting Defects	☐	☐			
Cleaning incomplete	☐	☐			
Construction material not removed	☐	☐			
Sealant missing in area	☐	☐			
Other items	☐	☐			

Interior Wall	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Added Wall/s not in Plumb	☐	☐			
Added Wall/s not Straight	☐	☐			
Plaster in Splint Locations	☐	☐			
Plaster in Bandage Locations	☐	☐			
Plaster in Jacketing work	☐	☐			
Other items	☐	☐			

Interior Ceiling	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Celing not level in areas	☐	☐			
Plaster defects	☐	☐			
Other items	☐	☐			

Interior Floor	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Floor dirty in areas	☐	☐			
Cement screeding and punning (IPS) cracks	☐	☐			
Other items	☐	☐			

Interior Doors	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Screws missing to hinge/s	☐	☐			
Door margins not even	☐	☐			
Door rubs onto the frame or floor	☐	☐			
Door rattles when closed	☐	☐			
Top or bottom of door not painted	☐	☐			
Other items	☐	☐			

Electrical	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Lights not working to some areas	☐	☐			
Light switches or power points are not level	☐	☐			
Electricty not connected	☐	☐			
Other items	☐	☐			

Plumbing	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
Leaks to plumbing fixtures	☐	☐			

Other Items Noted	Condition		Defect observations for the correction	Location	Date of completion
	Satisfa-ctory	Requires correction			
	☐	☐			

QA.11 | SCHOOL COMPLETION CERTIFICATE

One form to be completed per school, following inspection of all retrofitting buildings.

The school mentioned below successfully participated in the Nepal Safer Schools Project supported by UKAID. The summary of work completed is as mentioned below:

Name of school	
EMIS Number	
Province	
District	
Rural/Municipality	
Ward No.	

Retrofitted Block IDs	
Retrofitted Classroom Number	
Completion and Handover Date	

Leela Mulukutla Team Lead Nepal Safer Schools Project	Name Mayor Municipality

CHAPTER 3

HEALTH AND SAFETY

GENERAL HEALTH & SAFETY RULES

It is your right and duty not to undertake any activity which you believe is unsafe.

- Everyone is responsible for site safety.
- Everyone has the right to work in a safe environment.
- If you identify a hazard which you perceive presents an unacceptable risk to your safety then you must not continue with your undertaking until you are satisfied it is safe to do so. You must report any hazards you become aware of in the course of your work to the person managing the site and the project manager. If you consider these hazards present an unacceptable risk to others report them immediately.
- Everyone must have a Site Safety Briefing before going on site.
- The Sub Engineer is responsible for the Site Specific Risk Assessments within their cluster.
- The Construction Technician is responsible for ensuring everyone on-site has attended the safety briefing, can give people safety briefings and is the point of contact for site safety.

THIS CHAPTER COVERS:

TOPIC	RELEVANT FORM	PERSON RESPONSIBLE	WHEN?
3.1 PPE	HS.01 PPE Register	Construction Technician	For each new person on site
3.2 General Health Guidance			
3.3 Site Safety Briefing	HS.02 Site Safety Briefing Checklist	Construction Technician	For each new person on site
	HS.03 Site Safety Briefing Register	Construction Technician	One list per site to be kept up to date
3.4 Site Set Up	HS.04 Site Checklist - Daily	Construction Technician	Every morning
	HS.05 Site Checklist - Weekly	Sub-Engineer	During weekly site visit
3.5 Key Hazards	HS.06 Specific Activity Risk Assessment	Sub-Engineer	Whenever a high risk activity is planned
3. Accident Reporting	HS.07 Incident Log	Construction Technician (Reports to Sub-Engineer)	When there is an injury or accident on site
	HS.08 Near Miss Form	(Reports to Sub-Engineer)	When there is a “near miss” on site.

3.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

All workers should be issued a set of PPE for which they are responsible for throughout the construction works.

Inform everyone that if they do not have all their issued PPE, they will not be allowed to work.

TASK SPECIFIC PPE

- Ear protection
- Dust masks
- Welding masks
- Working at height

Image reference:
Arup (Vita Sanderson)

PPE ON SITE - EXAMPLES

Good Example:

All members of the team are wearing full PPE.

Bad Example:

- There are lots people on site who are not wearing any PPE.
- No one is wearing high-viz jackets.
- Lots of people are in sandals.
- Not using equipment to work at height safely

Everyone on the site must be wearing PPE at all times even if they're a visitor. If not, they should not be allowed to come onto the construction site.

Image reference:
Arup (Vita Sanderson)

MANAGING PPE ON SITE

An appropriate number of sets of PPE should be issued to the SMC and they should be responsible for ensuring that the PPE is well maintained over the course of the project.

The following guidelines should apply:

- A safe, lockable place for PPE to be stored should be made available by the SMC.
- All PPE should be returned to the Construction Technician at the end of each work day for safe keeping and reissued each morning.
- All PPE items should be numbered so that the workforce can keep track of the pieces of PPE they are using that day.
- If PPE is damaged, then the Construction Technician should put in a request to the Sub-Engineer for a replacement item who will collect the damaged item so that it is no longer used by mistake.
- PPE which has been lost must be replaced by the SMC at their own cost.
- PPE not being used will result in work being stopped and will delay the construction work and may affect future payments to the SMC.

For large group visits, the Sub-Engineer will keep a separate set of PPE with them and bring this to site on the day of the tour and then take it back after the tour is finished (see section on Large Group Visits in further pages). This is so that PPE is not in shortage for the workforce and also so that there are enough for large groups.

HS.01 | PPE REGISTER

By signing this form, the recipient accepts responsibility for his/her PPE for the duration of their work on site and agrees to return it at the end of the construction work they are involved in. Should any replacment be required, they must apply to the Construction Technician. Depending on circumstances, lost PPE may not be replaced in some cases and this will affect the person's ability to continue to work on site.

Recipient	Recipient Job title	Description of PPE (for example, eye protection or hand protection)	Date of issue	Special requirements (for example, fittting)	Training given (for example, use, storage or cleaning)	Issued By: (name and signature)	Recipient signature

3.2 COVID-19 HEALTH GUIDANCE

The health and safety requirements of any construction activity must not be compromised at this time. If any activity cannot be undertaken safely, it should not take place.

Detailed guidance which reflects the current epidemiological situation and regulation from the Government of Nepal can be found in the latest version of the NSSP Covid-19 Policy.

SITE REQUIREMENTS

Hand sanitiser and/ or hand washing station must be provided on site at all times. Wash hands immediately upon arrival and before leaving site.

Keep personal space of at least 1m when visiting site.

Face mask to be worn on site when it is appropriate and safe to do so.

Anyone who is displaying Covid-19 symptoms should not travel to or visit the site.

ADDITIONAL RECOMMENDATIONS

1. Work should be planned and organised to avoid crowding and minimise the spread of infection.
2. Allow regular break to wash hands and provide additional hand washing facilities.
3. Enhanced cleaning procedures for taps and washing facilities, toilets and door handles.
4. When working indoors, all possible precautions should be adopted such as opening windows and following social distancing as much as possible.
5. Where possible, keep groups of workers together in teams (e.g. do not change workers within teams) to minimise exposure.

If anybody shows symptoms you must follow guidance from the World Health Organisation and current local regulations.

For further information and advice, visit the World Health Organisation and Government of Nepal Ministry of Health and Population websites.

3.3 SITE SAFETY BRIEFING

WHEN

Everyone MUST have a Site Safety Briefing before being allowed onto the site.

WHAT

WHAT IS A SITE SAFETY BRIEFING?

A Site Safety Briefing is a short training which covers the basics of what works are going on and also the relevant Health and Safety considerations.

The Site Safety Briefing Checklist includes everything that should be covered in a briefing.

WHO

WHO NEEDS ONE?

Everyone who comes onto the site will need a Site Safety Briefing before they can be allowed to enter the construction area. This applies to people who are working on the project and visitors.

The Site Safety Briefing should be given by the Construction Technician responsible for that project.

Everyone who has received the briefing should be recorded in the Site Safety Briefing Register.

WHY

WHY ARE THEY NEEDED?

This makes sure that everyone who is on the site is informed about the organisation and operation of the works and is aware of the risks which arise on the site and what their responsibilities are while they are there.

Example Question:

Question:

A visitor from the community wants to go to site but they haven't had a site safety briefing, what should I do?

Answer:

To aid the replicability of earthquake resilient construction people visiting site should be encouraged, but if they haven't had a safety briefing they cannot go on site. The safety briefing isn't a long process, so in most cases people can be briefed and then carry on to site.

HS.02 | SITE SAFETY BRIEFING CHECKLIST

These topics are the minimum which should be covered in a Site Safety Briefing but there may be others which are relevant specifically to your site. Please review with the Sub-Engineer regularly and update as required.

There is a zero-tolerance policy on the use of Alcohol, Drugs and Other Substances whilst on site. This includes arriving to site still under the influence. This should be highlighted at the start of the briefing.	
Explain where there is vehicle/pedestrian segregation in place. Show them how this is marked on site.	
Explain where there are any areas of restricted access or exclusion zones. Show them how these are marked on site.	
Explain where there any unsafe structures or is there any unstable ground on site. Show them how these are marked on site.	
Show them where there is any potential for slips / trips / falls (open holes / steep slopes etc.). Explain how these are marked on site.	
Explain if there any utilities/services in the local vicinity that may affect the work being undertaken.	
If there a risk of exposure to hazardous substances, e.g. asbestos, contaminated land/water/vapours, legionella etc. explain what these are and any relevant additional risk assessment that needs to be done.	
Explain if there any other hazards to be considered (e.g. noise, inadequate lighting, invasive/injurious plants, livestock, local wildlife, anti-social behaviour/violence, etc.) and show them what these are and any relevant additional risk assessment that needs to be done.	
If weather conditions could affect the work to be undertaken (taking account of travel to/from site as well as the work on site), highlight these as well.	
Ask if there any other personal circumstances that need to be taken into account (disabilities, medications, injuries etc.). Be aware that this information may be sensitive, so please keep it confidential and cautious about how the questions are asked.	
If there are any person(s) attending site where an extra duty of care is required (expectant or nursing mothers, young persons etc.), explain about any additional measures. This is likely due to the construction site being on school property.	
Explain where they should go to summon help / receive first aid in case of an accident. Record any additional arrangements or training required if applicable.	
Explain where are the welfare facilities available on site (e.g. facilities for toilets, washing, drinking water etc.). If there are none on site, then show them what alternative arrangements are available.	
Explain the emergency plan to all site attendees including what happens in the event of an emergency (including fire), how to raise the alarm, where is the assembly point, who is responsible for firefighting and rescue, where firefighting equipment may be found.	
Any other risks? This should be regularly reviewed with the Sub-Engineer and updated accordingly.	

Site GPS Coordinates:_____

Site Emergency Telephone Number:_____

HS.03 | SITE SAFETY BRIEFING REGISTER

Location:

Delivered By:

Job Title: Construction Technician

I, the undersigned, confirm that I have received and understood the above Site Safety Briefing

No.	DATE:	NAME	JOB TITLE	SIGNATURE
1.				
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19.				
20.				

I confirm that I have delivered the above in accordance with the Site Safety Briefing Checklist

Name: Signature:

Date:

LARGE GROUP VISITS

As part of NSSP, the construction works will be available for the local community to come and see the retrofitting works to promote retrofitting as a form of building safety improvement. The following guidance should be followed for large (>5 people) group visits:

Group visits should be planned at least one week in advance and the Sub-Engineer notified.

The Sub-Engineer must be present for all group visits.

An extra check of the site (in addition to the Daily Site Checklist (HS.04)) must be done by the Construction Technician immediately before the visit to ensure all boundary tape is in place, all openings are covered and pathways are clear, safe and well marked.

The Construction Technician must provide the group a Site Safety Briefing before the tour and the Sub-Engineer will provide them with PPE.

Work on site must stop for the duration of the visit.

3.4 SITE SET UP - DO'S AND DON'TS

DO: Make sure that the site boundary is clearly marked.

Put up signs and communicate with local stakeholders to make sure it's clear that only authorised people are allowed into the site.

DO: Ensure materials are delivered in a tidy and orderly way.

DO: inventory materials as they arrive and make sure there is a record of what has been delivered which has been signed by both the driver and the Construction Technician.

DON'T: bring vehicles onto site if there is not safe access

DO: have a dedicated person assisting drivers when driving onto site. Make sure they are wearing their high visibility vest while doing this task.

Image reference:
Arup (Vita Sanderson)

HS.04 | SITE CHECKLIST - DAILY

WHO The Site Checklist is completed by the Construction Technician

WHEN The Site Checklist should be completed before work starts on site every morning.

Today:	Yes	No	N/A	Mitigation Measures / Additional Information (Include assessment of level of residual risk (Low/Med/High) in right hand column if applicable)
Have tools and materials been organised and tidied away safety	☐	☐	☐	
Are there any trip hazards remaining on the site	☐	☐	☐	
Are the any material that requires removal and disposal	☐	☐	☐	
Is the site secure (fences in place and stable, access secure)	☐	☐	☐	
Has everyone onsite understaken a site safety briefing	☐	☐	☐	
Is everyone on site wearing appropriate PPE	☐	☐	☐	
Is there any adverse weather that prevents safe working	☐	☐	☐	
Are emergency escape routes available and clear?	☐	☐	☐	
Any other risks?	☐	☐	☐	

Are there any high risk activities planned today?	
1. Working at Height	☐
2. Power Tools	☐
3. Hot Works	☐
4. Working near Asbestos Containing Materials/soils	☐
5. Excavation	☐
6. Manual Handling	☐
7. Demolition	☐
8. Temporary Works	☐
9. Work with hazardous substances (e.g. cement, paint, resin, glue)	☐
10. Removing finishes (exposure to lead paint, construction dust)	☐
If yes, fill in Specific Activity Risk Assessment (HS.06)	

HS.05 | SITE CHECKLIST - WEEKLY

This week:	Yes	No	N/A	Mitigation Measures / Additional Information (Include assessment of level of residual risk (Low/Med/High) in right hand column if applicable)
Is there adequate vehicle/pedestrian segregation in place?	☐	☐	☐	
Is there any potential for slips / trips / falls (open holes / steep slopes etc.)?	☐	☐	☐	
Could weather conditions affect the work to be undertaken (taking account of travel to/from site as well as the work on site)?	☐	☐	☐	
Are there any other personal circumstances that need to be taken into account (disabilities, medications, injuries etc.)?	☐	☐	☐	
If there are any person(s) attending site where an extra duty of care is required (expectant or nursing mothers, young persons etc.), have appropriate risk assessments been completed?	☐	☐	☐	
Are arrangements available on site for staff to summon help / receive first aid? Record any additional arrangements or training required if applicable.	☐	☐	☐	
Taking account of the activities being carried out this week, is any additional first aid equipment required besides the standard first aid kit contents?	☐	☐	☐	
Any other risks?	☐	☐	☐	

Are there any high risk activities planned this week?	
1. Working at Height	☐
2. Power Tools	☐
3. Hot Works	☐
4. Working near Asbestos Containing Materials/soils	☐
5. Excavation	☐
6. Manual Handling	☐
7. Demolition	☐
8. Temporary Works	☐
9. Work with hazardous substances (e.g. cement, paint, resin, glue)	☐
10. Removing finishes (exposure to lead paint, construction dust)	☐

3.5 KEY HAZARDS

1. Working at Height

When working at height, it's important to make sure it's possible to reach everything from a secure place. If not, it is possible that you could fall while doing work at height and seriously injure yourself. Measures that improve security during working at height could include but are not limited to: using well secured ladders, installation of platforms or planning construction works to minimise the amount of work which must be done at height.

2. Power Tools

The use of power tools comes with a number of risks which vary according to the type of tool. You must make sure everyone using the tools has been properly trained in their use. Along with the risk that injuries can occur from the tool itself, such as cuts and vibration exposure, there is the risk of electrocution from the connection. All electrical connections should be well maintained and safely installed.

3. Hot Works

Hot works include any works that use a flame or that may cause sparks, such as welding, grinding or flame cutting. Hot works are a major fire risk as a spark can easily ignite combustible materials and cause serious harm to the building and people involved. Before undertaking hot work, mitigation measures must be put in place, such as clearing away combustible materials from the work area, protecting the area with non-combustible materials, and making sure fire fighting equipment is on hand.

4. Asbestos

Asbestos is a substance that might be found in a number of building materials such roofing sheets and wall or flooring elements. When disturbed, it releases a dust which is toxic and can cause long term illness in the lungs. If you find something that looks like it might contain asbestos, alert the Sub-Engineer who will discuss with the District Engineer on how to proceed. In the meantime, do not move it or work on that element.

5. Excavations

Where excavations are needed on site for example for foundations or drainage, it is important that they are properly installed so that either people do not fall in them, they don't collapse onto someone who is working inside them or collapse and make structures around them unsafe.

6. Manual Handling

Manual handling relates to the moving of items either by lifting, lowering, carrying, pushing or pulling. Many things can contribute to injury including the weight of the item, how many times you have to pick it up or the distance you have to carry it. If you are picking up an item from an awkward or difficult to reach place, it is more likely you could injure yourself. It is important that you are aware of your limits when it comes to manual handling so that you do not injure yourself.

7. Demolition

Retrofitting solutions will require some demolition of the existing structure. This should be done careful and with pre-planning. Where structure is to be demolished, sufficient propping needs to be engineered and installed. See the propping specification.

8. Temporary Works

Temporary Works are the parts of a construction project that are needed to enable the permanent works to be built. They include access scaffolds, props, temporary bracing, excavation support, falsework and formwork. Temporary works should be designed by a qualified person and considered carefully how they interact with the existing building. Temporary works need to be inspected regularly to ensure they are still safe. The process of removing temporary works also needs to be considered carefully to make sure it is done safely.

The Specific Activity Risk Assessment sheet should be filled out for any of the above activities.

3.5 KEY HAZARDS

9. Working with Hazardous Substances

Many common construction materials, such as cement, paints, resins, coatings and glues can cause health problems if they are not handled correctly. These can include skin problems, like burns, and breathing problems like asthma. Ensure that a risk assessment is carried out and mitigation measures, such as proper ventilation, PPE and emergency procedures are in place.

10. Exposure to Lead Paint

Paint containing lead has historically been widely used in Nepal. Precautions need to be taken when removing old finishes as lead is most dangerous when it is in small particles such as during stripping of paint. You can absorb lead into your body when you breathe in dust, or if you eat, drink or touch your mouth without washing your hands or face. If the level of lead in your body gets too high it can cause headaches, tiredness, anaemia and stomach pains. If you continue to be exposed it can cause kidney, nerve and brain damage or even cancer. Lead is particularly dangerous to children. When stripping paint, dust masks should be worn and precautions taken to prevent the spread of lead contaminated dust.

11. Trips and Falls

It's important that people can move around the site safely so that injuries from tripping, falling or walking into things don't occur. Keeping a tidy site with clear pathways is vital to minimising the risk of injury to people who are working there.

12. Confined Spaces

A confined space is a place that is mostly or fully enclosed, where serious injury can occur from hazardous substances or conditions within the space, such as lack of oxygen. It is not expected that confined spaces will be within the works, but if it is necessary to carry out work in confined spaces, a risk assessment should be undertaken.

13. Lone working and working at night

It is the policy of NSSP to avoid all lone working and working at night as this creates additional and unnecessary risk to staff.

14. Working hours and Fatigue Management

At no time should staff compromise their safety by driving/ working an extended day.

15. Travel

When planning travel consider distance/duration/frequency of travel, duration of site visit/meeting, time of day (unsociable hours) etc. It is NSSP policy that staff avoid car travel after dark.

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 1)

High Risk Activities	
1. Working at Height	☐
2. Power Tools	☐
3. Hot Works	☐
4. Working near Asbestos Containing Materials/soils	☐
5. Excavation	☐
6. Manual Handling	☐
7. Demolition	☐
8. Temporary Works	☐
9. Working with Hazardous Substances	☐
10. Exposure to Lead Paint	☐

1. Working at Height - General Introduction

Working at height (WAH) means working in a place where, if precautions were not taken, a person could fall a distance liable to cause personal injury. A person is working at height if they:

- work above ground/floor level;
- could fall from an edge, through an opening or fragile surface; or
- could fall from ground level into an opening in a floor or a hole in the ground.

General information	Comments
Describe the activities planned (including approximate height, means of access, tools required, duration of activity etc.)	

Working at Height risk assessment	Yes	No	Mitigation Measures / Additional Information
Is working at height required? Consider whether the work can be done from ground level instead?	☐	☐	
How will the activity area be accessed and work be carried out?			
• Low risk (staircase, elevator etc.)			
• Stepladder			
• Ladder			
• Access platform (mobile/fixed)			
• Scaffolding			
• Other (please detail)			
Has the access equipment been inspected and is currently in good condition?	☐	☐	
Has the work been suitably planned, detailed and communicated to all applicable staff?	☐	☐	
Do the employee(s) have sufficient skills, knowledge and experience to perform the task safely?	☐	☐	
Have weather conditions been considered? No external working at height should be undertaken in poor weather conditions such as rain, ice, frost, snow or strong or gusting winds.	☐	☐	
Is the working at height low risk / short duration or high risk / long duration? Please detail.	☐	☐	
Can tools fall from the working area? If so they should be tethered or stored in a safe area from which they cannot fall and injure anyone passing underneath.	☐	☐	
Are there any exclusion zones on site that employees have been made aware of? If so provide details of any additional barriers/segregation that need to be considered, and who will be responsible for ensuring these are in place prior to the work being carried out.	☐	☐	

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 2)

2. Power Tools - General Introduction

Power tools can be extremely dangerous if they are used improperly. They must be well maintained and used appropriately by trained staff.

General information	Comments
Describe the activities planned (including means of access, tools required, duration and purpose of activity etc.)	

Power Tools risk assessment	Yes	No	Mitigation Measures / Additional Information
Is the tool appropriate to the task? Is it being used in accordance with the manufacturer's instructions?	☐	☐	
Is the tool in good condition?	☐	☐	
Is any additional PPE required? For example, ear defenders, dust mask.	☐	☐	
Are cables secured appropriately to avoid trip hazards? They should be taped, covered or attached at high level.	☐	☐	
Are appropriate guards in place as per the tool manufacturer's requrements?	☐	☐	
Is electricity source safe and in good condition? Is cable and plug in good condition?	☐	☐	
Is the user appropriately trained to use the tool? If the user is inexperienced are they under appropriate supervision?	☐	☐	
Is there sufficient space to work safely? Is the space clear from hazards such as trailing cables, tools, materials, debris and spills?	☐	☐	
Is there any risk of electricity coming into contact with water?	☐	☐	
Is the equipment heat generating? If so, fill out the risk assessment for hot works.	☐	☐	
Does the tool have moving parts? If so ensure clothing, jewellery and long hair is kept clear.	☐	☐	
How long can the tool be used safely? Should the user be rotated?	☐	☐	
Is the space ventilated appropriately if required?	☐	☐	
Are tools stored safely when not in use?	☐	☐	

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 3)

3. Hot Works - General Introduction

Hot works are any works that involve equipment that produces heat, sparks or flame, such as welding or grinding. Hot works can present numerous types of hazards to workers including fire, fumes and debris.

General information	Comments
Describe the activities planned (including type of hot works, area works will be carried out, duration and purpose of activity, likely ignition source types (e.g. flame, spark, hot object) etc.)	

Hot Works risk assessment	Yes	No	Mitigation Measures / Additional Information
Are hot works required? Consider whether the work can be done using another method instead?	☐	☐	
Is there an emergency response plan in place?	☐	☐	
Are evacuation routes available and clear?	☐	☐	
Is any additional PPE required? For example, welding masks	☐	☐	
Does any nearby equipment need to be isolated before starting work?	☐	☐	
Is there sufficient space to work safely? Is the space clear from hazards such as combustible materials, trailing cables, tools, debris and spills?	☐	☐	
Is hot works equipment in good condition?	☐	☐	
Is there a Qualified Person who is overseeing the works and decide if they can go ahead and monitor the activity to make sure it is done in a safe manner?	☐	☐	
Are gaps that sparks could get into protected using suitable flameproof sheeting/blankets/damp sand? Are heat senstivite items such as electrical cables covered?	☐	☐	
Have any pipes or containers in the area been assessed for hazardous contents or residues?	☐	☐	
Are fire safety systems (extinguishers, buckets of water or sand, water hose, alarms) in place and ready to be used if necessary? Are staff trained to use them?	☐	☐	
Is the user appropriately trained to undertake the hot works? If the user is inexperienced are they under appropriate supervision?	☐	☐	
Is the space ventilated appropriately if required?	☐	☐	
Is a fire watch in place during the works and for at least an hour following completion of the works?	☐	☐	
Has the environment been checked for flammable material following completion of the works, such as weld stub ends?	☐	☐	
Are hot works equipment cooled after use and stored safely when not in use?	☐	☐	

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 4)

4. Asbestos - General introduction
It is possible that existing school buildings contain asbestos. People onsite need to be made aware of any identified asbestos.

Is there asbestos present?		Location (eg classroom block A, external, roof) and description
 Roofing sheets	☐	
 Flat sheets	☐	
 Pipes	☐	
 Insulation	☐	
Made ground/rubble	☐	
Other	☐	
If the answer to any of the above is YES, work should not allowed on this area and be reported to the District Engineer for direction on action - see form below for completion:		

Image reference: Unknown

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 5)

Asbestos on Site - Following Assessment by Qualified Person		
Action required:	Asbestos needs to be cleared by **qualified staff** before any further work is done in this area.	☐
	Asbestos is safe in its current state can be left as no work is required in this area. It should be **clearly marked** for future information.	☐
Other information or notes: (for example if there are multiple instances of asbestos on site).		
Approved by District Engineer	Name	
	Signature	
	Date	
This information should then be included in the Site Safety Briefing and all workers on site should be clearly informed.		

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 6)

5. Excavation - General Introduction

Excavations must be safe before work can be carried out. Excavations can risk injuries from collapses and falling materials.

General information	Comments
Describe the activities planned (including type of excavation, area works will be carried out, duration and purpose of activity, any temporary works to support excavation or adjacent structures etc.)	

Excavation risk assessment	Yes	No	Mitigation Measures / Additional Information
Have the ground conditions been checked? Is the ground stable? Is the ground waterlogged or prone to areas of running sand?	☐	☐	
Are there any underground structures or water courses?	☐	☐	
Are there any underground services (e.g. electricity cables)?	☐	☐	
Are barriers in place to prevent access to the excavation when not working (including lunch breaks)?	☐	☐	
Has any temporary support such as propping or shoring been considered and planned?	☐	☐	
Where is excavated material going to be stored? It should be stored away from the excavation to prevent it falling in.	☐	☐	
Is all required equipment (e.g. shoring, props) on site before starting excavation?	☐	☐	
Is the excavation battered (dug at an angle) to make it safer?	☐	☐	
Can the excavation be accessed safely? Are ladders or boards required for safe access?	☐	☐	
Is there edge protection in place to stop material falling into the excavation?	☐	☐	
Has any excavation in proximity to buildings or other structures such as scaffolding been assessed by Competent Person before commencing work? Is extra support for the structure required?	☐	☐	
If any hazardous materials are found during excavation (such as Asbestos containing materials) is there a plan in place for remediation?	☐	☐	
Are excavations covered when access is not required such as outside working hours?	☐	☐	
Are vehicles prevented from parking or driving past close to excavations? This can load the soil and cause the excavation to collapse.	☐	☐	
Is the excavation inspected at the start of every day and after any event that may affect their sttability, such as a fall of earth.	☐	☐	

HS.06 | SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 7)

6. Manual Handling - General Introduction

Anyone involved in moving materials could be at risk of injury. There are risks in handling even light loads if the task is repetitive or is being carried out in poor conditions.

General information	Comments
Describe the activities planned (including load weight, frequency of lift, carry distances etc.)	

Manual Handling risk assessment	Yes	No	Mitigation Measures / Additional Information
Is manual handling required at all? Does the item have to be moved? Could it be moved using other methods (pulleys, trolleys, vehicles)?	☐	☐	
Does the activity involve any twisting, stooping, bending, pushing, pulling or sudden movement?	☐	☐	
Does the activity require more than one person to carry the same load? How is this planned e.g. how will workers communicate?	☐	☐	
Does the worker have any injury or disability that might affect how they carry the load?	☐	☐	
Is the load heavy, difficult to grasp, sharp, hot ot cold, or the contents are likely to move or shift?	☐	☐	
Is the floor surface level and without obstructions?	☐	☐	
Is there enough working space to maneuver easily?	☐	☐	
Are there confined spaces or narrow doorways?	☐	☐	
Is there good lighting?	☐	☐	
Are there difficult weather conditions, such as wind?	☐	☐	
Is movement or posture hindered by clothing or PPE?	☐	☐	
Are breaks planned into the work?	☐	☐	
Have workers received sufficient training to carry out the task successfully and safely?	☐	☐	

SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 8)

7. Demolition - General Introduction

Demolition must be carefully planned and carried out in a way that prevents danger by workers with the relevant skills, knowledge and experience.

General information	Comments
Describe the activities planned (including sequence of work, temporary support requirements, extent of demolition etc.)	

Demolition risk assessment	Yes	No	Mitigation Measures / Additional Information
Is the site secure so the public cannot access it unsupervised during the working day or overnight?	☐	☐	
Has a structural survey been undertaken considering the age of the structure, use, type of construction, nearby buildings and structures, and the weight of removed material on floors above ground level?	☐	☐	
Has the demolition sequence been considered to prevent accidental collapse of the structure?	☐	☐	
Are temporary works designed to support the structure during demolition by a Qualified Person?	☐	☐	
Have temporary works been installed as per the design information? Have they been inspected by a Qualified Person?	☐	☐	
Have gas, electricity, water and communications services been isolated before demolition? If not, are they clearly labelled to make sure they are not disturbed?	☐	☐	
Is there the possiblity of hazardous materials being encountered during the demolition process, such as asbestos, lead paint?	☐	☐	
Are exclusion zones required to keep non-essential workers away from demolition areas? Have workers been briefed on the works?	☐	☐	
Is an evacuation plan in place if any section of the building is deemed at risk during the works? Has this been communicated to workers?	☐	☐	
Is there a requirement for additional PPE? For example, dust masks, ear defenders.	☐	☐	
Where will demolished material be stored? Could this cause a trip hazard, or fall onto personnel?	☐	☐	
Do workers have the skills and experience to care out the demolition works safely?	☐	☐	
Has the extent of the demolition been marked?	☐	☐	

SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 9)

8. Temporary Works - General Introduction

Temporary works are used to support or protect the existing building or the permanent works during construction. Correct design and installation of temporary works is essential to risk prevention and mitigation in construction.

General information	Comments
Describe the activities planned (including sequence of work, equipment required, purpose of temporary works, impacts on adjacent buildings/works etc.)	

Temporary works risk assessment	Yes	No	Mitigation Measures / Additional Information
Has the temporary works design been carried out by a Qualified Person, and has it been communicated effectively to the construction team?	☐	☐	
Is all required temporary works equipment on site before beginning work?	☐	☐	
Is there an emergency response plan in place?	☐	☐	
Are evacuation routes available and clear?	☐	☐	
Do workers understand how to use temporary works equipment appropriately?	☐	☐	
Have the temporary works been installed in accordance with the design information?	☐	☐	
Have the temporary works been inspected by a Qualified Person before they are used?	☐	☐	
Is there any sign of structural distress in the existing structure or in the permanent works such as distortion, missing bracing, poor foundations, damaged components? Has this been communicated to the Temporary Works designer?	☐	☐	
Do workers understand the limits to which the temporary works can be loaded?	☐	☐	
Are temporary works being inspected at the start of every day to make sure that they are safe?	☐	☐	
Is it understood when the permanent works will obtain sufficient strength to allow dismantling of the temporary works?	☐	☐	
Has a Qualified Person given approval before dismantling temporary works?	☐	☐	

SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 10)

9. Hazardous Substances - General Introduction

Many construction materials can be hazardous to health if they are not handled correctly. Before using a product, consider carefully if any safety precautions should be taken.

General information	Comments
Describe the activities planned (including materials being used, method of work, time task should take, area work will be carried out, if any other works are being carried out in adjacent areas etc.)	

Hazardous Substances risk assessment	Yes	No	Mitigation Measures / Additional Information
Are there any instructions on the product on how it should be used and precautions to take?	☐	☐	
Do you need additional PPE or clothing? (e.g. dust mask if working with solvents in an unventilated space) Is PPE being worn correctly to protect against exposure (e.g. gloves, long sleeve shirt and boots to prevent against burns from cement)	☐	☐	
Is the space you are working in prepared appropriately? If indoors is there proper ventilation (e.g. open doors and windows)?	☐	☐	
Are good washing facilities available if a substance gets on someone's skin? (hot and cold water, soap, clean towels) Do workers wash their hands and forearms before eating, drinking, smoking etc.?	☐	☐	
Is eyewash available if a substance gets in someone's eyes?	☐	☐	
How is access to the working area controlled? (e.g. barriers - Non-essential workers or site visitors should not be in the area. This is especially important for children and pregnant women.)	☐	☐	
Is the substance stored safely? Can it be accessed by unauthorised people? Can it leak or spill? Does it react with other substances it is stored with?	☐	☐	

SPECIFIC ACTIVITY RISK ASSESSMENT (PAGE 11)

10. Exposure to Lead Paint - General Introduction

Lead is often present in existing buildings, particularly in paints. Workers need to take precautions when removing finishes in buildings to reduce the risks from lead, which can cause serious health problems.

General information	Comments
Describe the activities planned (including sequence of work, method used, time task will take, area working in etc.)	

Lead paint risk assessment	Yes	No	Mitigation Measures / Additional Information
Can the dust produced by the activities be controlled? (e.g. wetting down dust)	☐	☐	
Is additional PPE such as dust masks available? Do these fit well to the worker?	☐	☐	
How can the dust be prevented from spreading? (e.g. plastic sheeting to separate working area from rest of building, throroughly wash and clean surfaces after work, dispose of waste safely)	☐	☐	
How is access to the working area controlled? (e.g. barriers - Non-essential workers or site visitors should not be in the area. This is especially important for children and pregnant women.)	☐	☐	
Can protective clothing such as coveralls be worn during finishes removal, and removed before leaving work area to prevent spread of dust?	☐	☐	
Is clothing and PPE such as gloves worn in the work area washable? Is there somewhere this can be washed other than at home where children could be exposed to dust?	☐	☐	
Are washing facilities available? Do workers wash their hands and forearms before eating, drinking, smoking etc.?	☐	☐	
Is there a space away from the work area for meal and rest breaks? Can protective clothing be left elsewhere and not worn in the rest area?	☐	☐	
Is there a safe method to dispose of waste contaminated with lead dust (e.g. plaster waste, plastic sheeting)? How is it prevented from contaminating the environment with lead dust?	☐	☐	

3.6 ACCIDENT REPORTING

WHEN

When do you need to report an accident?

Whenever there is any type of accident or near miss.

ALL accidents and near misses MUST be reported

WHAT

What is an Accident?

- Accidents resulting in the death of any person
- Accidents resulting in specified injuries to workers
- Non-fatal accidents requiring hospital treatment to non-workers and
- Dangerous occurrences including any fire incidents, excavation or structural collapses and similar incidents.

What is a Near Miss?

This is when there hasn't actually been an accident but there was an unsafe occurrence which could have resulted in an injury. The reporting for a Near Miss is the same as if there was actually an accident.

WHO

Who is responsible for reporting an accident?

Everyone on site is responsible for reporting if there is an accident. The Construction Technician is the focal point for Health and Safety on any site. They should then send an Accident Report (HS.07) to the Sub Engineer within 24 hours of any accident. All accidents will be reported to the District Engineer for review and then to the PIU.

WHY

Why do we need to report accidents and near misses?

It is important to report accidents and near misses so everyone knows what happened and can plan construction activities to prevent accidents happening in the future. Changes to the risk assessment and to the control measures in place may be made based on the reporting of an accident or near miss.

3.6 ACCIDENT REPORTING

Classification of Accidents

The severity of the accident will affect how you react to the situation. Some accidents have the potential to cause large injuries, such as a being hit by a moving object or vehicle, but this will not always result in serious injuries.

Below are listed some of the most common accidents and injuries in the workplace. It is important to seek the medical attention required for each accident as appropriate.

Examples of Accidents:

MINOR

An injury that needs no/ minor treatment from a first aider/ doctor

- Slips, trips and falls
- Muscle strains
- Repetitive strain injury

MEDIUM

An injury that requires treatment by a first aider or a doctor

- Cuts and lacerations
- Exposure to loud noise
- Walking into objects
- Back injury

MAJOR

An injury that requires urgent attention by a doctor or emergency services staff

- Being hit by falling objects
- Crashes and collisions
- Inhaling toxic fumes
- Fires or structural collapse

HS.07 | ACCIDENT REPORT

Injured person's full name						
Injured person's address						
Injured person's Contact details						
Normal occupation						
Occupation at time of accident						
Exact location of accident						
Date and time of accident	Date		Time			
Date and time of ceasing work	Date		Time			
Precise nature of injury (if eye or limb, state left or right)						
To whom was the accident reported?						
	Date		Time			
Has accident been reported to NSSP PIU?			Yes	☐	No	☐
Was first aid given on site? If 'Yes' state name of first aider			Yes	☐	No	☐
If treatment was received from a doctor, state doctor's name						
Did the injured person go to hospital?			Yes	☐	No	☐
Give name of hospital						
Was the injured person authorised to be at the place of the accident for the purpose oftheir work?			Yes	☐	No	☐
How was the accident caused?						
Give a full description of what happened						
State what the injured person was doing at the time						
If the person fell from height or into an excavation, state distance of fall in metres						m
What action has been taken to prevent a recurrence?						
Was machinery involved?			Yes	☐	No	☐
What was the machinery and was it well maintained/worked at the time of the accident?						
Names, addresses, and contact numbers of witnesses to the accident *Include signed statements from each witness whenever possible*						

To be completed by the Head Office				
Further medical reports on the injured person	Yes	☐	No	☐
Has the injured person ceased employment?	Yes	☐	No	☐
Is a further investigation report required?	Yes	☐	No	☐
Have control measures been implemented to prevent a reoccurrence?	Yes	☐	No	☐
Describe control measures and date of implementation.				

HS.08 | NEAR MISS FORM

Name		Phone no.		Date	
Job Title		Signature			
Details of the learning event					

EMERGENCY PROTOCOLS

It is important that on every site there is a plan for what happens if there is an emergency while the construction is ongoing.

- The Sub-Engineer should prepare an Emergency Plan for each of the sites they are responsible for and must submit this to the District Engineer within 1 week of work starting on site.
- The Emergency Plan should contain sections on all relevant natural hazards and man-made hazards including earthquakes, floods, wildfires, building fires etc.
- The Sub-Engineer should nominate someone who will be in charge of the emergency response, as well as a backup person. This should be recorded in the daily worker register. The responsible person should receive training on how to manage the emergency plan, how to manage an evacuation, how to safely fight a fire, when it is no longer safe to fight a fire etc.
- The emergency plan should consider the emergency procedures for occupied areas of the school or other nearby buildings.
- You must train everyone who attends site in the emergency procedures as part of the site safety briefing.

In the Emergency Plan you should think about:

- How you will alert everyone around you about an incident (including those using the school as well as other workers).
- How occupants should respond e.g. evacuation, first-aid, fire fighting, seeking shelter etc.
- Where to go to reach a place of safety. Make sure everyone can reach this area and that the space is large enough for everyone from your building and any other buildings that use this area.
- How to call medical or other emergency services. Help them by clearly marking your premises from the road. Consider drawing up a simple plan showing the location of key parts of the site and access routes.
- How to access equipment such as first aid kits, fire fighting equipment, rescue equipment etc.
- If you are working inside, how to ensure that there are enough emergency exits for everyone to escape quickly, and that doors and escape routes remain unobstructed and clearly marked.

Work should not continue after an emergency unless it has been cleared by the PIU.

After an emergency, records should be kept of the incident indicating what worked well and what could be improved for next time.

CHAPTER 4

MATERIAL SPECIFICATION

This chapter covers the material specification and field testing of material quality which will be used in the retrofitting design of this school:

MAT.01

Brick Masonry

MAT.02

Stone Masonry

MAT.03

Concrete

MAT.04

Reinforcement (steel bar)

MAT.05

Timber

MAT.06

Structural steel

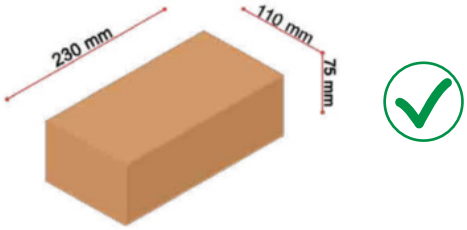
Image reference:
http://www.blackfriar.co.uk/product/red-oxide-metal-primer/
Others unknown

MAT.01 | FIRED BRICKS

The brick dimensions should be 230mm long by 110mm wide by 75mm high.

Fired bricks should have a minimum dry compressive strength of 7.5N/mm^2. This should be checked using lab tests identified in NBC 202.

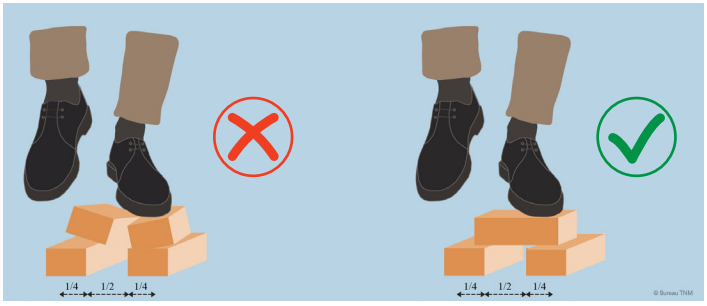
If lab tests cannot be done, the following site tests can be done quickly and cheaply to give an idea of brick quality. These should be done for every delivery of bricks which arrive on site. For the first delivery, 20-30 bricks should be tested. This can be reduced to 10-15 bricks for later deliveries if the bricks are good quality and consistent between deliveries.



- The drop test checks the block strength. A block should be dropped from a height of 1 metre. Good blocks do not break, except at the edges. Drop the bricks in a “T” shape as well.

- The bricks should have a metallic sound when knocked against one another

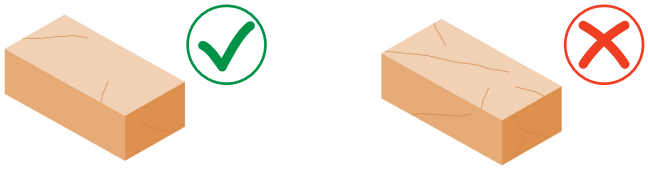
- The block bending test checks the bending strength of the block. Place blocks as shown below and stand on the top block with a full body weight at the centre. Good blocks will not break.



- The soak test checks how much water the brick will absorb. The bricks should be weighed then left in water for 24 hours and reweighed. If the weight has increased by less than 20% it can be used in construction. If the weight has increased by more than this it should not be used.

Image reference:
http://3.bp.blogspot.com/_EO8kdjHDWTI/Sry3OGj87RI/AAAAAAAAEEM/uJ-tlvDLiRs/s400/bricks_prep1.jpg
Malawi Safer Schools Construction Guidelines
Others unknown

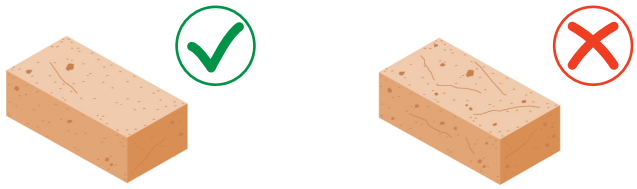
BRICK APPEARANCE



Cracks are not acceptable on faces to be exposed to water. On other faces, they should not exceed 1mm in width or depth or 10mm in length and there should be no more than 3 cracks on each face.

Lamination is not acceptable.

Chipped corners should not exceed 10 mm.



Holes or scratches should not exceed 10% of the surface area for bricks

Blocks must not display any significant and lasting **efflorescence** covering more than 1/3 of the total surface.

Image reference:
Malawi Safer Schools Construction Guidelines

MORTAR

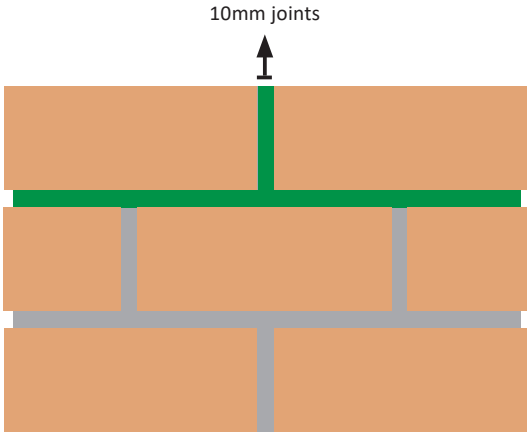
Cement mortar is advised for all construction.

Mortar mix should be cement:sand of 1:6 for a 9” wall and 1:4 for 4” wall.

Cement mortar should be used within 30 minutes of mixing to prevent it going off.

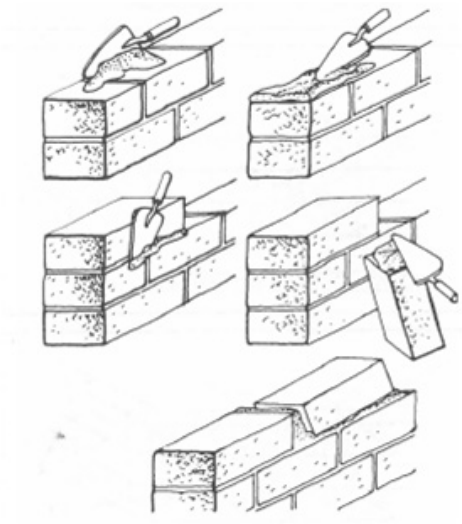
Use as little water in the mix as possible. Using too much water weakens the mortar.

Both horizontal and vertical mortar joints should be 10mm thick (+/- 2mm). Thick mortar beds weaken the wall and add cost due to additional mortar and hence cement required.



The masonry units should be pressed firmly into the mortar to ensure a decent bond is achieved. This applies to both the horizontal joints and the vertical joints.

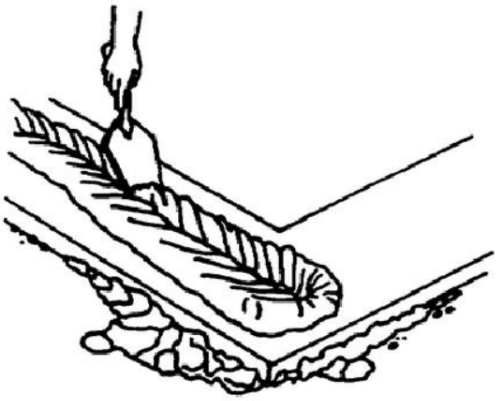
Slushed joints, where the mortar is placed into the vertical joint between two blocks after the block is laid, should be avoided as they will give a poor bond. Instead, the mortar should be applied to the block before being laid as shown in the figure.



9 - Hazardous Substance (Cement)

Refer to Chapter 3.3.

Image reference:
Unknown



When laying the horizontal mortar bed, do not spread it out more than three to five blocks in advance so that it does not dry out. 'Furrow' the mortar after it has been spread.

No more than half the height of a wall should be built in a day. The remaining half can be built the following day.

Bond strength is greatly influenced by workmanship. All bricks should be cleaned and wetted before applying mortar.

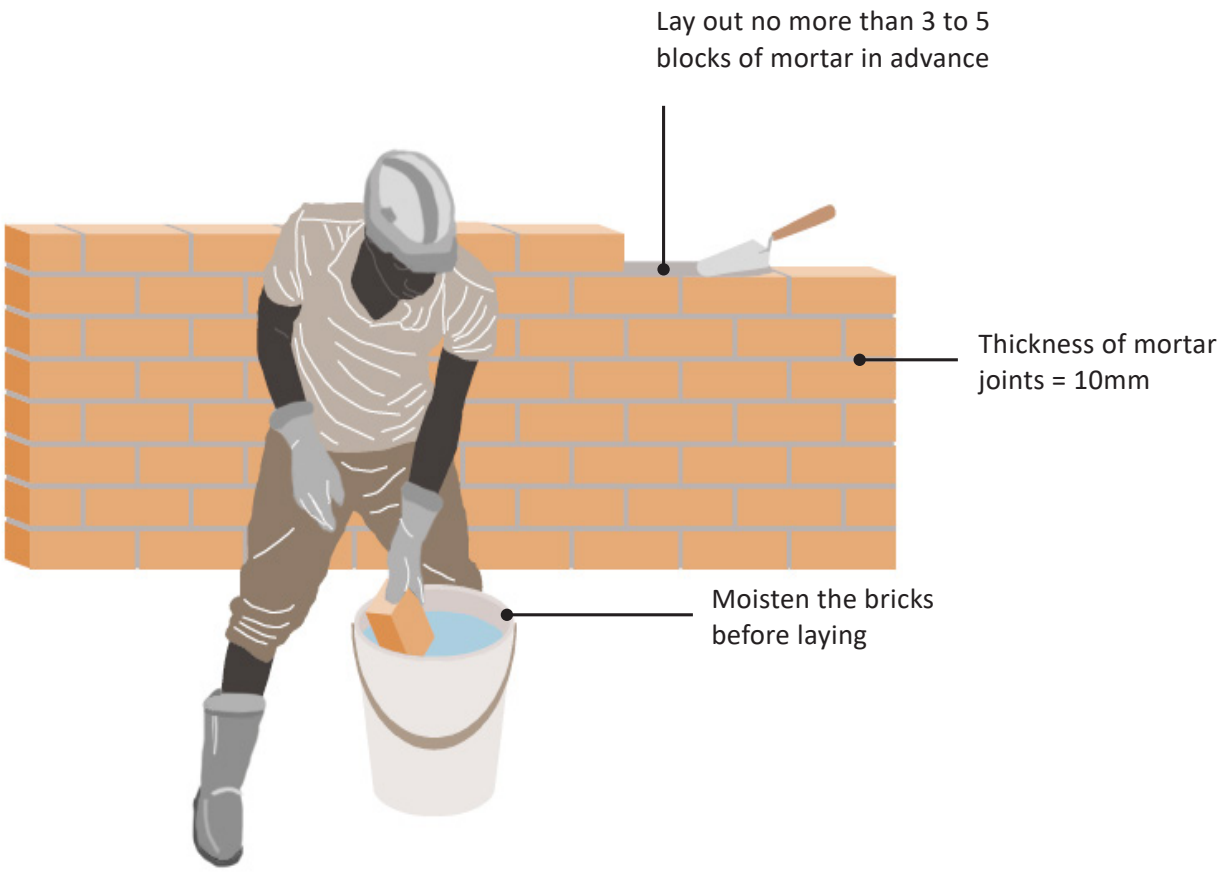
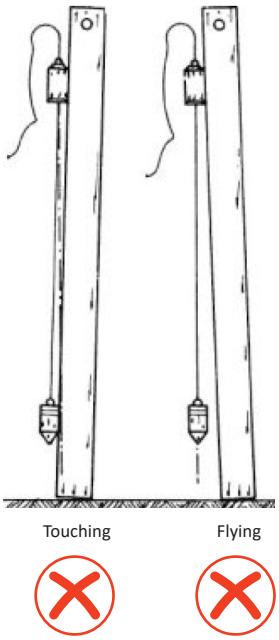


Image reference:
http://armyengineer.tpub.com/en5157a/Figure-2-6-Spreading-And-Furrowing-The-Mortar-Bed-27.htm
Malawi Safer Schools Construction Guidelines

WORKMANSHIP

Masons should use string to set the line of each course and should be checking verticality or 'plumb' with a plumb line. A plumb line consists of a weight at the bottom of a piece of string with a gauge (of the same width) at the top. Held against a vertical surface it will indicate verticality.

Plumb bob



Touching Flying

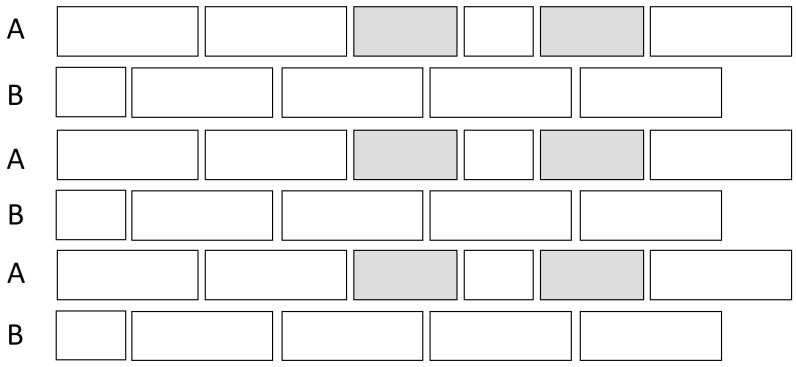
Image copyright (c) 1. NSET ; 2. RedR Engineering in Emergencies

BRICK COURSING

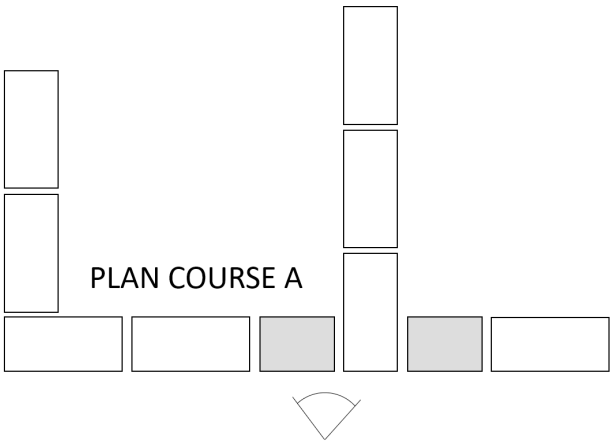
Correct block laying is required to achieve strength of the wall.

The brick bond used for the wall ensures that vertical joints in consecutive courses do not align, and are a minimum of a quarter of a block length apart.

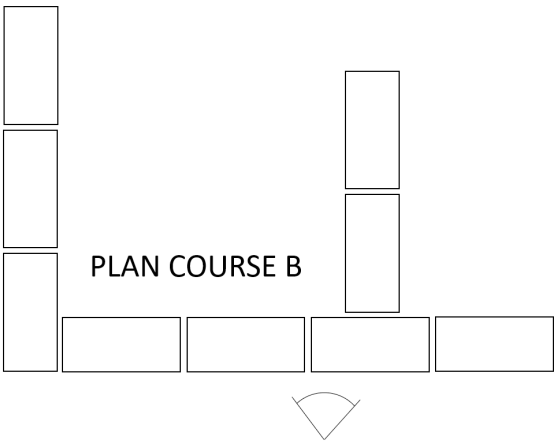
SINGLE SKIN BRICK (4½" THICK WALL)



Wall Elevation



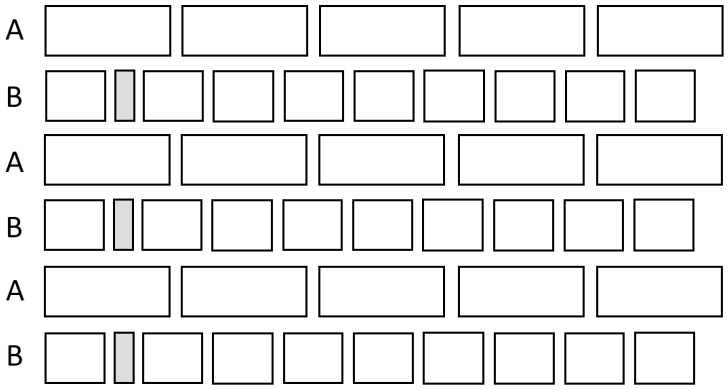
Plan View A



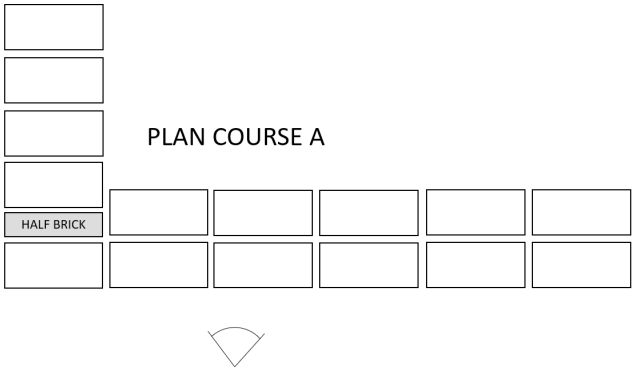
Plan View B

FULL BRICK WIDTH WALL (9” THICK WALL)

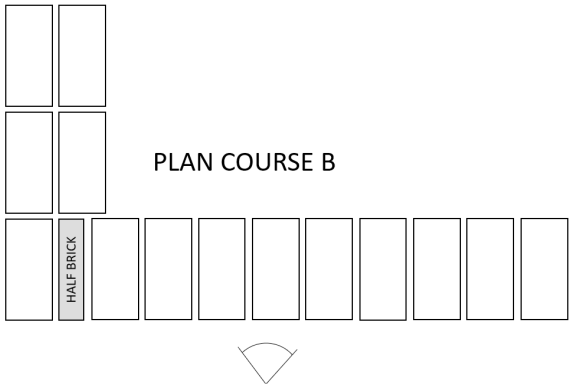
Wall Elevation



Plan View A

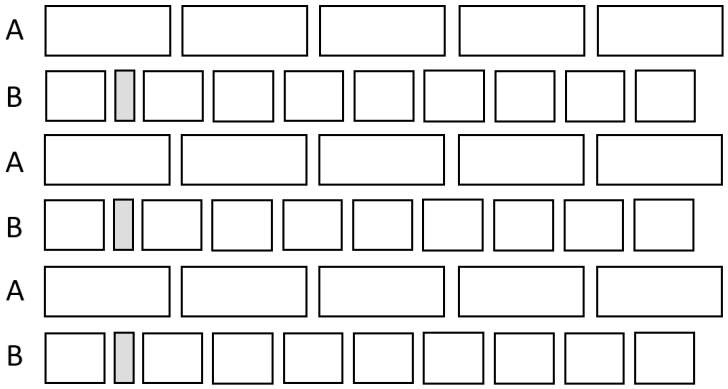


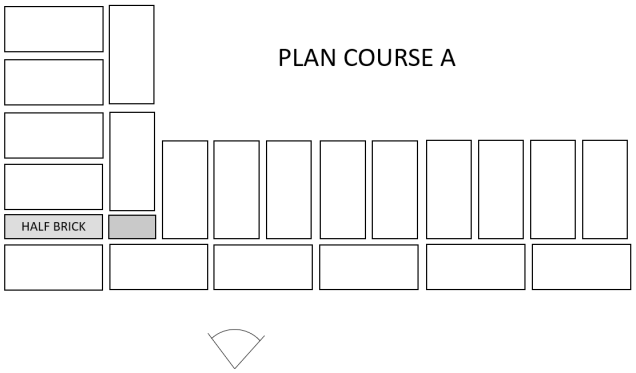
Plan View B



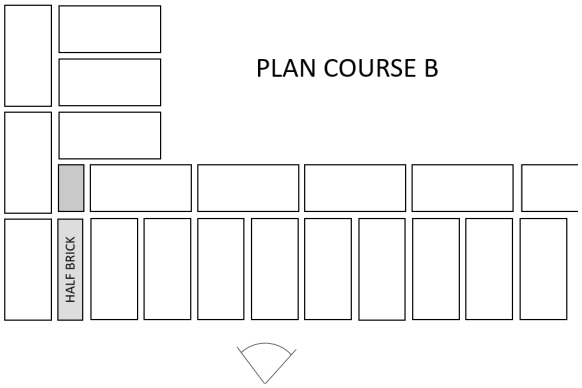
BRICK AND A HALF WIDTH WALL (14” THICK WALL)

Wall Elevation





Plan View A



Plan View B

MASONRY - PLASTER

The plaster is there to protect the masonry. Rain and sun will gradually damage the plaster. When this happens the plaster should then be repaired.

A sand-cement plaster should be used. This should have a cement: sand ratio of 1:6.

Plaster Application

1. When laying the bricks the mortar joints should NOT be made flush with the bricks. This will help the plaster to stick to the wall.

2. Roughen the surface of the wall with a sharp tool. Creating marks in the wall will again help the plaster to stick.

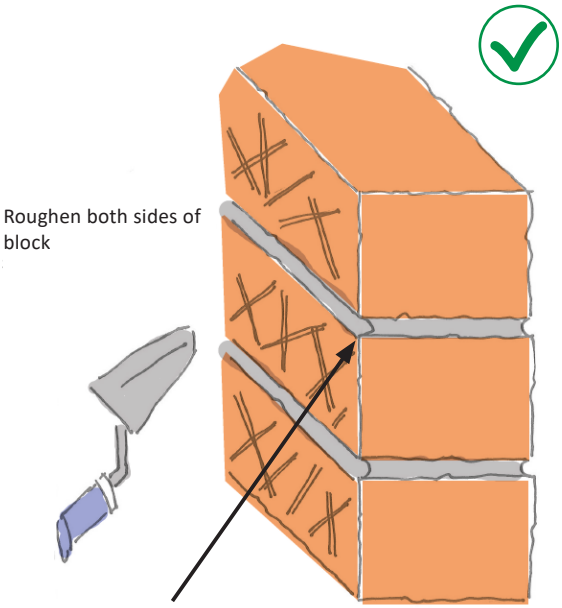
3. Clean any loose dirt from the wall.

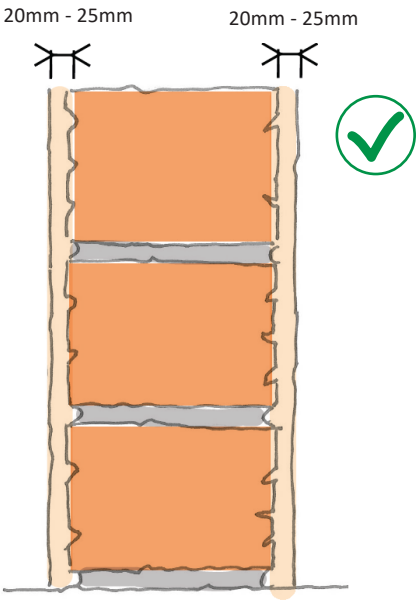
4. Pour water onto the surface of the wall with a watering can or similar immediately before applying the plaster. Wetting the surface of the wall helps to prevent the plaster from drying out too quickly and can help stop cracks.

5. The plaster should be applied to the wall as quickly as possible. The mason must work quickly to make the plaster smooth. Once the plaster is smooth the mason must STOP towelling and move to a new section of the wall. Towelling the plaster repeatedly sucks water from inside the plaster on to the surface where it evaporates. This makes the plaster crack.

6. Render is best applied in three layers. Each layer should be applied after the layer beneath has dried and therefore shrunk.

7. Once applied the render should be kept in the shade to protect it from the sun. The render should be kept wet for 3 days. This is to stop the render from drying out too quickly.





Rough surface helps render to stick

Refer to chapter 3.3.

1 - Working at Height
6 - Manual Handling
9 - Hazardous Substance (Cement)

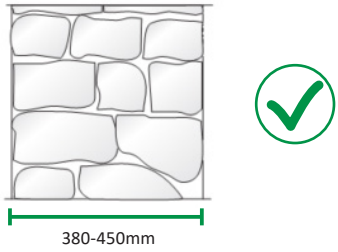
Image reference:
SABRE Kindergarten Specification

MAT.02 | STONE

Stone used in wall construction should be quarry stones with angular shape.

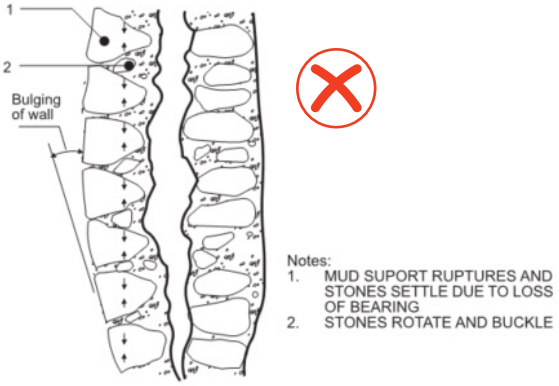
Round boulders may only be used in footing construction below ground level. If only round boulders are available, these should be partially (at least 50% each) dressed.

Stone walls should have a maximum thickness of 450mm and a minimum thickness of 380mm.



The major problems associated with random rubble stone walls are:

- Separation at corners and T junctions
- Delamination and bulging of walls (separation of internal and external wythes)



To minimise these issues the following steps should be taken:

Masonry should be brought to course every 600mm

'Through' stones of full-length equal to the wall thickness should be used every 600mm lift at not more than 1.2m horizontally. If full length stones are not available, paired stones at least 3/4 of the wall thickness may be used.

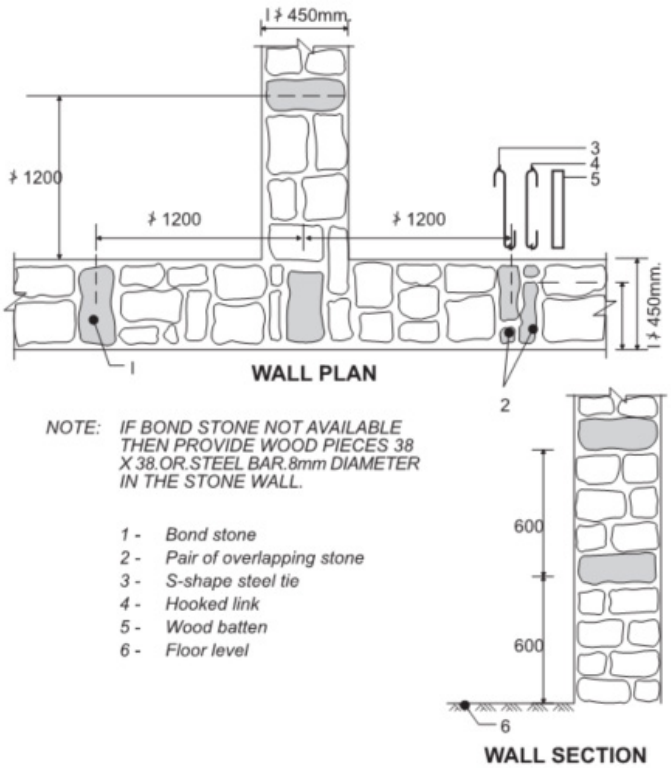


Image reference:
NSET/USAID/UNESCO Protection of Educational Buildings Against Earthquakes

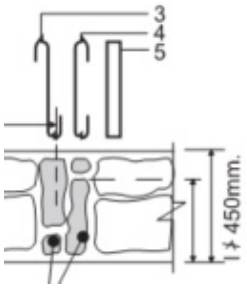
STONE SELECTION

Rough, broken or jagged stones are good for construction

Rounded stones like those found in river beds are not suitable for construction

Stones which have been cleaved into brick shapes are also good for construction

Instead of 'through' stone, 8mm reinforcing bar in S shape or a hooked link can be used with a cover of 25mm from the face of the wall.



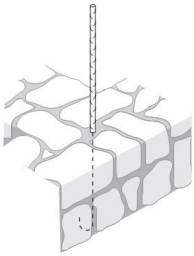
Wood battens of 38mm x 38mm cross section or plain cement concrete block of 150mm x 150mm could also be used in place of 'through' stone.

Long stones should also be used at corners and junctions of walls to break the vertical joint and provide bonding between perpendicular walls.

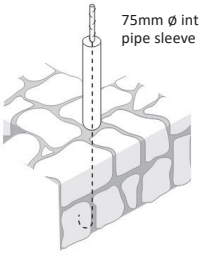
Vertical reinforcing bars should be provided at corners, T-junctions, doors and large openings.

Bars in various stories should be in the same vertical line and truly straight. Bars should start from the foundation and bust be anchored at roof level. If necessary, bars should be spliced just above the lintel band in each storey.

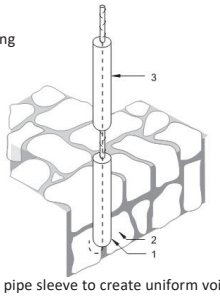
The cavities made around the bars during construction should be filled with cement concrete with a 1:2:4 mix with fine chips. The cavity should be formed using a pipe sleeve, which is removed before the concrete is set.



Reinforcement void to be filled with concrete



Void left around masonry to be filled with concrete is often unsatisfactory



Use of pipe sleeve to create uniform void for reinforcement as per following steps:

1. Place pipe sleeve around reinforcement
2. Build masonry around the pipe sleeve
3. Lift the pipe sleeve leaving hollow masonry
4. Fill the void with mixed concrete and coarse aggregate
5. Repeat process

Image reference:
NSET/USAID/UNESCO Protection of Educational Buildings Against Earthquakes

MAT.03 | CONCRETE

CONCRETE MIXES

The mix ratios by volume for concrete are as follows:

	PORTLAND CEMENT	SAND	AGGREGATE	WATER
STRUCTURAL CONCRETE (RCC)	1	1.5	3	0.9
MASS CONCRETE (PCC)	1	2	4	0.75
BLINDING	1	6	10	0.75
MORTAR	1	4	-	1.5

CONCRETE MATERIALS

Cement

- All cement used should be Ordinary Portland Cement.
- Cement must be as fresh as possible. The cement bag should clearly state the type of cement and the date of manufacturer. Do not use cement that doesn't have a date of manufacturer, or is more than 3 months old.
- Cement must be stored in a cool dry location. Workers should check that no moisture has entered the bag when it is opened
- Cement should not be used if there are hardened lumps.

9 - Hazardous Substance (Cement)

Refer to chapter 3.3.

Image reference: ABD /NSET Supervision Guideline for Technical People
Arup (Vita Sanderson)

OTHER MATERIALS IN CONCRETE

Sand

- Sand should be river sand or quarry dust.
- Coarse sand should be sieved to remove stones, plant roots, fine particles and dust.
- All sands should be clean before use. If left outside with variable rains this can usually do the trick. Pick up a handful of sand and drop it back on the pile. If this creates a small dust cloud then have the sand washed.
- A simple field test can be carried out to determine the proportion of undesirable fine particles in the sand.
    1. Fill a jar with sand up to 60mm.
    2. Fill with water to 25mm above the sand.
    3. Add one spoon of salt.
    4. Shake until the mixture is uniform
    5. Let the jar sit in a still position for three hours.
    6. Measure the silt above the sand
    7. Silt content should not be more than 5%.

Water

The water used for concrete must be soft, without salt, algae or any other vegetable matter. Check that the water is clear and that it is not salty. Let it evaporate completely and check for any deposits. These could include organic matter, which are acceptable only in very small quantities, or salt crystals, which are totally unacceptable. Sulphates are very harmful, especially calcium sulphate (anhydride and gypsum).

Acceptable

Salty water is not acceptable

Image reference:
Malawi Safer Schools Construction Guidelines
ABD /NSET Supervision Guideline for Technical People

OTHER MATERIALS IN CONCRETE

Aggregate

- The aggregate should have sharp edges. Flaky, elongated pieces should not be used.
- Excessively jagged or angular aggregate is harder to compact properly and should be avoided. Smooth river stones should also be avoided as they give weaker concrete
- The aggregate size that is acceptable depends on the size of the concrete element as shown in the following table:

Concrete element	Maximum stone size (mm)	Maximum stone size (inches)
Reinforced concrete greater than 40mm thick (e.g. column, foundation, beam, slab)	20mm	3/4"
Reinforced concrete retrofitting elements less than 40mm thick (e.g. splints and bandages, jacketing)	10mm	1/2"

ø < 20mm is acceptable for elements greater than 40mm thick.
ø < 10mm for elements less than 40mm thick

Rounded river stones are not acceptable

Image reference:
Malawi Safer Schools Construction Guidance

CONCRETE MIXING

Mechanical mixing

- Concrete should be mixed using a mechanical mixer where ever possible. This ensures consistency and avoids weak batches.
- The same bucket should be used for each material and it should be level filled, not heaped.
- Cement and aggregates should be thoroughly mixed together first before gradually adding water to the mix.
- Mixing should be done for 3 minutes after all materials are added.
- Do not add extra water to make the mix more workable. Water content should be checked with a slump test (see next page).
- Concrete is to be mixed continuously until poured.

Hand mixing

If hand mixing for concrete is the only option, extra care must be taken with the mixing process.

- An extra 10% of cement should be added to the mix.
- Mixers and pourers should be rotated to avoid fatigue in the mixers, which could reduce the mix quality.
- Mix on a hard, flat, clean surface. The first batch of concrete could be used to cast a mixing surface for future batches.
- Cement and aggregate should be mixed thoroughly first to a uniform colour before adding water.
- Concrete should be mixed for at least 5 minutes. The mix should be a uniform colour and consistency.
- Hand mixing with a correct water:cement ratio is hard. Do not add extra water to make the mix more workable. Water content should be checked with a slump test (see next page).

9 - Hazardous Substance (Cement)

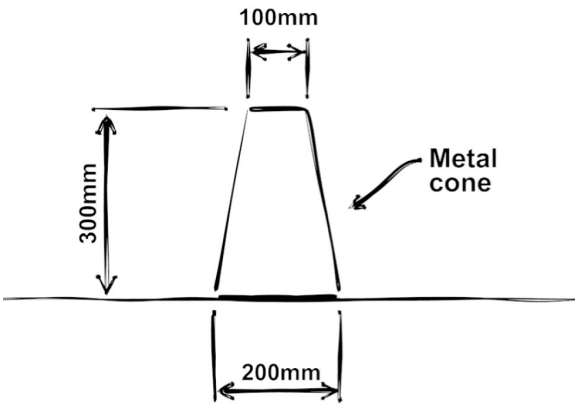
Refer to Chapter 3.3.

Image reference: ADB /NSET Supervision Guideline for Technical People
Other unknown

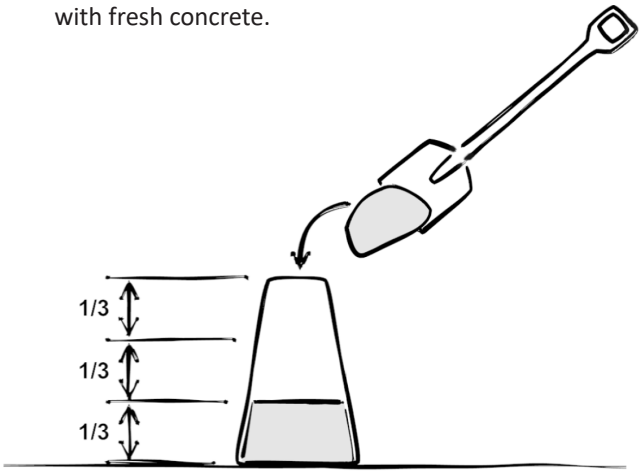
SLUMP TEST

A slump test should be carried out every time concrete is mixed. It will tell you if there is too much or too little water in the concrete mix.

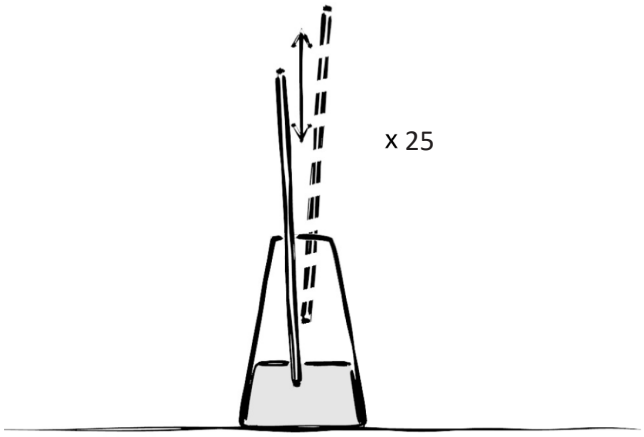
1 Make a metal cone that is 300mm tall, 100mm wide at the top and 200mm wide at the bottom. Each end of the cone should open. Ensure the cone is clean before use



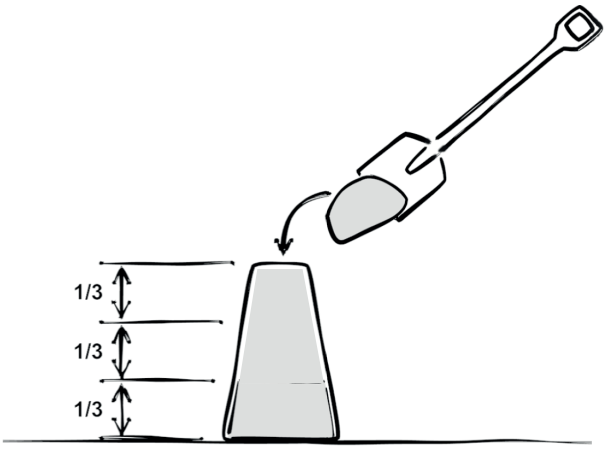
2 Place the cone on a flat surface. Fill 1/3rd of the cone with fresh concrete.



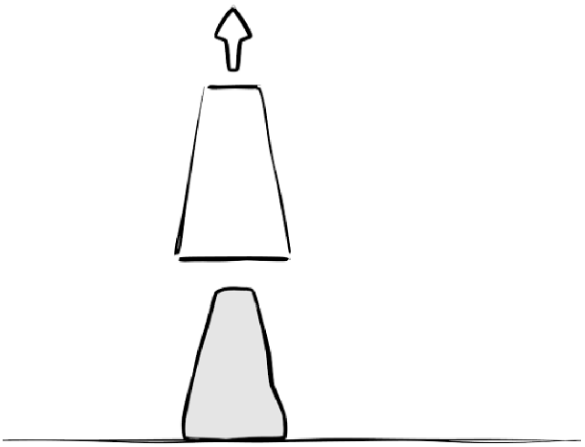
3 Compact the concrete 25 times with a 16mm diameter smooth steel rod that is straight with rounded ends - do not use rebar or sticks.



4 Repeat steps 2 and 3 twice so that the cone is now full of concrete. Level the top surface.



5 Carefully remove the slump cone slowly and steadily. It should take between 2 and 5 seconds to remove.



6 Using a smooth iron rod and tape measure, measure the slump from the highest point of the concrete to the top of the cone.

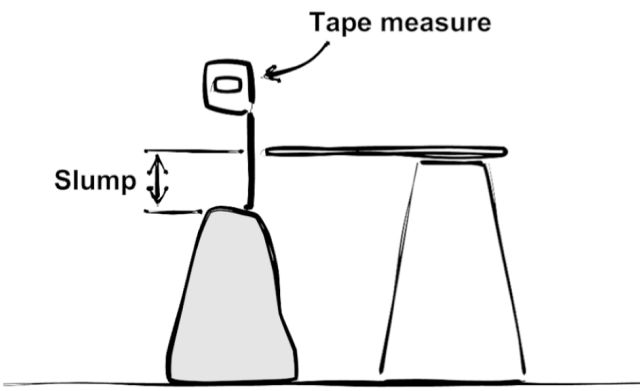


Image reference: Malawi Safer Schools Construction Guidance
SABRE Kindergarten Specification

CONCRETE SLUMP LOG

DAY AND DATE		MIX RATIO	
TITLE OF WORKS		WEATHER	
MIXER LOADS			

MATERIALS USED

MATERIAL	AMOUNT USED

SLUMP TEST RESULTS

TARGET SLUMP	

	RECORDED SLUMP
1	
2	
3	
4	
5	
6	
7	
8	

The slump should be as small as possible while still allowing for full compaction of the concrete. This will typically result in a slump measure of 50mm (+/- 5mm).

If the slump measures more than 50mm it means there is too much water in the concrete. Adding too much water to the concrete makes it weak.

If the slump measures less than 50mm there is not enough water in the concrete and it will be too stiff to use making it difficult to compact properly.

PLACING CONCRETE

If wheelbarrows are used, make sure that timber runways do not damage reinforcement.

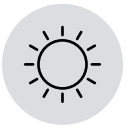
Concrete should be placed in the formwork as close as possible to its final position rather than moved around.

Mixed concrete should not be allowed to stay on the platform for more than 30 minutes. Concrete should normally be cast in a single, continuous operation.

If a single pour is not possible, avoid cold joints in adverse locations. Cold joints are where the concrete has set before the next concrete is placed.

When a pour must continue from a cold joint the connecting surface should be 'scabbled' to promote maximum bonding between new and old concrete. 'Scabbling' involves breaking back the concrete surface to expose the aggregate and give a jagged edge. Remove dust and loose material before pouring.

De-bonding agents such as wax and used cooking oil could be used on formwork. Diesel and used engine oil are not recommended due to the difficulty of disposing of them in an environmentally friendly manner.



Pouring concrete in HOT weather

Don't pour above 35 degrees Celsius as the concrete will dry out.

Refer to Chapter 3.3.

9 - Hazardous Substance (Cement)

Pouring concrete in COLD weather

If below 5 degrees Celsius use hot water for mixing.

If below 0 degrees Celsius do not pour any concrete.

If pouring foundations and the ground is frozen, do not pour any concrete (even if air temperature is above 5 degrees Celsius).

Do not add salt to the mix to prevent freezing as this can corrode rebar.

Admixture in Concrete

For cold weather it may be useful to use an admixture which will accelerate the setting time. Research locally available quick setting admixture on the market.

CONCRETE COMPACTION

Compacting the concrete properly is very important. When concrete is poured, air bubbles can become trapped inside. If the air bubbles are still trapped in the concrete when it hardens then the concrete will be made weaker. Compacting the concrete removes the air bubbles.

If a poker vibrator is available insert close to full depth for 15 seconds every 150-200mm. If a poker vibrator is not available, hand compaction can be achieved using smooth steel rods and timber sticks. All concrete should be thoroughly compacted.

Care should be taken not to damage the reinforcement. Pay particular attention to compacting the concrete into corners.

CONCRETE CURING

The concrete must not be allowed to dry out too quickly. This is bad for two reasons. Firstly it will weaken the concrete. Secondly the surface of the concrete will crack.

After the concrete had been poured it should be covered up to protect it from the sun and wind. It should be covered with plastic sheets or cement bags and watered twice a day for 7 days.

After 7 days the concrete will have reached 2/3 of its full strength. After 1 month the concrete has reached its full strength.

Plastic sheet

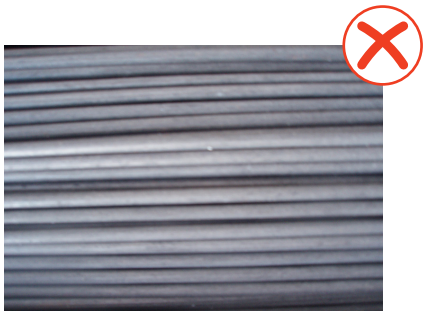
Cement bags

Image reference: Malawi Safer Schools Construction Guidance
SABRE Kindergarten Specification

MAT.04 | STEEL REINFORCEMENT

All reinforcement should be high strength (TMT Steel Fe 500 or TOR Steel Fe 415). Mild steel may be erroneously sold as high strength. Seek certificates if possible.

All reinforcement should be ribbed, smooth bars are not allowed in areas of seismicity.



Reinforcing bars are to be free of rust.

Check bar sizes by measuring at the narrowest point (do not include the ribs). Bar sizes may be mistakenly sold as one size that are actually another.

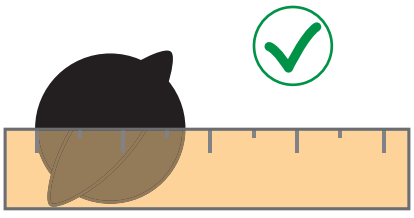
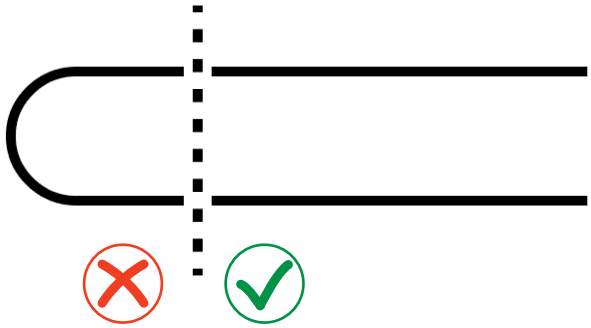
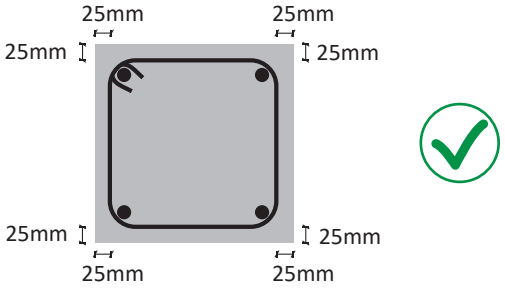


Image reference:
www.indiamart.com

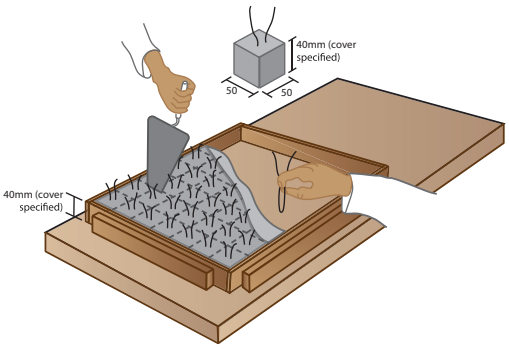
Bars will often be bent double at the point of manufacture for transport. Hammering the bar straight will make a weakness at the bend. This weaker part should not be used in elements which attract moments (for example columns, beams or suspended slabs). To reduce wastage, these previously bent sections can be used in ground bearing slabs and ramps but must be distributed between areas of unbent bars.



The cover may vary for different elements on the structural drawings, but the minimum cover recommended for any structural element is 25mm for robustness. Refer to drawing for the specified cover for each structural element.

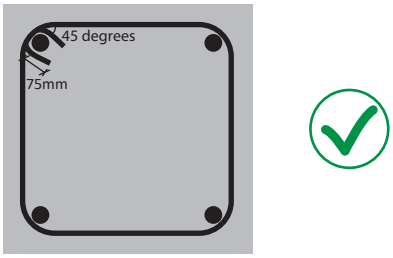


Spacer blocks should be used to help ensure cover requirements are followed. Blocks can be made on site by casting binding wire into mortar blocks with a 1:3 cement:sand ratio.



Lap splices should be 60 x the bar diameter at minimum. For a 12mm bar, this is 720mm.

Link return legs are to be bent at 45 degrees and 75mm long.



Refer to Chapter 3.3.

9 - Hazardous Substance (Cement)

Image reference:
Arup

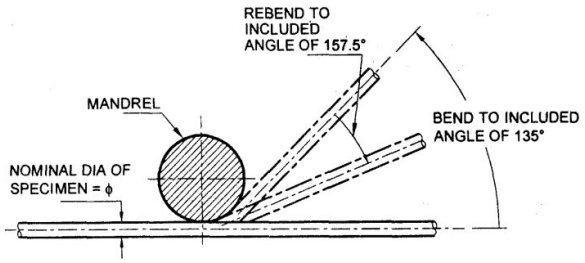
Rebend Test (Brittleness Test)

If the use of bent bars in moment carrying elements is completely unavoidable, a brittleness test could be used to assess the impact of bending on the steel. It is important to note that the consistency of the rebar is key to the applicability of this test to a large number of bars.

A section of reinforcement from each batch of reinforcement received should be tested for the re-bend test, as detailed in IS 1599, which is also described in BS4449:1997. This test is designed to measure the effect of strain ageing on the steel.

The test piece shall be bent to an inclined angle of 135° (see image) using a mandrel of appropriate diameter as shown below. The bent piece shall be aged by keeping in boiling water (100°C) for 30 minutes and then allowed to cool. The piece shall then be bent back to have an inclined angle of 157.5°.

The speciment shall be considered to have passed the test if there is no rupture or cracks visible to a person of normal or corrected vision on the rebent portion.



NOTE—ϕ Represents the nominal size in mm of the test piece.

9.4.1 The diameter of the mandrel shall be as given below:

Sl No.	*Nominal Size of Specimen*	*Dia of Mandrel for Fe 415 and Fe 500*	*Dia of Mandrel for Fe 415D and Fe 500D*	*Dia of Mandrel for Fe550 and Fe 600*	*Dia of Mandrel for Fe 550D*
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to and including 10 mm	5 ϕ	4 ϕ	7 ϕ	6 ϕ
ii)	Over 10 mm	7 ϕ	6 ϕ	8 ϕ	7 ϕ

where ϕ is the nominal size of the test piece, in mm.

MAT.05 | TIMBER

Timber must be in line with NBC 112.

When selecting timber for structural use, consider the following

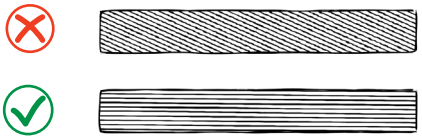
- check the timber dimensions are correct;
- make sure timber is as straight as possible;
- make sure there are no large splits;
- make sure the grain of the timber is straight;
- Timber without knots is better. If there are knots at the edge of the timber, make sure this is used as the loaded edge.

Take extra care when selecting timber for primary elements such as trusses and columns, compared to, say purlins.

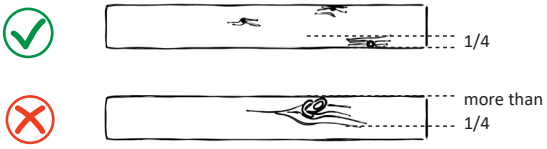
Try and ensure the timber is properly dried to prevent it shrinking in use. The timber should be stacked to allow air flow and left at least 72 hours if it has previously gotten wet.

Timber should be stored and covered to protect it from the rain and sun to prevent warping. This should be continued on site.

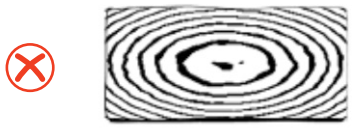
The grain of the timber should be straight. Sloping grain is not allowed. Timber with sloping grain is weak.



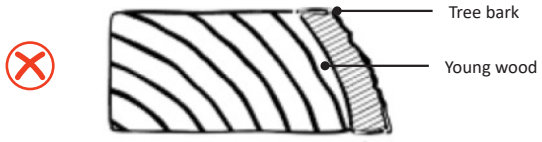
Knots are weaknesses in timber. Timber with a lot of knots is not allowed. Small nots that are less than 1/4 of the width of the timber are allowed. When joining one piece of timber to another make sure that there are no knots near to the connection.



The piece of timber that is cut from the very middle of the tree is known as boxed heart. This piece of timber will split easily and is not allowed.



Timber cut from the edge of the tree trunk is not allowed. This timber is easily attacked by insects.



Timber that shows signs of termites or any other insect attack is not allowed.

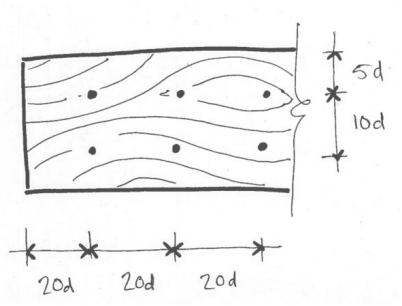
Image reference:
Arup

TIMBER CONNECTIONS

Nails

For nailed connections, check the following:

1. Diameter and length (5mm diameter, 100mm long recommended)
2. Nail spacings
3. Edge and end distances
4. Holes have been pre-drilled to reduce risk of splitting (3.5mm or 4mm drill bit recommended)
5. Material (galvanised is recommended)



Screws

For screwed connections, check the following:

1. Diameter and length -
2. Screw type - wood screws should be used where possible
3. Screw spacings
4. Edge and end distances
5. Holes have been pre-drilled to reduce risk of splitting (3.5mm or 4mm drill bit recommended)
6. Material (galvanised is recommended)

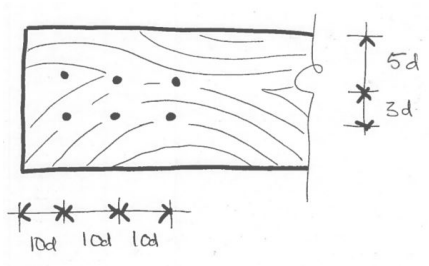


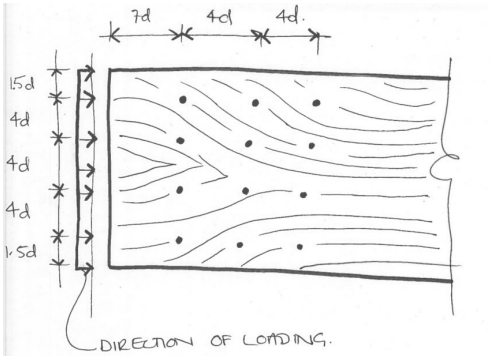
Image reference:
Arup

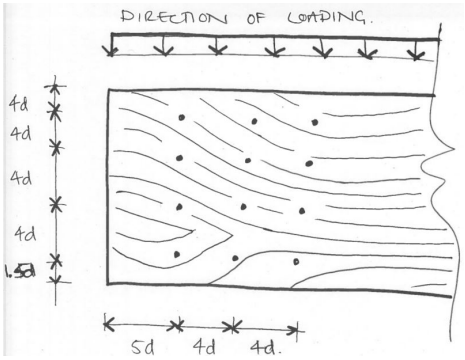
Bolts

For bolted connections, check the following:

1. Bolt strength (should be indicated on bolt head)
2. Diameter
3. Bolts spacings
4. Edge and end distances
5. Washers are in place
6. A minimum of two threads protrude through the nut
7. Corrosion protection to be repaired if damaged

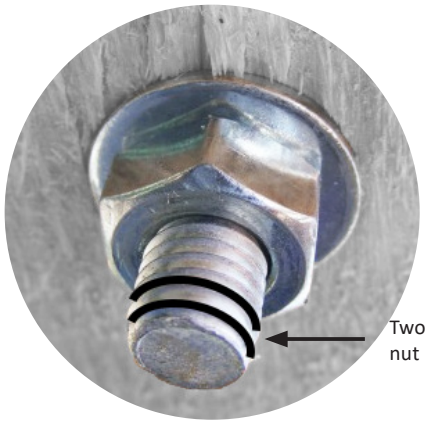
Plywood templates can be utilised to greatly speed up setting out of repeating nailed or bolted connections.





TREATMENT

All timber (and wooden) elements have to be treated against termites and insects in general, as well as against rot. Timber should be coated first with an anti-termite treatment such as borax, then with a water repellent treatment such as bitumen or Japan black before mounting. The timber must be well dried before applying the treatments.



Refer to Chapter 3.3.

9 - Hazardous Substance (Preservative)

Image reference:
Arup
Bolt image authored by Emilian Robert Nicol (licensed under Creative Commons Attributions 2.0 Generic licence) and modified by Arup.

MAT.06 | STRUCTURAL STEEL

All structural steel to be mild steel, 275N/mm². Seek certificates, labels or hard-stamps to check material, strength and manufacturer. Dimensions should also be checked.

Appropriate corrosion protection to be applied to all steel. The surface should be degreased and then prepared to ensure the protection will stick by grinders or other abrasive power tools, with hand tools such as scrapers and wire brushes as a last resort.

> Refer to Chapter 3.3.
>
> 2 - Power Tools

Corrosion protection can be achieved by galvanising or painting. Painting should include a red oxide paint which inhibits corrosion and a top coat to protect it. Corrosion protection is to be checked and repaired after any connections are made, and also after installation.

> Refer to Chapter 3.3.
>
> 9 - Hazardous Substance (Paint)

Image reference:
https://www.pannier.com/industrial-printers/ink-jet/sk-ink-jet-printers/
http://www.shutterstock.com
http://www.blackfriar.co.uk/product/red-oxide-metal-primer/
Vita Sanderson (Arup)

STEEL CONNECTIONS

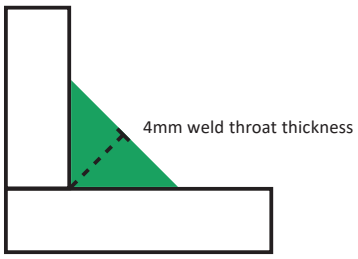
Welding

All welding surface to be clean and free of dust before welding

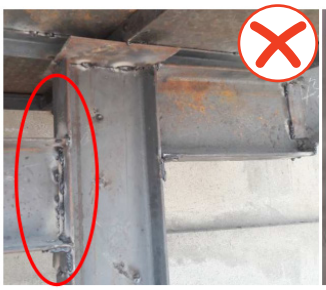
Welds to be continuous minimum 4mm fillet weld

All welds to be inspected. Check weld size and length. Check for evidence of element damage or deformation.

Corrosion protection to be applied after welding is finished

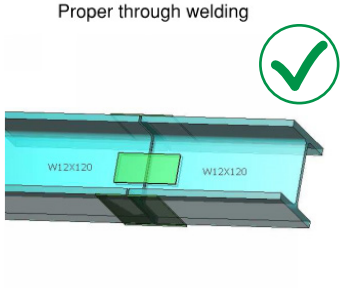


Refer to Chapter 3.3.
3 - Hot Works



Insufficient welding at joint

Proper through welding



Proper welding with additional member

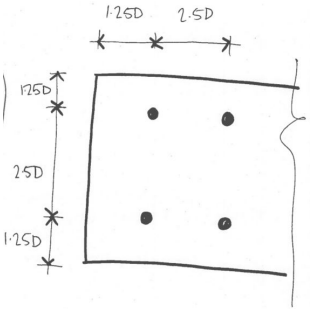
Poor welding connection at site

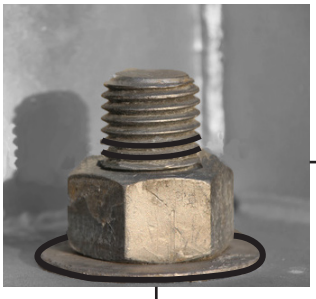
Poor welding connection at site

Bolts

For bolted connections, check the following:

1. Bolt strength (should be indicated on bolt head)
2. Diameter
3. Bolts spacings
4. Edge and end distances
5. Washers are in place
6. A minimum of two threads protrude through the nut
7. Corrosion protection to be repaired if damaged
8. There are bolts in every hole in the connection





2 threads minimum through bolt

Washers in place

Image reference:
ADB /NSET Supervision Guideline for Technical People
Arup
Others Unknown

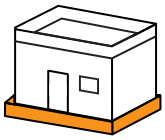
CHAPTER 5

CONSTRUCTION METHODOLOGY

This chapter contains guidance on retrofitting techniques.

The retrofitting techniques covered are:

RF.01	Foundation Improvements
RF.02	RC Jacketing to Masonry
RF.03	RC Jacketing to RC Frame
RF.04	Splint and Bandage
RF.05	Addition of Crosswalls
RF.06	Timber Diaphragm Improvements
RF.06A	Addition of Horizontal Bracing
RF.07	Replacement Slab
RF.08	Parapet Strengthening
RF.09	Gable Alterations
RF.10	Alterations of Existing Openings
RF.11	Repair Works: Exposed Reinforcement and Masonry Cracking

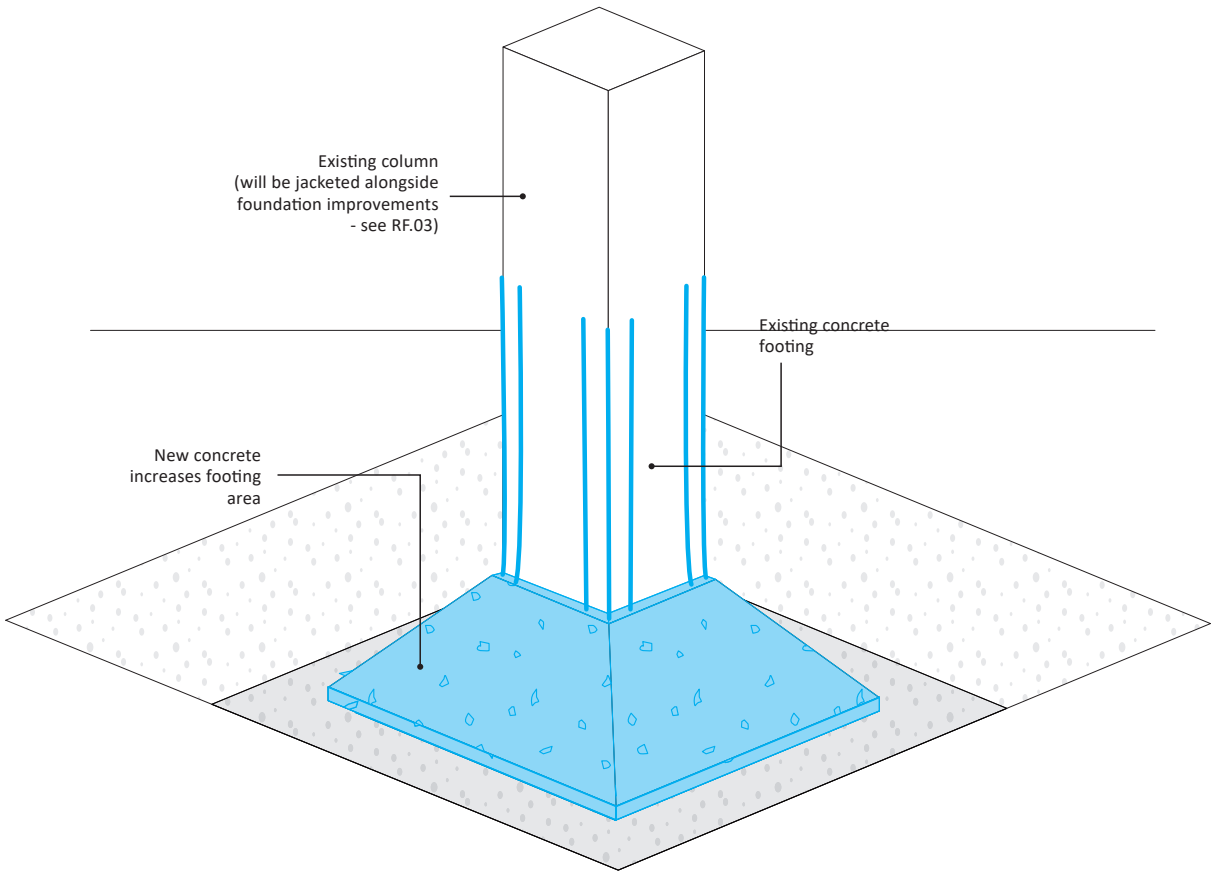


RF.01

FOUNDATION IMPROVEMENTS

Foundation retrofit is required if the size is inadequate, the foundations have been damaged or if other retrofit measures increase the load on the foundations.

3D view

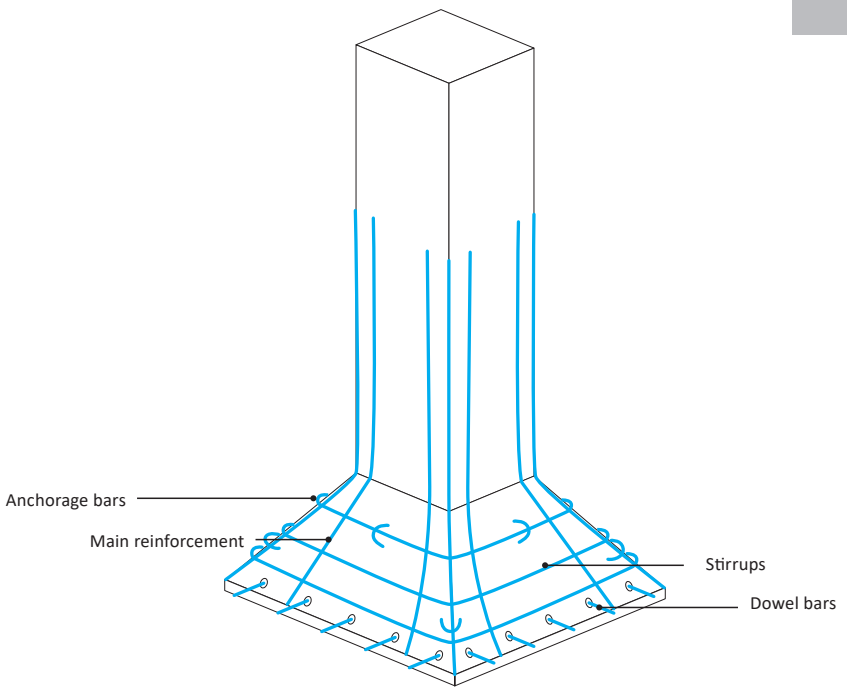


This technique involves the following:

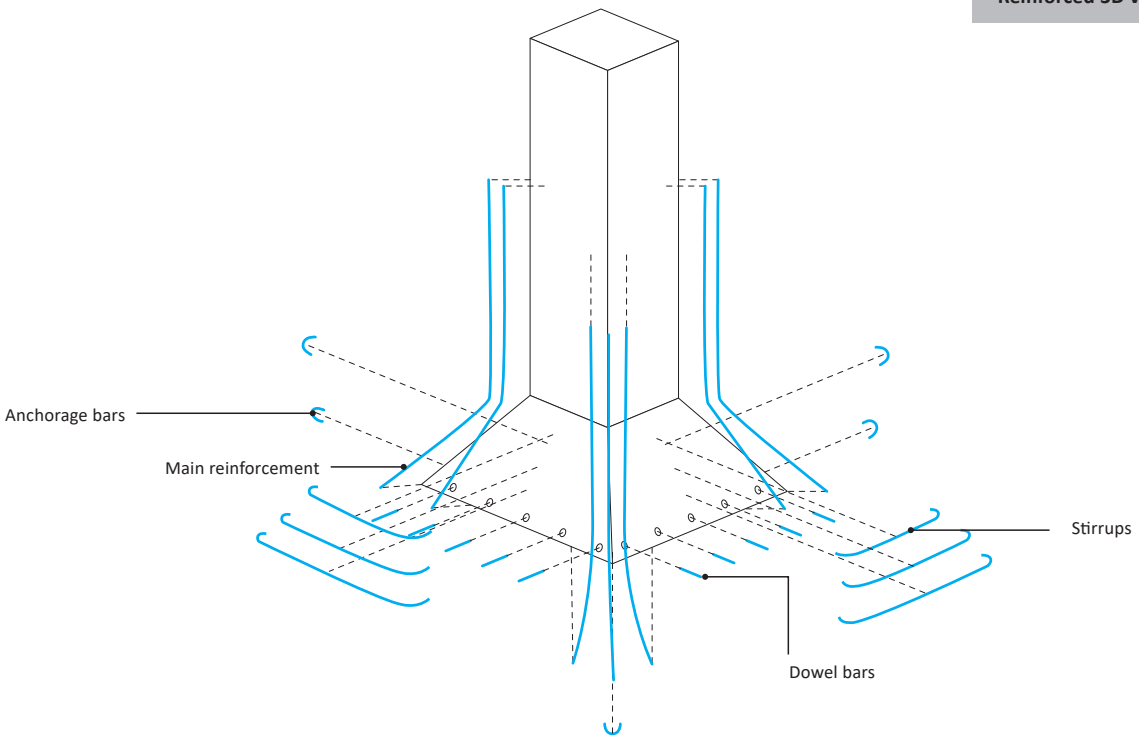
- A Excavation
- A Power Tools
- A Manual handling
- A Working with Hazardous Substances
- A Exposure to Lead Paint

FOUNDATION IMPROVEMENTS - REINFORCEMENT 3D VIEW

Reinforced 3D view

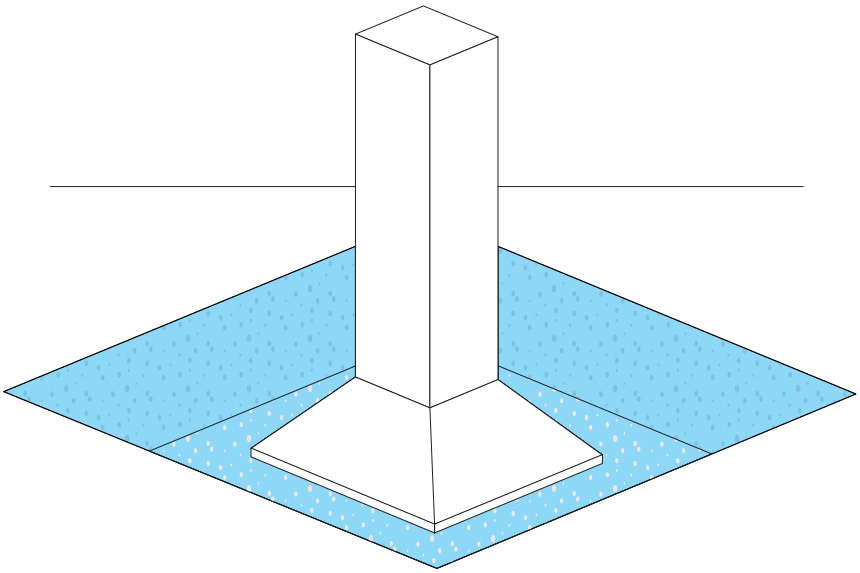


Reinforced 3D view - Exploded



FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

1 FOUNDATION PREPARATION



Remove finishes and break out floor around column. Excavate to expose footing and the new footing area. Clean existing footing to ensure bond with new concrete. Ensure founding surface is firm and flat by compacting and laying flat brick soling.

WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools
5 - Excavation
10 - Lead Paint

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Excavations are stable. Temporary support is installed if required
- Existing foundation is in good condition
- Top surface of footing is clean and free of loose material
- New founding surface is firm, flat and clean
- Foundation trench is properly marked and excavated to the design depth and width
- Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press froman adult heel
- Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface
- Soil at the base of the trench is not fill
- Soil at the base of the trench does not contain organic material (e.g. plant roots
- Flat brick soling is installed and is clean and level

FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

2 SURFACE PREPARATION

WATCH OUT:

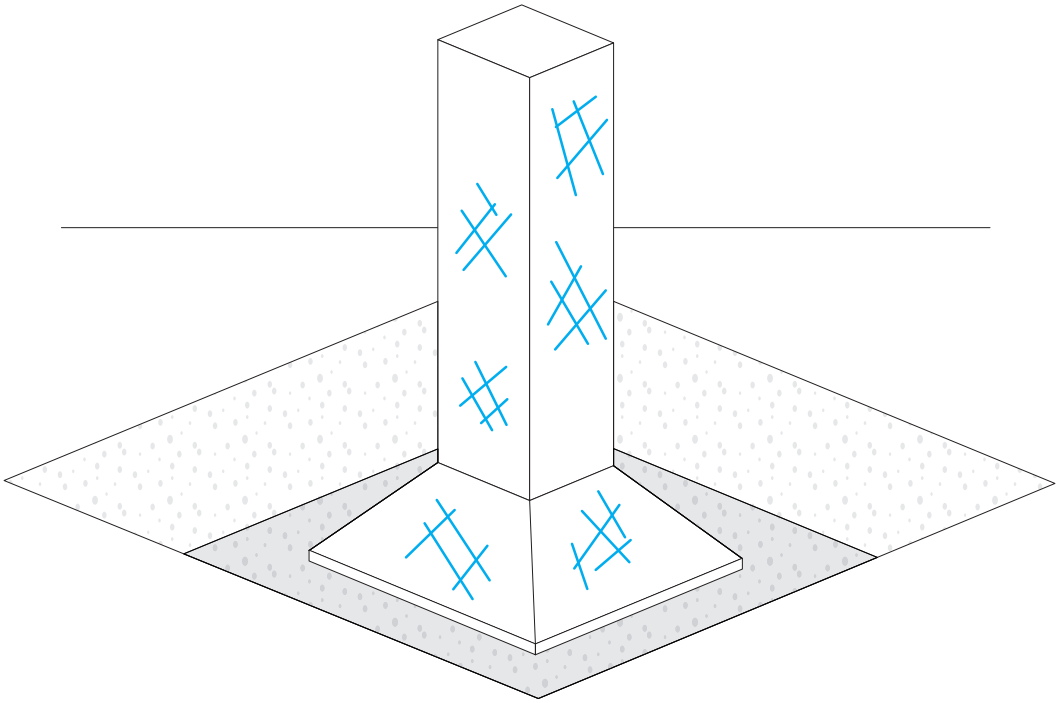
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material



Roughen the surface of the footing. Surface should be free of any loose material.

FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

3 ANCHORAGE PREPARATION

WATCH OUT:

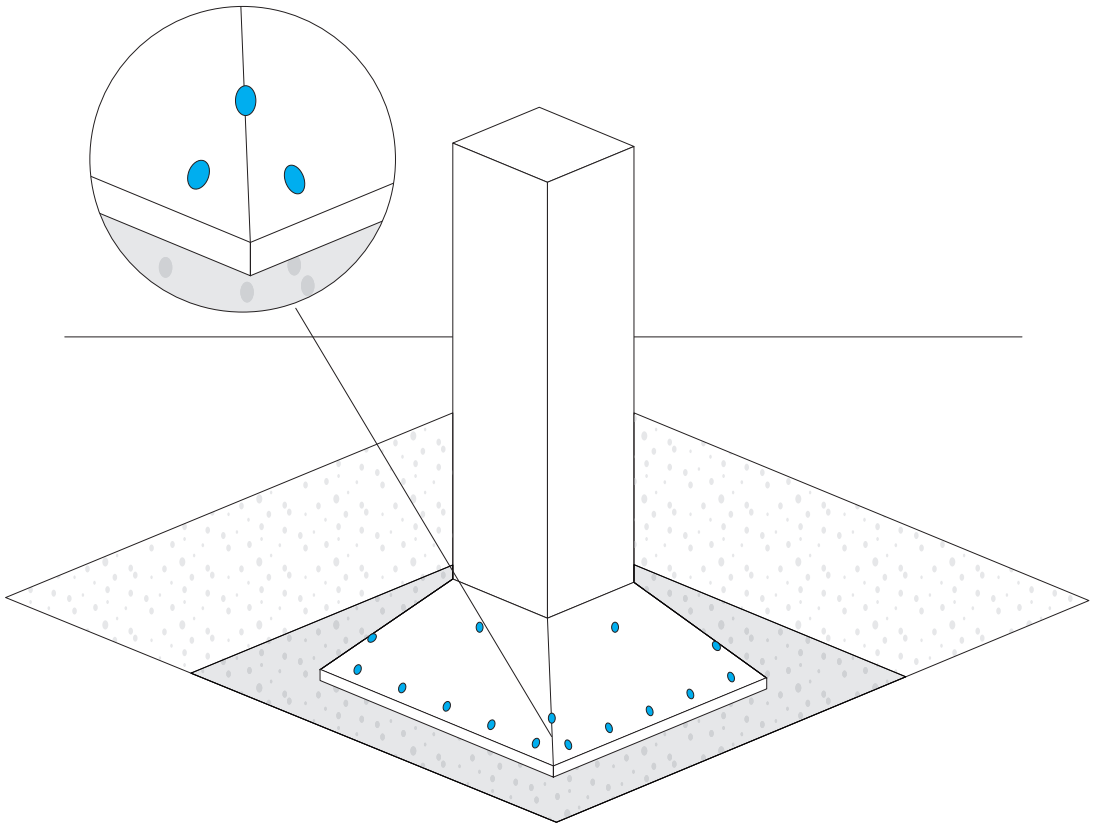
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing and depth of holes matches drawing



Drill holes for anchorage bars and dowel bars - see drawings for correct number, depth and spacing.

FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

4 REINFORCEMENT FIXING

WATCH OUT:

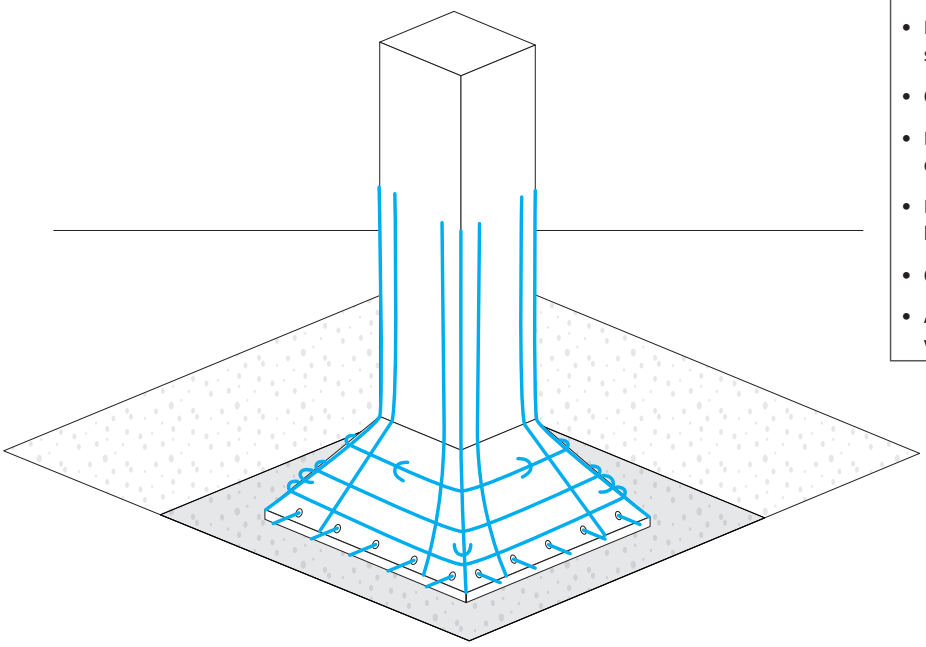
Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids

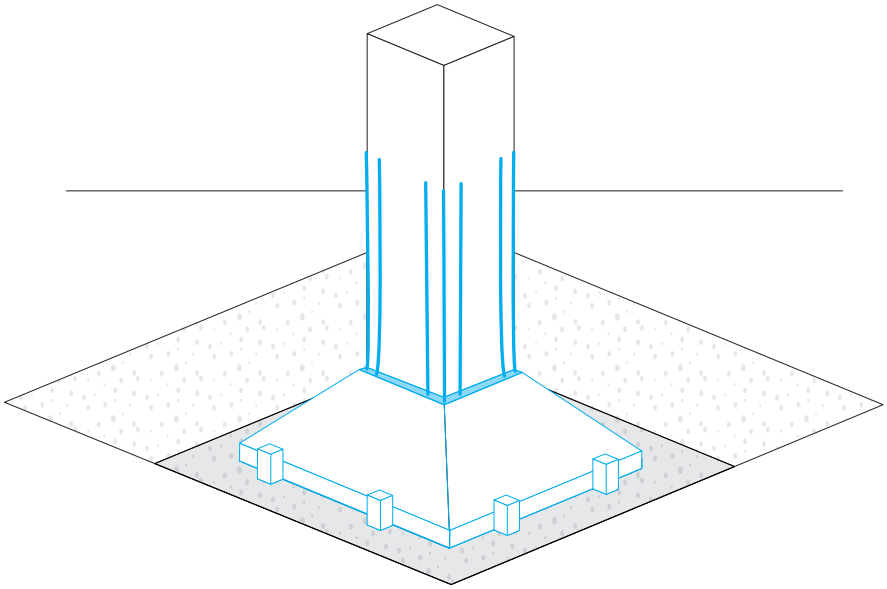


Fix reinforcement, using spacer blocks to ensure correct cover. See drawings for reinforcement sizes and spacings. Fix anchorage bars and dowel bars and fill in holes with cement.

See **MAT.04** Rebar specification →

FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

5 CONCRETE APPLICATION



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Fix formwork and pour concrete. See drawings for dimensions and concrete specification.

See **MAT.03** Concrete specification →

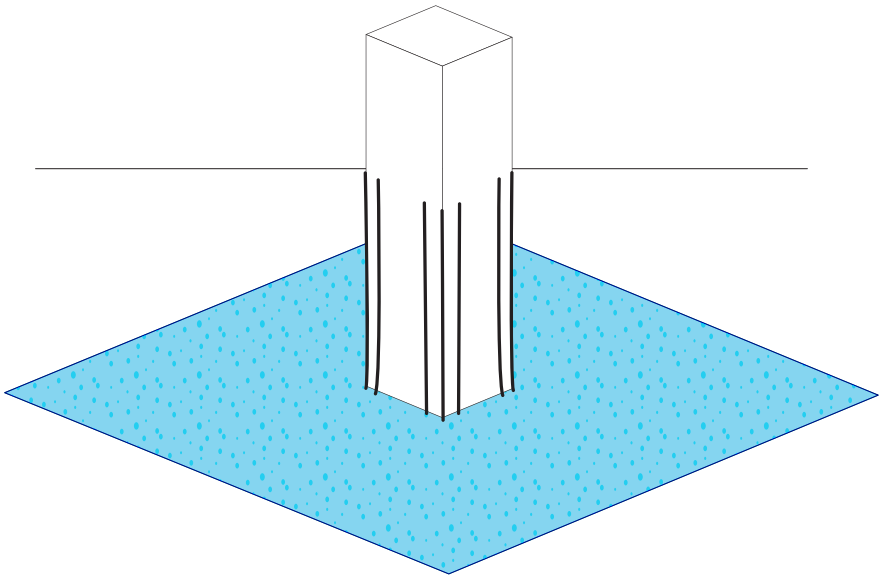
FOUNDATION IMPROVEMENTS - CONSTRUCTION SEQUENCE

6 CONCRETE CURING

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Appropriate curing time (14 days) is left before backfill etc.
- Concrete is kept moist during curing
- Backfill is properly compacted before reinstating floor



Allow concrete to cure for 14 days. Use wet jute bags or mats to keep concrete moist during curing. Once cured, backfill excavation, compact the fill and reinstate the floor.

Proceed to RC jacketing of column - See RF.03

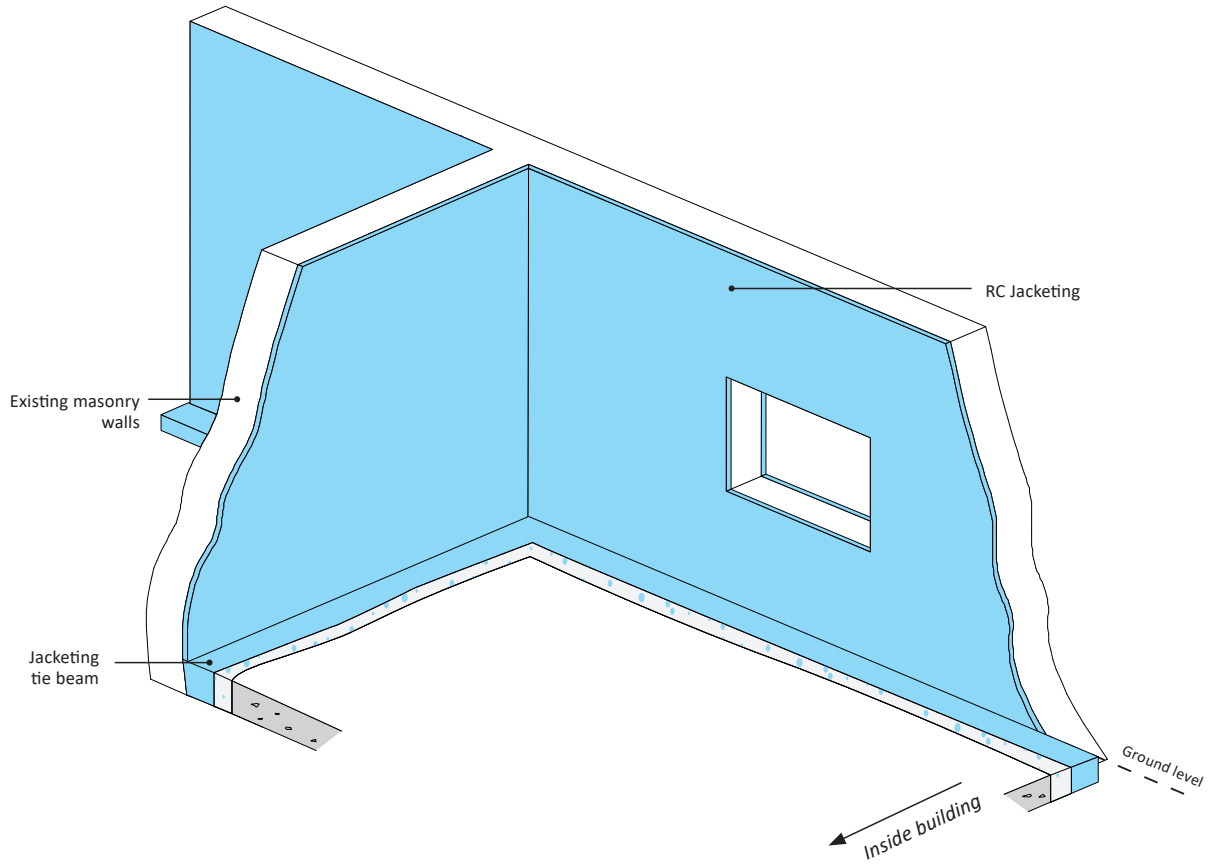
(Omit Construction Sequence step 1)

RF.02

REINFORCED CONCRETE JACKETING - MASONRY

Jacketing the walls with reinforced concrete strengthens them and prevents masonry from falling out. It may also improve fire safety.

3D view



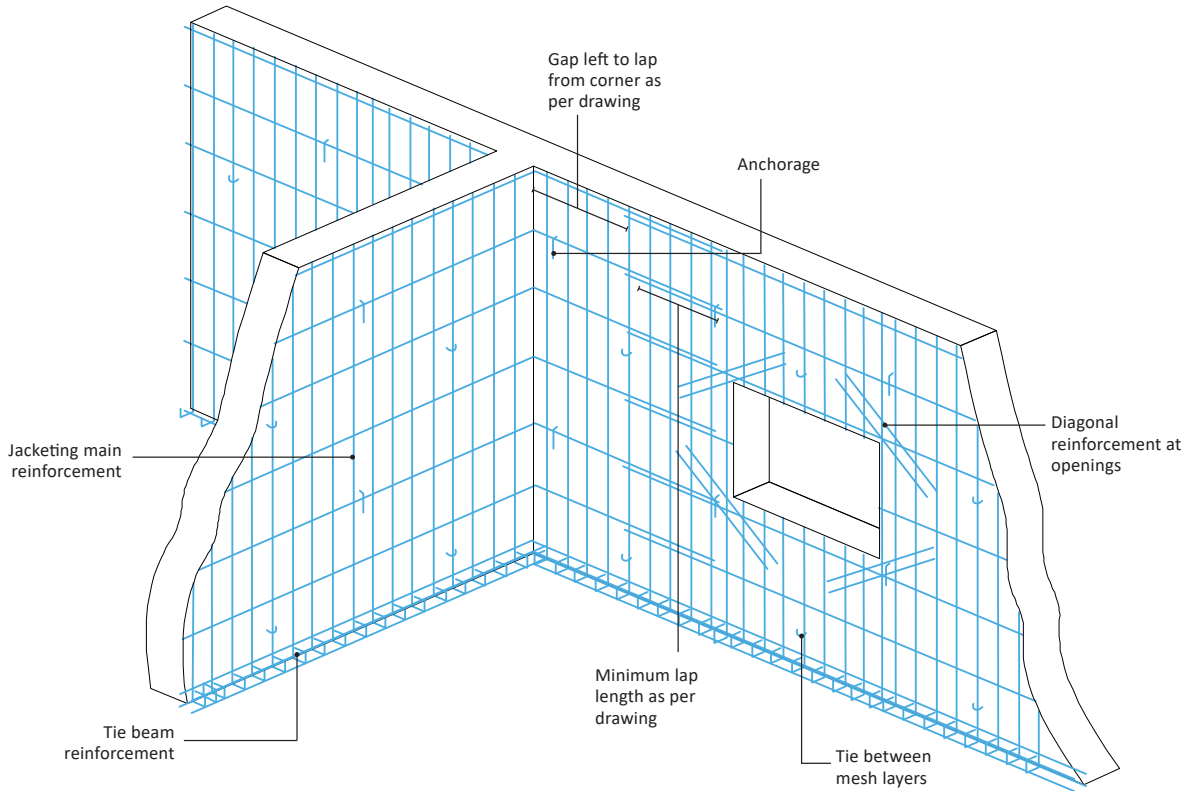
This technique involves the following:

- A Excavations
- A Power tools
- A Manual handling
- A Working with Hazardous Substances

REINFORCED CONCRETE JACKETING - REINFORCEMENT 3D VIEW

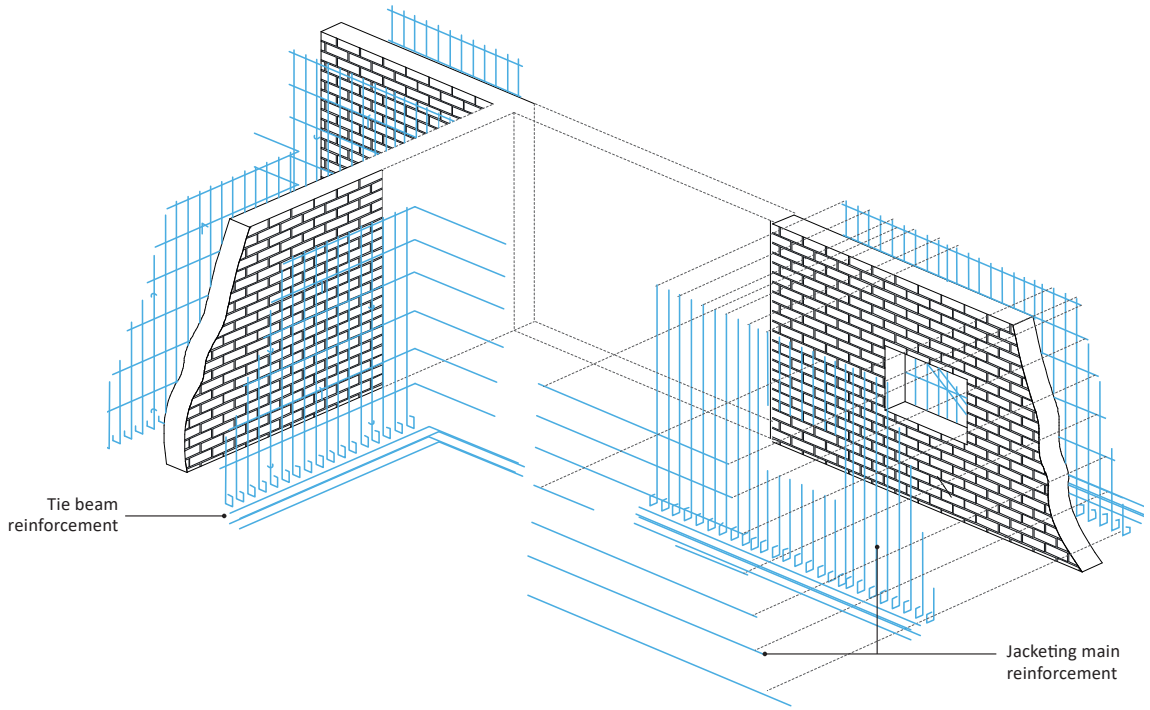
Length, size and spacing of all bars as per drawings

Reinforced 3D view

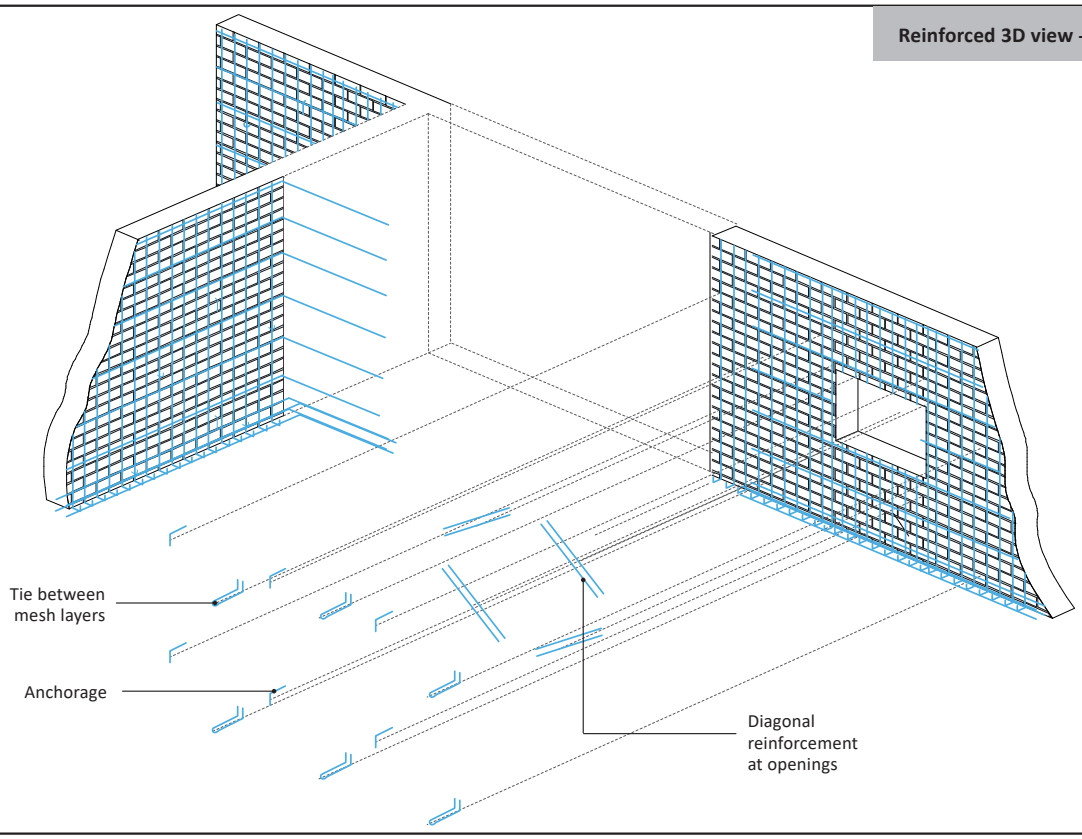


REINFORCED CONCRETE JACKETING - REINFORCEMENT 3D VIEW

Reinforced 3D view - Exploded

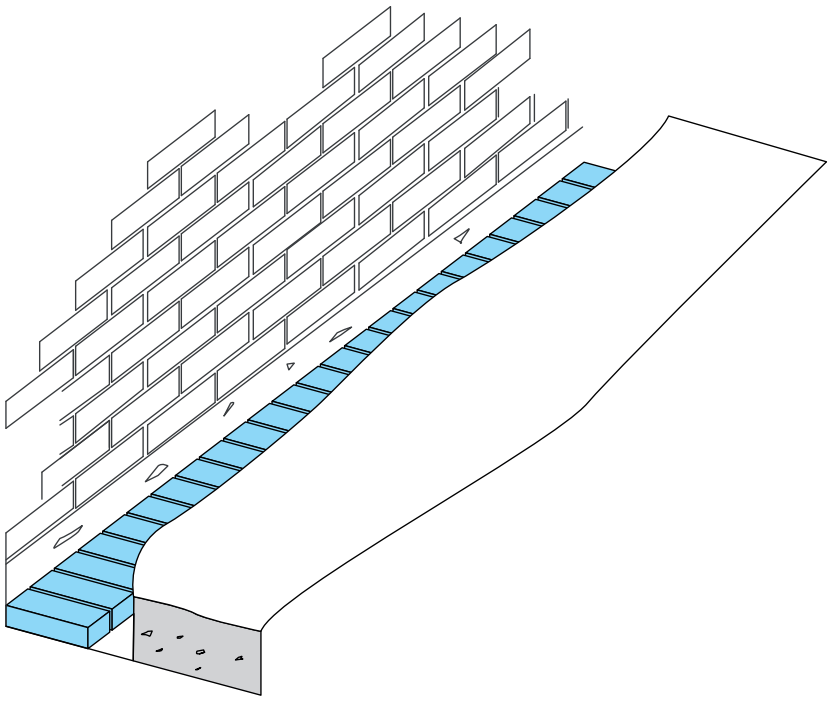


Reinforced 3D view - Exploded



REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

1 FOUNDATION PREPARATION



WATCH OUT:

Refer to Chapter 3.5.

5 - Excavation

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Excavations are stable. Temporary support is installed if required
- Existing foundation is in good condition
- Founding surface is firm, flat and clean
- Foundation trench is properly marked and excavated to the design depth and width
- Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel
- Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface
- Soil at the base of the trench is not fill
- Soil at the base of the trench does not contain organic material (e.g. plant roots)
- Flat brick soling is installed and is clean and level

Dig out trench for foundations as per depth on drawings for placing tie beams. Lay flat brick soling on the base of the trench.

REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

2 SURFACE PREPARATION

WATCH OUT:

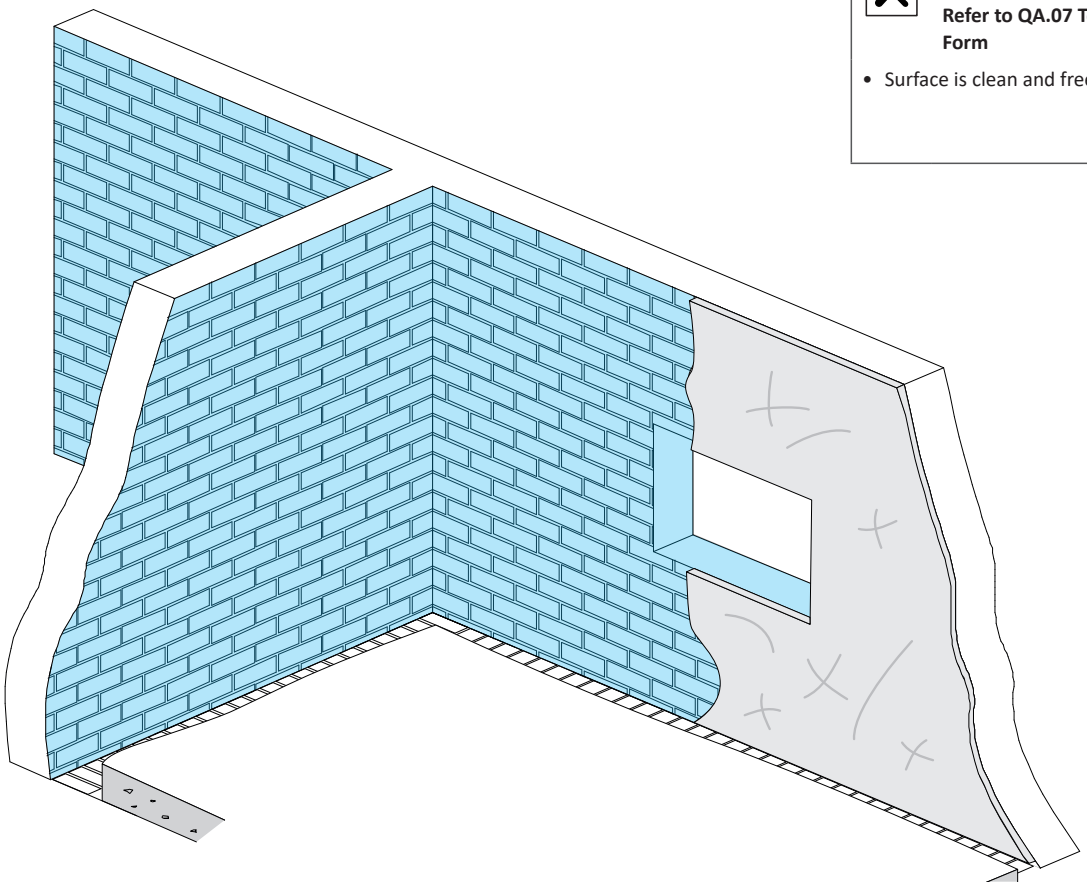
Refer to Chapter 3.5.

2 - Power Tools
9 - Hazardous Substance (Cement)
10 - Lead Paint

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material



Remove finishes and roughen/score the surface of the wall. Rake out mortar to a depth of 15mm. Surface should be clean and free of any loose material. Do not use water to clean surface as mud mortar will be removed. Apply a thin layer (12mm) of cement slurry.

REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

3 ANCHORAGE PREPARATION

WATCH OUT:

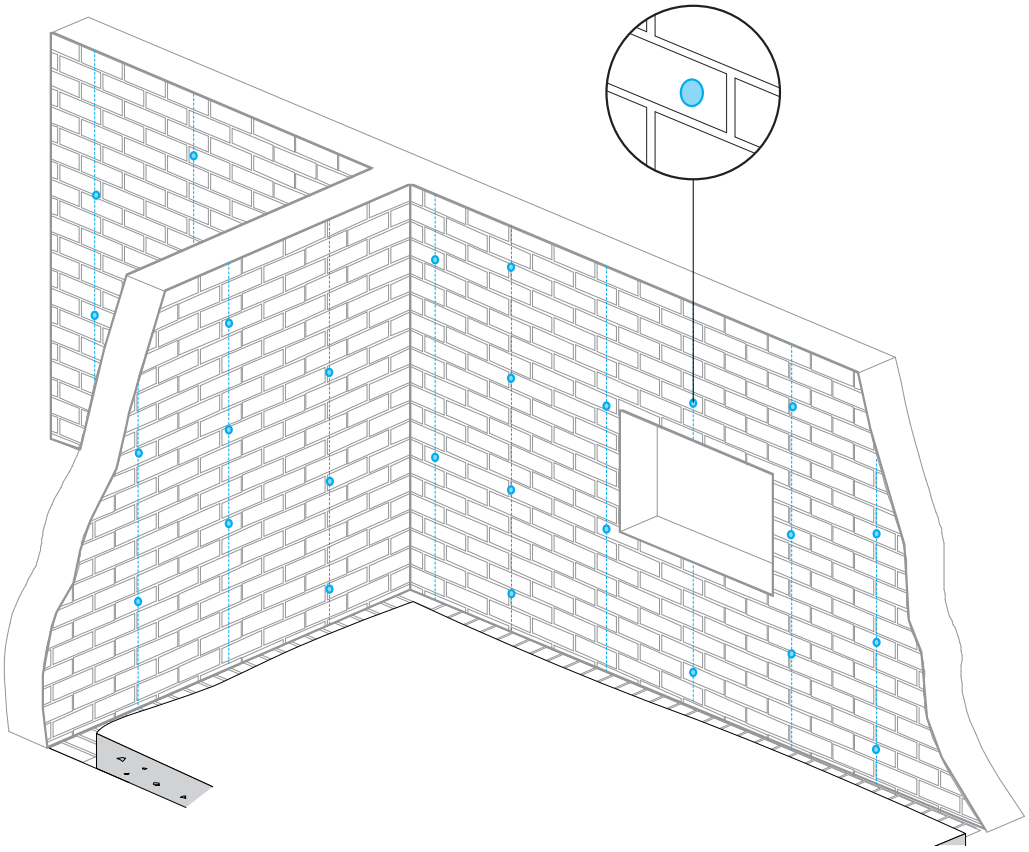
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing and depth of holes matches drawings

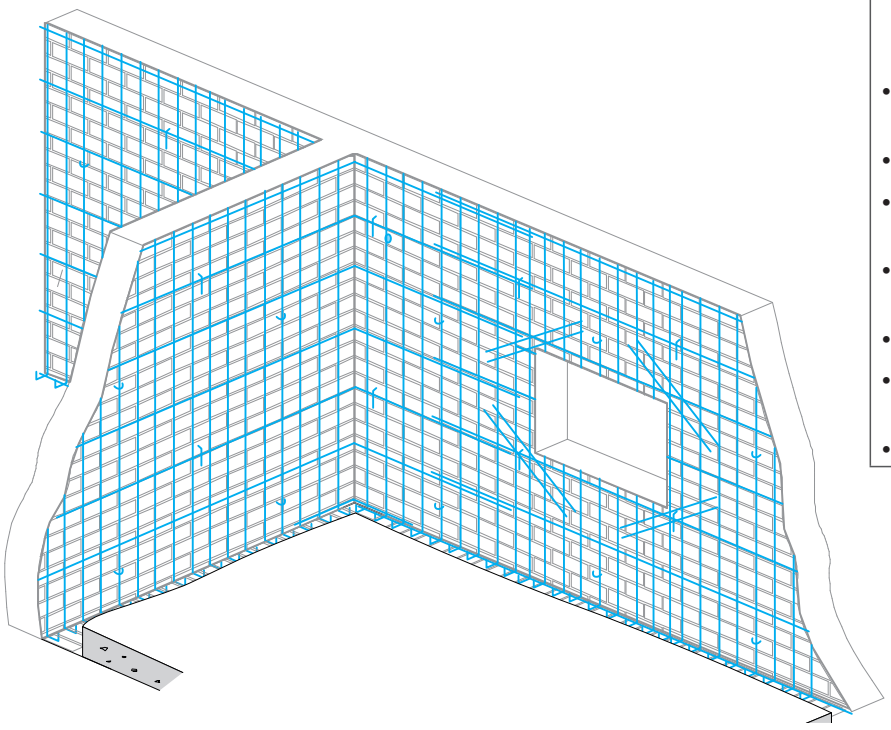


Make holes for anchorage bars and connecting wire between mesh layers - see drawing for correct number and spacing

See **MAT.04** Rebar specification →

REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

4 REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

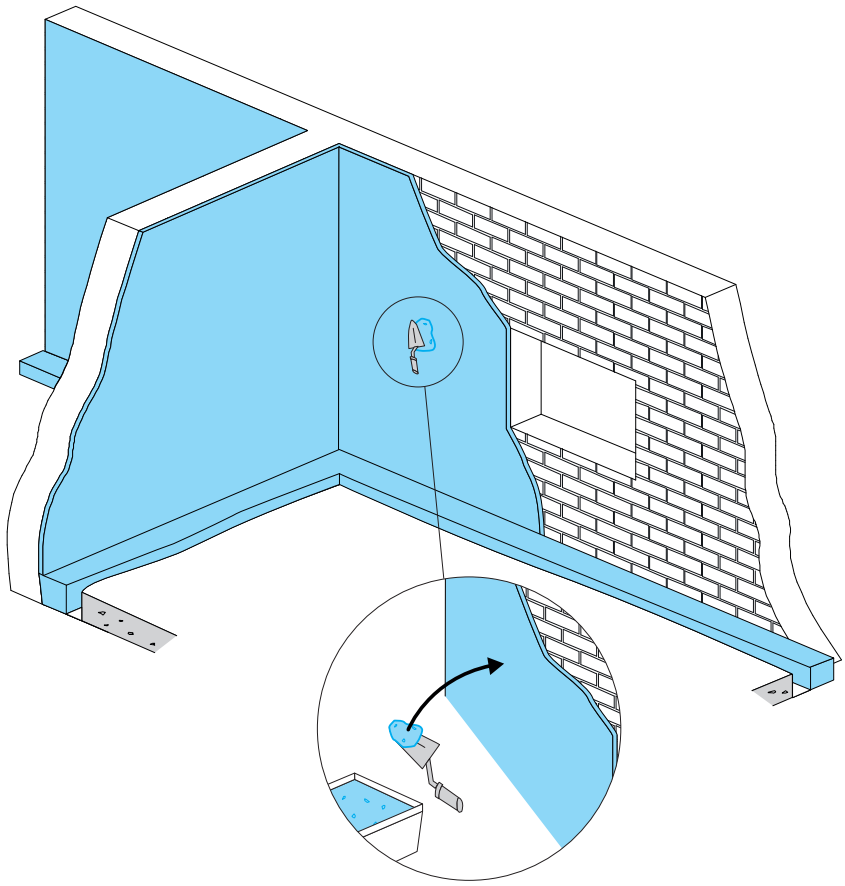
- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids
- Anchorage bars and wires are secure

Fix reinforcement - see drawings for rebar sizes and spacings. Install wire ties to connect the mesh on either side of the wall together. Fix anchorage bars and fill in anchor holes with cement slurry.

See **MAT.04** Rebar specification →

REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

5 CONCRETE APPLICATION



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Wet wall and apply cement slurry before applying concrete layers
- Dimensions of tie beam and thickness of concrete matches drawings
- If poured, concrete is not being dropped from a height of 1.5m or more
- If applied by hand, concrete is not overtrowelled. It needs to be quickly smoothed then move on to next section.
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Fix formwork for tie beam.

Pour tie beam and apply concrete layer to the wall in two layers manually using trowel - see drawing for thickness and concrete specification.

See **MAT.03** Concrete specification →

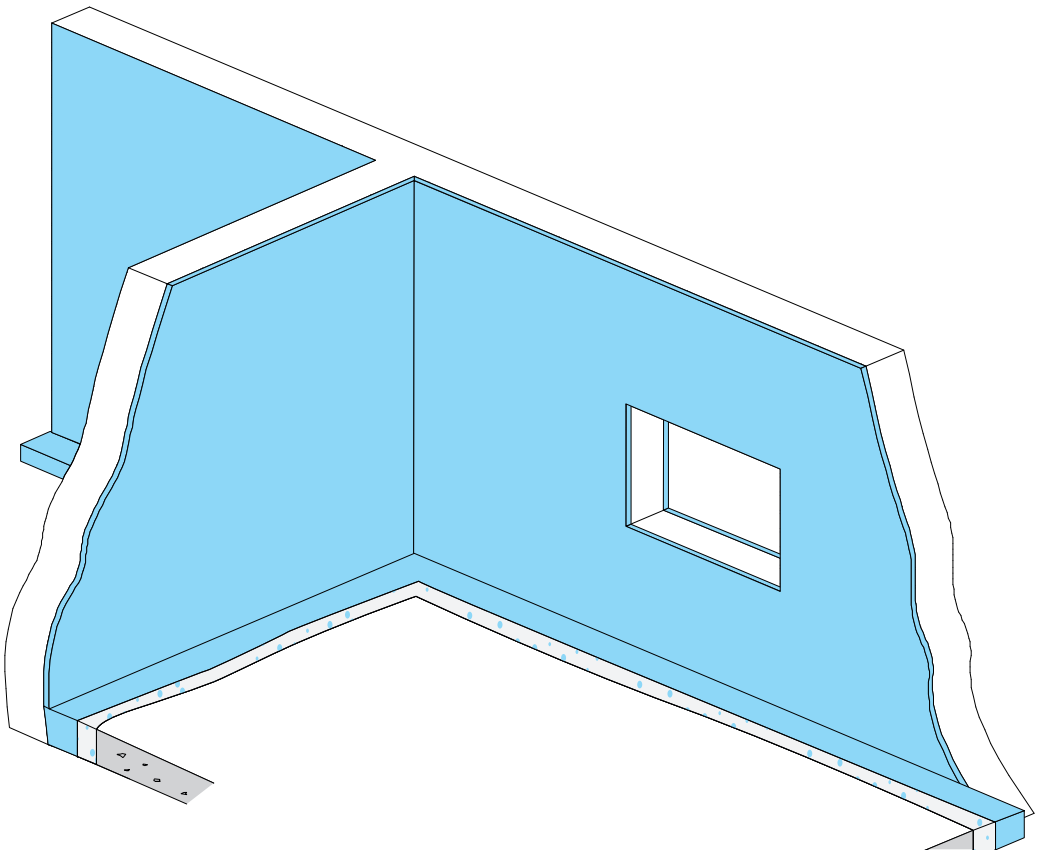
REINFORCED CONCRETE JACKETING - CONSTRUCTION SEQUENCE

6 CONCRETE CURING

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Appropriate curing time (14 days) left before striking formwork/applying finishes
- Concrete is kept moist during curing



Apply final cement plaster coat. Allow concrete to cure for 14 days. Use jute bags/ mats for better curing.

EXTEND TO NEXT FLOOR WITH SLAB CONNECTION DETAIL. REPEAT STEPS 2 TO 6 FOR UPPER STOREYS AS SHOWN ON DRAWINGS

REINFORCED CONCRETE JACKETING - DETAILS

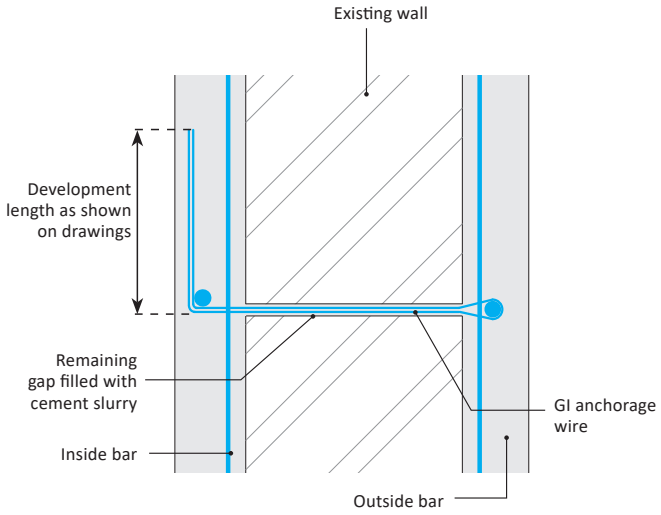
GALVONISED IRON (GI) WIRE:

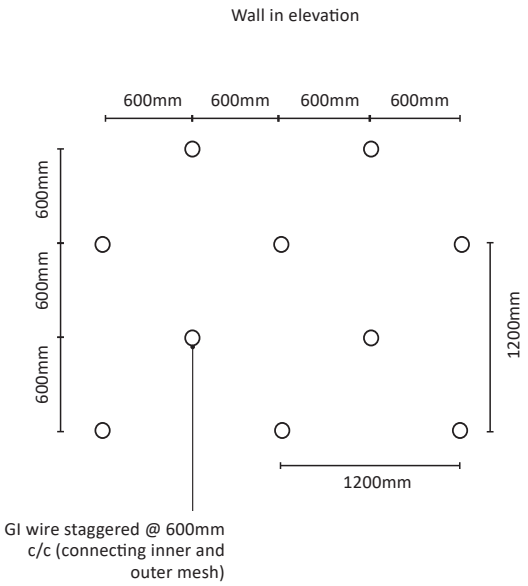
WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

Install wire ties to connect the mesh on either side of the wall together.





Site photograph of GI wire for local jacketing of masonry wall

Image reference: NSET

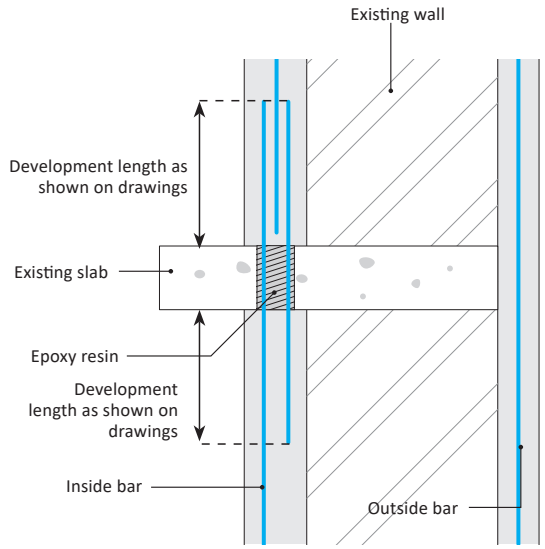
REINFORCED CONCRETE JACKETING - DETAILS

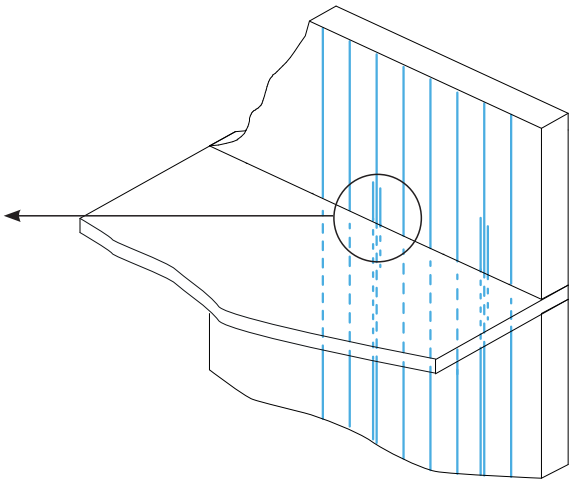
SLAB CONNECTION:

WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)



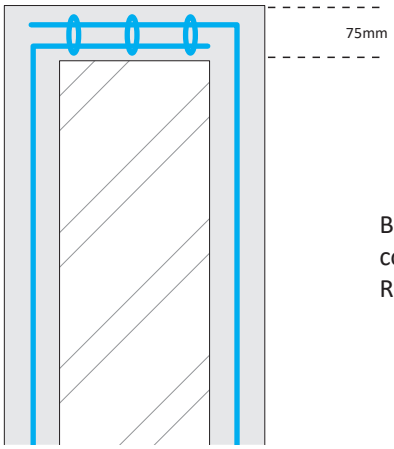


Outside bar passes slab. Inside bar - Every 4th bar drill hole through and pass up bar at least 300mm and insert additional bar. Fix using epoxy resin. Other bars stop at top and underside of slab.

TOP OF WALL:

KEY ENGINEERING CHECKS:

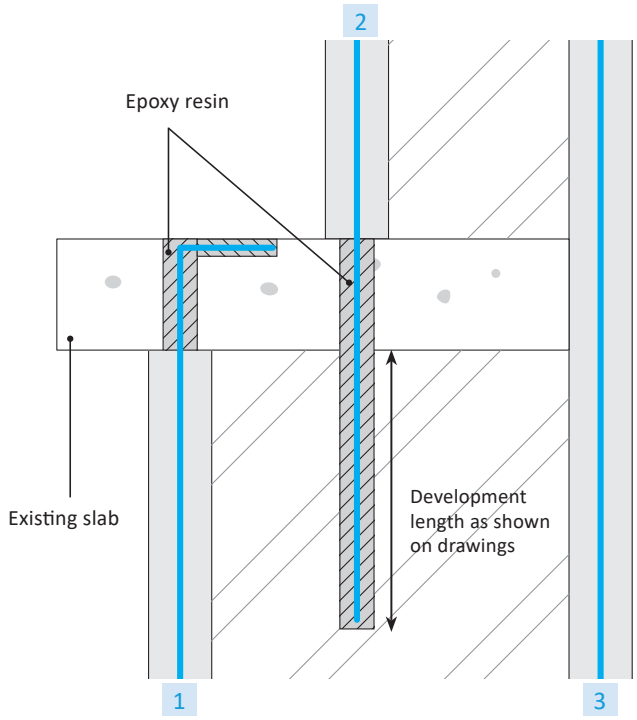
- Very important for bars lapping at top of wall to be securely tied together



Bend bars over the top of the wall and apply 75mm concrete at top of wall. For parapet strengthening see RF.01.

REINFORCED CONCRETE JACKETING - VARIATIONS

CHANGE IN THE WALL THICKNESS / STEPPED WALL:



WATCH OUT:

Refer to Chapter 3.5.

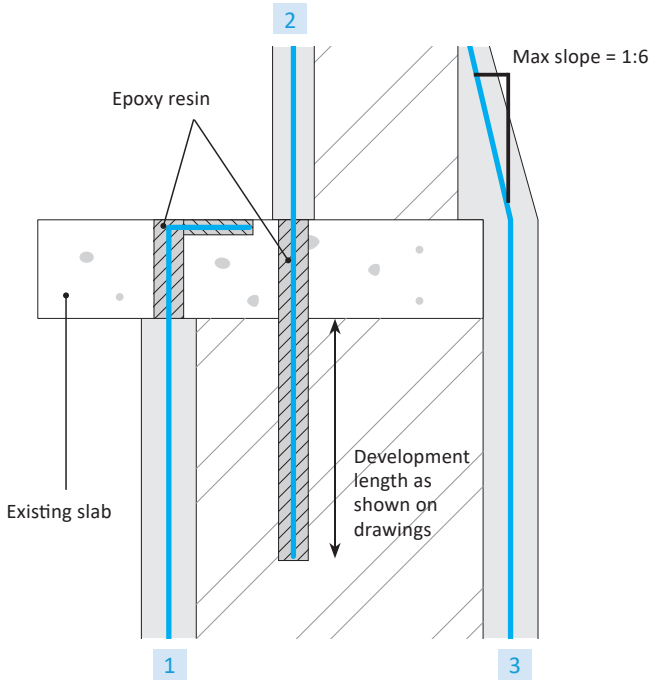
9 - Hazardous Substance (Epoxy resin)

1 - Lower inside bars - passed through the drilled in slab and bend, fixed with epoxy resin

2 - High level inside bar - passed through the drilled in slab and into wall at least 300mm using epoxy resin

3 - Outside bar passes slab edge. Lap if needed

INSET WALL:



WATCH OUT:

Refer to Chapter 3.5.

9 - Hazardous Substance (Epoxy resin)

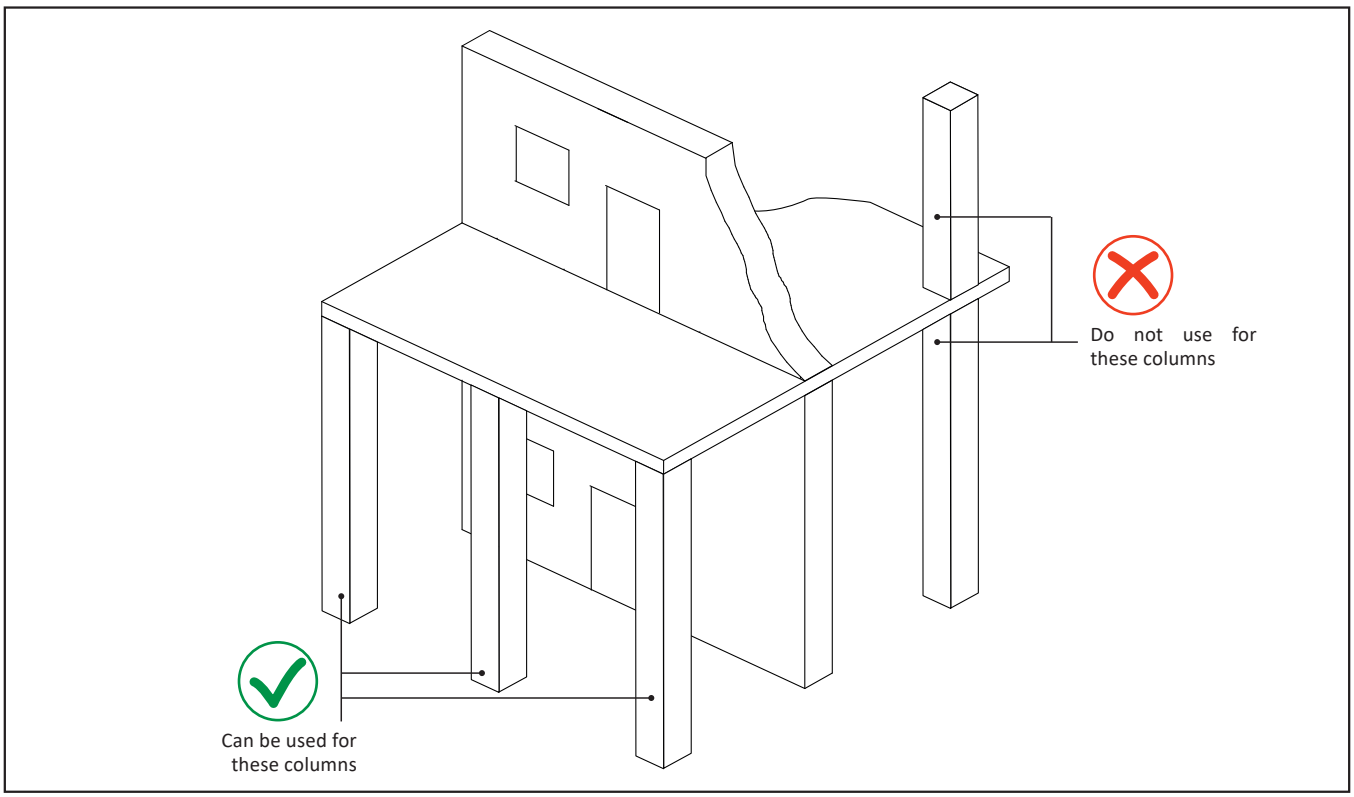
1, **2** - as per change in wall thickness detail.

3 - Bend bar inwards in slope to suit wall inset

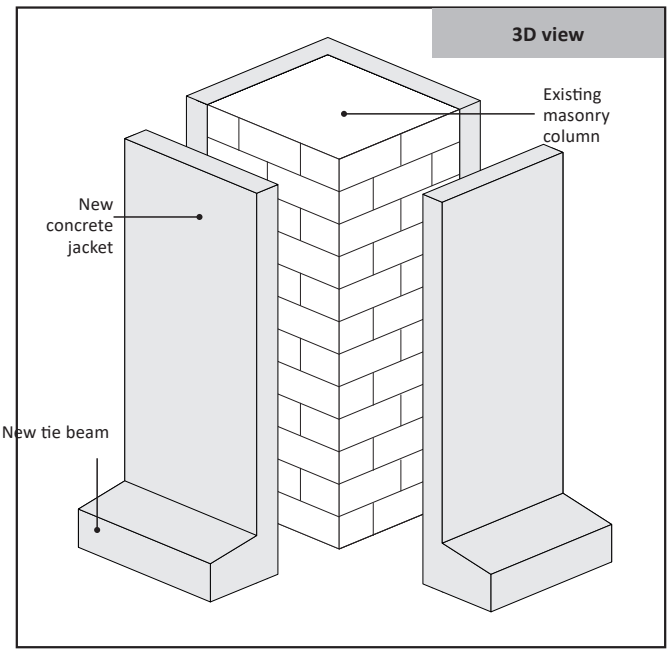
Maximum bend to bar is 1:6 - if greater than this would be required, use detail for stepped wall.

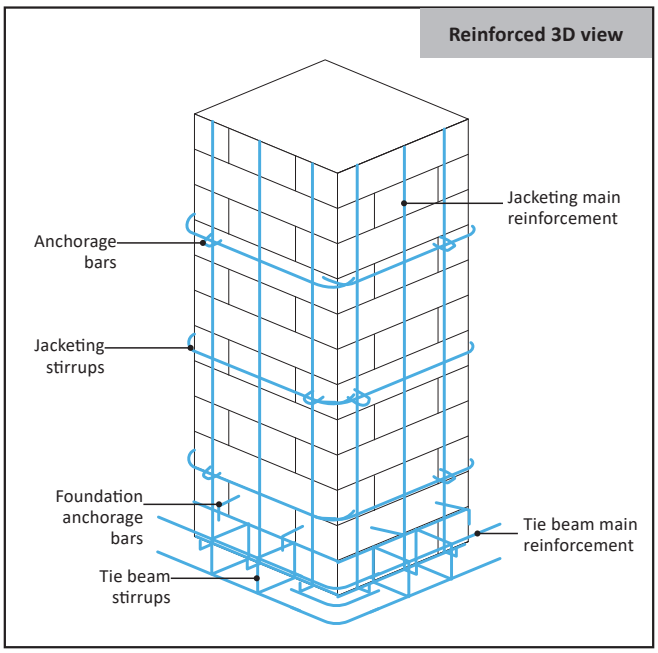
REINFORCED CONCRETE JACKETING - MASONRY COLUMNS

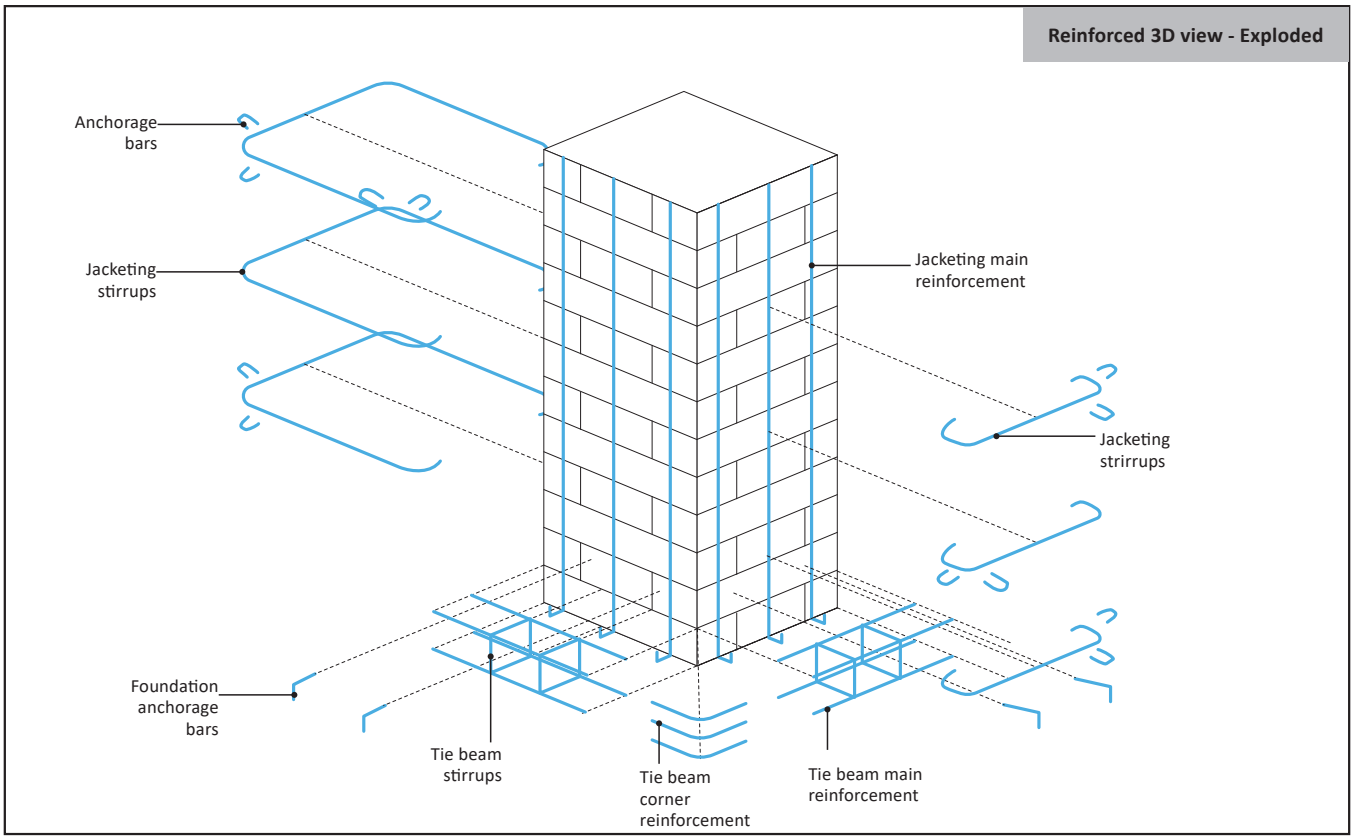
This construction method is only appropriate for columns that only support balconies and walkways. **DO NOT USE** for columns in the rest of the building.



REINFORCED CONCRETE JACKETING - MASONRY COLUMNS





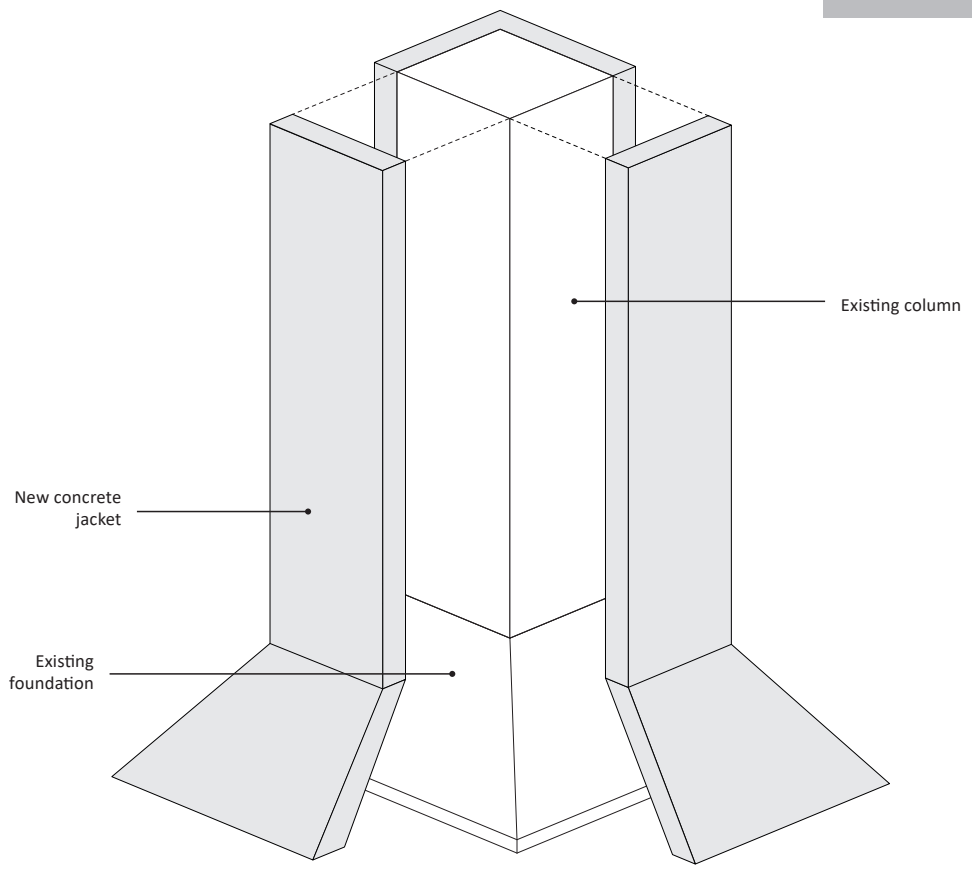


RF.03

REINFORCED CONCRETE JACKETING - RC FRAME

Jacketing the concrete frame confines and strengthens the existing concrete. It will also improve the fire resistance of the structure.

3D view

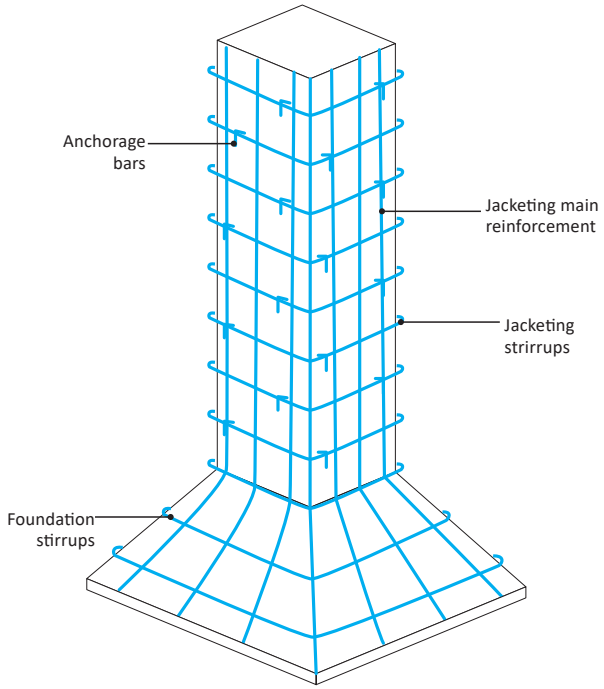


This technique involves the following:

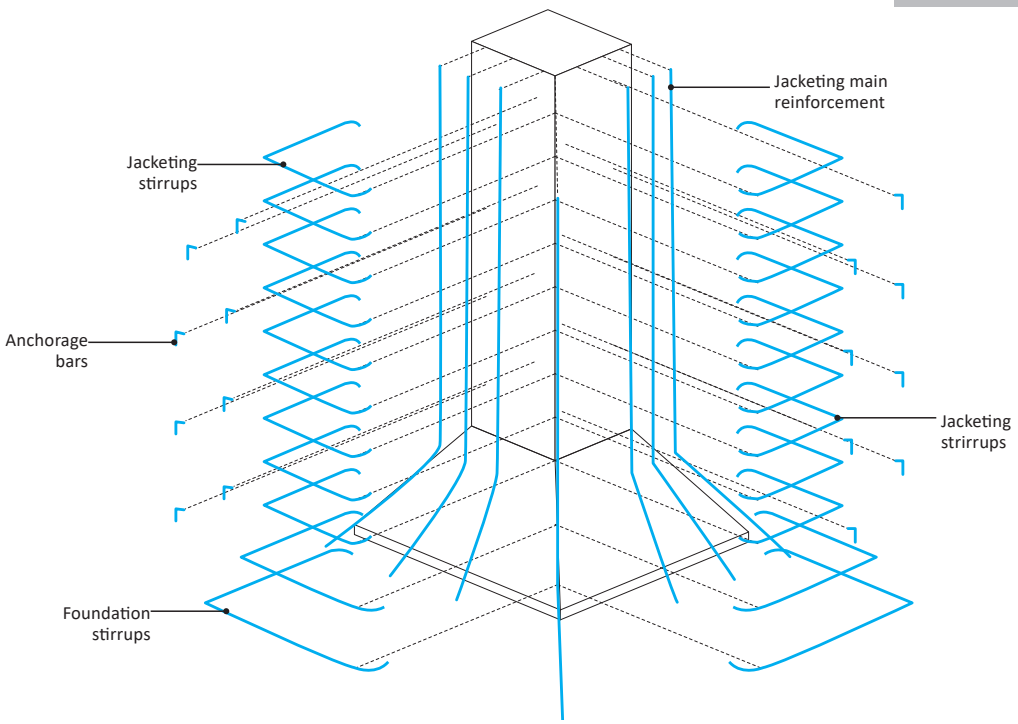
- A Excavations
- A Power tools
- A Manual handling
- A Working at Height
- A Working with Hazardous Substances
- A Exposure to Lead Paint

REINFORCED CONCRETE JACKETING - RC FRAME - REINFORCEMENT 3D VIEW

Reinforced 3D view

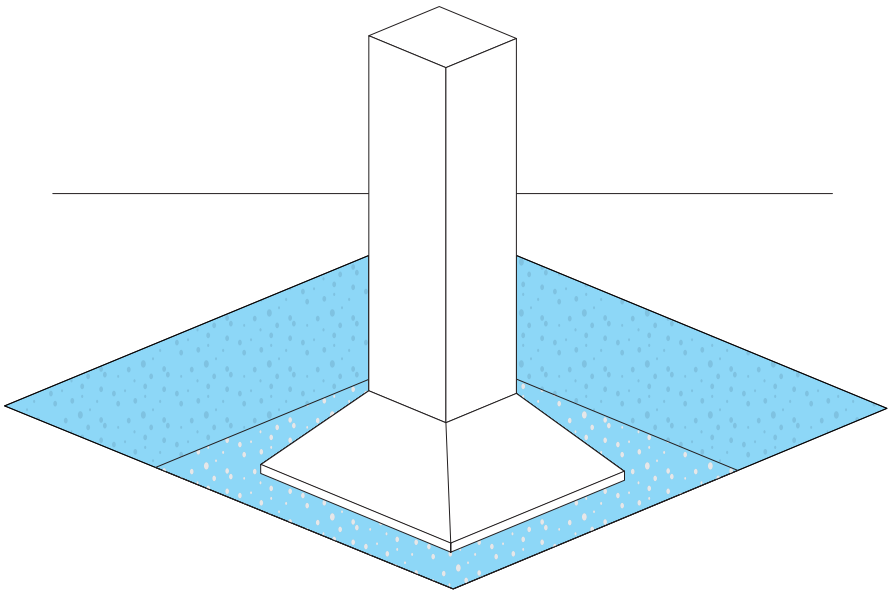


Reinforced 3D view - Exploded



REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

1 FOUNDATION PREPARATION



WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools
5 - Excavation
10 - Lead Paint

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Excavations are stable. Temporary support is installed if required
- Existing foundation is in good condition
- Founding surface is firm, flat and clean
- Foundation trench is properly marked and excavated to the design depth and width
- Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel
- Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface
- Soil at the base of the trench is not fill
- Soil at the base of the trench does not contain organic material (e.g. plant roots)
- Flat brick soling is installed and is clean and level

Remove finishes and break out floor around column. Excavate to fully expose footing.
Clean existing footing to ensure bond with new concrete.

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

2 SURFACE PREPARATION

WATCH OUT:

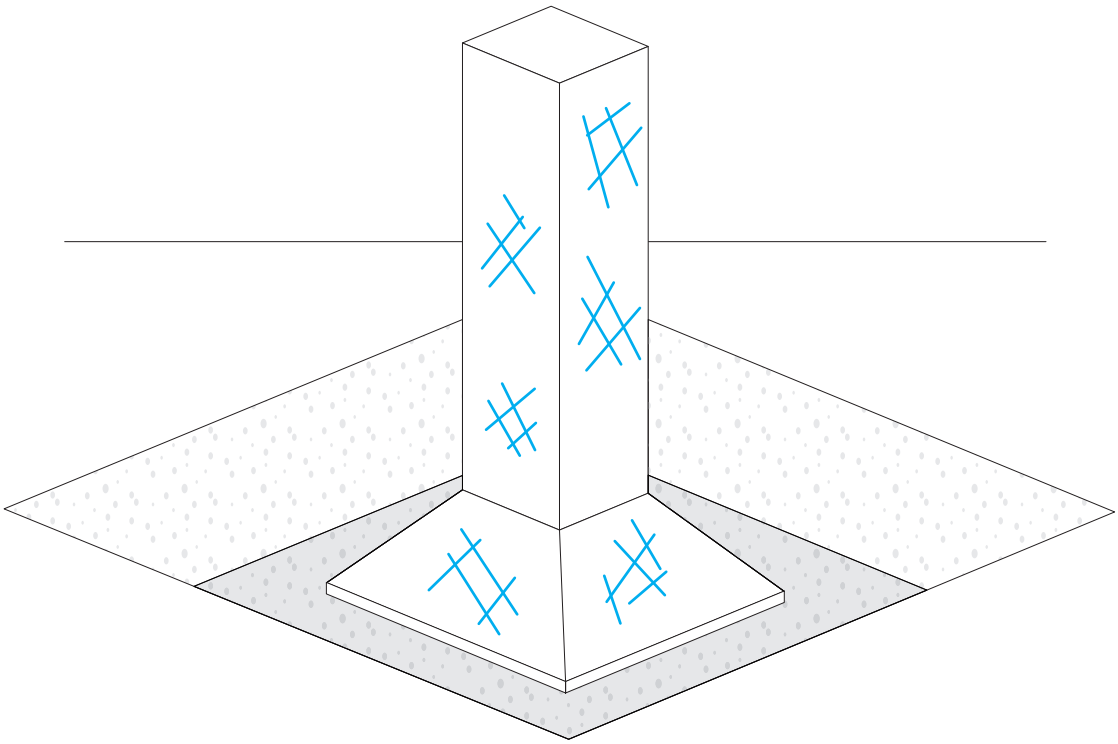
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material



Roughen the surface of the concrete column and footing. Surface should be free of any loose material.

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

3 ANCHORAGE PREPARATION

WATCH OUT:

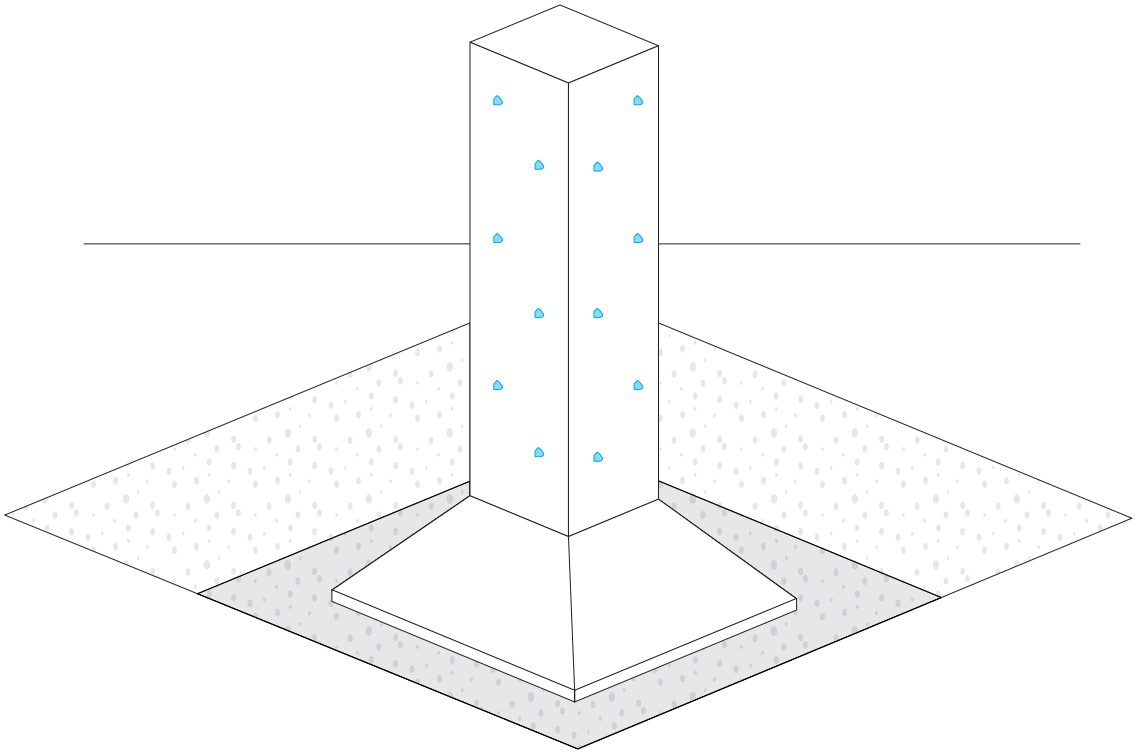
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

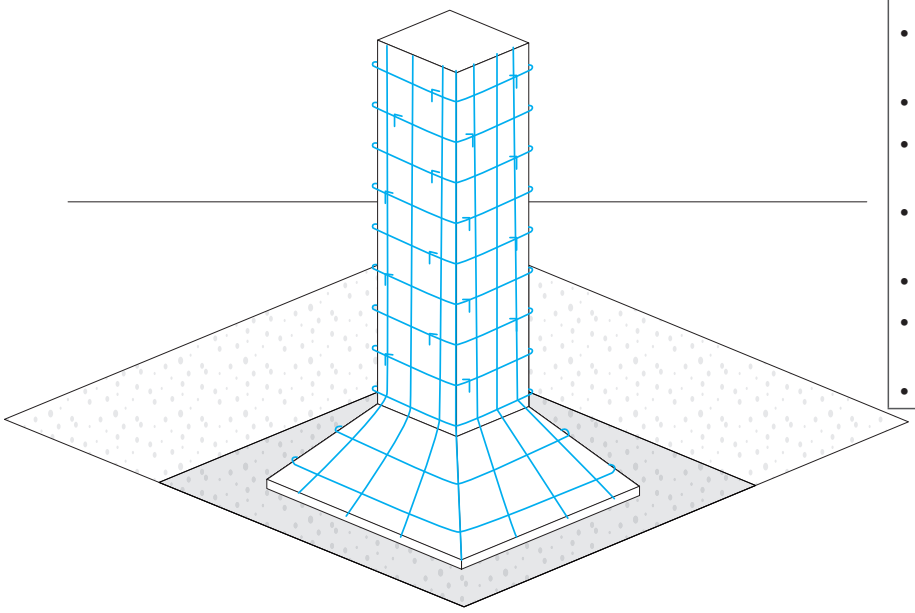
- Spacing and depths of holes matches drawings



Mark on rebar locations. Use this as guidelines to make holes for anchorage bars - See drawings for the correct number, depth and spacing.

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

4 REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids
- Anchorage bars are secure

Fix reinforcement, using spacer blocks to make sure cover requirements are met. See drawings for rebar sizes and spacings. Fix anchorage bars and fill in anchor holes with cement slurry.

See **MAT.04** Rebar specification →

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

5 SLAB CONNECTION PREPARATION

WATCH OUT:

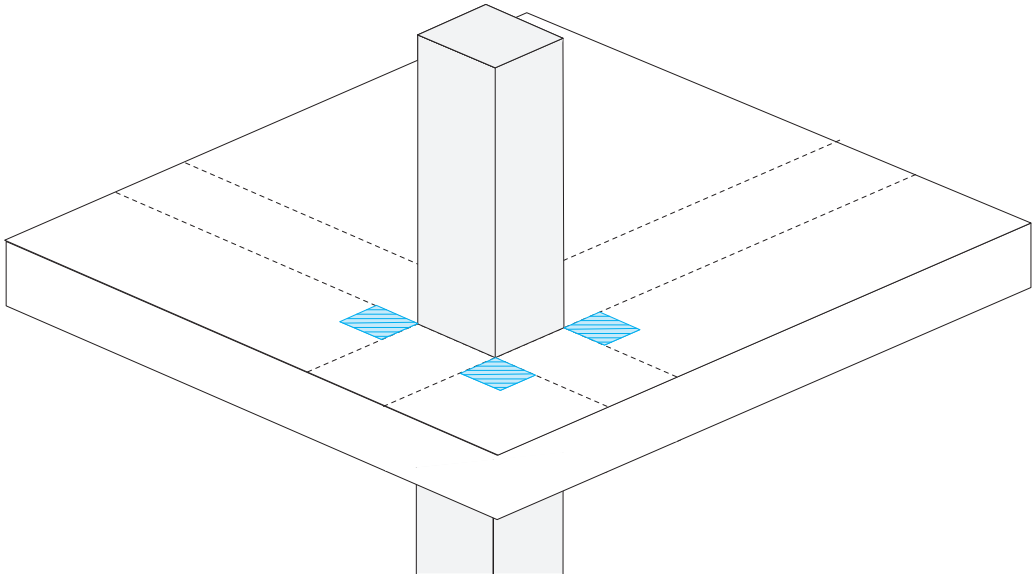
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for safe breaking out of holes
- Holes are to dimensions and placement as given on drawings
- Existing beams are not damaged
- Waste/rubble is removed and site is clean



Break out holes in the existing slab above to allow reinforcement to continue to the next storey. Ensure holes are between existing beams. See drawings for details.

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

6 SLAB CONNECTION

WATCH OUT:

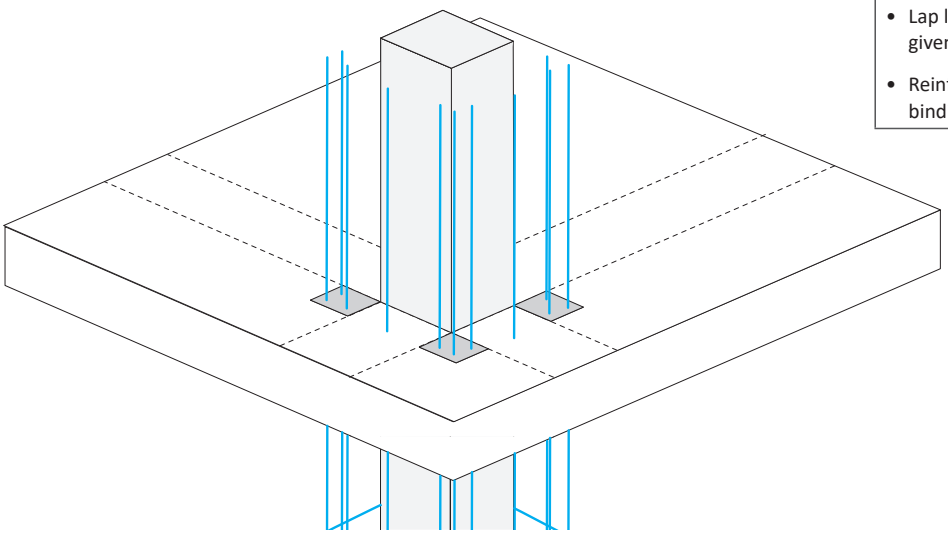
Refer to chapter 3.5.

6 - Manual handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the fixing of reinforcement
- Reinforcement placement, size and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire

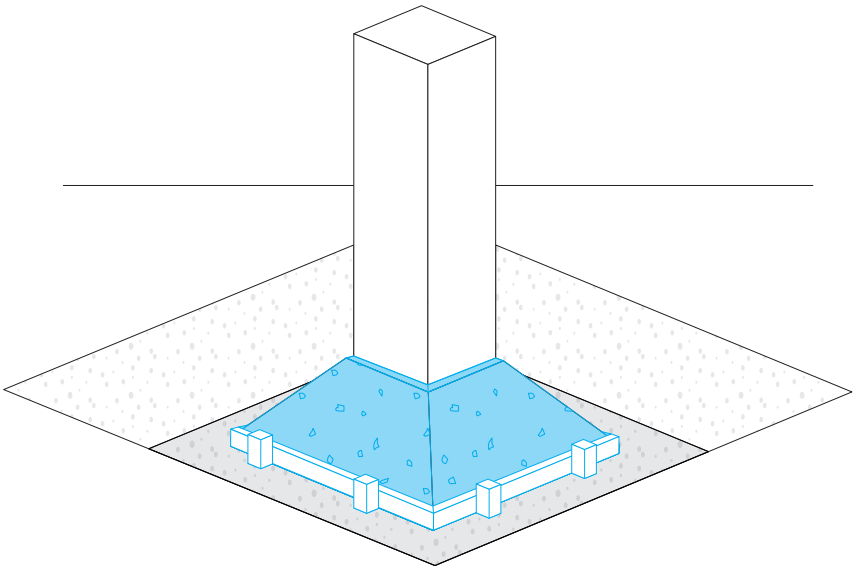


Fix reinforcement through the holes - See drawings for sizes and spacings. Ensure bars have sufficient lap length with bars from the storey below - see drawings for minimum lap length.

See **MAT.04** Rebar specification →

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

7 CONCRETE APPLICATION FOR FOOTING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

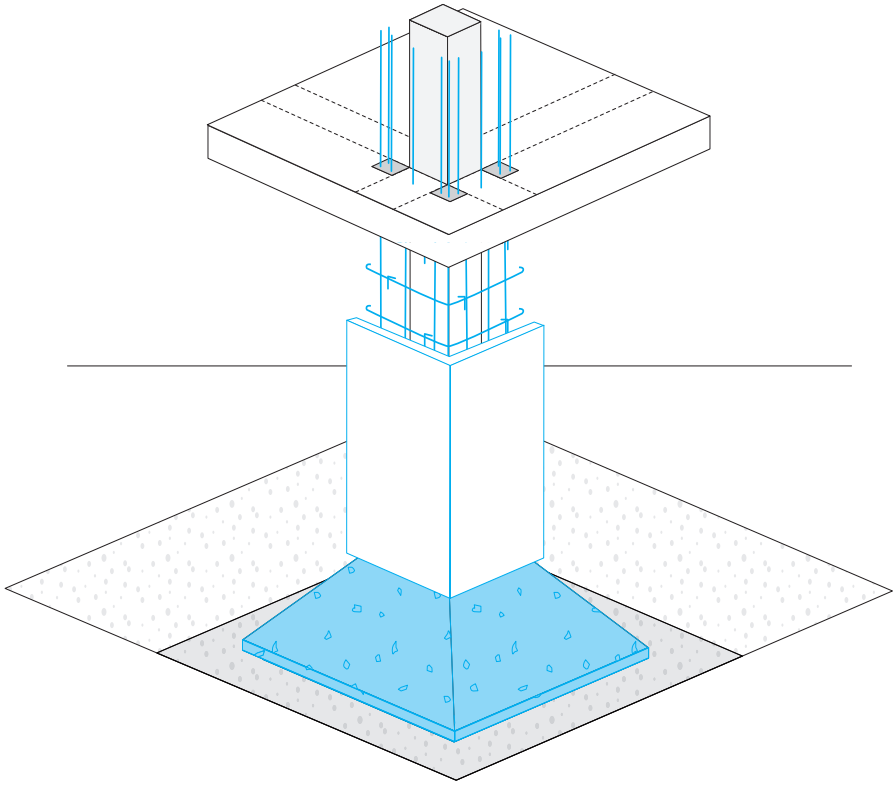
- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Install formwork for footing. Pour concrete - see drawings for thickness and concrete specification.

See **MAT.03** Concrete specification →

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

8 CONCRETE APPLICATION FOR BOTTOM SECTION OF COLUMN



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

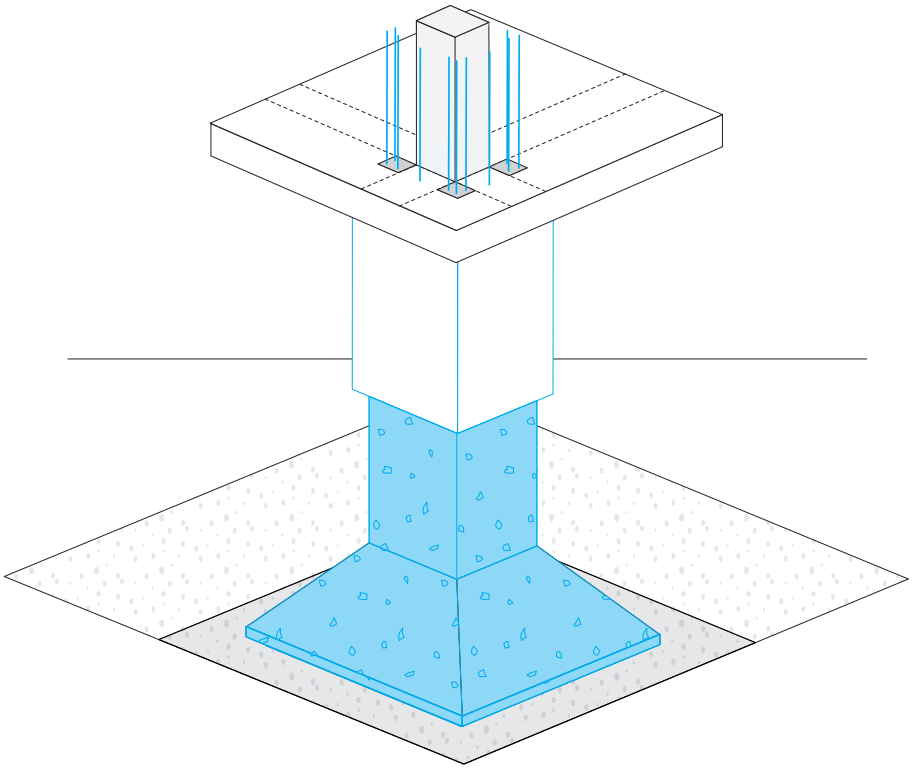
- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Install formwork for bottom two thirds of column. Pour concrete - see drawings for thickness and concrete specification

See **MAT.03** Concrete specification →

REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

9 CONCRETE APPLICATION FOR TOP SECTION OF COLUMN



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Install formwork for the top third of column. Pour concrete, utilising the holes cut in the slab above. See drawings for thickness and concrete specification.

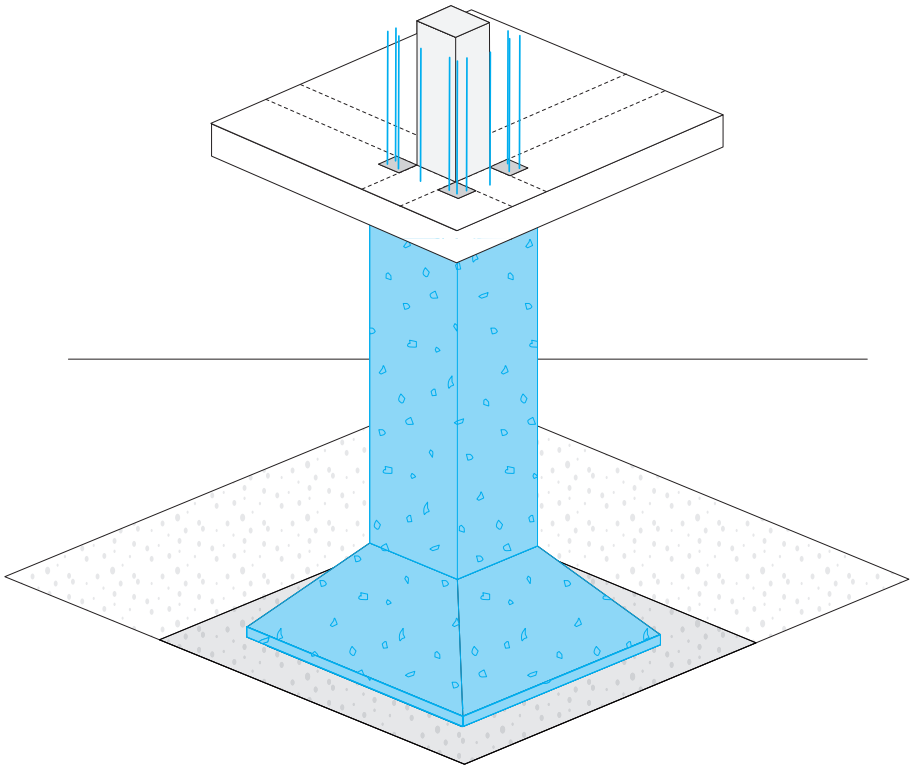
REINFORCED CONCRETE JACKETING - RC FRAME - CONSTRUCTION SEQUENCE

10 CONCRETE CURING

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Appropriate curing time (14 days) before applying finishes etc.
- Concrete is kept moist during curing
- Backfill is properly compacted before reinstating floor



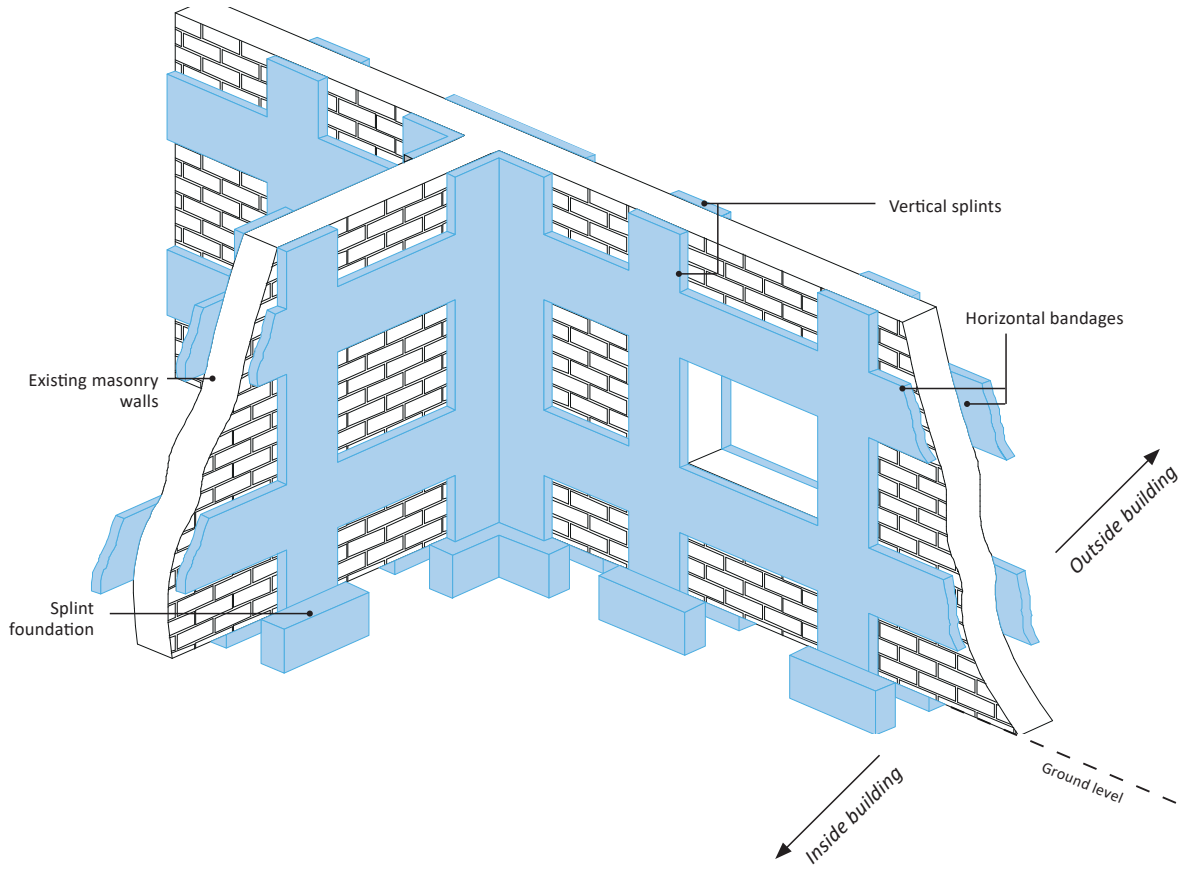
Allow concrete to cure for 14 days. Use wet jute bags to keep concrete moist during curing. Once cured, fill in excavation and compact back fill. Reinstate floor and apply finishes to column.

RF.04

SPLINT AND BANDAGE

Splint and bandaging the walls strengthens them and prevents masonry from falling out.

3D view

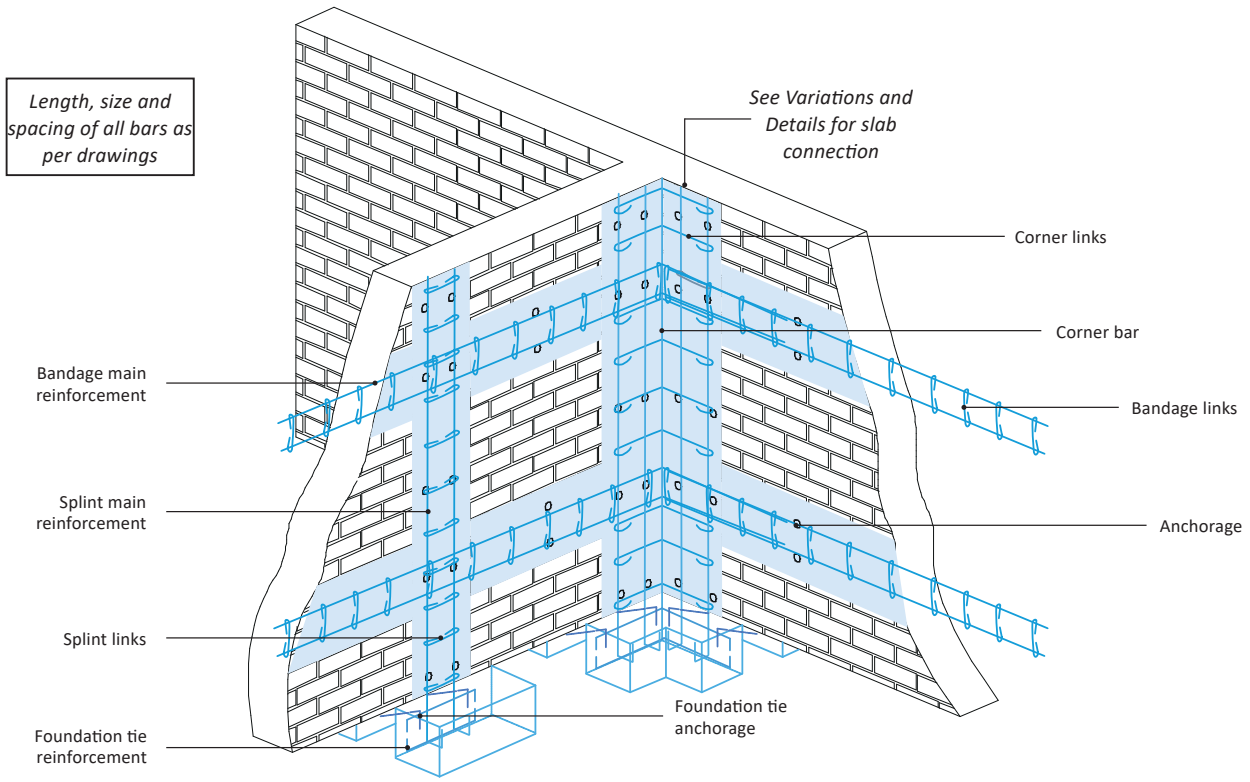


This technique involves the following:

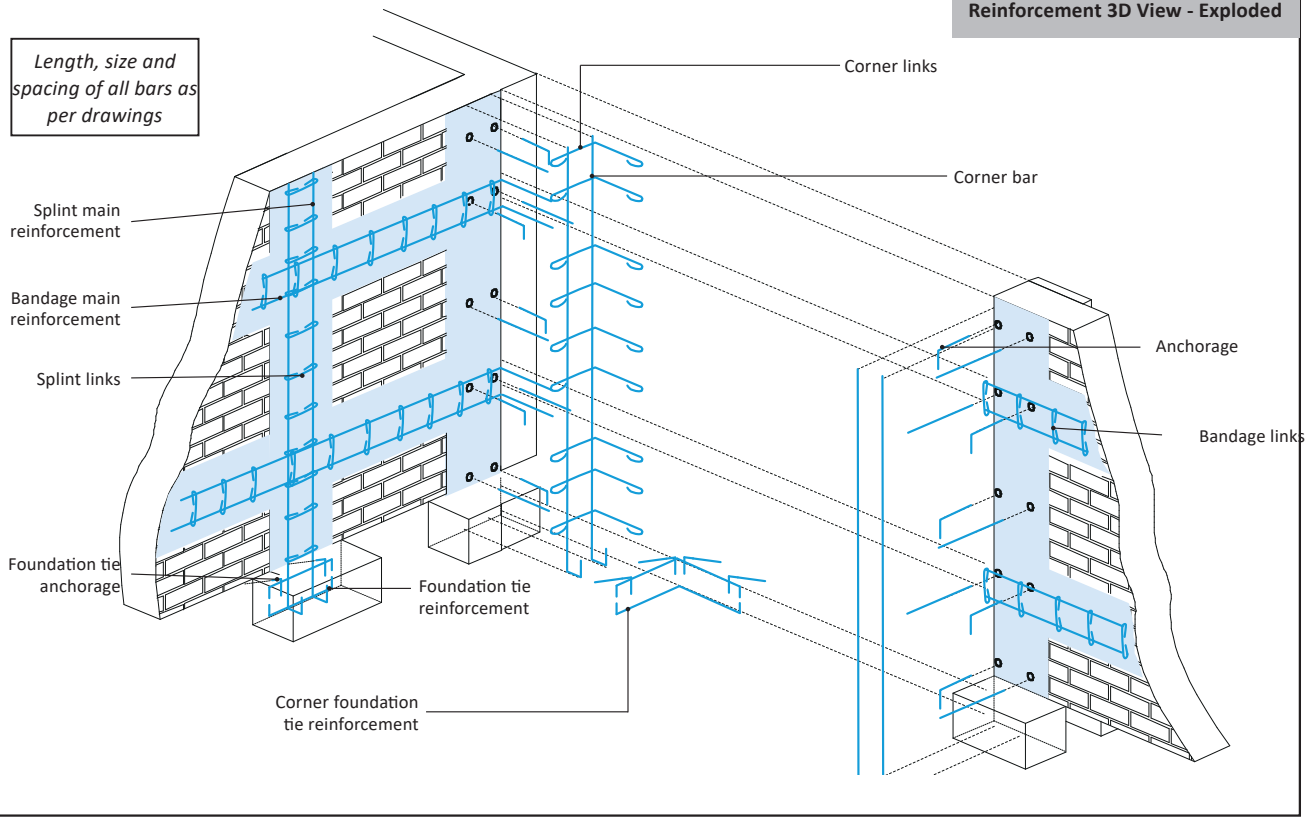
- A Excavation
- A Power Tools
- A Manual handling
- A Working with Hazardous Substances
- A Exposure to Lead Paint

SPLINT AND BANDAGE - REINFORCEMENT 3D VIEW

Reinforcement 3D view

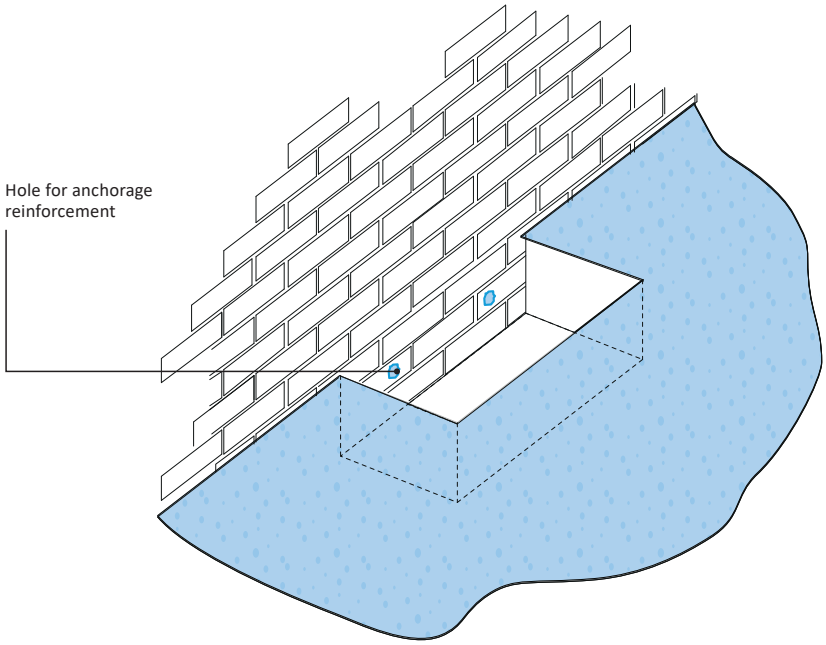


Reinforcement 3D View - Exploded



SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

1 FOUNDATION PREPARATION



Dig foundation. Lay flat brick soiling at base of excavation. Drill holes into the masonry wall for the anchorage connection

WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools
5 - Excavation

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Excavations are stable. Temporary support is installed if required
- Existing foundation is in good condition
- Founding surface is firm, flat and clean
- Foundation trench is properly marked and excavated to the design depth and width
- Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel
- Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface
- Soil at the base of the trench is not fill
- Soil at the base of the trench does not contain organic material (e.g. plant roots)
- Flat brick soling is installed and is clean and level
- Anchorage hole is at spacing shown on drawings
- Anchorage hole is slightly inclined downwards

SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE 2

2 SURFACE PREPARATION

WATCH OUT:

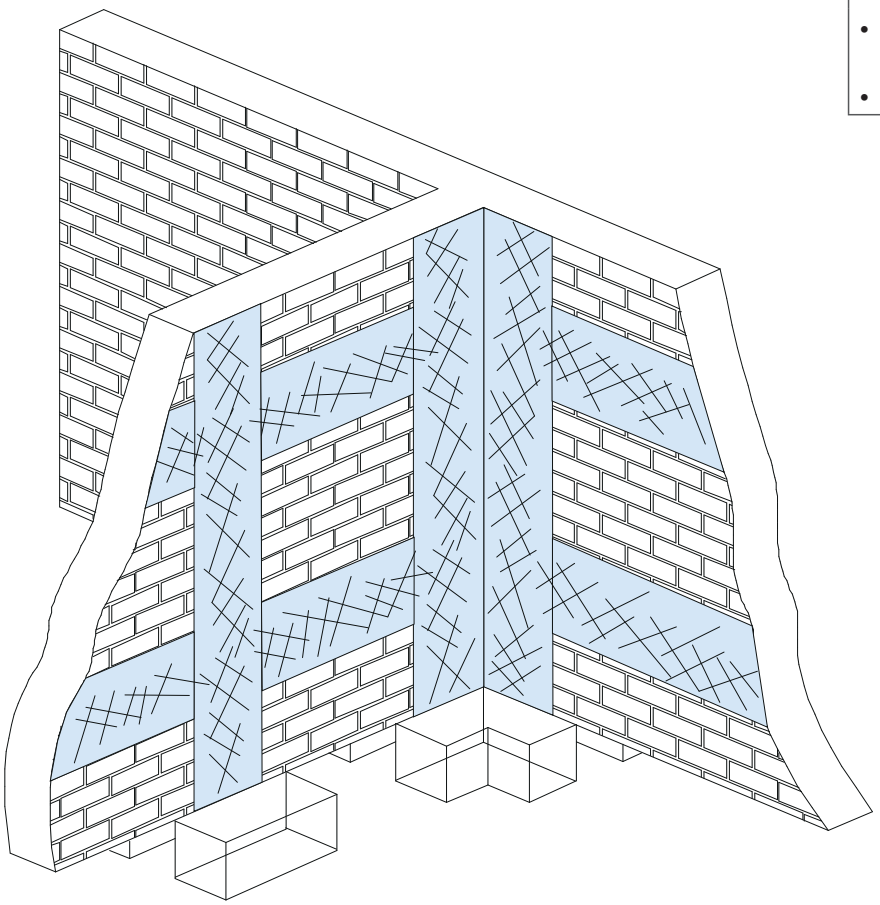
Refer to Chapter 3.5.

2 - Power Tools
10 - Lead Paint

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing of splints and bandages matches the drawings
- Surface is clean and free of loose material



Remove finishes and roughen/score the surface where the beam and splints will be placed. Rake out mortar to a depth of 15mm. Surface should be clean and free of any loose material. Do not use water for cleaning as mud mortar will be removed. Apply a thin (12mm) layer of cement slurry to these areas.

SPLIT AND BANDAGE - CONSTRUCTION SEQUENCE

3 ANCHORAGE PREPARATION

WATCH OUT:

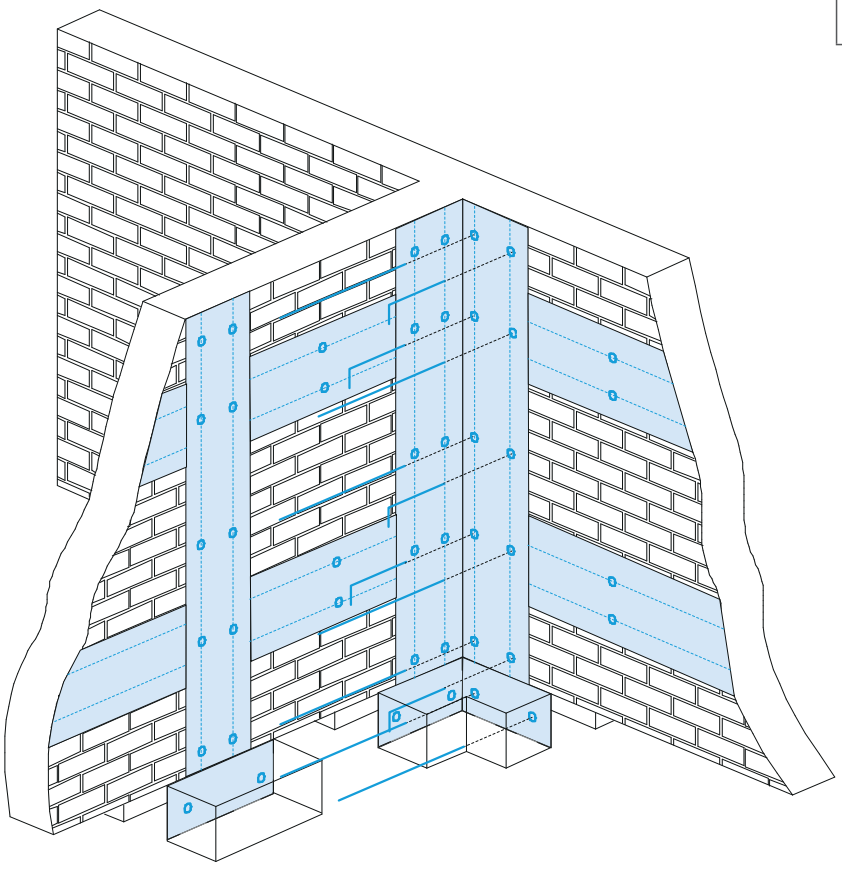
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing and depth of anchorage holes matches drawings

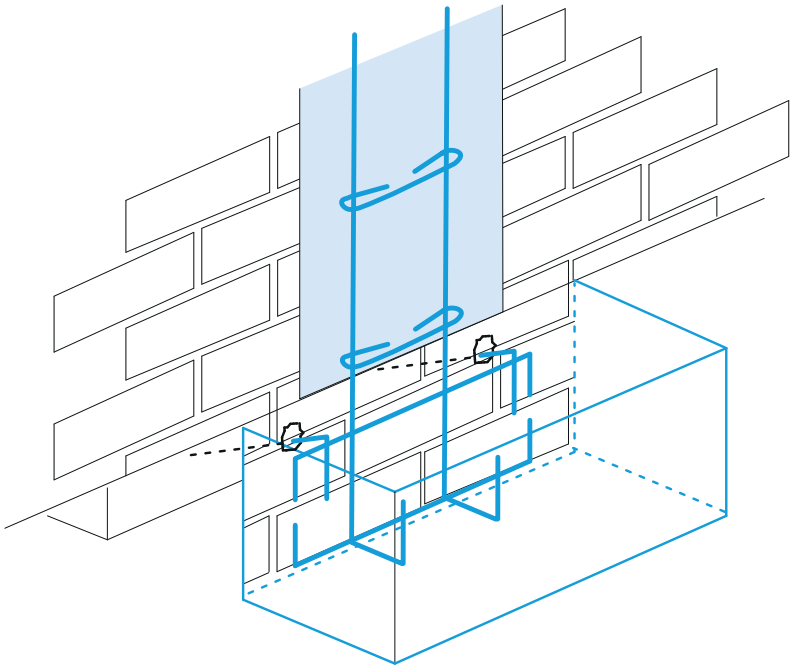


Mark rebar position. Use these marks as guidelines to make holes for anchorage bars, see drawing for the correct number and spacing.

See **MAT.04** Rebar specification →

SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

4 FOUNDATION REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substances (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

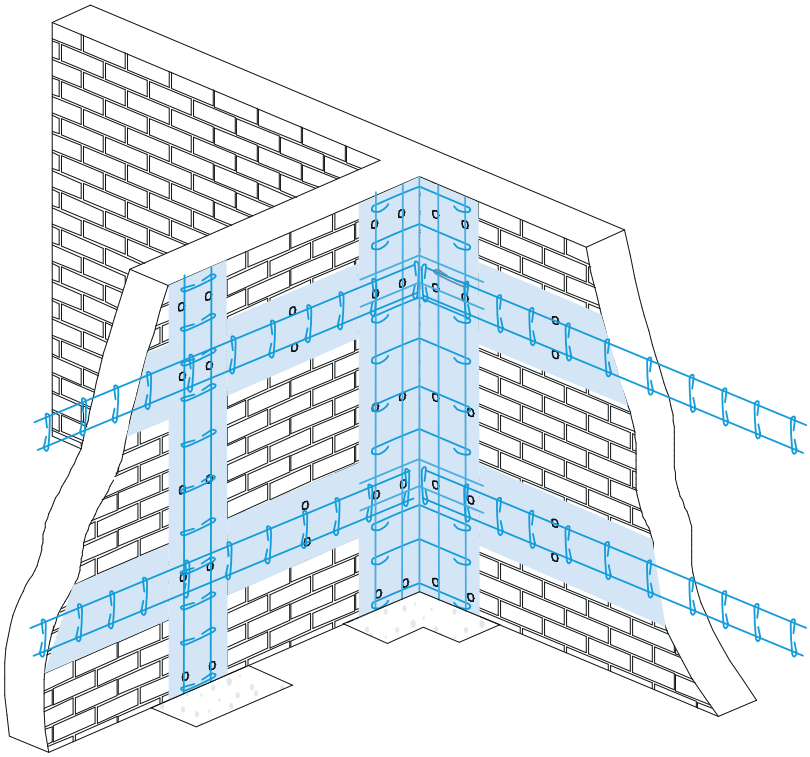
- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids

Fix foundation reinforcement - see drawings for rebar sizes and spacings. Bend anchorage bars into place. Use cement slurry to fix anchorage bars into place.

See **MAT.04** Rebar specification →

SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

5 REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substances (Cement)

KEY ENGINEERING CHECKS:

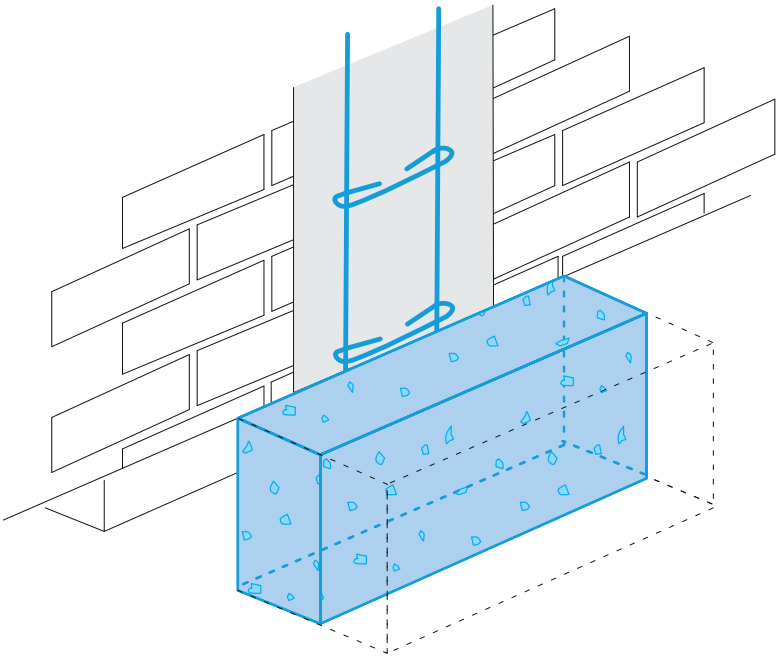
Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids

Fix reinforcement for splints and bandages - see drawings for rebar sizes and spacing. Install anchorage bars and wires and bend into place. Fill anchorage holes with cement slurry.

SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

6 FOUNDATION CONCRETE POUR



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substances (Cement)

KEY ENGINEERING CHECKS:

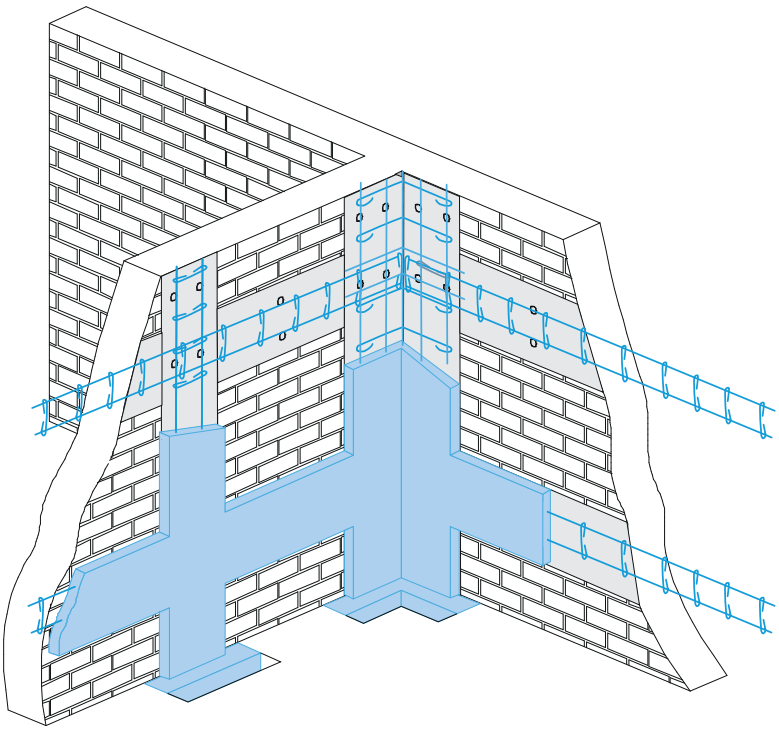
Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Dimensions of foundation matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.
- Appropriate curing time left (14 days) before striking formwork/backfilling around new footing

Fix formwork for foundation. Pour foundation concrete. Allow to cure. Backfill around foundation if required.

SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

7 CONCRETE APPLICATION



WATCH OUT:

Refer to Chapter 3.5.

9 - Hazardous Substances (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Wet wall and apply cement slurry before applying concrete layers
- Dimensions of concrete matches drawings
- Concrete is not overtrowelled. It needs to be quickly smoothed then move onto the next section.
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.
- Once concrete is applied check level of bandage and verticality of splint with plumb bob
- Cement slurry has been cleaned from areas where concrete has not been applied

Apply concrete layer to splints and bandages - see drawings for thickness and concrete specification.

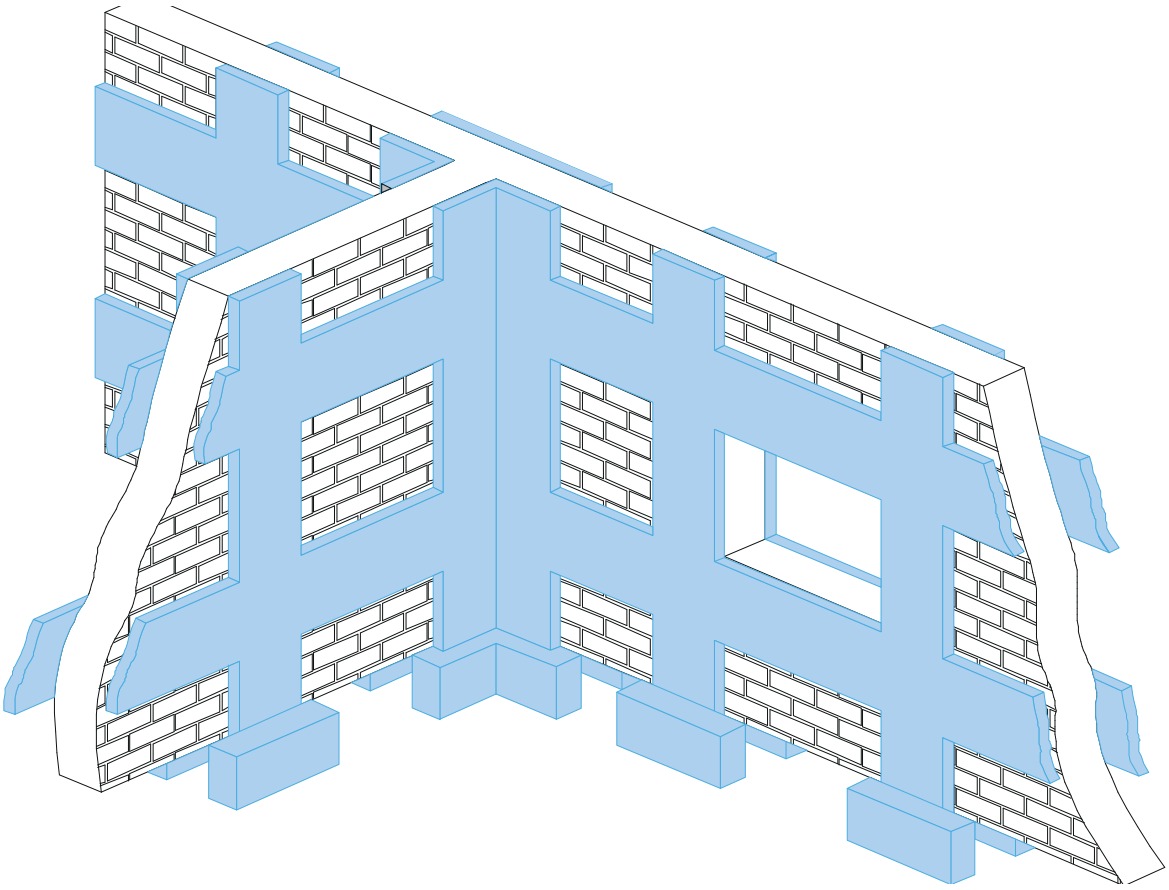
SPLINT AND BANDAGE - CONSTRUCTION SEQUENCE

8 CONCRETE CURING

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

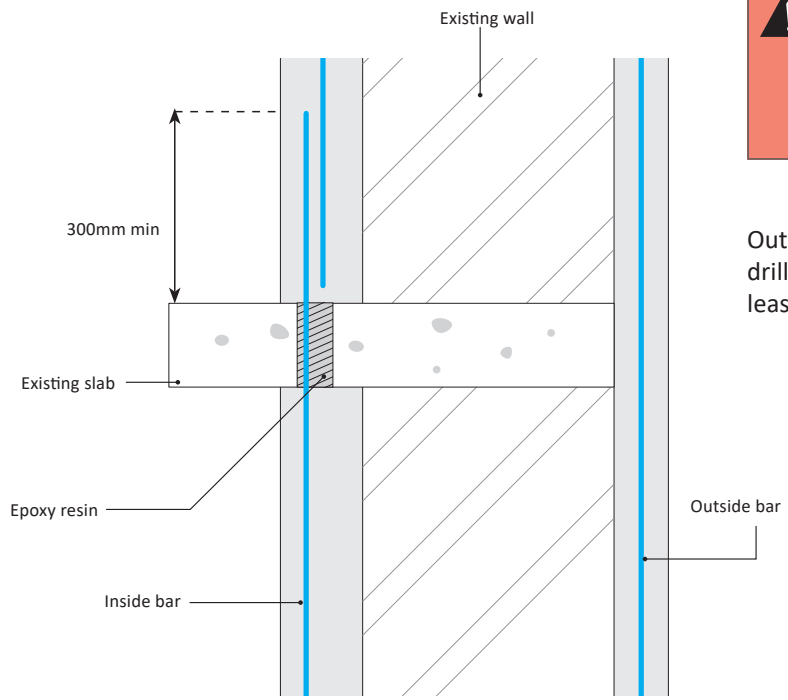
- Appropriate curing time (14 days) is allowed
- Concrete is kept moist during curing



Allow concrete to cure for 14 days. Use wet jute bags/mats to keep concrete moist during curing.

SPLINT AND BANDAGE - DETAILS

SLAB CONNECTION:



WATCH OUT:

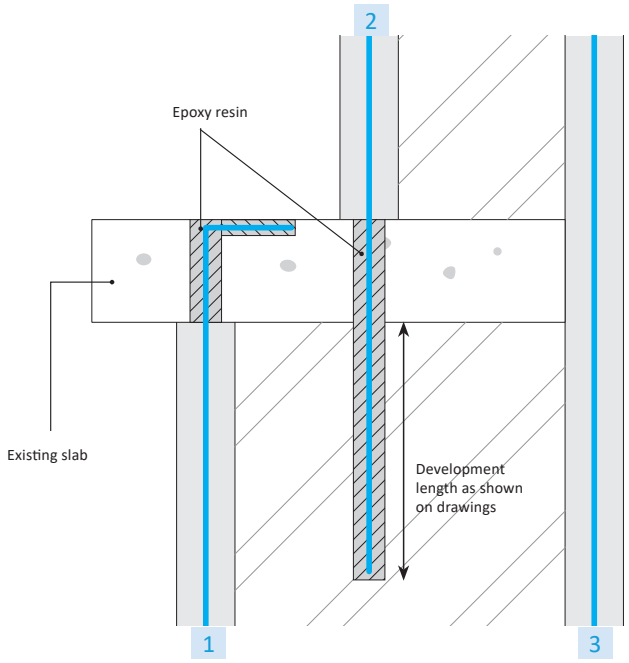
Refer to Chapter 3.5.

9 - Hazardous Substance (Epoxy resin)

Outside bar passes slab. Inside bar - drill hole through and pass up bar at least 300mm. Fix using epoxy resin

SPLINT AND BANDAGE - DETAILS

CHANGE IN THE WALL THICKNESS:



WATCH OUT:

Refer to Chapter 3.5.

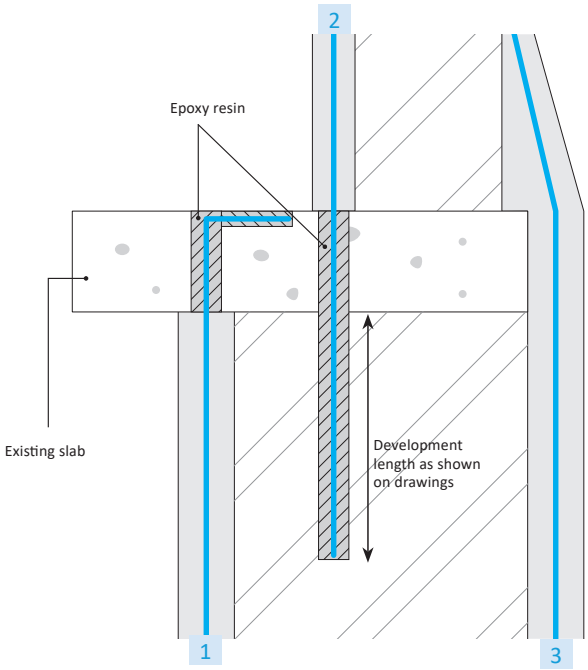
9 - Hazardous Substance (Epoxy resin)

1 - Lower inside bars - passed through the drilled in slab and bend, fixed with epoxy resin

2 - High level inside bar - passed through the drilled in slab and into wall at least 300mm using epoxy resin

3 - Outside bar passes slab edge. Lap if needed

INSET WALL:



WATCH OUT:

Refer to Chapter 3.5.

9 - Hazardous Substance (Epoxy resin)

1, **2** - as per change in wall thickness detail.

3 - Bend bar inwards in slope to suit wall inset

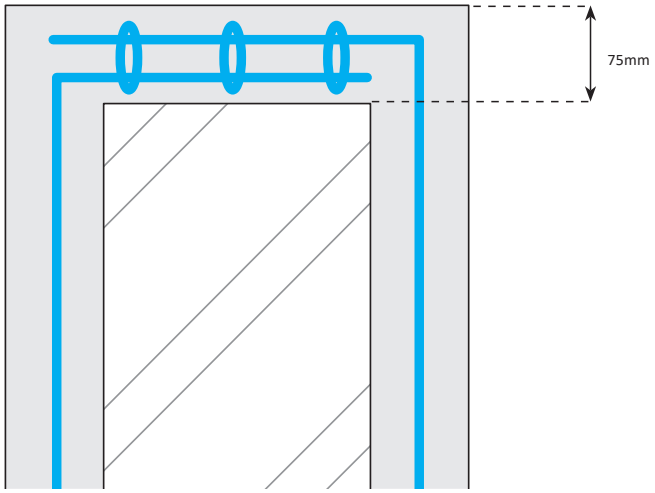
SPLINT AND BANDAGE - DETAILS

TOP OF WALL:

Bend bars over the top of the wall and apply 75mm concrete at top of wall. For parapet strengthening see RF.01.

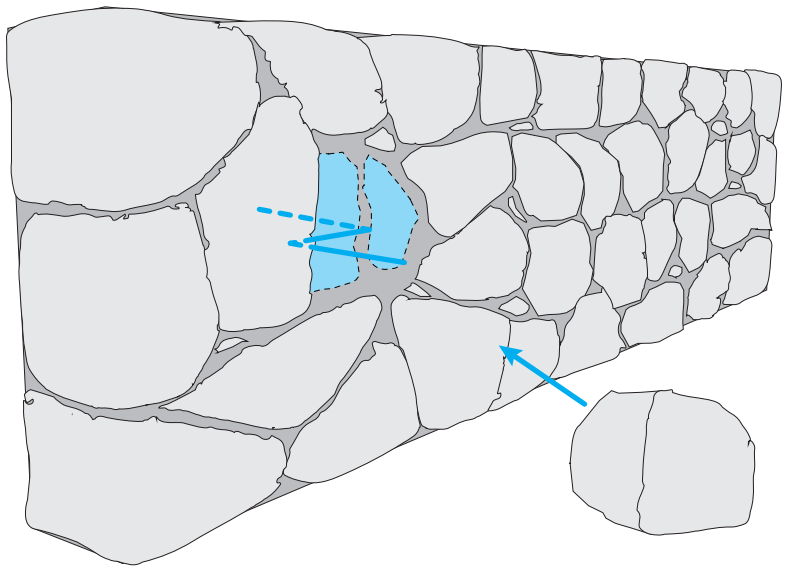
KEY ENGINEERING CHECKS:

- Very important for bars lapping at top of wall to be securely tied together.



DOUBLE LEAF STONE WALL:

When it is not possible to drill through full wall thickness for GI wire, remove stone on one side of wall. Insert wire through exposed mortar joint and bend to go around removed stone before reinstating the stone.

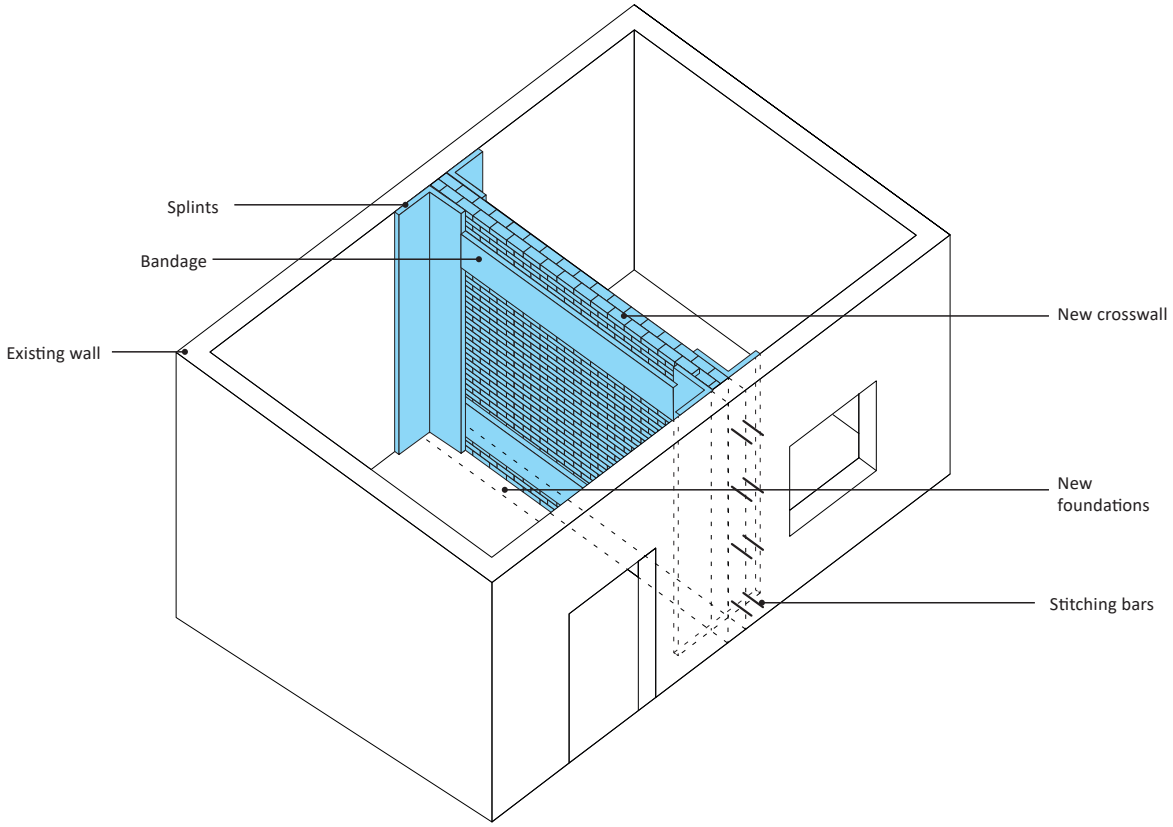


RF.05

ADDITION OF A CROSSWALL

Long walls can be stabilised by adding a crosswall, improving the stiffness of a building. With careful consideration of wall locations, it may also improve fire safety.

3D view



This technique involves the following:

- A Excavation
- A Power Tools
- A Manual handling
- A Working with Hazardous Substances

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

1 FOUNDATION PREPARATION

WATCH OUT:

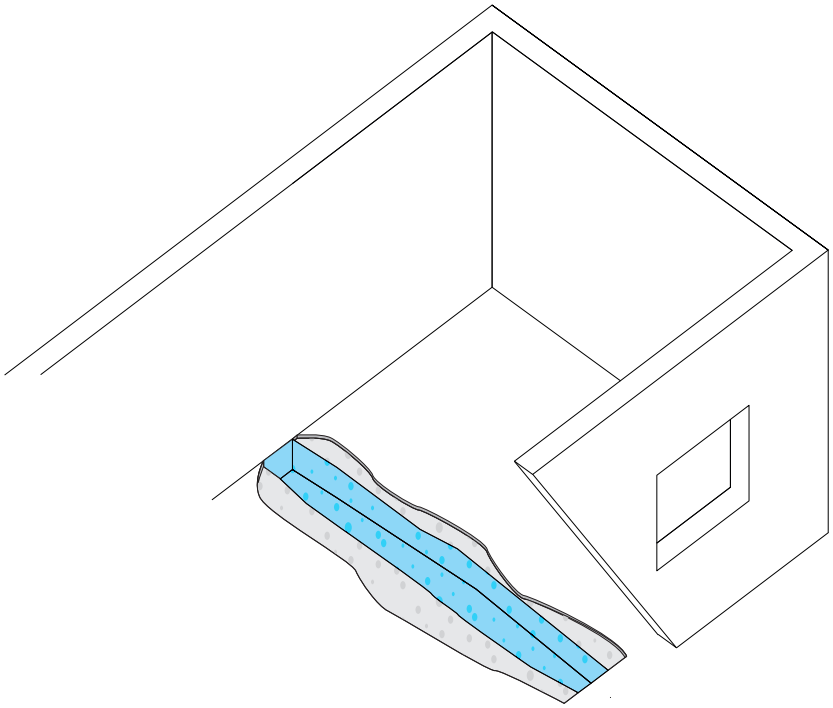
Refer to Chapter 3.5.

2 - Power Tools
5 - Excavation

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing foundations are in good condition where exposed
- Founding surface is firm and flat
- Foundation trench is properly marked and excavated to the design depth and wodth
- Excavations are stable. Temporary support is installed if required.
- Soil at the base of the trench passes heel test - no more than 5mm dent from a firm press from an adult heel
- Soil at the base of the trench is consistent across excavation and all loose rock has been removed from the surface
- Soil at the base of trench is not fill
- Soil at the base of the trench does not contain organic material (e.g. plant roots)
- Flat brick soling is installed and is clean and level



Break out existing floor in the location of the new crosswall foundation to a width sufficient to allow excavations. Excavate to width and depth of new foundations.

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

2 FOUNDATION ANCHORAGE

WATCH OUT:

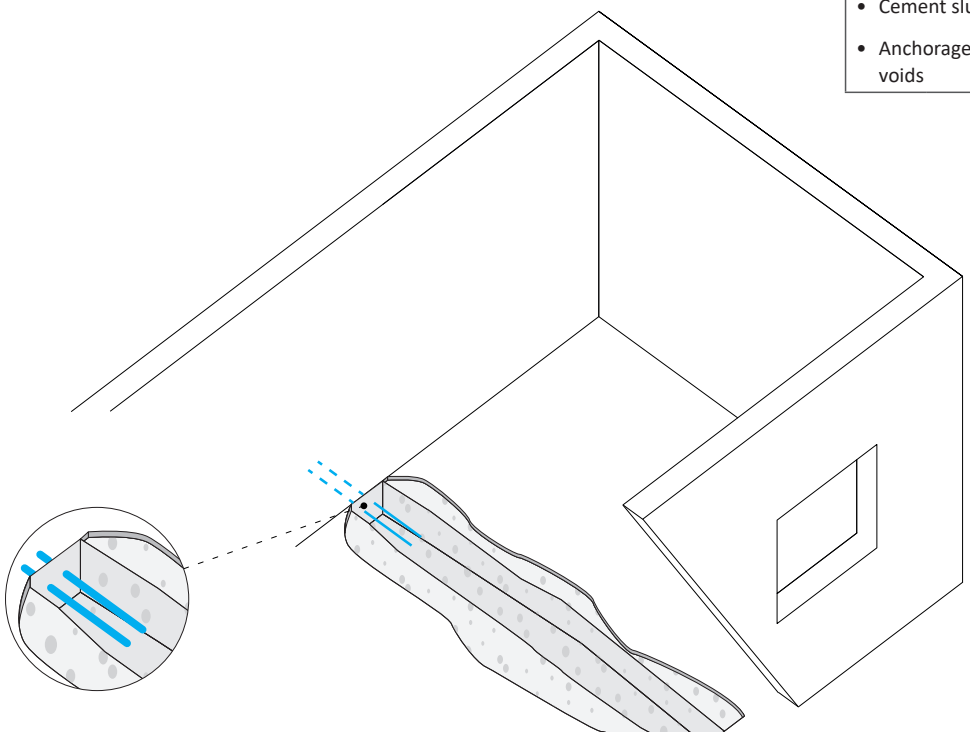
Refer to Chapter 3.5.

2 - Power Tools
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Holes drilled to depth and placement as given on drawings
- Anchorage bars to size and specification as given on drawings
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids

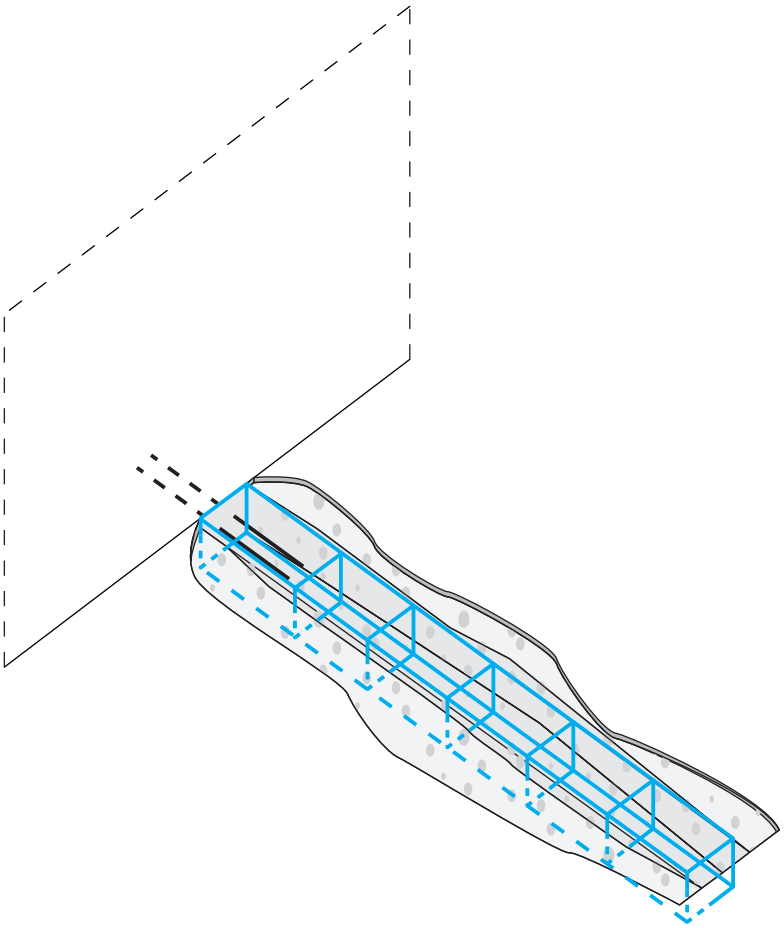


Drill into existing foundation and insert anchorage - see drawings for size and placement. Fix in place with cement slurry to infill holes.

See **MAT.04** Rebar specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

3 FOUNDATION REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

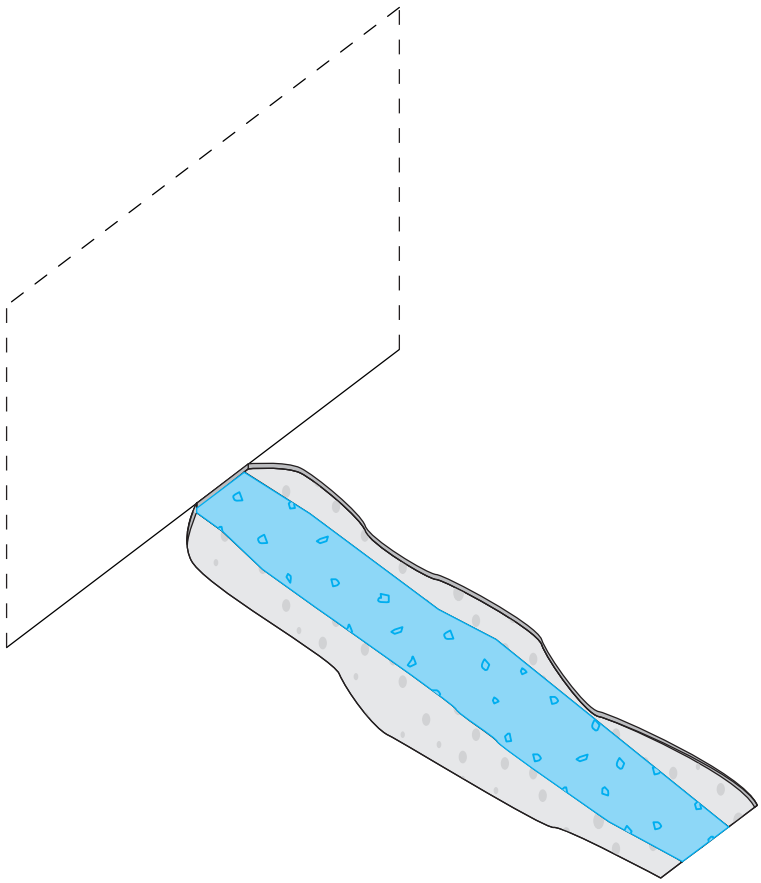
- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire

Fix foundation reinforcement, ensuring appropriate laps with foundation anchorage bars - see drawings for reinforcement lengths, diameters and placement.

See **MAT.04** Rebar specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

4 FOUNDATION CONCRETE POUR



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement).

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Formwork is secure and inside of formwork is clean
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Dimensions of foundation matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.
- Appropriate curing time (14 days) is allowed before continuing adjacent work

Pour the foundations and allow to cure. Once cured, backfill around if required and fill in gap in existing floor.

See **MAT.03** Concrete specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

5 STITCHING BARS PREPARATION

WATCH OUT:

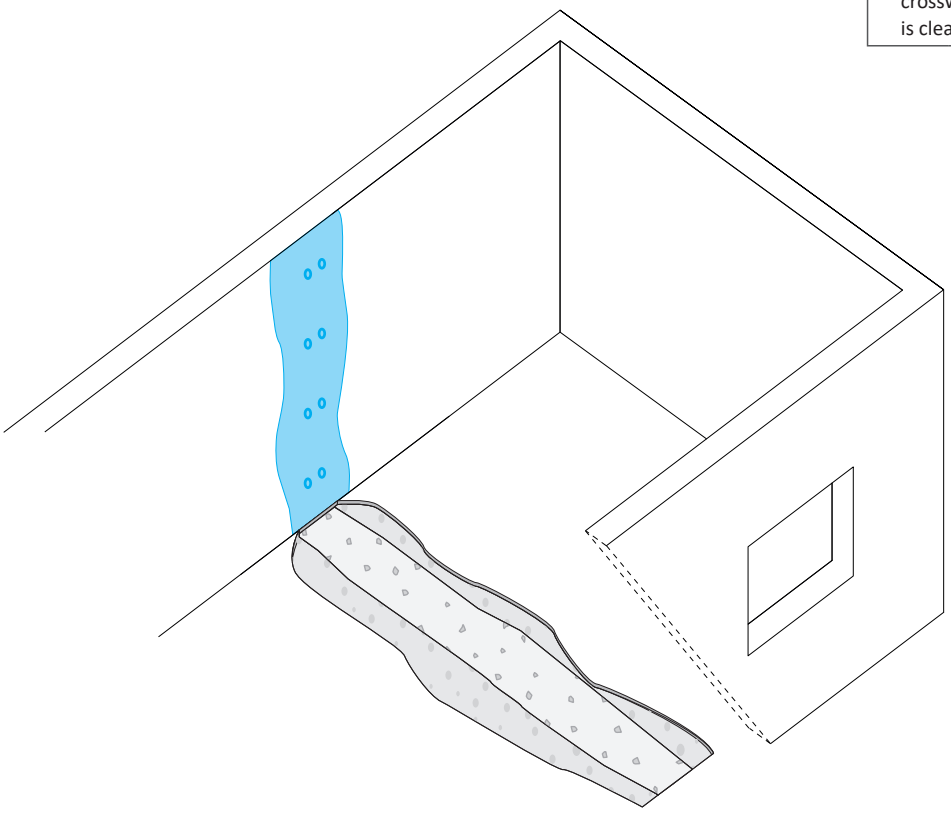
Refer to Chapter 3.5.

2 - Power Tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

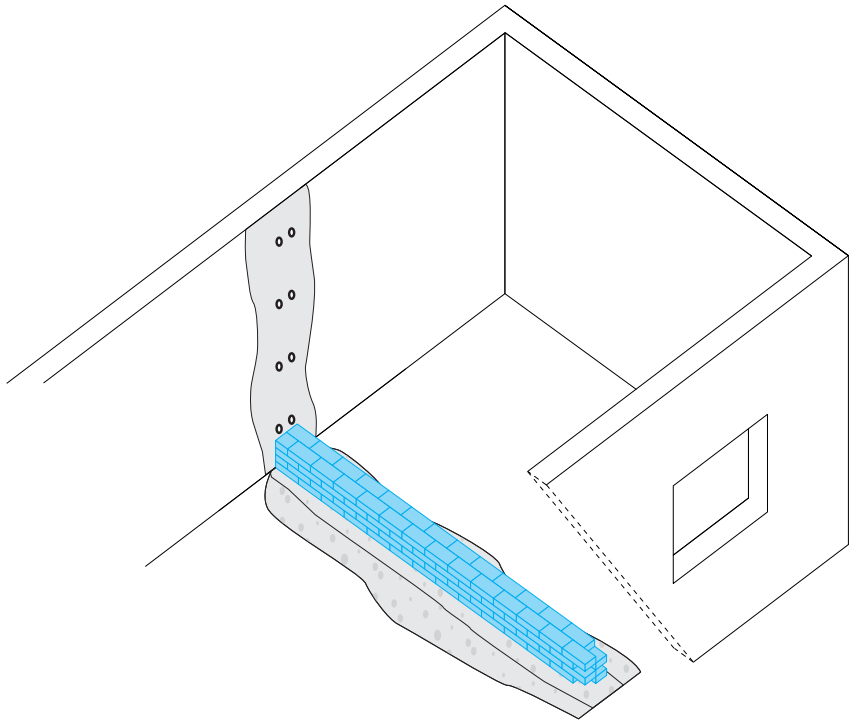
- Holes drilled to depth and placement as given on drawings
- Finishes are removed locally where new crosswall will abut existing wall and surface is clean and free of loose material



Remove finishes where crosswall will be built up to existing wall. Ensure exposed surfaces are clean and free of loose material. Drill holes into existing walls to spacing and depths as shown on the existing drawings

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

6 BRICKLAYING - TO UNDERSIDE OF FIRST HOLES



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Mortar joints do not exceed 10mm
- Mortar matches specification
- Bricks match specification and pass field test requirements
- Brickwork is laid as shown in chapter 3
- No slush joints - mortar is applied to vertical face of brick before laying not after
- Mortar is not laid for more than 3-5 bricks in advance
- Mortar is used within 30 minutes from mixing
- Wall line is set out with string and checked that it is plumb
- No more than half the height of the wall is laid in a day

Build the new crosswall up to the underside of the first holes.

See **MAT.01** Brick specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

7 STITCHING BARS

WATCH OUT:

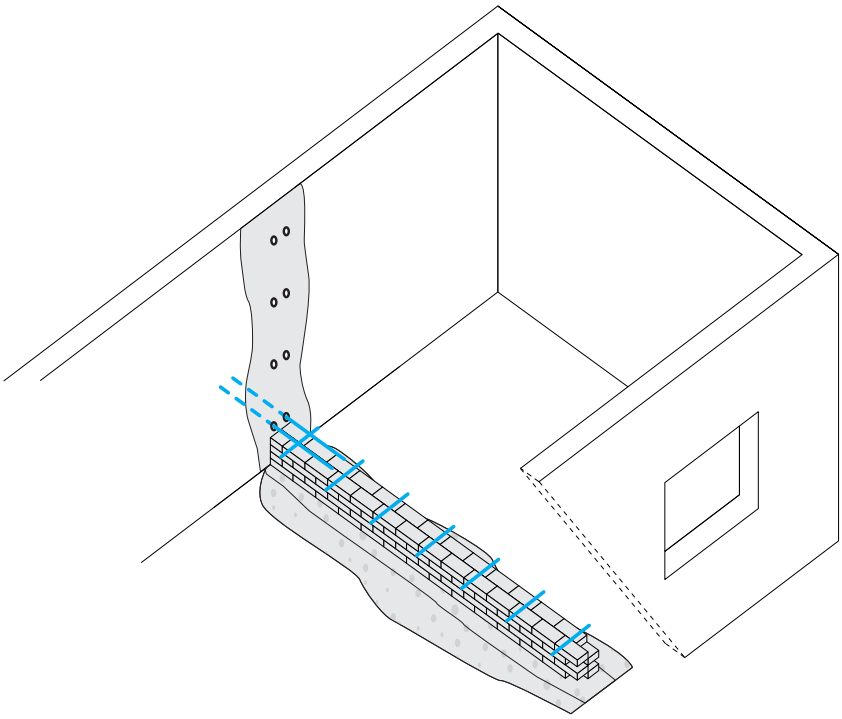
Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Reinforcement length, diameter and placement matches drawings
- Reinforcement matches requirements in specification
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids
- Bar installation does not disrupt masonry layout

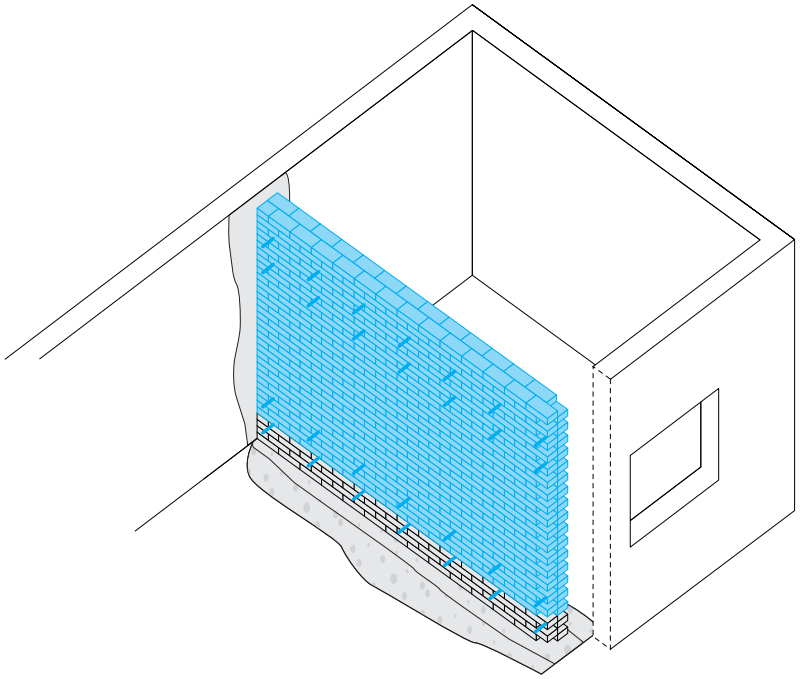


Fix stitching bars into holes in existing wall so they are within the mortar joint of the new masonry wall - see drawings for bar length, diameter and spacing. Fix bars for bandages at the appropriate level.

See **MAT.04** Rebar specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

8 BRICKLAYING - TO COMPLETE CROSSWALL



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Mortar joints do not exceed 10mm
- Mortar matches specification
- Bricks match specification and pass field test requirements
- Brickwork is laid as shown in chapter 4.
- No slush joints - mortar is applied to vertical face of brick before laying not after
- Mortar is not laid for more than 3-5 bricks in advance
- Mortar is used within 30 minutes from mixing
- Wall line is set out with string and checked that it is plumb
- No more than half the height of the wall is laid in a day
- Reinforcement length, diameter and placement of stitching bars and banadage bars matches drawings
- Reinforcement matches requirements in specification
- Cement slurry mix is correct
- Anchorage holes are well filled with no voids
- Bar installation does not disrupt masonry layout

Continue building masonry wall and installing stitching bars until crosswall is constructed to height shown on drawings

See **MAT.01** Brick specification →

ADDITION OF A CROSSWALL - CONSTRUCTION SEQUENCE

9 SPLINTS AND BANDAGES

WATCH OUT:

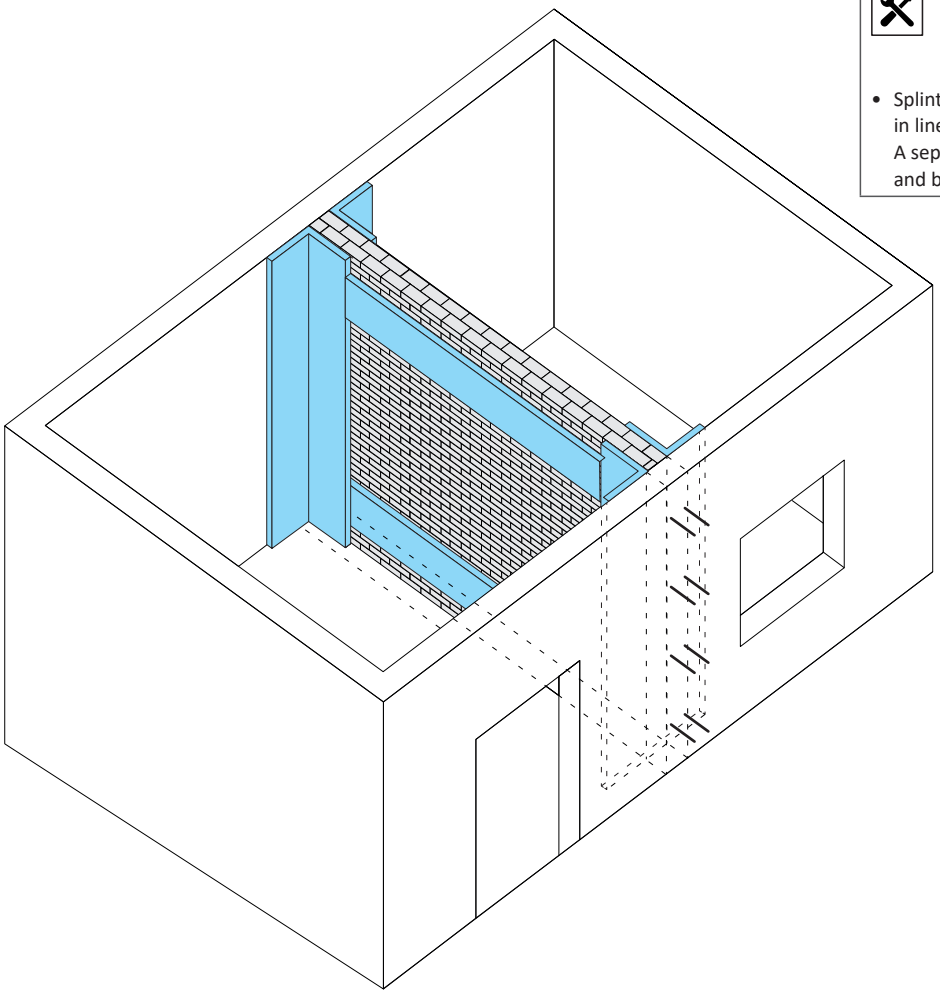
Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Splints and bandages have been installed in line with the drawings (as per RF.04). A separate QA.07 is completed for splints and banadages.

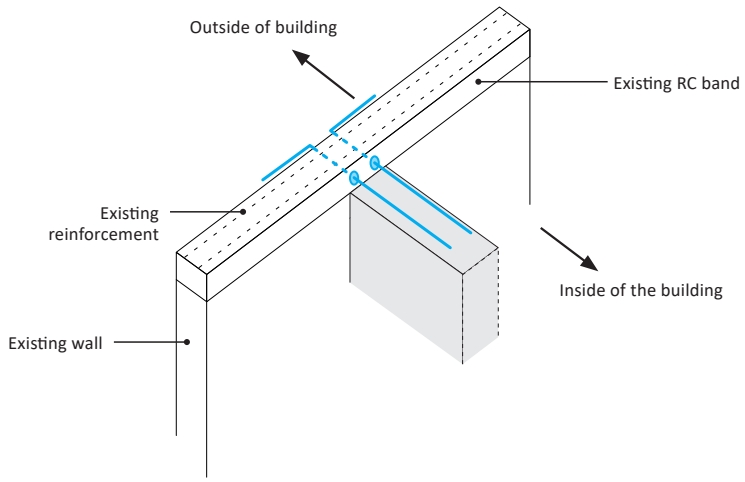


Install splints at the joints between the existing wall and the new crosswall and bandages to the new crosswall- see RF.05 for information on how to construct splints and bandages.

ADDITION OF A CROSSWALL - DETAILS

If existing wall has concrete seismic bands, these should be connected to the new shear wall as follows:

1



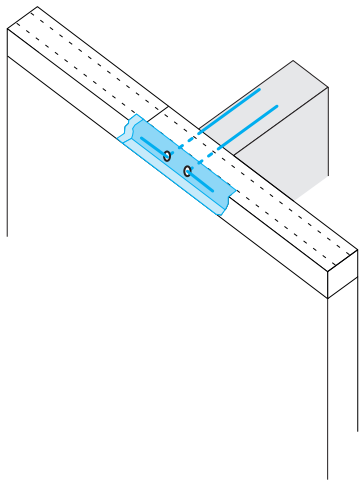
WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools

Drill and insert steel bars of the new crosswall into the existing wall band

2



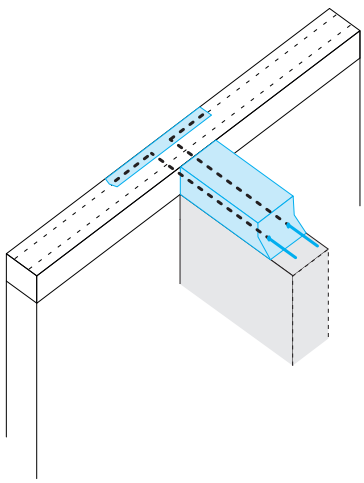
WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools

Remove cover from the band on the other side of the wall and bend the bars into place

3



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling

9 - Hazardous Substance (Cement)

Replace the concrete of the existing band.

The reinforcement for the crosswall can then be lapped onto the anchorage bars and the new band constructed

INCREASING THE THICKNESS OF WALL - DETAILS

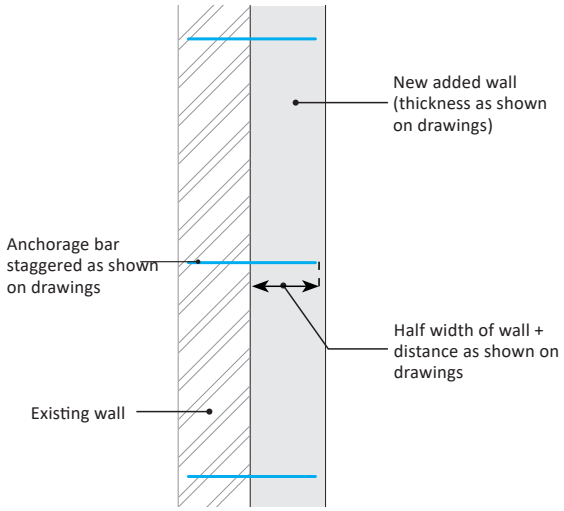
If existing wall requires thickening follow the information provided in detail drawings.

INCREASE IN WALL THICKNESS WITH SUFFICIENT EXISTING FOUNDATION:

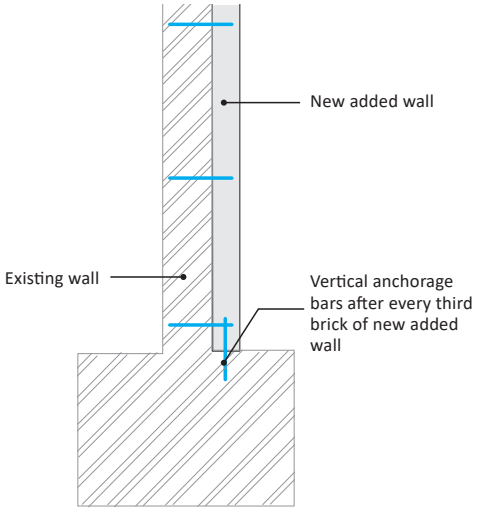
WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools
9 - Hazardous Substance (Cement)

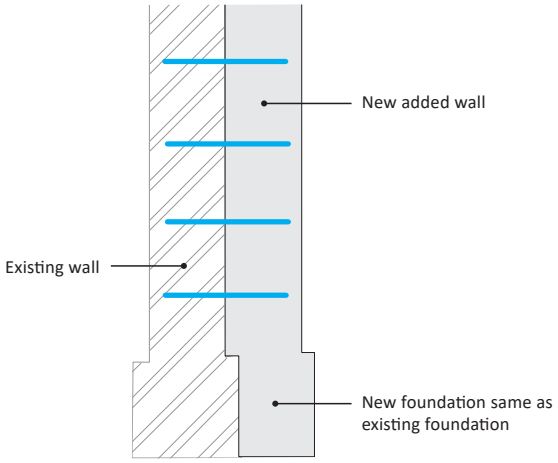


Increase in wall thickness

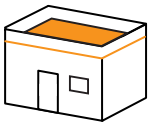


Increase in wall thickness for existing ground floor

INCREASE IN WALL THICKNESS WITH INSUFFICIENT EXISTING FOUNDATION:



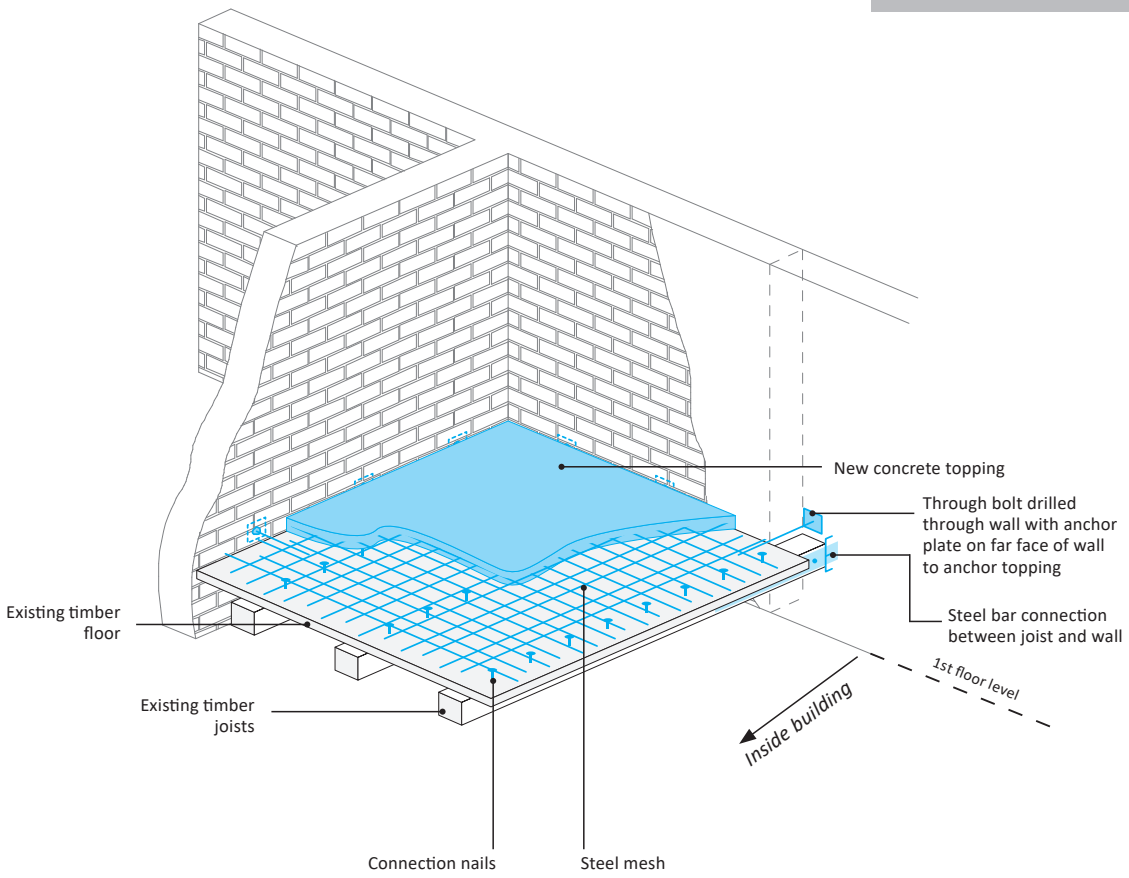
New foundation constructed for new added wall



RF.06 | DIAPHRAGM STIFFENING

Overlaying an existing timber floor or flat roof with a thin layer of RC will stiffen the floor and improve behaviour in earthquakes. It will also improve fire safety.

3D view

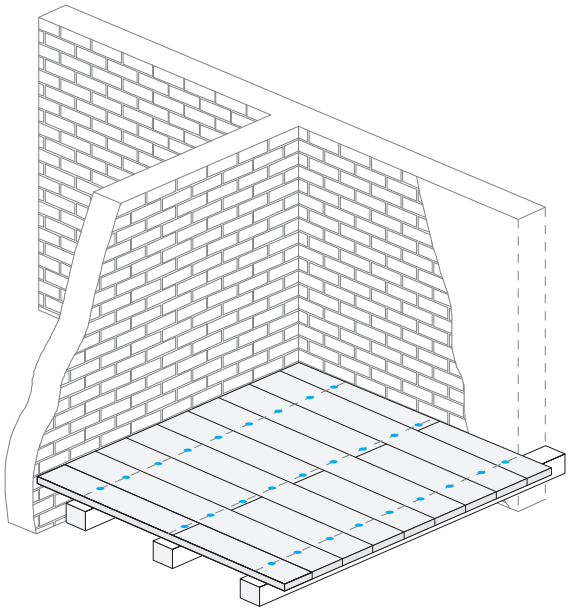


This technique involves the following:

- A Power tools
- A Manual handling
- A Working with hazardous substances

DIAPHRAGM STIFFENING - CONSTRUCTION SEQUENCE

1 SURFACE PREPARATION



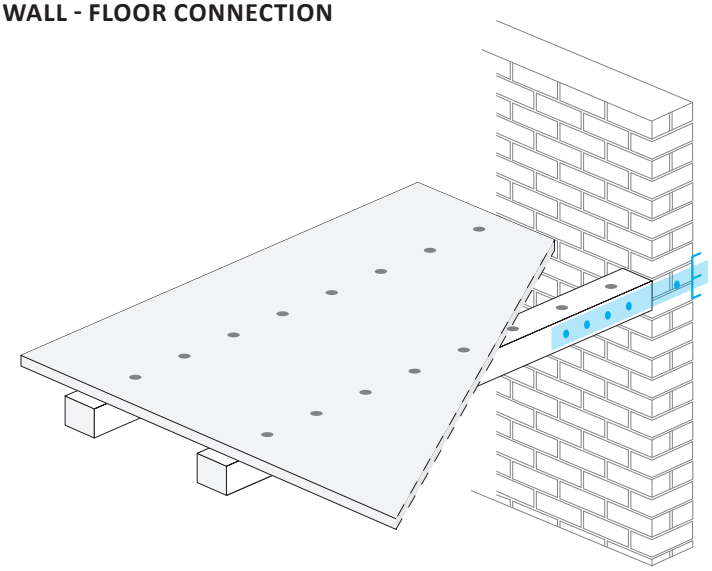
KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surfaces are clean and free of loose material
- Existing floor is fully connected e.g. no loose planks etc.

Floor should be clean and free of any surface material. Make sure all floor components are securely nailed together.

2 WALL - FLOOR CONNECTION



WATCH OUT:

Refer to Chapter 3.5.

2 - Power Tools
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Floor is properly connected to the walls. If repair is required, the connection detail matches drawings

Make sure the floor structure is well connected with the wall structure. If not, follow drawings to improve wall-floor connection. Typically this requires holes drilled into existing wall in order to insert steel bars which are nailed to timber joints or floor. Holes are then filled in with cement slurry.

DIAPHRAGM STIFFENING - CONSTRUCTION SEQUENCE

3 ANCHORAGE PREPARATION AND FIXING

WATCH OUT:

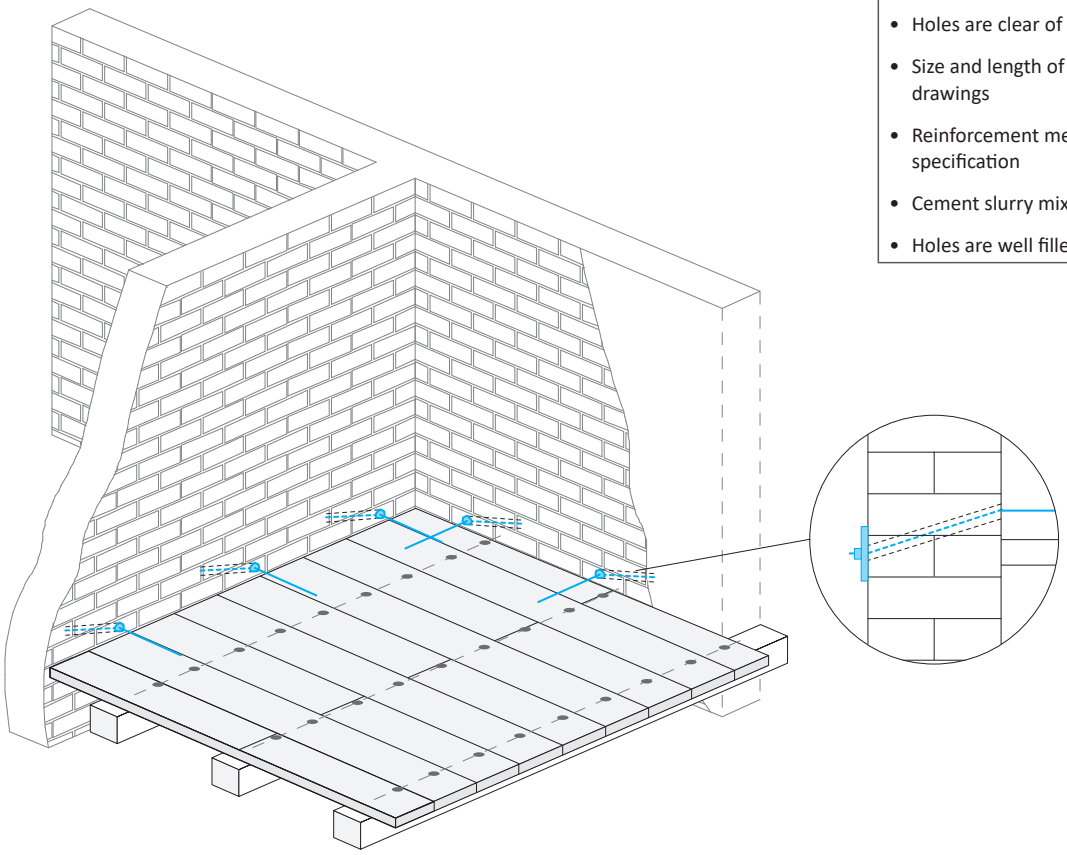
Refer to Chapter 3.5.

2 - Power Tools
6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing and depth of holes matches drawings
- Holes are clear of debris
- Size and length of anchorage bars matches drawings
- Reinforcement meets requirements of specification
- Cement slurry mix is correct
- Holes are well filled with no voids

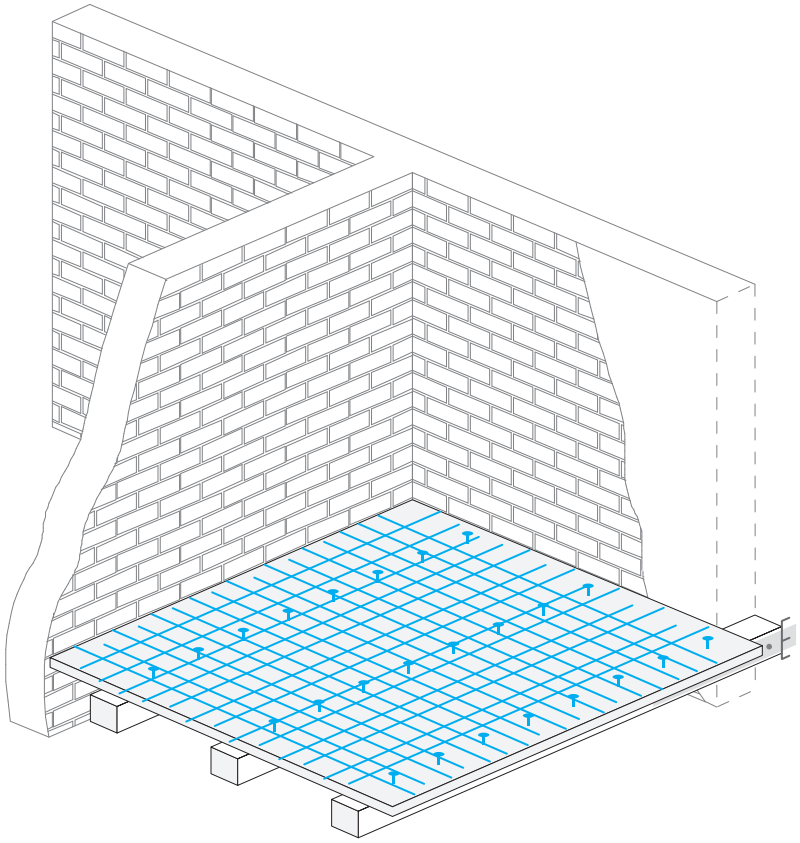


Drill sloping holes into the walls for topping anchorage bars. Ensure holes are clear debris. Place anchorage bars and fill holes with cement slurry

See MAT.04 Rebar specification →

DIAPHRAGM STIFFENING - CONSTRUCTION SEQUENCE

4 REINFORCEMENT FIXING



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling

KEY ENGINEERING CHECKS:

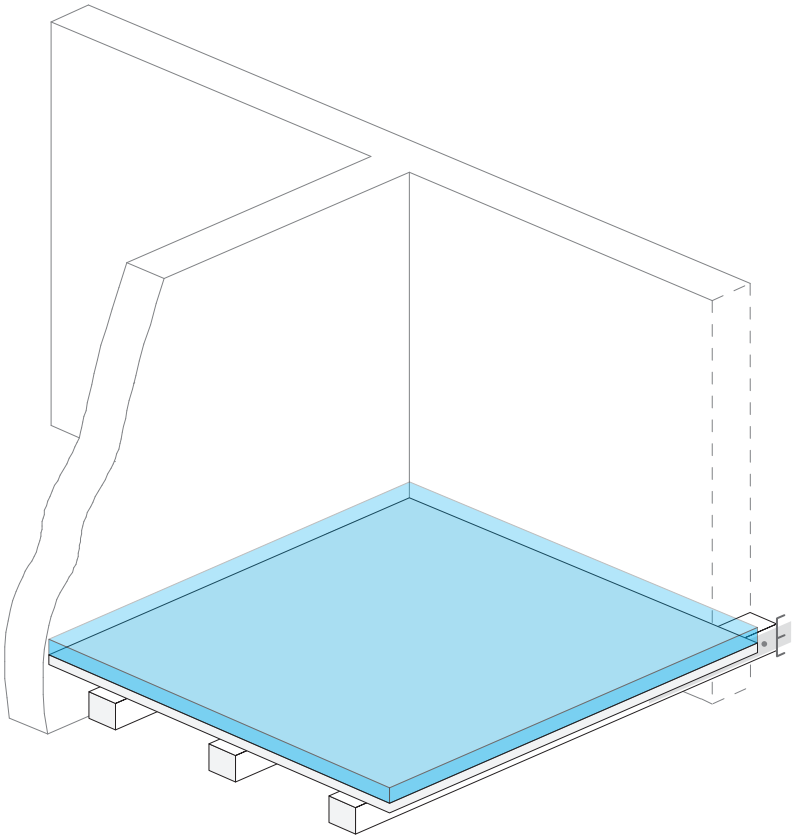
Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Connection nails protrde half of the proposed concrete thickness

Lay reinforcement, see drawing for correct size and spacing. Bend anchorage bars to lap with mesh. Nail in connection nails leaving the top protruding from the timber.

DIAPHRAGM STIFFENING - CONSTRUCTION SEQUENCE

5 CONCRETE POUR



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Floor surface is clean and free of loose material
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.
- Appropriate curing time (14 days) is left before applying finishes etc.
- Concrete is kept moist during curing
- Seal up around penetrations through the floor

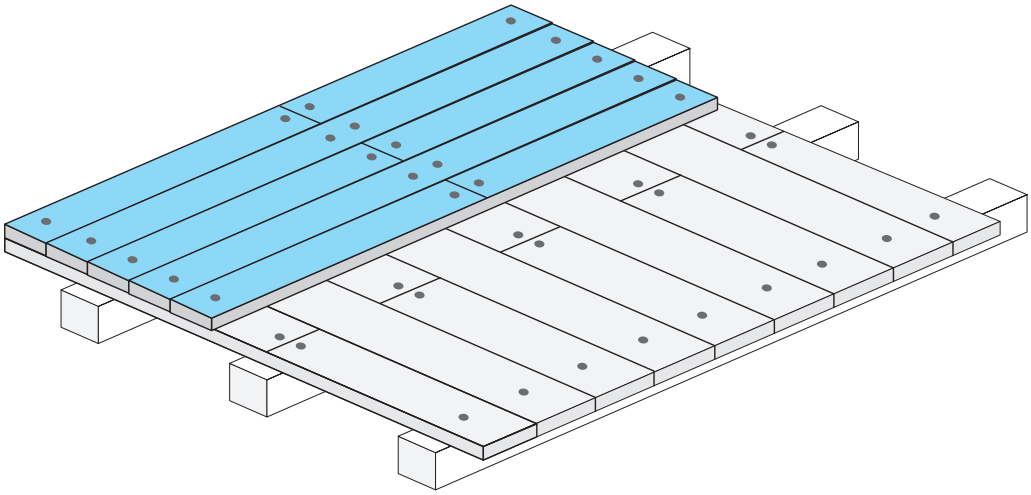
Pour concrete to the thickness and specification on the drawings. Allow to cure. Seal up any penetrations through the floor, such as for pipes.

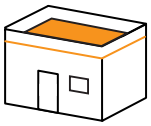
See **MAT.03** Concrete specification →

DIAPHRAGM STIFFENING - VARIATIONS

A

Nail a layer of new planks perpendicularly to existing floor planks

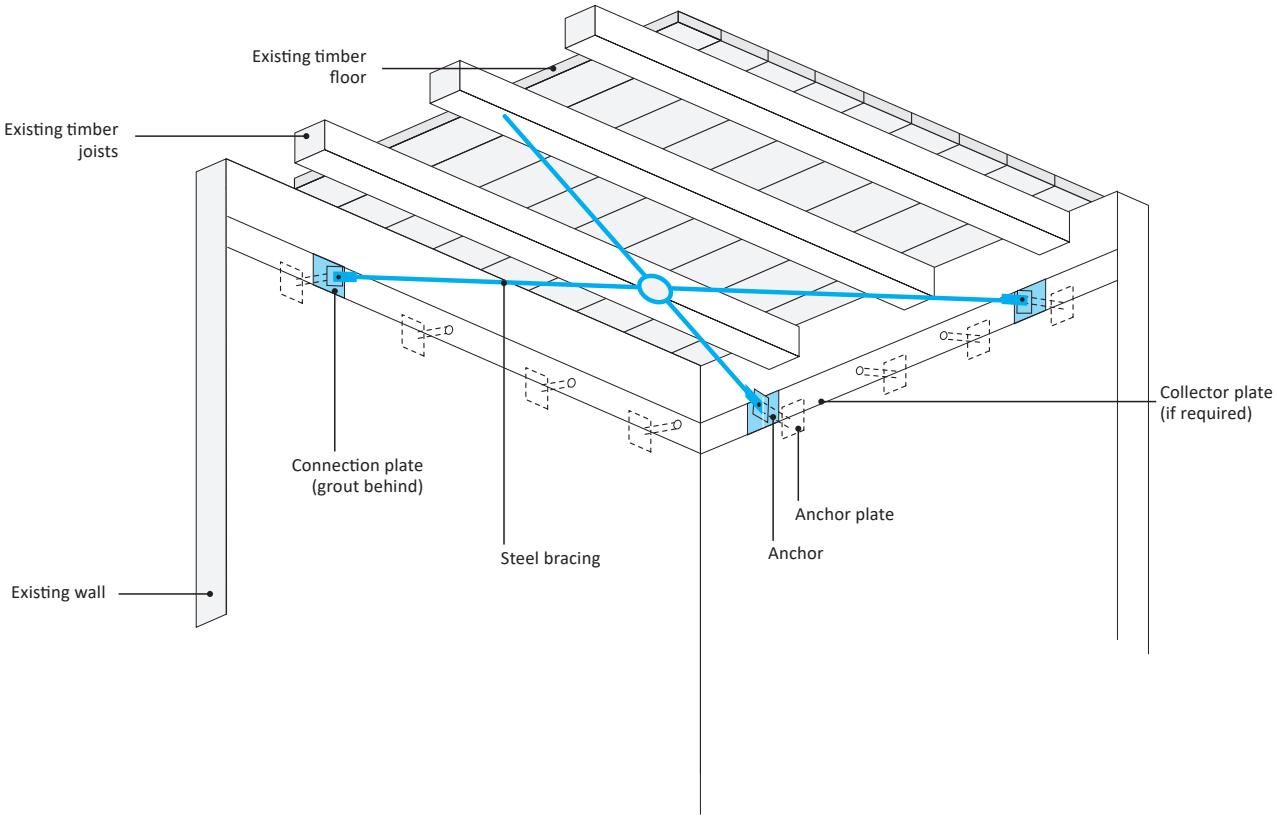




RF.06A | ADDITION OF HORIZONTAL BRACING

Horizontal bracing will provide a diaphragm which stiffens the structure and improves behaviour in earthquakes.

3D view



This technique involves the following:

- A Power Tools
- A Working at Height
- A Manual Handling
- A Hazardous Substances

ADDITION OF HORIZONTAL BRACING - CONSTRUCTION SEQUENCE

1 PREPARATION AND DRILLING

WATCH OUT:

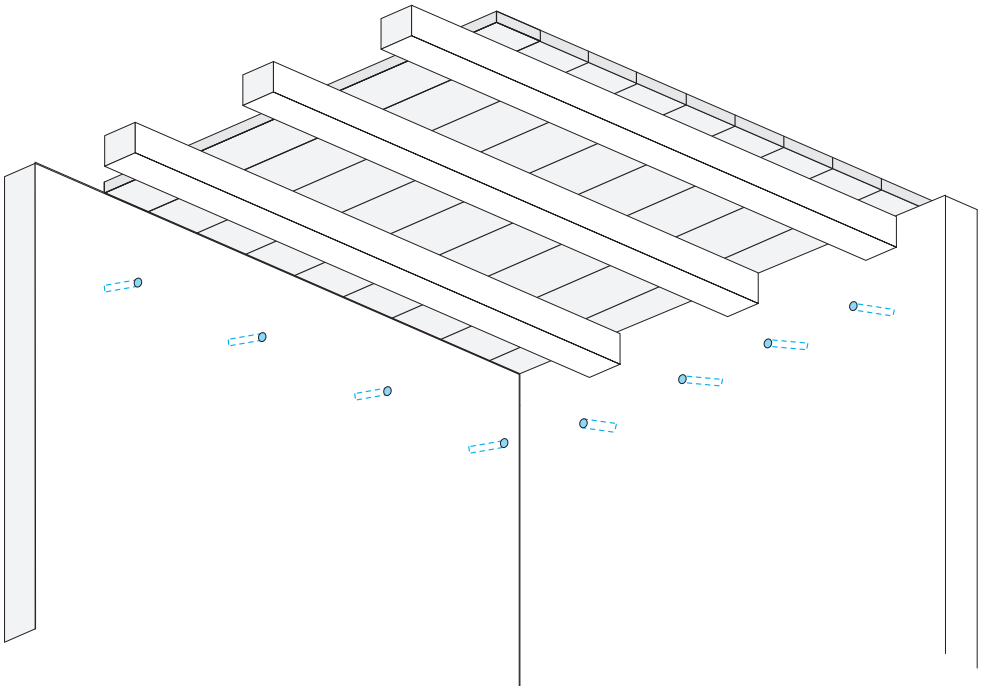
Refer to Chapter 3.5.

1 - Working at Height
2 - Power tools

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

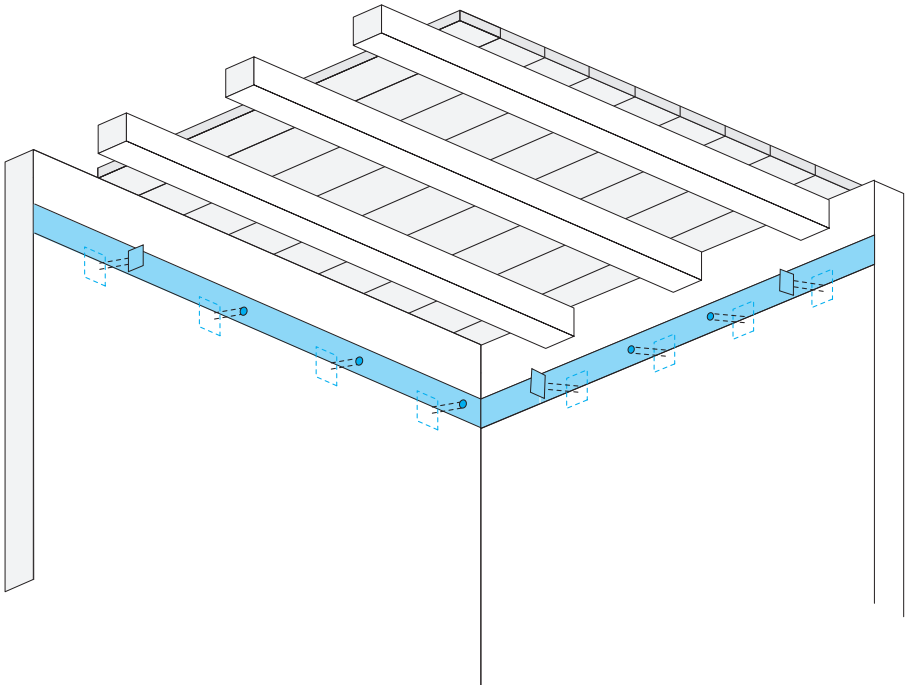
- Wall surface is flat and in good condition
- Wall surface is clear of finishes and loose material
- Anchorage holes are at size and locations as shown on drawings



Ensure wall surface is flat and in good condition at fixing locations. Drill anchorage holes at locations as shown on drawings.

ADDITION OF ADDITIONAL BRACING - CONSTRUCTION SEQUENCE

2 FIX CONNECTION AND COLLECTOR PLATES



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
3 - Hot Works
6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

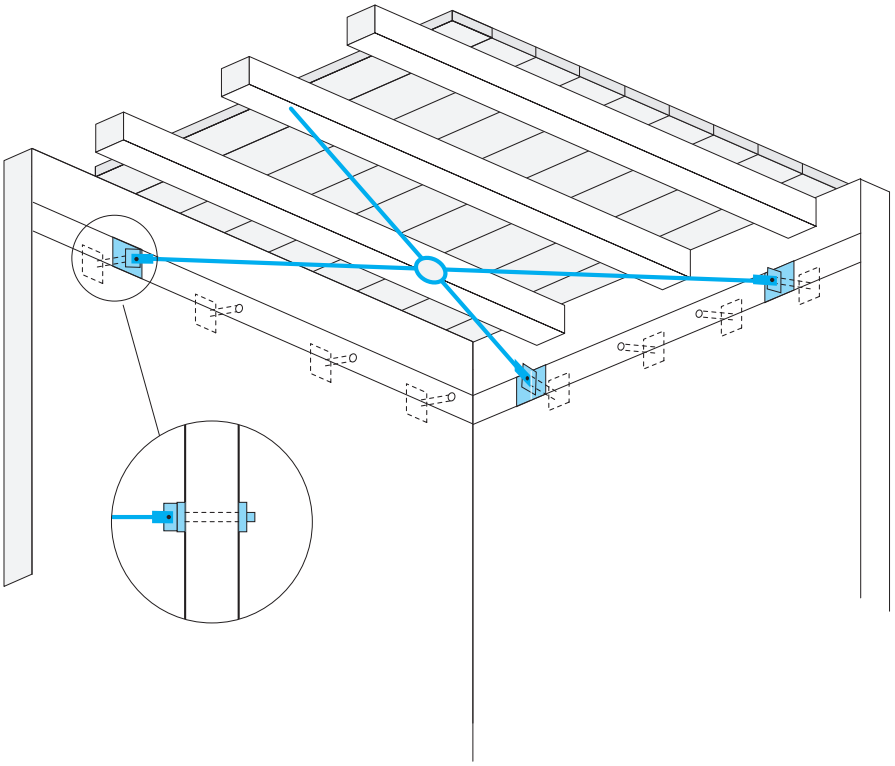
Refer to QA.07 Technical Checklist Form

- Steel is as per the specification
- Connection plates are as shown on the drawings (dimensions, holes, welds etc.)
- Collectors are installed at this level (ringbeam or bandage) or a collector plate as shown on the drawings is installed
- Welds are in good condition, continuous and to the size given on the drawings
- Anchorage plates are to the size shown on the drawings
- Bolts are to the size and strength shown on the drawings
- Connections are fully tightened
- Cement slurry mix is correct
- Holes are well filled with no voids

Fix connection plates - and collector plate if required - in place with anchors through existing walls. A collector plate will be needed if there is no ring beam or bandage at this level. Ensure connections are fully tightened. Once anchors are in place and fully tightened, fill holes with cement slurry.

See **MAT.06** Structural Steel specification →

3 FIX BRACING



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Steel is as per specification
- Bracing rods are as per drawings
- Connections are as per drawings (bolt size, strength, spacings, edge and end distances)
- Washers are in place
- A minimum of two threads protrude through each nut
- There are bolts in every hole of the connection
- Rods are in tension
- There is no visible sag in the rods

Fix bracing rods into connection plates. Tighten at central ring or tourniquet and ensure bracing is in tension.

See **MAT.06** Structural Steel specification →

4 FINISHING

WATCH OUT:

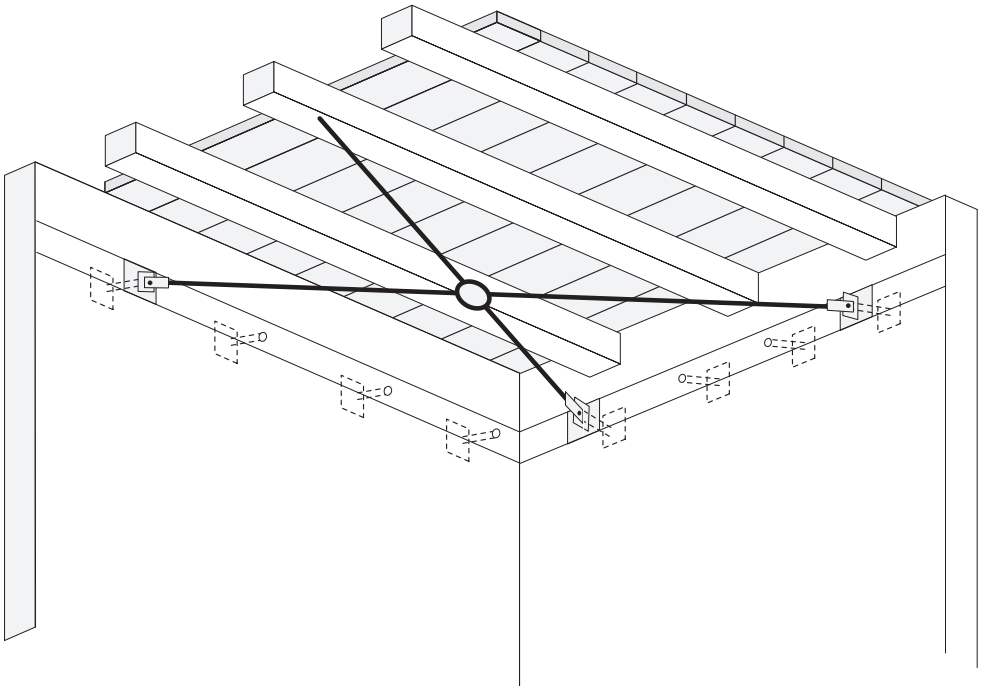
Refer to Chapter 3.5.

1 - Working at Height
9 - Hazardous Substance (Paint)

KEY ENGINEERING CHECKS:

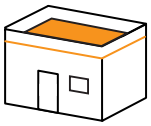
Refer to QA.07 Technical rectiChecklist Form

- Steel is fully corrosion protected
- Any minor damage to walls caused by drilling is repaired



Ensure all steel is corrosion protected and patch up paint if required. Repair any damage to existing walls from drilling.

See **MAT.06** Structural Steel specification →

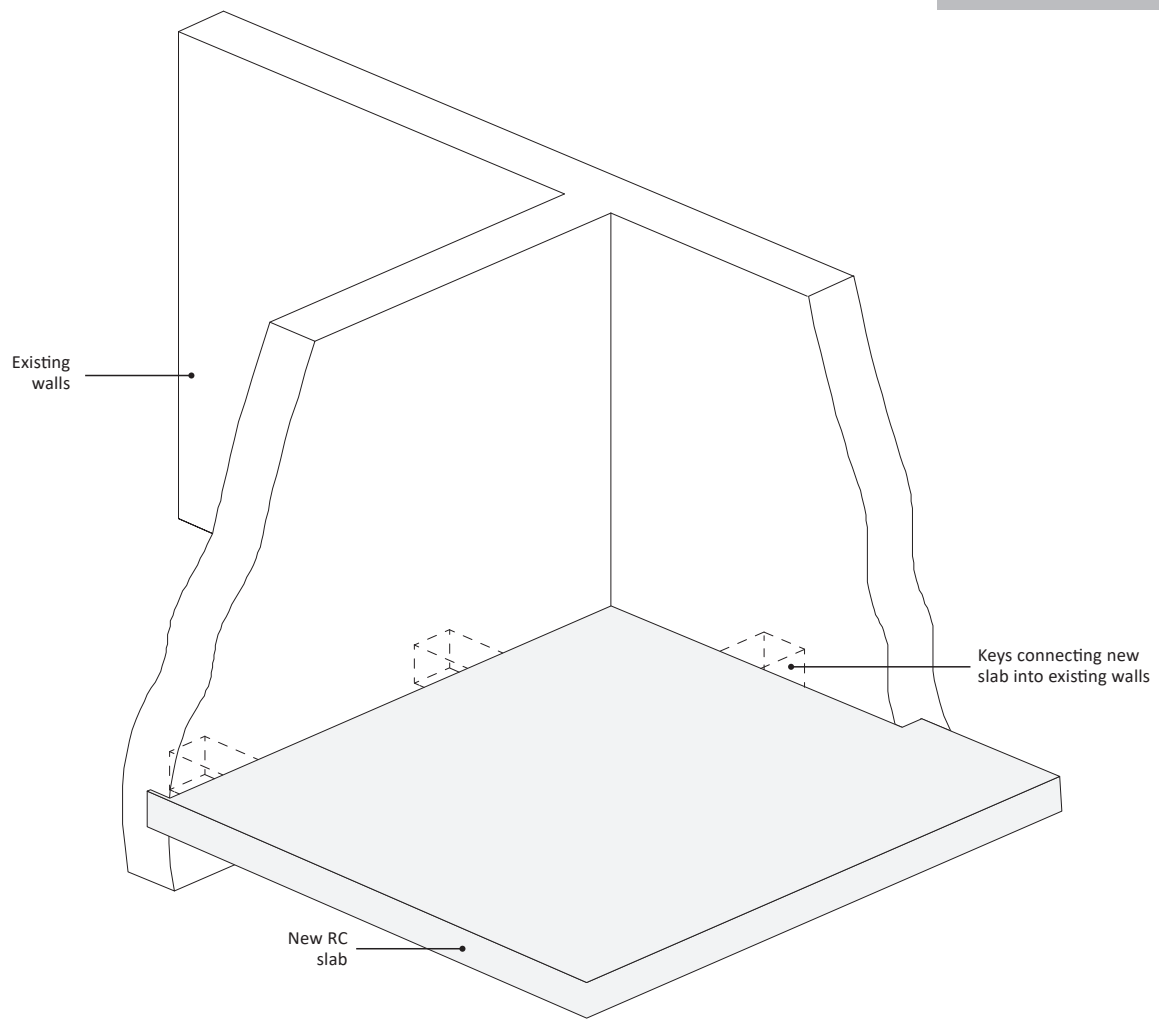


RF.07

REPLACEMENT SLAB

Replacing an existing timber floor with a rigid RC slab will improve seismic behaviour as the building is much stiffer. It may also improve the fire safety of the building.

3D view

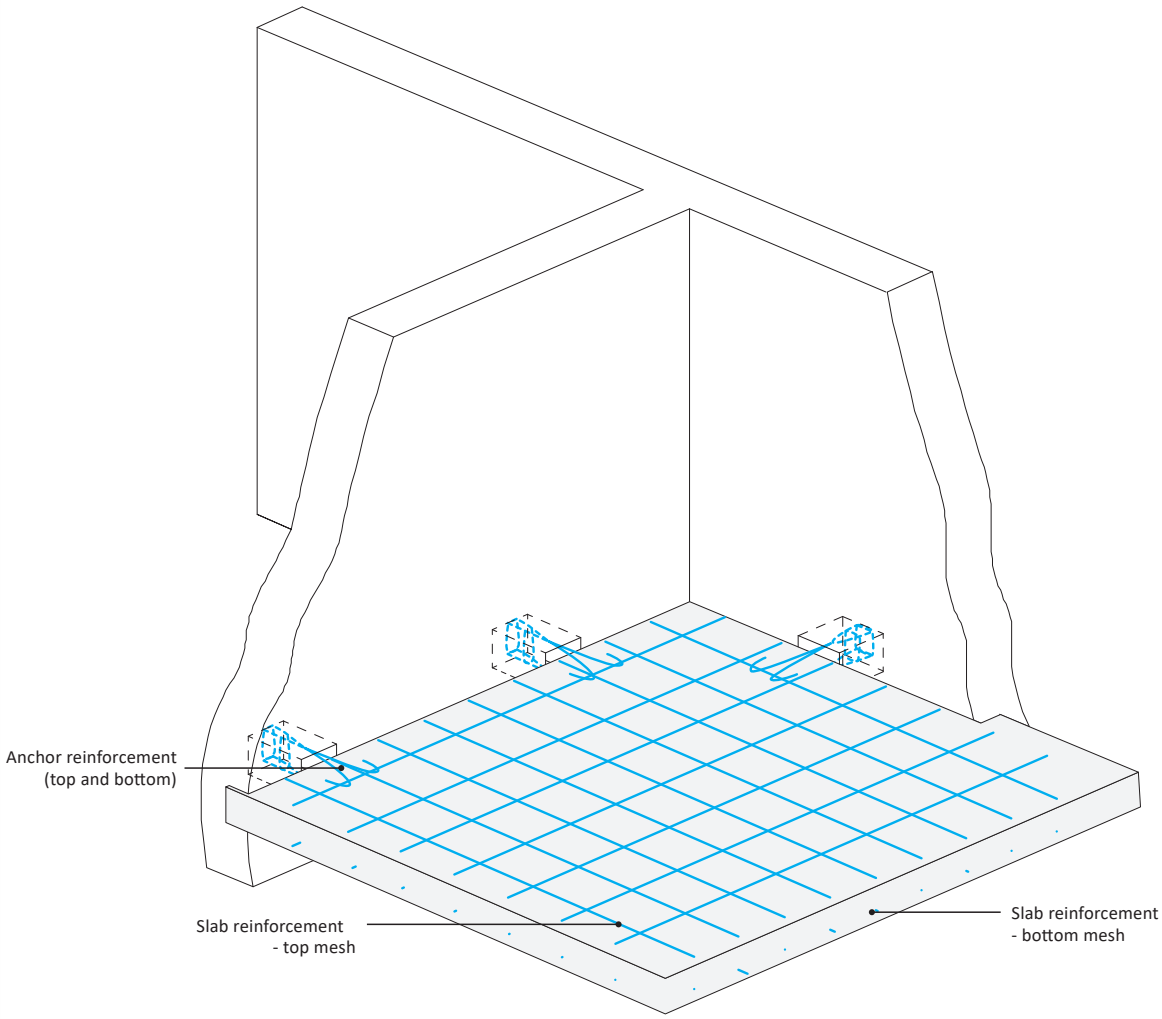


This technique involves the following:

- A Working at Height
- A Power Tools
- A Temporary Works
- A Demolition
- A Manual handling
- A Working with Hazardous Substances
- A Exposure to Lead Paint

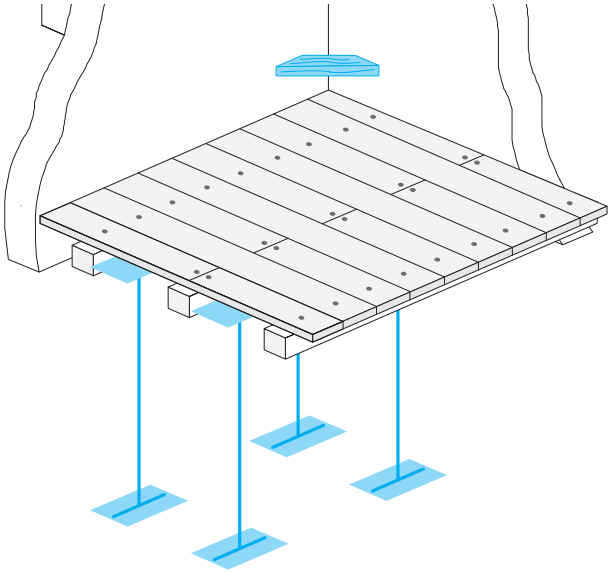
REPLACEMENT SLAB - REINFORCEMENT 3D VIEW

Reinforcement 3D view



REPLACEMENT SLAB - CONSTRUCTION SEQUENCE

1 DEMOLITION OF EXISTING STRUCTURE



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
7 - Demolition
8 - Temporary Works.

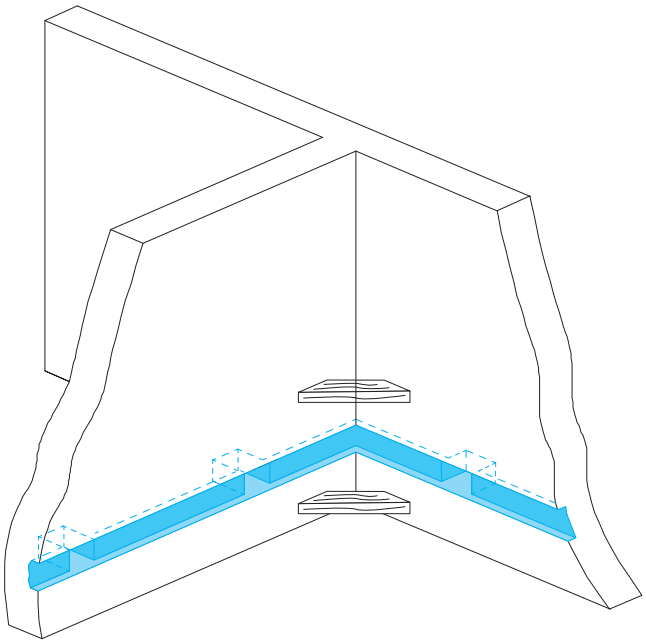
KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Temporary stability and propping is installed in line with temporary works drawings
- Extent of demolition is marked
- Demolition is carried out safely
- Waste/rubble is removed and site is clean

Ensure existing structure does not depend on existing timber floor for support and install alternative support if required. Prop existing floor in line with temporary works drawings. Install temporary timber bracing above and below floor. Demolish existing floor safely.

2 BREAKING OUT OF EXISTING WALL



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
2 - Power Tools
10 - Exposure to lead paint

KEY ENGINEERING CHECKS:

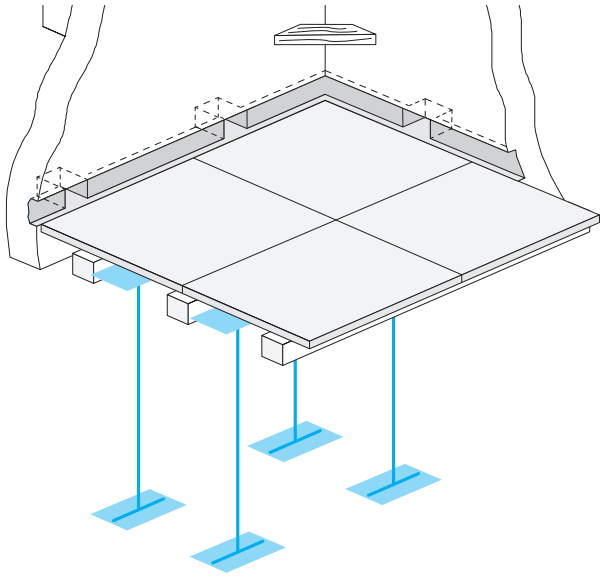
Refer to QA.07 Technical Checklist Form

- Channel dimensions match drawings
- Key dimensions and spacings match drawings
- Waste/rubble is removed and site is clean

Break out a channel in the existing wall for the new slab to bear on - see drawings for dimensions. Locally, break out the full wall thickness to form the keys to the spacing and dimensions given in the drawings.

REPLACEMENT SLAB - CONSTRUCTION SEQUENCE

3 FORMWORK AND FALSEWORK



Install formwork and falsework to allow construction of the new slab.

WATCH OUT:

Refer to Chapter 3.5.

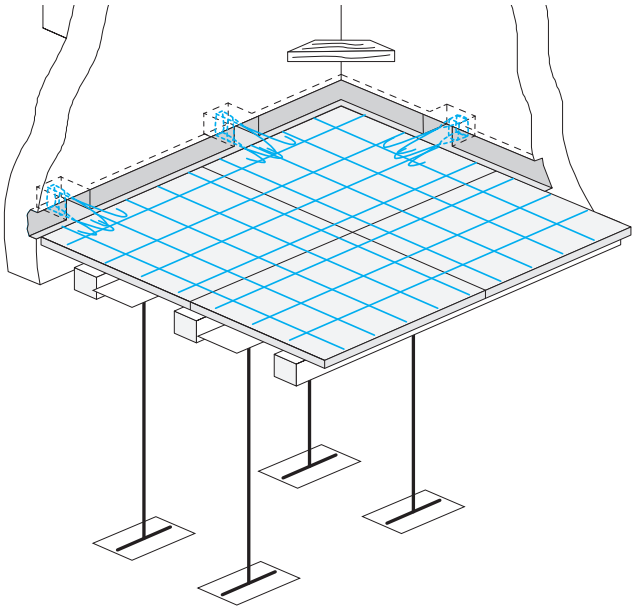
1 - Working at height
8 - Temporary Works

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Formwork and falsework is properly installed and well braced in line with temporary works drawings
- Formwork is properly aligned vertically and/or horizontally and is placed such that the element will be straight and plumb
- Inside of formwork is clean

4 REINFORCEMENT FIXING



Fix reinforcement, using spacer blocks to ensure correct cover requirements. See drawings for reinforcement sizes and placement.

See **MAT.04** Rebar specification →

WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
6 - Manual handling

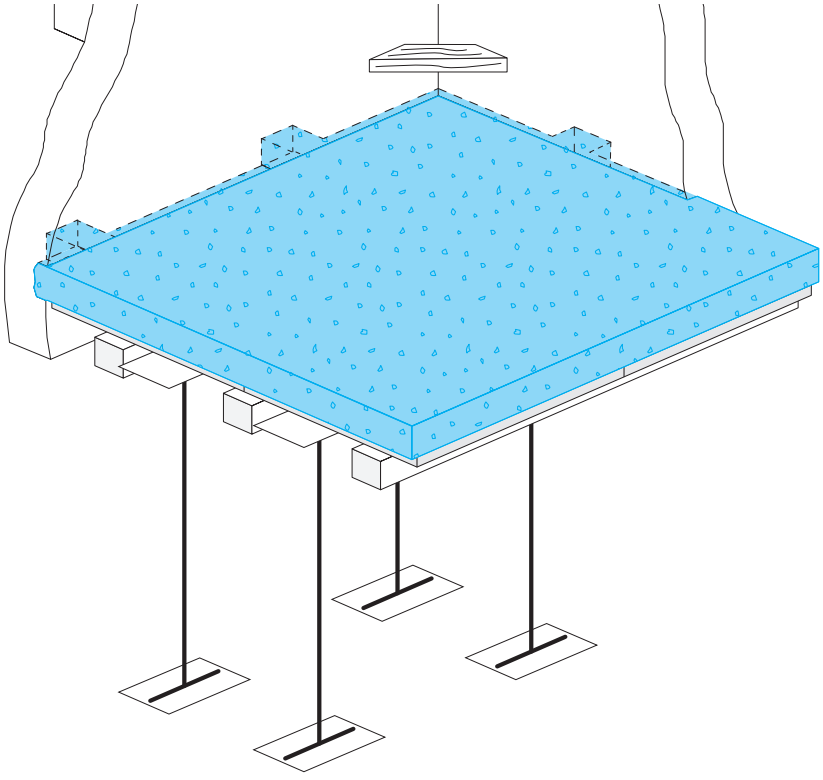
KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire

REPLACEMENT SLAB - CONSTRUCTION SEQUENCE

5 CONCRETE POUR



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply is working before start of concrete works
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Carpenters/other qualified workmen are available to correct any mishap with formwork during concreting
- Thickness of concrete matches drawings
- Concrete is not being dropped from a height of 1.5m or more
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification.

Pour concrete slab. Ensure concrete is well compacted, especially in enclosed areas such as the keys.

See **MAT.03** Concrete specification →

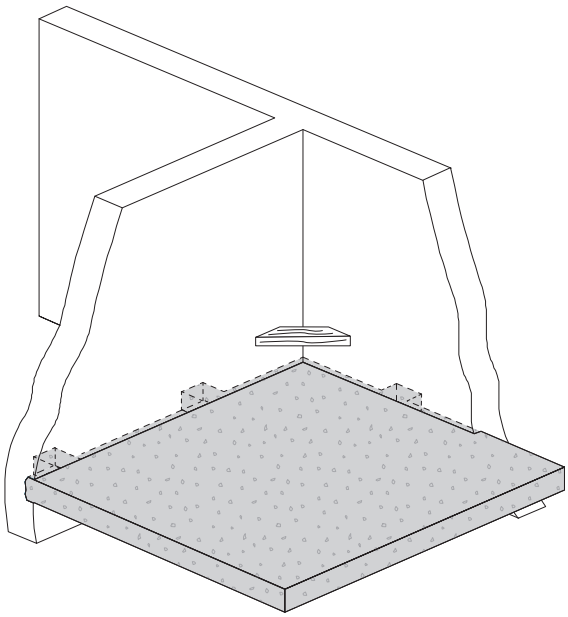
REPLACEMENT SLAB - CONSTRUCTION SEQUENCE

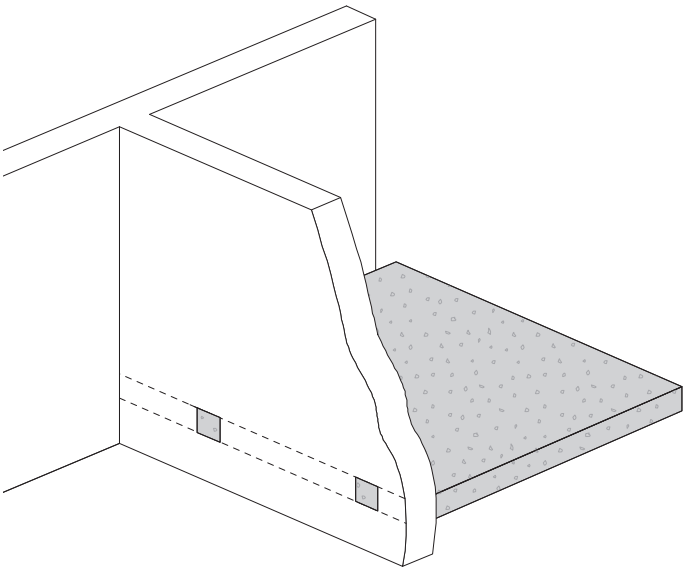
6 CONCRETE CURING

KEY ENGINEERING CHECKS:

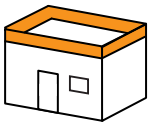
Refer to QA.07 Technical Checklist Form

- Appropriate curing time (14 days) left before formwork is struck
- Concrete is kept moist during curing
- Seal up around penetrations through the floor





Allow concrete to cure for 14 days before striking formwork. Use wet jute bags or mats to keep concrete moist during curing. Seal up any penetrations through the floor, such as for pipes.



RF.08 | PARAPET STRENGTHENING

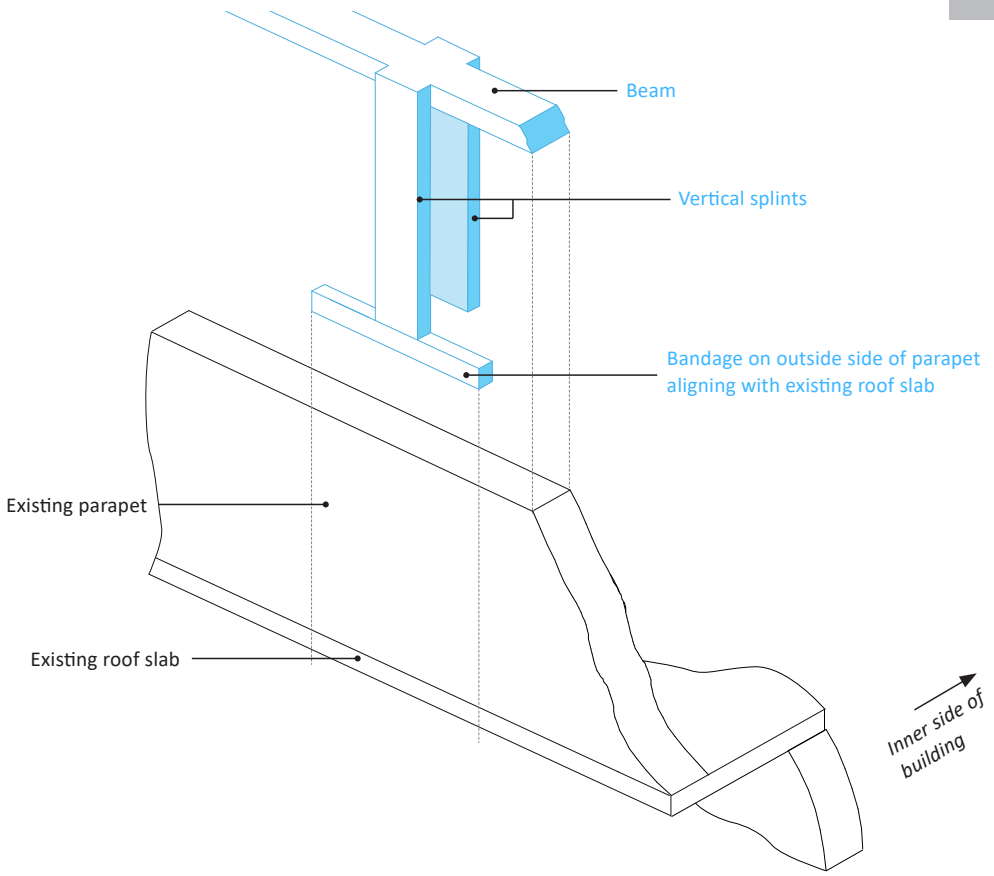
Strengthening the parapet will prevent it from falling and injuring people or blocking exits in the event of an earthquake.

Before carrying out parapet stregthening, consider if it is possible to remove the parapet and replace it with a lightweight, non-combustible solid construction as this will be less dangerous in an earthquake while ensuring a safe exit.

If parapet is in line with the wall below, it should be jacketed as part of the wall in line with RF.02 on RC jacketing.

The construction method that follows should be used if the parapet does not align with the wall below.

3D view - Exploded



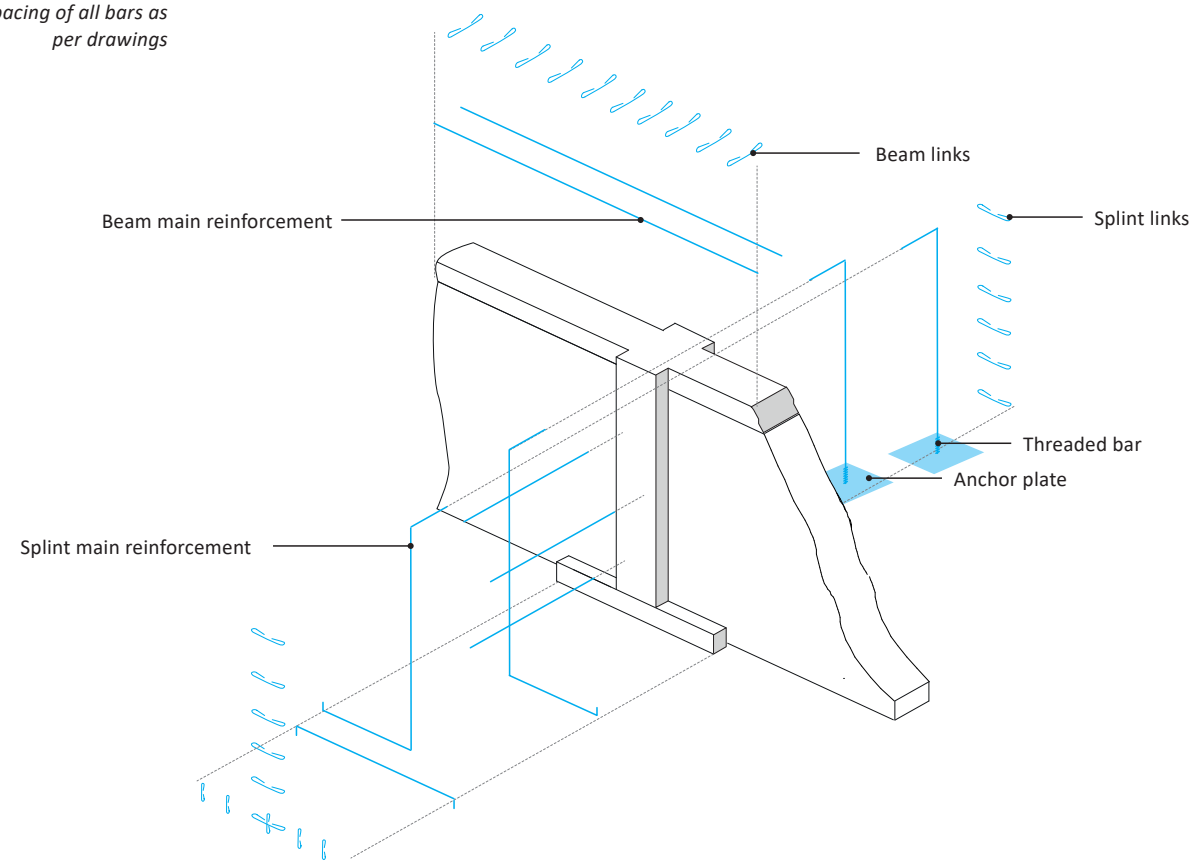
This technique involves the following:

- A **Working at height**
- A **Power tools**
- A **Manual handling**
- A **Working with hazardous substances**
- A **Exposure to lead paint**

REINFORCEMENT 3D VIEW

Reinforcement 3D view - Exploded

Length, size and spacing of all bars as per drawings



PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

1 SURFACE PREPARATION

WATCH OUT:

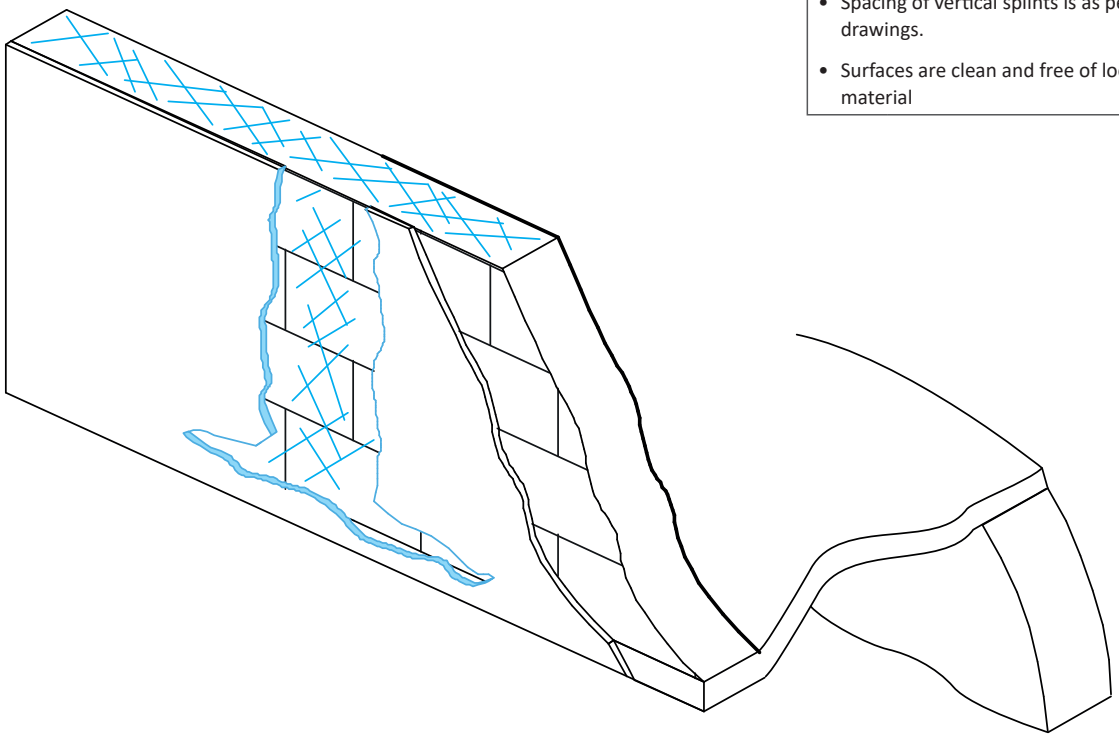
Refer to Chapter 3.5.

1 - Working at height
2 - Power Tools
8 - Temporary Works
10 - Exposure to lead paint

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing of vertical splints is as per drawings.
- Surfaces are clean and free of loose material



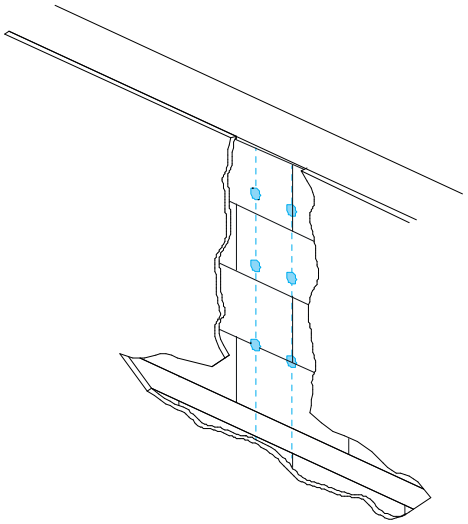
METHOD:

Remove finishes and roughen/score the surface where the beam and splints will be placed. Surface should be clean and free of any loose material.

See **MAT.04** Rebar specification →

PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

2 ANCHORAGE PREPARATION



WATCH OUT:

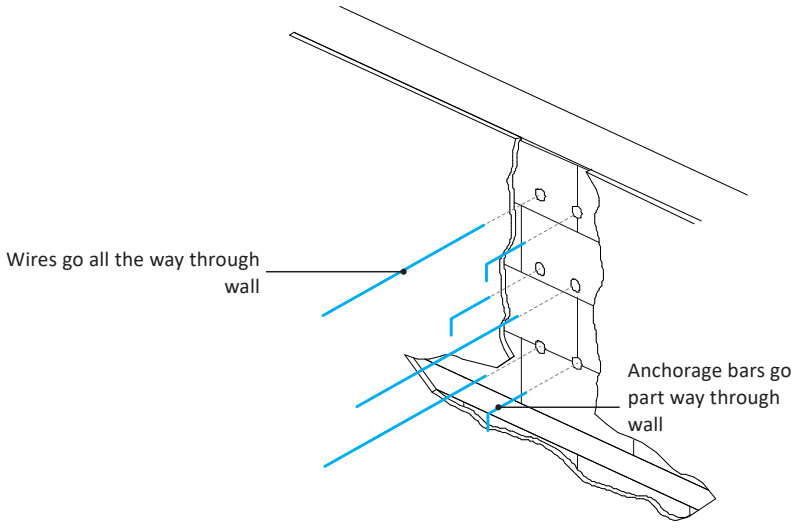
Refer to Chapter 3.5.

1 - Working at height
2 - Power Tools
8 - Temporary Works

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Spacing and depth of anchorage holes is as per drawings
- Reinforcement placement, sizes and spacing matches drawings (alternating between bars and wires)
- Reinforcement meets requirements in specification

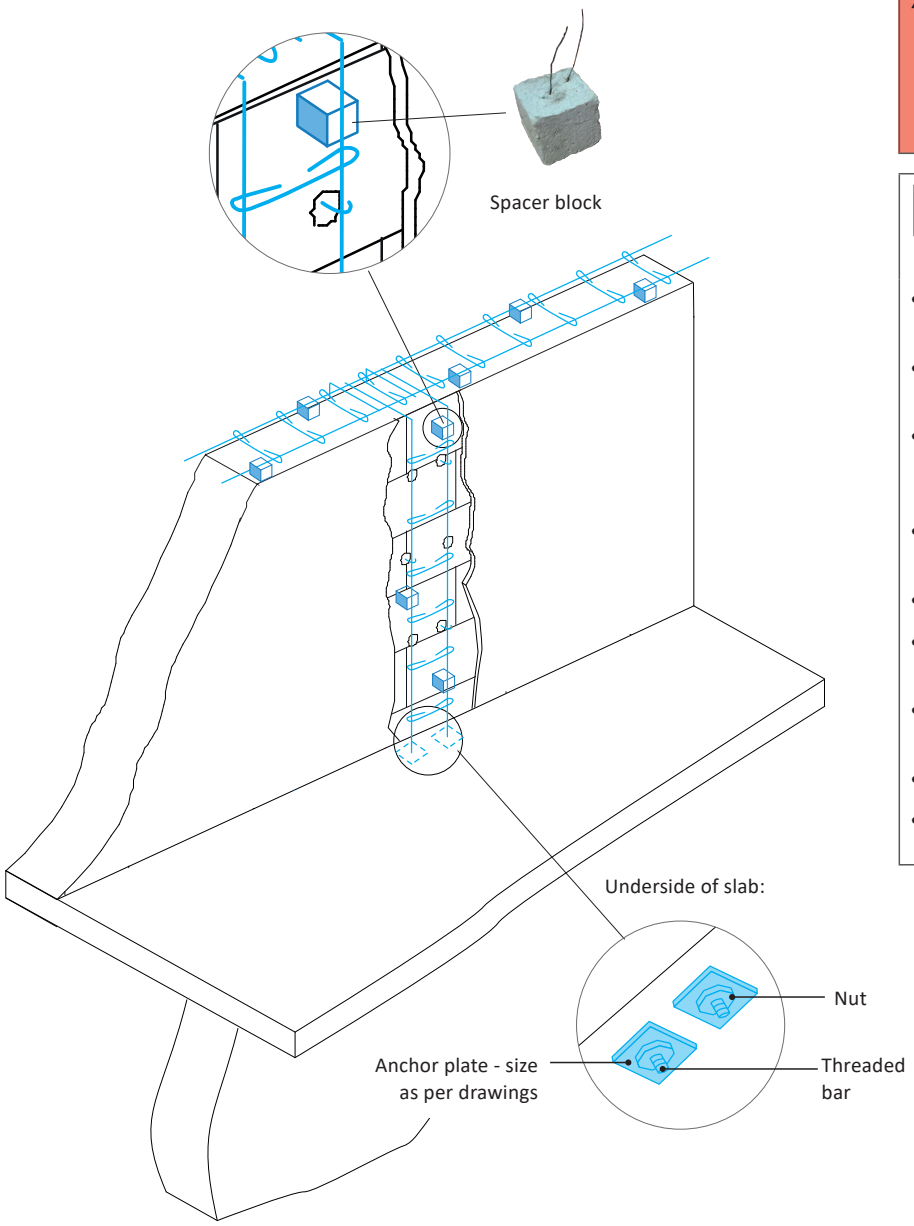


Make staggered holes for anchorage bars, see drawing for the correct number and spacing. Fix anchorage bars and wire through openings alternating as shown.

See **MAT.04** Rebar specification →

PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

3 REINFORCEMENT FIXING - 1



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
2 - Power Tools
6 - Manual Handling
8 - Temporary Works

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Adequate working space provided for the installation of reinforcement
- Reinforcement placement, sizes and spacing matches drawings
- Reinforcement bars are straight and bent sections are discarded rather than straightened out
- Reinforcement meets requirements in specification
- Cover requirements are met
- Lap lengths are at least the minimum given on drawings
- Reinforcement is properly tied with binding wire
- Anchor plate size matches drawings
- Internal bars are fixed securely at underside of slab as shown

Fix rebar using spacer blocks to ensure correct cover is acheived. Ensure rebar at internal face is fully anchored - holes should be drilled through the slab to allow threaded bars to go through the slab and be fixed at the underside with anchor plates and nuts

See **MAT.04** Rebar specification →

PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

4 REINFORCEMENT FIXING - 2

WATCH OUT:

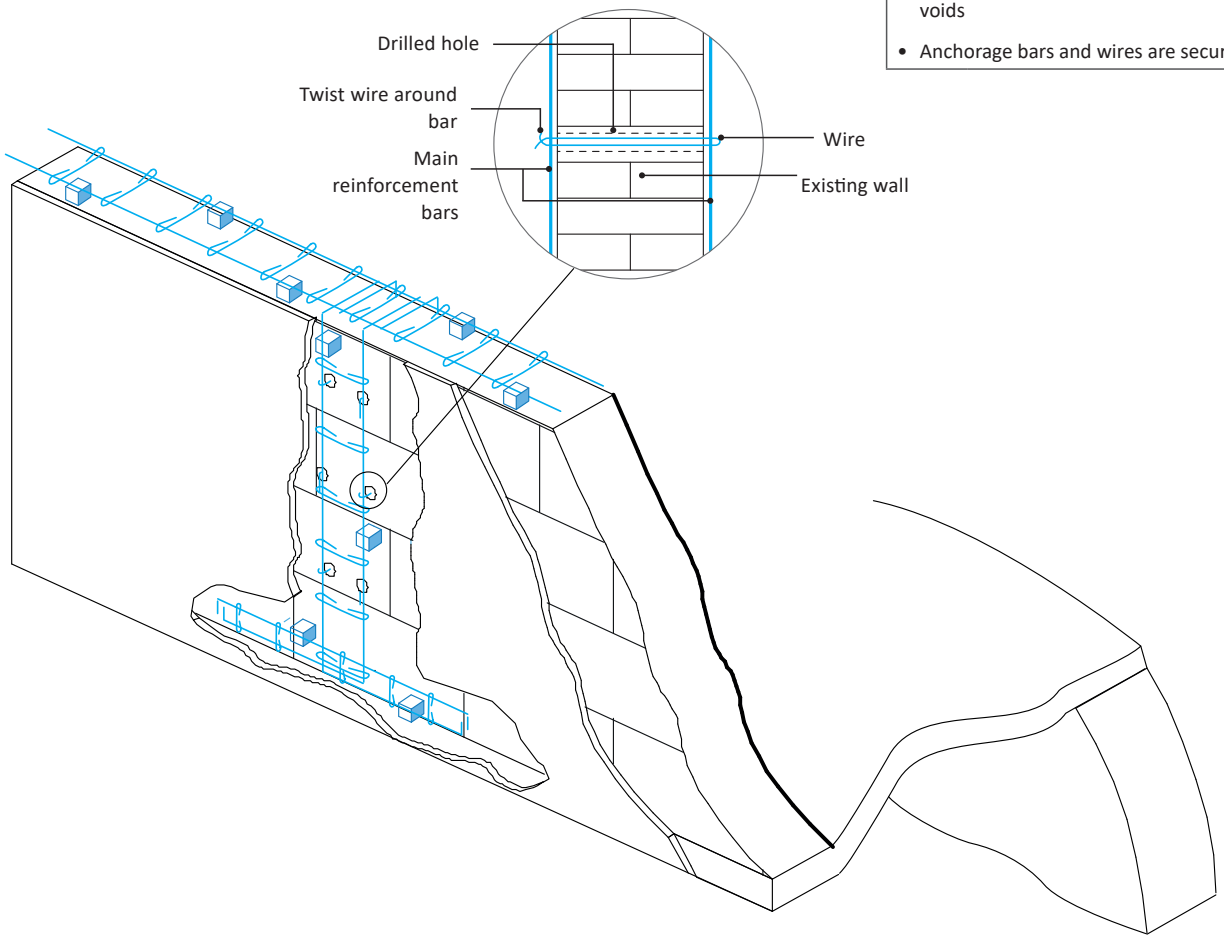
Refer to Chapter 3.5.

1 - Working at height
6 - Manual Handling
8 - Temporary Works
9 - Hazardous Materials (cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Cement slurry mix is correct
- Anchorage holes are well filled with no voids
- Anchorage bars and wires are secure

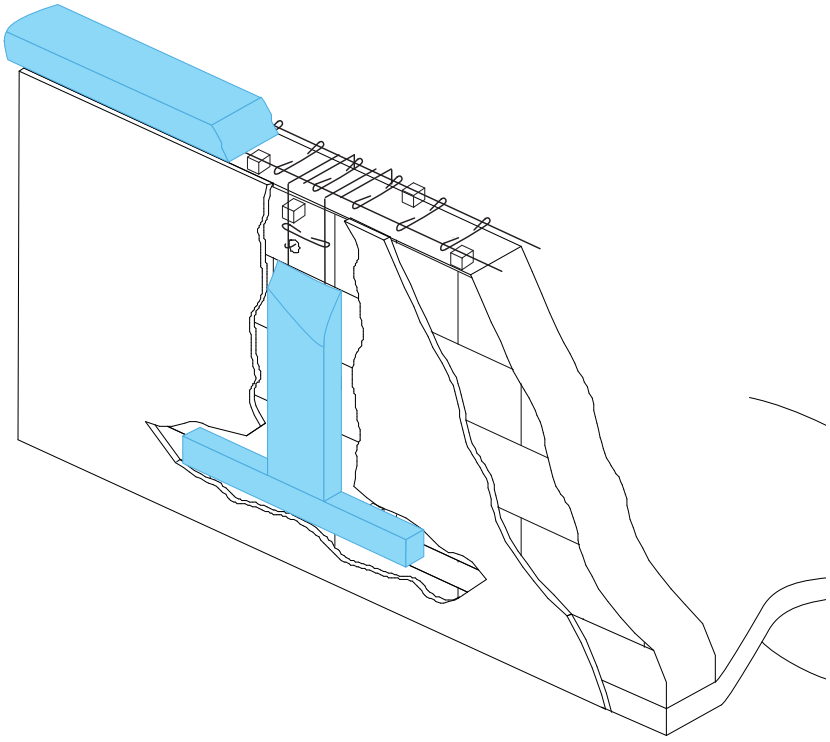


Secure anchorage wire around vertical reinforcement and return through hole - See detail. Fill the anchorage holes with cement slurry.

See **MAT.04** Rebar specification →

PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

5 CONCRETE APPLICATION



Apply concrete mixture.

WATCH OUT:

Refer to Chapter 3.5.

1 - Working at height
6 - Manual Handling
8 - Temporary Works
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Ensure all the required tools and materials are on site before the start of concrete works
- Ensure electricity supply to site is working before start of concrete works
- Weather is appropriate for concrete application
- Concrete mix and water content matches specification
- Concrete slump testing has been done
- Wet wall and apply cement slurry before applying concrete layers
- Dimensions of concrete matches drawings
- Concrete is not overtrowelled. It needs to be quickly smoothed then move on to the next section.
- Mixed concrete is not used if it has been waiting for over 30 minutes
- Concrete is well compacted (no voids)
- Concrete is poured in a single operation. If this is not possible, cold joints have been prepared as per the specification
- Cement slurry has been cleaned from areas where concrete has not been applied

See **MAT.03** Concrete specification →

PARAPET STRENGTHENING - CONSTRUCTION SEQUENCE

6 CONCRETE CURING

WATCH OUT:

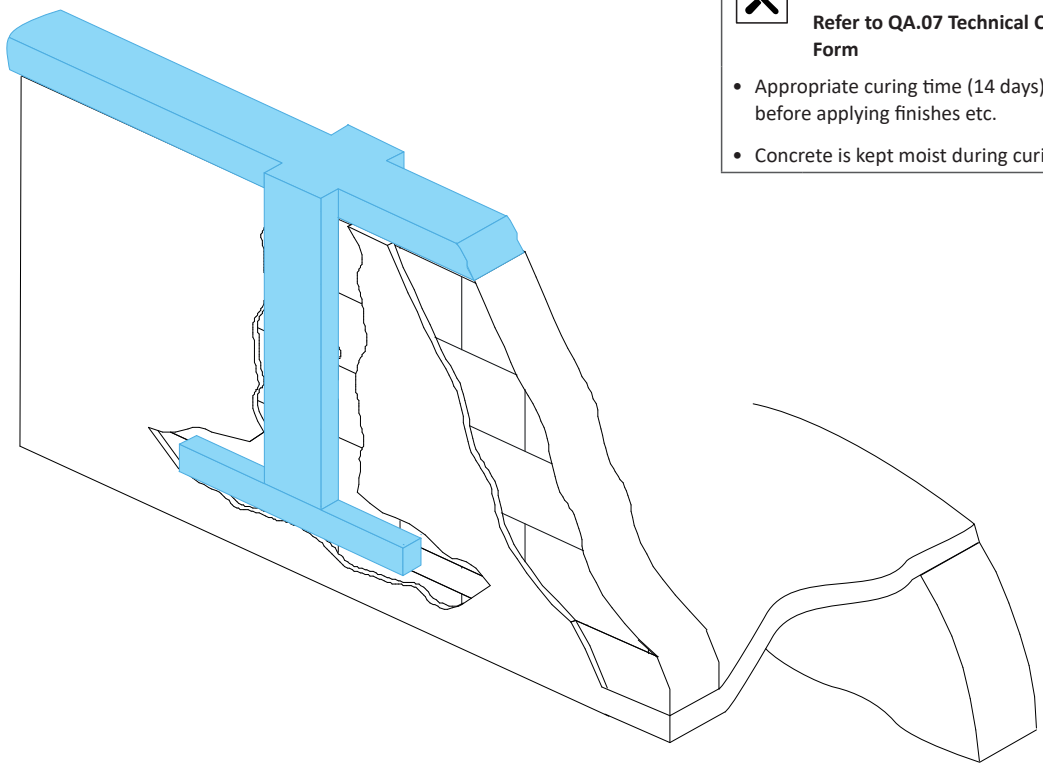
Refer to Chapter 3.5.

1 - Working at height
6 - Manual Handling
8 - Temporary Works
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Appropriate curing time (14 days) left before applying finishes etc.
- Concrete is kept moist during curing

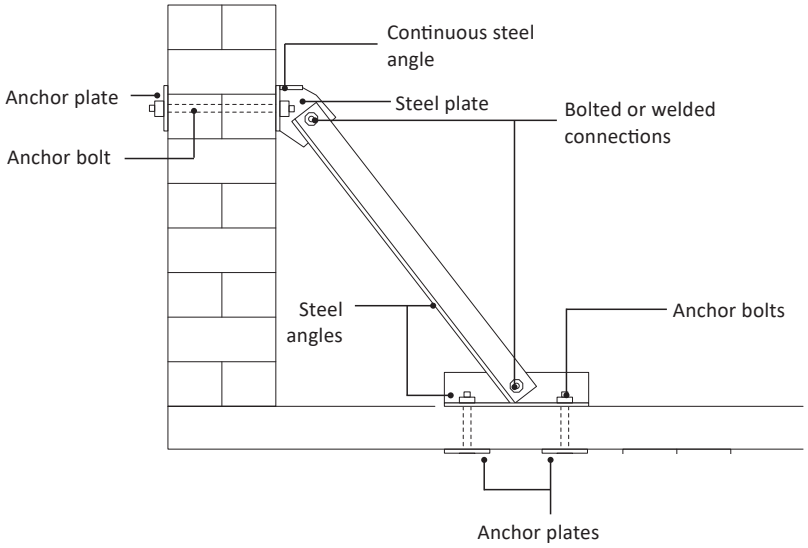


Cure concrete, keeping it wet for at least 7 days.

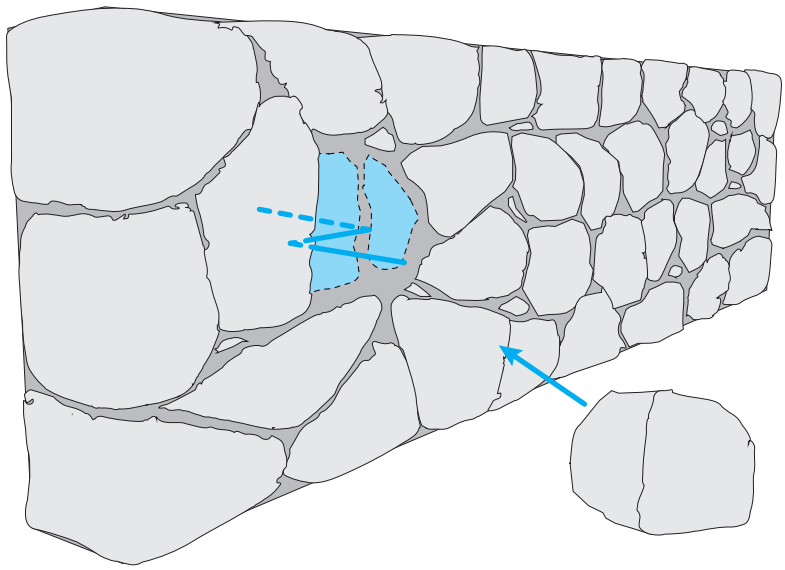
See **MAT.03** Concrete specification →

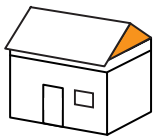
PARAPET STRENGTHENING - RF.08B

If it is possible to install without obstructing walkways, steel bracing to the parapet may also be used to strengthen the parapet.



When it is not possible to drill through full wall thickness for GI wire, remove stone on one side of wall. Insert wire through exposed mortar joint and bend to go around removed stone before reinstating the stone.

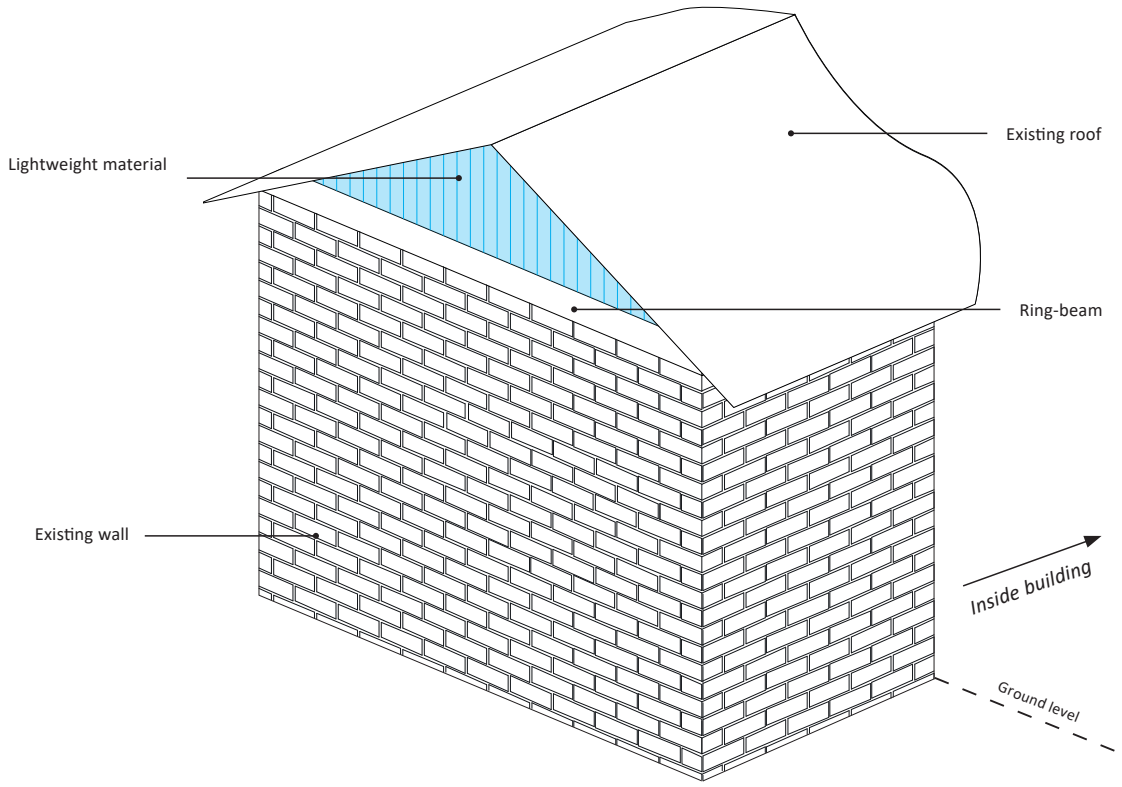




RF.09 | GABLE ALTERATIONS

Replacing a masonry gable with lightweight materials reduces the loading during an earthquake and reduces the risk of collapse.

3D view

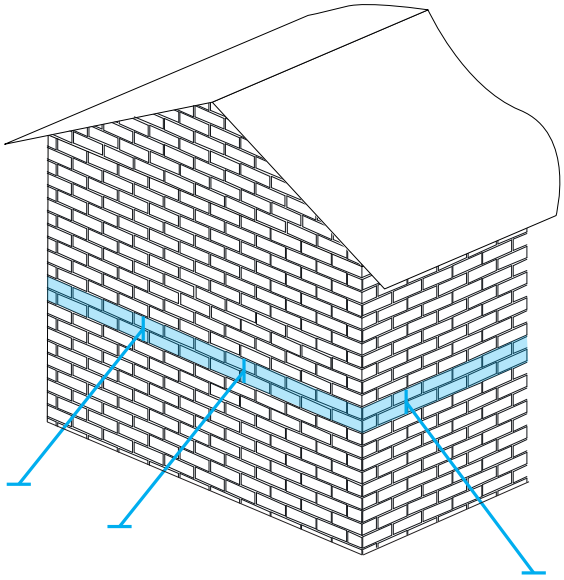


This technique involves the following:

- A Temporary Works
- A Demolition
- A Manual handling
- A Working at Height
- A Working with Hazardous Substances

GABLE ALTERATIONS - CONSTRUCTION SEQUENCE

1 STABILITY OF EXISTING STRUCTURE



WATCH OUT:

Refer to Chapter 3.5.

8 - Temporary Works

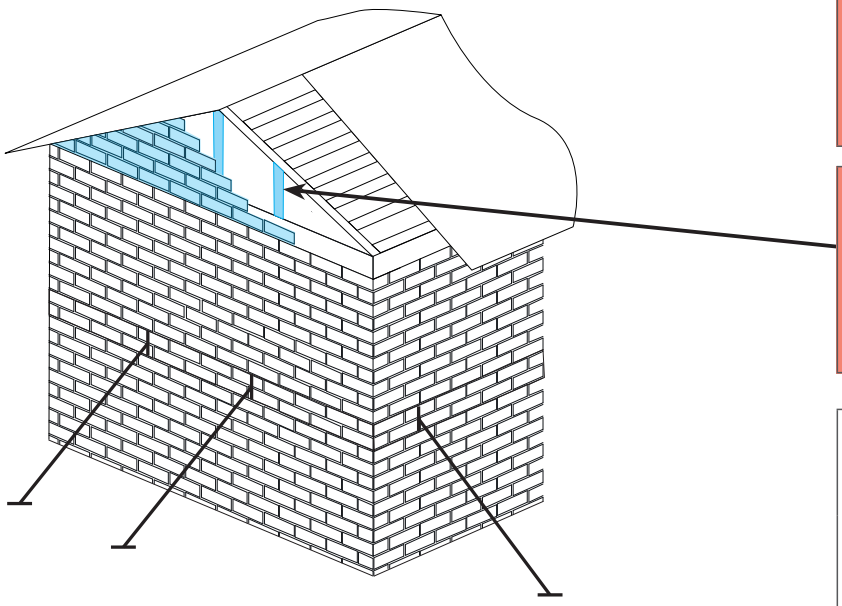
KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Temporary stability and propping is installed in line with temporary works drawings

Stabilise existing roof structure and walls. If necessary, remove roof panels locally.

2 DEMOLITION



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling
7 - Demolition

WATCH OUT:

If there is no end truss, propping will be required - refer to temporary works drawings

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Extent of demolition is marked
- Demolition is carried out safely
- Waste/rubble is removed and site is clean

Safely demolish gable down to same level as the top of other walls. See drawings for details.

GABLE ALTERATIONS - CONSTRUCTION SEQUENCE

3 BANDAGE CONSTRUCTION

WATCH OUT:

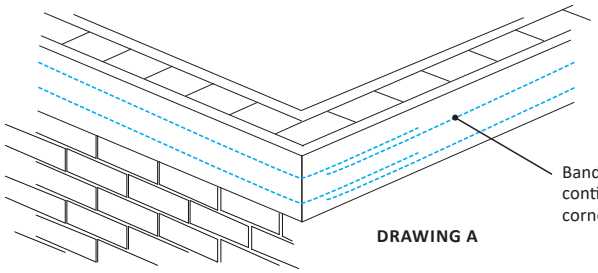
Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling
9 - Hazardous Substance (Cement).

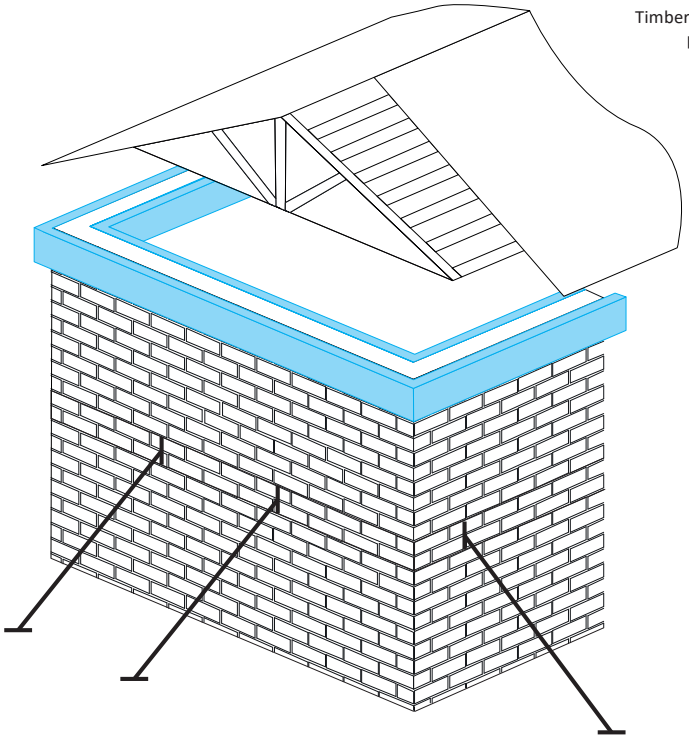
KEY ENGINEERING CHECKS:

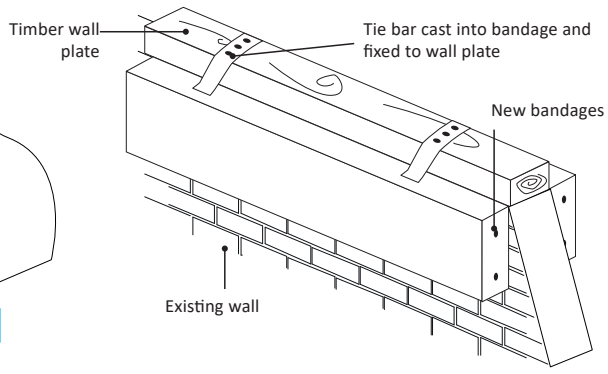
Refer to QA.07 Technical Checklist Form

- Bandage is installed in line with drawings (as per RF.04)
- Reinforcement is continuous at corners and junctions (See drawing A)
- Wall plate is installed in line with drawings. Wall plate is securely tied into bandage (See drawing B)

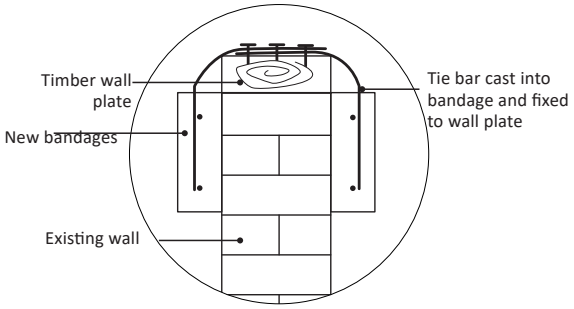


DRAWING A





DRAWING B



If ringbeam is not already in place, install bandage and wall plate at top of wall - see drawings for details.

GABLE ALTERATIONS - CONSTRUCTION SEQUENCE

4 REPLACE GABLE

WATCH OUT:

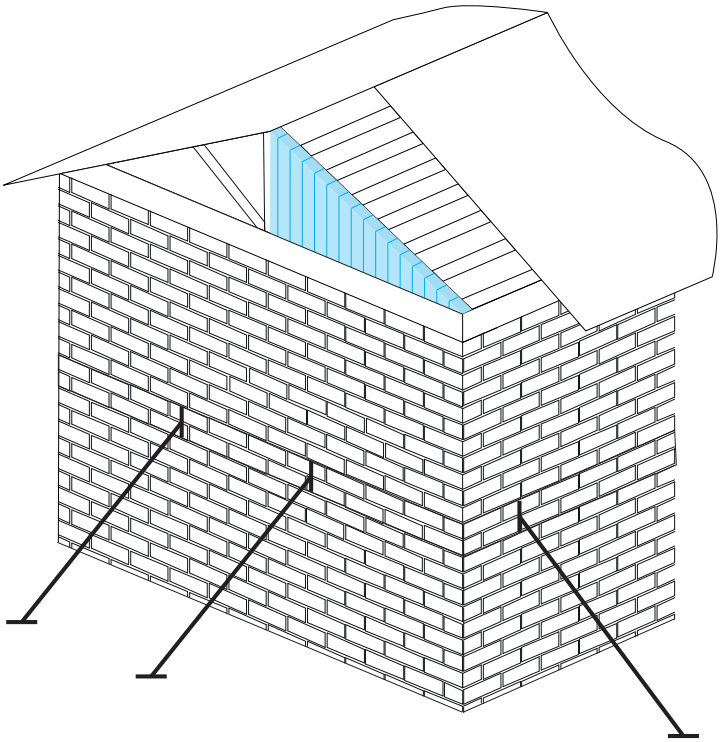
Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Material specification in line with drawings
- Fixings match with drawings
- Gable material is fixed securely into wall plate and into roof structure.



Replace roof sections if necessary. Fix lightweight material into gable in line with drawings. A non-combustible material such as corrugated iron is preferred for fire safety.

RF.10 | ALTERATIONS OF EXISTING OPENINGS

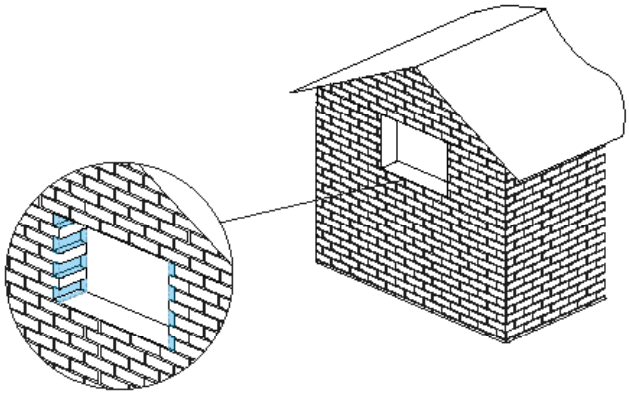
Filling in existing openings will improve the performance of the wall as a shear wall in unreinforced masonry buildings, and prevent short column behaviour in reinforced concrete frame buildings.

Existing openings that should be altered include openings that are not required, such as unused ventilation openings as shown in the image below.

Existing openings prior to retrofitting

Openings closed after retrofitting

1 REMOVE ALTERNATE EDGE BRICKS



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling
7 - Demolition

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Demolition is carried out safely

Remove alternate edge bricks of existing masonry either side of opening. If this is not possible, place rebar anchorages every three brick courses to connect the added wall portion with the existing one as described in RF.05.

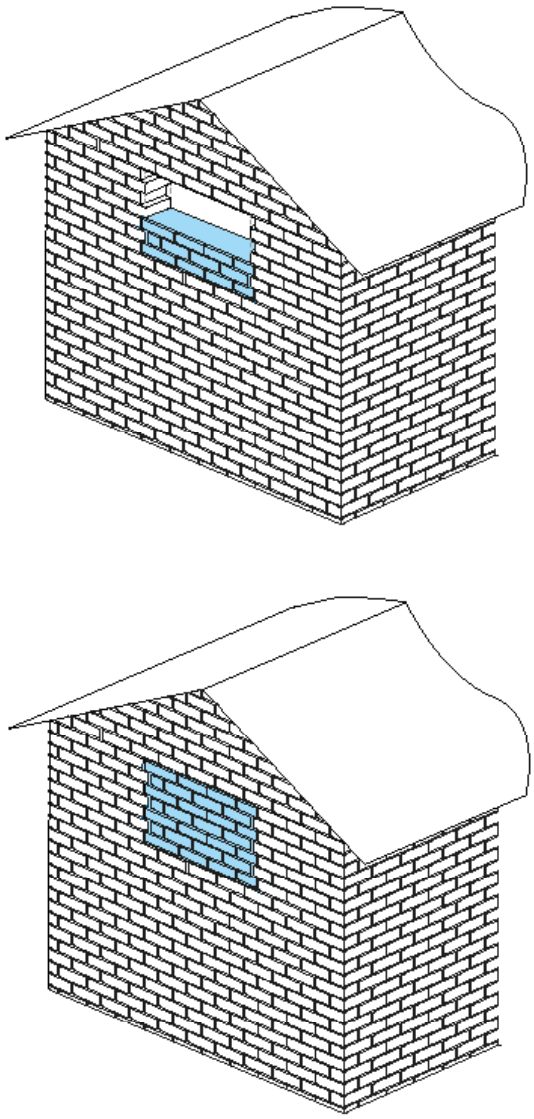
This technique involves the following:

- A **Working at height**
- A **Power tools**
- A **Manual handling**
- A **Working with hazardous substances**
- A **Exposure to lead paint**

Image reference: NSET

ALTERATIONS OF EXISTING OPENINGS - CONSTRUCTION SEQUENCE

2 FILL EXISTING OPENING



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling
9 - Hazardous Substance (Cement).

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Mortar joints do not exceed 10mm
- Mortar matches specification
- Bricks match specification and pass field test requirements
- Brickwork is laid as shown in chapter 4.
- No slush joints - mortar is applied to vertical face of brick before laying not after
- Mortar is not laid for more than 3-5 bricks in advance
- Mortar is used within 30 minutes from mixing
- Infill is set out with string and checked that it is plumb
- Cement slurry mix is correct

Fill the existing opening with masonry in line with the wall as described in Chapter 4.

RF.11 | REPAIR WORKS: MASONRY DAMAGE

MASONRY CRACKING

For improvement in capacity of wall, relevant retrofitting options are described, applied in the building according to the design drawings. Common examples of earthquake induced cracking in masonry walls are shown below.

Diagonal cracks

Corner separation

The following repair works are described in this section:

- *1: Cement grouting of cracks*
- *2: Rebuilding damaged wall sections*
- *3: Repairing exposed reinforcement*

This technique involves the following:

- **Working at height**
- **Manual handling**
- **Working with hazardous substances**
- **Exposure to lead paint**

Image references:
Repair and Retrofitting Manual for Masonry Structures, Government of Nepal

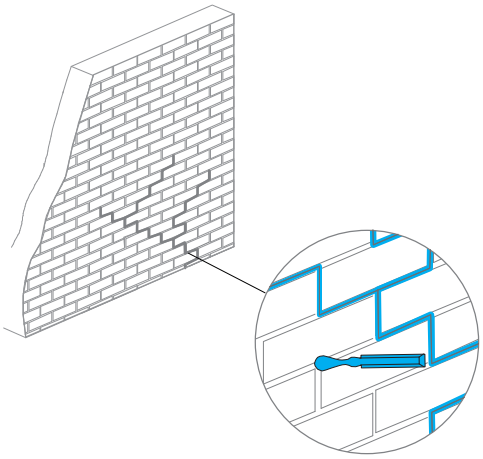
REPAIR WORKS - MASONRY CRACKING: CEMENT GROUTING

1 REMOVE LOOSE MATERIAL

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Waste/rubble is removed and site is clean



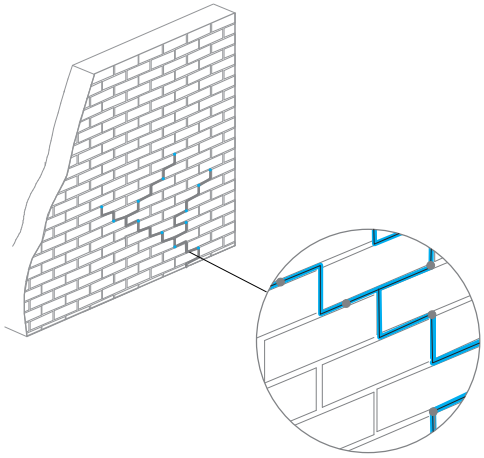
Remove plaster in the vicinity of crack exposing the cracked bare masonry. Clean the area and make the shape of the crack in V-shape by chiselling out.

2 FIX GROUTING NIPPLES IN V-GROOVE AND CLEAN THE CRACK

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material



Fix the grouting nipples in the V-groove on the faces of the wall at spacing of 15-20cm centre to centre. Clean the crack with compressed air through nipples to ensure that the fine and loose material inside the cracked masonry has been removed.

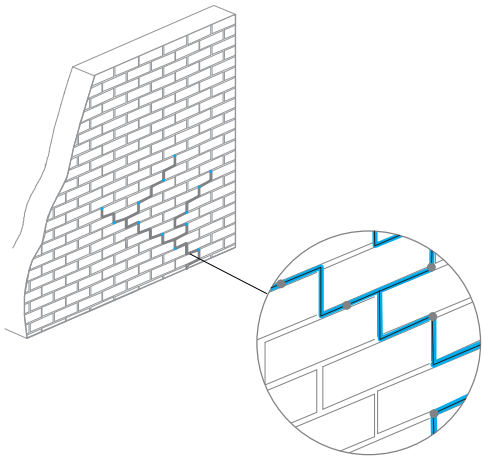
REPAIR WORKS - MASONRY CRACKING: CEMENT GROUTING

3 SEAL THE CRACK

WATCH OUT:

Refer to Chapter 3.5.

9 - Hazardous Substance (Cement)



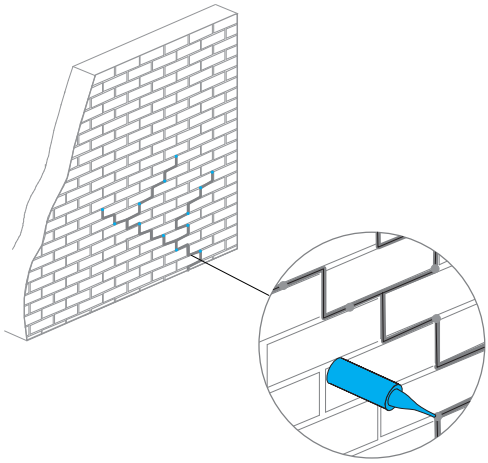
Seal the crack on both faces of the wall with 1:3 ratio cement mortar and allow to gain strength.

4 INJECT THE GROUT

WATCH OUT:

Refer to Chapter 3.5.

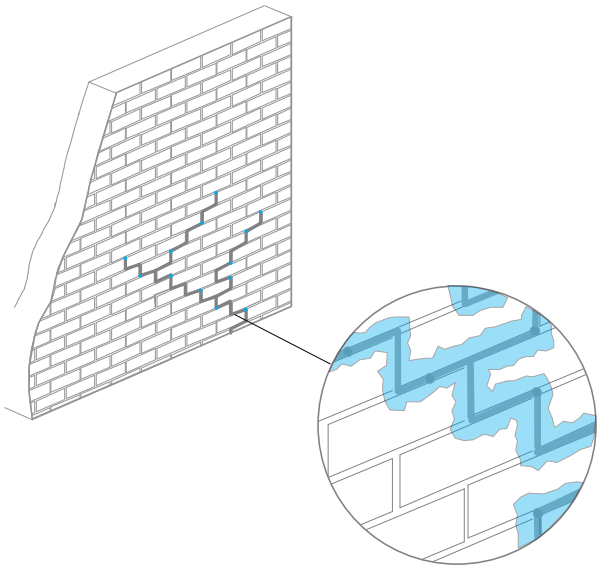
9 - Hazardous Substance (Grout)



Inject the grout from lower most nipple until it comes out from the next higher nipple and then move to next higher nipple.

REPAIR WORKS - MASONRY CRACKING: CEMENT GROUTING

5 RE-PLASTER THE SURFACE AND FINISH



WATCH OUT:

Refer to Chapter 3.5.

6 - Manual Handling
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

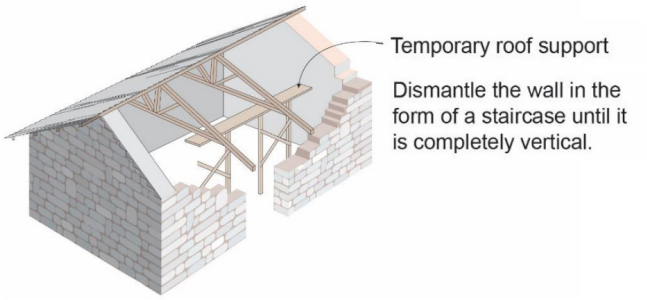
Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material
- Plaster is well-compacted (no voids)
- Waste/rubble is removed and site is clean

After injection of grout through all the nipples has been completed, re-plaster the surface and finish as required.

REPAIR WORKS - MASONRY CRACKING: REBUILDING

1 INSTALL TEMPORARY PROPPING



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Temporary Works

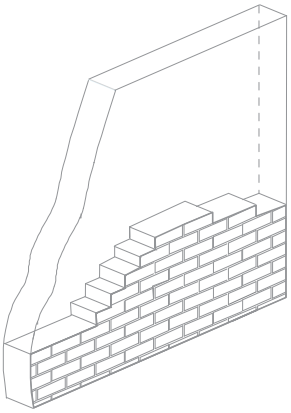
KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Temporary stability and propping is installed in line with temporary works drawings
- Waste/rubble is removed and site is clean

Install temporary propping to support the floors and walls above that depend on the extent of the damaged wall.

2 REMOVE DAMAGED PORTION OF THE WALL



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
6 - Manual Handling
7 - Demolition

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

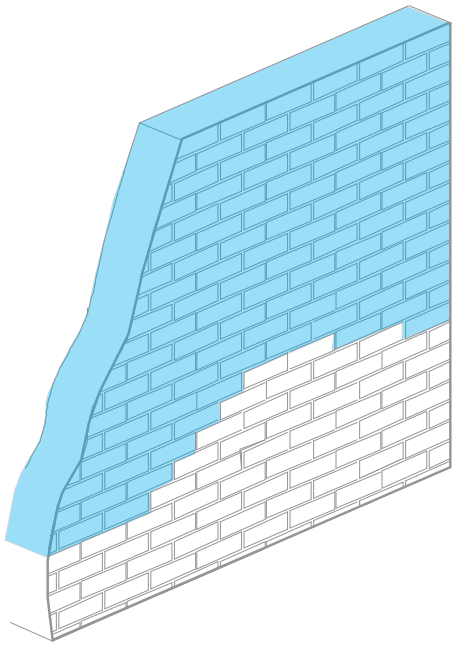
- Existing structure is stable
- Demolition is carried out safely

If the wall has a spread or humped on only one face, remove only damaged portion. Complete reconstruction is required for walls that have permanent lateral distortion or humping through the width of the wall, the distressed portion of the wall must be completely removed and reconstructed.

Image references:
Repair and Retrofitting Manual for Masonry Structures, Government of Nepal

REPAIR WORKS - MASONRY CRACKING: PARTIAL REBUILDING

1 REBUILD DAMAGED PORTION OF WALL



WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Mortar joints do not exceed 10mm
- Mortar matches specification
- Bricks match specification and pass field test requirements
- Brickwork is laid as shown in chapter 4.
- No slush joints - mortar is applied to vertical face of brick before laying not after
- Mortar is not laid for more than 3-5 bricks in advance
- Mortar is used within 30 minutes from mixing
- Wall line is set out with string and checked that it is plumb
- No more than half the height of the wall is laid in a day
- Cement slurry mix is correct

Rebuild damaged portion of wall using the same mortar as used in the existing construction, or as shown on construction drawings. Where wall is being partially rebuilt, use concrete or cement grout to completely fill all voids.

Once the wall has been built allow 48 hours for the mortar to set before removing all temporary propping.

Refer to RF.05 - addition of a new wall for construction methodology for full new or replaced wall.

REPAIR WORKS - MASONRY CRACKING: EXPOSED REINFORCEMENT (IF THE DIAMETER OF THE REBAR IS NOT REDUCED)

Follow the repairs below if the diameter of the rebar is not reduced.

1 CLEAN THE EXPOSED REBAR

Where exposed rebar is detected, clean the surface with a brush to remove any loose material.

WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Existing structure is stable
- Waste/rubble is removed and site is clean

2 APPLY CONCRETE

Apply microconcrete to surface to cover exposed rebar completely.

WATCH OUT:

Refer to Chapter 3.5.

1 - Working at Height
9 - Hazardous Substance (Cement)

KEY ENGINEERING CHECKS:

Refer to QA.07 Technical Checklist Form

- Surface is clean and free of loose material
- Concrete mix and water content matches specification
- Concrete is well-compacted (no voids)
- Concrete is applied in a single operation
- Cement slurry mix is correct

If the corrosion has resulted in a loss of the rebar section, the slab retrofit will need to be designed by an engineer to ensure the correct capacity of the slab. It is likely that the bar will need replacing or other strengthening works will be required if there is significant corrosion to the slab reinforcement.

Image reference: NSET