Fix Here

WELLINGTON CITY COUNCIL
Building Permit Application

1

WORKS DEPARTMENT
PLUMBING AND DRAINAGE BRANCH
RECEIVED
28 NOV 1986
MERCER STREET
WELLINGTON

To The City Engineer
I/the undersigned hereby apply for permission to carry out the works described in the attached plans and specifications deposited herewith and in accordance with the bylaws of the Wellington City Council.

PAGES 1 & 2 TO BE COMPLETED BY THE APPLICANT

ADDRESS OF PROPOSED WORK

Address Street No. and Name: 101-117 CUBA STREET

Suburb: WELLINGTON

OWNER

Name: THE TRUSTEES, WGTON WORKINGMENS CLUB

Address: PO BOX 6354

WORK DEPARTMENT
BUILDING INSPECTION BRANCH
20 NOV 1986
RECEIVED
MERCER STREET WELLINGTON

LEGAL DESCRIPTION (from property rates demand if available)

Lot No. 1 D.P. No. 15298 Area M² 1375

BUILDER (if owner builder, tick ☐)

Name of Company: DIXON & McKINLAY

Postal Address: PO BOX 40080 UPPER HUTT

Phone No. 289 789.

Description of Proposed Work

New Building	☐	Conversion	☐
Addition	☑	Demolition	☐
Alteration	☑	Repile	☐

Description of Use and Main Purpose of Building

ie Dwelling: Flats: Business: Other Building:

CLUB PREMISES

ESTIMATED VALUE OF WORK

Building $1,611,000

Mechanical Services $20,000 less materials 8611095 balance

Drainage $9000 – $3000 = $6000

Plumbing $90000 – $30000 = $60000

Total $1,730,000

Note Plan Examination Fee: A plan examination fee based on the total estimated value above is payable upon lodging this application. This will be forfeited if the building permit is not collected or is cancelled for any reason, but will be deducted from any fees paid upon collection.

TURN TO PAGE 2

FOR OFFICE USE

1-500 Sheet No. Q28 out Drainage Plan No. 8170

CE B239 Building District Te Aro

2

DETAILS OF PROPOSED BUILDING

Scope of Application

Complete project ☑ tick

Partial project ☐ tick

(state nature of partial work) .....

Number of Dwelling Units ☐ Number of Occupants ☐

AREA OF BUILDING

NEW BUILDING

Area of Addition

Ground Floor	M²	205
1st Floor	M²	205
2nd Floor	M²	205
3rd Floor	M²	345
4th Floor	M²	345
5th Floor	M²	
6th Floor	M²	
Total		1305

If additions to existing building give area of new work here Area of Adds M² 1100

APPLICANT (signed by person making application)

Name: A.J. Blake. P.P. DIXON + McKINLAY

Address: P.O. Box 400-80 UPPER HUTT

Contact Phone No's 289-705 Signed A.J. Blake

FOR OFFICE USE

DOCUMENTS ATTACHED AS PART OF THIS APPLICATION WHICH ARE APPLICABLE:

Drawings – two sets ☑ Specifications 2 ☑

Calculations ☑ Water Form ☒ Govt. Clearance ☑ 8611095

Bracing Schedule ☒ Drainage Plan ☒ Architects Signature ☑

Parking Area ☒

Application Received By: Signed N Bog

Plans Show: Elevations ☑ Sections ☑ Construction ☑

Full Dimensional Site Plan ☑

Contour Plans & longitudinal section through vehicle access from kerb ☒

ACTION TAKEN ON ABOVE .....

SPECIAL LICENCES ETC. Refer to: .....

MISCELLANEOUS NOTES: .....

3

HISTORY SHEET

	REFER TO	APPROVED BY	DATE
1. Water Supply			21/11/86
2. Town Planning		RAbop	21/11/86
3. Plumbing & Drainage	REF.	K Jeffery	4.12.86
4. Streetwork Design			20/11/86
5. Health Branch			
6. Parks & Recreation			
7. Structural		DW	21/11/86
8. Other			

REQUIREMENTS OF VARIOUS DEPARTMENTS

STRUCTURAL

SPECIAL FEES

Cellar Registration Fee $ —

Reserves Contribution $ 9515-00

Water Fee $ 337-50

Plan Examination Fee $ 785-00

DISTRICT BUILDING INSPECTOR

Excavation ☒ Retaining ☒ Disposal of Soil ☒

Ground Conditions Fill ? Natural ☐

Demolitions ☒ Hoardings ☒ Gantry ☒

Encroachments approved ☒ Building Line Restrictions ☒

Egress Refer to ✓

Signed by District Inspector: [signature]

Date 27-2-87

APPLICATION APPROVED

Signed [signature] pp [signature] Building Superintendent

Date 27.2.87

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PLUMBING AND DRAINAGE REQUIREMENTS

Sewa/drainage To be relaid to suit new fittings refer addenda sheet.

Stormwater drainage To be relaid to suit new down pipes refer addenda sheet.

Plumbing as proposed refer addenda sheet. No pipe work to be concealed without approval of inspector.

ING WORKS, BY LICENSED CRAFTSMAN PLUMBER UNDER SEPARATE PERMIT.

~~DRAINAGE WORKS, BY LICENSED DRAINLAYER~~ UNDER SEPARATE PERMIT.

ALL WORKS TO COMPLY WITH DRAINAGE AND PLUMBING REGULATION 1978 AND W.C.C. CONSOLIDATED BY-LAWS AND REQUIREMENTS.

BUILDING REQUIREMENTS

See Addenda Sheet

WELLINGTON CITY COUNCIL
WORKS DEPT.
COPY OF APPROVED PLAN
To be retained on Works and Produced on Request of Building Inspectors
Date 19-3-87
Building Supt.

005936
$29662-50

[redacted]

BUILDING PERMIT
(Office Copy)

WELLINGTON CITY COUNCIL
WORKS DEPARTMENT

No. D 005936

Date Issued 20 / 3 / 87

OWNER

Name: THE TRUSTEES, WGTN WORKING CLUB
Mailing Address: P. O BOX 6354
WGTN

BUILDER

Name: DIXON & McKINLAY
Mailing Address: P. O BOX 40080
UPPER HUTT

PROPERTY ON WHICH BUILDING IS TO BE ERECTED/DEMOLISHED

SITE

Street No.: 101 - 117
Street Name: CUBA ST
Town/District: CENTRAL
Riding:

LEGAL DESCRIPTION

Valuation Roll No.:
Lot: 1 D.P.: 15298
Section: Block:
Survey District:

DESCRIPTION OF PROPOSED WORK AND MAIN PURPOSE OF USE

ADDITION & ALTERATION - CLUB PREMISES
- SEESMIC UPGRADING & EXTENSIONS

FLOOR AREA

Whole Sq. Metres:

DWELLING UNITS

Number Erected:

ESTIMATED VALUES $

Building	1631000
Plumbing	90000
Drainage	9000
TOTAL	1730000

NATURE OF PERMIT (TICK BOX)

- [ ] NEW BUILDING — exclude domestic garages and domestic outbuildings
- [ ] FOUNDATIONS ONLY
- [x] ALTERED, REPAIRED, EXTENDED, CONVERTED, RESITED — include installation of heating appliances
- [ ] NEW CONSTRUCTION OTHER THAN BUILDINGS — include demolitions
- [ ] DOMESTIC GARAGES AND DOMESTIC OUTBUILDINGS

	FEES APPLICABLE	$	c		FEES APPLICABLE	$	c
294-902	Water Fee	337	50	263-939	Sewer Connections	120	
065-955	Inspection of Work/Documents	7115		263-939	Stormwater Connections	120	
061-902	Plumbing Permit Fee	9750		263-941	Manhole/LH CE Raise/Lower		
061-902	Drainage Permit Fee	975		Dep. No.	Demolition Deposit Rd/Path		
704-902	Building Research Levy	1730		263-940	Sewer Disconnections		
745-909	Reserves Contribution	9515		263-940	Stormwater Disconnections		
Dep No.	Access Guarantee Deposit	—		294-940	Water Disconnections		
Dep No.	Footpath Damage Deposit	—			EXC. GST	2696	91
225-971	L.D. Crossing & Conc. Cutting	—			GST =	269	59
225-971	Stormwater Alteration	—			TOTAL INC GST	2966	50
225-970	H.D. Crossing	—					
225-972	Builders Road Fee						
225-972	Drainlayers Footpath Fee						
225-972	Drainlayers Road Fee						
Dep. No.	Drainlayers Deposit Road/Path						

Received From: Bennett.
Address:
Machine Receipt No. C03 69551 Date 20.3.87
The above fees are payable in addition to the plan examination fee of $ 785 — already paid. Refer receipt C03 42627
Date 19.11.86

NOTICE TO APPLICANT

PERMISSION IS HEREBY GRANTED YOU, subject to conditions endorsed hereon, to carry out the work as proposed in your application, and in accordance with the Plans, Specifications, and other documents submitted to me. Such work is to be subject, at any time during progress, to my inspection, and to be carried out in strict compliance with all the requirements of the By-Laws of the City of Wellington, and with the attached "General Requirements for the Control of Building Construction Projects Affecting City Streets and Footpaths" and "General Requirements for Vehicular Access Construction".

NOTE THIS PERMIT IS VALID ONLY WHEN PAYMENT OF THE ABOVE FEES HAS BEEN MADE TO THE COUNCIL.

FOR CITY ENGINEER: [signature]
DATE: 20.3.87

BC/WG/01

WORKS DEPARTMENT
CHECKING & COMMENTS FORM
Structural Branch to Building Branch

Code 3

8979

CE R695 Stage 2

NATURE OF WORK Extension to Club Rooms	Dates when Plans Deposited	1 20.11.86	
NAME OF OWNER Wellington W.M.C. & L.I.	Dates received Structural Office	1 25-11-86	
ADDRESS OF NEW WORK 111-117 Cuba St	Date Calculations Received in Structural Office	1 25-11-86	
CONSULTING ENGINEER B.M.R.S. (Site) Smith Lemmens Ltd	Date of Inspection Time	A.M.	P.M.
ARCHITECT Keith Wilson	Dates Returned to Building Branch	1 25-11	
BUILDER	Date Letter Sent File	1	

PROPOSAL		Signature	Date
	REFERRED BACK		
	ACCEPTANCE	[illegible]	25-11

Referred Action required

ACCEPTANCE SUBJECT TO FOLLOWING CONDITIONS:–

Engineer to supervise.

Soils engineer to be consulted on results of site investigation.

Note: Where new foundations are involved the building inspector is to be given 24 hours notice before concrete is placed.

6/2087 PR:MD

Building Branch
Works Department
WELLINGTON CITY COUNCIL

26 February 1987

ADDENDA SHEET

WELLINGTON WORKING MENS CLUB (STAGE 2)
SEISMIC UPGRADING AND EXTENSIONS
101 - 117 CUBA STREET, TE ARO
WELLINGTON

1. Prior to excavation for foundations etc being commenced, the validity of the site boundaries is to be established to the satisfaction of the City Engineer in writing by notification from a Registered Surveyor that the site boundaries have been accurately defined by the correct placing of required pegs with offset reference marks where necessary.

2. The Contractor shall, before any reinforcing steel is placed, or concrete poured, satisfy the City Engineer that the building is correctly set out and adequate notice must be given to the Building Inspector concerned to enable the setting out to be checked to ensure no encroachment on Council or other adjoining properties.

3. The Contractor shall ensure that the official stamped copy of the plans and specifications as approved for permit purposes by the Wellington City Council are available on the site at all times during the period of the contract and that no deviation from the approved documents will be permitted until revised drawings and/or specifications have been submitted to and approved by the Building Branch, Works Department.

4. Should excavations be taken below the foundations of adjoining properties or retaining walls, the proposed method of shoring or underpinning these walls is to be to the approval of the engineering advisers to the affected parties.
Copies of letters of approval for this work are to be lodged with this department prior to work commencing.

5. The Contractor is responsible for the location and protection of any services within the affected area or on Road Reserve and is to notify the respective Authority including the Municipal Electricity Department, the Transport Department, Waterworks and Drainage Branches, Post Office and Wellington Gas Company of any services that may be affected at least 7 days prior to the commencement of the work, to enable the necessary disconnecting to be carried out.

6. The emergency lighting system is to be extended to cover all newly formed areas including exterior fire escapes to NZS 6742.

7. Exit and directional signs are to be illuminated by both mains and emergency power supplies.

   Note - letters are not to be less than 100mm in height.

d/6

[redacted]

[redacted]

[redacted]

1. [redacted]

2. [redacted]

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. The existing fire alarm system is to be extended to give complete coverage to NZS 4561 and the thermal detection system is to be amended accordingly(including the shops to ground floor).

9. Fire hose reels are to cover all floor areas.
Maximum permitted length of 12mm diameter hose is 25 metres.

10. Ducts, vents and false ceilings are to meet the provisions of NZS 1900 chapter 5 clause 5.23.

11. The surface finish of walls and ceilings early fire indices to where public have access is to be as follows:

EXITWAYS	Spread of flame index	0
	Smoke developed index	3
ALL OTHER	Spread of flame index	2
	Smoke developed index	5
DRAPES	Exitways index	6
	All other index	12

Any drapes or curtains are to be either made from non-combustible material or to be suit ably treated with an approved fire retardent solution.
A certificate of this undertaking will be required.

12. Floors and floor coverings are to comply with the requirements of NZSS 1900, chapter 5, clause 5.68.

13. Access and facilities for the disabled are required and are to be provided to the satisfaction of this Department in conformity with the Code of Practice NZS 4121.

19/3/87 Manager Works

14. <u>Plumbing and Drainage Requirements:</u>

<u>Stormwater Drainage</u>

(a) Surcharge via yard sump on drainage plans interception requir ed.

<u>Sewer Drainage</u>

(b) Surcharge via gully traps interception required.

<u>Plumbing</u>

(c) Main combined waste from urinals on first floor to be carried up as 80mm not 40mm as detailed on plan.

(d) All floor wastes to discharge to approved positions not into soil pipes as detailed on plans.

(e) All lobbies and sanitary rooms to be ventilated as required by Plumbing and Drainage Regulations 1978, Regulations 39 & 40.

(f) 50mm floor drain from tank room to be trapped and discharged via open channel to a sewer gully trap.

Plumbing (continued)

(g) All sanitary fittings to be vented as required in Plumbing and Drainage REgulations 1978.

(h) Water storage tank overflows to be fitted with W.C.C. approved visual or audible alarm system.

(i) No pipe works to be concealed without approval of the Inspe ctor.

(j) 24 hours notice required for all inspections.

(k) In addition to all the items, anything contrary to the Drainage and Plubing Regulations 1978 and amendments and W.C.C. Consolidated Bylaws shall be amended to comply.

(l) Water supply to urinals to be controlled through approved water saving devices.

(m) All hot water cylinders installed to manufacturers code of practice and W.C.C. requirements.

ALL WORKS TO COMPLY WITH DRAINAGE AND PLUMBING REGULATIONS 1978 AND W.C.C. CONSOLIDATED BYLAWS AND REQUIREMENTS.

15. Structural Requirements:

(a) Engineer to supervise.

(b) Soils engineer to be consulted on results of site investigation.

CONTRACTORS FULL NAME: Dixon & McKinnon

UPLIFTED BY: A J Blake

DATE: 19-3-87

Dear Sirs

Expiry date: ...../...2.../1987

The Economic Stabilisation (Building Registration and Construction) Regulations 1974

Registration number 8 6 1 1 0 9 5

Pursuant to these regulations the issue of a building permit has been considered and is authorised immediately/~~deferred~~ to allow construction to commence in ....2nd.....(month) 1986 (year). If the building permit is not uplifted by the expiry date or construction is abandoned, this certificate shall lapse. Please quote registration number when making inquiries.

Yours faithfully,

D5936

~~P.A. Williamson~~
Building Projects Authority

P.W. 753A (Rev. 11/74)
99551D/5/83

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

WELLINGTON CITY COUNCIL
BUILDING BRANCH
WORKS DEPARTMENT
CE A100
CITY ENGINEER N. FYFE
Municipal Office Building, 5 Mercer Street, P.O. Box 2199, Wellington 1, New Zealand

Reply to City Engineer
Attention: Mr P. Robinson
Telephone: 724-599
Extension: 601
Please Quote: 6/2087 PR:MD

WORK DEPARTMENT
BUILDING BRANCH
- 4 FEB 1987
RECEIVED
MERCER STREET, WELLINGTON

13 January 1987

Keith Wilson Architects,
P.O. Box 12-321,
Wellington North.

Attention Mr J. Mills

Dear Sir,

WELLINGTON WORKINGMENS CLUB
101-117 CUBA STREET, TE ARO

With reference to the aforementioned premises and previous discussions with the District Building Inspector, Mr P. Robinson, I wish to confirm that the following requirements will be necessary to satisfy the provisions of NZS 4121:

(a) A complying lift serving all new floor areas is required.

(b) Stair 2 is to be fully complying to second floor level and stair 1 from second floor level to level 4.

(c) Ramped access is to be provided to the first floor level main bar area b.

(d) Ramped gradients throughout the building are not to exceed 1:12.

(e) Rifle range and ten pin bowling facilities must be made possible to the wheelchair bound.

(f) All fittings and fixtures are to be of an approved height and type.

To expedite permit approval for this staged proposal, items a, b and c must be amended to comply and forwarded to this Department at your earliest convenience.

Yours faithfully,

D N Walker

BUILDING SUPERINTENDENT
for CITY ENGINEER

Graham Whitefield.

WORKS DEPARTMENT

[illegible]

keith wilson architects
phone 730834 box 12321
92 Cecil Road Wellington

2. Feb 87

Mr G. Whitefield
W.C.C. Box 2199
Wgtn

Sir

Wellington Workingmens Club.

I enclose copies of Phil Robinson's and the Department of Social Welfare's letter with regard compliance with NZS 4121, as requested.

Please contact the writer if you require any further information.

Yours faithfully

Keith Wilson

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

CONDITIONS OF CONTRACT AND SPECIFICATION

OF THE

WORKS TO BE EXECUTED AND MATERIALS TO BE USED

IN THE

STAGE II STRENGTHENING AND EXTENSIONS
OF THE SOUTH BUILDING

AT

WELLINGTON WORKINGMEN'S CLUB & LITERARY INSTITUTE

CUBA STREET

WELLINGTON

FOR

THE TRUSTEES

ENGINEER
Smith Leuchars Ltd
P.O. Box 27-349
212 Williis Street
WELLINGTON

QUANTITY SURVEYOR
Knapman Clark & Company
P.O. Box 358
WELLINGTON

ARCHITECT
Keith Wilson Architects
P.O. BOX 12-341
WELLINGTON

October 1986

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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[illegible]

[illegible]

5956

CONTENTS

CONDITIONS OF CONTRACT

GENERAL CONDITIONS

Except where modified by the Special Conditions, the Contract shall be governed by the document entitled:

"CONDITIONS OF CONTACT FOR BUILDING AND CIVIL ENGINEERING CONSTRUCTIONS, NZS 623"

including all current additions and alterations to that document..

The Contractor shall familiarise himself with all the provisions of this document which shall form part of the Contract.

SPECIAL CONDITIONS

General Instructions

Definitions

The Principal is:

THE TRUSTEES
WELLINGTON WORKINGMEN'S CLUB & LITERARY INSTITUTE
WELLINGTON

The term Builder, Contractor or General Contractor is to be taken as referring to the party contracting for the complete works as set out in the specification, and the words "Building Contract, General Contract or Contract" shall mean the contract to be let to the Contractor.

Subcontractor and approved firm refers to parties providing labour and/or materials, and employed by the Contractor. Approved firms are those firms approved or selected by the Engineer. Whereever the term "approved" or "selected" is used in this specification, the Engineer or his authorised agent shall be the sole judge and shall determine what is, and what is not, approved or selected.

The word " Engineer" shall mean Smith Leuchars Limited, P.O. Box 27-349, Wellington.

[illegible]

[illegible]

[illegible]

The word "Quantity Surveyor" shall mean Knapman Clark & Company, P.O. Box 358, Wellington.

The word "Architect" shall mean Keith Wilson Architects, P.O. Box 12-341, Wellington.

Where the terms "provide" or "fix" are used each shall be interpreted as meaning "provide and fix" unless otherwise indicated.

No expression of the Engineer's reasonable satisfaction shall be deemed to be acceptance of defective materials or workmanship within the terms of the Contract or an authority for any variation except where such variation is authorised as provided in the contract, nor shall it relieve the Contractor from his responsibility to properly co-ordinate all sections of the works and to fulfill the contract requirements and complete the works to the satisfaction of the Engineer.

EXTENT OF WORK

The work included in this contract includes but is not necessarily restricted to the following:-

a) Demolition of rear buildings & other sundry demolition as required.

b) The construction of a new 6-storey building at the rear.

c) Strengthening & upgrading of the existing south building.

d) New 2-storey extensions over the north building.

e) Fittings & finishes to the above.

TIME

The time for completion shall be nominated by the contractor.

1. Time Schedules & Programming of Work

It is essential that the construction work be programmed so that a minimal disruption and loss of facilities is imposed on the club and its tenants. A broad outline of the club's wishes is shown on the sequence programme included in the Temporary Works section of the Specification.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

[illegible]

1. [illegible]

[illegible]

The Construction Programme shall be finalised in accordance with the club's requirements.

Two copies of the finally agreed programme and of all subsequent programmes shall be supplied to the Engineer and the Contractor shall keep a copy up to date in his site office for the duration of the Contract.

The Contractor shall be held to the programme in accordance with the Conditions of Contract and shall execute the works generally in accordance with the programme, subject only to approved extensions of time as below.

2. Extension of Time

In order to ascertain the time provided by the Contract there shall be added to the period actually stipulated for completion a reasonable extension of time in all cases where the completion of the works shall be delayed or suspended:-

a) By reason of any combination of workmen, strike or lockout actually delaying the works.

b) By reason of destruction to the works or to any part thereof by fire, earthquake or other inevitable accident beyond the control of the Contractor.

c) By reason of the Engineer ordering variations to the works. Provided that if when a variation is ordered the time is agreed upon, such time shall constitute the extra. Where no additional time is claimed at the time a variation is ordered, no extension of time shall be permitted by way of the variation. In all cases the time extension in respect of any variation shall be the length of time agreed, irrespective of the actual completion date of the work involved.

d) By failure of the Engineer to supply the Contractor with such details or instruction in connection with the work as shall be reasonably necessary and shall have been applied for in writing by the Contractor.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

In addition to the foregoing provisions for the extension of time the Engineer may at any time by writing give to the Contractor such extension of time as he may in his absolute discretion think the circumstances of the case require; the Contractor shall nevertheless use his best endeavour to prevent delay and shall do all that may reasonably be require to expedite the works.

If any delays are incurred through extra work or other causes, the extended times are to be agreed to in writing by the Engineer and such added to the Contract time for completing and handing over the works. Claims due to extra work shall not be accepted unless previously instructed by the Engineer in writing and shall be submitted before such extra work is commenced and advice of delays through other causes shall be submitted immediately such causes of delay are known.

No extensions of time shall be made because of inclement weather.

CONTRACT DOCUMENTS

The Contract Documents shall mean the following:

a) the Conditions of Contract NZS 623: 1984;

b) the Specification;

c) the Contract Drawings;

d) the Schedule of Quantities;

e) the Contractor's Tender;

f) the Letter of Acceptance.

A reference to a standard, a specification or a code of practice in the Contract Documents shall, unless the Contract, otherwise requires, be deemed to be a reference to the edition of that document which was current at the date of closing of tenders.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

NATURE OF CONTRACT

The Contract is a Lump Sum contract based on this specification, the drawings, the schedule of quantities for preliminaries and the schedule of Provisional Sums for all trades.

SITE

The site is situated at Cuba Street, Wellington.

The Contractor shall check the conditions at the site and shall lodge any objection or complaint of such condition with the Engineer within two weeks of possession of the site.

SCHEDULE OF QUANTITIES

The Schedule of Quantities have been prepared generally in accordance with NZS 4202: 1975.

Trade Schedules will be issued for pricing as they are completed.

SUBCONTRACTORS

Trades to be sub-contracted are to be let by tender to a minimum of 3 subcontractors.

Tenders are to be opened in the presence of the Engineer.

Subcontractors who are members of the club are to be given the opportunity to price for work. A list of such subcontractors will be given to the Contractor, who has the right to object to any or all subcontractors putting their name forward.

The Contractor shall ensure that any sub-letting of the work shall be by way of written subcontract, incorporating the provisions of NZS 623 and relevant portions of these Contract Documents.

Before the Contractor places any order to commence any work specified herein to be of "approved material" or "done by an approved firm" he shall obtain the written consent and authority from the Engineer to do so.

Subcontractors employed for any section of the works will be required to conform strictly to the general requirements and discipline of the job as imposed on the Contractor. They will be required to commence their work and to deliver their material and equipment at such times as to suit the Contractor's programme.

Each subcontractor shall keep a competent foreman upon the subcontract works during such time as the said works are in progress.

INSURANCE

1. The Employer shall be responsible to insure the existing structure and the Works against all risks, fire, earthquake damage, etc. The Employer shall make the necessary arrangements with his Insurers to endorse the current insurance policy to include the full value of the Works and take out "Contract Works" insurance policy covering the existing structure as well as the "Works". Such policies shall cover the respective rights and interests of the Employer and the Contractor. Such policy shall cover All Risks including those incurred during the construction period.

   Note:

   There shall be a minimum value for claims under this insurance cover. Any claims less than $1,000.00 shall be carried by the Contractor. Likewise $1,000.00 shall be deducted from any claims in excess of that amount.

2. The Contractor shall take out Public Liability Insurance for an amount of not less than $1,000,000 in respect of any one claim, unlimited as to the number of claims, extended so that the risks of fire and explosion, damage to property and land by removal of support or by vibration and liability for property damage shall not be exceptions to the liability.

3. The Contractor shall carry his own insurance in respect of plant and equipment owned or hired by the Contractor or his subcontractors where these are related to the Works.

[illegible]

[illegible]

[illegible]

[illegible]

1. [illegible]

   [illegible]

2. [illegible]

Should the Contractor agree to any exclusions or excesses to the risks covered by the above policies, the Contractor shall indemnify the Principal against any claims arising. The insurances required by this clause shall not relieve the Contractor from any liability or obligation for which he would otherwise be responsible under this contract or by law.

The Contractor shall not enter into the site with plant or commence any work until the Public Liability Insurance has been effected. The cost of complying with the insurance requirements of the contract shall be included in the Contract Price. The costs of any additional premiums necessitated by extensions of time awarded by the Engineer shall be added to the Contract Price.

GUARANTEES

When guarantees are called for, the Contractor shall obtain a written guarantee from the firm supplying materials or doing the work and shall deliver these to the Engineer on completion of the work.

The guarantee shall state that workmanship, materials and installation are guaranteed for a period as specified from the date of issue of the Maintenance Certificate and that any defects that may arise during that period shall be made good and any such work in other trades resulting from such making good shall be done at the expense of the Guarantor, upon written notice from the Engineer to do so.

A guarantee will not be enforced if the work is damaged by structural defects in the works in which case the responsibility for replacement will rest entirely with the Contractor.

The Engineer shall be the sole judge of what cause is responsible for defects in the work and this ruling shall be final and binding.

PAYMENT

1. General

Within 15 working days of being awarded the Contract the Contractor shall submit to the Engineer a schedule of estimated amounts of Progress Payments, and estimated dated dates on which such payments will be claimed. No requrest for such payment will be considered until this instruction has been carried out.

Payments will be made in accordance with Clause 17 of the General Conditions of Contract NZS 623 on progress certificates in amounts at the Engineer's discretion. The Contractor shall set out each Statement of Claim for such payment in detail as required by the Engineer for his checking before issue of a Certificate of Payment.

If the Contractor shall fail to comply with any condition or requirements on the Contract the Engineer may withhold the issue of a Certificate of Payment or reduce the amount thereon until the Contractor shall have complied with such condition or requirement to the Engineer's satisfaction. This shall include the submission of an approved critical path programme in accordance with clause Time Schedules and Programming of Work.

Materials

Payment for materials will normally be made only on the value of materials actually delivered to the site but payment may be allowed for materials or items specifically programmed and approved which are purchased for the Contract but are not stored on the site providing that the following conditions are met in respect of these materials:-

a) the Statement of Claim separately designates such materials, with values, for which payment is sought;

b) the Contractor shall provide evidence that he has paid for such materials;

c) the materials are stored in a location and under conditions approved by the Engineer, are readily identifiable and are sorted in a manner ensuring that same will not be used for any purpose other than fulfilling said Contract;

d) access to these materials, for the purposes of inspection, shall be available to the Principal or the Engineer or the accredited representative of either, at any time by arrangement and the Contractor shall allow all reasonable facilities to permit such an inspection;

e) the materials are adequately insured.

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In consideration of the payment by the Principal herein provided no extra cost will be considered in respect of expense incurred by the Contractor for storage, insurance, handling, transport or any other costs involved in meeting these conditions.

2. Variation Procedures

In accordance with NZS 623 clause 13.2 all variations are to be confirmed by an order in writing from the Engineer. The normal procedure to be adopted for the documenting of alterations shall be as follows:-

a) a written "Site Instruction" will be prepared by the Engineer for the Contractor, describing the variation requested. In the event of adjustments to the schedule being required following measurement, step (a) may be omitted;

b) a "Variation Price Request" will then be prepared by the Engineer and supplied for the Contractor to price and submit to the Engineer for approval;

c) following approval of the variation price the Engineer will issue a "Variation Order" authorising the work to be carried out.

RETENTIONS

Retention will be at the rate of 10% of the value of the work certified by the Engineer as having been carried out. This retention shall include the amount retained in accordance with the Wages Protection and Contractors' Liens Act.

The provisions of Clause 17.4 of NZS 623 shall not apply to this Contract. Retention money in excess of that required to be held under the Wages Protection and Liens Act will become due thirty-one days after the Engineer has issued a Certificate of Substantial Completion. The remaining retention money shall become due thirty-one days after the Engineer has issued a Maintenance Certificate. Payments of the retention money shall be limited so that the amount held by the Principal always complies with the provisions of the Wages Protection and Contractors' Liens Act, 1939.

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No advances will be made against the value of any item of Contractor's plant or equipment.

MAINTENANCE

Except as otherwise mentioned in this clause maintain the works included in this Contract including preventative maintenance as required by this specification for a period of 90 days (180 days for Plumbing and Drainage, Ventilation and Electrical Works) from the date of completion in accordance with Parts 12 and 17 of the General Conditions of Contract. If any defects requiring attention under these Clauses are of such a nature as to endanger or prevent the operation of any plant, the Contractor on advice from the Principal or his agents, shall arrange for such work to be carried out immediately. If the Contractor is unable to arrange for such work to be carried out immediately, the Principal shall have the right to have defects rectified by others at the Contractor's risk and expense.

COMPLETION

1. Maintenance Certificate

Before the issue of a Maintenance Certificate in accordance with Part 17 of the General Conditions of Contract, NZS 623, The Contractor shall lodge with the Engineer:-

a) all guarantees specified;

b) a statement that he will not make any further claims for variations or otherwise in respect of the contract;

c) certificates of approval from all Authorities issuing such approval and having jurisdiction of the Works;

d) Contractor's Completion Certificate as noted in Clause below.

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2. Contractor's Certificate

The Contractor's Certificate shall include the following information:-

a) a statement certifying that he has completed the work in full accordance with the Contract requirements;

b) a statement that he has notified all sub-contractors, suppliers and others having the right to claim under the Wages Protection and Contractors' Liens Act, 1939, that he intends to give such notice;

c) a statement that the Works have been checked and that to the best of his knowledge and belief they qualify for completion as defined.

COST FLUCTUATIONS

The provisions of Appendix A to NZS 623 shall apply to this Contract, except that the allowance in Clause A22.01.2 shall be 18%.

PERMITS AND FEES

Please refer to Clause 8.18 of the General Conditions of Contract.

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PRELIMINARY AND GENERAL

1. Site Access and Availability

Refer to Site Plan.

The Contractor is to co-operate with the Principal at all times regarding access to the site.

Access to the site is available from the Right of Way off Leeds Street.

2. Management and Staff

Project Manager

A senior member of the Contractor's frim will be appointed as Project Manager and shall be available at times for consultation. He will be required to be available for meetings and site inspections. IHe will be empowered to make all necessary management decisions.

General Foreman

A high experienced foreman shall be appointed to ensure the proper execution of the detailed construction, also practical co-ordination of all services and subcontractors. Any instructions given to thhe General Foreman By the Engineer will be deemed to be given to the Contractor.

When tendering, tenders may submit for consideration in alternative management organisation to that indicated above.

The Contractor shall be fully responsible to ensure all subcontractors appoint experienced and competent foremen to perform their subcontract works.

The Contractor shall employ on site a trained Safety Officer. Full details of any reportable accident which may have occurred shall be reported to the Engineer. The Safety Officer shall immediately advise the Insurers of any accident.

SECURITY

The Contractor is to provide lock up facilities and security lighting to all access ways into the building area and is to provide the Principal with keys to the same.

The Contractor is advised that the Principal's security provisions will be active during the contract period. The Contractor and all subcontractors shall co-operate with Principal's officers and comply with the general security requirements and any additional security requirements that the Principal may impose.

These may include:-

a) identification of all personnel;

b) supervision by the Principal's security officers;

c) restricted access through the premises and/or special provisions for out of hours work.

PROTECTION OF EXISTING PROPERTY

1. General

The Contractor shall be held responsible for the adequate protection of the existing building, fixtures and services and shall make good any damage to them caused by all contract and subcontract operations.

The interests of the Principal must be safeguarded in every way.

All materials affected by the weather shall be covered and protected so as the keep them free from damage whilst being transported to the site. The Contractor will be responsible for the proper care and protection of all materials and equipment when they have been delivered to the site.

2. Services

The Contractor shall be responsible for locating services in the vicinity of his operations, and take all necessary precautions to protect them from damage. Any damage and consequential losses caused by the Contractor shall be made good by him at his expense.

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TEMPORARY WORKS

1. Scaffolding, Railings and Hoardings

All scaffolding used internal or external to the building shall be stable and shall comply with all governing regulations. Particular care shall be exercised to prevent damage to internal fittings and the febric of the existing building.

The Contractor shall securely screen off all sections of the site and temporary works and provide adequate signs and lighting to protect the works in accordance with the construction areas and sequence as shown on the drawings.

All barriers shall be to the approval of the Engineer and shall be maintained in first class order of effectiveness by the Contractor.

2. Temporary Buildings

The Contractor shall provide suitable accommodation facilities as follows:-

a) Offices for the Contractor's foreman and other site staff including subcontractors complete with telephone and pay all charges.

b) An office measuring 3m x 3m complete with desk and drawing layout area and telephone and electric light and power for use by Engineer's staff and Clerk-of-Works.

The Contractor's particular attention is drawn to the Principal's requirement that access for the Contractor and subcontractor staff through Club areas outside the defined construction site shall be kept to the essential minimum.

Completely removal all temporary buildings from site upon completion of work.

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Provide and place in the temporary site offices where and as directed by the Engineer two fire extinguishes for first aid fire fighting purposes. Extinguishes shall be as follows:-

a) One (1) Dry Chemical-Type Extinguisher having a net chemical content of not less than 7 kg for use on oil, gasoline, paint and grease fires and for electrical fires.

b) One (1) Pump Tank Water-Type Extinguisher having a capacity of not less than 25 litres of water for wood, textile, paper and rubbish fires.

The extinguishers furnished shall be new equipment, adequately tested. All extinguishers shall be checked once a week to see if they are in first-class operating condition. Extinguishers shall be serviced when and as required. If extinguishers are removed from the authorised locations, or used for extinguishing a fire, or in any way damaged, the Contractor will be held responsible for immediately replacing, recharging or repairing the extinguisher. All equipment damaged or lost shall be replaced immediately with the same type and quantity in serviceable condition. At the completion of the construction work covered by this specificatiOon, the extinguishers shall remain the property of the Contractor.

3. Weatherproofing

The Contractor will be held responsible for the continued watertightness of the premises in those areas affected by the works involved in this contract. The Contractor's particular attention is drawn to the necessity to provide and maintain suitable temporary weathering including the provision of any temporary downpipes, gutters, drains, etc. to effect this requirement.

4. Temporary Services

Water supplies and power supplies for light loading will be made available by the Employer. The Contractor shall make the connection to these supplies as necessary for temporary services, and he shall install all necessary meters, valves and switchboard. He shall make available to all subcontractors temporary services as required. For power for high loading such as welding machines the Contractor shall make available at his own expense an independent power supply or supply portable generating sets as and when required.

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TOOLS AND PLANT

The Contractor shall provide all tools, plant and equipment necessary to carry out the works and maintain them in good working order and he shall ensure that all subcontractors are similarly equipped. The Contractor shall allow use of planking, scaffolding and ladders as required to all subcontractors.

The insurance of all the above tools and plant shall be the responsibility of the Contractor.

MATERIALS AND WORKMANSHIP

All materials and workmanship shall be best quality throughout and subject to the approval of the Engineer and generally in accordance with the requirements of the relevant current SANZ, SAA and BSI codes.

Keep on the job for the duration of the contract a copy of each standard specification and code applicable to this Contract.

Keep on the job copies of manufacturer's instructions for all materials and equipment specified to be handled, applied or fixed in accordance with manufacturer's instructions. Unless otherwise specified all materials shall be new and applied or fixed in accordance with the manufacturer's instructions.

The Engineer shall be entitled to have any part of the qork opened up or cut away for inspection. If it is found to be defective it shall be removed and made good at the Contractor's expense and if not at the Employer's expense.

Make such tests as may be required to show that the requirements of the specifications have been fulfilled. All final tests shall be made under the supervision of the Engineer. Provide all necessary services, materials, and labour and apparatus. Prepare, adjust and run field tests before asking the Engineer to inspect them. Submit the work to laboratory tests as may be directed by the Engineer.

The costs of such laboratory tests shall be borne by the Employer unless they disclose faulty materials or workmanship, in which case the faulty materials and the cost of such tests shall be borne by the Contractor.

Make written request to the Engineer for approval of the Substitution of any materials or construction other than those mentioned as standard in the specification or indicated on the drawings and of materials, goods or construction specified to be "approved". When the substitution of one material for another is approved by the Engineer at the request of the Contractor, no additional cost will be allowed in respect of extra work caused by such substitution unless the substitutions is made because of non-availability of the materials specified. Where proprietary names are used in this specification they denote the standard required and the Conractor may submit for approval substitutions of equivalent standard. Nameplates, decals, trade names and signs of manufacturers' names and similar information shall not appear on any items of equipment without the Engineer's approval.

Obtain all necessary licences for imported materials and place all orders to ensure the delivery of all materials to suit the time programme for the Contract. Where it is not possible to store materials or goods on site arrange for storage elsewhere to the Engineer's satisfaction.

All materials, apparatus, equipment and work not in accordance with the specification are liable to rejection. All rejected items shall be removed from the site on written notice from the Engineer. Should the Contractor fail to do so, the Engineer reserves the right to have such items removed by others and deduct and cost of removal from moneys due to the Contractor.

ATTENDANCE

The Contractor shall allow for providing the following facilities or services without charge to all subcontractors. The extent of such attendance is to be clarified by Tenderers and to be allowed for when tendering.

Undertaking full responsibility for the supervision and control of the nominated subcontractors and for his own subcontractors and being responsible for seeing that all work carried out and materials supplied by the nominated subcontractors and his own subcontractors is in accordance with the subcontractors and is delivered and erected to suit the building programme.

Allowing the subcontractors to use scaffolding, ladders and other facilities upon the site.

Taking delivery and hoisting the subcontractors' materials and equipment.

Providing suitable lockable storage place for the subcontractors' use.

Conferring with the subcontractors and arranging for the forming or cutting away for the building in all plugs, brackets, sleeves, plant and equipment, forming and/or cutting holes, chases, recesses, etc. as required by the subcontractors and making good after all trades.

Protection of the subcontractors' work and making good or replacing any of the subcontractors' work which is damaged or which is defective.

Removal of rubbish as it accumulates and cleaning up after the subcontractors have left the site.

Protect all fittings, plant and equipment from dirt, plaster, moisture and damage.

CLEANING

The General Contractor shall, weekly or as it accumulates during the progress of the works, remove all rubbish from the site and keep the site and buildings clean to the satisfaction of the Engineer. On completion of the work and whenever directed, leave the building and site clean and tidy to the satisfaction of the Engineer or the Principal.

Trucks and vehicles shall be carefully loaded to prevent dropping materials on existing pavements or on the surrounding property. Any materials spilled should be removed immediately by the Contractor at his own expense.

SAFETY REGULATIONS

Throughout the work the Contractor shall provide adequate protection against fire and arc flash hazard from welding operations.

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The Contractor shall be responsible for the carrying out of the whole of the works and the requirements of the Contract and to see that they are carried out by subcontractors and others concerned in a thoroughly safe and satisfactory manner, and in particular shall:-

a) strictly conform to the requirements of any Act of Parliament an all regulations, by-laws or orders relating to the safety of persons on or about the site made by any public authority having jurisdiction in the matter;

b) ensure that all tackle , gear, stagings, scaffolding, ladders, machines, winding arrangements and other equipment used in connection with the works shall conform to the requirement of any Government regulations in relation thereto and in any case be adequately strong and safe for use;

c) immediately discontinue any practice or remove any equipment which becomes or is likely to become dangerous or unsafe;

d) remove from the works promptly any of his employees or representatives who by their conduct could create any danger to themselves or others;

e) the Contractor shall employ on this project a safety officer with authority to act on any matters pertaining to safety.

CONSTRUCTION LOADS

If necessary provide competently computed temporary supports to transfer loads to other parts of sufficient carrying capacity. Provide computations if required by the Engineer.

NUISANCE

The work shall be carried out in such a manner as to cause the least inconvenience to the Principal and the club and to keep the level of noise to a reasonable minimum. All plant working on the site including trucks transporting materials to and from the site shall have a noise level not

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exceeding 85 dB the "A : Scale at 7 metres". All internal combustion engines used on the site shall be fitted with exhaust scrubber or an alternative approved method on minimising exhaust fumes. Rubbish and rubble shall be sprinkled with water and kept damp as necessary to prevent dust arising. The Contractor shall be responsible for any damage or annoyance and for the settlement without cost to the Employers of any claims arising therefrom.

ALTERATIONS

Alterations to any part of the work required or ordered by the Authority having jurisdiction over that part of the work shall immediately be referred to the Engineers and, except in case of emergency, the alteration shall not be put into effect without prior confirmation by the Engineer.

Any such alteration shall then be recorded by the Contractor on the site documents as appropriate.

SUBSTITUTION

The substitution of goods, materials, proprietary products, workmanship, method and equipment may be approved by the Engineer on the Contractor's written request, giving technical information and certifying that it is of equal or better quality and effectiveness and price adjustment.

Any saving in cost resulting from substitution shall be deducted from the Contract Sum.

The Principal shall not be responsible for payments of extra costs because of non-approval by the Engineer of alternative products.

Should import licenses be unobtainable for the materials nominated, even though application has been made in adequate time, alternative materials may be substituted to the Engineer's approval and adjustment of costs made by variation to contract.

PROPRIETARY PRODUCTS

All proprietary products used shall be installed in strict accordance with the manufacturer's recommendations.

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NOTICEBOARD

The Contractor shall erect and maintain in a prominent position at the t=entrance to the site an approved 3m x 2m signboard displaying the name of the project, the name of the Principal, Engineer, Architect, Quantity Surveyor, and Contractor, and telephone numbers indicating where the Contractor's Representative may be contacted after working hours.

SITE MEETINGS

The Contractor shall allow for two weekly site meetings with an average duration of two hours per meeting. Provide for subcontractor's attendance when required.

FORMAT

The site meetings shall generally be conducted under the following format:-

a) Apologies.

b) Minutes of Last Meeting,
Verification of receipt and acknowledgement.

c) Matters arising.
Items requiring comment from previous meetings.

d) Contractor's Report.
The Contractor shall provide copies of a report for the period outlining:-

i) Progress/Programme:

A summary of works undertaken and their relative progress.
An update of the Contract Programme.
The number of employees utilised in each trade.

ii) Information required.

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iii) Time Extensions:
Any pending or current claims.

e) Variations.

f) New Business.

g) Next Meeting.

DAYWORKS

Wherever possible variations to the Contract will be measured at Schedule of Quantities rates (or agreed prorata rates), or by obtaining quotations if appropriate.

Where the above conditions do not apply the work will be paid for by day work hours and materials.

Where the Contractor believes that the work to be done must be charged by dayworks, he shall first notify the Engineer. The Engineer shall confer as necessary with the Quantity Surveyor to confirm the need for dayworks charges.

Daywork hours shall be recorded on employee's time sheets and material payments will be on invoice. The invoices shall be stamped and initialled by the Engineer "DAYWORKS PAYMENT ONLY' and shall be initialled as necessary by the Engineer and the Contractor shall abstract hours and materials onto a daywork charge sheet.

Wherever possible the Engineer will supervise work carried out on day work charges.

Site diary records will not be acceptable for daywork charges whether countersigned or not.

Approved daywork charges may be paid up to 80% of value in Progress Claims. Full payment will be made when the dayworks have been processed as a Variation Order.

Approved daywork charges may be paid up to 80% of value in Progress Claims. Full payment will be made when the dayworks have been processed as a Variation Order approved by the Client.

B1.0 DEMOLITION

B1.1 General

Refer to Section A of this specification which is binding on all sections. This section is to be read in conjunction with Section B2.0 TEMPORARY WORKS.

B1.2 Scope

The work in this section comprises all of the demolition work as detailed or inferred in the documents and as required for the satisfactory completion of the contract. The demolition shall include but is not necessarily limited to the following:-

i) Rear buildings at ground level including foundation.

ii) Brick masonry wall to east side of existing building.

iii) Brick masonry flat & concrete slab at roof level of north existing building including timber access stairs.

iv) Interior partitioning including fixtures & fittings.

v) Miscellaneous work in forming new openings.

vi) Existing ceilings & floor coverings.

B1.3 Site

The site is situated at 111 Cuba Street. The extent of the site is shown on the drawings.

B1.4 Site Inspection

The buildings will be available for inspection during the tender period and tenderers are required to respect the rights of the remaining tenants still in occupation.

Tenderers will be deemed to have inspected the site and made themselves familiar with the existing conditions and buildings adjacent to the site.

B1.5 Protection of Public

The Contractor shall take all precautions to protect the public throughout the contract.

B1.6 Responsibility

The Contractor shall be solely responsible for the execution and completion of the Contract and entirely responsible for ensuring that all operations, methods, workmanship, equipment and materials are safe, sufficient and in accordance with the Contract documents. No inspection by the Engineer and no instruction given or certificate issued by the

Engineer shall be deemed to imply that the Engineer has assumed or taken over any part of the Contractor's responsibility.

No variation of the Contract Sum shall be made on the Grounds of injunctions against the Contractor or the Principal which restricts the Contractor's working hours or type of equipment which may be used.

B1.7 Regulations and Fees

The Contractor shall comply with all regulations of all Authorities having jurisdiction over the works. He shall obtain all licences, consents and permits of these Authorities and he shall give all notices and pay all fees and customary charges.

The demolition permit will have separately been applied for by the Principal but should be uplifted and paid for by the Contractor.

The Contractor shall comply with Labour Department Regulations.

B1.8 Access

All work shall be confined within the legal boundaries of the site. The Contractor shall comply with WCC Streetworks requirements regarding access to the site.

The Contractor shall keep the right of way clear and maintain a clear accessway from existing fire escapes at the rear at all times during non-working hours.

B1.9 Demolition

The whole of the demolition work shall be carried out by a specialist firm of Demolition Contractors employing skilled workmen experienced in this type of work.

All demolished materials and equipment shall become the property of the Contractor and shall be removed from the site as demolition proceeds, except for items scheduled to be stored for re-use which shall be carefully removed, damage free.

The Contractor shall dispose of or re-use all the demolished materials as he sees fit. No materials shall be sold direct to the public from the site. The Contractor shall pay all the cartages and tip fees. No materials whatsoever shall be burnt or buried on the site, the lighting of any fires on the site is forbidden.

All of the buildings on the rear of the site are required to be demolished and removed including foundations.

Demolition shall be done in a careful manner in small sections to reduce noise and dust nuisance. All falling materials to be dropped and contained within the site during demolition and prior to removal. Blasting will not be permitted on site.

The Contractor shall employ an independent registered engineering consultant to ensure that the proposed methods of demolition maintain necessary levels of safety and ensure the structural stability of all works during all stages of the contract.

B1.10 Fire Protection

The Contractor shall keep a water supply available to the site from a street hydrant with Fire Brigade approval at all times for wetting down.

Two fully charged CO^2 fire extinguisher cylinders shall be kept on site at all times. Two fully charged powder extinguishers shall be kept on site at all times.

B1.11 Site Supervisor and/or Foreman

The Contractor is to retain on site, at all times during carrying out of demolition works, a competent site supervisor and/or foreman. Any instructions or explanations given by the Engineer to such site supervisor and/or foreman shall be held to have been given to the Contractor.

There shall be the same site supervisor and/or foreman on the site throughout the demolition works except through sickness or through leaving the Contractor's employ or with the Engineer's written approval following written applications.

B1.12 Adjoining Properties

The Principal will have a photographic survey made of the adjoining buildings to record their present condition. The Contractor is required to carry out an inspection of these adjoining buildings in the company of the Engineer and a representative of the adjoining owners before commencing any work in order to agree that the photographic survey is correct. On completion of the demolition works the Contractor, in the presence of the Engineer and in company with a representative of the adjoining owners is to carry out an inspection of the previously surveyed properties.

Any damage or defects recorded which are not shown in the survey documents referred to above and which in the opinion of the Engineer are due to demolition work shall be made good by the Contractor at his cost without delay.

The Contractor shall carry out the demolition to cause the minimum of interference to adjoining properties. The demolition work required on the party wall is to be carried out of normal working hours.

No activity on site shall generate a noise level of greater than 80 dbA during normal working hours. The Engineer shall have the right to restrict the Contractor's activities which cause unnecessary noise or undue distress to the occupants of the neighbouring properties, and instruct this work to be continued out of normal working hours at no variation to the contract.

Normal working hours are deemed to be 8.30a.m. to 5.00p.m., Monday to Friday.

The Contractor is required to submit a detailed proposal covering the methods of demolition, aspects of safety, protection and nuisance requirements to the neighbouring properties along with his tender submission.

B1.13 Protection of Property

The Contractor, whenever required by a requirement of any public or other authority and whenever necessary or prudent shall take all such precautions to ensure the safety and freedom from damage (whether directly or indirectly caused) of all adjoining or nearby services, land or buildings, footways, roadways, public or private services or of any other real or personal property whatsoever which may be, or may come to be, in the vicinity of the site, and also for ensuring the safety of persons and animals who or which may be at any time upon or in the vicinity of the site.

The Contractor shall comply with the foregoing prior to commencing any other work on the site and shall be responsible for the adequacy and timing of all such precautions and work.

The Contractor shall be responsible for and make good any property damage and be responsible for costs or losses that may be sustained to the works or to nearby buildings, properties and their contents, to nearby roads, lane-ways, or other constructions and to any persons, vehicles or animals therein or thereon whether the aforesaid bodily injury and/or property damage costs or losses arise directly or indirectly out of the works of this contract.

The Contractor is to make good as directed, flashings and similar parts of adjoining buildings disturbed by demolition.

The Contractor shall take appropriate measures to restrict unauthorised access to the site.

B1.14 Railings and Hoardings

Where required by the Local Authority or the Engineer and as necessary for public safety, the Contractor shall erect and maintain temporary railings, hoardings and other measures to ensure the protection of workmen and others to the satisfaction of the Engineer. Hoardings, railings and other guards at roads and footways shall be adequately lit at night.

No advertisements of any kind will be permitted on the hoardings or elsewhere. The Contractor shall leave the hoardings and railings etc. fixed in position on the site at the completion of the works.

B1.15 Utilities

The Contractor shall arrange disconnection and removal, plugging or alterations of all utilities including gas, electricity, telephones, sprinklers, transport, water and stormwater drainage.

The Contractor shall notify the NZ Fire Service and the Wellington Regional Water Board should it be necessary to terminate and remove an existing sprinkler system. The Contractor shall cooperate with the appropriate authorities should retrieval of any redundant services be required.

B1.16 Tidiness

The Contractor shall prevent the spillage of earth and/or demolition materials onto the adjacent roadways, footways or other private or public property and shall clear up and remove any such spillage immediately on notice from the Engineer or Local Authority.

On conclusion of this contract, the Contractor shall vacate the site and leave the site in a tidy state to the satisfaction of the Engineer.

B1.17 Support and Shoring

The Contractor shall provide any necessary shoring, needling, strutting, planking, sheet piling and the like to adjoining buildings and other property. If in the opinion of the Engineer and such provision is insufficient he may order additional provision at the demolisher's expense. Any such instruction shall not relieve the Contractor of sole responsibility for sufficient support of the buildings or other property.

The Contractor shall alter, adapt and maintain all such temporary works as necessary and strike or withdraw them progressively as the work proceeds. Written consent of the Engineer shall be obtained if any such works are to be left in position at the completion of the work.

B1.18 Breaking Out

Breaking out work shall be to the extent shown on the drawings or to the minimum required for the satisfactory completion of the other trades for which it is carried out.

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When constructing new openings in walls provide a sawcut on both faces around perimeter and break own plumb square and accurately to site.

B1.19 Co-Operation

Co-operate with other trades as necessary to seal off, disconnect or relocate services or equipment effected by the demolition work.

B1.20 Cleaning

Remove all demolition debris from the site as the work proceeds and leave work areas clean and tidy.

B1.21 Preparation for Making Good

The Contractor shall be responsible for demolishing structure, fittings, materials etc. to the lines, levels and dimensions required for making good by other trades.

Unless indicated otherwise in the Contract Documents all bolts, screws, nails and other fixings into remaining structure following demolition shall be removed to suit making good by other trades.

B1.22 Encroachment

Should demolition reveal that adjoining property encroaches onto the site, or the demolition encroaches onto the adjoining property, then the Contractor shall refer to the Engineer for instructions before proceeding with that portion of the work.

Allow to arrange for, and pay any local authority approval and damages for encroachment necessary on to public streets as required to undertake the contract.

B1.23 Backfilling

Backfilling of any voids left by removal of buildings, foundations or underground utilities is not required.

B2.0 TEMPORARY WORKS

B2.1 General

Refer to section A of this specification which is binding on all sections. Refer to section 1.0 DEMOLITION.

B2.2 Scope

This section covers all temporary works required to maintain the operations of the Wellington Workingmen's Club during and following demolition and during the various construction phases.

The work includes, but is not necessary restricted to the following:-

i) Temporary east wall from ground to roof including waterproofing of floor.

ii) Dividing wall to South tenancy.

iii) Access hatch & chute from first floor to South tenancy.

iv) 2 portaloos on low roof to north building.

v) Shift north building WC's and install temporary drainage.

vi) Dividing wall to billiard room and main bar entrance adjacent to lift.

vii) Access to right of way. Keep clear.

viii) Dividing wall to lounge 1 on entrance to lounge 2 adjacent to lift.

ix) Floor protection to foyer and passage at top of stairs (second).

x) Miscellaneous electrical wiring when south building sub-boards removed.

xi) Maintain water tanks and supply FHR's.

xii) Waterproof roof area when flats and lower roof removed.

xiii) Waterproof new truss roof over kitchen and lounge 1.

xiv) Maintain services to Main Bar (Plumbing and drainage).

xv) Maintain chiller unit to kitchen (on roof).

xvi) Upgrade ground level north end toilets.

Construction details for temporary works, plumbing and drainage etc are shown on the drawings.

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B2.3 Permits & Fees

Obtain all permits and pay associated fees necessary for temporary works.

B2.4 Maintaining Temporary Works

Allow to maintain the temporary works for as long as they are required and allow to remove off site when no longer required.

B2.5 Time Programme

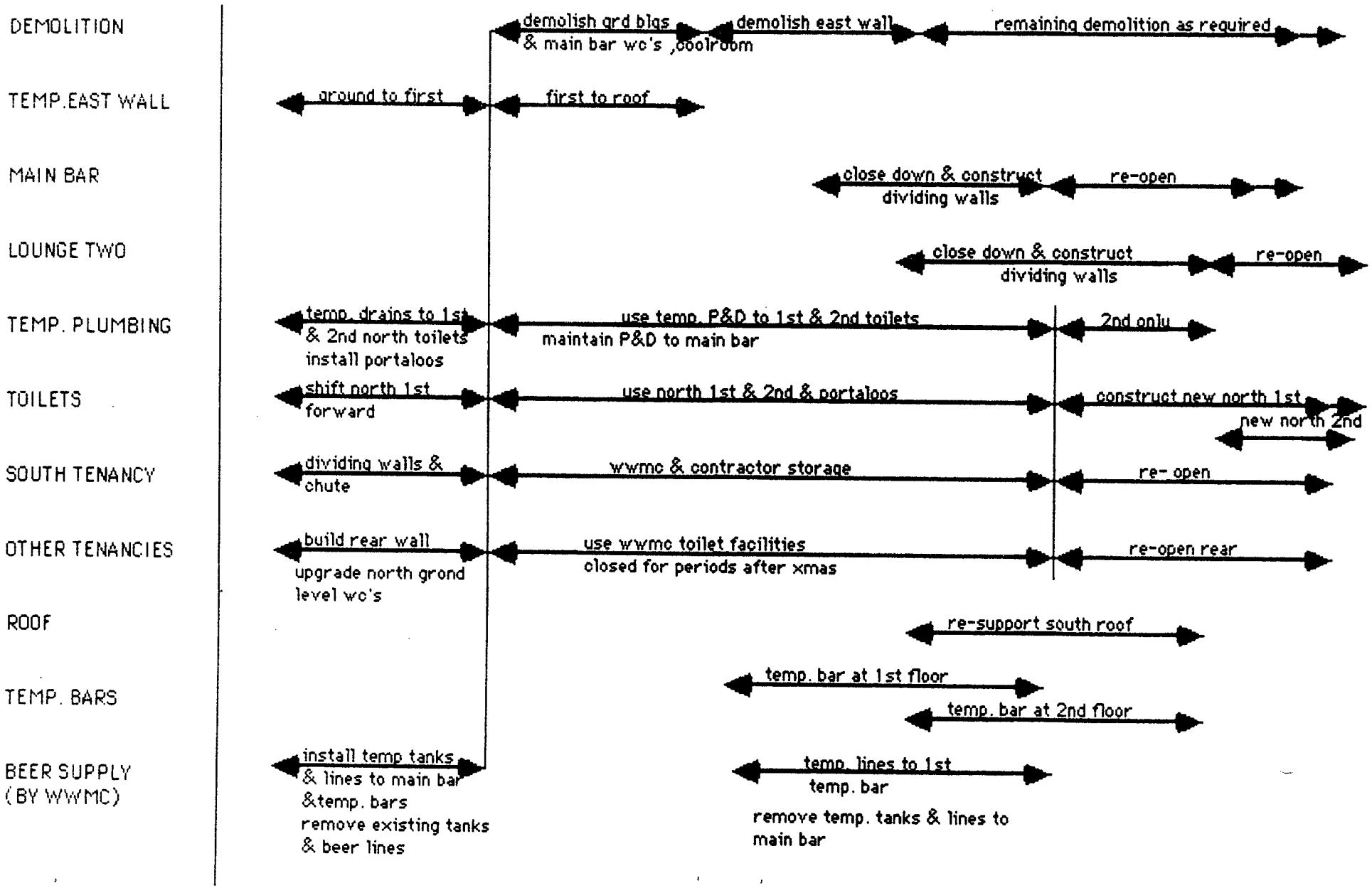
Temporary works are to be maintained according to the Main Contractor's Construction Programme and in line with the attached sequence of Temporary Works and Use of Facilities.

B2.6 Co-operation

Allow to co-operate and liaise with the Club's management when carrying out temporary works, particularly as regards notifying the Club of imminent work. At least 2 weeks' notice is to be given to the Engineer.

WELLINGTON WORKINGMEN'S CLUB — STAGE II STRENGTHENING & EXTENSIONS

SEQUENCE OF TEMPORARY WORKS & USE OF FACILITIES



A EXCAVATION & FILLING

1. SCOPE

This section of the specification covers the excavation, filling and subfloor drainage required for the building works and foundations. The extent of work is to include the stripping to waste any areas of unsuitable soil, replacing these soils with compacted in-place quarried material and the supply and placing of hardfill, filter material, drainage material, and subfloor drains.

The Contractor shall supply materials, plant, labour and supervision required to carry out the works as specified.

2. SETTING OUT

All setting out and establishment of bench marks and levels shall be done in accordance with the Drawings.

3. PROTECTION

The Contractor shall be responsible for providing all temporary structures, underpinning, shoring, needling, planking and strutting and other supports required by the nature of the works and of the surroundings. Refer also to Section 1.18.

Maintain and support as necessary all roadways and footpaths which may be affected in any way by the works of this Contract.

Preserve from damage all public and private services.

Alter all such temporary works as required during the progress of the Contract, maintain in sound condition and finally ease, strike, demolish and take away.

4. SERVICES

Before commencing any excavations the Contractor shall check the location and be satisfied as to the locations of all services in the area and shall arrange to disconnect, seal off or divert any such services where required.

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5. NUISANCE

The Contractor shall carry out the work in such a manner as to cause the lease possible inconvenience to the Principal. Sprinkle rubbish and rubble with water to keep damp to prevent dust arising.

The Contractor shall be responsible for any damage or annoyance and for the settlement of any claims arising therefrom without cost to the Principal.

6. EXCESSIVE EXCAVATION

Should the Contractor take any subgrade excavation to a greater depth than required without instruction to do so from the Engineer, he shall fill to the correct level with Site Concrete or basecourse, as directed by the Engineer, at his own expense.

7. DISPOSAL OF SPOIL

All excavated material from excavations made on the site, shall be disposed of away from the site. The Engineer may direct that some site materials be retained for future use. The Contractor shall stockpile these materials on the site away from areas of work and in such a manner that they are undisturbed by ongoing activities on the site.

8. TEMPORARY DRAINAGE

The Contractor shall provide and maintain during the whole period of the Contract, such culverts, ditches and sumps as may be necessary to effectively control stormwater, runoff, on, over, and from construction areas, and to control erosion and prevent damage to or fouling of work in progress or completed. The Contractor shall be responsible for making good any work or property damaged by neglecting such provisions. The contractor shall provide temporary drainage as shown on the drawings and shall take any other measures necessary to lower the water table over the excavation to beneath the basement slab.

9. PUMPING

Keep all excavated areas, sumps and pits free from water during the progress of the works by pumping or other suitable means. Provide adequate means of disposing of such water to the approval of the Engineer and Local Authority.

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10. EXCAVATION

The Contractor shall carry out the excavation in an ordered sequence to minimise disturbance to the exposed site soils. The Contractor shall employ the use of tracked backhoe excavators fitted with smooth edge ditching bucket. These machines shall operate not closer than 0.5 metres above the final subgrade level and outside the areas finally trimmed to subgrade level.

Construction plant of other than that specified above shall not be permitted on to the exposed subgrade. The Engineer shall be notified in advance of the excavator commencing in order to be represented on the site to inspect the subgrade as exposed.

11. INSPECTION

Give the Engineer and the Local Authority ample notice of completion of the excavation to enable inspections to be made. Do no further work in these areas until they have been approved.

12. OVER-EXCAVATION

The Engineer may instruct the Contractor to carry out some over-excavation in the areas where unsuitable soils are exposed at subgrade level. Where these areas are located away from the digging face a temporary earth ramp shall be pushed out over the subgrade to enable suitable location of the excavator and trucks without damaging the approved subgrade. Such excavation is to be carried out under the on-site direction of the Engineer. The Contractor shall provide all means of controlling ground-water inflows in these areas of over-excavation.

13. BACKFILL

The backfill for the areas of over-excavation as directed by the Engineer shall comprise imported quarried material which complies with the NRB Specification M4: June 1965 "Crushed Basecourse Aggregate", Grading A. This material is also termed "Standard Grade". The prepared material shall comply strictly with the grading, plasticity and broken face criteria but may be relaxed for aggregate hardness. The Contractor shall supply to the Engineer a sample of the material to be used for independent analysis. The Engineer reserves the right to reject any material and/or supply of material for use on the site.

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The Contractor shall arrange to have tests carried out on the supplied quarried material in accordance with the criteria set by the NRB/M4: June 1965 Specification. The tests shall be provided as follows:

(i) Before construction - three sets of tests carried out within two months of supply.

(ii) During construction - one set of tests performed for every 100 cubic metres provided to the site.

Where the test results do not comply with the requirements of the NRB/M4: June 1965 specification, material will be rejected. Deficient materials placed on the site shall be removed and replaced with conforming material at the Contractor's expense.

The use of 'crusher run' or 'lime stabilised' materials are not permitted as a substitute for the specified materials.

Site material may not be used for backfilling.

14. PLACEMENT AND COMPACTION OF SUBGRADE FILLING

Basecourse material shall be placed and compacted in layers with an uncompacted thickness not exceeding 150 mm and not less than 100 mm. Each layer shall be compacted by multiple passes of a smooth steel wheeled roller or other plant approved by the Engineer, to not less than 95% relative standard compaction in terms of NZS 4402: Part 2, 1981
Test 14.

Compaction of basecourse shall take place at a water content appropriate to the plant being used. If water is required to be added, a fine mist spray shall be used and excess water shall be prevented from damaging the subgrade or sub-base.

The Contractor shall provide daily site tests to monitor the compaction being achieved. Tests shall be carried out at the rate of one test for every twenty cubic metres of filling placed. The laboratory engaged by the Contractor to provide the testing service is to be approved by the Engineer before backfilling commences.

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15. FILTER MATERIAL

The filter material to be placed beneath the basement slab shall comrpise NRB type F2 graded filter material. The Contractor shall supply to the Engineer a sample of the material to be used for independent analysis. The Engineer reserves the right to reject any material and/or supply of material for use on the site.

The filter material should be placed and compacted in accordance with section 14 above. Extreme care should be taken to prevent contamination of the filter layer during placing and compaction. The subfloor Novaflo drains should be protected with a minimum of 100 mm thickness of filter material all around to prevent contamination and possible blocking of the drains.

16. DRAINAGE MATERIAL

The drainage material to be placed within the drainage tunnels formed within the basement slab shall comprise washed rounded pebbles of size 13 mm to 20 mm. The pebbles must be clean and free of contamination or fines. Crushed stones are not acceptable.

17. DRAINS

Supply and place the Novaflo drains as detailed on the drawings and in accordance with the manufacturers instructions. Splice separate lengths of Novaflo carefully to prevent fouling of the drains.

The subfloor drains shall be placed beneath the basement slab and located within the filter material such that there is a minimum of 200 mm of filter material on top of the Novaflo and 100 mm of filter material around the other sides of the Novaflo. Connect these drains to the spigots cast in to the sides of the main drainage channel.

The subfloor drains are provided to protect the basement slab against uplift until sufficient of the superstructure has been completed to counter-balance the uplift forces.

UNDER NO CIRCUMSTANCE SHOULD THE SUB FLOOR DRAINS BE CAPPED UNTIL THE ENGINEER HAS GIVEN HIS WRITTEN APPROVAL.

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The drainage tunnels within the basement slab itself are provided to protect the upper slab in the event that some slight leaks occur through the lower slab. Place Novaflo drains within the 150 mm cast-in sleeves to connect the drainage tunnels to each other and to the main drainage channel. Fill the drainage tunnels with drainage material as specified in section 16.

18. PRESSURE RELIEF PORTS

Provide pressure relief ports through the lower part of the basement slab as shown on the drawings. These ports are provided to further protect the basement slab from uplift in the event that the sub floor drains become blocked. These ports must be capped once sufficient superstructure has been completed to counter-balance the uplift forces.

UNDER NO CIRCUMSTANCES SHOULD THE PRESSURE RELIEF PORTS BE CAPPED UNTIL THE ENGINEER HAS GIVEN HIS WRITTEN APPROVAL.

19. SHORING AND UNDERPINNING

Carry out the shoring and underpinning as shown on the drawings.

Refer to the piling specification for the driving of the shoring piles.

The underpinning details are based on assumed foundations for the neighbouring buildings. These will need to be confirmed during excavation of the site. The Contractor shall notify the Engineer when each foundation is exposed and shall not carry on with the underpinning work until written approval has been given by the Engineer.

The underpinning shall be carried out in stages with every second soldier completed initially and then the remaining soldiers completed during the second stage. The Contractor shall be responsible for the stability and integrity of the neighbouring buildings and shall make good any damage caused.

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B PILING

1. SCOPE

This section includes but is not limited to the supply in place of all piles, including reinforcing, as detailed on Smith Leuchars Ltd drawings and summarised below:

(i) the installation of the steel shoring piles

(ii) the boring and installation of reinforced concrete foundation piles, including belled bases

(iii) the driving and installation of reinforced concrete bulbed piles.

2. SAFETY

Notwithstanding the requirements of this specification, nothing contained herein shall absolve the Contractor from responsibility for the temporary and permanent safety of the concrete work.

Where, in the opinion of the Contractor anything contained in this specification, the drawings or Engineer's instructions would impair the safety of the work, he shall immediately inform the Engineer in writing requesting further instructions, and shall thereafter carry out such instructions.

3. SUPERVISION

The Contractor shall be wholly responsible for producing concrete with the specified properties. Produce and place all concrete under the supervision of a foreman experienced in this class of work, under the control of a registered Engineer all as described in NZS 3109 (1980).

No concrete placing shall commence until the Engineer is satisfied that all provisions of this specification with respect to foundations, formwork, reinforcing, construction joints, etc. have been complied with. The Contractor shall give the Engineer at least 24 hours notice of intention to pour.

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4. STANDARDS

Unless noted to the contrary in this specification materials for and the construction of reinforced concrete shall be in accordance with NZS 3109 (1980) (metric version) including all current amendments; a copy of this standard shall be kept on site.

The related documents listed on page 6 of NZS 3109 (1980) (or their current metric equivalents) shall also be taken to be requirements of this specifications.

Where there is any conflict in requirements between this section of the specification and NZS 3109 (1980) the former shall take precedence.

5. ORDER OF WORK

The order of carrying out the Concretor's work shall be agreed with the Engineer and shall conform to the agreed programme for the work as a whole and the Contractor shall adhere to this schedule.

6. DRAWINGS

All concrete work specified hereafter shall be carried out in strict accordance with the drawings and instructions as issued.

7. ADMIXTURES

Incorporate no admixtures in the concrete unless specified or otherwise approved in writing by the Engineer. If approved, use strictly in accordance with the Manufacturer's directions and carefully measure the correct quantities under expert supervision. Calcium chloride or any derivative thereof will not be permitted under any circumstances.

8. AGGREGATES

Coarse and fine aggregates shall comply with the requirements of NZS 3121. Coarse aggregate shall have a maximum size of 20 mm.

9. CEMENT

Cement shall comply with the requirements of NZS 3122 Portland Cement (ordinary and rapid hardening) and all subsequent amendments. All cement shall be delivered in the original sealed bags of the manufacturer or in bulk

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container approved by the manufacturer. Rapid hardening cement may be usd only when the brand and the proposed method of use are approved by the Engineer.

When cement is stored it shall be protected to prevent deterioration. Any damp, lumpy or otherwise defective cement shall not be used. The system of storage shall be such that cement consignments are used in order of delivery and each consignment is to be kept separate and distinguished from other deliveries. If, in the opinion of the Engineer, cement has been damaged in transit or during storage, then it shall be immediately removed from the site.

10. WATER

Use only fresh clean water of drinking quality for concrete, mortar, grout, cleaning out and wetting formwork, washing materials and for curing.

11. REINFORCEMENT

Reinforcement steel shall be to the varying requirements of type as shown on the drawings. Steel shall comply with the following standards or their metric equivalents:

NZS 3421: 1975	Hard drawn mild steel wire concrete reinforcement.
NZS 3402P: 1973	Hot rolled steel bars for concrete reinforcement.
NZS 3422: 1975	Welded fabric of drawn steel wire for concrete reinforcement.

Steel reinforcement shall be free from all paint, grease, mill or rust scale or other coatings that will destroy or reduce the bond. Steel which has been allowed to oxidise to the extent that resultant pitting has reduced the effective cross sectional area to less than the permitted rolling minimum shall be rejected.

Where reinforcement is not particularly specified or detailed for concrete, the Contractor shall ask the Engineer for his instructions.

Review of any placing drawings and lists by the Engineer shall in no way relieve the Contractor of his responsibility for the accuracy of these drawings and for the correctness of the fabrication and placing, setting out and erection of the reinforcing steel, and the cost of rectifying any errors shall be at the Contractor's sole expenses. Supply and incorporate

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in the work all reinforcement complete with tie wire, spacer bars, support bars and bar chairs and the like all as necessary to complete the work.

Where concrete spacers are used these are to be manufactured from structural concrete as used in the work with embedded ties which are to be of stainless steel or non-corrosive wire.

Supply copies of the steelworks test certificates for the piling reinforcement to the Engineer for check against design criteria.

12. STORAGE AND HANDLING

Storage and handling of materials shall be to the requirements of NZS 3109 and related documents.

13. READY MIXED CONCRETE

The use of ready mixed concrete for the production of any concrete elements associated with the works shall be permitted provided it is from a supplier who has satisfied the Engineer that the production of his concrete complies in all respects with the requirements of NZS 3104 and of this specification. Before any concrete is placed in the works the various mix designs shall be submitted to the Engineer for review.

14. CONCRETE GRADES AND STRENGTHS

Concrete grades and strengths for the various parts of the building shall be as noted on the drawings and shall be in accordance with NZS 3109 (1980) in respect to design, placing and testing, except where modified by this specification.

Concrete for the piles shall be 25 MPa unless noted otherwise.

Unless otherwise specifically stated slump values shall not vary from the values given in Table 6 of NZS 3109 (1980) by more than + 25 mm.

15. SAMPLING AND TESTING OF CONCRETE

15.1 Concrete Testing

Compression tests and slump tests shall be carried out during the progress of the work generally to the requirements of NZS 3109 9.5 except that four cylinders are to be cast. One cylinder shall be tested at 7 days and

the other three at 28 days and this latter will constitute a 28 day set. Allow for an additional five comparison tests (four cylinders each) to be prepared as and when directed by the Engineer. The Contractor shall provide at his own cost sufficient standard moulds for concrete specimens 100 mm diameter x 200 mm high, one standard slump mould and any other apparatus required to carry out the tests and shall be responsible for maintaining all apparatus in good order and condition. On completion of the contract all apparatus will remain the property of the Contractor. The Contractor shall be responsible for the casting, marking, advice and delivery to the laboratory of the concrete specimens to the satisfaction and under the supervision of the Engineer. All compression tests shall be carried out in an independent testing laboratory and the 7 day strength shall be at least 70% of the 28 day strength called for on the drawings. The cost of the compression and slump tests is to be allowed for in the basic concrete rates.

15.2 Certificates

Retain on site one copy of the manufacturer's certificate for each batch of ready-mix concrete delivered to site.

16. REJECTION

The Engineer may reject any concrete because of failure to conform with the requirements of this specification.

Upon request, the Engineer's approval may be given for the Contractor to carry out suitable tests on the rejected concrete and the Contractor shall bear the cost of such tests and of all labour and materials required for the provision of such tests and making good on completion of the tests.

Rejected concrete for which testing approval was sought and not approved, for which testing approval was not sought, which failed to withstand suitable tests, and which it was impracticable to test, shall be cut out within the limits defined by the Engineer removed from the site and replaced with new concrete conforming to the requirements of this specification at the Contractor's expense.

The Engineer may reject any truckload of ready mixed concrete because of failure to conform with the requirements of this specification or failure to provide or complete the concrete manufacturer's delivery docket.

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17. PLACING REINFORCEMENT

The reinforcing for each pile shall be of the sizes given and fabricated in rigid cages as shown on the drawings. If practicable main longitudinal bars shall be supplied in single lengths but when necessary laps in the main bars shall be 60 diameters unless shown otherwise on the drawings. Lapped bars must be tied to the spiral binding at sufficient points to ensure that the whole cage is rigid, and can be handled without distortion or damage. The specified cover shall be maintained by welding approved steel spacers to 100 mm x 10 mm stiffened hoops. The cages shall be adequately supported at the top to hold the bottoms of the main bars 75 mm above the final founding level. The cages will not be permitted to extend into any spigot that may have been formed. Welding of grade 380 steel shall be subject to the Engineer's approval, providing a welding supervisor is engaged and provided the bars are preheated and treated to the steel manufacturers specifications. Tenderers shall allow for all shop drawings and bar bending schedules that may be required for the production of the cages.

18. TOLERANCES

The reinforcing cage shall be nowhere less than the nominal diameter given on the drawings. The maximum and minimum diameters of the pile cage measured at any given level shall not differ by more than 50 mm.

When a plumb line is passed through the centre of the pile at the top of the casing then:

(a) This line shall pass within 75 mm of the pile's design vertical axis as given on the drawngs.

(b) The line shall pass within 50 mm of the centre of the reinforcing cage at any point within 3.0 m of the casing top and 75 mm at any point lower down the pile.

19. PLACING AND VIBRATION OF CONCRETE

The mix design and full details of the proposed method of placing the concrete must be submitted to the Engineer for his approval before commencing work on the site, and shall be such that the reinforcing is not displaced and the completed pile contains no voids, and provides complete protection for the reinforcement.

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The top concrete surface of the first stage of pouring is to be treated as a construction joint as described in NZS 3109, Section 5.6. This also applies to any other concrete surface where the placed concrete sets so that it cannot be made plastic by revibration.

20. SHORING PILES

20.1 Scope

This section covers the supply and installation of vertical structural steel soldier piles for the perimeter shoring of the excavation.

The Contractor shall supply store, pitch and drive the soldier piles at the locations shown on the drawing and in accordance with the requirements of this specification.

The Contractor shall provide all materials, plant, labour and supervision to carry out the works as specified.

20.2 Soldier Piles

Each soldier pile shall comprise unused steel sections of continuous lengths to provide for the cantilever and pile embedment as given on the drawings. The structural steel used for the soldier piles shall be in accordance with AS 1204 "Structural Steel Ordinary Weldable Grades".

20.3 Inspection

All materials and procedures shall be subject to inspection by the Engineer or his representative during any stage of fabrication and erection.

20.4 Rejections

Defective material or workmanship found at any time prior to the final acceptance of the work will be rejected. Defective materials shall be removed and replaced by the Contractor at his own expense and he shall be responsible for all delays caused by rejection. Any rejected work or material is to be repaired or replaced without delay.

20.5 Driving of Piles

The Contractor shall have available pile driving equipment to install the soldier piles to the embedded elevations as shown on the drawings.

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Piles are to be top driven with a single action drop weight hammer fitted to a crane operated pile driving frame fitted with adequately sized leaders ties and straps. The use of vibrating plant without an adequate driving frame, leaders, etc. is not permitted.

The Contractor shall use all necessary driving helmets, cushions, packers, girders, etc. to fully protect the pile from damage due to top driving. Any damage to the piles resulting from the Contractor's overall operation while piles are stored, lifted, transported, positioned and driven, shall be made good at the Contractor's expense.

Piles shall be driven to the embedment elevations irrespective of the number of blows required.

If difficulty is experienced in fully driving the piles to the required depths, the Contractor may predrill and temporarily line vertical shafts extending from ground level to RL 0.0 metres. Piles shall be installed vertically inside the shafts and then driven to the embedment level. On completion of driving the temporary shaft liner shall be extracted.

20.6 Tolerances on Soldier Piles

All soldier piles shall be positioned and installed with tolerances as follows:

(i)	Vertical position at time of driving	± 50mm
(ii)	Verticality on line of shoring	1 in 50 over cantilever length
(iii)	Verticality transverse to lined shoring	1 in 50 over full length of pile

Forcible corrections to the piles where as-driven they exceed the position and verticality tolerances specified above shall not be made.

Piles which exceed the tolerances specified shall be extracted, reset and redriven.

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20.7 Extraction

The shoring piles are provided for temporary ground retention only and may be withdrawn on completion of the level 2 slab and subsequent backfilling between the shoring and the basement walls. Any soldier piles used for underpinning should be cut free of the underpinning concrete prior to being extracted.

21. BORED PILES

Before drilling starts on any pile the positions of all piles and steel sections shall be set out and checked and certified by an Engineer or Registered Surveyor employed by the Contractor for this purpose. No work on any pile is to proceed until this certification has been delivered to the Engineer.

The pile shafts shall be drilled by machine to not less than the diameters shown on the drawings and to such depths that the bells if any are formed in material which is firm enough to stand safely after the sloping sides of the bells have been formed and, at the same time, the bases of the piles are founded on material which is capable of maintaining the design loadings.

Estimated founding depths have been determined from boring information and are shown on the drawings. The design pressures at these estimated founding depths have been based on the assumption that pile bases will be located in a layer of colluvium comprised primarily of grey wacke debris.

Every second pile shall be proof tested prior to drilling, under the supervision of approved Soils Engineering Consultants.

If the assumed conditions are not observed within the proving depth, the piles shall be deepened accordingly on the written instruction of the Engineer. The base of each pile shaft shall be hand cleaned and inspected prior to pouring concrete.

Final founding depths and levels shall be determined by the Engineer from the inspections of the founding materials and/or tests in each pile position.

All safety precautions necessary shall be provided to allow the Engineer to inspect the excavation, this shall include an air supply to the base of the shaft, electric light, assistance and full time attendance at the shaft by an experienced foreman. Pumps used in shafts shall have explosion proof

electric motors. The Contractor shall be responsible for the stability of the excavation and safety of his own workmen or other persons who may have to enter the excavation and shall comply with the requirements of the Construction Regulations 1967 and amendments.

Tenderers shall allow in their tender for the supply and driving of temporary protective steel casing or other temporary ground support if necessary extending from the level from which the piles are drilled down to the top level of the bells or rock below. The temporary support may be withdrawn or removed after concrete has been placed.

The protective casing shall be sufficiently strong to hold the surrounding material and to withstand being driven.

The casing shall be driven as drilling proceeds.

After drilling to the final founding level the bases of the piles shall be belled or shaped to the sizes shown on the drawings. Mechanical belling equipment may be used and the material then trimmed by hand where necessary to achieve the specified slope. The bases of the piles shall be horizontal over the whole area except that a central spigot to hold the belling equipment will be allowed to extend below the final founding level. The edges of such spigots shall be chamfered or rounded. All piles are to be inspected by the Engineer before concrete is poured.

After excavation and immediately before placing the reinforcing and concrete, the base of the excavation shall be cleaned of all loose material and all water removed by bailing or pumping.

The Contractor shall keep a complete record of each pile showing dates and times taken for excavation, driving, casing and concreting, the types and depths of materials encountered during excavation, the actual lengths of casing driven and reinforcing placed and the final founding level of the piles.

Allowance is to be made for 12 hours standing time per pile for plant, supervision and labour involvement between the hours of 9 am and 5 pm Monday through Friday to allow a decision on the founding levels.

Concrete placing shall be co-ordinated with the withdrawal of casings to achieve the minimum 75 mm cover outside the spiral reinforcement, avoid ground water ingress, and ensure full compaction for the full diameter and length of every pile.

22. CONCRETE BULBED PILES

22.1 Scope

This section includes, but is not limited to, the supply in place of all reinforced concrete bulbed piles, including reinforcing.

The piles are detailed on Smith Leichars Ltd drawings.

Piles are detailed as driven bulb type (alternatively known as enlarged base type).

22.2 Load Capacities

The piles shall have the ultimate load capacities noted on the drawings.

In the building calculations, the ultimate capacities have been divided by 1.1 to derive allowable ultimate loads for seismic conditions, and by 1.8 to derive allowable ultimate loads for vertical dead plus reduced live load conditions, in accordance with the recommendations in NZS 4203: 1984.

Actual pile lengths shall be determined on site, and shall be related to a set to achieve the required loads, the relationship between such loads, and sets to be made by the use of formulae approved by the Engineer.

Tension piles shall not be shorter than specified. Allow to predrill as necessary to achieve this length.

The founding depth of all piles shall be subject to the Engineer's approval prior to pouring concrete.

22.3 Tolerances

The reinforcing cage shall be nowhere less than the nominal diameter given on the drawings nor cover to main steel less than 75 mm. The maximum and minimum diameters of the pile cage measured at any given level shall not differ by more than 50 mm.

When a plumb line is passed through the centre of the pile cage at the top of the casing then:

(a) This line shall pass within 75 mm of the pile's design vertical axis as given on the drawings.

(b) The line shall pass within 50 mm of the centre of the reinforcing cage at any point within 3.0 m of the finished pile top level and 75 mm at any point lower down the pile.

The top of the concrete in the pile is to be within 40 mm of the level shown on the drawings.

22.4 Records

The Piling Contractor shall keep records of the installation of each pile. These shall be made available to the Engineer at the end of each week's work. Any unexpected driving conditions shall be noted in the records.

The records shall include the following:

(a) Contract

(b) Pile reference number

(c) Pile type

(d) Nominal diameter

(e) Date and time of driving

(f) Date of concreting

(g) Ground level at commencement of installation of pile

(h) Depth from working level to pile toe

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(i) Toe level

(j) Length of casing

(k) Type, weight, drop and mechanical condition of hammer

(l) Number and type of packings used and type and condition of dolly used during driving

(m) Sets taken at intervals during the last 3 m of driving

(n) Set of pile tube in mm per 10 blows or number of blows per 25 mm of penetration

(o) Temporary compression of ground and pile from time of a marked increase in driving resistance until pile reaches its final level

(p) Length and details of reinforcement

(q) Concrete mix

(r) Volume of concrete supplied to pile

(s) All information regarding obstructions, delays and other interruptions to the sequence of work

22.5 Concrete Placing

Concrete placing shall be co-ordinated with the withdrawal of casings to achieve the minimum 75 mm cover outside the spiral reinforcing, avoid ground water ingress, and ensure full compaction for the full diameter and length of every pile.

Piles shall be over filled as required, depending on method of compaction of concrete, and cutting down of tops shall be sufficient to leave sound concrete.

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C. CONCRETE AND REINFORCING STEEL

1. GENERAL

1.1 Conditions of Contract

Refer to the Conditions of Contract which are binding on all sections.

1.2 Scope

The work in this section includes, but is not limited to, the supply and placing of concrete work together with sundry items in connection therewith including reinforcement and formwork.

1.3 Safety

Notwithstanding the requirements of this specification, nothing contained herein shall absolve the Builder from responsibility for the temporary and permanent safety of the concrete work.

Where, in the opinion of the Builder, anything contained in this specification, the drawings or Engineer's instructions would impair the safety of the work, he shall immediately inform the Engineer in writing requesting further instructions, and shall thereafter carry out such instructions.

1.4 Supervision

The Contractor shall be wholly responsible for producing concrete with the specified properties. Produce and place all concrete under the supervision of a foreman experienced in this class of work, under the control of a registered engineer all as described in NZS 3109 (1980).

No concrete placing shall commence until the Engineer is satisfied that all provisions of this specification with respect to foundations, formwork, reinforcing, construction joints, etc. have been complied with. The Contractor shall give the Engineer at least 24 hours notice of intention to pour.

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1.5 Standards

Unless noted to the contrary in this specification materials for and the construction of reinforced concrete shall be in accordance with NZSS 3109 (1980) (metric version) including all current amendment; a copy of this standard shall be kept on site.

The Related Documents listed on page 6 of NZSS 3109 (1980) (or their current metric equivalents) shall also be taken to be requirements of this specification.

Where there is any conflict in requirements between this section of the specification and NZSS 3109 (1980) the former shall take precedence.

1.6 Order of Work

The order of carrying out the Contractor's work shall be agreed with the Engineer and shall conform to the agreed programme for the work as a whole and the Contractor shall adhere to this schedule.

1.7 Drawings

All concrete work specified hereafter shall be carried out in strict accordance with the drawings and instructions as issued.

1.8 Admixtures

Incorporate no admixtures in the concrete unless specified or otherwise approved in writing by the Engineer. If approved, use strictly in accordance with the Manufacturer's directions and carefully measure the correct quantities under expert supervision. Calcium chloride or any derivative thereof will not be permitted under any circumstances.

1.9 Work for Subcontractors

Build in fillets, cast in fastenings, bolts and sleeves, and form all holes, recesses and chases as required by all subcontractors.

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1.10 Protection

The Contractor shall be wholly responsible for protecting the works. In particular, protect all brickwork and all fairface concrete work from damage staining and contamination of any sort, and keep all projecting bolts, lugs and other fixings free from damage.

During curing of concrete the work shall be protected from damage by workmen, equipment, overloading or any other cause.

During the concreting of beams on other structures take special measures as necessary to prevent leakage of grout or water into areas where permanent damage may occur.

1.11 Concrete Surface Finishes

ALL concrete surface finishes shall be to the type detailed within the Contract Documents and shall be in accordance with NZS 3114 (1980) including all current amendments.

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2. MATERIALS

2.1 Aggregates

Coarse and fine aggregates shall comply with the requirements of NZS 3121. Coarse aggregate shall have a maximum size of 20 mm.

2.2 Cement

Cement shall comply with the requirements of NZS 3122 Portland Cement (ordinary and rapid hardening) and all subsequent amendments. All cement shall be delivered in the original sealed bags of the manufacturer or in bulk container approved by the manufacturer. Rapid hardening cement may be used only when the brand and the proposed method of use are approved by the Engineer.

When cement is stored it shall be protected to prevent deterioration. Any damp, lumpy or otherwise defective cement shall not be used. The system of storage shall be such that cement consignments are used in order of delivery and each consignment is to be kept separate and distinct from other deliveries. If, in the opinion of the Engineer, cement has been damaged in transit or during storage, then it shall be immediately removed from the site.

2.3 Water

Use only fresh clean water of drinking quality for concrete, mortar, grout, cleaning out and wetting formwork, wash materials and for curing.

2.4 Reinforcement

Reinforcement steel shall be to the varying requirements of type as shown on the drawings. Steel shall comply with the following standards or their metric equivalents:

NZS 3421:1975	Hard drawn mild steel wire concrete reinforcement
NZS 3402P:1973	Hot rolled steel bars for concrete reinforcement
NZS 3422:1975	Welded fabric of drawn steel wire for concrete reinforcement

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Steel reinforcement shall be free from all paint, grease, mill or rust scale or other coatings that will destroy or reduce the bond. Steel which has been allowed to oxidise to the extent that resultant pitting has reduced the effective cross sectional area to less than the permitted rolling minimum shall be rejected.

Where reinforcement is not particularly specified or detailed for concrete, the Contractor shall ask the Engineer for his instructions.

Review of any placing drawings and lists by the Engineer shall in no way relieve the Contractor of his responsibility for the accuracy of these drawings and for the correctness of the fabrication and placing, setting out and erection of the reinforcing steel, and the cost of rectifying any errors shall be at the Contractor's sole expense.

Supply and incorporate in the work all reinforcement complete with tie wire, spacer bars, support bars and bar chairs and the like all as necessary to complete the work.

Bar chairs and/or spacers shall be of an approved metal, plastic or concrete type. Metal chairs shall be galvanised where the legs will be exposed in finished concrete surfaces.

Where concrete spacers are used these are to be manufactured from structural concrete as used in the work with embedded ties which are to be of stainless steel or non-corrosive wire.

2.5 Storage and Handling

Storage and
handling of materials shall be to the requirements of NZS 3109 and related documents.

2.6 Ready Mixed Concrete

The use of ready mixed concrete for the production of any concrete elements associated with the works shall be permitted provided it is from a supplier who has satisfied the Engineer that the production of his concrete complies in all respects with the requirements of NZS 2086 and of this specification. Before any concrete is placed in the works the various mix designs shall be submitted to the Engineer for review.

3. CONCRETE

3.1 Concrete Grades and Strengths

Concrete grades and strengths for the various parts of the building shall be as noted on the drawings and shall be in accordance with NZS 3109 (1980) in respect of design, placing and testing, except where modified by this specification.

Unless noted otherwise on the drawings, concrete strengths shall be as follows:

Piles	25 MPa
Foundations & basement slab	25 MPa
Basement walls & shear walls	30 MPa
Precast frames	40 MPa
Precast floor units	25 MPa
unless specified otherwise	25 MPa

Unless otherwise specifically stated slump values shall not vary from the values given in Table 6 of NZS 3109 (1980) by more than ± 25 mm.

3.2 Sampling and Testing of Concrete

3.2.1 Concrete Testing

Compression tests and slump tests shall be carried out during the progress of the work generally to the requirements of NZSS 3109 9.5 except that four cylinders are to be cast. One cylinder shall be tested at 7 days and the other three at 28 days and this latter will constitute a 28 day set. Allow for an additional five comparison tests (four cylinders each) to be prepared as and when directed by the Engineer. The Contractor shall provide at his own cost sufficient standard moulds for concrete specimens 100 mm cdia x 200 mm high, one standard slump mould and any other apparatus required to carry out the tests and shall be responsible for maintaining all apparatus in good order and condition. On completion of the contract all apparatus will remain the property of the Contractor. The Contractor shall be responsible for the casting, marking, advice and delivery to the laboratory of the concrete specimens to the satisfaction and under the supervision of the Engineer. All compression tests shall be carried out in an independent testing laboratory and the 7 day

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strength shall be at least 70% of the 28 day strength called for on the drawings. The cost of the compression and slump tests is to be allowed for in the basic concrete rates.

3.2.2 Certificates

Retain on site one copy of the manufacturer's certificate for each batch of ready-mix concrete delived to site.

3.3 Rejection

The Engineer may reject any concrete because of failure to conform with the requirements of this specification.

Upon request the Engineer's approval may be given for the Contractor to carry out suitable tests on the rejected concrete and the Contractor shall bear the cost of such tests and of all labour and materials required for the provision of such tests and making good on completion of the tests.

Rejected concrete for which testing approval was sought and not approved, for which testing approval was not sought, which failed to withstand suitable tests, and which it was impracticable to test, shall be cut out within the limits defined by the Engineer, removed from the site and replaced with new concrete confirming to the requirements of this specification at the Contractor's expense.

The Engineer may reject any truckload of ready mixed concrete because of failure to conform with the requirements of this specification or failure to provide or complete the concrete manufacturer's delivery docket.

3.4 Placing Reinforcement

Placing of reinforcement shall comply with the requirements of NZSS 3109 (1980) and as follows:

Bars intended to be in contact at passing points shall be securely wired together at all such points with 1.6 mm dia annealed soft iron tying wire or approved clips.

Binders, stirrups and links shall tightly embrace the bars with which they are intended to be in contact.

Reinforcement projecting from work being concreted, or already concreted, shall not be set out of its correct position for any reason unless approved. It shall be protected from deformation and other damage.

Rods with kinks or bends not shown shall not be used. All reinforcing fabric shall be supplied on flat sheets.

Any reinforcement which has been damaged while fixing in position shall be replaced.

3.5 Inserts and Openings

Cast in to concrete pipe sleeves, service lines and other fixings and fittings and make provision for the penetrations required by other trades and subcontractors and set out the positions of such penetrations accurately in conjunction with the specialists concerned.

Provide and maintain securely in position all cast-in items, during the placement of concrete.

Cut off projecting sleeves to finish flush with the adjacent faces of structural concrete.

Form all holes, recesses, chases and openings to the sizes and in the positions shown on the drawings.

3.6 Mixing, Transporting and Placing

Do not deposit concrete in wet trenches or running water.

Deposit concrete as nearly as practicable to its final position. Free dropping of concrete from a height greater than 1.2 metres or dumping of a large quantity away from its final position and working it along the forms will not be permitted.

Concreting shall proceed at such a rate that it remains sufficiently plastic to be worked readily into the final position.

Do not place concrete at a rate greater than that which will permit satisfactory compaction, nor to a depth greater than 450 mm before compaction. Provide adequate labour to ensure that the concrete is compacted to these requirements.

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Except where the use of construction joints is approved, place each monolithic portion of the work in one continuous operation. The order of placing shall be as required by the Engineer, and shall be so arranged that new concrete is continually being placed against unset concrete so that a monolithic structure shall result.

Before placing concrete around any steelwork, such steelwork shall be securely fixed in position on correct alignment, level and rigidly held in such a manner that it will not be displaced during placement of concrete.

Beams shall be poured to the full height of each unit. Vertical and horizontal construction joints shall be permitted in predetermined locations only after approval by the Engineer.

Runways along which concrete will be transported shall be built over the reinforcement and in an approved manner. All preparation work shall be inspected and approved by the Engineer before pouring is commenced.

3.7 Vibrating

All concrete except concrete in sprayed walls shall be vibrated sufficiently to produce dense concrete of a uniform texture. Concrete in vertical sections shall be placed in layers not exceeding 500 mm deep, and each layer shall be vibrated by methods which will not permit the ingredients to separate. Finished surfaces shall be smooth (unless otherwise specified) and free from voids.

Vibrators shall be of sturdy construction, adequately powered and capable of transmitting to the concrete not less than 4,500 impulses per minute when operating under load.

To ensure that full compaction of the concrete is attained the number of vibrators employed shall be related to the rate of placement of concrete such that vibration throughout the entire volume of each layer of concrete is completed.

Internal vibrators shall be employed at uniformly spaced points not farther apart than the diameter over which the vibrator is visibly effective and shall be applied close enough to the forms to vibrate the surface concrete effectively. Care shall be taken to avoid hitting the forms or reinforcements.

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3.8 Curing and Protection

All concrete is to be cured.

Alternative wetting and drying will not be permitted during curing. Membrane curing is permitted.

Trowelled or other finished surfaces shall be shaded from the sun and effectively protected from premature drying as specified above. Stripping forms shall be carried out with care. Shaking must be avoided in stripping.

Work shall be protected from damage by workmen, equipment, overloading or any other cause.

Protect all concrete work from damage of any sort and keep all projecting bolts, lugs and other fixings free from damage.

3.9 Drilled in Dowels and Stirrups

Drill existing concrete and masonry elements to the depths shown on the drawings. Hole diameters shall be made a maximum of 6 mm larger than the diameter of the dowel or stirrup. Where possible and unless otherwise detailed on the drawing drill holes at a slope of 20° to the horizontal to facilitate filling with epoxy grout or neat cement grout.

After cleaning out holes and trial fitting of dowels or stirrups mix and place sufficient epoxy to a consistency to allow ready filling of holes for the full depth. Place sufficient grout to ensure that when inserted it just overflows from the hole fully enclosing the embedded dowel or stirrup.

Where holes are drilled to the specified slope to the horizontal use purpose made epoxy packs with sufficient material so that when inserted in the hole and mixed the volume completely surrounds the dowel or stirrup for the full embedded length.

3.10 Neat Cement Grout

Grout shall contain "Febgrout" or similar approved grout - expanding additive and shall be mixed according to the manufacturer's instructions and to a consistency suitable for its use.

3.11 Epoxy Grout

In general, epoxy grout to be used for the purpose of bolt and reinforcing bar fixing shall be Araldite K80 or a similar approved epoxy.

4. JOINTS

4.1 Materials

Sealants

All sealants used shall be those manufactured by Expandite Ltd, or Epiglass Ltd or an approved equivalent, unless noted otherwise on the drawings. Joints to be sealed and the types of sealant to be used shall be as detailed on the drawings or as noted elsewhere in this specification. Joint surface preparation and sealant application shall be in strict accordance with the manufacturer's recommendations.

4.2 Construction Joints

A structural unit where mentioned in the specification shall mean a portion of the structure that must be poured in one continuous operation. Structural units shall start and finish at approved predetermined construction joints or levels.

Where concrete has taken its initial set by reason of placing being stopped or delayed before completion of that portion of the work, the point of stopping shall be deemed a construction joint.

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5. FORMWORK AND FALSEWORK

5.1 General

All staging, formwork and supports thereto shall be designed and constructed to the satisfaction of the Engineer, so braced and of such strength and stiffness as to safely support the loads directly and indirectly imposed upon them, and so that removal can be carried out without damage to the concrete. Soleplates shall be used for all supports which are supported on finished concrete surfaces.

Where concrete surfaces are scheduled to be plastered the surface forming the base of this finish shall be scarified with a stiff wire brush and thoroughly roughened by chipping or picking immediately the shuttering is removed to form a suitable base for the plastering. With the Engineer's approval a retarder may be used to assist the process but the responsibility for such use and the resulting reactions will be the Contractor's.

5.1.1 Types of Boxing

The Contractor may use any material for boxing provided that the requirements for texture and finish can be complied with and the materials used do not adversely affect the properties of the concrete.

5.1.2 Extent

All concrete work other than sprayed concrete walls shall be boxed unless the Engineer approves to the contrary in particular cases

5.1.3 Tightness and Rigidity of Forms

Joints being individual boards forming shutters, between adjoining shutters and elsewhere must be mortar tight at the time of pouring concrete and must remain so under the effects of the vibration necessary to give the full specified compaction to the concrete.

Forms shall be designed so that the deflection of the sheathing shall not exceed 1/300th of the span between joints or other supports and in any case shall not exceed 5 mm. They shall be of sufficient rigidity and strength to prevent distortion due to pressure from the concrete and other loads incidental to the construction operation, including the effects of vibration during the placing of concrete for which purpose, vibrated concrete shall be assumed to exert the same pressure as would a fluid of a density equivalent to that of unset concrete.

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5.1.4 Vertical Surfaces

The methods of construction shall be such that vertical surfaces can be stripped without disturbing boxing or supports to soffits which may require to be left in place for a longer period.

5.1.5 Fillets, Chamfers and Bevels

Concrete which is to be left unfinished and elsewhere as indicated on the drawings shall have all internal and external corners filleted or bevelled 20 mm x 20 mm as appropriate.

Areas of concrete which are to receive applied finishes shall have all internal and external corners filleted or bevelled as appropriate to a dimension which will suit the applied finish and which will also ensure the easy removal of formwork without damage to the concrete.

At the top of all pours 25 mm grout checks shall be used to ensure clean, sharp, joint lines.

5.1.6 Temporary Fittings

Bolts and other temporary metal fittings used in formwork erection shall be placed so as to permit their easy removal to a depth of at least 50 mm from the face without injury to the concrete, and so that upon their removal the cavities left are of the smallest possible size. The cavities shall be filled to the Engineer's requirements. Where the face finish is Class F3 or better all joints and bolts shall be positioned to a regular pattern which has been approved by the Engineer.

5.1.7 Wire Ties

The use of wire ties for formwork is prohibited.

5.1.8 Re-use of Forms

Sound, unwarped forms may be re-used provided they will still satisfy the requirements of this specification.

1.1 Central Bank Policy

Central banks are institutions that manage a country's currency, money supply, and interest rates. Their primary goal is to maintain stable prices and support economic growth.

1.1.1 Monetary Policy Tools

Interest rates are a key tool. Lowering rates makes borrowing cheaper and encourages spending and investment. Raising rates does the opposite, cooling down an overheated economy.

Open market operations involve buying or selling government bonds to influence the money supply. When a central bank buys bonds, it injects money into the economy; when it sells bonds, it withdraws money.

Reserve requirements dictate how much money banks must keep on hand versus how much they can lend out. Lowering reserve requirements allows banks to lend more, increasing the money supply.

1.1.2 Inflation Targeting

Many central banks now use inflation targeting as their primary monetary policy framework. The idea is to announce a specific inflation rate (typically around 2%) and adjust policy tools to keep actual inflation close to that target. This gives businesses and consumers a clear expectation of future price levels, which helps them plan ahead.

1.1.3 Exchange Rates

The exchange rate between currencies affects imports, exports, and tourism. A weaker currency makes exports cheaper for foreigners but makes imports more expensive. Central banks may intervene in currency markets to smooth out volatile exchange rate movements.

1.1.4 The Federal Reserve

The Federal Reserve is the central bank of the United States. It consists of a board of governors in Washington and twelve regional banks across the country.

1.1.5 The Federal Funds Rate

The federal funds rate is the interest rate at which banks lend reserves to each other overnight. It is the most widely watched interest rate in the world and influences almost all other interest rates in the economy.

5.1.9 Coating for Forms

The inside surface of all forms shall be given a coat of an approved parting-oil or similar which shall not adhere to or stain the concrete or they shall be saturated with water immediately prior to placing concrete. Except for water, such coatings shall be applied before placing reinforcing steel in order to avoid fouling steel surfaces. No oil based parting mediums may be used.

5.1.10 Cleaning

Immediately before any concreting is commenced, formwork shall be carefully examined to see that all dirt, shavings, sawdust and other refuse has been removed. See also Clause D6.1.11

5.1.11 Inspection of Doors

Openings shall be provided in the formwork to facilitate cleaning before concrete is poured. These openings together with any other openings provided for other purposes shall be fitted with closers equipped with fasteners capable of withstanding loads appropriate to the formwork design pressures.

5.1.12 Bulging

If during a pour, settlement, bulging or other defects become apparent in the formwork, the Contractor shall cease pouring and shall take all necessary steps to the satisfaction of the Engineer to remedy such defects.

5.2 Stripping and Removal

The stripping of formwork shall be done in accordance with Table 5 NZS 3109. Under special circumstances the Engineer may allow earlier or require later stripping times but no stripping shall take place until the concrete is 24 hours old.

Falsework shall be struck in such a manner as to permit the concrete to take the stress due to its own weight gradually and uniformly, without shock.

9.1.1 Examples of Scenes

Scenes are specified in the Scene Table. Each scene has a unique identifier, a descriptive name, a start time, a duration, a set of active objects, and a set of active sensors. Scenes may overlap in time. When two scenes overlap, the union of their active objects and active sensors is used. Scenes are processed in order of their start time.

9.1.2 Scenes and Events

Scenes and events are independent. A scene may contain zero, one, or many events. Events may occur outside any scene. Scenes do not trigger events directly; events are triggered by the simulation engine according to the rules in section 9.2.

9.1.3 Scenes and Sensors

Sensors are attached to scenes by their identifier. A sensor may be active in more than one scene. When a sensor is active in two overlapping scenes, it produces one set of readings per scene, each tagged with the scene identifier.

9.1.4 Scenes and Objects

Objects are attached to scenes by their identifier. An object may be active in more than one scene. When an object is active in two overlapping scenes, its state is updated once per time step, not twice.

9.2 Scenes and Events

Events are triggered by the simulation engine when a condition specified in the Event Table is satisfied. The condition may be a time, a sensor reading, or a combination of both. Events have a type, a target, and a payload. The payload is a key-value pair. Events are logged in the Event Log.

The simulation engine evaluates conditions at every time step. If a condition is satisfied, the event is logged and the corresponding action is applied. Conditions are evaluated in order of the event identifier. If two events are triggered at the same time, the lower identifier is processed first.

5.3 Remedial Treatment of Surfaces

Make no repairs to concrete unless specified or permitted by the Engineer.

Any remedial treatment to surfaces shall be carried out without delay and such treatment shall be agreed with the Engineer following an inspection immediately after the removal of the formwork.

The surface of any concrete which has been treated before being inspected by the Engineer shall be liable to rejection.

5.4 Tolerances

Tolerances shall be as specified in NZS 3109.

6. FLOORS

6.1 Floor Slabs

Where specified to have a screeded finish concrete floor surfaces shall be screeded to a level and uniform surface immediately on completion of vibration, the surface being worked no more than is essential and left until evaporation of all surface moisture has taken place. The surface shall be floated with a "Kelly" float or similar approved rotary power float when the concrete has hardened enough to prevent any excess of fine material and water being worked up to the surface. The concrete shall be finished to a smooth, hard surface which shall conform with the requirements of this specification, particularly in respect to tolerances and surface finish.

Immediately the required standard has been achieved a curing membrane shall be applied to the finished surface, refer to Clause 3.8.

Where specified to have a floated finish, hand float to a smooth and even surface.

Slabs specified to be prepared for future finishes shall be levelled to an even surface and treated as noted in the drawings.

Slab finishes are to be as ordered.

Power floating shall be carried out by an experienced operator and a test area shall be approved by the Engineer before general pouring of slabs is commenced. The test area shall be such as to enable the Contractor to show that he is able to comply with all aspects of this specification related to surface finish of floor slabs. Subsequent finishes shall conform to the approved area.

All surfaces visible on completion of the works shall be free from surface blemishes, entrapped air bubbles and ridges and surface displacements greater than 2 mm at joints.

Refer section 7.1 for prefinished precast floor slabs.

6.2 Floor Levels

Construct all concrete floor slabs accurately to the structural thickness shown on the drawings and to the correct levels to allow the full specified thickness of floor finish to be provided and finished to the correct datum.

6.3 Floor Joints

Floor joints shall be made as and where shown on the drawings.

Sawn joints shall be sawn as soon after pouring as the concrete shall have hardened sufficiently to permit this to be done without damaging the concrete. Sawn joints shall be cut 25 mm deep using a 5 mm blade. All sawing shall be done in straight continuous lines. As late as possible in the contract the sawn joints shall be filled flush with sealant.

Formed construction joints shall be cut as late as possible in the contract, the time for this being agreed with the Engineer before this work is started. The saw line shall be the exact line of the joint as disclosed by shrinkage. All sawing shall be done in straight continuous lines. Formed construction joints shall be cut 15 mm deep using a 5 mm blade. As late as possible in the contract, the formed construction joint shall be filled flush with sealant.

The Contractor shall ensure that foreign matter is prevented from entering a sawcut and that such sawcuts are clean and free from debris before filling.

All of this work shall be carried out by a specialist subcontractor approved by the Engineer.

Formed construction joints shall be roughened to produce a surface with peaks and valleys approximately 3 mm above and below the average level.

7. PRECAST CONCRETE

7.1 Scope

This section covers all precast concrete work (other than proprietary precast floor units) and shall be read in conjunction with the remainder of this Specification as applicable.

The precast concrete units shall be manufactured and installed in accordance with the drawings and to the standards set down in this ection of the specification.

7.2 Approved Sub-Contractor

The precast work shall be done by a specialist sub-contractor approved by the Engineer whose plant, materials and completed units are to be available for inspection by the Engineer at any reasonable time.

7.3 Shop Drawings

Submit to the Engineer for inspection three copies of the shop drawings of all precast concrete units indicating the location of each unit and its relationship to the adjacent building work. Indicate dimensions and profiles of each unit, reinforcement, location of lifting points and all fixing provisions and associated components. Two weeks is to be allowed for the processing of these drawings by the Engineer and no production may be commenced until the final drawings have been returned to the Contractor.

7.3 Responsibility

Inspection of shop drawings by the Engineer and permission to proceed shall in no way relieve the Contractor of his responsibility for the accuracy of these drawings and for the correctness of the fabrication, setting out and castings of the precast work. The cost of rectifying any errors shall be at the Contractor's sole expense.

7.4 Workmanship

Manufacture and handle precast concrete units in accordance with the requirements of the current CP 116 as published by the British Standards Institution.

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7.5 Rejection

The Engineer may reject any concrete because of failure to conform to the requirements of this specification.

7.6 Precast Spandrel

Where precast spandrels are specified, and prior to full production of precast spandrel units is commenced, provide for inspection and approval by the Engineer a prototype of a full assembly, comprising typical components and their fixings and sealing.

The prototype assemblies may be included in the building if approved by the Engineer.

7.7 Supervision

Carry out precast concrete work to all stages under the supervision of engineers and/or foremen experienced in the production and application of structural precast concrete.

The work is also subject to inspection by the Engineer at any stag.e Give the Engineer written notice of not less than one working week of the commencement of production casting.

7.8 Identification

All units shall show a suitable identification mark indicating its position in the job, the concrete from which it was cast and the date on which it was cast.

7.9 Concrete Strength and Tests

The concrete used in precast work shall comply in all respects with the other clauses of this specification, unless specifically noted to the contrary on the drawings or elsewhere in this specification.

Concrete grades and strengths for the various units shall be as noted on the drawings.

7.10 Surface Finishes

Finish to all precast concrete units shall be as specified on the drawings.

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7.11 Joints

Refer to drawings for joint locations.

Unless detailed otherwise provide joints of 12 mm minimum width between precast panels and between precast panels and cast in-situ elements.

The tolerance for joint widths shall be + 3mm.

Before sealing the joints provide concrete surfaces that are sound, smooth, clean and free of all mortar dust or other contaminants that may affect adhesion.

The whole of the joint preparation, cleaning, priming, sealing and finishing off shall be carried out strictly in accordance with the sealant manufacturer's written instructions and to the Engineer's approval.

7.12 Moulds

Provide accurate and rigid moulds conforming to the shape, lines and dimensions of the precast units to be produced and ensure the specified dimensional accuracy. All moulds shall be kept clean.

7.13 Reinforcement

Reinforcement shall comply in all respects with this specification.

On exposed faces the bar supports used to maintain the required cover and/or bar spacings shall be such as to present no visible evidence of their use after completion of the units.

7.14 Inserts

Cast in to the units all required inserts, including ferrules and fixings and mechanically bond them into the precast units by welding to the reinforcement. Ensure any surface plates and ferrules finish flush with the concrete surface.

Maintain all cast-in items securely in position during the placement of concrete.

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All precast panel connection brackets and all other cast-in components shall be galvanised in accordance with the requirements of the structural steelwork trade section and the weight of coating shall be not less than 380 gm/m^2.

7.15 Compaction

All concrete shall be vibrated in accordance with the requirements of Clauses 3.6 and 3.7 or by alternative approved methods.

7.16 Curing

The minimum amount of curing of precast concrete sections shall consist of keeping the concrete moist for a period of at least 7 days if made with normal Portland cement, and for at least four days if made with high early strength cement.

Curing shall be carried out in accordance with the requirements of Clause 3.8 as applicable.

Steam curing methods may be employed. A minimum pre-setting period of two hours shall be allowed before the application of steam and this shall be followed by a minimum 8 hour period of steam curing. The temperature rise shall not exceed 2^0C per minute. The minimum temperature shall be 54^0C and the maximum 77^0C.

During the curing period the temperature shall be maintained within $\pm 2^0C$ of the selected value. After cessation of steaming the product shall be allowed to cool gradually to air temperature.

Test cylinders representing the units poured shall be steam cured under identical conditions to ensure that they are truly representative.

If high early strength cement is used, adequate precautions shall be taken to avoid damage to the units by the inherently high heat of hydration.

Time for removal from moulds shall be related to the method of handling and the strength attained at such time and shall be subject to the Engineer's approval.

Units must have a minimum age of 21 days before they are delivered to the site or, alternatively, field control blocks may be used to establish a strength of at least 85% of the 28 day strength called for.

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7.17 Deliveries

The Contractor shall arrange deliveries to suit the general programme of the work. No extra cost will be allowed due to deliveries being either too early or too late for the programme.

7.18 Handling and Transportation

After curing, sections shall be stored, loaded and transported, unloaded and placed such that no longitudinal or transverse cracks develop. Adequate instructions are to be given to handlers and as far as possible only experienced men should be put in charge of this phase of work.

Units are to be stored in such a fashion that permanent sets do not occur due to solar effects.

To ensure the eventual placement of the sections in the structure without cracks, the handling whether manually or in slings or cradles, shall be done in such a manner that bending about either the vertical or the horizontal axis of the cross section will be reduced to a minimum. The final proposed method of handling the sections during erection is to be approved by the Engineer before work proceeds.

Provide lifting hooks adequate to handle all the loads involved and securely anchored to reinforcement. After erection, hooks shall be burnt off flush with the surface and given two coats of an approved zinc-rich primer.

7.19 Temporary Protection

Protect precast units adequately at all stages against damage and staining. Sub-standard or damaged units may be rejected at any stage and shall be replaced without additional cost to the Principal.

7.20 Patching

Make no repairs to precast units unless permitted by the Engineer, and then in strict accordance with this specification. Use only personnel experienced and skilled in precast concrete repair work.

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7.21 Tolerances

Permitted tolerances for finished concrete members shall be:

Transverse breadth and depth:	± 3mm
Overall length:	± 3mm
Deviation from straight	$\frac{L}{500}$

7.22 Precast Concrete Beams and Frames

Precast concrete beams shall be manufactured by a specialist sub-contractor approved by the Engineer. Shop drawings of all beams shall be submitted to the Engineer for inspection indicating the location of each unit and its relationship to the adjacent building work. Seven days is to be allowed for the processing of these drawings by the Engineer.

Inspection of shop drawings by the Engineer and permission to proceed shall in no way relieve the Contractor of his responsibility for the accuracy of these drawings and for the correctness of the fabrication, setting out and castings of the precast work. The cost of rectifying any errors shall be at the Contractor's sole expense.

All construction joints shall be roughed to produce a surface with peaks and valleys approximately 3 mm above and below the average level.

7.23 Precast Prefinished Floor Units

The precast floor units have been designed as prefinished and must therefore be cast and placed in position with sufficient accuracy to produce a level and uniform surface without humps, hollows or other discontinuities. The Contractor shall repair unsatisfactory areas of the floor at his own expense.

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8. PROPRIETARY PRECAST FLOORING

8.1 Alternative

The following specification is written to cover DY-CORE flooring, without in any way whatsoever wishing to limit competition by any other suitable equivalent alternative. Should a Tenderer wish to do so, he may submit an alternative Tender based on an equivalent suspended floor system. In that case, he shall advise the Engineer of all details of his proposed alternative with the Tender. The Engineer reserves the right at his absolute discretion, to reject any alternative he considers will not meet his requirements. Where an alternative system is used, the proprietor's instructions shall be exactly followed, should they be at variance with the following subclauses and no extra cost shall rise therefrom. The Tenderer will be required to demonstrate that such alternatives meet the requirements of the specification together with the maximum self weight, superimposed loading and fire rating criteria shown on the drawings.

8.2 General

Where shown on the Drawings, the suspended floor slabs shall be DY-CORE as manufactured by Stresscrete Limited under licence, and who shall be responsible for:

(i) Design fully complying with NZS 4203: 1976 and NZS3101: 1982 and the preparation of the necessary suspended slab drawings and submission, in duplicate, of all calculations and drawings for review by the Engineer. Such review shall be to check the drawings generally and to verify that the seismic provisions of the overall building design (as shown on the drawings) are effectively incorporated into the flooring design. Comment or lack of comment by the Engineer after such review shall not be taken to mean that the Engineer accepts responsibility for the structural sufficiency of the flooring, which responsibility shall remain with the supplier at all times.

The live load and fire resistant rating for which the floor shall be designed is as shown on the drawings.

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(ii) Provision of a written Design Certificate by a Registered Engineer of structural performance and sufficiency of the floor slab by the manufacturer, (which certificate may be tagged to the effect "providing that the construction, workmanship and materials are as specified"). Any deviations from this Specification required by the manufacturer must be brought to the notice of the Engineer by the Contractor before Tenders close, and written consent for such changes obtained from the Engineer.

(iii) Direction and supervision during the unloading and placement of the prestressed slabs and during the pouring of the concrete topping.

8.3 Handling, Support and Placing of Members

This shall all be strictly in accordance with the manufacturer's written instruction. If temporary propping of the units is required until the floor reaches its design strength then an allowance to cover the cost of such propping shall be included in the rates.

8.4 Services

No holes may be made in the floor and no services may be accommodated within the structural topping concrete unless shown on the drawings or agreed in advance by the manufacturer and the Engineer.

8.5 Reinforcement

Refer also Section 2.4 of the specification.

Continuity reinforcing (for live load only) over the beams and topping reinforcing has been detailed on the drawings and the Contractor shall ensure that this reinforcing is satisfactory for the floor system being used. If this reinforcing is not satisfactory the Contractor shall allow in his Tender for the supply and placing of any additional reinforcing considered necessary.

Supply and fix mesh and other reinforcement as shown in the drawings, the cover to which shall be 20 mm. Diaphragm reinforcement from slab to beam or wall shall be as per detailed on the drawings, but in any case not less than D10 at 300 mm, and it shall be fully anchored.

8.6 Formwork and Screeds

Provide and fix formwork as required at slab perimeters, cutouts etc. The ends of all precast units are to be blanked off before pouring the structural screed.

Set screeds for the topping concrete to the required levels. The average thickness of topping concrete shall be 65 mm; however, the topping thickness at any point over the floor shall not be less than 50 mm.

Adequate shear connection shall be provided between the precast units and the screed.

8.7 Construction Joints

The location of all construction joints are to be agreed with Stresscrete and the Engineer before this work starts. Construction joints at right angles to units are not permitted without express approval from Stresscrete and the Engineer.

8.8 Concreting

Concrete in the suspended floor slabs and beams supporting the slabs shall be in accordance with this specification except it shall have:

Maximum aggregate size	-	12 mm
Maximum slump	-	115 mm
Compressive strength at 28 days	-	25 MPa

Thoroughly hose down the units prior to pouring the topping, making sure that the upper surface of the units is washed clean of all dirt. Place the topping concrete to the thickness specified in clause 8.6 above, ensuring that it is well vibrated around the reinforcement.

8.9 Timber Infills

These may be used with the Engineer's approval under certain circumstances. Timber shall comply with T.P.A. Specification C7.

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8.10 Removal of Props

Temporary supports may be removed after ten days or when the concrete has developed a proven compressive strength of 17.5 MPa. For construction purposes, the floor may be loaded before prop removal (but not sooner than 48 hours after pouring of topping) in a manner approved by Stresscrete.

8.11 Fixings

The size and location of fixings which may be drilled into the DY-CORE units has been determined and these are shown on Sketch SK1, a copy of which is bound into this Specificaiton at the end of this Section. Under no circumstances will drilling into units at other locations or any other alteration to the Units be permitted except with the express authority of the Engineer.

8.12 Surface Finish

U3X - as for U3 except for abrupt changes.

Consult with the Floor Coverings Subcontractor to ensure that the surface will enable him to achieve a perfect end result without any further preparatory work being required.

8.13 Concrete Floor Units

8.13.1 Strength and Quality Control

The nominal strength at 28 days shall be a minimum of 40 MPa.

8.13.2 Workability and Compaction

The concrete for the precast units shall always be of such workability as to satisfy all requirements for the surface finish and to produce a homogeneous mass which completely fills all the space, including all corners, and perfectly surrounds all reinforcement. The slump shall not exceed 50 mm.

Concrete shall be properly vibrated by internal or external vibrators. The use of vibrators shall not at any stage cause displacement of reinforcement, embedded fixtures, or disturb the formwork.

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8.13.3 Concreting and Curing

Units shall be cured either by being kept continuously moist until the required release strength is achieved, or by low pressure steam curing.

All concrete shall be protected from the effects of frost, drying winds or other harmful conditions for 14 days after casting.

8.13.4 Floor units shall be supplied free from cracking, broken edges, hogging or sag and twisting and any units considered unsatisfactory by the Engineer shall be removed from site.

8.14 Finishes to Concrete Floor Units

Finishes to the concrete floor units shall meet the following requirements:

(i) The finish to the underside of precast concrete floor units shall be general commercial fair face finish. However, panels which have honey-combing, are broken or which have defects which will in any way impair their strength will not be accepted.

(ii) The upper surface of all concrete units shall be sufficiently rough in order to provide satisfactory bond with the in-situ concrete to the requirements of N.Z.S.R.32.

8.15 Openings

Where any flooring units are terminated by an opening and cannot be carried through to the main supporting structural member, then the supplier shall be responsible for the design and detailing of the trimming required to accommodate such openings.

D. CONCRETE MASONRY

1. SCOPE

The work specified in this section includes the supply and construction of the concrete masonry.

2. STANDARD SPECIFICATIONS

Masonry shall comply with the appropriate clauses in NZS 4210P: 1981 and current amendments.

3. TESTS

At the beginning of all masonry work at least one test sample of the mortar and grout shall be taken on each of three successive working days and continuously stored in moist air until tested, for each test given in the table below, and these shall meet the minimum strength given therein.

Additional samples shall be taken whenever any change in materials or job conditions occur or whenever in the opinion of the Engineer such tests are necessary.

In making the mortar test specimens, the mortar shall be taken from the unit soon after spreading. After moulding, the mould shall be carefully protected by a covering which shall be kept damp for at least 24 hours after which specimens shall be stored and treated as required for concrete cylinders.

Grout prisms may be made by filling the cell of a block similar to that proposed for the construction. The shell of the unit shall be removed prior to the compression test.

4. MORTAR AND GROUT STRENGTHS

Minimum mortar and grout strengths shall be as follows:

	7 days	28 days
Mortar	6.20	12.4
Grout	8.20	17.3

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If compression tests fail to develop a minimum compression strength at 28 days, the work may be deemed to be defective and shall be replaced without cost to the Employer.

5. CONCRETE BLOCKS

Concrete blocks shall be modular concrete masonry units nominally 390mm long, 190 mm high and either 140 mm or 190 mm wide as indicated on the drawings. Use correspondingly fractional blocks for bond and closures.

Blocks shall be machine made, of uniform shape, obtained from an approved source and constructed with a well compacted concrete having a low water cement ratio and shall be manufactured in accordance with NZS 3102 and shall be "Vibrapac" or similar approved by the Engineer.

Use open end blocks, lintel blocks, etc for building around reinforcing.

"Knock in" bond beams shall not be used unless approved by the Engineer.

Concrete blocks shall be carefully handled and stacked to preserve clean, sharp arrises. Blocks shall be covered with tarpaulins if stacked without weather protection.

Where any form of masonry anchor or bolting is required for securing plates or fittings to the walls, place expanded metal in the cavities affected and fill solid with mortar.

Bond beams and lintel blocks, where required to reinforce heads of walls and to trim door openings, shall be of similar thickness to wall blocks and of same manufacture and to same standard.

Blocks with chipped or broken arrises or corners will be rejected. Where cut blocks are required, blocks shall be machine cut.

6. MORTAR

Cement, sand, water and waterproofing compounds shall conform to Section 2. of the "Concrete and Reinforcing Steel" Section of the specification. All mortar shall be machine mixed and shall be in accordance with NZS 1900, Chapter 9.2, which requires a minimum crushing strength of 12.4 MPa at 28 days. Proportion of cement to sand shall be 1.4 by weight. An approved plasticising agent may be added to the gauging water in strict accordance with the manufacturer's instructions, and with the Engineer's approval.

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7. TIES AND REINFORCEMENT

Starter rods for securing brick walls to concrete work and existing work are shown on the drawings.

Reinforce all cavity brick walls as shown on the structural drawings.

Reinforcement shall be as specified in the "Concrete and Reinforcing Steel" section of the specification.

8. GROUT FOR FILLING BRICKWORK CAVITIES

The whole of the work to be in accordance with NZS 4210P, 1981. All cavities shall be filled solid.

The nominal mix proportions for cement for filling the cells shall be composed of one part Portland cement, two parts sand, two parts 12.5 mm aggregate. The water cement ratio shall not exceed 0.7.

When the cells of the hollow masonry exceed 100 mm in least dimensions, concrete of maximum size aggregate of 20 mm may be used. The mix shall have a minimum compressive strength of 17.5 MPa at 28 days.

9. WORKMANSHIP STANDARDS

All masonry work shall be laid in accordance with NZS 1900 Chapter 9.2 by experienced brick or block layers under the direct supervision of a registered brick or block layer.

10. RETEMPERING MORTAR

Any mortar which has stiffened within one hour of mixing may be retempered with sufficient water to regain the slump specified above. Retempering water shall be added into a basin formed in the mortar and carefully and completely worked in. Retempering by splashing water over mortar without full mixing will not be permitted.

11. LAYING

All concrete blocks shall be laid dry. Lay blocks generally in stretcher bond. No portion of the work shall be carried up more than 1.2 metres above any adjoining part. All blockwork shall be fairface finished. The joints

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shall be neatly and uniformly finished with joints formed to slightly concave profile flush at the edges with the surface of the blocks, and the blocks set perfectly flush in position. All other work shall have mortar struck off the joints as the work arises.

All reinforced masonry shall be built to preserve vertical continuity of the cells to be filled so that a minimum continuous clear flue is not less than 75 mm x 50 mm and the cross webs of these cells shall be fully bedded in mortar.

Mortar overhangs and droppings not otherwise accessible shall be removed by hosing with a jet stream at least twice per day and no excess mortar shall be allowed to harden before removal.

Where cut blocks are required at either horizontal or vertical joints, they shall be machine cut. Leave block openings at bottom of walls to facilitate cleaning out and block up on completion.

12. GROUTING

Grouting of the wall may be carried out using either the low lift grouting method or the high lift grouting method as specified in NZS4210P: 1981.

Where cut blocks are required at either horizontal or vertical joints, they shall be machine cut. Leave block openings at bottom of walls to facilitate cleaning out and block up on completion.

12.1 Low Lift Grouting Method

The maximum height of pour shall generally be 1200 mm except that this height shall be restricted to 400 mm when using 100 mm blocks. All grout must be fully compacted by vibrating.

12.2 High Lift Grouting Method

The maximum height of pour shall be 3.6 m as a semi-continuous operation with each separate lift not exceeding 1200 mm in height. After each separate lift the grout shall be fully compacted by vibrating and then left for a period of time for the grout to settle. This period of time shall be sufficient for the grout to become plastic but not so that it takes on any permanent set, and in any case, shall be not less than 15 mins. nor more than 60 mins. After the settling period, the next lift may be grouted and the complete sequence repeated for each lift.

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13. BUILDING IN

Build in all necessary plugs, bolts, ties, metal clamps, metal flashings, dowels, fastenings, and fixings required by this and other trades, and allow to fully co-operate with other trades in order for this to be carried out.

14. GAUGE

The gauge rod for concrete blockwork shall be 800 mm to four courses for full height blocks.

15. CHASES AND RECESSES

Chases and recesses shall be formed only where shown on the drawings.

16. CUTTING OUT

Cutting out of concrete blockwork by other trades will not be permitted. The Blocklayer is to leave the necessary holes in the structure for pipes and other works required by any subcontractor. He shall do whatever cutting is necessary and all patching and making good required after all trades have completed their work. Cut all chases necessary for metal flashings.

17. BLOCKWORK PERIMETER PANELS

All blockwork panels adjoining existing and new concrete work shall have the external joints around the entire panel (i.e. on all abutting concrete surfaces), raked out for approximately 9 mm cleaned completely and fitted with an approved joint sealer (Formrok 28T or similar), or shall be fitted with an approved mineral fibre fireproof rope where specifically indicated on the drawings.

18. CLEANING

On completion wash and clean down masonry as necessary before scaffolding is removed, removing all efflorescence and excess mortar from exposed masonry faces and adjoining surfaces and floors, leaving the work perfectly clean.

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19. CO-OPERATION

The work in this section of the specification shall be carried out in full co-operation with all other trades to ensure that all work is fully co-ordinated and in particular with the Concretor to ensure the correct placing and spacing of reinforcement starters.

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E. STRUCTURAL STEEL

1. SCOPE

The work covered by this section includes all structural steel as called up on the drawings.

2. STANDARDS

The whole of the structural steel shall be of a standard required by the relevant standard specification. Copies of all relevant standard specifications shall be available at all times.

NZS 3404: 1977	Code for design of steel structures and related documents
NZS 4711: 1973	Qualification tests for Manual Metal-Arc Welders
BS 5135: 1984	Specification for the process of arc-welding of Carbon and Carbon Manganese steels

3. DRAWINGS

All work and materials shall be in accordance with the specification and the drawings. If any discrepancies are found within those documents refer to the Engineer for instructions before proceeding.

The structural steel drawings are intended to be complementary to the rest of the contract drawings and are to be read in conjunction with them. The Contractor is to consult all of the drawings for materials and details not shown on the structural steel drawings and is to take into consideration the work of other trades as they may affect the structural steelwork.

The Contractor shall provide all necessary holes for all other trades, as advised prior to proceeding through the shop.

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4. SUBSTITUTION

Where any sections shown on the drawings are not available, allowance must be made for the substitution of equivalent plain or built up sections which are available. The prior approval of the Engineer to such substitutions is to be obtained before the work is proceeded with and such substitution shall not delay the normal progress of the work.

5. ACCESS TO WORKS

The Engineer shall have access to the fabrication shop at all reasonable times during fabrication and shall be provided with all facilities as will allow the works of this contract to be inspected.

6. INSPECTION

All materials and procedures shall be subject to inspection by the Engineer or his representative during any stage of fabrication and erection.

7. REJECTIONS

Defective material or workmanship found at any time prior to the final acceptance of the work will be rejected. Defective materials shall be removed and replaced by the Contractor at his own expense and he shall be responsible for all delays caused by rejection. Repair or replace any rejected work or materials without delay.

8. WORKMANSHIP

Workmanship shall comply with the requirements of NZS 3404 and related documents.

Grind smooth all welds, sharp corners and marred or roughened edges on steelwork exposed to view.

8.1 Splices

All members indicated on the drawings shall be in one length without splicing other than at positions shown on the drawings. If additional splicing is found to be necessary or should the Contractor desire to position splices elsewhere submit details of the design and position of the proposed splices to the Engineer for approval. Do not proceed with fabrication until this approval has been obtained.

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8.2 Connections

Connections and joints shall be as detailed, or in the absence of any specific detail, in accordance with relevant codes. Submit any suggested variations from drawings for approval, prior to fabrication. No extra will be allowed for variation to drawings unless approved in writing by the Engineer.

All connections except where specifically detailed may be regarded as typical standard connections developing full strength of members.

9. APPROVED SUBCONTRACTORS

The Contractor shall not sublet the work of this trade or any section of this trade without the approval of the Engineer.

10. RESPONSIBILITY

Inspection of shop drawings by the Engineer and permission to proceed shall in no way relieve the Contractor of his responsibility for the accuracy of these drawings and for the correctness of the fabrication, setting out and erection of the steelwork. The cost of rectifying any errors shall be at the Contractor's sole expense.

11. WELDING SUPERVISION

Welding shall be carried out only under the constant supervision of a skilled welder who can satisfy the Engineer of his responsibility, training, experience and competence in the type of welding to be used.

12. WELDING INSPECTION

The Engineer shall be given reasonable notice when each section of the work is prepared and ready for welding, and shall be given every opportunity to arrange for inspection and to satisfy himself as to the competence of the operators and as to the quality of the work. Welding inspection will be arranged by the Engineer and may include radiographic testing. The Contractor shall provide all necessary facilities, ladders and light scaffolding required for adequate inspection and radiography.

The Contractor shall arrange the sequence of work where required to facilitate random radiographic testing. The Contractor shall meet all costs for welding inspections arranged by the Engineer.

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13. STEEL

Steel shall be 250 Grade steel to AS 1204 or Grade 43A to BS 4360, see NZS 3404, unless noted otherwise.

14. FASTENERS

All mild steel bolts and nuts shall be Grade 4.6, to the requirements of AS 1111 and AS 1112. See NZS 3404.

High Strength steel bolts and nuts shall comply with the requirements of AS 1252.

15. WELDING ELECTRODES

Mild steel electrodes shall comply with the requirements of BS 5135: 1984.

16. STRUCTURAL STEEL SECTIONS

Structural steel sections shall comply with the appropriate Australian or British Standard as specified in NZS 3404 2.1.1 Specification.

17. CERTIFICATION

If requested the Contractor shall supply the Engineer with copies of certificates from the supplier of the steel.

18. HANDLING AND STORAGE

All steelwork shall be placed upon substantial shores or blocking, of sufficient size and strength to prevent any steelwork touching the ground. Each piece shall be placed so that water cannot stand thereon and in such a manner that bending under its own weight or superimposed weights or any other cause will not injure the piece.

The Contractor shall use care in storing, handling and erecting all material and shall support it carefully at all times to ensure that no piece will be bent, twisted or otherwise injured. The Contractor shall notify the Engineer in writing of any defects or damage in material before it is erected. If such defects or damage cannot be corrected in the field, the material shall be returned to the shop for new parts, furnished as the Engineer directs, and the Contractor shall pay all expenses therefore if such defects or damages are due to his negligence.

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The acceptance of damaged material which has been improperly piled, stacked or stored will be entirely at the discretion of the Engineer.

Store fasteners in water-tight premises.

Handle and store electrodes, and electrode wire and flux in accordance with the following requirements:

(a) Electrodes which have been wet shall not be used, whether dried out or not.

(b) Flux which has become damp shall not be dried and reused, nor shall flux fused in the welding process be ground and reused. Flux shall be dry and free from contamination from dirt, mill scale, rust or other foreign material.

(c) Electrode wire shall be clean and free from rust, oil, grease and any other deleterious substance.

(d) Electrode wire and flux shall be stored in their original containers, in a dry and weatherproof location.

19. IMPORTED STEEL

All structural steel for this contracted shall be obtained from sources approved by the Engineer. Tenderers shall state in their tender any ways in which the work may be affected by the need to obtain import or other licences and shall set out their proposals for obtaining any materials or plant so affected.

20. FABRICATION

Fabrication of steelwork shall conform to the requirements of NZS 3404 and related documents as appropriate, including provisions as to straightening, clearances, cutting, machining, holing, assembly, rivetting, bolting, and welding.

Steelwork shall be of the sections and dimensions shown on the drawings or specified hereafter and fabricated at an approved workshop in accordance with the detail drawings or approved shop drawings.

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21. FABRICATION TOLERANCES

Steel after fabrication shall conform with the tolerances given in AS 1250 Clause 11.2 being part of NZS 3404.

21.1 Straightness

All material before and after fabrication shall be straight unless shown on the plans as required to be curved. It shall also be free from twists.

21.2 Clearances

The clearances where specified on the drawings shall be adhered to. The erection clearances for cleated ends of members (shear connections) connecting steel to steel shall not be greater than 1.5 mm at each end. The erection clearances at ends of beams without web cleats (bearing connections) shall not be more than 3.0 mm at each end.

22. CUTTING

Cutting shall be performed by either shearing, cropping, sawing or machine flame cutting. Hand flame cutting will NOT be permitted.

Shearing and cropping shall be neatly and accurately done and all portions of the work exposed to view neatly finished. In medium steel over 20 mm thick, all sheared edges shall be planed and all holes shall be drilled or reamed to a diameter 3.0 mm larger than punched holes to remove sheared surface of metal. Steel that does not satisfy the drifting test must have holes redrilled.

The several pieces forming one built up member shall be straight and fit closely together and finished members shall be free from twists, bends and open joints. Abutting joints shall be cut or dressed true and straight and fitted closely together, especially where open to view. In compression joints depending on contact bearing, the surfaces shall be truly faced so as to have even bearing after the completion of each joint.

Flame cutting may be used only where permitted by the Engineer and shall be permissible only if the metal is not carrying stress during the cutting. Stresses shall not be transmitted through a flame cut surface.

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23. WELDING

All welding shall conform to BS 5135: 1984.

All surfaces to be welded shall be cleaned of loose scale, slag, rust, grease, paint and other foreign matter by vigorous wire brushing.

All sections to be fillet welded shall be in close contact. In no case shall separation be greater than 2.0 mm. Sections to be butt-welded shall not be put out of alignment by more than 3.0 mm. Work is to be positioned for flat wleding whenever possible.

Preparatory work procedure and sequence of welding shall be such as to obviate distortion and minimise shrinkage stresses. Where necessary to ensure satisfactory welds preheating of the steel sections shall be carried out.

The Contractor shall arrange for the testing of all welders employed on the work. Testing is to be carried out by welding inspectors nominated by the Engineer. The welders shall only be employed on the types of weld for which tests have been satisfactorily completed. The Contractor shall be responsible for payment of all costs in respect of testing of welders. All testing of welders shall be in accordance with NZS 4711. The whole of the welding shall be subject to welding inspection by inspectors nominated by the Engineer.

Testing of welds will be carried out as follows:

The Engineer will direct tests to be made in a selected laboratory. Such test may include radiographic testing of welds and other methods of testing as may be considered necessary by the inspector. The Contractor shall comply with all reasonable demands and shall supply the plant necessary for the purpose. "Reasonable" shall mean the cutting out of not more than 25 mm per 2500 mm of the total welding; except that where a particular weld is under suspicion or after discovery of a defect, the Contractor shall cut out such additional amounts as the inspector may require.

23.1 Unacceptable Defects

The following defects discovered by visual, radiographic or other means shall not be acceptable.

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(a) Any crack, suspected crack, lack of fusion, incomplete root penetration, overlap, incompletely filled grove, or excessive undercut.

(b) Porosity shall be unacceptable where the total area of gas pores shown on any 625 mm^2 of radiograph is greater than either 2% of the radiograph of plate up to 12 mm thickness or 3% of the radiograph of plate 12 mm and over in thickness, except that, where any defect acceptable under the provisions of this specification occurs with porosity, the allowance limit for porosity shall be reduced by 1%.

(c) Inclusion of blow holes shall be unacceptable if it can be shown by radiograph or other means that:

(i) the length of any such defect along the weld is greater than T/3 where T is the thickness of the thinner plate welded, except that any such defect shorter than 6 mm shall be acceptable for all plate thicknesses and that the maximum length of any such defect shall be 19 mm for all plate thicknesses; or

(ii) the ratio of the depth of any such defect to the depth of the weld is greater than T/12; or

(iii) there are two such defects along the weld within the above limits separated by less than 6L of acceptable weld metal where L, the length of the larger defect exceeds T/12; or

(iv) there are several such defects within the above limits the sum of the largest dimensions of all defects exceeding T in the weld length of 12T, or where length of weld is less than 12T, the sum of the largest dimensions exceeding 1/12 the length of the weld; or

(v) the total width of defects across the width of a weld at any section exceeds T/4.

Notwithstanding the above, any defects shall be considered acceptable if the thickness in the depth of the weld is less than 2% of T.

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23.2 Repair of Defects

(a) If in the opinion of the inspector, the total amount of repair in any one welded seam is excessive, the whole of the seam shall be cut out and rewelded.

(b) In the case of a crack at least 50 mm of welded seam beyond each end of the crack shall be cut out for other defects the cutting out shall be to sound metal and shall be sufficient to allow the repair to be effected.

Defects shall be cut out by flame gouging. The gouging head shall be the smallest necessary to satisfactorily cut out the defect.

The inspector shall examine all seams from which defects have been cut out and his approval obtained before rewelding is commenced. Rewelding shall be executed in a manner and by practices acceptable under this specification. Where practicable, the rewelding shall be by the same process as used in the original welding.

Preheating shall be used for all weld repairs.

The cost of repairs to all defects shall be borne by the Contractor.

All butt welds except those produced with the aid of backing material shall have the root or initial layer gouged or clipped out from the back side before welding is started from the side. Ends of butt welds shall have the start and stop zones removed by the use of run-on run-off places. Remove such plates after use.

24. HOLING

Form holes for bolts as specified in AS 1250 being part of NZS 3404.

Where holes are drilled in one operation through two or more separate parts, these parts shall be separated after drilling and the burrs removed.

25. ASSEMBLY

Accurately assemble the parts as shown on the drawings and follow match marks.

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The component parts shall be assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified cambers are obtained if required. All tubular members shall be sealed so as to prevent the ingress of moisture to the inside of the members.

Mild steel flat and angle section braces shall be erected true to line and shall be drifted or preheated before welding in position to achieve drum tightness.

All steel members including girts which may be capable of holding water such as upturned channels, horizontally placed beams, composite members etc. shall be punched with weep holes to prevent accumulation of water during construction or of condensation afterwards. These weep holes shall be clearly shown on the shop drawings.

25.1 Bolted Construction

(a) All parts of bolted members shall be well pinned or bolted and rigidly held together. Drifting done during assembly shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the bolts shall be reamed. Poor matching holes shall be cause for rejection.

(b) Bolts

Washers shall be provided tapered or otherwise suitably shaped to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least one thread. In no case shall the threaded portion of the bolts come within the thickness of the parts bolted together.

After the nuts of the bolts have been drawn up the threads of the bolts shall be either mutilated with an old chisel or tack welded to maintain a tight connection.

(c) Drilled in Bolts

All drilled in Chemset Anchorage Bolts, Rawl Bolts and Ramset Masonry Anchors shall be fixed according to the manufacturer's specifications.

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Notwithstanding this all drilled in anchorages shall be tightened to the torque levels set out in the following:

Bolt Designation	Torque
M12	55 Nm
M16	100 Nm
M20	160 Nm
M24	230 Nm

26. MARKING

Before leaving the shop, every member shall be clearly marked in accordance with the general arrangement drawings and shall bear all marks required to facilitate site erection. Markings must be adequate but shall be such that finish painting will completely obliterate them.

27. ENCASED STEELWORK

Steelwork which is to be encased in concrete shall not be painted. All such surfaces shall be left in a perfectly clean condition free from all dirt, dust, grease or paint spots immediately prior to the placing of the encasement.

28. SHOP PAINTING

All structural steel, including bolts, nuts, washers, fittings, etc which is not to be encased in concrete or similarly treated is to be painted with two coats of an approved primer before delivery to the site.

Before painting, steelwork shall be thoroughly cleaned of all loose scale, rust, oil, paint, etc to Swedish Standard ST2 and left dry. Use metal brushes, scrapers, chisels, hammers, sandpaper, etc for such cleaning and bristle brushes for removing dirt.

Apply paint by brush only to dry dust free surfaces in accordance with the manufacturer's instructions, each paint coat to be thoroughly dry before the next is applied. Lack of complete coverage and/or of uniform texture will be cause for rejection. Surfaces not accessible for painting after shop assembly shall be painted before assembly.

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To ensure complete coverage of the steelwork the second primer coat shall be colour tinted.

All painting damaged during erection shall be made good.

29. DELIVERY

Deliver steelwork to the site at the times and sequences as set out in the works schedule. Transport and handle structural steel carefully and protect from damage at all times.

The Contractor shall deliver steelwork to the site, unload and site assemble subsections where necessary, touch up priming paint as necessary and stack and protect. All damage to the steelwork shall be made good by the Contractor.

The Contractor shall arrange for a delivery of all long lengths of steelwork at times to avoid peak traffic periods and shall make arrangements with the Traffic Authorities regarding transport of sample.

30. ERECTION

The Contractor shall give at least 48 hours notice of the time when he proposes to start erection in order that the proper inspection can be provided. The Contractor shall be responsible for the accurate bearing of the steel on the foundation and for the correct location and verticality of columns. Bases and bearing plates which require to be grouted shall be supported exactly to the established lines and levels.

Detailed proposals setting out the method of erection and erection equipment to be used are to be submitted in advance for approval in principle by the Engineer.

31. CO-OPERATION WITH OTHER TRADES

Co-operate with all other trades as necessary to ensure an orderly progress of the work, and in particular with those responsible for concrete and carpentry as they affect this section of the specification.

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32. PLANT AND EQUIPMENT

Provide falsework and all the tools, machines and appliances including pilot and driving nuts, drift pins and fitting up bolts necessary for the expeditious handling of the work. Remove from the site after completion

33. TEMPORARY BRACING

Provide and install and afterwards remove if necessary, sufficient temporary bracing to keep the structure plumb and in true alignment until other structural units provide the necessary permanent bracing. The steelwork shown on the drawings is that required in design for the finished structure only and is not necessarily adequate for construction pruposes. Any failure to make proper and adequate provision against damage during erection shall be entirely the responsibility of the Contractor. The temporary guying and bracing should be adequate to resist all wind and earthquake forces on the structure during the erection period.

Do not use bracing to force the structural frame into its correct plumbed position. Tighten bracing only after the frame has been squared and plumbed or if inserted at an earlier time, loosen to permit plumbing.

34. ERECTION TOLERANCES

Erect steel to conform to the tolerances given in AS 1250 being part of NZS 3404, Clause 11.4.2.

35. GROUTING

Bedding of stanchion bases and tie rods etc shall be carried out with Portland cement mortar mixed as dry as possible and having a thickness as required by the drawings. The mortar shall be not leaner than 1:2 cement to fine aggregate and shall contain "Febgrout" or similar approved grout - expanding additive mixed according to the manufacturer's instructions. Consolidate grout in position by thoroughly ramming with a suitable blunt rammer against properly fixed supports until the space has been completely filled.

Keep grout damp for seven days by wrapping in hessian continuously kept moist or by other approved means. Remove any adjusting wedges after grout has set, fill wedge holes and point up around steel.

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36. FIELD WELDING

Field welding shall comply with the provisions of Clause E3.4.

Except where shown on the structural drawings, field welding will NOT be permitted.

37. PURLINS

All purlins shall be delivered to site pre-primed.

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1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Materials: Cement and water shall be as specified under 'Concretor'. Sand shall be clean and graded in accordance with N.Z.S. 2129, Class A, for all work except fine smooth steel trowelled surfaces which shall be Class B graded.

All plaster mixes shall be appropriately tempered with either hydrated Lime or J.H.M. Carpenter's 'Mortarlox' or similar approved, in accordance with the Plasterer's preference. Proprietary agents shall be used in strict accordance with the manufacturer's instructions.

It is the responsibility of the Plasterer to produce an impervious plaster finish of adequate strength and completely bonded to the base material and to this end it is at his discretion whether or not to use proprietary bonding agents or similar to provide a key or to control suction.

3. Workmanship: All work by experienced tradesmen and in accordance with best trade practice. Cover and protect work of other trades. Inspect surfaces to be plastered and adjust or treat as necessary to obtain proper conditions for satisfactory results. Cover or protect new plaster from drying winds, rain or other damaging conditions. Properly cure all plaster. Imperfect or drummy work to be neatly cut out and made good.

4. Plaster: For sand plaster the cement (plus tempering agent) content shall be kept as low as practicable consistent with good results in order to minimise shrinkage cracking (endeavour to obtain accurately graded sand to assist in cement reduction). Hardwall plaster mixes shall be as strong as possible with just sufficient workability to achieve finely finished surfaces.

Plaster shall be used within 1 hour of first contact between cement and water and no retempering of partially set or dried material shall be permitted and all such material shall be discarded.

5. Preparatory Coats: A well bonded slurry coat shall be applied to all masonry or concrete or other hard (i.e. asbestos or similar) surfaces.

A flanking coat (properly screeded to smooth finish areas) approximately 12mm minimum thickness and lightly combed to a horizontal wavy pattern shall be applied to all mesh base and/or smooth finish areas.

6. Plastering: All work shall comply with NZS 4251:1974 (Code of practice for solid plastering). Allow to hardwall beam soffits exposed in 'operations' areas, cement plaster where existing window sills are raised and plaster elsewhere as necessary to make good.

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1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Standards: All framing and general work shall conform to N.Z.S. 3604 and the related Standard Specifications mentioned on Page 10 of that Code. Heavy timber construction shall conform to N.Z.S. 1900, Chapter 9.1, and boxing and preparation for concrete shall conform to N.Z.S. 1900, Chapter 9.3 as appropriate.

3. General: This section includes the measuring, ordering, receiving, stacking and storage of all Carpenter's materials and the fabrication, erection and fixing of all framing and finishing timbers, including work incidental to neatly finishing in other trades and all temporary work and temporary bracing. Supply, erect and afterwards strip and remove all formwork for concrete as specified under Concretor.

The Carpenter shall attend upon all trades. He shall coordinate their work and determine their timing and sequence of operations. The Carpenter shall supply and fix all obviously necessary but not specifically mentioned fixings and materials.

4. Timber: All timber shall be true to N.Z.S. 3631 (National Grading Rules) and equal or better than No. 1 Framing for all framing timbers and Dressing A for all finishing timbers. All timber which in the opinion of the Architect is sub-standard shall be removed from the site.

All timber shall be seasoned to the stable moisture content suitable for its location in the finished work (approximately 18% for framing timbers, 12% for finishing timbers) and if the use of inadequately seasoned timber results in damage or opening joints in finished work the timber shall be replaced. All kiln dried, dressed or finishing timber shall be stacked under cover on delivery to the site. All timber shall be to the nominal sizes specified or shown, subject only to normal cutting and dressing tolerances.

All non-heart timber used, including cores to doors, coreboard etc. shall be treated. Treat timber in accordance with the provisions of 'Timber Preservation in New Zealand II : Specifications', issued by the Timber Preservation Authority, 1963. All treated timber shall be suitably identified and marked as specified in the Code. Re-season to correct moisture content after treatment. All finishing timber shall have all machine marks, roughness and stains removed and shall be sanded smooth.

Ensure that the Painter fully primes all enclosed surfaces of exterior finishing timber or joinery before fixing. The Painting Subcontractor shall carry out the priming of all those surfaces on which he will be responsible for further coats.

Unless subsequently specified otherwise, timbers as follows (the use of alternate grades and varieties to those specified is subject to approval in each instance) :

B.A. Ht. Rimu or No. 1 10kg/m^3(C4) tanalised radiata	Exterior exposed sawn framing. Plates etc. in contact with concrete.
No. 1 5kg/m^3(C7) tanalised radiata	Subfloor framing.
No. 1 Equivalent Boric N.I. Douglas Fir	Interior exposed framing (usually sawn finish).
No. 1 Boric Radiata	Enclosed framing (usually gauged).

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Finishing 5kg/m^3(C7) Tanalised Radiata	Weatherboards and any exterior dressed timber specified painted.
D.B. Boric Rimu	Sawn exterior facings, barges etc.
D.A. Rimu	Finishings and facings specified clear finish.
Finishing Boric Radiata	Finishings and facings specified painted.

5. Workmanship: All work shall be carried out under the supervision of competent and experienced tradesmen in accordance with the best and latest trade practice.

Fix 3ply bituminous fabric dampcourse under or behind all timber where it abutts masonry or concrete to provide complete separation. Line behind all exterior wall coverings with saturated heavyweight building paper, fixed horizontally. Lap not less than 100mm, 150mm each way around corners, and staple at 300mm centres.

All timberwork joints shall be accurately fitted to ensure close contact over the full surface of the joint. All exposed nailing shall be carefully punched and all bruises and tool marks shall be removed. Split timber and hammer marked finishing timber shall be replaced.

Acceptable defects in timber shall be distributed so as not to impair the strength of appearance of the finished work. Checking and cutting away of timbers shall be avoided whenever possible and shall be limited to such dimensions as will not prejudice the purpose for which the timber is used. Wherever possible beams and joists shall be holed at the neutral axis and the hole size shall be limited to one-fifth of the depth of the member. Holing or checking (other than checking over plates) within 600mm of the ends of members shall be avoided. No studs shall be cut across the grain to straighten them.

Ensure that dead air spaces in timber framed walls, ceilings etc. are positively ventilated and vermin proofed. Build in as work proceeds all necessary flashings to windows, doors etc. supplied by Plumber.

6. Nailing: Substantially nail all timber contacts and intersections (all framing skew-nailed). Generally nails to penetrate the second timber 1½ times the thickness of timber fastened. Finishing brads to all finishing timbers, punched to diameter of nail below surface. Nails fixing exposed timbers, nails in Cedar, Redwood or Totara, and nails which will be covered with plaster or similar shall be galvanised. Bore slightly undersize holes for any nailing which is likely to cause splitting.

7. Screw Fixing: Unless otherwise specified screws shall be of steel and of suitable gauge and length to obtain secure fastening. Screws fastening hardware or metal work shall be of same material and finish and screws exposed to the weather shall be brass.

8. Bolts: Unless otherwise specified or shown, holding down bolts for plates on horizontal surfaces shall be 12mm ø at 1000mm maximum centres, bolts holding plates against vertical surfaces to support joists shall be 12mm ø at the same spacing as the joists and bolts holding vertical timbers against concrete or masonry shall be 12mm ø at 600mm maximum centres. In all cases there shall be a bolt within 300mm of each end of the timber.

All bolts shall have hexagonal heads and nuts and have heavy gauge washers bearing on the timber. Bolts to project through nuts at least one full thread after tightening and nuts secured by punching thread. Bolts set 150mm into concrete and where closer than 80mm to edge to be bent into the body of concrete. All bolts exposed to weather shall be galvanised. Bolts required for fixing or joining exposed timber framing shall be as separately specified.

9. Percussion Fastenings: Shall be of gauge and charge strength suitable to application involved, of recognised manufacture and carried out by experienced operators. Percussion fastenings used for shear load applications only; do not use for withdrawal load applications.

10. Framing Hardware: Trip-L-Grip, Multigrips, joist shoes, gang nail plates etc. shall be used to provide necessary joint rigidity, or with the Architect's permission to obviate traditional jointing procedures. Items shall be galvanised, free from distortion and fixed in accordance with the manufacturer's recommendations.

11. Mastics: Excepting where otherwise noted or specified, use Seelastic for back beading and general caulking which is not exposed and Thioflex 1 in all positions exposed to sunlight. Surface cleaning and priming, and use of mastic all completely in accordance with the manufacturer's instructions. All exposed fillets kept as fine as possible and finished to neat even line.

12. Adjustments: On completion and again at the end of the maintenance period ensure that all window sashes, interior and exterior doors, and fittings' doors neatly fit the openings with regular tolerances on all edges and that all drawers slide freely. Ensure that all locks, latchsets, closers, sliding door gear, stays etc. are operating correctly and are appropriately oiled or greased.

13. Joinery Fixing: Take delivery of and install in the positions shown, and accurately plumb, square and level, and securely fix in accordance with best trade practice all windows, doors and frames, fittings and sundry other items supplied by the Joiner. Window and door frames full width and exact thickness packed at each fixing position (minimum three per jamb more than 1200 length, two per window jamb less than 1200). Frames generally nail fixed to framing and Dynascrewed to masonry except where concealed fixings are detailed, and flashings (supplied by Plumber) incorporated where detailed. Finish with neat mastic fillets as detailed or directed.

Carcases accurately fitted to adjoining work and loose supplied tops generally countersunk screw fixed from underneath at approximately 400 centres. Protect all installed joinery until contract completion, and make good any damage as directed.

14. Hardware: Allow the net sum as noted on the drawings for the supply only of selected hardware to be installed, oiled and adjusted for smooth operation by the Contractor, and protected until completion. This sum shall include door latchsets, door knobs and locks, window casement or telescopic stays, window catches, coat hooks, barrel bolts, cupboard handles, curtain tracks and sundry other finishing hardware, but does not include door hinges, window hinges or Interloc stays, floor springs, sliding door gear or other hardware specified or noted elsewhere.

15. Exposed Framing: Accurately set up, temporarily brace and fix as noted or detailed all sawn timber posts, beams, braces, rafters, handrails etc. as shown on the drawings. Except where specifically noted otherwise bolts in exposed timber framing shall be 16mm diameter with hexagonal heads and nuts, heavy washers each side and when finally tightened the bolt shall project at least one full thread through the nut for securing by punching thread. Bolted connections may be temporarily nailed during erection provided nails are withdrawn after bolting and no splitting or surface bruising results. Posts shown with their bottoms flush with the floor shall be 12mm diameter by 150mm long galvanised steel dowelled unless detailed otherwise. Very slightly arris sawn edges where appropriate to avoid splintering and accurately cut rebates, flashing gooves etc. as detailed or required, before erection.

16. Enclosed Framing: All enclosed framing shall be thicknessed, true to line, plumb and square with maximum tolerance of 10mm in 2400mm without local irregularities. Plates accurately positioned, true and level, scarf joined and bolted or well nailed as appropriate. Construct wall framing where shown with full height studs at 400mm centres, skew nailed at both ends, dwangs cut in at 45° where necessary. Accurately set up enclosed floor, roof or ceiling framing and sundry other work as required and securely skew nail; cut in blockings as shown or required to suit linings, services etc. Security of framing fixings to Architect's approval, and Carpenter shall increase or adjust if directed.

17. Particle Board Work: All material shall be 19mm thick high density temporary weather proofed particle board ("Plycopyne" or "Fina-floor" only). All sheets accurately cut to size with edges shot as necessary to provide tight butt joints and nailed with 65mm galvanised finishing nails at 100mm centres around edges and at 200mm centres along every intermediate support. Commence laying at centre of each area and work to outside edges. Sand flooring areas to an even finish and hand sand as required at edges and corners, taking care to avoid damage to finished work. Punch nails immediately before sanding and stop after first polyurethane coat.

18. Gibraltar Board Work: To all exterior walls and ceilings as required shall be 9.5mm 'Gibfoil' board and to all internal walls shall be 9.5mm 'Gibraltar' board. Fix board in full length sheets, space 3mm apart to give key for stopping and nail as recommended by the manufacturer. Finish projecting corners with 32x32mm timber beads and stop and sand down ready for painter work. (Use Gibfoil to fibreglass insulated roofs to provide vapour barriers.)

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[illegible]

[illegible]

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1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Timber: All timber shall be equal to or better than N.Z.S. 3631 : Dressing A unless noted otherwise. All timber shall be properly seasoned before machining to the stable moisture content suitable for its location in the finished work (approximately 10-12% for interior work and 12-14% for exterior frames etc.) and if the use of inadequately seasoned timber results in warping, twisting, winding or shrinkage opening of joints during the maintenance period the timber shall be replaced as directed (excepting where the damage results from excessive heating, placing in direct sun, or other improper use.) All non-heart timber used shall be treated as specified under Carpenter.

Unless noted or subsequently specified otherwise, timbers as follows (the use of alternate grades and varieties to those specified is subject to approval in each instance) :

D.A. Ht. Rimu or D.A. Ht. Matai	Window frames, exterior door frames, exterior glazed doors.
1st quality Redwood	Sashes, exterior door sheathing.
D.A. Rimu	Interior door frames, interior doors (except hollow core), Cabinets and Carcases specified clear finish.
Finishing Boric Radiata	Cabinets and Carcases for paint finish.
Finishing Tanalised Radiata	Window frame facings painted.

3. Hardware: Prehang all doors and casement windows larger than $1m^2$ or higher than 1500mm on $1\frac{1}{2}$ pairs butts, and if smaller 1 pair. Use galvanised fixed brasspin butts for casements and exterior doors, b.m.a. or bronzed or brass as noted for fittings doors, sizes as appropriate, broad butt as noted or appropriate for full opening, and with all screws finished to match hinges. Interloc stays size selected assuming always exposed conditions.

4. Workmanship: All work shall be carried out by or under the direct supervision of competent joiners in accordance with recognised good trade practice and in a properly established shop complete with all mechanical equipment appropriate for the work. All work shall be in strict accordance with the drawings and must be inspected and approved prior to fixing.

Confer with the Main Contractor to check openings sizes, fittings limiting dimensions and available access sizes (and make provision for site assembly of large units if appropriate). Additional dimensions will be supplied by the Architect as requested.

All items shall be assembled by means of the appropriate joints customarily employed in good quality work. All joints shall be accurately cut, fitted and full surface glued (glue types and use as per N.Z.S. 523) and shall be tongued, mortice and tenon, dowelled or housed in preference to scarfed or mitred. Screws shall be used in preference to nails or brads, and where liable to corrosion shall be non-corrodible or galvanised. Fix glue blocks in appropriate positions. Screws etc. may only be used in visible positions in clear finished cabinets when specifically approved.

Adjacent veneers and boards shall be carefully selected to provide reasonable continuity of colour and grain pattern in the finished work; this particularly applies to clashing strips on veneered chipboard which shall be 3mm minimum thickness.

Fine machine sand all visible surfaces and handsand finish to a clean, even surface all fittings specified for clear finishing. Lightly sand arris all projecting edges and neatly punch all nails or brads.

The following are generally unacceptable defects and are thus liable to be rejected :

a. Scratches, bruises, machine or hammer marks on exposed surfaces;

b. Glue stains on clear finish specified items;

c. Iron-on veneers unless specifically approved;

d. Corrugated fasteners and machine staples unless specifically approved;

e. Chipboard showing through veneers through excessive sanding (including inside of doors).

5. Delivery: Brace and/or crate all items as required to prevent distortion or disfigurement during transit. Arrange for delivery to the site, not during inclement weather, and attend upon the Carpenter to identify units and instruct in assembly procedures as required.

6. Windows and Exterior Doors: All timber sections for window and exterior doors joinery shall be to exact sizes, and profiles rebated, throated, grooved, sunk etc. as shown on the drawings or as required to suit weather-proofing, linings, trim etc. (all sash or door frame rebates twice 6mmx6mm weathergrooved as a minimum where no specific detail). After checking rough opening sizes on job adjust actual frame sizes if necessary to suit edge conditions as detailed. Unless otherwise approved fabricate frames with housedand checked joints, exterior doors with mortice and tenon joints and sashes with tenoned and dowelled joints (all full surface waterproof glued).

All fixed glass windows beaded directly into frames (no sub-sash) and all glazed doors beaded. Beads shall project slightly from frame face and shall be square profile to heads and jambs and weathered to sills. Ensure that all rebates, beads etc. are fully primed before glazing and where appropriate full frames shall be primed by Painter before leaving workshop.

Make appropriate allowance for hardware, particularly in rebate depths where Interloc stays are fitted.

7. Interior Flush Doors: Shall be of approved manufacture, hollow core unless noted otherwise and shall be plywood surfaced. Doors specified clear finished shall have selected heart Rimu faces with colour matched clashing strips to both edges and doors specified painted shall have ordinary Rimu faces and leading edge only clashed. Doors which warp or twist during the maintenance period shall be replaced.

Frames shall be d.a. Rimu finished 25mm thickness (± 2mm to suit economical cutting from stock) by the full width of the specified framing and linings and shall have 14x45mm tightly fixed planted stops.

8. Fittings: Site check overall dimensions where appropriate and allow 10mm positioning tolerance at each end of fittings shown full length between walls. Carcases assembled true and square basically from 19mm timber although selected veneered chipboard may be used providing front rails and divisions front 60-90mm is matching solid timber members. All carcases shall have full surface backs of plain white seratone or 4.75mm Bisonboard as noted. All divisions between cupboards are full depth. Substrate for tiles where shown is 9.5mm chipboard recessed into top rails. Where appropriate supply bases forming toe recesses loose and with sufficient cross bearers to fully support carcase.

Cupboard doors clashed veneered chipboard. Drawers all 19mm and 12mm timber (no chipboard) with plain white Seratone or Bisonboard bottoms as noted and drawer sides and runners ht. Rimu or Matai, full depth of carcase irrespective of depth of drawer. Allow 2mm painting (or varnishing) tolerance all around doors and drawer fronts.

Supply all exposed shelves in kitchens etc. where specified varnished and assemble complete where finite dimensions are given.

9. Plastic Laminates: Where shown for fittings tops shall be Architect selected plain colour satin finish laminate applied to the chipboard substrate by an approved specialist firm in accordance with recognised good practice for this trade. Heat worked 'post forming grade' shall be used wherever radiused corners are required. Substrate surfaces shall be appropriately prepared to receive laminates, and use resorcinal or ureaformaldehyde glues strictly in accordance with the glue manufacturer's instructions. All exposed edges shall be laminated, all joints shall be accurately cut and tightly butted, all external corners shall be lightly arrised and sanded smooth and all internal cutouts shall be small radiused in corners to prevent stress cracking.

Any chipped, scratched or bubbled laminates shall be replaced.

ROOFER

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Guarantees: The whole of the roof covering work shall be complete in all respects and absolutely watertight. The commencement of roofing by any Subcontractor indicates their agreement to and acceptance of an unwritten guarantee to maintain the whole of their work in a satisfactory and watertight condition, and to arrange and pay for any damage consequential upon the failure of their roofing, for the periods stated below, irrespective of the general maintenance 90 day period. (Refer to Preliminaries, Clause 11, Responsibility.)

a. Butylclad roofer, five years after completion.

b. Steel roofer, two years after completion.

3. Cooperation: Roofers shall cooperate fully with the Carpenter to ensure that each section is weatherproofed as soon as possible after the Carpenter work is complete, and in no instance shall finished timber work be left uncovered for more than ten days.

4. Butylclad Roofing: Ensure that the plywood substrate has been satisfactorily fixed, that all timber fillets etc. are in place and that the surface is thoroughly clean. Full surface glue down 1.5mm Butylclad roofing with laps, junctions, upstands, edges etc. all neatly formed fully in accordance with the manufacturer's recommendations, and to the Architect's reasonable satisfaction.

5. Iron Roofer: Fix heavyweight Duroid building paper and sheath with 0.55xG250xZ400 corrugated galvanised steel in full length sheets. Side laps 1½ corrugations. Fix with appropriate nails in straight rows at each point of support and at every second corrugation.

6. Flashings: All flashings required in conjunction with the roofing surface for ridges, barges, upstands, skylights, vents and other penetrations etc. are the responsibility of the Roofing Contractors. Form these flashings in 0.6mm galvanised flat steel, all machine folded and rivetted to profiles shown or required with lead edges as necessary and with stop-ends, external angles and junctions neatly soldered.

Overflashings requiring dissimilar metals and electrolitic separation shall be the responsibility of the Plumber.

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. General: All plumbing shall comply with all provisions of the Drainage and Plumbing Regulations and any amendments thereto all as currently in operation, together with the appropriate Local Bylaws and the requirements of the Health Department Regulations where appropriate. The Plumbing Subcontractor shall obtain all necessary permits and consents, serve all notices, arrange for all tests and pay all fees and customary charges in connection with his work.

The Plumber shall carry out all of the works required to leave the water, wastes and vents systems serving the sanitary fittings and plumbing hardware shown on the drawings and specified hereunder in correct working order and complete with all normal incidental works customarily performed by this trade, notwithstanding any omission herein.

Cooperate with all other trades and attend upon the Concretor, Drainlayer and Carpenter to set out the exact positions of pipe runs before adjacent work is put in hand and ensure that all pipes, sleeves, fixings, flashings etc. are correctly incorporated as work proceeds.

3. Workmanship: All plumbing work shall be carried out by, or under the direct control of, properly qualified tradesmen, and shall be to recognised high standards of performance.

The cutting away and checking of timbers shall be limited to such dimensions as will not prejudice the purpose for which the timber is used, and wherever possible beams and joists shall be holed at the neutral axis and the hole limited to one-fifth of the depth of the member. The cutting away and checking of other materials shall be always subject to the Architect's approval.

Adequately protect all surfaces. Any damage to fittings or surfaces shall be made good by the appropriate trade at the Plumber's expense.

Bending and folding of sheet metals shall be done by machine wherever possible. All joints between pipes of different materials shall be to the complete satisfaction of the plumbing inspector.

4. Pipework: All pipework in the building shall be concealed except where otherwise indicated or approved and all exposed pipework shall be accurately and neatly run with smooth bends, junctions etc. Arrange all pipes (and especially traps) in a manner which will allow the utmost future accessibility for repairs and maintenance, arrange for the Main Contractor to provide access panels to important maintenance positions and provide accessible gate valves and 'Ballofix' valves to close off the supply to each section of the system for the replacement of washers etc.

Where pipes are to be covered by nail fixed linings or other finish, special care shall be exercised to mark their locations after the linings are fixed to minimise the hazard of further nailings penetrating pipes and all such damage arising from nailings or otherwise shall be remedied without delay with all consequential work made good.

Waterpipes shall be set out in straight runs and in even gradients, with easy bends, and unless unavoidable elbow fittings shall not be used. Where rigid p.v.c. pipes are used for pressure systems, adequate precautions shall be taken to ensure that no hammer effect occurs in the completed system.

Supply all necessary fixings to adequately secure all pipes throughout their length, both vertically and horizontally, to prevent sagging or vibration. Fixings of same material as the pipe for internal work. Fittings, brackets, bolts, screws etc. for external pipework generally brass or copper.

All sleeves for exposed pipework penetrating concrete or masonry shall be heavy gauge galvanised steel, 1" greater internal diameter than the outside diameter of the pipe and of length to finish flush with the finished surfaces as appropriate. Pack with mastic or compo or flash as necessary to seal around pipe.

5. Materials: Materials not otherwise specified shall be the best of their respective kinds. All materials shall conform to the relevant N.Z. Standard and unless otherwise specified or detailed shall be of weights, gauges etc. as specified hereunder. All incidental materials (fittings, fixings, jointing compounds etc.) shall be appropriate for the application involved and shall be used in accordance with the manufacturer's instructions. All pipes, and especially cast iron pipes, shall be smooth, full bore and to the full diameter throughout all joints and junctions.

Cast Iron pipes (N.Z.S. 286 and 512).

Screwed galvanised wrought iron pipes (N.Z.S. 219) Water quality.

Lead pipes (N.Z.S. 1053).

Copper tube (N.Z.S. 546) 12mm and 19mm internal diameter, 1mm wall thickness. 25mm, 32mm and 38mm internal diameter, 1.2mm wall thickness.

Rigid p.v.c. pipes for pressure systems (N.Z.S. 7648).

Galvanised steel sheet (N.Z.S. 1343) 0.6mm.

Aluminium sheet (N.Z.S. 1418) 0.8mm soft alloy.

Copper sheet (N.Z.S. 835). For flashings etc. 450g soft (roofing temper). For unsupported work 450g hard (cornice temper).

Zinc sheet. 'Century' or equivalent. For flashings etc. half hard Titan grade. For unsupported work hard Titan grade.

Lead sheet. 25kg/m^2 grade.

6. Separation of Materials: Wherever dissimilar metals occur in circumstances which could produce contact or electrolytic action by a water film, full precautions shall be taken to ensure adequate separation by use of bituminous felt separators and bituminous paint. Wherever pipes are in contact with or built into concrete or masonry work, they shall be spiral wrapped with Denso Tape or similar material to provide separation and freedom of movement.

7. Temperature Movement: All plumbing work shall be carried out in a manner which will respect in full the adjustments arising from contraction or expansion under temperature changes. All such plumbing work shall be arranged with tolerances and form of jointing which will allow for full temperature movement without risk of prejudice to watertight conditions, or damage from straining to pipes which will generate failures and leaks.

8. Testing: All water or other plumbing services shall be completed in stages which will allow for proper testing under normal working pressures prior to the application of insulation, concealment or other enclosures to pipework. All leaks disclosed from such testing shall be remedied and retested before proceeding. On completion the whole of the plumbing services shall be subjected to full operational tests in the presence of the plumbing inspector with all defects properly remedied.

9. Water Seal at Bolts etc.: Wherever bolts, screws or other fastenings or pipes pass through exterior finish such as roofing, sheathing, plasterwork etc. such bolts or other fastenings shall be provided with a suitable compressible weather seal gasket of the correct size bedded both sides in mastic and compressed to ensure absolute security of weather seal.

10. Wastes and Vents: All wastes shall be in copper tube in Densotape in concrete, elsewhere rigid P.V.C. All vents where accessible shall be rigid P.V.C., where inaccessible copper tube. All fittings shall be trapped and vented in accordance with the local bylaws, and where allowed anti-siphonage traps shall be used to avoid venting. Note that gulley traps are back inlet type.

11. Stainless steel benches: Supply for fixing by Carptenter 1mm thick stainless steel sink benches as required with 150mm upstands to walls (including ends where appropriate) and standard domestic spillage lips to free edges, complete with pinex softboard underlinings and 19mm timber subframes. Check all dimensions on site and confirm with Carpenter and/or Joiner before fabrication.

DRAINLAYER

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Standards: All work shall comply with all provisions of the Drainage and Plumbing Regulations and all amendments thereto and all Local Authority Drainage Bylaws. The Drainlayer shall obtain all necessary permits, pay all fees and serve all notices in connection with the work. All work shall comply with N.Z.S. 671 and shall be carried out by, or under the direct control of, registered tradesmen.

3. Building In: Cooperate with the Carpenter and Concretor to build in soil and stormwater drains which pass through foundations and under slabs etc. in their exact locations as work proceeds or alternatively supply sleeves for casting in. Isolate drains from masonry with a full spiral binding of Denso Tape, and pack between drains and sleeves with bitumastic.

4. Trenches: All trenches and backfilling work is specified under Excavator. Check all levels, gradients and positions as work proceeds and immediately prior to laying of pipes.

5. Gulley Traps: Check position and levels of all wastes and set gulley traps on concrete beds. Gullies shall be level inlet type without dished top and shall be fitted with 110mm glazed earthenware lining extensions encased in concrete to not less than 100mm above permanent ground level. Movable gratings shall be fitted flush with extension tops and waste pipes shall pass through the side of the extensions. The extensions shall be as short as practicable and not more than 600mm long. Waste pipes shall finish flush with the interior surface of the extensions.

ELECTRICIAN

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. General: The work comprises the supply, delivery and installation of all materials, including all minor and incidental items necessary for proper completion and testing of all of the Electrical Services specified and/or shown on the drawings. Provide all temporary works, ladders and tools, specialised equipment etc. as required and allow to make all tests prescribed by the Electrical Wiring Regulations, Part 9. The Contract shall not be deemed to be completed until the Electrician has filed his 'Notice of Completion' with the Local Supply Authority and the installation has been authorised for service by its Inspector.

Leave the works clean and tidy, in full operational order and deliver all equipment guarantees and instructions to the Architect.

3. Setting Out: The positions of all switches, light and power outlets and other fittings, although shown specifically in some cases are in general only shown diagrammatically. Exact location and height above floor will be determined on the works by the Architect; the Subcontractor shall give reasonable notice of when this information is required.

Any items positioned in contravention of this shall be repositioned if so directed by the Architect, including re-wiring of the circuit if insufficient cable has been run, all at the Electrician's expense.

4. Workmanship: All work shall be by Registered Tradesmen and shall comply in all respects with the 1976 N.Z. Electrical Wiring Regulations, its amendments (and in detail with the 1980 handbook thereto), and the local Supply Authority's requirements. Obtain all permits and pay all fees

Workmanship shall be in accordance with accepted best trade practices, and such as to leave an efficient, robust and neat installation. Materials, fittings and equipment shall be installed exactly in accordance with the manufacturer's recommendations.

Cooperate with all trades to ensure the efficient progress of the works, and with the Concreter to ensure that all necessary sleeves, holes, conduit, flush boxes, fixings etc. (provided by Electrician) are incorporated in their exact positions as work proceeds. Electrician shall allow for normal drilling, cutting away or chasing of masonry, and notching or drilling of timbers, but no work of other trades shall be so cut that damage is caused to structural or finished work. Carpenter will provide and fix all necessary dwangs and timber supports in exact locations determined by Electrician.

Neatly label switchgear and fuseboards to identify each circuit and which circuits are controlled by each switch.

5. Materials: Attention is directed to the appropriate Standards of the Standards Association, Wellington, and their provisions shall be deemed to be included in this Contract. Where no special reference is made and where a Standard provides for an alternative the best quality of materials and the highest standard of workmanship shall be deemed to be required.

6. Wiring: Conceal all wiring except as specifically noted otherwise or as approved on site by the Architect. All circuits shall be wired to carry the maximum design loading plus not less than 25% margin except where specified or noted otherwise. Mineral insulated metal sheathed cables, neutral screened cables, and P.V.C. insulated power and lighting cables shall comply with N.Z.S.6401. Flexible cords shall comply with N.Z.S.6402.

Wiring shall be properly supported throughout its entire length with clips or saddles so spaced as to obviate any sagging; Catenary wires will not be permitted. The earch continuity wire shall be separately insulated incorporated within the cables, and where Tee or other joints are required, joint boxes of all insulated pattern and of substantial construction may be used.

Conduit where required or directed shall be rigid p.v.c. complying with N.Z.S.2250 neatly installed in exactly straight vertical and horizontal runs with a minimum of bends.

7. Distribution Elements: Miniature circuit breakers shall be time delay type with instantaneous tripping on fault conditions complying with N.Z.S.2205. Use front connected N.Z. Insulators S901 M.C.B.s mounted by means of front accessible studs unless otherwise indicated.

H.R.C. fuses and semi enclosed (rewirable) fuses where noted shall comply with N.Z.S.1951. Switches on boards shall comply with N.Z.S.388 and be P.D.L. cat's 2/S, 3/S, 4/S, 5/S or 7/S unless otherwise required or directed.

Outlet boxes for use with all flush mounted accessories shall comply with 1201 and be P.D.L. cat 141 for concrete block walls, P.D.L. cat 144 for framing and P.D.L. cat 140 for concrete walls.

8. Accessories:

a. Power outlets complying with N.Z.S.2065 shall be P.D.L. cat 292 generally, with P.D.L. cat 291SH where specifically indicated. Wire circuits with 3/7/0.67 from 20 amp M.C.B.s with a maximum of six outlets per circuit.

b. Service switches for fixed equipment shall comply with N.Z.S.2065 and for water heaters, cupboard heaters etc. be P.D.L. cat 253 where flush, cat 10 where surface mounted. Where required to suit loadings use P.D.L. cat 1F1, 2F1, 3F1 or 4F1.

c. Shaving outlets complying with N.Z.S.1524 shall be P.D.L. cat 63.

d. Lights. Wire circuits with 3/7/0.5 from 10 amp M.C.B.s with a maximum of ten outlets per circuit. Switches complying with N.Z.S. 2065 shall generally be P.D.L. cat 281 or 282 (do not use cat 283 - group switches); where narrow switches are required use C.P.I. Ring-grip cat CMS1A or CMS2A, where dimmers are required use P.D.L. cat 220. Ceiling roses shall be cord grip pattern complying with N.Z.S.354, P.D.L. cat 44 (white on white or black on black only - black on white is not acceptable). Lampholders complying with N.Z.S.144 shall be P.D.L. cat 26 suspended on white 3/16/0.2 flexible cord round profile, heights as directed on site by Architect. Provide 100 watt (or less if so indicated on selected fitting) bulbs and fluorescent tubes to all positions.

9. Hot Water Cylinder Complete with heating element and thermostat shall be provided and installed by others in the position shown on the drawings but Electrician shall make all necessary electrical connections.

10. Lighting Fittings: Include the sum of $2500.00 (Two Thousand, Five Hundred Dollars) for the purchase of lighting fittings selected by the owner. Electrician shall take delivery and install fittings where directed Electrician shall allow in his tender for fixing selected fittings and providing incandescent lamps, lamp holders, ceiling roses, flexes.

11. Demolition: Remove all redundant wiring and elements from new mezzanine space. The fittings remain the property of the Employer and several may be re-used in the new work.

12. Switchboard: Existing switchboard retained and modified only to approval to accommodate additional equipment required. Note that most of the existing surface distribution wiring will have to be re-routed as directed (allow to re-route - but not to extend).

GLAZIER

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Glass: All glass shall be in accordance with N.Z.S. 2258 (1969) and shall be Ordinary Glazing Quality, free from defects other than those acceptable within this grade.

Thicknesses for individual panes shall be in accordance with the following except where specifically noted otherwise on the drawings : Fixed panes less than $0.5m^2$, 4mm glass, Fixed panes between $0.5m^2$ and $1m^2$, 5mm glass, Fixed panes greater than $1m^2$, 6mm glass. 'Fixed panes' applies only to vertical windows glazed four edges. For sloping panes (glazed three edges), opening sashes and glazed doors double the area to obtain the glass thickness required.

3. Putty: All putty or other bedding shall be appropriate for the purpose for which it is to be used. Glazing in wood frames shall be with good oil putty of recognised manufacture and where to be finished other than by painting putty shall be stained as necessary to match adjoining work. Glazing with wood beads shall be bedded and sealed with approved butyl glazing compound, glazing into steel frames shall be with Expandite Mica Metal Casement Putty or approved equal and skylights glass shall be bedded in Expandite Seelastrip BR606 and face beaded with polysulphide or polyurethane elastomeric sealant. Internal glazing shall have all edges 'capped' with approved resiliant glazing strip.

4. Glazing: All glazing work shall be carried out in accordance with best trade practice for the nature of work concerned. All glass shall be cut to full size of openings subject only to proper edge tolerances to allow for temperature movement spacing and bedding required. All rebates shall be primed or oiled before glazing. All glass shall be evenly bedded on the back and edges, seated and spaced with neoprene blocks at quarter points, sprigged at 300mm centres and finished with clean straight putty fillets finishing slightly below the line of the bedding putty. External glazing with beads shall have bedding on back, edges and face of glass under beads and bedding shall be applied so as to completely fill all voids when beads are placed and secured.

Skylight frames shall be primed with Expandite Primer, porous or non-porous as appropriate, before placing BR606, and glass edges shall be meths cleaned before positioning. Use of BR606 and face beading shall be exactly in accordance with the manufacturer's instructions.

5. Completion: Replace any cracked, broken or otherwise defective glass and make good. Leave the whole of the glazing work completely watertight and leave all glass properly cleaned and ready for occupation.

6. Mirrors: Shall be 6mm float glass silvered, polished, and with edges and corners rounded and polished. Fix with a ventilating space behind with screws through drilled holes with domed caps tapped into screw heads. All mirrors in 'wet' areas shall be backed by an approved specialist firm.

P A I N T E R

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Preparation of Surfaces: No painting, varnishing, oiling or other surface coating shall be undertaken unless the surfaces to be coated are in a fit and proper condition to ensure first class results.

The Painter shall inspect the work of other trades upon which his material is to be applied and report to the Architect and Main Contractor any defects or irregularities in the work that would prevent the satisfactory execution or permanency of his work, and he shall not proceed until all such unsatisfactory preparatory work has been corrected. Failure to examine and report will be construed as an acceptance that preparatory work is satisfactory.

This clause does not relieve the Painter of any of the normal preparatory work of surfaces customarily performed by this trade.

3. Protection: All surfaces to receive Painter work shall be thoroughly swept and wiped down and all dust, rubbish etc. shall be completely removed from the areas involved immediately prior to commencement. Take adequate precautions during and after operations, both inside or out, to protect work from dust, dirt or any disfigurement whatsoever.

No Painter work shall be carried out on surfaces which are not perfectly dry, and no external work shall be done during frosty or unsuitable weather. Take adequate precautions to prevent paint spots etc. from falling on floors and similar surfaces, and extreme care to keep absorbent surfaces scheduled unpainted (i.e. fairface concrete, brickwork) clean during adjacent Painter work.

4. Workmanship: All work shall be of the highest reasonable standard and shall be executed by skilled tradesmen to the satisfaction of the Architect. Manufacturers' instructions shall be strictly adhered to.

In all finishes any irregularities, brushmarks, dust etc. in each preceding coat shall be rubbed down to provide a smooth and clean surface for the following coat. Each coat shall be finished one coat over all surfaces before a further coat is applied, and each coat shall be perfectly dry before subsequent coats.

All painting of putties shall be carried out within one month of the glass being glazed. Paint shall impinge upon the glass for weather protection.

All locks, fastenings and other hardware shall be removed while painting work is in progress and refixed when complete. Knuckles of hinges and butts must not be painted.

Wallpapers and lining papers, where scheduled, shall be hung plumb, true and square and patterns shall be accurately matched. All edges shall be neatly and accurately trimmed and the paste shall include an appropriate fungicide.

5. Painter Work: The Main Contractor shall assign to the Painter a separate portion of the premises for the general storage and mixing of his materials.

The schedules indicate the general extent of the works but are in no way exhaustive in their description of actual items for Painter work. All items and portions of items reasonably inferrable but not specifically mentioned are deemed included, i.e. the interiors of all cupboards, the tops and bottoms of doors, etc. All cupboard doors shall have equal Painter work on each side.

All stopping work shall be carried out immediately priming coat or sealing coat is dry, and shall be solidly placed to finish clean and smooth. Stopping tinted to match timber for clear varnish work, and tinted to match anticipated final colour for oiled timber work.

6. Materials Generally: All materials ready mixed highest quality reputable manufacture delivered in unopened containers. Where a maker's name is specified this does not preclude the use of other brands providing approval is first obtained.

Materials shall be used only for the purpose and in the manner intended by the manufacturer, and any apparent scheduled discrepancy in this respect shall be immediately referred to the Architect for clarification.

Where work is specified to be finished in a particular material or manner, all preparatory work, priming or undercoating necessary to ensure proper finish shall be provided, notwithstanding any omission herein.

7. Priming: Various materials shall be primed before fixing as specified under the Sectional Trades concerned.

Timber work shall have the priming thoroughly brushed in to ensure the whole surface is completely covered and all exterior timberwork shall be primed within one week of fixing, and should more than two months elapse between priming and undercoating of any surface it shall be reprimed.

Steel windows will be primed by the manufacturer before delivery but this coating shall be checked immediately before fixing and any damage shall be corrected.

8. Completion: Allow to touch up to approval any Painter work damaged during finishing work by other trades. On completion thoroughly clean all paint marks, smears etc. from glass, hardware, and other surfaces and leave ready for occupation. Avoid scratching glass or hardware when cleaning.

9. Schedules: The schedules below indicate the general extent of the work but no painting whatsoever shall be undertaken until each specific item has been confirmed in writing by the Architect. A detailed schedule of specific colours and finishes will be issued during construction.

10. Exterior: Allow to single oil coat and two acrylic coat all galvanised steel surfaces, to three coat acrylic coat all concrete and masonry surfaces and to three oil coat all timber surfaces.

11. Interior: Allow to single oil and two acrylic coat ALL new and reinstated interior wall and ceiling surfaces (except prefinished surfaces i.e. Aquapanel and Rocfibre).

SHEET VINYL WORKER

1. Preliminary: Refer to the General Conditions of Contract and to all provisions of the Preliminary Section of this Specification as appropriate.

2. Guarantee: Sheet Vinyl Subcontractor shall provide a written guarantee covering the whole of the workmanship and materials used for a period of two years.

3. Substrate: Before commencing work on any space the Sheet Vinyl Subcontractor shall satisfy himself that all surfaces are fit for covering, dry and suitable to provide a first class finish. Commencement of work will be deemed acceptance of all matters affecting production of a first quality finish.

4. Completion: On completion of work thoroughly clean and polish surfaces and remove all waste, glue stains, offcuts, etc.

5. Sheet Vinyl Work: All sheet vinyl shall be selected colour, fully flexible vinyl sheet as manufactured by Polyfloor Products (N.Z.) Limited or similar approved. All vinyl shall be fixed with contact type neoprene adhesives, spray or roller applied, and all adhesives shall be waterproof, mildew resistant, strong bonding and have good ageing characteristics. Allow to prime substrate as required.

All work shall be executed by competent experienced tradesmen in accordance with best recognised trade practice. Use as large sheets as possible with a minimum of joints and scribe all edges neatly to perimeters, coved as required. All joints shall be tightly butted and true to line.

WELLINGTON WORKINGMEN'S CLUB & LITERARY INSTITUTE 1868

STAGE II STRENGTHENING & EXTENSIONS NOV 1986

STRUCTURAL CALCULATIONS

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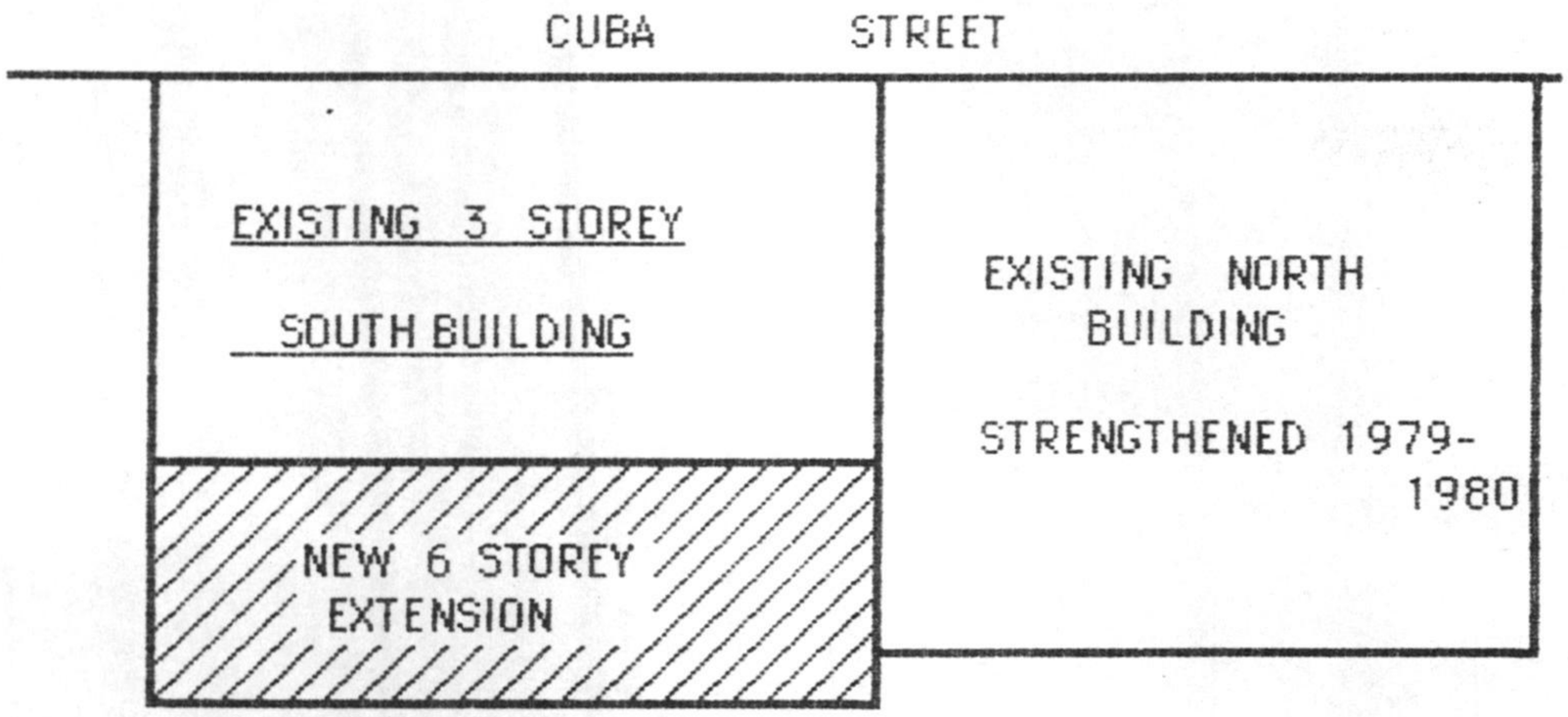
WELLINGTON WORKINGMEN'S CLUB & LITERARY INSTITUTE
STAGE II STRENGTHENING & EXTENSIONS

Introduction



SITE PLAN

Description

The Wellington Workingmen's Club comprises basically 2 three-storey buildings separated by a common wall. At the rear of the South building there is a single-storey attached building. Both buildings consist of brick masonry walls supporting timber and concrete floors. The North building has been strengthened, as a Stage I contract, to 2/3 the earthquake loadings required under NZS 1900, chap. 8:1965. This was done by incorporating new concrete frames and shear walls within the confines of the existing building.

Strengthening

The South building is now being strengthened to the same level as the North building, principally by tying it to a new 6-storey extension located at the rear of the building. The strengthening generally consists of strapping brick walls for face loading and connecting the various elements of the existing building to the new extension by means of diagonal bracing.

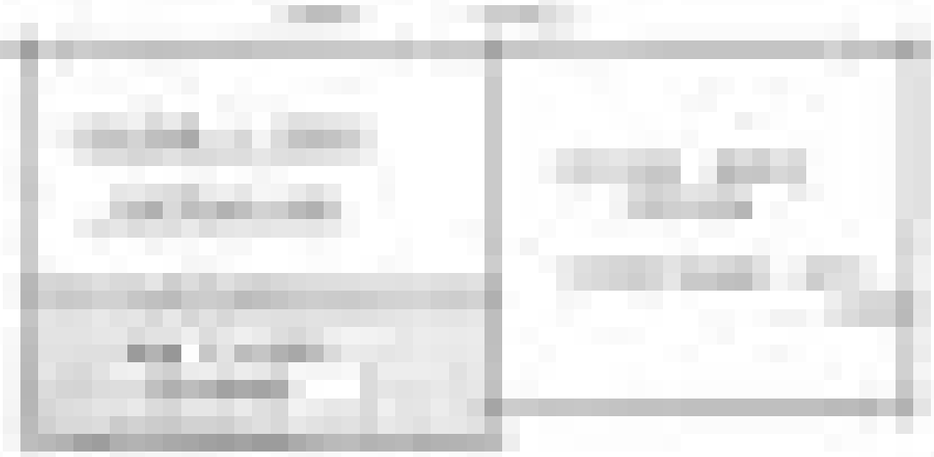
6-Storey Extension

The extension at the rear of the South building consists of proprietry precast flooring supported by reinforced concrete frames and shear walls. The primary earthquake structure has been designed to the same level of earthquake loading as the North building (2/3 NZS 1900, Chap. 8:1965) and as to deflect comparably with the North building frames. Limited ductility has been applied. Far North-South loading, all torsion has been assigning to the new and shear walls.

Foundations

The 6-storey extension is to be supported on bored cast-in-place piles founded in alluvial gravels.

The final positioning of the piles, and thus the ground beam design, has yet to be determined as it is dependent on the location of a stormwater culvert running under the building. This will be done



immediately following demolition.

Foundation Investigation

A foundation investigation has been carried out and the report is attached.

Design Codes

NZS 1900, Chap. 8:1965

NZS 4203:1984

NZS3101:1982

NZS3404:1977

NZS4203P:1985

(M.J. Orsman, MIPENZ)

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JOB No. 5002 PAGE 1

JOB WELLINGTON WORKING MENS CLUB, CUBA ST BY WZM

DATE 18/8/86

Seismic Building Masses

Old Bldg

1st floor

D	Walls	N	24 x .45 x 4 x 15	=	648
	Conc.	Interior	4 x 24 x .23 x 2.1 x 15	=	696
		S			648
		W(Cols)	6 x 24 x 2.3 x .8 x .5		1132
		W	24 x .6 x 2 x 21	=	605
		Tbr Interior	.5 x 2.1 x 40	=	42
	Floor		1 x 21 x 15	=	315
					3086
L	L/3 = 1kPa				315

2nd floor

D	Walls	N & S	2 x 24 x .45 x 2.0 x 15	=	648
		N & S	2 x 24 x .35 x 1.8 x 15	=	454
		W	24 x .6 x 3.8 x 21	=	1149
		Tbr	.5 x 2.1 x 40	=	42
			.5 x 1.8 x 40	=	36
	Floor				315
					2644
L					315

3rd floor (roof)

D	Walls	N & S	2 x 24 x .35 x 1.8 x 15	=	454
		N & S	2 x 24 x .23 x 2.5 x 15	=	414
		W	24 x .6 x 5 x 21	=	1512
		Tbr	.5 x 1.8 x 40	=	36
	Roof		.5 x 21 x 15	=	158
					2573

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JOB _____ BY WZM

DATE 18/8/86

New Bldg

Mezz. Floor

		S	24 x .15 x 2.5 x 9 =	81
D	Walls	E	4 x 2.5 x 21 =	210
		Hor.	.5 x 2.5 x 20 =	25
	floor		4 x 21 x 9 =	756
	beams		2x24x 1x .6 x 20 =	576
	cols		10 x 24 x 1.0 x .6 x 2.5 =	288
				1936
L			1.67 x 21 x 9 =	316

1st floor

		S	24 x .15 x 3 x 9 =	97
D	walls	E	4 x 3. x 21 =	252
		Hor	.5 x 3 x 20 =	30
	floor			756
	beams			576
	cols		=	288
				1999
L			1 x 21 x 9	189

2nd floor, 3rd floor

D	walls	S	24 x .15 x 3.7 x 9 =	120
		E	4 x 3.7 x 21	311
		Hor	.5 x 3.7 x 20	37
	floor		=	756
	beams			576
	cols			288
				2088
L				189

4th floor

D	as above	2088	
	roof	95	} ≐ 10% ⇒ o.k.
	walls	120	
		2303	
L		316	

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DATE 18/8/86

Final Seismic Masses

LEVEL	OLD BLDG D	OLD BLDG L/3	NEW BLDG D	NEW BLDG L/3	Wt
4	—	—	2303	316	2619
3	2573	—	2088	189	4850
2	2644	315	2088	189	5236
1	3086	315	1999	189	5589
M	—	—	1936	316	2252
					20546

Seismic Coefficient

Design to 2/3 1965 code rqmts

$V = KCW_t$

$2/3\ KC = 2/3 \times 1.25 \times .12 = 0.1$

$V = 0.1\ W_t = 2055$ kN

LEVEL		h_x	W_x	$W_x h_x$	F_x	TOTAL V_x	FRAME DESIGN FORCES F_x	V_x
4	3.7	16.4	2619	42952	476	476	238	238
3	3.7	12.7	4850	61595	682	1158	341	579
2	4.0	9.0	5236	47124	522	1680	261	840
1	2.4	5.0	5589	27945	310	1990	155	995
M	2.6	2.6	2252	5855	65	2055	33	1028
				185471				

$F_x = \dfrac{V W_x h_x}{\Sigma W_x h_x}$

$h/l = 16.4/21 = .8 < 3$

$\Rightarrow$ No 0.1 V @ top.

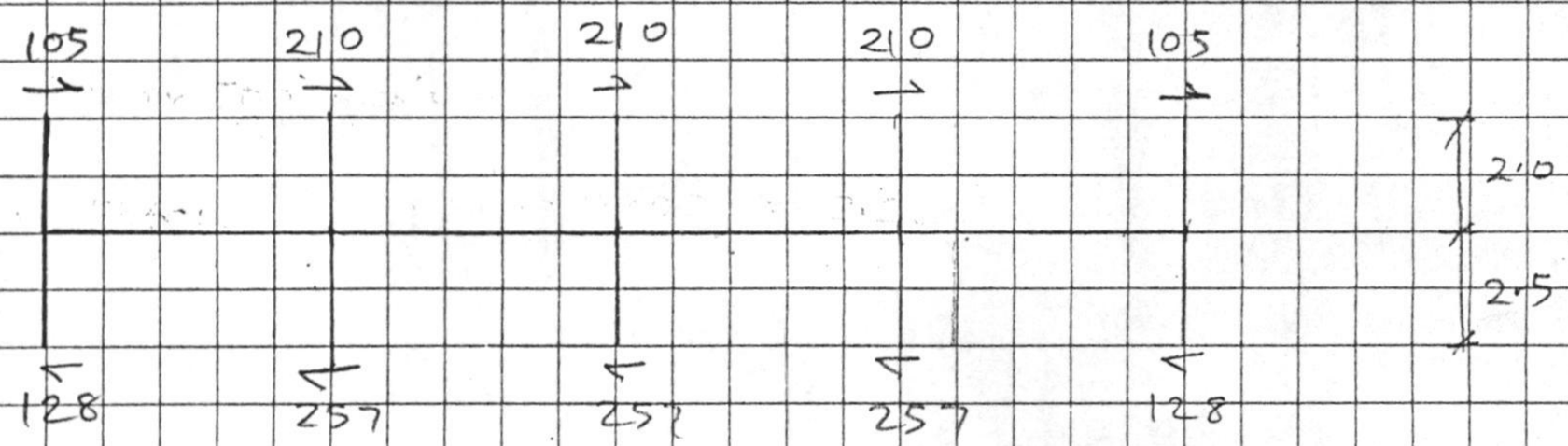
Have two identical frames & torsion will be taken out by shear walls in opposite dir^n

$\Rightarrow$ Design forces for frame are 50% of total

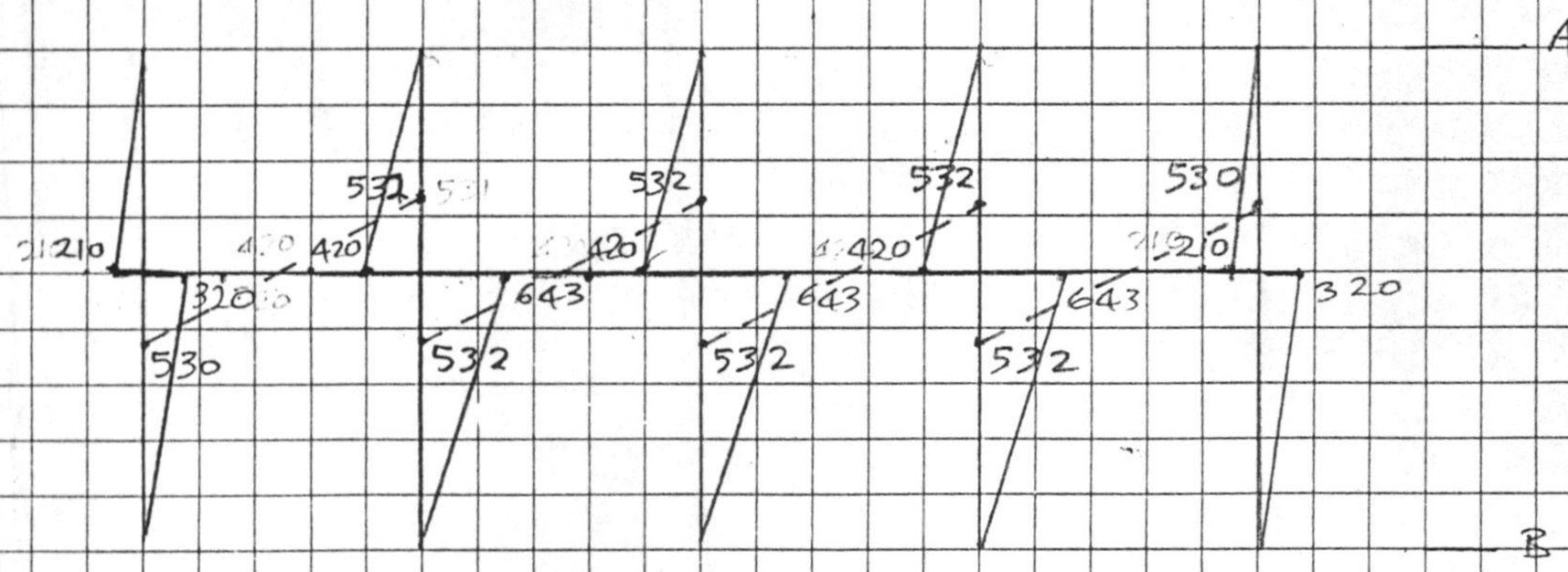
Scheme

Assume pt. of contraflexure @ mezzanine level
(Ignore mezz. level for purpose of scheme)

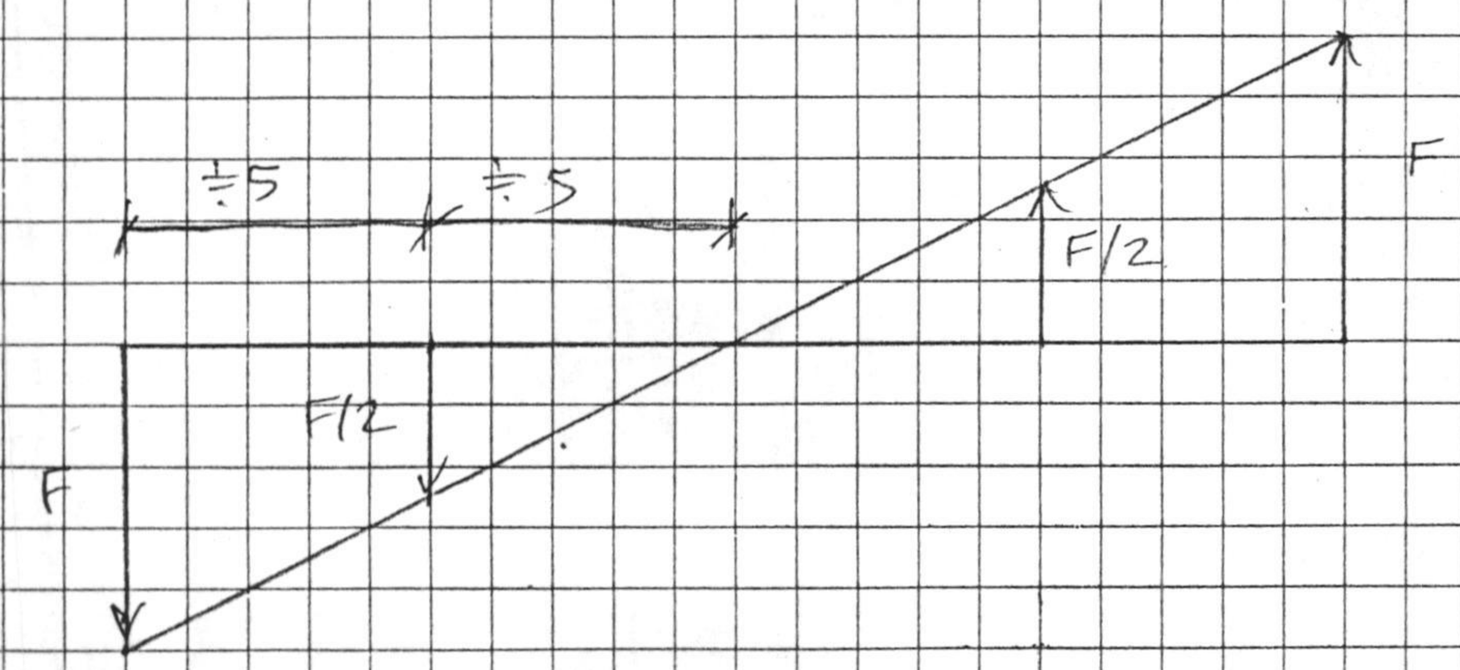
Shear Forces levels G-1, 1-2 — Assume end cols have I = 0.5 internal cols } ⇒ Equivalent of 8 cols



BMD



Axial Forces in cols – assume axial forces in cols are proportional to distance from centroid of cols.



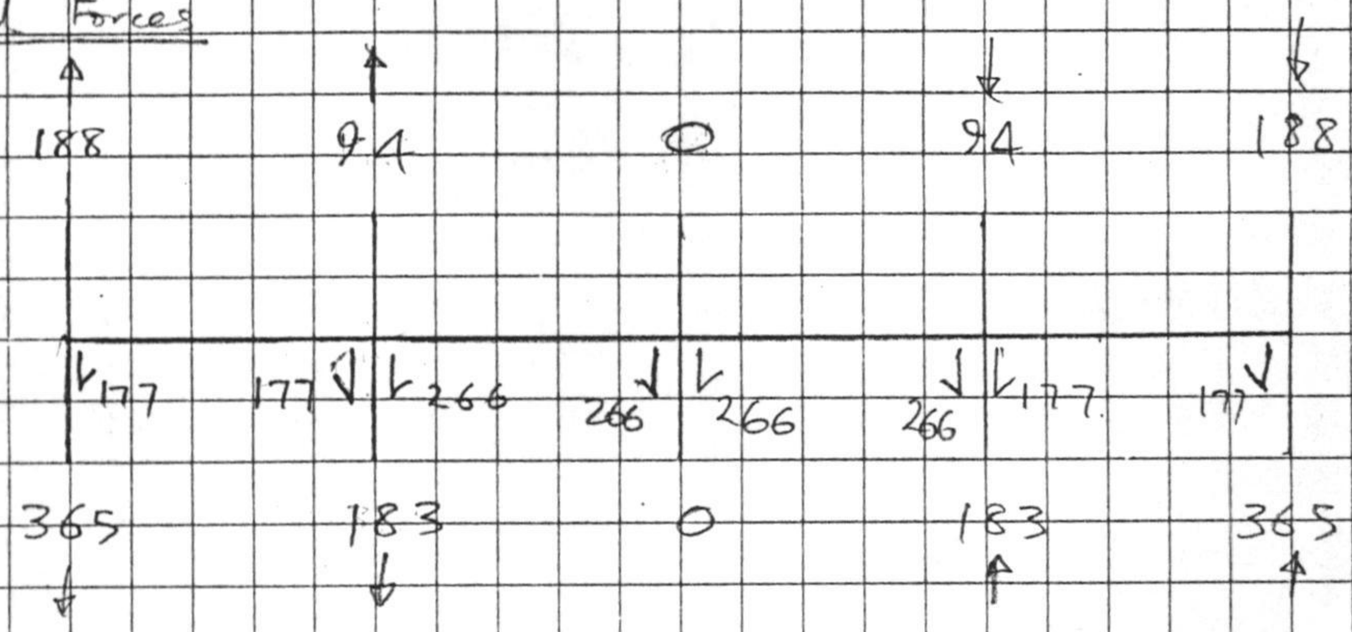
$[(F \times 10) + (F/2 \times 5)] \times 2 = 25F$

Moment @ A = 238 x 9·4 + 341 x 5·7 + 261 x 2 = 4703 kNm/frame.

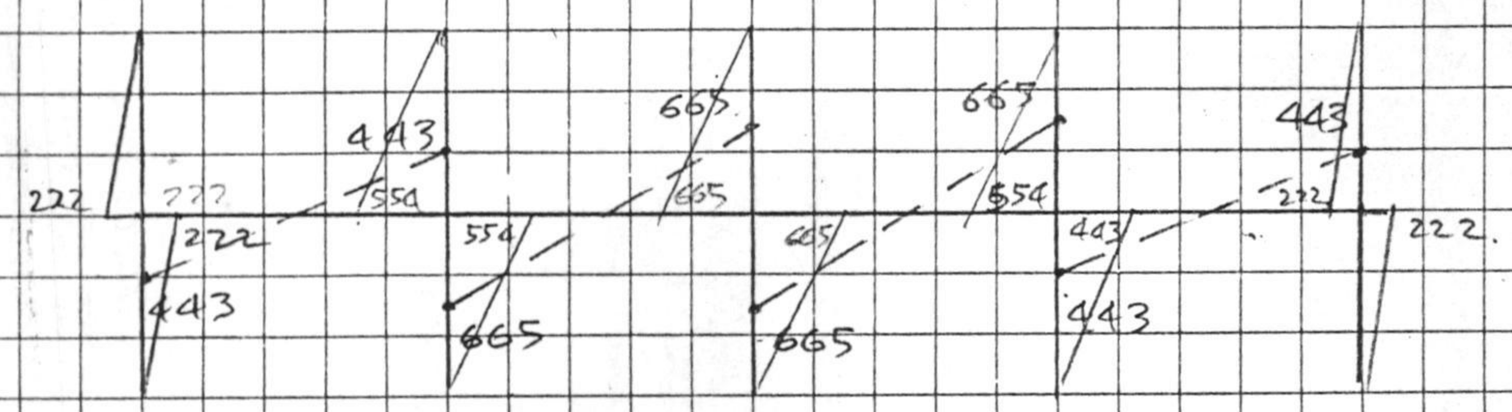
Moment @ B = 238 x 13·9 + 341 x 10·2 + 261 x 7·5 + 155 x 2·5
= 9131 kNm/frame

⇒ At A ·25F = 4703 ⇒ F = 188 F/2 = 94 kN
B 9131 365 183

Axial Forces



BMD (Check only)



⇒ Consider worst cases — cols

M_E = 320 kNm
P_E = 365 kN tension

M_E = 665 kNm
P_E = 183 kN tension

Beams — M_E = 665 kNm.

Try 850 x 500 R_u = 2·77 ρ = ·008 A_s = 2920
ρ = ·010 (f_y = 300) A_s = 3650

⇒ 4HD32 or 5D32

⇒ Probably OK.

Gravity

Internal beam – level 2

Span = 11.0 m

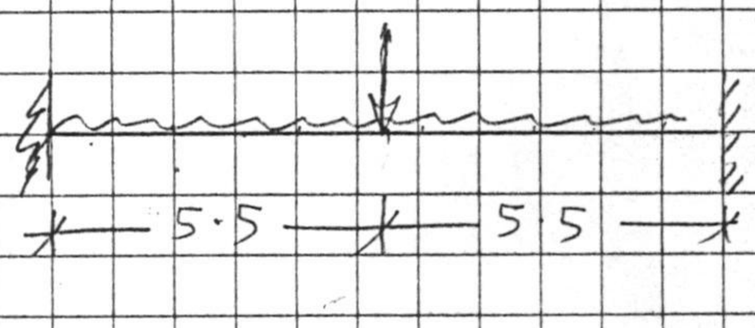
Includes SDL 0.5 kPa

D floor (900 Ti 250) 3.2 x 4.5 x 11 = 158
beam 24 x 1.2 x .5 x 11 = 158
316

D PL – floor 1 x 1.8 x 5.7 = 10
– beam 24 x .5 x .3 x 1.8 = 6
16

L UDL 3 x 5 x 11 = 165 A = 55 } R = .67 L_R = 111
PL 3 x 1.8 x 5.7 = 31 A = 10 } L_R = 21

D	166	D	166
LL	98	LL	98
L_R	66	L_R	66
1.4D+1.7L_R	345	1.4D+1.7L_R	345



	FEM	MSM
D	290 + 22 = 312	145 + 22 = 167
L_R	102 + 29 = 131	51 + 29 = 80
1.4D+1.7L_R	660	370

Redist. ⇒ M_u^- = .7 x 660 = 462 kNm
M_u^+ = 568 kNm.

$R_u = 568 \times 10^6 / .9 \times 500 \times 730^2 = 2.37$

⇒ 800 x 500 OK as for seismic

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JOB _____ BY WZM

DATE 19/8/86

Cols

Try 800 x 500 cols

$M_i / f'_c b h^2 = 665 \times 10^6 / .9 \times 25 \times 500 \times 800^2 = .092$

$P_i / f'_c b h = -183 \times 10^3 / .9 \times 25 \times 500 \times 800 = -.02$ } $\rho_t m = .30$

$g = 660/800 = .8$

$M_i / f'_c b h^2 = 320 \times 10^6 / .9 \times 25 \times 500 \times 800^2 = .044$

$P_i / f'_c b h = -365 \times 10^3 / .9 \times 25 \times 500 \times 800 = -.04$ } $\rho_t m = .16$

$\rho_t = .0168$ $A_s = 6720 \text{ mm}^2 \Rightarrow 10$ HD 32

$\Rightarrow$ 800 x 500 cols OK

Gravity Loadings

West frame

Lev 4

D roof ·5 x 4·5 = 2·3
walls ·5 x 4 = 2·0
floor 3·2 x 4·5 = 14·4
beam 24 x ·8 x ·5 = 9·6
28·3 kN/m say 30

L 3·25 x 5 = 16·3 say 17

Levs 4 & 3 D 30 kN/m
L 17 kN/m

Lev 3

D floor 14·4
beam 9·6
roof ·5 x 7 = 3·5
walls ·5 x 3·7 = 1·9
29·4 say 30

L 3 x 5 = 15·0
·25 x 7 = 1·8
16·8

Levs 2 & 1

D floor 3·2 x 4·5 = 14·4
beam 9·6
24·0 kN/m

PL 16·0 kN

L 3 x 5 = 15 kN/m

PL 31 kN

Lev M

D floor 3·42 x 4·5 = 15·4 (900 T; 300)
beam 9·6
walls ·5 x 2·4 = 1·2
26·2 say 27

L 5 x 5 = 25 kN/m

*Note
PL ≑ midspan @ lev 2 but @ lev. 1 PL is just away from col. pos^n under

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East Frame

Lev 4

D	roof		2.3	
	walls	4 x 4 =	16.0	
	floor		14.4	
	beam		9.6	
			42.3	say 43 kN/m
L			16.3	say 17 kN/m

Levs 3, 2 & 1

D	floor		14.4	
	beam		9.6	
	walls	4 x 3.2 =	12.8	
			36.8	say 37 kN/m
L			15.0	

Lev M

D	floor		15.4	
	beam		9.6	
	walls	4 x 1.6 =	6.4	
			31.4	say 32 kN/m
L	5 x 5 =	25 kN/m		

Shear Walls

Torsion $e_{max} = .1b = .1 \times 25 = 2.5$ m from COM

Centre of Stiffness = midway btn frames $x = 20$ m
Assume COM @ mid-way of bldg = 12.5 m
N-S
$\Rightarrow$ Torsional Moment $= V \times (7.5 + 2.5) = 10V \Rightarrow T = (10/21)V = .48V$

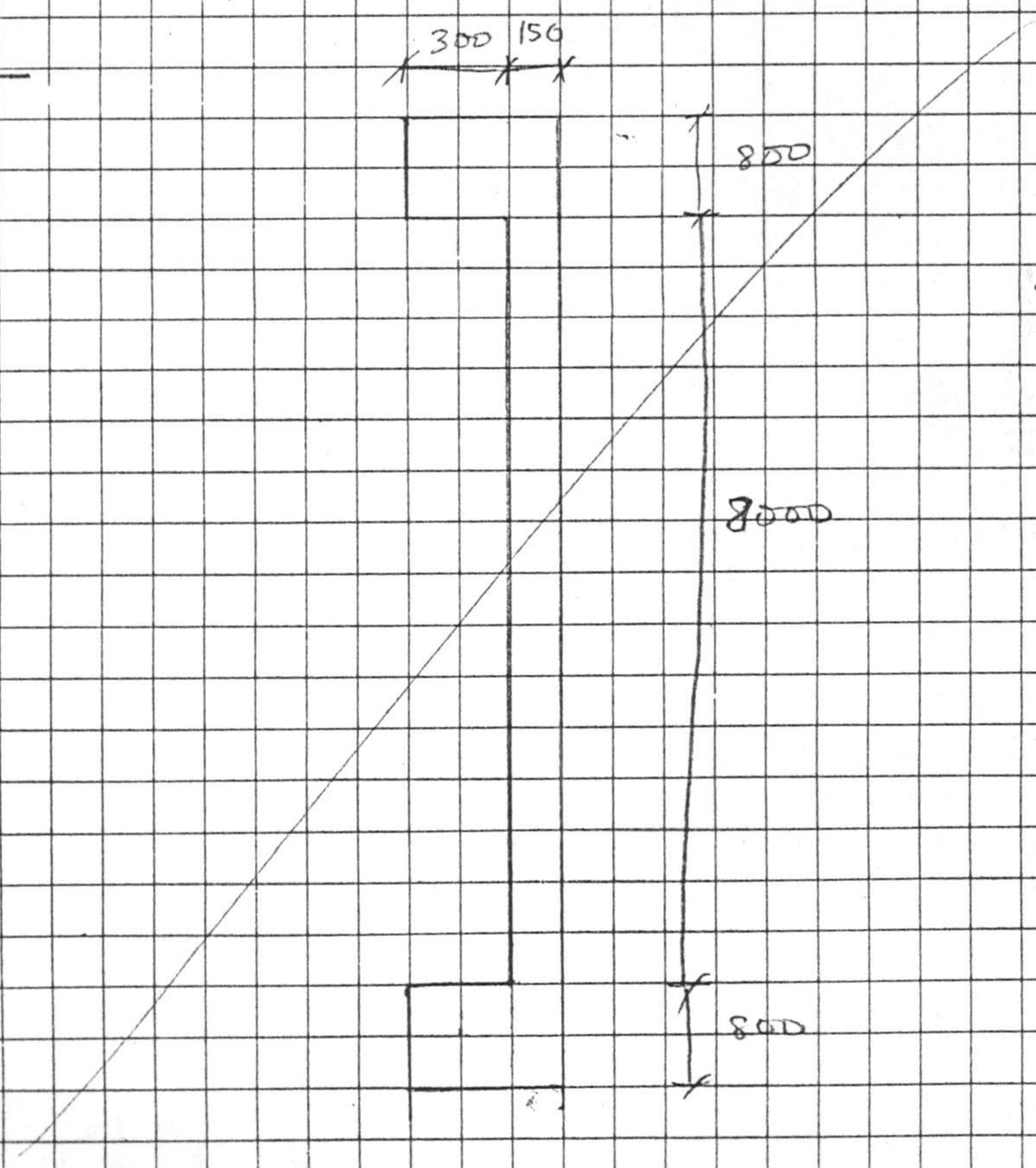
$\Rightarrow$ E-W TM $= V \times 2.1 \Rightarrow T = 2.1/21\,V = .10V$ $\Rightarrow$ Design Force $= 0.60V$

LEV	Total Force	Design Force	h	Meq (MNm)	Veq (kN)
4	476	286	16.4	—	286
3	682	409	12.7	1.302	695
2	522	313	9.0	4.473	1008
1	310	186	5.0	7.662	1194
M	65	39	2.6	1.478	1233
				13.733	

$l_w = 9600$
$H/6 = 2733$ } End region $= 9600$

Try 150 RC

Effective Section



$\bar{x} = \int x\,da / A$

$= 4800$

Flex. Capacity

Assume $P_i = D+L_e/\phi = 0$

$\Rightarrow C = T$

$c_{max} = .3 l_w = 2880$ 10.5.2

Try $c = 800$

$C_c = .85 f'_c\, ab = .85 \times 25 \times .85 \times 800 \times 450 = 6.50$

$C_s = 3968 \times .380 = 1.51$

$T_{col} = 1.51$

Wall - min steel 2 HD10 @ 300 ($s_{max} = 2t = 300$)
(Use HD16 @ 300)

$T_{web} = 2 \times 78.5 \times 8/.3 \times 380 = 1.59$

$C = 6.50 + 1.51 = 7.51$
$T = 1.51 + 1.59 = 3.10$

Try $c = 400$

$C_c = 3.25$

Assume $C_s = T_s$ (col)

$T_{web} = 1.59$
$T_{col} = 1.51$ } 3.10

Try $c = 380$

$C_c = 3.09$
$T = 3.10$ } ok

Take moments about centroid

$M_i = 3.09 \times (4.8 - .85 \times .38/2) = 14.33$
$1.59 \times 0 =$
$1.51 \times (4.8 - .4) = 6.64$
20.97

$M_u = \phi M_i = 18.9$ kNm

M_u rqd $= 12.59$ MNm $\Rightarrow$ OK

Shear Walls

150 RC
HD16 @ 300 vert

Shear

$v_i = 1131 \times 10^3 / .85 \times 150 \times (.8 \times 9600) = 1.16$ MPa

$.2 f'_c = 5$ MPa ⇒ OK

$.3\sqrt{f'_c} = 1.5$ MPa $v_i > 1.5$ ⇒ 2 layers not reqd.

$v_c = 0.6\sqrt{\frac{P_e}{A_g}}$ $A_g = 1.92\ m^2$

$P_e = D = 24 \times 16.4 \times [(.15 \times 8) + (2 \times .45 \times .8)] = 756$ kN

$v_c = .6\sqrt{\frac{756000}{1.92 \times 10^6}} = .38$ MPa

$v_s = 1.16 - .38 = 0.78$

$A_v = v_s\, b_w s / f_y$ $A_{v\,min} = .7 b_w s / f_y$

$s_{max} = 201.5 \times 380 / 0.78 \times 150 = 653$

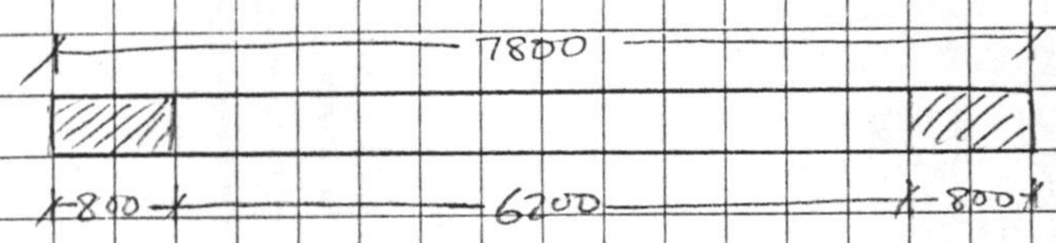
⇒ HD16 @ 300 horiz. OK

Shear Walls
150 R.C.
HD16 @ 300 horiz.

Total reo for walls
HD16 @ 300 BW
9.4 kg/m²

(Total 1500 kg)

Effective Section



Flex. Capacity

Try c = 500

$C_c = .85 f'_c ab = .85 \times 25 \times .85 \times .500 \times .150 = 1.35$ MN

$T_w = 1.58$
$T_{col} = 1.51$ } 3.09

Try c = 600

$C_c = 1.63$
$C_s = 1.03$ } 2.66 HD24 @ 100.

$T_s = .34$
$T_w = 1.58$
$T_{col} = 1.37$ } 3.29

Try c = 700

$C_c = 1.90$
$C_s = 1.20$ } 3.1

$T_s = .14$
$T_w = 1.58$
$T_{col} = 1.37$ } 3.09

$M_i = 1.9 \times (3.9 - .85 \times .7/2) = 6.84$
$1.2 \times (3.9 - .35) = 4.26$
$- .14 \times (3.9 - .75) = - 0.44$
$1.58 \times 0 =$
$1.37 \times (3.9 - .4) = 4.80$
15.46

$M_u = \phi M_i = 13.91$

M_u req'd $= 13.73$ MNm $\Rightarrow$ OK

Lev 1

Try 8HD20, HD12 @ 300

Try c = 500

C_c = 1.63
C_s = .72 } 2.35

T_s = .24
T_w = .89
T_{col} = .96 } 2.09

Try c = 550

C_c = 1.49
C_s = .66 } 2.15

T_s = .30
T_w = .89
T_{col} = .96 } 2.15

M_i

1.49 × (3.9 − .85 × .55/2)	=	5.46
.66 × (3.9 − .275)	=	2.39
− .30 × (3.9 − .675)	=	−0.97
.89 × 0		
.96 × (3.9 − .4)	=	3.36
		10.24

M_u = 9.22

M_u rqd = 7.662 ⇒ ok.

North Wall

150 RC
25 MPa.
Vert Reo
Levs G — 1
8HD24 @ 100
beside door
HD16 @ 300 web
Levs 1 →
8HD20 @ 100
beside door
HD12 @ 300 web
Horiz Reo
Levs G — 1
HD16 @ 300
Lev 1 →
HD12 @ 300

Lev 6 – M

$v_i = 1131 \times 10^3 / .85 \times 150 \times .8 \times 7800 = 1.42$

$.2 f'_c = 5$ MPa ⇒ OK

$.3\sqrt{f'_c} = 1.5$ $v_i < 1.5$ ⇒ One layer OK

$P_e = D = 461$ kN $v_c = .6\sqrt{\frac{P_e}{A_g}} = .6\sqrt{\frac{461\,000}{1.17 \times 10^6}}$

$v_c = .38$

$v_s = 1.04$

$A_{v\,min} = .7 b_w s / f_y$ $s_{max} = 2t = 300$

HD16 $s_{max} = 201 \times 380 / 1.04 \times 150 = 490$.

Door Opening

Trim with HD16 bars

Lev 1–2

$v_i = 1.16$ $v_c = .25$ $v_s = .91$

HD12 $s_{max} = 315$.

South Wall

$A_{s\,min}$ horiz $= .002 \times 175 \times 1000 = 350$ mm²/m

⇒ Detail as for North wall.

South Wall

175 RC
25 MPa
Levs G – 1
HD16 @ 300 BW
except
Levs 1 – ⊥
HD12 @ 300 BW

SMITH LEUCHARS LTD
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 16

JOB _____ BY WJM

DATE 26/8/86

Frame Analysis

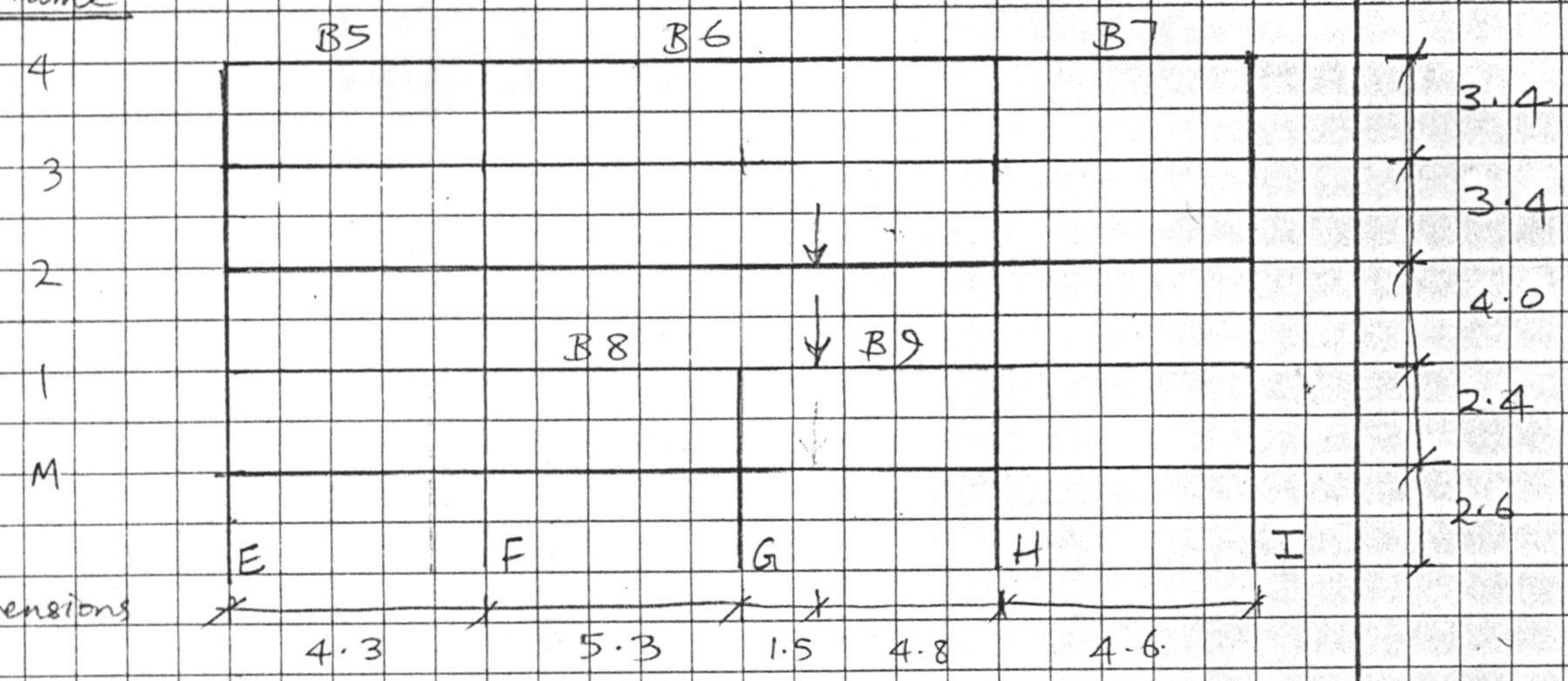
Gravity Loadings

(A = 10)

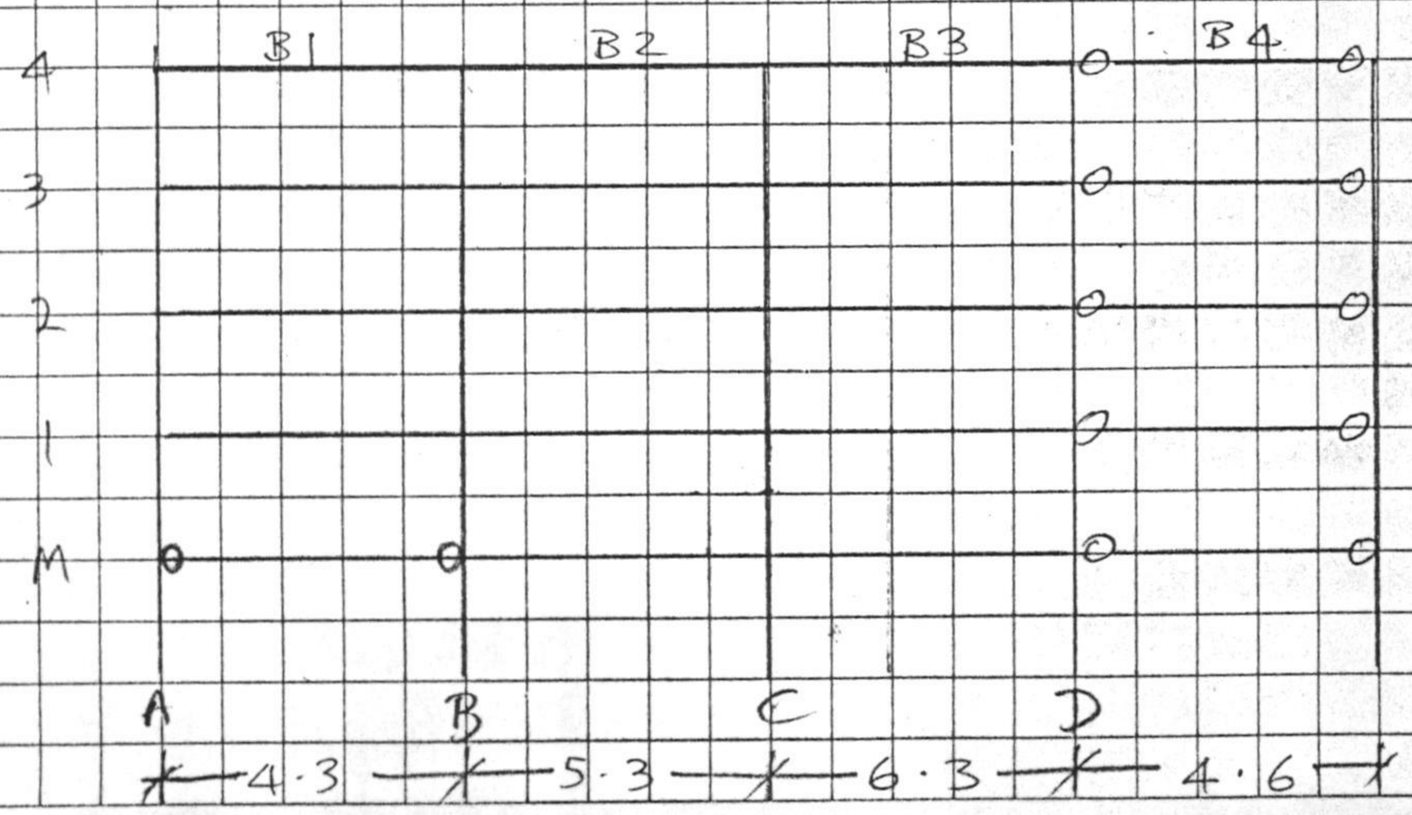
North End

South End

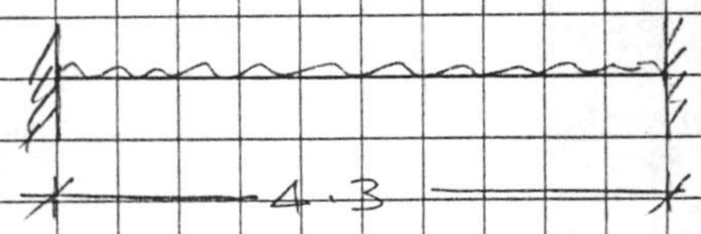
West Frame



East Frame



Beams 4 – 1B1, 4 – MB5



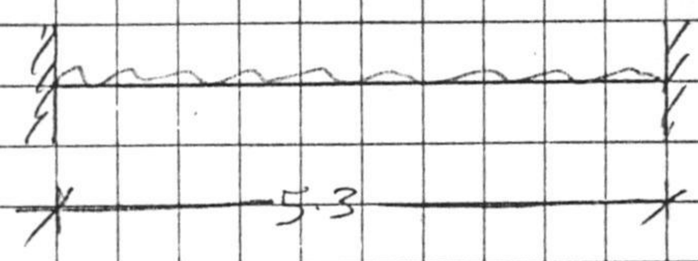
D	93
LL	54
L_R	52
1.4D+1.7L_R	219
D+1.3L_R	161
.9D	84

D 43 x 4.3 = 185 kN

LL 25 x 4.3 = 108 A = 21.5 R = .95 L_R = 103 kN

	FEM	MSM
D	66	33
L_R	37	18
1.4D+1.7L_R	155	77
D+1.3L_R	114	56
.9D	59	30

4 – MB2, 1 – MB8



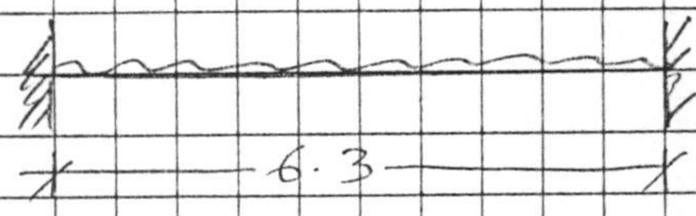
D	114
LL	67
L_R	59
1.4D+1.7L_R	260
D+1.3L_R	191
.9D	103

D 43 x 5.3 = 228

LL 25 x 5.3 = 133 A = 26.5 R = .88 L_R = 117

	FEM	MSM
D	101	50
L_R	52	26
1.4D+1.7L_R	230	114
D+1.3L_R	169	84
.9D	91	45

4 – MB3, MB9



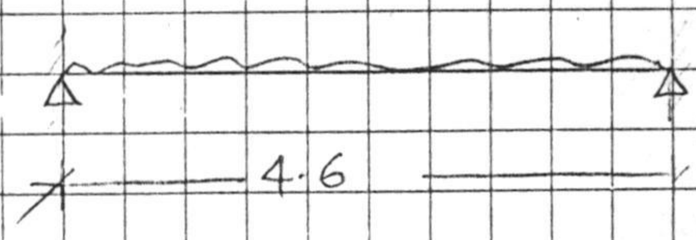
D	136
LL	79
L_R	66
1.4D + 1.7L_R	303
D + 1.3L_R	222
.9D	122

D 43 x 6.3 = 271

LL 25 x 6.3 = 158 A = 31.5 R = .83 L_R = 131

	FEM	MSM
D	142	71
L_R	69	34
1.4D + 1.7L_R	316	157
D + 1.3L_R	232	115
.9D	128	64

4 – MB4, MB1



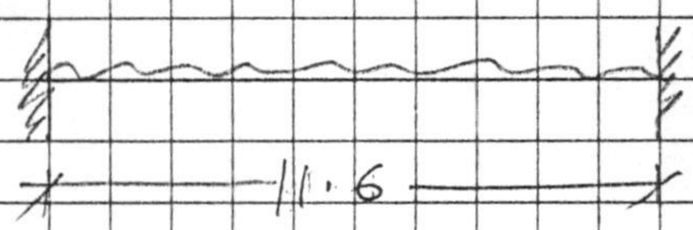
D	99
LL	58
L_R	54
1.4D + 1.7L_R	230

DL 43 x 4.6 = 198

LL 25 x 4.6 = 115 A = 23 R = .93 L_R = 107

	SSM
D	114
L_R	62
1.4D + 1.7L_R	265

Beams 4-3 B6



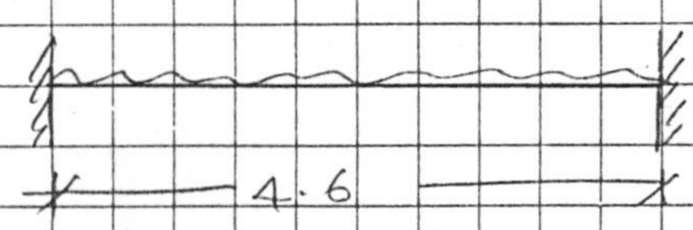
D	174
LL	99
L_R	68
1.4D+1.7L_R	359
D+1.3L_R	262
.9D	157

DL 30 x 11.6 = 348 kN

LL 17 x 11.6 = 197 A = 58 R = .69 L_R = 136

	FEM	MSM
D	336	168
L_R	131	66
1.4D+1.7L_R	693	347
D+1.3L_R	506	254
.9D	302	151

Beams 4-MB7



D	69
LL	58
L_R	54
1.4D+1.7L_R	188
D+1.3L_R	139
.9D	62

DL 30 x 4.6 = 138

LL 25 x 4.6 = 115 A = 23 R = .93 L_R = 107

	FEM	MSM
D	53	26
L_R	41	21
1.4D+1.7L_R	144	72
D+1.3L_R	106	53
.9D	48	23

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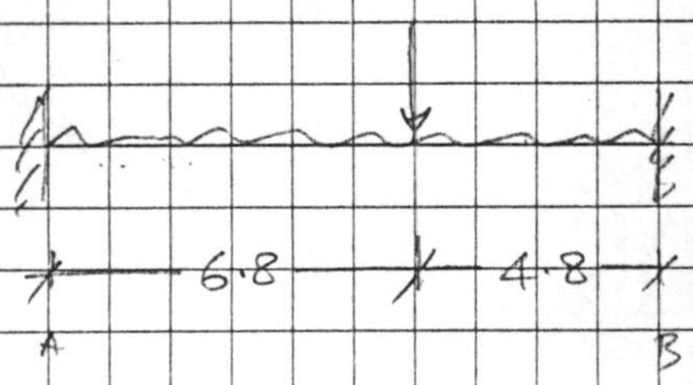
Beam 2B6

D	146	D	148
LL	100	LL	105
L_R	66	L_R	69
1.4D+1.7L_R	317	1.4D+1.7L_R	325
D+1.3L_R	232	D+1.3L_R	238
.9D	131	.9D	133



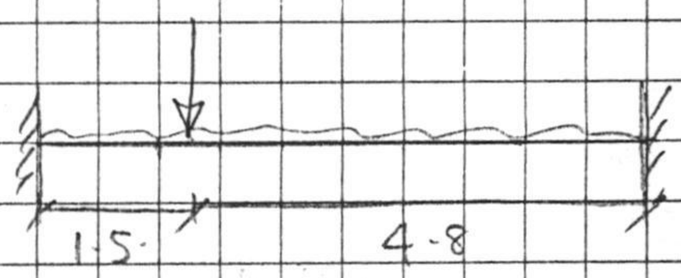
DL - UDL 24 x 11.6 = 278
- PL 16
294

LL - UDL 15 x 11.6 = 174. L_R = 115
- PL 31 20
205 A = 68 R = .66 45

	FEM_A	FEM_B	MSM
D	284 + 19 = 303	284 + 26 = 310	142 + 22 = 164
L_R	168 + 36 = 204	168 + 51 = 219	84 + 42 = 126
1.4D+1.7L_R	771	806	444
D+1.3L_R	568	595	328
.9D	273	279	148

Beam 1B9

D	88	D	79
LL	71	LL	55
L_R	54	L_R	42
1.4D+1.7L_R	215	1.4D+1.7L_R	182
D+1.3L_R	158	D+1.3L_R	134
.9D	79	.9D	71



DL UDL 24 x 6.3 = 151
PL 16
167

LL UDL 15 x 6.3 = 95 72
PL 31 24
126 A = 42 R = .76 L_R = 96

	FEM_A	FEM_B	M_C	MSM
D	79 + 14 = 93	79 + 4 = 83	10 + 7 = 17	40 + 5 = 45
L_R	38 + 27 = 65	38 + 8 = 46	5 + 13 = 18	19 + 9 = 28
1.4D+1.7L_R	241	194	154	111
D+1.3L_R	178	143	40	81
.9D	84	75	45	41

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CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 21

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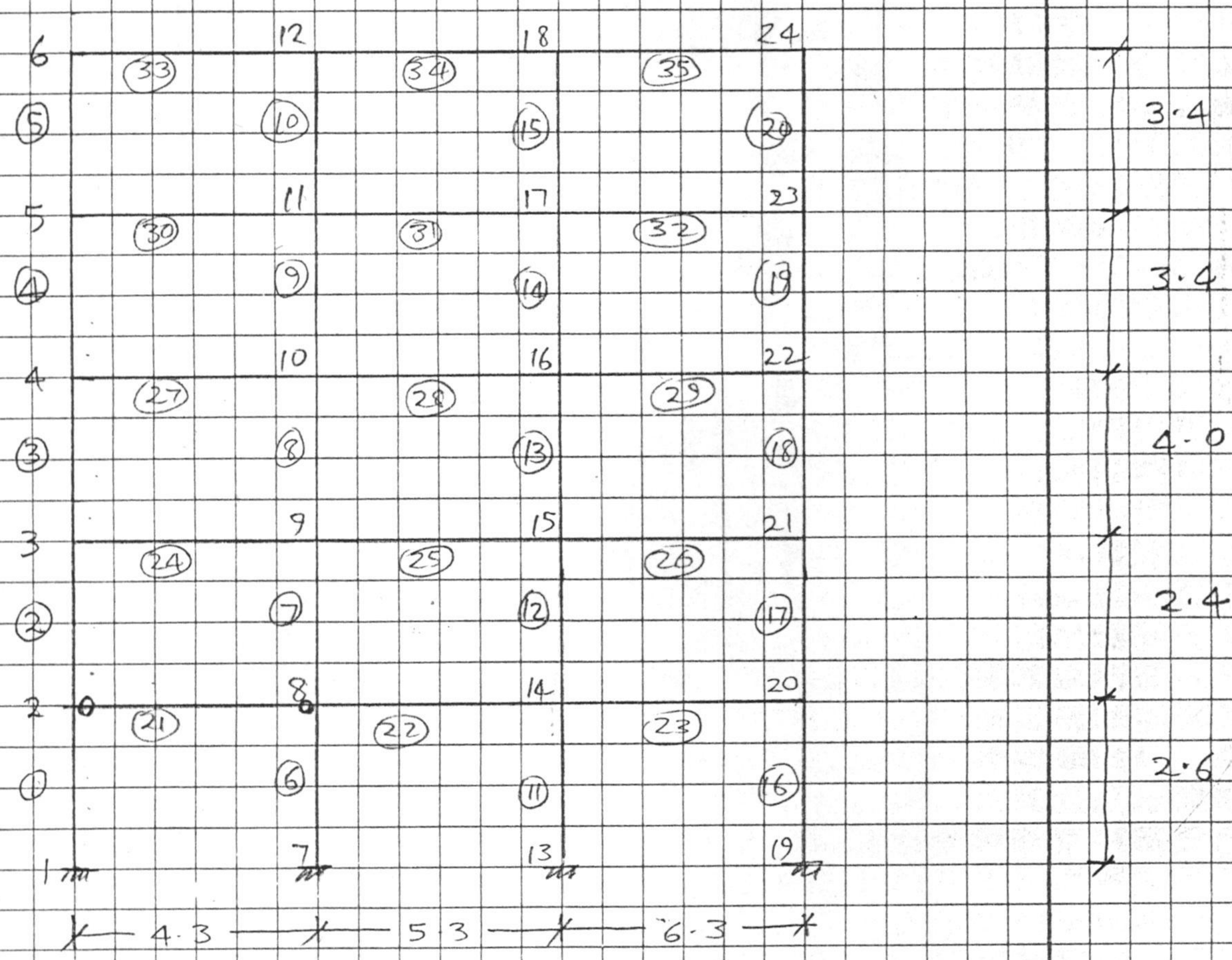
DATE 28/8/86

Computer Model - Frame 80

East Frame



24 joints
35 mbrs
4 supports

$E = 4700\sqrt{f'_c} = 2.35\ E+07$ kPa

Max node difference = 6

Mbrs

	x/s Area (m^2)	I_{xx} (m^4)	Type
1-5	350 x 800	0.28	.002	1
6-20	800 x 500	0.40	.016	1
21	500 x 500	0.25	.004	4? ← Look up book (p. 25 also) mbr pinned both ends
22-35	800 x 500	0.40	.016	1

$A = A_g$

Assume $I_{cr} = .75\ I_g$ for consistency with existing building analysis

Coords

	x	y		x	y
1	0	0	13	9.6	0
2	0	2.6	14	9.6	2.6
3	0	5	15	9.6	5
4	0	9	16	9.6	9
5	0	12.4	17	9.6	12.4
6	0	15.8	18	9.6	15.8
7	4.3	0	19	15.9	0
8	4.3	2.6	20	15.9	2.6
9	4.3	5	21	15.9	5
10	4.3	9	22	15.9	9
11	4.3	12.4	23	15.9	12.4
12	4.3	15.8	24	15.9	15.8

Nodal Loads

Load Case	Joints				P-X (kN)
① E	2	8	14	20	8
	3	9	15	21	39
	4	10	16	22	65
	5	11	17	23	85
	6	12	18	24	60

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CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 23

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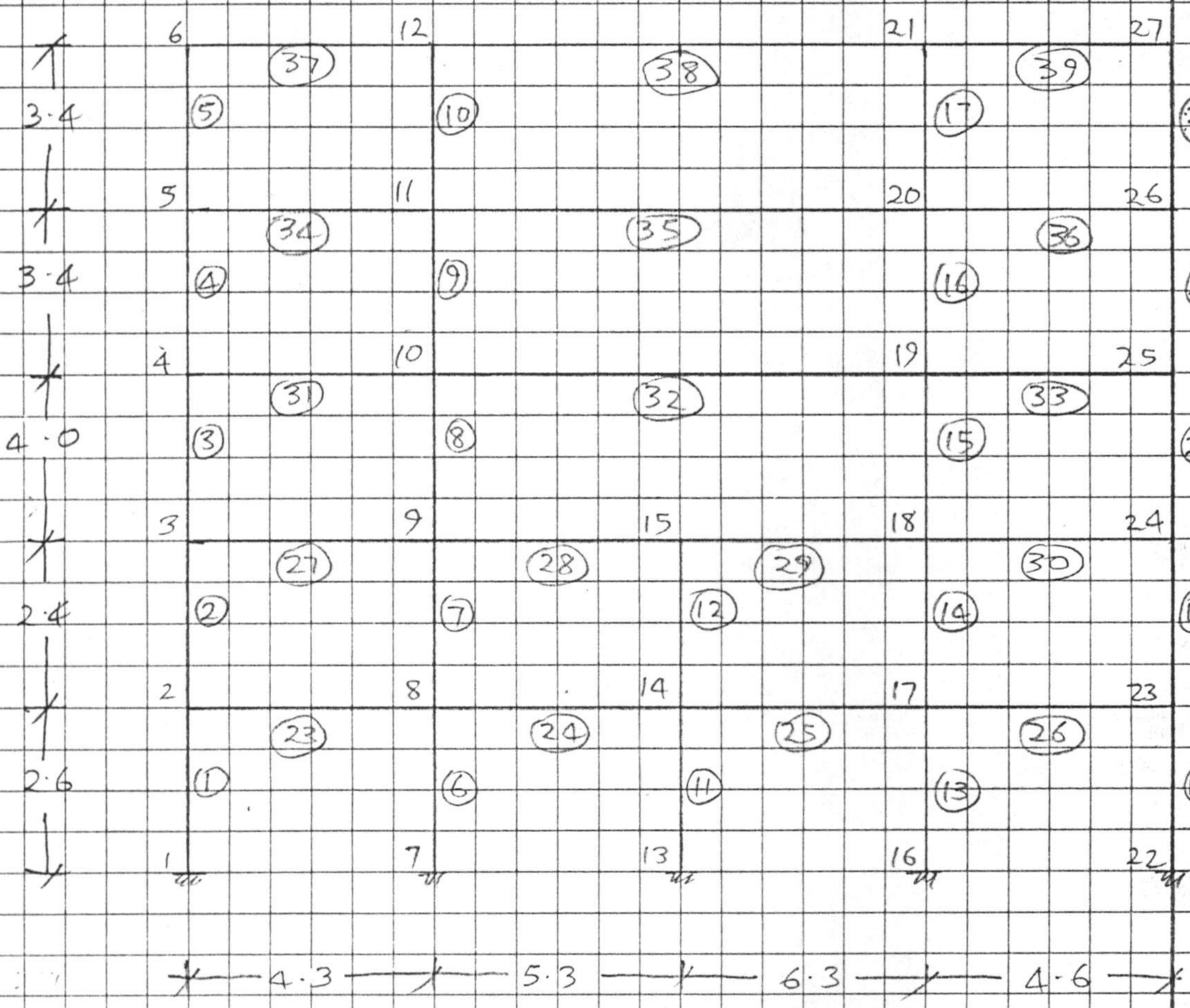
West Frame



27 joints

39 mbrs

5 supports

E = 2·35 E+07 kPa

Max node Δ = 9

Mbrs

	X/S	Area (m^2)	I_{xx} (m^4)	Type
1–17	800x500	0·40	·016	1
18–22	350 x 800	0·28	·002	1
23–39	800 x 500	0·40	·016	1

Coords

	x	y		x	y
1	0	0	15	9.6	5
2	0	2.6	16	15.9	0
3	0	5	17	15.9	2.6
4	0	9	18	15.9	5
5	0	12.4	19	15.9	9
6	0	15.8	20	15.9	12.4
7	4.3	0	21	15.9	15.8
8	4.3	2.6	22	20.5	0
9	4.3	5	23	20.5	2.6
10	4.3	9	24	20.5	5
11	4.3	12.4	25	20.5	9
12	4.3	15.8	26	20.5	12.4
13	9.6	0	27	20.5	15.8
14	9.6	2.6			

Nodal Loads

Load Case	Joints					P-X
① E	2	8	14	17	23	7
	3	9	15	18	24	31
	4	10		19	25	65
	5	11		20	26	85
	6	12		21	27	60

FRAME 80 V1.0

FRAME 80 V1.0

STRUCTURE TITLE : WMCE

LOAD CASE TITLE : 1A(E)

JOINT DISPLACEMENTS

JOINT	D-X	D-Y	R-Z
1	0.0000E+00	0.0000E+00	0.0000E+00
2	3.1128E-03	1.7016E-04	-2.1827E-03
3	7.3085E-03	3.2723E-04	-1.6493E-04
4	1.6336E-02	4.9024E-04	-2.4032E-04
5	2.1275E-02	5.5026E-04	-2.1605E-04
6	2.3707E-02	5.6529E-04	-1.2541E-04
7	0.0000E+00	0.0000E+00	0.0000E+00
8	3.0722E-03	8.1169E-05	-1.4313E-03
9	7.2833E-03	1.0523E-04	-1.2701E-03
10	1.6312E-02	1.2819E-04	-1.1739E-03
11	2.1252E-02	1.3795E-04	-6.8925E-04
12	2.3692E-02	1.4189E-04	-3.0992E-04
13	0.0000E+00	0.0000E+00	0.0000E+00
14	3.0334E-03	-4.3191E-05	-1.0963E-03
15	7.2439E-03	-6.7910E-05	-1.3198E-03
16	1.6296E-02	-9.3750E-05	-1.1381E-03
17	2.1241E-02	-1.0401E-04	-6.8679E-04
18	2.3687E-02	-1.0650E-04	-2.8149E-04
19	0.0000E+00	0.0000E+00	0.0000E+00
20	2.9719E-03	-1.5709E-04	-1.4011E-03
21	7.2624E-03	-2.6638E-04	-1.6753E-03
22	1.6287E-02	-3.7761E-04	-1.5313E-03
23	2.1252E-02	-4.1912E-04	-8.5023E-04
24	2.3703E-02	-4.3109E-04	-4.0376E-04

MEMBER FORCES

MMBR	J--J		<---------- J A ---------->			<---------- J B ---------->		
			AXIAL	SHEAR	MOMENT	AXIAL	SHEAR	MOMENT
1	1	2	-4.31E+02	8.83E+00	5.09E+01	4.31E+02	-8.83E+00	-2.80E+01
2	2	3	-4.31E+02	5.62E+01	2.80E+01	4.31E+02	-5.62E+01	1.07E+02
3	3	4	-2.68E+02	7.24E+01	1.46E+02	2.68E+02	-7.24E+01	1.44E+02
4	4	5	-1.16E+02	5.97E+01	1.01E+02	1.16E+02	-5.97E+01	1.02E+02
5	5	6	-2.91E+01	2.66E+01	4.39E+01	2.91E+01	-2.66E+01	4.64E+01
6	7	8	-2.93E+02	3.11E+02	6.11E+02	2.93E+02	-3.11E+02	1.97E+02
7	8	9	-9.42E+01	3.16E+02	3.54E+02	9.42E+01	-3.16E+02	4.05E+02
8	9	10	-5.40E+01	2.92E+02	5.75E+02	5.40E+01	-2.92E+02	5.93E+02
9	10	11	-2.70E+01	2.03E+02	2.92E+02	2.70E+01	-2.03E+02	3.99E+02
10	11	12	-1.09E+01	8.51E+01	1.03E+02	1.09E+01	-8.51E+01	1.87E+02
11	13	14	1.56E+02	4.13E+02	6.95E+02	-1.56E+02	-4.13E+02	3.78E+02
12	14	15	9.68E+01	4.28E+02	5.49E+02	-9.68E+01	-4.28E+02	4.79E+02
13	15	16	6.07E+01	2.92E+02	5.66E+02	-6.07E+01	-2.92E+02	6.00E+02
14	16	17	2.84E+01	2.12E+02	3.10E+02	-2.84E+01	-2.12E+02	4.10E+02
15	17	18	6.88E+00	9.18E+01	1.11E+02	-6.88E+00	-9.18E+01	2.01E+02
16	19	20	5.68E+02	2.95E+02	5.87E+02	-5.68E+02	-2.95E+02	1.81E+02
17	20	21	4.28E+02	1.95E+02	2.78E+02	-4.28E+02	-1.95E+02	1.92E+02
18	21	22	2.61E+02	1.84E+02	3.55E+02	-2.61E+02	-1.84E+02	3.82E+02
19	22	23	1.15E+02	1.05E+02	1.04E+02	-1.15E+02	-1.05E+02	2.54E+02
20	23	24	3.31E+01	3.66E+01	1.28E+01	-3.31E+01	-3.66E+01	1.12E+02
21	2	8	5.54E+01	0.00E+00	0.00E+00	-5.54E+01	0.00E+00	0.00E+00
22	8	14	6.88E+01	-1.99E+02	-5.52E+02	-6.88E+01	1.99E+02	-5.04E+02
23	14	20	9.19E+01	-1.40E+02	-4.22E+02	-9.19E+01	1.40E+02	-4.59E+02
24	3	9	5.52E+01	-1.62E+02	-2.53E+02	-5.52E+01	1.62E+02	-4.46E+02
25	9	15	6.97E+01	-2.03E+02	-5.34E+02	-6.97E+01	2.03E+02	-5.41E+02
26	15	21	-2.76E+01	-1.67E+02	-5.04E+02	2.76E+01	1.67E+02	-5.46E+02
27	4	10	5.23E+01	-1.52E+02	-2.45E+02	-5.23E+01	1.52E+02	-4.08E+02
28	10	16	2.88E+01	-1.79E+02	-4.77E+02	-2.88E+01	1.79E+02	-4.72E+02
29	16	22	1.38E+01	-1.47E+02	-4.38E+02	-1.38E+01	1.47E+02	-4.85E+02
30	5	11	5.18E+01	-8.71E+01	-1.46E+02	-5.18E+01	8.71E+01	-2.29E+02
31	11	17	1.85E+01	-1.03E+02	-2.74E+02	-1.85E+01	1.03E+02	-2.73E+02
32	17	23	-1.63E+01	-8.17E+01	-2.48E+02	1.63E+01	8.17E+01	-2.67E+02
33	6	12	3.34E+01	-2.91E+01	-4.64E+01	-3.34E+01	2.91E+01	-7.87E+01
34	12	18	8.36E+00	-4.00E+01	-1.08E+02	-8.36E+00	4.00E+01	-1.04E+02
35	18	24	-2.34E+01	-3.31E+01	-9.69E+01	2.34E+01	3.31E+01	-1.12E+02

SUPPORT REACTIONS

JOINT	R-X	R-Y	R-Z
1	-8.8320E+00	-4.3064E+02	5.0939E+01
7	-3.1101E+02	-2.9346E+02	6.1131E+02
13	-4.1285E+02	1.5615E+02	6.9525E+02
19	-2.9534E+02	5.6795E+02	5.8656E+02

LOAD SUMMATION

HORIZONTAL	APPLIED	1028.00	REACTION	-1028.04	BALANCE	-0.04
VERTICAL	APPLIED	0.00	REACTION	0.00	BALANCE	0.00

FRAME 88 V1:8

STRUCTURE TITLE : WMCW

LOAD CASE TITLE : 1*(E)

JOINT DISPLACEMENTS

JOINT	D-X	D-Y	R-Z
1	0.0000E+00	0.0000E+00	0.0000E+00
2	1.8584E-03	2.4133E-04	-8.2041E-04
3	4.7057E-03	4.2427E-04	-1.2624E-03
4	1.3342E-02	6.2826E-04	-1.4783E-03
5	1.8733E-02	7.0151E-04	-9.5317E-04
6	2.1686E-02	7.1990E-04	-5.5511E-04
7	0.0000E+00	0.0000E+00	0.0000E+00
8	1.8962E-03	-1.4912E-04	-6.3944E-04
9	4.6417E-03	-2.7704E-04	-1.0074E-03
10	1.3348E-02	-4.4065E-04	-1.2880E-03
11	1.8740E-02	-4.9672E-04	-8.4734E-04
12	2.1679E-02	-5.0914E-04	-4.3316E-04
13	0.0000E+00	0.0000E+00	0.0000E+00
14	1.9514E-03	-1.7834E-05	-7.7804E-04
15	4.5234E-03	-2.6011E-05	-3.9981E-04
16	0.0000E+00	0.0000E+00	0.0000E+00
17	1.9207E-03	5.9976E-05	-6.9919E-04
18	4.6153E-03	1.1464E-04	-1.1143E-03
19	1.3393E-02	1.8806E-04	-1.4317E-03
20	1.8795E-02	2.1398E-04	-8.7744E-04
21	2.1694E-02	2.1892E-04	-4.2630E-04

22	0.0000E+00	0.0000E+00	0.0000E+00
23	1.9392E-03	-1.9192E-04	-2.3653E-04
24	4.6230E-03	-3.3695E-04	-3.0322E-04
25	1.3423E-02	-4.9952E-04	-2.5800E-04
26	1.8819E-02	-5.6108E-04	-2.9392E-04
27	2.1709E-02	-5.7668E-04	-2.0278E-04

MEMBER FORCES

MMBR	J--J		<---------- J A ---------->			<---------- J B ---------->		
			AXIAL	SHEAR	MOMENT	AXIAL	SHEAR	MOMENT
1	1	2	-8.72E+02	2.03E+02	3.83E+02	8.72E+02	-2.03E+02	1.46E+02
2	2	3	-7.17E+02	1.14E+02	2.06E+02	7.17E+02	-1.14E+02	6.70E+01
3	3	4	-4.79E+02	2.22E+02	4.65E+02	4.79E+02	-2.22E+02	4.25E+02
4	4	5	-2.03E+02	1.44E+02	1.87E+02	2.03E+02	-1.44E+02	3.03E+02
5	5	6	-5.08E+01	4.47E+01	3.19E+01	5.08E+01	-4.47E+01	1.20E+02
6	7	8	5.39E+02	2.73E+02	4.48E+02	-5.39E+02	-2.73E+02	2.63E+02
7	8	9	5.01E+02	2.51E+02	3.59E+02	-5.01E+02	-2.51E+02	2.44E+02
8	9	10	3.84E+02	2.90E+02	6.07E+02	-3.84E+02	-2.90E+02	5.54E+02
9	10	11	1.55E+02	2.02E+02	2.95E+02	-1.55E+02	-2.02E+02	3.93E+02
10	11	12	3.43E+01	8.75E+01	1.03E+02	-3.43E+01	-8.75E+01	1.95E+02
11	13	14	6.45E+01	2.41E+02	4.26E+02	-6.45E+01	-2.41E+02	2.01E+02
12	14	15	3.20E+01	3.78E+02	3.94E+02	-3.20E+01	-3.78E+02	5.13E+02
13	16	17	-2.17E+02	2.60E+02	4.39E+02	2.17E+02	-2.60E+02	2.37E+02
14	17	18	-2.14E+02	1.69E+02	2.68E+02	2.14E+02	-1.69E+02	1.38E+02
15	18	19	-1.73E+02	2.60E+02	5.49E+02	1.73E+02	-2.60E+02	4.90E+02
16	19	20	-7.17E+01	1.69E+02	2.27E+02	7.17E+01	-1.69E+02	3.49E+02
17	20	21	-1.37E+01	7.85E+01	8.35E+01	1.37E+01	-7.85E+01	1.83E+02
18	22	23	4.86E+02	5.24E+01	7.23E+01	-4.86E+02	-5.24E+01	6.38E+01
19	23	24	3.98E+02	8.31E+01	1.01E+02	-3.98E+02	-8.31E+01	9.84E+01
20	24	25	2.67E+02	6.77E+01	1.35E+02	-2.67E+02	-6.77E+01	1.36E+02
21	25	26	1.19E+02	6.40E+01	1.09E+02	-1.19E+02	-6.40E+01	1.08E+02
22	26	27	3.02E+01	2.94E+01	4.86E+01	-3.02E+01	-2.94E+01	5.12E+01
23	2	8	-8.27E+01	-1.56E+02	-3.51E+02	8.27E+01	1.56E+02	-3.19E+02
24	8	14	-9.80E+01	-1.18E+02	-3.02E+02	9.80E+01	1.18E+02	-3.22E+02
25	14	17	4.58E+01	-8.54E+01	-2.74E+02	-4.58E+01	8.54E+01	-2.64E+02
26	17	23	-3.77E+01	-8.81E+01	-2.40E+02	3.77E+01	8.81E+01	-1.65E+02
27	3	9	1.40E+02	-2.37E+02	-5.32E+02	-1.40E+02	2.37E+02	-4.88E+02
28	9	15	2.10E+02	-1.21E+02	-3.63E+02	-2.10E+02	1.21E+02	-2.77E+02
29	15	18	-1.37E+02	-8.86E+01	-2.36E+02	1.37E+02	8.86E+01	-3.22E+02
30	18	24	-1.56E+01	-1.30E+02	-3.66E+02	1.56E+01	1.30E+02	-2.33E+02
31	4	10	-1.31E+01	-2.77E+02	-6.12E+02	1.31E+01	2.77E+02	-5.79E+02
32	10	19	-3.60E+01	-4.74E+01	-2.70E+02	3.60E+01	4.74E+01	-2.80E+02
33	19	25	-6.13E+01	-1.48E+02	-4.37E+02	6.13E+01	1.48E+02	-2.45E+02
34	5	11	-1.47E+01	-1.52E+02	-3.35E+02	1.47E+01	1.52E+02	-3.17E+02
35	11	20	-4.44E+01	-3.10E+01	-1.79E+02	4.44E+01	3.10E+01	-1.81E+02
36	20	26	-5.04E+01	-8.90E+01	-2.52E+02	5.04E+01	8.90E+01	-1.57E+02
37	6	12	1.53E+01	-5.08E+01	-1.20E+02	-1.53E+01	5.08E+01	-9.86E+01
38	12	21	-1.22E+01	-1.65E+01	-9.60E+01	1.22E+01	1.65E+01	-9.56E+01
39	21	27	-3.06E+01	-3.02E+01	-8.77E+01	3.06E+01	3.02E+01	-5.12E+01

SUPPORT REACTIONS

JOINT	R-X	R-Y	R-Z
1	-2.0327E+02	-8.7249E+02	3.8290E+02
7	-2.7338E+02	5.3914E+02	4.4787E+02
13	-2.4131E+02	6.4478E+01	4.2622E+02
16	-2.5974E+02	-2.1683E+02	4.3877E+02
22	-5.2360E+01	4.8571E+02	7.2343E+01

LOAD SUMMATION

HORIZONTAL	APPLIED	1030.00	REACTION	-1030.06	BALANCE	-0.06
VERTICAL	APPLIED	0.00	REACTION	0.00	BALANCE	0.00

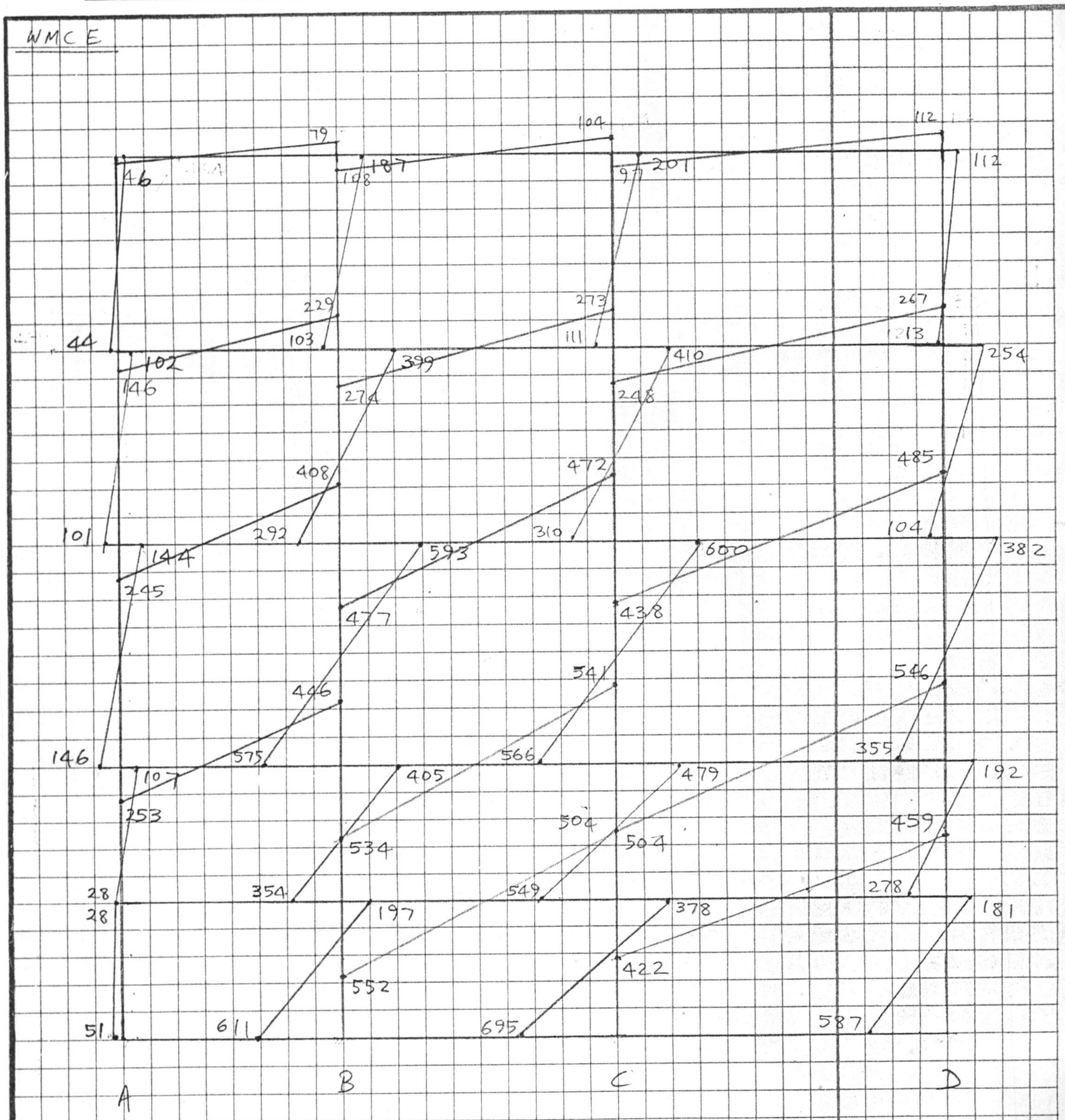
SMITH LEUCHARS LTD
CIVIL & STRUCTURAL ENGINEERS

JOB No. _____ PAGE 30

JOB _____ BY WZM

DATE 1/10/86

WMCE



Lev	Δ new	Δ exist. (Stage I)
4	23·7	
3	21·3	26
2	16·3	21
1	7·3	11
M	3·1	—

⇒ Frame is of right order of stiffness to be compatible with existing stage 1 bldg

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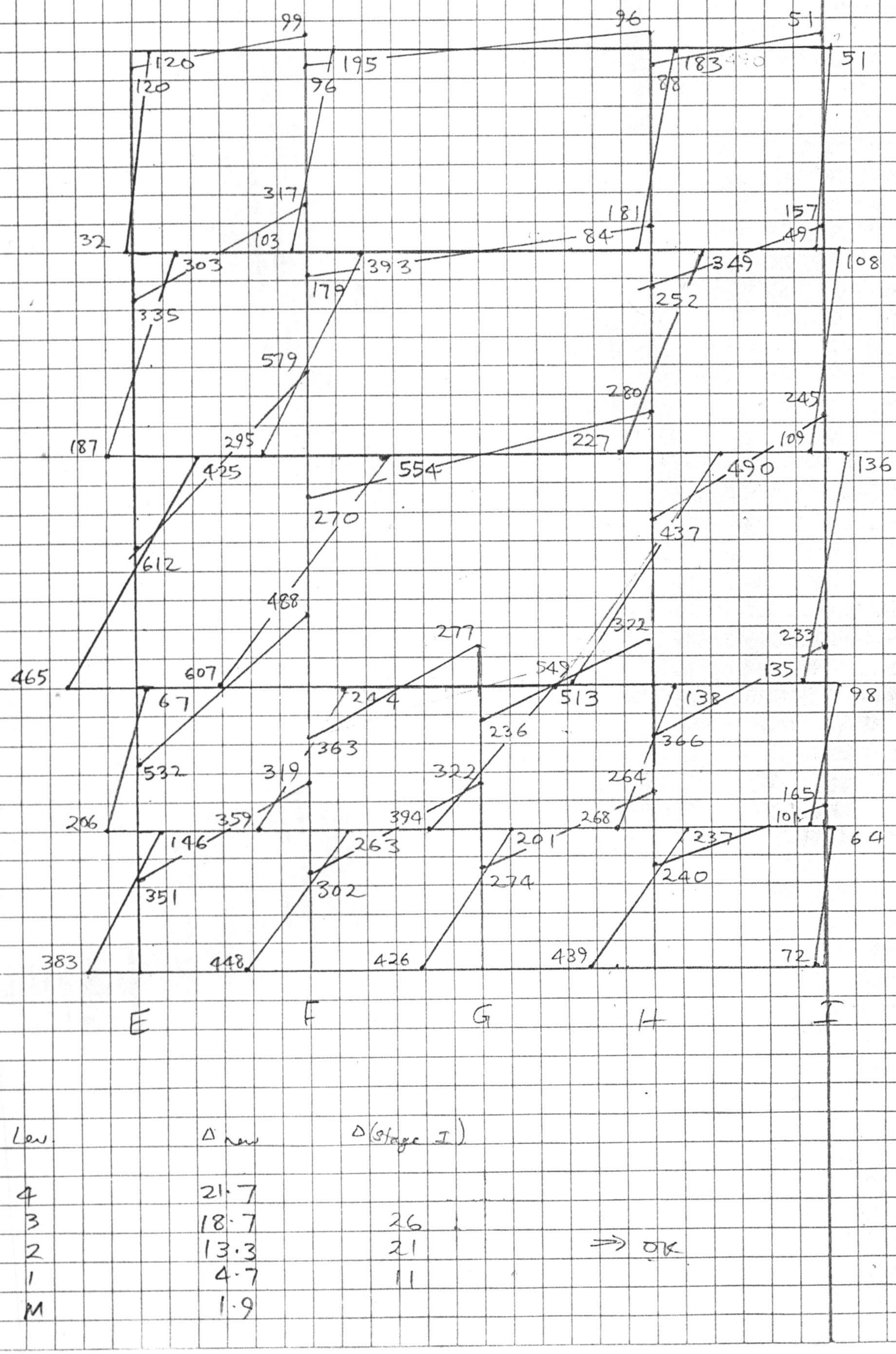
CIVIL & STRUCTURAL ENGINEERS

JOB No. _____ PAGE 31

JOB _____ BY WZM

DATE 1/10/86

WMCW



Lev.	Δ new	Δ (Stage I)	
4	21.7		
3	18.7	26	
2	13.3	21	→ OK
1	4.7	11	
M	1.9		

SMITH LEUCHARS LTD

CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 32

JOB _____ BY WJM

DATE 1/10/86

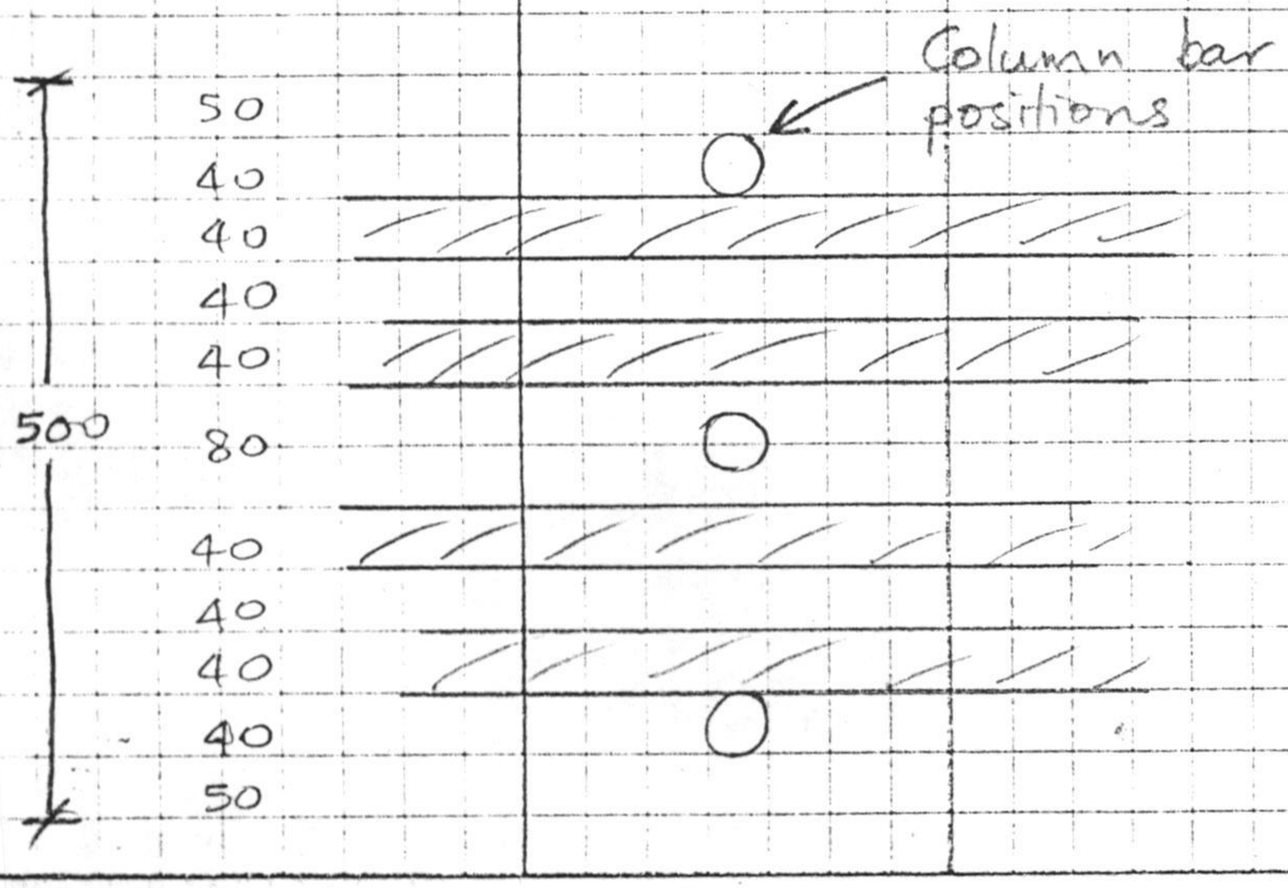
Beam Section 800 x 500

$f_y = 380$ $\rho_{min} = .0037$

$f'_c = 25$ MPa

$\rho_{max} = .75\rho_b$
$= .0218$

Bars	A_s (mm²)	d (mm)	ρ	R_u	M_u (kNm)	M_o (kNm)
3HD24	1357	730	.0037	1.34	321	
2HD24 + 2HD20	1533	730	.0042	1.50	360	
4HD24	1810	730	.0050	1.80	432	
4HD28	2463	730	.0067	2.38	571	
4HD32	3217	730	.0088	3.12	748	



800 x 500
Beam bar positions

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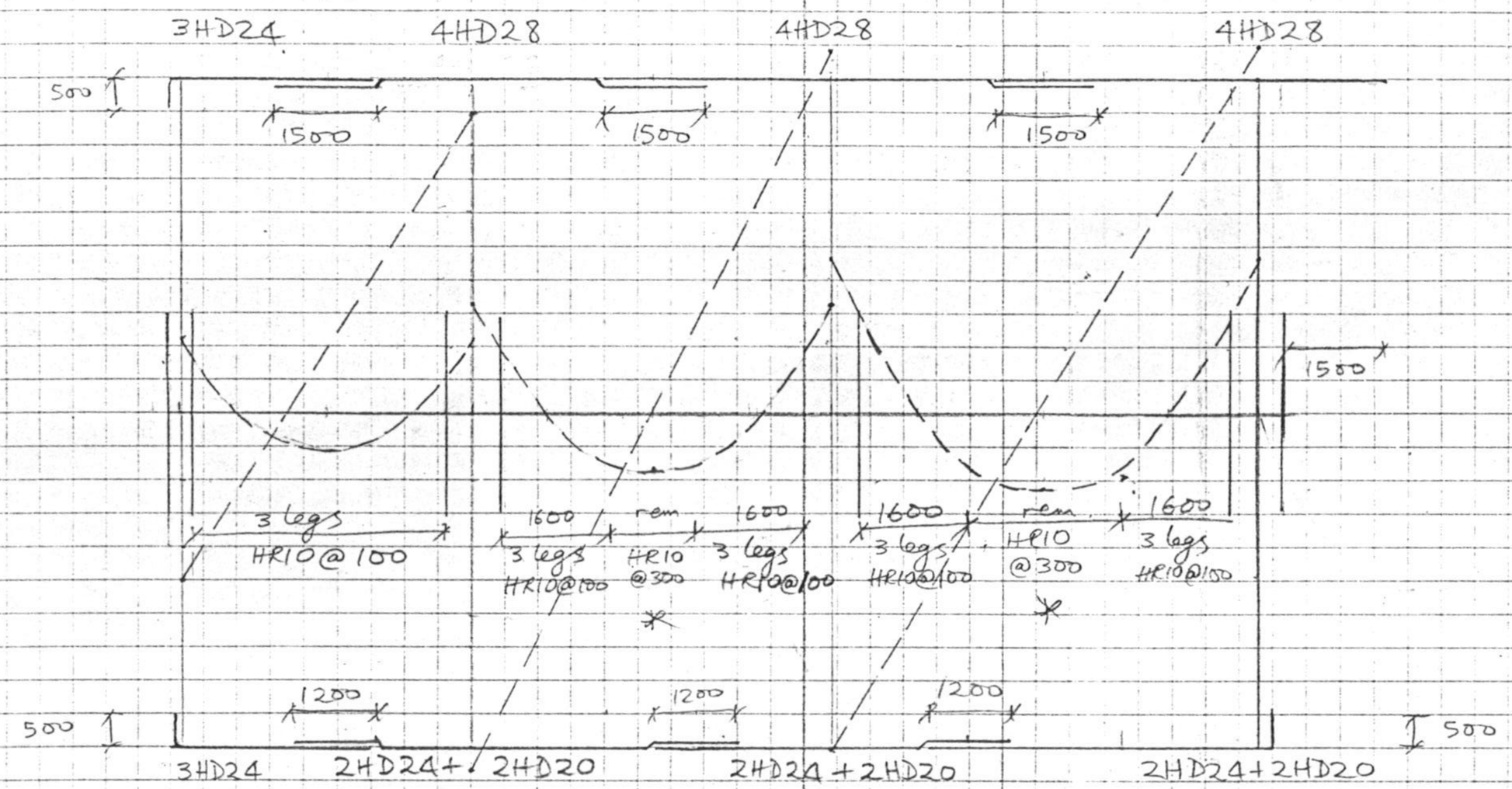
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

East Frame - 800 x 500 beams — all levels same except for pinned beams



* Transverse Reo Note

If transverse reo region @ midspan becomes less than 1000, extend end region transverse reo. for full length of beam.

D+1.3Lr	80	60	60	100	90	100	140	120	140
E(±)	220		370	450		460	420		480
D+1.3Lr+E	-300		+310	-550		+360	-560		+340
D+1.3Lr-E	+140		-430	+350		-560	+280		-620
D+1.3Lr-E redist.	+210		-360	+350		-560	+330		-570
Design M_u^-	-300		-550			-560			-570
M_u^+	+210		+350			+360			+340
Seismic S.F		163			203			167	
Vu 1.4D+1.7Lr	219		219	260		260	303		303
Vu D+1.3Lr	161		161	191		191	222		222
Vu max	324		324	394		394	389		389

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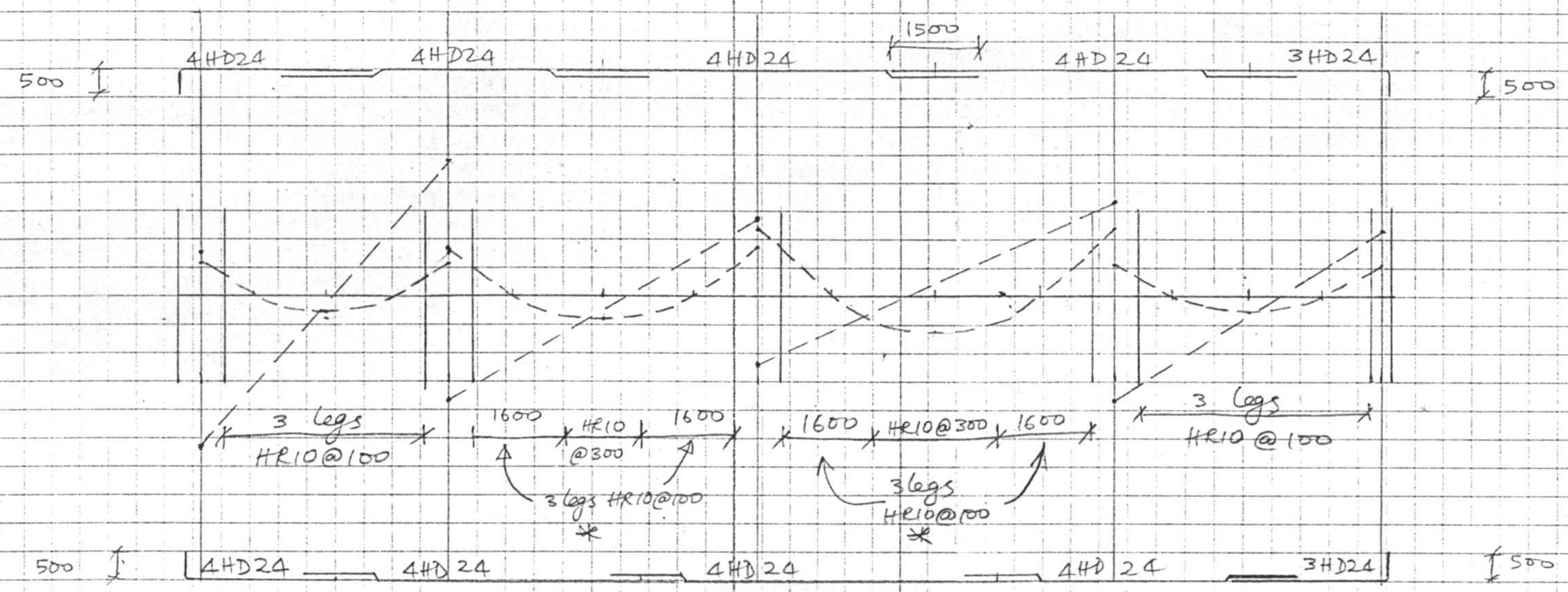
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

West Frame – levels M, 1



Transverse Reo

* Delete middle zone if becomes less than 1000 long

D+1·3L_R	80	60	80	100	90	100	-170	120	-170	-70	50	90
E (±)	430		380	310		220	200		300	310		200
D+1·3L_R+E	-510		+300	-410		+120	-370		+130	-380		+110
D+1·3L_R-E	+350		-460	+210		-320	+30		-470	+240		-290
D+1·3L_R+E redist	-430		+380	-410		+120	-370		+130	-380		+110
D+1·3L_R-E redist	+380		-430	+210		-320	+70		-430	+240		-290

Seismic SF		237			121			89			130	
V_u 1·4D+1·7L_R	219		219	260		260	303		303	188		188
D+1·3L_R	161		161	191		191	222		222	139		139
V_u max	398		398	312		312	311		311	269		269

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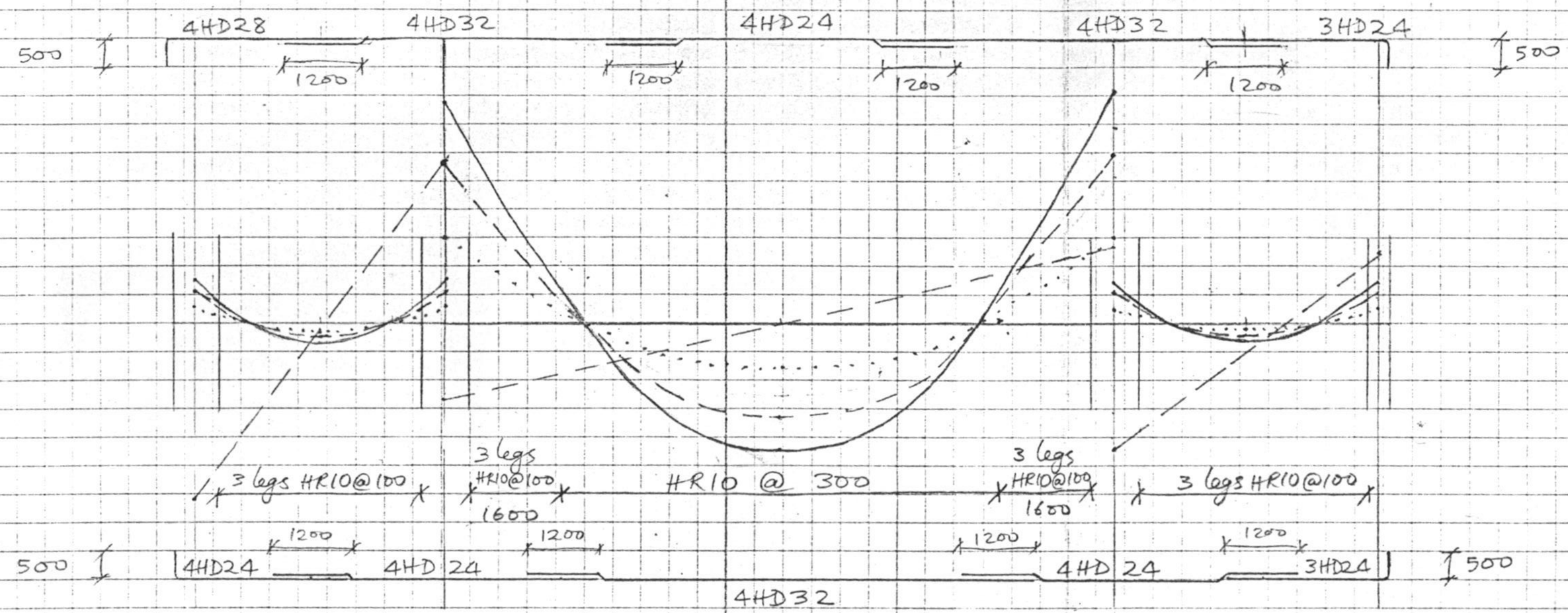
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

West Frame – Levels 2–4



1·4D+1·7Lr				620	450		650			
D+1·3Lr	50	50	50	450	330		490	50	50	90
·9D	30		30	230			240	30		40
E(±)	500		460	250			250	380		210
D+1·3Lr+E	−550		+390	−700	330		−240	−430		+120
D+1·3Lr−E	+450		−510	+200	330		−740	+330		−300
·9D+E	−530		+430	−480			+10	−410		+170
·9D−E	+470		−490	+20			−490	+350		−250
D+1·3Lr−E redist	+430		−530							
·9D−E redist	+430		−530							
Design Mu	−550		−700				−740			−300
	+430		+430		+450		+350			+170
Seismic SF		277			47				148	
Vu 1·4D+1·7Lr	219		219	359			359	188		188
D+1·3Lr	161		161	262			262	139		139
Vu max	438		438	359			359	287		287

Design done with no redistribution to reduce possibility of midspan hinge

SMITH LEUCHARS LTD
CIVIL & STRUCTURAL ENGINEERS

JOB No. _____ PAGE 36

JOB _____ BY WJM

DATE 2/10/86

Transverse Reo 6.5.3

PH Regions $S_{max} = d/4 = 183$ $6d_b = 114$ 150

$A_{te} = 1.5 \times 804 \times 380 \times 150 / 16 \times 380 \times 100 = 113 \text{ mm}^2$.

⇒ HR12 @ 150 ok. (3 legs)
or HR10 @ 100 (3 legs)

PH Region Assume $v_c/2$.

$v_i = 438 \times 10^3 / .85 \times 500 \times 730 = 1.41$ MPa.

$\rho_w = .0050$ $v_c = .6$ $v_c/2 = .3$ $v_s = 1.01$

$A_v = v_s b_w s / f_y = 1.01 \times 500 \times 150 / 380 = 199$

(⇒ 3 legs HR10 @ 150 ok)

Outside PH region. $S_{max} = 730/2 = 365$.

Middle spans only

$v_i = 191 \times 10^3 / .85 \times 500 \times 730 = .62$

$v_s = .62 - .6 = .02$

$A_{v\,min} = .35 b_w s / f_y$

$= .35 \times 500 \times 300 / 380 = 138$

⇒ HR10 @ 300 ok.

Transverse Reo

PH Regions
1600 from face
3 legs HR10 @ 100

Rem.
HR10 @ 300

Gravity Beams

Beams MB1, 4-MB4

$M_u = 265$ kNm $V_u = 230$ kN

Try 500x500

$R_u = 265 \times 10^6 / .9 \times 500 \times 430^2 = 3.18$ $\rho = .009$

$A_s = 1935$ mm^2

$\Rightarrow$ 4HD28

$v_i = 230 \times 10^3 / .85 \times 500 \times 430 = 1.26$ MPa

$\rho_w = .011$ $v_c = .92$ $v_s = .34$

$A_{v\,min} = .35 b_w s / f_y$ $s_{max} = d/2 = 215$.

$= .35 \times 500 \times 200 / 380 = 92$ mm^2

$\Rightarrow$ HR10 @ 200 OK

Pinned End Detail

Try 300 x 500 connection

$v_i = 230 \times 10^3 / .85 \times 500 \times 230 = 2.35$

$.2 f'_c = 5$ MPa $\rightarrow$ ok

$A_{vf} = V_u - P_u / \phi \mu f_y = 230 \times 10^3 / .85 \times .7 \times 380 = 1017$ mm^2

$\Rightarrow$ 6HD16. (3T & B)

End stps to take reaction

$A_v = .230 \times 10^3 / .9 \times 380 = 673$ mm^2

$\Rightarrow$ 673/157 = 4.3
673/226 = 3.0 673/339 = 2.0

Shear

$\rho_w = .0052$ $v_c = .61$ $v_s = 1.74$

$A_v = v_s b_w s / f_y = 1.74 \times 500 \times 50 / 380 = 114$ mm^2

$\Rightarrow$ HR10 @ 50 OK

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CIVIL & STRUCTURAL ENGINEERS

JOB No. _____ PAGE 38

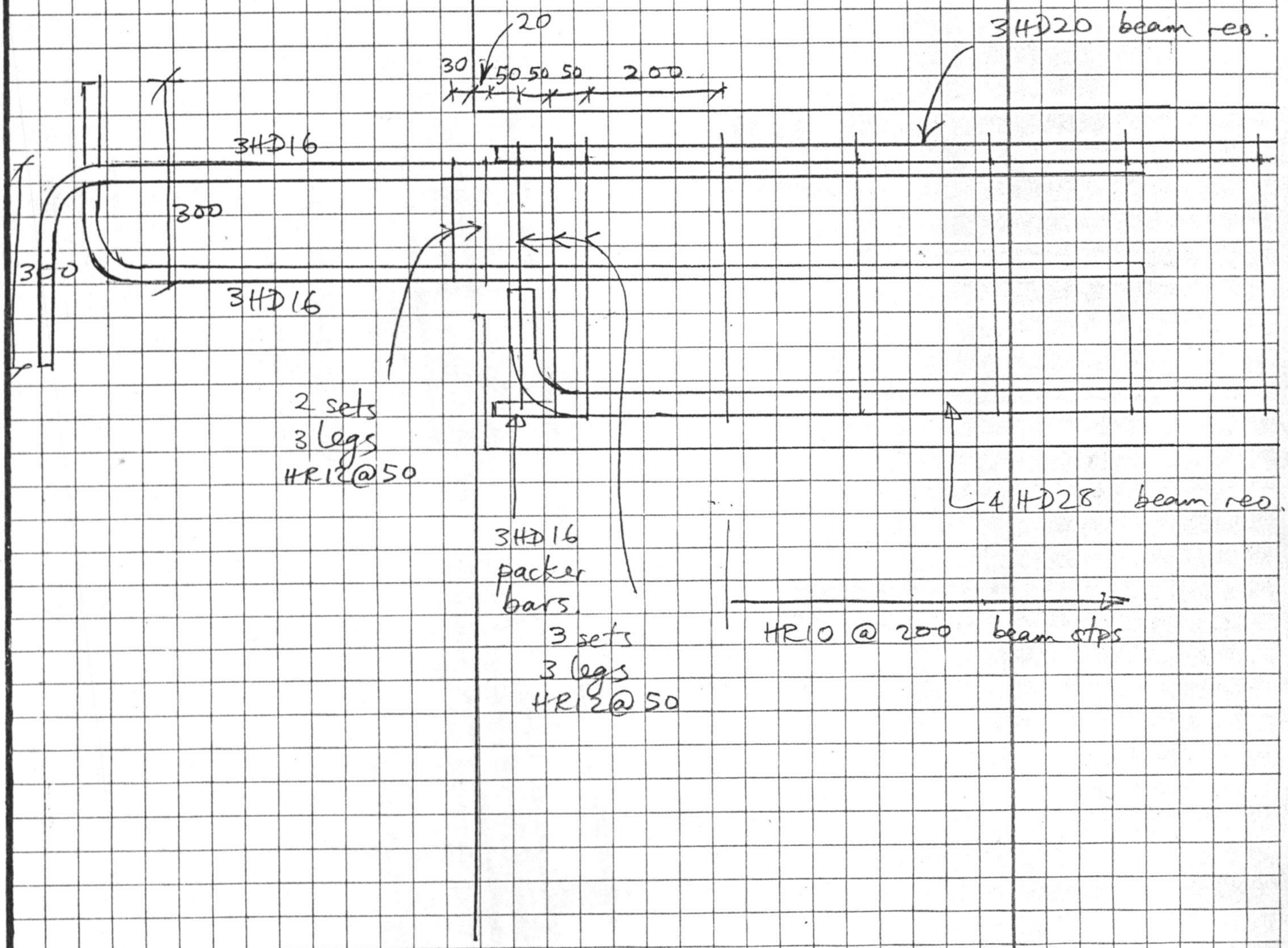
JOB _____ BY WZM

DATE 3/10/86

Gravity Beams — 500 x 500 East Frame — North end level M
— South end levels M-4
(refer pinned end beams shown on frame p. 32)

3HD20 T
4HD28 B
HR10 @ 200.

Pinned End Detail



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CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 39

JOB _____ BY WJM

DATE 2/10/86

COLUMN AXIAL LOADS — EAST FRAME.

COL	LEV	D	LR	E (±)	D + LR	1.4D + 1.7LR	D + 1.3LR + E*	.9D + E*
A	4	93	52	29	145	219	190	55
	3	186	104	116	290	437	437	51
	2	279	156	268	435	656	750	−17
	1	372	208	431	580	874	1073	−96
	M	471	262	431	733	1105	1243	−7
B	4	207	111	111	318	479	362	175
	3	414	222	27	636	957	730	346
	2	621	333	54	954	1436	1108	505
	1	828	444	94	1272	1914	1499	651
	M	1041	557	293	1598	2404	2058	644
C	4	250	125	7	375	563	420	218
	3	500	250	28	750	1125	853	422
	2	750	375	61	1125	1688	1299	614
	1	1000	500	97	1500	2250	1747	803
	M	1250	625	156	1875	2813	2219	969
D	4	235	120	33	355	533	424	179
	3	470	240	115	710	1066	897	308
	2	705	360	261	1065	1599	1434	374
	1	940	480	428	1420	2132	1992	418
	M	1175	600	568	1775	2665	2523	490

Have ignored LL red^{n} factor (cumulative) ⇒ conservative

SMITH LEUCHARS LTD

CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. _____ PAGE 40

JOB _____ BY WZM

DATE 2/10/86

COLUMN AXIAL LOADS – WEST FRAME

COL	LEV	D	LR	E°	D + LR	1.4D + 1.7LR	D+1.3LR+E°	.9D + E°
E	4	93	52	51	145	219	212	33
	3	186	104	203	290	437	524	−36
	2	279	156	479	435	656	961	−228
	1	372	208	717	580	874	1359	−382
	M	465	260	872	725	1093	1675	−454
F	4	267	120	34	387	578	457	206
	3	534	240	155	774	1156	1001	326
	2	773	358	384	1131	1691	1622	312
	1	980	469	501	1449	2169	2091	381
	M	1187	580	539	1767	2648	2480	529
G	1	202	113	32	315	475	381	150
	M	250	238	65	488	755	624	160
H	4	243	122	14	365	548	416	205
	3	486	244	72	730	1095	875	365
	2	703	367	173	1070	1608	1353	460
	1	851	463	214	1314	1979	1667	552
	M	1056	583	217	1639	2470	2031	733
I	4	69	54	30	123	188	169	32
	3	138	108	119	246	377	397	5
	2	207	162	267	369	565	685	−81
	1	276	216	398	492	754	955	−150
	M	345	270	486	615	942	1182	−176

Cols

6.4. Max axial $= .85 \phi P_o$

$= .85 \phi [.85 f'_c (A_g - A_{st}) + f_y A_{st}]$

$= .85 \times .7 [.85 \times 25 (500 \times 800 - 3968) + 380 \times 3968]$

$= 5904$ kN.

6.5. Max axial $= .7 \phi f'_c A_g = 4900$ kN.

or $.7 \phi P_o = .7 \phi [.85 f'_c (A_g - A_{st}) + f_y A_{st}]$

$= 4861$ kN

Max. $P_u = 2813$ kN $\Rightarrow$ ok

$\phi = 0.7$

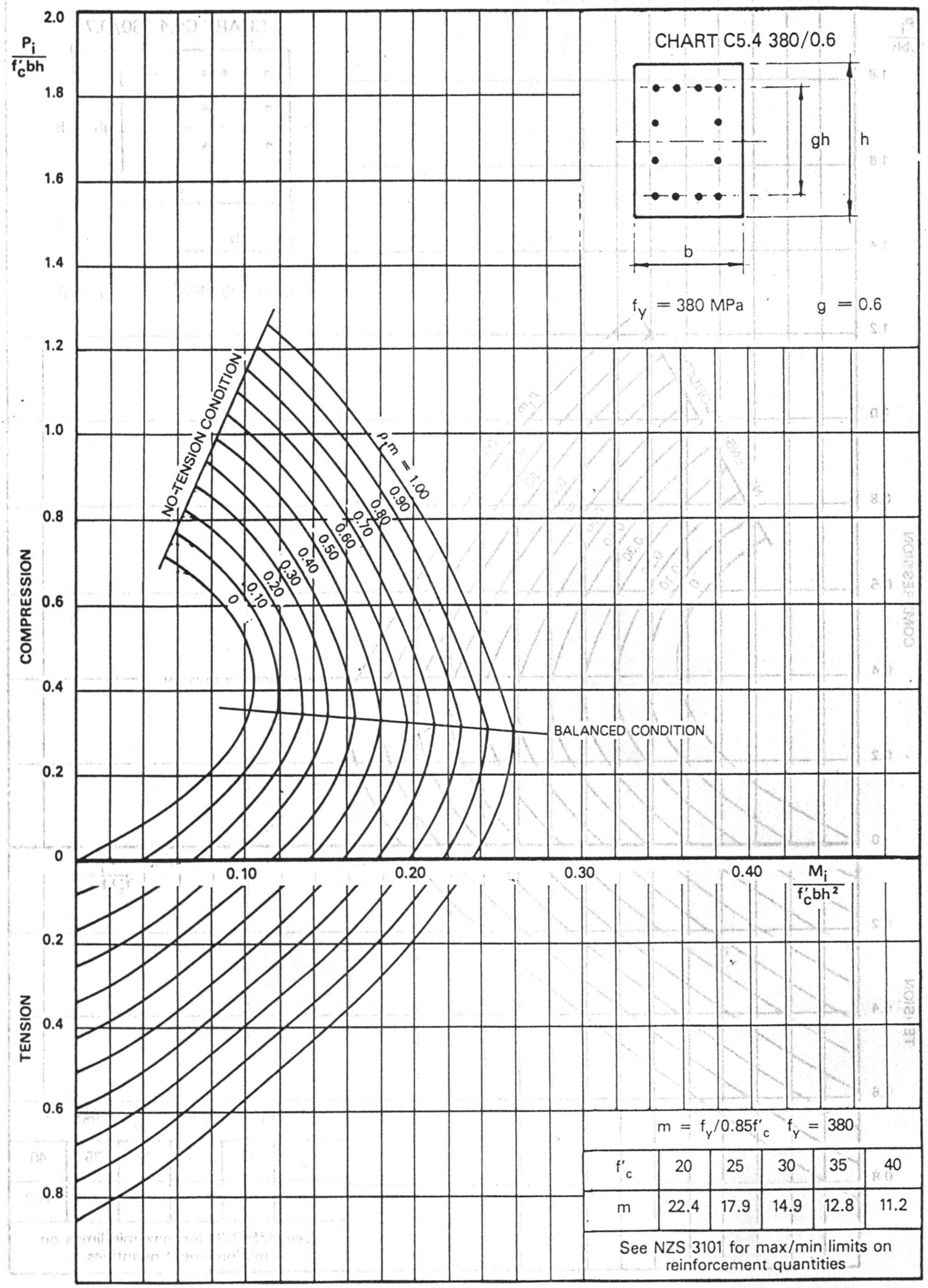
800×500 $g = .8$

350×800 $g = .6$

6HD20 + 4HD20 $A_s = 3971$ $\rho_t = .0099$ $\rho_t m = .177$ $(f'_c = 25)$ 800×500.

10HD20 $A_s = 3142$ $\rho_t = .0112$ $\rho_t m = .200$ $(f'_c = 25)$ 350×800

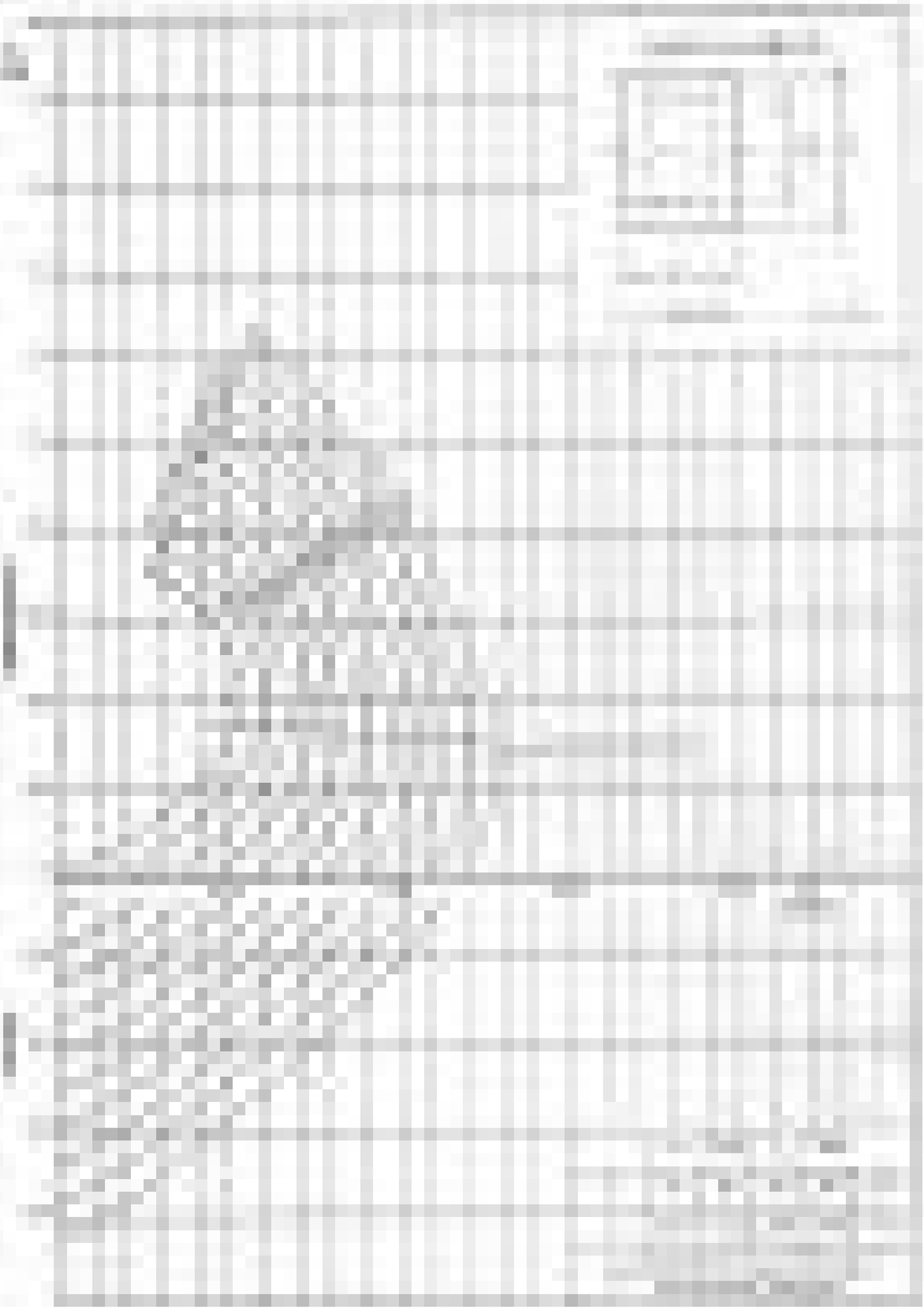
C5.4 COLUMN DESIGN CHART



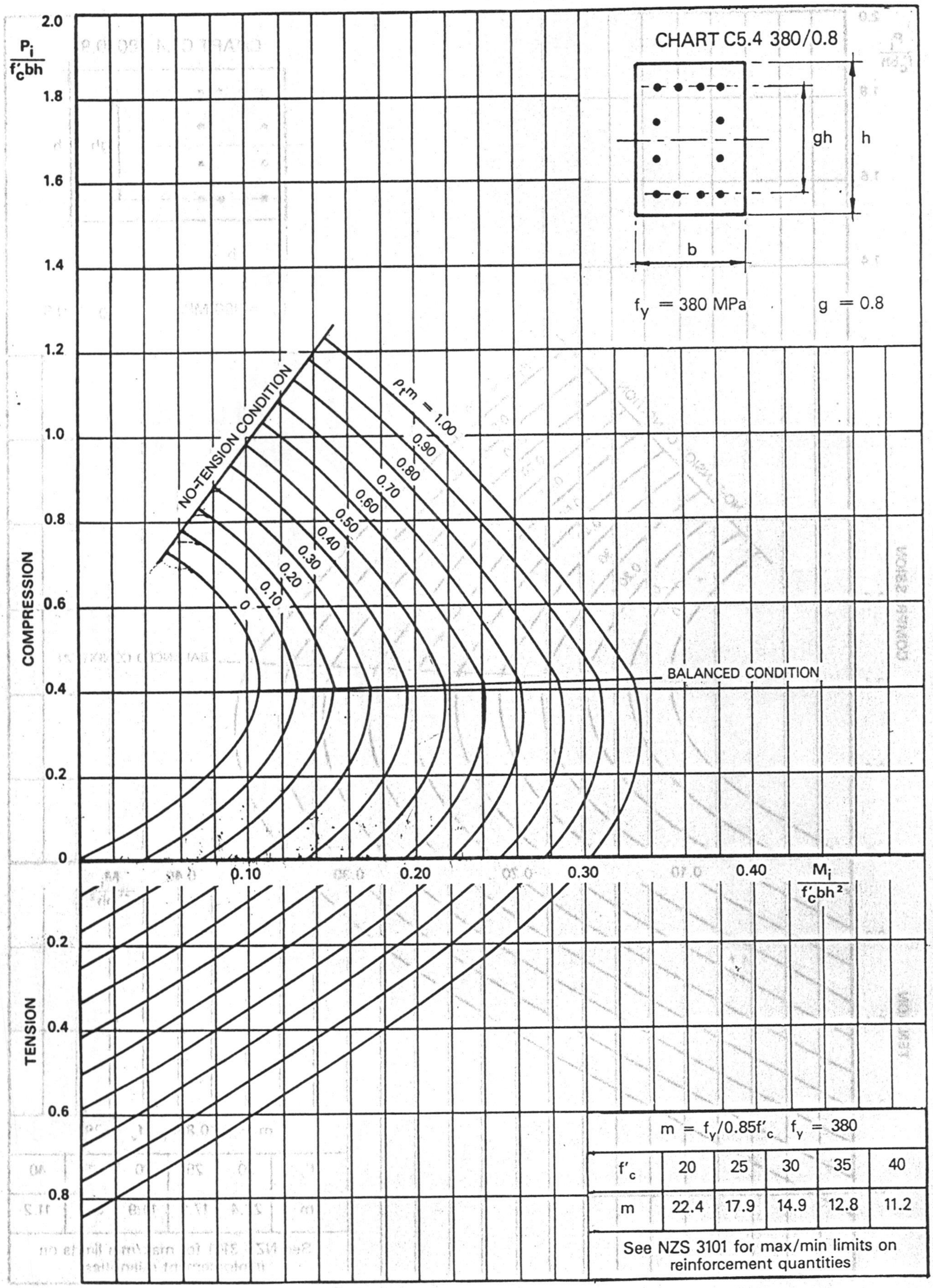
$m = f_y/0.85f'_c$ f_y = 380

f'_c	20	25	30	35	40
m	22.4	17.9	14.9	12.8	11.2

See NZS 3101 for max/min limits on reinforcement quantities



C5.4 COLUMN DESIGN CHART



f'_c	20	25	30	35	40
m	22.4	17.9	14.9	12.8	11.2

SMITH LEUCHARS LTD
CIVIL & STRUCTURAL ENGINEERS

JOB No. _____ PAGE 44

JOB _____ BY WZM

DATE 2/10/86

COLUMNS - EAST FRAME

$\phi = .9$ $\phi = .9$

LEV	P_u max D+1·3Le+E	P_u min ·9D+E	M_u	$P_u/f'_c bh$ max	min	$M_u/f'_c bh^2$	$\rho_t m$	ρ_t	A_s	BARS	f'_c
COL	A	350 x	800								
4	190	55	46		·01	·021	<·20		min	10HD20	25
3	437	51	102		·01	·046				"	"
2	750	-17	146		—	·066				"	"
1	1073	-96	107		—·02	·049				"	"
M	1243	-7	51	·25	—	·023				"	"
COL	B	800 x	500								
4	362	175	187		·02	·026	<·177			6HD24+4HD20	25
3	730	346	399		·04	·055				"	"
2	1108	505	593		·06	·082				"	"
1	1499	651	405		·08	·056				"	"
M	2058	644	611	·29	·08	·085				"	"
COL	C	800 x	500								
4	420	218	201		·03	·028	<·177			6HD24+4HD20	25
3	853	422	410		·05	·057				"	"
2	1299	614	600		·08	·083				"	"
1	1747	803	549		·11	·076				"	"
M	2219	969	695	·32	·14	·097				"	"
COL	D	800 x	500								
4	424	179	112		·02	·016	<·177			6HD24+4HD20	25
3	897	308	254		·04	·035				"	"
2	1434	374	382		·05	·053				"	"
1	1992	418	278		·05	·039				"	"
M	2523	490	587	·36	·06	·082				"	"

M_u values $\phi = .7 - .9$ are @ ℄ ⇒ Conservative.

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COLUMNS – WEST FRAME

LEV	P_u max DL+1.3LL+E	P_u min .9D+E	M_u	$P_i/f_c bh$ max	$P_i/f_c bh$ min	$M_i/f_c bh^2$	ρ_{tm}	ρ_t	A_s	BARS	f_{lc}
COL E		800 x	500								
4	212	33	120		—	.017	<.177			6HD24+4HD20	25
3	524	−36	303		—	.042				"	"
2	961	−228	465		−.03	.065	.20	.0112	4480	6HD28+4HD20	"
1	1359	−382	206		−.04	.029				"	"
M	1675	−454	383	.24	−.05	.053	.20			"	"
COL F		800 x	500								
4	457	206	195		.02	.027	<.177			6HD24+4HD20	25
3	1001	326	393		.04	.055				"	"
2	1622	312	607		.04	.084	.20			6HD28+4HD20	"
1	2091	381	359		.05	.050				6HD24+4HD20	"
M	2480	529	448	.35	.07	.062				"	"
COL G		800 x	500								
1	381	150	513		.02	.071	<.177			6HD24+4HD20	25
M	624	160	426	.08	.02	.059				"	"
COL H		800 x	500								
4	416	205	183		.02	.025	<.177			6HD24+4HD20	25
3	1875	365	349		.04	.048				"	"
2	1353	460	513		.06	.071				"	"
1	1667	552	268		.07	.037				"	"
M	2031	733	439	.29	.10	.061				"	"
COL I		350 x	800								
4	169	32	51		—	.023	<.200			10HD20	25
3	397	5	109		—	.049				"	"
2	685	−81	136		−.01	.062				"	"
1	955	−150	101		−.02	.046				"	"
M	1182	−176	72	.24	−.03	.033				"	"

$\phi = .7 \rightarrow .9$ $\phi = .9$

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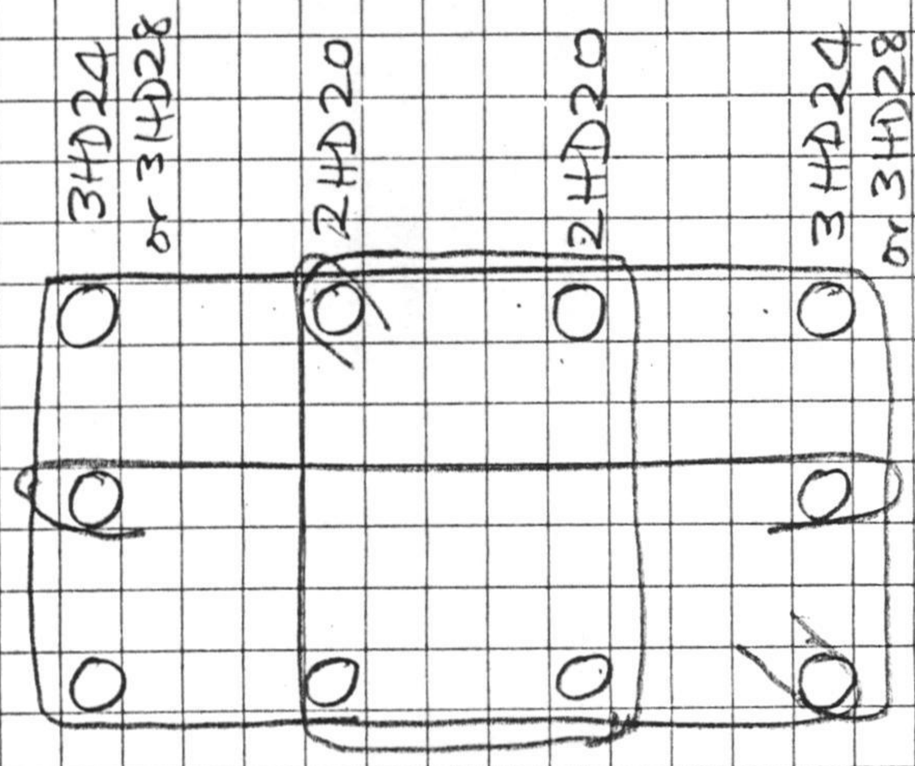
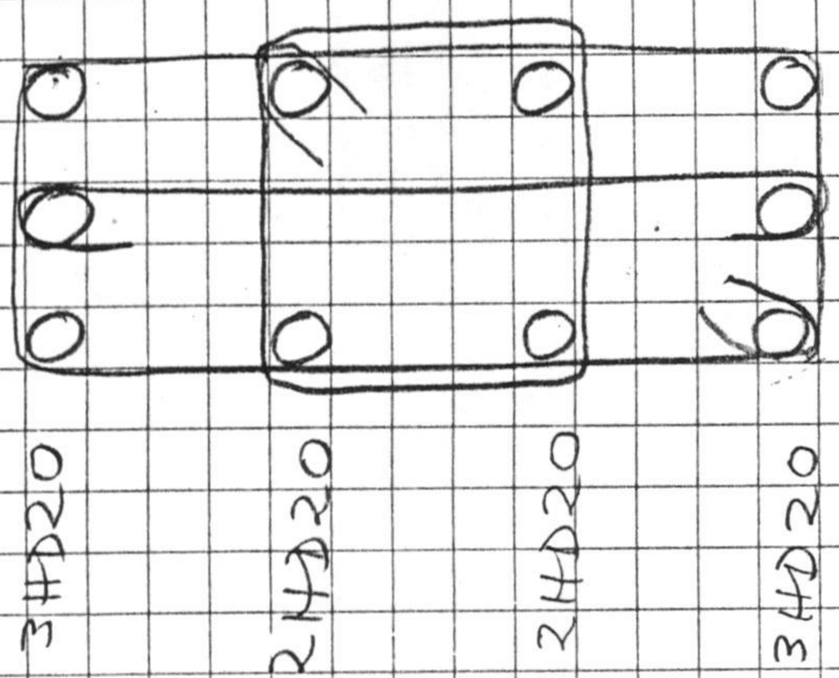
Cols

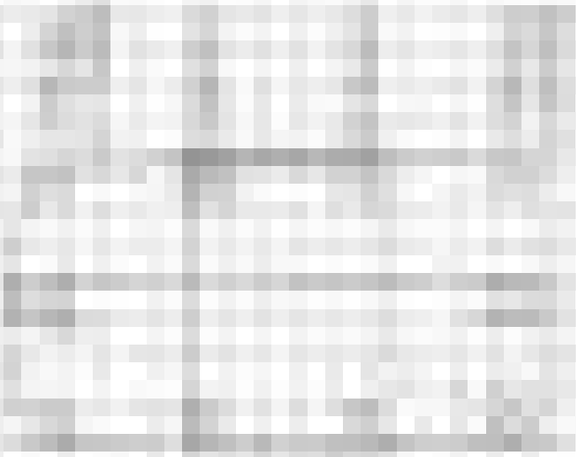


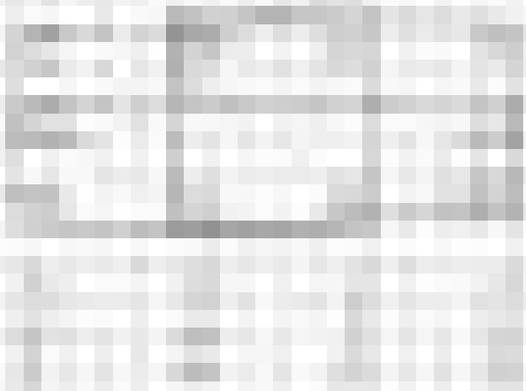
800 x 500



350 x 800

Note 1) 50 cover to all bars





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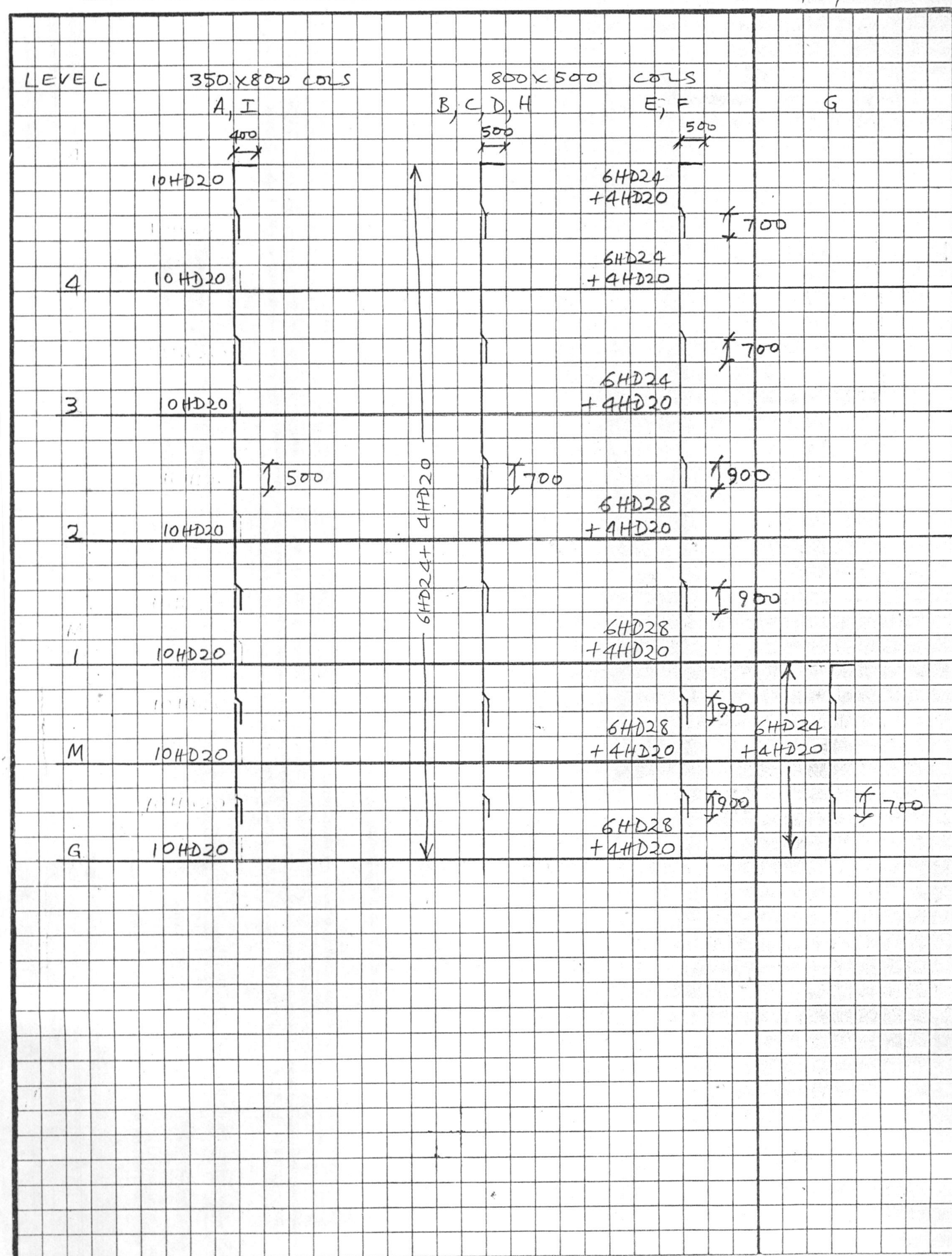


Transverse Reo.

Confinement Reo – Ltd Ductile End Regions

$$\gamma = \frac{M_e^* + .3 P_e h}{.6 \phi f'_c A_g^* k} = \frac{(695\times10^6 + .3\times 2219\times10^3 \times 800)}{.6\times.9\times25\times.2\times800\times500\times800}$$

$$= 1.42.$$

$$\gamma = \frac{587\times10^6 + .3\times 2523\times10^3\times 800}{.6\times.9\times25\times.2\times800\times500\times800} = 1.38$$

$$R_c = \frac{\gamma}{1+\rho^* m} - 1 = \frac{1.42}{\left(1+\frac{1848}{500\times.2\times800}\times\frac{380}{.85\times25}\right)} - 1$$

$$= .005$$

$$A_{sh} = R_c\,(.02 s_h h f'_c / f_{yh}) = .005(.02\times150\times800\times25/380)$$
$$= 0.8\ mm^2$$

⇒ ok

$S_{max} = 10\times20 = 200.$

V_u max = 447 kN.

$v_i = 447\times10^3/.85\times500\times680 = 1.55$

$v_c = .4\sqrt{P_e/A_g} = .4\sqrt{969\times10^3/500\times800} = .62$

$v_s = .93$ $\quad s_{max} = 680/4 = 170$

$A_v = v_s b_w s/f_y = .93\times500\times150/380 = 184\ mm^2$

⇒ 3 legs HR10 @ 150 ok.

6.4 $S_{max} = 500,\ 16\times20 = 320,\ 480.$

⇒ End Regions HR 10 sets @ 150 ok.

End Regions 800 from face

Outside ER

v_c 7.3.2

$\rho_w = 3\times616 + 2\times314 / 500\times680 = .0073$

$v_b = .72$

$\left(1 + \frac{3P_u}{A_g f'_c}\right) v_b = \left(1 + \frac{3\times969\times10^3}{500\times800\times25}\right) .72 = .93$

$v_s = 1.55 - .93 = .62$

$A_v = v_s b_w s / f_y$

$\Rightarrow s_{max} = 236\times380 / .62\times500 = 289$

$\Rightarrow$ HR10 sets @ 250

Joint Reo

Design M_u beam $-560 \quad +390$

$T_{top} = 560/.73 = 767$ kN

$T_{bott} = 330/.73 = 452$ kN

$V_{col} = 2\left(\frac{l_1}{l_{1n}} M_1 + \frac{l_2}{l_{2n}} M_2\right) / (l_c + l_c')$

$V_{col} = 2\left(\frac{5.3}{4.5}\times330 + \frac{6.3}{5.5}\times560\right) / 6.6 = 312$ kN

$V_{jh} = 767 + 452 - 312 = 907$ kN

$V_{jv} = V_{jh}\frac{h_b}{h_c} = 907$ kN

$v_{jh} = V_{jh} / b_j h_c = 907\times10^3 / 500\times800 = 2.27$ MPa

$1.5\sqrt{f'_c} = 7.5 \Rightarrow$ OK

$V_{sh} = .5 v_{jh}\left(1 + \frac{G_j P_u}{.4 A_g f'_c}\right) = .5\times907\left(1 + \frac{614\times10^3}{.4\times500\times800\times25}\right)$

$= 523$ kN

$V_{sh} = 907/.85 - 523 = 544$ kN

$A_{jh} = V_{sh}/f_y = 544 \times 10^3 / 380 = 1432\ mm^2$

Clear space = 620 1432/236 = 6.

→ HR10 sets @ 100 (A_j = 1652 mm²)

$V_{cv} = \frac{A_{jc}}{A_{sc}} V_{jv} \left(.6 + \frac{C_j P_u}{A_g f'_c} \right) = 1 \times 907 \left(.6 + \frac{614 \times 10^3}{500 \times 800 \times 25} \right)$

$= 600$ kN.

$V_{sv} = 907/.85 - 600 = 467$ kN

$A_{jv} = V_{sv}/f_y = 1229$

A_{jv} provided = 4 × 314 = 1256 ⇒ OK

350 × 800

Max V_u = 77 kN

$v_i = 77 \times 10^3 / .85 \times 800 \times 290 = .39$ MPa

$.07 f'_c = 1.75$ ⇒ OK $s_{max} = d/2 = 145$.

⇒ HR10@100.

Outside PHR HR10@150

Note – All cols.

800 × 500 Cols

Transverse Reo

HR10 @ 100 joint
HR10 @ 150 for 800 from face
HR10 @ 250 rem.

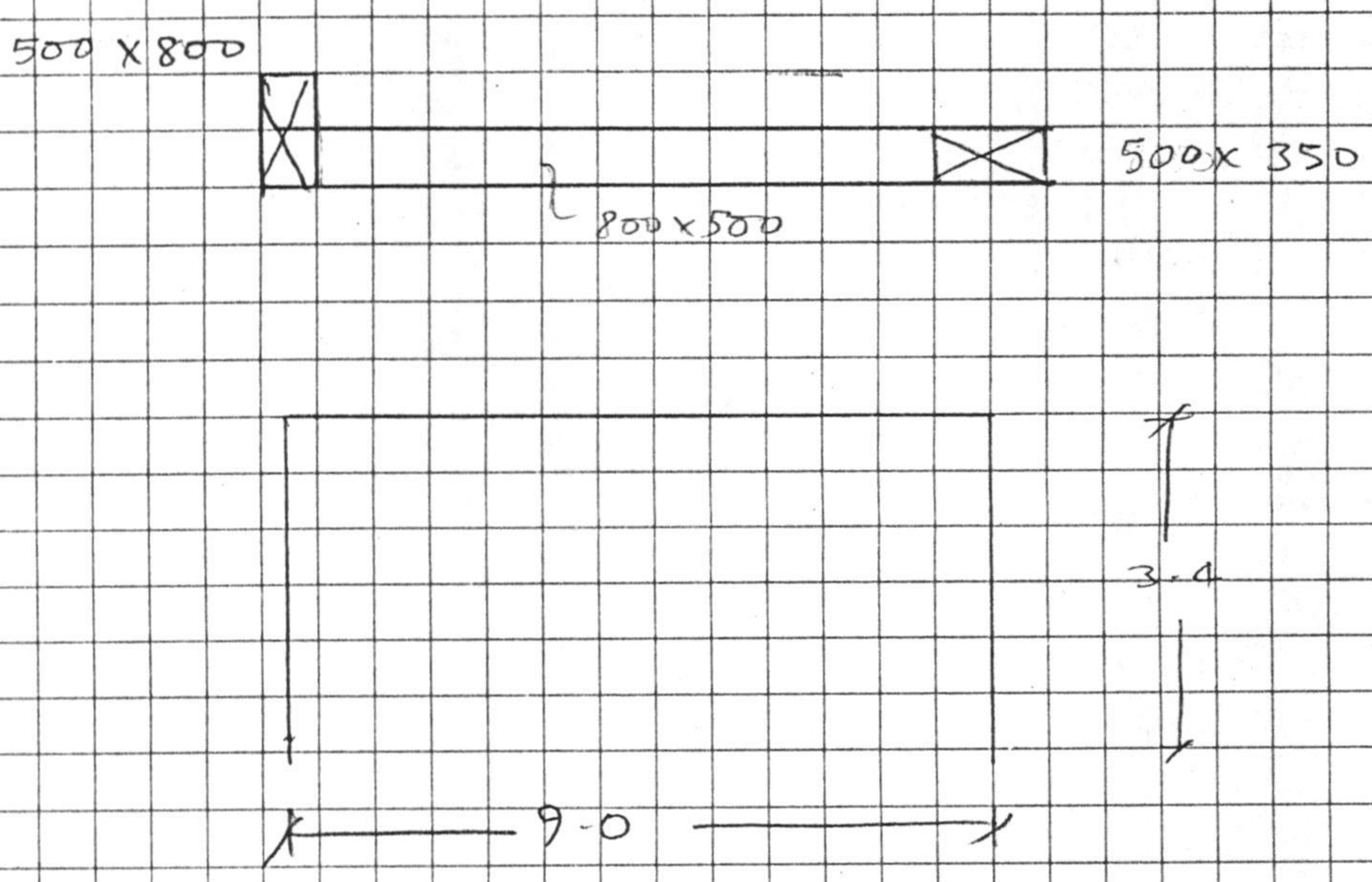
350 × 800 Cols

HR10 @ 100 joint
HR10 @ 100 for 800 from face
HR10 @ 150 rem.

Middle zone (rem.) levels 2–4 only.
Levels G–2 one zone for full height between beam faces.

Refer p. for stirrup sets

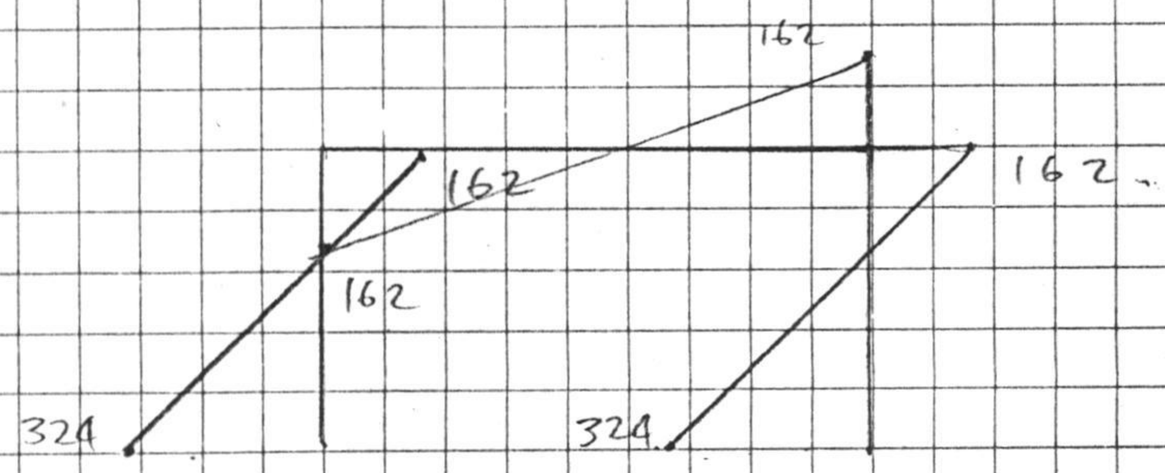
Level 4 frame



Assume conservatively frame takes V/2 + torsion

$F = (476/2) + 48 = 286$ kN

BMD – assume pt of contraflexure @ 2/3 ht.



Cols $M_i / f'_c b h^2 = 324 \times 10^6 / .9 \times 25 \times 800 \times 500^2 = .072$

$f_c m = .20$ $\rho_t = .0112$ $A_s = 4480$

$\Rightarrow$ 10HD24 Col E

$M_i / f'_c b h^2 = 324 \times 10^6 / .9 \times 25 \times 350 \times 500^2 = .165$

$\Rightarrow$ NG

$\Rightarrow$ Try 2 frames

Distribute shears according to col. stiffnesses

$f = H/AE \cdot [(H/L)^2 + 3]$

500 x 800 $\quad f = \{3.4/.5 \times .8 \times 23500 [(3.4/.5)^2 + 3]\} \times 10^3 = 17.81$

500 x 350 $\quad f = 40.71$

$S = 1/f$ $\quad$ 500x800 $\quad S = .056 \times 3 = .168$

500 x 350 $\quad .025$

$.193$

Shear 500 x 800 $\quad V = [.168/.193 \times 286]/3 = 83$ kN

500 x 350 $\quad V = .025/.193 \times 286 = 37$ kN

500 x 800 $\quad M = 188$ kNm

$M_i/f'_c bh^2 = .042 \Rightarrow$ Min steel OK

500 x 350 $\quad M = 84$ kNm

$M_i/f'_c bh^2 = .043 \Rightarrow$ Min steel OK

A_s min = 8HD16 but have HD20's below

$\Rightarrow$ 8HD20

<u>Beams</u> - Typ 800 x 500

$M_E = 94$ kNm.

$W_D = 24 \times .8 \times .4 + 5 \times 1 + 1 \times 3 = 15.7$ kN/m.

$W_{Le} = 3 \times 4 = 12$ kN/m

$W_u = 1.4 \times 15.7 + 1.7 \times 12 = 42.4$ kN/m

$M_u = 42.4 \times 9^2/12 = 286$ kNm

Cantilever

$P_u = 1.4 \times 24 \times .8 \times .4 \times 5 + 1.4 \times 60 + 1.4 \times 5 \times 5 \times .8 = 166$ kN

$W_u = 1.4 \times 24 \times .8 \times .5 = 13.4$ kN/m

$M_u = 13.4 \times 2^2/2 + 166 \times 2 = 359$ kNm

$D + 1.3L_e + E$ $\quad M_u = 305$ kNm

$\Rightarrow$ 4HD24 T & B

Shear

$V_u = 166 + 13.4 \times 2 = 193$ kN or $42.4 \times 9/2 = 191$ kN

$v_i = 193\,000 / .85 \times 500 \times 730 = .62$

$\rho_w = .0050$ $v_c = .60$

$A_{v\,min} = .35\, b_w s / f_y$

$s_{max} = 157 \times 380 / .35 \times 500 = 341$

$\Rightarrow$ 3 legs HR10 @ 100 for 1600 from face

HR10 @ 300 rem.

Edge Beam — Try 600 x 300

$w_{DL} = 1.4 \times 24 \times .8 \times .4 + 1.4 \times 5 \times .8 + 1.4 \times 10.3 = 30.8$

$M_u = 30.8 \times 2^2/2 = 62$ kNm

or $30.8 \times 5^2/8 = 96$ kNm

$R_u = 96 \times 10^6 / .9 \times 300 \times 530^2 = 1.27$ $\rho = .0035$

$A_s = .0037 \times 300 \times 530 = 588$ mm^2

$\Rightarrow$ 2HD24 T & B

$V_u = 30.8 \times 5/8 \times 5 = 96$ kN

$v_i = 96 \times 10^3 / .85 \times 300 \times 530 = .71$

$\rho_w = .0057$ $.64$

$s_{max} = 157 \times 380 / .35 \times 300 = 568$

$\Rightarrow$ HR10 @ 200

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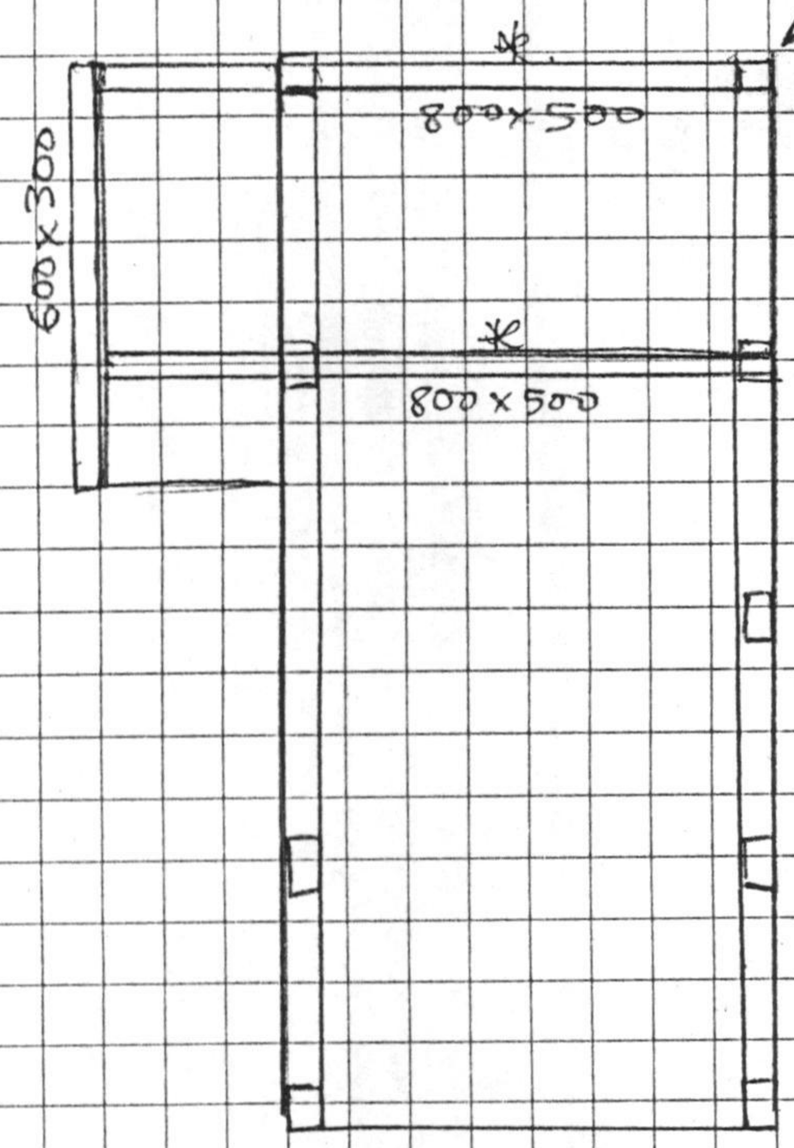
Level 4 Frames

800 x 350
Col. reduced to
500 x 350 @ lev. 3
(Reduce long reo.
from 10HD20 to 8HD20)



* 800 x 500 beams.
4HD24 T & B
3 legs HR10 @ 100 for 1600 from face (not on cantilever)
HR10 @ 300 rem.
HR10 @ 200 cantilever.

600 x 300 beam
2HD24 T & B
HR10 @ 200

600 x 300 beam connection

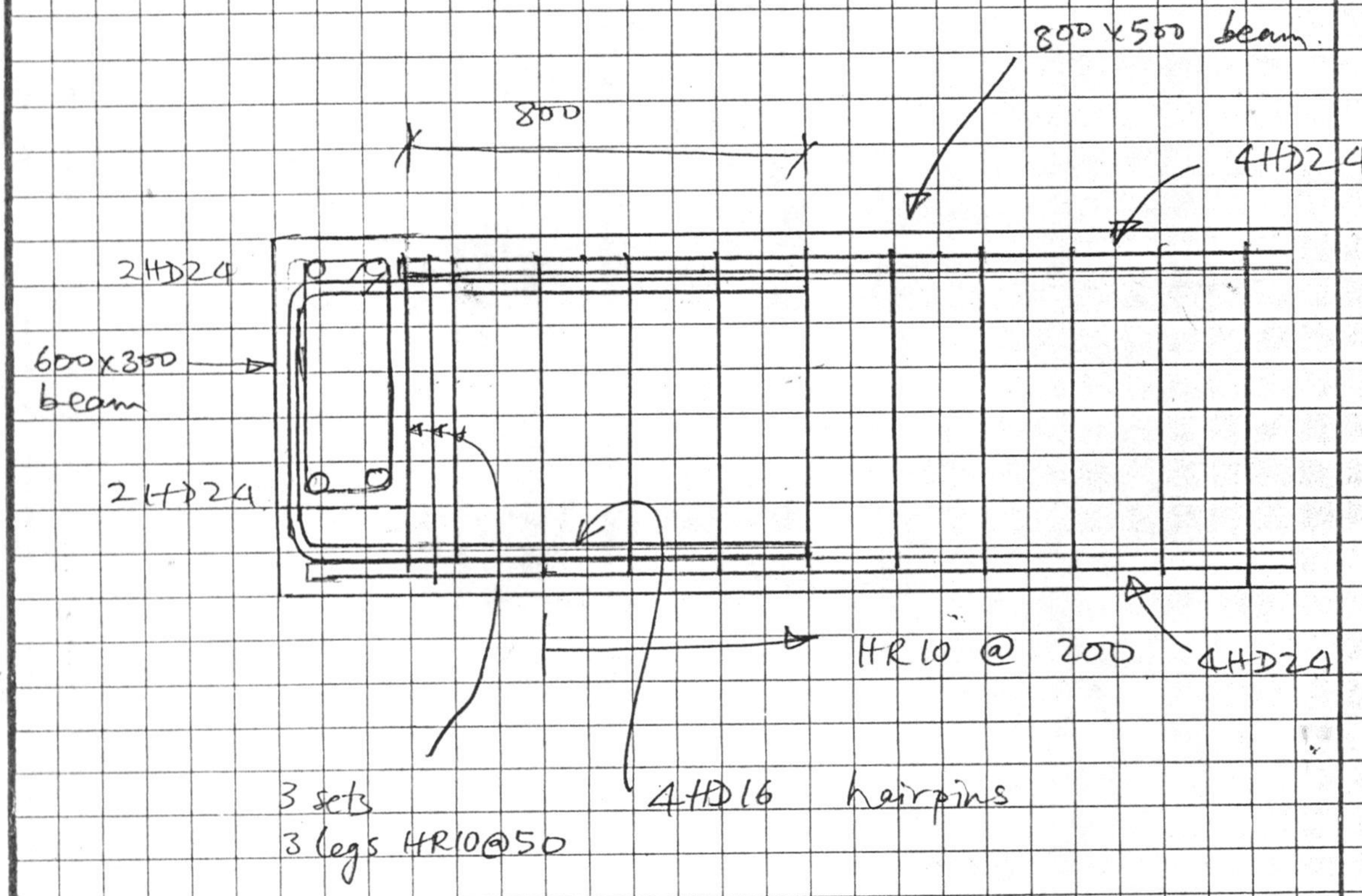
$A_{vf} = V_u - P_u / \phi \mu f_y = 166\,000 / .85 \times .7 \times 380 = 734\ mm^2$

$\Rightarrow$ 4HD16

$A_v = V_u / \phi f_y = 166 \times 10^3 / .85 \times 380 = 514\ mm^2$

514/236 = 2.2 sets 3 legs HR10 w/i d/2 = 365 of beam

Require 3 sets 3 legs HR10 @ 50



Level 4 Water Tanks
600 x 300
beam connection

Roof Cols – HH. 3·2 m

$W_p = 1 \times 8 \times 5 = 40$ kN.

$R_p = 1.5$ $C_p\,max = .6$ $C_p\,min = .3$

$C_p = 1.5 K_z S_p M_p R_p C_d$

$C_p = 1.5 \times \frac{19}{9} \times 1 \times .8 \times 1.5 \times .1 = .38$

$\alpha K_z Z R C_p\,min = \frac{9}{15.8} \times \frac{19}{9} \times 1 \times .3 = .36$

$F_p = .38 \times 40 = 15.2$ kN.

$M = 15.2 \times 3.2 = 49$ kNm

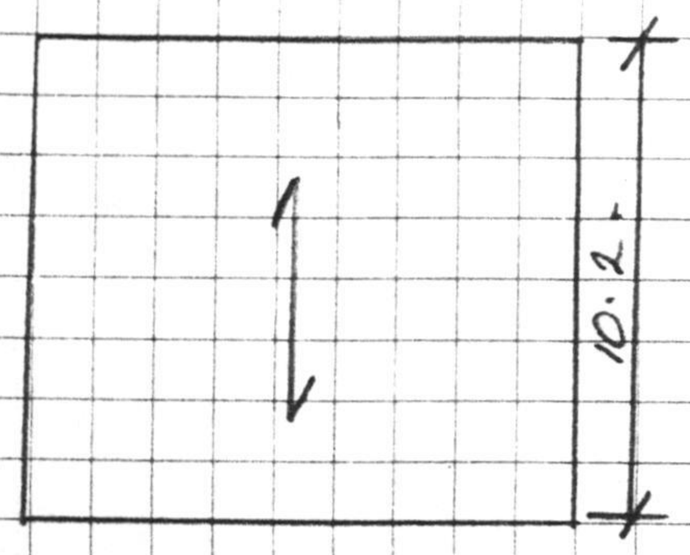
$R_u = 49 \times 10^6 / .9 \times 800 \times 430^2 = .37$

$\Rightarrow$ OK (Cols OK for min steel).

NORTH EXTENSION.

New 4th floor.

Option 1



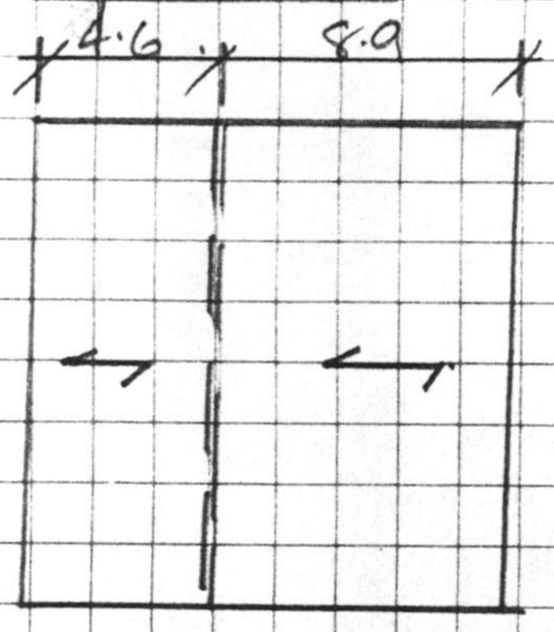
Live load = 3.0 KPa.

900 ti 300.

(2.92 KPa).

$\frac{10.2}{35} = .291$.

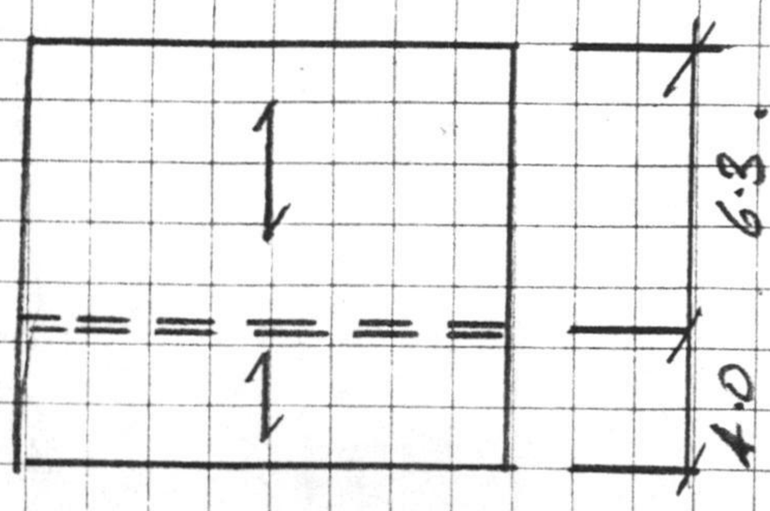
Option 2



900 ti 160 (2.27 KPa)

900 ti 250. (2.7 KPa)

New 3rd Floor.



Existing 350×65 - 400.

Load cap = 5.47 KPa.

See page P/14

4m Span.

Dead = .8 KPa.

Live = 3 KPa.

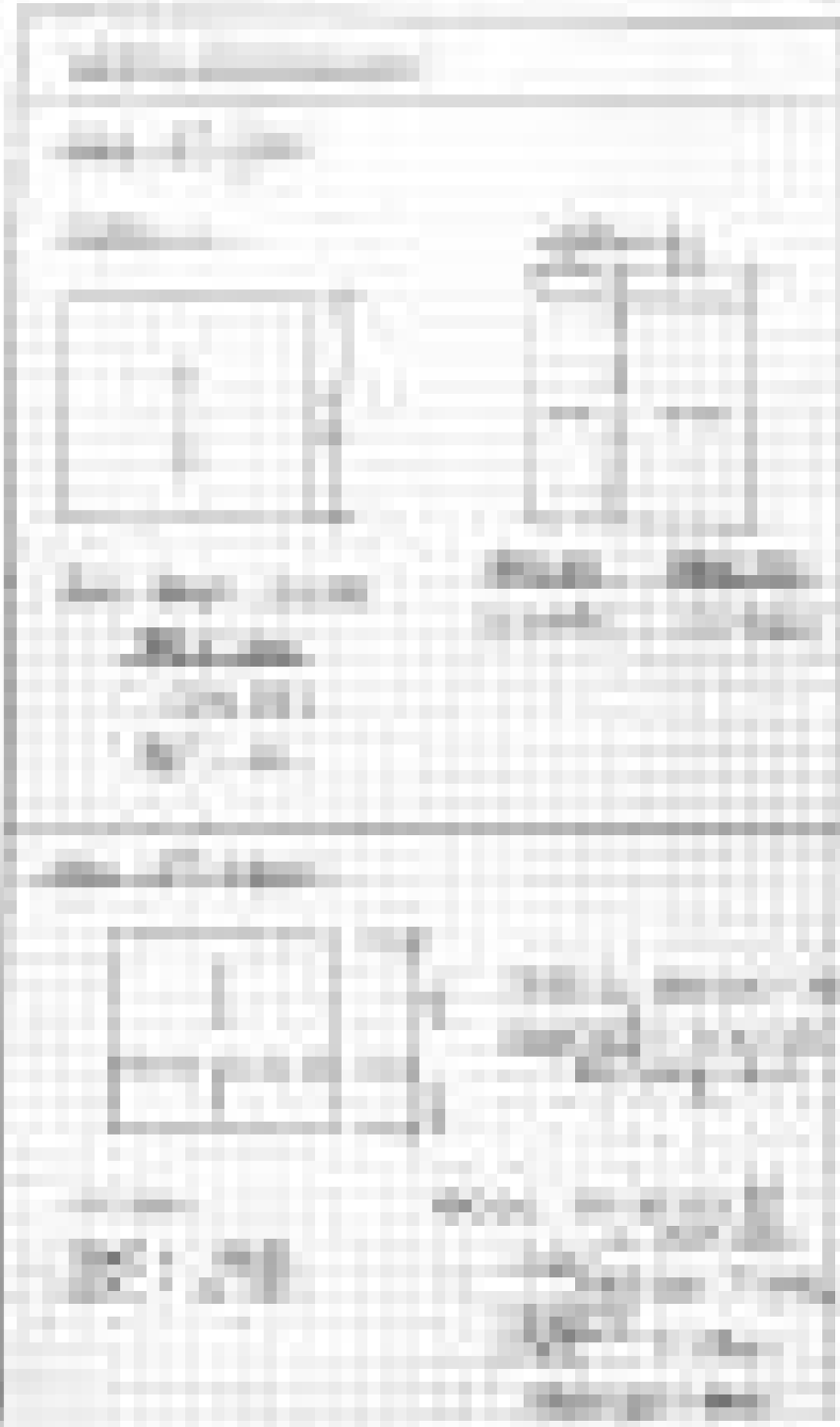
400 UB. $M = .4 \times 3.8 \times \frac{4^2}{8}$

$= 3.04$ KNm.

$3.04 / 1.35 \times .006 = 375 cm^3$.

$\sqrt{\frac{375 \times 6}{4.6}} = 22 cm$.

250×30 - 400.



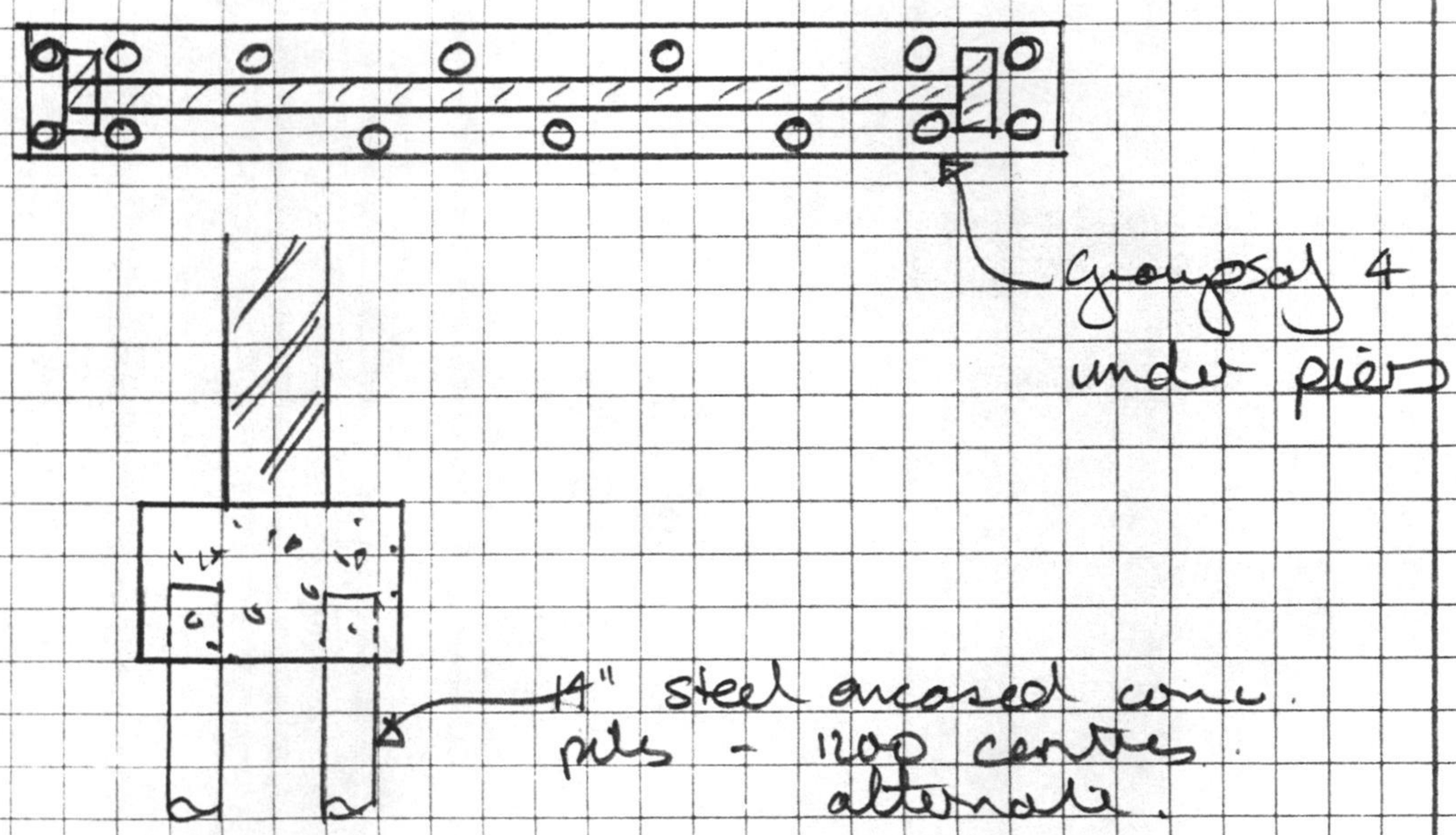
$$\delta_{live} = \frac{5 \times 3 \times \cdot 4 \times 4000^4}{384 \times 8000 \times 55 \cdot 7E6}$$

$= 9mm \quad = (\cdot 0022L)$

$\therefore$ Use 250×50 – 400cc.

Check Existing Foundations.

Wall Grid G.

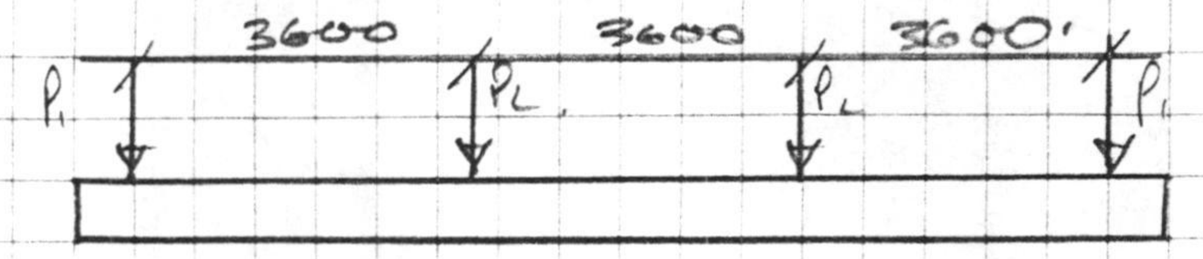


Existing Loading.

1. UDL.

Roof.	$1 \cdot 1 \times \frac{6 \cdot 3}{2}$	= 3.46.
Brick wall	$22 \times (\cdot 35 \times 7 \cdot 33 + \cdot 48 \times 5 \cdot 5)$	= 114
footing.	$24 \times 1 \times 1$	= 24
2nd floor	$0 \cdot 8 \times \frac{6 \cdot 3}{2}$	= 2.52.
	Σ	= 144.5 KN/m.
Live say	$2 \cdot 25 \times \frac{6 \cdot 3}{2}$	= 7.1 KN/m.

2. Point Loads.



P_1. Dead.

Roof.	$\cdot 7 \times \frac{20}{2} \times \frac{4.4}{2}$	= 15.4
Col.	$\cdot 51 \times \cdot 48 \times 24 \times 12.33$	= 72
Beams.	$(\cdot 45 + \cdot 65) \times \cdot 25 \times 24 \times \frac{4}{2}$	= 13.2
Shear wall.	$\cdot 18 \times 5 \times 24 \times \frac{3.6}{2}$	= 39.0
Existing bms.	$\cdot 6 \times \cdot 5 \times 24 \times (\frac{4}{2} + 6.3)$	= 60.0
1st floor	$\cdot 23 \times 24 \times \frac{10.3}{2} \times 3.6$	= 102
2nd floor	$(\cdot 8 \times \frac{10}{2} \times \frac{10.3}{2}) + (3.3 \times \frac{11.2}{2} \times \frac{4}{2})$	= 58
	Σ	359 KN.

Live. $3.0 \times (\frac{10.3}{2} \times 3.6 + \frac{10}{2} \times \frac{10.3}{2} + \frac{11.2}{2} \times \frac{4}{2})$ = 166 KN.

P_2 Dead.

Cols	Say as P_1	= 72
Existing bms.	" "	= 60
Shear wall	" "	= 39
1st Floor	" "	= 102
	Σ	= 273 KN

Live.
$3.0 \times \frac{10.3}{2} \times 3.6$ = 56 KN.

Pile Loads.

	Dead	Live	Total	
End piles (4off)	144	44	188	
Under wall (1.200)	173	8.4	181.4	
Under P_2.	446	64.4	510.4	*
(if 2 piles)	(223)	(32.2)	(255.2)	

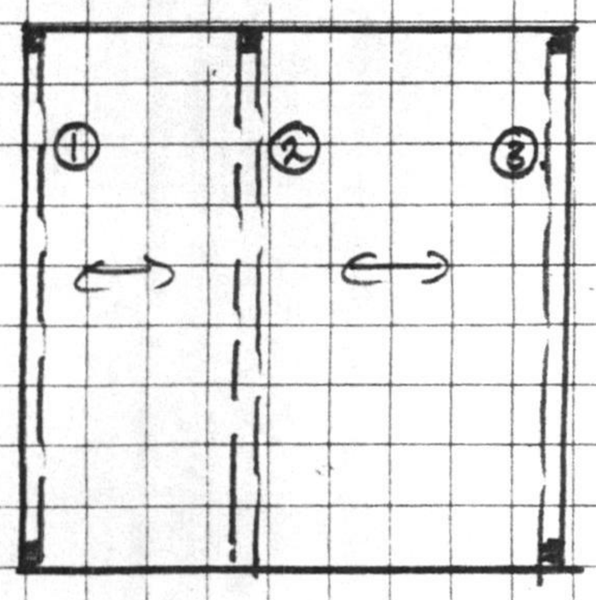
14" steel encased piles

If ultimate load capacity (soils)
= say 1200KN (All = 400KN.
& f'_c = 20 MPa. (All = say ~~10~~ 8 MPa).

Then additional load capacity of piles could be:

	Existing load	Capacity conc.	Capacity pile	Add'l Capacity
End piles	188	770	400	212 KN
Wall.	182	770	400	218 "
Middle piers.	255.	770.	400	145 "

New 4th Floor. Using Option 2



Beam 1

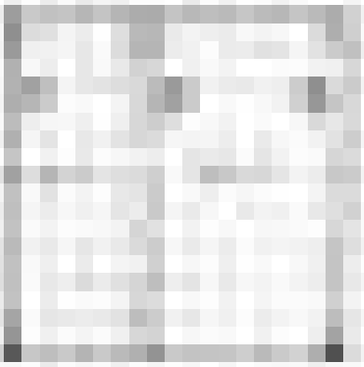
Span = 10.2m.

$W_u = 1.7 \times 3 \times \left(\frac{4.6}{2}\right) + 1.4 \times \left(2.29 \times \frac{4.6}{2} + .6 \times .4 \times 24 + .5 \times \frac{4.6}{2} + .5 \times 3\right)$

$= 11.7 + 19.5 = 31.2$ KN/m.

$M_u = 31.2 \times \frac{10.2^2}{8} = 406$ KNm.

$V_u = 31.2 \times \frac{10.2}{2} = 159$ KN.



$d = \sqrt{\frac{3.68 \times 406E6}{25 \times 400}} = 386.$

$\frac{10200}{17} = 600.$

Try 700x400 Beam.

$d = 700 - 50 - 50 = 600.$

$R_u = 3.13.$

$\rho = .004.$

$A_s = 2160 mm^2.$ 4 - HD28.

$v_i = \frac{1540000}{.85 \times 600 \times 400} = .79$ MPa.

$v_b = (.004 \times 10 + .07) \times 5 = .55$

Use min A_{vs}

$\frac{A_{vs}}{s} = \frac{.35 \times 400}{225} = .51 mm^2/mm.$

$s = 300$ $A_{vs} = 152.$

2 - R10 - 300

Beam ①
700 x 400
4 - HD24 B
2 - HD20 T
2 - R10 - 300

Beam ②

$W_u = 1.7 \times \left(\frac{8.9 + 4.6}{2}\right) \times 5.0 + 1.4 \times \left(2.27 \times \frac{4.6}{2} + 2.7 \times \frac{8.9}{2} + .8 \times .5 \times 24 + 1.8\right).$

$= 34 + 40 = 74.5$ kN/m.

$M_u = 969$ kNm.

$V_u = 380$ kN

Try 800x500 Beam.

(4-HD28 - M_u = 585 kNm.
4+2HD28 - M_u = 824 kNm.)

$R_u = 4.39$ MPa.

$\rho = .013$

$A_s = 4550 mm^2.$ 4 + 4 - HD28.

$d = 800 - 50 - 30 - 15 = 705.$
Assume 700.

$v_i = 1.27$ MPa.

$v_c = .55$ MPa.

$\frac{A_{vs}}{s} = \frac{.72 \times 500}{275} = 1.31 \text{ mm}^2/\text{mm}$.

$s = 200$.
$A_{vs} = 261$ 4 - R10 - 200.

2 - R10 - 300 $\frac{A_{vs}}{s} = .533$

$\times \frac{275}{500} = .293$

$+ .6 = 0.9$ MPa.

$.9 \times \frac{705 \times 500}{1} \times .85 = 268$ KN

$380 - 74.5 \times x = 268$

$\Rightarrow x = 1.5$ m.

Beam (2)
~~600~~ x 500
4+4 - HD28
~~4 R10~~
4 - R10 - 200 - 200c
then 2-R10-300

Beam (3)

$W_u = 1.7 \times 30 \times \frac{8.9}{2} + 1.4(.8 \times .5 \times 24 + 2.7 \times \frac{8.9}{2} + 0.5 \times \frac{8.9}{2} + 0.6 \times 3)$

$= 22.7 + 25.6 = 48.3$ KN/m

$M_u = 628$ KNm.

$V_u = 246$ KN

~~600~~ x 500

$R_u = 2.85$ MPa.
$\rho = .0085$
$A_s = 2975 \text{ mm}^2$ 3 + 2 - HD28
$v_c = .626$. (3 - HD28 $M_u =$)
$v_b = .55$

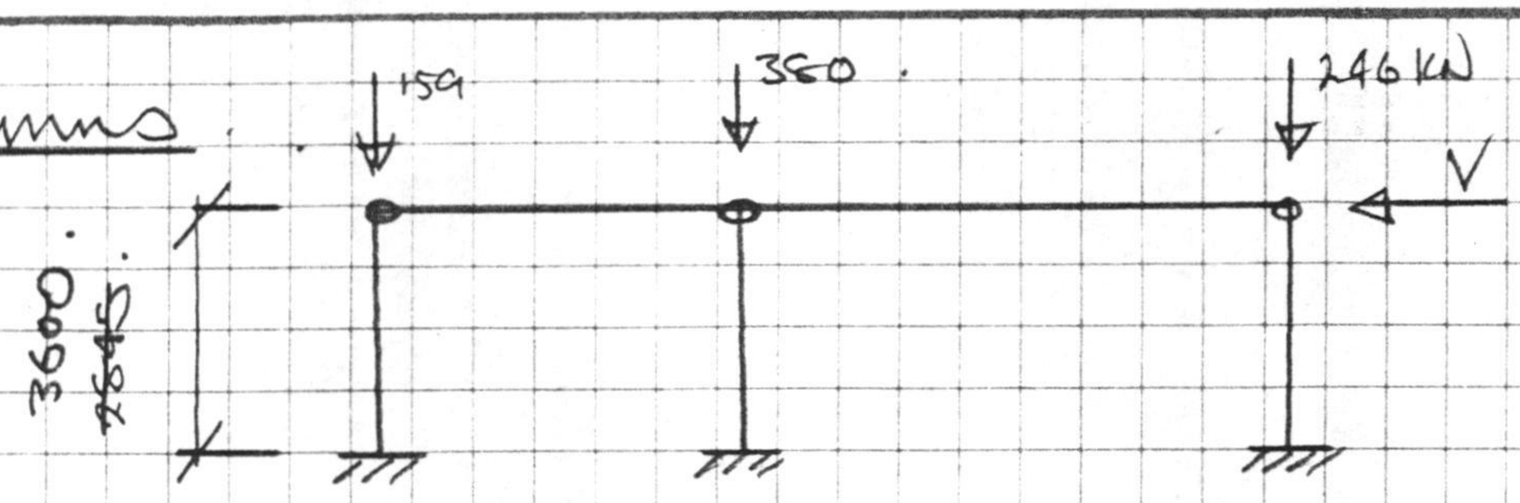
$\therefore$ Min $\frac{A_{vs}}{s} = .636$.

2 - R10 - 250.

Beam (3)
~~600~~ x 500
3+2 HD28
2-R10-250.

Change Beam (3) to 700 x 400
4 + 2 - HD28.
2 - R12 - 250.

Columns



Try 500x400 cantilevered columns.

Use $V = \frac{2}{3} \times 3 \times .12 \times wt = .24\ wt$.

Max $\frac{P_u}{A_g} = 1.9\ MPa = .076 f'_c$.

Total Mass $= \left(\frac{25.6 + 40 + 19.5}{1.4}\right) \times 10.2 = 620$

+ seismic live $= \frac{3}{3} \times (8.9 + 4.6) \times 10.2 = 137.7$

$758\ kN$.

$V/col = \frac{758}{3} \times .24 = 60.6\ kN$.

$M_u = 60.6 \times \cancel{2.845}\ 3.6 = \cancel{173}\ 218\ kNm$.

$V_u = 60.6\ kN$

$d = 435\ mm$

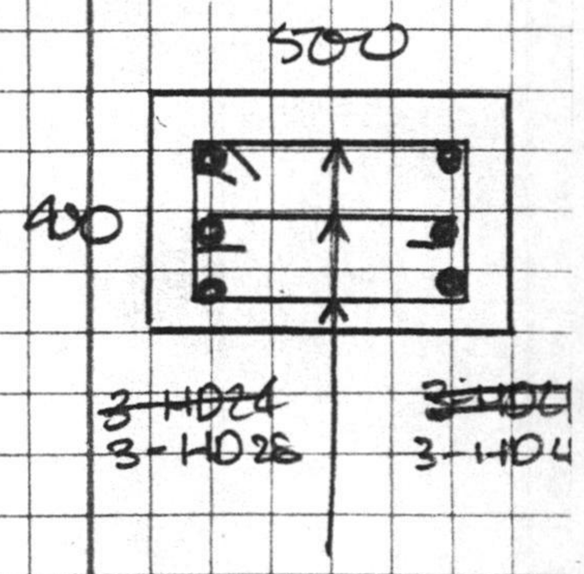
$R_u = \cancel{2.54\ MPa}$. $3.2\ MPa$

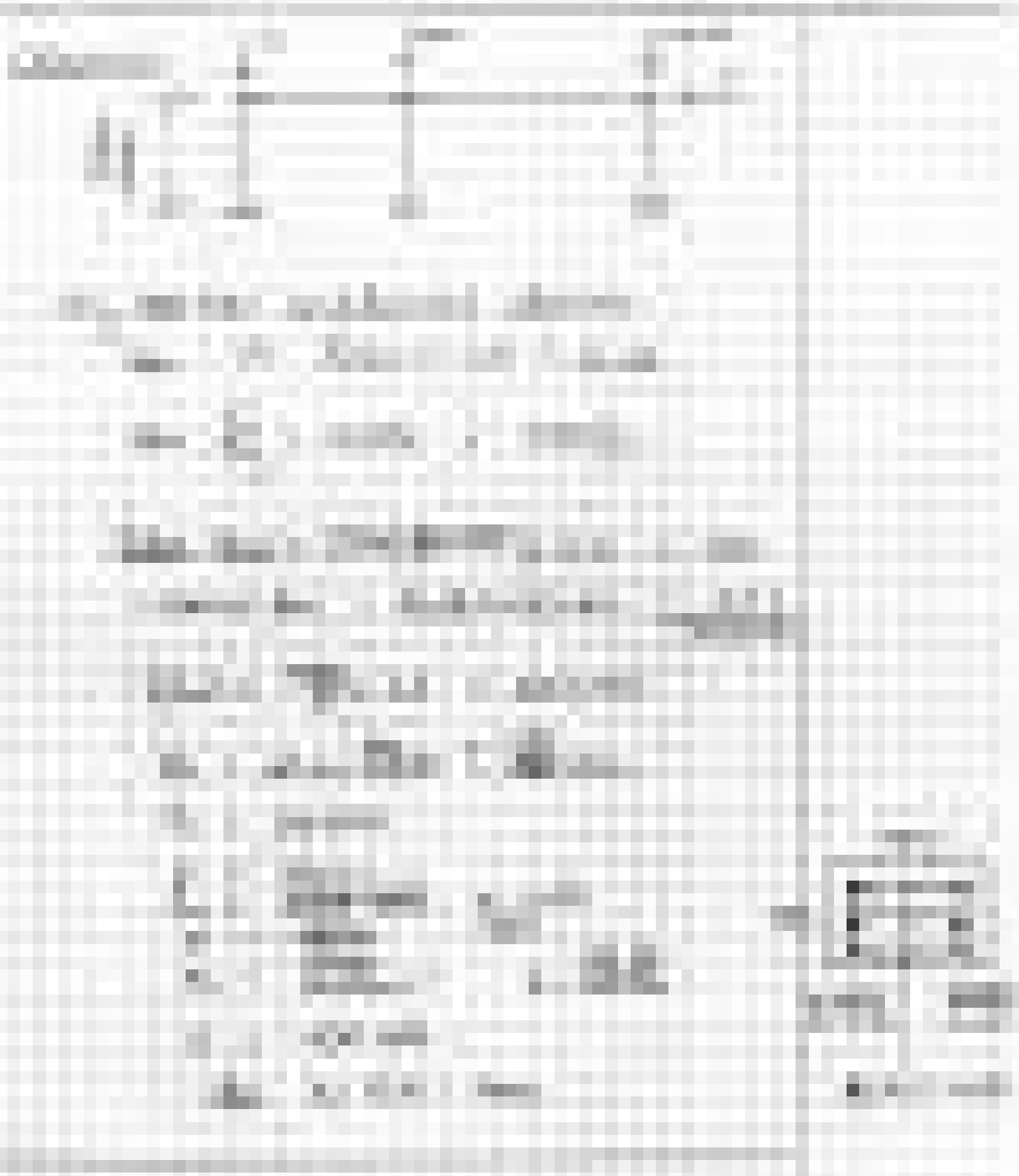
$\rho = \cancel{.0073}$ $.009$

$A_s = \cancel{1270\ mm^2}$ 1566. $3 - \cancel{HO24}$ HO 28

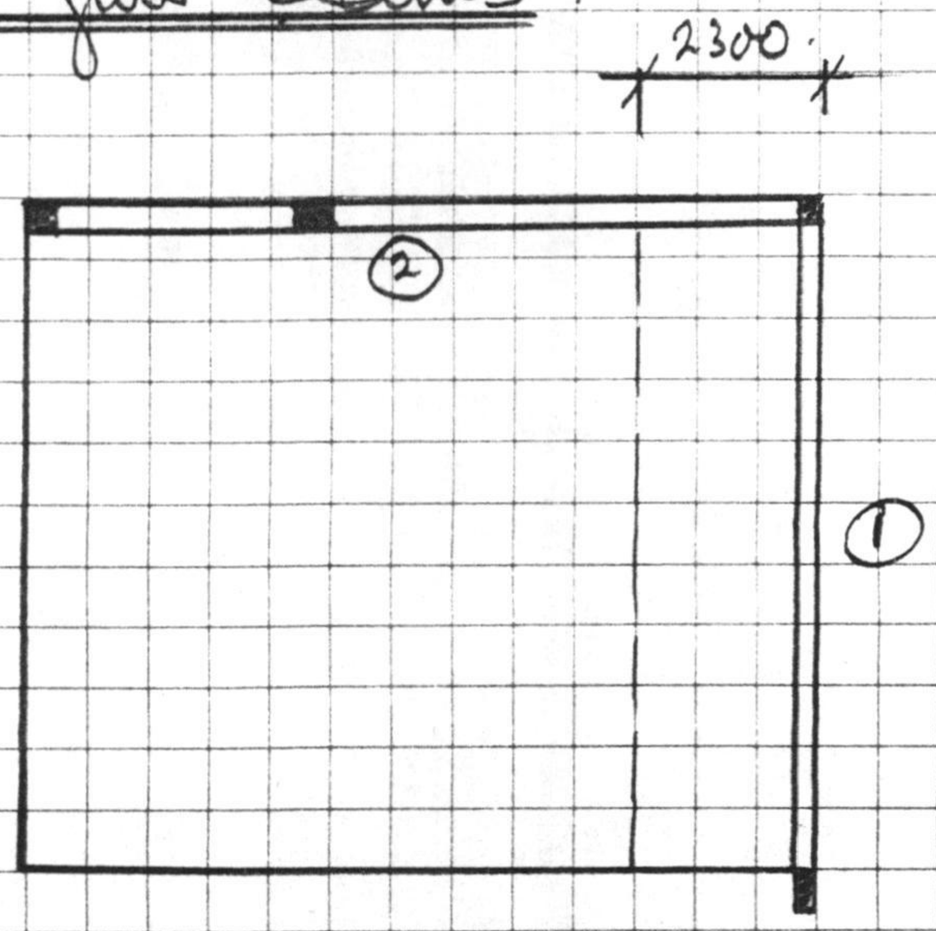
$v_i = .409\ MPa$.

Use 3 - R10 - 200





3rd floor Beams.



Beam 1

$W_u = 1.7 \times 3 \times \frac{2.3}{2} + 1.4\left(1 \times \frac{2.3}{2} + .5 \times .5 \times 24 + .8 \times 3\right)$
$= 5.9 + 18.41. = 24$ KN/m.

$M_u = 24 \times \frac{10.7^2}{8} = 190$ KNm.

$V_u = 130$ KN.

Try 700 x 400 Beam.

$d = 700 - 50 - 15 = 635$ mm
$R_u = 1.3$ MPa.

Min $A_s = .004 \times 635 \times 400 = 1016$.

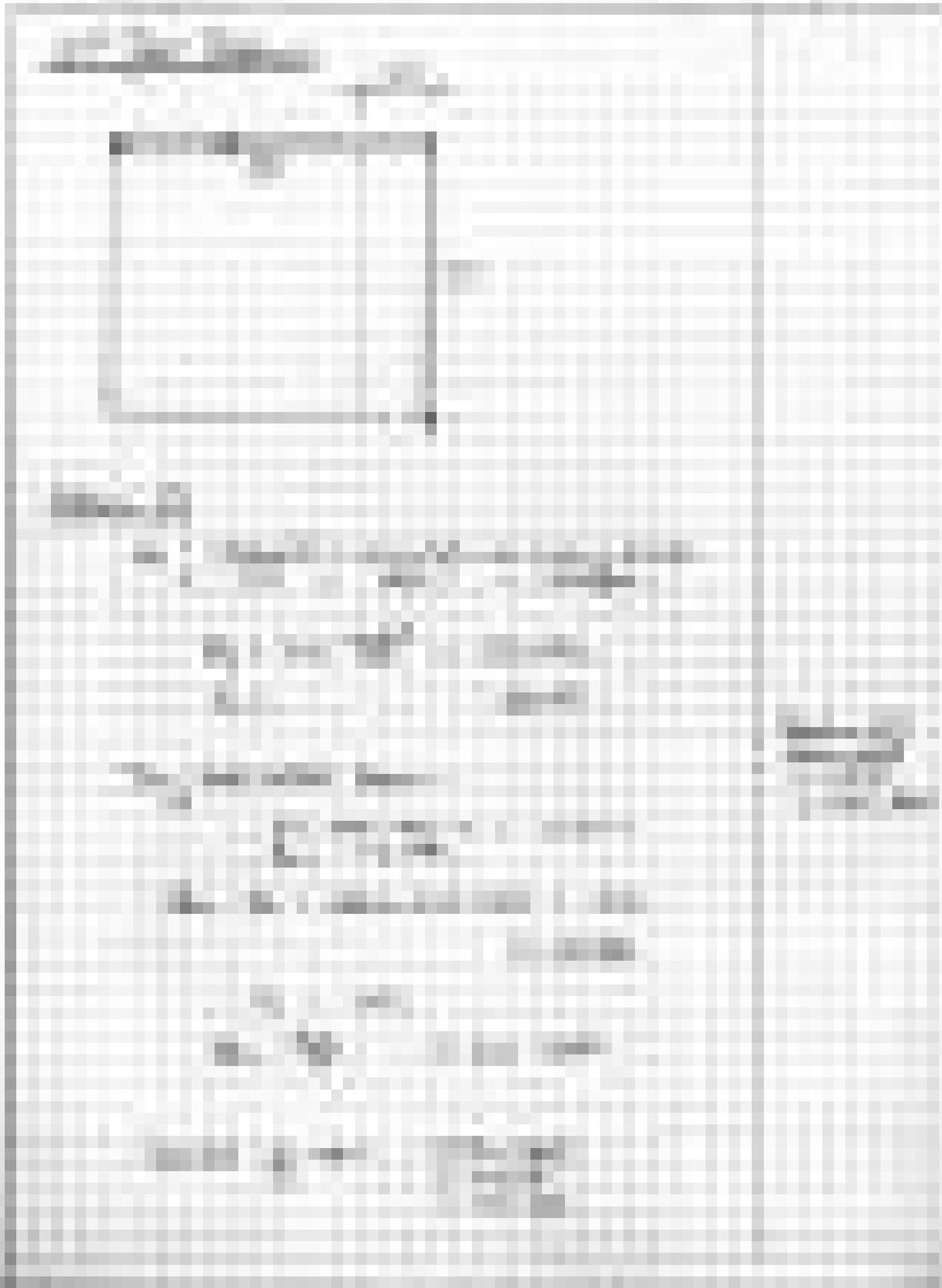
2-HD28.

$v_i = .602$.

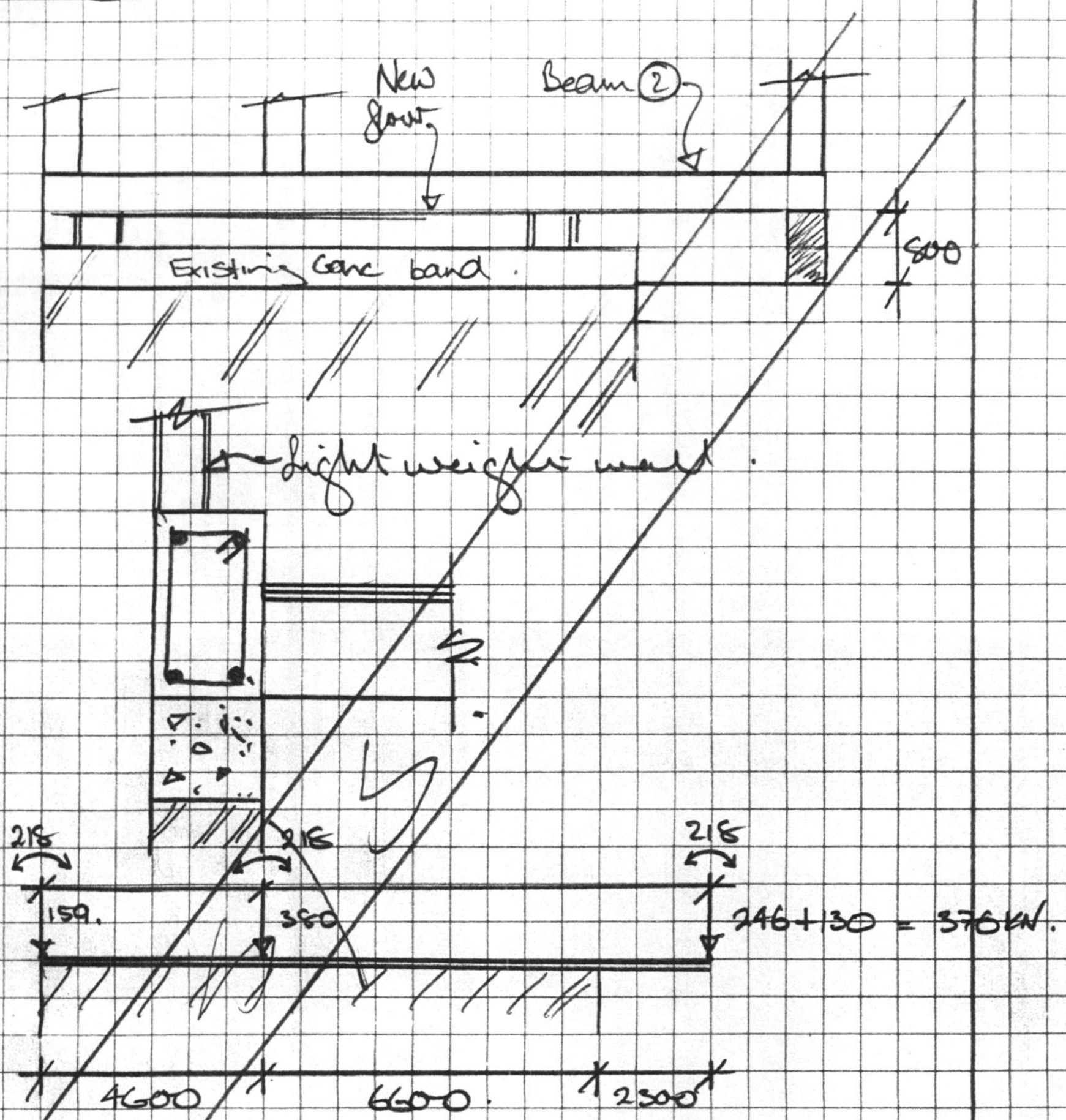
Min $\frac{A_{vs}}{S}$ 2-R10-300.

Could use 650 x 300
3-HD24
2-R10-300.

Beam 1
700 x 400
2-HD28
2-R10-300.



Beam (2).



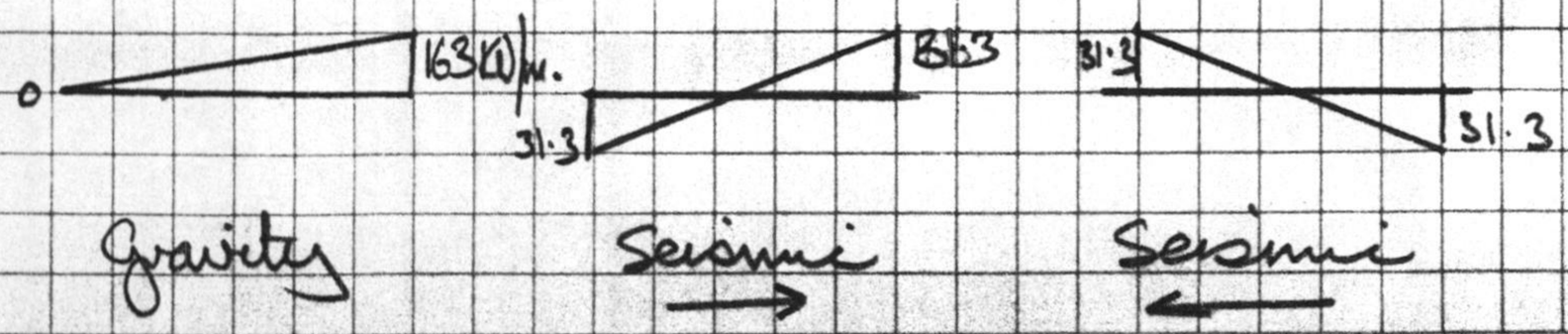
Assume Elastic distribution.

$$C.o.M = \frac{380 \times 4.6 + 376 \times 13.5}{159 + 380 + 376} = 7.46m.$$

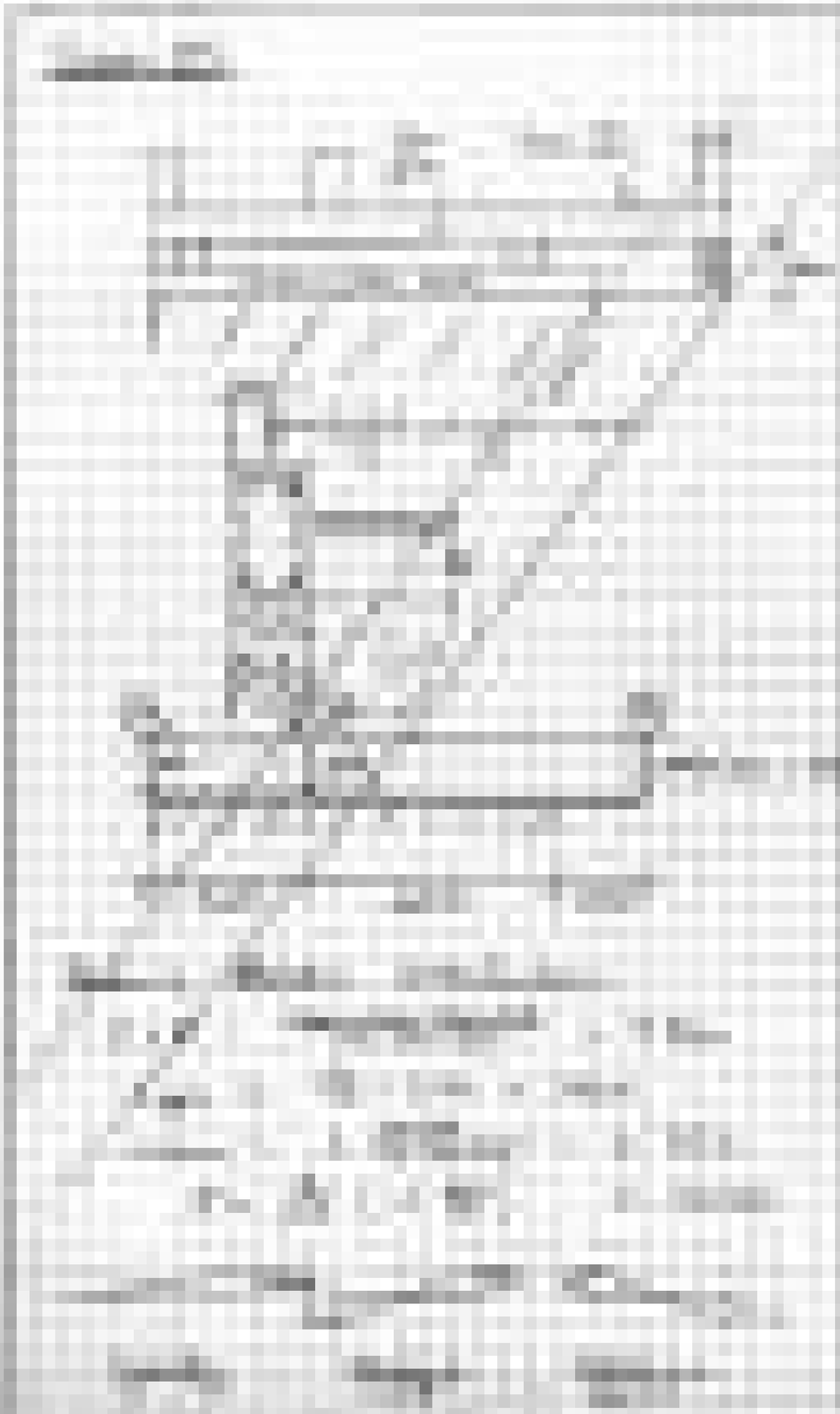
$$e_{grav.} = \frac{11.2}{2} - 7.46 = 1.86m$$

$$e_{seismic} = \pm \frac{3 \times 218}{159 + 380 + 376} = \pm .715m.$$

$$\sigma = \frac{P}{L.B}\left(1 \pm \frac{6e}{L}\right) \qquad P = 915KN.$$



Gravity Seismic → Seismic ←



Max Punch stress $= \frac{163+31.3}{.35} = 555$ Kpa

Max tension $= \frac{31.3}{.35} = 89$ Kpa.

Max Cantilever moment

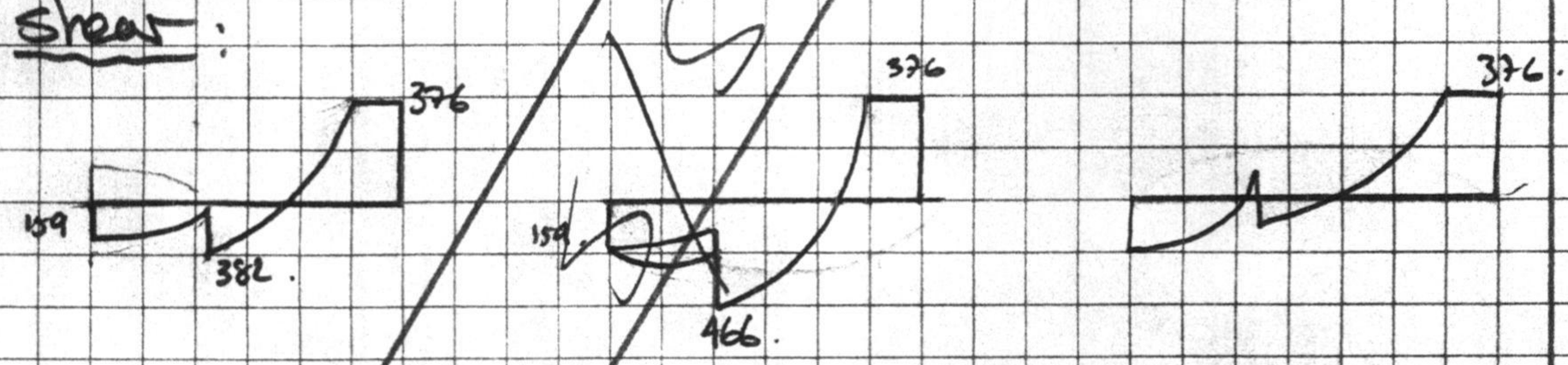
$= 218 + 376 \times 2.5 = 1082$ KNm.

Say 1200 x 400 Bm.

$R_u = 2.48$ MPa. ∴ OK.

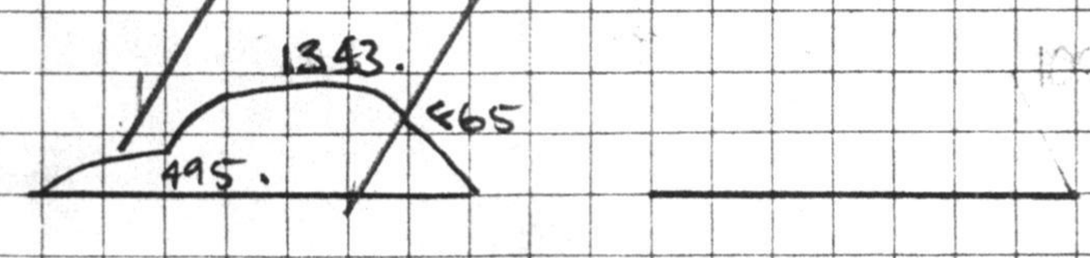
Beam Design

Shear:



Max $V_u = 466$ KN.

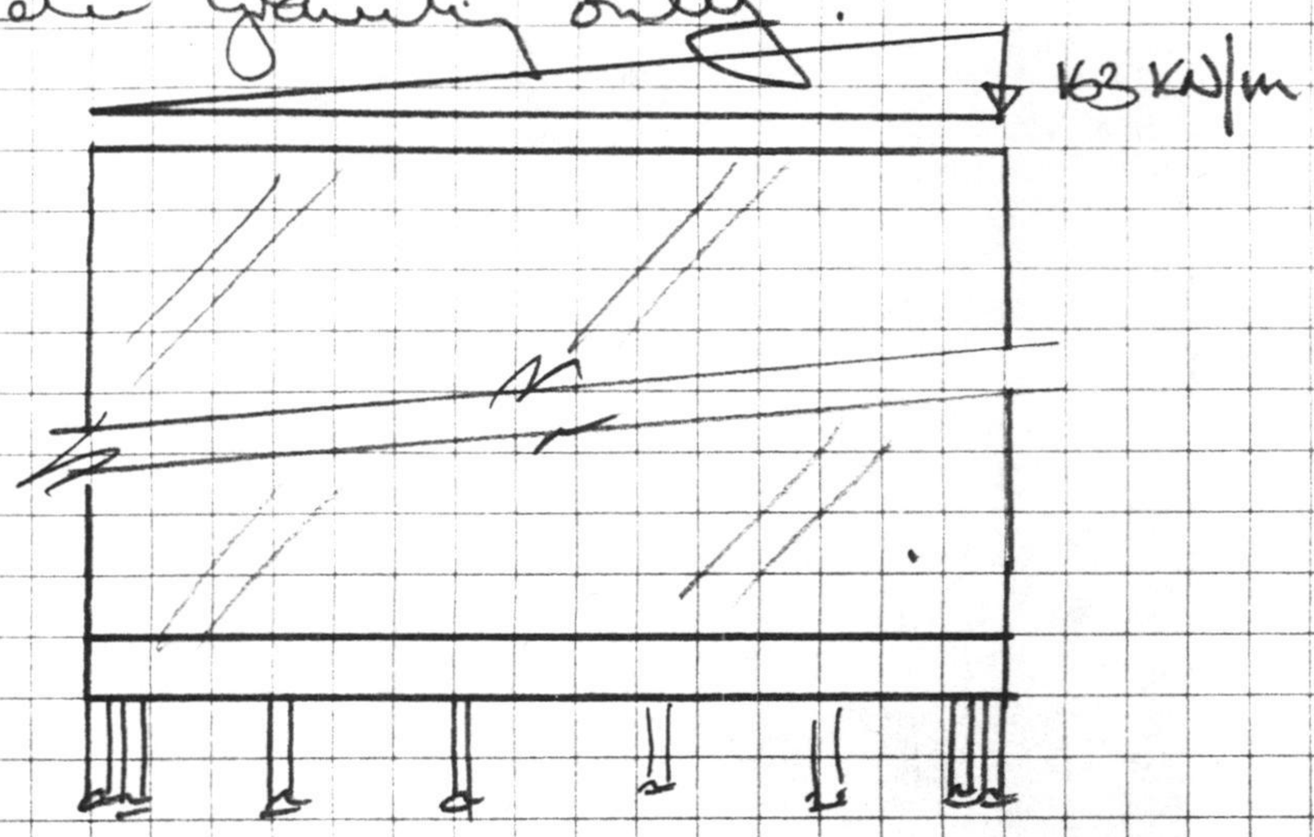
B.M^s.



Additional Loads to Piles.

3rd line $3 \times \frac{6.3}{2}$ = 9.5 KN/m
Beam 800 x 400 x 24 = 7.7
17.13 KN/m

Consider Gravity only.



Max add'l load to end piles

$= 163 \times \frac{1.5}{4} = 61$ KN. << 212

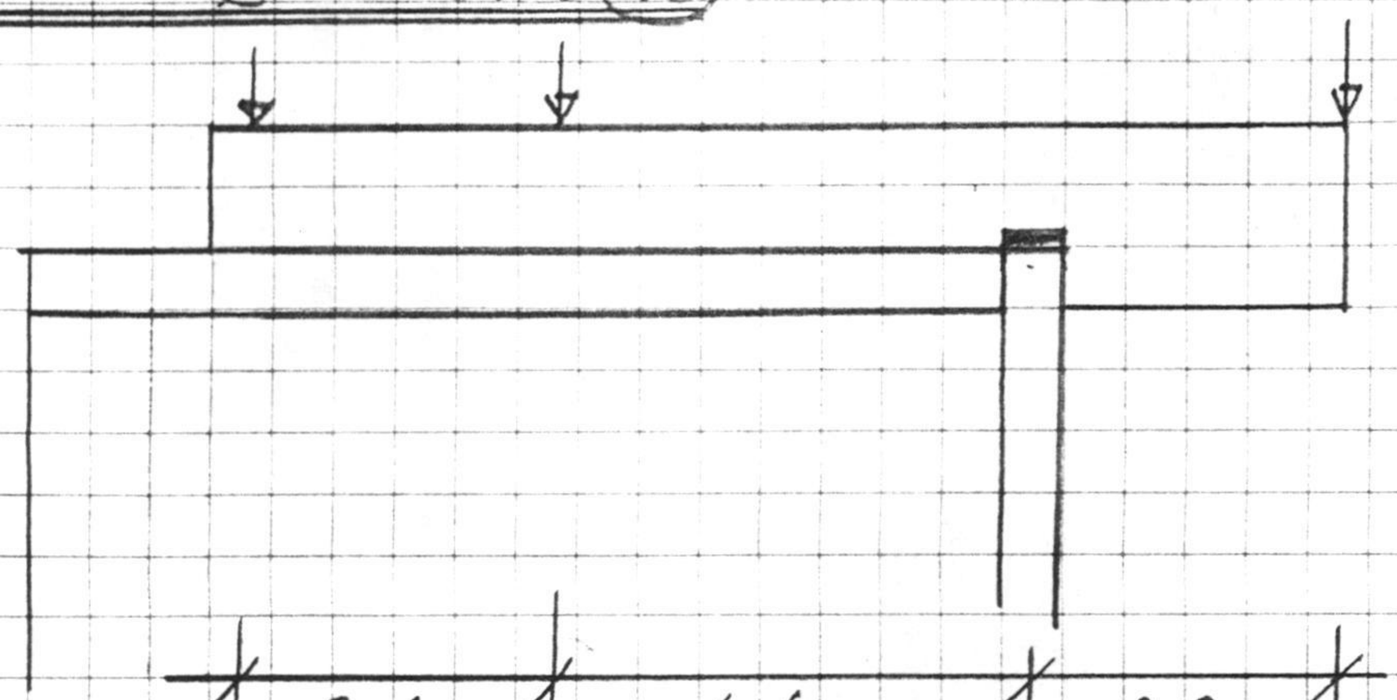
Add'l load to P_2

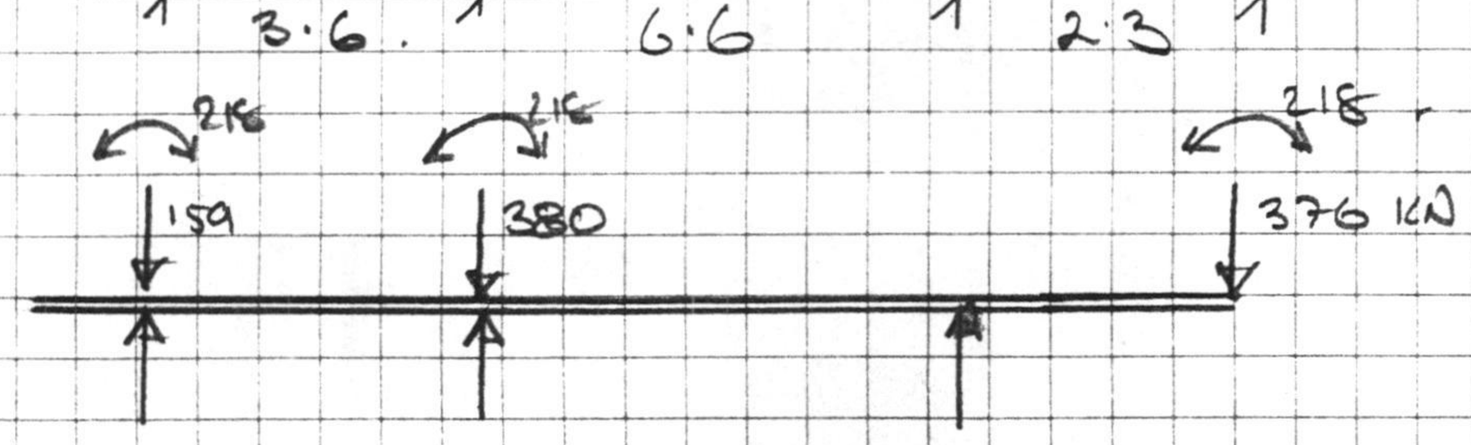
$= 163 \times \frac{11.2 - 3.8}{11.2} \times 1.2/2 = 65$ KN << 145 KN

Refer page NE/4.

Conservative as ultimate loads used

Alternative Beam (2)

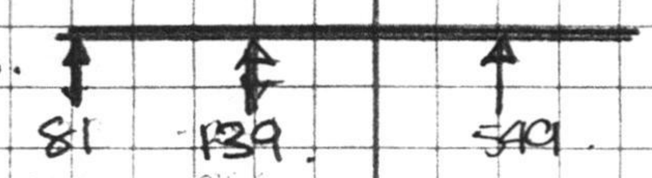


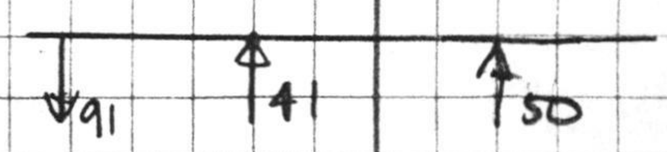


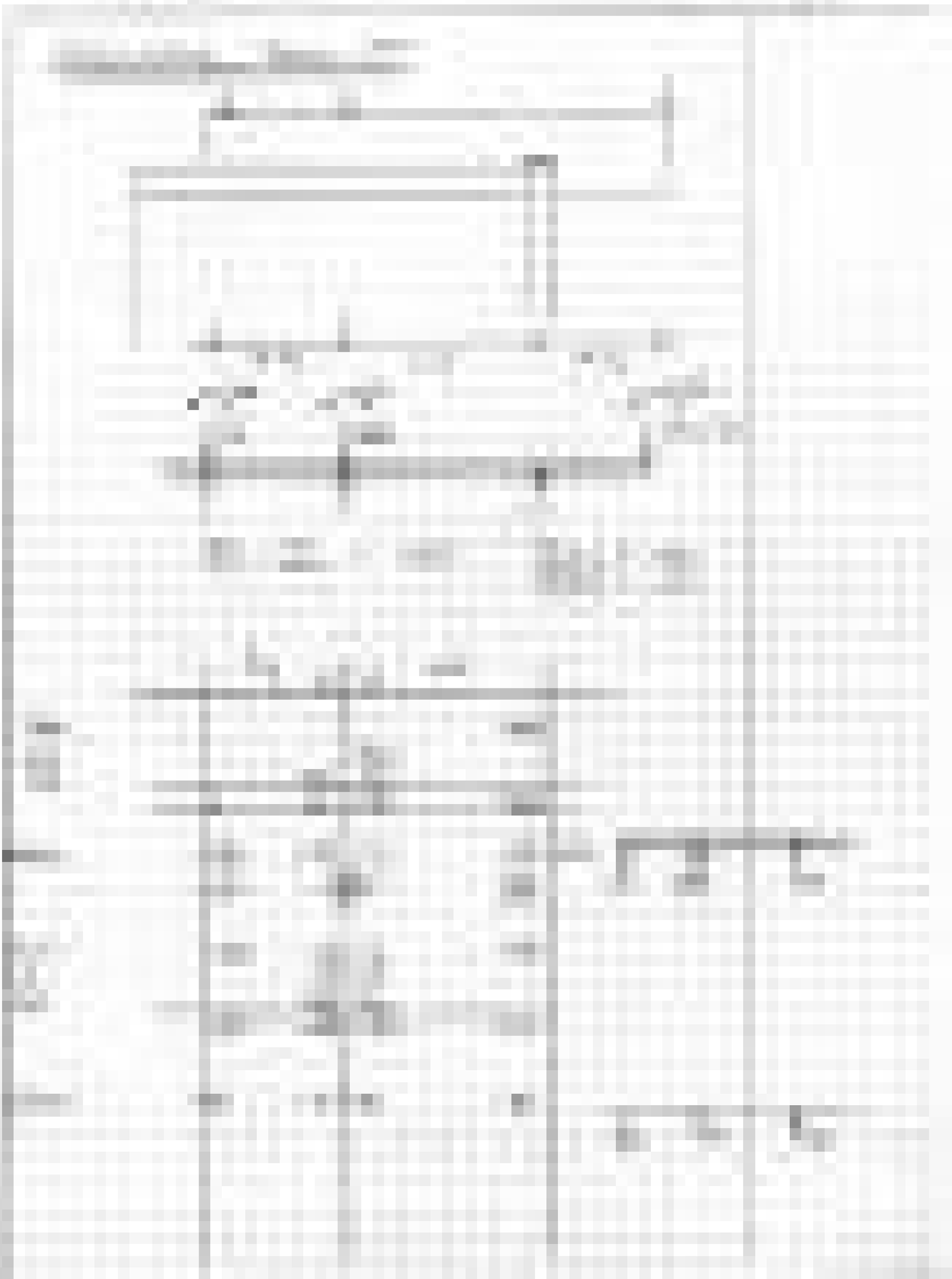
$\frac{1}{3.6} + \frac{1}{6.6} = .429.$

$Df_{3.6} = .65$
$Df_{6.6} = .35.$

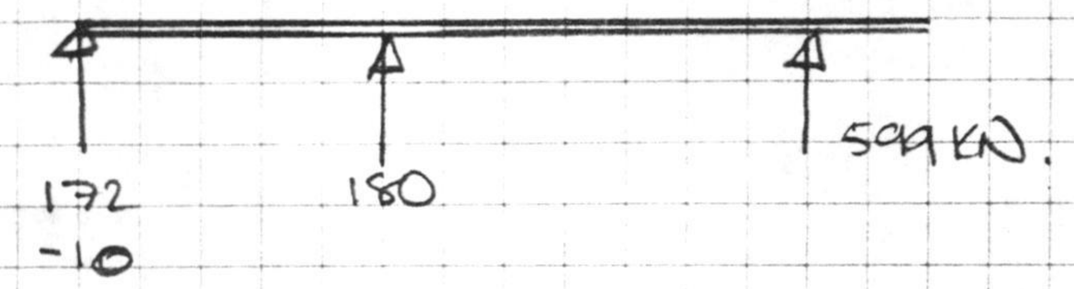
		.65	.35		
FEM.				-864	
CO.			-432		
Bal.		281	151		
	0	281	-281	-864	
Shear.	-78	-78	173	173	-376.
	159	380.		376	
	81	139		549.	
FEM.	-218	-142	-76	-218	
CO.		-109	-109		
Bal.		142	76.		
	-218	-109.	-109	-218	
Shear.	-91	-91	-50	-50.	



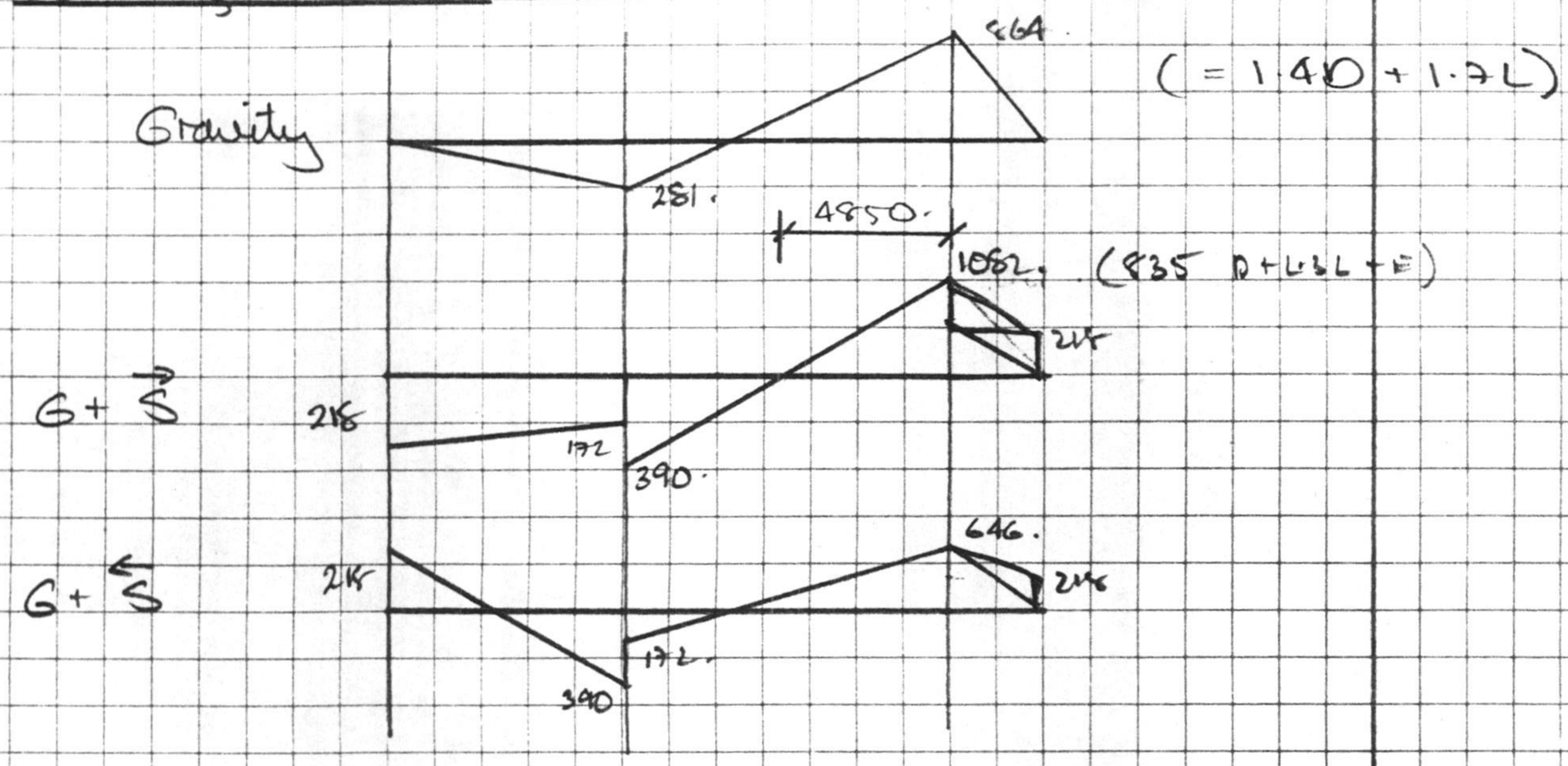




Max Reactions



Bending Moments.



(D+1.3L+E) Max $M_u = \frac{864}{1.4} + 218 = 835$ kNm.

Require $d \geq 554$

800 x 400 Beam.

$R_u = 4.73$

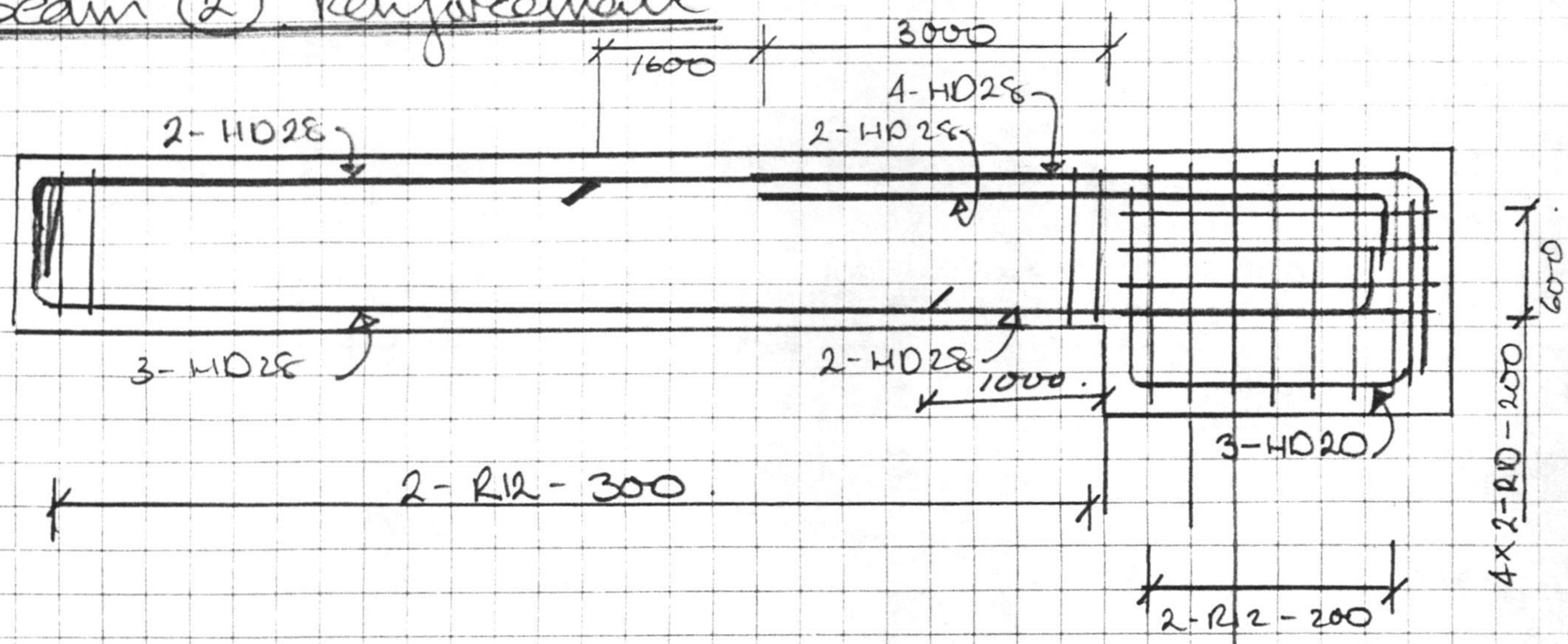
$\rho = .0142.$

$A_s = 3978$ 4 + 2 - HD28.

Max $V_u = 376$ kN.

$v_i = \frac{376000}{.85 \times 400 \times 700} = 1.58$ MPa.

Beam (2) Reinforcement



Negative Reo:

2-HD28 M_u = 300 kNm.

+ve Reo:

$$R_u = \frac{390000000}{.9 \times 400 \times 735^2} = 2.0.$$

ρ = .0055 A_s = 1617 mm².
3-HD28.

Shear:

800 × 400 section.

Max V_u = 173 + 50 = 223 kN

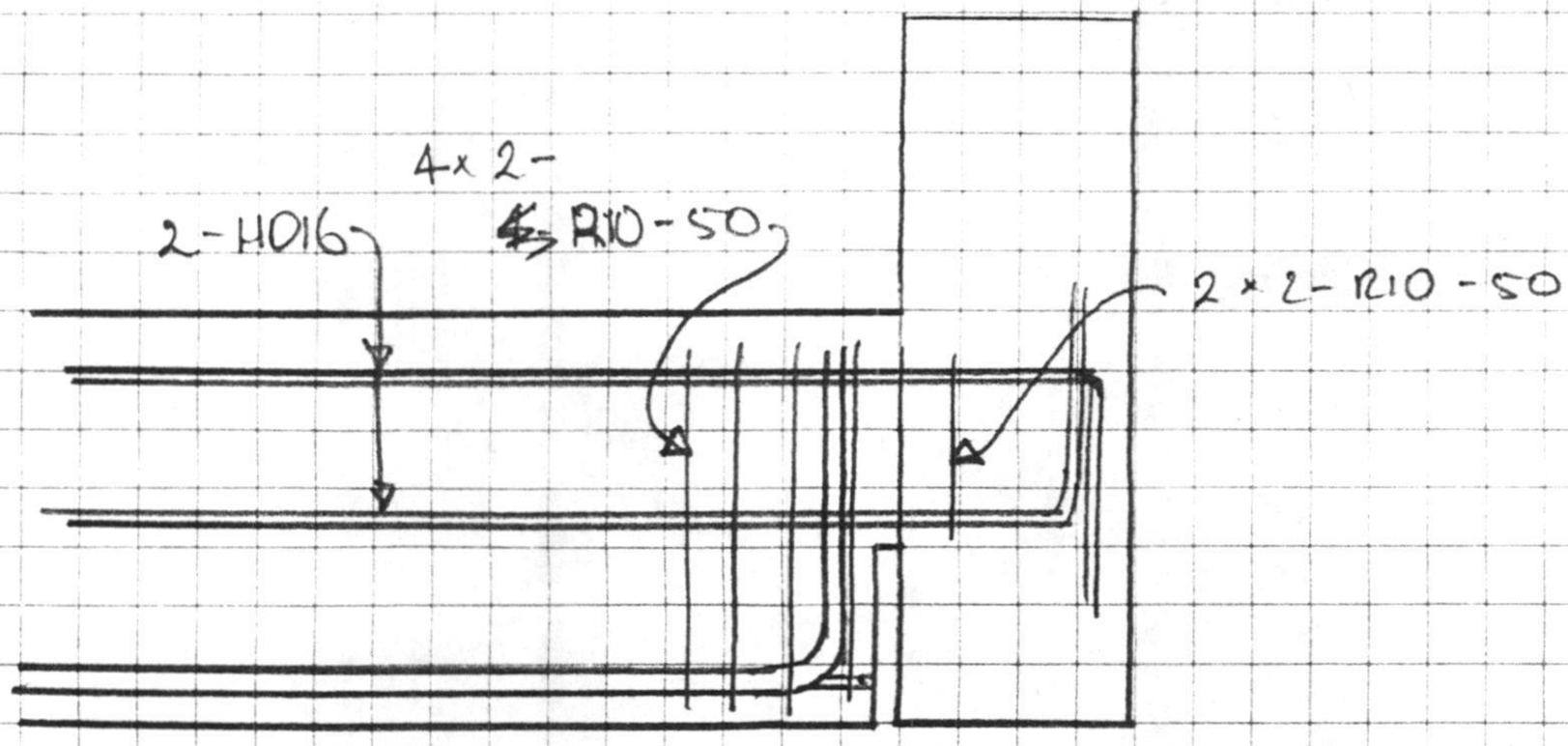
v_i = .936 MPa.
v_b = say .5 MPa.

$\frac{A_v s}{s}$ = .634. – 2-R12-300.

$$\frac{376000}{.85 \times 900 \times 400} = 1.23 \text{ MPa}.$$

$\frac{A_v s}{s}$ = 1.06.
2-R12-200.

Pinned End for beam (1)



Beam Reaction = 130 KN.

Try 300 x 300 connection

$v_c = 2.12$ MPa.

$$A_{vf} = \frac{130000}{.85 \times .7 \times 300} = 574 \text{ mm}^2$$

Use 4-H016.

Beam reaction stirrups

$$A_v = \frac{130000}{.85 \times 275} = 556 \text{ mm}^2$$

$$\frac{556}{160} = 3.47.$$

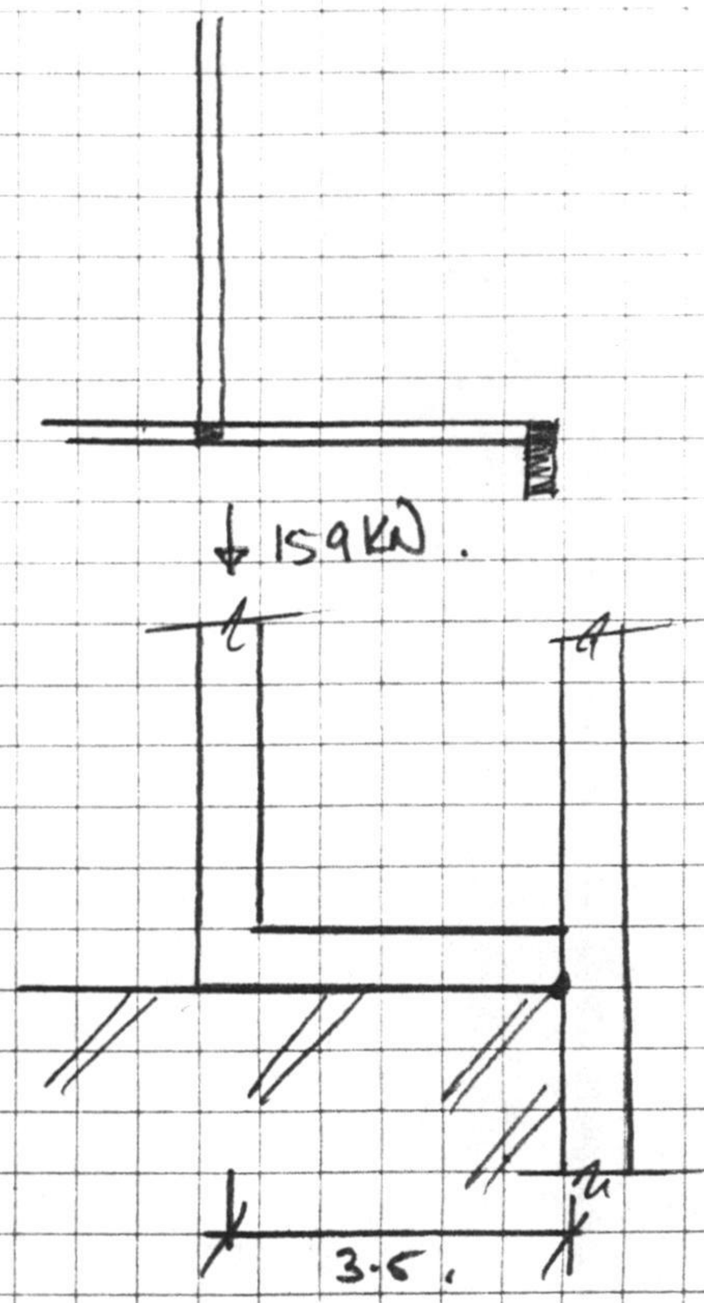
Shear. $v_c = 2.12$ MPa.

$v_c - v_b = 1.77$ MPa.

$$A_v = \frac{1.77 \times 300 \times 50}{275} = 96 \text{ mm}^2$$

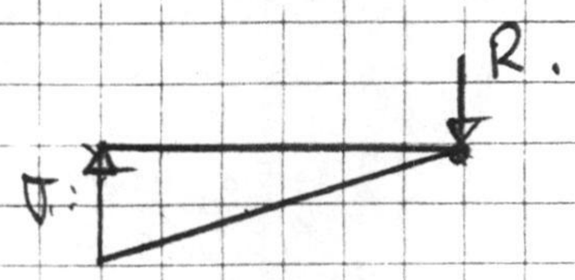
2-R10-50 OK.

E West Beam Support (South).



$$79.5 \times 3.5 - 136/2 \times 3.5 \times \frac{3.5}{3} = 0.$$

Assume elastic reaction.



$$\frac{\sigma}{2} \times 3.5 = R + 159.$$

$$159 \times 3.5 = \frac{\sigma}{2} \times 3.5 \times \frac{2}{3} \times 3.5$$

$$\therefore \sigma = 136 \text{ kN/m}.$$

$$R = 79.5 \text{ kN}.$$

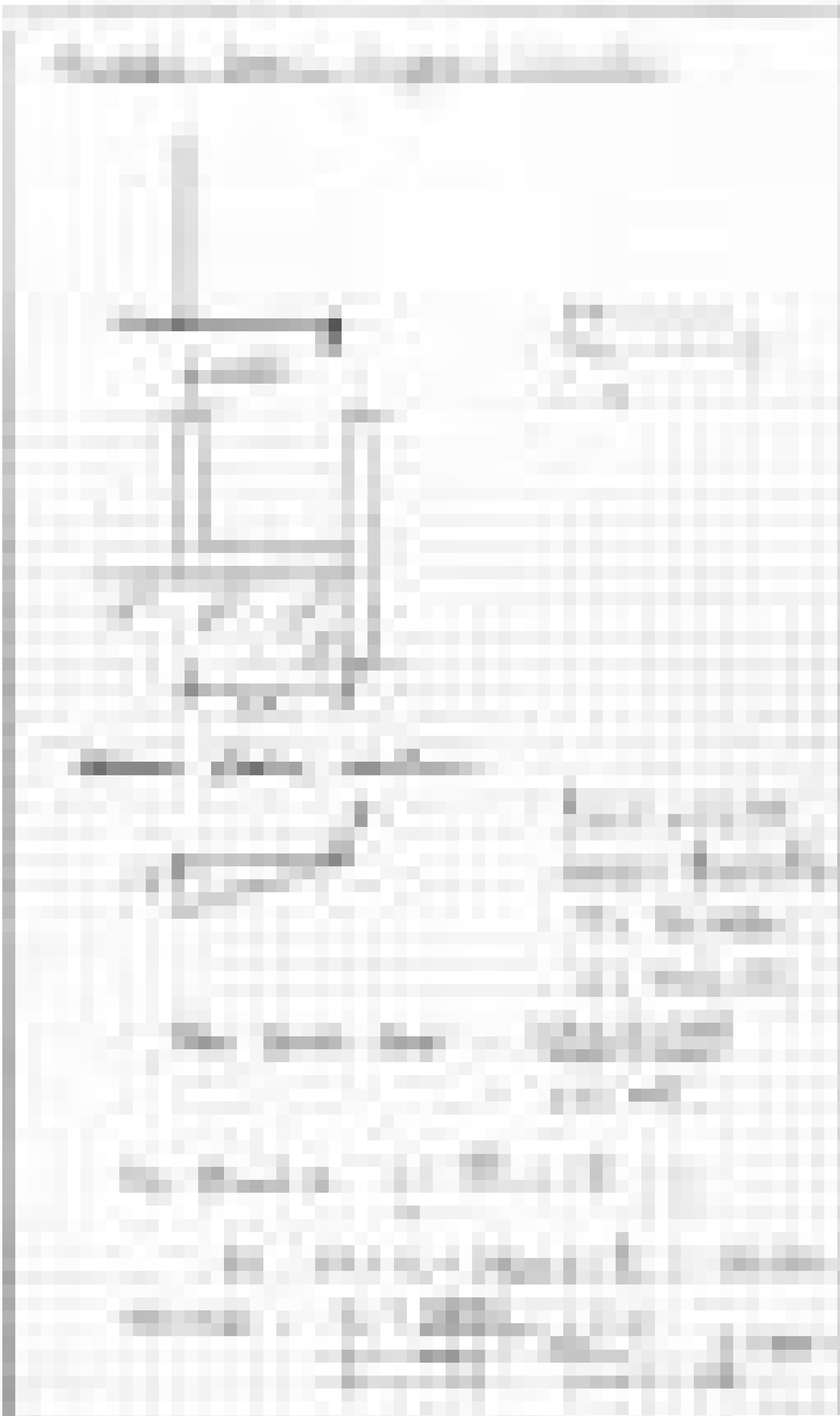
$$\text{Max Brick load} = \frac{136 \times .4 \times 1000}{400 \times 350} = .389 \text{ MPa}$$

400 × 350.
2-H024 + 1-H016
2-R12 - 150

Max Moment @ x: $R - \frac{136}{3.5} \times x \times \frac{x}{2} = 0.$
$= 2.$

$$M = 79.5 \times 2 - 78/2 \times 2 \times \frac{2}{3} = 106 \text{ kNm}.$$

400×350 : $R_u = \frac{106E6}{.9 \times 350 \times 355^2} = 3.0$
$\rho = .0085$ 996 mm². 2-H024 + 1-H016
$v_c = 1.59$ 2-R12 - 150.



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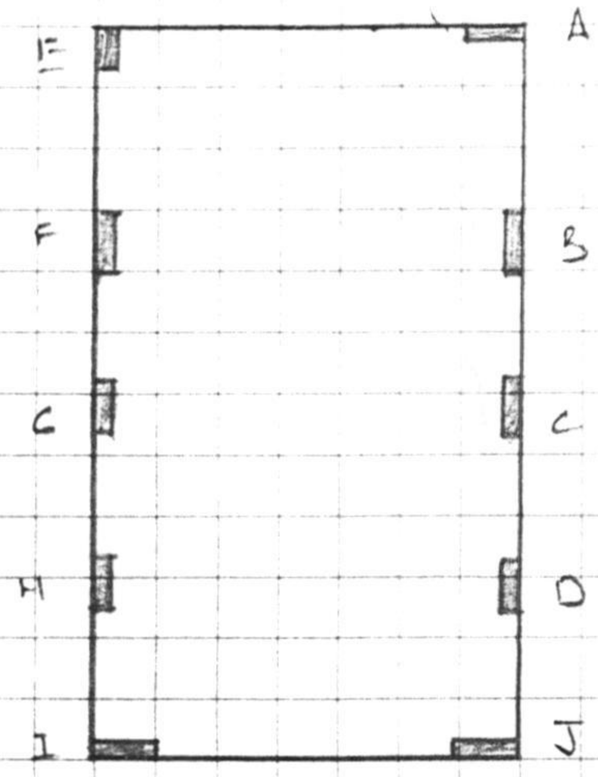
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No 1868 PAGE F|1

JOB BY MJO

DATE 10/86



N-S torsion

$1530 \times \frac{.48}{.6} = \pm 1224$

Gravity $Q_A = \frac{3000}{3} = 1000$ Kpa.

Seismic $Q_A = \frac{3000}{2} = 1500$ Kpa.

Uplift 2m ϕ, 7m depth.

Allowable $= \frac{5000}{2} = 2500$ KN.

Column	D	L	D+L	E'Quake. E	W	N	S	D+L+.8E	.7D+.8E
A	705	262	967	1530	-1530	431 1224	-431 -1224	2291	-831
B	1041	557	1598			293	-293	1832	
C	1250	625	1875			156	-156	2000	
D	1175	600	1775			-568	568	2229	
E	700	260	960	-1530	1530	872 -1224	-872 1224	2184	-734
F	1187	580	1767			-539	+539	2198	
G	250	238	488			-65	+65	540	
H	1056	583	1639			+217	-217	1813	
I	761	270	1031	-1530	1530	-486 1224	486 -1224	2255	-692
J &	700		700.	1530	-1530	- -1224	- 1224	1924	-734

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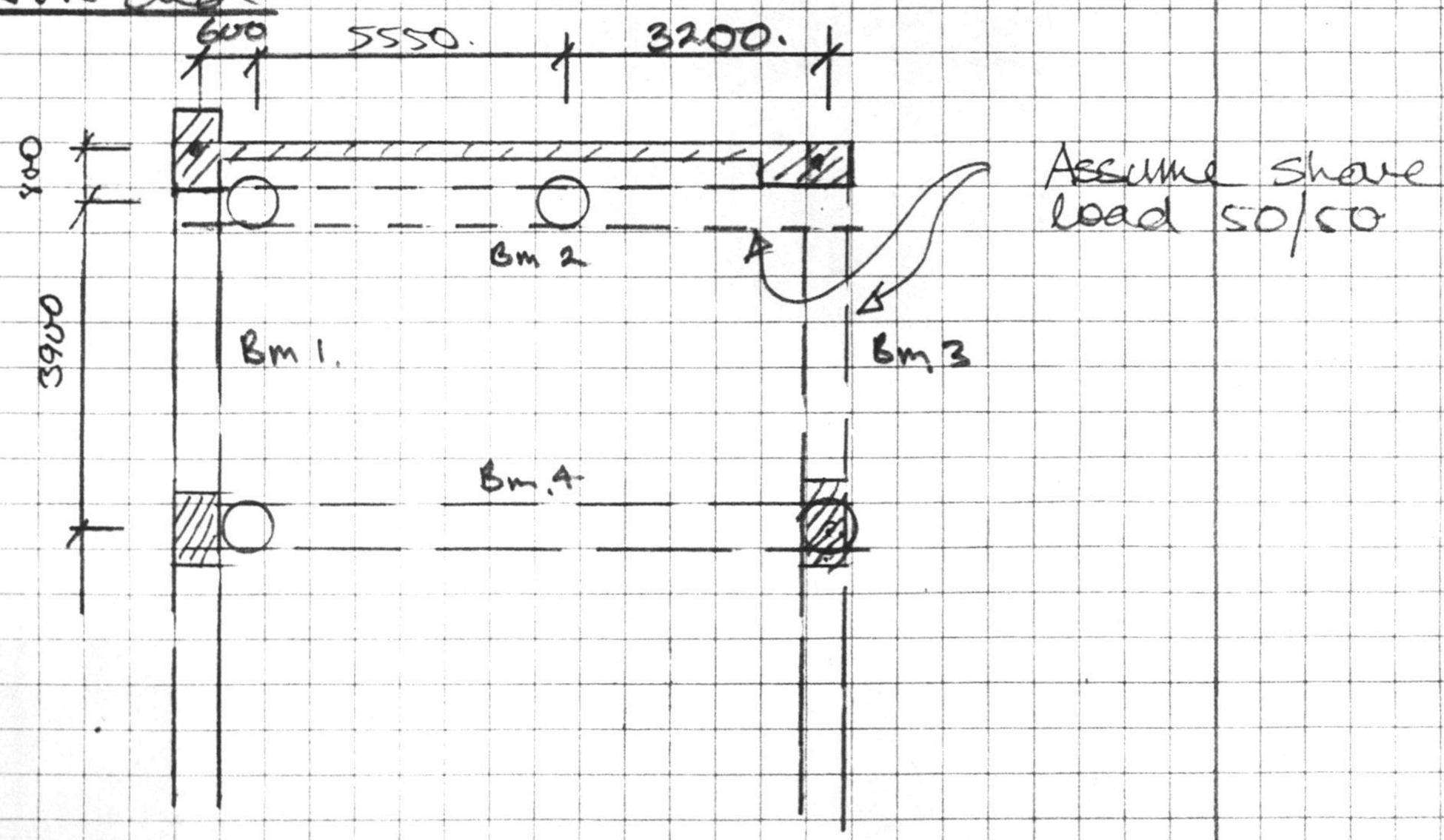
JOB BY MJO

DATE 10/86.

Pile	D+L	D+L+SE	·7D+·8E	Pile Area G.	Pile Area S.	Pile Bell ϕ.
A	967	2291	-831	·967	1.53	1400
B	1598	1832		1.598	1.22	1426
C	1875	2000		1.875	1.33	1545
D	1775	2229		1.775	1.49	1503
E	960	2184	-734	·96	1.46	1363
F	1767	2198		1.767	1.47	1500
G	488	590		·488	·36	788
H	1639	1813		1.639	1.21	1444
I	1031	2255	-692	1.031	1.50	1382
J	~~700~~ 967	2291	-734.	·967	1.53	1400.

Piles Shifted to avoid Tunnel.

North End.



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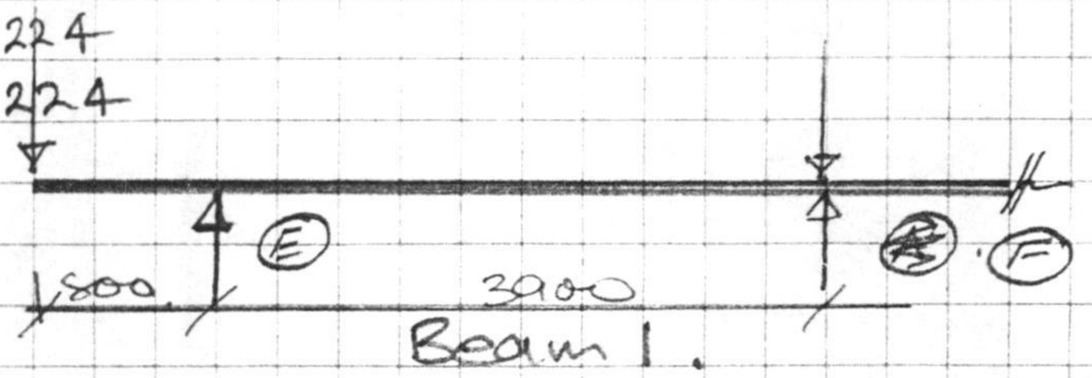
JOB No 1868 PAGE F/3

JOB BY MJD.

DATE 10/86.

D+L	960	1767.
·8E (N)	-107	431
·8E (S)	107	-431
·8E (E)	-1224	
·8E (W).	+1224	

BEAM 1



Beam 1.

Reactions

$\frac{\cdot 8}{3a} = \cdot 205$ $\quad 1 + \frac{3}{2} \times \cdot 205 = 1 \cdot 307.$

$\frac{3}{2} \times \cdot 205 = \cdot 307.$

D+L	1255	1767 - 233 = 1534
·8E (N)	-140	431 + 43 = 474
" (S)	140	-431 - 43 = -474
" (E)	-1600	376
" (W)	1600.	-376.

Moments.

D+L		-768.
·8E	N	86
"	S	-86
"	E	979
"	W	-979.

Beam 2.

D+L		1255
·8E	N	-140
"	S	140
"	E	-1600
"	W	1600.

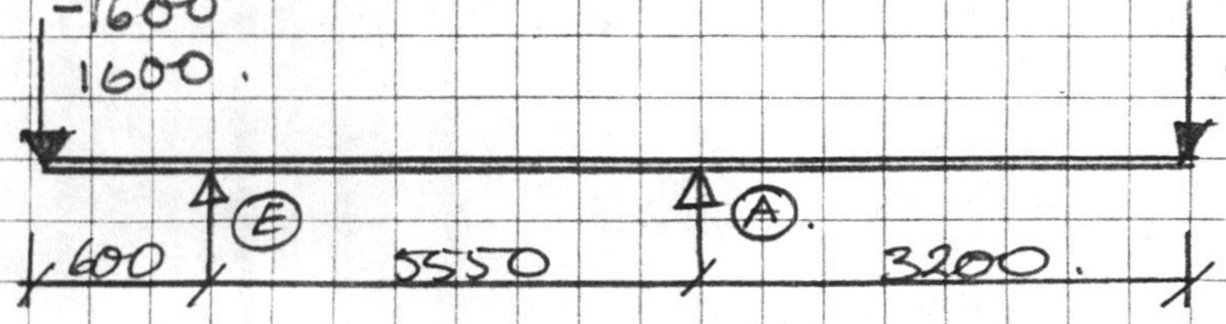
967/2 = 484

1655/2 = ·828

-1655/2 = -828

1224/2 = 612

-1224/2 = -612.



Reactions: $\times \frac{6 \cdot 15}{5 \cdot 55} - \times \frac{3 \cdot 2}{5 \cdot 55} - \times \frac{\cdot 6}{5 \cdot 55} + \frac{8 \cdot 75}{5 \cdot 55}$

$= \times 1 \cdot 1 - \times \cdot 58 = 1 \cdot 58 \times - \cdot 12$

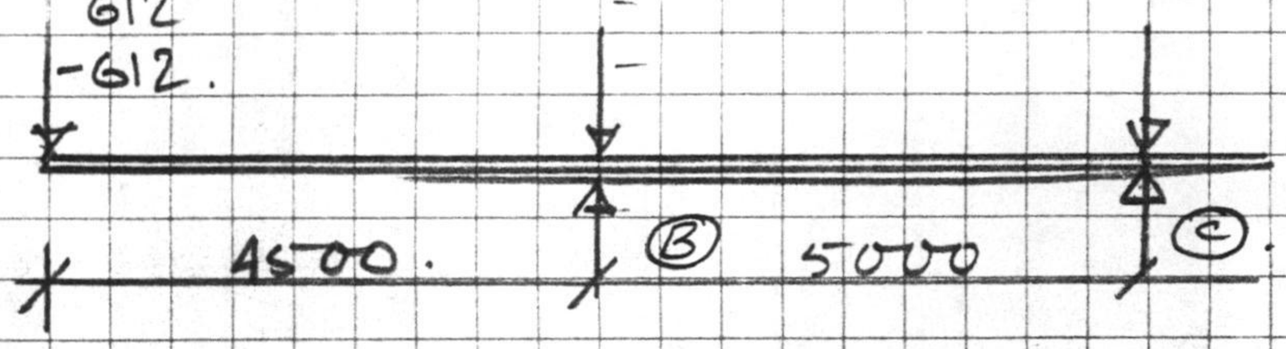
D+L		1100	614
·8E	N	-634	1325
"	S	634	-1325
"	E	-2115	1159
"	W.	2115	-1159.

Moments.

D+L	-753	-1549
·8E N	84	-2650
" S	-84	2650
" E	960	-1958
" W.	-960.	1958.

Beam 3.

D+L	484	1598	1875
·8E N	828	234	125
" S	-828	-234	-125.
" E	612	–	
" W	-612.	–	



Reactions.

	$\times \frac{9.5}{5.0}$	$-\frac{1.5}{5}$
D+L	2517	1439.
·8E N	1807	-620
" S	-1807	620
" E	1162	-551
" W.	-1162	551.

Moments.

-2178.
-3726
3726
-2754
2754

Max. Pile loads.

Pile	D+L ↓	+0·8E ↑	D+L ↑	+8E	Area load	φ. mm
A	614	1939	—	711	1·29	1281
B	2517	4324	—	—	2·88	1915
E	1100	3215		-1015	2·14	1651
F	1534	2008	—	—	1·53	1396

Ground Beams

Beam 1

Max $V_u \simeq 1.48 \times 960 + \frac{1600}{.8} = 3420$ kN

Max $M_u \simeq 1.48 \times 768 + \frac{979}{.8} = 2360$ kNm.

@ $v_i \leq .2 \times 25 = 5$ MPa.

Require $b.d = \frac{3420000}{.85 \times 5} = 804894$ mm²

(600 × 1340)

Say 1500 × 600 beam.

$R_u = \frac{2360\ E6}{.9 \times 1300^2 \times 600} = 2.59$ MPa.

∴ OK.

Beam 1
1500 × 600.

Beam 2.

Max $V_u = 1.48 \times 1255 + \frac{1600}{.8} = 3857$ kN.

Only 600 long ∴ corbel.

At other end.

$V_u = 1.48 \times 484 + \frac{828}{.8} = 1751$ kN.

$M_u = 1549 \times 1.48 + \frac{2650}{.8} = 5605$ kNm.

1500 × 800 beam.

$R_u = 4.6$ MPa.

Beam 2
1500 × 800.

Beam 3.

$M_u \simeq 1.48 \times 2178 + \frac{3726}{.8} = 7880$ kNm.

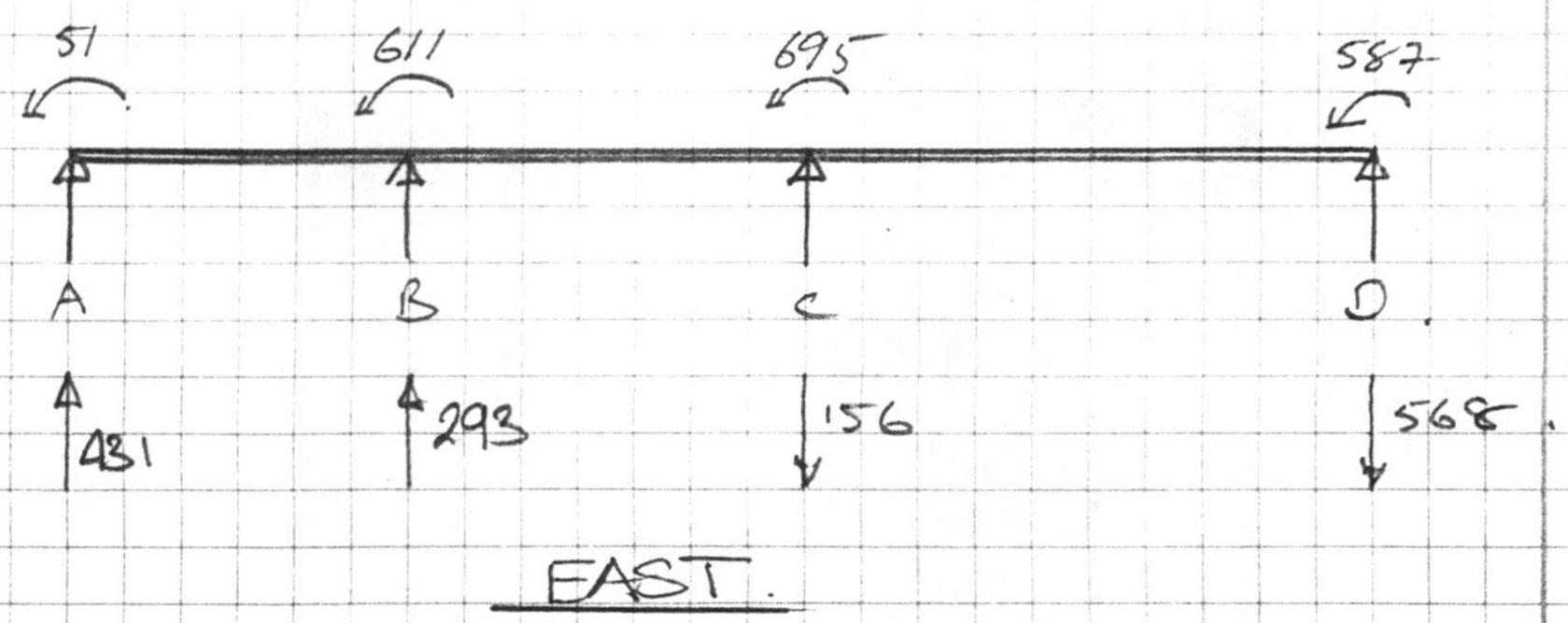
2000 × 800 beam.

$R_u = 3.38$ MPa.

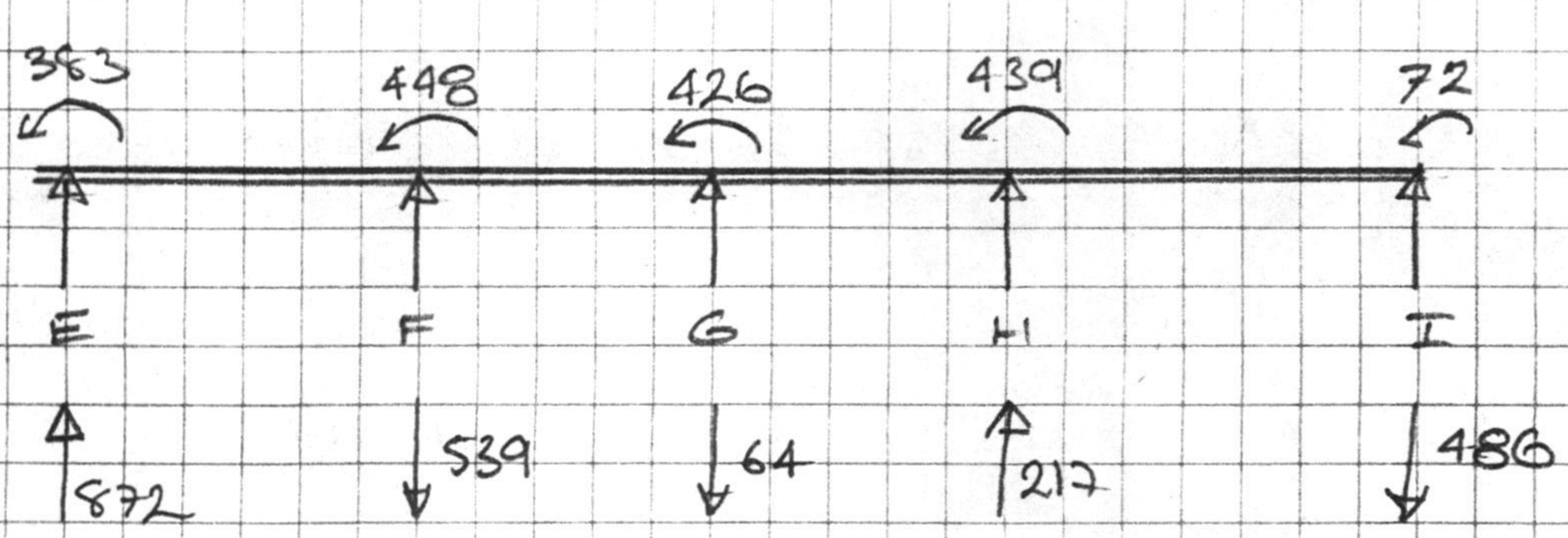
Beam 3
2000 × 800.

Ground beam forces from Seismic Frame.

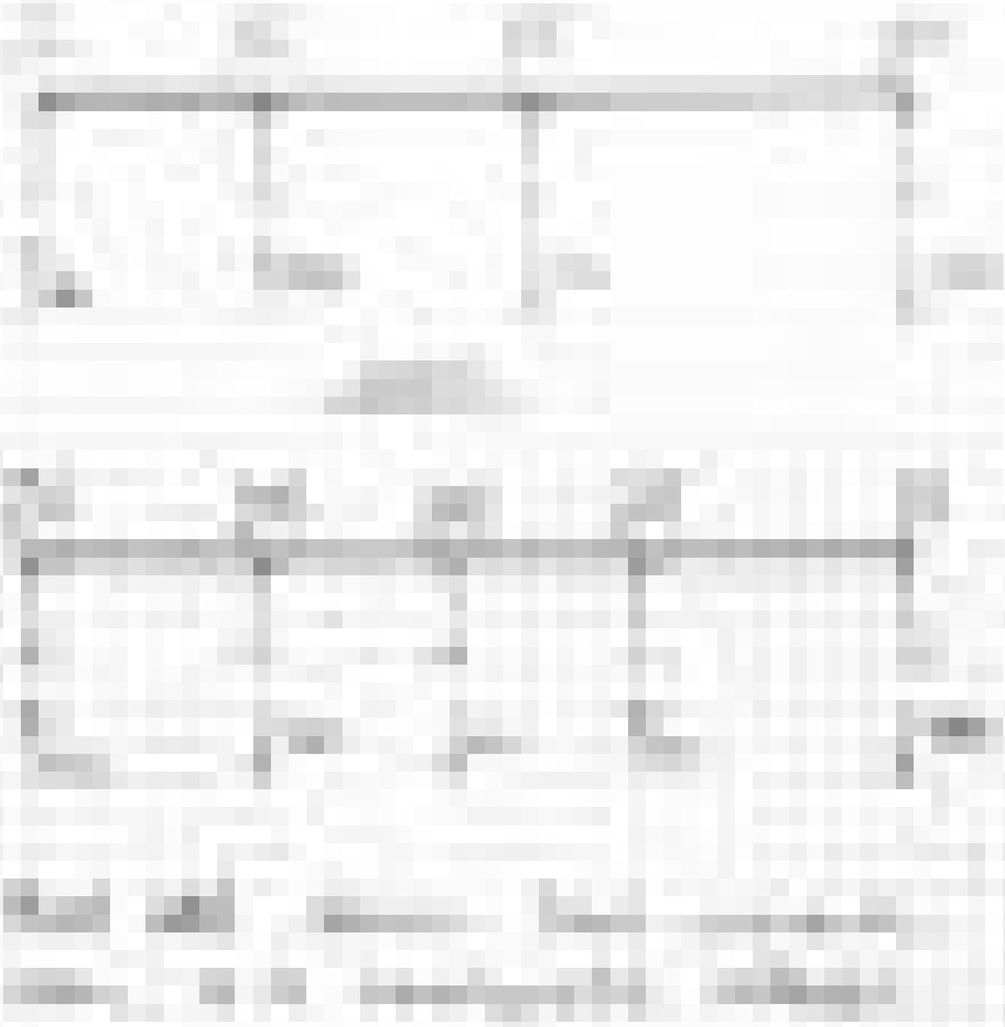
Refer Sheets 21 - 32.



EAST.



Must add column base moments when N-S earthquake critical.



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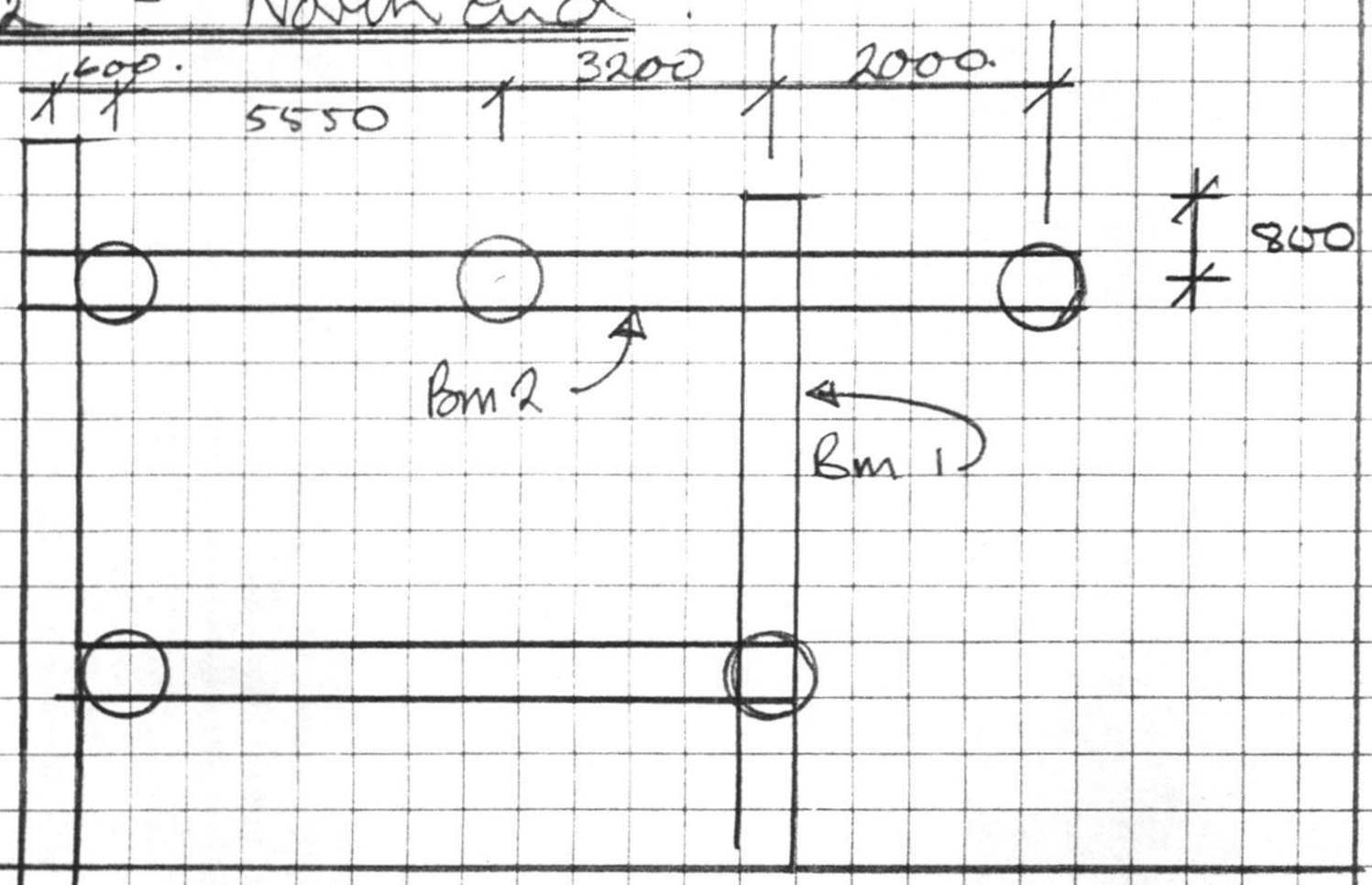
JOB No 1868 PAGE F/8

JOB BY MJO.

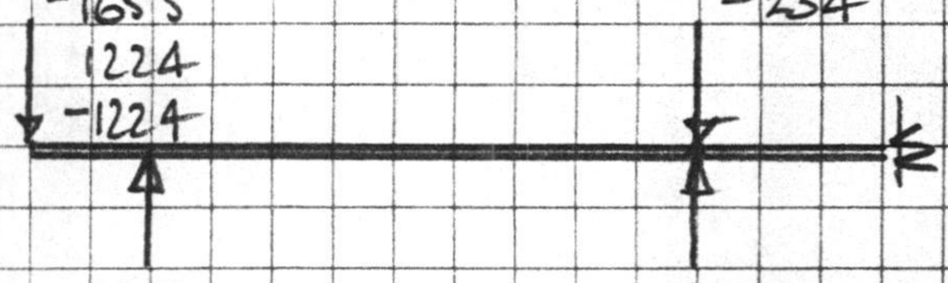
DATE 10/86.

Option 2 - North End.



Beam 1.

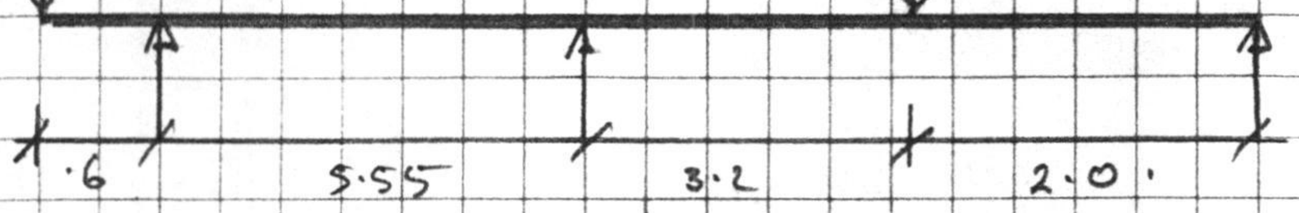
D+L		967	1598.
·8E	N	1655	234
"	S	-1655	-234
"	E	1224	
"	W.	-1224	



D+L		1224	1340
·8E	N	2096	-207
"	S	-2096	207
"	E	1550	-326
"	W.	-1550.	326

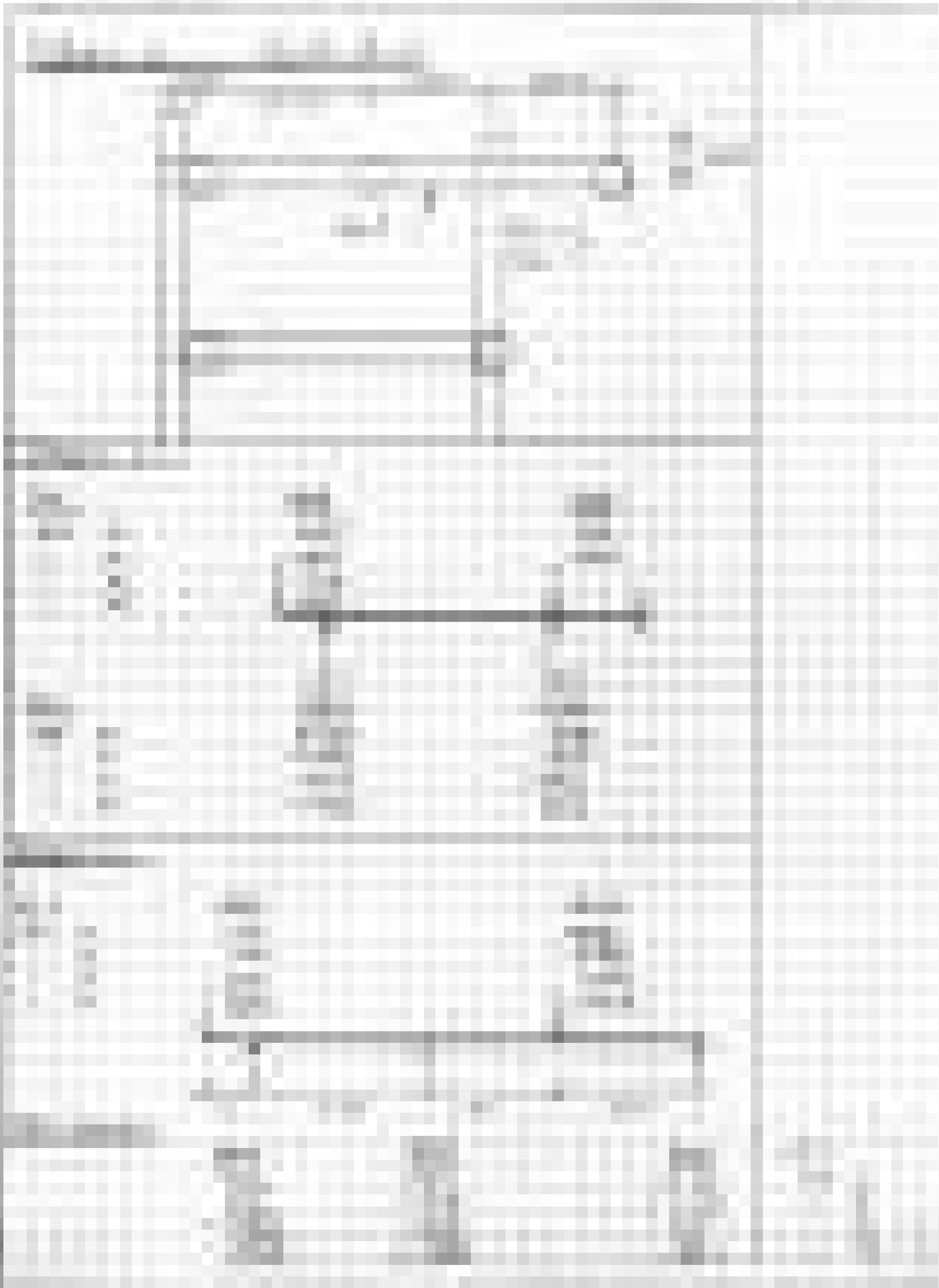
Beam 2.

D+L		1255	1244
·8E	N	-140	2096
"	S	140	-2096
"	E	-1600	1550
"	W.	1600.	-1550.



Approx Reactions:

1343	458	660	D+L	
-306	1155	1110	·8E	N
306.	-1155	-1110	"	S
-1932.	1109	821	"	E
1932.	-1109.	-821.	"	W



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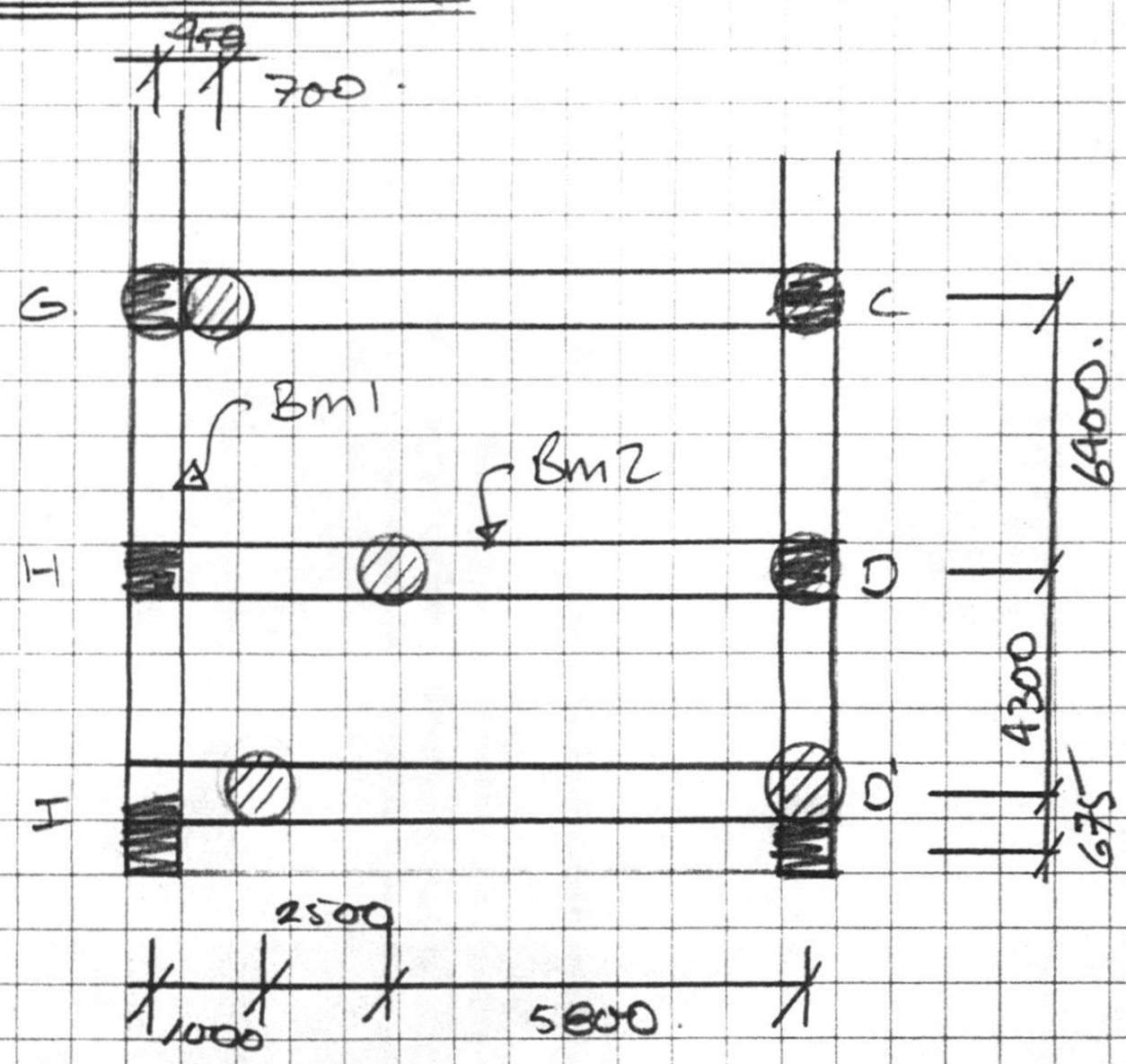
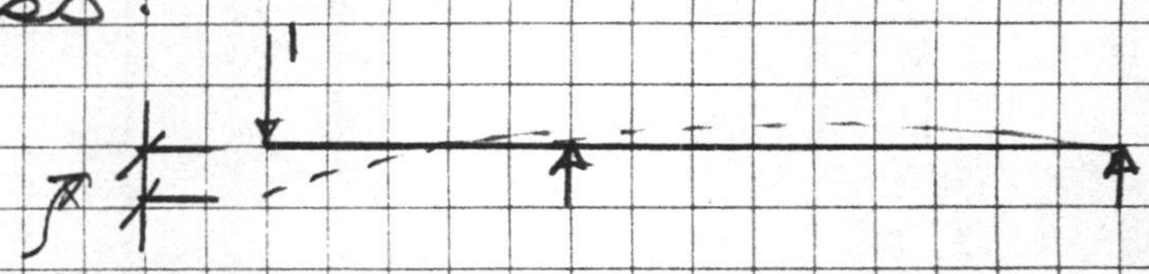
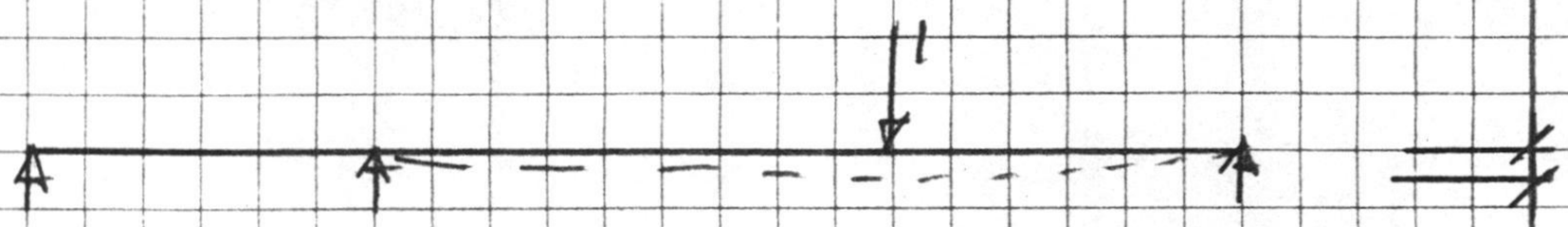
South End



Stiffness:



$\delta_x = -0.38$



$\delta_x = -0.16$

Bm1 : Bm2 load share

≃ 1 : .421.

(70.4%) (29.6%)

Load.			Bm1	Bm2.
D+L		1639	1154	485
·8E	N	217	153	64
"	S	-217	-153	-64
"	E	—	—	—
"	W	—	—	—

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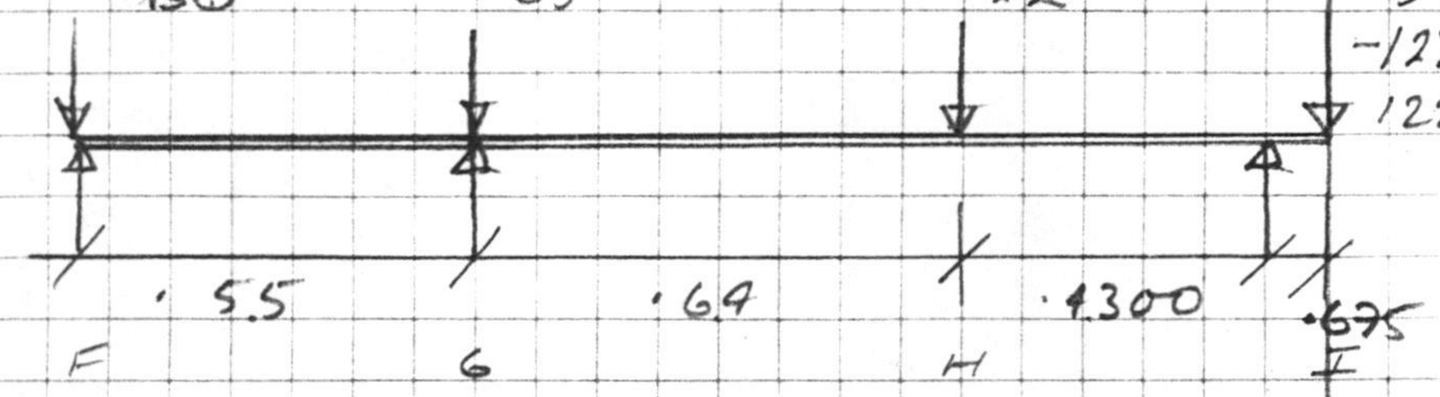
JOB No 1868 PAGE F/10

JOB BY MJD.

DATE 10/86.

Beam 1:

D+L	1767	488	1154	1031.
.8E N	-430	-65	122	590
" S	430	+65	-122	-590.
" E				-1224
" W.				1224



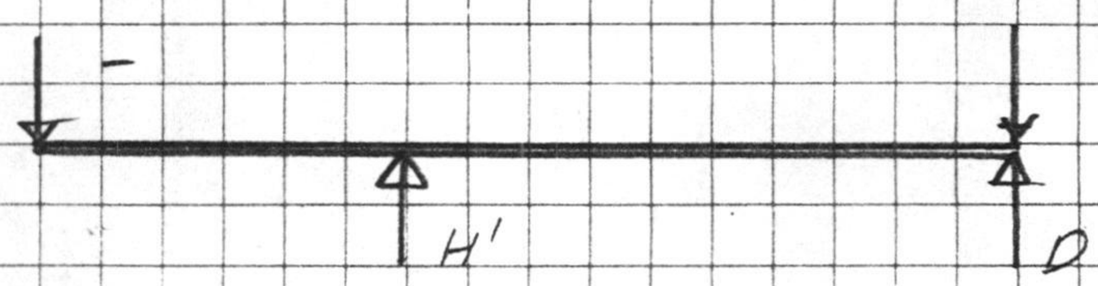
Reactions:

D+L	1516	1330	1596
.8E N	-456	24	650
" S	+456	-24	-650
" E			-1224
" W			1224.

Moments: -1373. 2411, 255, -255

Beam 2:

D+L	485		1775
.8E N	64		-454
" S	-64		454
" E	-		
" W.	-		



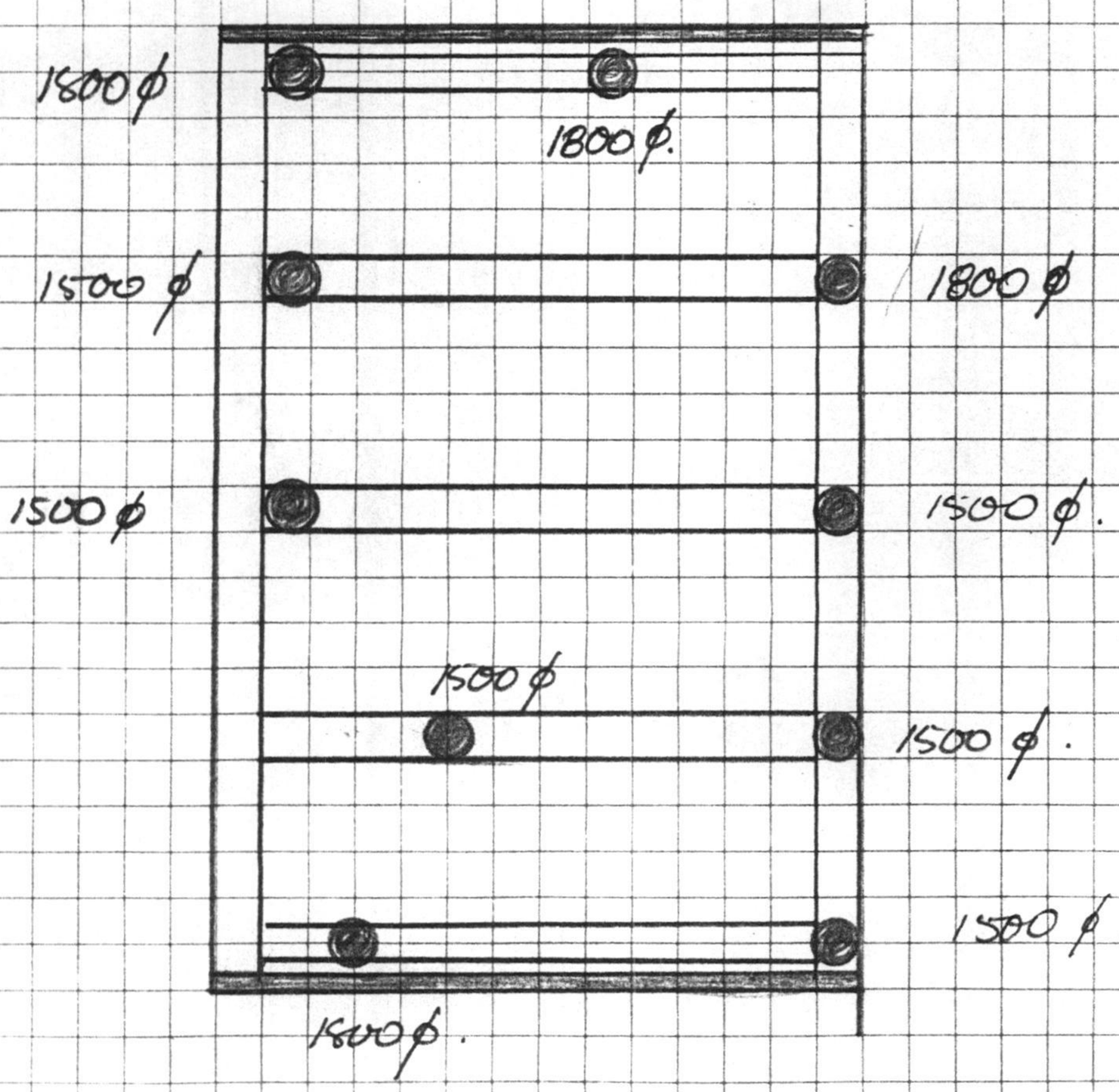
	777	1482
	102	492
	-102	492.

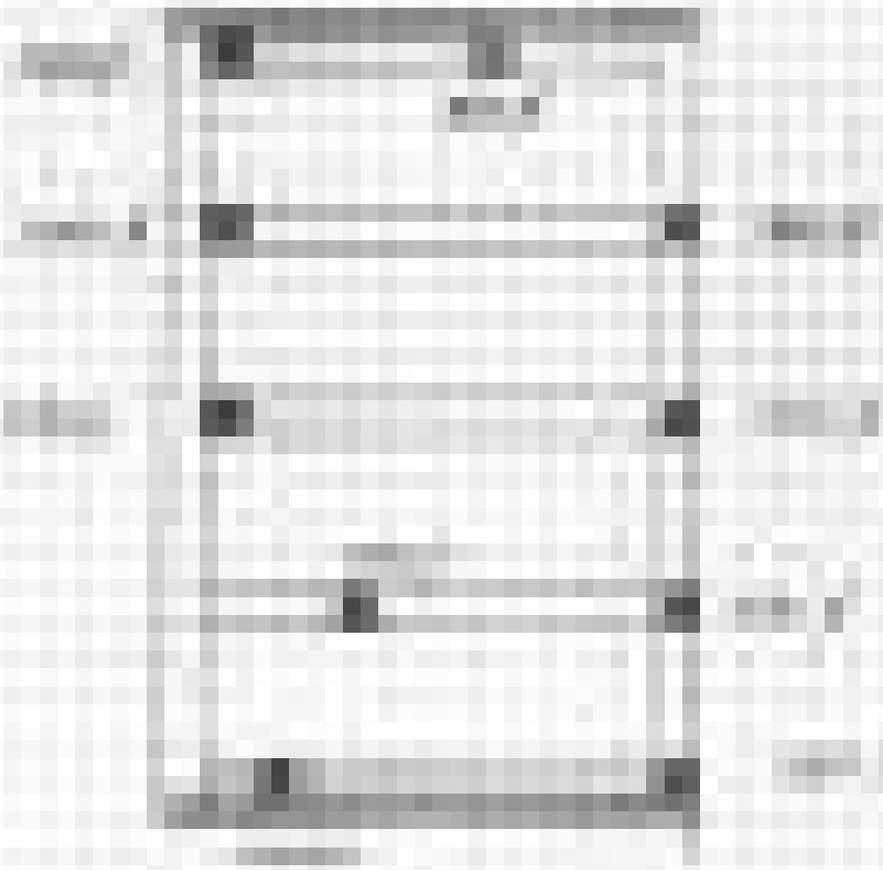
Moments. 1697

Piles

	D+L ↓	+0·8E	D+L ↑	+0·8E.	Pile Area	φ mm.
F	1516	1972	NO TENSION		1·52	1391
G.	1330	1354			1·33	1301
I	1596	2820			1·88	1547
H'	777	879			·78	997
D	1482	1974			1·48	1372.

All pile stems. 900 φ.





Lateral load

$V_b = 2055$ kN

$V_{passive}$

$P_p = K_p \gamma d = 3 \times 18 \times 1.5 = 81$ kPa

$P_p = .5 \times 81 \times 1.5 = 60.8$ kN/m

$V = 2 \times 9.6 \times 60.8 = 1167$ kN

$V_{piles\ rqd} = 2055 - 1167 = 888$ kN

$\Rightarrow$ V/pile = 89 kN/pile

Say pile fixed 1 D into rock

$M_u = 89 \times 7.4 = 659$ kNm $\quad g = .8$

$M_i / f_i D^3 = .040$ $\quad k_t m = .15$ $\quad f_t = .0089 \Rightarrow$ OK

$P_i = 0$

Check beam cap for lateral pressure

$w_u = 60.8$ kN/m $\quad W = 60.8$

$M_u = 2Wa/3 = 2 \times 60.8 \times 1.5/3 = 60.8$ kNm

$R_u = 60.8 \times 10^6 / .9 \times 1000 \times 520^2 = .25$ $\quad \rho = .0005$

$A_s = 260$ mm²/m $\Rightarrow$ HR10 @ 300 O.K.

Try full load on piles – Reese & Matlock

$P = P_T/n = 2055/10$ $\quad f = 7$ kPa/mm

$= 205.5$ kN

$T = (EI/f)^{0.2} = (23.5 \times 10^6 \times 3.22 \times 10^{-2} / 7 \times 10^3)^{0.2}$

$= 2.551$

$L/T = 7/2.551 = 2.74$

z = depth/T.

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JOB No. 1868 PAGE F/12

JOB BY WJM

DATE 8/10/86

Depth	z	Fd'	Fm'	δp (mm)	Mp (kNm)
0	0	1.05	-0.95	4.7	-498
1	.39	1.00	-0.57	4.5	-299
2	.78	0.80	-0.22	⇓	-115
3	1.18	0.65	-0.07		-37
4	1.57	0.38	0.06		31
5	1.96	0.22	0.08	OK	42
6	2.35	0	0.04		21
7	2.74	-0.15	-0.02		-10

$$\delta_p = F_d'\left(\frac{PT^3}{EI}\right) = F_d'\left(\frac{205.5 \times 2.551^3}{23.5\times10^6 \times 3.22\times10^{-2}}\right) = 4.508\times10^{-3} F_d' \text{ (m)}$$

$$= 4.508\ F_d' \text{ (mm)}$$

$$M_p = F_m'(PT) = F_m'(205.5 \times 2.551) = 524.23\ F_m'$$

$M_u/f_c' D^3 = 498\times10^6 / .9\times25\times900^3 = .030$

from P_i are $=0$ (conservative) $\Rightarrow \rho_m = .10$ $\rho_t = .0056$

$A_g = .636\times10^6\ mm^2$

$\rho_{t\,min} = 2200/f_y\sqrt{2A_g} = .0051$

$A_s = .0056\ A_g = 3562\ mm^2$

$\Rightarrow$ 12HD20 OK

Shear $V_u = 205.5$ kN

$v_c = 205500/.85\times600\times600 = .67$ MPa

$v_c = .61$ $v_s = .06$

$A_v\,min = .35 b_w s/f_y$

$s_{max} = 151\times320/.35\times600 = 228$ $\Rightarrow$ HP10@250 spiral min.

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JOB BY WJM

DATE 9/10/86

[illegible] 900 [illegible] 5 2 = 6 5 4 3

[illegible] 900/5 = 180

6 x 2 = 120

200

[illegible] = 400

$$.45\left(\frac{A_g}{A_c} - 1\right) + 1.25\left(\frac{\pi \times 450^2}{\pi \times 385^2} - 1\right) = .165$$

$$\rho_s = .165 \frac{f'_c}{f_{sh}}\left(.5 + \frac{1.25 P_o}{\phi f'_c A_g}\right) \qquad P_o = [illegible] \times 29.3 = 3897 kN$$

$$= .165 \times \frac{25}{380}\left(.5 + \frac{1.25 \times 3897 \times 10^3}{.9 \times 25 \times \pi \times 450^2}\right) = .0091$$

$$\therefore \frac{A_r \pi d_s}{s_h \pi d_s^2/4} = \frac{4 A_r}{s_h d_s}$$

$\therefore$ HR12 $.0091 = 4 \times 113 / s_h \times 770$

$s_h = 65$ $\Rightarrow$ HR12 @ 60

N_d in PH zone $.5\rho_s$ $\Rightarrow$ HR12 @ 120 for 2700 (3 pile ϕ's)

Rem HR12 @ 300.

Piles
900 ϕ
25 MPa
12-HD20.
Shear wall (corner) piles 1800 ϕ bell

Middle pile on west frame - no bell

Remainder 1500 ϕ bell

HR12 @ 60 for 900 from beam face
HR12 @ 120 for next 2700
HR12 @ 300 rem.

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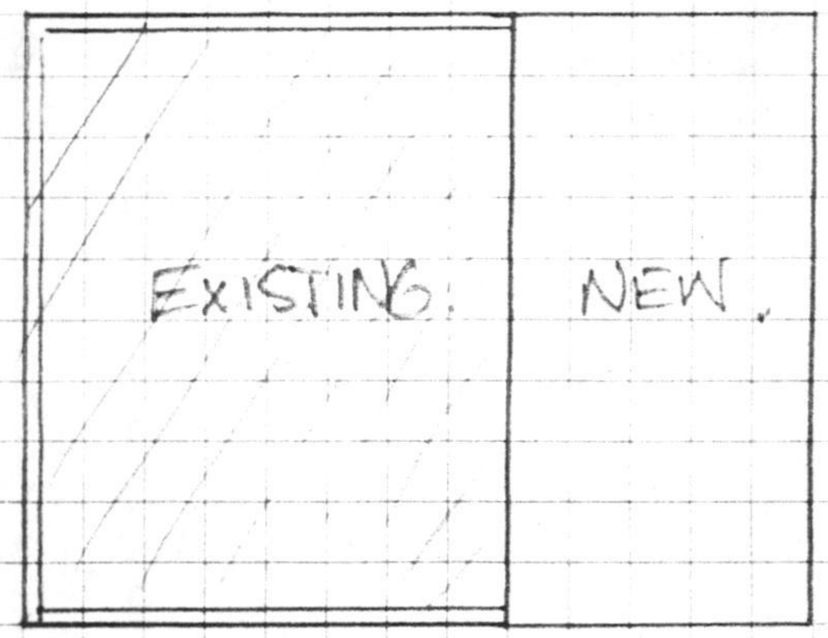
JOB No 1868. PAGE P/0

JOB BY MJO.

DATE 8/86

Strengthening of Existing Bldg.



Design Philosophy

1. Strengthen to 2/3 P165
2. Tie existing to new for overall earthquake loads by diagonal steel bracing.
3. Strengthen all existing brick walls & parapets for face loading with structural steel members dowelled to brickwork. Centres determined by brick strength spanning horizontally.
4. Carry floor level reactions to diagonal bracing by a combination of diaphragm action and steel trimming members. (which will also carry existing floor joists should brick walls fail)

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JOB No 1868 PAGE P/1

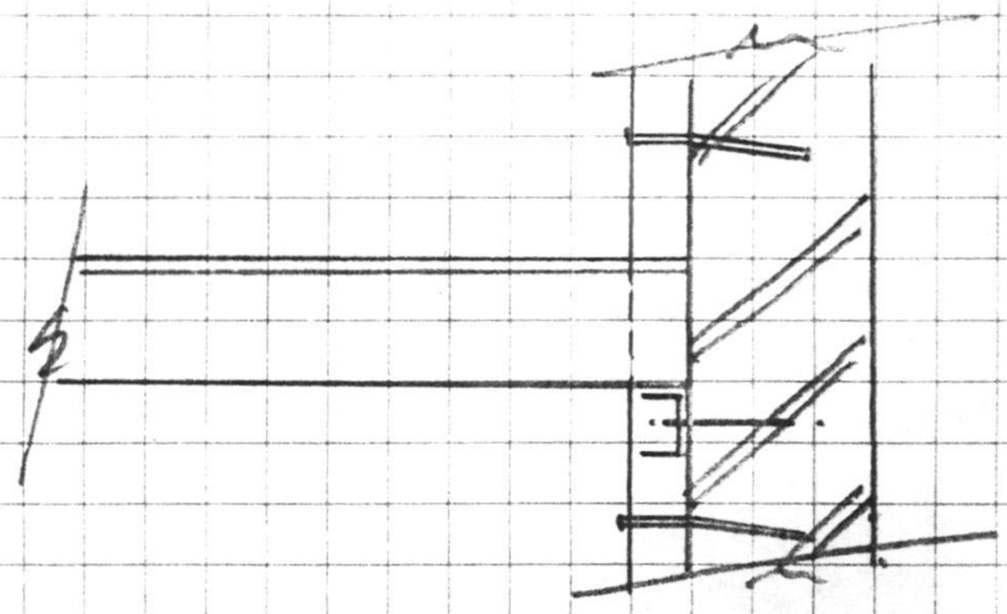
JOB WWMC & LI BY MJO.

Strengthening Scheme. DATE 8/86.

Existing Walls.

Design Assumptions:

Design to support wall face loads + Floor gravity.



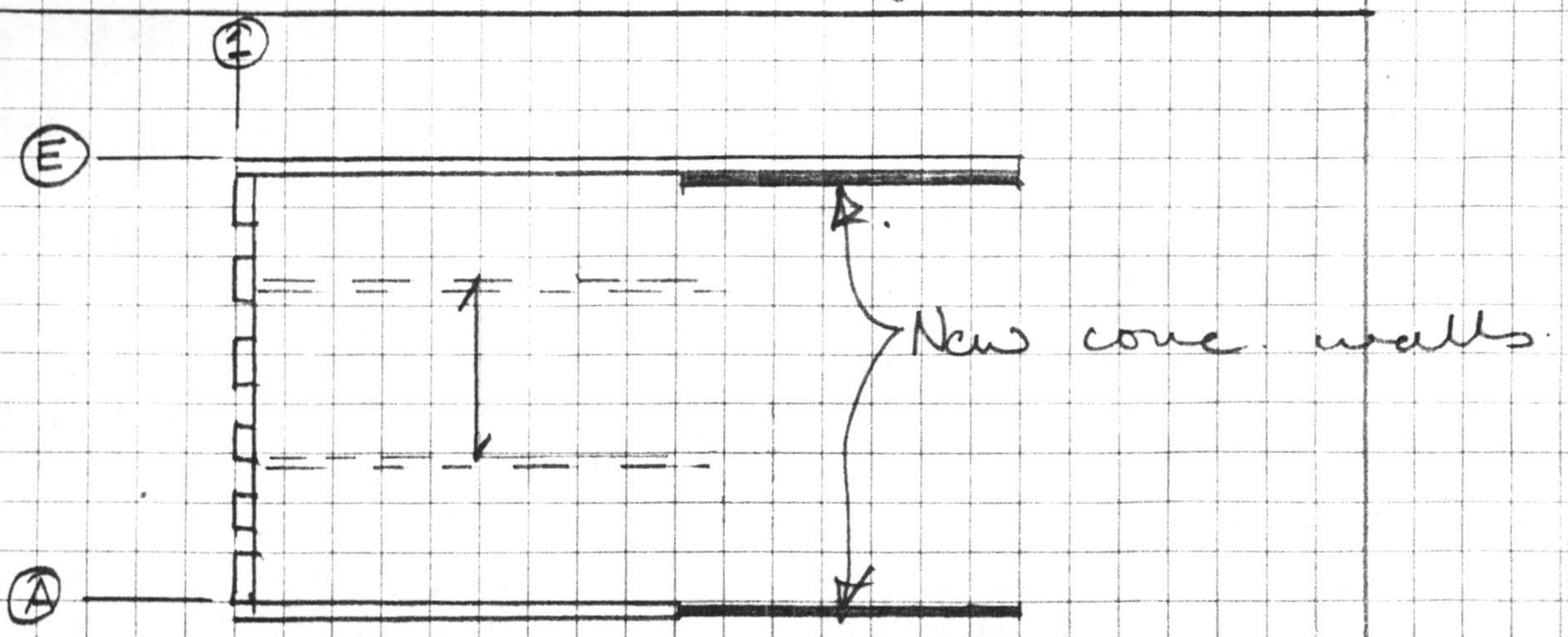
Face Loading: $\frac{2}{3} \times 1965$

Treat as veneer: Veneer $= \frac{2}{3} \times 6 \times .12 = .48$

connections $= 2 \times = .96$

NZS 4203 $C_p = 2.0$.

Use $C_p = 0.48$. for walls.
& $C_p = 1.0$ for connections.



Wall lyrid (A) & (E).

Floor span = 4.5m.

2 → C = 240 brick
C → 2 = 360 "
2 → G = 480 "

Brick strength spanning horizontally.

Allowable Tension = say 2×10 = 20psi (= 136 KPa).

$$M = \frac{WL^2}{10.} \text{ say}$$

$$W = t \times 22 \times .48. = 10.6t \text{ KN/m/m}.$$

$$f_{bt} = \frac{M}{Z}. \quad Z = \frac{1 \times t^2}{6} = \frac{t^2}{6} \text{ m}^3/\text{m}.$$

$$\therefore 136 = \frac{10.6 \times t \times L^2 \times 6}{10 \times t^2}$$

$$\therefore L = 4.62t \text{ m}.$$

240 wall : Max brick span = 2.27m.
360 " " " " = 2.77m
480 " " " " = 3.2m.

Use 3.0 steel cts for 360 & 480 walls.
& 2.3 " " " 240 walls.

$$10.6 \times .24 \times 2.3 \times 1.2 \text{ (continuity)} = 7 \text{ KN/m}.$$

$$10.6 \times .48 \times 3.0 \times 1.2 = 18.3 \text{ KN/m}.$$

Steel: Assume steel fully laterally supported.

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DATE 8/86.

Floor/Floor	span	loads axial	loads face	calc	size
Roof → 2nd C	2400.	10 KN	5 KNm.	$\frac{5}{1.33 \times .165} = 23 cm^3$	102 x 51 C
2nd C → G.	5000 max.	10 + $2 \times 2 \times \frac{4.5}{2} \times 3$ = 37	57 KNm.	$\frac{57}{.2} = 286 cm^3$	200 UB 30

$f_{ac} = \frac{37000}{3600} = 10$ MPa.

$\delta = \frac{5 \times 5000^4 \times 18.3}{384 \times 210E5 \times 28.456}$.

$= 24$ mm (= .005L)

Will refine for smaller spans & wall t's later.

Floor Support. (if wall collapses).

span = 3m.

load = $(.5 + 1.5) \times \frac{4.5}{2} = 4.5$ KN/m.

M = 5 KNm.

$\frac{5}{.165} = 31 cm^3$

102 x 51 C OK. 102 x 51 C.

Ground → 1st Partitions

span = 4.267.

240 mm brick 127 x 64 C.

Support at say 2.3 m crs.

$M = 7 \times \frac{4.27^2}{8} = 16$ KNm.

Axial = 15 KN.

$\frac{16}{1.33 \cdot .165} = 73 cm^3$ 127 x 64 C.

Refurb Vertical face loading Steelwork.

Roof → 2nd Ceiling:

Span = 2.0m.
W = 7 KN/m
M = $\frac{2^2}{8} \times 7$ = 3.5 KNm.

$\frac{3.5}{.2}$ = 17.5 cm³

Use 102×51 MSC (E). (or 70×70×3.6 RHS). 2.3m crs

Second Floor.

Span = 3.3m.
W = 18.3 × $\frac{.36}{.48}$ = 13.7 KN/m.
M = 18.7 KNm.
Z = $\frac{18.7}{.2}$ = 93 cm³

Use 120×80×8 RHS. – 3000 crs.

First Floor.

Span = 3.6m.
W = 18.3 KN/m.
M = 29.6 KNm.

Z = 148 cm³.

Use 200×100×~~6.3~~ 5.0 RHS. – 3000 crs.

Ground Floor.

480 wall. M = 18.3 × $\frac{4.2^2}{8}$ = 40.3
Z = 201 cm³

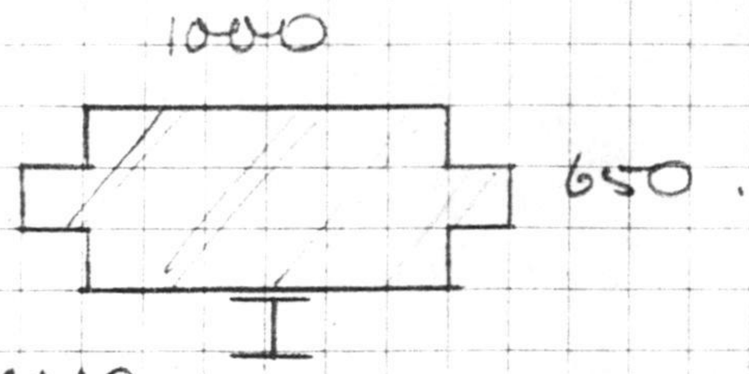
Use 200×100×8 RHS. 2000 crs.

240 wall. M = 16 KNm
Z = 73 cm³

Use 100×100×6.3 RHS.

Wall Grid (1).

Large Piers:



Max Span = 4000.

$W = 1.0 \times .65 \times 22 \times .48 = 6.86$ KN/m.

$M = 6.86 \times \frac{4^2}{8} = 13.7$ KNm.

$\frac{13.7}{.2} = 68.5 cm^3$.

152 x 76 [. ($Z = 112 cm^3$) 152x76 [

$\delta = 12.8mm = .0032 L$ ∴ OK. or 100x100x6.3 RHS

Small piers.

500 x 650

∴ $M = \frac{13.7}{2} = 6.9$ KNm.

$\frac{6.9}{.18} = 38 cm^3$

102 x 51 [. 102x51 [or 90x90x3.6 RHS

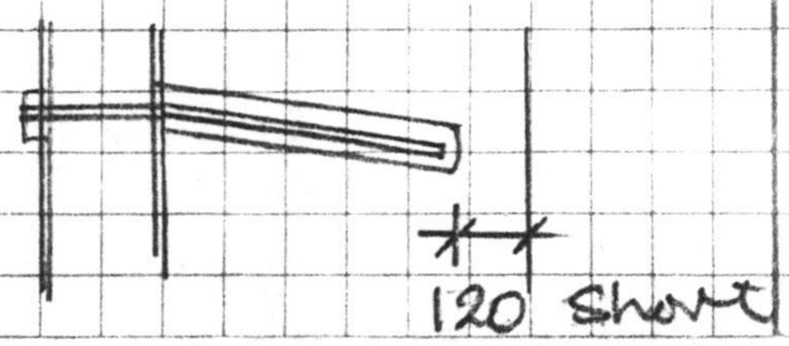
Connections.

From previous testing use max. all. load = 15 KN. (D12 dowells)

Max Loading = 15.3 KN/m.

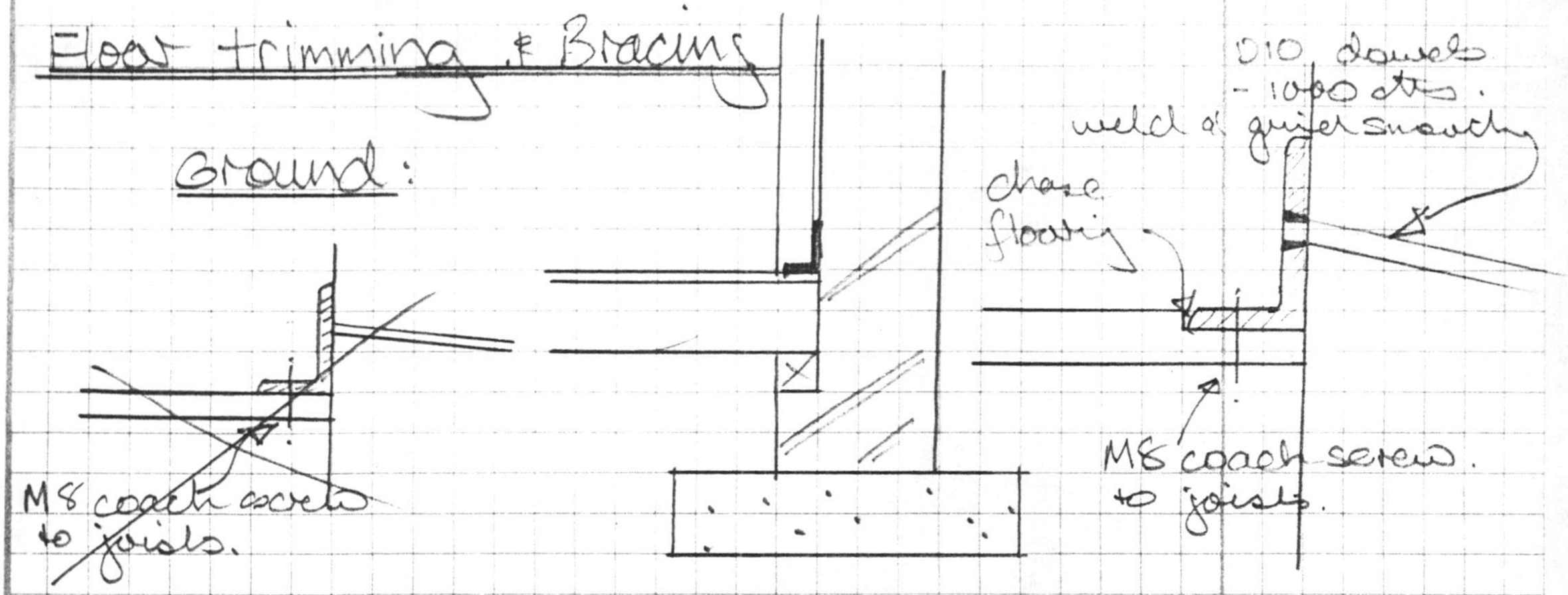
∴ Use D12 (M12) dowells.

@ say 800 crs max.



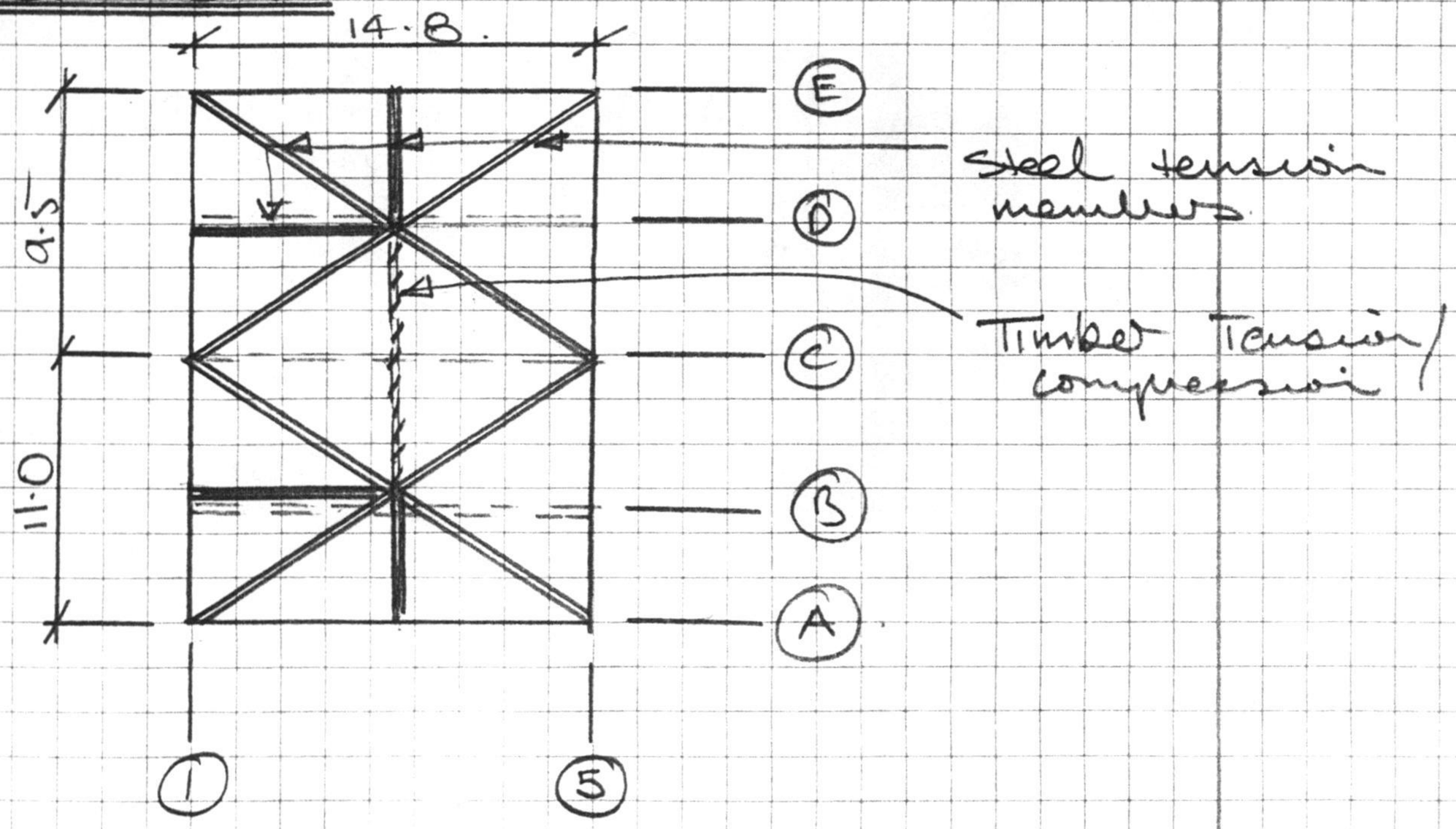
Floor trimming & Bracing

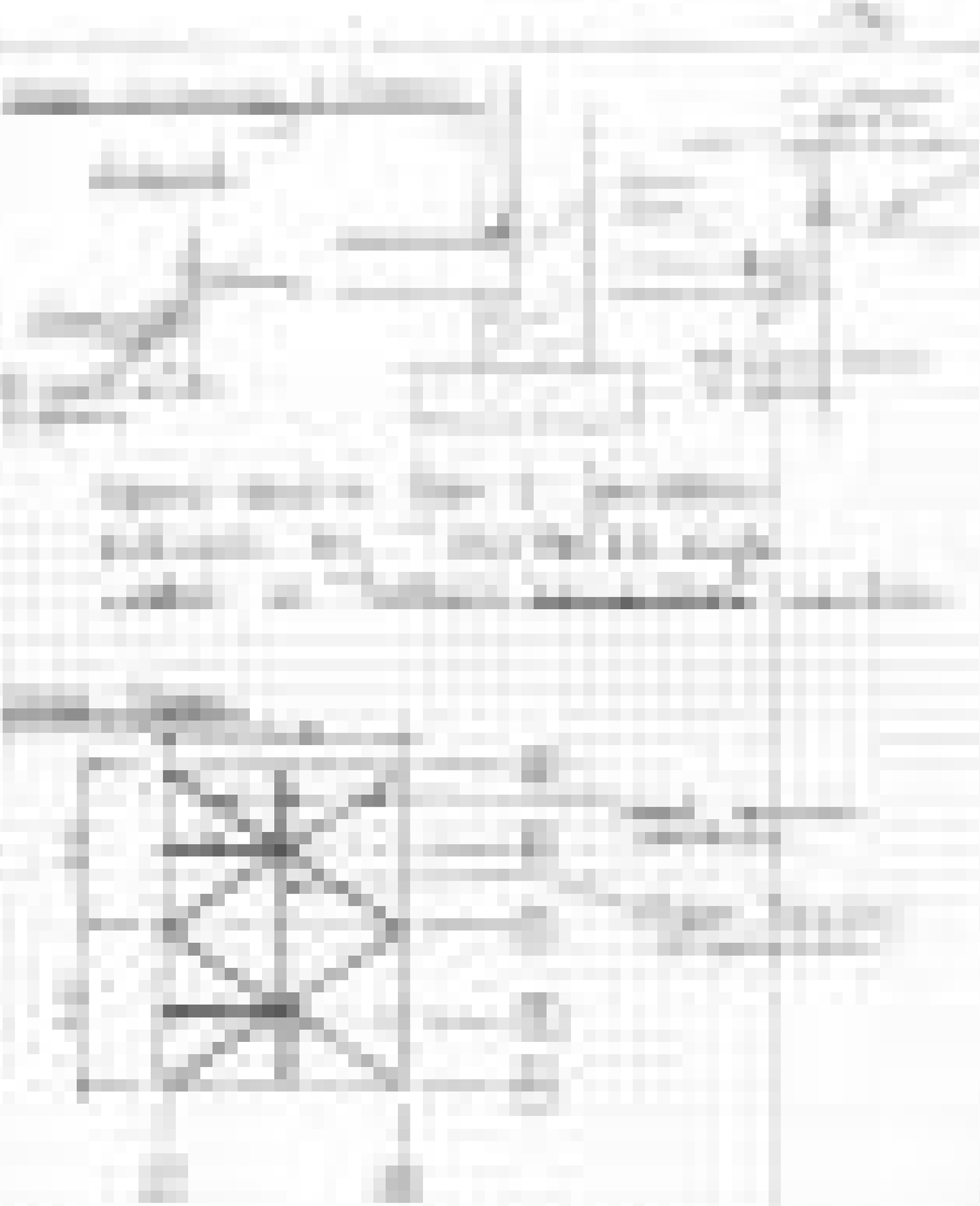
Ground:



Spread load to floor & foundation brickwork by 102 x 76 x 6.5 angle welded to vertical ~~mommembers~~. members.

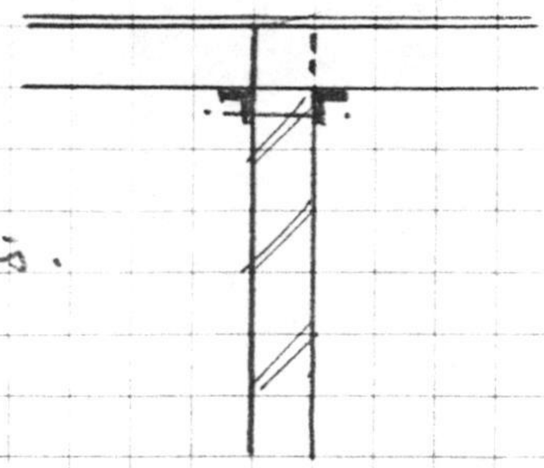
First Floor.





Floor Trim

Walls B, C & D.



Connect walls & vertical steel to central floor joists. which transfer load to diagonal bracing.

Use angles each side - composite action.

~~So~~ Span = $\frac{14.8}{2}$ = 7.4m.

Load = $7 \times \frac{4.7}{2} \times \frac{1}{2.3}$ = 7.15 kN/m.

M = $7.15 \times \frac{7.4^2}{8}$ = 49 kNm.

T = C = $\frac{49}{.25}$ = 196 kN.

At. $F_T = F_C$ = 150 MPa.

Use 80×80×8 L.

End reaction = $7.15 \times \frac{7.4}{2}$ = 26 kN.

Horizontal shear = $\frac{26}{.25}$ = 104 N/mm

Too high.

∴ ~~Screw~~ Trim tops of RHS sections with ~~[illegible]~~ 80×80×8 L and use diaphragm action to transfer load to central floor joists.

Check. Joist Load: = 26 kN × 3 = 78 kN.

350×57 joists : $f_{ac} = \frac{78}{.35 \times 57}$ = 3.91 MPa ∴ OK.

Walls. (A) & (E) Similar. except use DRESIC under.
As is wall (1).

Diaphragm & fixing

20mm Particle board.

~~Max Shear~~ =

Load = $\frac{3.3+3.6}{2} \times 18.3/3 = 21$ KN/m $\times$ ~~48~~

$21 \times \frac{7.4}{2} = 78$ KN.

$\frac{78000}{9500 \times 20} \times 2 = .82$ MPa.

$\frac{78}{9.5} \times 2 = 16$ KN/m.

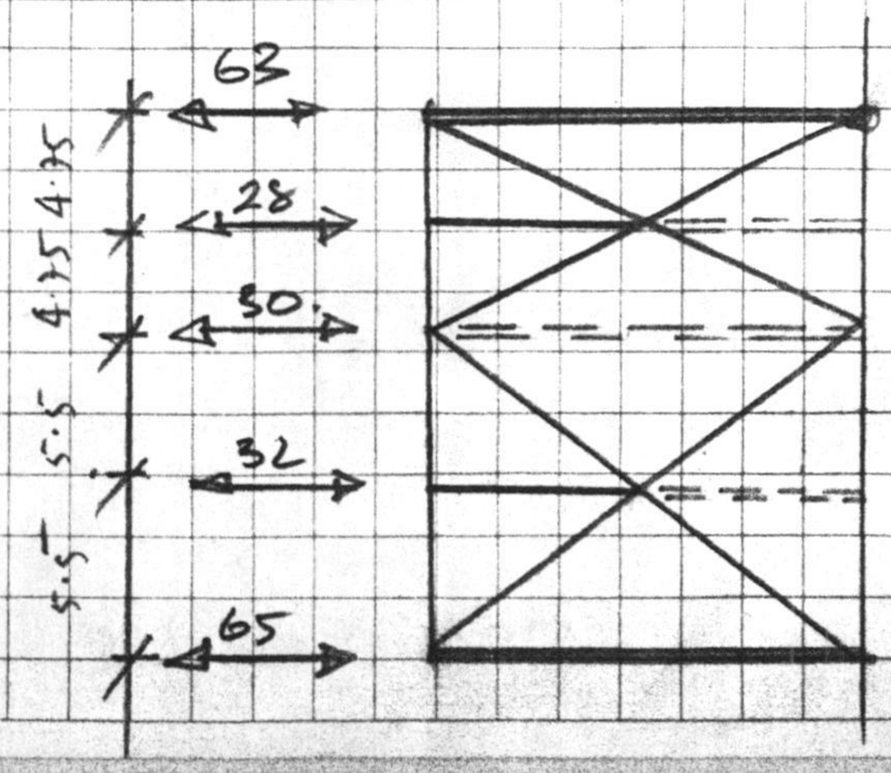
Use 4mm ø nails @ $\frac{.98}{16} = 60$mm centres.

Note: have used $K_x = 4.8$.

Steel Bracing

Floor weight - particle board = .116
roof board = .10
flooring = .18
ceiling = .29
joists = .21
.90 KPa.

E-W E'Quake.



$F_s = C.K_x.W_s$

$K_x = \frac{f_x}{Cw_x}$

$= \frac{234}{.1 \times 4098} < 1.$

Use $C = 0.1$
$K = 1.0$.

Wall (E) & (A) load = 492 × .1 = 49.2 KN.

UDL = (290 + 470 + 161 + 322) × .1 / 21.5 = 5.8 KN/m.

$49.2 + 5.8 \times \frac{9.5}{4} = 63$ KN

$49.2 + 5.8 \times \frac{11}{4} = 65$ "

$5.8 \times 4.75 = 28$ "

$5.8 \times 5.5 = 32$ "

$5.8 \times \frac{5.5 + 4.75}{2} = 30$ "

Line (E) & (A) ties : Have provided

102 × 51 ⊏ : Tall = 1330 × .2 = 266 KN.

Lines (B) (C) & (D) Compression.

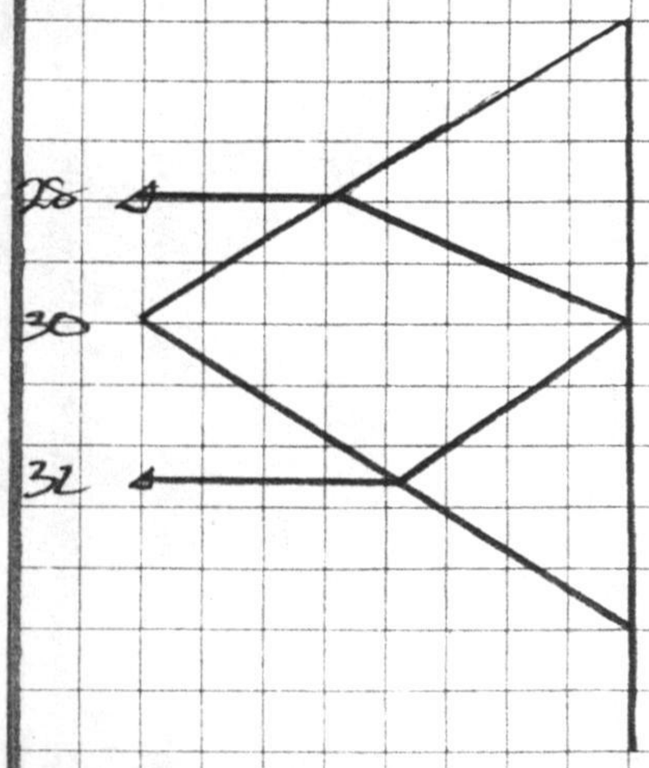
Max C = 32 KN.

@ Fac = 1.5 × 7.1 = 10.65 MPa.

need. 3004 mm²

Use 150 × 50 timber blocking.

Bracing.



Max Tie force

$\leftarrow \left(32 + \frac{30}{2}\right) \times \frac{\sqrt{5.5^2 + 7.4^2}}{7.4}$ (9.22).

= 58 KN.

∴ need $\frac{58}{.2}$ = 292 mm² steel.

30 × 10 ⊓

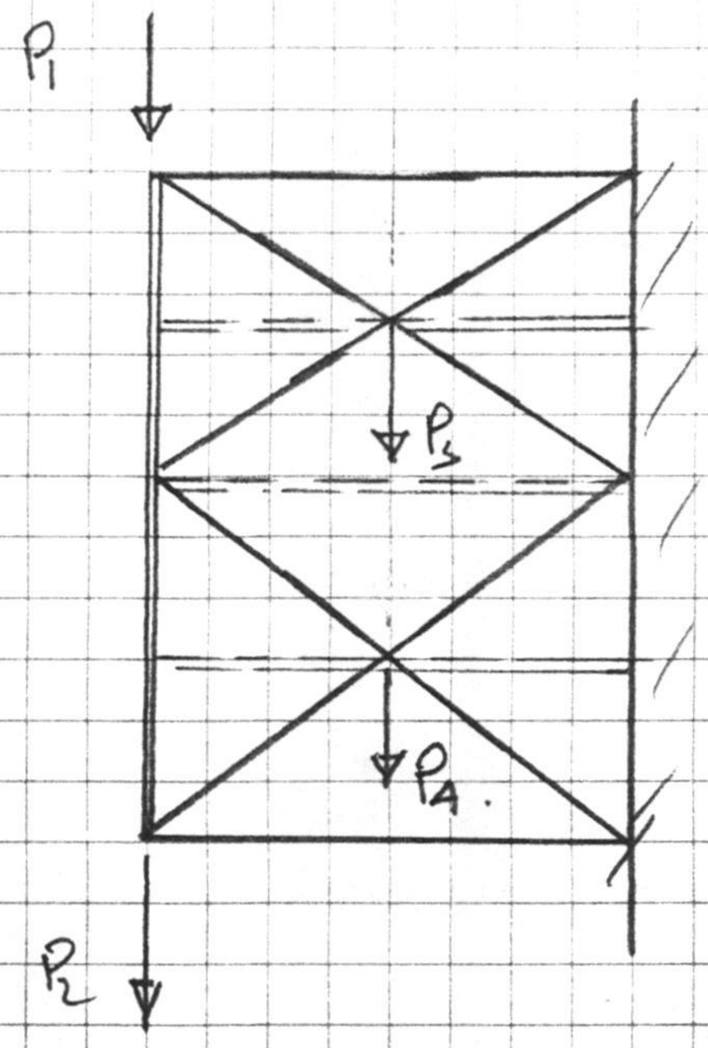
or 60 × 5 ⊓.

Max reactions

Line.	←	↖ or ↙
A	65	39
C		20 + 20.
E	63	39

North South E'Quake

Note use 2nd floor E'Quake loads to maximise design.

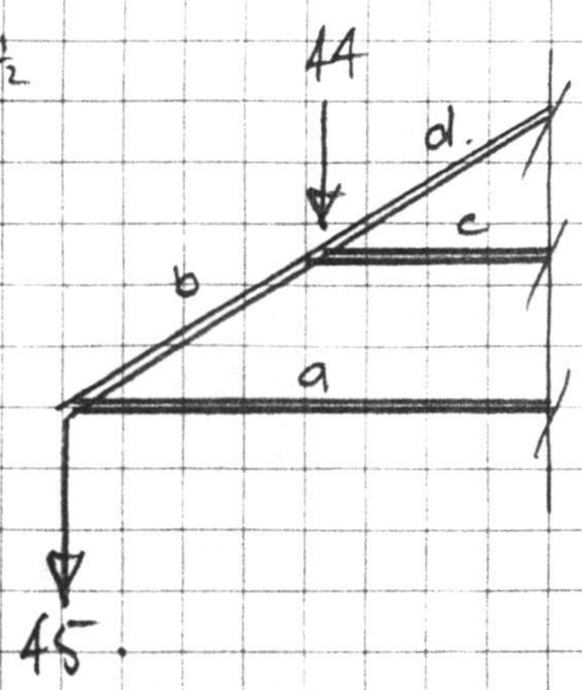


$P_1 = P_2$ = wall ① $\frac{470}{2} \times .1$ = 23.5
+ walls Ⓐ & Ⓔ $\frac{492}{4} \times .1$ = 12.3
+ floor $\frac{(322+161+290)}{14.8} \times \frac{14.8}{4} \times \frac{.1}{2}$ = 9.7

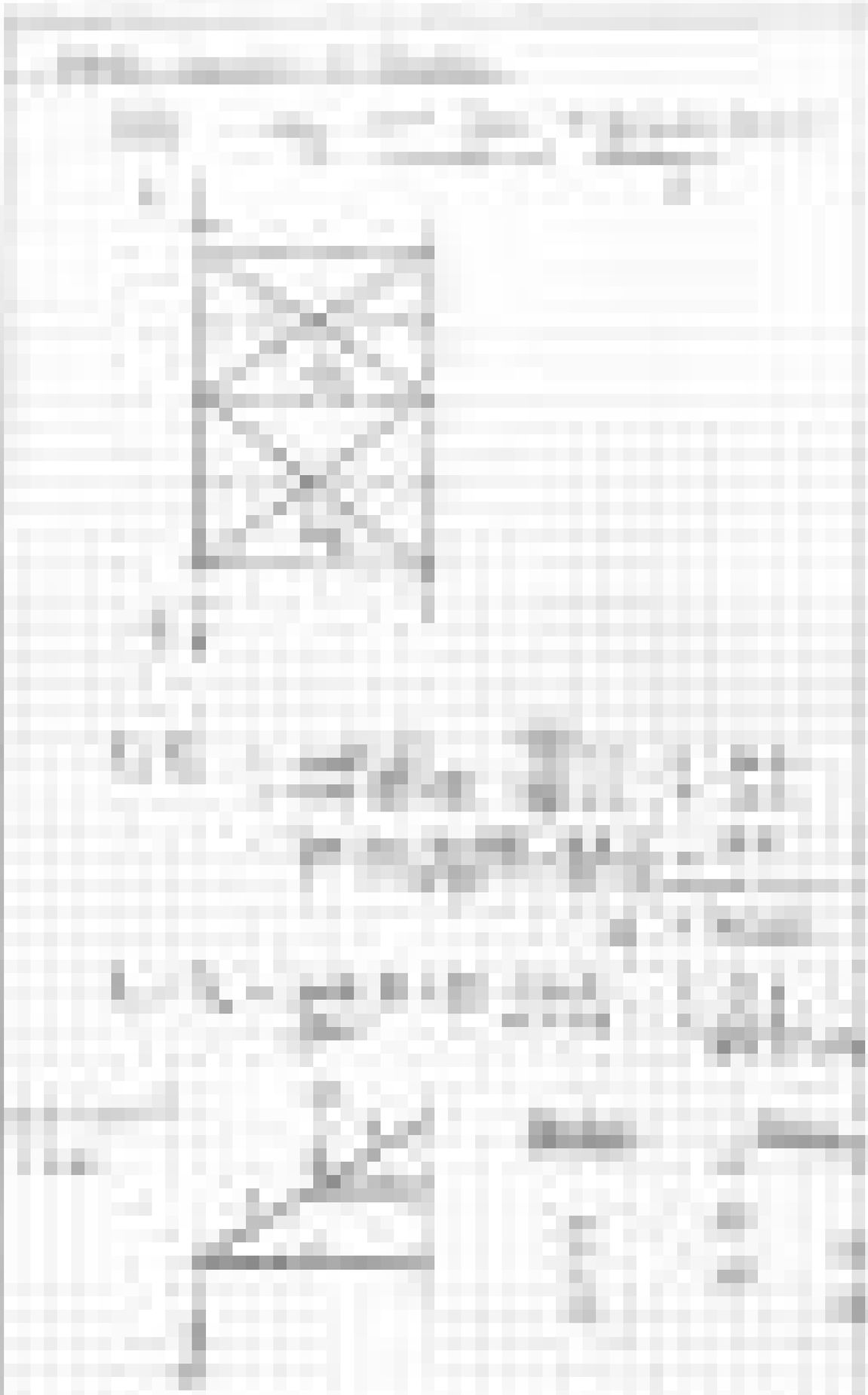
Σ = 45 KN.

$P_2 = P_3$ = Walls Ⓐ & Ⓔ 12.3×2 = 24.6
floor 9.7×2 = 19.4
44.0 KN.

$(4.75^2 + 7.42^2)^{\frac{1}{2}}$
= 8.79.



Member.	Force. C	T
a	70	
b		83
c	69	
d.		165



$T = 83\,kN \quad A = \frac{83}{.2} = 415\,mm^2 \quad : 50 \times 10\,PL$

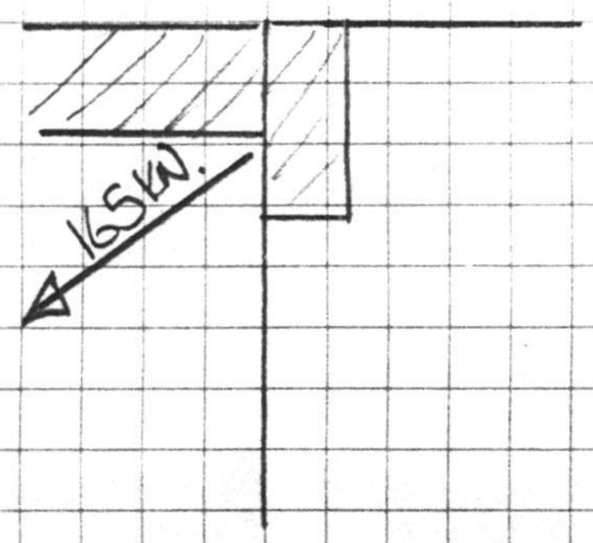
$T = 165\,kN \quad : 100 \times 10\,PL$

$C = 70\,kN.$

$F_{ac} = 10.63\,MPa \quad \therefore A = 6572.$

Use 150×100 blocking.

Reactions



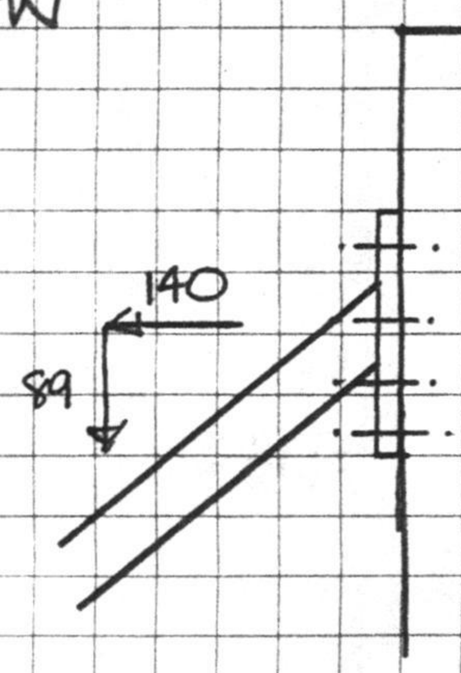
Welding.

Using 8mm FW

need $\frac{165}{.77}$

= 214mm weld.

∴ Butt weld end Plate.



Say have ~~8~~ bolts.

6 - M20. bolts.

$F_V = 18 \times 1.2 = 21.6\,kN.$

$F_T = 35 \times 1.33 = 47$

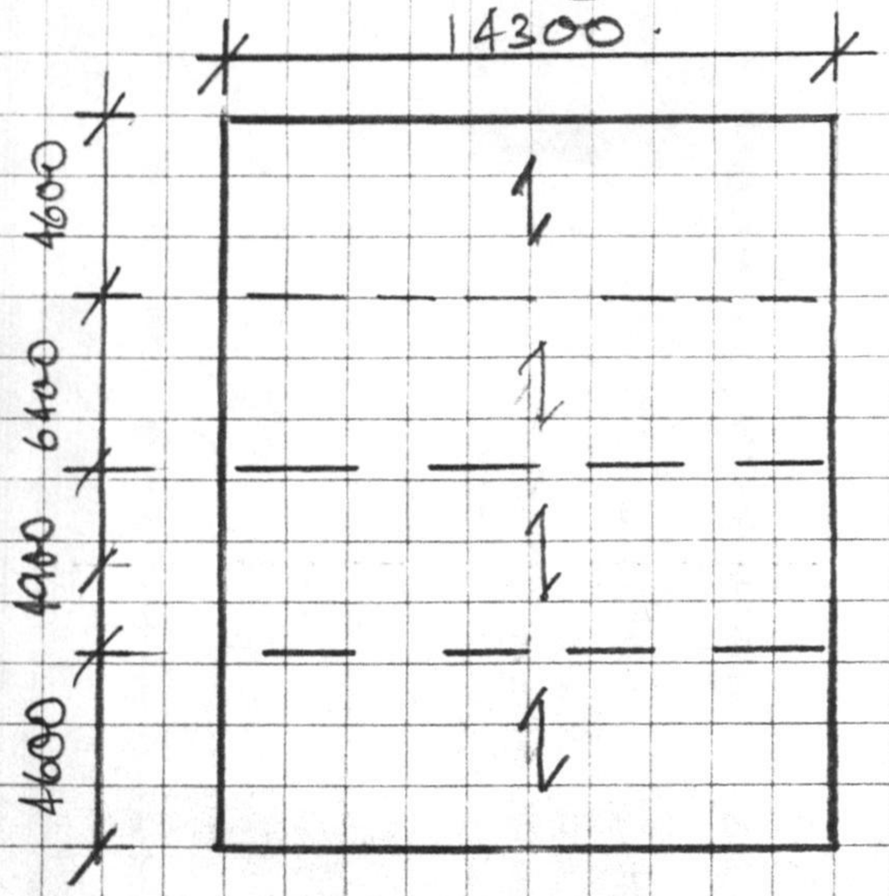
$\left(\left(\frac{89}{6 \times 21.6}\right)^2 + \left(\frac{140}{6 \times 47}\right)^2\right)^{\frac{1}{2}} = .847$

∴ OK.

Use 200×150×10 PL.
6 - M20 Bolts.

Second Floor Strengthening

Replacement of Support Columns.



Dead: Particle Board = ·14 KPa.
Rockwool = ·13
flooring ·037 × 5 = ·19
joists ·35 × ·057 × 6/·45 = ·27
Ceiling 2 × ·13 = ·26
Σ = ·98 KPa.

Live: = 3.0 KPa

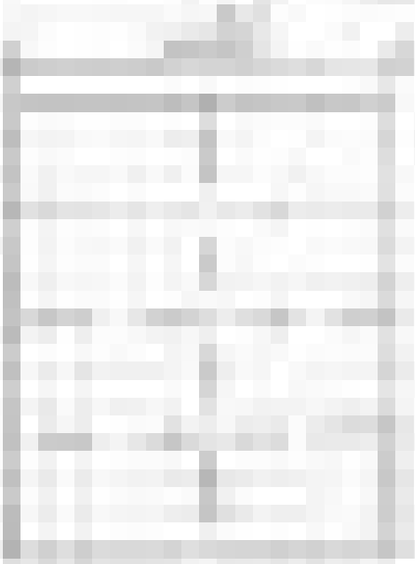
Consider using a pair of beams:

Max. $W = 3.98 \times \left(\frac{6.4+4.9}{2}\right) + 2 \times 1 = 24.5$ KN/m.

(Σ load = 350 KN).

Try 2 × 530UB92's

Z = 2080 × 2 cm³
I = 554 E6 mm⁴ × 2.
r_y = 45.1
r_t = 34.1



$W = 398 \times \left(\frac{6.4+4.6}{2}\right) + 2 \times 1 = 23.9 \text{ KN/m}$

$(\times 14.3 = 342 \text{ KN.})$

$M = 23.9 \times \frac{14.3^2}{8} = 611 \text{ KNm}$

2 beams @ 306 KNm each.

@ Fbc = 150 MPa.

Require Z = 2036 cm³.

For $\delta_{live} \leq 25$ mm (.0017L).

$I \geq \frac{5 \times 3 \times 5.5 \times 14300^4}{384 \times 2 \times 2.1E6 \times 25}$

$= 856 E6 \text{ mm}^4$

610 UB125 available

$I = 986 E6 \text{ mm}^4$
$Z = 3222 \text{ cm}^3.$
$\frac{D}{T} = 81.2.$
$\frac{T}{t} = \frac{19.6}{11.9} < 2.0$
$\frac{d_1}{t} = \frac{547}{11.9} = 46. < 85.$

Laterally restrain @ 2920 mm c/s.

$M = 24.5 \times \frac{14.3^2}{8} = 626$ KNm

$f_{bc} = \frac{626}{2 \times 2080} = 150$ MPa

$\delta_{live} = \frac{5 \times 3 \times 5.65 \times 14300^4}{384 \times 2.1E5 \times 2 \times 554E6}$

$= 39.7$ mm $= .0028L$ $\left(\frac{L}{360}\right)$.

$\delta_{D+L} = .0028 \times \frac{24.5}{3 \times 5.65} = .004L$ $\left(\frac{L}{250}\right)$.

If restrict δ_{live} to 25 mm.

Require $I = \frac{3 \times 5.65 \times 14.3^3}{2 \times .337} \times \frac{572}{500}$

$= 841$ EG mm^4

610 UB 113.

Use 610 UB 125. $\delta_{live} = \frac{841}{985} \times 25 = 21.3$ mm. $\times \frac{5.5}{5.65} = 20.8$ mm.

100 mm long by 20 thick flange pl.

Direct Bearing $= 126 + 2.26 \times 100 + 20 \times 3.92$

$= 126 + 226 + 78 = 430$ KN.

Consider removing ~~replacing~~ East col. of middle row.

span = 7.0 m.

Load $= \frac{24.5 \times 7}{3 \times 5.65 \times 7} = 172$ KN. (= 86/beam).

310 UB 46.

$f_{bc} = \frac{150}{.648 \times 2} = 116$ MPa.

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JOB

BY MJO

DATE 10/86.

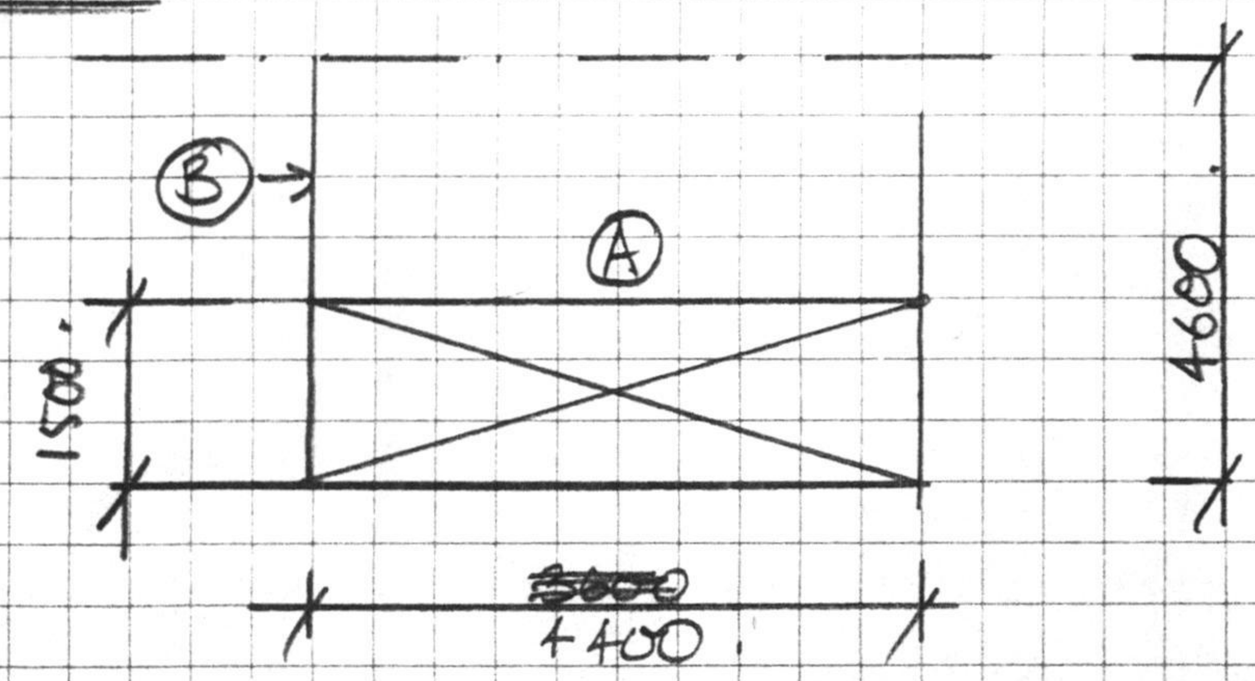
$$\delta_{live} = \frac{5 \times 3 \times 5.65 \times 7000^4}{384 \times 2.1E6 \times 2 \times 99.5E6}$$

$$= 12.7\,mm \quad (= .00181L) \quad \left(\frac{L}{550}\right)$$

2nd Floor Bracing

Identical to 1st Floor but check realignment for stair opening.

Stair Trim.



Trim Beam (A):

Dead: Floor $1 \times \frac{3.1}{2}$ = 1.6 kN/m
Partition $.5 \times 3.5$ = 1.75
3.3 kN/m

Live $3.0 \times \frac{3.1}{2}$ = 4.65 kN/m.

Σ load = 7.95 kN/m.

M = 19.2 kNm.

Try 300×100 green gauged.

Z = 1354 cm³
I = 199.1E6 mm⁴
Fbc = 6 × 1.25 = 7.5 MPa.
E = 8000 MPa.

$f_{bc} = \frac{17.7}{1.354} = 13$ MPa.

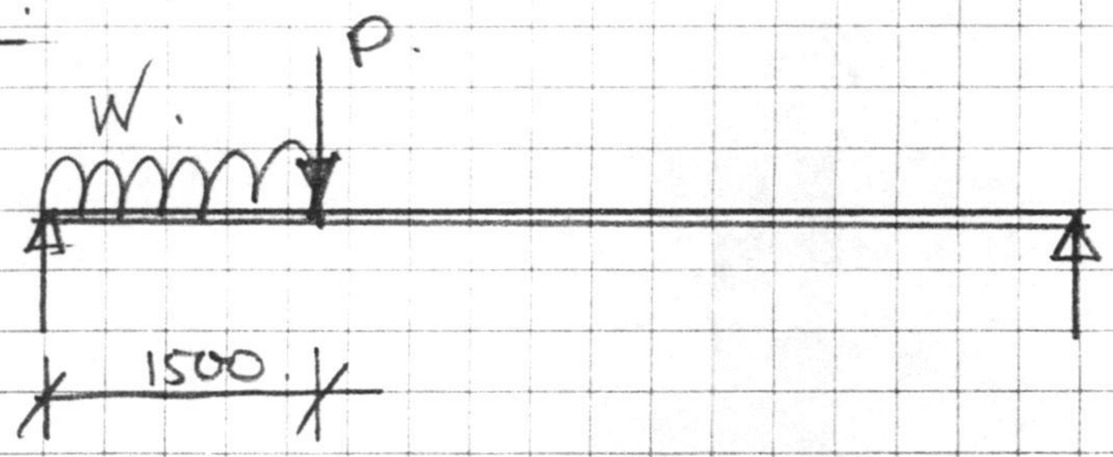
Try Steel. Fbc = 150 MPa.
Z = ~~118 cm³~~

178×76 MSC.

Incie $\delta = \frac{.5 \times 6.9 \times 3600^4}{384 \times 2.1E5 \times 13.6E6} = 5.4mm.$

$= .0015 L.$

Beam (B).



$P = \cancel{10.952} \times \frac{7.95 \times \frac{4.4}{3.6}}{2} = \cancel{19.71}\ 17.5\ KN$

W = stairs

$= (1+3) \times \frac{\cancel{4.4}\ 5.7}{2} = \cancel{9.8}\ 11.4\ KN/m.$

$R_L = (\cancel{19.71}\ 17.5 \times 3.1 + \cancel{9.8}\ 11.4 \times \frac{1.5}{2} \times 3.85)/4.6$

$= \cancel{25.6}\ KN.\quad 26\ KN$

max $M = (25.6 \times 1.5) - (9.8 \times \frac{1.5^2}{2})$

$= 27\ KNm.$

require $Z = \frac{27}{.15} = 182\ cm^3$

Use 203x 76 MSC.

Max C_c = 29.8 kN.

span = 4.8 m (max).

$F_c = 7.1 \times 1.5 \times K_8$ MPa.

100 wide timber

$\frac{la}{a} = \frac{4800}{100} = 48$.

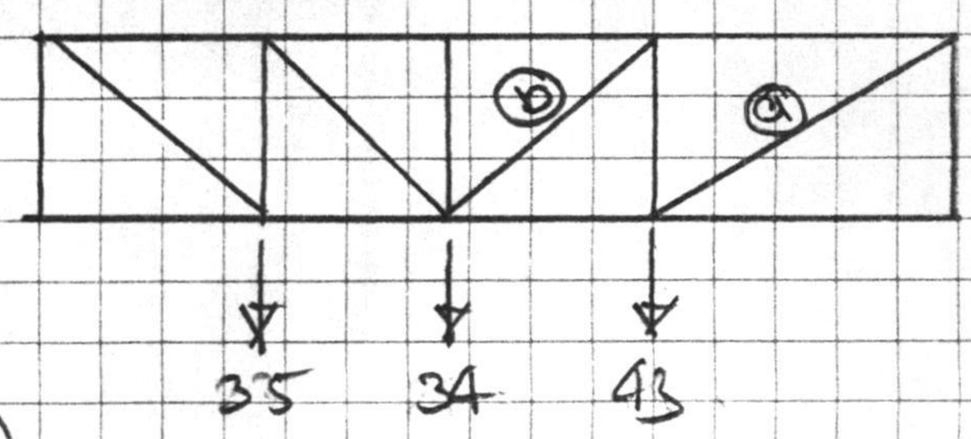
$K_8 = .16$.

$\therefore$ Require $d = \frac{29800}{.16 \times 7.1 \times 1.5 \times 100} = 174$

<u>Use 200×100 Blocking</u>.

<u>North South</u>.

@ <u>Southend Truss</u>.



2 walls

$P = 2 \times \frac{18}{5} \times S + 11.8 \times \frac{21.5}{5 \times 14.8} \times S = 10.75 S$ kN.

S: 3.2 m 3.3 m 4 m.

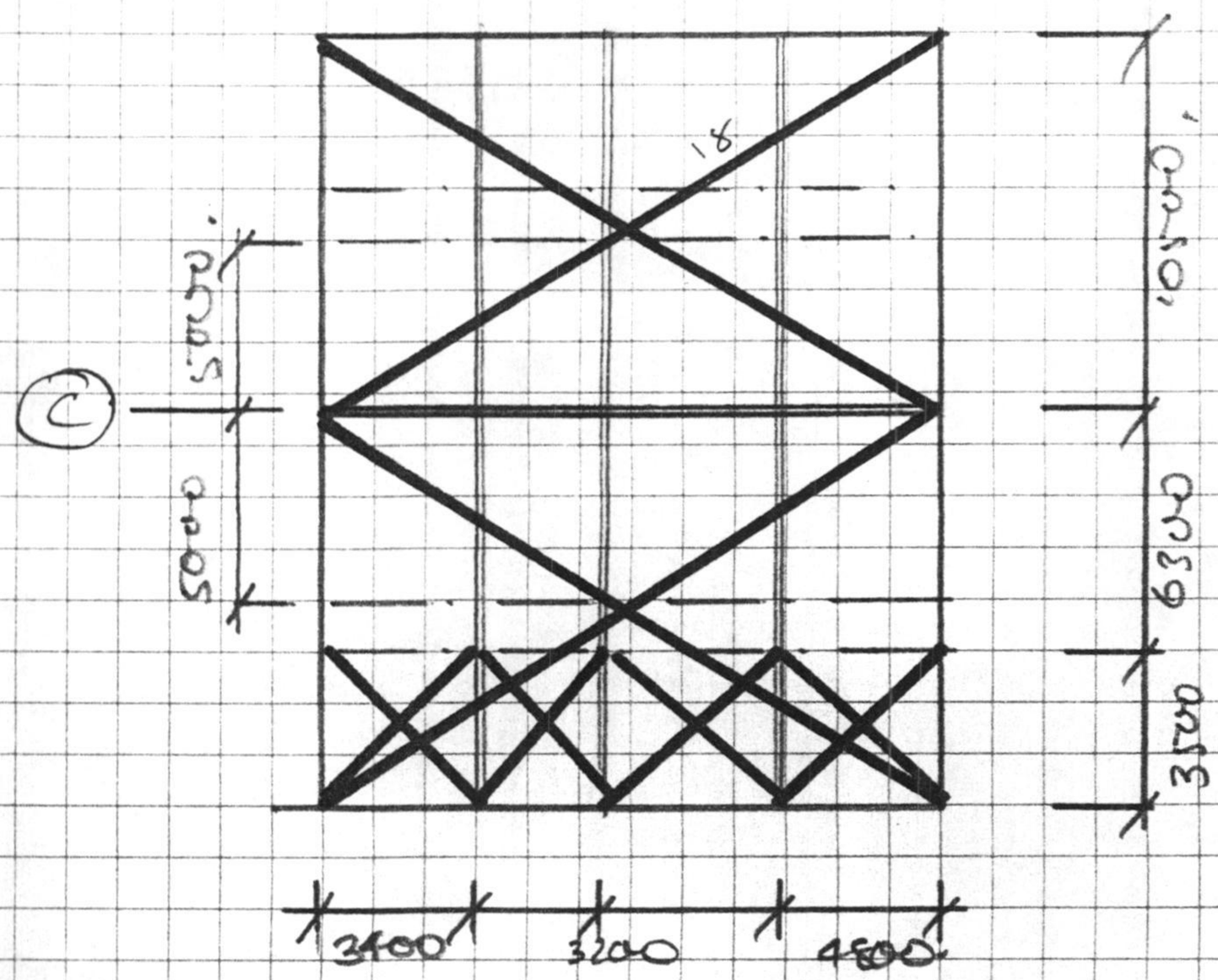
P: 34 35 43

$R_L = (35 \times 11.2 + 34 \times 8 + 43 \times 4.8)/14.6$

$= 59.6$ kN

$R_R = 112 - 59.6 = 52.4$ kN.

Roof Bracing.



East - West.

Load Grid Ⓒ

$$K_x = \frac{549}{4096} = \cdot 133.$$

$$P = \cdot 133 \times \left(2.5 \times \cdot 24 \times 22 + \frac{3.5}{2} \times \cdot 36 \times 22\right) \times 5$$

$$= 18 \text{ KN}$$

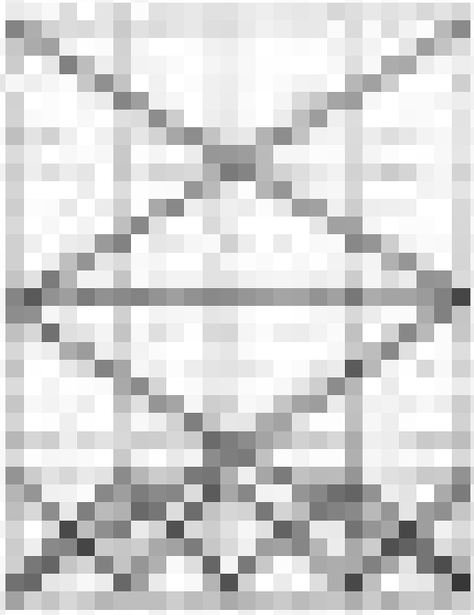
$$+ \text{Roof.} \quad 1.2 \times 5 \times 14.8 \times \cdot 133 = 11.8$$

$$29.8 \text{ KN}.$$

Tension: $T = 29.8 \times \frac{\sqrt{14.6^2 + 10.5^2}}{14.6} = 51 \text{ KN}.$

$$\frac{51}{\cdot 2} = 255 \text{ mm}^2$$

25 × 10 ℞ (50 × 5 ℞).



(a) $T = 52.4 \times \frac{\sqrt{4.8^2 + 3.5^2}}{3.5} = 88.6.$

$A = \frac{88.6}{.2} = 443$

50×10 PL

(b) use 50×10 PL also.

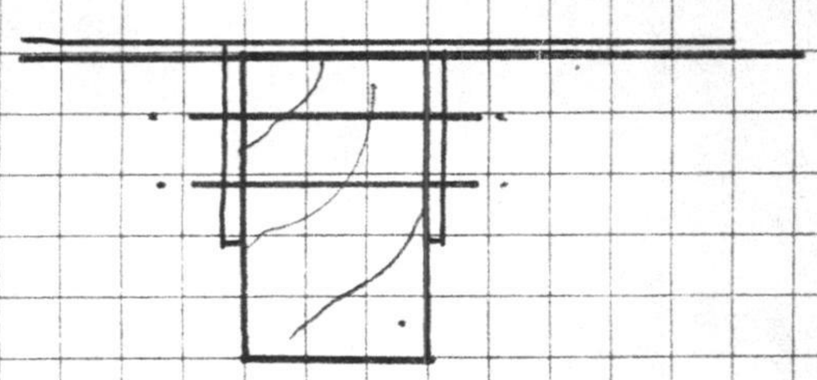
Truss bottom chords to take compression.

Max Tie/Shear load.

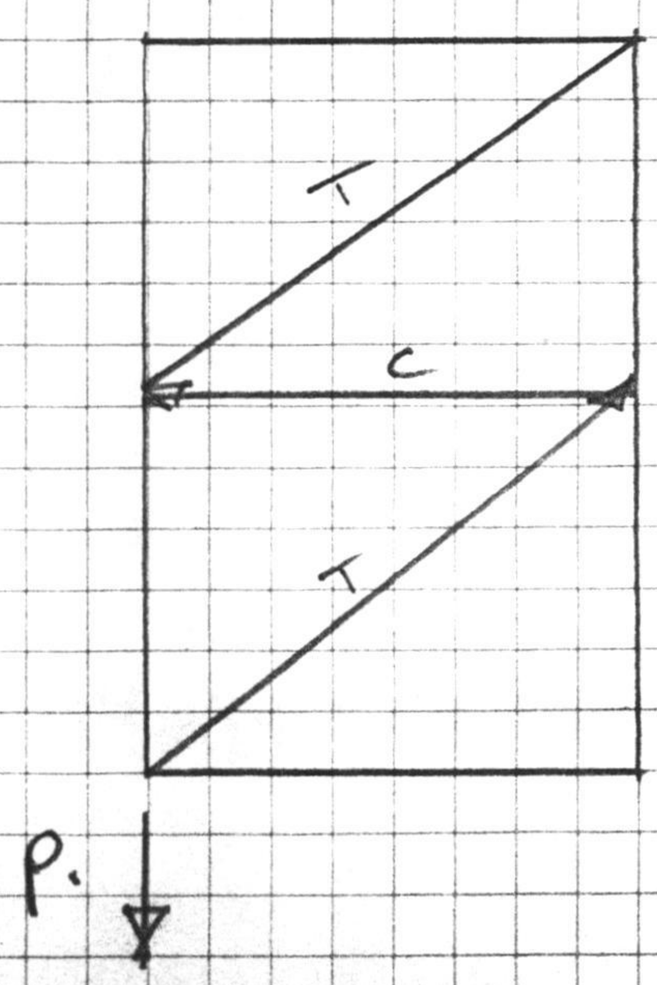
$= \cancel{34.3} = 52.4 - 43 =$ kN.

or $59.6 - 35 = 24.6$ kN.

Require 2-M20 bolts.



Main Bracing.



$P = 59.6 + \frac{18}{5} \times 21.5$

$= 137$ kN.

$T = \frac{137}{2} \times \frac{18}{10.5}$

$= 117$ kN.

$A = \frac{117}{.2} = 587$ mm²

60×10 PL

$$C = 117 \times \frac{14.86}{18} = 95\,kN$$

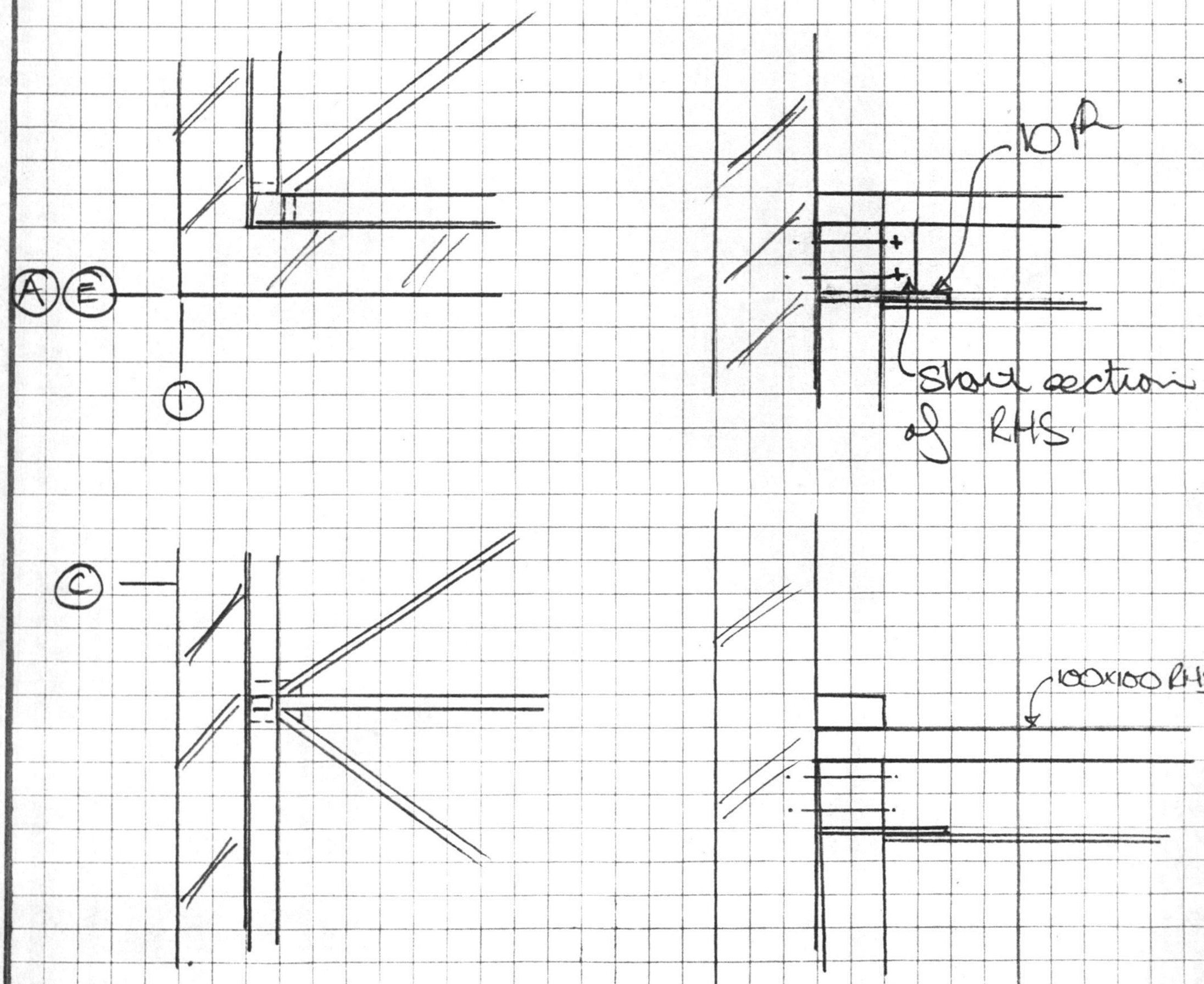
Try 100x100x4 RHS.

$$f_{ac} = \frac{95}{1.53} = 62\ MPa.$$

$$\frac{l}{r_y} = \frac{4800}{39.1} = 123$$

$$F_{ac} = 56 \times 1.33$$
$$= 74\ MPa \quad \therefore OK.$$

Connections



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26 Sept., 1986

Smith Leuchars Ltd.,
Consulting Engineers,
P.O. Box 27349,
WELLINGTON

Attention - Mr M. Orsman

Dear Sir,

LIMITED SUBSURFACE INVESTIGATION
PROPOSED REDEVELOPMENT
WELLINGTON WORKING MENS CLUB
CUBA STREET, WELLINGTON

This report presents the results of a one boring investigation of the subsoil conditions near the site for redevelopment of the Wellington Working Mens Club on Cuba Street, Wellington. The location of the site in relation to existing buildings is shown on the attached plate 1, Site Plan.

The area for redevelopment is rectangular in shape and is located at the rear (eastern side) of the existing Club buildings. The building is to be of multi level construction and have plan dimensions of about 10.0 metres by 13.6 metres. Structural loads imposed at ground level have been given in your Fax dated 12 September 1986. The perimeter columns will impose dead plus live loads up to 1850 KN. Under seismic loading the compression forces of columns are likely to be up to 2300 KN and tension forces some 130 kN.

At the time of our investigation the site was fully occupied by existing buildings which precluded drilling on the area for redevelopment. The only point where a drilling rig could be established near to the building was in a narrow service lane off Leed Street east of the site.

The boring was drilled using rotary wash equipment supplied and operated by Lemmon Piling and Drilling Limited of Seaview. The fieldwork was supervised on a full time basis by our field geologist who logged the soils encountered and specified the type and depth of insitu testing. A log of the boring as recorded in the field and amended where necessary from laboratory examination of the soils recovered, is given on Plate 2, Boring Log. Notes, abbreviations and symbols used on the Logs are given on Plate 2. The soils have been classified generally in accordance with the Unified System, a summary of which is given on Plate 3 Method of Soil Classification.

At the point explored by the boring, the subsurface soil conditions comprise alluvially deposited soils which extend beyond the depth explored. These soils comprise predominantly silty gravels which contain random inclusions of silt. These layers of fine grained soil were encountered at depths 3.3 metres, 6.3 metres and at 9.2 metres, and are generally between 0.3 metres and 0.5 metres thick. The surface gravels are moderately dense and become more dense with depth. At depth 4.7 metres, the gravels are dense.

Groundwater was encountered in the boring and at the time of drilling this was measured to be at depth 2.2 metres below ground surface.

You have advised us that design of the building is proceeding based on supporting the structure on a shallow founded raft slab. The alternative foundation option of supporting the proposed building on drilled cast-in-place piles has not at this time been discounted. Based on the results of the one boring drilled at the site, there is a third foundation system which may be appropriate to the site soils, that being a combination of isolated spread and strip footings. The three foundation alternatives are discussed under headings as follows:-

RAFT SLAB FOUNDATION

We understand the raft slab is likely to be about 0.6 metres thick with its upper surface comprising the ground floor. From the dead plus real live loads given, we estimate that a uniform rigid raft would apply a bearing stress of 83 kPa on the supporting soils.

For the purposes of raft slab design, we recommend soil stiffnesses as follows:-

	Dead Plus Live Load	Factored Dead Plus Live Earthquake
Centre of raft	3 kPa/mm	12 kPa/mm
Edge of raft	6 kPa/mm	24 kPa/mm
Corner of raft	9 kPa/mm	36 kPa/mm

* It should be noted that the soil stiffnesses for dead plus live load conditions apply for stresses up to 85 kPa. Where permanently applied stresses exceed 85 kPa the soil stiffness should be reassessed by us. The effect of increased dead plus real live load pressure would be to reduce the design soil stiffness.

The soil stiffness increases towards the edges and corners of a uniformly loaded raft foundation and this is due to the localised edge effects. For the purposes of design, a linear variation may be taken over the centre to edge, edge to corner and centre to corner. This simplifies the correct distribution, however we expect this simplification to be within normal design tolerance.

The soil stiffnesses have been based on the typical soil profiles encountered at the boring location. We recommend that a sensitivity analysis be carried out using a range of soil stiffnesses to determine the effects of any variation on the raft foundation and superstructure

performance. For this analysis we suggest the range of values be 20 percent and 100 percent of the soil stiffnesses given above.

The excavation to underside of the raft slab foundation will expose naturally deposited gravels at the point explored. The uniformity and compactness of these gravels will have a large effect on the performance of the raft. We recommend that excavation and subgrade preparation works be carried out as follows:-

(i) Excavate for the raft slab to required depth with a tracked back-hoe fitted with a smooth edge ditching bucket. The excavator should operate from outside the excavation and trucks loaded on the upper level. The excavation should extend 150 mm below the underside of the bearing level or to sufficient depth to remove any unsuitable soils which are exposed at the bearing surface.

(ii) Geotechnical engineer to inspect.

(iii) Compact the exposed subgrade with several (not less than two) passes of a "Bomag" Tandem BW 100AD Vibrating Roller or equivalent.

(iv) Make up the subgrade to underside of the raft slab with NRB:M/4 1984 AP40 basecourse placed in one layer and compact with three passes of the Vibrating Roller referred to in (iii) above.

(v) Cover the prepared area with a concrete tidy slab.

While we did not encounter any unsuitable soils at the point explored, we recommend that provision be made to provide some overexcavation and replacement with selected on site material or imported well-graded 50 mm down low fines quarry material. Any backfill should be placed in horizontal layers of loose thickness not greater than 150 mm and be compacted to a uniform dense subgrade using plant described above.

The seismic base shear forces developed on the structure will be distributed to ground through the shear friction on the underside of the raft and some passive reaction due to its embedment. The development of shear friction requires the least amount of lateral displacement to be fully developed and, hence, will need to be overcome before the passive capacity at the raft edges is developed.

The following shear friction values may be used for the raft/soil interaction in assessing the foundation resistance to sliding:-

Raft/Soil Interaction	Coefficient of Friction
1. Raft concrete in direct contact with the naturally occuring site soils	0.6
2. Raft concrete separated from soil by DPC etc.	0.1

SHALLOW FOOTINGS

As an alternative to a raft slab foundation, the structure may be supported on shallow footings constructed to derive foundation support from the gravels at depth 2.0 metres below the ground surface.

For the purposes of foundation design, isolated pads and strip footings may be proportioned for a maximum bearing pressure of 600 kPa provided the following conditions are met:-

(a) All foundations have minimum plan dimensions of at least 1.0 metre.

(b) The bearing surface of individual fotings is confined at least 0.5 metres below adjacent lowest final grade.

(c) All footing excavations are inspected by a geotechnical engineer to ensure that the material exposed meets the design criteria given in this report.

Appropriate factors of safety should be applied to the maximum bearing capacity for shallow pad foundations as given above. The recommended maximum bearing capacity should be divided by an appropriate factor of safety as follows:-

Design Procedure	Factor of Safety
Strength Method	1.8 for factored loads
Capacity Design	1.1
Alternative Method	3.0 for dead plus live load 2.0 for load combinations including earthquake and wind loads.

Footings should be dimensioned by considering all of the above criteria and using whichever gives the largest size.

The base shear forces transferred to ground through the foundations will apply inclined loads to the foundation bearing surfaces. The appropriate ultimate bearing pressures for inclined loads as applied to the full bearing surface reduces as the angle of force attack on the footing flattens. The following ultimate bearing capacities may be used for design:-

Eccentricity of Load (c/b)	Reduced Ultimate Bearing Capacity (kPa)
0	600
0.2	500
0.4	320
0.5	260
0.6	200

Settlement of foundations supporting columns on shallow footings is likely to be about 20 mm. The superstructure frame should be designed for differential settlement causing an angular rotation of 1:500 between adjacent columns.

PILED FOUNDATIONS

Large diameter piles may found on the gravel stratum at RL 2.0 metres at boring B1, and these piles may be either straight sided shafts for moderate compression loads or belled piles for high compression and tension loads. The depth to founding for belled piles required to resist tension forces may need to be deepened below the minimum elevations given above to provide resistance to pull-out. Both straight sided and belled cast-in-place piles may be designed for a suitably factored ultimate bearing capacity of 3.0 MPa provided the following parameters are included in the pile design:-

(a) The stem diameters are at least 0.9 metres and the bell diameters to stem diameter ratio does not exceed 2.0.

(b) The ratio of pile depth (i.e. net confinement below measured adjacent ground surface) to the bell diameter, is not less than 4.0.

(c) Each pile bearing surface is proven by drilling investigation before the shaft is excavated and the results are interpreted by us in context with this report.

(d) Each shaft base is inspected by us when it is at the design depth and before the bells are cut.

For design purposes the ultimate end bearing capacity for drilled piles as given above should be reduced by dividing by the appropriate factor of safety as given under shallow footings above.

The rupture uplift capacities for belled piles may be determined from the chart given on Plate 4, Ultimate Uplift Capacities for Belled Piles. The appropriate factor of safety as given above for bearing should also be applied to the rupture uplift capacity determined.

The lateral base shear developed on the structure due to seismic attack may be resisted by the piles acting laterally against the surrounding soil.

Piles subject to lateral load may be designed according to the "Reese and Matlock" analysis which is summarised on Plates 5A, 5B and 5C, Design Procedure for Laterally Loaded Piles. A coefficient of variation of soil modulus with depth (f) of 7 KPa/mm is appropriate.

SUBSOIL FLEXIBILITY

In terms of the criteria specified in Clause 3.4.3 of NZS 4203:1984 "Code of Practice for General Structural Design Loadings for Buildings", the site is "flexible".

FURTHER SUBSURFACE INVESTIGATION

The geotechnical recommendations contained in this report are based on the results of one boring drilled near to the site.

The feasibility of the raft slab foundation to support the building is dependent on the gravel stratum encountered in the boring occurring at similar depths over the entire site. If these gravels are discontinuous

and/or at irreglar depths across the site, then the displacement performance of the raft slab foundation may be significantly affected.

We recommend that, on completion of demolition, a series of relatively shallow borings be drilled on the vacant site to confirm the founding stratum for the raft slab and/or shallow footings. Three investigation borings should each extend to depth 8 metres and the soils encountered should be observed and sampled by a geotechnical engineer.

This additional investigation work should be carried out as soon as practically feasible to enable any changes to be made to the foundation in the event that below ground conditions are found to differ from those expected.

GENERAL

The following plates are attached to complete this report:-

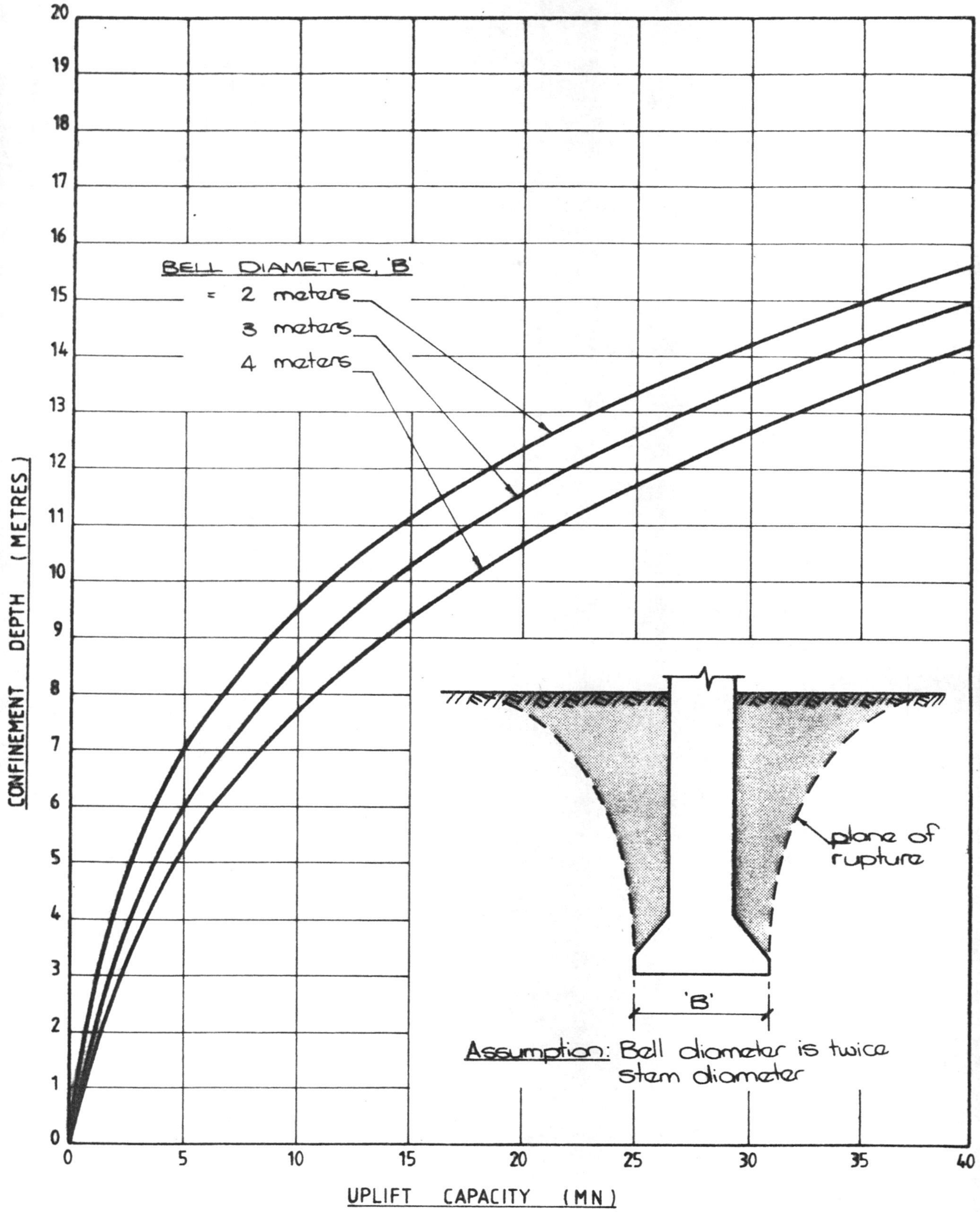
Plate 1	Site Plan
Plate 2	Boring Log
Plate 3	Method of Soil Classification
Plate 4	Ultimate Uplift Capacities for Belled Piles
Plates 5A, 5B, 5C	Design Procedure for Laterally Loaded Piles

Yours faithfully,
pp BRICKELL MOSS RAINES & STEVENS LTD

J. H. Travers

J. H. TRAVERS

GCA:JHT:lcs



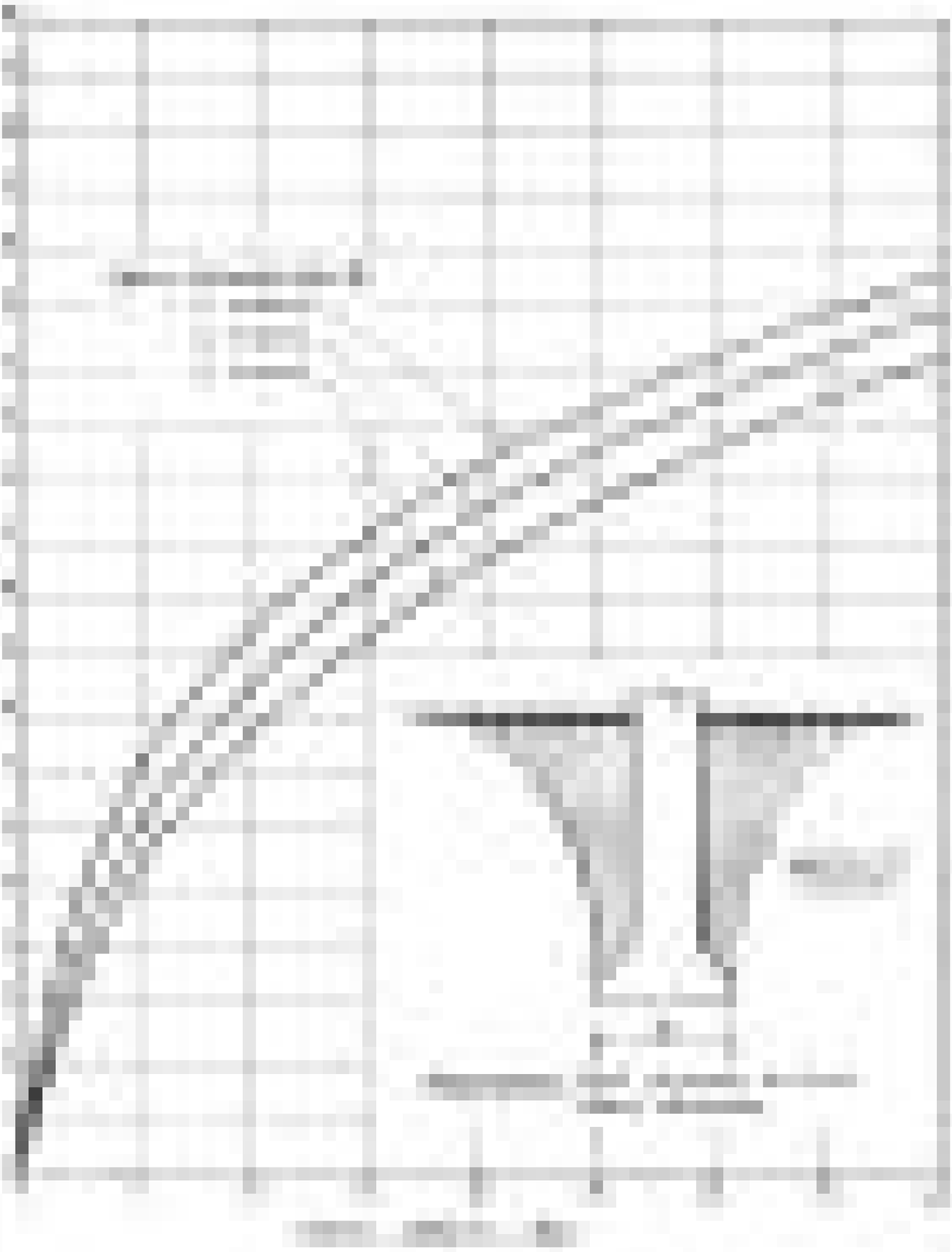
ULTIMATE UPLIFT CAPACITIES FOR BELLED PILES

REFERENCE: 'Resistance to breaking out of mushroom foundations for pylons,' by Dr. A. Balla.

BRICKELL MOSS RAINES & STEVENS LTD.

JOB _____ CLIENT _____ LOCATION _____ BY _____ CHECKED _____ DATE _____

PLATE 1



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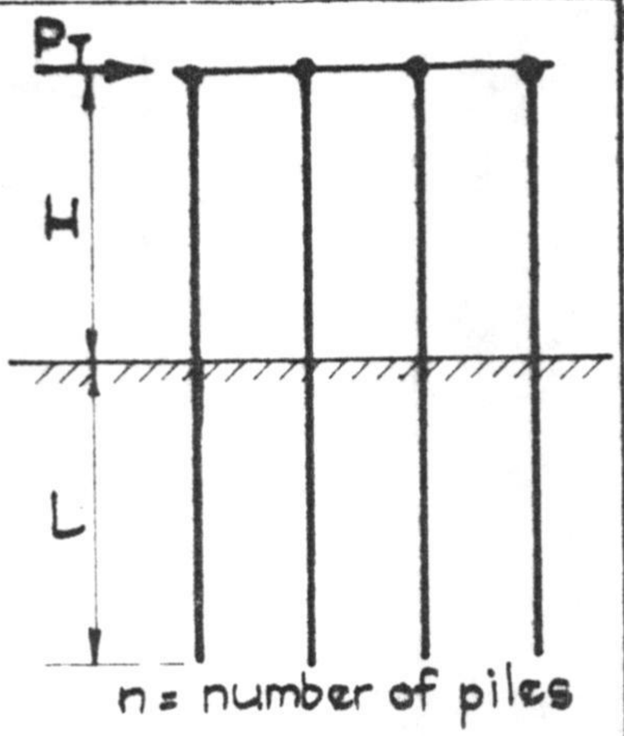
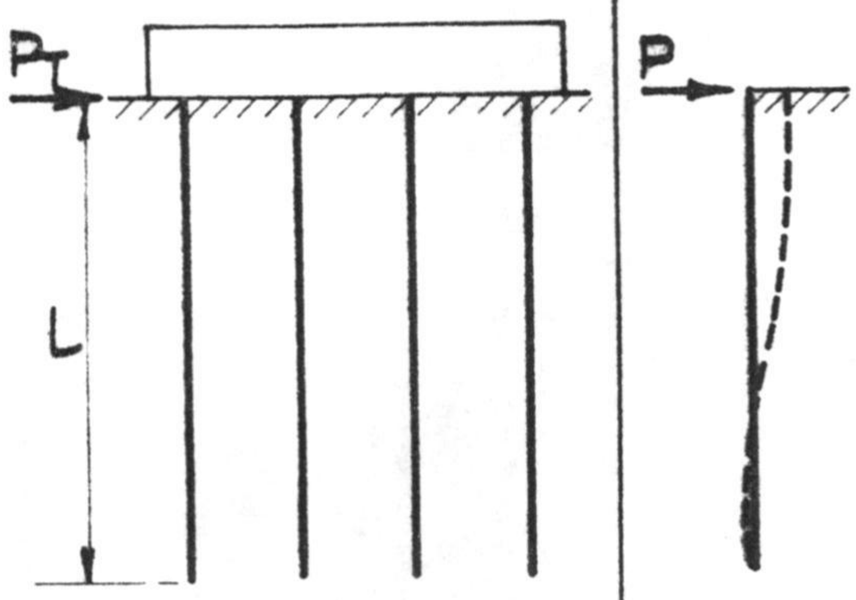
CONDITION	LOAD AT GROUND LINE	DESIGN PROCEDURE
	For each pile $P = \frac{P_T}{n}$ $M = PH$ 	1. Compute relative stiffness factor $T = \left(\frac{EI}{f}\right)^{1/5}$ 2. Select curve for relevant $\frac{L}{T}$ 3. Obtain coefficients F_d, F_M, F_V, or F_d', F_m', F_v', at depths desired. 4. Compute deflection, moment and shear at desired depths, using formulae of Plate

CASE 1. PILES WITH FLEXIBLE CAP OR HINGED END CONDITION

		1. Proceed as in step 1, case 1. 2. Compute deflection and moment at desired depths, using coefficients F_d', F_M' and formulae of Plate 3C 3. Maximum shear occurs at top of pile and equals $P = \frac{P_T}{n}$ in each pile.

CASE 2. PILES WITH RIGID CAP AT GROUND SURFACE

DEFINITIONS:

- P = Lateral force applied on pile
- H = Vertical distance between P and ground surface
- M = PH = Moment on pile applied at ground surface
- Z = Depth factor below ground to point to be checked, $= \frac{\text{depth}}{T}$
- f = Coefficient of soil modulus variation
- L = Length of pile below ground surface
- T = Relative stiffness factor
- E = Modulus of elasticity of pile
- I = Moment of inertia of pile cross section
- δ_p, M_p, V_p = Deflection, moment and shear at any depth, Z, due to force P
- δ_m, M_m, V_m = Deflection, moment and shear at any depth, Z, due to moment M

DESIGN PROCEDURE FOR LATERALLY LOADED PILES

REFERENCE: Reese & Matlock : 8th Texas Conference, SMFE. (NAVFAC DM 7)

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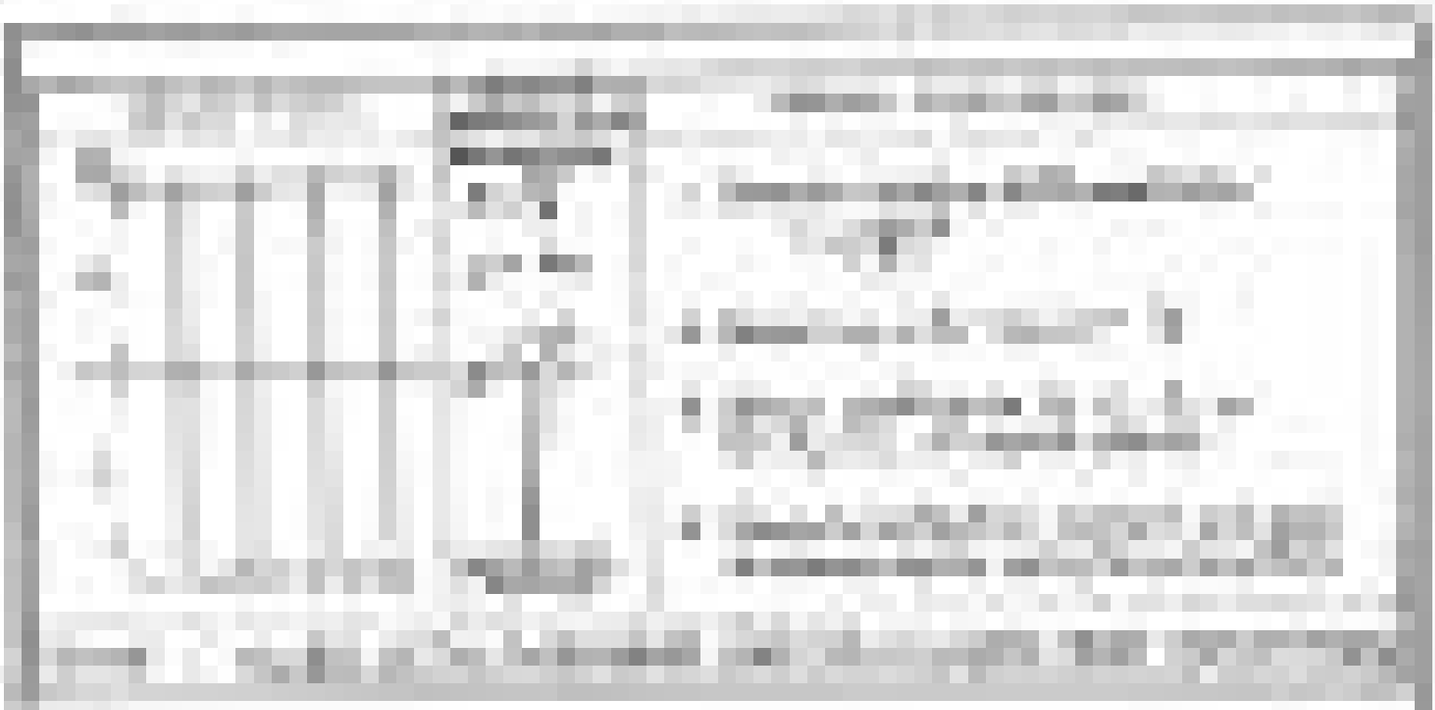
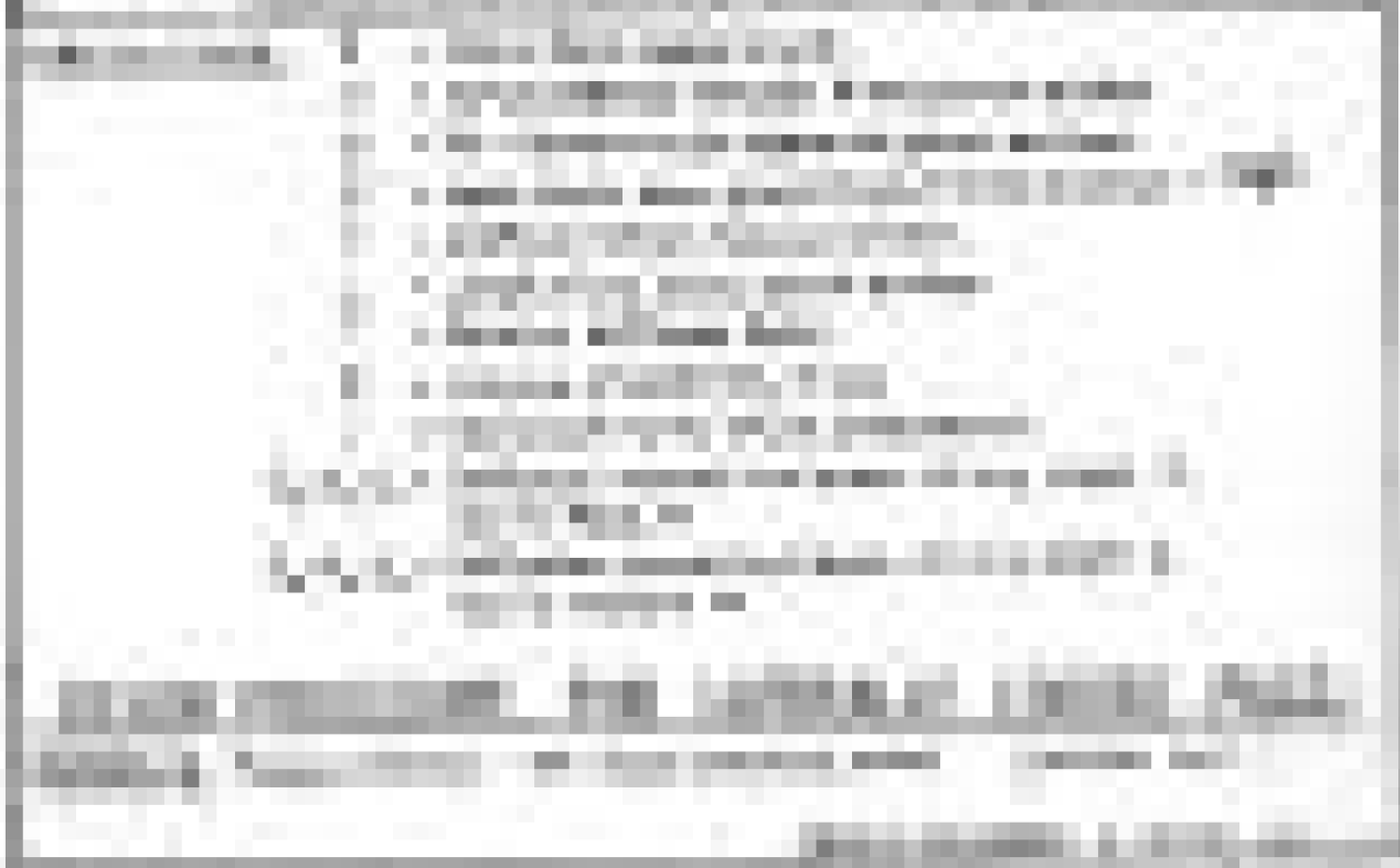
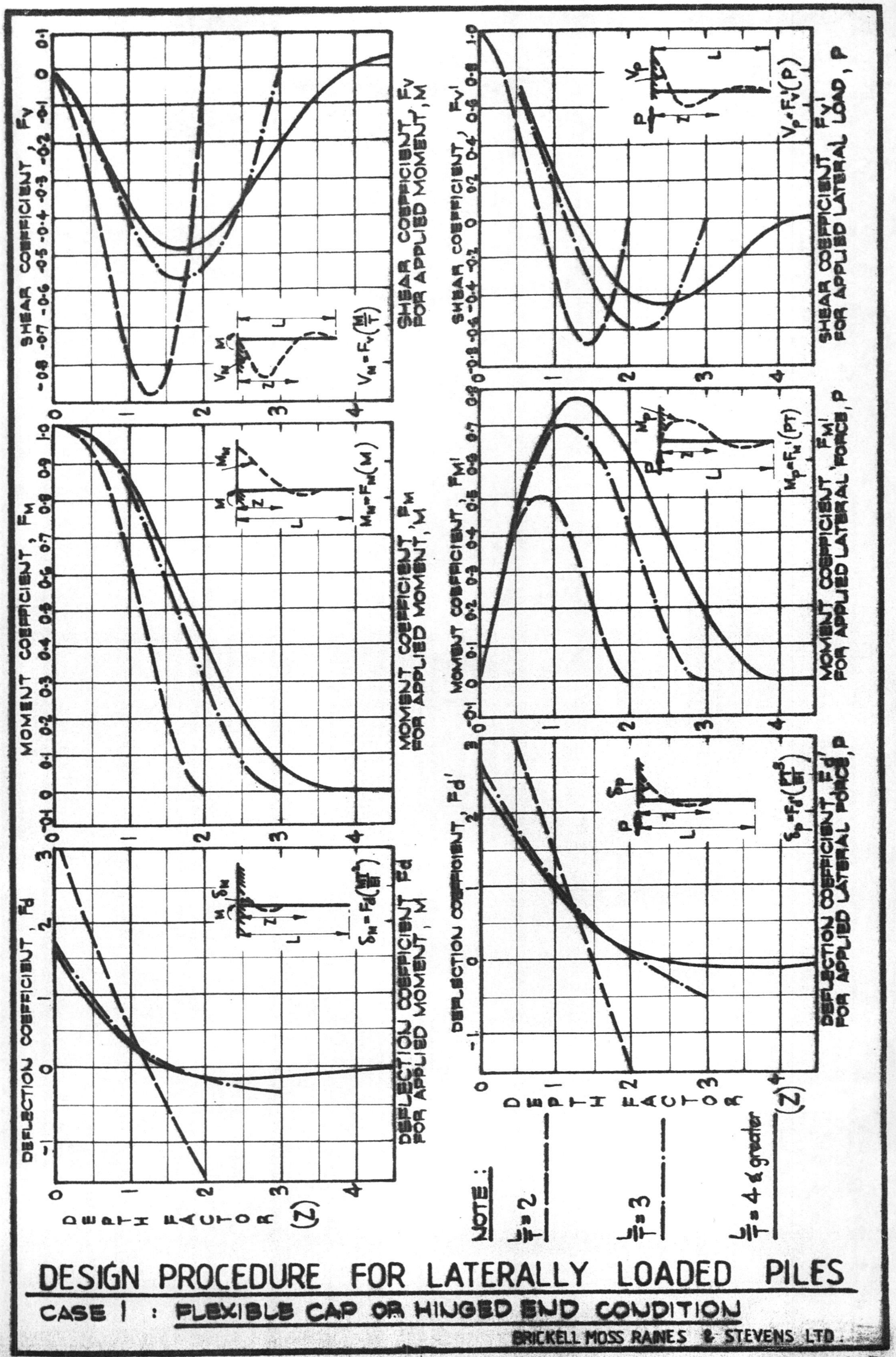
PLATE 5A

JOB CLIENT LOCATION BY CHECKED DATE





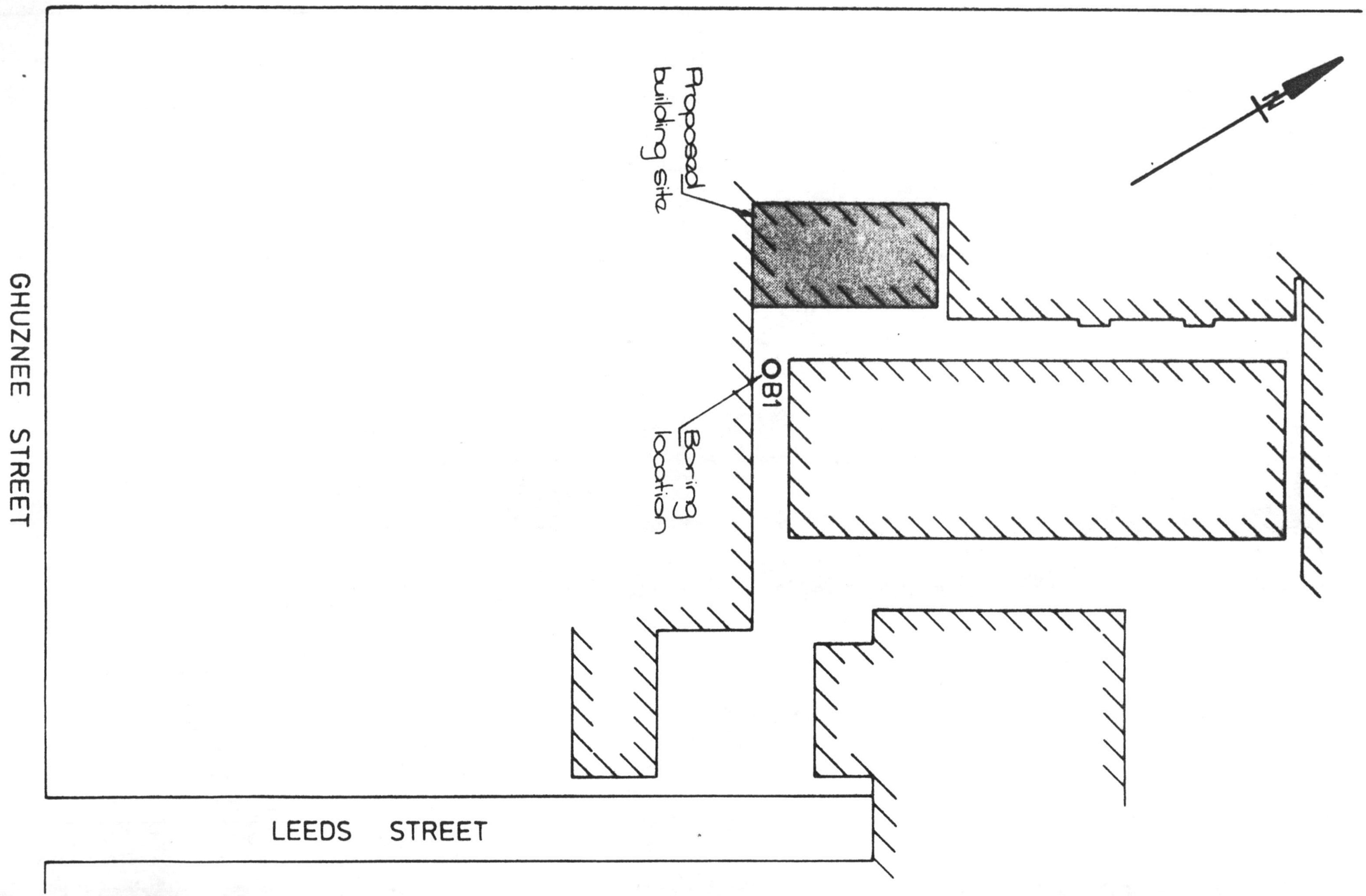


DESIGN PROCEDURE FOR LATERALLY LOADED PILES

CASE 1 : FLEXIBLE CAP OR HINGED END CONDITION

BRICKELL MOSS RAINES & STEVENS LTD.

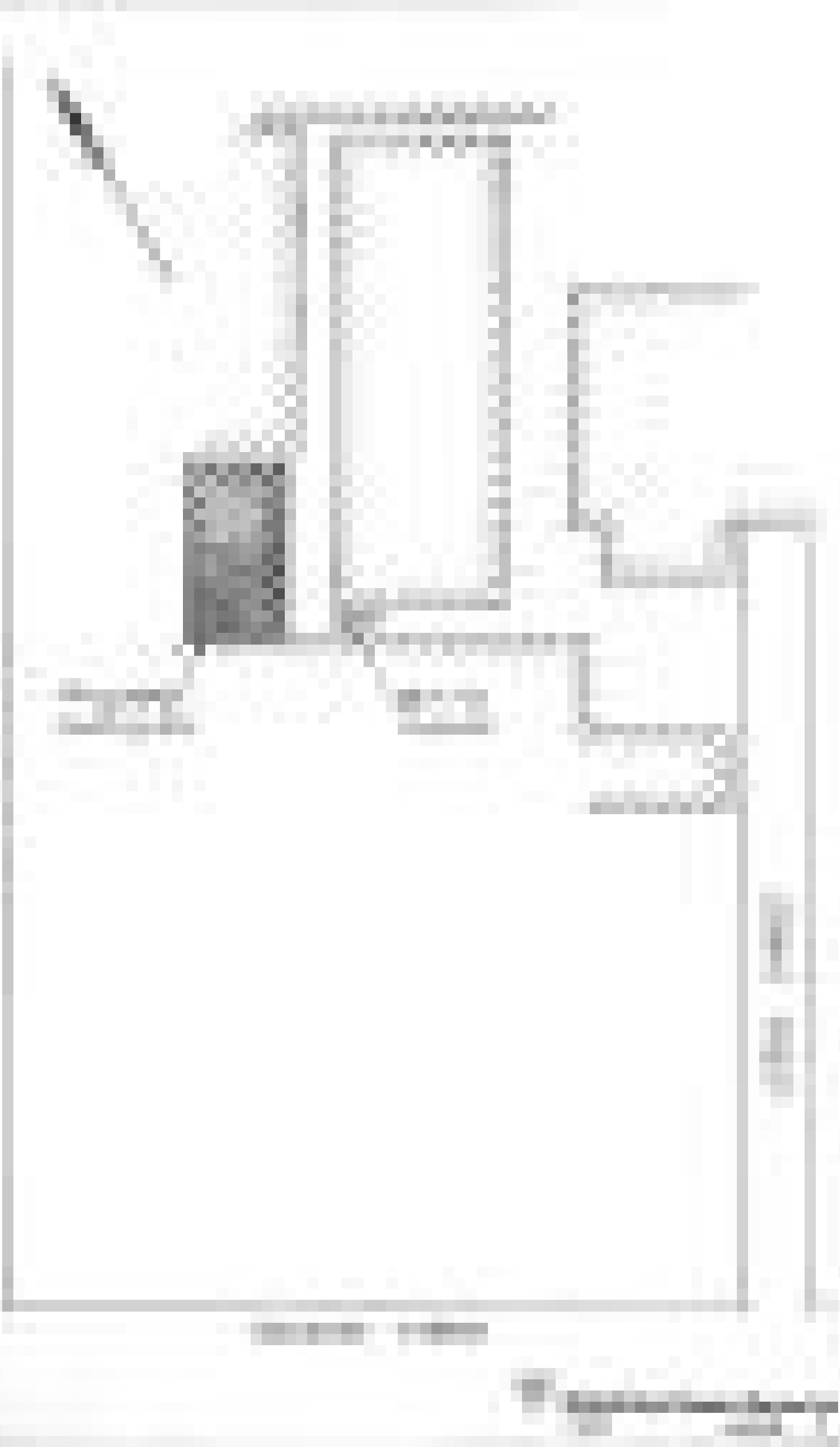
JOB No: 52512 CLIENT: Smith Leuchars LOCATION: Leeds St. BY: J.E.P DATE: Sept. '8



Brickell Moss Raines & Stevens Ltd

1:450

PLATE: 1



BORING B1

ELEVATION: 8.5 METRES

CLASSIFICATION DATA			STRENGTH DATA			WATER - DENSITY DATA		FIELD DATA	DEPTH IN METRES	
% FINES (-63μm)	LIQUID LIMIT	PLASTICITY INDEX	TYPE OF TEST	TEST SURCHARGE PRESSURE KPa	SHEAR STRENGTH KPa	NATURAL WATER CONTENT %	DRY DENSITY kg/m³	PENETRATION RESISTANCE		
									0	Brown SILTY GRAVEL (GM) (moderately dense, coarse, weathered, sub-angular)
								N = 16	1	
									2	
										(grades more dense)
								N = 21	3	(layer brown SANDY SILT (ML) (firm)
									4	
								N = 31		(grades dense)
									5	
								N = 19	6	(layer grey CLAY (CL)(firm)
									7	Pile founding.
								N = 41		
									8	
								N = 21	9	Grey SANDY SILT (ML) (firm)
									10	

BORING DEPTH : 9.5 METRES

CASING DEPTH : 3.0 METRES

1. The boring was drilled on 11 September 1986 with truck mounted rotary wash equipment.
2. 100 mm size casing was used in the borings.
3. ▽ Standard Penetration Test (SPT), performed in accordance with standard ASTM D1586-67.
4. 50/285 Number of blows with SPT hammer and penetration (mm) of sampler.
5. • Disturbed observation sample.
6. ▼ Observed ground water level.
7. The elevations of the borings refer to New Wellington City Datum.
8. Indicated depths are in metres below the existing ground surface.

BORING LOG NOTES

BORING LOG

Brickell, Moss & Partners

Date :

Location :

Client :

Job No

RELATIVE DENSITY OF COHESIONLESS SOILS

	Corrected SPT 'N' value (blows/300 mm)
Very Loose	0 to 4
Loose	4 to 10
Moderately Dense	10 to 30
Dense	30 to 50
Very Dense	> 50

GRAIN SIZE

BOULDERS	> 200 mm
GRAVEL	
Very coarse	200 mm to 60 mm
Coarse	60 mm to 20 mm
Medium	20 mm to 6 mm
Fine	6 mm to 2 mm
SAND	
Coarse	2 mm to .6 mm
Medium	.6 mm to .2 mm
Fine	.2 mm to .06 mm
SILT & CLAY	< .06 mm

GRAIN SHAPE

Angular	Showing little or no evidence of wear; edges and corners sharp, secondary edges present.
Subangular	Showing some effect of wear; faces virtually untouched but edges and corners slightly worn.
Subrounded	Showing considerable wear; edges and corners rounded off to smooth curves, original faces considerably reduced.
Rounded	Original faces almost completely destroyed, but some comparatively flat surfaces present. All original corners smoothed off to broad curves.
Well rounded	No original faces, corners or edges left. The entire surface consists of broad curves; flat areas absent - virtually spherical.

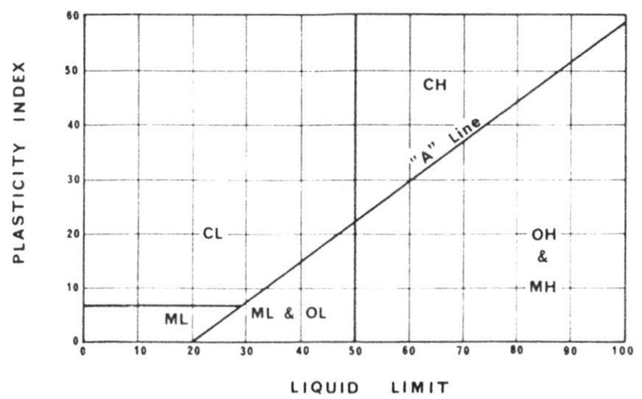
CONSISTENCY OF COHESIVE SOILS

Very Soft	-	squeezes between fingers
Soft	-	easily moulded by fingers
Firm	-	moulded by strong finger pressure
Stiff	-	dented " " " "
Very Stiff	-	dented only slightly by finger pressure
Hard	-	dented only slightly by pencil point.

STRUCTURE

Layer	A relatively continuous planar unit of soil, limited by difference in composition, texture or structure.
Lens	A discontinuous unit of soil, usually of limited area and generally less than 300 mm thick.
Bed	One distinct soil unit of sedimentary origin, confined within distinct bedding planes.
Homogeneous	Uniform properties within a soil unit.
Interbedded	Alternate beds of soil within a major soil unit.
Laminated	Distinct, fine layers each generally less than 3 mm thick.
Banded	Alternate layers of soil with distinct colour differences.
Mottled	Irregularly marked with spots or zones of different colours.
Slikenside	Smooth, polished sometimes striated planar structures resulting from insitu movement.

DEFINITIONS OF DESCRIPTIVE TERMS



PLASTICITY CHART

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > 0.06 mm)	GRAVELS (More than 1/2 of coarse fraction > 2 mm)	GW	Well graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 1/2 of coarse fraction < 2 mm)	SW	Well graded sands or gravelly sands, little or no fines.
		SP	Poorly graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 1/2 of soil < 0.06 mm)	SILTS & CLAYS (L L < 50)	ML	Inorganic silts and very find sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays of low plasticity.
	SILTS & CLAYS (L L > 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts.
HIGHLY ORGANIC SOIL		Pt	Peat and other highly organic soils.

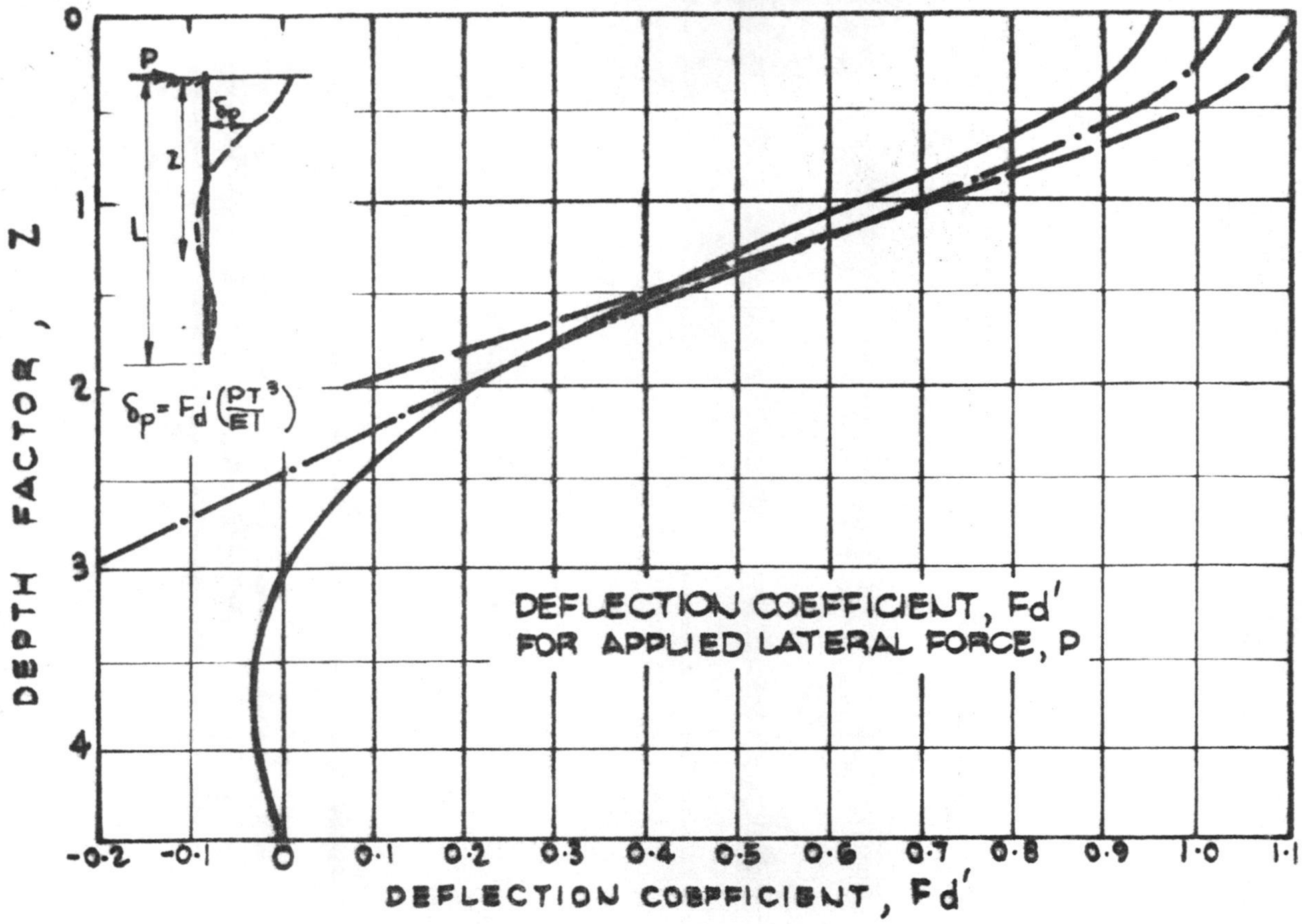
CLASSIFICATION CHART

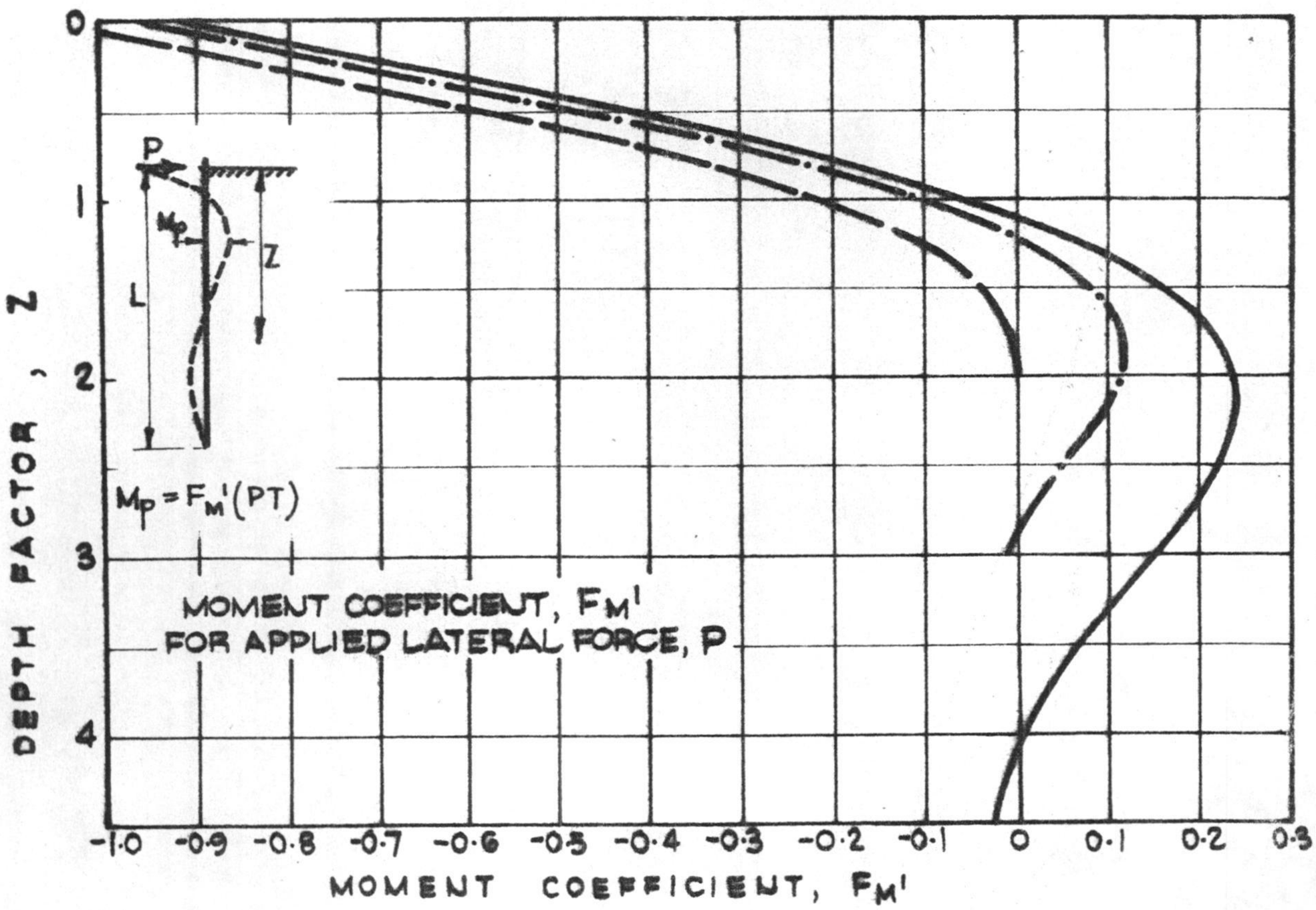
(Unified Soil Classification System)

METHOD OF SOIL CLASSIFICATION

BRICKELL, MOSS & PARTNERS

PLATE





KEY :

$\frac{L}{T} = 2$ ——— $\frac{L}{T} = 3$ —·—·— $\frac{L}{T} = 4$ & greater ———

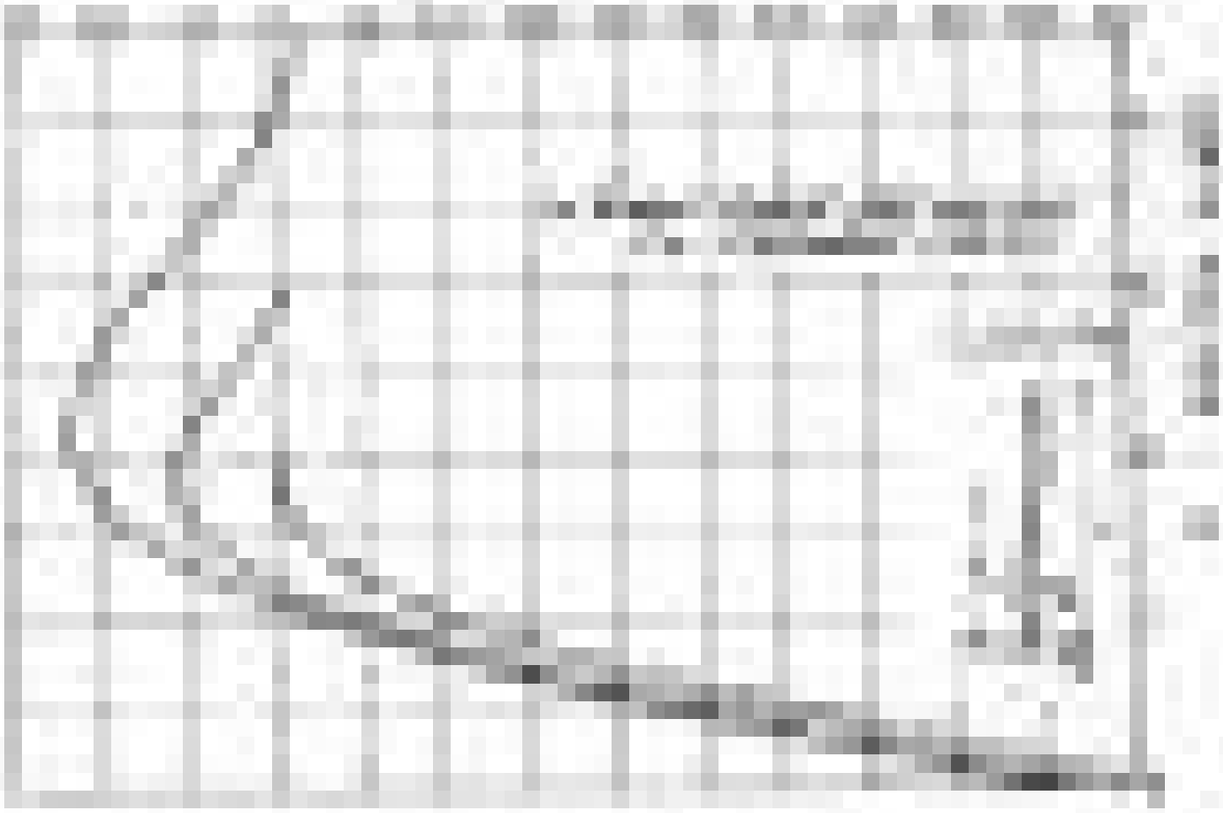
DESIGN PROCEDURE FOR LATERALLY LOADED PILES

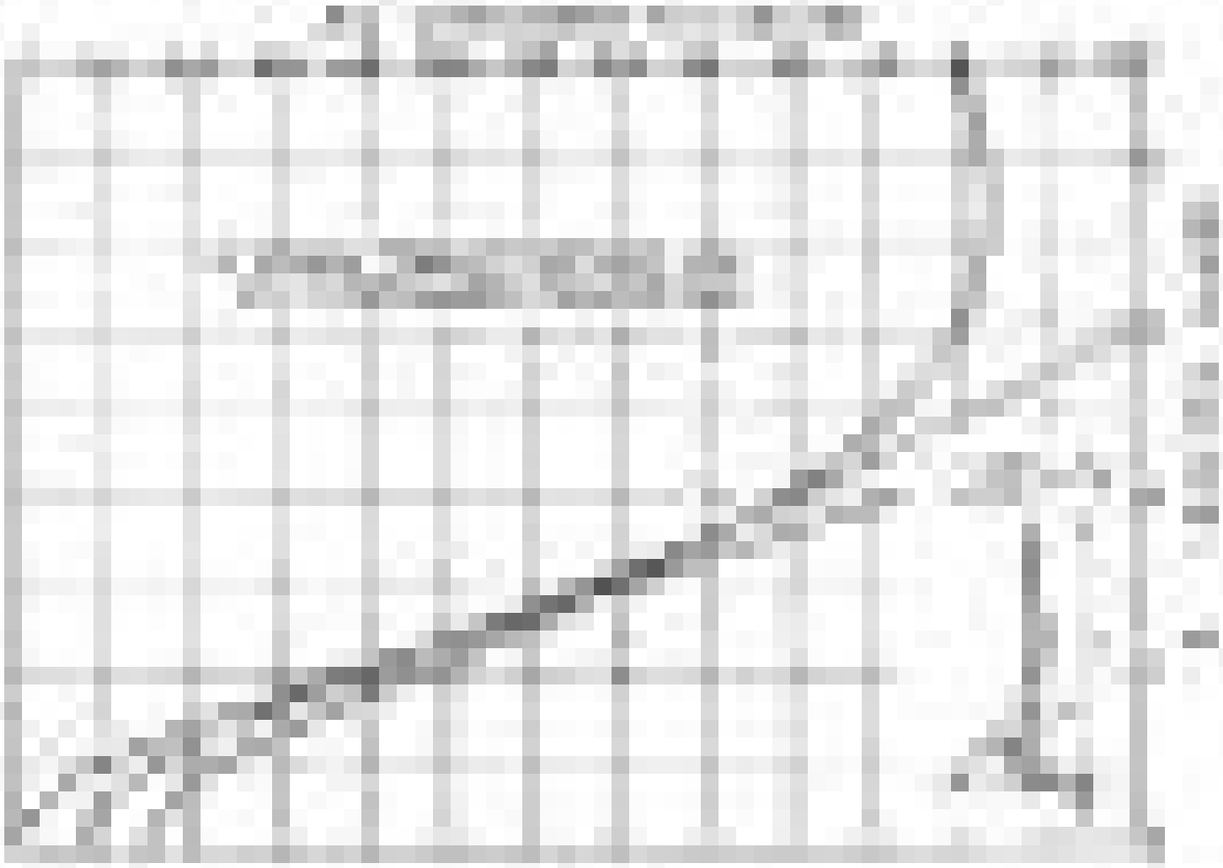
CASE 2 : FIXED AGAINST ROTATION AT GROUND SURFACE

BRICKELL MOSS RAINES & STEVENS LTD.

PLATE 5C

JOB ---- CLIENT ---- LOCATION ---- BY ---- CHECKED ---- DATE ----



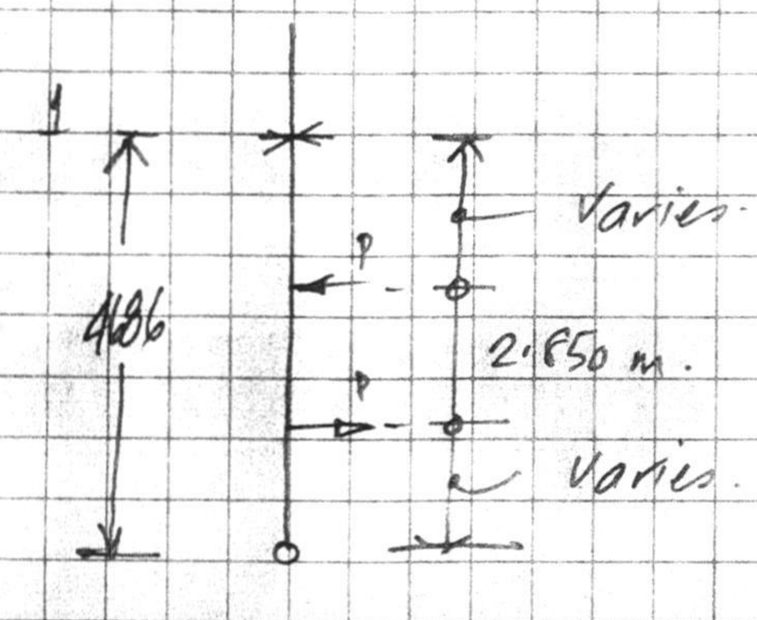


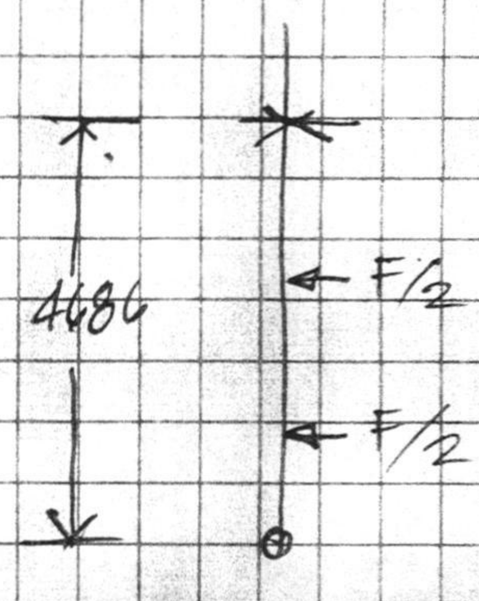
Structure:-

Lvls Ex R to G incl.

- Building Floors restrain RHS posts

Max Span to Post = 4.69 m. - Continuous -



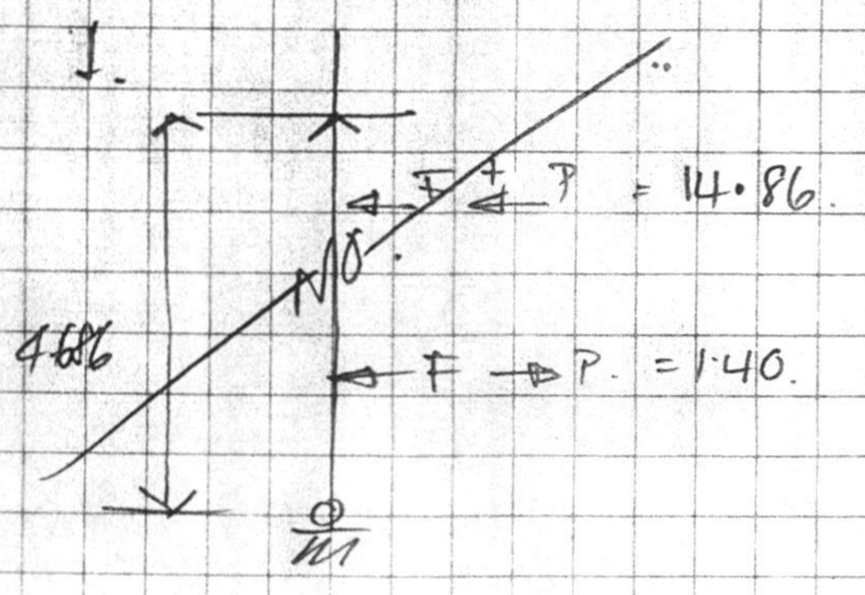


P = 8.13 kN.

CASE A
SAFETY GEAR.

F = 6.73 kN.

CASE B.
SEISMIC



Max Moment in Stanchion =

- Case A

- P at mid Span ⇒ $M_{max} = \frac{8.13 \times 4.686}{4} = 9.52$ kNm

CASE B

$M_{max} = 3.38$ kNm

CASE C

~~$M_{max} = 17.41$ kNm~~ when top of Car at mid ht of shaft.

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CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. 1868L PAGE 30

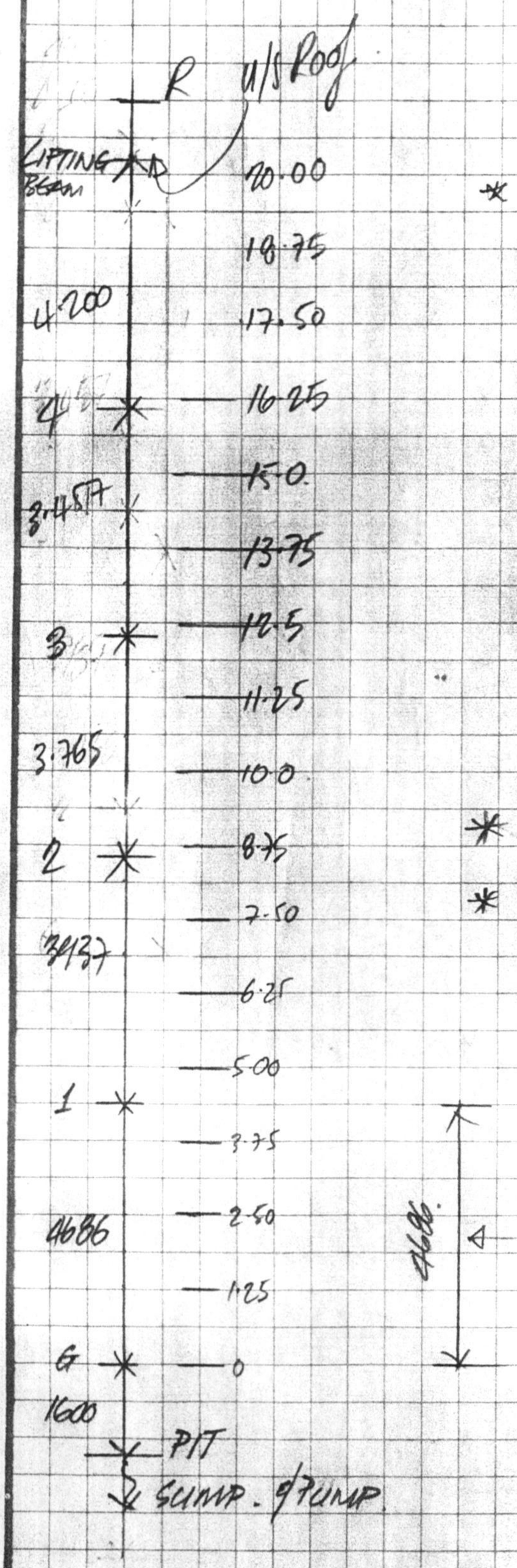
JOB NWMC BY RJT

HYDRAULIC LIFT DATE

① Hoistway Clear Dims Int.
2000 W x 2300 D

② Capacity 780 kg

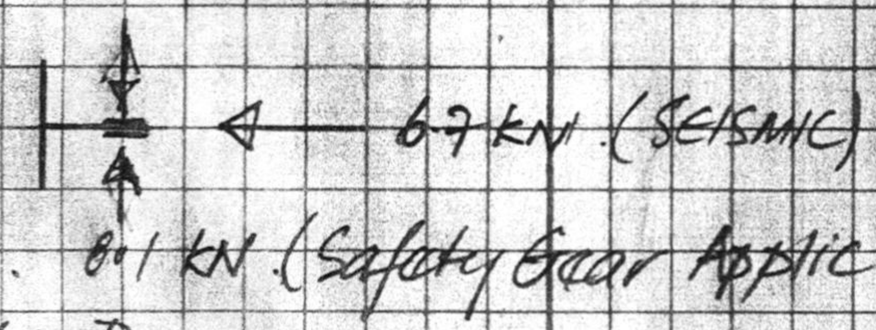
③ Lifting Beam above U/S Roof 200 kg (2T) at back of Shaft & above buffers in Pit.
Impact Loads
- Base of Ram Cylinder support 96kN



* Check if this is carried by 2/203 x 76 C's.
- Appears to act on pit base as end capped.
- Rope hitch to 2/203x76 C's = 39 kN.
- Acts on 2/203 x 76 C's.

Top Rail connections (restraint)
req'd at 1250 crs. vertical.

Loads.

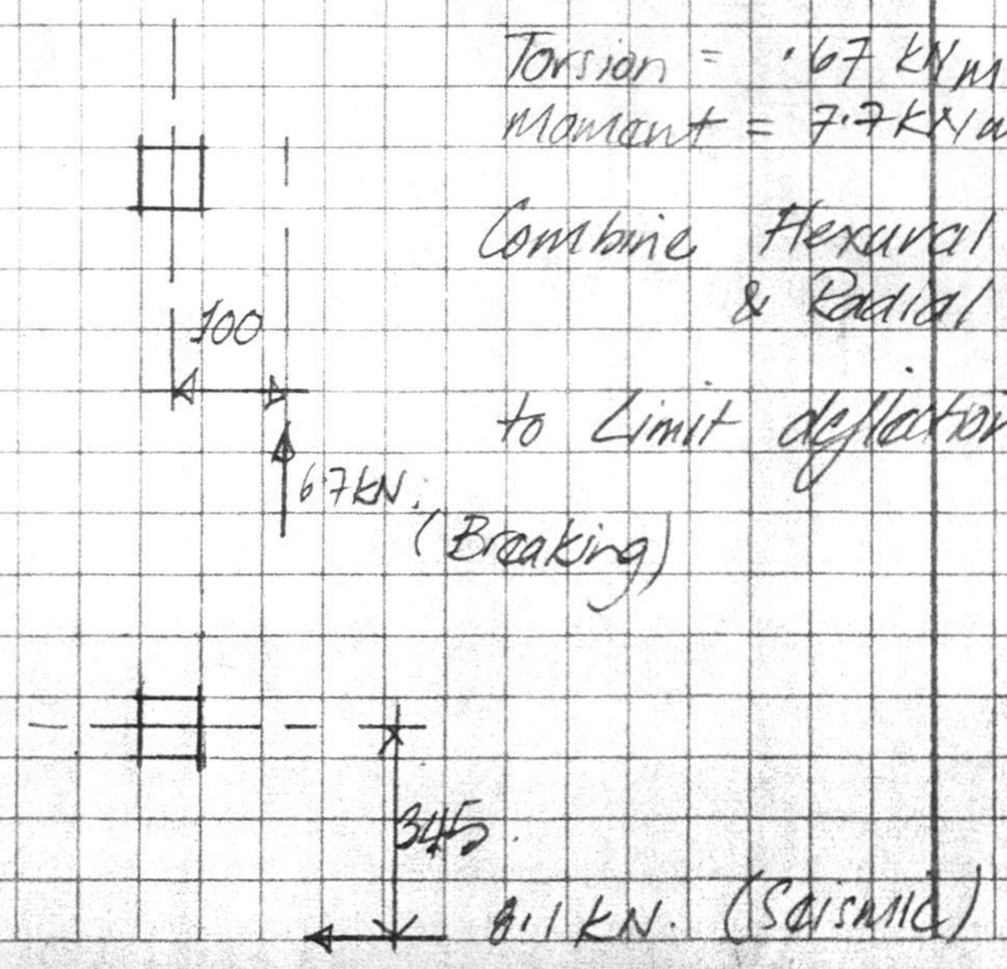


Top Rails: Loads P.
* Do these loads always oppose each other.

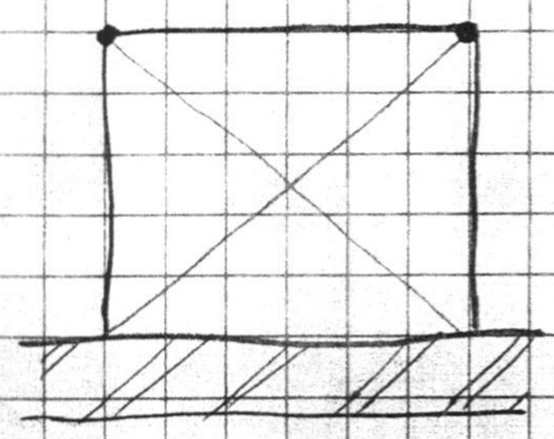
* Pillar & Ram Support Brackets ? OK into Studs ? timber.

Torsion = ·67 kNm.
Moment = 7.7 kNm.

Combine Flexural Defl^n & Radial Defl^n to Limit deflection



L ④	nil	L ④	D+L = 11 kN
③	D+L = 4 kN	③	D+L = 10 kN
②	D+L = 18 kN	②	D+L = 18 kN
①	23 kN	①	23



In the analysis of the tower posts the loading from levels 3 & 4 lift lobbies etc. was ignored. In the worst column this amounted to 21 kN. In comparison to the 89 kN post axial load from wind loading, this amounts to 24% extra loading.

Since, for wind loading it is permissable to apply a factor of 1.33 to allowable stress, the design is OK as it stands. (i.e. since 24% underdesigned loading < 33% overstress allowable).

SMITH LEUCHARS LTD
CIVIL STRUCTURAL & EARTHQUAKE ENGINEERS

Wellington: 212-214 Willis Street, P.O. Box 27-349, Telephone 857-809, Fax No. 851-441

Smith Leuchars Ltd.
4 New Street
P.O. Box 1126
Nelson.
Phone (054) 84-272

DOCUMENTS TRANSFER

TO Wellington City Council.

DATE 4/2/88.

JOB NUMBER 18681

JOB NAME NWMC 2 Lift Upgrading.

ATTENTION Building Inspector.

We are sending separately / attached the following:

☑ prints	☑ calculations	☑ contractor	☐ surface mail
☐ photostats	☐ sketches	☑ client	☐ air mail
☐ specifications	☐ report	☑ architect	☐ SL consultants messenger
☐ draft specification	☐ draft report	☑ quantity surveyor	☐ recipients messenger
☐ tracings	☐	☑ WCC	☐

Copies to:

Sent per:

No.	Drawing No.	Description
2	18681/21	Structural Steel & Reinforced Concrete Details.
	22	
	23	
	24	
2	7915 & A36.	Architectural Details.
1	Set of Calculations.	

WORK DEPARTMENT
BUILDING INSPECTION BRANCH
FEB 1988
RECEIVED
MERCER STREET, WELLINGTON

Sent to you for the following reasons: Structural Documents in Satisfaction of Permit Addenda for Stage 2 Works item. 13.

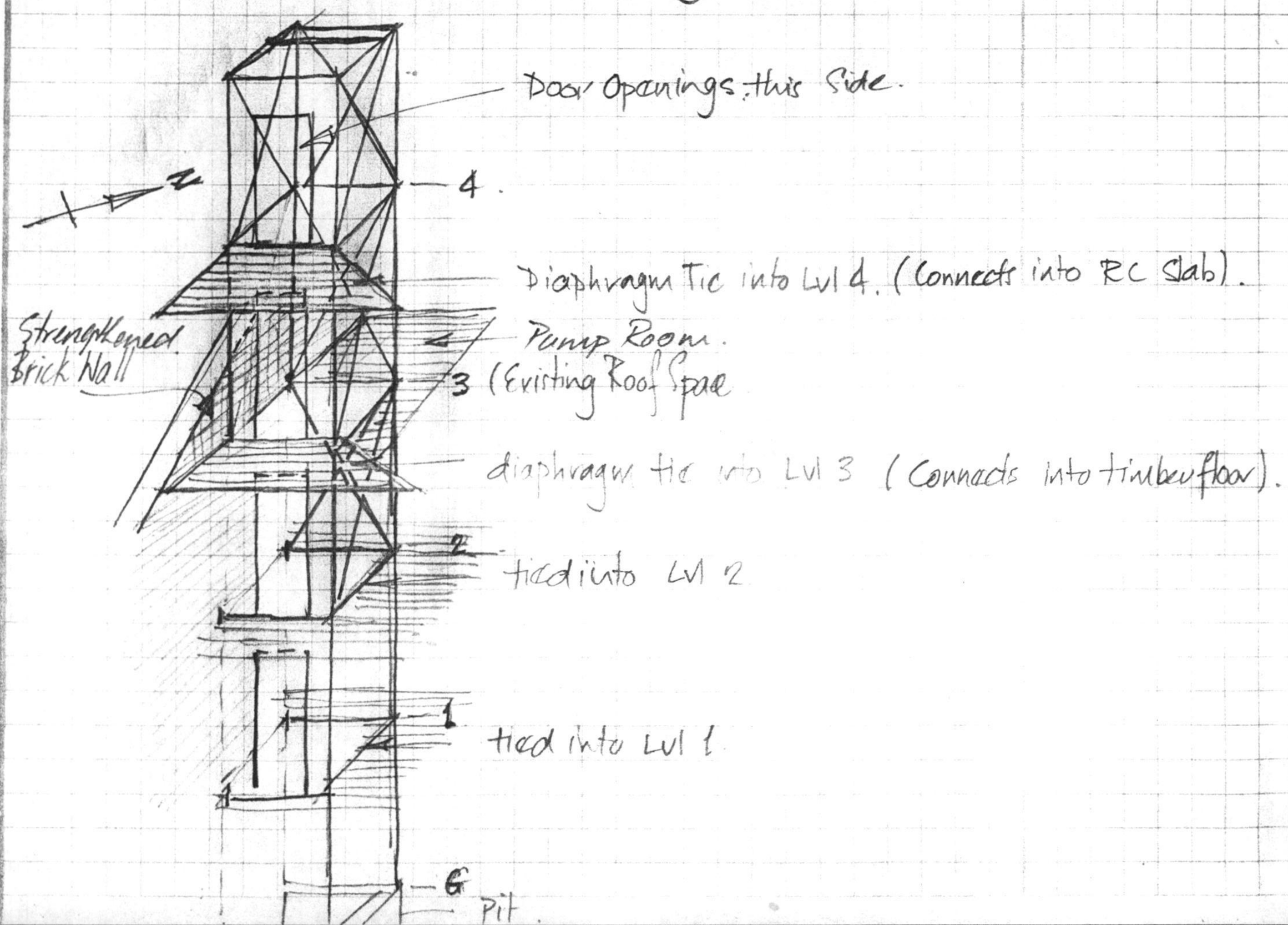
Signature for Smith Leuchars Limited

Design of Lift Tower to WWMC. -

The following are the calculations for the design of the lift tower to the above building.

As the building will have been substantially strengthened to 2/3 NZS 1900 chapter 8 requirements by the time the work on the new lift tower is commenced. The building is considered to be of sufficient strength to adequately laterally support the lift car loads at each floor level.

The Lift tower has been designed to cantilever above Level 2 Slab and accordingly is cross braced above this level so that lateral induced loads are transmitted into the supporting corner steel members below this Level which in turn are founded off the lift pit below ground level. Where existing strengthened brick walls bound the shaft, the lift tower is supported by direct connection into the wall. Secondary effects of direct connection of guide rail supports have been considered in sizing tower members.



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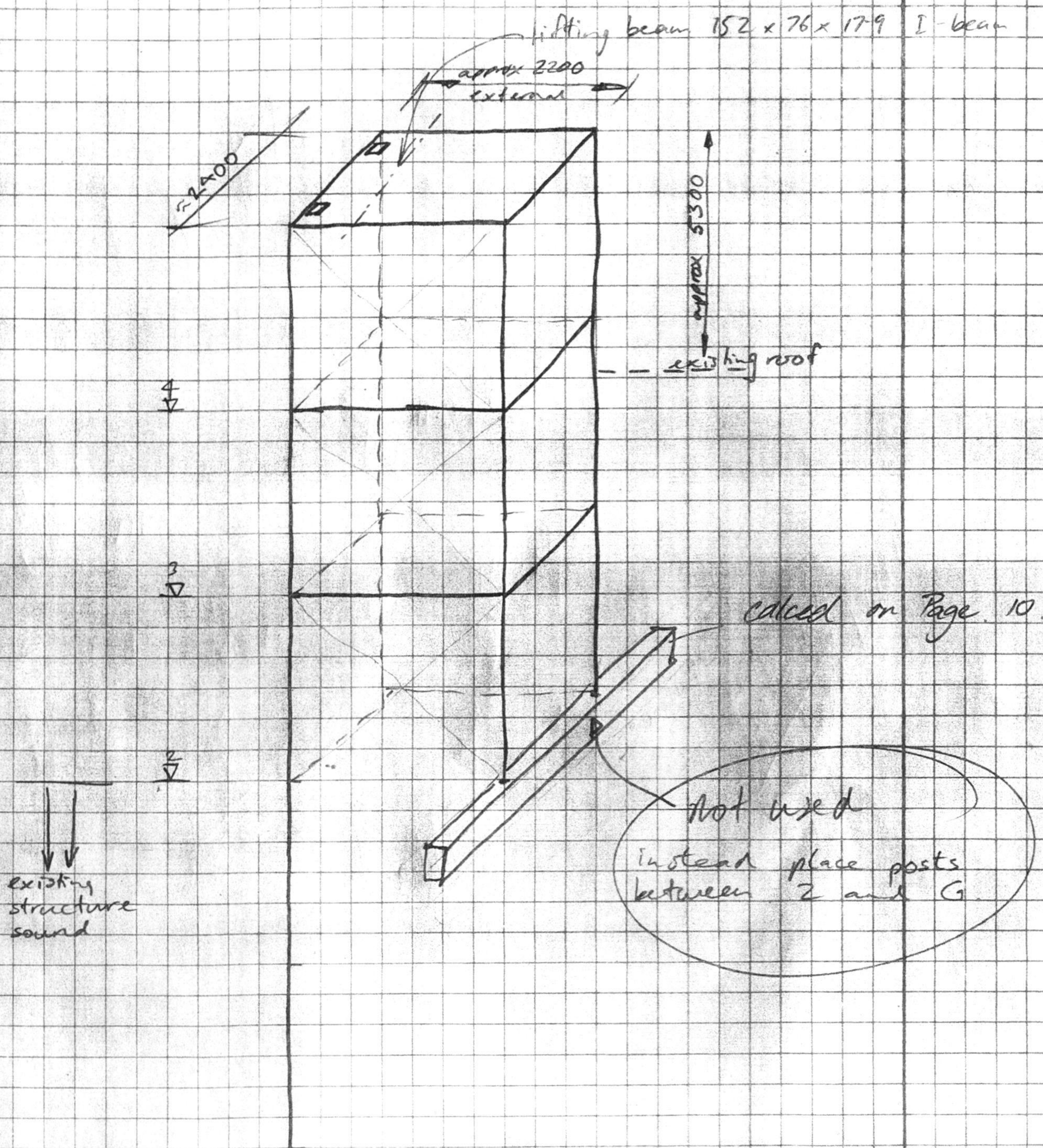
JOB No. 1868/C PAGE 2

JOB WNMC — LIFT TOWER BY RP

DATE 3/12/87



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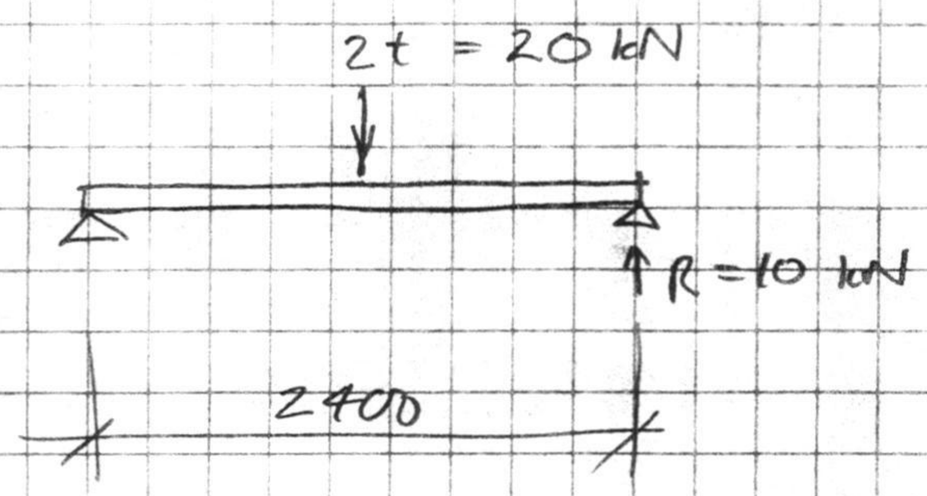
CIVIL, STRUCTURAL AND EARTHQUAKE ENGINEERS

JOB No. 1868/L PAGE 3

JOB WWMC – LIFT TOWER BY RP

2 t capacity lifting beam DATE 3/12/87



$M = 20 \times 2.4 / 4$
$= 12.$ kN.m

estimate $Z = 12 \times 10^6 / 0.6 \times 250$
$= 80 \times 10^3$ mm³

Try 152 x 76 x 17.9 RSJ
$l/r_y = 2400/16.3$
$= 147 > 260/F_y$

∴ cl 5.4 applies.
$D/T = 15.9$
$T/t < 2$
$d_1/t = 23 < 85$

∴ use T 5.4.4 (3)
⇒ $F_b = 128$ MPa

$f_b = 12 \times 10^6 / 115 \times 10^3$
$= 104$ MPa
∴ $f_b < F_b$ → O.K.

LIFTING BEAM
152 x 76 x 17.9 RSJ

CHECK SHEAR
$f_v = [10000 / 152 \times 5.84] \times 2$
$= 11.$ MPa. x 2
$= 22$ MPa. → N.C. ∴ OK!

The lifting beam is placed eccentrically at the top of the frame. Therefore we can conservatively assume that one corner column carries all the 20 kN reaction (20 kN since the load may be at one end of the lifting beam.

Check 100 x 100 x 8 L

$r_v = 20.0$ mm

$\therefore \quad l/r_v = 4200/20$

$= 210$

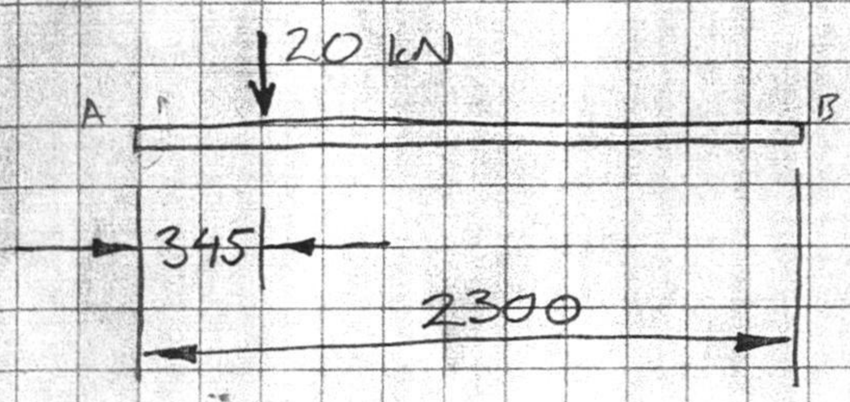
T 6-1-1 $\Rightarrow \quad F_{ac} = 21$ MPa.

$f_{ac} = 20 \times 10^3 / 1540$

$= 13.$ MPa.

$\therefore \quad f_{ac} < F_{ac} \quad \therefore$ OK!

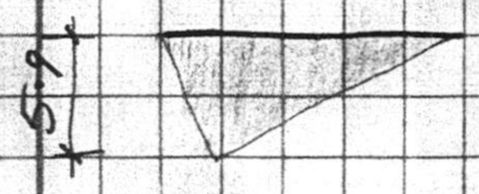
CHECK 100 x 100 x 8L TO SUPPORT THIS REACTION



$Z_x = 20.4 \times 10^3$

simply supported: $M = \frac{20 \times 1.955}{2.3} \times 0.345$

$= 5.9$ kN.m

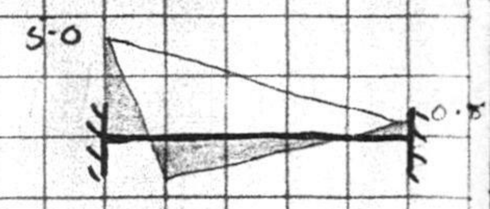


FEM $M_A = \frac{20 \times 0.345 \times 1.955^2}{2.3^2}$

$= -5.0$ kN.m

$M_B = 5.0 \times 0.345/1.955$

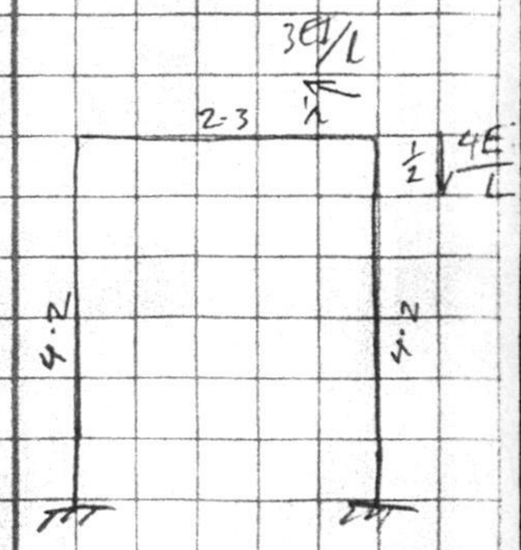
$= +0.88$ kN.m



$S_{post} = 4EI/L = \frac{4}{4.2} EI = 0.95\ EI$ $\quad d_{post} = 0.42$

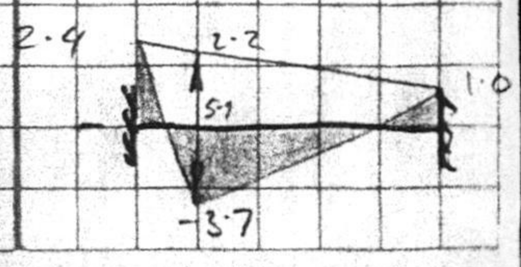
$S_{horiz} = 3EI/L = \frac{3}{2.3} EI = 1.30\ EI$ $\quad d_{horiz} = 0.58$

2.25

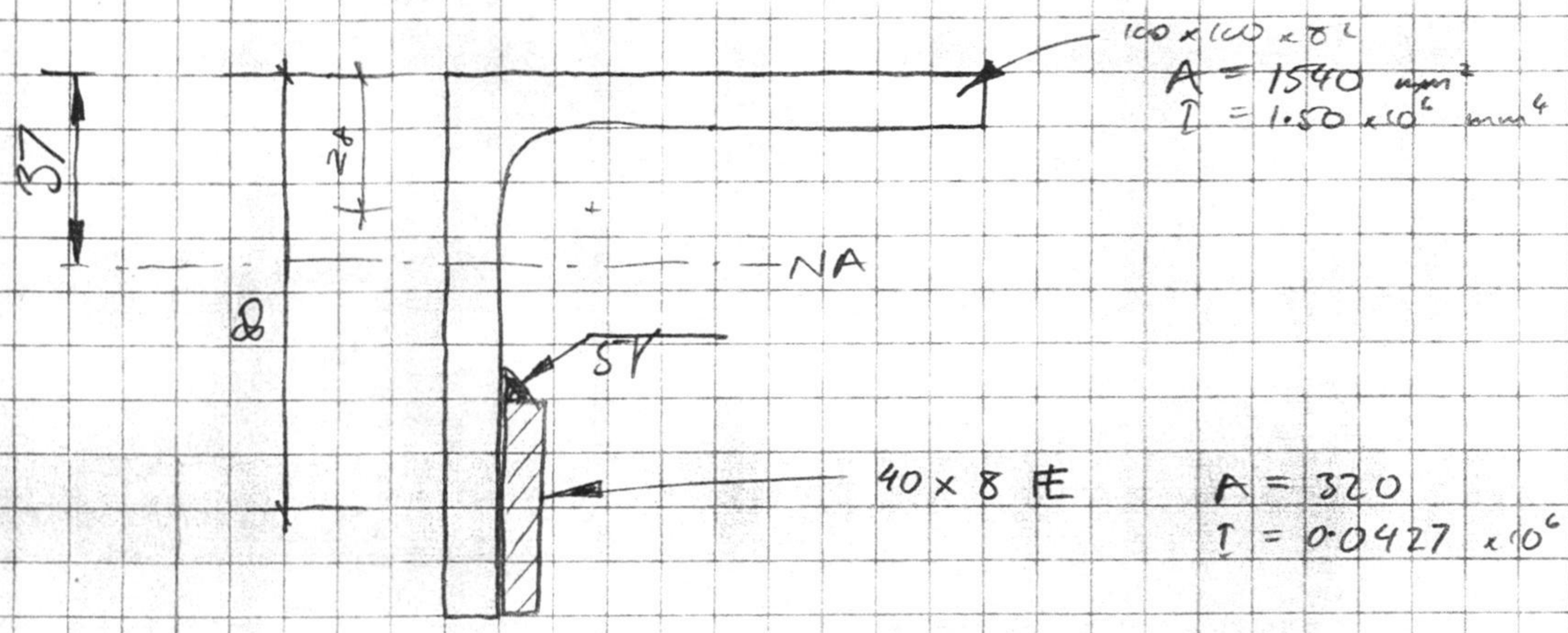


	A		B		
	post	horiz	horiz	post	
	0.42	0.58	0.58	0.42	
		-5.0	+0.9		
	+2.1	+2.9	-0.5	-0.4	
+1.0		-0.3	+1.4		-0.2
	+0.1	+0.2	-0.8	-0.6	
		-0.4	+0.1		-0.3
	+0.2	+0.2	-0.1	-	
	2.4	-2.4	+1.0	-1.0	
1.0					

dist factors
FEM
~~bal~~ bal
~~bal~~ dist
bal
dist
bal
Totn.



Try a 40×8 FE welded to Angle



$\bar{y} = [(28 \times 1540) + (80 \times 320)] / [1540 + 320]$
$= 37$ mm

$I = (1.50 + 0.04) \times 10^6 + (1540 \times 9^2) + (320 \times 43^2)$
$= 1.54 + 0.12 + 0.59$
$= 2.26 \times 10^6$ mm⁴

$Z = 2.26 \times 10^6 / (100 - 37)$
$= 35.8 \times 10^3$ mm³

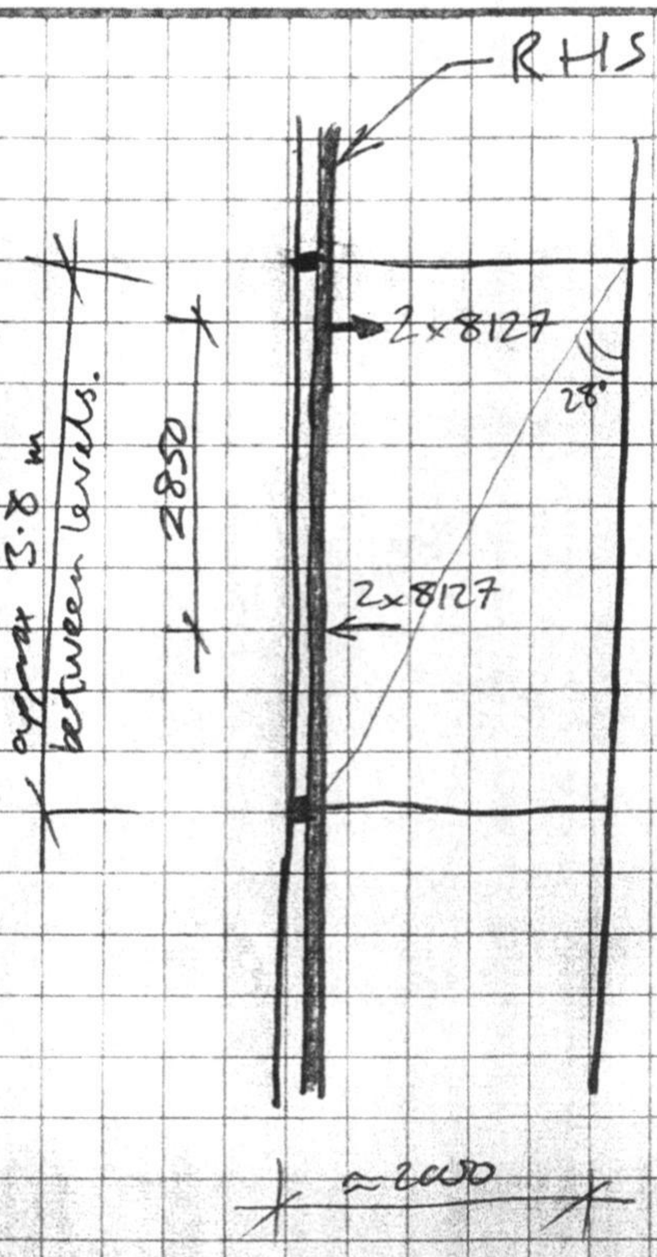
$f_b = 3.7 \times 10^6 / 35.8 \times 10^3$
$= 103$ MPa
$= 0.41\ F_y$ → OK

Check shear flow across weld.

shear flow $v = VQ/I$
$Q = (40 \times 16) \times (100 - 37 - 20)$
$= 27.5 \times 10^3$ mm³
use $V = 20$ kN

$\therefore v = 20 \times 27.5 \times 10^3 / 2.26 \times 10^6$ kN/mm
$= 0.24$ kN/m

$\therefore$ 5 mm fillet OK
allowable load = 0.48 kN/m



Mom. onto RHS = 2 × 8127 × 2.85 N·m
= 46.3 kN·m

If this is resisted by forces at the floor levels F = 46.3 / 3.8
= 12.2 kN

This force will be distributed between the diaphragm and the diagonal tension tie.

force in diagonal T = 12.2 / sin 28°
= 26 kN

required A_s, = 26000 / 250
= 105 mm² i.e. neglible

$\boxed{\text{provide } 40 \times 6 \text{ FE diagonals}}$

Compression caused in column

2 × C = 26 × cos 28° kN
= 23.15 kN

C = 12 kN

Mom from cols = 2 × 23.15/2 × 2
= 46.3 kNm ✓✓
= applied moment.

f_{ac} = 23.15×10³ / 1540 × ½
= 7.5 MPa < 21 = F_{ac} ∴ OK

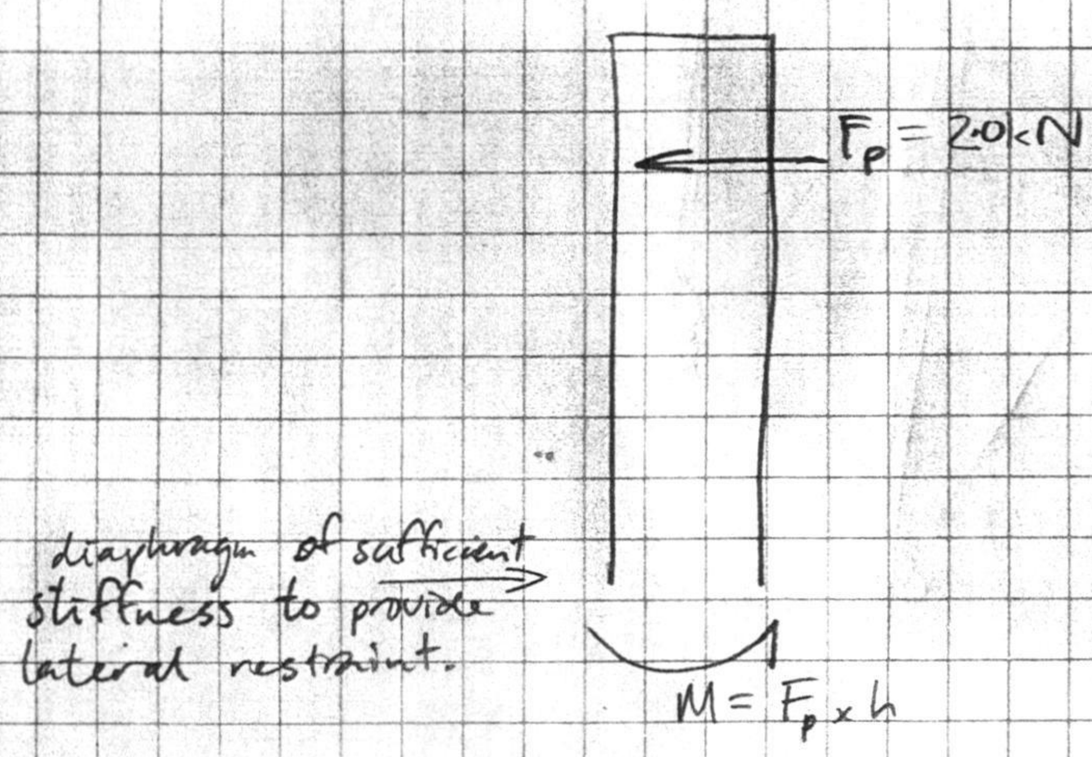
Assume car mass
$M = 2.0\ t$

Assume $C_a = 0.1$ This is from the original strengthening calcs and is based on 2/3 of 1985 code.

Seismic force $F_p = 0.1 \times 9.81 \times 2.0$
$= 2.0\ kN$

This shear will easily be resisted by the diagonals detailed for the "safety gear" case.

This lateral force will cause a moment, lower down in the tower.



Since, for the load case "safety gear" the columns could resist the 46 kNm moment input; we can infer that h may be at least 23 m.
Clearly, therefore, this case is not critical.

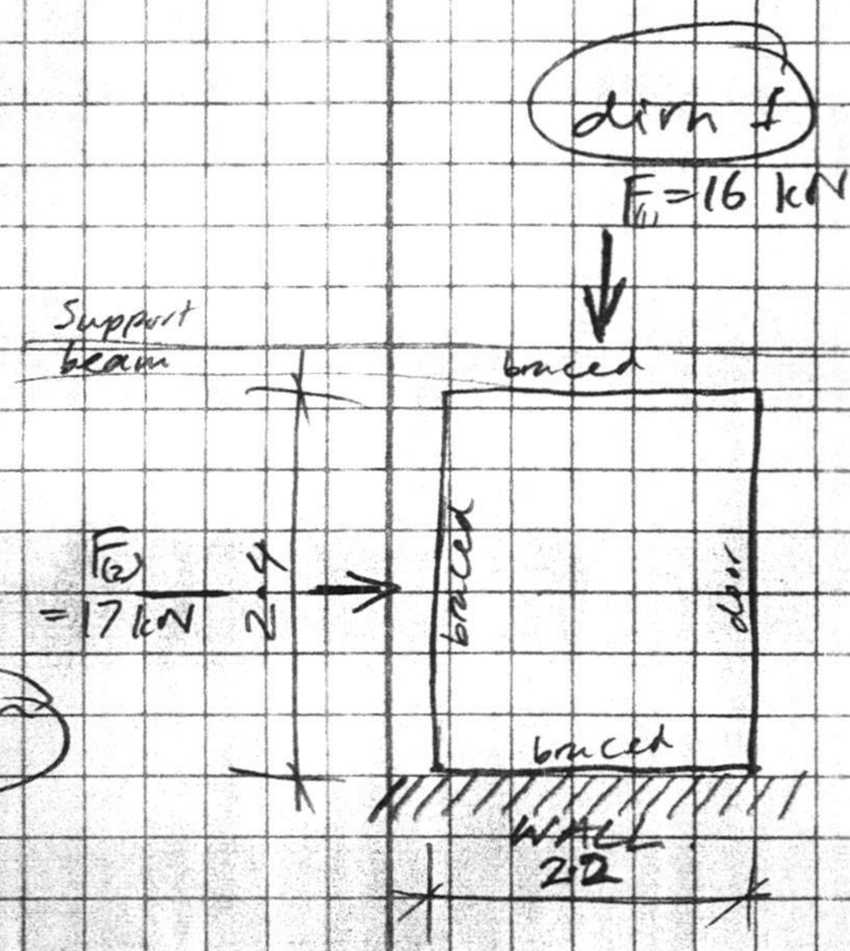
→ OK for seismic.

$$V_s = \underset{(S_1)}{1.0} \times \underset{(S_2)}{0.90} \times \underset{(V)}{50}$$
$$= 45 \text{ m/s}$$
$$\Rightarrow \quad q = 1.24 \text{ kPa.}$$

Use
$$C_{pi} = 0.3$$
$$C_{pe} = 0.8$$
$$\Rightarrow \quad C_p = 1.1$$

∴ wind pressure $P = 1.1 \times 1.24$
$= 1.36$ kPa.

$$F = 1.36 \times 2.2 \times 5.3$$
$$= 16 \text{ kN}$$



DIRN 2:

Calc. moment resistable by col.s based upon $F_{ac} = 21$ MPa.
Col. compression $= 21 \times 1540$ N
$= 32.3$ kN
∴ $M_{cm} = 2 \times 32.3 \times 2.0$ m
$= 129$ kN·m

∴ maxm height above a stiff reaction point at which $F_{(2)}$ may act is
$h = 129/17$ m
$= 8$ m

This is only a little less than the distance between LL2 and the centroid of the wind loaded area ∴ OK!

DIRN 1:

Assume the shear is resisted by the braced wall opposite the door, and torsion is absorbed by the 2 walls normal to $F_{(1)}$.

Assume centroid of wind load is 9 m above resistance at level 2.

A/ Shear: $M = 16 \times 9 = 144$ kN·m.
$\Rightarrow \quad C_{col,A} = 144/2.4 = 60$ kN
B/ Torsion: $T = 16 \times 1.0 = 16$ kN·m
$V = 16.0/2.4 = 7$ kN.
$C_{col,B} = 7 \times 9/2.2 = 29$

TOTAL, $C = 89$ kN $\Rightarrow f_{ic} = 58$ MPa.

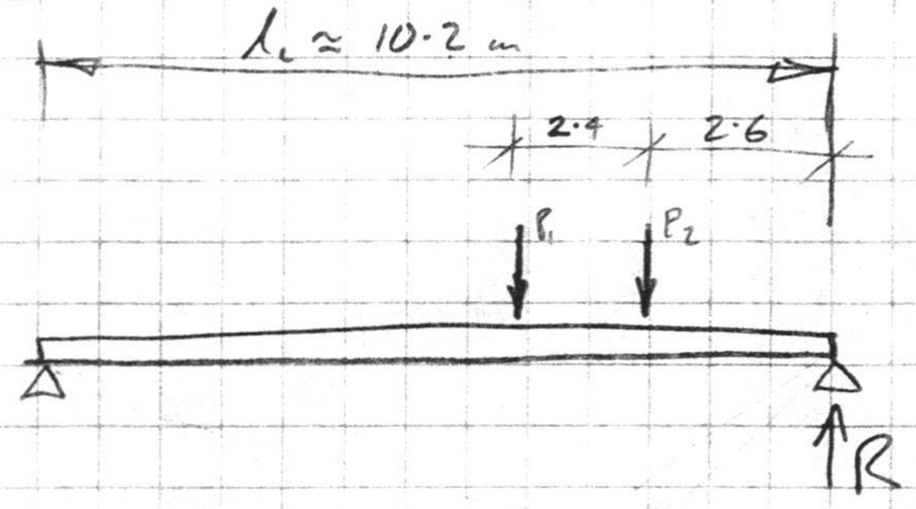
for $F_y = 250$
and $F_{ac} = 59$
T6-1.1 ⇒ $\lambda/r_y = 120$
⇒ $\lambda = 2400$ ($r_y = 20$ mm)

This can be accomodated by bolting into the masonary in the wall on the opposite side to the lift door (?)

∴ OK

OR Can rely on the woodwork nogging.

To ensure stability is given to Column members at level 2 - Members will be cleated to timbers within thickness of flooring. Details will be produced once flooring is opened up to determine exact location of structural members.



NB. dimensions approximate.

NOT USED (posts to ground).

LOADS

1/ Lifting beam : P_1 or P_2 = 20 kN
or $P_1 + P_2$ = 20 kN

2/ Safety gear : $P_1 = P_2 = 14$ kN

3/ Seismic : Not critical

4/ Wind :

dirn 2 $P_1 = -P_2 = 32$ kN

dirn 1 $P_1 = 31$, $P_2 = 89$ or $P_1 = 89$ kN, $P_2 = 31$ kN

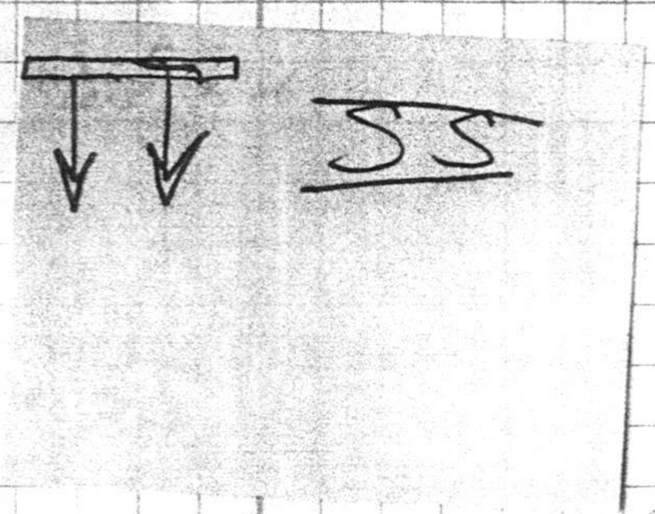
critical case

add 5 kN to each of these loads as an allowance for dead weight of the tower.

∴ Use $P_1 = 36$, $P_2 = 94$

LOAD EFFECTS

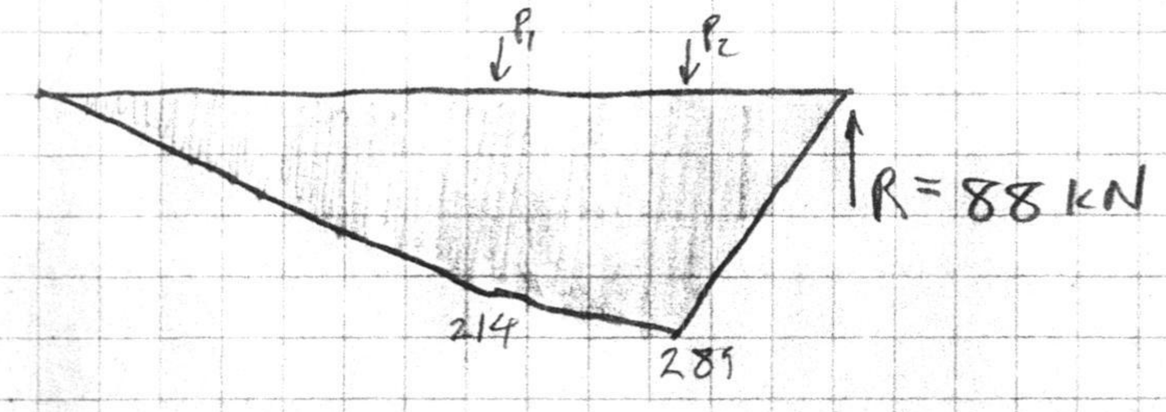
Reaction $R = \frac{10.2 - 2.6}{10.2} \times 94 + 88.$ kN



@ P2 $M_{(2)} = 88 \times 2.6 = 289$ kN·m

@ P1 $M(1) = 88 \times 5.0 - 94 \times 2 = 214$ kN·m

BMD



estimate section $Z \approx M/f_s$
$= 289 \times 10^6 / 0.6 \times 250$
$= 1927 \times 10^3 \ mm^3$

$\Rightarrow$ 530 UB 92

$D_{self} = 9.81 \times 92 \ N/m$
$= 0.9 \ kN/m$
$M_{self} = 0.9 \times 10.72^2 / 8$
$= 12 \ kN.m$

Not used.

Combine $M = 289 + (3/4 \times 12)$
$= 298 \ kN.m$

5/5 ?

$f_b = 298 \times 10^6 / 2080 \times 10^3$
$= 143$
$= 0.57 F_y$

$Z_x = 2080 \times 10^3 \ mm$

$F_y = 250 \ MPa.$

can be used to support lateral flexural torsional buckling, therefore ignore cl5.4.
$\therefore$ bending OK!

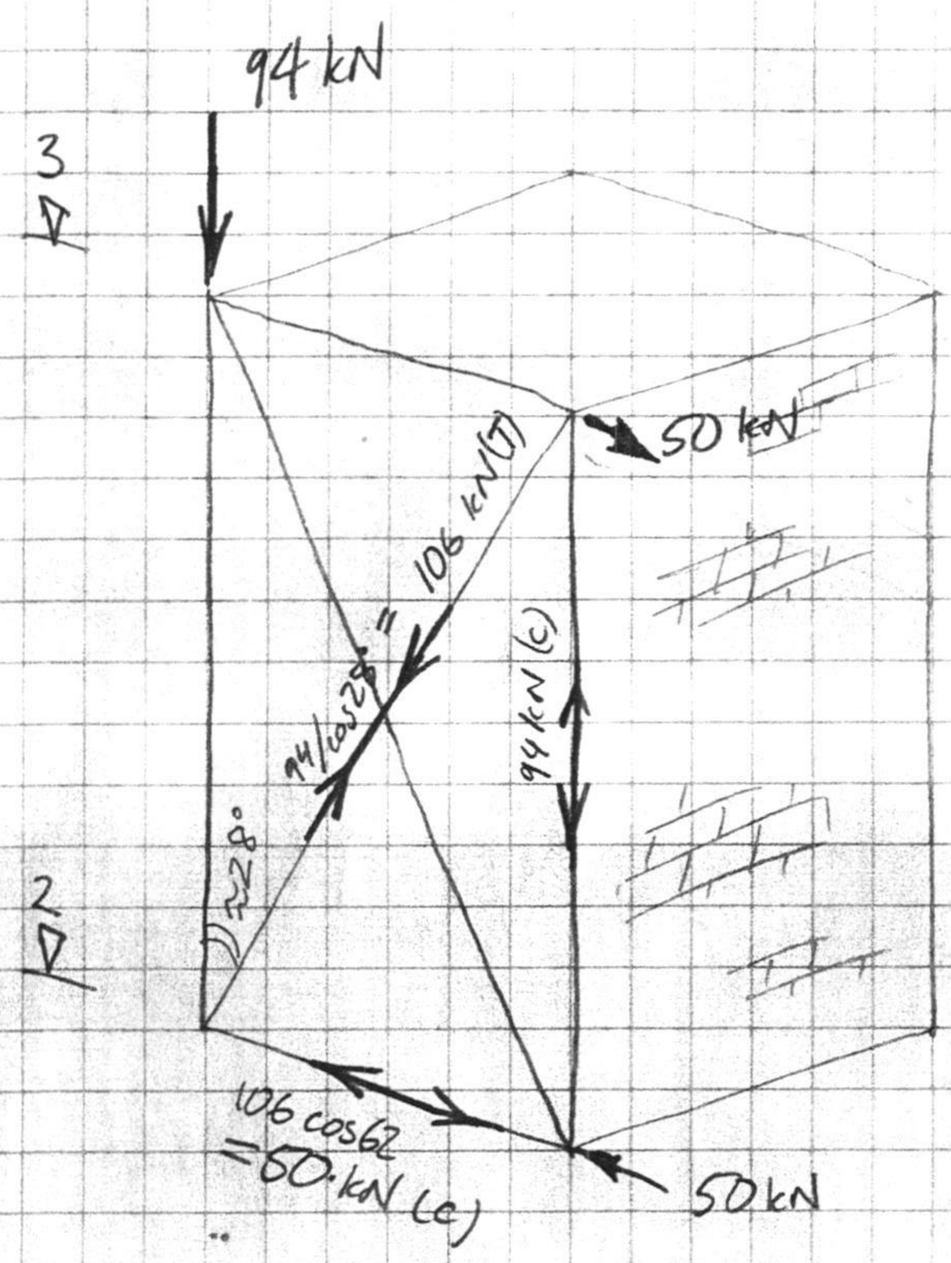
Check Shear
$f_v = 88 \times 10^3 / 533 \times 10.2$
$= 16 \ MPa.$
$= 0.065 F_y << 0.37 F_y$
$\therefore$ Shear OK!

$\longrightarrow$ Support beam 530 UB92

CHECK DEFLECTION

Corbel detail at ends needs designing.

NOT USED (posts to ground)



Tension diagonal:

required $A_s = 106 / 0.6 \times 0.25$
$= 707 \text{ mm}^2$

→ DIAGONALS 60×12 FE

Horizontal strut:

Compressive force $c = 50$ kN.
$l \simeq 2000$

Try 50×50×8 L

$r_v = 9.85$
$l/r_v = 203$ MPa.

T6.1.1 ⇒ $F_{ac} = 23$ MPa.

$f_{ac} = 50000 / 739$
$= 68$ MPa > 23 ∴ NG!

Try 76x76x8L

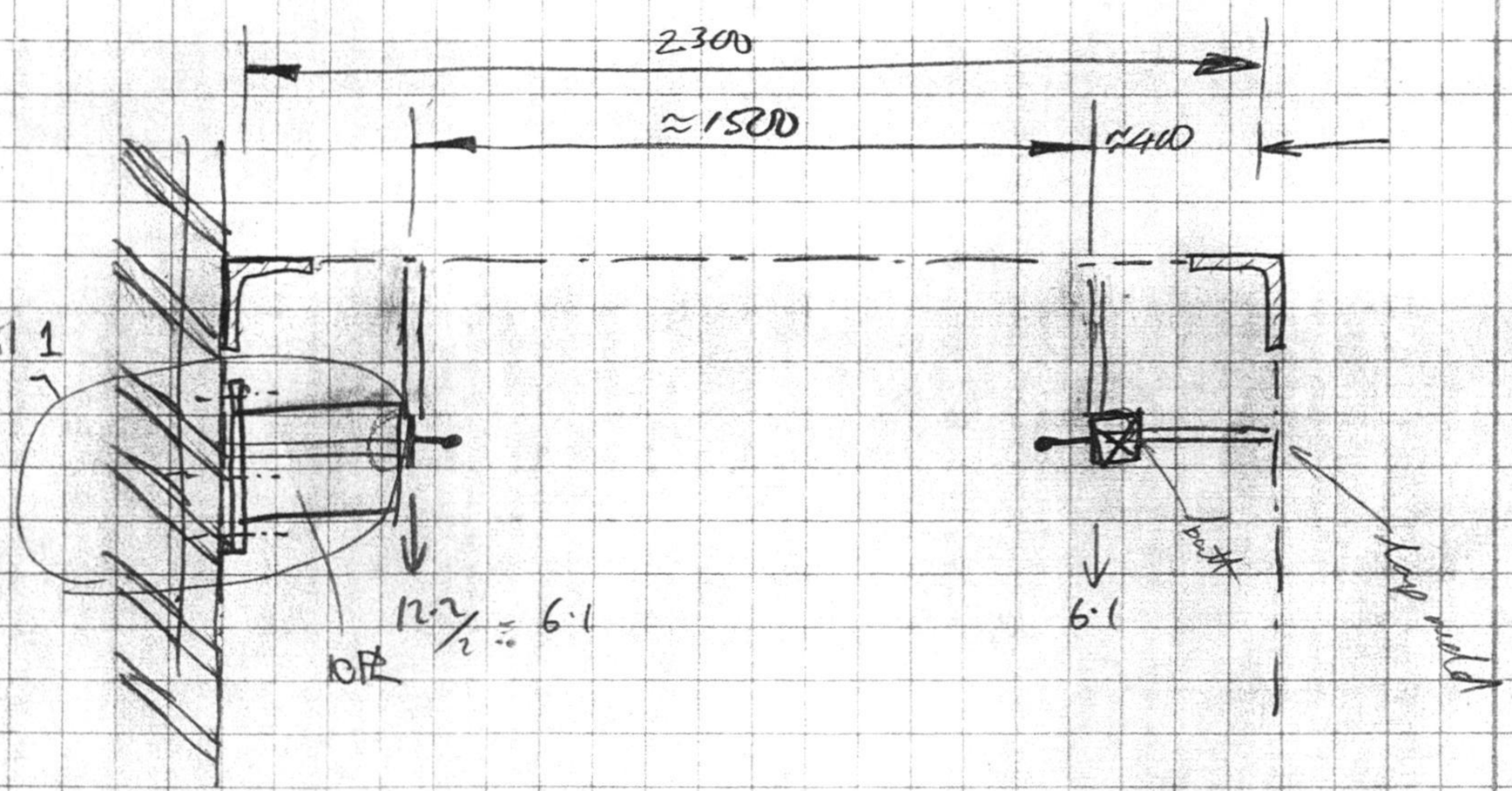
$l/r_v = 2000/14.9$
$= 134$

T6.1.1 → $F_{ac} = 48$ MPa.

$f_{ac} = 50 \times 10^3 / 1140$
$= 44$ MPa < 48 ∴ OK!

CHECK HORIZONTAL STRUT FOR LOADS FROM RHS

Use detail 1 on ECC

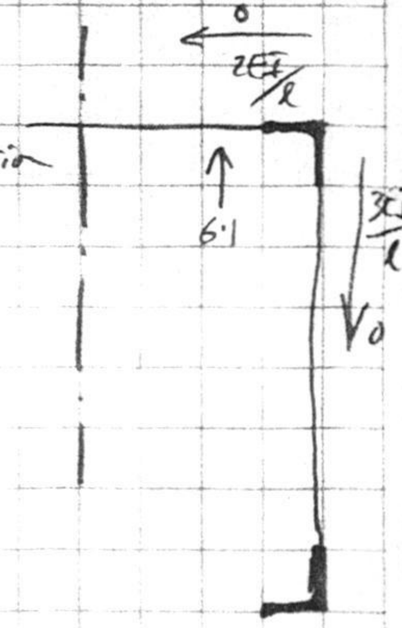


load on the RHS → FEM

$= 6.1$ kN from "safety gear" load case

$M^F = 6.1 \times 0.4 \times 1.9/2.3$
$= 2.0$ kN.m

distribution factors $d_1 \simeq 0.4$, $d_2 \simeq 0.6$ } assumes that L-bracing has low torsional stiffness.

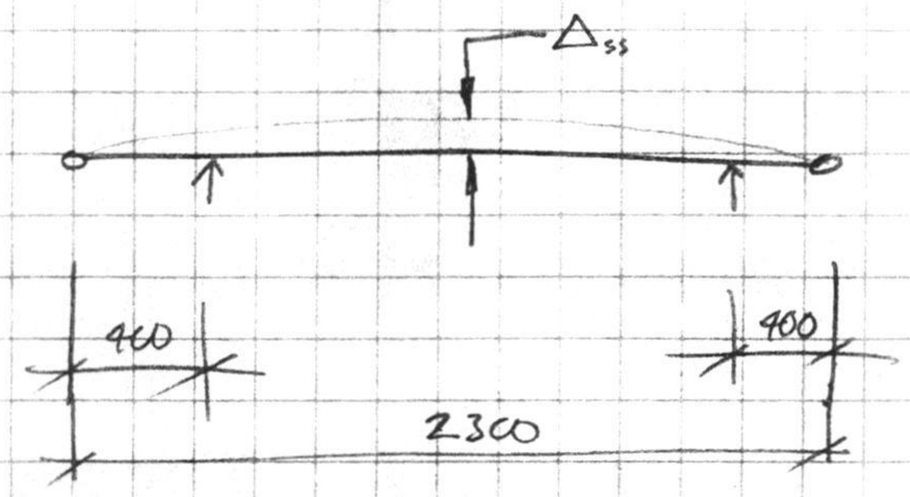


2.0		FEM
-0.8	-1.2	bal
1.2	-1.2 kN.m	total

Try 76x76x8L

$f_b = 1.2 \times 10^6 / 11.2 \times 10^3$
$= 107$ MPa
$= 0.43\ F_y$ → OK!

CHECK DEFLECTION



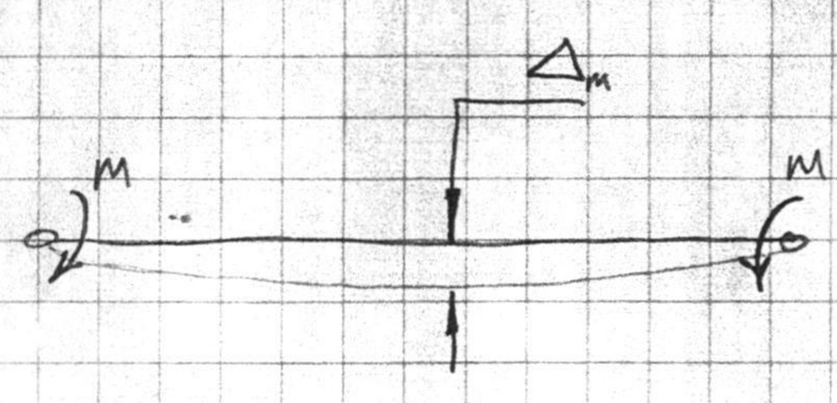
$\frac{a}{l} = \frac{400}{2300} = 0.17$

$P = 6100$ N

$$\Delta_{ss} = \frac{PL^3}{6EI}\left[\frac{3}{4}\frac{a}{l} - \left(\frac{a}{l}\right)^3\right]$$

$$= \frac{400 \times 2300^3}{6 \times 200 \times 10^3 \times 0.609 \times 10^6}\left[\frac{3}{4} \times 0.17 + 0.17^3\right] \text{ mm}$$

$$= \underline{13.7} \text{ mm}$$



$$\Delta_m = -ML^2 / 8EI$$

$$= -12 \times 10^6 \times 2300^2 / 8 \times 200 \times 10^3 \times 0.609 \times 10^6$$

$$= \underline{-6.5} \text{ mm}$$

Total $\Delta = \Delta_{ss} + \Delta_m$

$= 13.7 - 6.5$

$= \underline{7.2}$ mm > 3.0 ∴ NG

required by Lift Power Rules.

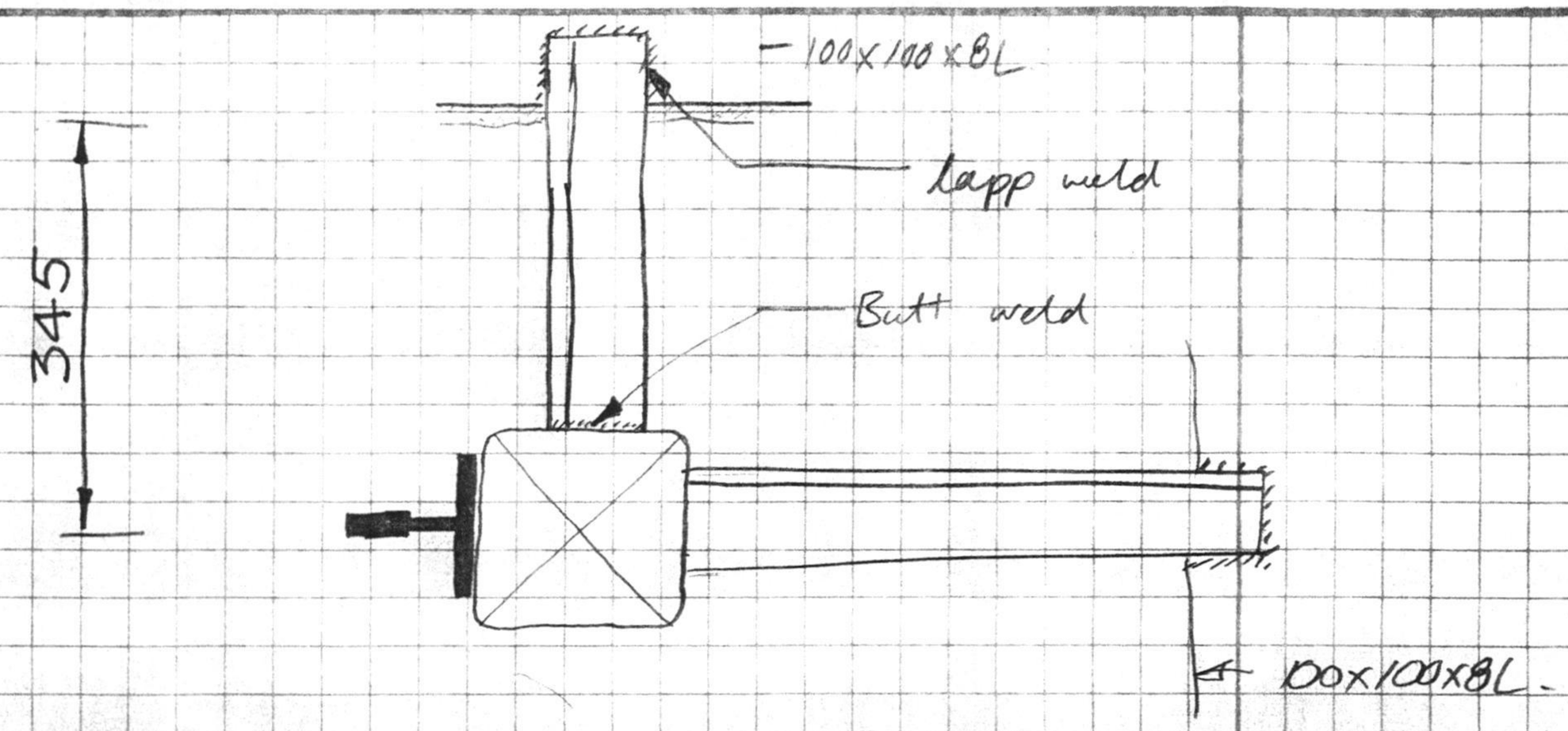
required $I = 7.2/3.0 \times 0.609 \times 10^6$

$= 1.46 \times 10^6$ mm^4

∴ Use $100 \times 100 \times 8$ L

$I = 1.50 \times 10^6$ mm^4

Use 100×100×8L



Maximum axial load input for RHS
= 8.127 kN (safety gear application)

Try 25 x 25 x 6.3 L

$L/r_v = 345/4.88$
$= 71.$

T6.1.1 ⇒ $F_{ac} = 116$ MPa.

$f_{ac} = 8127/284$
$= 29.$ MPa.

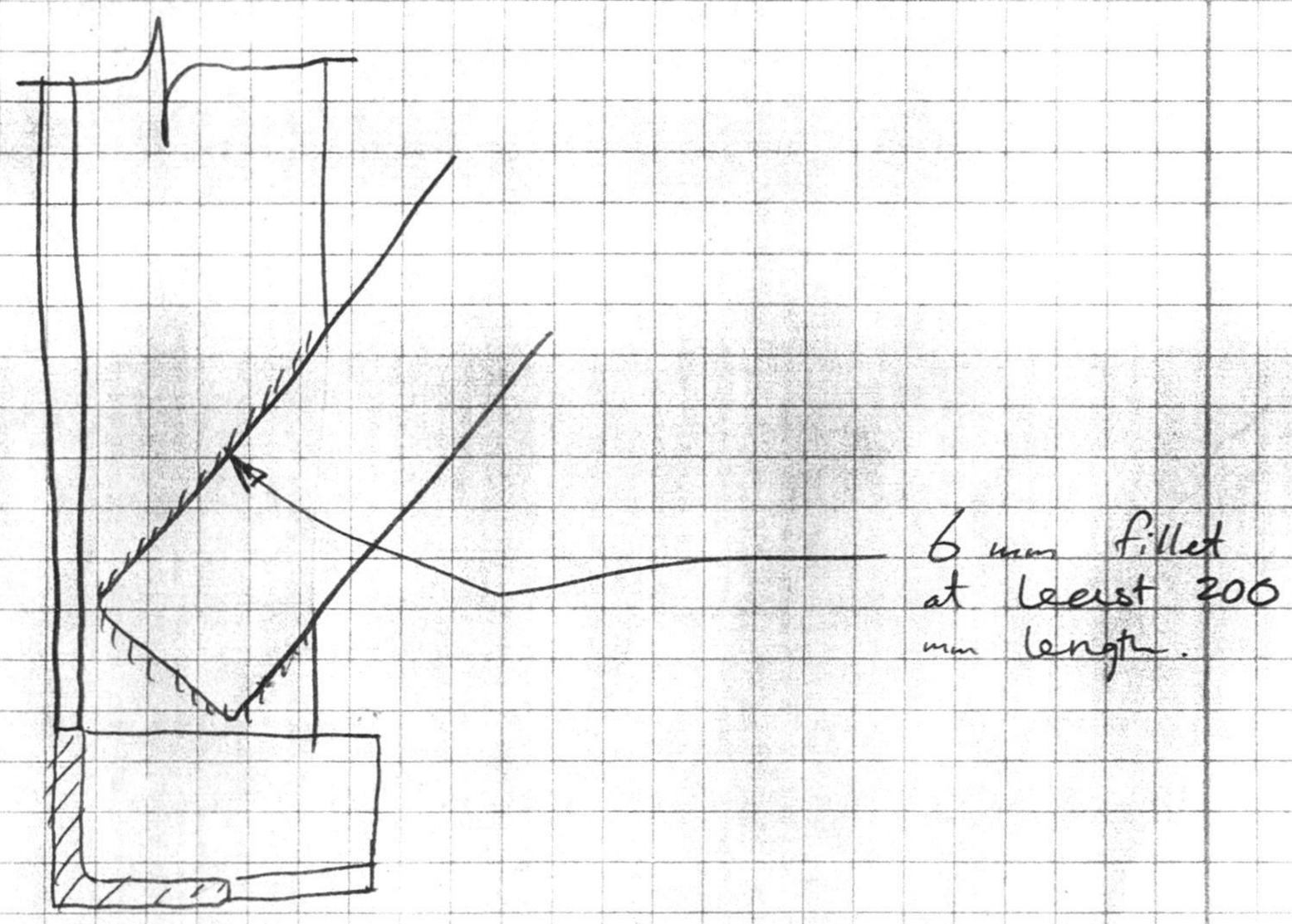
$29 < 116$ ∴ OK.

CONNECTION OF 60 x 12 FE TO 100 x 100 x 8 L

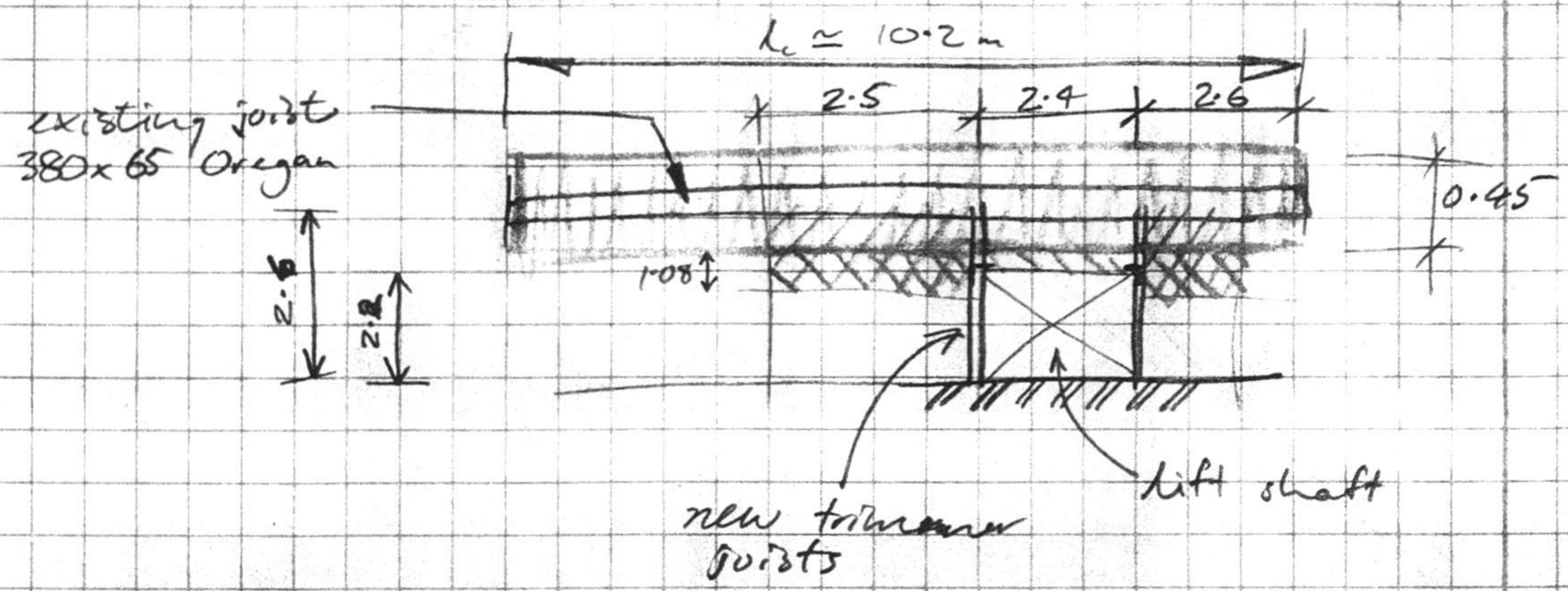
Tension force to transmitt = 106 kN

Try 6 mm Fillet
BCSA, "Handbook on Structural Steelwork", 1971, P252
⟹ permissable load = 0.67 kN/mm run

∴ required lap length = 106/0.67
= 158 mm use 200



CHECK EXISTING JOIST



LOADS

Self: $= 0.38 \times 0.065 \times 800 \times 9.81 \times 10^{-3}$ kN/m
$= 0.2$ kN/m.

floors $D = 0.12$ kPa.

S.D.L. $SDL. = 0.25$ kPa.

$D = 0.37$ kPa.

Live $LL = 3.0$ kPa

Use distributed load
$D+L = 3.5$ kPa. and ignore joist self weight.

total $W = 3.5\left[(10.2 \times 0.45) + (1.08 \times (2.5+2.6)) + (0.18 \times 2.4)\right]$
$= 37$ kN

$M \simeq WL/8$
$= 37 \times 10.2 / 8$
$= 47$ kN.m

380 x 65 section $\Rightarrow$ $Z = \frac{1}{6} \times 65 \times 380^2$
$= 1.56 \times 10^6$

$f_b = 47 \times 10^6 / 1.56 \times 10^6$
$= 30$ MPa.

This is too high $\therefore$ $\longrightarrow$ NG

Hence, instead of relying upon the joist these loads must be carried down using posts.

Assume that each of the 2 posts takes ½ of the load that would have been taken by the joist. i.e. $P_{floor} = 18$ kN

add to this the axial load in the column above L2

$P = 18 + 94$
$= 112$ kN.

Try 100 x 100 x 8L

$f_{ac} = 112 \times 10^3 / 1540$
$= 73$ MPa.

T6.1.1 ⇒ that for $F_{ac} = 73$
⇒ then $l/r_v = 105$ $r_v = 20$
⇒ max $l = 105 \times 20$
$= 2100$ mm.

∴ 100 x 100 x 8L OK only if laterally supported at 2 m intervals. → OK.

provide bracing within stud line

If unsupported between L6 & L1 then $l = 4725$ mm

Try 2 - 89 x 89 x 6.3 RHS

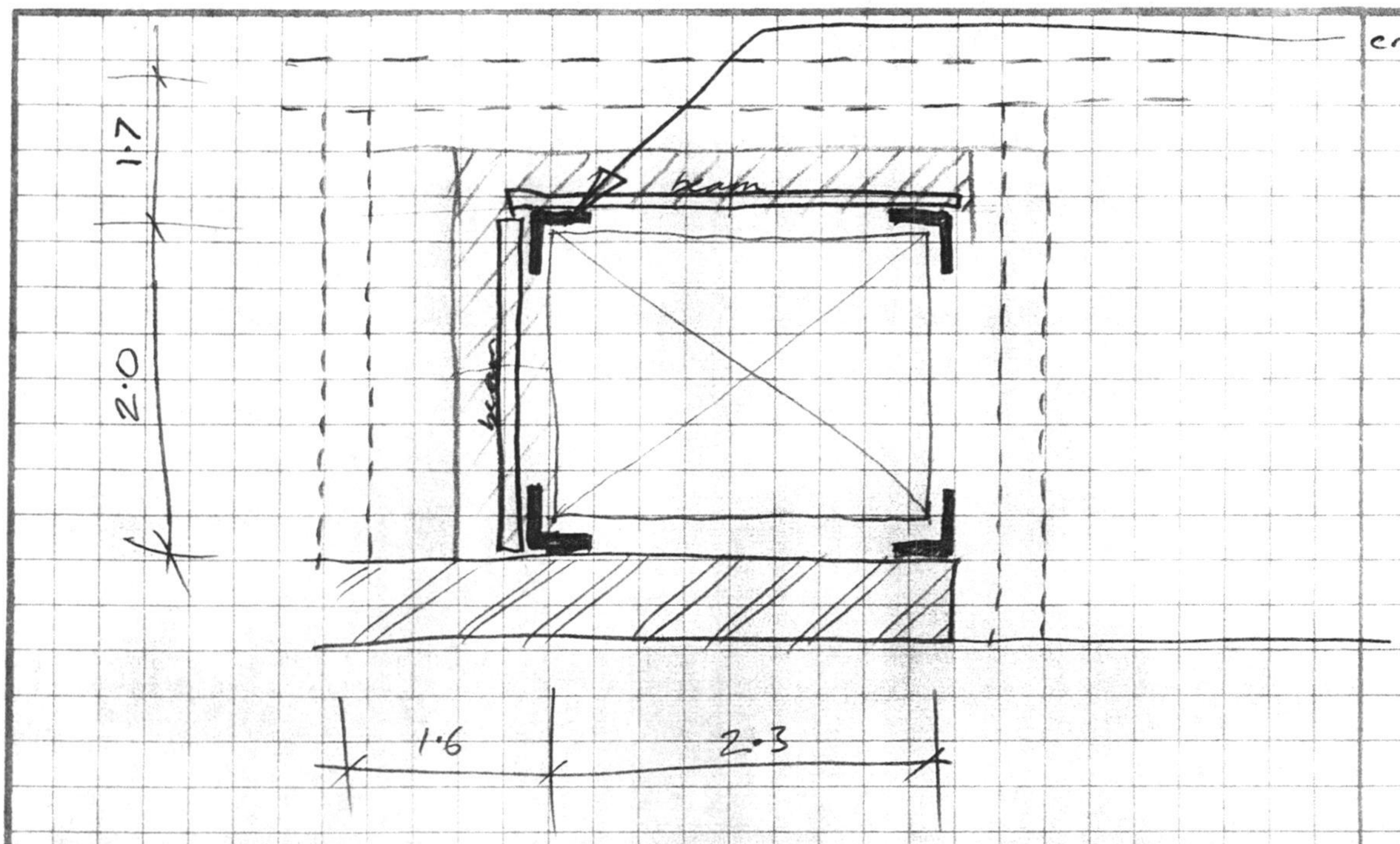
$r_v = 33.2$ mm
$l/r_v = 4725/33.2$
$= 142$

T6.1.1 ⇒ $F_{ac} = 44$ MPa

$f_{ac} = 112 \times 10^3 / 2 \times 1990$
$= 28$ MPa.

28 < 44. → 2 - 89 x 89 x 6.3 RHS OK!

(not needed)



LOADS

Assume 250 thick existing conct. slab

$D_{slab} = 0.25 \times 24$

$= 6.0$ kPa

SDC $= 0.25$ kPa.

LL $= 3.0$ kPa

Use distributed load $D+L = 9.25$ kPa.

LOAD EFFECTS

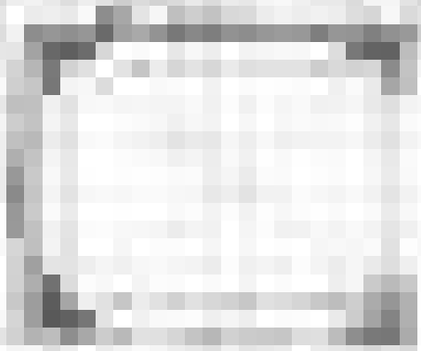
Tributary area onto critical col.

$A = [0.8 \times (1.0 + \frac{1.7}{2})] + [\frac{1.7}{2} \times \frac{2.3}{2}]$

$= 2.46$ m^2

$P_{D+L} = 9.25 \times 2.46$ kN

$= 23$ kN



Axial load above level 1 ;
$P = 112$ kN

below level 1 ; $P = 112 + 23$
$= 135$ kN

Try 102 x 102 RHS
r_v ≮ 37.4
L/r_v ≯ 4725/37.4
$= 126$

T6.1.1 ⇒ $F_{ac} = 54$ MPa.
∴ required $A_s = 135 \times 10^3 / 54$
$= 2500$ mm²

⇒ 102 x 102 x 9.5 RHS
$A_s = 3460$ mm²

⇒ If unbraced between LG & L1 we can use 102 x 102 x 9.5 RHS

Design if braced at mid-height

try 89 x 89 RHS
r_v ≮ 33.2
L/r_v ≯ 4725/2 x 33.2
$= 71$

T6.1.1 ⇒ $F_{ac} = 116$ MPa
required $A = 135 \times 10^3 / 116$
$= 1164$ mm²

⇒ 89 x 89 x 3.6 RHS OK! ($A_s = 1210$ mm²)

Try 76 x 76 RHS
r_v ≮ 28 mm
$L/r_v = 84$

T6.1.1 ⇒ $F_{ac} = 98$ MPa.
rqd $A_s = 135 \times 10^3 / 98$
$= 1378$ mm²

76 x 76 x 6.3 NG

⇒ If braced at midheight of LG - L1 then can use 89 x 89 x 3.6 RHS or larger.

Try 2 - 89 x 89 x 6.3 RHS
UNBRACED
$L/r_v = 4725/33.2 = 142$

T6.1.1 ⇒ $F_{ac} = 44$ MPa.
$f_{ac} = 135 \times 10^3 / 2 \times 1990$
$= 34$
$f_{ac} < F_{ac}$ OK!

∴ USE 2 - 89 x 89 x 6.3 RHS (bracing not needed)

Try 127x64 RHS

$L/r_y = 4725/25.3$

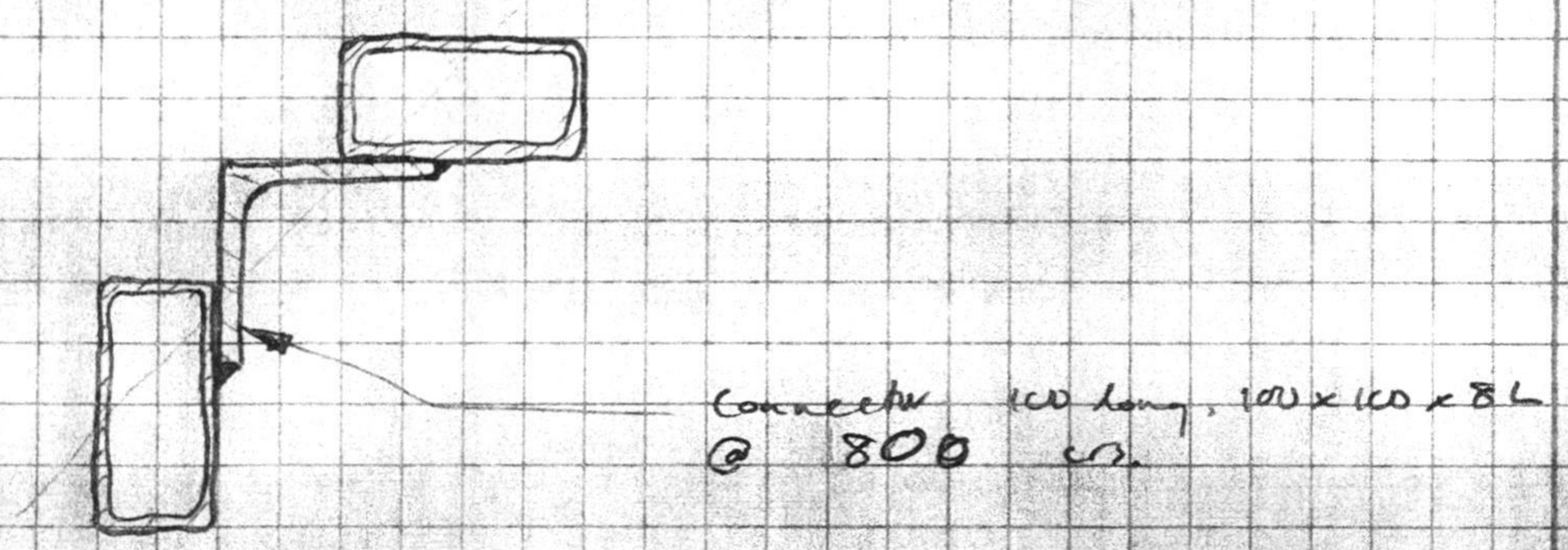
$= 187$

T6-1.1 → $F_{ac} = 27$ MPa

→ reqd. $A = 135 \times 10^3/27$ P = 135 kN

$= 5000$ mm² = 2500 mm²/RHS

too high, therefore require bracing



Using 127 x 64 x 6.3 RHS

A = 2240

which is marginally less than the 2500 required if the sections are unbraced. Since the connection will markedly increase the strength of the struts, the 10% shortfall in section area is considered OK!

CONNECTION BETWEEN RHSS and ANGLE ABOVE (at level 2)

P = 112 kN

= 66 kN/RHS

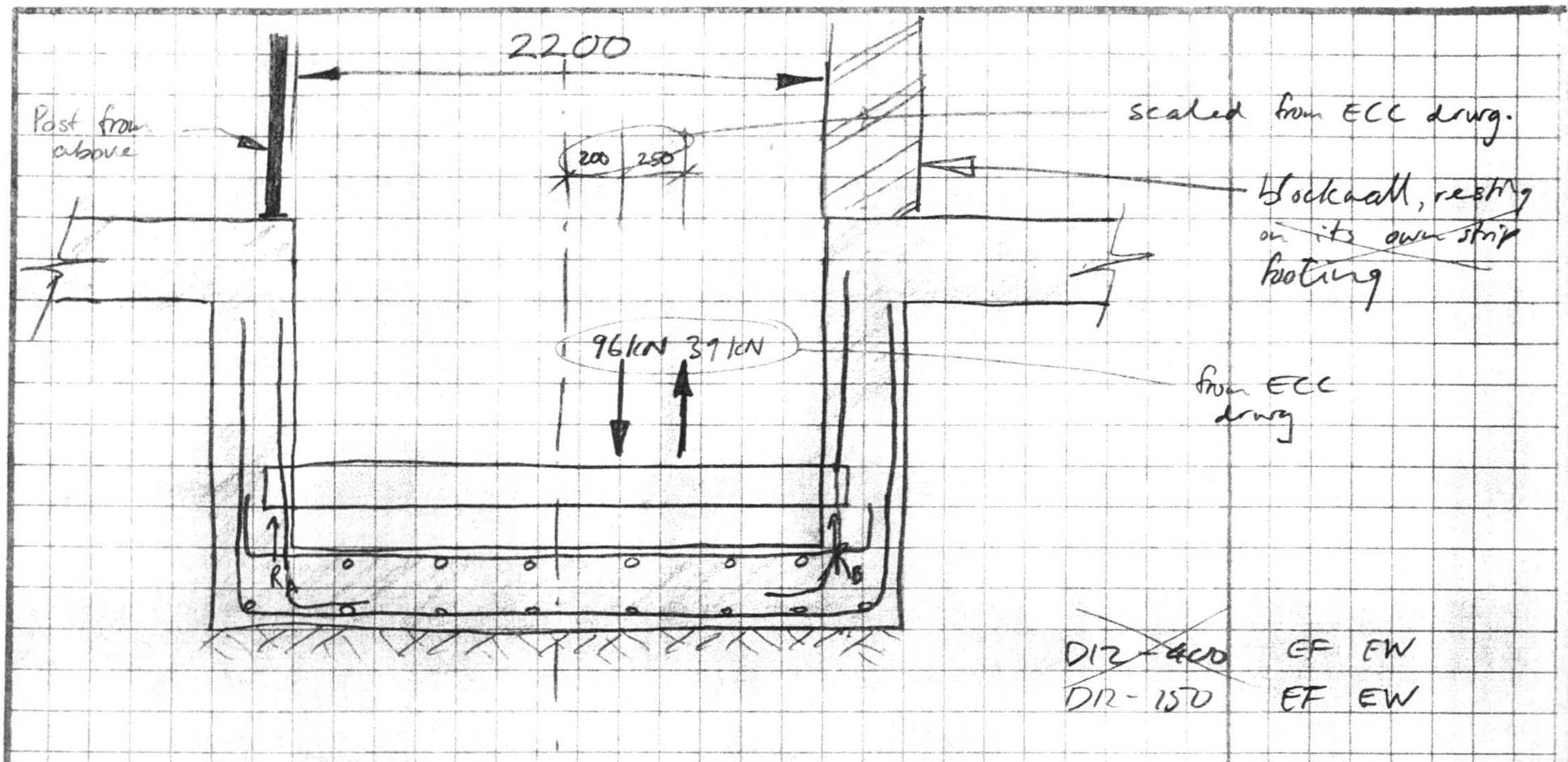
Safe load of 6mm fillet = 0.57 kN/mm

ref. AISC safe load tables 1976, p 219

∴ required weld length $L = 66/0.57$

= 116 mm → Use 150 long 6 mm fillet.

Use



Load from lifting gear etc.:

$R_B = \frac{1}{2.2}\left[(96 \times 1.30) - (39 \times 1.55)\right]$

$= \underline{29}$ kN

$R_A = 96 - 39 - 29$

$= \underline{28}$ kN

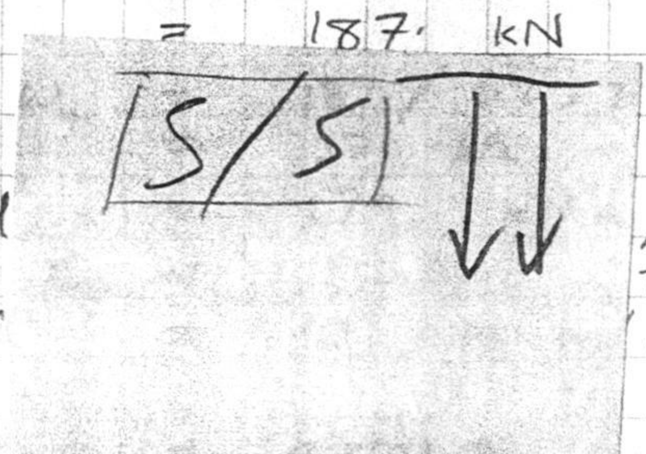
Load from posts above:

$P_1 + P_2 = 36 + 94$ from superceded LL2 beam calc.

$= 130$ kN

∴ Total soil press to be resisted by underside of pit floor; $W = 130 + 29 + 28$

$= 187$ kN



w_u [illegible] /m

$l_x/l_y = 1.0 \Rightarrow$ [illegible] T 11.1) (Simply supported edges

w [illegible] m

200 slab $A_{s\,min}$ = [illegible] × 1000

$= 400$ mm²/m

divide by 2 for steel on both sides

$A_{s\,min} = 200$ mm²/m

Try D12 @ 400 crs

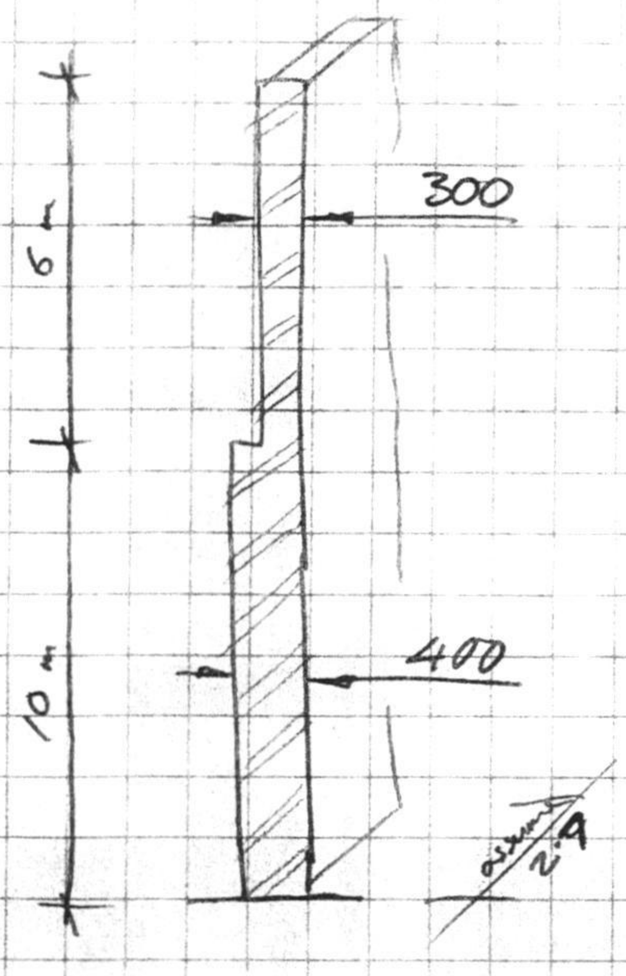
$A_s = 283$ mm²/m

$a = 283 \times 225 / 0.85 \times 25 \times 1000$ $f'_c = 25$ MPa

$= 4$ mm 35 cover.

$M_u = 0.9 \times A_s f_y \times (200 - 35 - 6 - 2) = 12$ kN·m/m

OK!



weight of blockwork $= 24 \times 2.7 \left[(10 \times 0.4) + (6 \times 0.3) \right]$
$= 376$ kN

∴ Total load on top blockwork floor:

$W = 187 + 376$
$= 563$ kN

$M = 563/187 \times 10$
$= 30.$ kN.m

Try D12 – 150 crs (200 thick slab)

$A_s = 754$

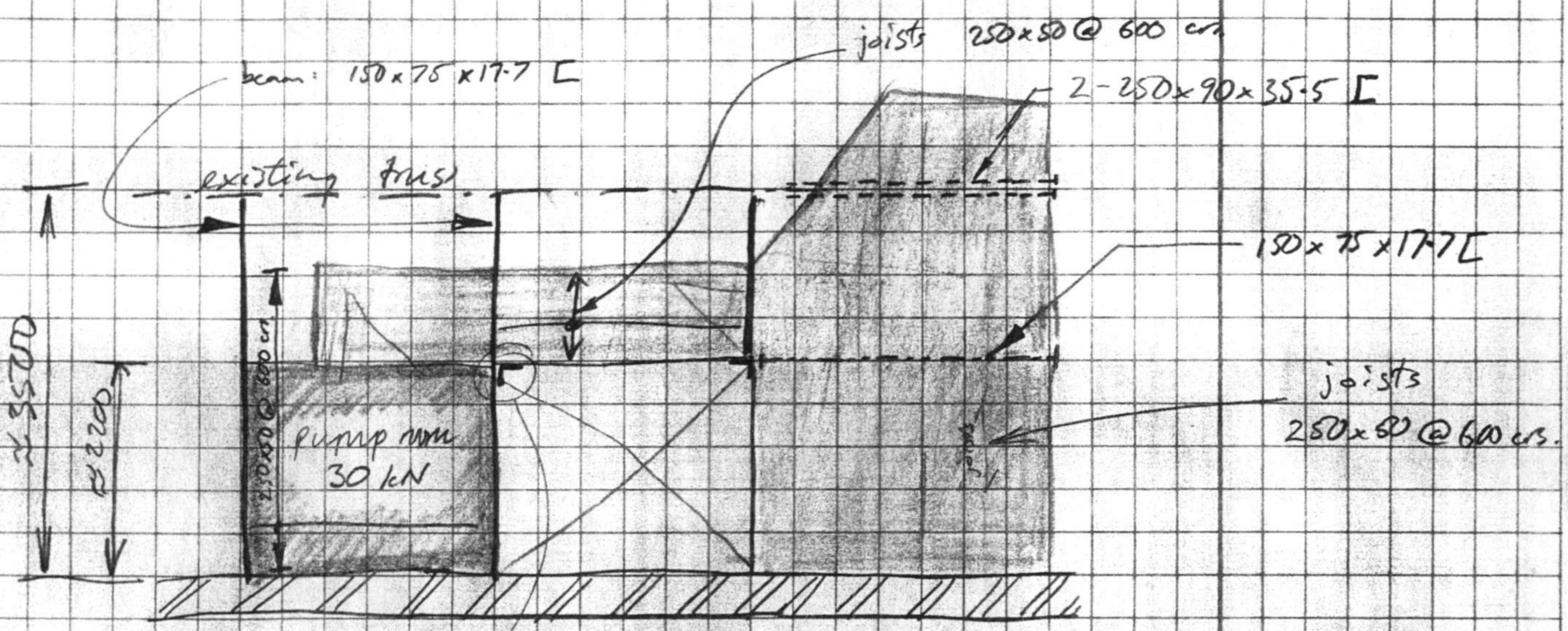
$a = A_s f_y / 0.85 \times 25 \times 1000$
$= 10$ mm

35 mm cover $M_u = 0.9 \times A_s f_y \times (200 - 35 - 6 - 5)$
$= 30.8$ kN.m /m

Pump room internal size = 2400 x 2000
= 4.8 MPa

L = 5.0 kPa
Assume D+L ≃ 6.2 kPa

∴ total weight: W_{D+L} = 6.2 x 4.8 kN
= 30 kN



NB: No connection between post and channel.

Pump room floor

Try 250 x 50 @ 400 crs

Z = 466.4 x10³ mm³

w_{D+L} = 0.4 x 6.2 = 2.5 kN/m

M = 2.5 x 2.4²/8

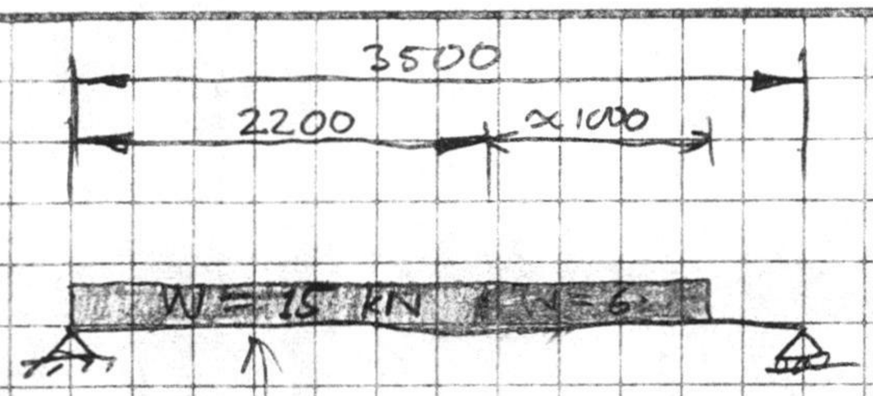
= 1.8 kN·m

f_b = 1.8x10⁶ / 466.4 x10³

= 3.82 MPa.

D/B = 5 L/B = 2400/50 = 48 ∴ K_8 = 0.66

F_b = 0.66 x 6.0 = 4.0 > 3.82 ∴ OK!



$w = 15/2.2 = 6.8$ kN/m

$M \simeq \frac{3.5}{2.2} \times 15 \times 3.5/8$
$= 10.$ kN·m

$Z \simeq 10. \times 10^6 / 0.6 \times 250$
$= 66.7 \times 10^3$ mm³

Try 150 × 75 × 17.7 [

$f_b = 10 \times 10^6 / 111 \times 10^3$
$= 90$ MPa,
$= 0.36 F_y$

$L/r_y = 3500/23.9$
$= 146$
$d/t = 21.8 < 85$
$T/t < 2.0$ } ∴ 75.4.1(3)

+ 5.5.1(3) ⇒ $F_b = 128$ MPa.

∴ OK! in bending.

CHECK DEFECTION:

$\Delta/L = \frac{5}{384} \times \frac{wL^3}{EI}$
$= \frac{5}{384} \times 6.8 \times (3.5 \times 10^3)^3 / 200 \times 10^3 \times 8.34 \times 10^6$
$= 0.0023 < 0.003$ ∴ OK!

LOADS ONTO EXISTING TRUSS

Self weight:

bottom chord, vol. $V = 0.300 \times .100 \times 10.3$ (12" × 4") $= 0.31$ m³

top chord $V = .175 \times 0.1 \times 11.9 = 0.21$

braces $V = .1 \times 0.075 \times 6.0 = 0.05$

0.57 m

$W_{wood} \simeq \underline{5.}$ kN

Roofing: guess purlins, cladding etc weigh 0.4 kPa on plan area.

$W_{roofing} = 0.4 \times 10.3 \times 3.3$
$= \underline{14.}$ kN

Wind:

$V_s = 1.0 \times 0.78 \times 50$
$= 39$ kN
$q = 0.93$ kPa
$C_{pi} = \pm 0.3$
$C_{pe} = -0.9$
$p = 1.1 \times 0.93$
$= 1.0$ kPa. uplift.

$F_{wind} = 1.0 \times 10.3 \times 3.3$
$= \underline{34.}$ kPa ↑ uplift.

Pump room:

pump room weight $= 30$ kN.
∴ load onto truss $\simeq \underline{15}$ kN

Pumproom access walkway:

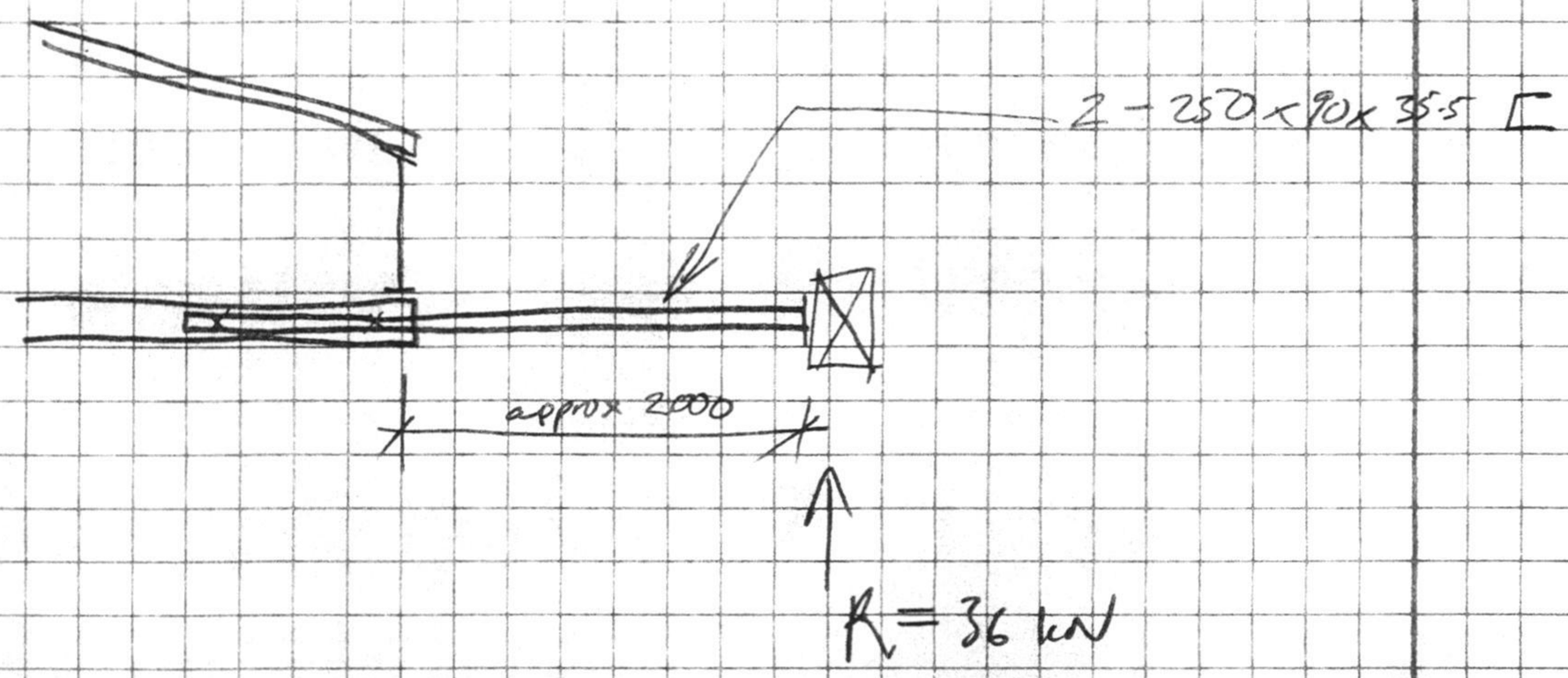
Area $A \simeq 5$ m²

assume D+L $= 1.2 + 1.5$
$= 2.7$ kPa.
$W_{D+L} = \underline{14.}$ kN

Walkway wall $A \simeq 5 \times 4$
$= 20$ m²

Assume wall frame, cladding and lining etc weigh
$\omega = 0.5$ kPa.
$W_{wall} = \underline{10.}$ kN

Reaction, D+L $R = \frac{1}{2}[5 + 14] + \frac{2}{3}[15 + 14 + 10]$
$= 36$ kN



$M = 36 \times 2$
$= 72$ kN·m

$Z \simeq 72 \times 10^6 / 0.6 \times 250$
$= 480 \times 10^3$ mm³

Try 2 - 250 x 90 x 35.5

$Z = 2 \times 361 \times 10^3$
$= 722 \times 10^3$ mm³

$f_b = 72 \times 10^6 / 722 \times 10^3$
$= 100$ MPa.
$= 0.40 F_y$ ($f_y = 250$ MPa)

$T/t = 15/8 < 2.0$
$d/t = 27.5 < 85$ ∴ T5.4.1(3)
$L/r_y = 2000/28.4$
$= 70.$

T5.4.1(3) ⇒ $F_b = 165$ MPa.

Hence section ok for bending

CHECK BENDING IN BOTTOM CHORD

$12'' \times 4''$ $= 300 \times 100$ mm

$Z = \frac{1}{6} \times 100 \times 300^2$ mm^3

$= 1.5 \times 10^6$ mm^3

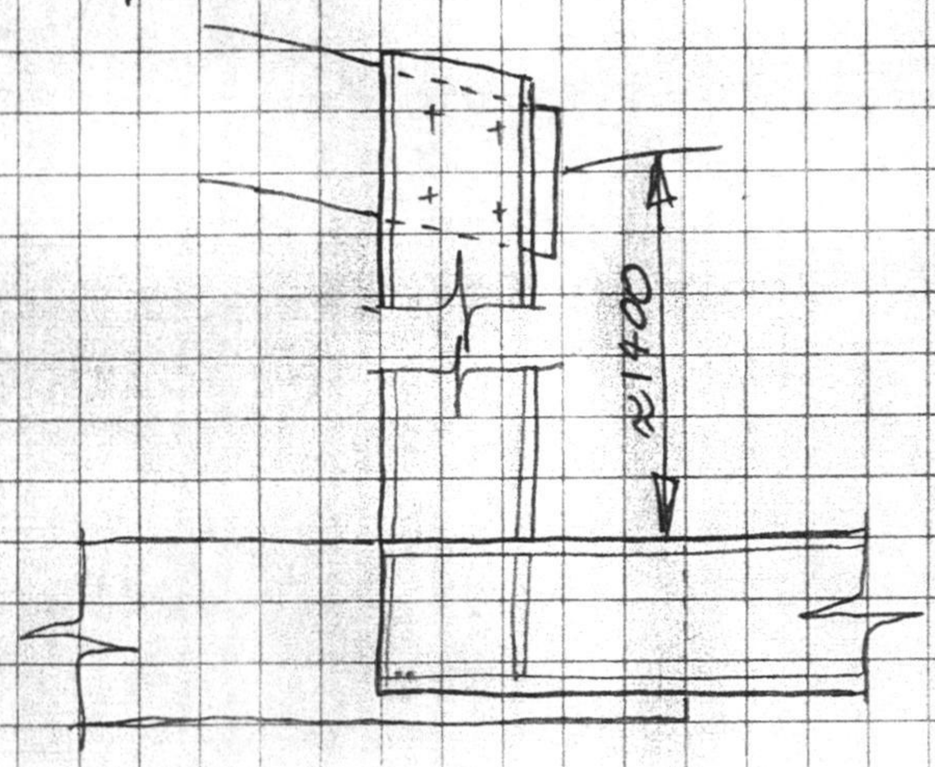
$f_b = M/Z$

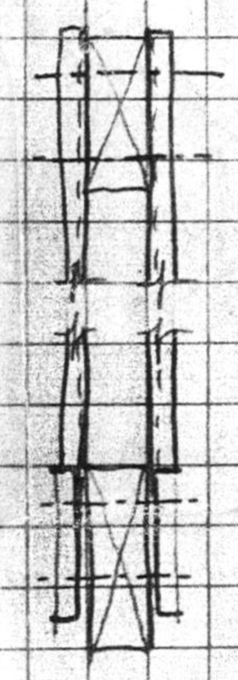
$= 72 \times 10^6 / 1.5 \times 10^6$

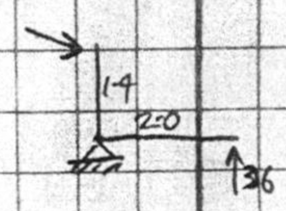
$= 48$ MPa. ⟶ NG.

too high.

Use a post to connect the channels to the top chord.







Axial compression induced into top chord

$\simeq 2.0 \times 36 / 1.4$

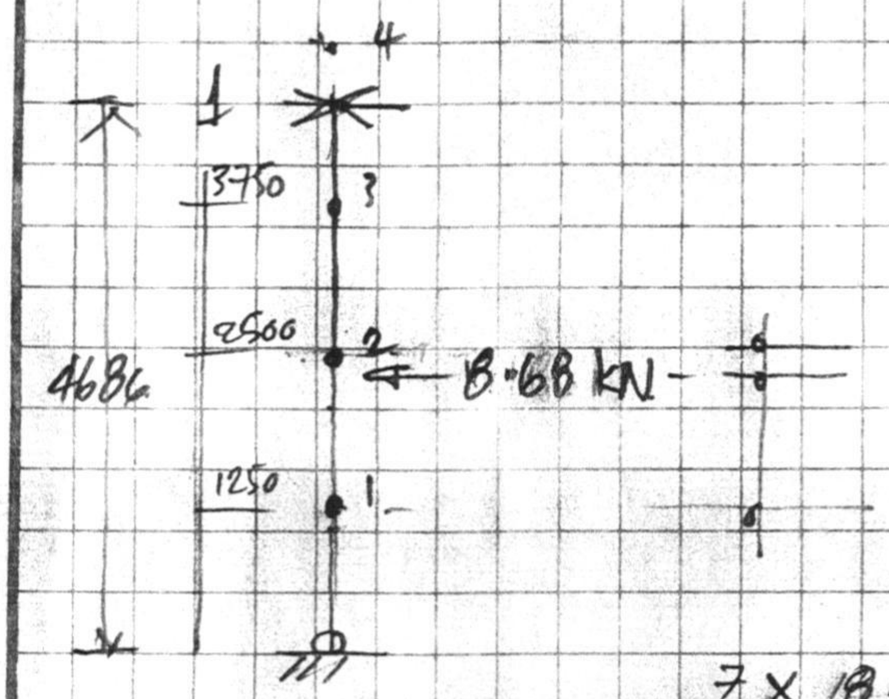
$= 51$ kN

$7'' \times 4''$ $f_a = 51 \times 10^3 / 175 \times 100$

$= 2.9$ MPa.

⇒ Approx Defl^n ≤ 3mm. at Points of Support ⇒ (Differential deflection)

ie if total Defl^n ≤ 6mm at mid span then OK



Place 14 kN load at Conn 2.

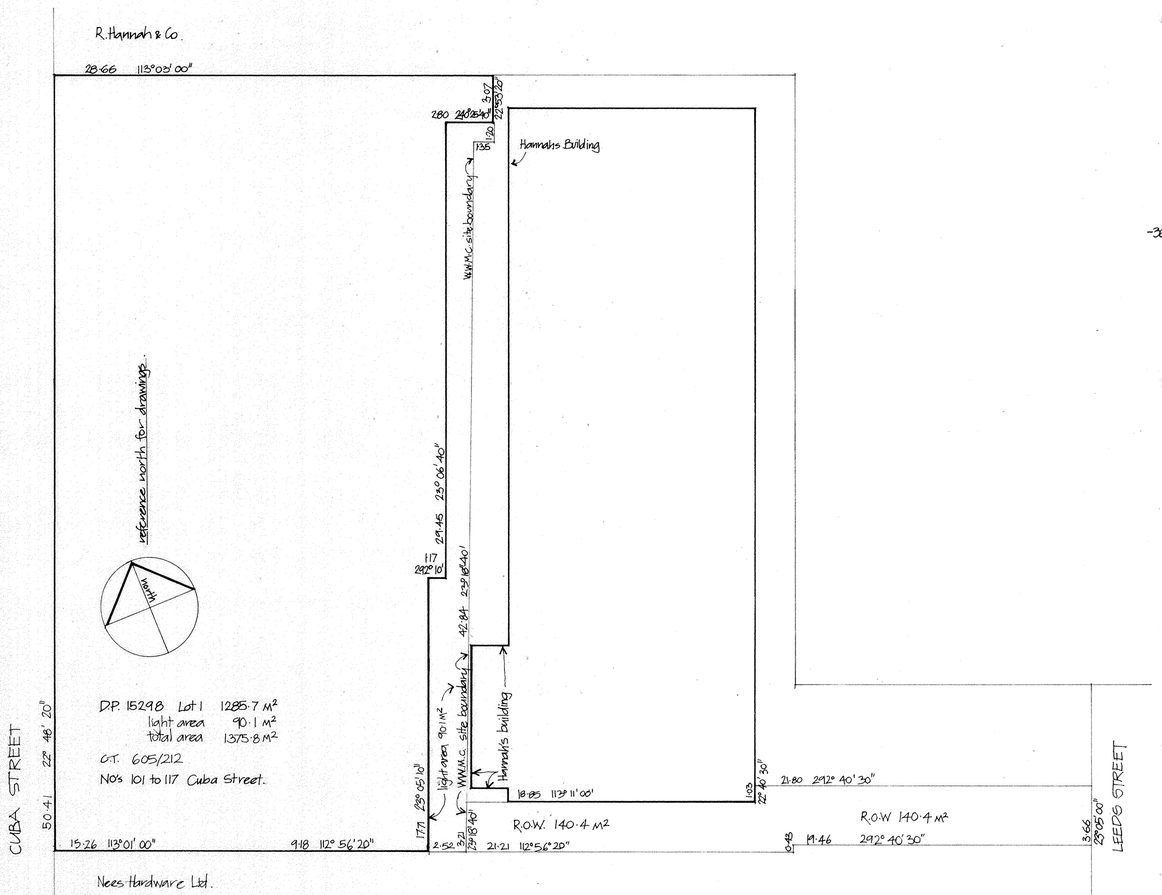
$$\Delta = \frac{7 \times 18.68 \times 10^3 \times 4686^3}{768 \times 210{,}000 \times I}$$

$$I_{req} \geq \frac{7 \times 18.68 \times 10^3 \times 4686^3}{6 \times 768 \times 210{,}000} \text{ mm}^4$$

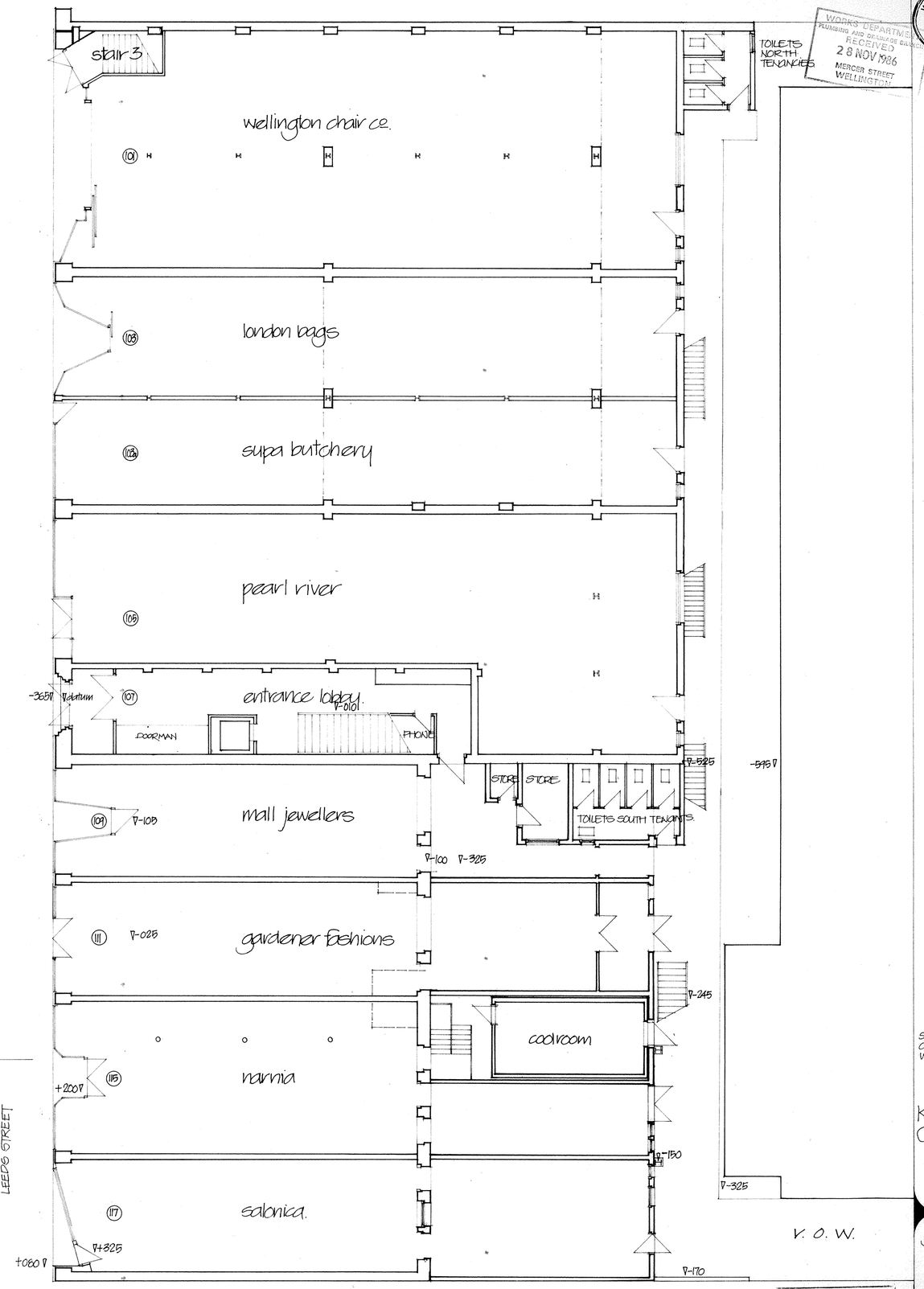
$$= 16.46 \times 10^6 \text{ mm}^4$$

114 x 114 x 9.5 RHS min.

Support NW rail off 152 x 152 x 6.3 RHS connected into flooring at Lvl G (Side of Pit)
Lvl 1 (Reinf' Concrete Flr)
Lvl 2 (Diagonally braced Flr)



1:200 site plan



1:100 ground floor plan

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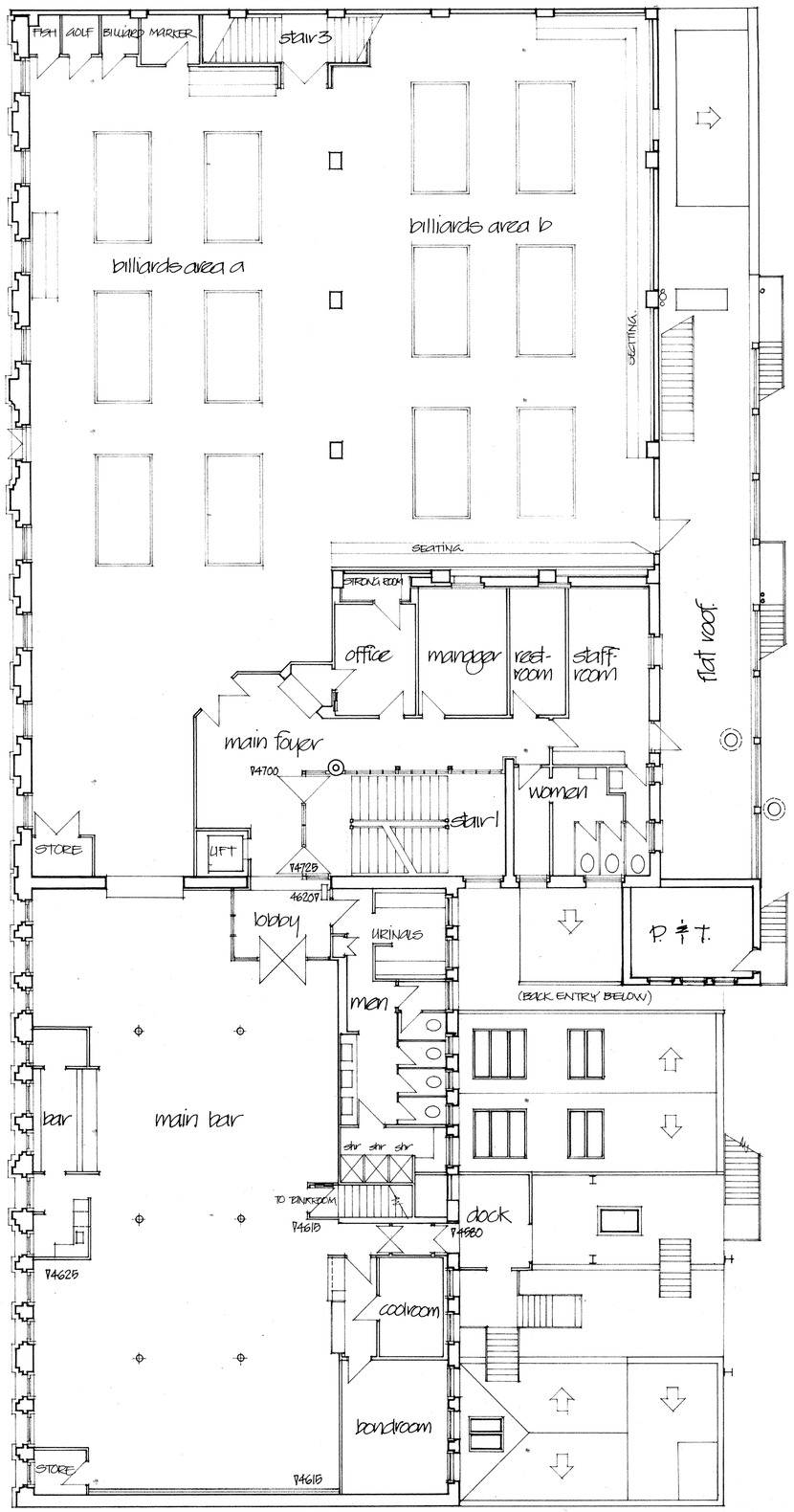
p.o. box 12321.

ground floor plan,
existing.
site plan

7915aA1



1:100 first floor plan

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first floor plan, existing

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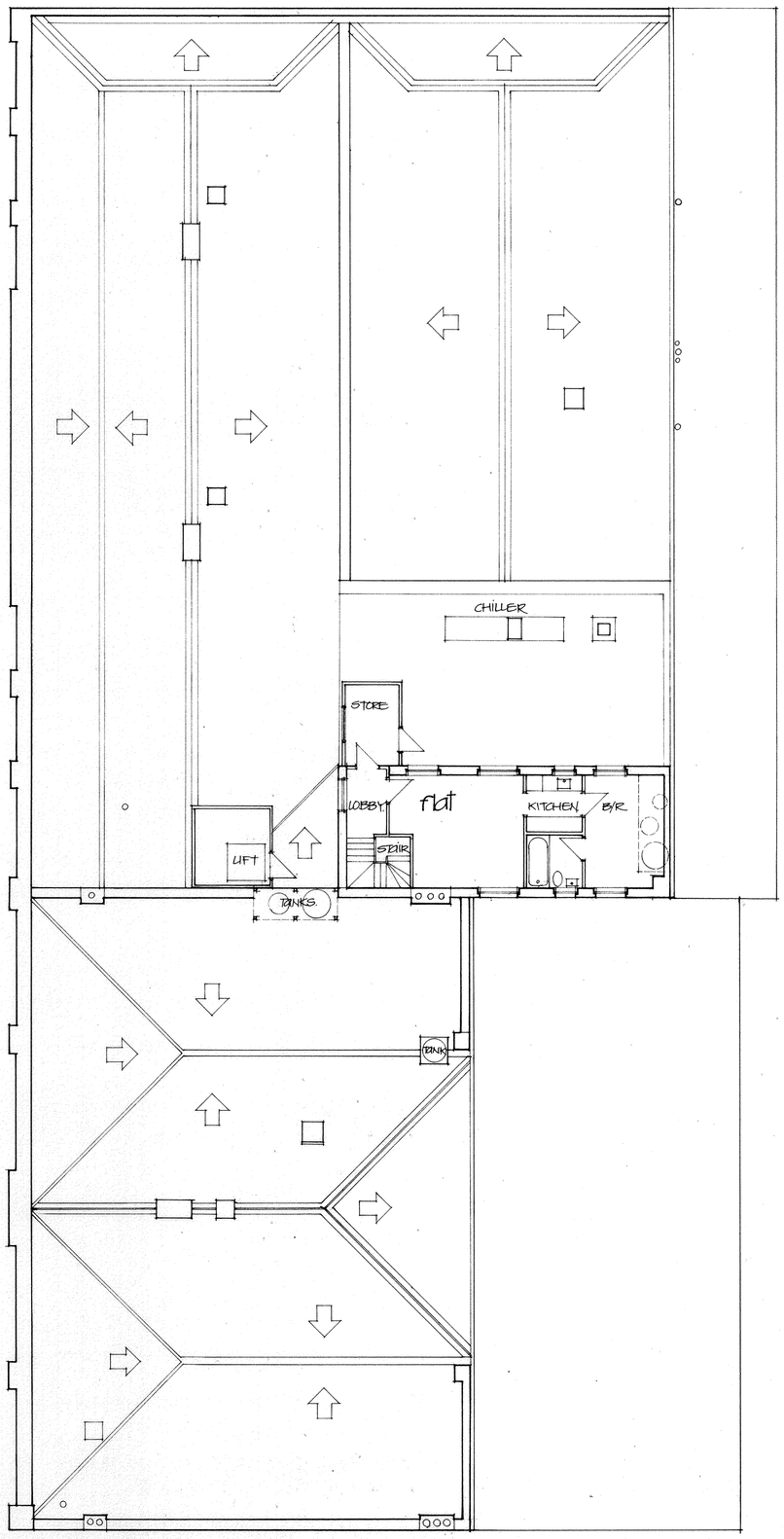

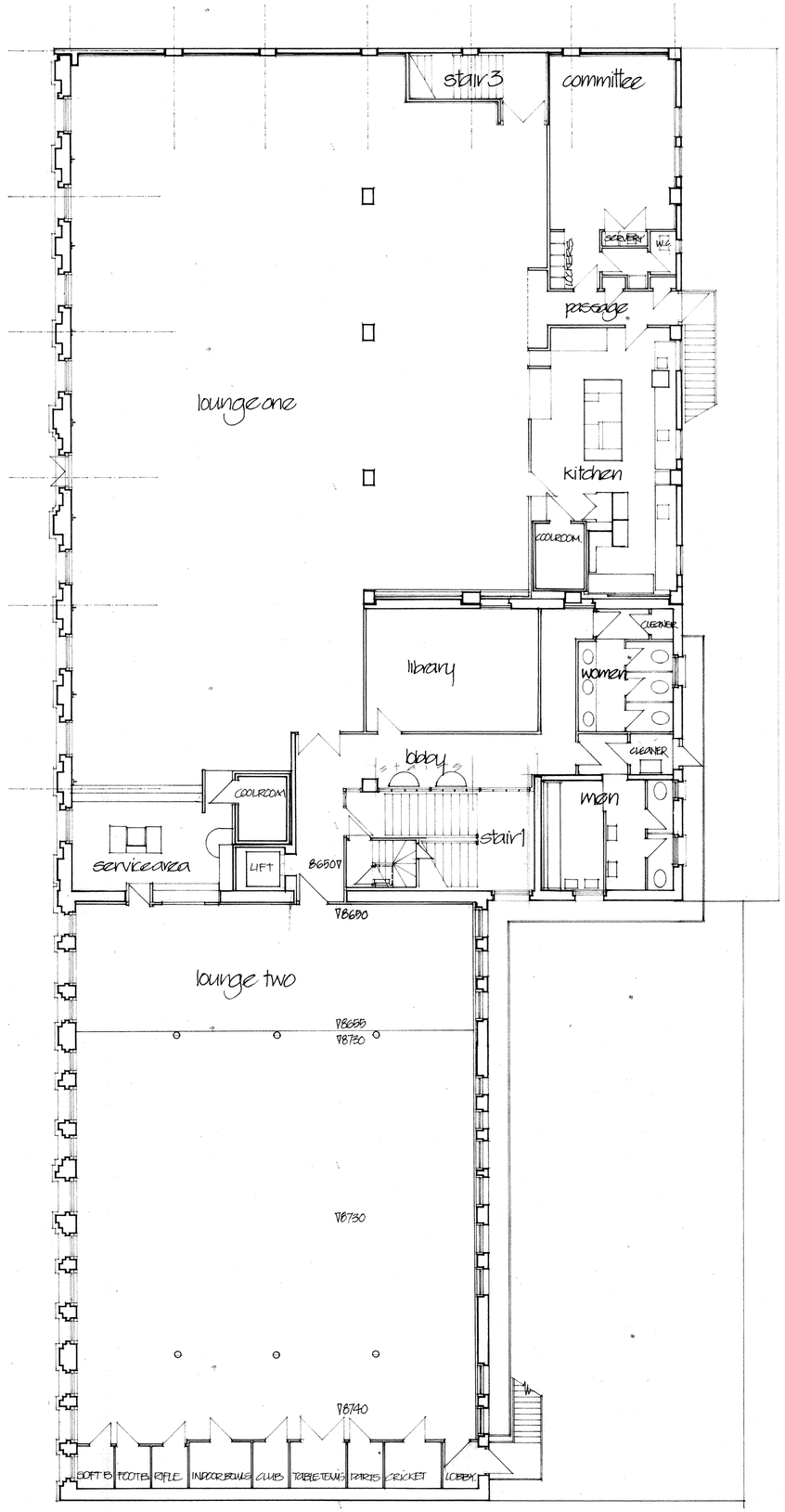

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roof-existing second floor, existing.

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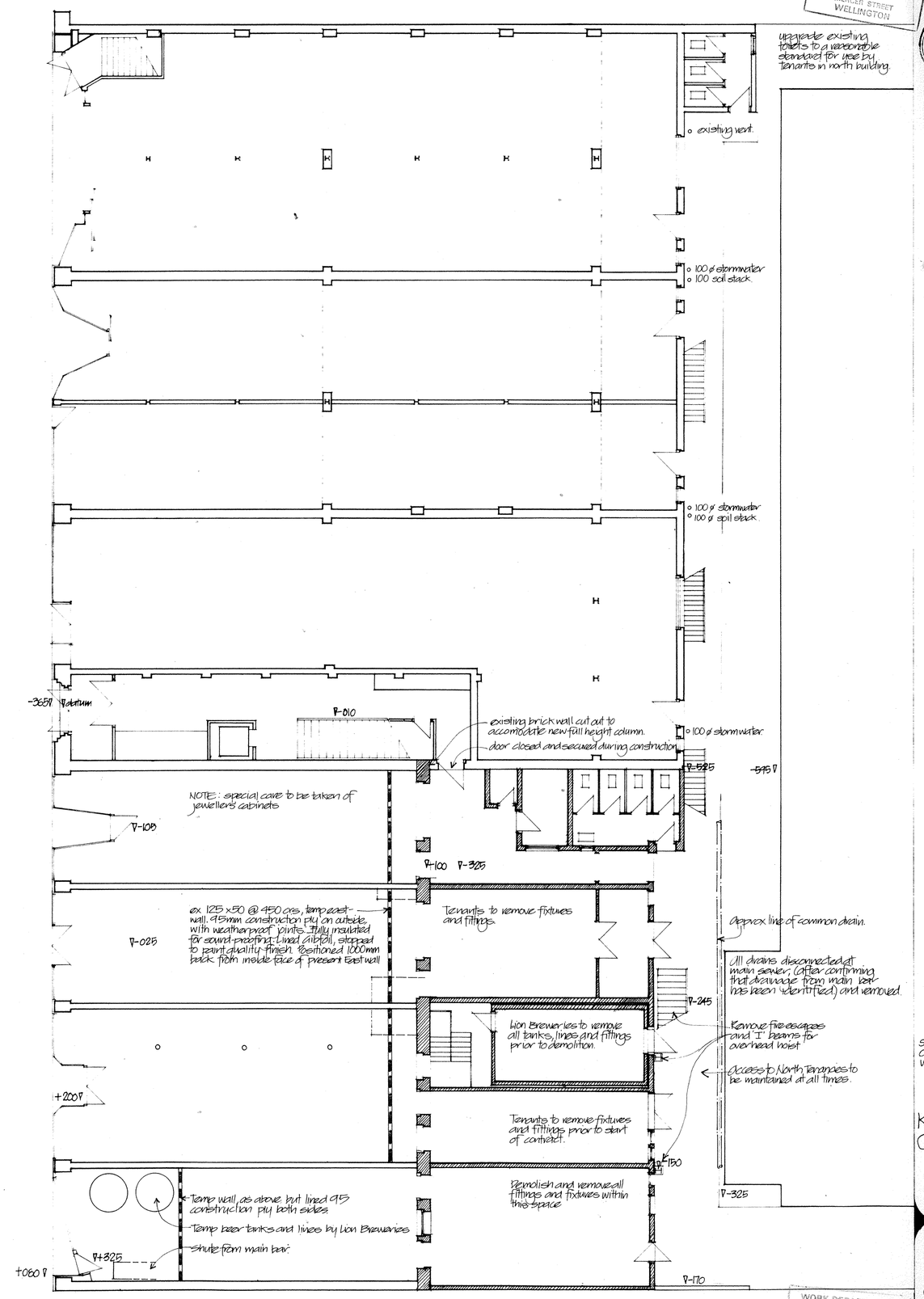

1:100 ground floor-existing

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demolition and temporary works ground floor

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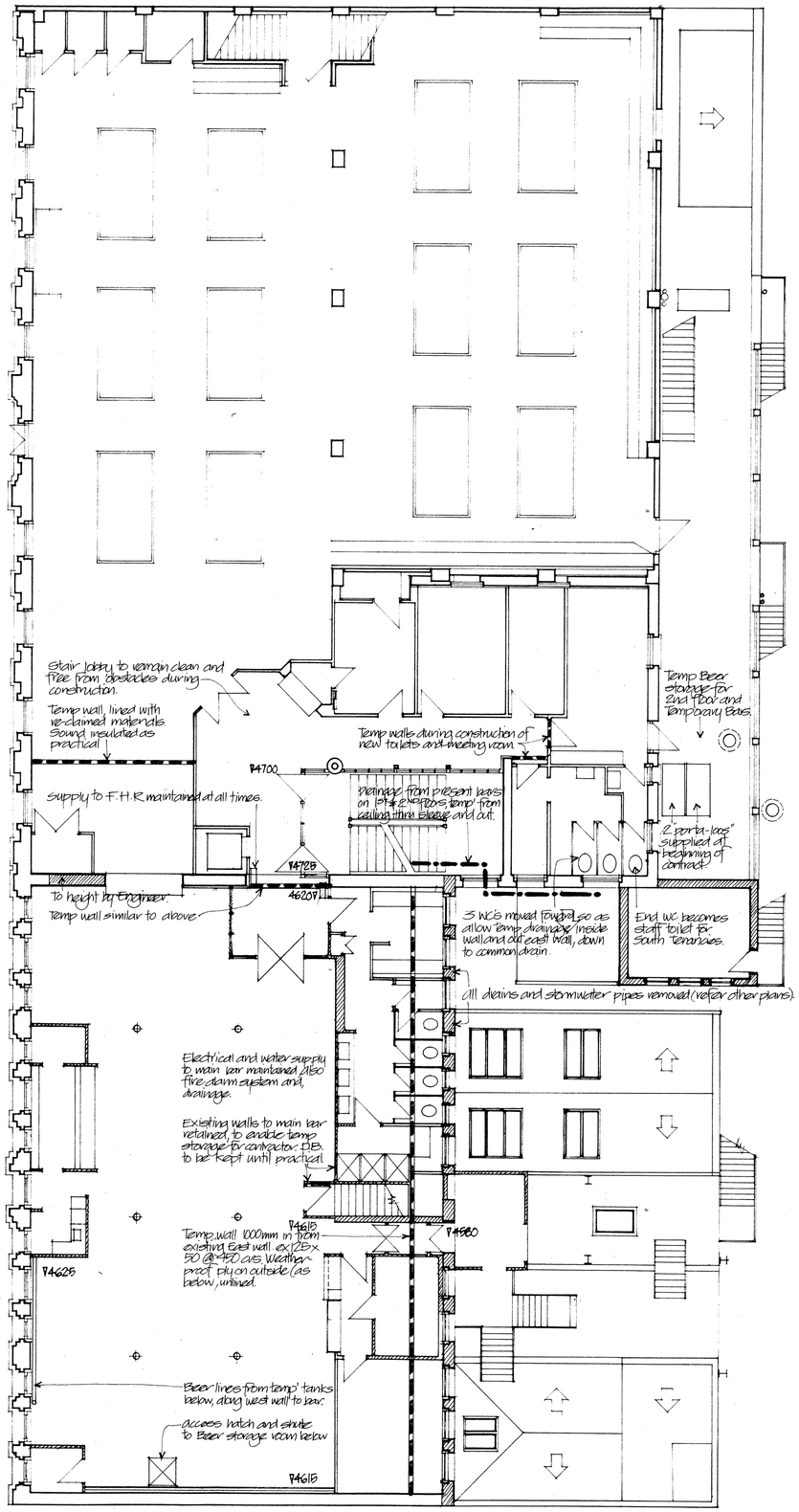

1:100 first floor plan - existing

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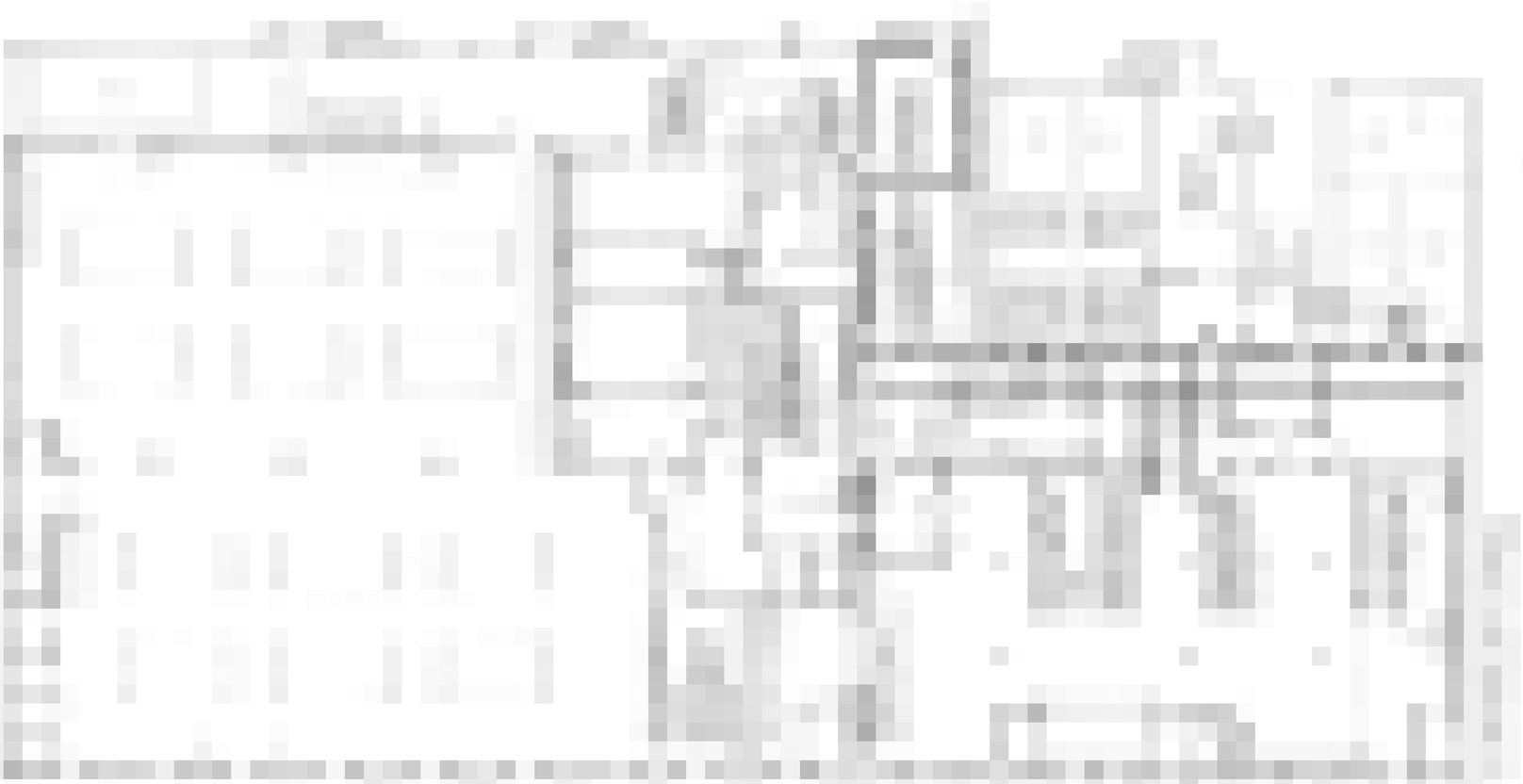
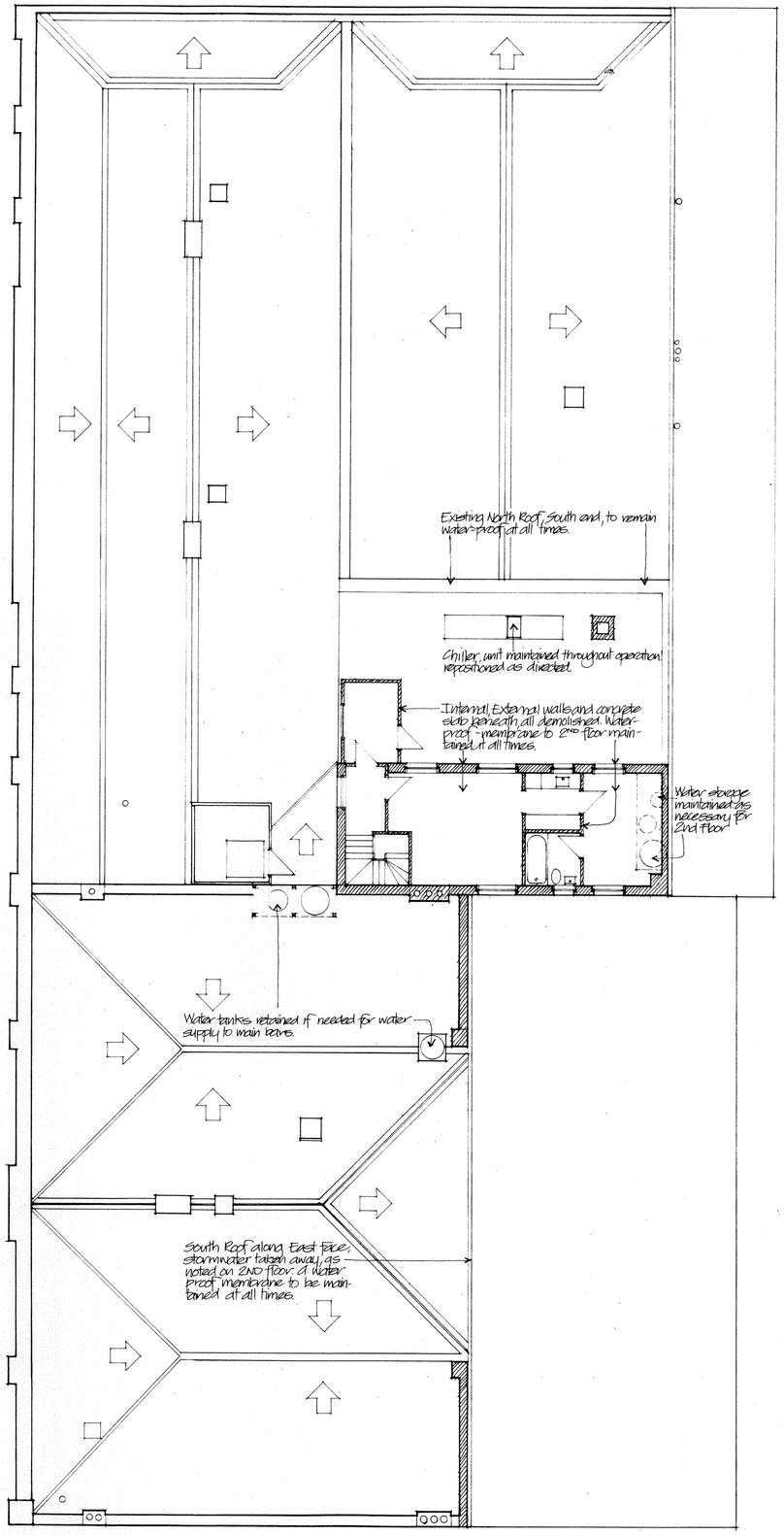
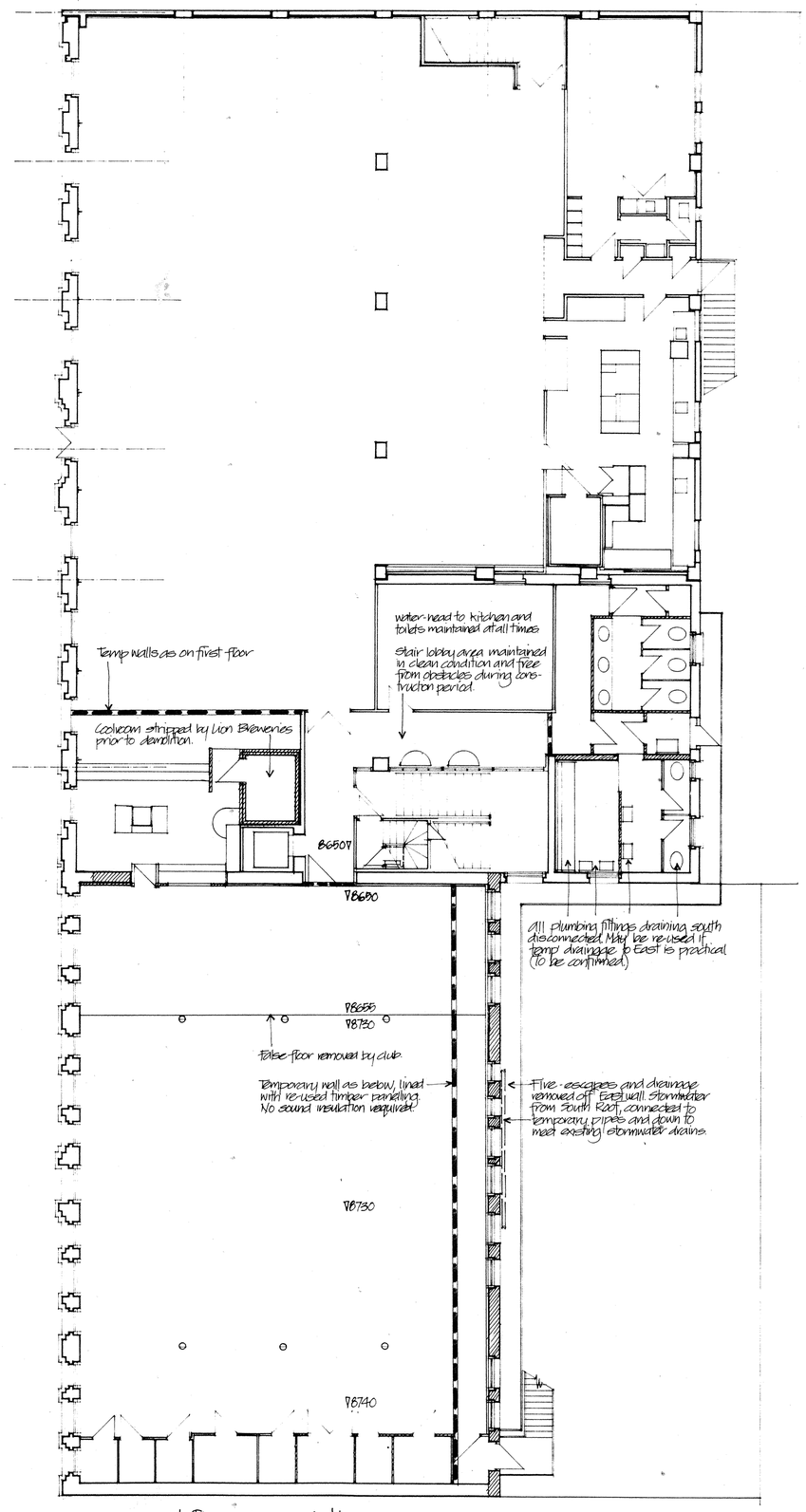
demolition and temporary works first floor.

7915aA5





1:100 roof plan - existing



1:100 second floor plan - existing.

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demolition and temporary works second floor, roof.

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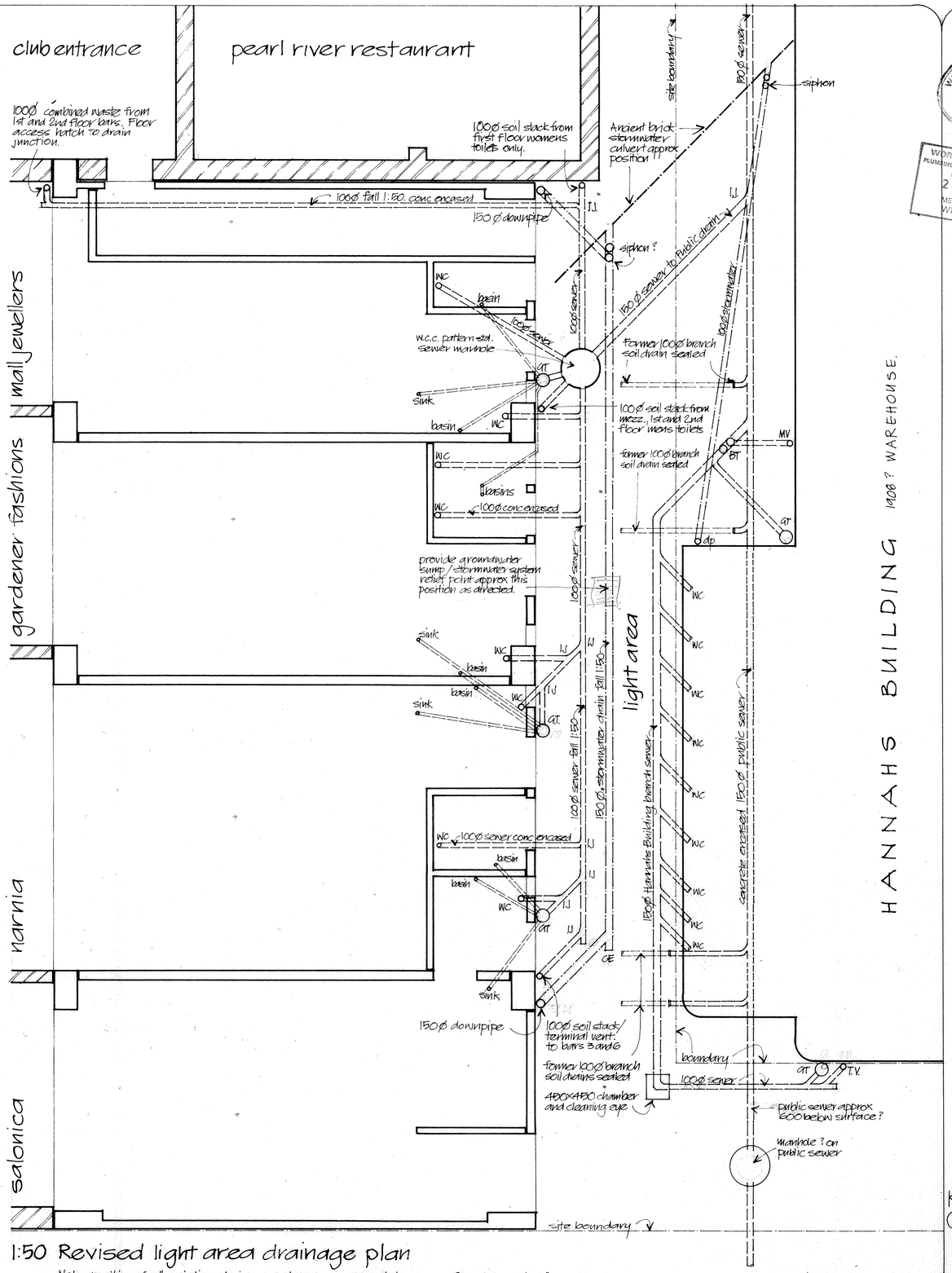

1:50 Revised light area drainage plan

Note: position of all existing drains are shown as accurately as confused records allow. Position of all new drains and associated items will be confirmed when existing situations clarified. Contractor shall keep accurate records to enable an "as built" drawing to be done.

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revised light area drainage

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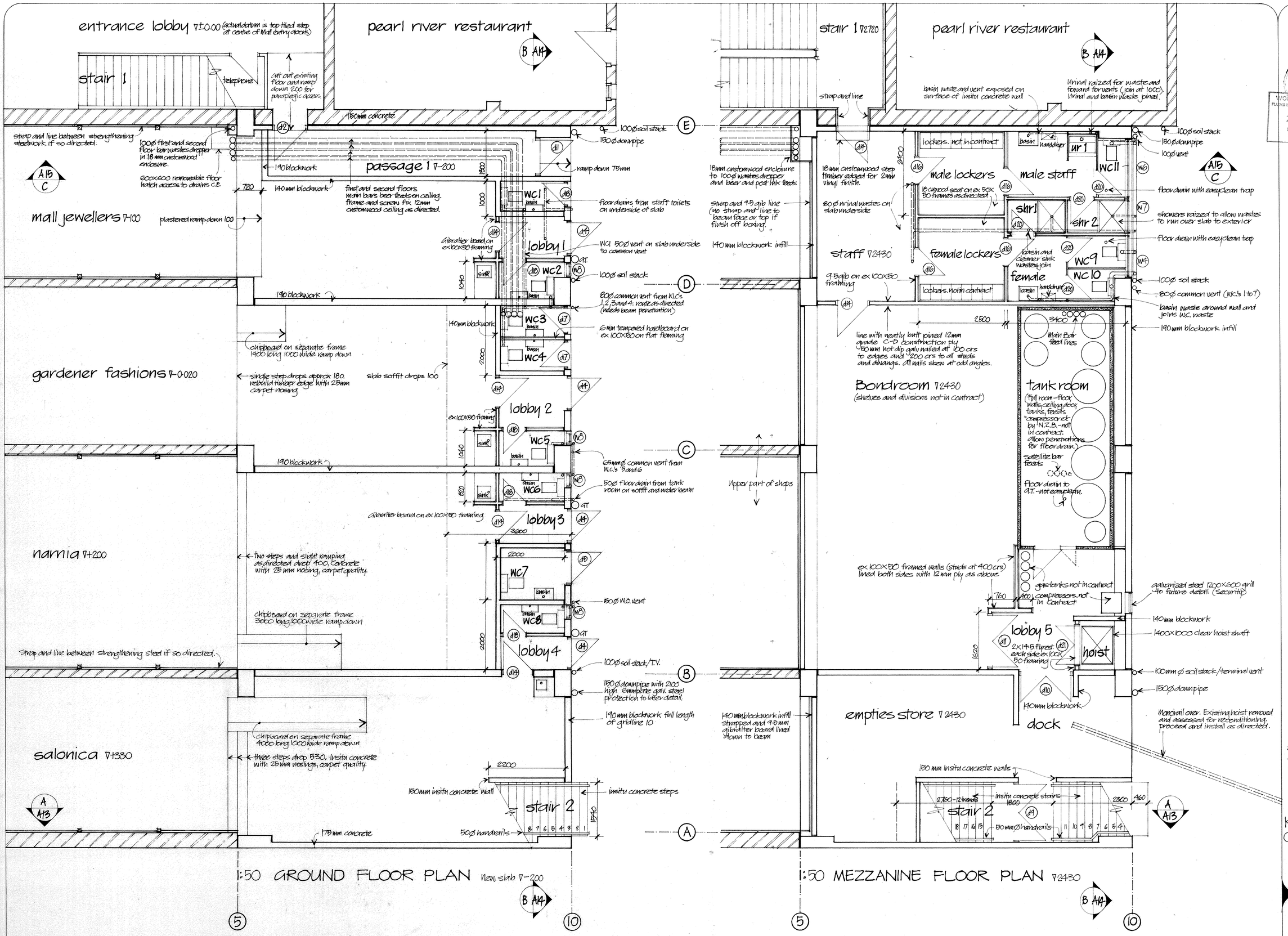

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ground and mezzanine floor plans

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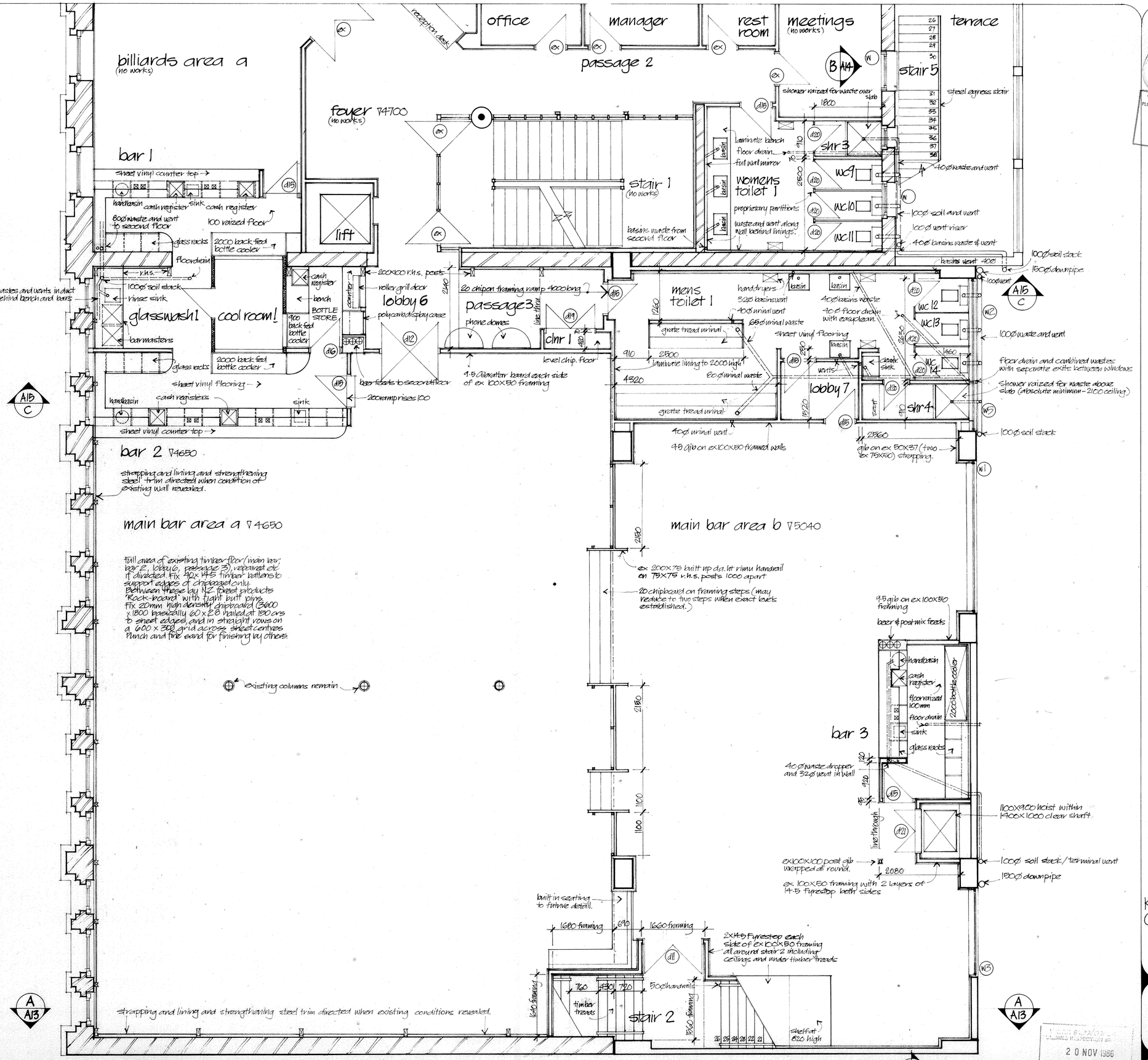

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first floor revised plan

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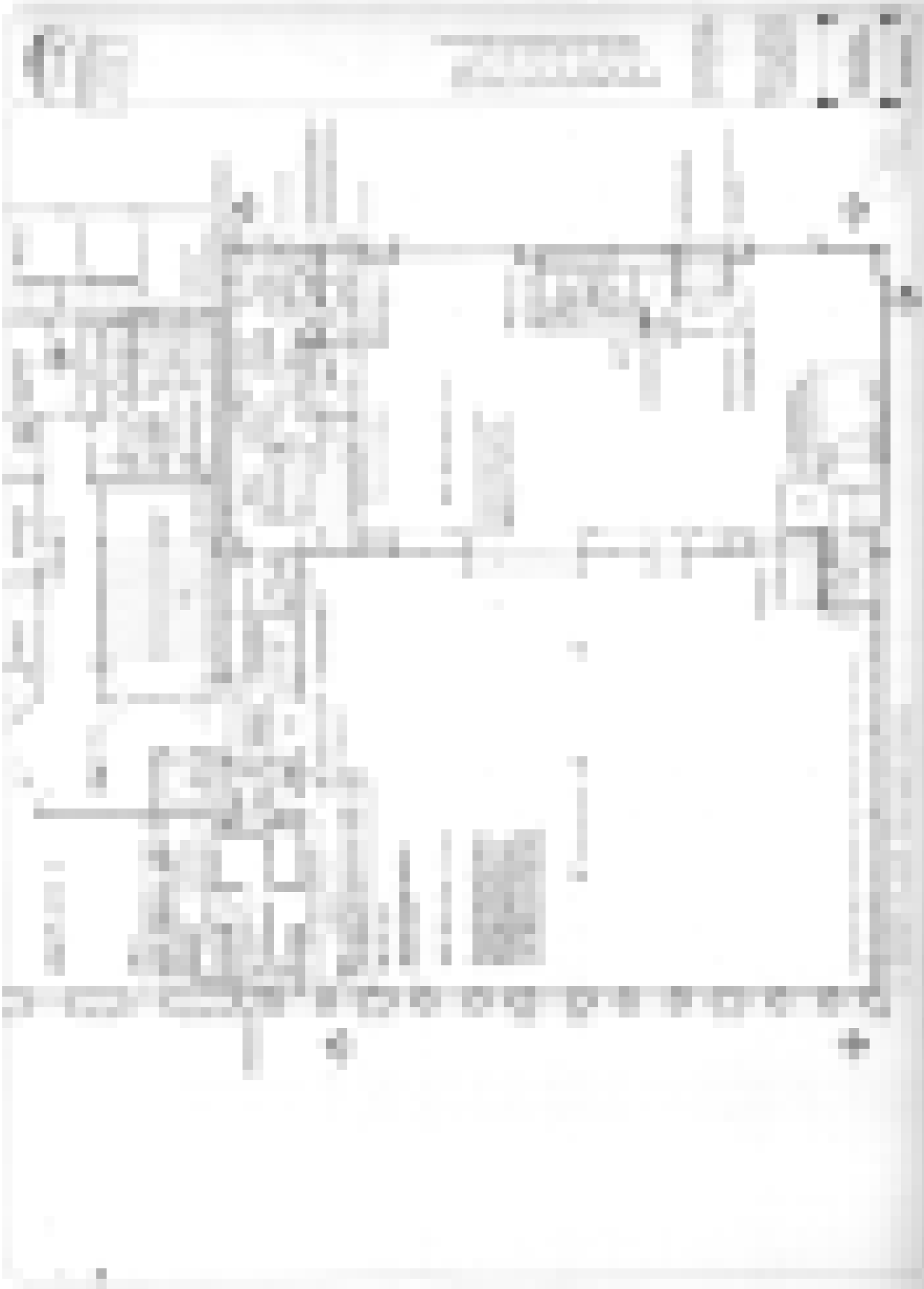

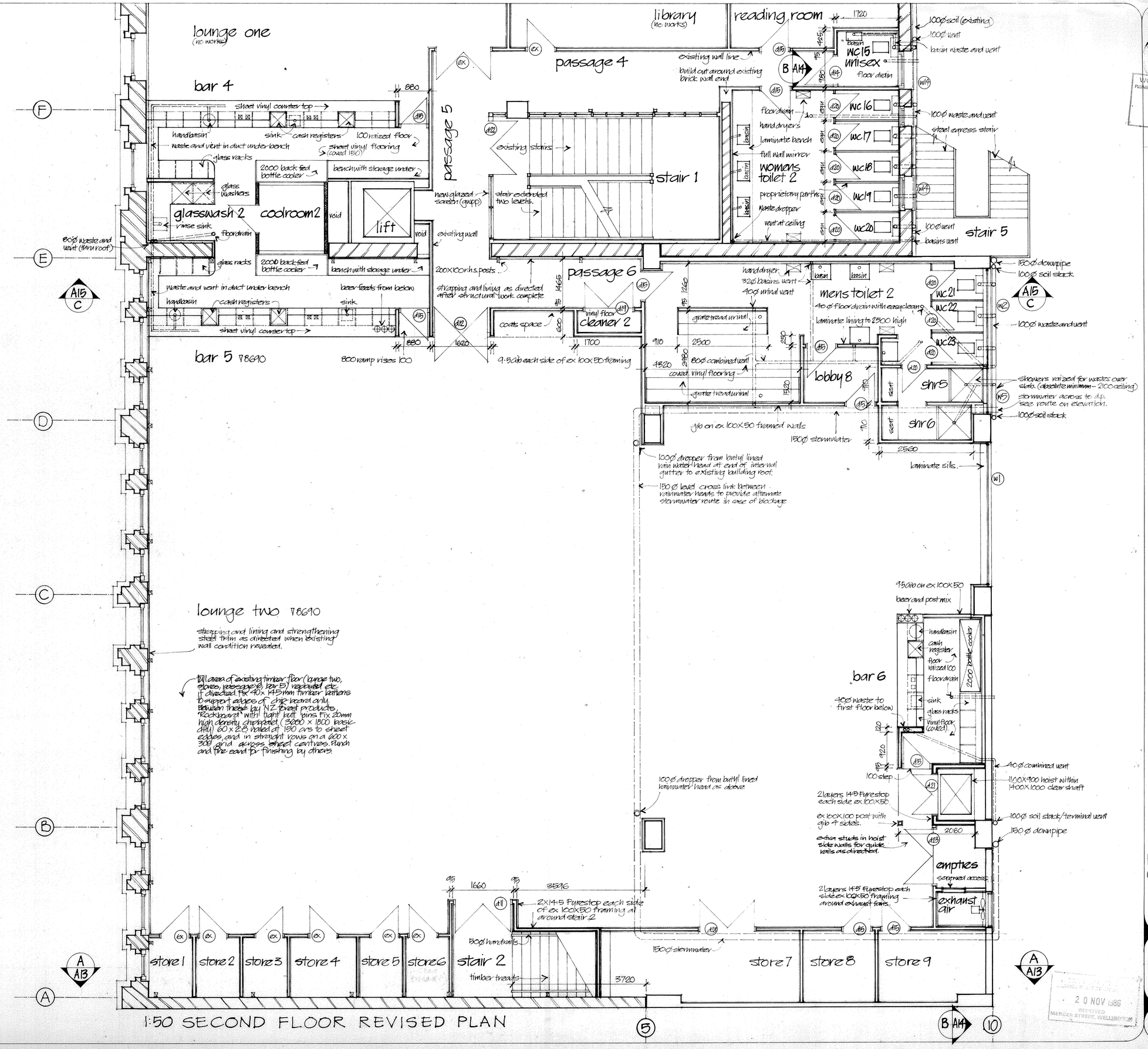

1:50 SECOND FLOOR REVISED PLAN

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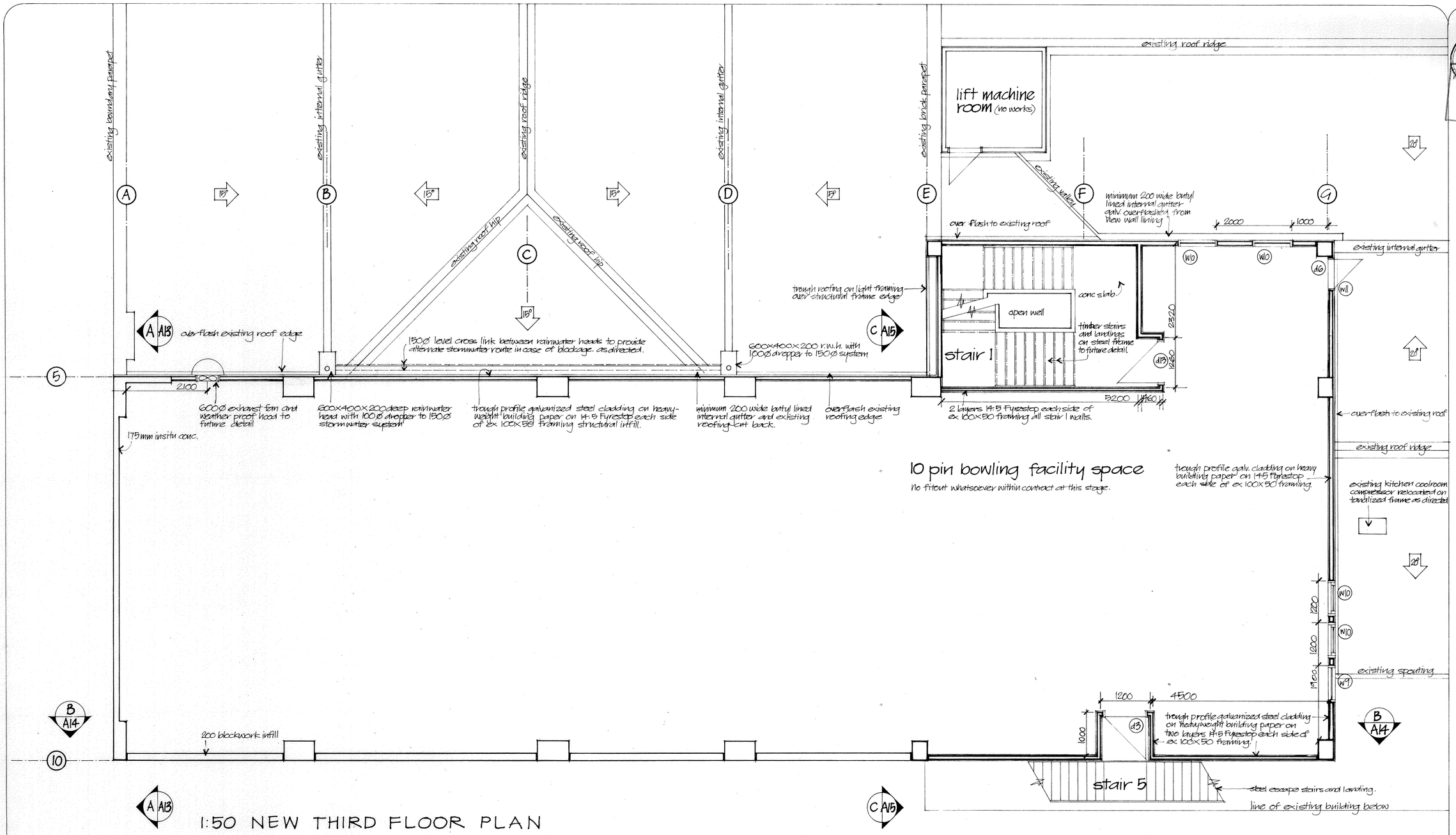
second floor revised plan

7915aA10



1:50 NEW THIRD FLOOR PLAN

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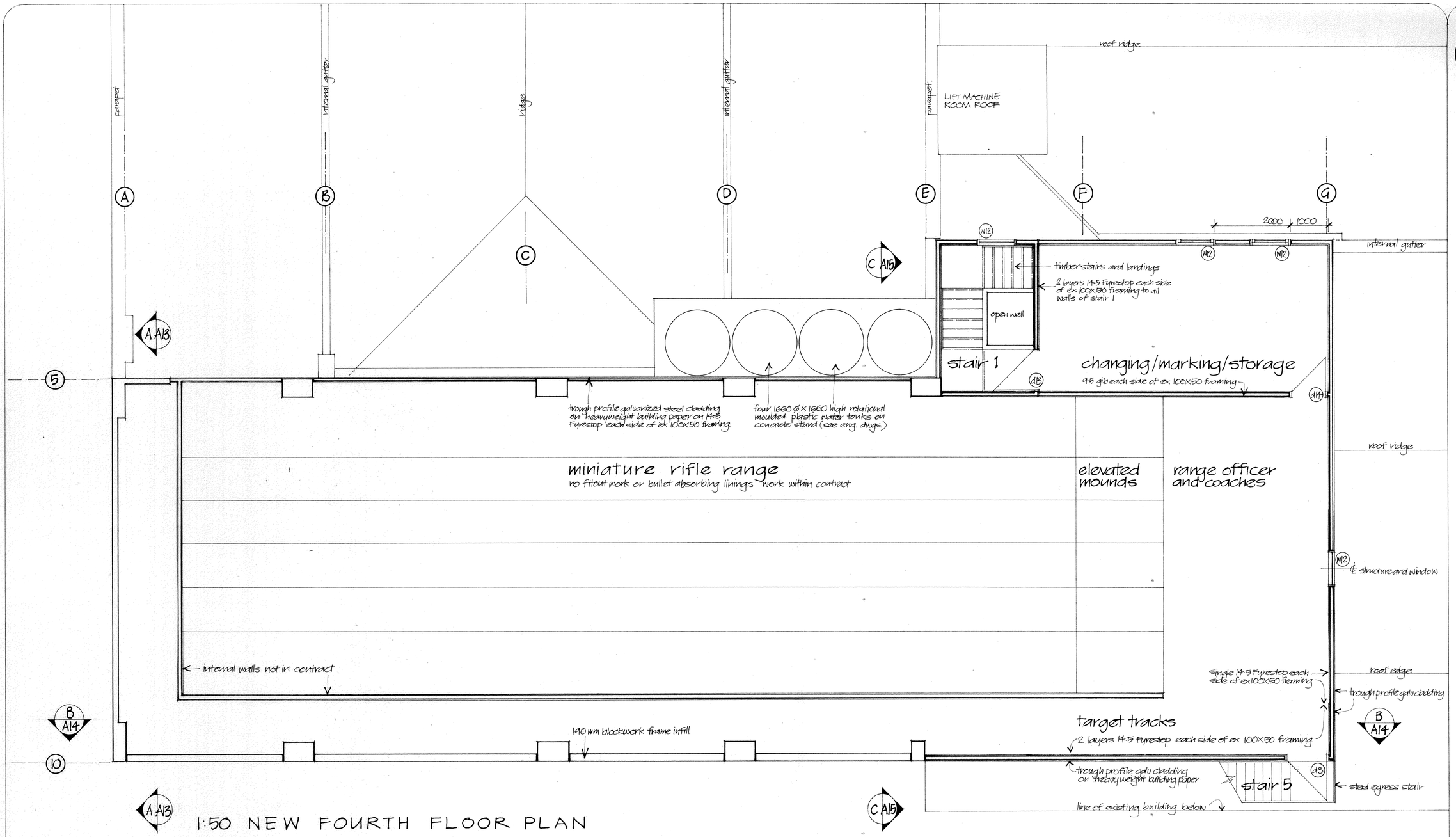
third floor plan

7915aA11



1:50 NEW FOURTH FLOOR PLAN

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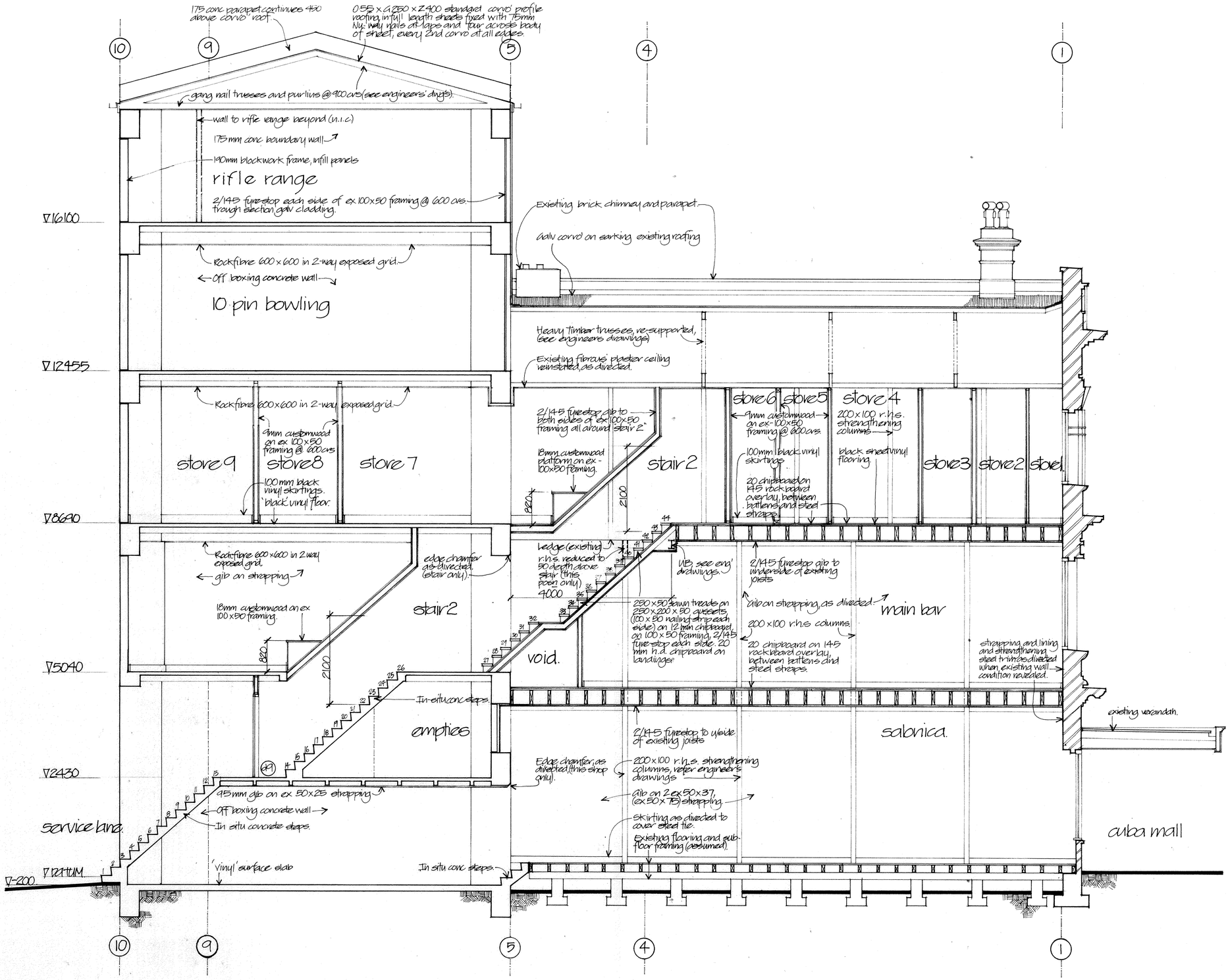
fourth floor plan

7915aA12



1:50 SECTION A (looking south to grid line A)

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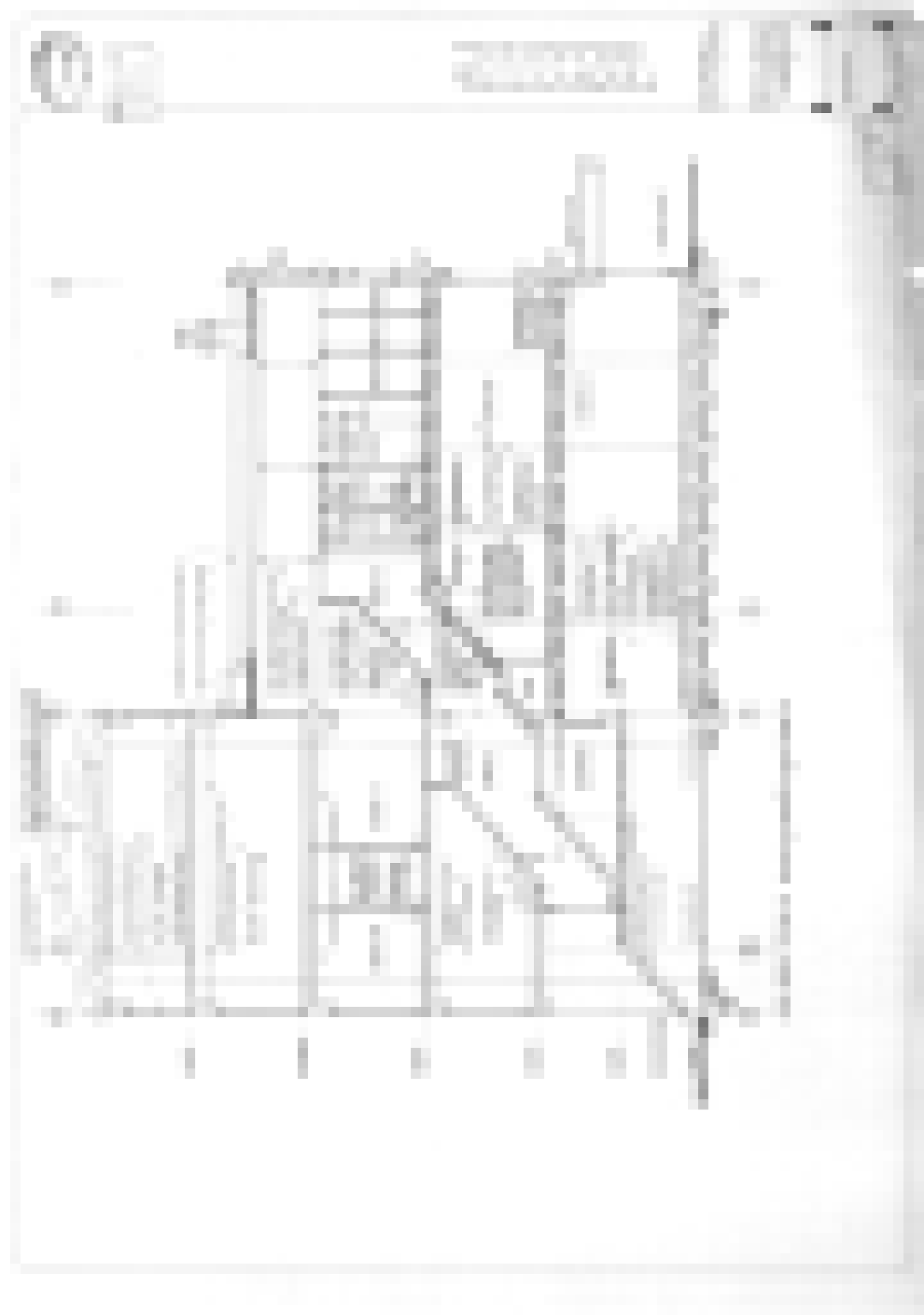
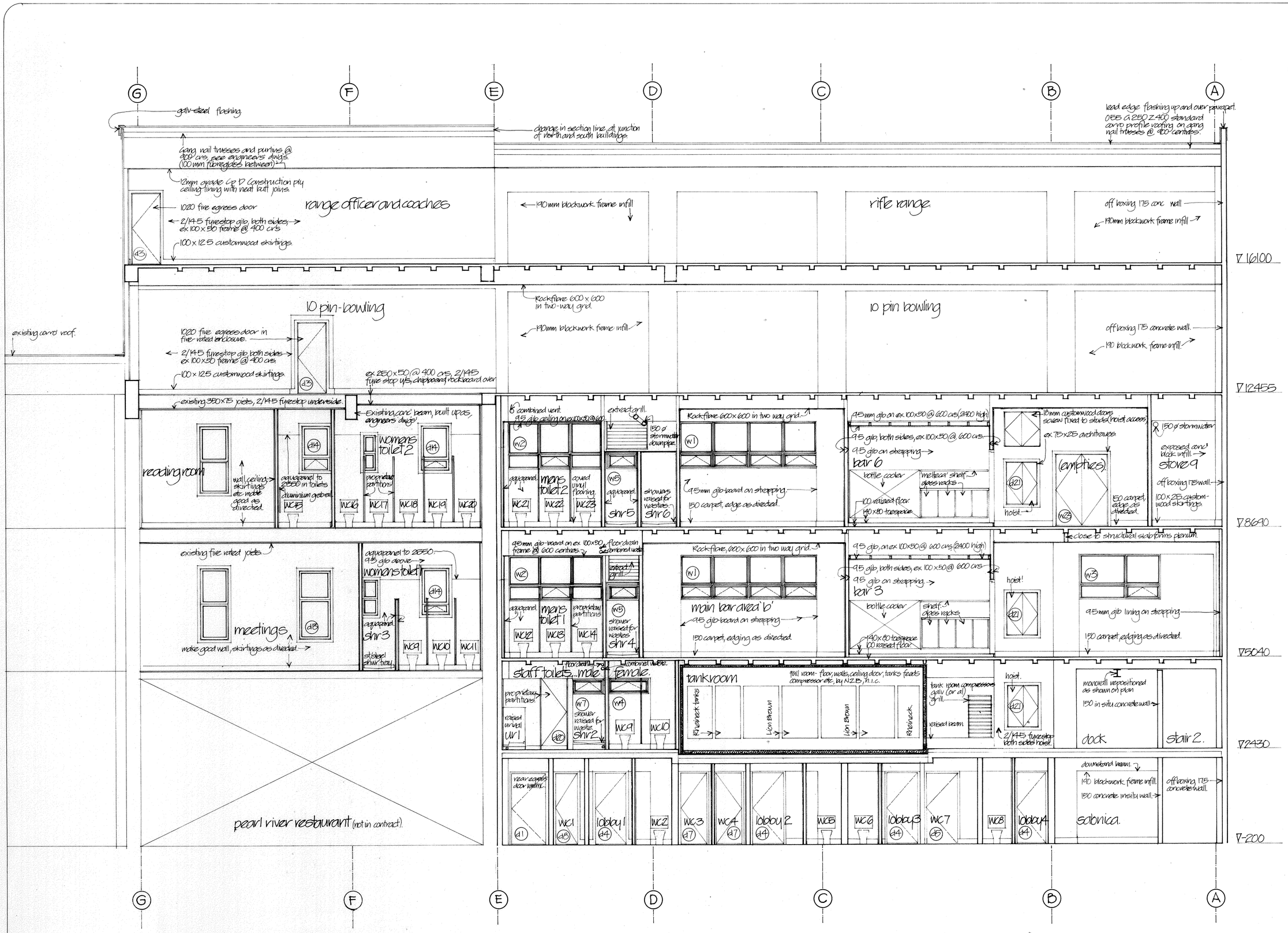
section A.

7915aA13





1:50 SECTION (looking east to grid line 10)

WELLINGTON WORKINGMENS CLUB AND LITERARY INSTITUTE
STRENGTHENING AND ALTERATIONS 40-42 BLAIS ST PREVIEW

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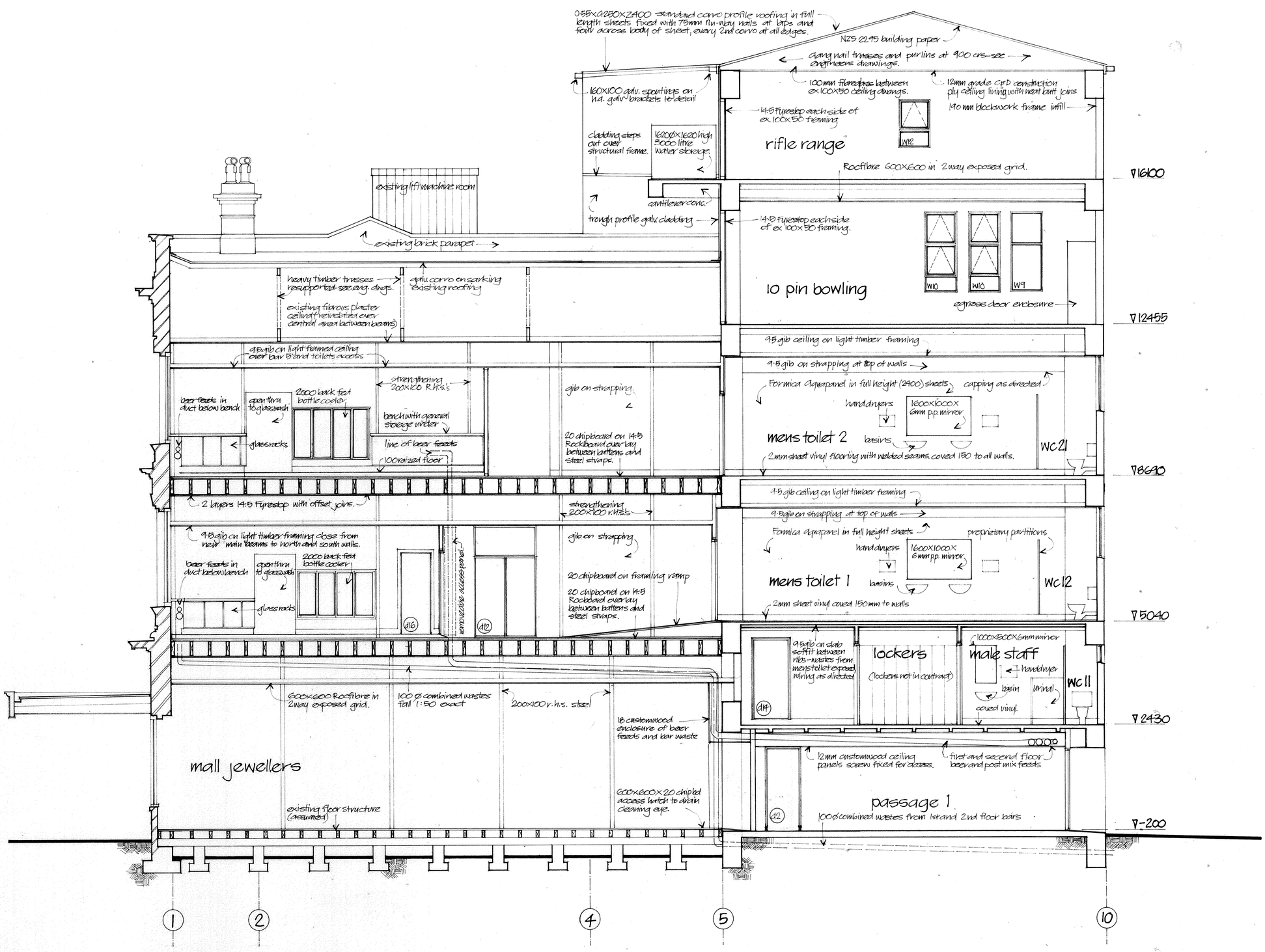
section B

7915aA14



1:50 SECTION C (looking north to grid line E)

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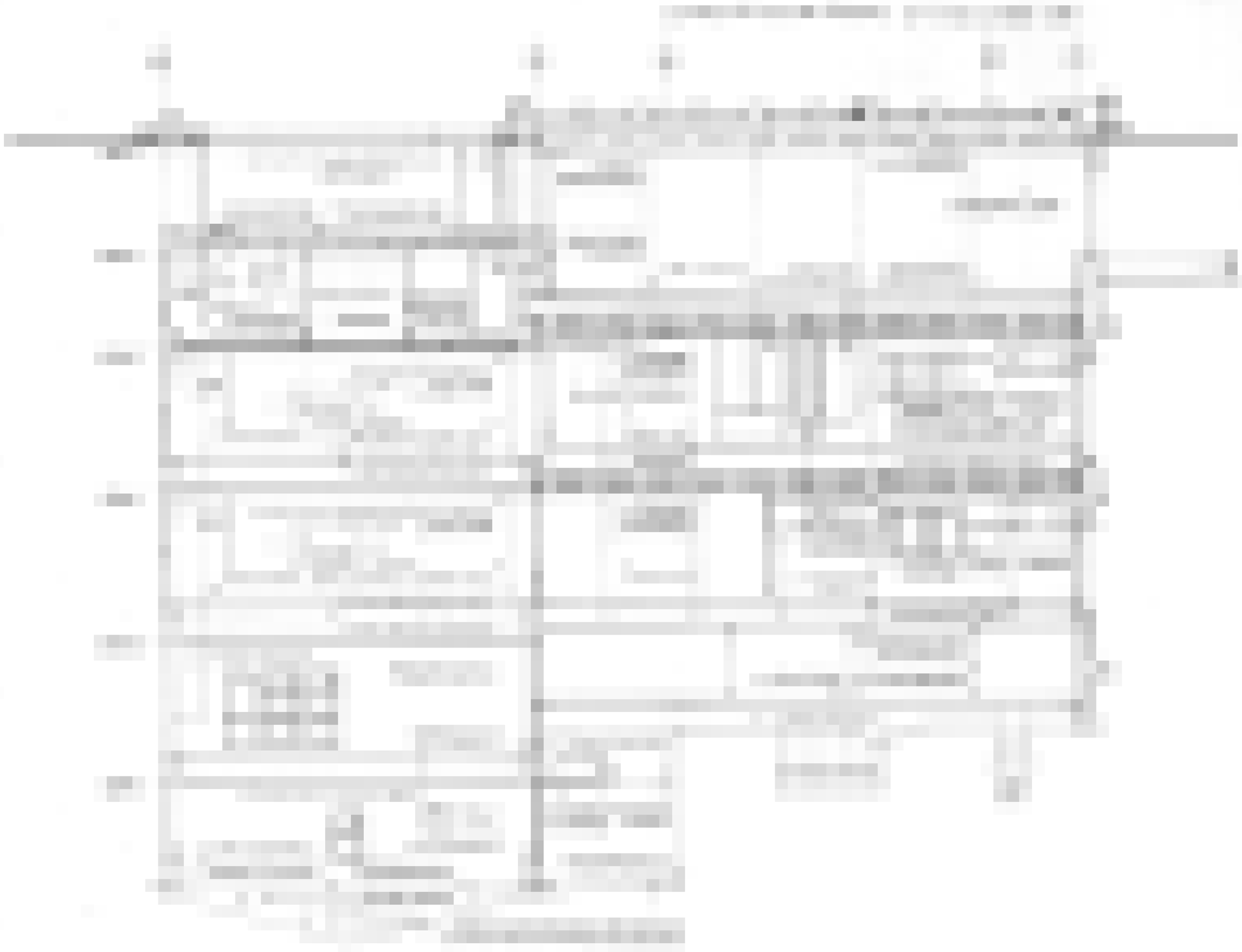
section C

7915aA15



A450 high insitu concrete parapet
lead edged rolltop galv ridging
0.55 galv corro roofing
160x100 galv spouting on galv ms. brackets
ex 200x25 tan fascia
150 mm Ø P.V.C. downpipe
190 mm blockwork frame infill
insitu concrete structural frame
terminal vent
main bar and lounge two exhaust system galv (or aluminium) grills
150Ø downpipe
bars 3 and 6 items combined vent
bar 6 floor waste (from below raised floor)
190 mm blockwork frame infill
insitu concrete structural frame
open
monorail
150 mm insitu wall
stair 2
dock
12 11 10 9 8 7 6 5 4 3 2 1 gnd
lounge two exhaust system galv grill to future detail
combined vent from urinals, basins and cleaners sinks to 1st & 2nd floor mens toilets.
150 mm Ø downpipe
saddle
cistern overflows
100Ø vent
shrs
WC
100Ø soil.
cleaning eye
main bar exhaust system galv grill to future detail
floor drain outlet.
100Ø soil stack
mens toilet 2 urinals, basins and cleaner sink comb. wastes
cistern overflows
shr.
floor drain outlet.
CE
urinal, basin, shr sink wastes
100Ø vent.
cistern overflows
combined vents.
WC's 1,2,3 and 4 combined vent.
WC 7 vent
WC 8 vent.
cistern overflows
WC 6 vent
tankroom floordrain
WC 5 vent
cistern overflows
staff toilet floordrains.
100Ø soil.
cistern overflows
100Ø soil stack/terminal vent
bar 3 floor waste (from below raised floor)
bars 3 and 6 items combined wastes.
tankroom compressors galv (or al.) grill
lead edged rolltop ridging
100Ø combined vent
160x100 galv spouting on galv m.s. brackets
150Ø downpipe
190 mm blockwork structural frame infill (paint)
combined vent from all basins in womens toilets
remake sills to match existing
unisex toilet basin vent
cistern overflows
100Ø vent
existing connections plugged.
floor drains
100Ø soil (existing)
100Ø vent.
remake sills to match exist.
cistern overflows.
womens toilet 1 floor drain
combined waste from all basins in womens toilets
100Ø soil stack to manhole - see dwg A7.
urinal and basin waste
door to risers riser.
0.55 galv corro roofing
100Ø combined vent
ex 200x25 tan fascia
trough profile galv. cladding
steel escape stair N°5 (painted) to future detail.
vent cranked out around cantilever
100Ø galv tube with 'crank' in case not really supporting cantilever.
steel egress stair.
existing roof spouting, r.w.h. etc.
existing 100Ø d.p. and soil stack.
(exist)

1:50 EAST ELEVATION

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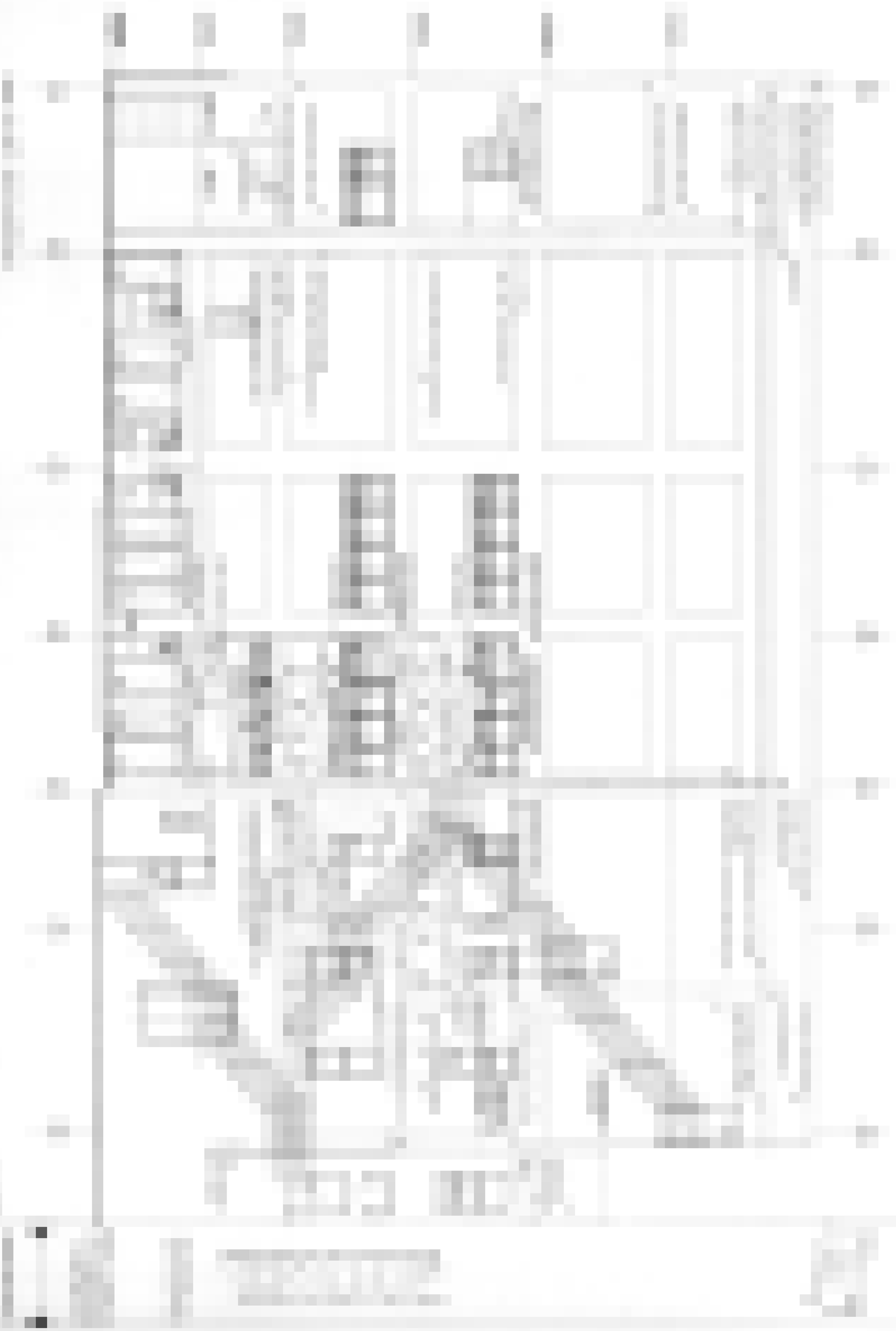
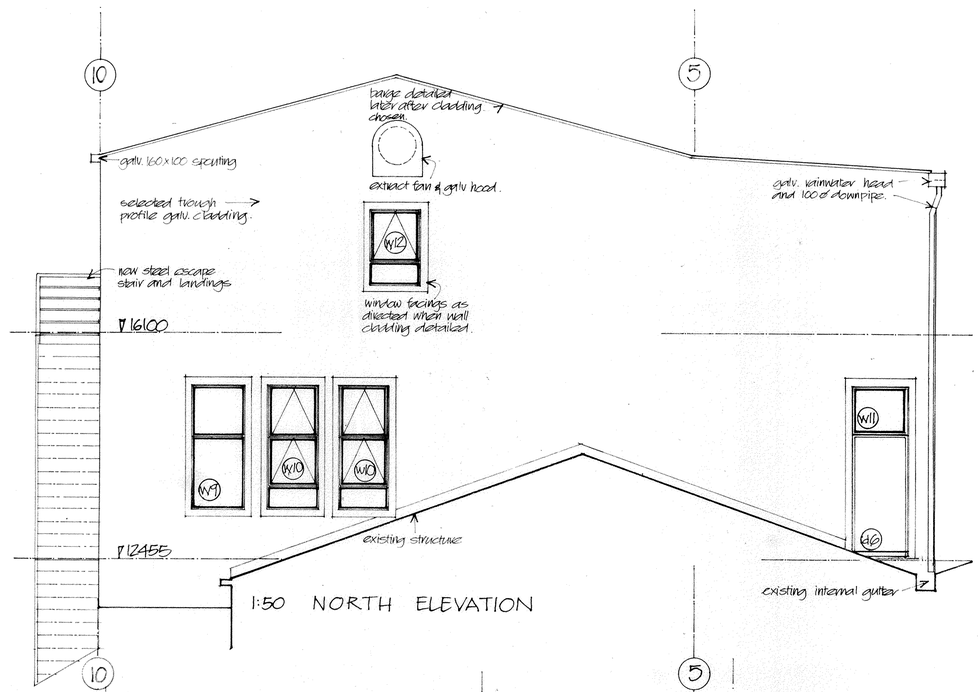
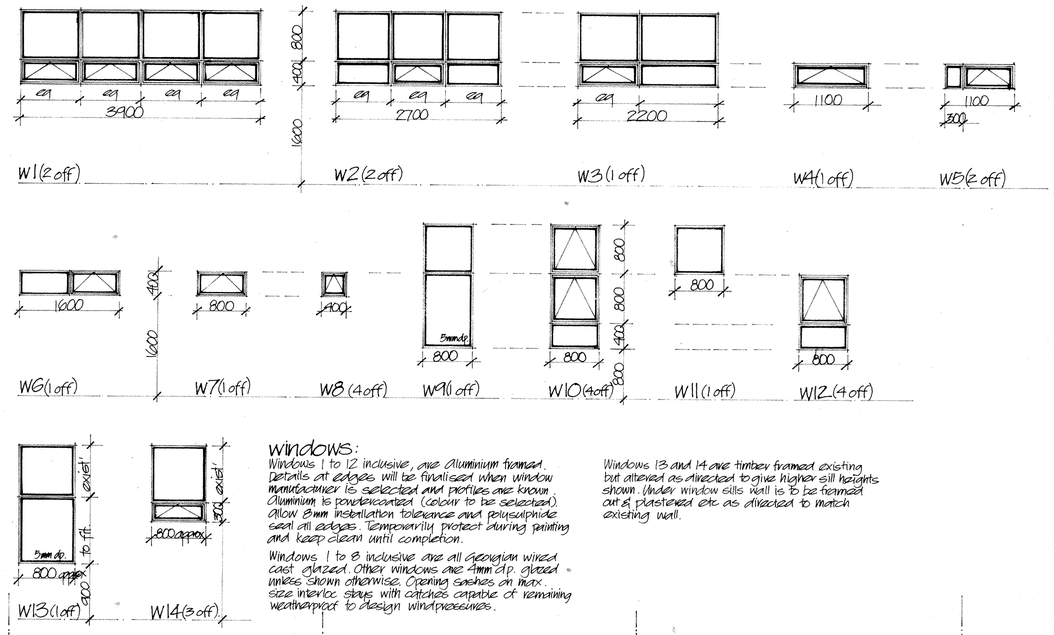
east elevation

7915aA16





1:50 NORTH ELEVATION

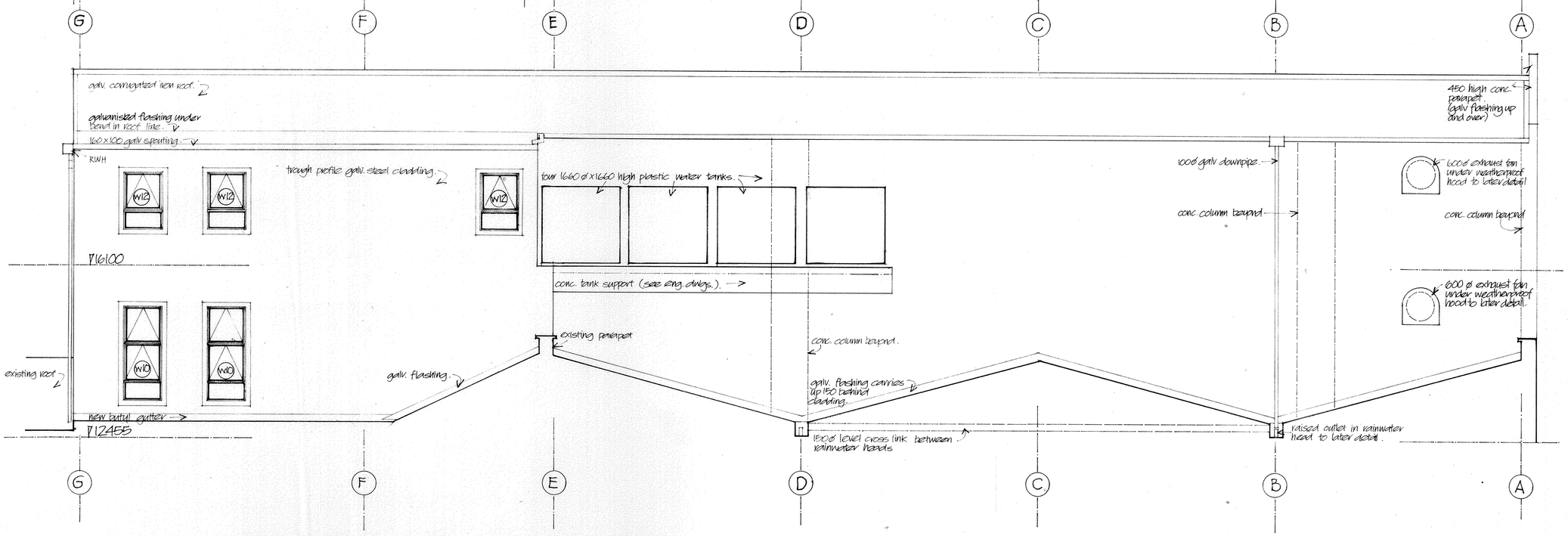


windows:

Windows 1 to 12 inclusive, are aluminium framed. Details at edges will be finalised when window manufacturer is selected and profiles are known. Aluminium is powdercoated (colour to be selected). Allow 8mm installation tolerance and polysulphide seal all edges. Temporarily protect during painting and keep clean until completion.

Windows 1 to 8 inclusive are all georgian wired cast glazed. Other windows are 4mm dp. glazed unless shown otherwise. Opening sashes on max. size interlock stays with catches capable of remaining weatherproof to design windpressures.

Windows 13 and 14 are timber framed existing but altered as directed to give higher sill heights shown. Under window sills well is to be framed out & plasterwork etc as directed to match existing wall.



1:50 WEST ELEVATION.

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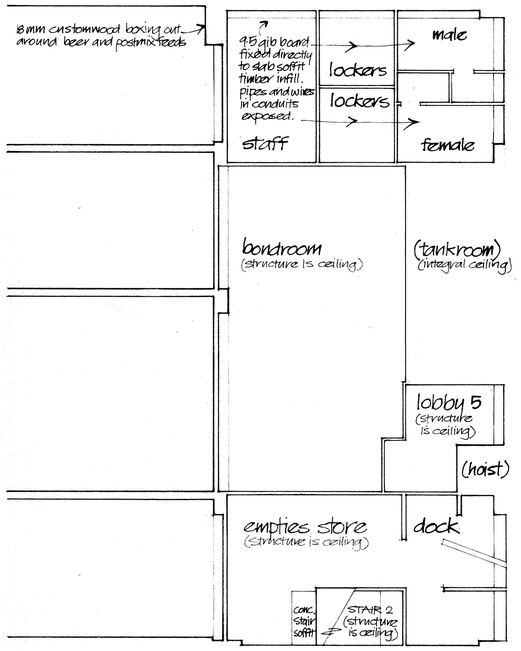
WELLINGTON.

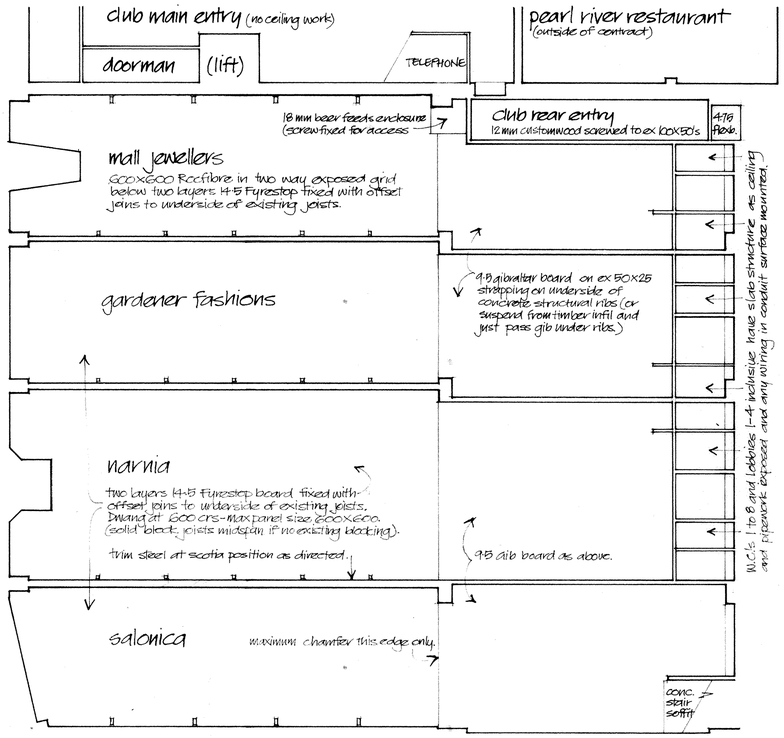
keith wilson architects wellington
telephone 730834
po. box 12321 wellington.

north elevation
west elevation
window schedule

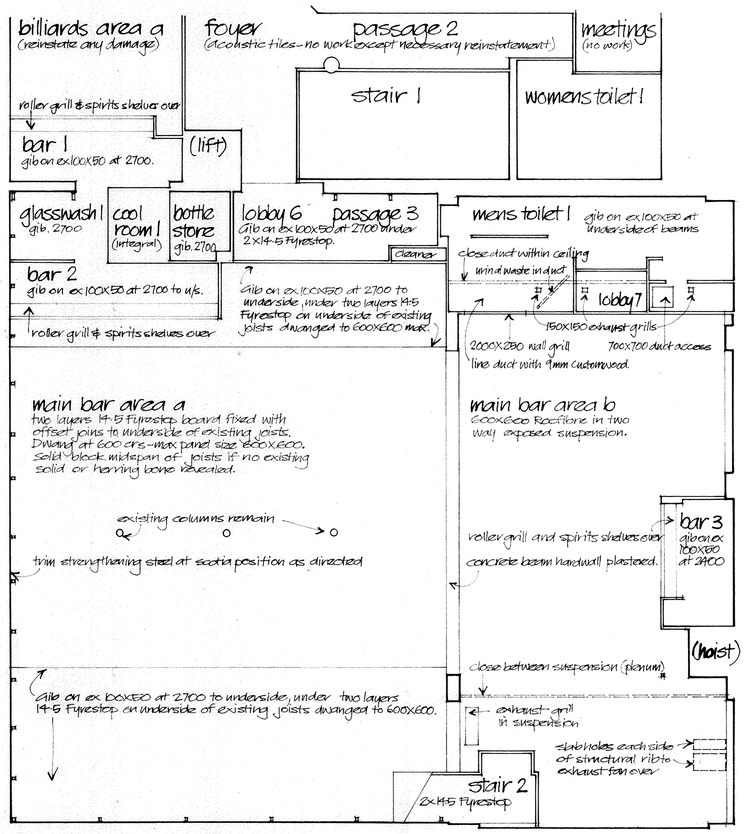
7915aA17



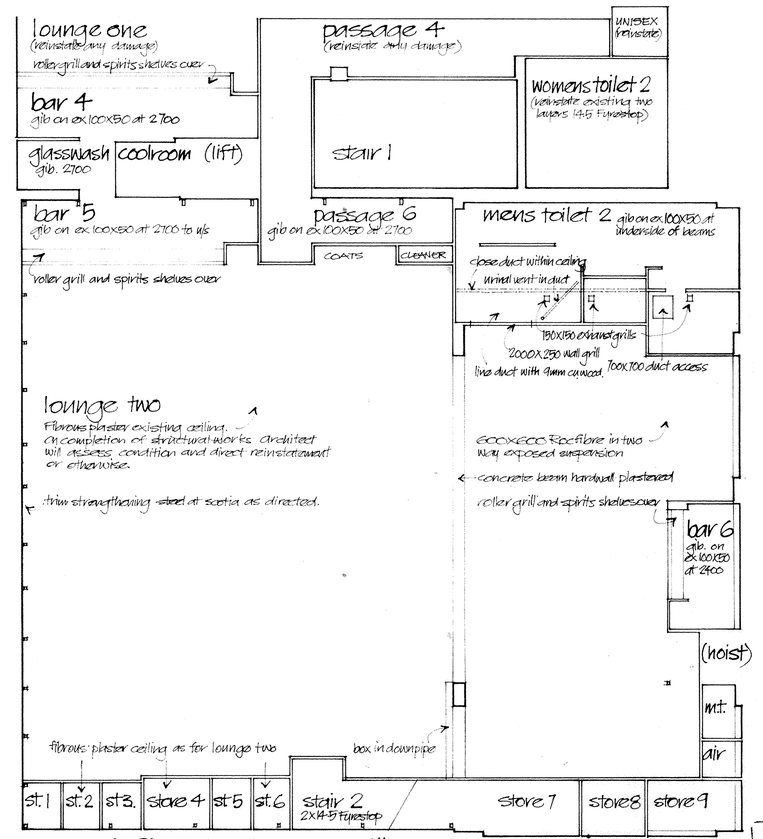
mezzanine reflected ceiling



ground floor reflected ceiling



first floor reflected ceiling



second floor reflected ceiling

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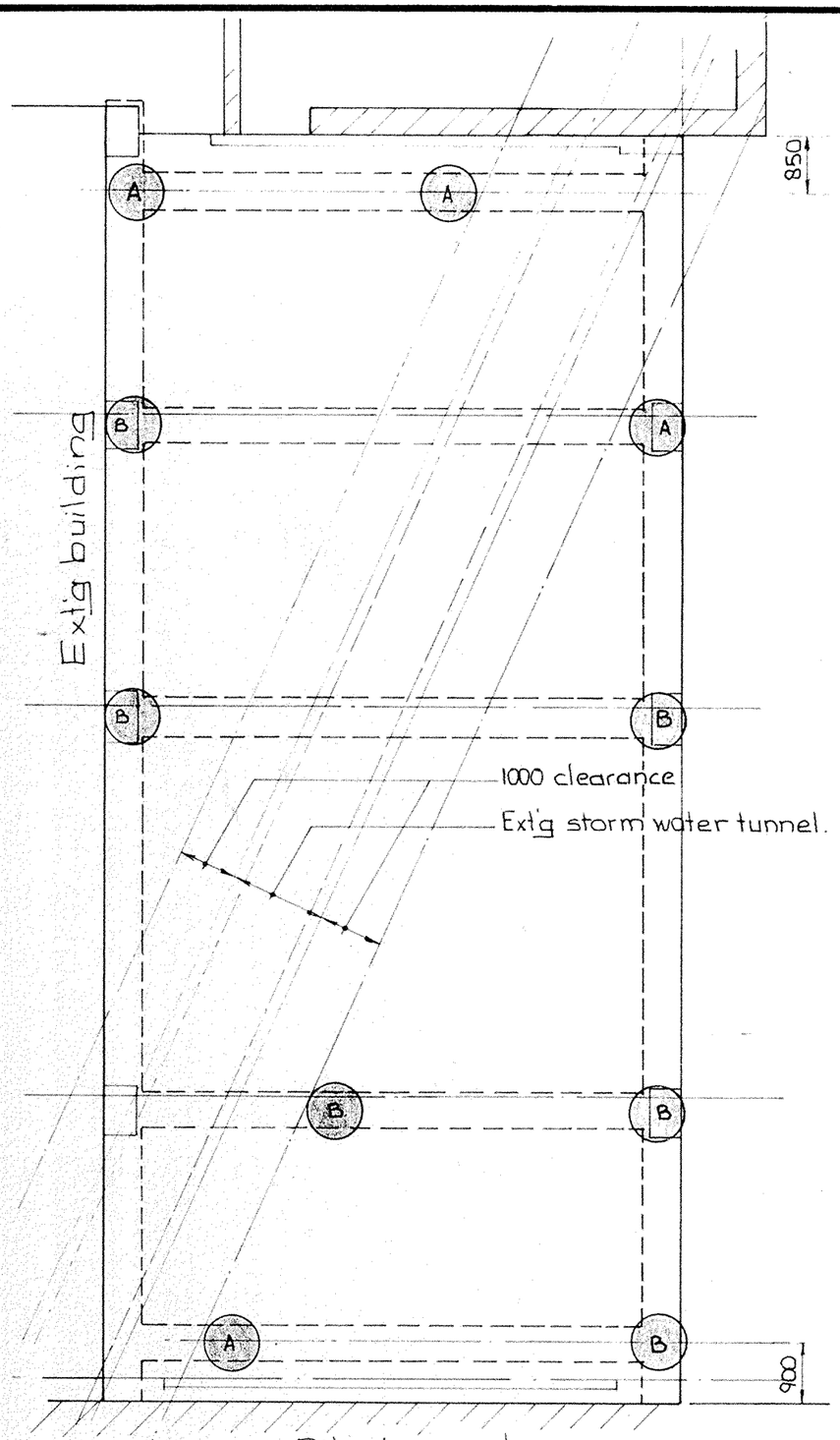
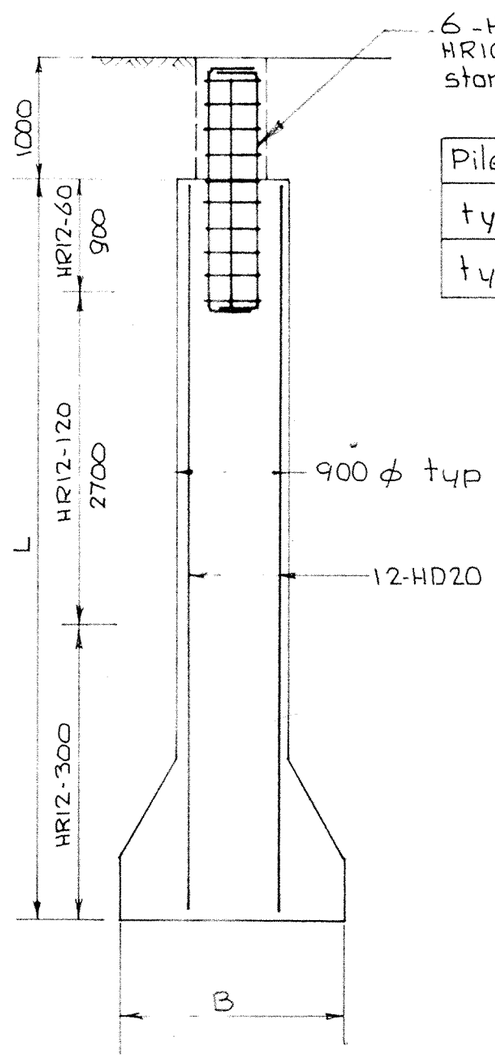
1:100 reflected ceiling plans

7915aA18



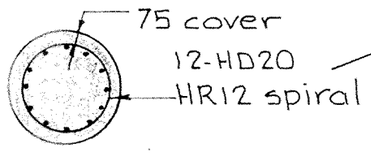
Pile layout



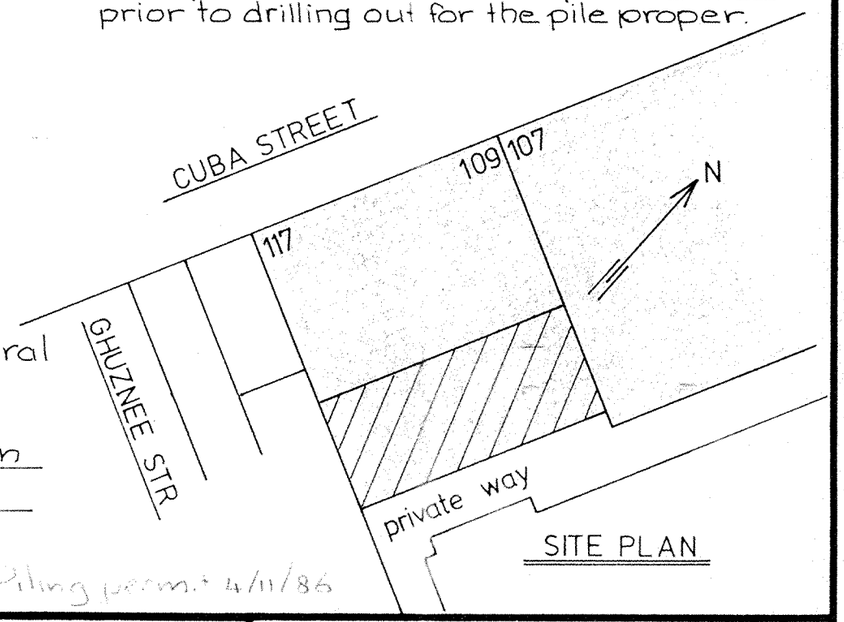
Pile type	L.(mm)	B Bell ϕ
type A	6200	1800
type B	5500	1500

Notes.

1. Concrete strength to be 25 MPa @ 28 days
2. The location of the piles adjacent to the stormwater tunnel may be adjusted following demolition and a more accurate assessment of the tunnel position.
3. Each pile location is to be proof drilled prior to drilling out for the pile proper.



Typ pile section
All piles 900 ϕ



SITE PLAN

Piling perm.: 4/11/86

CONTRACTORS MUST VERIFY ALL DIMENSIONS AT THE JOB BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS WHICH MUST BE SUBMITTED AND APPROVED BEFORE MANUFACTURE

WELLINGTON WORKINGMENS CLUB & LITERARY INSTITUTE
STRENGTHENING AND UPGRADING CUBA ST PREMISSES.

SMITH LEUCHARS LIMITED
CIVIL STRUCTURAL & EARTHQUAKE ENGINEERS
Wellington.
Ph 739-175, P.O Box 10-153

Provisional piling

SCALE 1:100 1 50		DATE Oct' 86.
DRAWN JL	TRACED	DWG No 1868/P1.
CHECKED	APPROVED	

WELLINGTON WORKINGMEN'S CLUB & LITERARY INSTITUTE
STRENGTHENING & UPGRADING STAGE 2

ENGINEERS: SMITH LEUCHARS
ARCHITECT: KEITH WILSON.

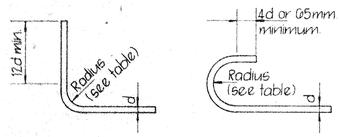
DWG Nº	TITLE
1868/ST 1	STANDARD DETAILS REINFORCED CONCRETE
ST2	STANDARD DETAILS MASONRY.
/1	PILE PLAN
/2	GROUND, MEZZANINE & FIRST FLOOR PLANS
/3	SECOND & THIRD FLOOR PLANS
/4	FOURTH & ROOF LEVEL PLANS
/5	WALL ELEVATION ON GRID E
/6	WALL ELEVATION ON GRIDS B.C & D BELOW 1ST FLOOR.
/7	WALL ELEVATION ON GRID A
/8	" " " " 1
/9	" " " " 5
/10	" " " " 10
/11	SECTION ON GRIDS B & D
/12	CONCRETE STAIR ON GRID A
/13	TYPICAL STEEL CONSTRUCTION. SHEET 1
/14	" " " " 2

BENDS AND ANCHORAGE

BAR SIZE	D BARS	HD BARS	BEAM AND COLUMN TIES (PLAIN ROUND)
D10, D12, D16	2½ d	4 d	Equal to radius of enclosed bar but not less than d except that for ties larger than 20mm dia the minimum radius shall be 2d.
D20, D24	3d	5d	
D28, D32	4d	5d	
D40	5d		
Max. for std. hook	6d	6d	

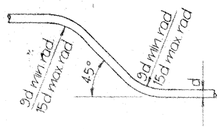
RADII OF BENDS (INSIDE FACE)

Note: d = Diameter of bar being bent.



90 Bend (equiv. std. hook) Standard Hook

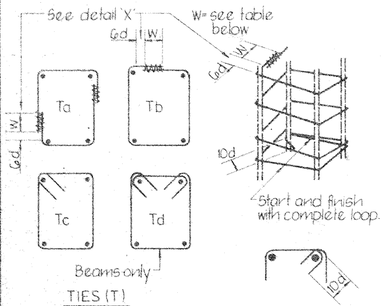
STANDARD END ANCHORAGE



45° CRANK

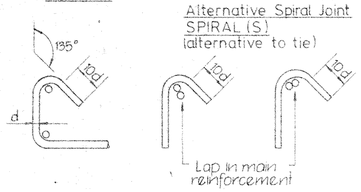
TIES FOR BEAMS AND COLUMNS

Note: 1 First beam tie positioned flush with column face.
2 All ties to be plain round bars.
3 All non welded beam ties to close in top of beams, unless shown otherwise on the drawing.

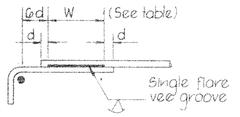


TIES (T)

Alternative Spiral Joint SPIRAL (S) (alternative to tie)



TIE ANCHORAGE



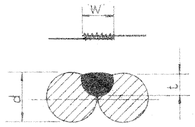
DETAIL 'X'

SINGLE FLARE VEE GROOVE WELD

(for grade 275 steel only)

d	w min	t min
10	50	5
12	75	6
16	105	6·5
20	130	7·5

WELD SIZE (mm)



WELD DETAIL

Note: Alternatively Butt Weld

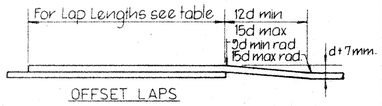
LAP LENGTHS

275 GRADE STEEL

MINIMUM LAP LENGTHS CONCRETE 25 MPa to 30 MPa				
BAR SIZE	Anchorage	BEAMS TOP STEEL	BEAMS STANDARD	COLUMNS & WALLS
10	300	300	300	300
12	300	370	300	340
16	300	480	340	450
20	330	610	430	570
24	480	890	630	820
28	650	1190	850	1110
32	840	1540	1100	1430
40	1320	2410	1720	2250

380 GRADE STEEL

10	300	410	300	380
12	300	510	360	460
16	360	660	470	620
20	460	840	600	790
24	660	1210	860	1130
28	890	1630	1160	1520
32	1170	2150	1530	1990



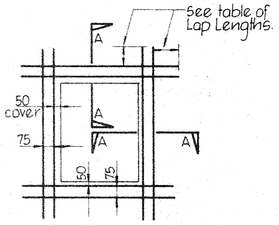
OFFSET LAPS

MINIMUM REINFORCEMENT FOR WALLS 200mm THICK OR LESS

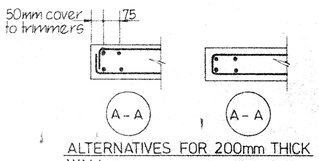
(ALL DIMENSIONS IN MM)

WALL THICKNESS	TRIMMING BARS TO OPENINGS	MIN. WALL REINFORCEMENT
200	2-D12-75 E.F.	D10-300 E.F.
175	2-D16-75 C.	D12-250 C
150	2-D16-75 C	D12-300 C or D10-200 C
100-125	2-D12-75 C	D10-225 C

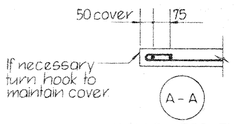
No trimmer bars at sides of openings 300mm or less in length.



ELEVATION OF OPENING

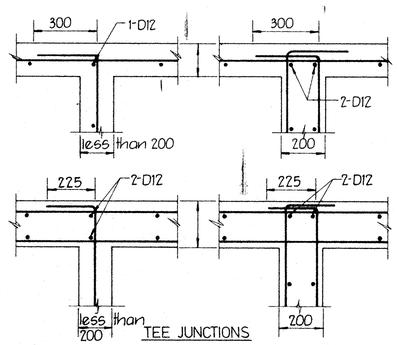


ALTERNATIVES FOR 200mm THICK WALL

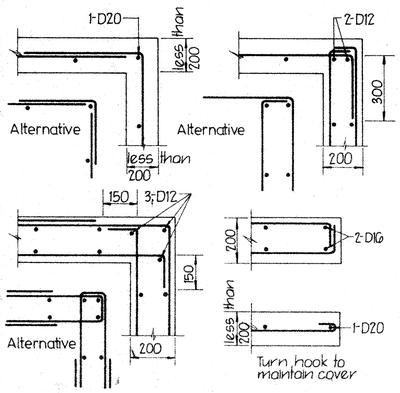


WALLS LESS THAN 200mm

JUNCTIONS & ENDINGS OF WALLS 200mm & LESS WITH MINIMUM REINFORCEMENT



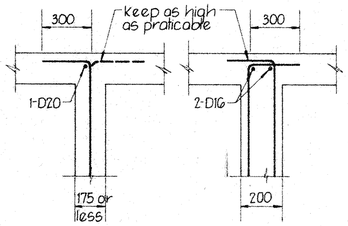
TEE JUNCTIONS

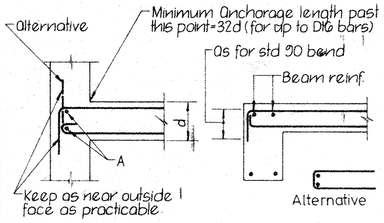


L JUNCTIONS (for Lap Lengths see table)

ENDINGS

SLAB JUNCTIONS WITH EDGE BEAMS & WALLS 200mm THICK OR LESS.





DEPTH OF SLAB 'd'	A
Less than 150	2-D12
150-175	2-D16

COVERS

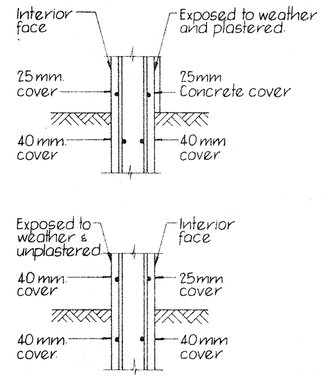
1. Fire Rating may necessitate greater cover than shown.
2. For Reinforcement tolerances see specification.
3. ** Increase by 15mm. where D20 bars or larger are used.

MEMBER	BELOW GROUND LEVEL Cast against Ground	BELOW GROUND LEVEL Against approd boxing or skin
Footings	75	50
Beam and Column (A) Principal reinf.	75	50
(B) Secondary reinf **	65	40
Slabs	50	35
Walls **	50	40

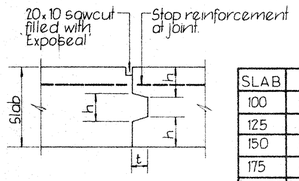
MEMBER	ABOVE GROUND LEVEL Exposed to weather & unplastered	Exposed to weather & plastered	Not exposed to weather
Beam and Column (A) Principal reinf.	50	40	40
(B) Secondary reinf **	40	25	25
Slabs	35	20	20
Walls **	40	25	25

DOUBLE REINFORCED WALL AT GROUND LEVEL

Showing re-arrangement of horizontal bars to obtain extra cover.

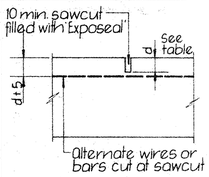


CONSTRUCTION JOINT (C.J.)



SLAB	t	h
100	25	40
125	25	50
150	30	60
175	40	65
200	40	75

CONTRACTION JOINT (S.J.)

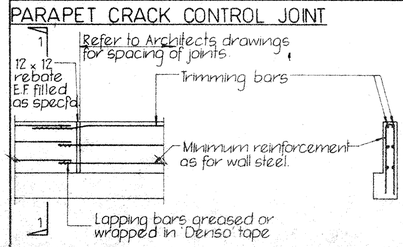


SLAB	d
100	20
125	25
150	30
175	40
200	45

SLAB ON GRADE

Note: Sawcutting for contraction joint to be commenced as soon as possible after concrete has hardened sufficiently to prevent ragged edges with a minimum of 24 hours and a maximum of 3 days after pouring.

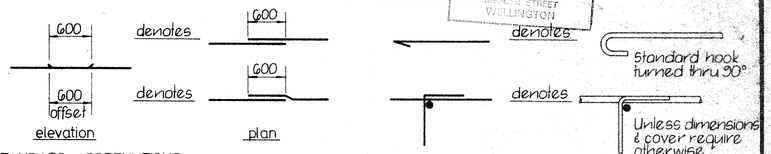
PARAPET CRACK CONTROL JOINT



NOTES

1 PICTORIAL REPRESENTATION OF REINFORCING BARS ON DRAWINGS

(A) PARALLEL AND OFFSET LAPS (B) HOOKS AND BENDS



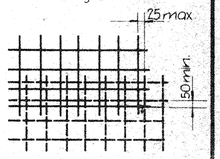
2 STANDARD ABBREVIATIONS

ALT	Alternate	EF	Each Face	R	Plain Round bars
B	Bottom	EW	Each Way	SFL	Structural Floor Level
C	Central	FF	Far Face	STA	Starter
CJ	Construction Joint	FFL	Finish Floor Level	T	Top
d	Nominal bar dia. in mm.	LAR	Lap at Random	TRM	Trimmer
D	Deformed bars	NF	Near Face	VL	Varying Lengths
DPC	Damp Proof Course	NL	No Laps	SJ	Contraction Joint

NB All abbreviations (except 'd') should be shown in upper case printing.

3 REINFORCEMENT NOTATIONS

30-D12-250 denotes 30-12mm dia. deformed bars at 250mm centres.
30-R12-250 denotes 30-12mm dia. plain round bars at 250mm centres.
30-HD12-250 denotes 30-12mm dia. high tensile grade 380 deformed bars at 250 centres.



4 CONCRETE MIX NOTATIONS

20mm C30 denotes 20mm - Maximum aggregate size.
C - Insitu concrete
30 - 28 day compression strength. MPa.
12mm P35 denotes 12mm - Maximum aggregate size.
P - Precast concrete
35 - 28 day compression strength. MPa.

5 IN GROUND SUPPORTED SLABS

welded wire mesh reinforcement to be lapped as shown above

6 SLABS ON GROUND

Shall be poured in alternate panels not exceeding 25 sq.m or 7m on any side with 14 days between adjacent panels. Alternatively sawcut to an approved pattern (see construction & contraction joint details on this sheet.

7 SLABS

Top reinforcement shall be supported by high chairs or other approved methods. Top reinforcement not to be supported on precast blocks.

8 MESH REINFORCEMENT

is designated on the drawings by the pitches of wire in inches followed by respective size of wires
e.g. 665 - Mesh
Pitch of wire in inches — Size of Wires (S.W.G.)
N.B. Mesh Sizes are designated in imperial units because metric sizes are not available.

9 LAPS

Where laps are not shown on the drawings reinforcement in walls and slabs may, if approved be lapped at random in a staggered pattern, bars longer than 3m where length is critical for accurate placing should incorporate one lap.

10 TIMBER GROUNDS

are not to be used without approval where used they are to be at least 20mm. clear of any reinforcing.

11 ANCHOR BOLTS

For stud wall plates etc. to be 12mm diameter minimum embedment 75mm excluding upstands if used. Shot fired fixings only to be used if approved.

12 DEFORMED BARS

The diameters given for deformed bars are nominal only. The actual diameter over deformations is approximately 10% greater than these.

13 WELDS

To be not closer than 6d to bends in reinforcing bars.

GENERAL

1. Check all dimensions on site.
2. Where alternatives are shown on this sheet the Contractor must obtain approval for use of one of these, and shall not change from this without further approval.
3. Current versions of standard specifications to be used.
4. Where applicable this sheet to be read in conjunction with.
   Reinforced masonry
   Structural Steel and timber.
5. Metric dimensioning throughout this set of drawings the following rules apply. A. On dimension Lines all lengths of under one metre are given in millimetres. 420 B. On dimension Lines lengths of one metre and over are 12·420 Given in metres decimalised to three places.
   C. On dimension Lines no length symbols will be shown except
   1. Where whole metres are shown. e.g. 65m
   2. Where decimals of a millimetre are shown e.g. 24·5mm
   D. Descriptions with single measurements have symbols e.g. 250mm centres. E. Descriptions with two or more measurements have no symbols e.g. 900 x 350 beam.
6. Structural drawings to be read in conjunction with the drawings of other specialists. (e.g. Architects, Mechanical, Building Services, Electrical etc.) The Architect must be notified of any discrepancy between structural and other drawings.

NB: Unless otherwise specified or detailed on the drawings these notes & details shall apply but inclusion of this sheet in this contract set does not imply that all details occur in this contract.

Copies	Issued to	Date

SMITH LEUCHARS CONSULTANTS
CIVIL STRUCTURAL & EARTHQUAKE ENGINEERS
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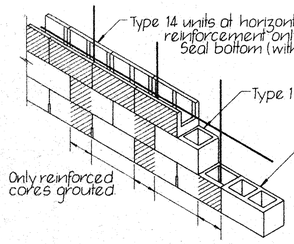
Braemar, 32 The Terrace, Wellington.

JOB TITLE
WELLINGTON WORKINGMENS CLUB & LITERARY INSTITUTE STRENGTHENING AND UPGRADING CUBA ST PREMISES

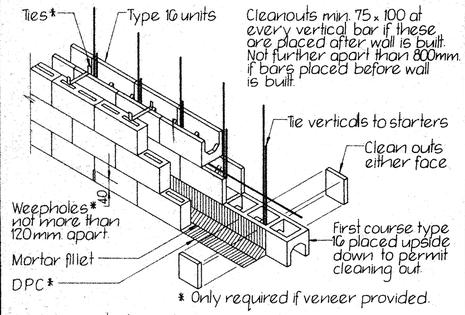
DWG TITLE
STANDARD DETAILS REINFORCED CONCRETE

DRAWN A.M.H.	SCALES
CHECKED J.M.L.	
APP'D J.M.L.	DWG No
DATE Nov. '86.	1868/ST1

TYPICAL CONSTRUCTION

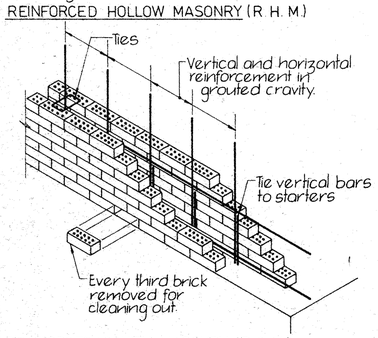


INTERMITTENTLY GROUTED (low lift only)



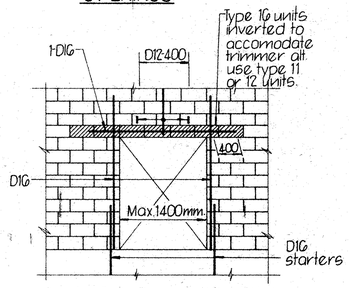
All cells grouted.

REINFORCED HOLLOW MASONRY (R. H. M.)



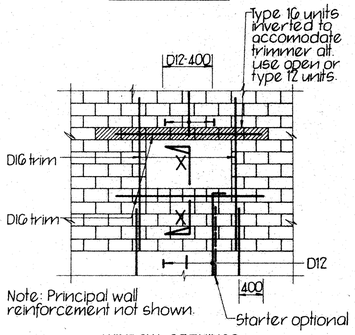
REINFORCED CAVITY MASONRY (R.C.M.)

OPENINGS



Note: Principal wall reinforcement not shown.

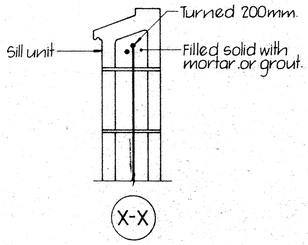
DOOR OPENINGS



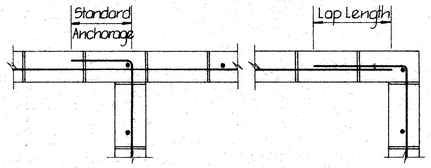
Note: Principal wall reinforcement not shown.

WINDOW OPENINGS

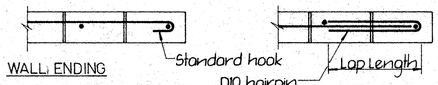
Reinforcement shown for openings of 1400mm max width.



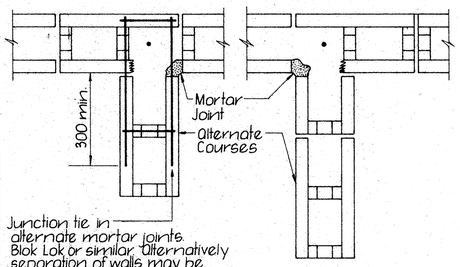
WALL JUNCTIONS



WALL INTERSECTION CORNER DETAIL



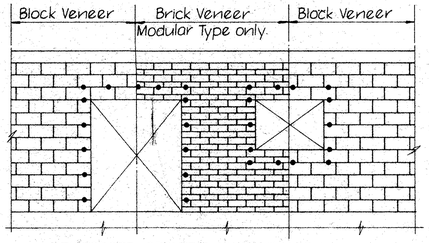
WALL ENDING TYPICAL REINFORCEMENT ALTERNATIVE



TEE JUNCTION CONSTRUCTION

TIE SPACING - VENEER & R.C.M.

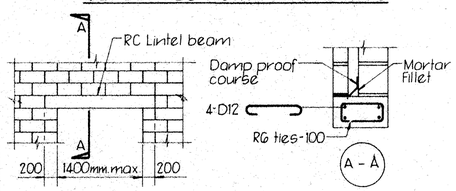
Veneers: Maximum tie spacing: To Timber Wall 600 H x 350 V or 450 H x 400 V. To RC or R.C.M. Wall 600 H or 400 V. But not more than 5 courses in either case.
A horizontal row of ties to be provided at not more than 200mm. above the bottom and below the top of the veneer. Additional ties to be provided around all openings and wall endings in a perimeter band (as shown below) not exceeding 200mm. wide at the same spacing as required elsewhere.



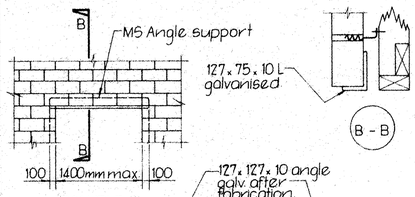
REINFORCED GROUTED CAVITY WALLS

Ties to be provided at maximum of 900mm. horizontally and the lesser of 600mm or 6 courses vertically.

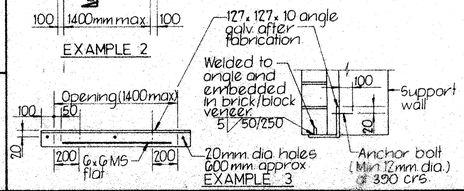
VENEER SUPPORT AT OPENINGS



EXAMPLE 1

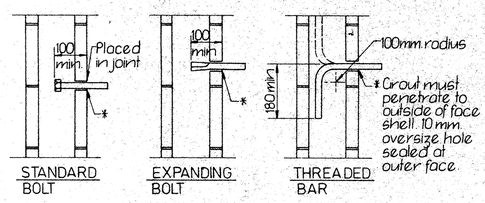


EXAMPLE 2



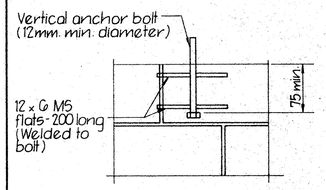
EXAMPLE 3

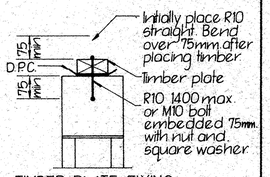
ANCHOR BOLT DETAILS



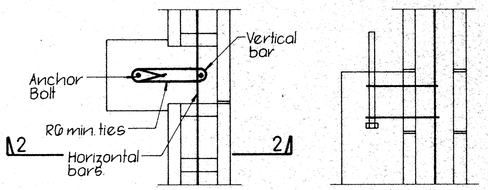
STANDARD BOLT EXPANDING BOLT THREADED BAR

HORIZONTAL BOLTS
(12 mm. diameter minimum) - if supporting floor or Roof stringer, see NZS 3604 for spacings.





TIMBER PLATE FIXING

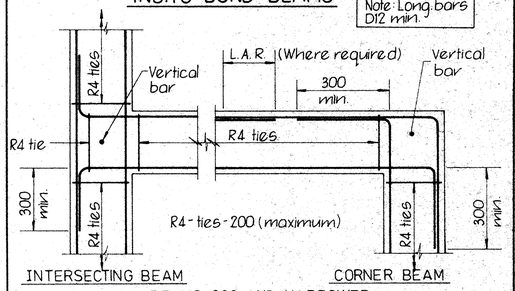


INSITU COLUMN PLAN

VERTICAL BOLTS
(12 mm. dia. min)

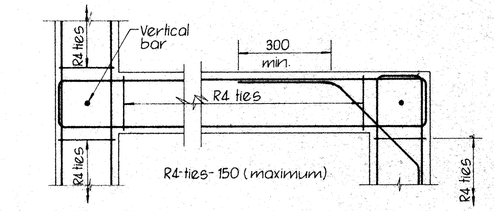
INSITU BOND BEAMS

Note: Long. bars D12 min.



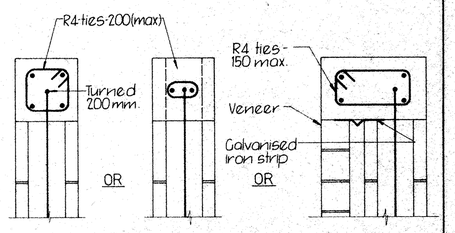
INTERSECTING BEAM CORNER BEAM

BEAMS 200 AND NARROWER



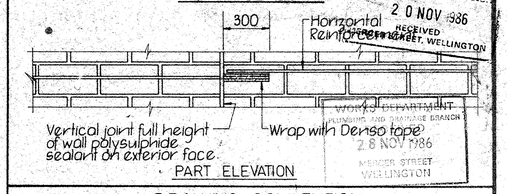
INTERSECTING BEAM CORNER BEAM

BEAMS WIDER THAN 200



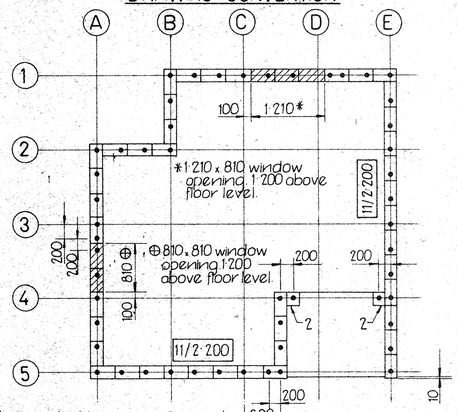
TYPICAL SECTIONS

CONTROL JOINT



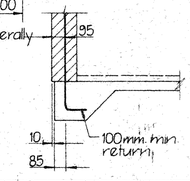
PART ELEVATION

DRAWING CONVENTION



Notes: 1) Vertical bars are D12 except for D16 at wall endings & adjacent to windows. 2) Horizontal bars are generally D12-600. 3) 11/2·200 denotes 11 courses at 200 = 2·200 high.

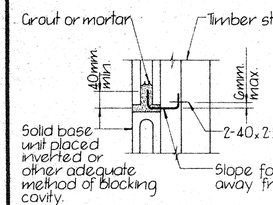
4) Block Sizes: Full Size Unit, 3/4, 1/2, 1/4



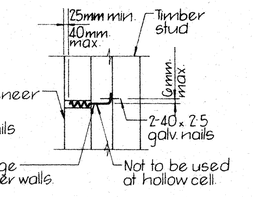
GENERAL NOTES

1. Reinforcement.
   All bars to be of deformed grade 275 steel. Lap Length 40 D minimum starters to project 40D minimum. Vertical reinforcement to be placed centrally in cell. Placement tolerance ± 25mm. Longitudinally ± 6mm. Laterally. Place horizontal bars alternately each side of vertical bars, except at corners where always outside. Notations: - D12-12mm diameter deformed bar. - R6-6mm diameter plain round bar. - L.A.R. - Lapped at random in a staggered pattern. Minimum reinf. in R.M. Walls to be D12-600 horizontally and vertically.
2. The forming of chases, recesses, or the embedment of timber grounds, pipes and electrical conduit require the approval of the site supervisor.
3. Construction to be "all cells filled" unless otherwise approved. Minimum grout strength 17·5 MPa at 28 days. Minimum mortar strength 12·5 MPa at 28 days.
4. Definitions: R.H.M. - reinforced hollow masonry. R.C.M. - Reinf. cavity masonry. R.M. - reinf. masonry masonry. R.C. - reinf. concrete masonry.
5. Unit types are referred to by standards numbers allocated by the NZ concrete masonry association eg. Type 10 = open end bond beam unit.
6. This sheet to be read in conjunction with specification and drawings.

CAVITY TIES & ANCHORAGES: EXAMPLES

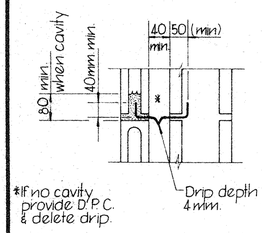


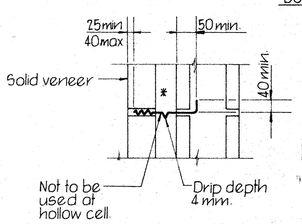
I FLAT TIE - TIMBER SUPPORT WALL WITH CAVITY



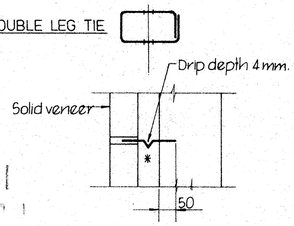
II FLAT TIE - TIMBER SUPPORT WALL WITH CAVITY

Ties:
A) Ties to conform to masonry veneer specification. Approval to be obtained for ties & anchorages in all cases.
B) Ties to be of stainless steel or galv. mild steel.
C) Single leg ties to be of at least 4·75mm. dia. rods or 25 x 1·5 MS flat.
D) Double leg ties to be at least 4mm. dia. rod.
E) Ties to have minimum 25mm. cover from veneer face.
F) For R.C.M. use double leg-tie-drip may may be deleted.





DOUBLE LEG TIE



Note: Brick Veneer units to be modular with RHM support walls.

III FLAT TIE RC OR RM SUPPORT WALL WITH OR WITHOUT CAVITY

IV FLAT TIE RC OR RM SUPPORT WALL WITH OR WITHOUT CAVITY

V WIRE TIE RC OR RM SUPPORT WALL WITH OR WITHOUT CAVITY

NB. Unless otherwise specified or detailed on the drawings, these notes and details shall apply but inclusion of this sheet (200/2) in this contract set does not imply that all details occur in this contract.

SMITH LEUCHARS CONSULTANTS
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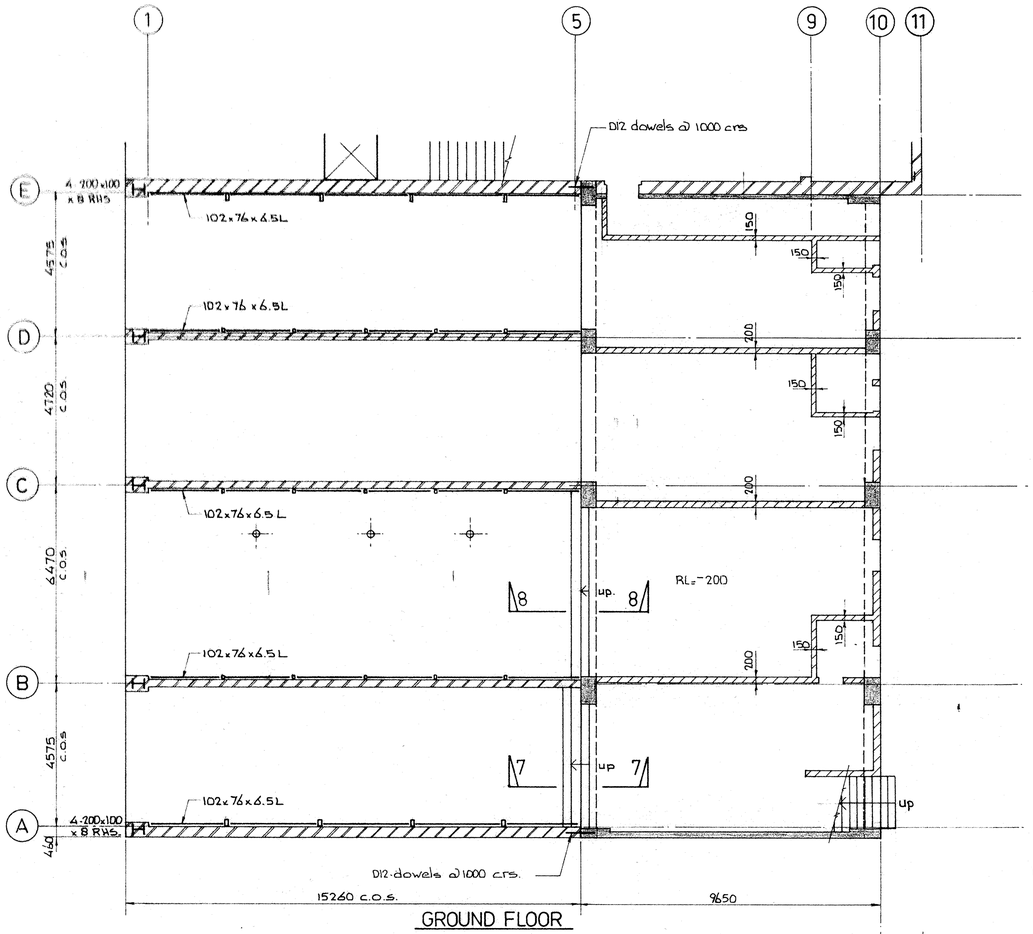
Braemar, 32 The Terrace, Wellington.

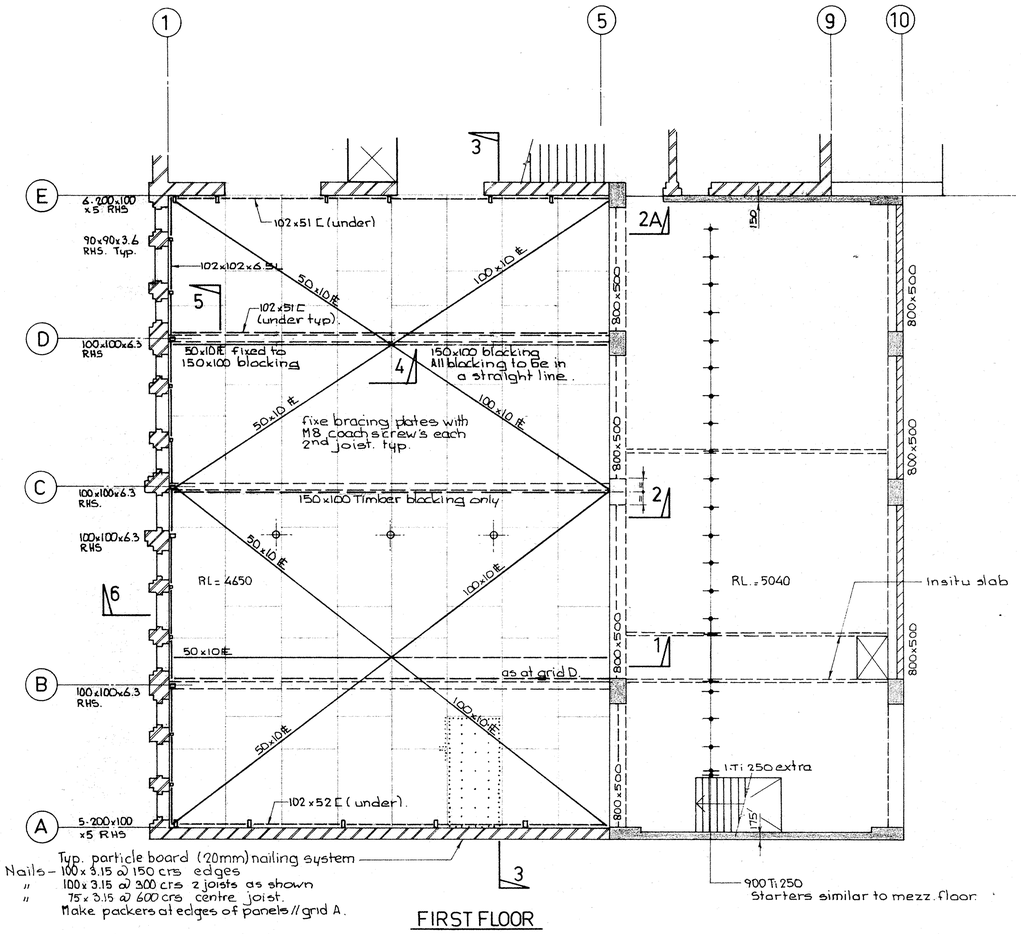
JOB TITLE
WELLINGTON WORKINGMENS CLUB & LITERARY INSTITUTE STRENGTHENING AND UPGRADING CUBA ST. PREMISES.

DWG TITLE
STANDARD MASONRY DETAILS

DRAWN A.M.H.	SCALES
CHECKED J.M.L.	
APP'D J.M.L.	DWG No
DATE Nov. '86	1868/ST2

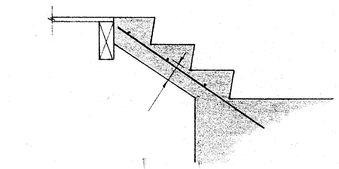


GROUND FLOOR

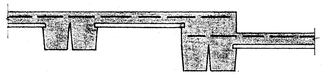


Typ. particle board (20mm) nailing system
Nails – 100x3.15 @ 150 crs edges
" 100x3.15 @ 300 crs 2 joists as shown
" 75x3.15 @ 600 crs centre joist.
Make packers at edges of panels // grid A.

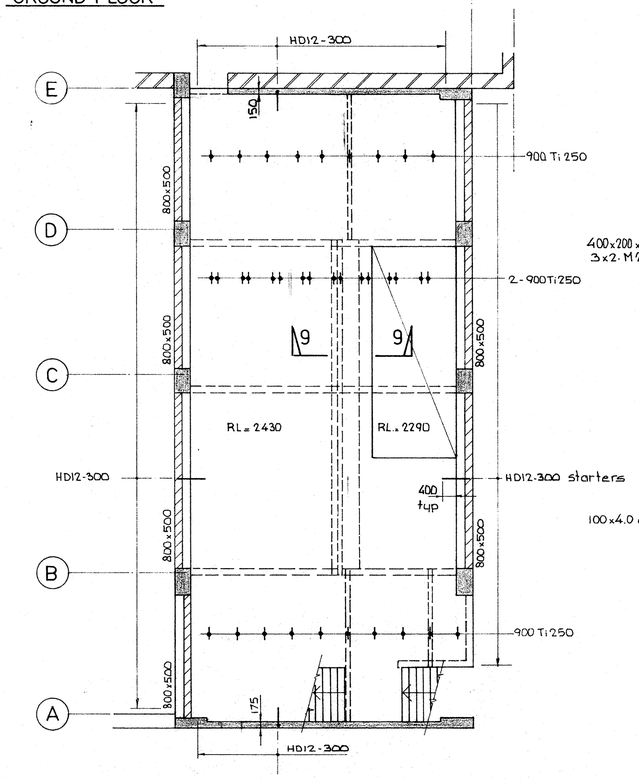
FIRST FLOOR



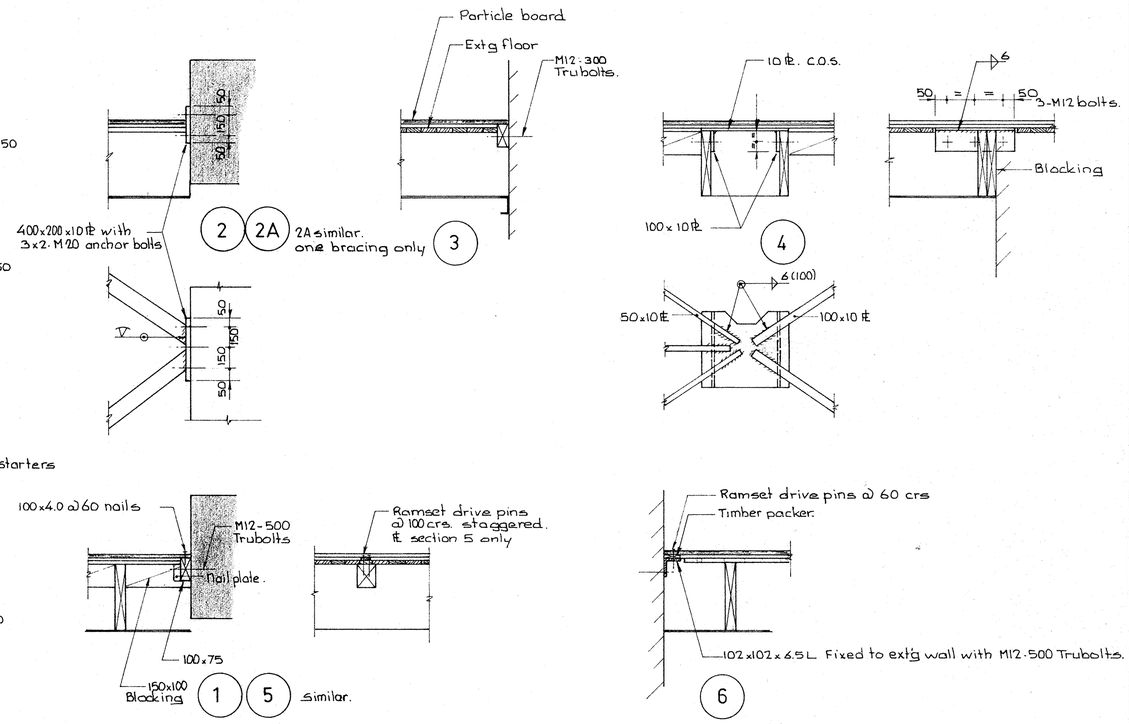
7–7 8–8 similar 2 risers only.



9–9



MEZZANINE FLOOR



2 2A 2A similar. one bracing only 3 4 1 5 similar. 6

CONTRACTORS MUST VERIFY ALL DIMENSIONS AT THE JOB BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS WHICH MUST BE SUBMITTED AND APPROVED BEFORE MANUFACTURE.

ISSUE	AMENDMENT	BY	DATE

WORKS DEPARTMENT PLUMBING AND DRAINAGE BRANCH RECEIVED 28 NOV 1986 WELLINGTON

NOTES:

1) Concrete strength to be 25 MPa at 28 days.
2) Check all dimensions on site.
3) All welds 6mm fillet welds all round unless noted otherwise.
4) Welder to be in possesion of an approved extinguisher at all times while site welding.

WORK DEPARTMENT BUILDING INSPECTION BRANCH 20 NOV 1986 RECEIVED MANAGER STREET, WELLINGTON

COPIES	ISSUED TO	DATE
4	2-KC46. 2-WCC	11/11/86
	Piling permit	6/11/86

SMITH LEUCHARS LIMITED

CIVIL STRUCTURAL & EARTHQUAKE ENGINEERS

Wellington: Ph. 857-809 P.O. Box 27349

Auckland: Ph. 399-614 P.O. Box 6324

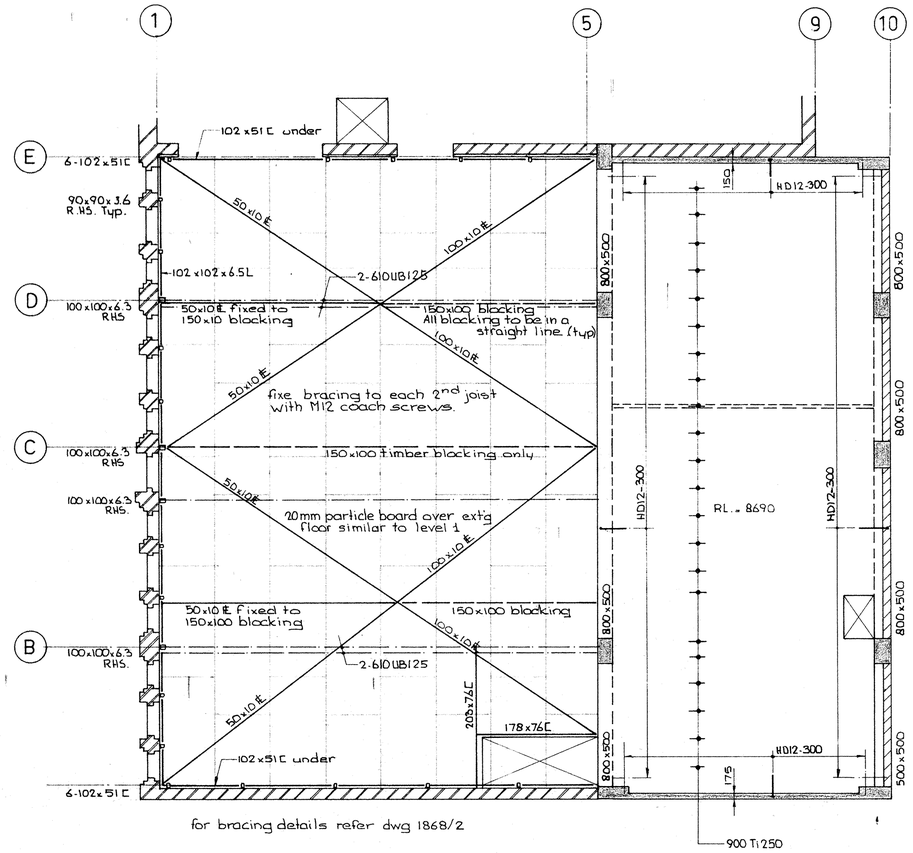
Hamilton: Ph. 82760 P.O. Box 753

JOB TITLE
WELLINGTON WORKINGMENS CLUB & LITERARY INSTITUTE STRENGTHENING AND UPGRADING CUBA ST PREMISES

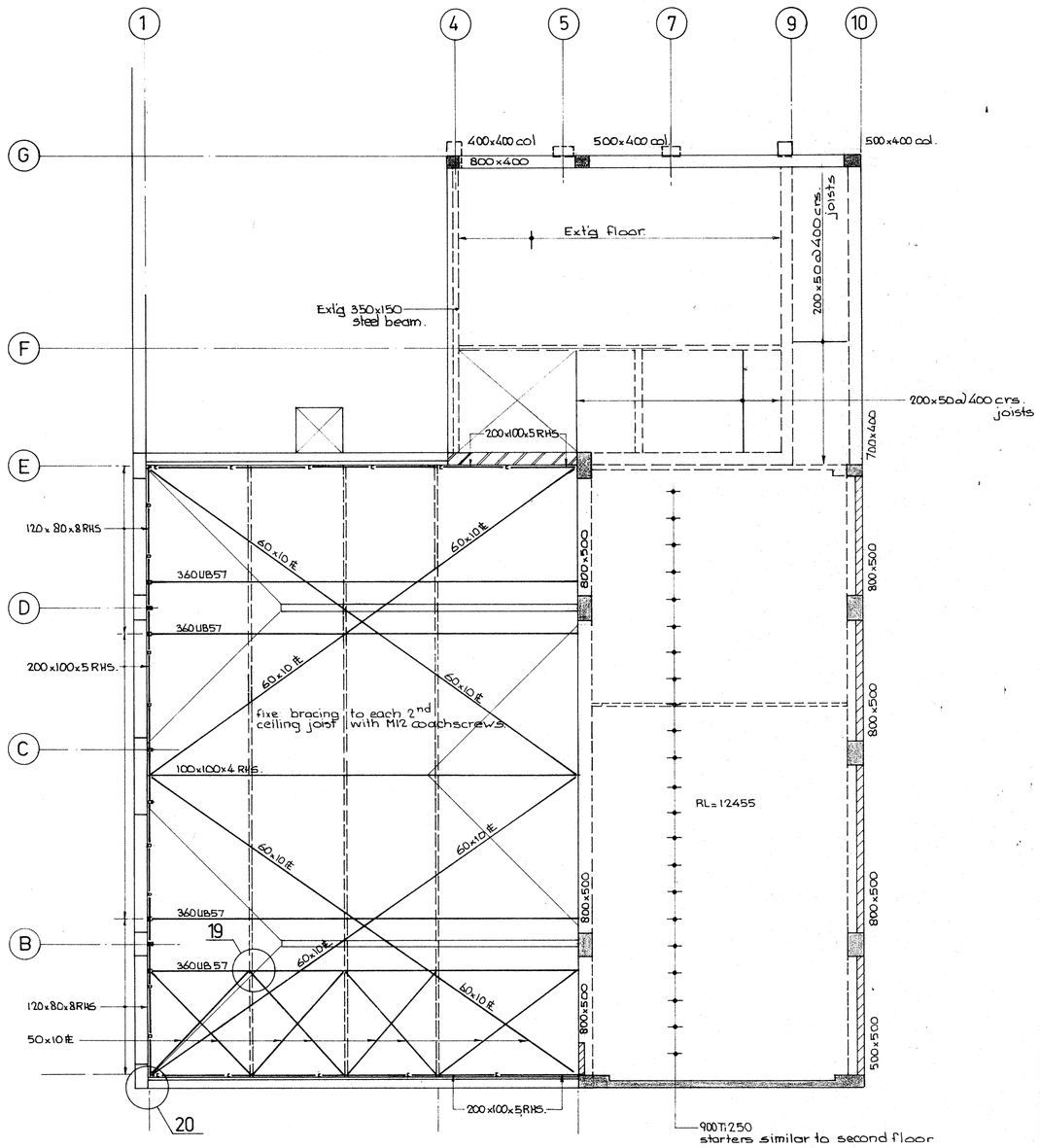
DWG TITLE
GROUND, MEZZANINE & FIRST FLOOR PLANS

WORKS DEPARTMENT BUILDING INSPECTION BRANCH 20 NOV 1986 RECEIVED MANAGER STREET, WELLINGTON

DRAWN J.v.d.L.	SCALES 1:100
CHECKED	
APP'D	DWG Nº 1868/2
DATE Nov. '86	



SECOND FLOOR



THIRD FLOOR

CONTRACTORS MUST VERIFY ALL DIMENSIONS AT THE JOB BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS WHICH MUST BE SUBMITTED AND APPROVED BEFORE MANUFACTURE.

ISSUE	AMENDMENT	BY	DATE

WORKS DEPARTMENT PLUMBING AND DRAINAGE BRANCH RECEIVED 28 NOV 1986 MERCER STREET WELLINGTON

For general notes refer dwg 1868/2.

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DWG TITLE
SECOND & THIRD FLOOR

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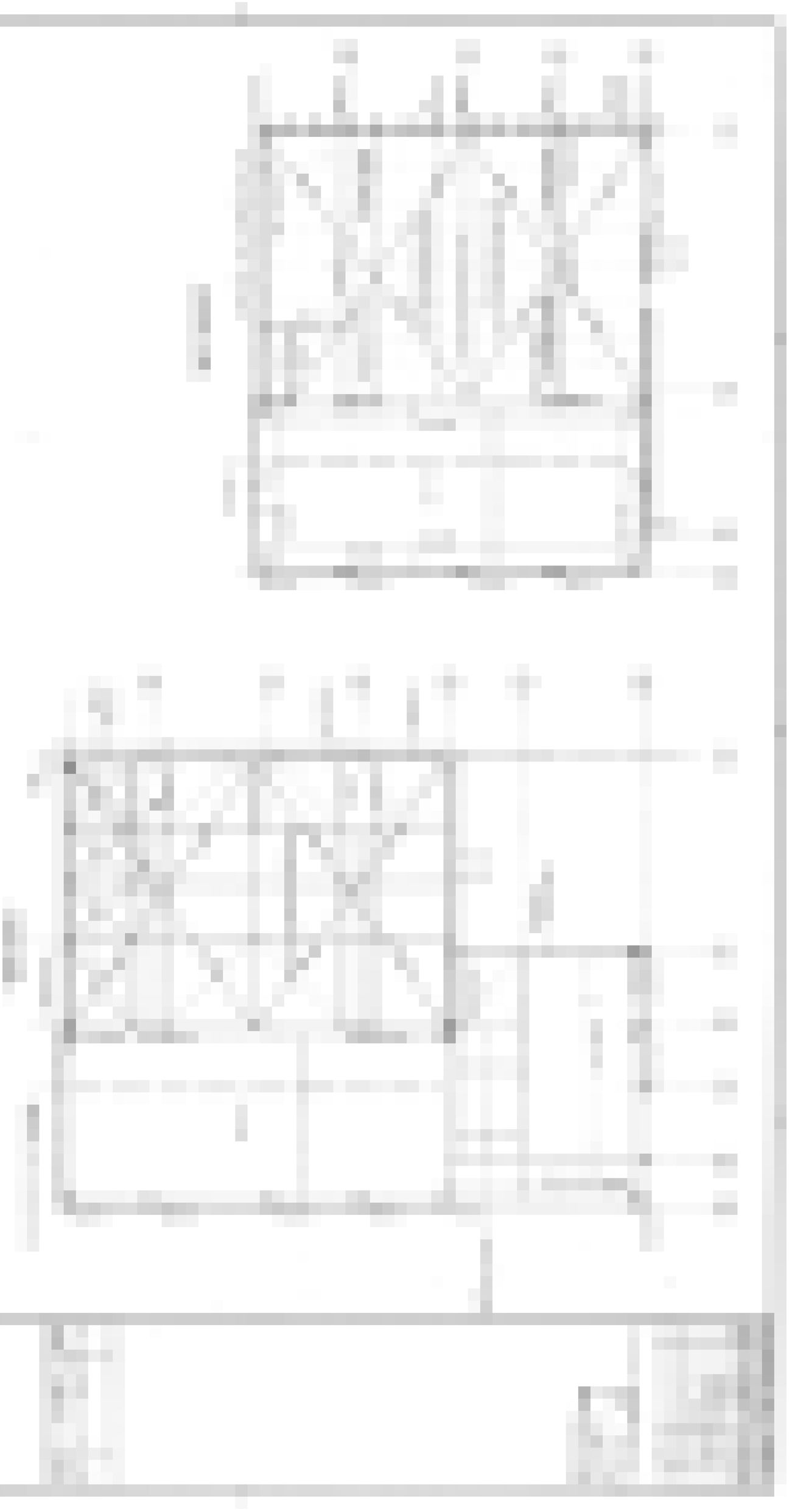
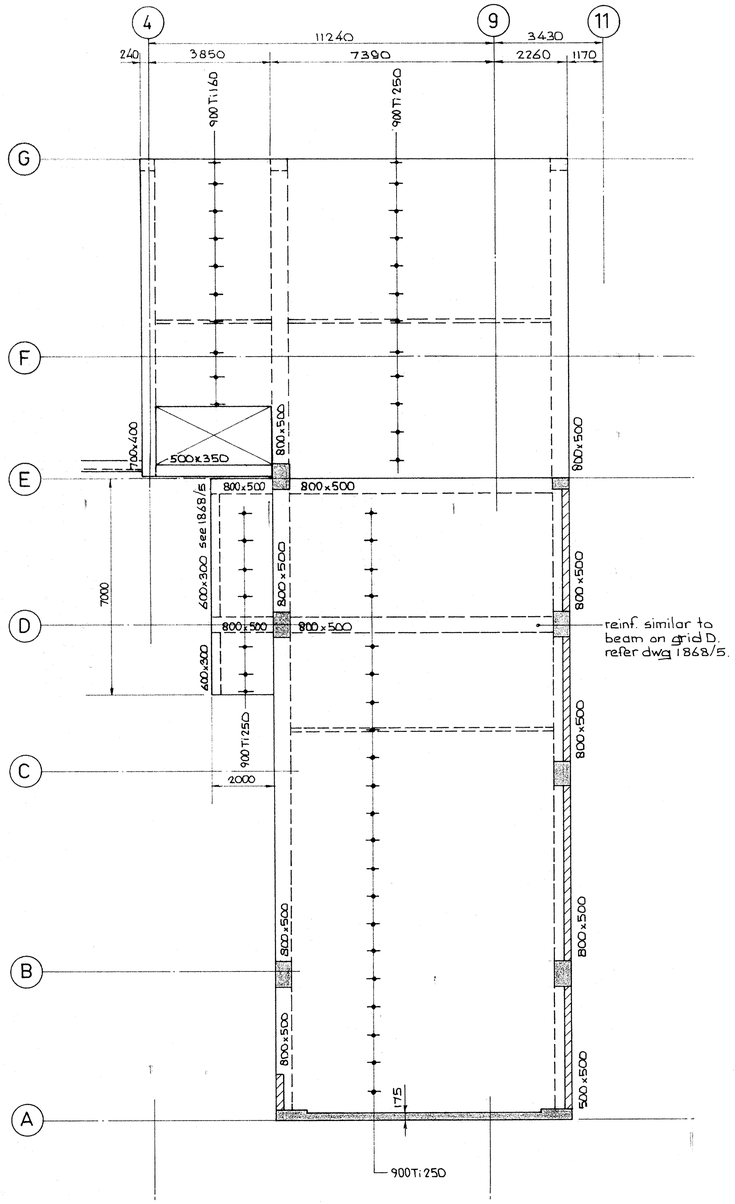
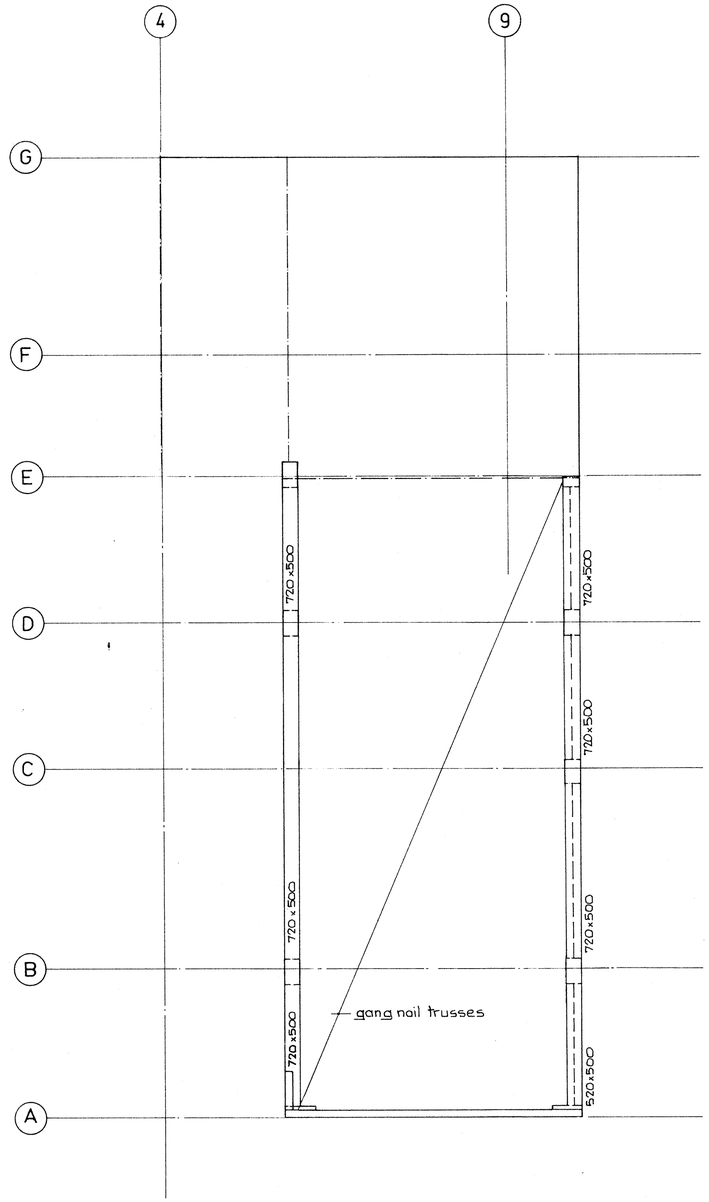




FOURTH LEVEL



ROOF LEVEL

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ISSUE	AMENDMENT	BY	DATE

WORKS DEPARTMENT PLUMBING AND DRAINAGE BRANCH RECEIVED 28 NOV 1986 MERCER STREET WELLINGTON

For general notes refer dwg 1868/2.

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DWG TITLE

FOURTH & ROOF LEVEL

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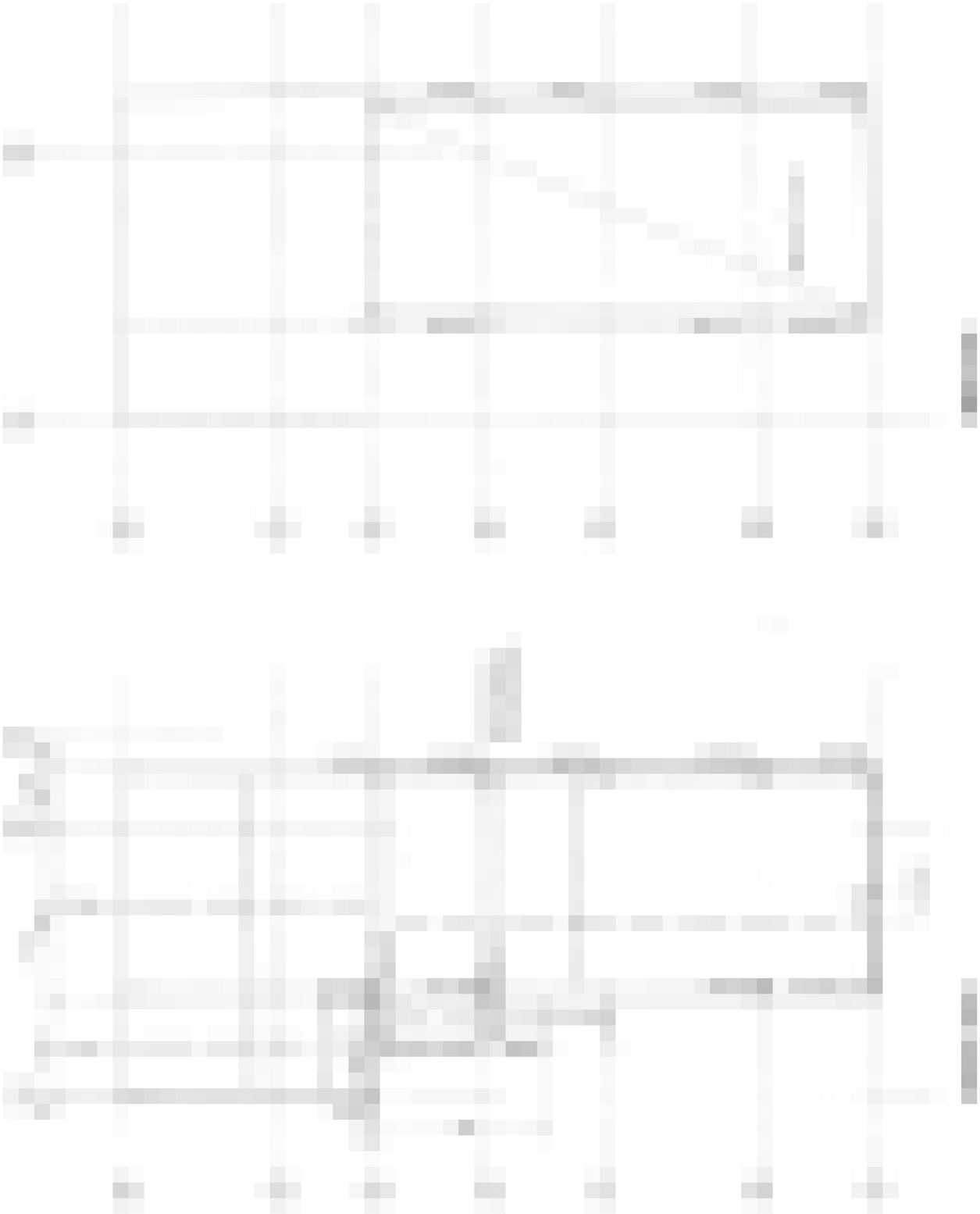
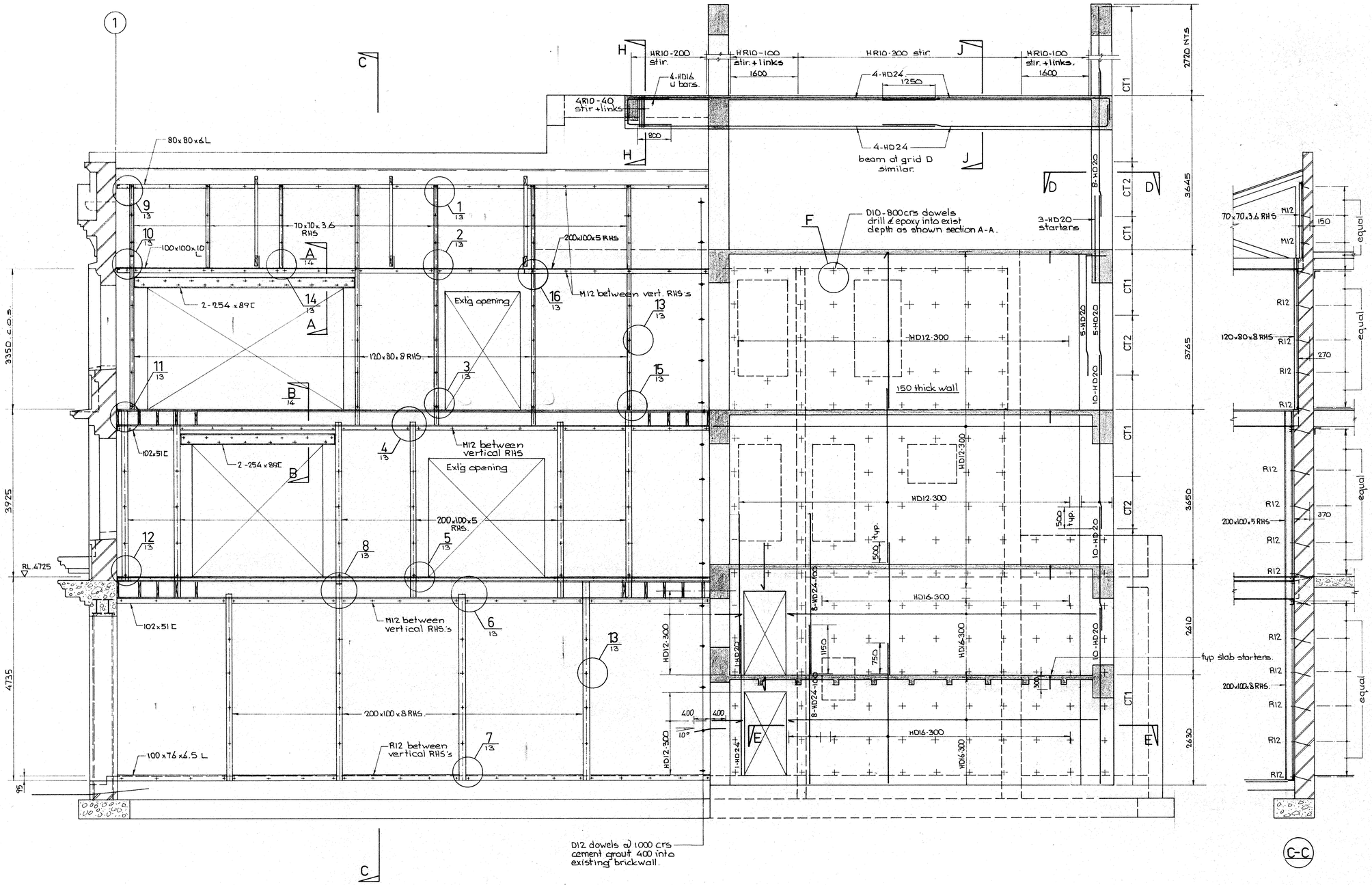
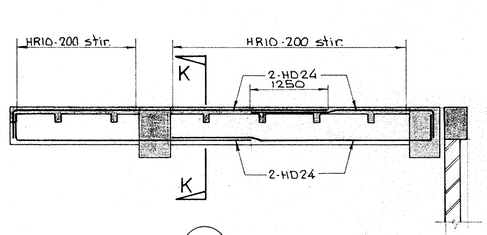
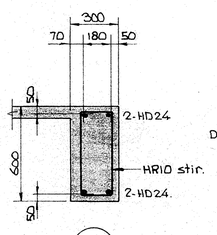
APP'D	DWG Nº 1868/4
DATE Nov. '86	







(H-H) Beam on grid 5



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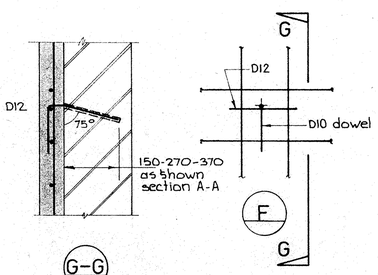

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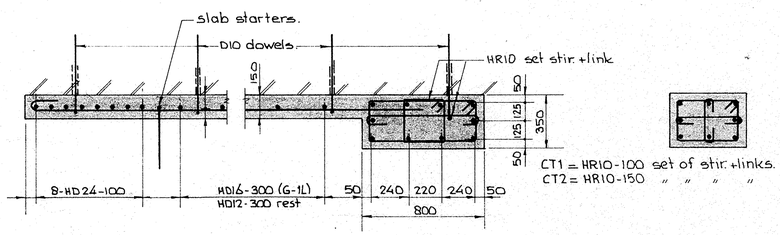
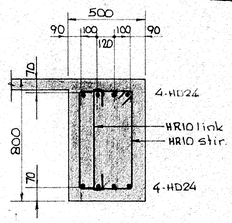


(E-E)

(D-D)

(C-C)



(J-J)

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DWG TITLE

WALL ELEVATION ON GRID E

WORKS DEPARTMENT BUILDING INSPECTION BRANCH 20 NOV 1986 RECEIVED MERCER STREET, WELLINGTON

DRAWN J.v.d.L	SCALES 1:50 1:20
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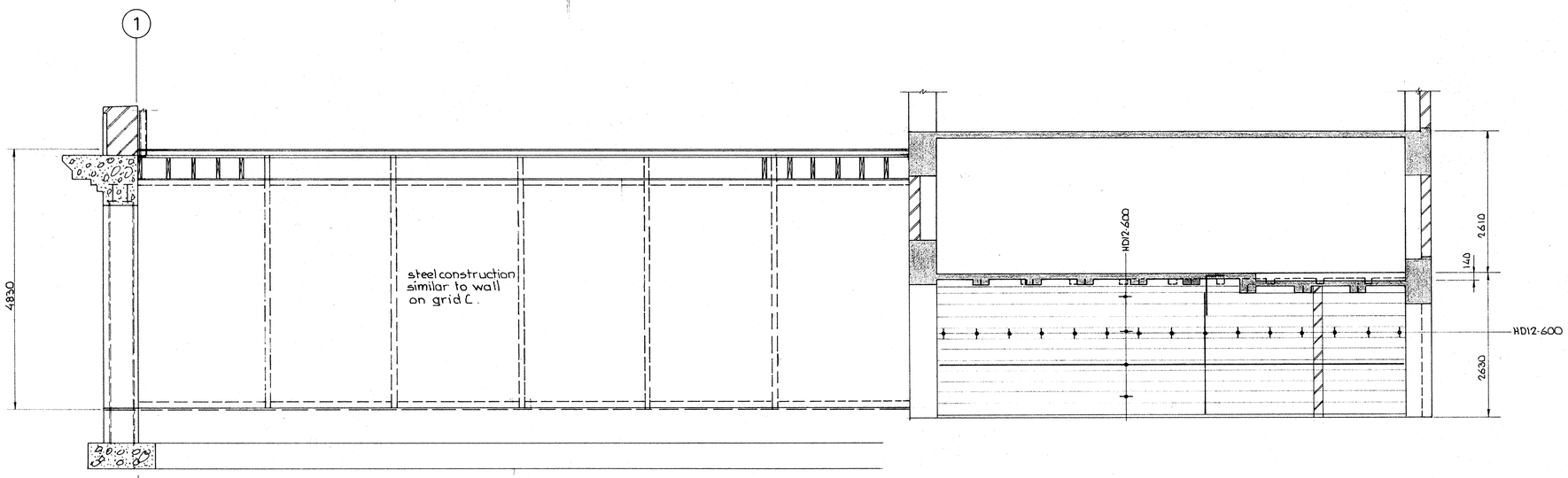
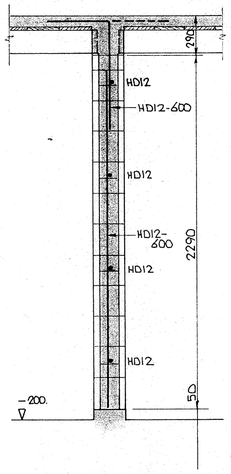
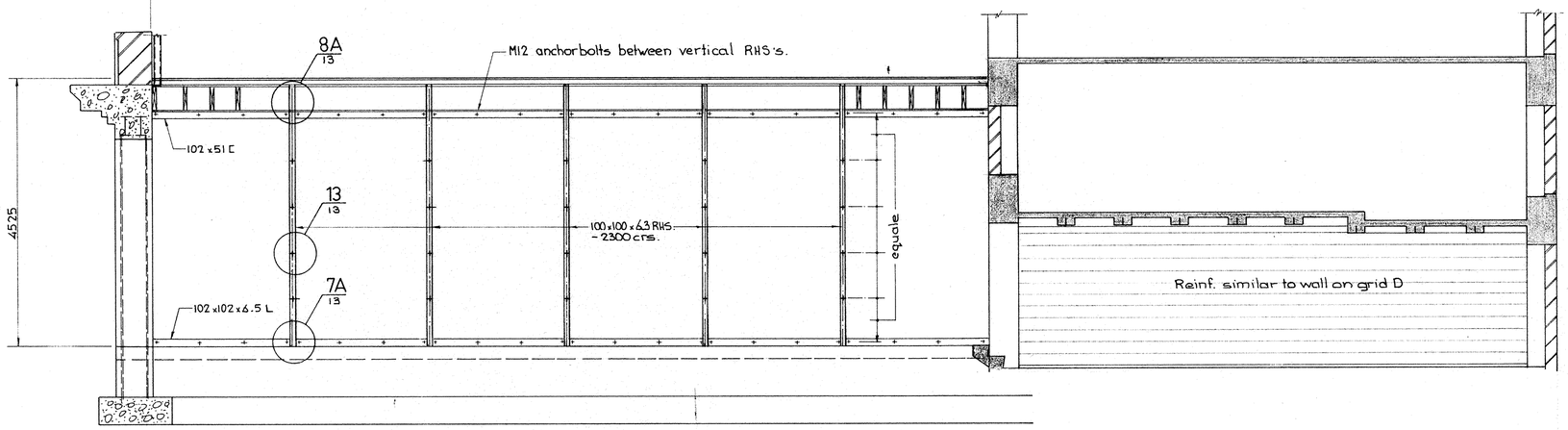
APP'D	DWG Nº 1868/5
DATE Nov. 86	



SECTION ON GRID D



TYP. BLOCK WALL SECTION.
200 BLOCKS



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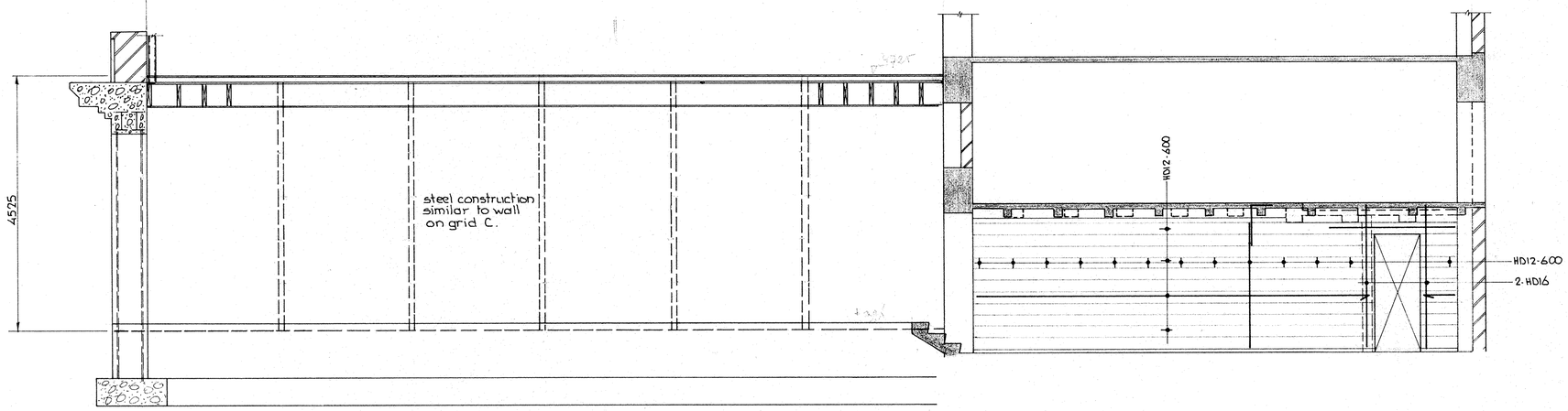

SECTION ON GRID B

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DWG TITLE
WALL ELEVATION ON GRIDS B, C & D.

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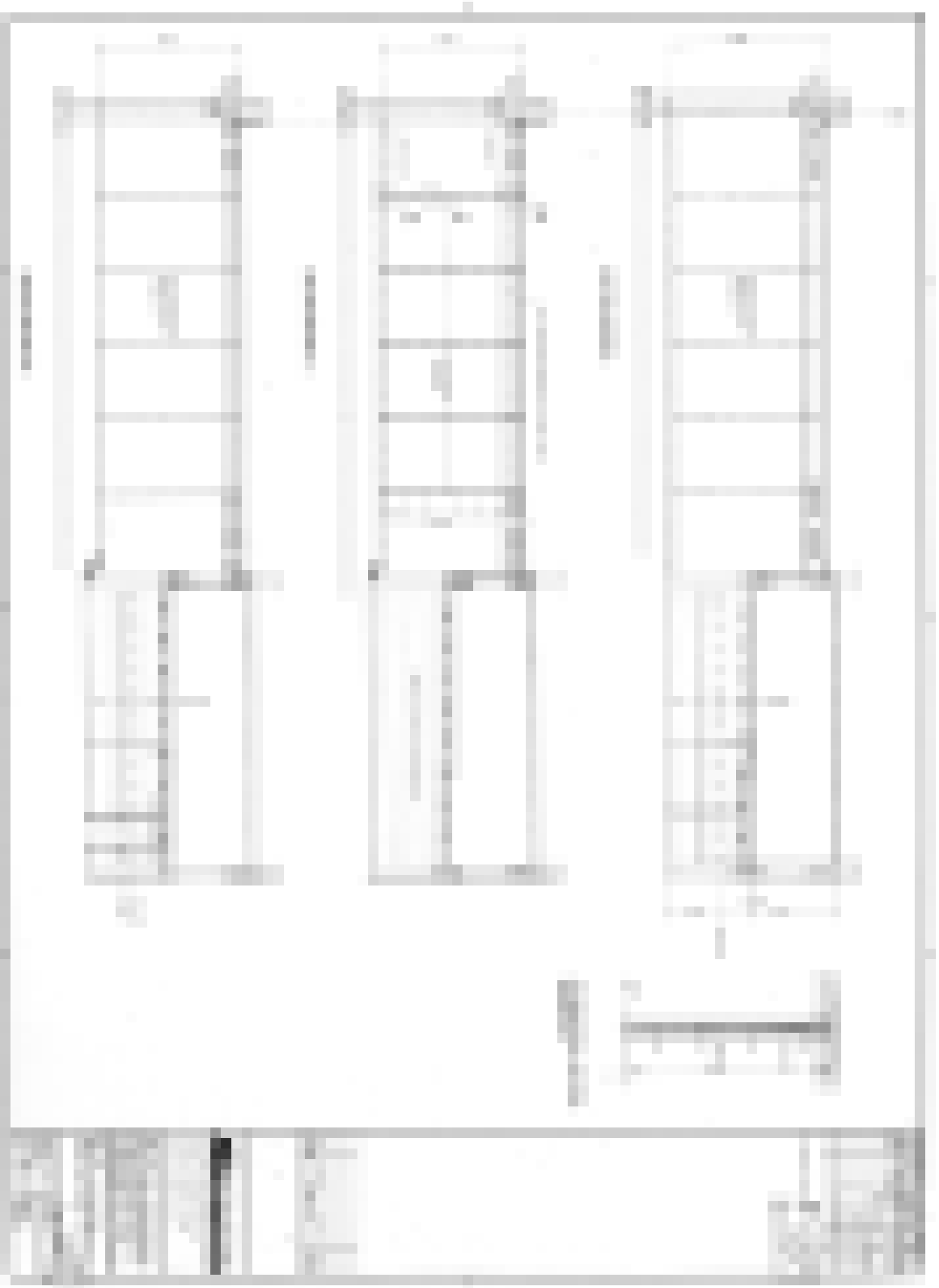
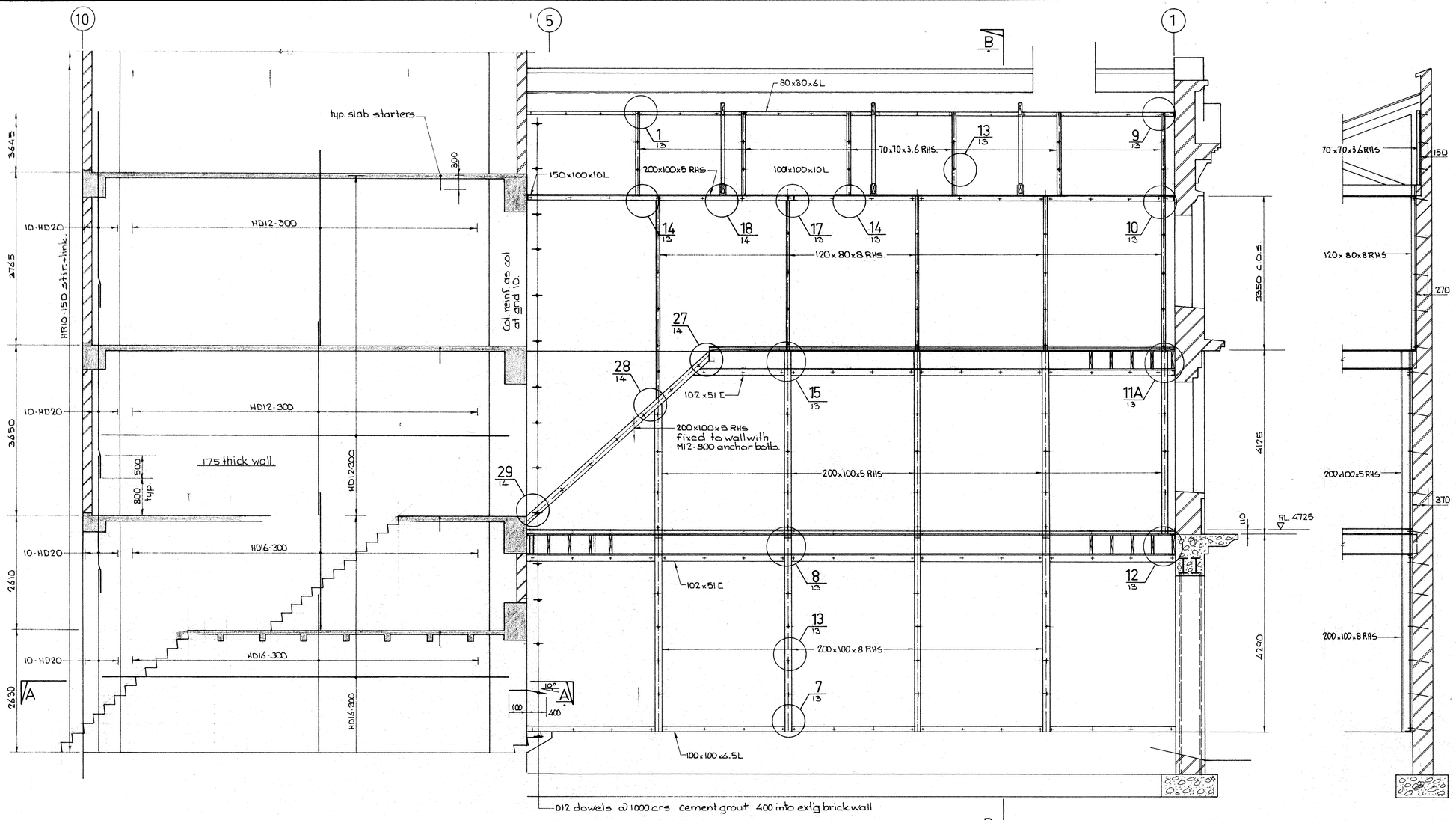
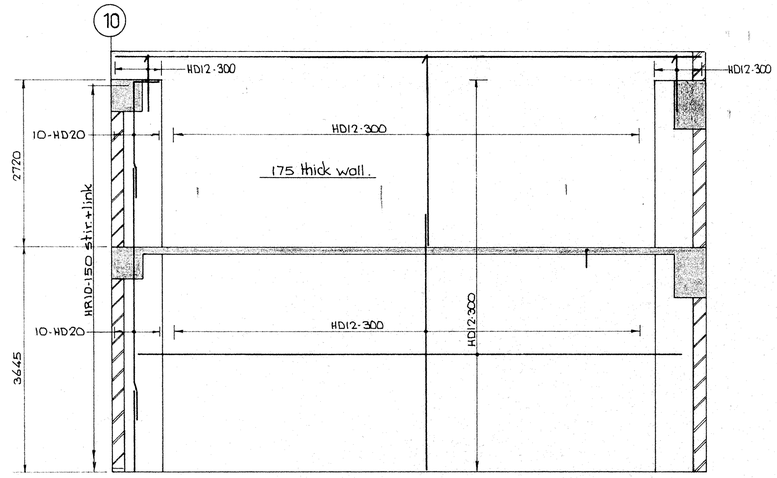
DRAWN J.v.d.L	SCALES 1:100 1:20
CHECKED	
APP'D	DWG Nº 1868/6
DATE NOV '86	

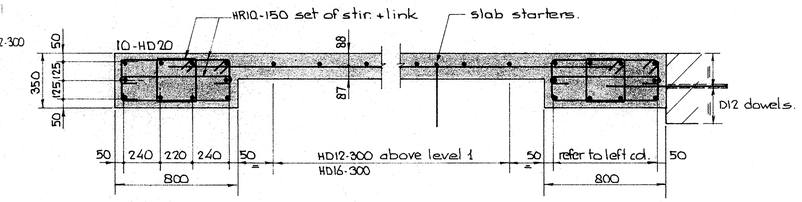




WALL ELEVATION ON GRID A fixing of steel member to brickwall similar to wall on grid E.



WALL ELEVATION ON GRID A
ABOVE LEVEL 3



A-A

B-B

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DWG TITLE
WALL ELEVATION ON GRID A

DRAWN J.v.d.L.
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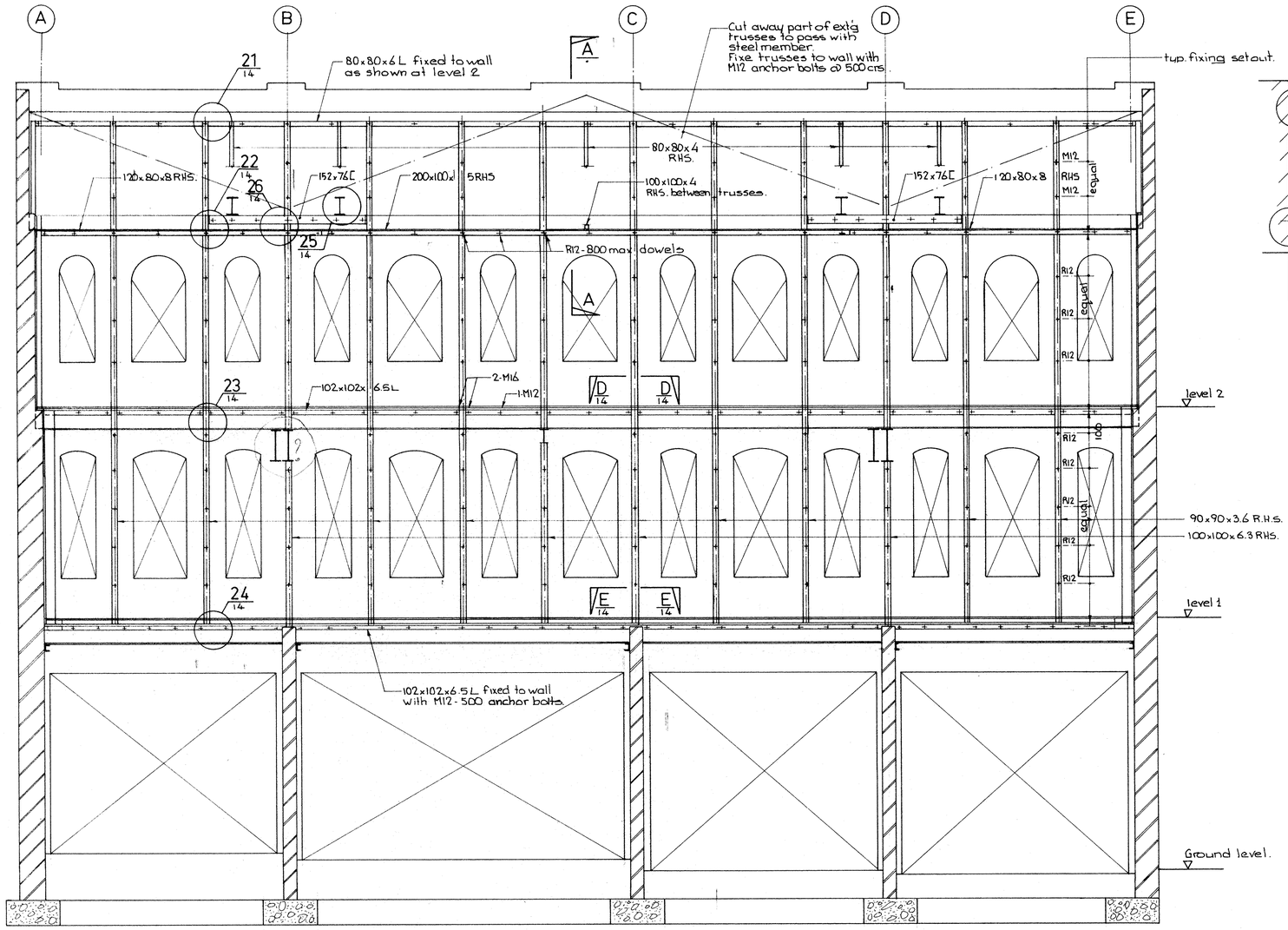
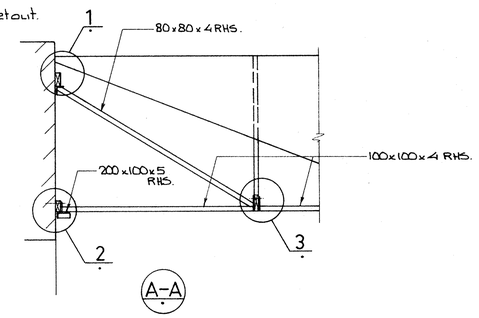
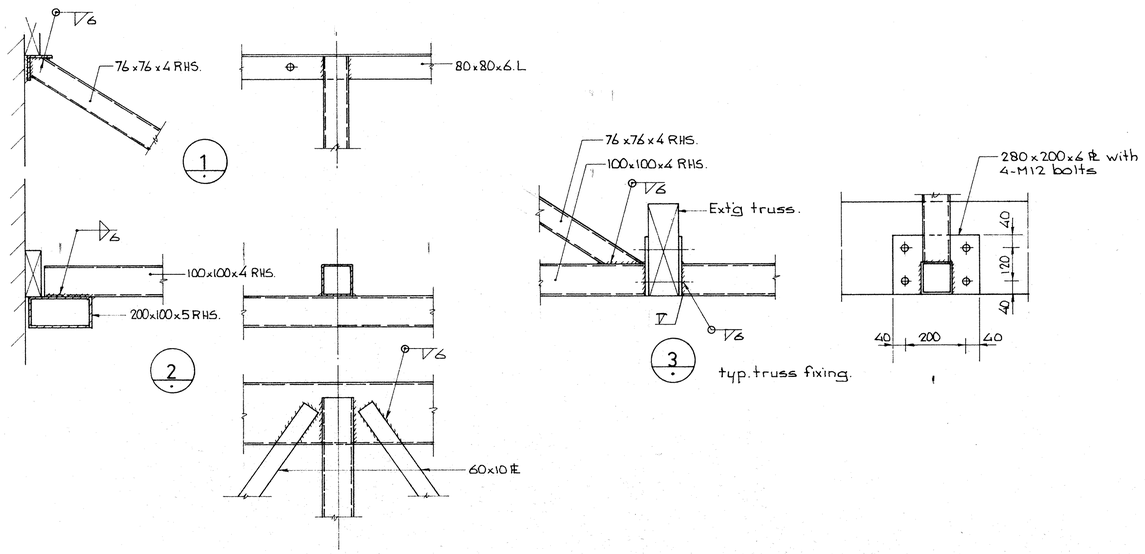
APP'D
DATE

SCALES 1:50 1:20

DWG NO 1868/7







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DWG TITLE

WALL ELEVATION ON GRID 1

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APP'D	DWG Nº 1868/8
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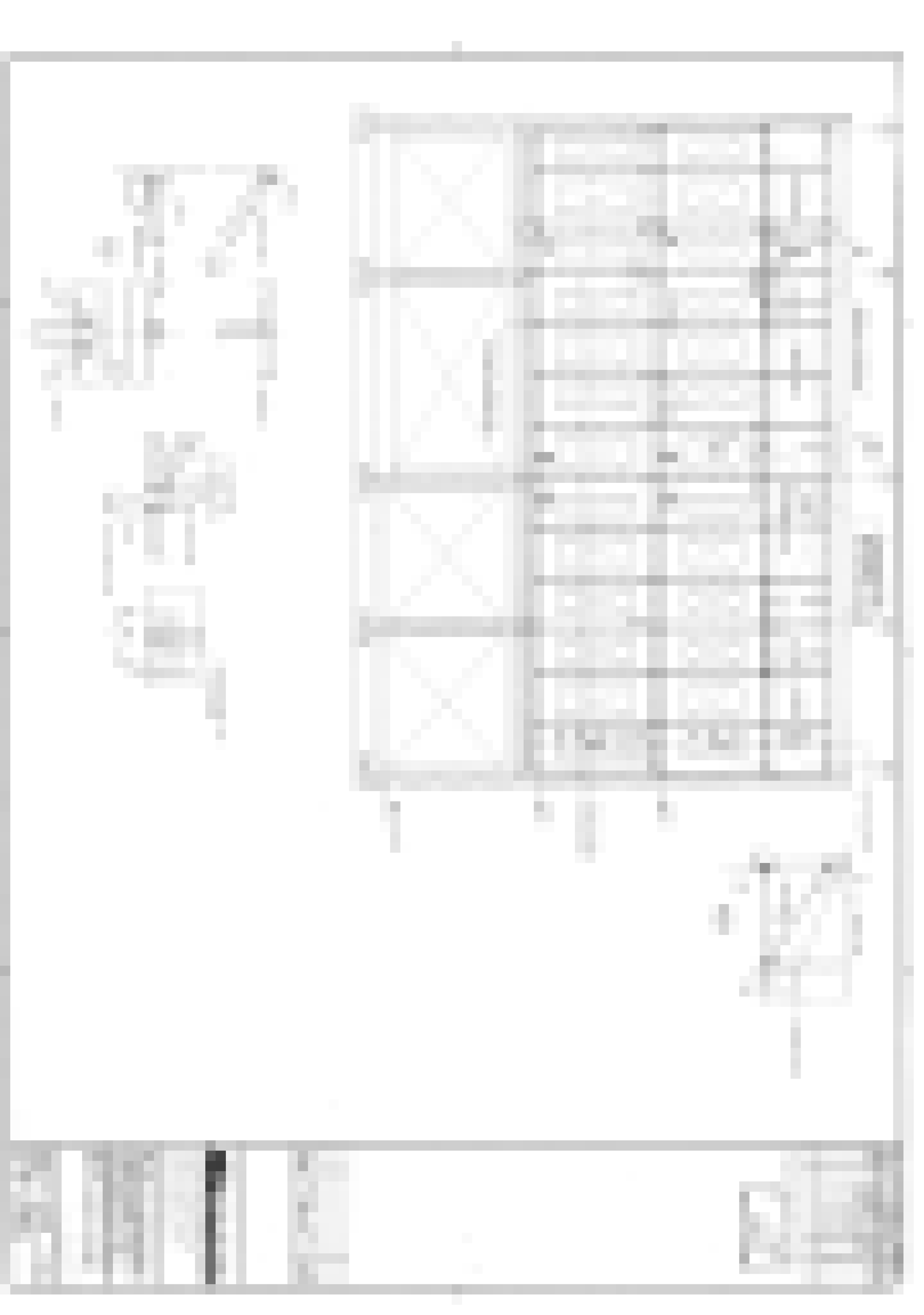
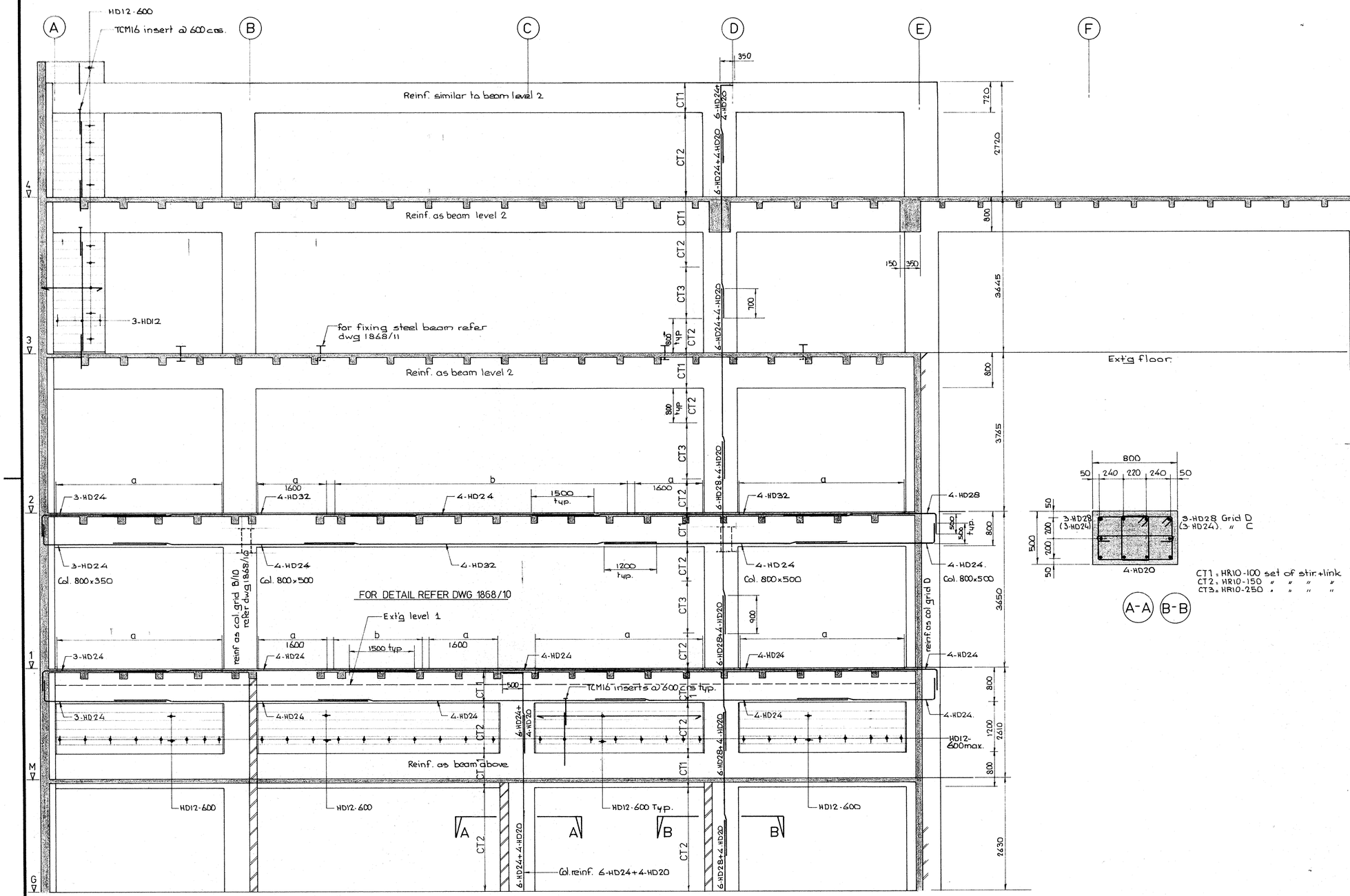


beam stirrups
a . HR10-100 stirrups + links
b . HR10-300 stirrups.



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For general notes refer dwg 1868/1

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JOB TITLE
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DWG TITLE
WALL ELEVATION ON GRID 5

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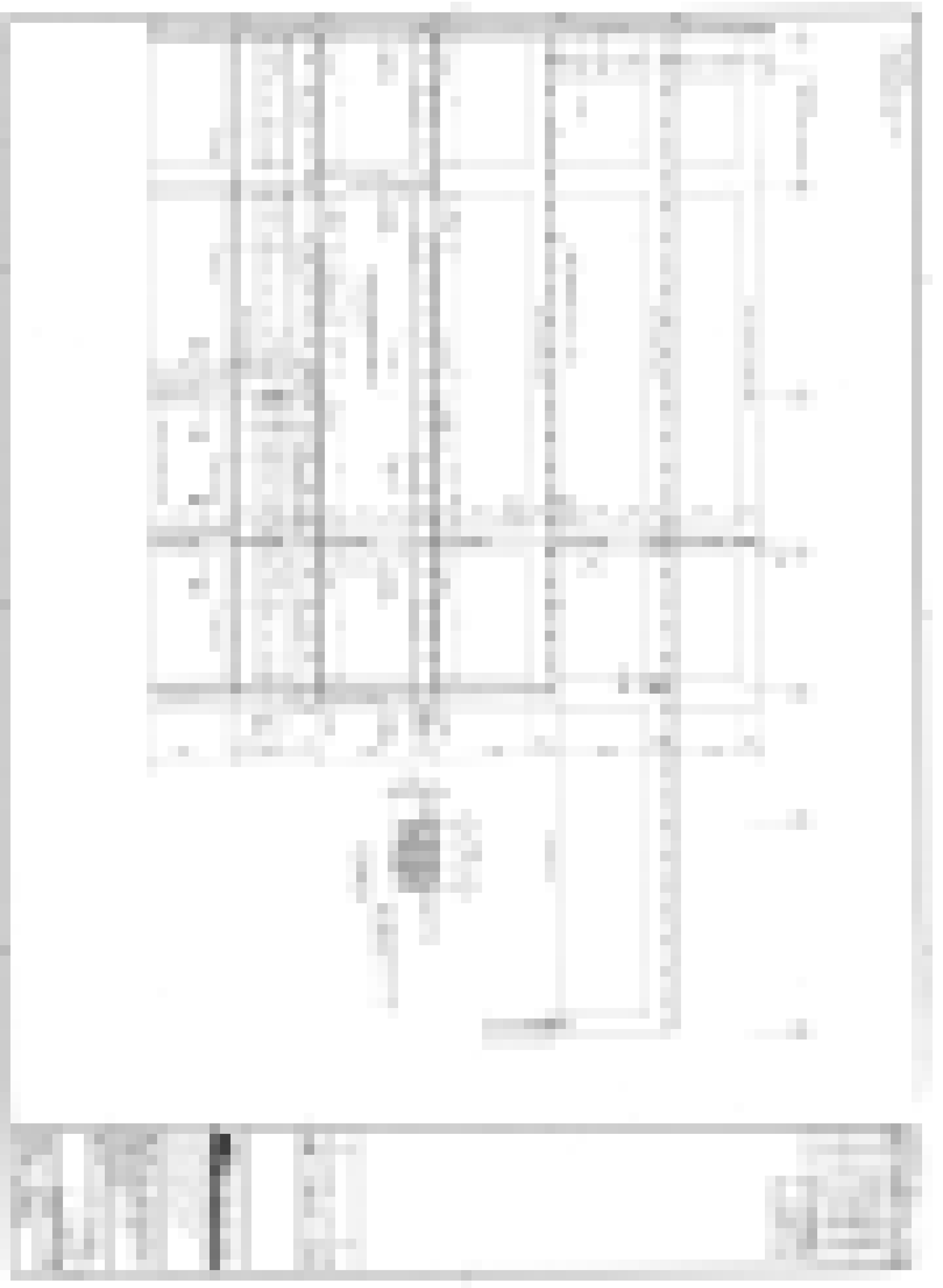
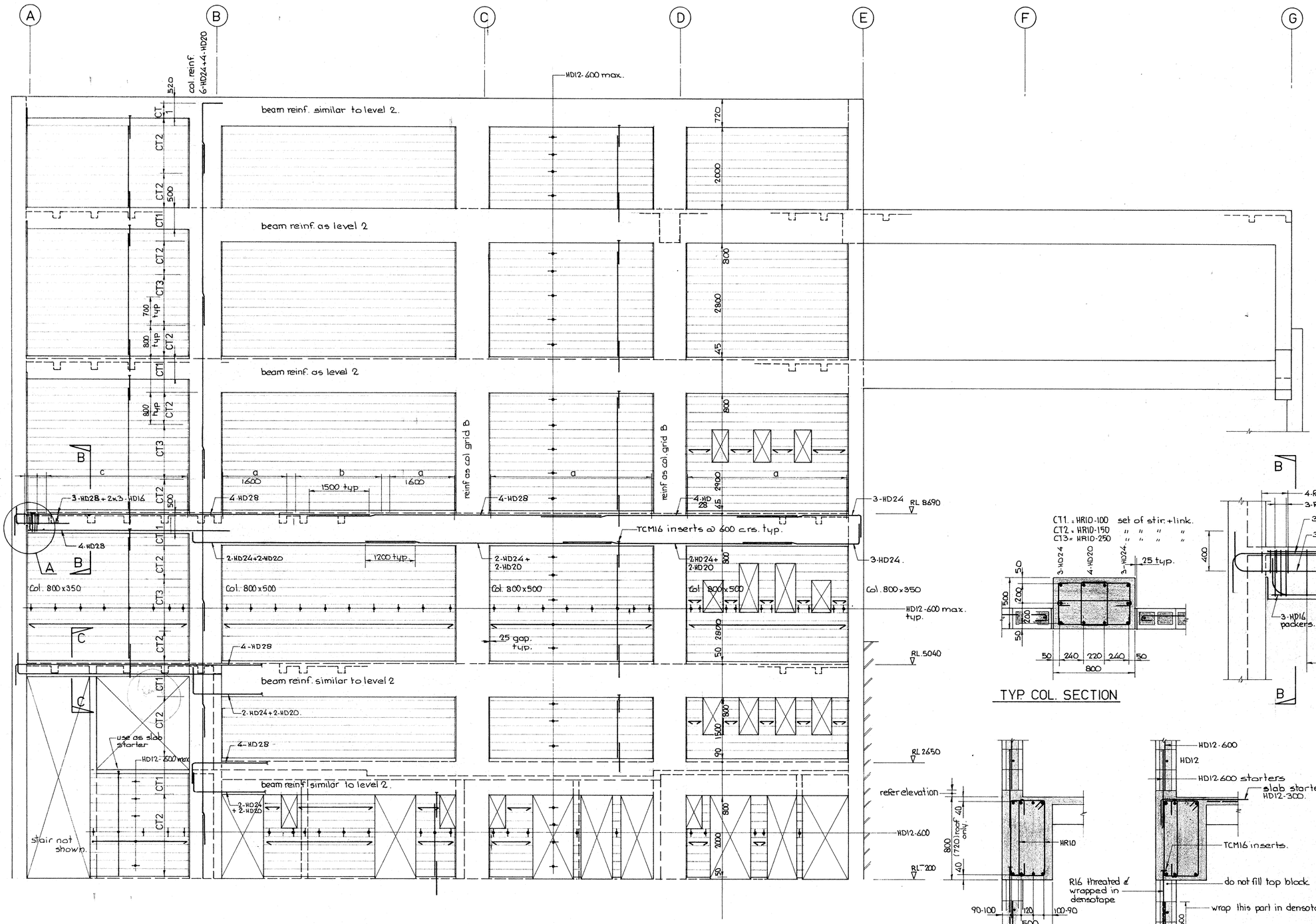


beam stirrups
a = HR10-100 stir + link
b = HR10-300 stir
c = HR10-200 stir.



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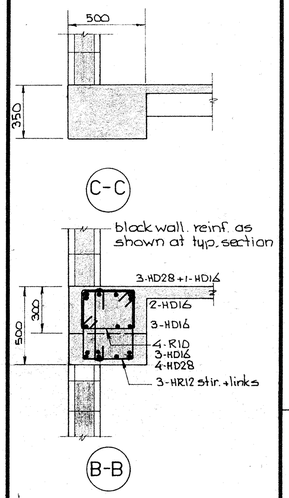
Works Department Building Inspection Branch 20 NOV 1986 Received Mercer Street, Wellington



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DWG TITLE
WALL ELEVATION ON GRID 10

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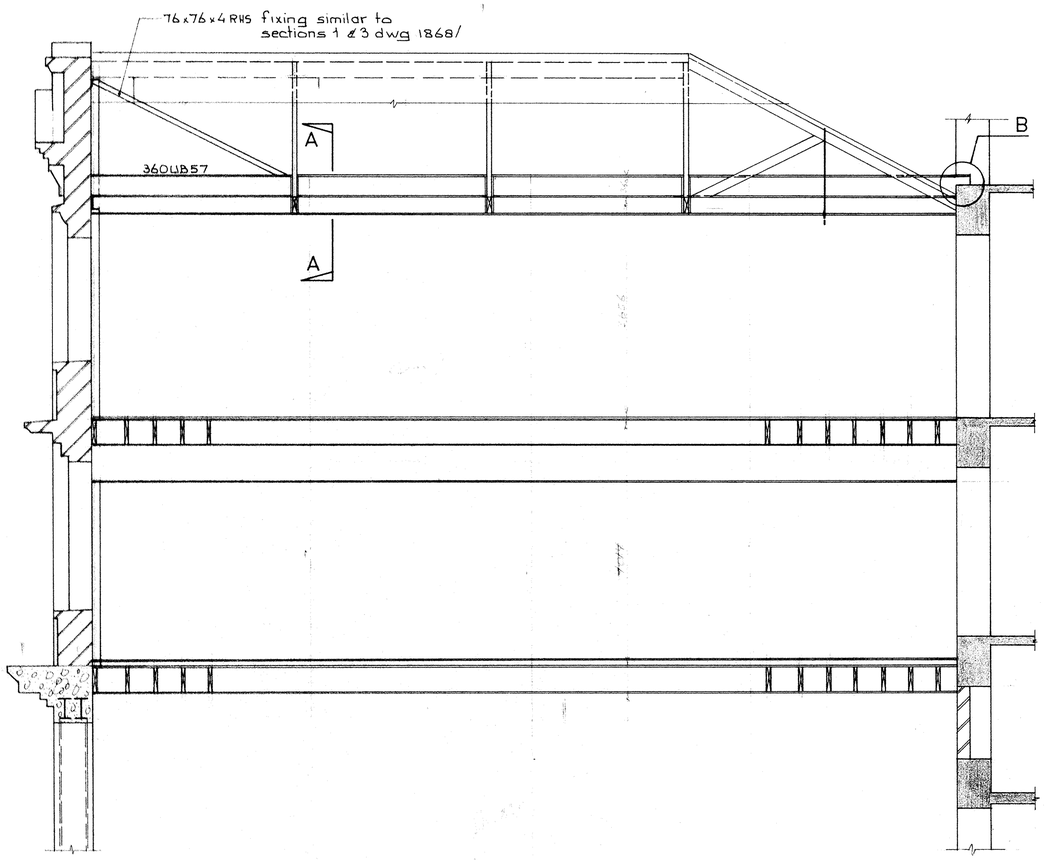

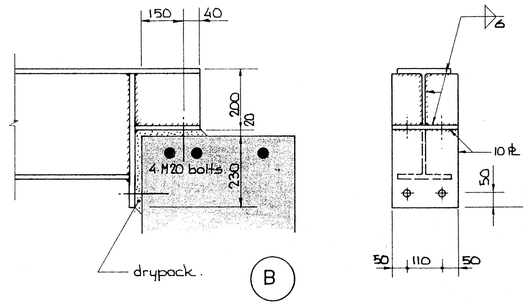

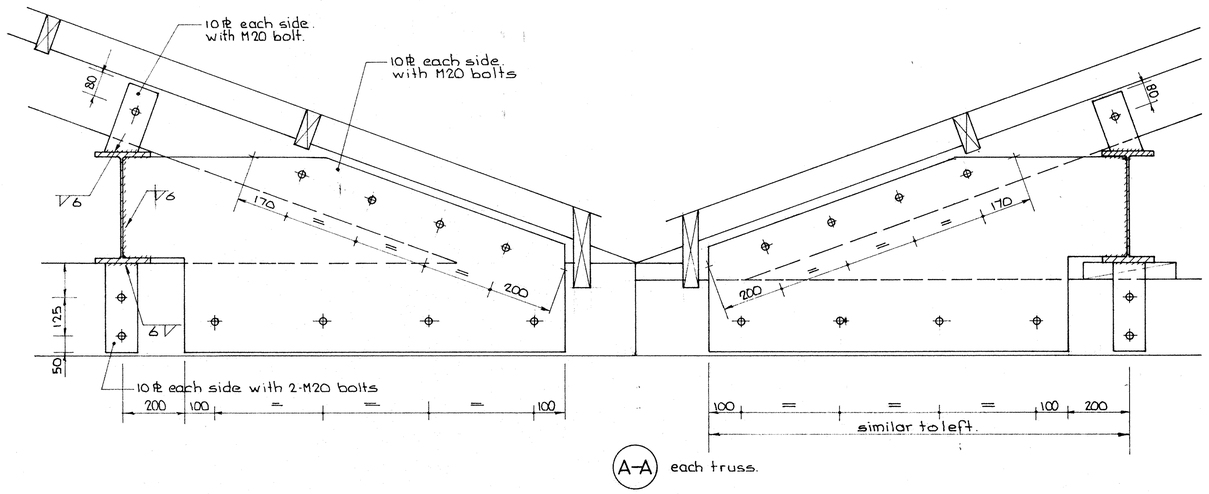

A-A each truss.

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For general notes refer dwg 1868/2

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DWG TITLE
SECTION AT GRID B & D

WORKS DEPARTMENT BUILDING INSPECTION BRANCH 20 NOV 1986

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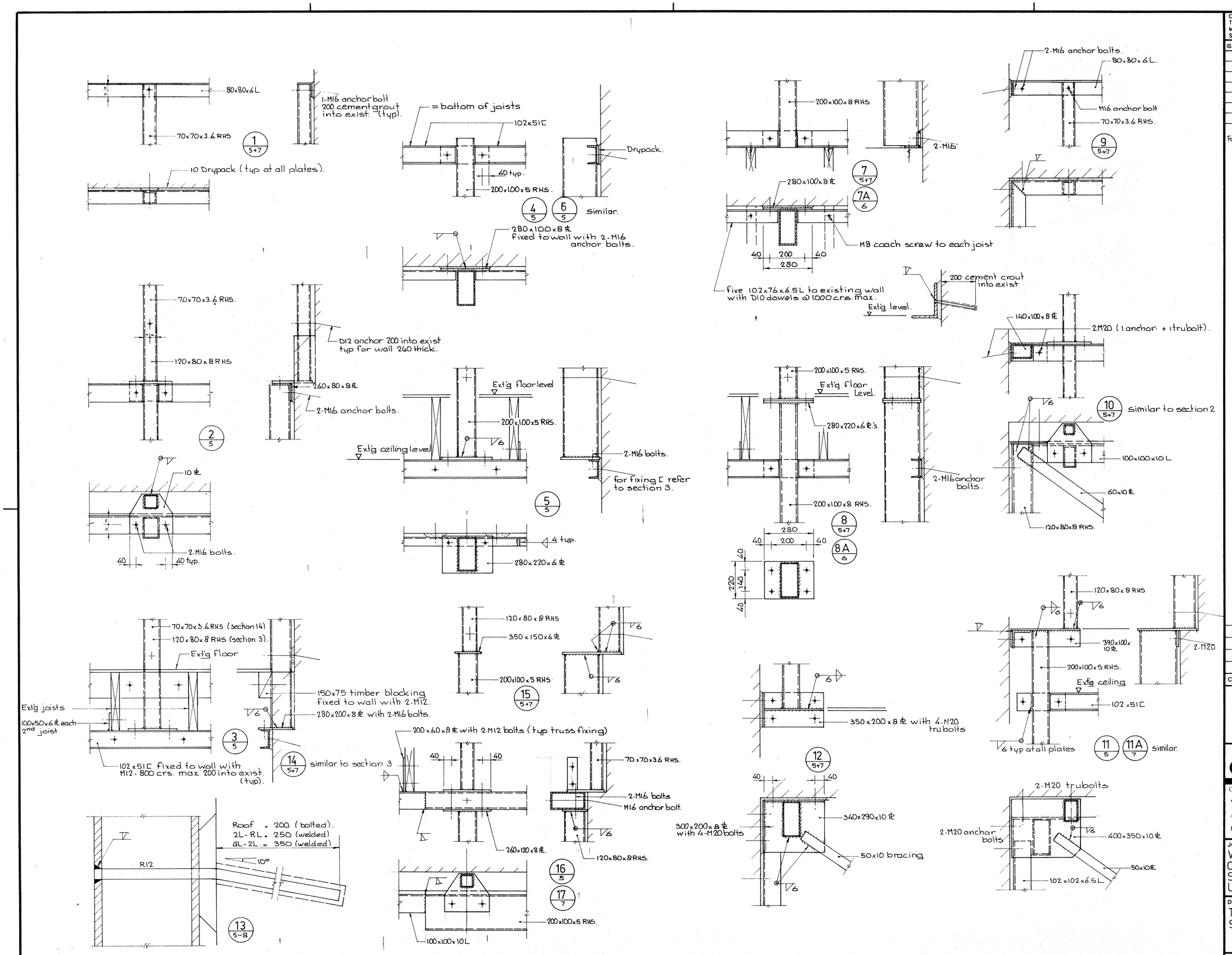

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DWG TITLE

TYPICAL STEEL CONSTR. SECTIONS & DETAILS

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SHEET 1

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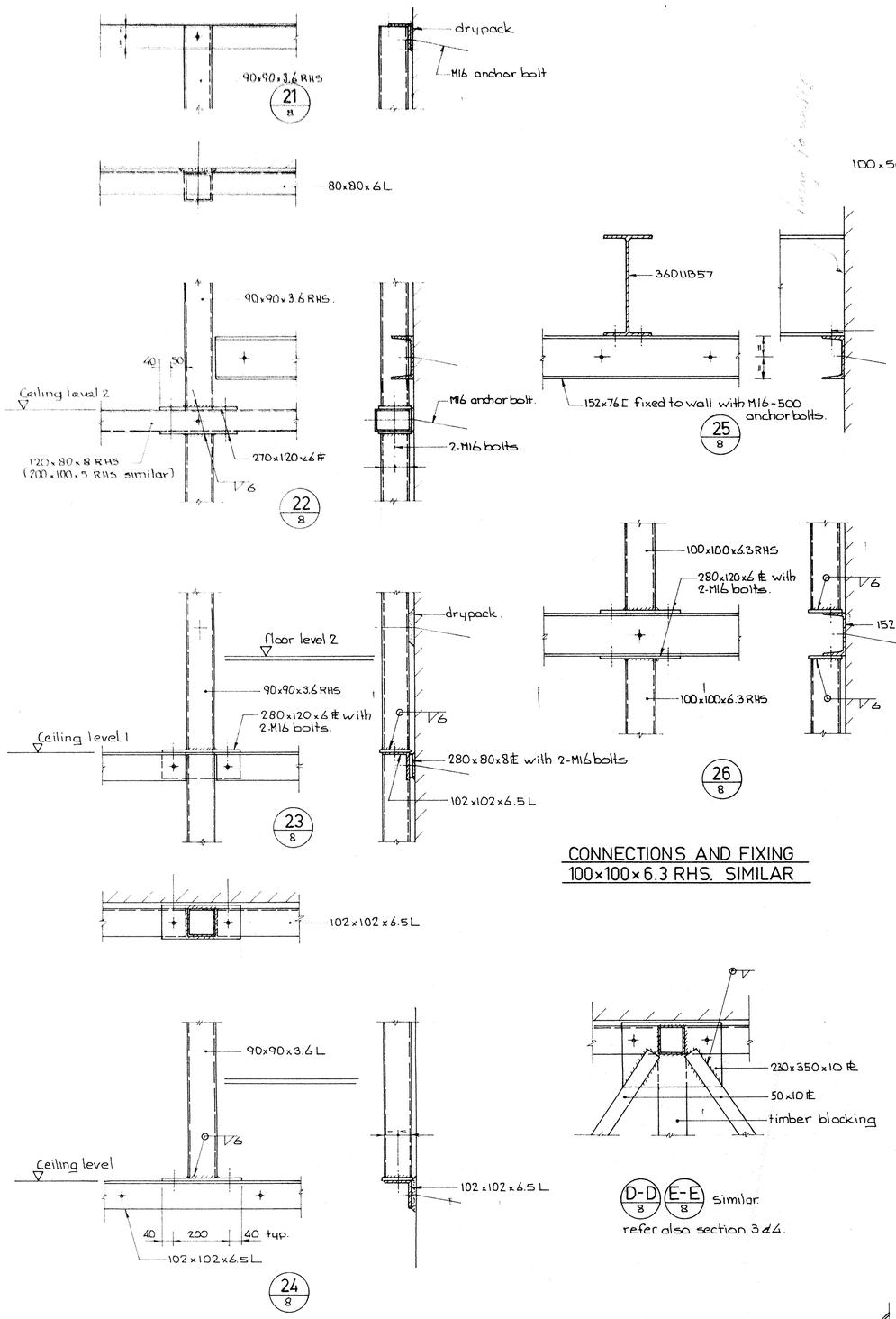
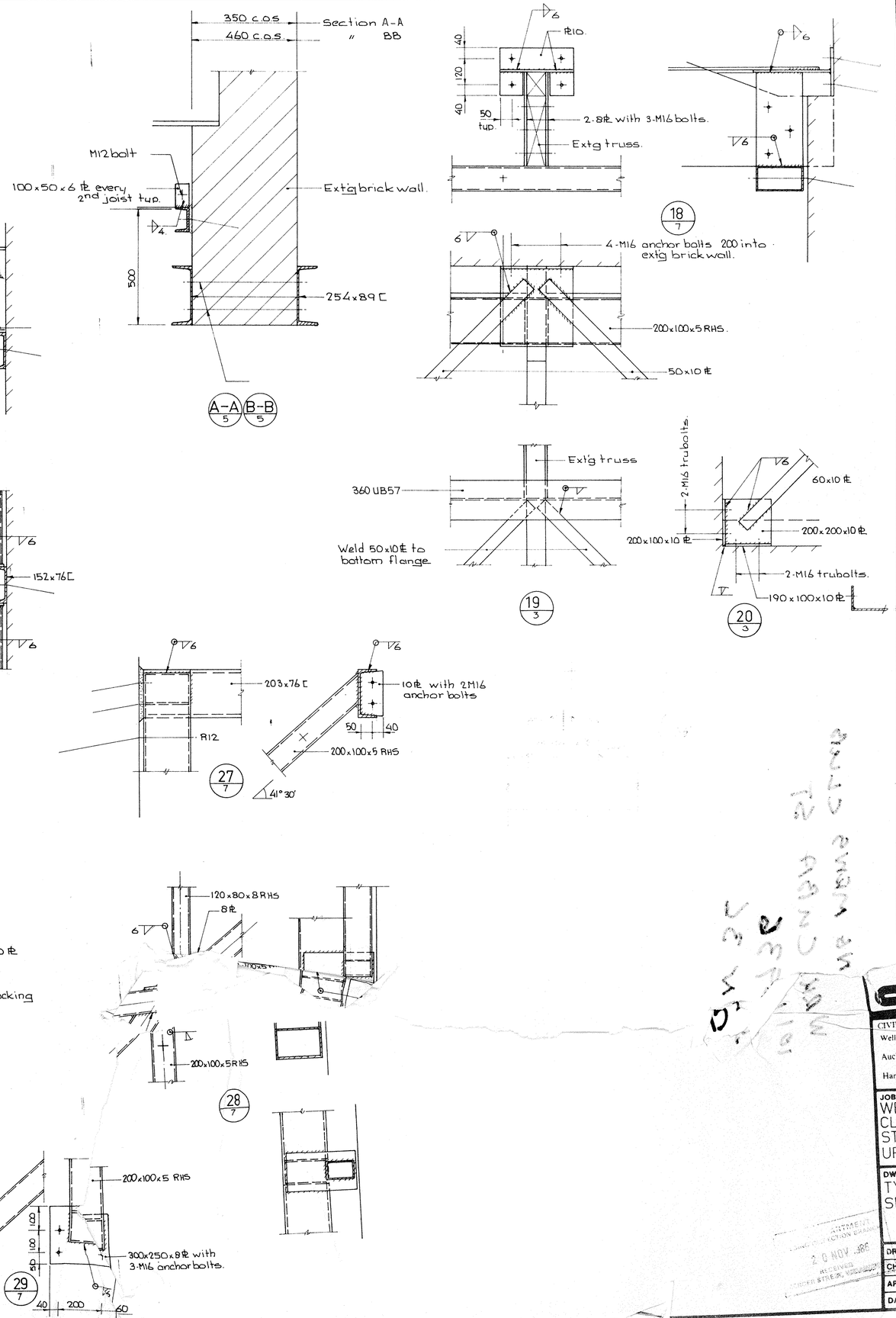
DATE Nov. '86	





CONNECTIONS AND FIXING
100x100x6.3 RHS. SIMILAR

CONTRACTORS MUST
THE JOB BEFORE
MAKING ANY SHOP
SUBMITTED AND APPR

ISSUE	AMENDMEN

WORKS
PLUMBING AND
28 NO
MERCER
WELLIN

For general notes refer dwg 1868/2.

WORK DEPARTMENT
BUILDING INSPECTION BRANCH
20 NOV 1986
RECEIVED
MERCER STREET, WELLINGTON

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DWG TITLE
TYPICAL STE
SECTIONS &

WORK DEPARTMENT
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DRAWN	SCALES 1:10
CHECKED	
APP'D	DWG No 1868/1
DATE	

notes:

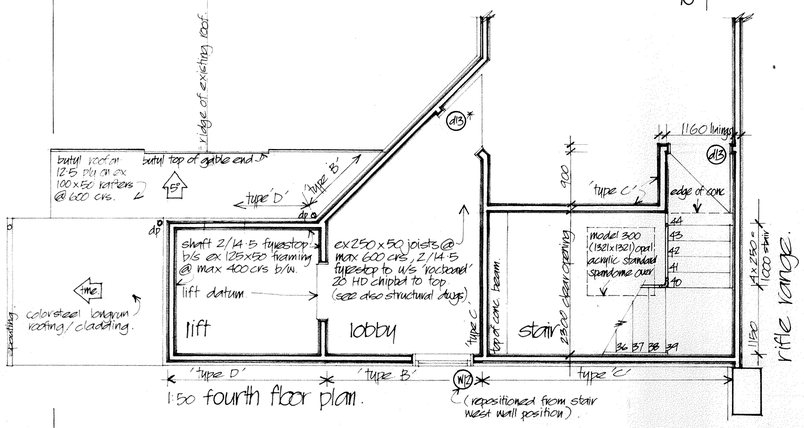
wall types: A: 9.5 gibraltar board both sides of ex 100x50s @400 max crs (studs) drawing at max 600 crs.

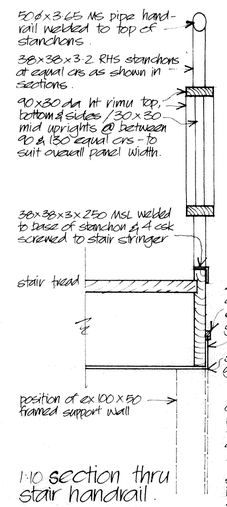
B: 14.5 firestop both sides of ex 100x50 framing crs as type A.

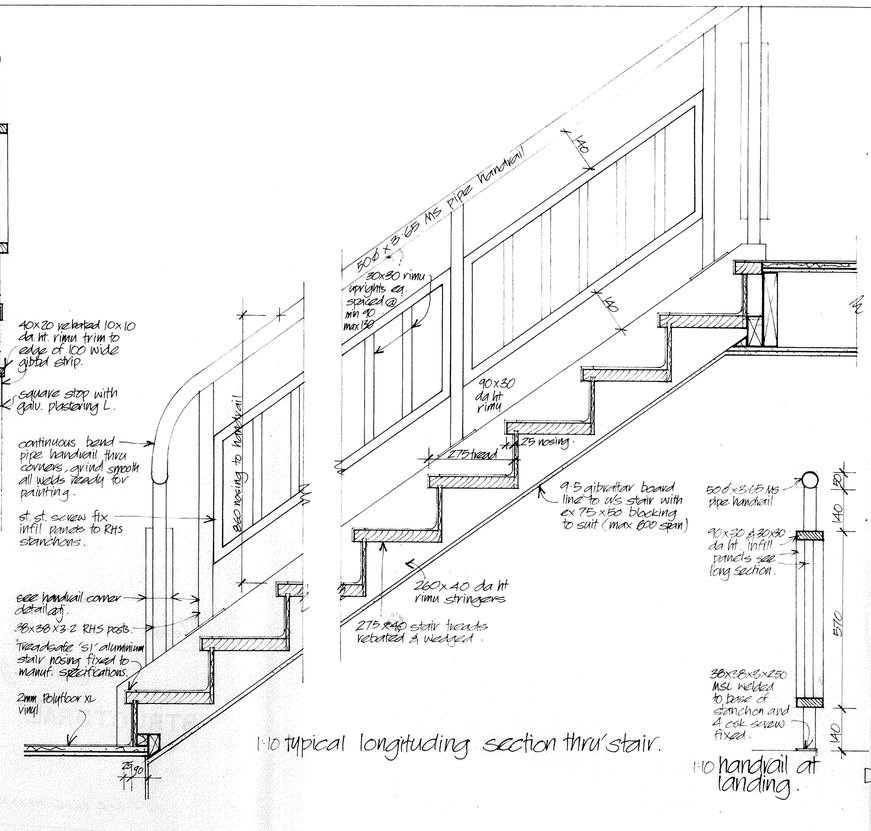
C: 2/14.5 firestop both sides of ex 100x50 framing crs as type A. (stair shaft walls).

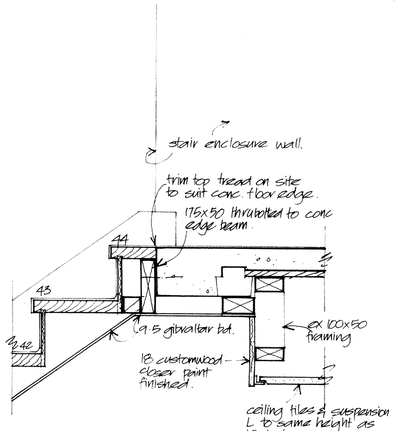
D: 2/14.5 firestop both sides of ex 125x50 framing @ 400 max crs b/w. (lift shaft walls)

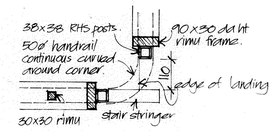
* - indicates additional door or window to contract to same details as elsewhere



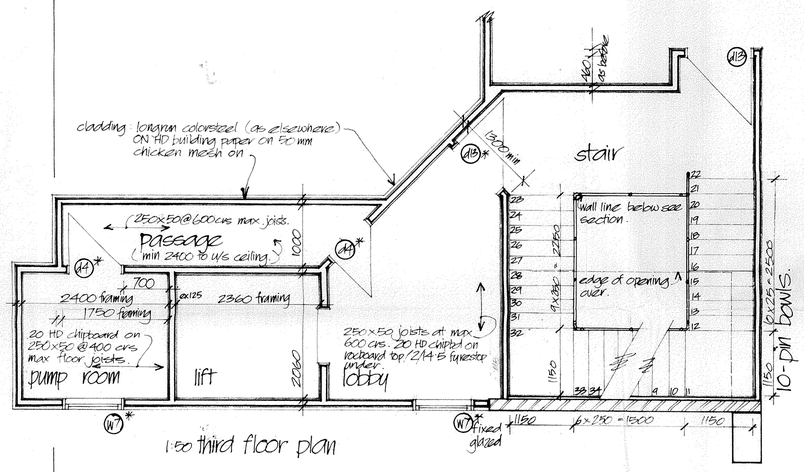


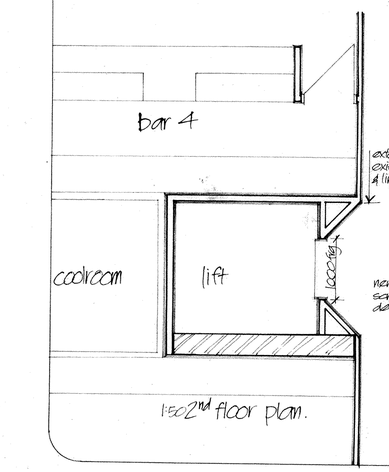


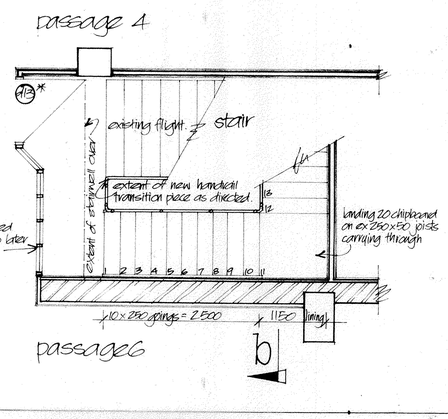


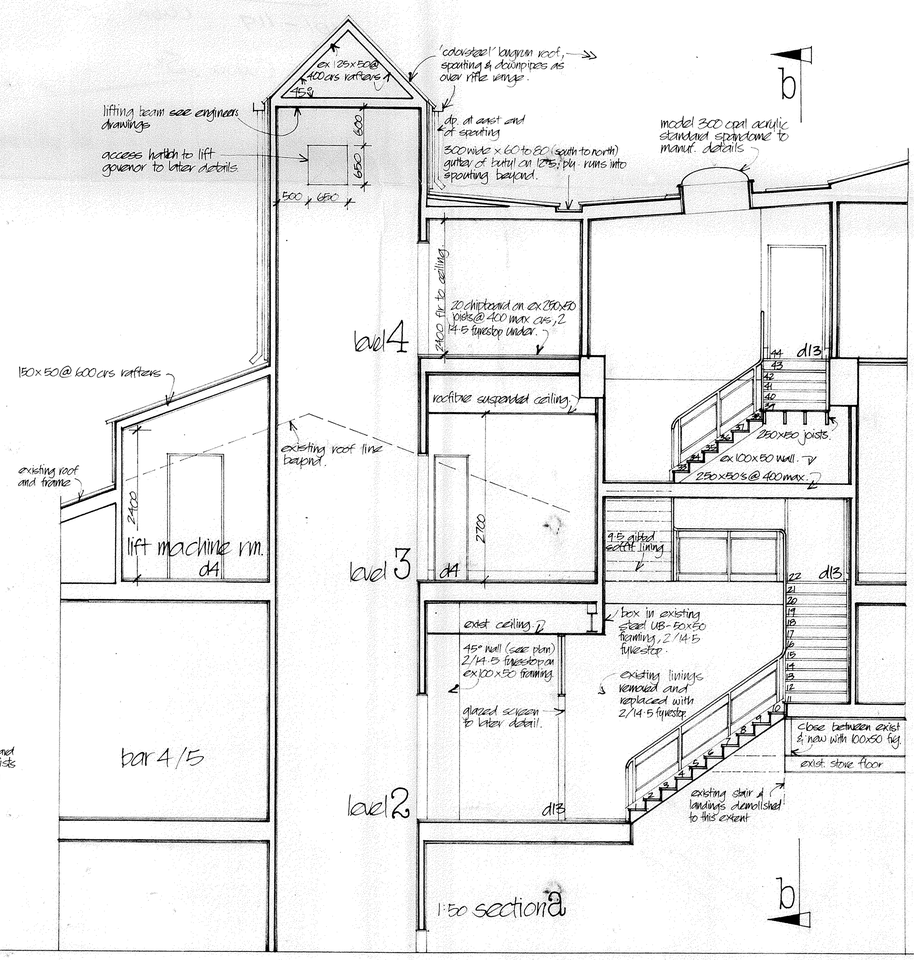


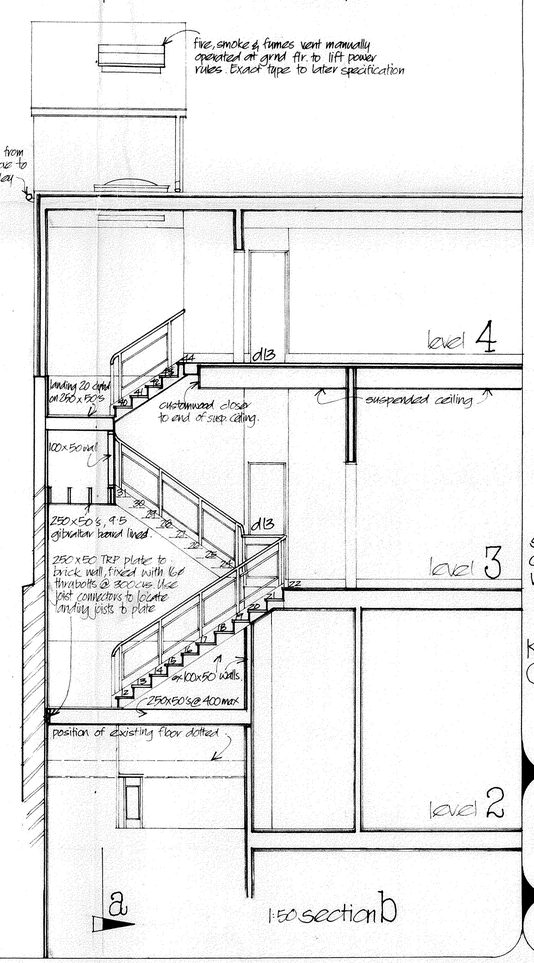
revisions:
a: 4 feb 88 general revisions.











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keith wilson architects wellington
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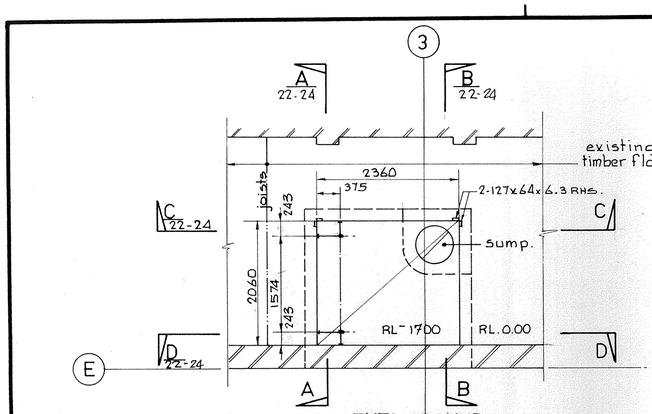
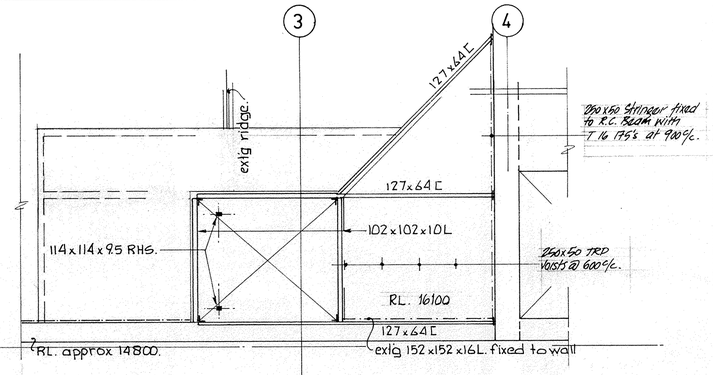
stair 1
lift shaft

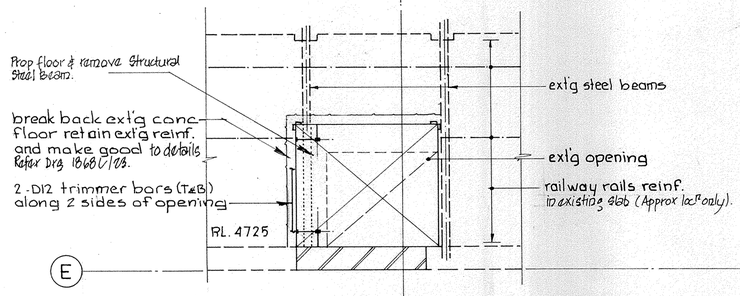
7915 a A36a



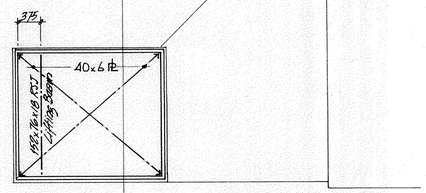
LEVEL GROUND



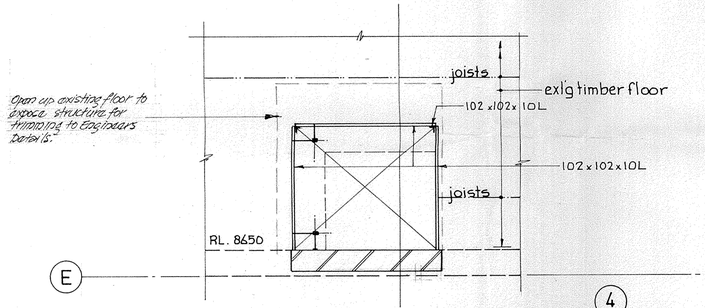
LEVEL 4



LEVEL 1



ROOF LEVEL



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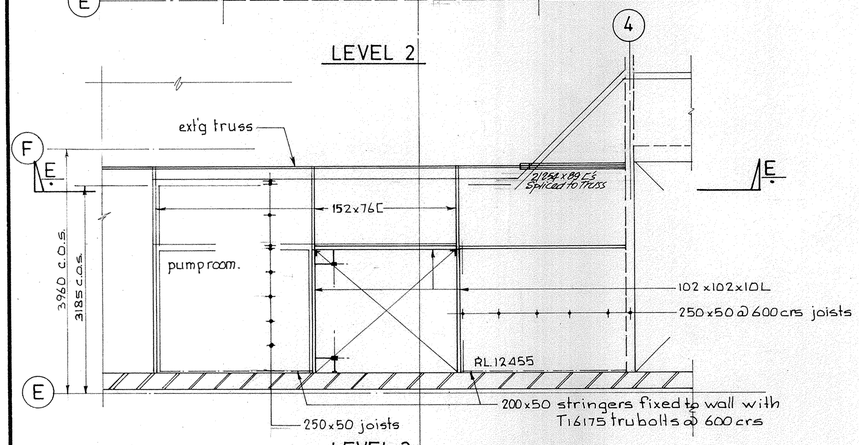
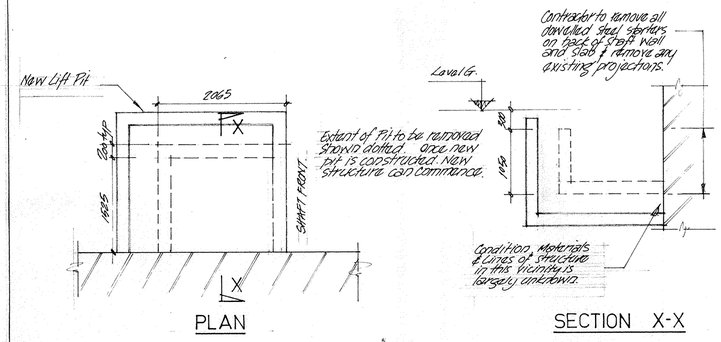


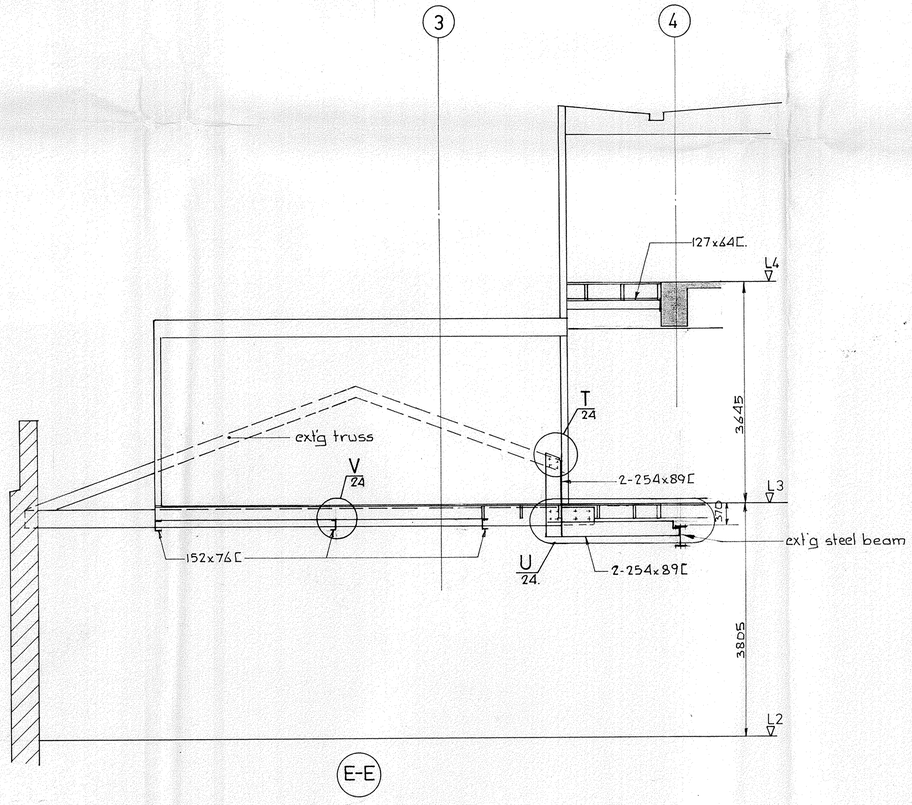
LEVEL 3



PLAN

SECTION X-X

LIFT PIT DEMOLITION DETAILS



E-E

FOR CONSTRUCTION

WORK DEPARTMENT
BUILDING INSPECTION BRANCH
10 FEB 1988
RECEIVED
MERCER STREET, WELLINGTON

AMENDED PLAN

	SENT TO	APPROVED BY	DATE
Town Planning			
Plumbing & Drainage			
Streetwork Design			
Health Branch			
Parks & Recreation			
Structural			11-2-88
Other Bldg		J.A. Robertson	11-2-88

CONTRACTORS MUST VERIFY ALL DIMENSIONS AT THE JOB BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS WHICH MUST BE SUBMITTED AND APPROVED BEFORE MANUFACTURE.

ISSUE	AMENDMENT	BY	DATE

Notes.

1. Removal of existing shaft rails and lift motor room equipment to be carried out by others prior to access being given to contractor.
2. Contractor to erect fully dust proof screens with sealed access doors into shaft as and where required by him to enable work to proceed within the shaft without undue disruption to the client & his members.
3. Contractor to ensure that the lift shaft remains fully watertight during all operations. Any resulting damage and removal operations consequent to inadequate protection shall be at his expense.

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JOB TITLE
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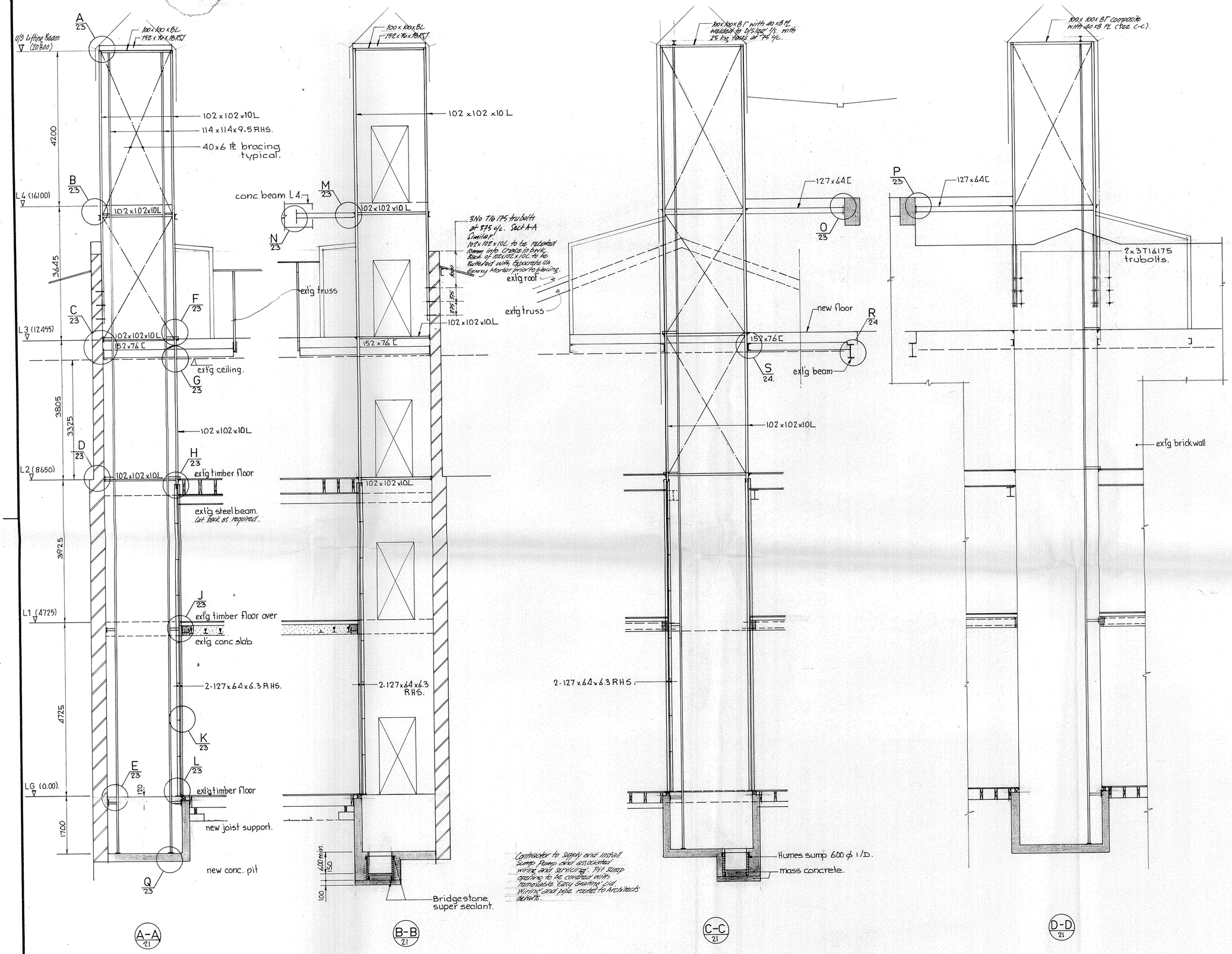
DWG TITLE
LIFT SHAFT PLANS. AND SECTION.

DRAWN J.v.d.L.	SCALES 1:50		
CHECKED			
APP'D	DWG Nº 1868L/21	REV	
DATE Jan'88			



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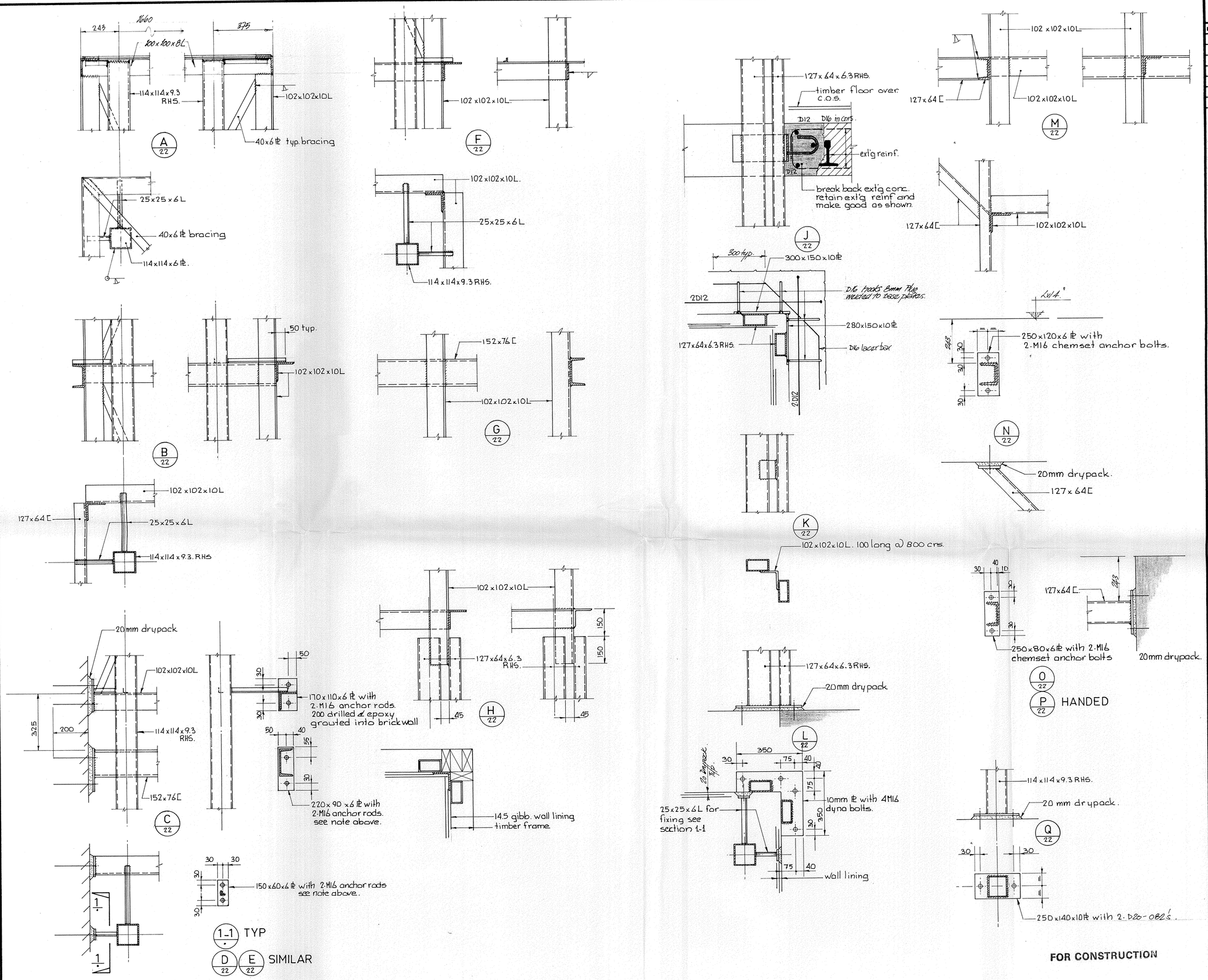
DWG TITLE
LIFT SHAFT ELEVATIONS

DRAWN	J.v.d.L.	SCALES	1:50.
CHECKED			
APP'D		DWG Nº	1868L/22
DATE	Jan. '88		REV



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ISSUE	AMENDMENT	BY	DATE

Notes.

1. All welds to be 6mm F.W. unless noted otherwise.
2. All structural steel to be painted with 2 coats red oxide primer HD441 or equivalent. All work to be undertaken in strict accordance with manufacturers instructions.

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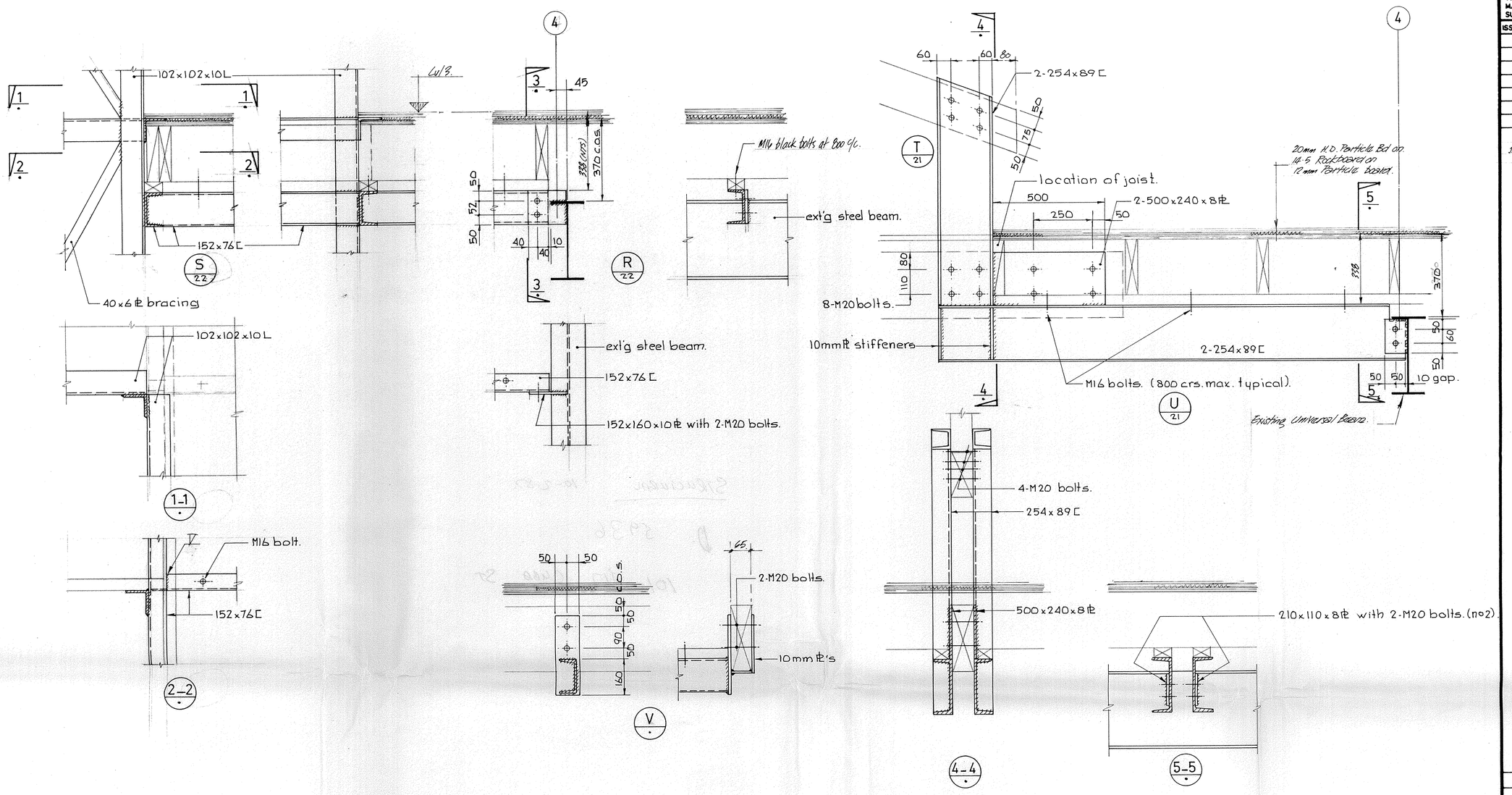
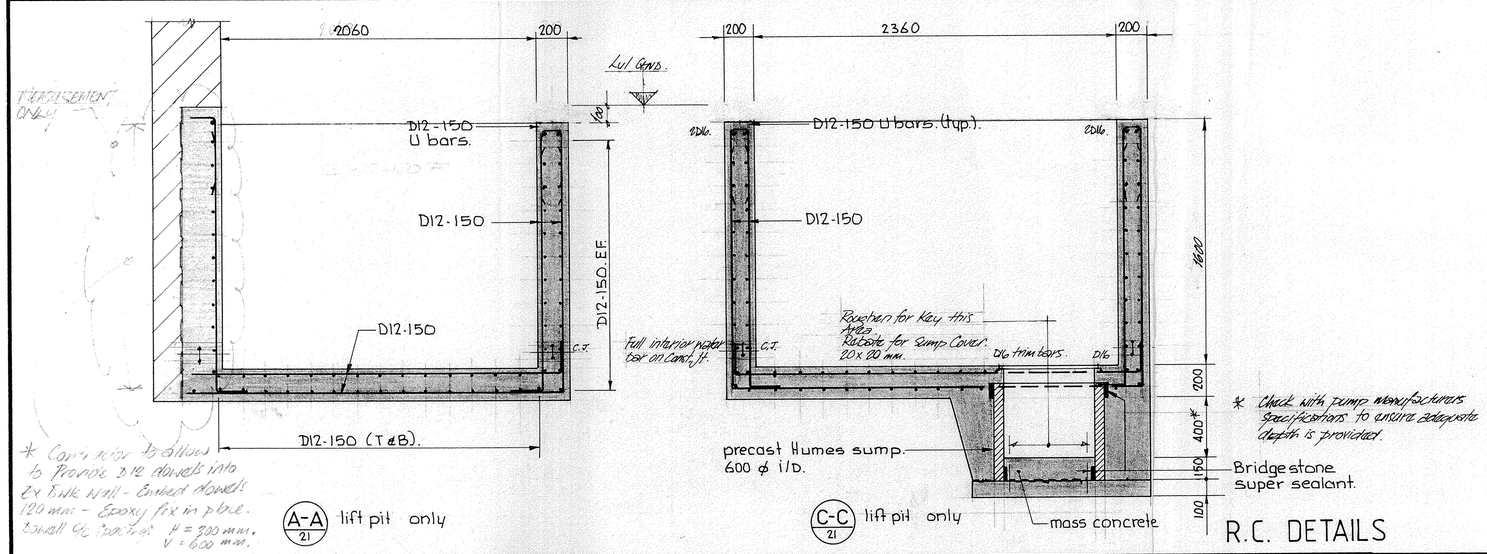
DWG TITLE
LIFT SHAFT STRUCTURAL STEEL SECTIONS.

DRAWN J.v.d.L	SCALES 1:10	
CHECKED		
APP'D	DWG Nº 1868L/23	REV
DATE Jan. '88'		



STRUCTURAL STEEL DETAILS



R.C. DETAILS

FOR CONSTRUCTION

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ISSUE	AMENDMENT	BY	DATE

Note.
1. Concrete crushing strength to be 25 Mpa at 28 days.

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DWG TITLE
LIFT SHAFT STRUCTURAL STEEL & REINFORCET CONCRETE SECTIONS & DETAILS.

DRAWN J.v.d.L.	SCALES 1:10 1:20	
CHECKED		
APP'D	DWG NR 1868L/24	REV
DATE Jan '88.		