Speedfloor System

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

Name and Address of Certificate Holder:	Performance Appraisal Certificate No.
M/s Jindal Steel & Power Ltd **First Floor, Tower B, Jindal Centre, Plot No.4, Sector 32** **Gurgaon – 122001 (Haryana)** **Tel: 0124-6689000**	PAC No **1013-S/2014** Issue No. **01** Date of Issue: **16.10.2014**

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
Government of India
Core 5A, First Floor, India Habitat Centre,
Lodhi Road, New Delhi – 110 003

Tel: +91-11-2463 8096, 2463 8097; Fax: +91-11-2464 2849
E-mail: bmtpc@del2.vsnl.net.in Web Site: http://www.bmtpc.org

PERFORMANCE APPRAISAL CERTIFICATE

FOR

SPEEDFLOOR SYSTEM

ISSUED TO

M/s JINDAL STEEL & POWER LTD.

STATUS OF PAC 1013- S/2014

S. No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1.	2.	3.	4.	5.	6.	7.	8.	9.
1	01	16-10-2014	16-10-2016	--	--	15-10-2016		

Dr. Shailesh Kr. Agarwal
Chairman, TAC
& Member Secretary, SBRI
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 6A, 1st Floor, India Habitat Centre, Lodhi Road
New Delhi-110 003

CONTENTS

PART 1 CERTIFICATION

1.1 Certificate Holder: M/s Jindal Steel & Power Ltd.

1st Floor, Tower B, Jindal Centre
Plot No. 4, Sector 32
Gurgaon - 122001
C. No. 0124-6689000

1.2 Description of System

1.2.1 *Name of the System*– 'Speedfloor System ' – in collaboration with M/s Speedfloor Holdings Ltd, New Zealand

1.2.2 *Brief Description*

Speedfloor system is a suspended concrete flooring system using a roll formed steel joist as an integral part of the final concrete and steel composite floor. The Speedfloor system essentially is a hybrid concrete/steel tee-beam in one direction and an integrated continuous one-way slab in other direction. The joists of different depths are manufactured from pre-galvanized high tensile steel in a one pass roll former, where it is roll formed, punched, pressed and slotted in a fully computerized machine manufactured in New Zealand. The joist depth and the concrete thickness are varied depending on the span, imposed loads and other functional considerations. The Speedfloor composite floor system is suitable for use in all types of construction. The Speedfloor joists are custom manufactured to suit particular job conditions.

1.2.3 *Components*

1.2.3.1 *The joist*

The joist shall be manufactured from G 350 Z275 pre-galvanized steel conforming to AS 1397:2001.
Size may be any one of the following, depending upon the design requirements: 200mm, 250mm, 300mm, 350mm and 400mm.
Concrete thickness may be 75mm or 90mm as required.

The joist weight vis-à-vis the depth are as shown in Table 1:

Table 1

Depth (mm)	Weight (kg/ lin m)
200	9.41
250	10.59
300	11.76
350	12.94

400	14.12

The top section of the joist is embedded in concrete and has 4 functions:

(i) It is the compression element of the non-composite joist during construction

(ii) It is a 'chair' for the welded mesh or the reinforcement which develops negative moment capacity in the concrete slab over the joist

(iii) It locks in and supports the slab shuttering system (lock bar and plywood forms)

(iv) It becomes a continuous shear connector for the composite system. The bottom section of the joist acts as a tension member both during the construction phase and when the joist is acting compositely with the slab.

1.2.3.2 *The lockbar*

The lockbars support the temporary plywood formwork between the joists during construction. They shall be spaced approx. 300mm apart and engage in the slotted holes punched in the top section of the joist. They also maintain the exact spacing of the joists.
The standard lockbars when installed will position the joists 1230mm, 930mm or 630mm apart. There are also special adjustable lockbars that will position the joists in increments of 50mm from 330mm upto 1530mm. Other type of lockbars provide for special situations such as cantilevers or lowered soffits.

1.2.3.3 *Temporary plywood formwork*

High density paper overlaid 12mm shuttering plywood conforming to IS 4990:2011 or equivalent is used as formwork to produce a good finish to the underside of the slab. The rigid plywood sheets are used in conjunction with the lockbars and when locked in place, provide lateral stability to the entire Speedfloor system during the construction phase.

1.2.3.4 *Reinforcing mesh*

Reinforcing mesh made of 8mm dia, bar (fy 415N/mm^2) placed at 200 mm c/c in both directions is laid and tied into place. No chairs are required as it is held off the plywood forms by the top section of the joist, which becomes embedded in the concrete.

1.2.3.5 *Concrete*

(i) Minimum grade of concrete shall be M25 as per IS 456:2000. It should preferably be batched at 60mm and super plasticized to 110mm slump to provide good placement and shrinkage characteristics. A curing compound should be used and an expanding agent may be introduced in consultation with the engineer to further control shrinkage during the curing period.

(ii) The concrete should initially be placed evenly and continuously over the area to be formed. Special attention should be given to ensure the

concrete is screeded and finished to the specified thickness so that designed deflections are achieved in the Speedfloor joists and the supporting structures.
(iii) In carpark structures an expanding agent is generally used to reduce the effect of shrinkage during initial cure and a curing compound is used to help control the curing process.

1.2.4 *Accessories*

1.2.4.1 *Edge angles*

A standard edge form shall be available in two heights – 75mm & 90mm.Special heights and specially shaped edge angles may be manufactured but would require longer lead times.

1.2.4.2 *Jointers*

Precut sections of galvanized sheet steel may be supplied to overlay joints in the ply to ensure they are flush and remain well supported while the concrete is poured.

1.2.4.3 Lockbar Hanger Angles

A galvanized steel angle with pre-punched lockbar holes shall be used for situations where the lockbars need support on slab edges parallel to the joists.

1.3 Assessment

1.3.1 *Scope of assessment*

1.3.1.1 Scope of assessment included conformance of manufactured steel joists to the specified requirements for suspended concrete flooring/roofing system in following structures:

i) Steel frame
ii) RCC frame
iii) Poured insitu or precast concrete frames
iv) Light gauge steel frames
v) Multistory residential complexes
vi) Conventional brick wall constructions

1.3.2 *Basis of Assessment*

Assessment of the suitability of the Speedfloor system manufactured at M/s Jindal Steel & Power Ltd., Raigar as framed structure is based on

(i) Inspection of the factory for production and quality assurance
(ii) Design calculations and Load Charts for all types of joists for different spacing and thickness of concrete slab
(iii) Fire Rating Certification according to SA Standard

(iv) Inspection of OPJIT Boys Hostel at Punjipathra, Raigarh.

1.4 Use of the Speedfloor System and Limitations

1.4.1 The system shall be used as framed steel structure in all types of construction for laying RCC roof.

1.4.2 *Limitation of Use*

Maximum length of joist which can be used is 10m.

1.4.3 *Durability*

The Certificate Holder shall provide necessary structural warranty ensuring durability of the system to the user, on demand.

1.5 Conditions of Certification

1.5.1 *Technical Conditions*

(i) Raw materials and the finished joists shall conform to the requirements of the prescribed specifications.

(ii) The building to be constructed using Speedfloor system shall be in accordance with the specifications, manufacturing & construction process prescribed by the manufacturer and designed by competent structural Engineers.

(iii) Buildings to be constructed with the Speedfloor system should be constructed only with technical support or supervision by qualified engineers and builders, based on structural designs and Seismic evaluation & Wind forces carried out to comply with prevailing standards; this is applicable even for low-rise and affordable mass housing to provide safety of structures.

(iv) It is strongly recommended that structural engineers and building designers associated with such type of construction should be thoroughly familiar with the various structural aspects. It is also recommended that Architects and Construction Engineers who undertake such building design and construction gain familiarity with the properties and materials, characteristics of Speedfloor system and its applications.

1.5.2 *Quality Assurance*

The Certificate Holder shall implement & maintain a quality assurance system in accordance with Scheme of Quality Assurance (SQA) given in Annex A attached with this Certificate. Process Flow (Standard Operating Procedure) for Speedfloor is also given in Annex B.

1.5.3 *Handling of User Complaints*

1.5.3.1 The Certificate holder shall provide quick redressal to consumer/user complaints proved reasonable & genuine and within the conditions of warranty provided by it to customer/purchaser

1.5.3.2 The Certificate holder shall implement the procedure included in the SQA. As part of PACS Certification he shall maintain data on such complaints

with a view to assess the complaint satisfaction and suitable preventive measures taken.

1.6 Certification

1.6.1 On the basis of assessment given in Part 3 of this Certificate & subject to the conditions of certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part 1 & 2 of this Certificate, the joists covered by this Certificate are fit for use set out in the Scope of Assessment.

PART 2 CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

2.1 General

2.1.1 The PAC holder shall manufacture these joists in accordance with the requirements specified in the relevant Standards. In addition it shall follow the Company standards specifying requirements of various materials used in the manufacture of these sections (see Part 5)

2.2 Specification of the System

2.2.1 *Specification*

The specifications for raw materials & finished joists shall be as per performance criteria when tested in accordance with the company & relevant Standards listed in Part 5 of this Certificate**.**

2.2.1.1 *Performance requirement*

When tested in accordance with the Structural stability test specified in the relevant Standard, joists shall have a deflection limit of max. L/360 and Ultimate failure stress of joists shall be <=1MPa.

2.2.2 *Technical Specifications*

2.2.2.1 *Raw materials*

(i) *Speedfloor joists* are roll formed from zinc coated steel conforming toIS277:1992.The min mass coating of galvanizing is 275g/m^2.
(ii) The standard steel used is Grade 350 and has a min yield stress of 35 MPa and min. tensile stress of 380MPa.
(iii) The concrete slab decking requires a min compressive strength of 25MPa in 28 days and the steel mesh is of high tensile cold drawn wire conforming to NZS 3422:1975 or equivalent.
(v) *HR plate* shall conform to IS 2062:1999, E250
(vi) *G.I. coil:* 16mm thick for Edge angle and Hanging angle
(vii) *Other components:* Joists, Shoes, Lockbars, 12mm plywood

2.2.2.2 *Permissible tolerances*

(i) Profile: As per relevant drawing
(ii) Length: Plus or minus 2mm
(iii) Straightness: Top and bottom flanges within 3mm per m of length

(iv) Twist: Not more than 10mm when lying flat on the ground under own weight
(v) Service hole position from top: Plus 4mm, minus 0 mm
(vi) Service hole spacing: Plus or minus 10 mm
(vii) Service hole lips formed: No splitting
(viii) Lockbar slot position from top: Plus or minus 1 mm
(ix) Lockbar slot spacing: Plus or minus 5 mm
(x) Pre-camber measured: 2 mm per m of length

2.3 Design Consideration

i) Design of the system shall be based on the Architectural drawings which shall satisfy the various requirements. However, design of any structure shall be done based on the details given in Annex E

ii) The design assumptions, detailed calculations, references to necessary and detailed design drawings shall be made available on demand, if required. The structural design calculations should clearly demonstrate structural integrity and stability including connection details. Design calculations should have proper sketches annotated in English.

iii) In addition, any other requirement regarding safety against earthquake need to be ensured by the designer as per prevailing codal requirements.

iv) Detailing for connection between the wall and the slab, edge support for concrete and masonry and at high bearing & shearing zones shall be part of structural design and drawing.

v) Structural drawings (Fig. 1 to 21) showing Standard details of Speedfloor System are appended a t Annex C.

2.4 Machinery Involved

(i) One Speedfloor Machine (make Howick Ltd, New Zealand) having capacity of 100m/hr and production rate of 800 linear meters per day per shift.

2.5 Manufacturing Process

(i) The joists are manufactured from pre-galvanized high tensile steel in a one pass roll reformer, where it is roll formed, punched, pressed and slotted at a fast production rate.
(ii) The ends are bolted to the joists which are then ready for shipping to site.
(iii) The individually marked joists are placed on the support medium where the Speedfloor shuttering system locks the joist into the exact position.
(iv) The Speedfloor joist's modular spacing can be adjusted to suit varying conditions.

2.6 Inspections & Testing

Inspections & testing shall be done at appropriate stages of manufacturing process. The inspected joists shall be stored &packed to ensure that no damage occurs during transportation. As part of quality assurance, regular in-process inspections shall be carried out by the trained personnel of the PAC holder.

2.7 Delivery, Handling and Storage and Marking & identification

2.7.1 *Delivery, Handling and Storage*

(i) Speedfloor joists shall be delivered to site on a flatbed truck, banded in bundles ready to be placed on the supporting structure.

(ii) All joists should be checked immediately against the delivery dockets for length, quantity and damage during transit. Any deviation from the documentation or damage to the joists should be reported to the manufacturer immediately.

(iii) If the Speedfloor joists are to be stored on site, the bundles should be lifted off the trucks using soft straps and placed well dunnaged on the level surface. The joists should remain banded and upright until they are ready to be lifted onto the supporting structure.

(iv) If the Speedfloor joists are to be used immediately, the bundles should be lifted and placed on the structure.

(v) They should remain in bundles until they are ready to be locked out, when the bands can be broken and the joists slid into place near their final position.

(vi) Care must be taken to keep the joist perpendicular and central across the supporting structure.

2.7.2 *Marking and Identification*

2.7.2.1 Groups like members shall be marked with a label or a tag attached thereto. Marking shall include the manufacturer's identification (name, logo etc.), length and quantity etc.

2.7.2.2 In addition to the marking reference, individual members shall have a legible label, stencil or embossment at a max. distance of 2.44m on centre of the member.

2.8 Installation Procecess

2.8.1 Installation prorcess shall be as follows:

(i) Lightweright bundles of joists shall be lifted into position and then individual joists are placed by hand.

(ii) Speedfloor joists shall generally be placed at 1250 mm centres.

(iii) Joists shall be held in place using the lockbars which slip into slotted holes.

(iv) At supports additional 8mm bars shall be provided throughout the periphery to provide ductility.

(v) The lockbars shall be placed at 300mm centres to support plywood formwork. Propping is not required.

(vi) Full sheets of 12.5mm plywood formwork shall be laid from above creating a working platform. Cam action of lockbars secures plywood.

(vii) Mesh is placed on top section of joist thereby embedded in the concrete poured thereafter.

(viii) After three days of concreting, lockbars and plywood are removed from the underside revealing a clean surface ready for services or a fire rated suspended ceiling.

Drawings (Fig. 22 to 29) showing the details of Installation process are appended at Annex D for guidance.

For detailed Installation process, manufacturer's Installation Manual should be referred.

2.9 Good Practices for Installation & Maintenance

Good practice as per requirement including Do's and Don'ts of working with Speedfloor system of the manufacturer given in Annex Fshall be followed for erection of these sections.

2.10 Maintenance Requirements

2.10.1 *Speedfloor system* is a composite floor system using both steel and concrete. The two elements must be treated and maintained separately.

2.10.1.1 If the joists are in a clean and dry environment, they may not require any maintenance. If they are exposed, they shall require maintenance to ensure the expected performance is achieved. Guidelines given below should be followed for maintenance

a) Keep surfaces clean and free from continuous contact with moisture, dust and other debris.

b) Periodically inspect the joists for any signs of corrosion. Remove any by-products of the corrosion by mechanical means and spot prime the exposed steel substrate with an approved steel primer. Repaint the area using an appropriate paint to manufacturer's recommendations.

c) Due care shall be taken for protection of the joists by additional protective measures in highly corrosive environment.

2.10.1.2 *Concrete*

During the service life of the Speedfloor system, if any cracks appear in the concrete floor, they should be filled using an epoxy injection system or equivalent, to completely close the crack and prevent moisture ingress.

2.11 Skilled /Training Needed For Installation

Workers shall be trained/ oriented on handling of joists and their erection and support system etc. with all required safety measures taken including heavy hats, protective shoes etc.

2.12 Guarantees/Warranties Provided by the PAC Holder

PAC holder shall provide necessary guarantees/ warranties of the system to the client. A brochure giving relevant details of the Speedfloor system shall be made available to the client.

2.13 Services Provided by the PAC Holder to the Customer

In-house testing of joists at regular intervals as per the QCA requirement shall be ensured by M/s Jindal Steel & Power Ltd.

2.14 Manuals

A site Installation Manual and a Manual for Health & Safety shall be provided for each project incorporating the Speedfloor system.

2.15 Responsibility

● Specific design using Speedfloor system is the responsibility of the designer with the instructions, supervision and approval of M/s Jindal Steel & Power Ltd.

● Quality of installation of the system on site is the responsibility of the trade persons engaged by the agency

● Quality of maintenance of the building is the responsibility of the building owner.

● Providing necessary facilities and space for movement of cranes and vehicles is the responsibility of the building developer.

PART 3 BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Assessment

3.1.1 *Factory Inspections*

The factory at Raigarh was inspected by the technical team of the Council. The raw materials and finished products were found to be as per specifications. The firm has got necessary manufacturing and test facilities to produce the required components as per design and specifications. It operates a Quality Assurance system in the factory to ensure that the product conforms to the specified requirements. Persons involved in testing were found to be well conversant with testing procedures required for the quality control of the system. Inspection of OPJIT Boys Hostel at Punjipathra, Raigarh.

3.1.2 *Design Procedure*

The agency follows a well-defined design procedure based on relevant Indian Standards as given in Annex E.

3.1.3 *Tests Performed by Professional Engineers*

3.1.3.1 *Structural stability of the joists*

Sample design calculations show that the deflection limit works out to less than L/360 and Ultimate failure stress less than 1MPa for a typical 200mm joist for 90mm slab at a spacing of 1230mmin accordance with AS/NZS 1170.0:2202 (Annex D)

3.1.3.2 *Fire rating certification by ES professional engineers, South Africa*

As per the Fire Rating Certification carried out by M/s ES Professional Engineers, South Africa on Speedfloor according to South-African Standard SANS 10400 – Part 1, it has been concluded that the unprotected steel joist Deflection (span/30) = 166mm,Fire rating = 120 min (2hr) and Siliceous aggregates in concrete due to correct cover = 3hr. Average fire rating = 2.5 hr

Report on full scale fire testing has established that the Speedfloor system can be fire rated and meet fire rating requirements set out in the relevant Standards. Options for fire protection include:

- Using a fire rated ceiling (30, 60, 90 min)
- Using sprayed cementitious products directly onto Speedfloor joist (30, 60, 90 min)
- Intumescent paint products directly on Speedfloor joist (30, 60, 90 min)
- The addition of reinforcement to the concrete topping

3.1.4 *Execution of Projects*

The firm has executed the projects using the Speedfloor system as per the details given below**.**

S. No.	**Name & address of the Person/ Organization**	**Project**	**Period of completion**
1.	Jindal Steel & Power Ltd., Parsada, Raigarh	A-type Dormitory	July 12 to Sep. 2012
2.	Nalwa Steel & Power Ltd., Nalwa, Raigarh	Lunch Room	29 Nov 12 to14 Dec.12
3.	Jindal Steel & Power Ltd., Tamnar, Raigarh	G-type housing	25 Dec 12 to7 Jan 13
4.	Jindal Steel & Power Ltd., Tamnar, Raigarh	D-type housing	8 Jan 13 to23 March13
5.	O P Jindal Instt. of Tech. Punjipathra, Raigarh	OPJIT Boys Hostel	5 Feb 13 to24 April 13
6.	Sri City, Chennai	Sri City	13 Feb 13 To20 Feb 13
7.	GD Goenka Educational City, Sohna, Gurgaon	GD Goenka Educational City	11 Mar 13 to23 March 13
8.	Power Grid Corporation India Ltd, Maneshwar, Gurgaon	Power Grid Corporation India Ltd.	7 Jan 13 to 7 May 13

PART 4 STANDARD CONDITIONS

This certificate holder shall satisfy the following conditions:

4.1 The certificate holder shall continue to have the product reviewed by BMBA.

4.2 The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.

4.3 The quality of the product shall be maintained by the certificate holder.

4.4 The product user should install, use and maintain the product in accordance with the provisions in this Certificate.

4.5 This certificate does not cover uses of the product outside the scope of this appraisal.

4.6 The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.

4.7 Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)

4.8 The certificate holder agrees to inform BMBA of their distributors / licensees whenever appointed by him and agrees to provide to BMBA a six monthly updated list thereof.

4.9 The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.

4.10 If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

4.11 In granting this Certificate, BMBA takes no position as to:

(a) The presence or absence of patent or similar rights relating to the product;
(b) The legal right of the Certificate holder to market, install or maintain the product;
(c) The nature of individual installations of the product, including methods of workmanship.

4.12 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

4.13 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

4.14 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

4.15 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

4.16 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

4.17 The PAC holder shall not use this certificate for legal defense in cases against him or for legal claims he may make from others.

Dr. Bhaskar Kr. Agarwal
Chairman, TAC
& Chairman, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5A, 1st Floor, India Habitat Centre, Lodi Road,
New Delhi-110 003

for and on behalf of
Member Secretary, BMB

Place: New Delhi

Date of issue 16-10-14

PART 5 LIST OF STANDARDS & CODES USED IN ASSESSMENT

(Clause 2.1)

These Standards are referred for carrying out particular tests only and do not specify the requirement for the whole product as such.

5.1 IS 277:1992 – Specifications for galvanized steel sheets (plain & corrugated)

5.2 IS 456:2000 –Code of practice for plain & reinforced Concrete (fourth revision)

5.3 IS 875 (Parts1to3):1987 – Code of practice for design loads (other than earthquake) for buildings & structures

5.4 IS 2062:2011– Specifications for hot rolled medium & high tensile structural steel

5.5 IS11384:1985 – Code of practice for composite construction in steel and concrete

5.6 AS/NZS 1170-2 (Parts 0 & 2):2002 – Structural design Actions—General principles and Wind actions

5.7 AS 2327(Part1):1996–Design of simply supported Composite structures

5.8 NZS 3101(Part1):2006– Design of concrete structures

5.9 NZS 3404 (Part1):1997 – Design of steel structures

5.10 AS/NZS 4600:2005 – Design of cold formed steel structures

5.11 AS/NZS 4671: 2001 – Specifications for steel reinforcing materials

5.2 Company Standards of the PAC holder – The branded design &specifications of the raw materials and finished product are as submitted by the manufacturer. The PAC holder has to make available the company standards to the consumer according to which testing have been done.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **SPEEDFLOOR SYSTEM** bearing the mark manufactured by M/s Jindal Steel & Power Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No.1013-S/2014** is awarded to **M/s. Jindal Steel & Power Ltd.**

The period of validity of this Certificate is as shown on Page 1 of this PAC. This Certificate consists of pages 1 to 58.

Embossing Seal of BMBA

Dr. Shailesh Kr. Agarwal
Chairman, TAC
Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, Govt. of India
1st Floor, India Habitat Centre,Lodhi Road,
New Delhi-110 003

On behalf of BMTPC Board of Agreement, Chairman, Technical Assessment Committee (TAC) of (BMBA) Under Ministry of Housing and Urban Poverty Alleviation, Government of India

Place: New Delhi, India

Date: 16-10-14

PART 6 ABBREVIATIONS

Abbreviations

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

Performance Appraisal Certification Scheme —A Brief

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing &Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing &Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (T AC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No. 49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org

ANNEX A

(Clause 1.5.2)

QUALITY ASSURANCE PLAN FOR SPEEDFLOOR

S.No	Process/ Operation	Parameters to check	Acceptance Norms	Frequency of testing	
A-1 Raw Materials				Level (i)	Level (ii)
A-1.1	G P Coil	Dimensions & Properties	ASTM A568, ASTM A653 S50, Z275 & E350	MTC – 100%	Dimension - 100%
A-1.2	Bolts & Nuts	During receipt & issue for fabrication	HILTI /BTC	MTC – 100%	Dimension - 100%
		Visual		Visual– 100%	Visual - 100%
A-2 Process					
A-2.1	Roll Forming	Dimensions	ASTM C955:07	Dimension 100%	Dimension - 100%
		Visual		Visual - 100%	Visual - 100%
A-2.2	Packing	Visual	As per panel wise drawing details	Visual - 100%	Visual - 100%
A-2.3	Dispatch	Visual		Visual - 100%	Visual - 100%
A-2.4	Assembly	Dimensions		Dimension 100%	Dimension - 100%
		Visual		Visual - 100%	Visual - 100%

Category of Quality Level Checks:

Level (i) Manufacturer's Test Certificate as per tests conducted at its premises or other laboratories

Level (ii) Laboratories established at site

Level (iii) Independent laboratory

ANNEX B

(Clause 1.5.2)

PROCESS FLOW FOR SPEEDFLOOR MACHINE (STANDARD OPERTING PROCEDURE)

Enter the program of joist as per BOQ/PO into the machine

↓

Load the GP coil on the decoiler

↓

Feed the GP coil into the machine

↓

Run the machine in auto mode

↓

Internal inspection (twist, bow bend and length)

↓

Fixing of shoe and NBW to the roll formed joist

↓

Material ready for dispatch

ANNEX C

{Clause 2.3(iv)}

STANDARD DRAWINGS

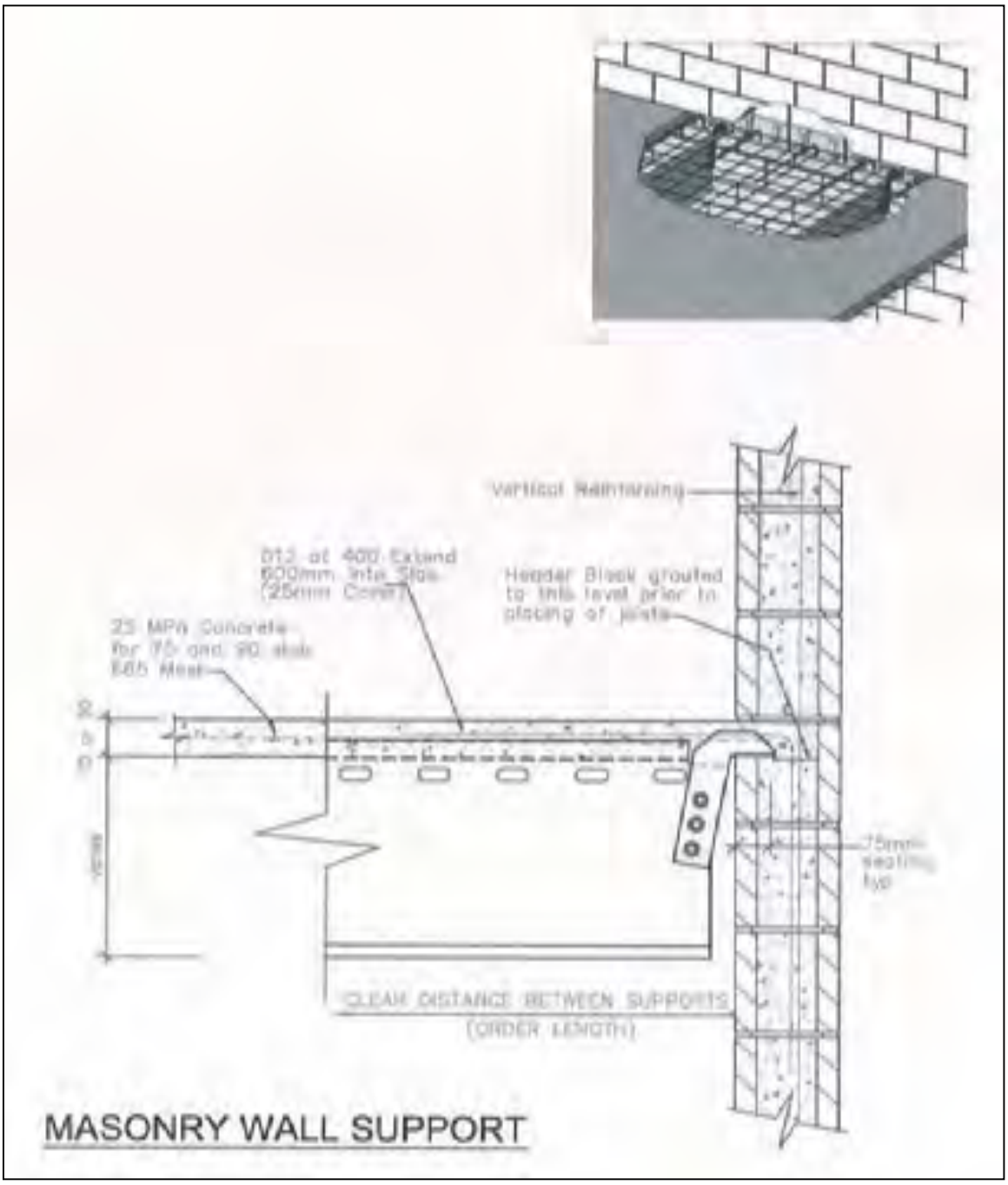


Fig. 1

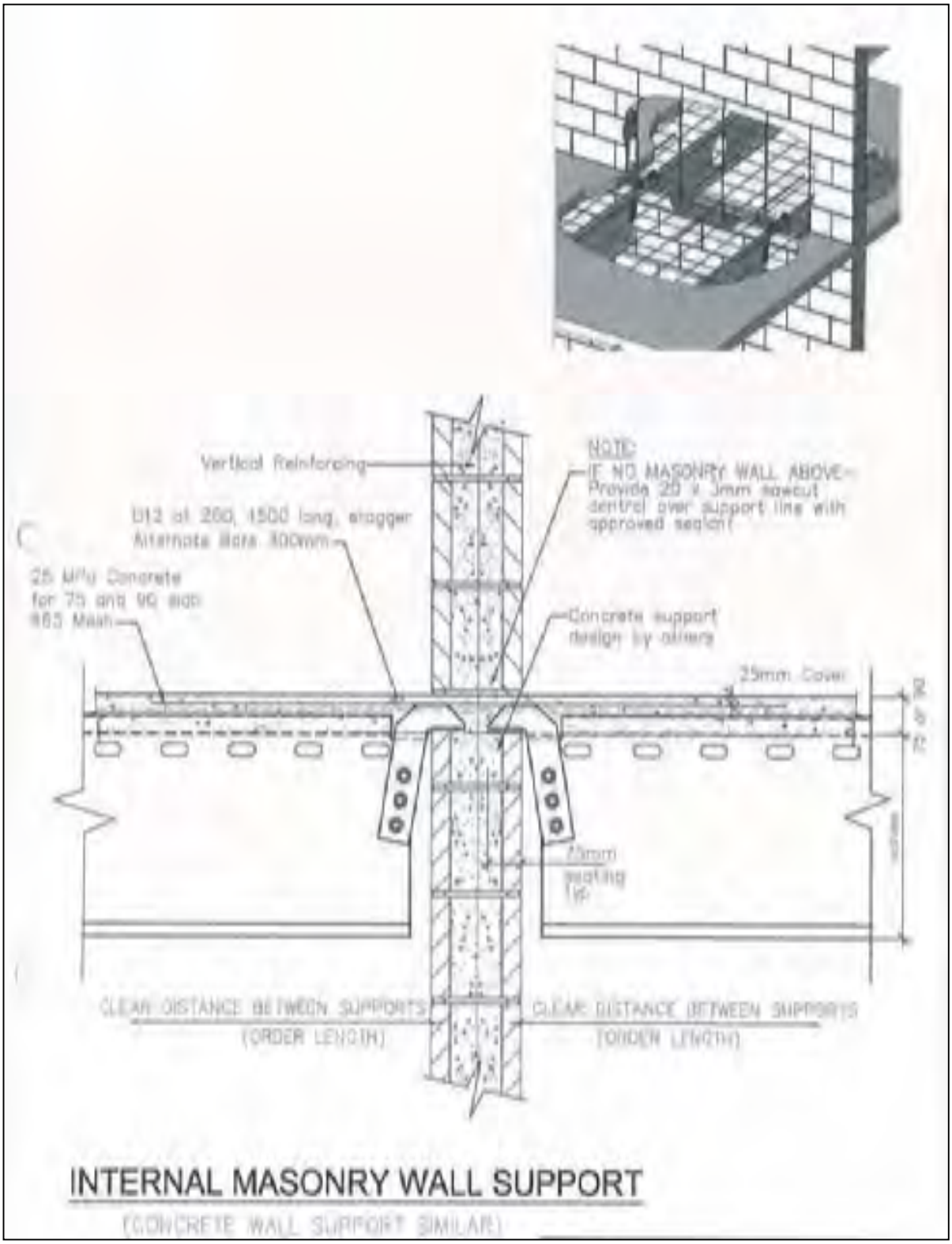

Vertical Reinforcing
NOTE:
IF NO MASONRY WALL ABOVE-
Provide 20 x 3mm sawcut
control over support line with
approved sealant
D12 at 200, 1500 long, stagger
Alternate Bars 400mm
25 MPa Concrete
for 75 and 90 slab
665 Mesh
Concrete support
design by others
25mm Cover
75mm
Seating
Typ.
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
INTERNAL MASONRY WALL SUPPORT
(CONCRETE WALL SUPPORT SIMILAR)

Fig. 2

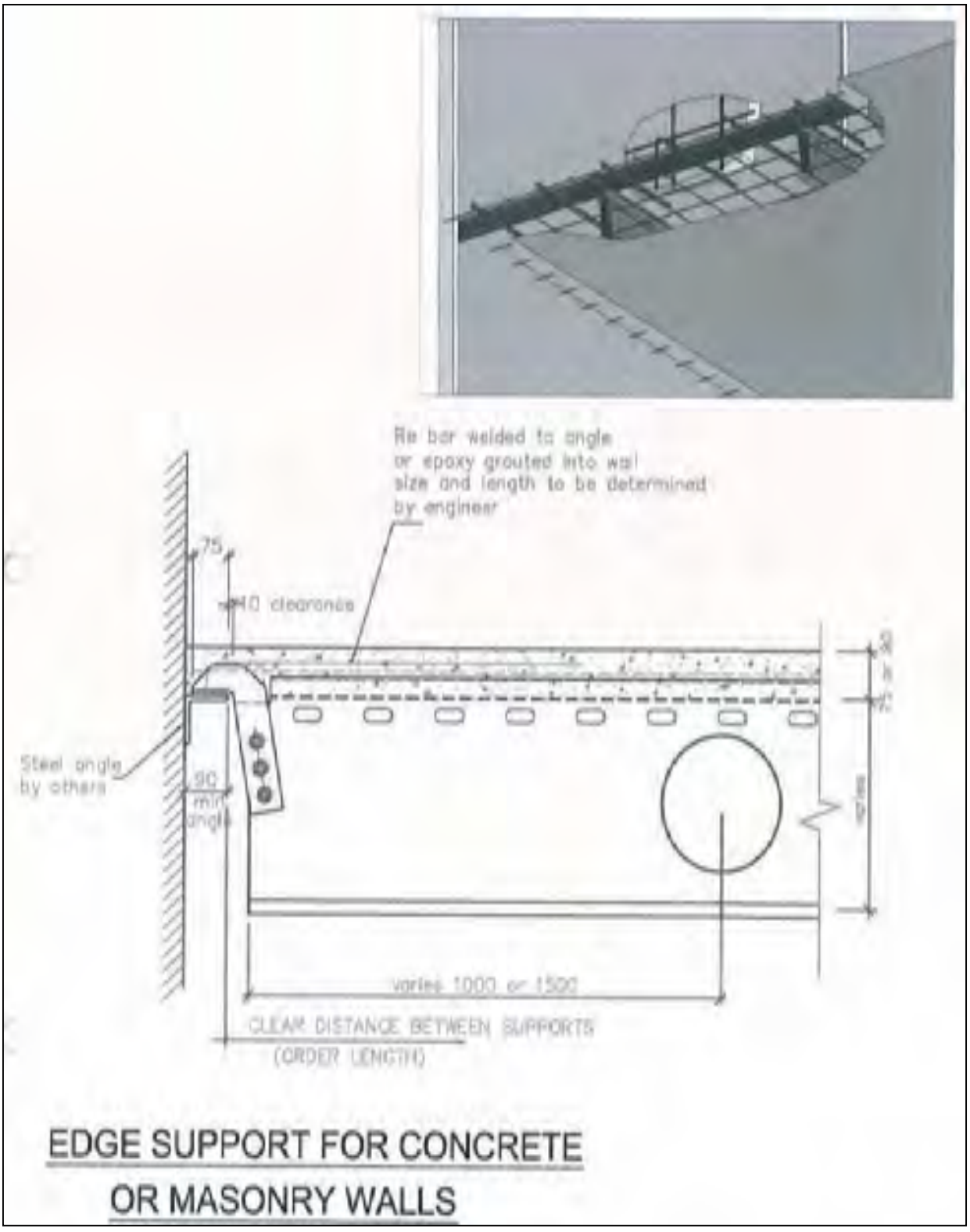
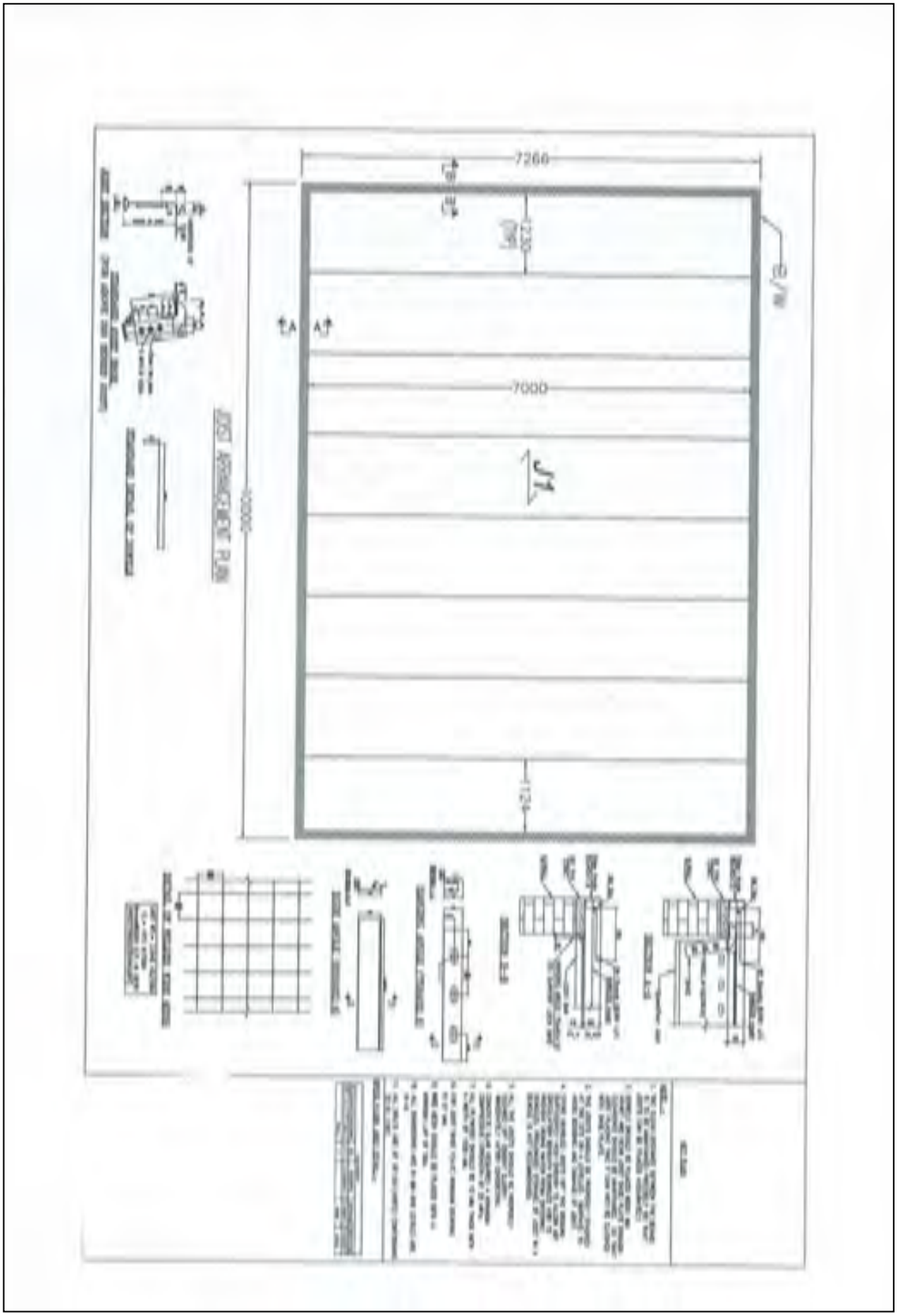
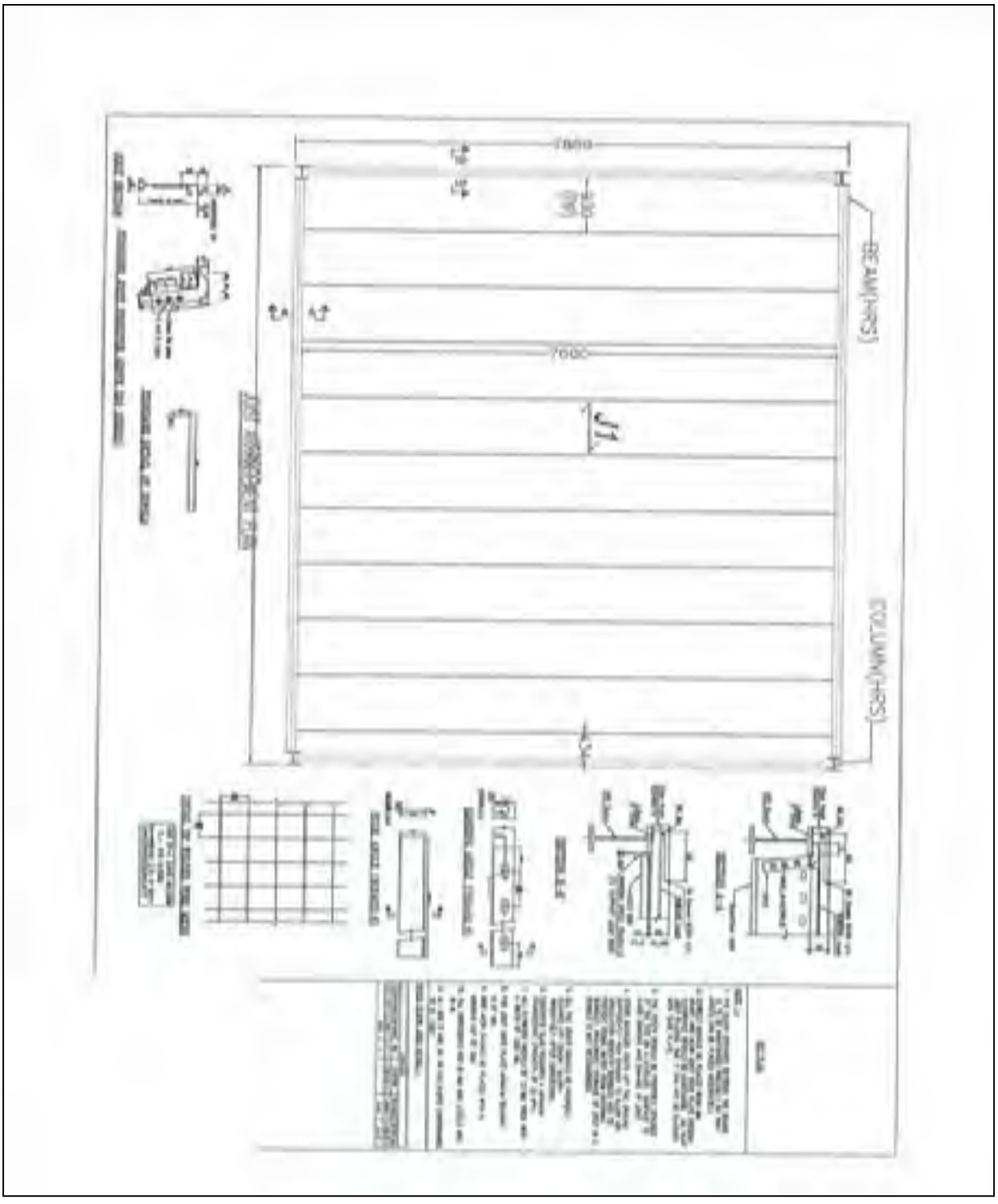

Re bar welded to angle
or epoxy grouted into wall
size and length to be determined
by engineer
75
40 clearance
Steel angle
by others
90
min
angle
varies 1000 or 1500
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
EDGE SUPPORT FOR CONCRETE
OR MASONRY WALLS

Fig. 3

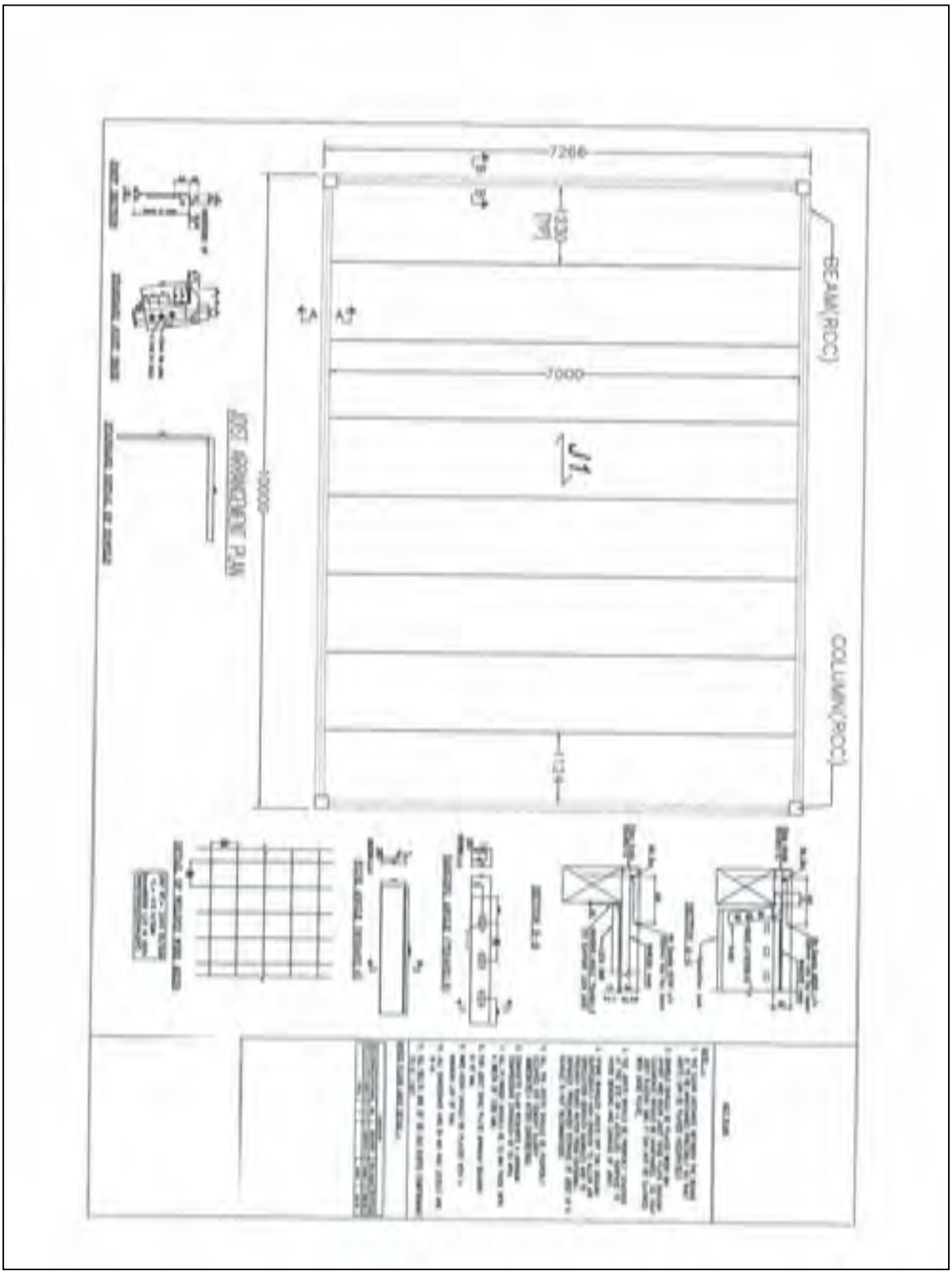


JOIST ARRANGEMENT PLAN 1
Fig. 4



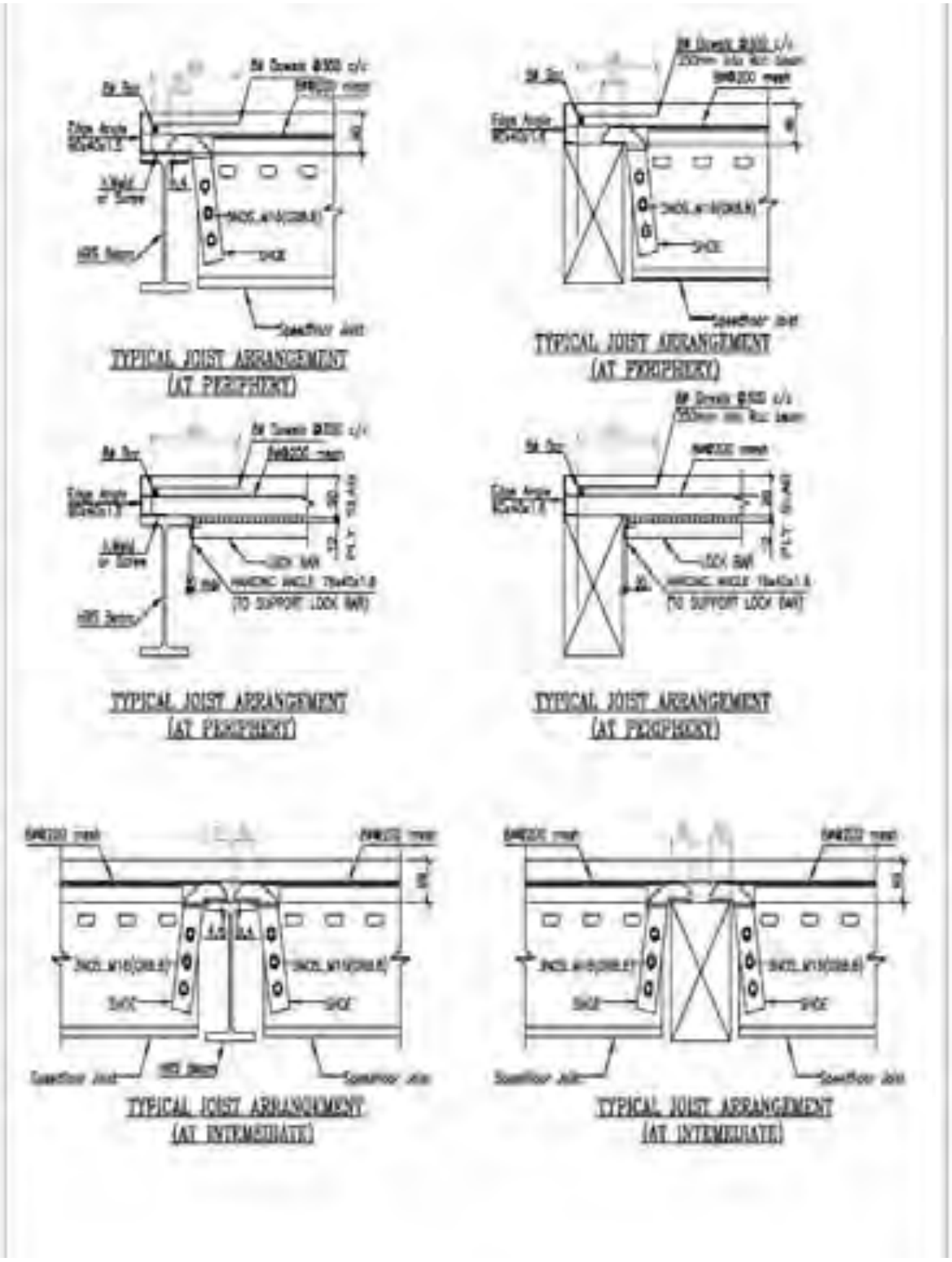
JOIST ARRANGEMENT PLAN 2

Fig. 5



JOIST ARRANGEMENT PLAN 3

Fig. 6



TYPICAL JOIST ARRANGEMENT DETAILS

Fig. 7

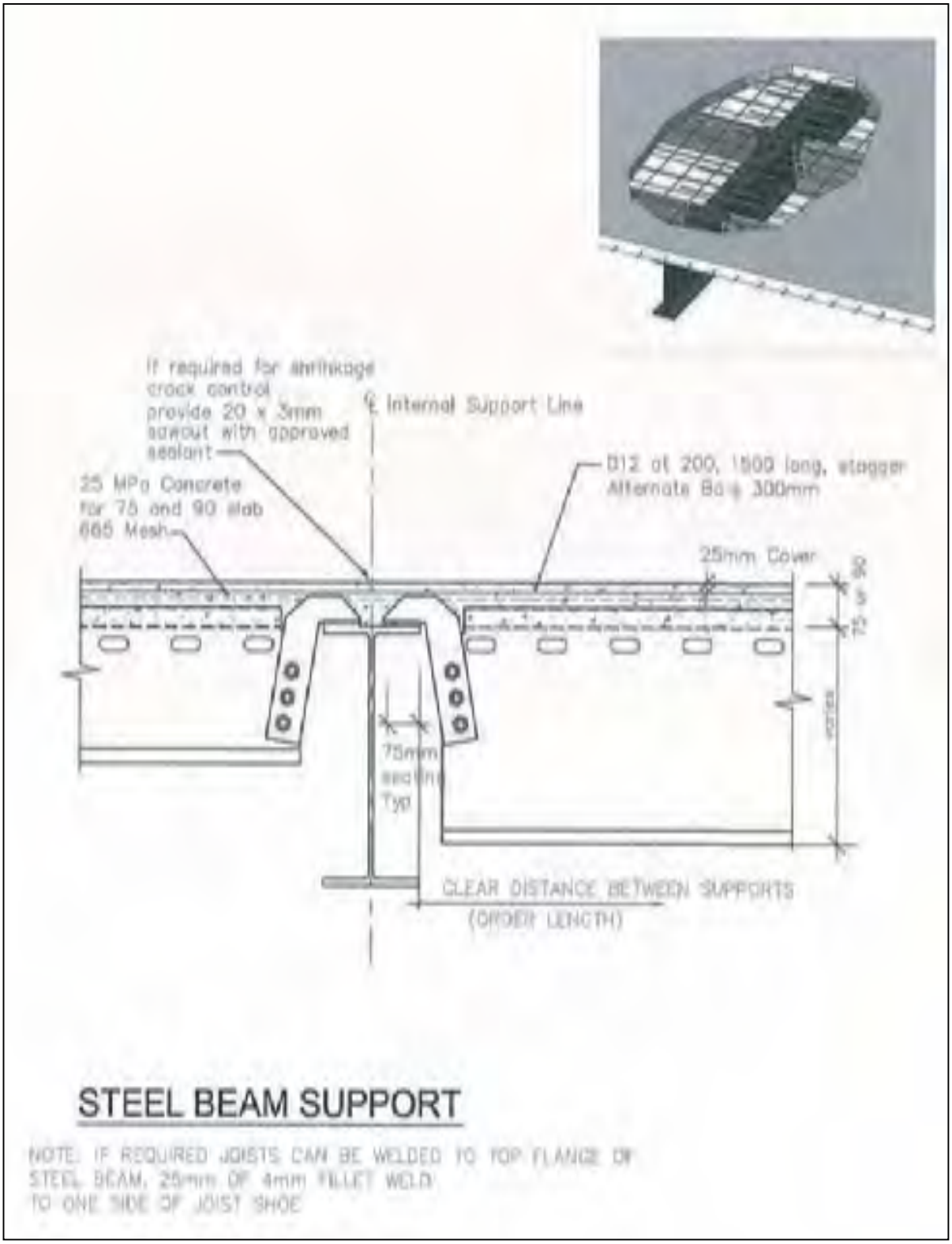

If required for shrinkage crack control provide 20 x 3mm sawcut with approved sealant
℄ Internal Support Line
25 MPa Concrete for 75 and 90 slab
665 Mesh
D12 at 200, 1500 long, stagger Alternate Bars 300mm
25mm Cover
75mm seating Typ
CLEAR DISTANCE BETWEEN SUPPORTS (ORDER LENGTH)
STEEL BEAM SUPPORT
NOTE: IF REQUIRED JOISTS CAN BE WELDED TO TOP FLANGE OF STEEL BEAM, 25mm OF 4mm FILLET WELD TO ONE SIDE OF JOIST SHOE

Fig. 8

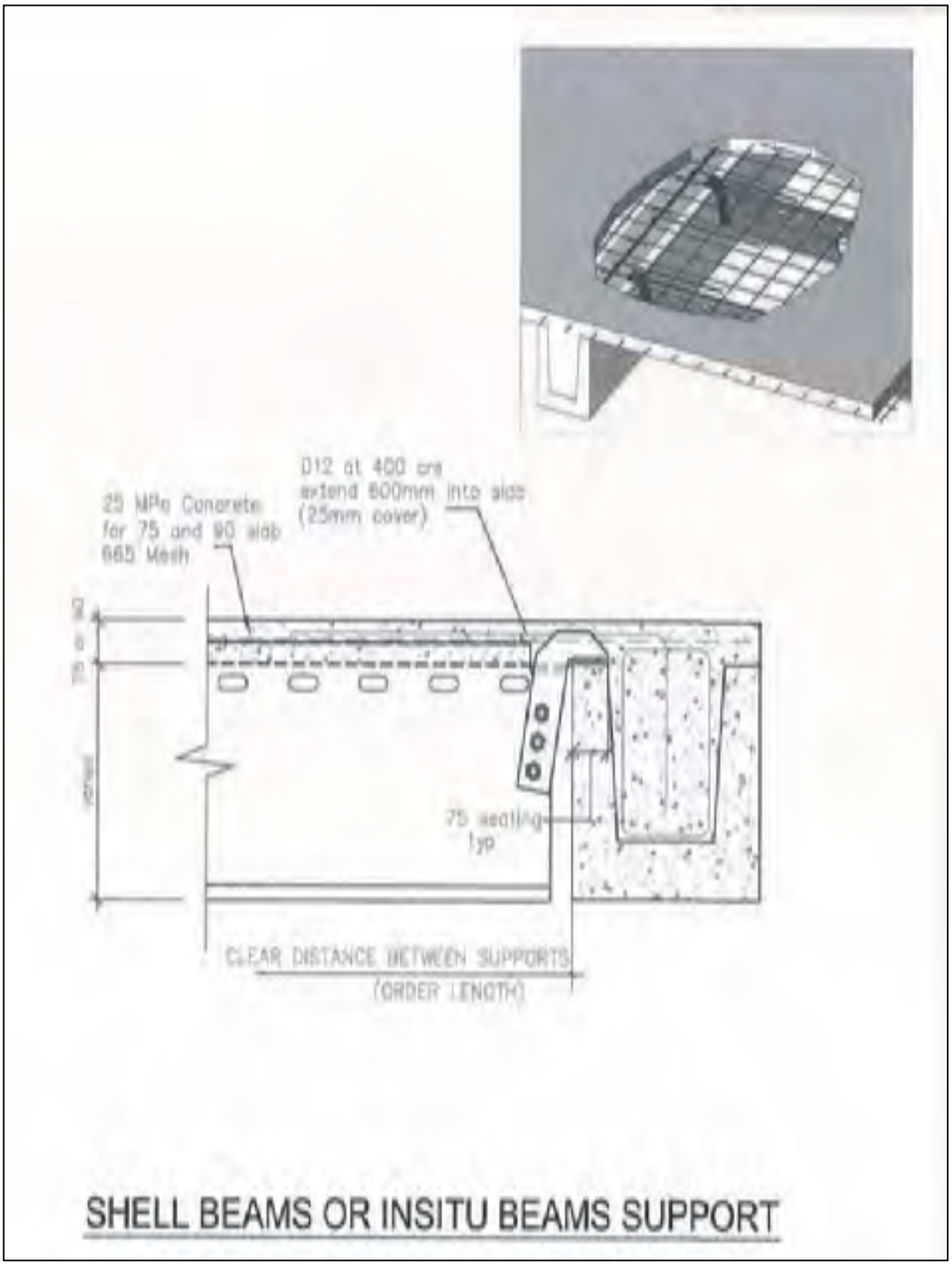

D12 at 400 crs
extend 600mm into slab
(25mm cover)
25 MPa Concrete
for 75 and 90 slab
665 Mesh
75 seat l/g
typ
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
SHELL BEAMS OR INSITU BEAMS SUPPORT

Fig. 9

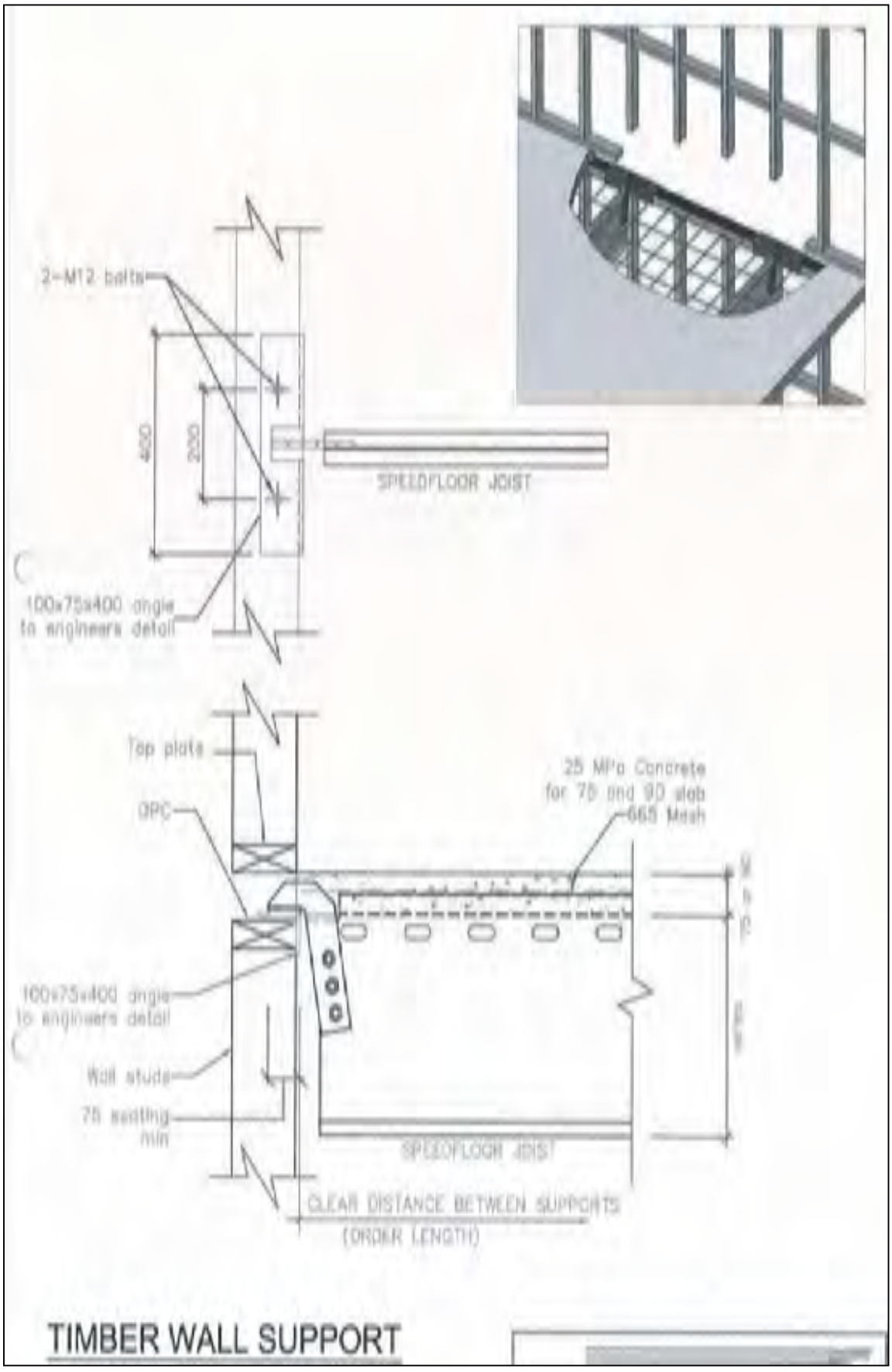

2-M12 bolts
400
250
SPEEDFLOOR JOIST
100x75x400 angle
to engineers detail
Top plate
OPC
25 MPa Concrete
for 75 and 90 slab
665 Mesh
100x75x400 angle
to engineers detail
Wall studs
75 seating
min
SPEEDFLOOR JOIST
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
TIMBER WALL SUPPORT

Fig. 10

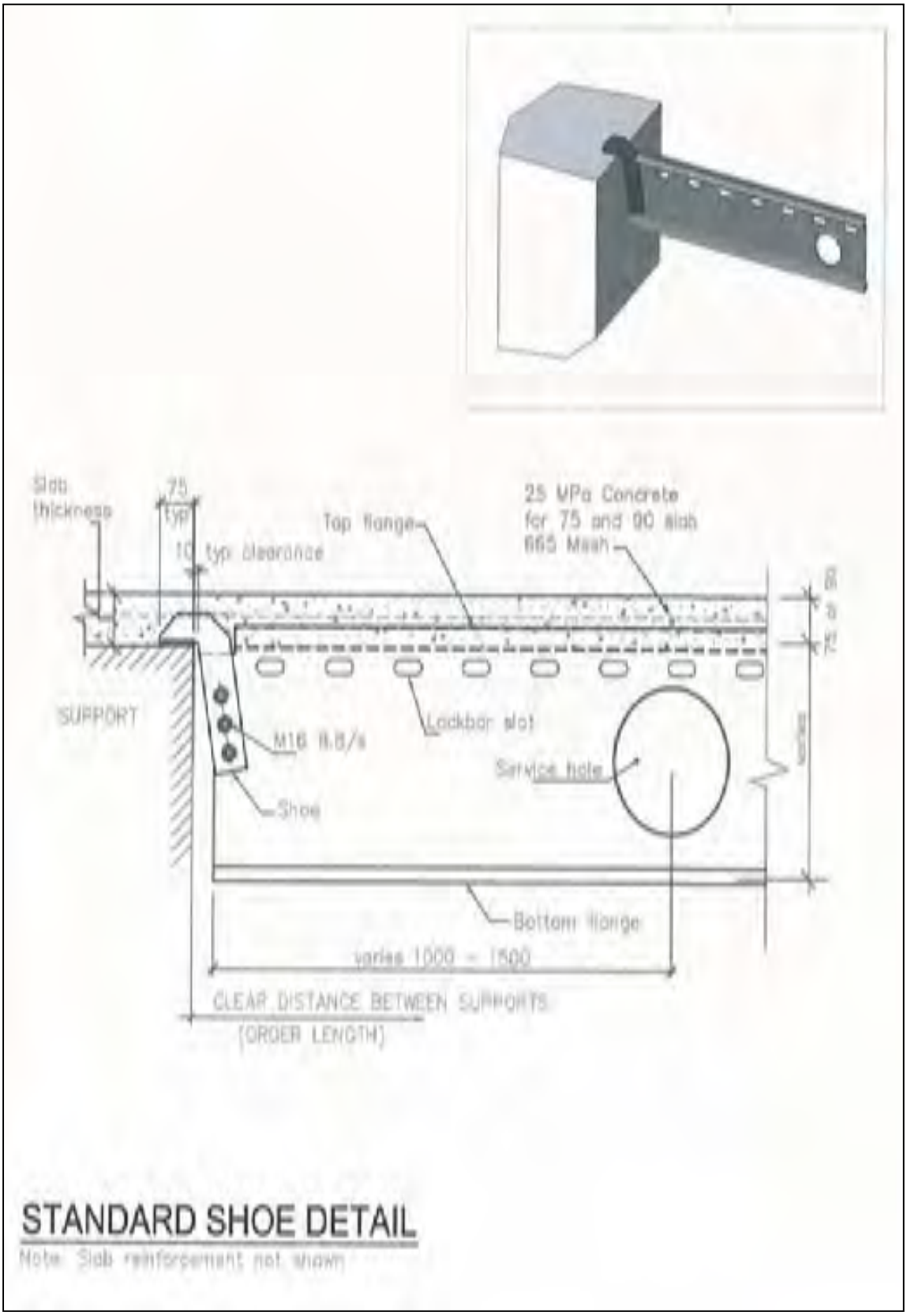

Slab thickness
75 typ
10 typ clearance
Top flange
25 MPa Concrete for 75 and 90 slab
665 Mesh
SUPPORT
M16 8.8/s
Lockbar slot
Service hole
Shoe
Bottom flange
varies 1000 - 1500
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
STANDARD SHOE DETAIL
Note: Slab reinforcement not shown

Fig.11

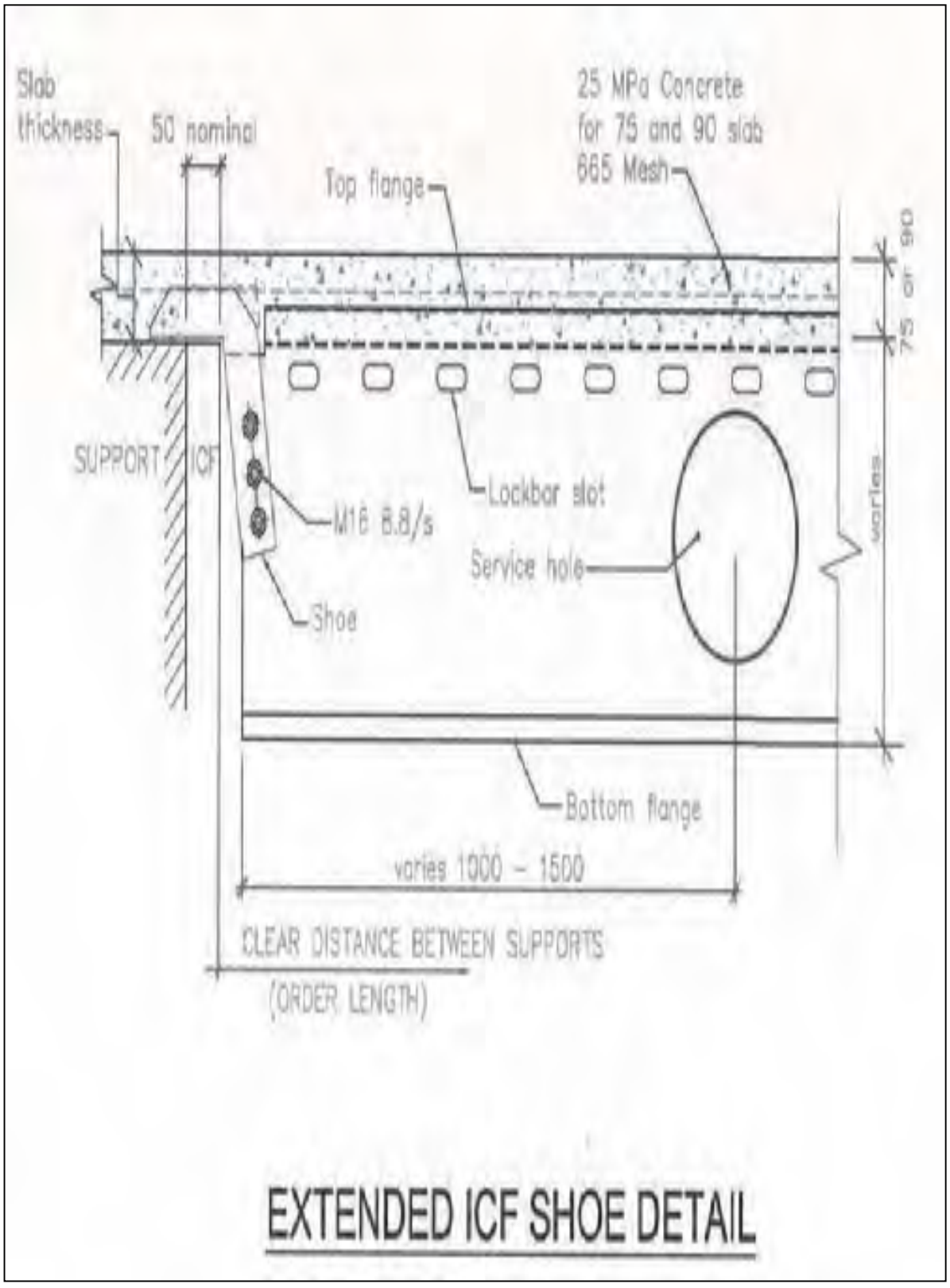

Slab thickness
50 nominal
25 MPa Concrete for 75 and 90 slab
665 Mesh
Top flange
75 or 90
SUPPORT
ICF
Lockbar slot
M16 8.8/s
Service hole
varies
Shoe
Bottom flange
varies 1000 - 1500
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
EXTENDED ICF SHOE DETAIL

Fig. 12

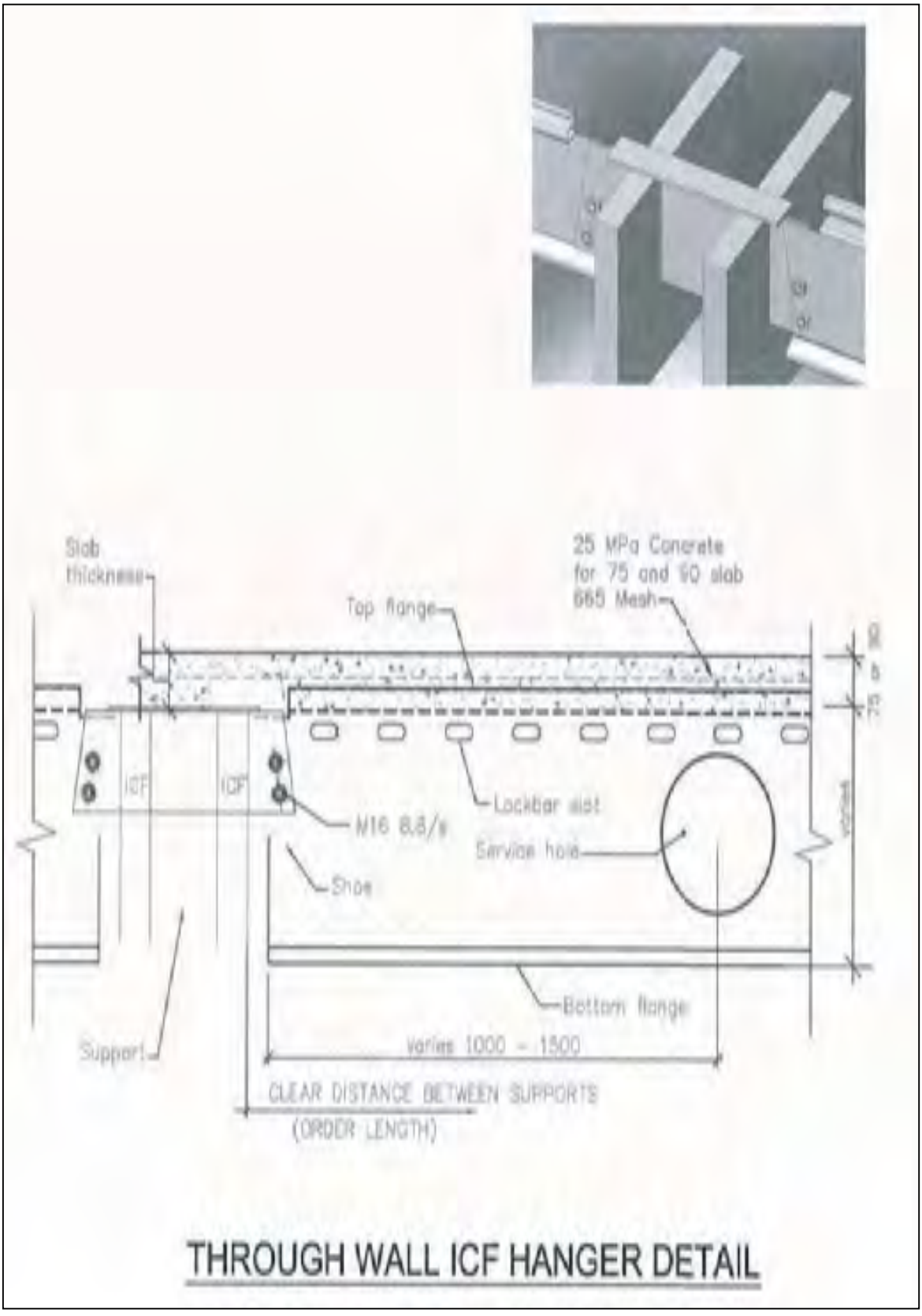

Slab thickness
25 MPa Concrete for 75 and 90 slab 665 Mesh
Top flange
ICF
ICF
M16 8.8/S
Lockbar slot
Service hole
Shoe
Bottom flange
Support
varies 1000 - 1500
CLEAR DISTANCE BETWEEN SUPPORTS
(ORDER LENGTH)
THROUGH WALL ICF HANGER DETAIL

Fig. 13

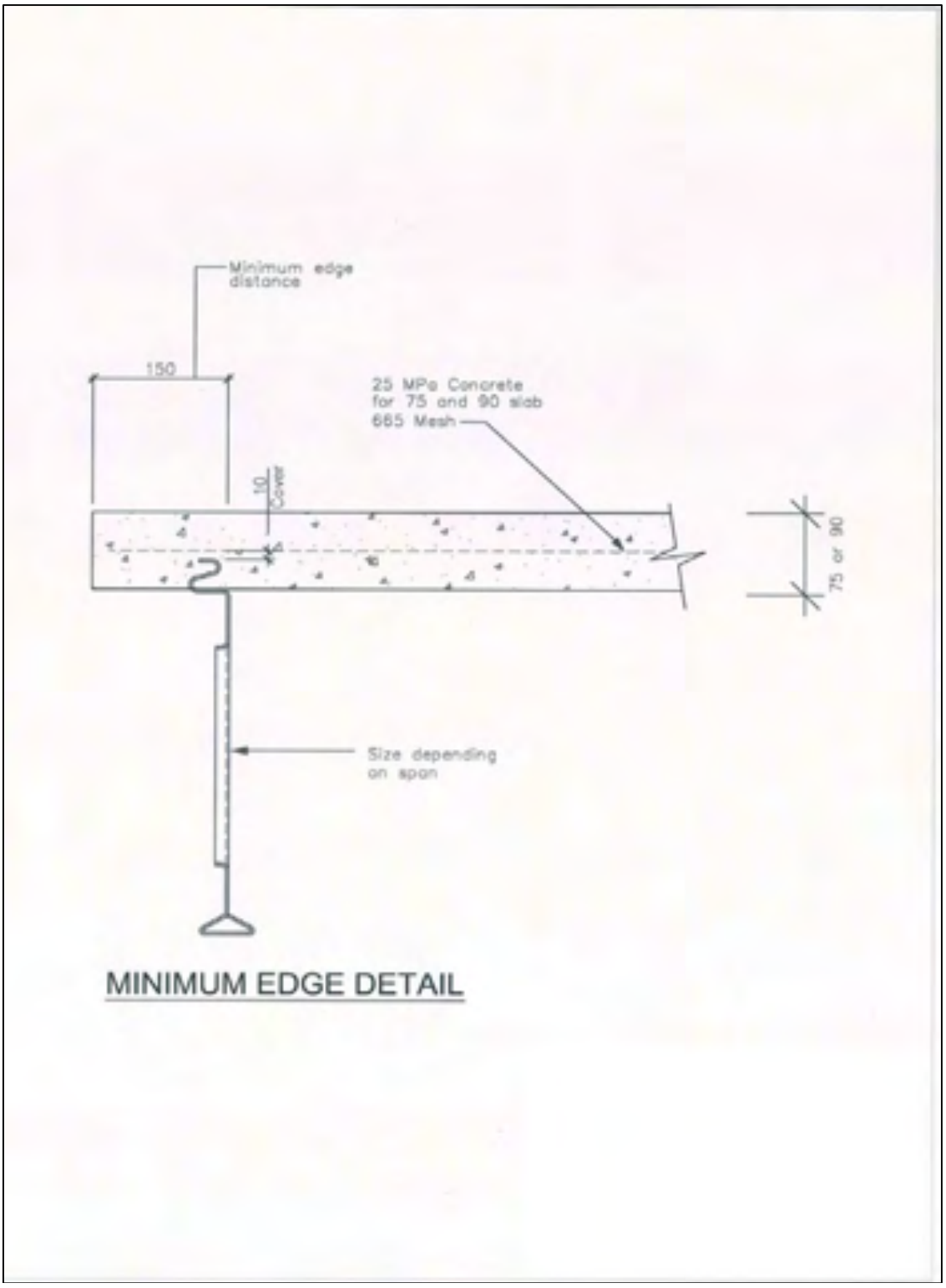
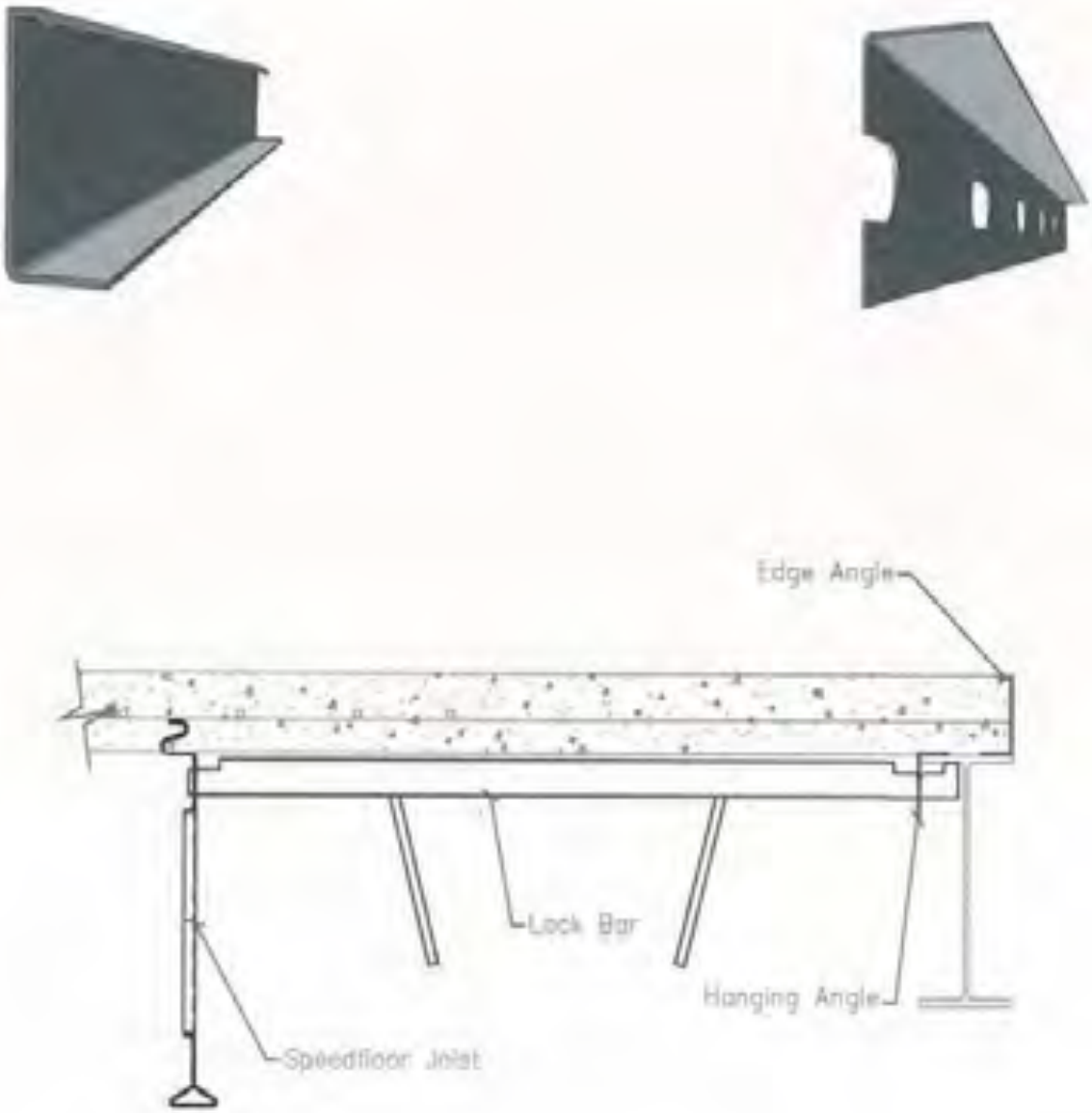

Minimum edge distance
150
25 MPa Concrete for 75 and 90 slab
665 Mesh
10
Cover
75 or 90
Size depending on span
MINIMUM EDGE DETAIL

Fig-14



HANGING ANGLE AND EDGE ANGLE

Fig-15

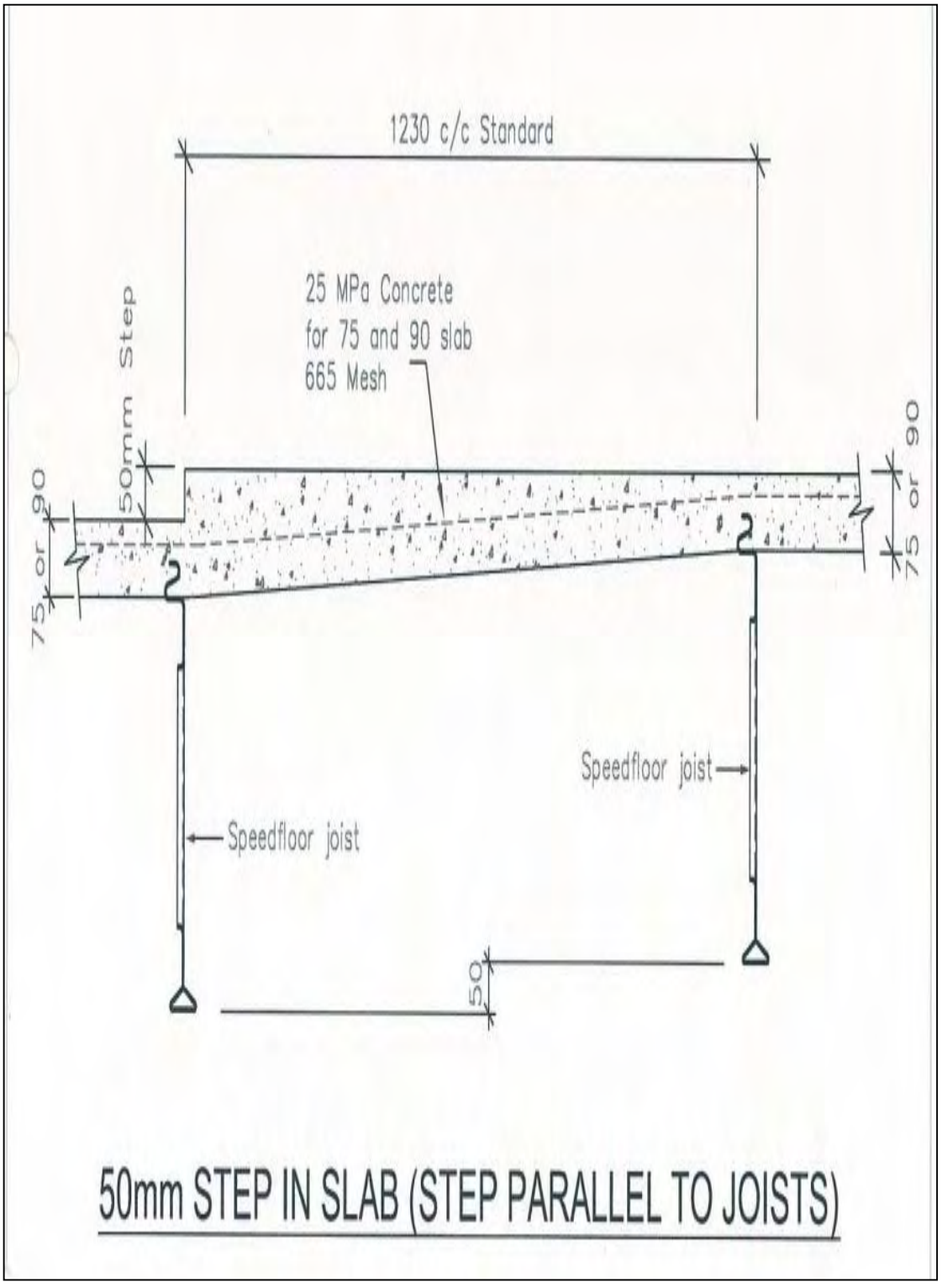

1230 c/c Standard
25 MPa Concrete
for 75 and 90 slab
665 Mesh
50mm Step
75 or 90
75 or 90
Speedfloor joist
Speedfloor joist
50
50mm STEP IN SLAB (STEP PARALLEL TO JOISTS)

Fig. 16

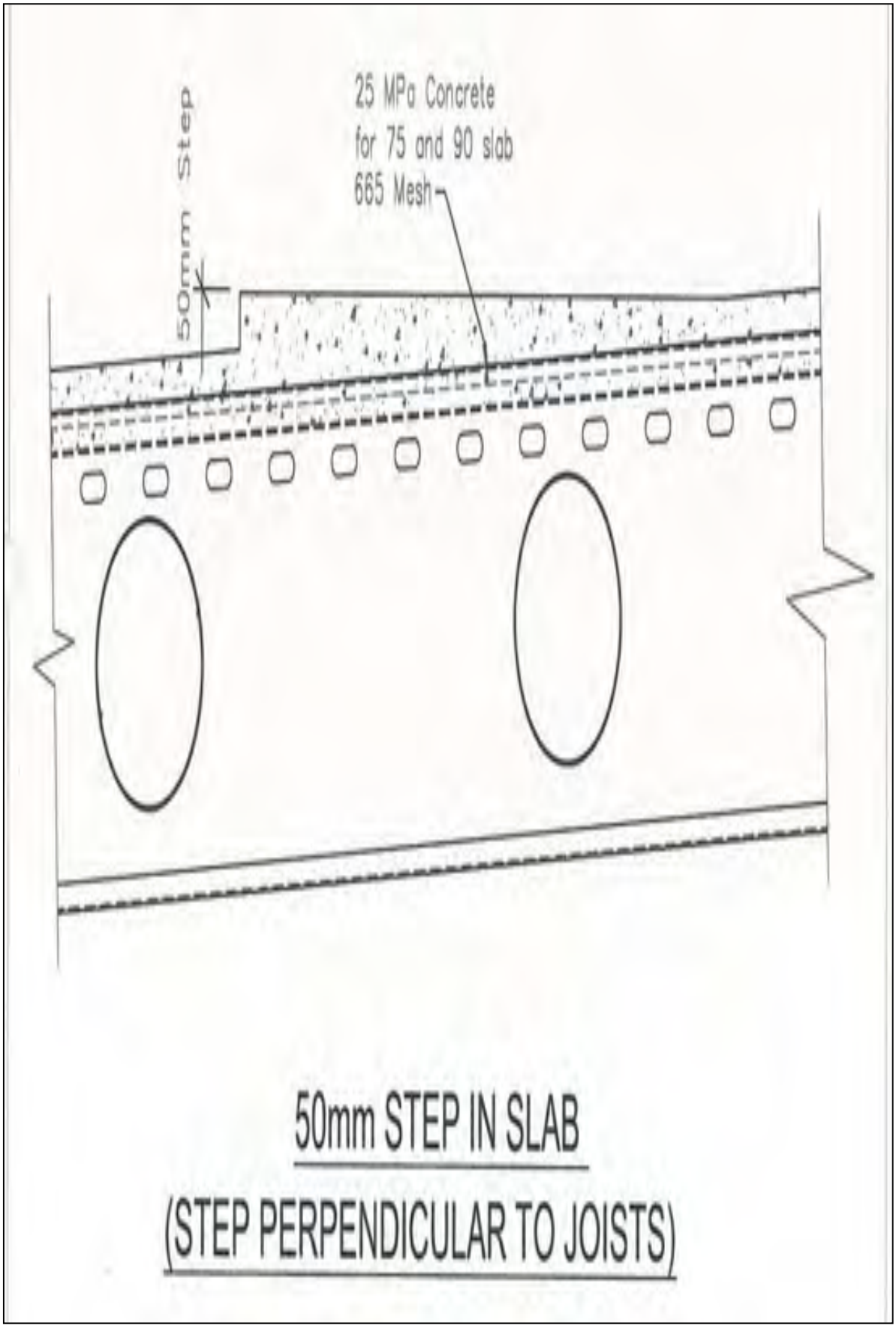

25 MPa Concrete
for 75 and 90 slab
665 Mesh
50mm Step
50mm STEP IN SLAB
(STEP PERPENDICULAR TO JOISTS)

Fig. 17

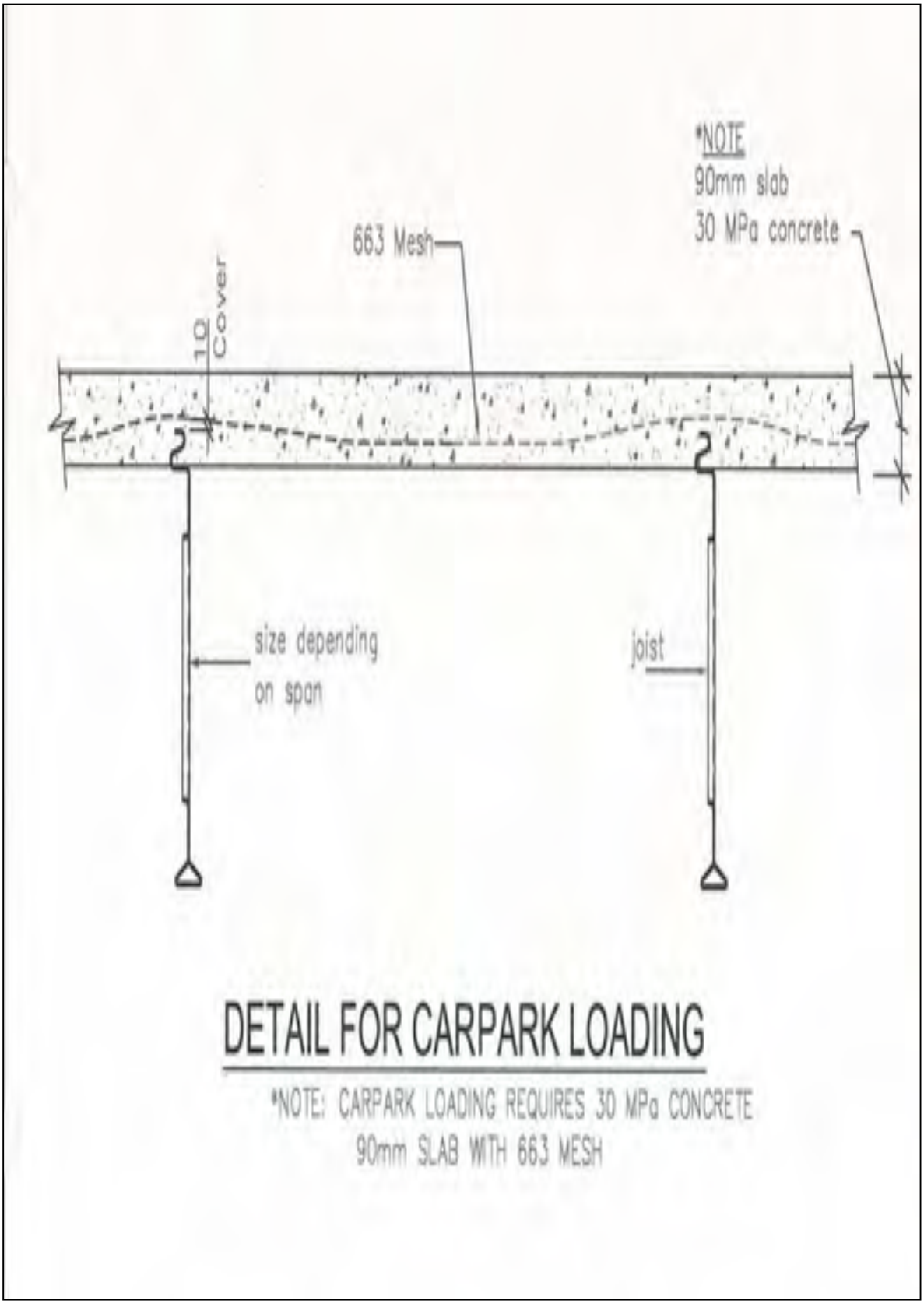
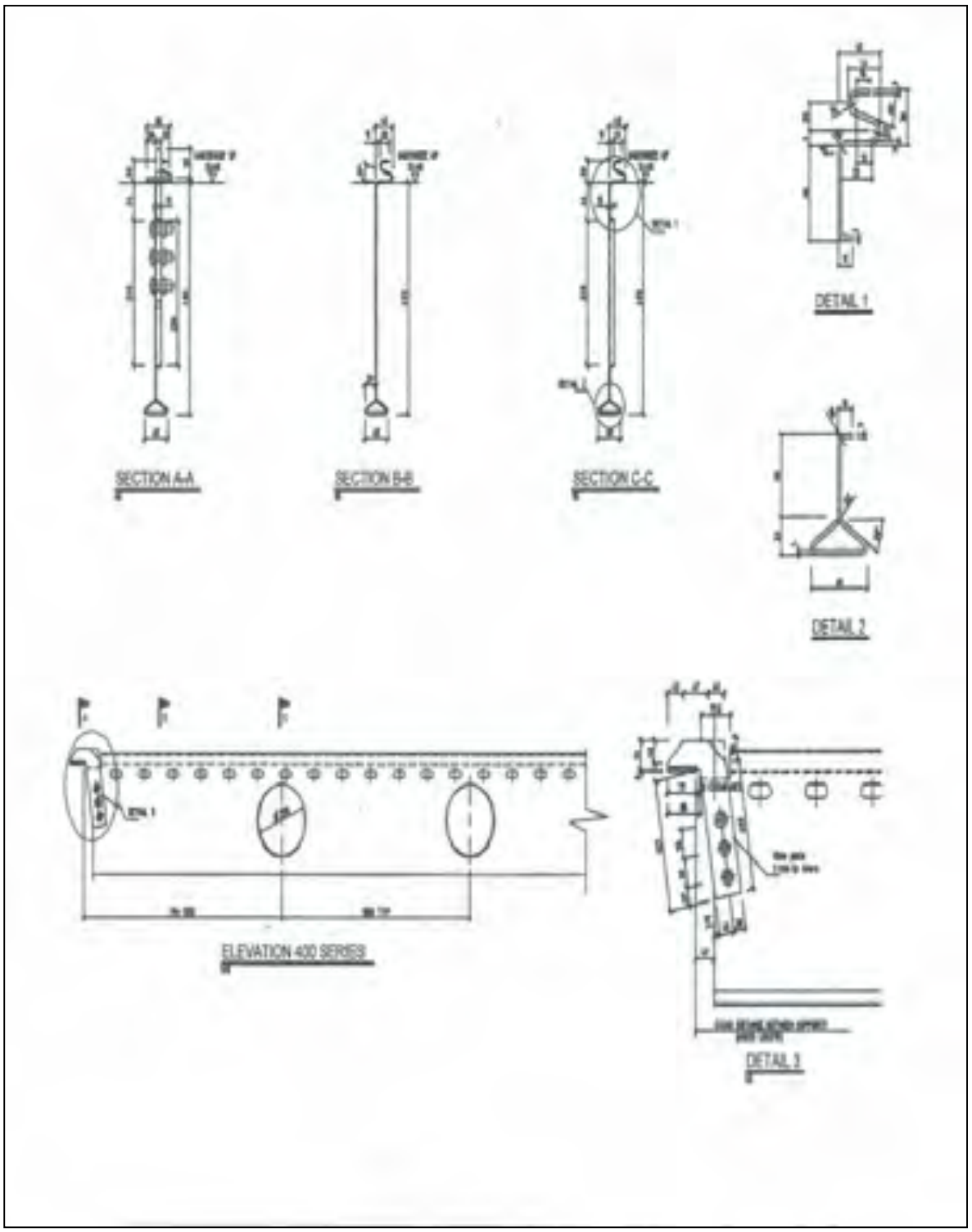
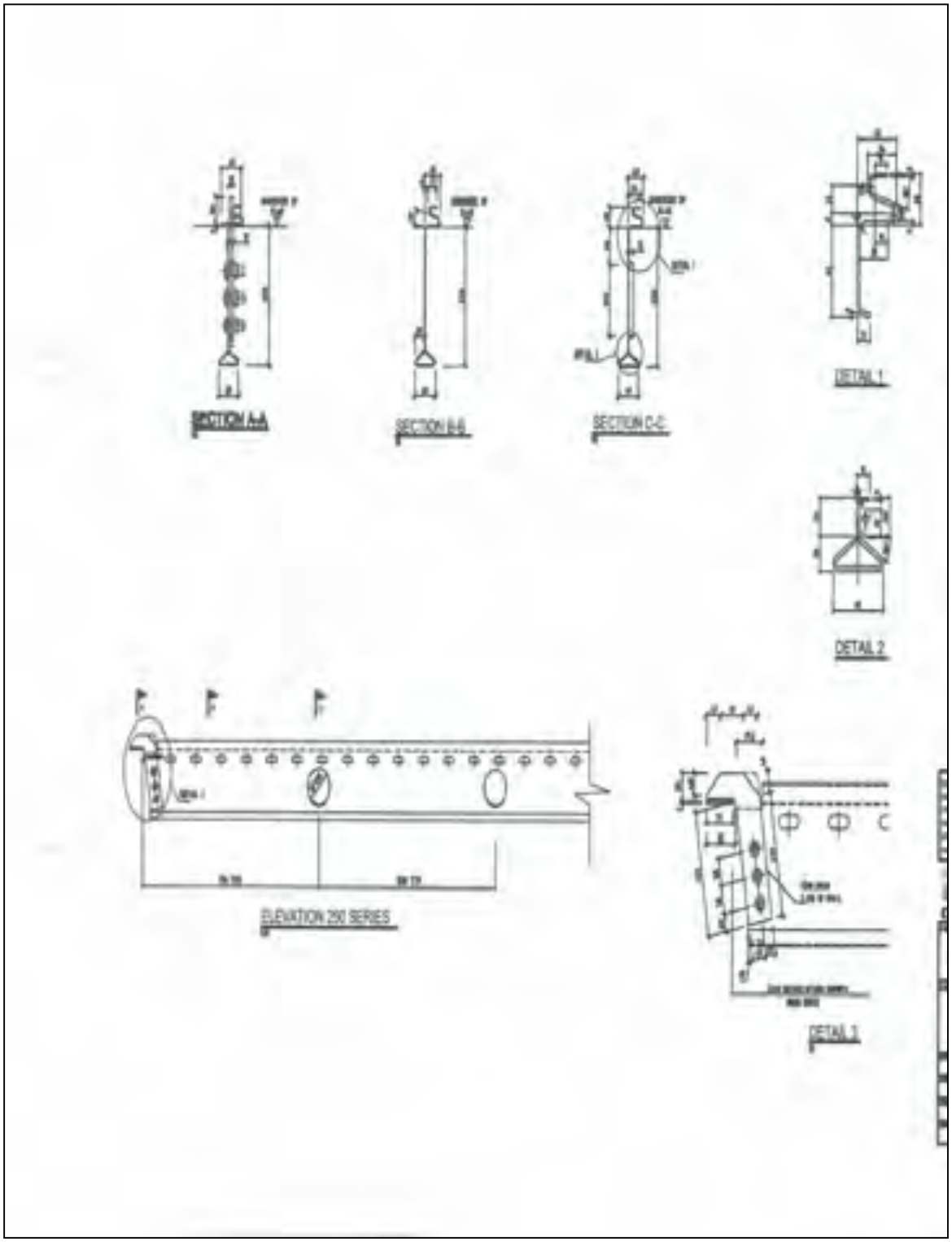

*NOTE
90mm slab
30 MPa concrete
663 Mesh
10 Cover
size depending
on span
joist
DETAIL FOR CARPARK LOADING
*NOTE: CARPARK LOADING REQUIRES 30 MPa CONCRETE
90mm SLAB WITH 663 MESH

Fig. 18



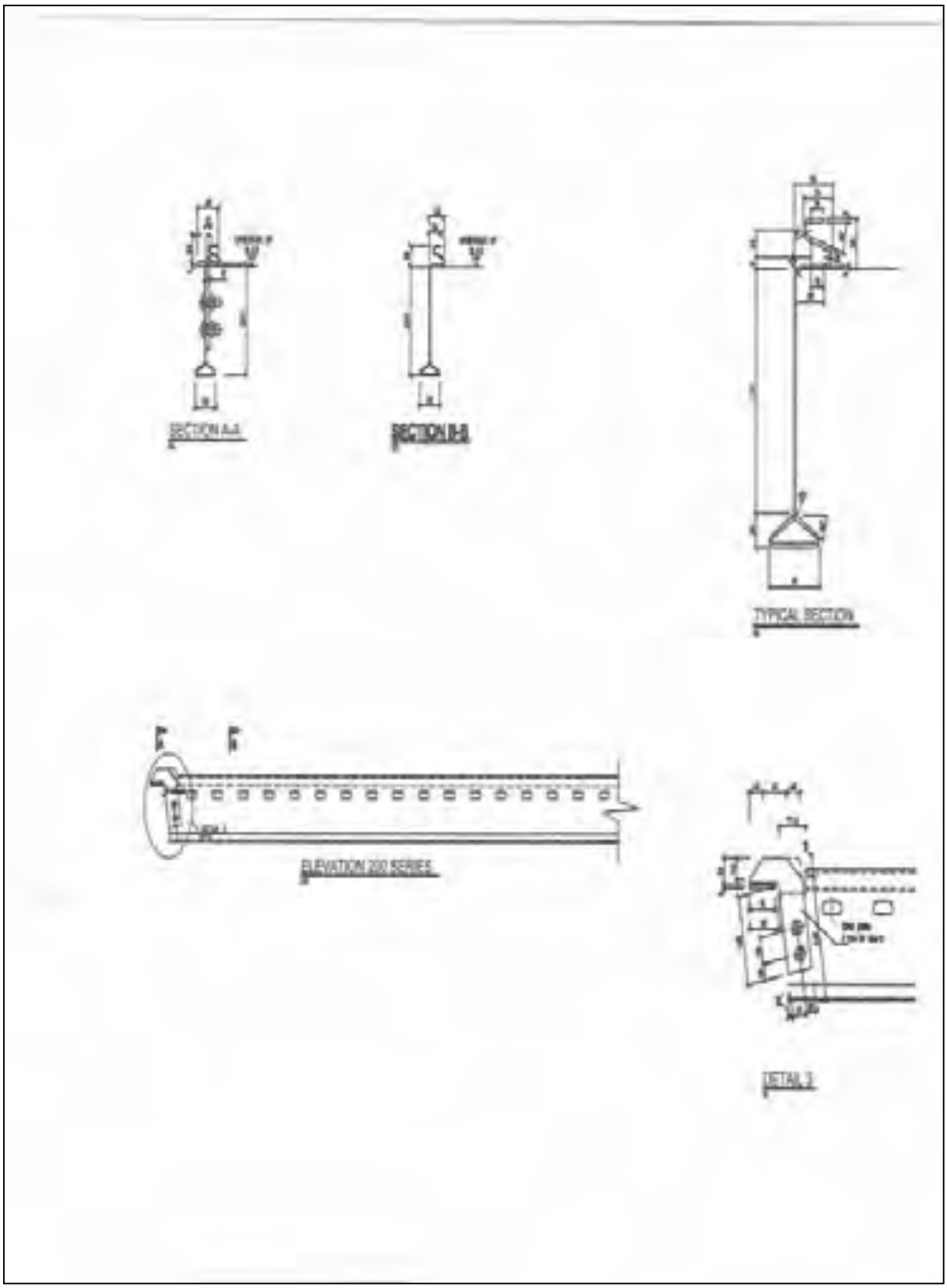
400 Series Joint Elevation and Details

Fig.19



250 Series Joint Elevation and Details

Fig. 20



200 Series Joint Elevation and Details

Fig.21

ANNEX D

(Clause 2.8.1)

INSTALLATION DRAWINGS

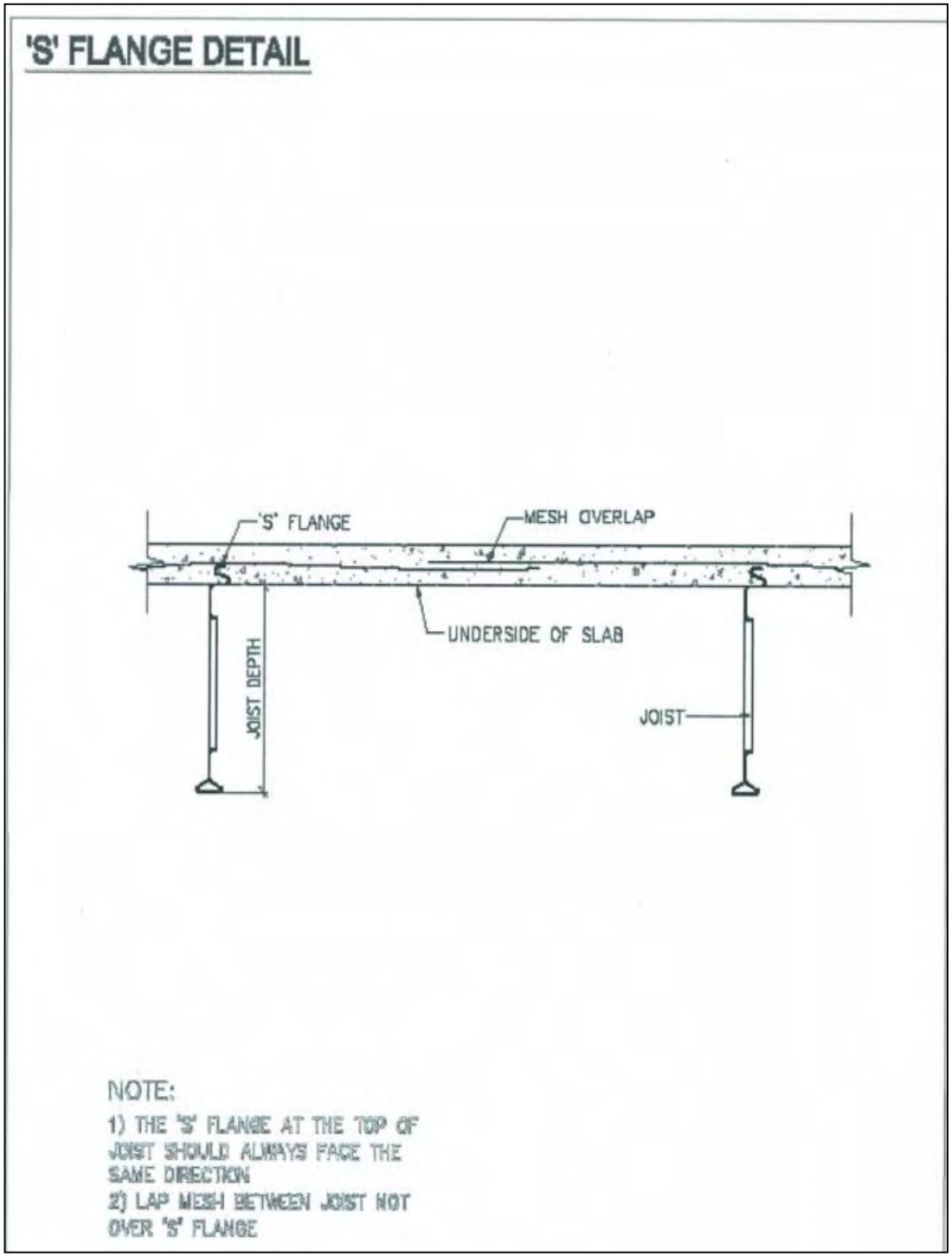


Fig. 22

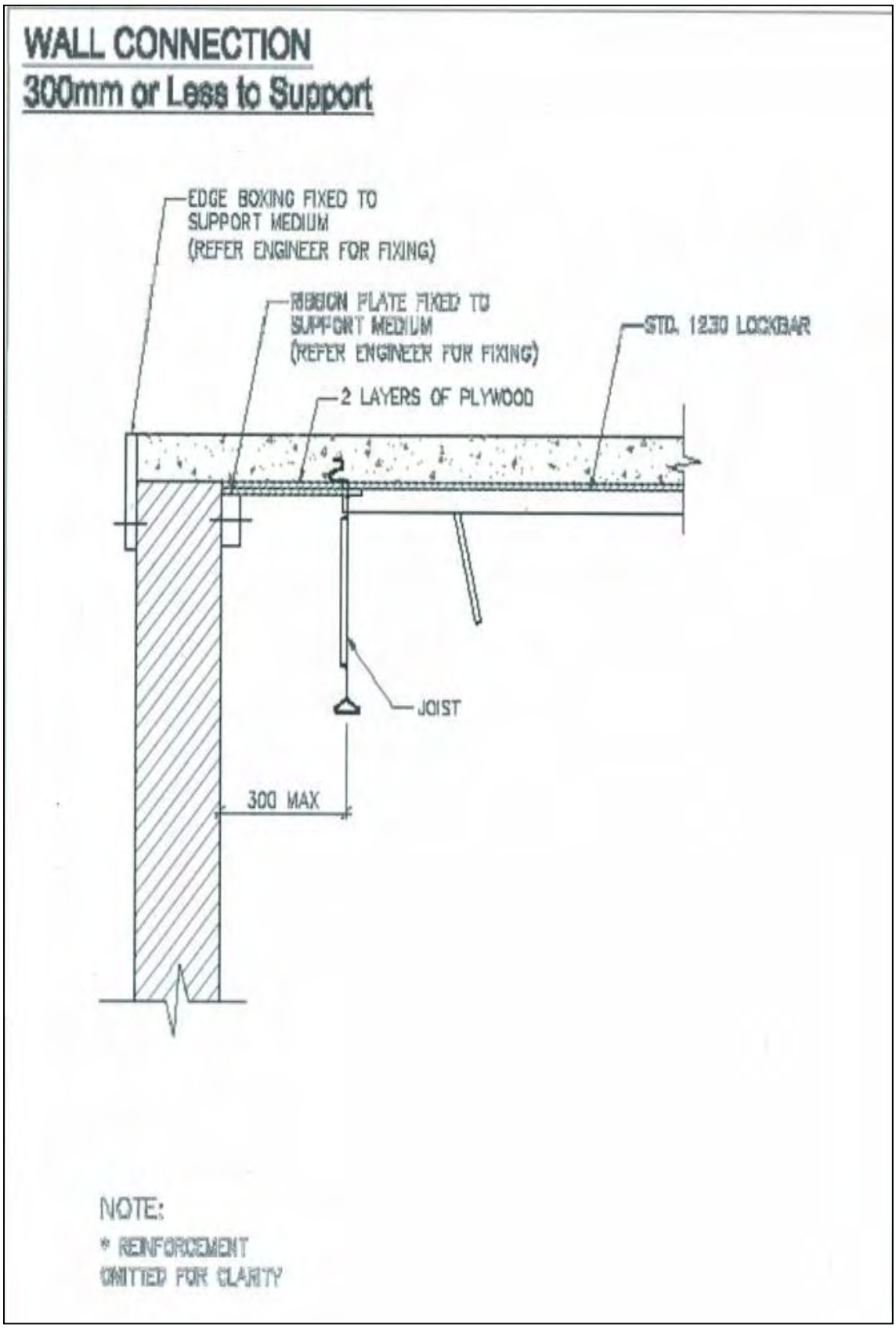

WALL CONNECTION
300mm or Less to Support
EDGE BOXING FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
RIBBON PLATE FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
STD. 1230 LOCKBAR
2 LAYERS OF PLYWOOD
JOIST
300 MAX
NOTE:
* REINFORCEMENT OMITTED FOR CLARITY

Fig. 23

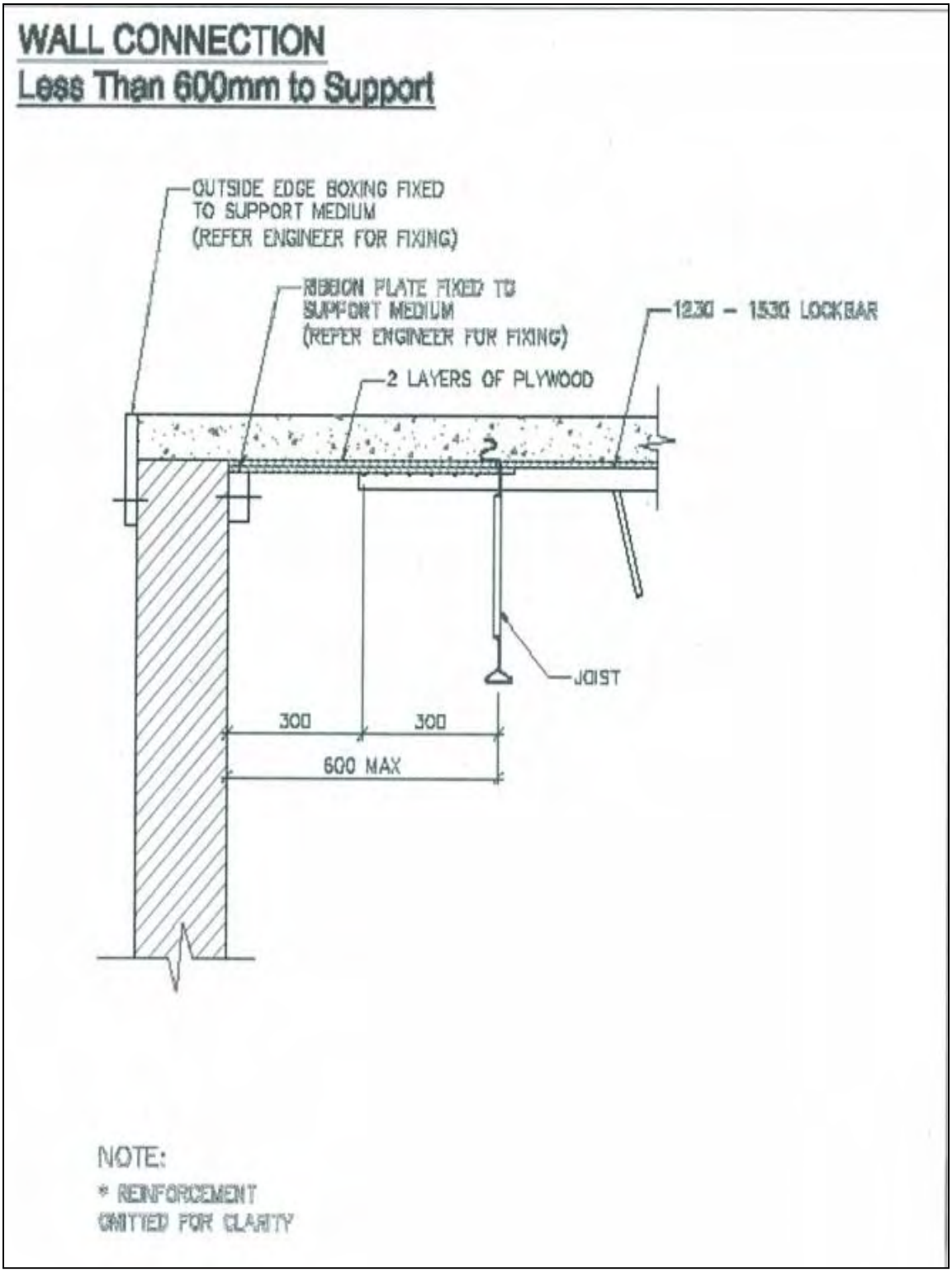

WALL CONNECTION
Less Than 600mm to Support
OUTSIDE EDGE BOXING FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
RIBBON PLATE FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
1230 - 1530 LOCKBAR
2 LAYERS OF PLYWOOD
JOIST
300
300
600 MAX
NOTE:
* REINFORCEMENT OMITTED FOR CLARITY

Fig.24

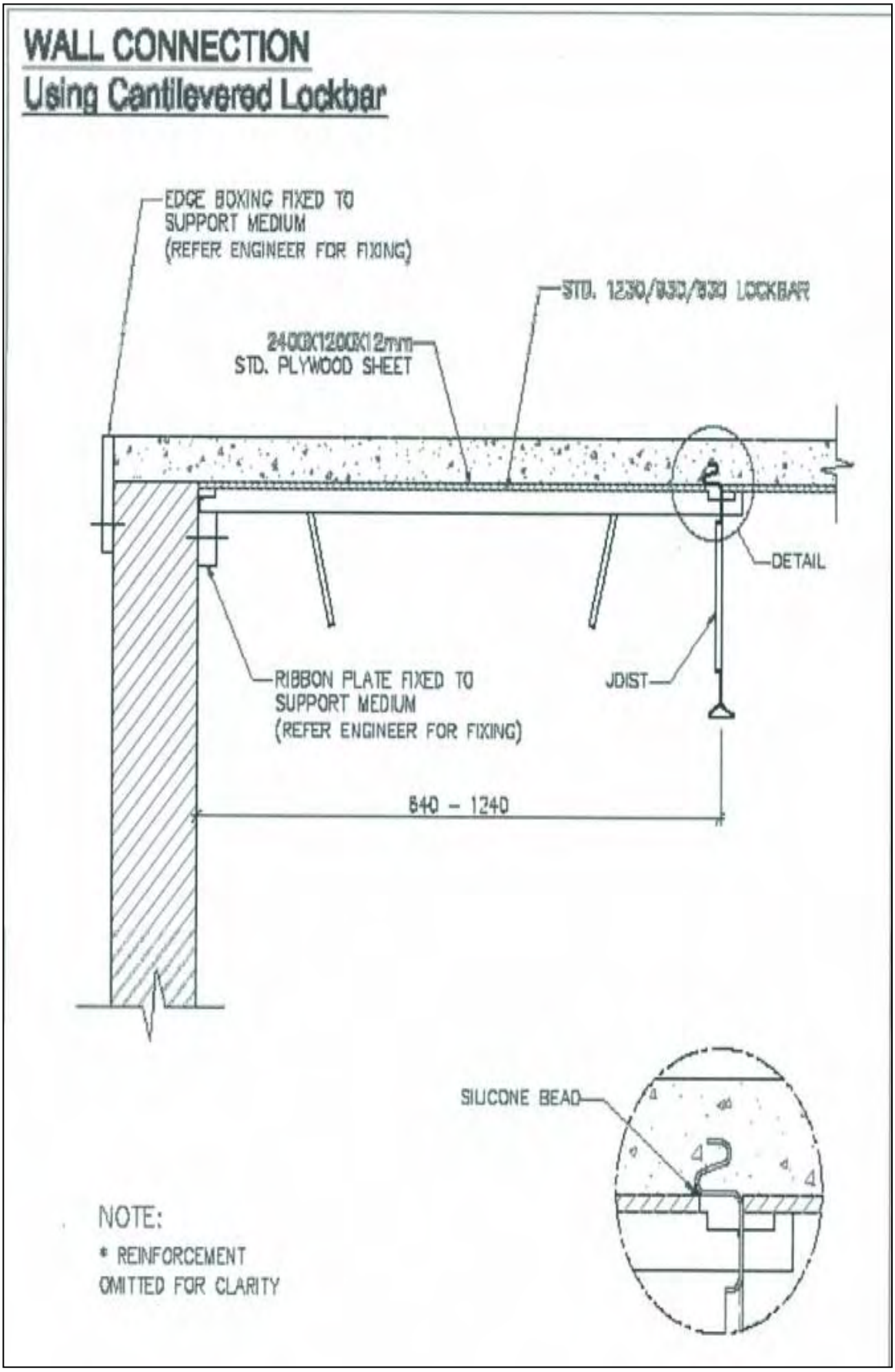
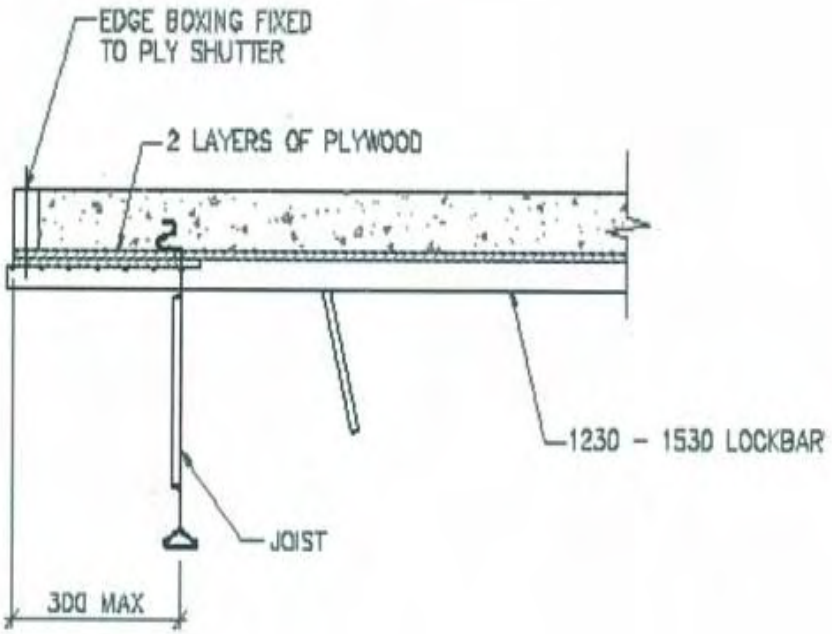

WALL CONNECTION
Using Cantilevered Lockbar
EDGE BOXING FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
STD. 1230/930/630 LOCKBAR
2400X1200X12mm STD. PLYWOOD SHEET
DETAIL
RIBBON PLATE FIXED TO SUPPORT MEDIUM (REFER ENGINEER FOR FIXING)
JOIST
640 – 1240
SILICONE BEAD
NOTE:
* REINFORCEMENT OMITTED FOR CLARITY

Fig.25

CANTILEVER EDGE BEAM

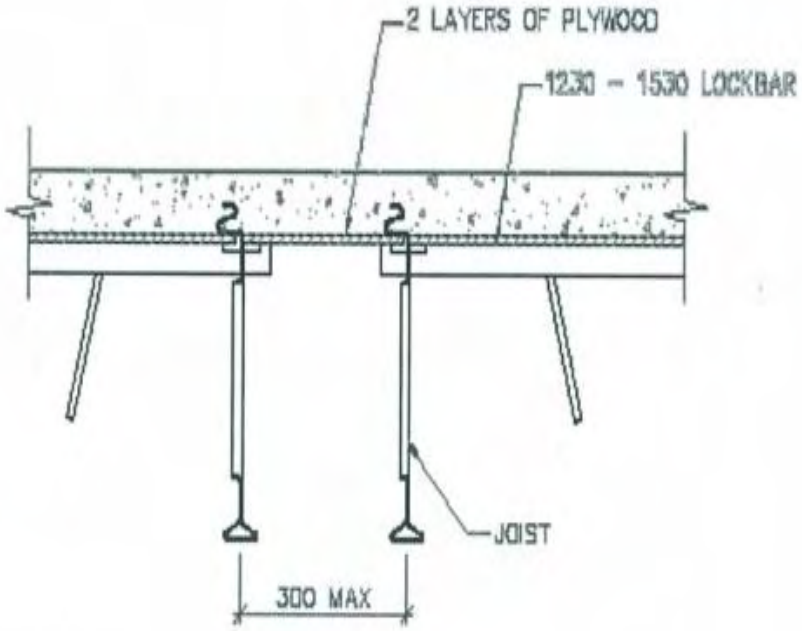


NOTE:

* REINFORCEMENT OMITTED FOR CLARITY

Fig. 26

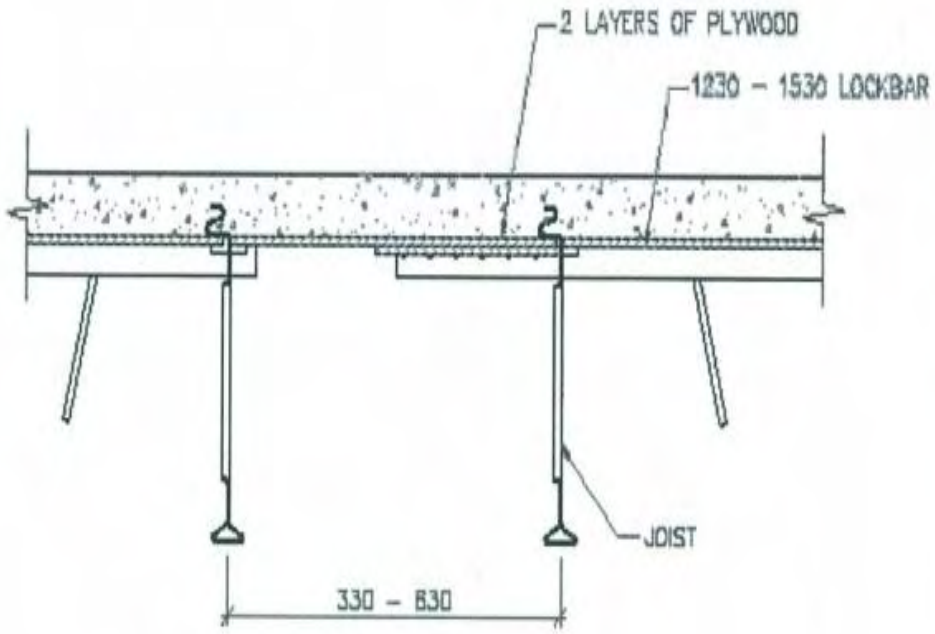
LOCKBAR DETAIL
Spanning 300mm or Less



NOTE:
* REINFORCEMENT
OMITTED FOR CLARITY

Fig. 27

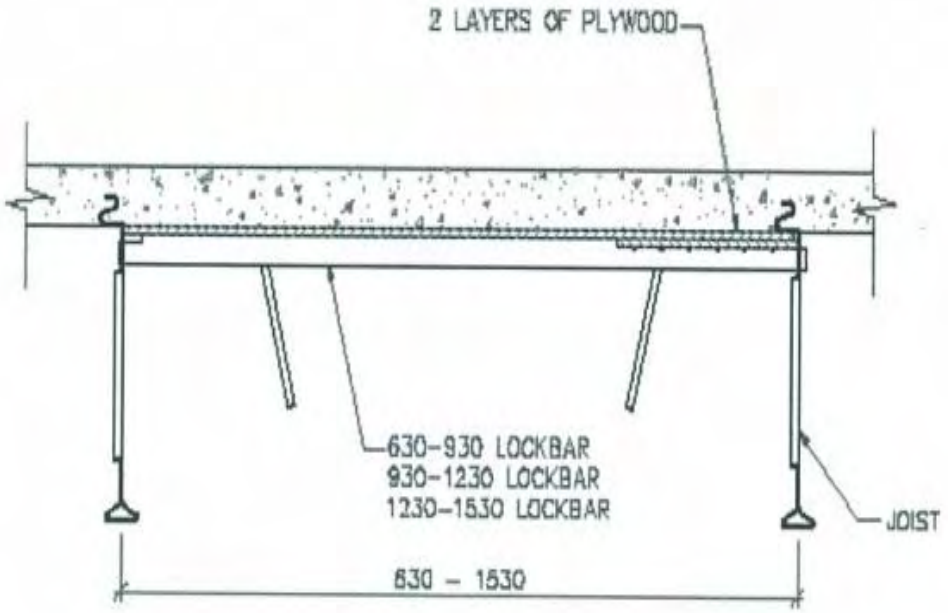
LOCKBAR DETAIL
Spanning 330mm - 630mm



NOTE:
* REINFORCEMENT
OMITTED FOR CLARITY

Fig.28

LOCKBAR DETAIL
Spanning 630mm - 1530mm



NOTE:
* REINFORCEMENT
OMITTED FOR CLARITY

Fig.29

ANNEX E

{Clause 2.3 (i)}

DESIGN PHILOSOPHY

E-1 DESIGN PRINCIPLES

The design of the Speedfloor system is based on NZS 3404 (Part1&2): 1997, AS/NZS 4600:1996 and the Australian Composite Standard AS 2327(Part1). The design loads shall be taken as prescribed in relevant IS 875(Part1& 3):1987

E-2 *DESIGN PARAMETERS*

The section properties& capacities (given below for concrete slab thickness of 75mm and 90mm) and design parameters are calculated from the section geometry, supplementary full scale tests and finite element analysis.

Speedfloor joists have flanged service holes in the web to assist in web stiffening and to provide practical services access. The joist is simply supported during construction generally with no propping required.

The concrete is cast in place and acts compositely with Speedfloor joist.

E-2.1 Speedfloor With 75mm Concrete Slab

E-2.1.1 *Section Properties*

Joist Series (mm)	**Non-composite**			**Composites**				
	Ist ($x10^6mm^{4)}$	Zt ($x10^3mm^{3)}$	Zb ($x10^3mm^3$)	Icomp ($x10^6mm^4$)	Zt ($x10^3mm^3$)	Zb ($x10^3mm^3$)	Iefffor deflection ($x10^6mm^{4)}$	
200	8.14	65.00	72.00	29.38	594.70	130.20	26.00	
250	14.00	92.90	101.90	38.30	776.80	138.90	34.70	
300	20.40	108.00	136.00	60.80	1117.60	189.60	54.50	
350	28.70	129.00	173.00	87.90	1465.00	240.80	79.00	
400	38.10	160.60	189.70	95.20	1649.90	228.00	86.60	

E-2.1.2 *Section Capacities*

Joist Series (mm)	**Non-composite**		**Composite**			
	Shear capacity with holes ØV (kN)	Shear capacity without holes ØVv (kN)	Ø Msx (kN.m)	Shear capacity with holes ØVrc (kN)	Shear capacity without holes ØVrc (kN)	ØMrc (kN.m)
200	-----	71.00	20.50	-----	73.00	44.80
250	30.20	100.00	29.30	32.20	102.20	41.40
300	42.00	85.00	34.00	44.00	87.00	61.00
350	60.00	72.00	40.60	62.00	74.00	83.00
400	30.20	62.00	50.50	32.20	64.40	72.30

E-2.2Speedfloor With 90mm Concrete Slab

E-2.2.1 *Section Properties*

Joist Series (mm)	Non-composite			Composites				
	Ist ($x10^6mm^4$)	Zt ($x10^3mm^3$)	Zb ($x10^3mm^3$)	Icomp ($x10^6mm^4$)	Zt ($x10^3mm^3$)	Zb ($x10^3mm^3$)	Iefffor deflection ($x10^6mm^4$)	
200	8.14	65.00	72.00	35.20	633.00	150.70	31.20	
250	14.00	92.90	101.90	43.30	798.20	155.70	39.70	
300	20.40	108.00	136.00	67.70	1130.00	205.00	60.40	
350	28.70	129.00	173.00	96.30	1488.40	256.60	86.00	
400	38.10	160.60	189.70	99.00	1578.90	231.60	89.90	

E-2.2.2*Section Capacities*

Joist Series (mm)	Non-composite		Composite			
	Shear capacity with holes ØVv (kN)	Shear capacity without holes ØVv (kN)	Ø Msx (kN.m)	Shear capacity with holes ØVrc (kN)	Shear capacity without holes ØVrc (kN)	ØMrc (kN.m)
200	------	71.00	20.50	------	73.00	47.80
250	30.20	100.00	29.30	32.60	102.20	43.30
300	42.00	85.00	34.00	44.00	87.00	64.00
350	60.00	72.00	40.60	62.00	74.00	86.00
400	30.20	62.00	50.50	32.60	64.40	74.70

Notations:
Ist : Second moment of area of steel alone
Zt: Effective section modulus of speedfloor top chord
Zb: Effective section modulus of speedfloor bottom chord
Icomp: Second moment of area of composite beam transformed into equivalent steel section
Ieff: Second effective moment of area
ØVv: Normal shear capacity of a non-composite section
ØMsx: Normal moment capacity of a non-composite section
ØVrc: Normal shear capacity of a composite section
ØMrc: Normal moment capacity of a composite section

Assumptions relating to Properties and Charts
General

- *Steel joist: f´y = 350 MPa*
- *Steel thickness: 3 mm*
- *Concrete strength: 25 MPa (30 MPa for carparks)*
- *Joist spacing: 1230mm, 830mm and 630mm*
- *Slab topping typical: 75mm and 90mm*
- *Capacity of end bolted support bracket: 200mm series joist is 48 kN,250mm-400mm series joists are 77KN(limit state)*
- *First hole 1300mm min from edge of support*
- *200mm series joist has no service holes, 250mm-350 series joist holes are 130mm diameter and 400 series joist holes are 250mm diameter*
- *All joists are precambered.*

E-3 LOAD CALCULATION

E-3.1 Dead Load

Even though total Weight of floor depends on the type of finishes, normally it varies from 0.8 Kn/m^2 to 1.5 Kn/m^2.
Weight of the floor slab varies from 1.75 Kn/m^2& 2.25 Kn/m^2.
Load for Roof finishing normally varies from 1.25 Kn/m^2 to 2.5 Kn/m^2 for depending upon the water proofing treatment adopted. These are indicative values and Dead load has to be calculated based on the unit weight provided in IS 875 (Part1):1987 for each work.

E-3.2 Live Load

Live load for different occupancies can be considered from Table 1 of IS 875 (Part 2):1987

E-3.3 Wind Load

Wind loads applied on the building is a part of structural system, resisted solely by moment connection & Wind bracings, however the speed floor joist is independent of any force caused by the wind load.
Wind load analysis conduct as per IS875-Part3. The 90 degree case acts on the side elevation and 0 degree wind load case acts on the front or back elevation. Each elevation will be analysed separately and the highest calculated load will be applied throughout the entire structure. Therefore, this technique is deemed to be conservative.
Overturning (global stability) and holding down analysis is conducted for the widest cases.
Comprehensive explanation of the global stability analysis follows.

Design wind pressure (N/m^2) Pz = 0.6 x Vz^2 {(*Refer* 5.4 of IS 875(Part 3):1987}

Design wind speed (m/s) Vz = VbxK1xK2xK3 {(*Refer* 5.3 of IS 875 (Part-3):1987};

Basic wind speed (m/s) Vb {(*Refer* Fig 1of IS 875 (Part 3):1987};

Risk coefficient factor (K1) {(*Refer* Table 1, 5.3.1 of IS 875(Part 3):1987};

Terrain, height and Structure factor (K2) {(*Refer* Table 2, 5.3.2 of IS 875 (Part 3):1987};

Topographic factor (K3) {(*Refer* 5.3.3.1 of IS 875(Part 3):1987};

E-3.3 Seismic Load

Seismic loads apply on the each floor and roof level of the buildings.
The horizontal loads are transferred from the floor diaphragm to the walls tying or supporting the floors and roof. Seismic loads applied on the building is a part of structural system, resisted solely by moment connection &bracings in the structure, however the speed floor joist is independent of any force caused by the seismic action.

Total Design lateral Force or Seismic Base Shear V (kN) = Ah x W total (*Refer* 7.5.3 ofIS1893:2002)

Design Horizontal Seismic Coefficient Ah= (ZISa/2Rg)
(*Refer* 6.4.2 of IS1893:2002);
Zone Factor (Z) (*Refer* Table2, 6.4.2 of IS1893:2002);
Seismic Zone (*Refer* Seismic Zone Map of IS1893:2002);
Seismic Intensity (*Refer*Table2, 6.4.2 of IS1893:2002);
Importance Factor (I) (Refer Table 6, 6.4.2 of IS1893:2002);
Response Reduction Factor (R)
(*Refer* Table7, 6.4.2 of IS1893:2002);
Average response acceleration coefficient factor (Sa/g) (Refer 6.4.5 of IS1893:2002);
Total weight of building (W, total) (kN) (Refer 7.3 of IS1893:2002)

E-4 COMPONENT DESIGN & CHECKS

E-4.1 Joist Design

E-4.1.1 *Combined Bending and Crushing {Refer 5.5.1 of BS 5950 (Part 5): 1998};*

Flat webs of sections subject to a combination of bending and concentrated load or reaction should be designed to satisfy the following relationships at the limit state:

a) sections having single-thickness webs

$$1.2\ \frac{Fw}{Pw} + \frac{M}{Mc} + \leq 1.5$$

$$\frac{Fw}{Pw} \leq 1$$

$$\frac{M}{Mc} \leq 1$$

Where *F*w is the concentrated web load or reaction
*P*w is the concentrated load resistance determined in accordance with 5.3
The resistance to local crushing of the webs of beams at support points or points of concentrated load should be evaluated using the equations given in Table 7 and Table 8 of BS 5950. For built-up I-beams, or similar sections, the distance between the connector and beam flange should be kept as small as practicable.

The equations in Table 7 and Table 8 apply to the following:

Beams with: $D/t \leq 200$

$r/t \leq 6$

In these relationships and the equations in Table 7 and Table 8:
D is the overall web depth in mm;
t is the web thickness in mm;
r is the inside bend radius in mm;
N is the actual length of bearing in mm; for the case of two Equal and opposite concentrated loads distributed over unequal bearing lengths, the smaller value of *N* should be taken;
*P*w is the concentrated load resistance of a single web in N;
C is the distance from the end of the beam to the load or the reaction in mm.

C is a constant with the following values:
*C*1 = (1.22 2 0.22*k*)
*C*2 = (1.06 2 0.06*r*/*t*) ≤ 1.0
*C*3 = (1.33 2 0.33*k*)
*C*4 = (1.15 2 0.15*r*/*t*) ≤1.0 but not less than 0.50
*C*5 = (1.49 2 0.53*k*) ≥0.6
*C*6 = (0.88 + 0.12*m*)
*C*7 = 1 +*D*/*t* / 750 when *D*/*t* < 150;
*C*7 = 1.20 when *D*/*t* > 150
*C*8 = 1/*k*, when *D*/*t* < 66.5;
*C*8 = (1.10 2 *D*/*t* / 665)/*k* when *D*/*t* > 66.5
C9 = (0.82 + 0.15*m*)
*C*10 = (0.98 2 *D*/*t* / 865)/*k*
*C*11 = (0.64 + 0.31*m*)
*C*12 = 0.7 + 0.3 (θ/90)2
where
$k = p_y/228$ where p_y is the design strength in N/mm^2;
m = *t*/1.9;
θ is the angle in degrees between plane of web and plane of bearing surface, where 45° ≤ θ ≤ 90°
M is the applied bending moment at the point of application of *F*w
*M*c is the moment capacity determined in accordance with (Fig 5 of BS 5950 (Part 5):1998)
*M*c= p_0 x Z
p_0 is the compressive Stress
Z is the section modules

E-4.1.2 *Combined Bending & Shear Check {(Refer 5.5.2 of BS 5950 (Part 5):1998}*

For beam webs subjected to both bending and shear stresses the member should be designed to satisfy the following relationship

$$\left(\frac{Fv}{Pv}\right)^2 + \left(\frac{M}{Mc}\right)^2 + \leq 1.0$$

Where *F*v is the shear force
*P*v is the shear capacity or shear buckling resistance determined in accordance with 5.4.3and is equal to *P*v*Dt* or *q*cr*Dt* whichever is the lesser.
The maximum shear stress, calculated on the basis of an accepted method of elastic analysis, should not be greater than 0.7p_y, where p_y is the design strength.

*P*v = 0.6*P*y

$$q_{cr} = \left(\frac{1000\ t}{D}\right)^2$$

*p*y is the design strength in N/mm^2;
t is the web thickness in mm;
D is the web depth in mm;
M is the value of the bending moment acting at the same section as

*F*v
*M*c is the moment capacity determined in accordance with {Fig 5, 5.2.2 of BS 5950 (Part 5):1998};

The compressive stress, p_0, in a stiffened element which results from bending in its plane, should not exceed the lesser of the following values:

$p_0 = p_y$

or

$$P_0 = \left\{1.13 - 0.0019 \frac{D_W}{t}\left(\frac{Y_S}{280}\right)^{1/2}\right\} P_y$$

*D*w is the section depth or twice the depth of the compression zone, *D*c whichever is the greater in mm
*D*c is the depth of the compression zone of the web, taken as the Distance from the neutral axis of the gross cross-section to the compression element in mm;
*Y*s is the material yield strength in N/mm^2;
t is the web thickness in mm;
p_y is the design strength in N/mm$^{2;}$

E-5 DEFLECTION CHECK

E-5.1 {Refer 2.4.2 of BS 5950 (Part 5):1998}

The deflection under serviceability loads of a building or its members should not impair the strength or efficiency of the structure or its components or cause damage to the finishing. Table 3 of BS 5950 gives recommended deflection limits for certain structural members.

E-5.2 {Refer 6.2.1 of SCIP301)

E-5.2.1 *Static Criteria*

(a) The maximum deflection for a single joist subject to dead and imposed loads is limited to the smaller of span/350, or 15 mm.
(b) The maximum deflection for a single joist subject only to imposed load is limited to span/450.

E-5.2.2 *Dynamic Criteria*

(c) The natural frequency of the floor should be limited to 8 Hz for the uniformly distributed load case of dead plus 0.3 KN/m^2, which represents the nominal load on lightly loaded floor. This is achieved by limiting the deflection of a single joist to 5mm for this loading condition.
(d) The deflection of the complete floor (i.e. series of joists plus the flooring Material) when subject to a 1 KN point load, should be limited to the values presented in Table 6.1 of BS 5950.
(e) For the floor subjected to imposed loads in excess of 1.5 KN/m^2, the governing criterion is most likely to be (a) (Span/350 or a maximum of 15mm)
Deflection of uniformly distributed simply supported beam can

be calculated by

$$Deflection = \left(\frac{5Wl^4}{383\ EI}\right)$$

E - is the modules of Elasticity 205000 N/mm^2
I - is the moment of inertia mm^4
W - is the total uniform load
l - Span length

Note: The manufacturer has also submitted various Load charts and Tables for working out total deflection for 200mm, 250mm, 300mm, 350mm & 400mm joists for both 75mm & 90mm concrete topping for each joist at spacing of 630mm, 930mm & 1230mm individually

ANNEX F

(Clause 2.9)

DO'S AND DON'TS OF WORKING WITH SPEEDFLOOR

F-1 PLY SHEETS

- Don't cut up full sheets of plywood unless it's a last resort or specifically instructed.
- Don't drop full sheets of ply on corners
- Don't notch corners out of full sheets of ply
- Do water-blast full sheets of ply after use and before pours
- Edges and ends shall be cleaned when water-blasting
- Release agent shall always be used but sparingly
- Do stack full sheet only neatly in separate bundle
- Do stack nearly full sheets separately: separate part by width and part by length
- If near full width/length needed don't rip full sheet, use two part width/length sheets
- If holes need to be drilled, these should be decided early and use part sheets in these areas
- Do remove tape before stacking
- Don't cut full sheet ends out of square
- Do use full width square when cutting less than full sheets
- Use 3 dunnage to stack full sheets of ply on
- If possible plastic strap full bundles of ply together

F-2 LOCKBARS

- Do stack all sizes of lockbars separately
- If lockbars are 1230mm or bigger, stack stillages in one direction only
- Don't leave lockbars behind in multilevel development
- Don't stack damaged lockbars with good ones
- Don't put special notches in lockbars

- Don’t use lockbars for any other purpose
- Don’t stack lockbars in the recommended fashion in stillages
- If not enough stillages, matter shall be reported
- Don’t cut ends off lockbars
- Don’t open up notches with angle grinder
- Don’t cut handles off lockbars
- Don’t overload stillage
- Don’t drag half full stillages around with digger
- Look after stillages when empty
- Don’t cut joist end brackets
- Don’t cut into support medium
- Don’t shorten joist without consultation with speedfloor

F-3 JOISTS

- Do lay out as close as possible to joists layout provided
- When laying down joists, dunnage every 3 m on an even terrain
- Don’t cut holes in web of joists without consultation
- Don’t cut or damage top or bottom of joists in any way.