UNDER	THE COMMISSIONS OF INQUIRY ACT 1908
IN THE MATTER OF	ROYAL COMMISSION OF INQUIRY INTO BUILDING FAILURE CAUSED BY CANTERBURY EARTHQUAKES KOMIHANA A TE KARAUNA HEI TIROTIRO I NGA WHARE I HORO I NGA RUWHENUA O WAITAHA
AND IN THE MATTER OF	THE CTV BUILDING COLLAPSE

FIRST STATEMENT OF EVIDENCE OF ASHLEY HENRY SMITH IN RELATION TO THE NON-LINEAR SEISMIC ANALYSIS OF THE CTV BUILDING

DATE OF HEARING: COMMENCING 25 JUNE 2012

FIRST STATEMENT OF EVIDENCE OF ASHLEY HENRY SMITH IN RELATION TO THE NON LINEAR SEISMIC ANALYSIS OF THE CTV BUILDING

INTRODUCTION

1. My name is Ashley Henry Smith. I live in Auckland. I am the director of StructureSmith Ltd, a consulting engineering company specialising in structural engineering.

QUALIFICATIONS AND EXPERIENCE

2. I graduated from the University of Auckland in 1981 with a Bachelor of Engineering (Civil). In 1997, I graduated Master of Engineering (Civil) from The University of Auckland.

3. I am a Member of the Institution of Professional Engineers New Zealand ('IPENZ'), the New Zealand Structural Engineering Society, and the New Zealand Society for Earthquake Engineering. I was President of the New Zealand Structural Engineering Society from 2005 to 2008 and was elected a life member in 2010.

4. From 2003, I have been a member of the Head Committee for the latest Concrete Structures Standard NZS3101:2006. In that role, I was responsible for re-organising major parts of the standard from the previous version, and leading the sub-committees that drafted new sections in the Standard for Structural Analysis and Precast Concrete.

5. My areas of specialist professional expertise are: structural engineering analysis and design; earthquake engineering; wind engineering; and monitoring the construction of building structures to ensure they are built in accordance with the design.

6. I have practised as a structural engineer since 1981, when I joined Upper Hutt City Council as a graduate engineer.

7. From 1987-1989, I worked for Ove Arup & Partners in London. During that period, I was Project Engineer for the Obunsha Corporation's Century Tower in Tokyo, an office building comprising a three-level basement and twin towers 18 and 20 storeys high. I led the team that designed the steel superstructure for that development, for which we were required to carry out non-linear time history analysis for seismic loads.

8. I returned to Auckland in 1989 and joined KRTA Limited (later Kingston Morrison Limited and SKM) as a Senior Structural Engineer. Major projects from this period included: design and analysis for the seismic strengthening and refurbishment of Auckland Town Hall; Project Engineer for the first seven buildings at The University of Auckland's Tamaki Campus; carrying out a seismic risk assessment for Auckland International Airport Limited; and a period as Lead Structural Engineer for geothermal steam field developments in the Philippines and Indonesia. During this period I also carried out the conceptual and developed design for a proposed development on Princes Wharf, which was to be base isolated and which involved non-linear time history analysis for seismic loads.

9. In 1994, I joined Murray Jacobs Limited as a Senior Associate. Major projects that I worked on, in and around Auckland, included:

   9.1. Master planning of the Sylvia Park shopping centre development in Mt Wellington and Project Engineer for the southern half of that development;

   9.2. Project Engineer for the 32-storey Quay Street tower known as the PricewaterhouseCoopers (PwC) Centre;

   9.3. Project Engineer for the 41-storey Vero Centre in Shortland Street; and

   9.4. Project Engineer for the 35-storey Quay West apartments in Albert Street.

10. In 2006, I formed StructureSmith Limited. I am the firm's Managing Director and Chief Design Engineer. At StructureSmith, I have:

    10.1. Undertaken the structural design for a 5-storey development at Garfield Street in Parnell;

    10.2. Carried out a comprehensive design review of the as-built roof structure of Vector Arena, to resolve problems with the expected performance of steel members and connections that had been designed by others;

    10.3. Carried out the structural design review of a 4-storey extension on top of an existing 16-storey office building in downtown Auckland;

    10.4. Undertaken the design of seismic strengthening works to the historic six-storey Imperial Buildings in Queen Street.

11. A more comprehensive CV, further outlining my experience is attached and marked **"A."**

12. I have been asked to provide evidence to the Canterbury Earthquake Royal Commission relating to specific aspects of my involvement in the report prepared by Compusoft entitled, "CTV Building Non-Linear Seismic Analysis Report" (the report) on the CTV Building.

EVIDENCE

13. My evidence will address the following topics:

    13.1. The background to the report.

    13.2. The purpose of the report.

    13.3. Input data StructureSmith provided to Compusoft.

    13.4. The Non Linear Time History Analysis (NLTHA).

    13.5. The interpretation of the NLTHA results.

14. This brief will address the first three of these topics. The others will be dealt with in a further brief.

15. I have read and agree to comply with the Code of Conduct for Expert Witnesses, a copy of which is attached and marked **"B"**.

16. I confirm that the matters I am giving evidence about are within my areas of expertise.

BACKGROUND TO THE REPORT

17. On 16 April 2011 Hyland Consultants and StructureSmith put forward a joint proposal to DBH to investigate the collapse of the CTV building. In that proposal Clark Hyland and I were nominated as key personnel, and personnel from Compusoft Engineering Ltd and Tonkin and Taylor Ltd were nominated to assist

with structural analysis and geotechnical engineering respectively. At the time of submitting the proposal the required extent and nature of the structural analysis and geotechnical engineering was not clear.

18. StructureSmith were responsible for briefing and coordinating with Compusoft and Tonkin & Taylor. StructureSmith and Compusoft share the same office in Newmarket, Auckland and worked closely together throughout this project.

19. During the period April 2011 to July 2011, the CTV Building investigation was progressing and evidence of various forms was being gathered including building records, materials testing, and interviews with involved parties and eye witnesses.

20. During this same period, preliminary structural analyses including static gravity load analyses and seismic modal response spectrum analyses were carried out by Compusoft using the ETABS Version 9 computer programme.

21. ETABS is the brand name of the program distributed by Computers and Structures Inc. (CSI), of Berkeley California. This program is widely used in New Zealand for analysis and design of multi-storey building structures. I understand that an earlier version of ETABS had been used for the seismic analysis of the CTV building when it was designed in 1986.

22. The attached "Computer Modelling Assumptions 27-06-11.xlsx" table (Attachment "C"), which I prepared, shows the various ETABS response spectrum analyses that were initially carried out. The table also lists the key analysis inputs that came from the structural specification, from the design standards and from other key references that were applicable either in 1986 (for the middle columns in the table) or in 2011 (for the right hand columns in the table).

23. These ETABS gravity and response spectrum analyses were done primarily by Derek Bradley of Compusoft, and reviewed by me. Hand calculations and spreadsheet calculations relating to these analyses were also done by Derek Bradley and me.

24. The ETABS analysis inputs that were established at this stage included the structure geometry and section sizes, gravity loads, seismic masses, soil spring stiffnesses and the effective section properties (constant stiffness) that would normally be used for modal response spectrum analysis and design in accordance with the applicable Standards.

25. The inputs into these preliminary ETABS analyses reflected the geometry of the structure as it had been shown on the building consent drawings and the material properties as listed in the structural specification.

26. SAP is the brand name of a more sophisticated computer program than ETABS, also distributed by CSI. SAP is a more general purpose program that incorporates the additional features necessary to model the non-linear properties of structures and to carry out non-linear seismic analysis. SAP2000 was the version used by Compusoft.

27. Compatibilities between the two software packages, ETABS which was used for the initial gravity and seismic response spectrum analyses, and SAP which was used subsequently for the non-linear seismic analysis, allowed many of the inputs to be copied across from ETABS to SAP, which Derek did.

28. The SAP model for the non-linear seismic analysis was then modified by Derek to suit the as-built arrangement of the building as we understand it had existed just prior to the earthquakes. Expected material properties (varying stiffness and strength) were input as assessed by Compusoft from materials testing by Hyland Consultants or from relevant references, and the various non-linear features were added into the model, all as explained in the Compusoft report.

29. The 'non-linear seismic analysis', all of which was carried out using variations of the same SAP2000 computer model, comprised three different types of analyses, including:

    29.1. Modal analysis
    29.2. Non-Linear Static (Pushover) Analysis, and
    29.3. Non-Linear Time History Analysis (referred to as NLTHA in this brief, and referred to as NTHA in the CTV Building Collapse Investigation report by Hyland and StructureSmith)

PURPOSE OF THE REPORT

30. The purpose of the Compusoft report was explained in the following extract from the Contract between the Department of Building and Housing and StructureSmith, as follows:

> During the investigation into the collapse of the CTV building, it became clear to the Department and the Expert Panel that more sophisticated non-linear push-over and time history analyses were required to give a better understanding of the likely behaviour of the building during the 4 September 2010 earthquake and 22 February 2011 aftershock.

31. Further explanation was given in the introduction to the Compusoft report, as follows:

> The non-linear analyses outlined in this report are intended to:
>
> 1. Assist with the identification of the probable sequence of failure.
> 2. Report displacement and storey drift demands, identifying the onset and progression of damage throughout the structure.
> 3. Monitor seismic demands on critical structural elements.
> 4. Determine whether column hinging is expected, and if so, to what extent.
> 5. Investigate the significance and effect of vertical accelerations on the performance of the structure.
> 6. Investigate the variances in structural form i.e. the contribution of the masonry infill panels, and precast spandrels to the seismic response and performance of the structure.

WHAT COMPUSOFT WAS ASKED TO DO

32. I will start by explaining what StructureSmith was asked to do and then follow with what Compusoft was asked to do, acting as sub-contractor to StructureSmith.

33. I received a draft 'Contract for Services' from DBH for the CTV Building Analysis by email from DBH on 10 November 2011. That draft contract reflected the previous discussions and correspondence that had taken place prior to the commencement of the NLTHA and during its development up to this point.

Schedule 1 (Department's Objectives/Requirements) on page 7 in that draft contract set out what my company had been asked to do, including:

> **Requirements:**
>
> The Contractor (i.e. StructureSmith) is appointed to carry out additional SAP non-linear push-over and time history analyses for the CTV building. The additional work will be jointly carried out by the Contractor, with Compusoft Engineering Limited as sub-contractor…
>
> The Contractor will also be responsible for:
>
> - Briefing Compusoft Engineering Limited.
> - Providing Compusoft Engineering Limited with the necessary documents and other relevant input data.
> - Investigation into and resolution of queries from Panel members.
> - Involvement in regular in-house discussions about interim analysis results and consequent adjustments to model.
> - Liaison with Hyland Fatigue and Earthquake Engineering Limited and Expert Panel members about interim results.
> - Selected quality assurance checking of input data and results.
> - Direction regarding output formats so as to be useful for incorporation into the CTV building collapse report.
> - Editorial input into the non-linear seismic analysis report produced by Compusoft Engineering Limited.
> - Preparation of a report on the results of the analysis suitable to support the CTV Collapse Report.

34. Preceding this, on 23 July 2011, I had briefed Barry Davidson, Derek Bradley and Tony Stuart of Compusoft, both verbally at a meeting at our office, and by email, on what was required for the NLTHA and I had asked them to prepare a proposal accordingly. This resulted in a proposal by Compusoft dated 27 July 2011, which essentially set out what Compusoft would do.

35. On 5 September 2011 I prepared, and we executed, a subcontract agreement for Compusoft for the CTV building analysis, based on earlier correspondence and discussions with DBH and based on the Compusoft proposal of 27 July 2011.

36. Under this agreement, I (representing StructureSmith Ltd) undertook to coordinate inputs into the Compusoft non linear seismic analysis, as follows:

INFORMATION OR SERVICES TO BE PROVIDED BY THE CLIENT:

- Structural drawings, specification, and other information that has been obtained about the building structure during the course of the investigation.
- Site examination and materials tests report by Hyland.
- Coordination with Hyland and DBH expert panel.

WHAT INPUT DATA STRUCTURESMITH PROVIDED TO COMPUSOFT

37. I provided the following input data to Compusoft. Some of these inputs were transmitted by email, some as hardcopies, and some may have been transmitted verbally at various meetings or simply by me talking to Derek in our office.

37.1. Structural drawings for the base building by Alan Reay Consultants Ltd (ARCL), file reference 2503, dated August 1986 and stamped approved by Christchurch City Council (CCC) on 30 September 1986, as follows:

Drawing	Revision	Title
S1	-	Index
S2	-	Foundation Layout
S3	-	Foundation Reinforcing
S4	-	Foundation Reinforcing
S5	-	Foundation Reinforcing
S6	-	Foundation Reinforcing
S7	-	Foundation Reinforcing Details
S8	-	Foundation Reinforcing Details
S9	-	Level 1
S10	-	Wall Reinforcing Lines 1 & 5
S11	-	Wall Reinforcing Lines C - E
S12	-	Wall Reinforcing Details
S13	-	Wall Reinforcing Details
S14	-	Columns
S15	-	Levels 2 – 6
S16	-	Shear Core Floors, Levels 2 - 8
S17	-	Blockwork

S18	-	Precast Floor Beams Location
S19	-	Beam / Column Joints
S20	-	Precast Floor Beams
S21	-	Precast Floor Beams
S22	-	Precast Floor Beams
S23	-	Precast Floor Beams
S24	-	Precast Floor Beams
S25	-	Precast Spandrel Panels
S26	-	Planter Boxes & Precast Panel 1 (revised after CCC approval)
S27	-	Steelwork: Roof Plan
S28	-	Steelwork: Frames 2 & 3
S29	-	Steelwork: Frames 1 & 4
S30	-	Internal Stair Layout, Stairs S1 & S2
S31	-	Internal Stair Layout, Stairs S3 to S10
S32	-	External Stair Layout S11 – S21
S33	-	Stair S11 & S12
S34	-	Stairs S14 to S20
S35	-	Stair S13 & S21
S36	-	Entrance Canopy and Security Grill
S37	-	Lift Machine Steelwork
S38	-	Lift Mullions & Separator Beams
S39	-	Weldplates and Fixings

37.2. Architectural drawings for the base building by Alun Wilkie Associates, dated August 1986 and stamped approved by CCC on 30 September 1986, as follows:

Drawing	**Revision**	**Title**
A1	E	Floor Plans, Site & level 1
A2	A	Floor Plans, Level 2 & Level 3
A3	A	Floor Plans, Level 4 & Level 5
A4	B	Floor Plans, Level 6, Plant Room &

		Roof
A5	A	Elevations
A6	B	Cross Sections
A7	-	Details
A8	A	Stair Details
A14	A	Toilet Details

37.3. Architectural drawings for modifications to ground floor block walls on grid 4 by Design Edge dated November 1998, as follows:

Drawing	**Revision**	**Title**
WD01	-	Existing / Demolition & New Floor Plans

37.4. The latest tenancy floor layouts, which I had searched for and extracted from the Christchurch City Council property file for each floor in the building. These plans enabled assessment of typical superimposed dead loads and live loads including areas that were understood to be vacant at the time of the earthquakes. These are the plans that were attached to my email to Clark Hyland dated 5 July 2011 (attachment "**D**").

37.5. An architectural drawing showing the alteration that was carried out to create a void in Level 2 floor slab for an internal stair by Warburton Team Architecture dated 4-5 May 2000 and stamped 'received' by the Christchurch City Council on 8 May and approved by CCC on 10 May 2000, as follows (this drawing was included in the 'latest tenancy floor layouts' from the item above):

Drawing	**Revision**	**Title**
A004	A	CHTV Fitout, New Floor Plans

37.6. A structural drawing showing the same alteration to create a void in Level 2 floor slab for an internal stair by Falloon and Wilson engineers dated May 2000 and stamped approved by CCC on 10 May 2000, as follows (this drawing was also included in the 'latest tenancy floor layouts'):

Drawing	Revision	Title
S1	-	New Floor Opening for Stair

37.7. The Structural Specification labelled "2503" that I received by email from ARCL via Clark Hyland on 26 April 2011 (attachment "**E**"), which included the specified concrete strengths and steel reinforcement grades.

37.8. Soil spring stiffnesses and comments about applicability of the available GNS earthquake records for use in the non linear seismic analyses, as advised by Tim Sinclair of Tonkin & Taylor Ltd in the CTV Building Geotechnical Advice dated 11 July 2011 which I (representing StructureSmith Ltd) had arranged.

37.9. Various editions of the Site Examination and Materials Tests report by Dr Clark Hyland and interim findings from that report as it was developed.

37.10. Derek and I both attended the CTV Technical Workshop meeting on 16 August 2011 at the DBH office Wellington. At that meeting the following inputs for the non-linear seismic analysis were agreed:

37.10.1. The Level 2 and Level 3 floor diaphragm connections to the lift shaft walls were to be modelled as compression only.

37.10.2. No connection was to be modelled between the eastern lift shaft wall and the column that abutted it at the top.

37.10.3. The stiffness and strength for the masonry infill panels was to be modelled as shown in Figure 16 of the Compusoft report, and comparative analyses were to be carried out with and without masonry infill.

37.10.4. The column concrete strengths were to be modelled as specified strength + 2.5MPa.

37.10.5. Three earthquake records were to be used for the 22 February aftershock and one earthquake record was to be used for the 4 September earthquake.

Signed: ....

ASHLEY HENRY SMITH

Date: 27 April 2012

STRUCTURE SMITH
Consulting Engineers

Curriculum Vitae

ASHLEY H. SMITH

Director

Academic Qualifications	Master of Engineering (Civil), 1997. University of Auckland. Bachelor of Engineering (Civil), 1981. University of Auckland.
Professional Qualifications	Member of the Institution of Professional Engineers NZ Chartered Professional Engineer International Professional Engineer (NZ) Life Member & Past President of NZ Structural Engineering Society Member of NZ Society for Earthquake Engineering
Particular Expertise	Structural Engineering Design Earthquake Engineering Design and Evaluation Wind Engineering Analysis of complex structures Construction Monitoring Forensic Engineering, Investigation and Reporting Expert Witness
Overseas Experience	United Kingdom, Indonesia, Philippines, Japan.

Professional Activities

- 2003-Present; Member of Head Committee for new Concrete Structures Standard NZS3101:2006. Responsible for drafting new sections in that Standard for Structural Analysis and for Precast Concrete.
- 2002-2011; Member of Management Committee for NZ Structural Engineering Society (SESOC), including term as President from 2005 to 2008. Awarded life membership of SESOC in 2010.
- 2002-2005; Chairman of Auckland Structural Group.
- 2001; Treasurer for Auckland Structural Group.
- 1991-1992; Secretary for NZ Structural Engineering Society.
- 1988-1989; Treasurer for NZIE (UK Division).

Publications and Seminars

- "SESOC Practice Guideline – Independent Review of Structural Designs for Building Consent." Co-author of Practice Guideline published in SESOC Journal Volume 23 No 2 September 2010.
- "IPENZ Structural Task Force – SESOC Committee Update." Co-author and editor for article published in SESOC Journal Volume 20 No 1 April 2007.

- "Design of Precast Concrete Buildings" - seminar segment by Ashley Smith with Precast Concrete Design tour of New Zealand by PCNZ and NZCS, May 2005.
- "Wind Induced Vibrations in Multi-Storey Apartment Buildings", ME Report, University of Auckland, February 1997.
- "Quay West Apartments, Auckland - Design and Construction Aspects including a Post-Tensioned Floor System", Ashley H. Smith. Paper presented at the 1996 NZ Concrete Society Conference, Wairakei.
- "Design Guidelines for a Fibreglass Mesh Reinforced Plaster Strengthening System", A.H. Smith and T.W. Robertson. Paper presented at the 1992 IPENZ Conference, Christchurch.

Professional Experience

2006 - Present — ***StructureSmith Ltd, Auckland,***
Managing Director and Chief Design Engineer
Selected projects:

Canterbury Television (CTV) Building, Christchurch, Collapse Investigation
for Department of Building and Housing
Carried out an investigation into the reasons for the collapse of the CTV building during the 22 February 2011 Lyttelton earthquake, in association with Hyland Consultants Ltd. Produced a report and will appear to give evidence at the upcoming Canterbury Earthquakes Royal Commission hearing.
(refer http://canterbury.royalcommission.govt.nz/documents-by-key/20120210.2865)

Stadium Southland, Invercargill, Collapse Investigation
for Department of Building and Housing
Carried out a technical investigation into the reasons for the collapse of the Stadium Southland roof on 18 September 2010 following a period of heavy snowfall, in association with Hyland Consultants Ltd.

Snowtown Wind Farm, South Australia
for Suzlon Energy and Tower Foundations
Carried out per review of design for post-tensioned reinforced concrete foundation for large wind turbine in South Australia. Wind tower hub height is approximately 80m above ground level.

Garfield St Development, Parnell, Auckland
for Hawkins Family Trust
Designed and produced full CAD documentation for this new 5-storey mixed use carpark, office and apartment development with precast concrete walls and concrete floors on steel decking and structural steel frame.

Imperial Buildings Refurbishment, Queen St, Auckland
for AMP Capital Investors and Structure Design Ltd
Designed and produced full CAD documentation and construction monitoring for the seismic upgrade, structural alteration and refurbishment of this 6-

storey historic brick building in downtown Auckland to accommodate high end retail and commercial tenancies.

Vector Arena, Auckland
for Mainzeal Construction
Carried out a comprehensive design review of the as-built new arena roof structure, that had been designed by others, to resolve problems with the expected performance of steel members and connections. Worked in collaboration with, and coordinated the efforts of, a number of other specialist consultants for this project including Auckland UniServices (for review of design wind pressures) and Compusoft Engineering Ltd (for review of structural computer analyses and seismic response). Certified the extensive structural modifications that were required prior to the public opening of the Arena.

AMP Downtown Redevelopment, Auckland
for Fletcher Construction
Carried out the structural design review for this new 4-storey extension and plant room on top of an existing 16-storey office building in downtown central Auckland. The extension comprised concrete floors on steel decking and structural steel frame. In addition to the new 4-storey extension, this project included extensive structural modifications inside the existing tower building and total replacement of the curtain wall, building services and fitout elements throughout.

Barclay on Albert Apartments, Auckland
for Hawkins Construction
Carried out the structural design review for this new 27-storey apartment building in Albert St Auckland central. The structure comprised precast floors on a combination of precast concrete and insitu concrete load-bearing shear walls.

Acted as an expert witness for the following projects:

- *Argent Hall, 2 Eden Crescent, Auckland, apartment tower*
- *27 Hill St, Onehunga, apartment complex*
- *128 Stancombe Road, Botany, apartment complex*
- *Fern Gardens, 51 Ireland Road, Panmure, apartment complex*

1994 - 2006 ***Murray Jacobs Limited, Auckland. Senior Associate***

Structural Design Team Leader and Principal Design Engineer for the following selected projects:

Sylvia Park Business Centre, Mt Wellington, Auckland
for Kiwi Income Property Trust & Mutliplex Constructions
Structural consultants for master planning of entire 24Ha site as mixed use retail, education, entertainment, office and carpark development.
Lead structural designer for 23,000m^2 specialty shopping mall and Foodtown supermarket. Structural design allowed for initial development as single level

retail with rooftop carparking, and for future expansion of retail to Level 2. Structural features included shallow raft foundations and modular precast concrete to enable rapid construction. Architectural features included intricately patterned and textured precast concrete walls, extensive skylights and canopies and 22m high signage towers.

Forte Apartments, and The Crescent Apartments, Auckland
for Charta Ltd
Project engineer for these two very efficient apartment developments in the Auckland central university precinct. Forte comprising 16 storeys, with an insitu concrete core and structural steel frame, and The Crescent comprising 14 storeys with precast load-bearing perimeter walls.

Oakridge Apartments, Newmarket, for Marcam Development
Project engineer for this upmarket 12-storey apartment building with two level basement carpark. Building height limitations necessitated a floor system comprising shallow concrete beams and precast flooring. The building features a curved facade to the north side.

1 Parliament St. Apartments, Auckland
for Multiplex Constructions
Engaged by the main contractor to redesign site retention systems and to replan the detailed construction sequence following the collapse of a large retaining wall and a stop work order by OSH. Construction of the three level basement was successfully completed with minimal disruption to allow construction of the tower building above to proceed.

PricewaterhouseCoopers Tower, Auckland
for AMP and Fletcher Construction
Structural design team leader and principle design engineer for this 32-storey office building which has a large (1400m^2) column free typical office floor. Structural features include:

- A combination of reinforced concrete shear walls and frames in the tower and Speedfloor on structural steel frames in the podium carpark areas.
- Site retaining and waterproof basement structures down to 8m below level of ground water table.
- Design of typical floors included exhaustive analysis and testing to limit floor vibrations. Travelled NZ in May 2005 as a speaker for the PCNZ / CCANZ Seminar Series on Precast Concrete Design – featuring PwC Tower as a case study.

Royal SunAlliance (now Vero) Centre, Auckland
for Kiwi Income Property Trust and Fletcher Construction
Project Engineer for this prestigious 41-storey office building which is NZ's tallest. Structural features include:

- Boundary site retention walls which reach up to 20m high on one side of the site and yet only 4m on the opposite side. Consequently long-term lateral soil loads to be resisted by the structure are very large - significantly higher than potential seismic loading.

- Measures to retain an existing 10-storey building on the same site until very late in the construction period, including temporary underpinning of foundations.
- Optimization of floor and beam systems on typical floors within a minimum depth ceiling space to accommodate the owners & tenants demands for heavy floor loading and high spec. building services.
- A wide range of significant architectural features including a large aluminium clad "halo", colonnade and mast on the rooftop, as well as canopies and feature facades near street level. The cladding to the main entrance comprises a 10m high frameless glass wall supported by stainless steel tension trusses.

Accident Compensation Board - Headquarters Building, Apia, Samoa
Concept Engineer for a new 7-storey office/retail/carpark building in Apia, Samoa, to tender documentation stage. Structural Reviewer subsequently, on behalf of the owner, of detailed construction documentation produced by the design-build contractor.

IBM Office Centre & Heritage Hotel, Auckland
for Symphony / Dynasty Pacific Group Joint Venture.
This project involved the seismic upgrading and refurbishment of the historic 7-storey Farmers buildings in Hobson St. Auckland, and construction of a 6 level carpark and office building on the adjoining site. Project Engineer for seismic upgrade of the historic brick and timber buildings including steel braced frames which were detailed to become architectural features inside the building.

Bulk Retail Development, Albany for Challenge Properties.
Project Engineer for comprehensive development planning, bulk excavation, site drainage and sediment control systems and application for resource consents. The development comprised eighteen bulk retail tenancies totalling 37,000m2 gross floor area and parking for 1300 cars on a 9Ha site.

Quay West, Auckland for Mirvac Group and Civil & Civic.
Project Engineer for this high quality 35-storey apartment/hotel in Albert St. Auckland - at the time of construction the tallest residential building in NZ. This building includes a podium, with 2 levels underground and 5 levels above ground, and a 28 level tower of residential units topped by a large plant room with a curved steel roof and facade structure. A feature of the tower was the all insitu concrete construction incorporating a post-tensioned flat plate floor system - the first in NZ for a multistorey building designed to modern earthquake standards. Presented a paper on this latter aspect at the NZ Concrete Society Conference in 1996.

Bank of New Zealand Office Building
for Auckland International Airport Ltd.
Project Engineer for this prominent three-storey office building and associated carparking and siteworks.

CityLife Hotel, Auckland
for Pacific Group and Mainzeal Property & Construction Ltd.
Computer analysis and design for this 25-storey serviced apartment/hotel building in Queen St. Auckland. A feature was the development of an all-precast load-bearing perimeter wall system.

1993 - 1994 ***Kingston Morrison Limited (incorporating KRTA and Morrison Cooper), Auckland. Senior Structural Engineer.***
Selected projects:

Auckland Town Hall, for Auckland City Council
Concept design for seismic strengthening and refurbishment of the historic Auckland Town Hall. Responsible for detailed computer analysis of the building which was constructed of unreinforced brick and stone masonry with timber floors.

Tamaki Campus, for University of Auckland
Concept design and preparation of design brief for new departmental buildings and lecture theatres at University of Auckland Tamaki Campus. Lead structural engineer for detailed design and contract documentation for the first seven of these buildings.

Seismic Risk Assessment for Auckland International Airport Ltd.
Project manager for assessment of seismic risk to all significant buildings and services owned by AIAL for insurance purposes. Scope included evaluation of earthquake hazard for site and assessment of likely seismic performance of facilities.

Leyte A Geothermal Steamfield Development, for PNOC-EDC, Philippines, and Awibengkok Geothermal Steamfield Development, for UNOCAL, Indonesia.
Lead structural engineer for a 350 MW geothermal steamfield development on Leyte Island in the Philippines, and a 110 MW geothermal steamfield development at Gunung Salak, Java, Indonesia. Responsible for feasibility studies, establishing structural design criteria, briefing and reviewing work by local joint venture partners, and design of structures to support many kilometres of large diameter, high temperature, steel piping and associated vessels and plant.

1989 - 1993 ***KRTA Limited, Auckland. Senior Structural Engineer.***

Mangatangi Dam and Lower Nihotupu Dam Safety Evaluation Studies for Auckland Regional Council.
Project Engineer for two separate dam safety evaluation studies. Coordinated work by joint venture geotechnical / seismic risk consultants and carried out structural analyses and safety evaluations of concrete spillway and valve towers which, in the case of Mangatangi, were 50 metres and 65 metres tall respectively.

Princes Wharf Redevelopment, Auckland for Mace Development.
Assisted with developed design for a proposed 12-storey hotel, office and retail development to be built above Princes Wharf, Auckland. Particular responsibilities included comparison of "base isolated" versus "conventional" structures under seismic loads, requiring non-linear seismic analyses.

Polyplast Strengthening System, Plaster Systems Limited
Responsible for the development of an engineering design manual for a proprietary glass fibre reinforced plaster system to strengthen unreinforced masonry walls against earthquake loading. Presented a paper on this subject at the 1992 IPENZ Conference in Christchurch.

The Plaza, Pakuranga, Challenge Properties Ltd.
Structural design and observation of construction for alterations and extensions to a large shopping centre at Pakuranga.

1987 - 1989 ***Ove Arup & Partners, London. Senior Design Engineer.***

Century Tower, Obunsha Corporation
Chief Project Engineer, reporting to Ove Arup division head, for this world-class office building in Tokyo, Japan. The structure comprises a three level basement and twin towers, 20 and 18 storeys high respectively, linked by a full height atrium. Responsible for coordination of design with Norman Foster Architects and Japanese design/build contractor. Structural team leader for design of the steel superstructure including non-linear time-history computer analyses for seismic loading.
Other projects included:
- Concept design for an underground rail passenger terminal and surrounding above ground development to include channel tunnel rail services at Kings Cross Station, London - also with Norman Foster & Associates as architects.
- Completed concept and developed design for an 8-storey steel framed office building to be constructed above one of the existing London Underground stations.
- Settlement analysis and design of a basement raft foundation for a new 8-storey office building in central London.

1987 ***Harris & Sutherland Ltd., London. Design Engineer.***
Completed the design of a large 3-storey reinforced concrete courthouse building in West London and then became resident engineer on site to supervise construction.

1984 - 1986 ***Holmes Wood Poole & Johnstone Ltd., Wellington.***
Structural Engineer.

Harbour and City Towers, Mainzeal Properties Ltd.
Leader of structural design team for twin 17-storey office/retail towers in central Wellington. A feature of the project was the up/down method of

construction that enabled construction of the basement parking level to progress simultaneously with that of the towers above.

IBM Complex, Petone, IBM NZ Limited
Structural design and observation of construction for five 2-storey modular precast office buildings and a large warehouse complex on the waterfront at Petone.

Ansett Passenger Terminal Building, Wellington, Ansett New Zealand.
Lead structural designer of a 2-storey steel framed airline passenger terminal building at Wellington airport.

1983 - 1984 ***Nightingale Bentall Partnership, Lower Hutt. Graduate Engineer.***
Head Office Building, Hutt Valley Energy Board, Lower Hutt
Project management, design of architectural elements, contract administration and observation of construction for a 7-storey *reinforced concrete office/retail building in Lower Hutt.*

1981 - 1983 ***Upper Hutt City Council. Graduate Engineer.***
Projects included:

- Design, site supervision and contract administration for several major stormwater and waterworks projects.
- Management of in-house water and wastewater service crews.
- Structural checking for building consent applications.

Statutes of New Zealand

High Court Rules

Schedule 4

Code of conduct for expert witnesses

r 9.43

Duty to the court

1 An expert witness has an overriding duty to assist the court impartially on relevant matters within the expert's area of expertise.

2 An expert witness is not an advocate for the party who engages the witness.

Evidence of expert witness

3 In any evidence given by an expert witness, the expert witness must—

(a) acknowledge that the expert witness has read this code of conduct and agrees to comply with it:

(b) state the expert witness' qualifications as an expert:

(c) state the issues the evidence of the expert witness addresses and that the evidence is within the expert's area of expertise:

(d) state the facts and assumptions on which the opinions of the expert witness are based:

(e) state the reasons for the opinions given by the expert witness:

(f) specify any literature or other material used or relied on in support of the opinions expressed by the expert witness:

(g) describe any examinations, tests, or other investigations on which the expert witness has relied and identify, and give details of the qualifications of, any person who carried them out.

4 If an expert witness believes that his or her evidence or any part of it may be incomplete or inaccurate without some qualification, that qualification must be stated in his or her evidence.

5 If an expert witness believes that his or her opinion is not a concluded opinion because of insufficient research or data or for any other reason, this must be stated in his or her evidence.

Duty to confer

6 An expert witness must comply with any direction of the court to—

(a) confer with another expert witness:

(b) try to reach agreement with the other expert witness on matters within the field of expertise of the expert witnesses:

(c) prepare and sign a joint witness statement stating the matters on which the expert witnesses agree and the matters on which they do not agree, including the reasons for their disagreement.

[7 In conferring with another expert witness, the expert witness must exercise independent and professional judgment, and must not act on the instructions or directions of any person to withhold or avoid agreement.**]**

History Note - Statutes of New Zealand

Clause 7 was substituted, as from 1 December 2009, by r 10 High Court Amendment Rules (No 2) 2009 (SR 2009/334).

History Note - Statutes of New Zealand

The High Court Rules were substituted, as from 1 February 2009, by s 8(1) Judicature (High Court Rules) Amendment Act 2008 (2008 No 90). See s 9 of that Act for the transitional provisions.

CTV Building - ETABS Computer Analyses										Issue Date:	27/06/2011
Modelling Assumptions and First Mode Period, Base Shear Comparisons											
	Units	Analysis Model 1								Analysis Model 2	
References		1986 Codes								Current Codes	
		NZS4203:1984								AS/NZS1170.5	
		NZS3101:1982								(pre DBH amndmt)	
										NZS3101:2006	
										NZSEE Guidelines	
Objective		1986 Design Code compliance check								Spectra, Period T1, comparisons with Current Code	
Software program used		ETABS								ETABS	
Analysis Type		Elastic, 3D, Dynamic Spectral Modal Analysis								Elastic, 3D, Dynamic	
Seismic Load Input		Response Spectra								Response Spectra	
Superimposed Dead Load	kPa	0.55								0.55	
Live Load	kPa	2.50								3.00	
Seismic Live Load	kPa	0.83								0.45	
T & L Beams - slab overhang each side	mm	300								300	
Material Properties	Various Units	Specified Material Properties (f'c 25MPa typical - up to 35MPa for level 1 columns)								Specified Properties	
Effective Section Properties, I_e, Av_e											
- I_e, T & L beams	Fraction of I_g	0.50								0.33	
- I_e, Columns	Fraction of I_g	1.00								0.66	
- I_e, Walls	Fraction of I_g	0.60								0.33	
- I_e, Diagonally reinforced coupling beams, Grid 1	Fraction of I_g	0.40								0.60	
- Av_e, Diagonally reinforced coupling beams, Grid 1	Fraction of A_g	0.83								varies 0.048 to 0.092	
Code Subsoil Flexibility / Site Subsoil Class (for seismic load input)		Flexible subsoil								Class D (deep or soft soil)	
Modelled foundation spring stiffness - where k = expected stiffness, 0.77k = lower bound stiffness and 1.36k = upper bound stiffness (refer Tonkin & Taylor report)		Rigid Foundation		1.36k						1.36k	
Accidental Eccentricity		Concentric		**Concentric**		+0.1B		-0.1B		Concentric	
	EQ Direction	N-S (X)	E-W (Y)	**N-S (X)**	**E-W (Y)**	N-S (X)	E-W (Y)	N-S (X)	E-W (Y)	N-S (X)	E-W (Y)
Model 1a. - Concrete Walls only (As-Drawn)											
First mode period of vibration, T1	seconds	0.82	0.79	**1.20**	**0.94**	1.22	0.81	1.21	1.02	1.39	1.19
Base Shear - (ductile S=1, M=0.8)	kN	2716	2776	**1797**	**2488**	1796	2728	1796	2220		
				*	*						
Model 1b. - Concrete Walls + Masonry Walls (As-Built)											
First mode period of vibration, T1	seconds	N/A	N/A	**1.03**	**0.70**	N/A	N/A	N/A	N/A	N/A	N/A
Base Shear - (ductile S=1, M=0.8)	kN	N/A	N/A	**2342**	**2660**	N/A	N/A	N/A	N/A	N/A	N/A
				*	*						
Model 1c. - Concrete Walls + Masonry Walls + Frame (As-Built)											
First mode period of vibration, T1	seconds	N/A	N/A	**0.88**	**0.60**	N/A	N/A	N/A	N/A	N/A	N/A
Base Shear - (ductile S=1, M=0.8)	kN	N/A	N/A	**2590**	**2996**	N/A	N/A	N/A	N/A	N/A	N/A
				*	*						
LEGEND		= Analyses to compare first mode period and / or base shear only								Note: Current Code has Ie for beams based on f'c 40MPa	
	(shaded) *	= Analyses referred to in this report									

WIT.SMITH.0001.25

BUI.MAD249.0364.2

From: Ashley Smith (StructureSmith) [mailto:ashley@structuresmith.co.nz]
Sent: Tuesday, 5 July 2011 7:10 p.m.
To: Clark Hyland (clark@fatigueandfracture.com)
Subject: CTV - floor plan layouts from CCC files

Clark,

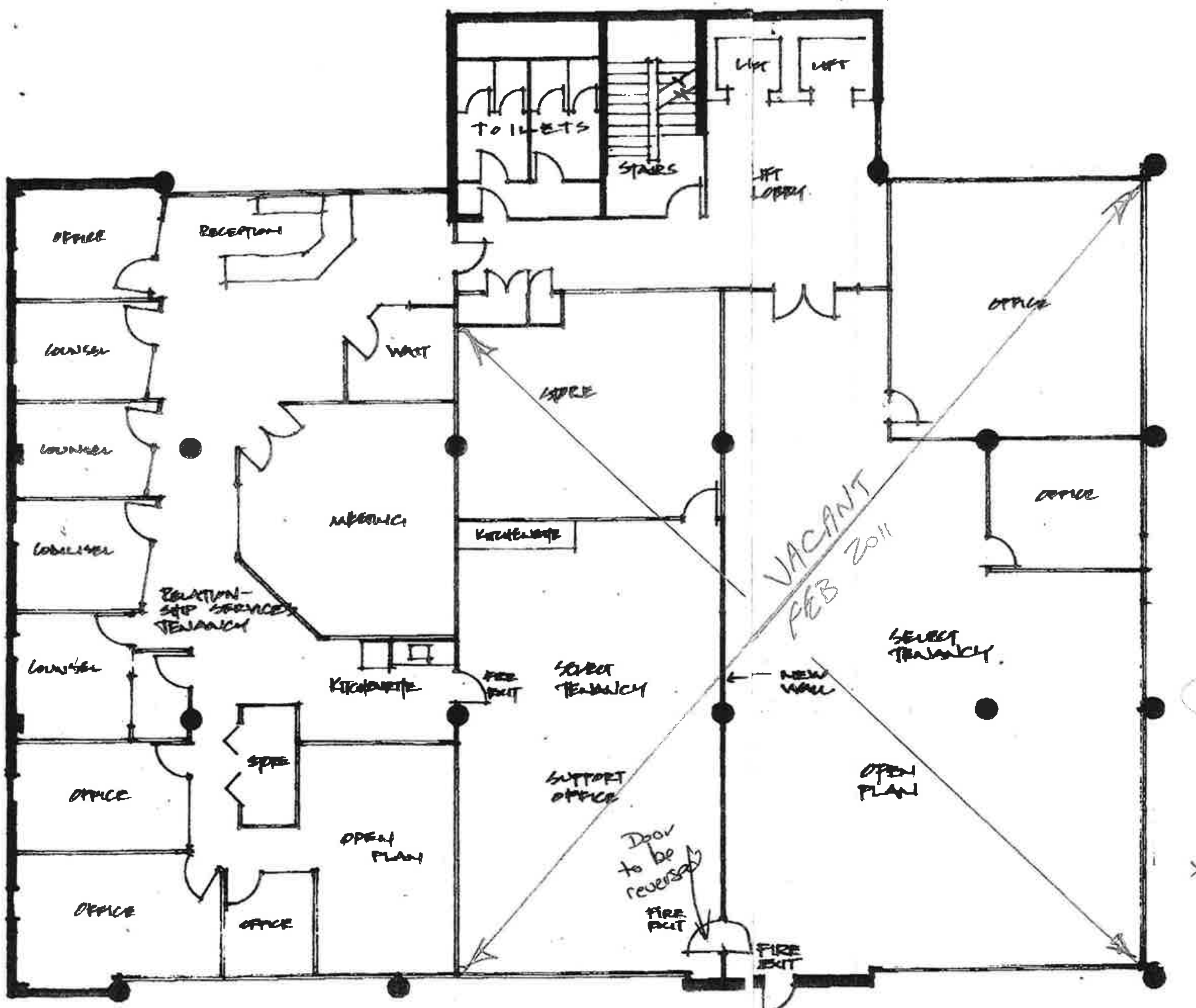
I have spent some time today going back through the CCC files and have compiled the attached set of drawings, being the latest floor plan layouts on file. It is very confusing because the floor level numbering is generally different (by one level) from that on the original architectural and structural drawings.

Following up on Peter Fehl's query about lundia loads – the lundia that I had previously identified is on level 5, as per the attached plan. However, according to the USAR sketch plans that you sent me on 29 April, that space appears to have been changed into a "treatment room". It therefore appears that the lundia would not have been present at the time of the February earthquake.

Ashley Smith
Director
STRUCTURESMITH | Consulting Engineers
Level 1, 8 Railway Street, Newmarket | PO Box 26502 Epsom, AUCKLAND 1344
ph (09) 377 9739 | mob 027 230 5153 | email ashley@structuresmith.co.nz

REVISIONS

PH/FAX: 03 439 5060
PO BOX 375
OAMARU
MARK VRYENHOEK, ANZIA



LEVEL 6

NEW FLOOR PLAN REV A 6/4/98 SELECT TENANCY INCLUDED
SCALE 1:100

PROJECT No. SELECT TENANCY LEVEL 5 249 MADRAS ST	
SCALES 1:100	DATE APRIL '98
SHEET No. WD 05	

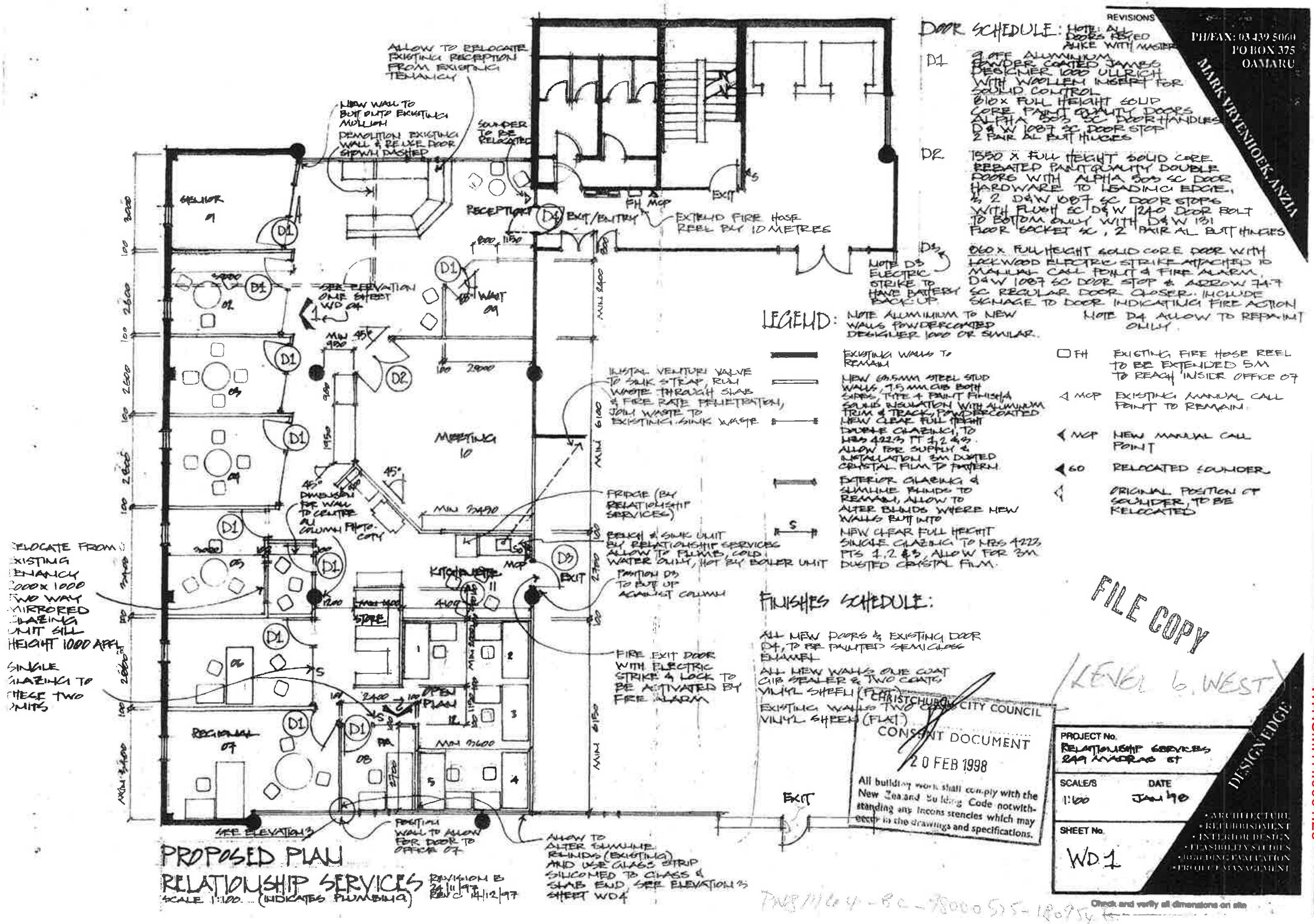
DESIGN PLUS

Check and verify all dimensions on site prior to commencement of works.

PN811144-BC-98000575-1809546

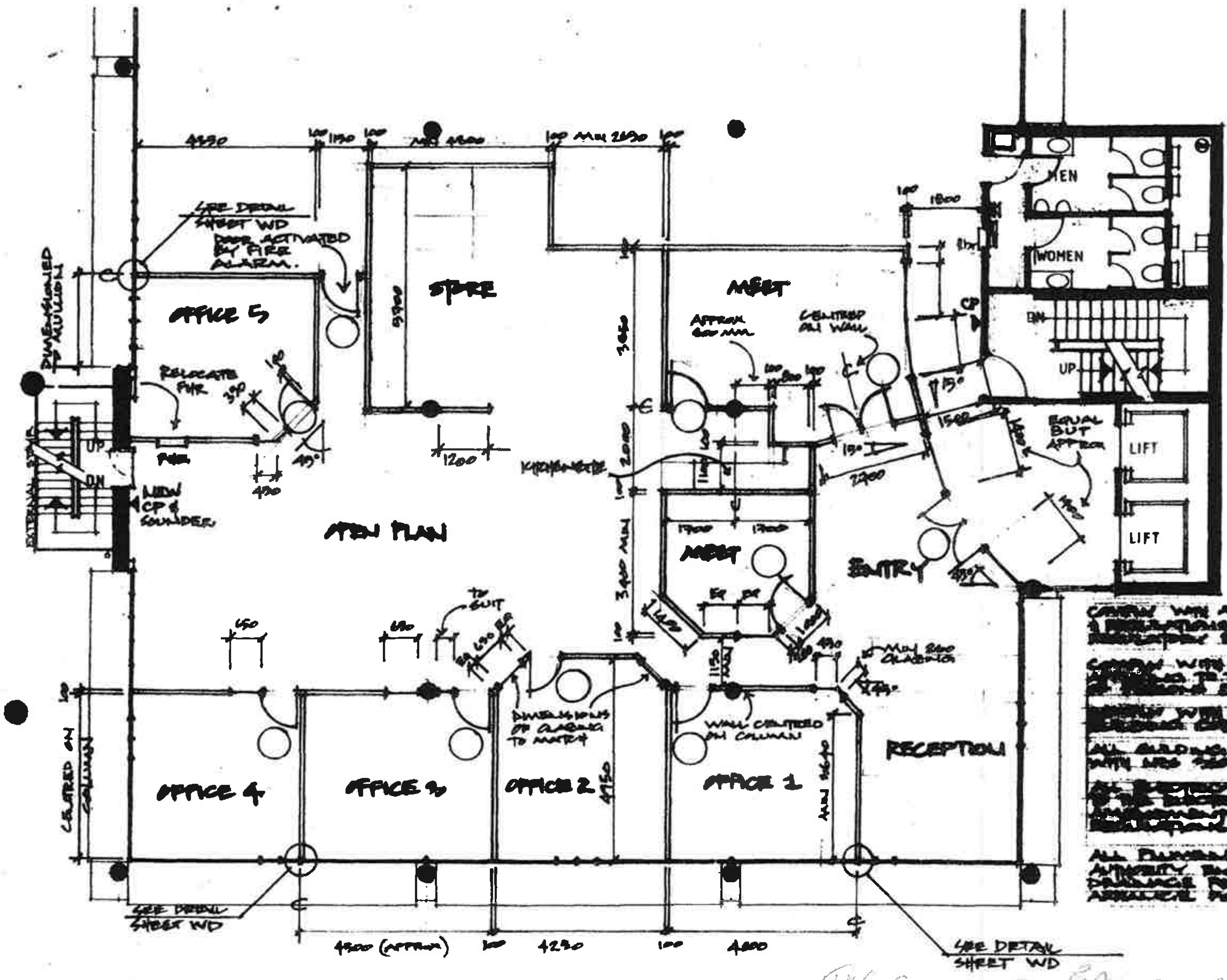
BUI.MAD249.0365.2

WIT.SMITH.0001.27


DOOR SCHEDULE: NOTE: ALL DOORS KEYED ALIKE WITH MASTER
D1 9 OFF ALUMINIUM POWDER COATED JAMBS DESIGNER 1000 ULLRICH WITH WOOLLEN INSERT FOR SOUND CONTROL 810 x FULL HEIGHT SOLID CORE PAINT QUALITY DOORS ALPHA 505 SC DOOR HANDLES D&W 1087 SC DOOR STOP 2 PAIR AL BUTT HINGES
D2 1550 x FULL HEIGHT SOLID CORE REBATED PAINT QUALITY DOUBLE DOORS WITH ALPHA 505 SC DOOR HARDWARE TO LEADING EDGE, & 2 D&W 1087 SC DOOR STOPS WITH FLUSH SC D&W 1240 DOOR BOLT TO BOTTOM ONLY WITH D&W 131 FLOOR SOCKET SC, 2 PAIR AL BUTT HINGES
D3 860 x FULL HEIGHT SOLID CORE DOOR WITH LOCKWOOD ELECTRIC STRIKE ATTACHED TO MANUAL CALL POINT & FIRE ALARM. D&W 1087 SC DOOR STOP & ARROW 747 SC REGULAR DOOR CLOSER. INCLUDE SIGNAGE TO DOOR INDICATING FIRE ACTION
NOTE D4 ALLOW TO REPAINT ONLY
NOTE D3 ELECTRIC STRIKE TO HAVE BATTERY BACK UP
LEGEND: NOTE ALUMINIUM TO NEW WALLS POWDERCOATED DESIGNER 1000 OR SIMILAR.
EXISTING WALLS TO REMAIN
NEW 63.5MM STEEL STUD WALLS, 9.5 MM GIB BOTH SIDES, TYPE 4 PAINT FINISH & SOUND INSULATION WITH ALUMINIUM TRIM & TRACK, POWDERCOATED
NEW CLEAR FULL HEIGHT DOUBLE GLAZING, TO NZS 4223 PT 1,2 & 3. ALLOW FOR SUPPLY & INSTALLATION 3M DUSTED CRYSTAL FILM TO PATTERN
EXTERIOR GLAZING & SUNLINE BLINDS TO REMAIN, ALLOW TO ALTER BLINDS WHERE NEW WALLS BUTT INTO
NEW CLEAR FULL HEIGHT SINGLE GLAZING TO NZS 4223 PTS 1,2 & 3, ALLOW FOR 3M DUSTED CRYSTAL FILM.
FH EXISTING FIRE HOSE REEL TO BE EXTENDED 5M TO REACH INSIDE OFFICE 07
MCP EXISTING MANUAL CALL POINT TO REMAIN
MCP NEW MANUAL CALL POINT
60 RELOCATED SOUNDER
ORIGINAL POSITION OF SOUNDER, TO BE RELOCATED
FINISHES SCHEDULE:
ALL NEW DOORS & EXISTING DOOR D4, TO BE PAINTED SEMIGLOSS ENAMEL
ALL NEW WALLS ONE COAT GIB SEALER & TWO COATS VINYL SHEEN (FLAT)
EXISTING WALLS TWO COATS VINYL SHEEN (FLAT)
FILE COPY
(LEVEL 6, WEST)
CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
20 FEB 1998
All building work shall comply with the New Zealand Building Code notwithstanding any Incons stencies which may occur in the drawings and specifications.
MARK VRYENHOEK, ANZIA
PH/FAX: 03 439 5060
PO BOX 375
OAMARU
REVISIONS
DESIGNEDGE
• ARCHITECTURE
• REFURBISHMENT
• INTERIOR DESIGN
• FEASIBILITY STUDIES
• BUILDING EVALUATION
• PROJECT MANAGEMENT
PROJECT No. RELATIONSHIP SERVICES 249 MADRAS ST
SCALE/S 1:100
DATE JAN 98
SHEET No. WD 1
Check and verify all dimensions on site
ALLOW TO RELOCATE EXISTING RECEPTION FROM EXISTING TENANCY
NEW WALL TO BUTT ONTO EXISTING MULLION
DEMOLITION EXISTING WALL & REUSE DOOR SHOWN DASHED
SOUNDER TO BE RELOCATED
RECEPTION
EXIT/ENTRY
EXTEND FIRE HOSE REEL BY 10 METRES
EXIT
WAIT 09
MEETING 10
INSTAL VENTURI VALVE TO SINK STRAP, RUN WASTE THROUGH SLAB & FIRE RATE PENETRATION, JOIN WASTE TO EXISTING SINK WASTE
FRIDGE (BY RELATIONSHIP SERVICES)
BENCH & SINK UNIT BY RELATIONSHIP SERVICES ALLOW TO PLUMB, COLD WATER ONLY, HOT BY BOILER UNIT
POSITION D3 TO BUTT UP AGAINST COLUMN
KITCHENETTE
STORE
FIRE EXIT DOOR WITH ELECTRIC STRIKE & LOCK TO BE ACTIVATED BY FIRE ALARM
RELOCATE FROM EXISTING TENANCY 2000 x 1000 TWO WAY MIRRORED GLAZING UNIT SILL HEIGHT 1000 AFFL
SINGLE GLAZING TO THESE TWO UNITS
SENIOR 01
REGIONAL 07
POSITION WALL TO ALLOW FOR DOOR TO OFFICE 07
ALLOW TO ALTER SUNLINE BLINDS (EXISTING) AND USE GLASS STRIP SILICONED TO GLASS & SLAB END, SEE ELEVATION 3 SHEET WD4
SEE ELEVATION 3
SEE ELEVATION ONE SHEET WD 04
PROPOSED PLAN
RELATIONSHIP SERVICES
SCALE 1:100 ... (INDICATES PLUMBING)
REVISION B 24/11/97
REV C 14/12/97

BUI.MAD249.0365.4

WIT.SMITH.0001.29



NEW FLOOR PLAN

LEGEND

EXISTING WALLS

NEW 63.5 MM STEEL STUD WALLS, 9.5MM GIB BOARD BOTH SIDES WITH SOUND INSULATION & ALUMINIUM HEAD & STARTER TRACK.

OUTLINE SPECIFICATION:

COMPLY WITH ALL STATUTORY REGULATIONS & REGULATIONS OF LOCAL AUTHORITIES & [illegible]

COMPLY WITH ALL ACTS & REGULATIONS [illegible] SAFETY [illegible] & WELFARE [illegible] CONSTRUCTION

COMPLY WITH ALL ASPECTS OF THE NZ BUILDING CODE

ALL BUILDING WORK & MATERIALS TO COMPLY WITH NZS [illegible]

ALL ELECTRICAL WORK TO BE INSTALLED ACCORDING TO THE ELECTRICAL WIRING REGULATIONS & [illegible] & LOCAL AUTHORITY SUPPLY [illegible]

ALL PLUMBING WORK TO COMPLY WITH LOCAL AUTHORITY BY-LAWS & THE PLUMBING & DRAINAGE REGULATIONS. CARRY OUT TESTS & ARRANGE FOR INSPECTIONS.

REVISIONS

PH/FAX: 03 439 5060
PO BOX 375
OAMARU
MARK VRYENHOEK, ANZIA

PROJECT	BAYLISS & SHELDON LEVEL 4 245 MADRAS ST. CHRISTCHURCH.
SCALE/S 1:100	DATE JULY '98
SHEET No. WD 02	

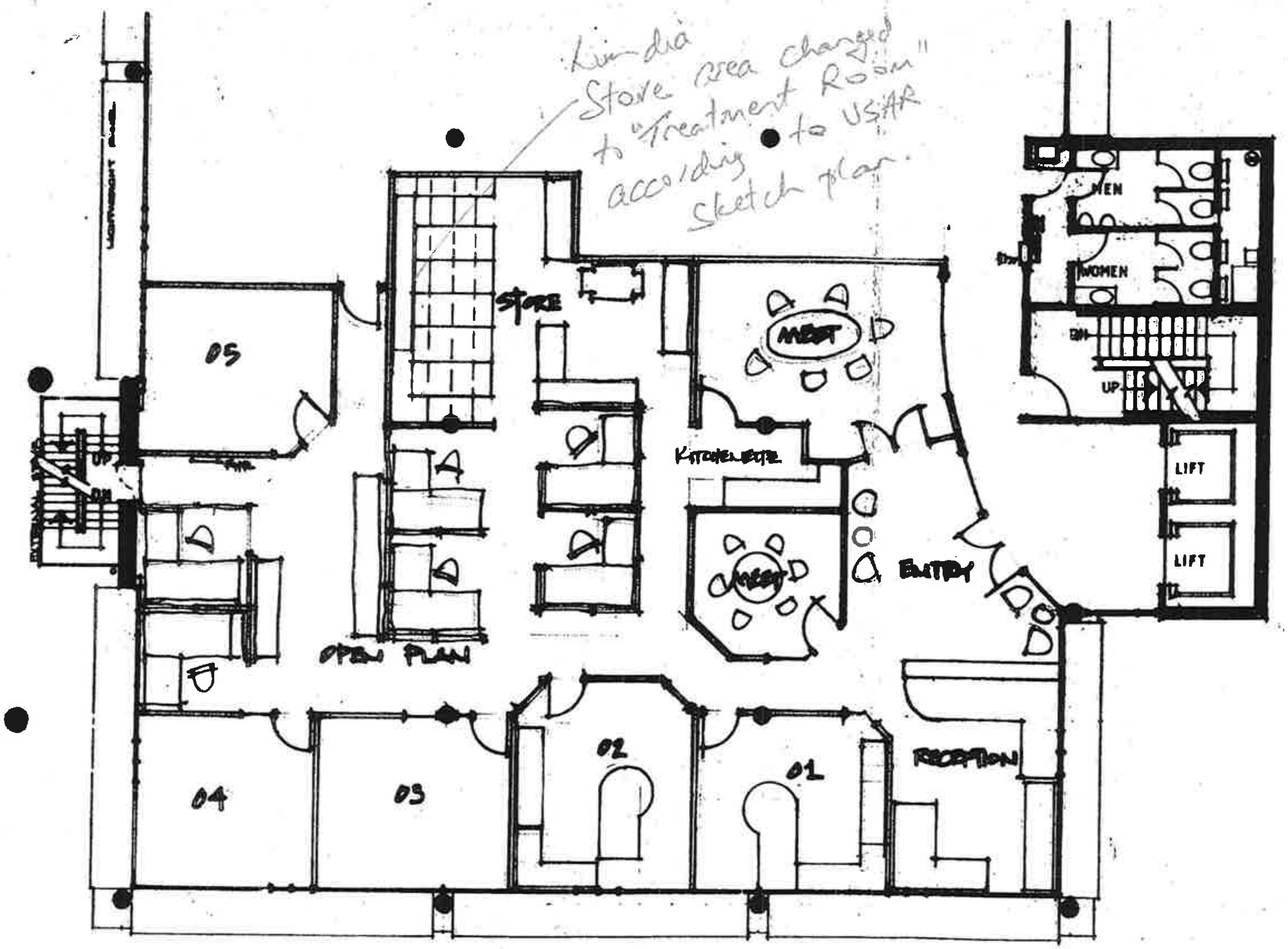
DESIGNEDGE

- ARCHITECTURE
- REFURBISHMENT
- INTERIOR DESIGN
- FEASIBILITY STUDIES
- BUILDING EVALUATION
- PROJECT MANAGEMENT

Check and verify all dimensions on site prior to commencement of works.

THE CLINIC ← ~~BAYLISS & SHELDON~~ (LEVEL 4/5 EAST)

PN BU [illegible] - BC - CON 98005655 - 180951



Kim-dia Store area changed to "Treatment Room" according to USAR sketch plan.

NEW FURNITURE LAYOUT
SCALE 1:100

LEGEND

THE CLINIC
↑
~~BAYLISS & SHELDON~~
(LEVEL 4 EAST)
5

REVISIONS

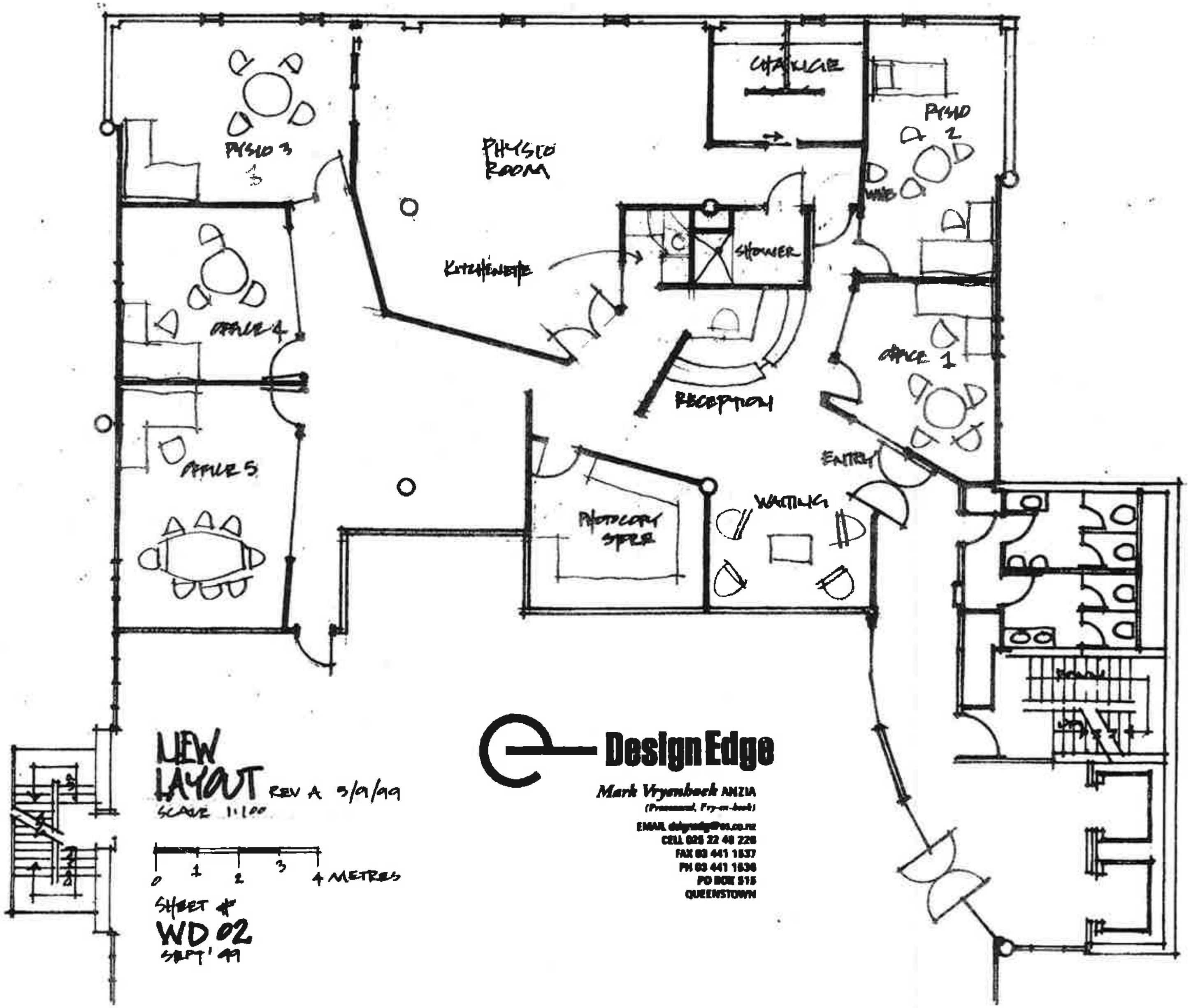
MARK VRYESHOEK ANZIA

DESIGNEDGE
• ARCHITECTURE • REFURBISHMENT • INTERIOR DESIGN • FEASIBILITY STUDIES • BUILDING VALUATION • PROJECT MANAGEMENT

PROJECT	
BAYLISS & SHELDON LEVEL 4, 245 MADRAS ST CHRISTCHURCH	
SCALE/S 1:100	DATE JULY '98
SHEET No. WD 01	

Check and verify all dimensions on site prior to commencement of works.

TN8 11144-BC-CON98005655-180957



LEGEND:

- EXISTING GLAZING (EXTERIOR)
- EXISTING WALLS
- NEW WALLS
- NEW FULL HEIGHT GLAZING, CLEAR.

NEW LAYOUT REV A 3/9/99
SCALE 1:100

0 1 2 3 4 METRES

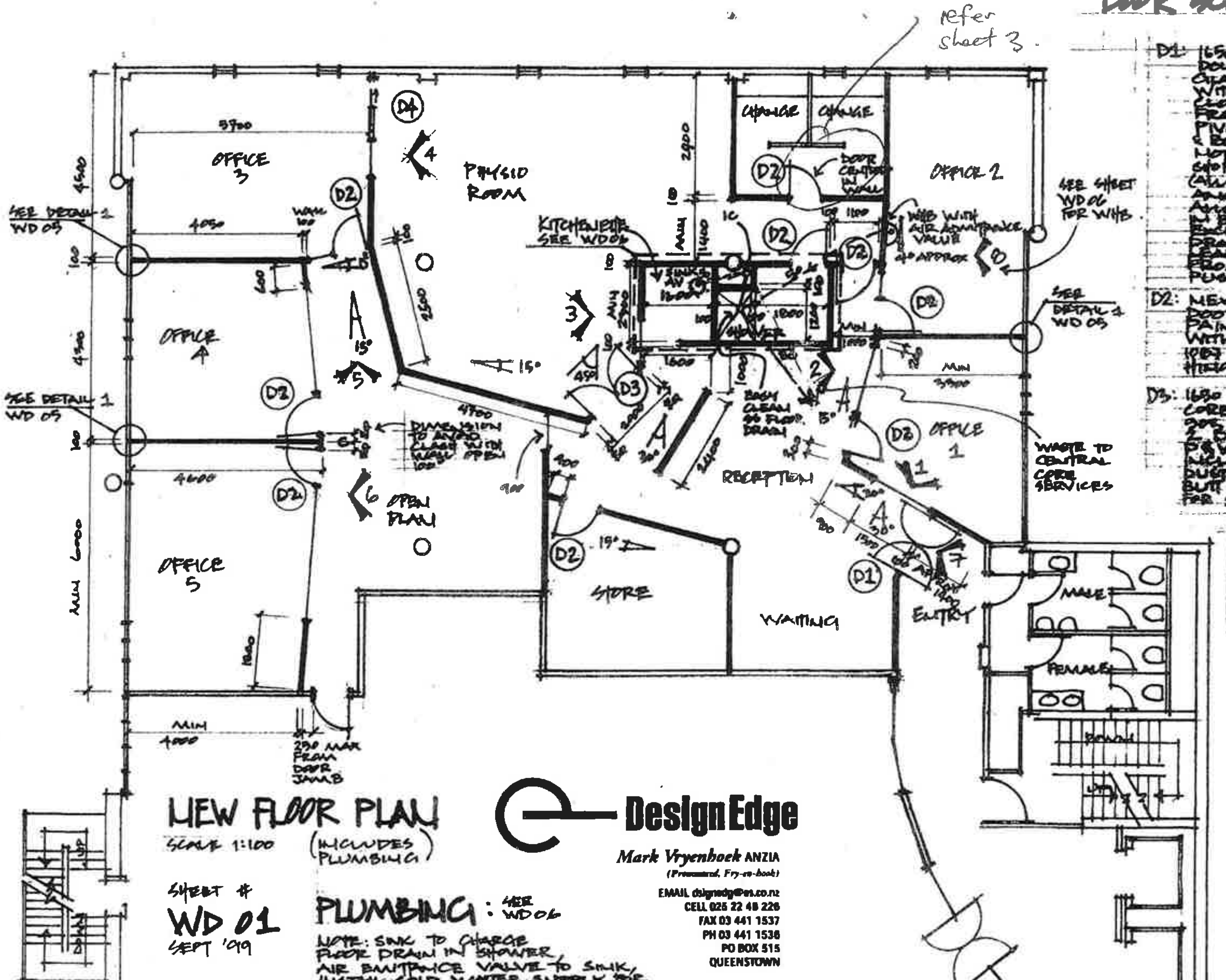
SHEET # WD 02
SEPT '99

DesignEdge
Mark Vryenhoek ANZIA
(Proceed, Fry-on-hook)
EMAIL designedge@xx.co.nz
CELL 025 22 48 226
FAX 03 441 1537
PH 03 441 1536
PO BOX 515
QUEENSTOWN

CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
14 OCT 1999
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

LEVEL ~~4~~ 5 WEST
(THE CLINIC)
Empower
~~Rehabilitation Ltd~~

AN8111144 - SC - CON99008556 - 180954 3



NEW FLOOR PLAN

SCALE 1:100 (INCLUDES PLUMBING)

SHEET # **WD 01**
SEPT '99

DesignEdge
Mark Vryenhoek ANZIA
(Pronounced, Fry-en-hook)
EMAIL dsignedg@es.co.nz
CELL 025 22 48 226
FAX 03 441 1537
PH 03 441 1536
PO BOX 515
QUEENSTOWN

DOOR SCHEDULE:

NOTE ALL DOORS KEYED ALIKE WITH MASTER KEY

D1: 1650 WIDE BY FULL HEIGHT DOUBLE CLEAR TOUGHENED GLASS DOORS, FRAMELESS WITH DORMER RTS 83 TRANSOM CLOSER CONCEALED IN AL FRAME, WITH DORMER FLOOR PIVOT BEARING & DORMA TOP & BOTTOM RAILS TO BOTH LEAFS. NOTE ALUMINIUM FRAME TO BE SHOP FRONT TO SUITE RTS CLOSER (ALL ALUMINIUM TO BE SILVER ANODISED) ALLOW FOR LOCKS TO BE INSERTED IN BOTH BOTTOM RAILS WITH DUST EXCLUDING SOCKETS. DRAKE & WRIGLEY 181 (4 OFF) TO EACH LEAF, 250 MM SC, INSTALL 100MM FROM EDGE ALLOW FOR D&W PUSH PULL SIGNAGE.

D2: NEW 810 BY FULL HEIGHT SOLID CORE DOORS WITH WOLLEN INSERT TO AL JAMBS, PAINT QUALITY, SEMI-GLOSS ENAMEL WITH ALPHA 303 SC DOOR HANDLES, D&W 1087 SC DOOR STOPS, 2 PR ALUMINIUM BUTT HINGES, ALL DOORS LOCKABLE

D3: 1650 WIDE × FULL HEIGHT REBATED, SOLID CORE PAINT QUALITY DOORS WITH ALPA 303 SC DOOR HANDLE TO LEADING EDGE 2 D&W 1087 SC DOOR STOPS, & FLUSH SC D&W 1240 DOOR BOLT TO BOTTOM & TOP INCLUDE STRIKE PLATE & D&W 131 SC DUST EXCLUDING SOCKET, 2 PAIR AL BUTT HINGES WITH WOLLEN INSERT FOR SOUND CONTROL

D4: 1980 × 810 CAVITY SLIDER C/S SINGLE SOLID CORE PAINT QUALITY TIMBER JAMBS. REBATED FOR [illegible] CAYLOCK CHRISTCHURCH [illegible] TO OFFICE SIDE (LEVER HANDLES/SCP)

CONSENT DOCUMENT
14 OCT 1999
All Building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specification

LEGEND

EXISTING WALLS TO REMAIN

NEW 63.5 MM STEEL STUD WALLS WITH 9.5MM GIB BOARD TO BOTH SIDES, DESIGNER 1000 SERIES ULLRICH POWDERCOATED WITH HEAD & STARTER TRACKS, ALL WALL WITH SOUND ABSORBING BATTS WALLS FLOOR TO SUSPENDED CEILING & BRACED TO SLAB ABOVE TO NZS 4203

NOTE WET AREA GIB 9.5MM TO SHOWER

FULL HEIGHT SAFETY GLAZING TO NZS 4223 PTS 1, 2, & 3 IN DESIGNER 1000 SERIES GLAZING SECTION, POWDERCOATED WITH 3M DUSTED CRYSTAL FILM SEE ELEVATIONS SHEET WD05

WASTE PVC PIPES TO CODE TO TRAVEL UNDER FLOOR NOTE ALL FLOOR PENETRATIONS TO BE FIRE RATED SIZES INDICATED

PLUMBING : SEE WD06

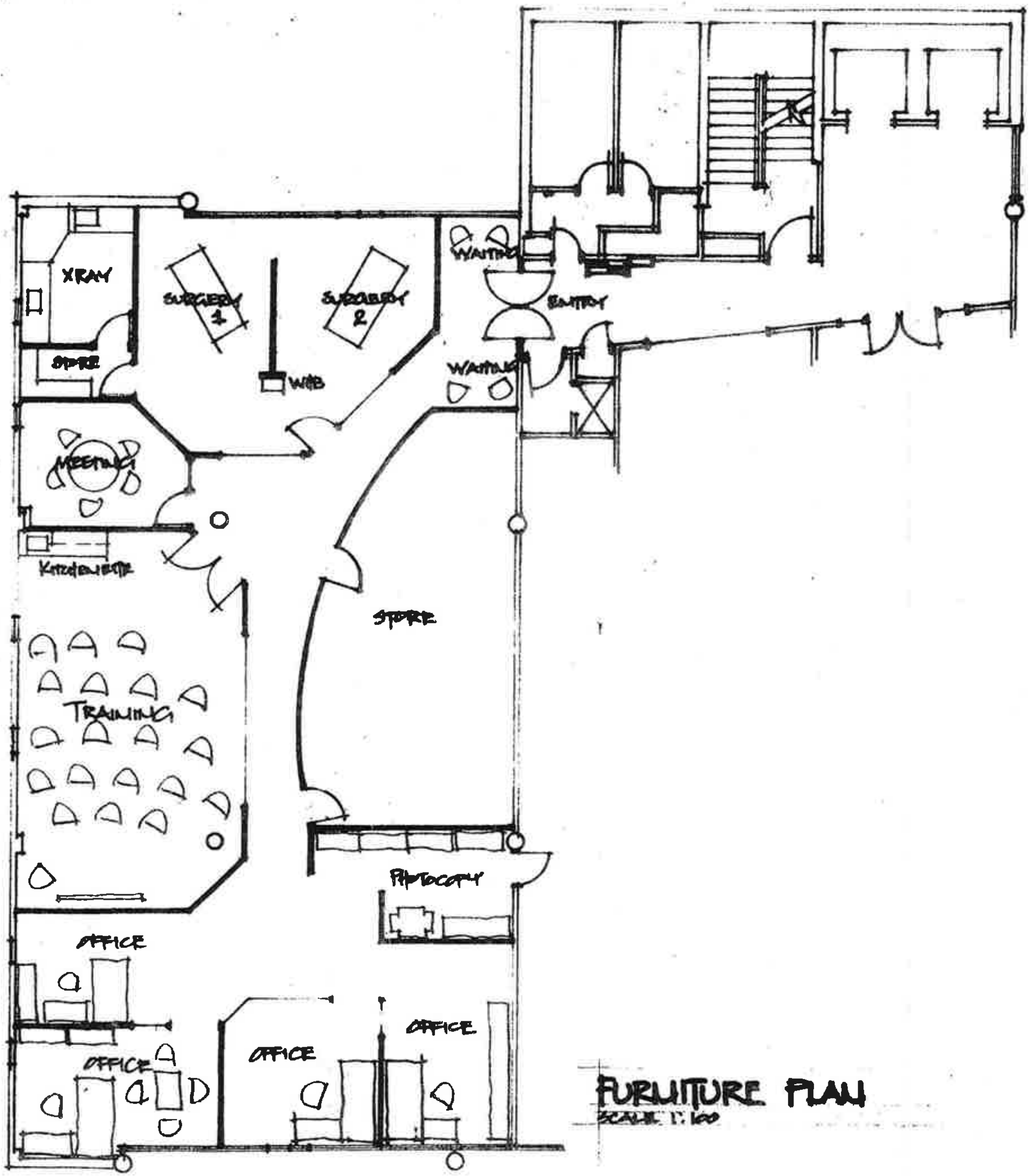
NOTE: SINK TO CHARGE FLOOR DRAIN IN SHOWER, AIR ADMITTANCE VALVE TO SINK, INSTALL COLD WATER SUPPLY FOR DISHWASHER, SEE JOINERY FOR KITCHENETTE SHEET WD06

INSTALL COLD WATER TO SINK & PAREX & DISHWASHER
TAP: METHVEN CENTIQUE CHROME SINGLE LEVER
SINK: MERCER FIN, SS ROUND
PAREX PH2.0/12 WHITE WITH HOT WATER EXTENSION TO SINK
SHOWER: METHVEN OLYMPUS 180 MASSAGE SLIDE, WITH MIXER AT TRU TEMP (NOTE: ALL CHROME, HOT & COLD WATER FROM CENTRAL CORE MIXER ANTI SCALD DEVICE.
WHB: CAROMA FLORA 500 WITH SHROUD, WHITE
TAP: METHVEN SINGLE LEVER OLYMPUS OSLB BASIN MIXER, CHROME

(THE CLINIC)

LEVEL 5 WEST – Empower Rehabilitation Ltd.

PN 811144 – BC – CON9900856 – 180953



FURNITURE PLAN

SCALE 1:100

REVISIONS

MARK VRYENHOEK ANZIA

OAMARU

Kings Education

~~Health Link South~~

Level ~~3~~ West 4

CHRISTCHURCH CITY COUNCIL

CONSENT DOCUMENT

30 APR 1999

All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may occur in the drawings and specifications.

PROJECT	HEALTH LINK SOUTH, LEVEL 3, 245-9 MADRAS ST.
SCALE/S 1:100	DATE JAN '99
SHEET No	WD 02

DESIGN EDGE

- ARCHITECTURE
- REFURBISHMENT
- INTERIOR DESIGN
- FEASIBILITY STUDIES
- BUILDING EVALUATION
- PROJECT MANAGEMENT

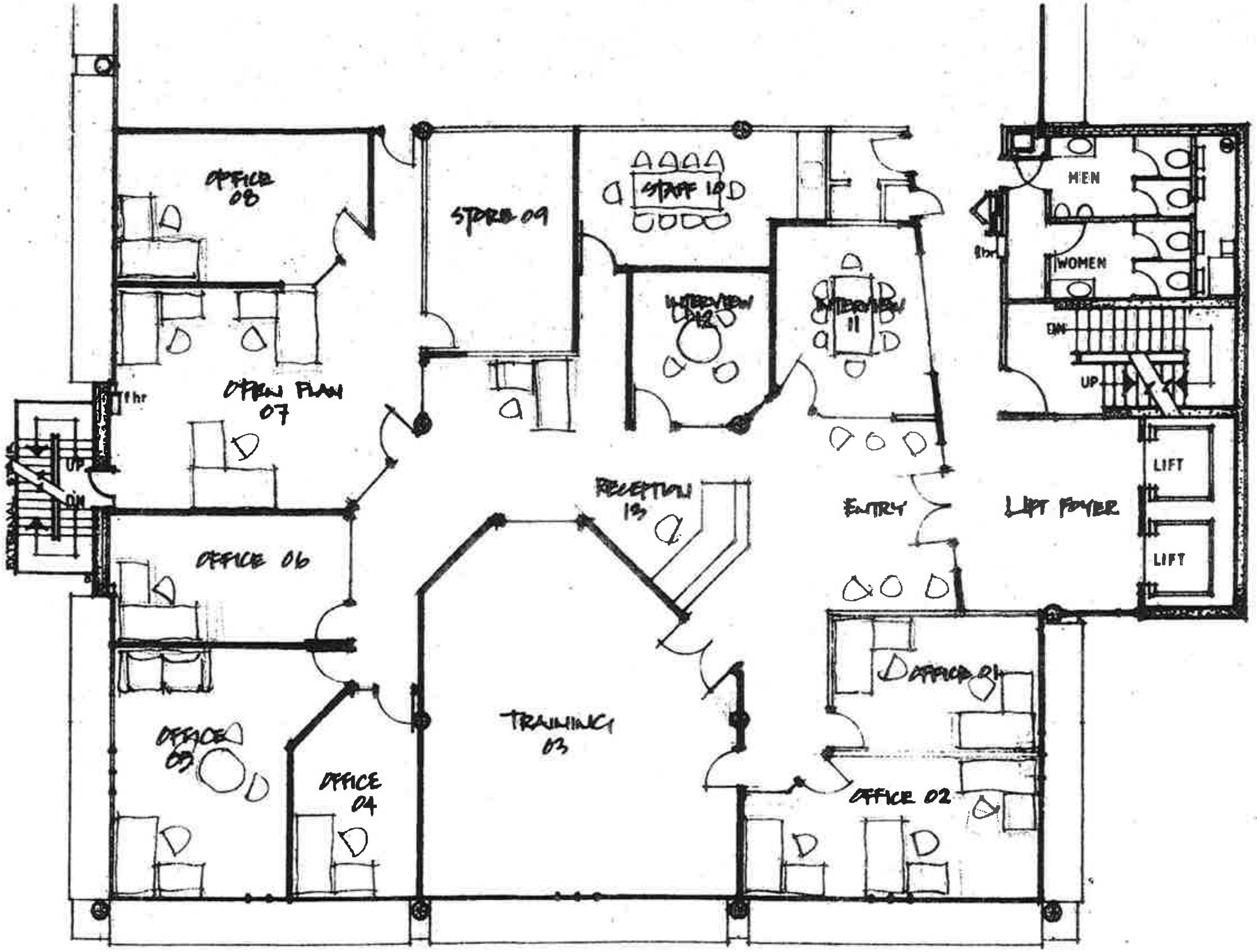
Check and verify all dimensions on site prior to commencement of works

PNS 4464 - BC - CON 99000309 - 180954

REVISIONS

PH/FAX: 03 439 5060
PO BOX 375
OAMARU

MARK VRYENHOEK ANZIA



NEW FURNITURE LAYOUT
SCALE 1:100

KINGS EDUCATION
~~Richmond Fellowship~~
Level ~~3~~ 4 East.

PROJECT RICHMOND FELLOWSHIP LEVEL 3 245-9 MADRAS ST	
SCALE/S 1:100	DATE OCT '98
SHEET No. WD 02	

DESIGNEDGE
• ARCHITECTURE
• REFURBISHMENT
• INTERIOR DESIGN
• FEASIBILITY STUDIES
• BUILDING EVALUATION
• PROJECT MANAGEMENT

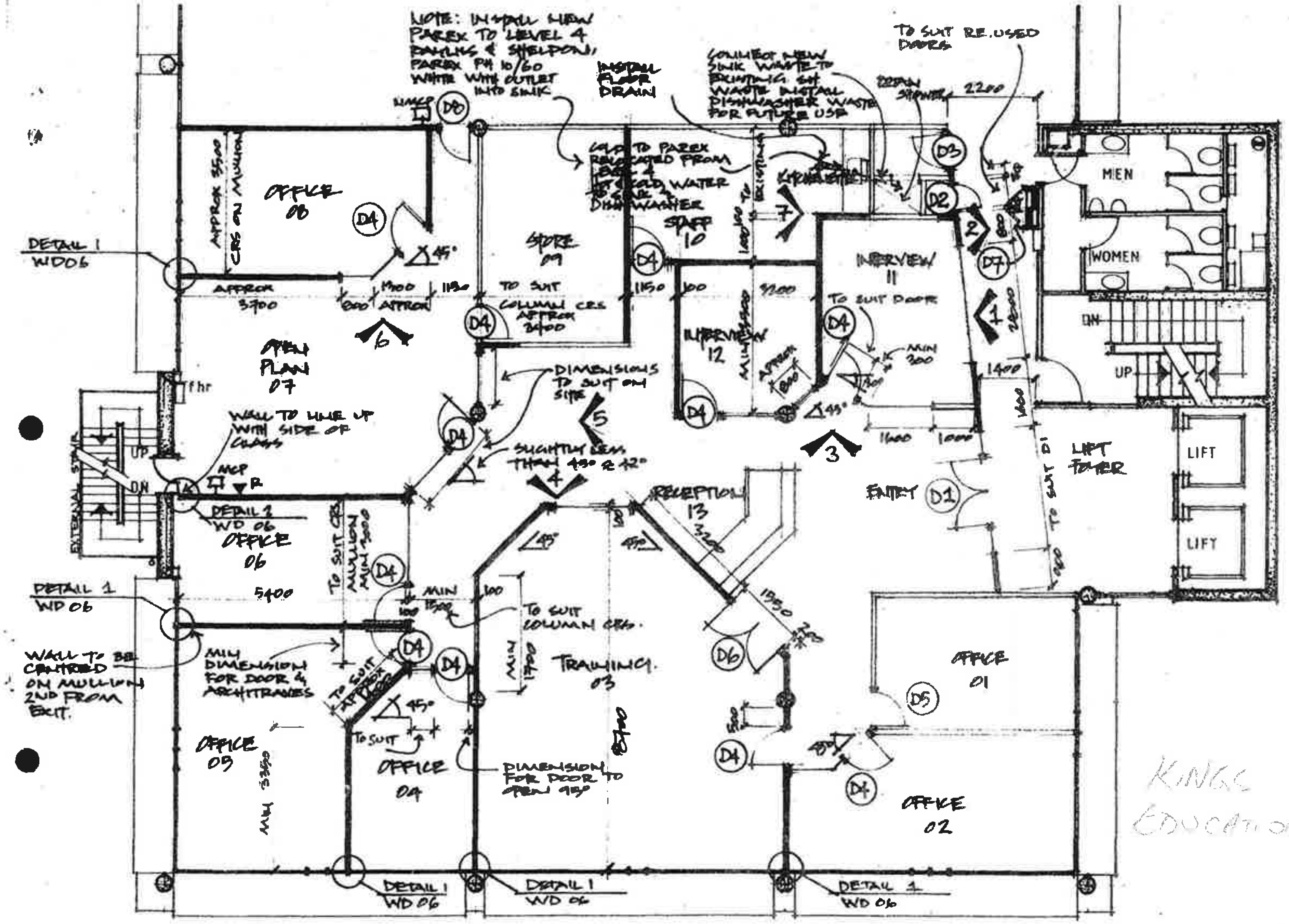
Check and verify all dimensions on site prior to commencement of works.

PNBUILDING-BC-CON98008102 - 180956

BUI.MAD249.0365.10

WIT.SMITH.0001.35

REVISIONS
PH/FAX: 03 439 5060
PO BOX 375
OAMARU
MARK VRYENHOEK, ANZIA



LEGEND

NEW STEEL STUD, 9.5MM GIB BOARD TO BOTH SIDES, ACOUSTIC BATTS TO INTERIOR OF WALL, SKIRTING, RE.USE EXISTING & NEW SERVICE 45X12MM BEVELLED MDF PAINTED

NEW FULL HEIGHT SAFETY GLAZING, CLEAR TO NZS 4223 PTS 1, 2, 4.3, WITH POWDER COATED ALUMINIUM ULLRICH TUA 1034 GLAZING BAR OR SIMILAR MDF ...

EXISTING WALLS, EXISTING CORNICE SKIRTINGS TO REMAIN TO BE REPAINTED SEE FINISHES

MCP RELOCATED MANUAL CALL POINT, M DENOTES NEW MANUAL CALL POINT

(R) RELOCATED SOUNDER

KINGS ~~Richmond Fellowship~~
EDUCATION Level ~~3~~ 4 East

NEW FLOOR PLAN

SCALE 1:100 (INCLUDES PLUMBING)

DOOR SCHEDULE

NOTE: ALL DOORS NEW & RE.USED TO BE PAINTED SEMI-GLOSS ENAMEL.

NOTE: ALL DOORS TO BE KEYED ALIKE WITH MASTER KEY, REPLACE ALL CYLINDERS WITH NEW IF NECESSARY. RE.USE ALL HARDWARE, REPLACE TO MATCH IF DEFECTIVE.

D1 RE.USE EXISTING DOORS & SIDELIGHTS INCLUDING DOOR CLOSERS & ARCHITRAVES

D2 RE.USE EXISTING SHOWER DOOR, & ARCHITRAVES NEW DOOR STOP ADJACENT TO WALL D&W SC 1087

D3 RE.USE EXISTING DOOR TO SHOWER INCLUDING ARCHITRAVES & NEW DOOR STOP TO MATCH D2.

D4 NEW SOLID CORE FULL HEIGHT DOOR PAINT QUALITY, RE.USE HARDWARE, NEW D&W SC 1087 DOOR STOP, 2 PAIR 100MM BUTT HINGES ALL WITH AL POWDERCOATED FRAMES, DESIGNER 1000 SERIES

D5 REMOVE EXISTING DOOR & ARCHITRAVES & INSTALL NEW FULL HEIGHT DOOR TO MATCH D4

D6 1530 x FULL HEIGHT SOLID CORE REBATED PAINT QUALITY DOUBLE DOORS WITH DOOR HANDLE & LOCK TO MATCH EXISTING TO LEADING EDGE, FLUSH D&W 1240 SC DOOR BOLT TO BOTTOM ONLY WITH SC D&W 131 FLOOR SOCKET, 2 PAIR AL HINGES TO EACH LEAF.

D7 UNDERCUT BY 25MM NEW 25MM MDF DOORS BIFOLD WITH SCOTT FS B75, 4 PAIR GRASS OVER LAY HINGES & FULL LENGTH PIANO HINGE, SEE ELEVATION 2 WD 06, 2 MAGNETIC CATCHES & 95MM D HANDLE (SC)

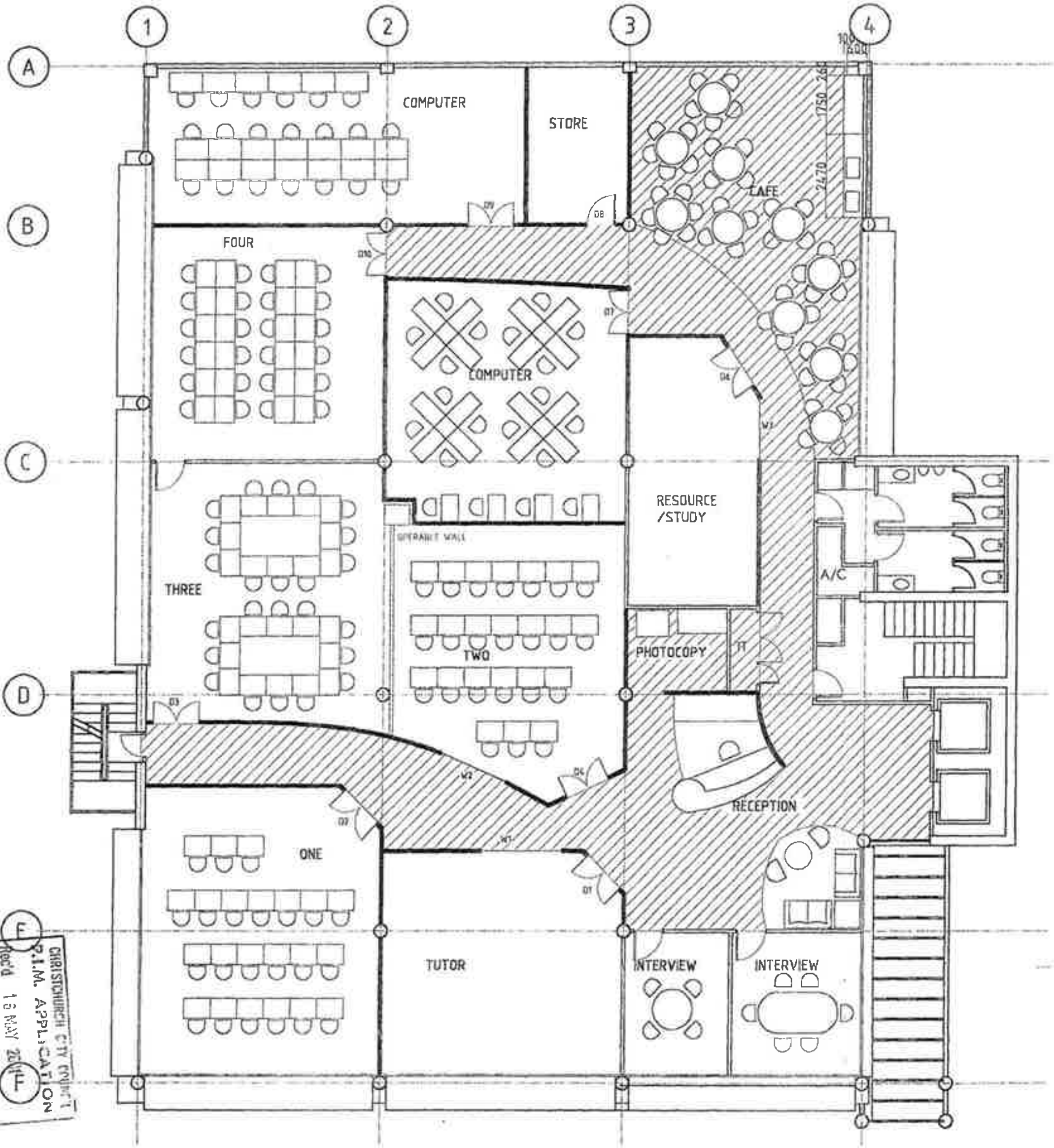
D8 860 x FULL HEIGHT SOLID CORE DOOR WITH LOCKWOOD ELECTRIC STRIKE WITH BATTERY BACK-UP, ATTACHED TO MANUAL CALL POINT, & FIRE ALARM, D&W 1087 SC DOOR STOP & ARROW 7473 SC REGULAR DOOR CLOSER, INCLUDE SIGNAGE TO DOOR INDICATING FIRE ACTION.

PROJECT	RICHMOND FELLOWSHIP LEVEL 4 245-9 MADRAS ST
SCALE/S 1:100	DATE OCT '98
SHEET No.	WD 03

DESIGNEDGE
• ARCHITECTURE
• REFURBISHMENT
• INTERIOR DESIGN
• FEASIBILITY STUDIES
• BUILDING EVALUATION
• PROJECT MANAGEMENT

Check and verify all dimensions on site prior to commencement of works.

PN811144-BC-CON98008102-18D75ET



LEGEND

- EXISTING ACOUSTIC WALLS TO REMAIN
- NEW 63.5MM STEEL STUD WALLS WITH 9.5MM GIB BOARD TO BOTH SIDES
- FULL HEIGHT SAFETY GLAZING TO NZS 4223
- VINYL FLOORING
- ALL OTHER FLOORS TO BE CARPET
- DESK AND CHAIR
- TWO SEATER COUCH
- CAFE TABLE AND CHAIRS

22×30 = 660
× 4 levels
= 2640
+ 1 level at
→ N
GOING PLACES → TRAVEL SCHOOL (VACANT FEB 2011)
LEVEL 3.
26 × 11.5 299
≈ Total 2939.
Carparks req. 14. OK
" Prov. 36

Design Edge

Mark Vryenhoek ANZIA
(Phonetic: Fry-en-hook)
EMAIL designedge@xtra.co.nz
CELL 025 22 48 226
FAX 03 441 1537
PH 03 441 1536
PO Box 515
QUEENSTOWN

SHEET TITLE
245-9 MADRAS STREET
LEVEL ~~TWO~~ THREE
FLOOR PLAN
FURNITURE & FINISHES PLANS

THESE DRAWINGS ARE ONLY TO BE USED FOR THE PURPOSE AS STATED ABOVE, UNLESS NOTIFIED BY DESIGN EDGE
THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING CONSTRUCTION. DO NOT SCALE OFF DRAWINGS

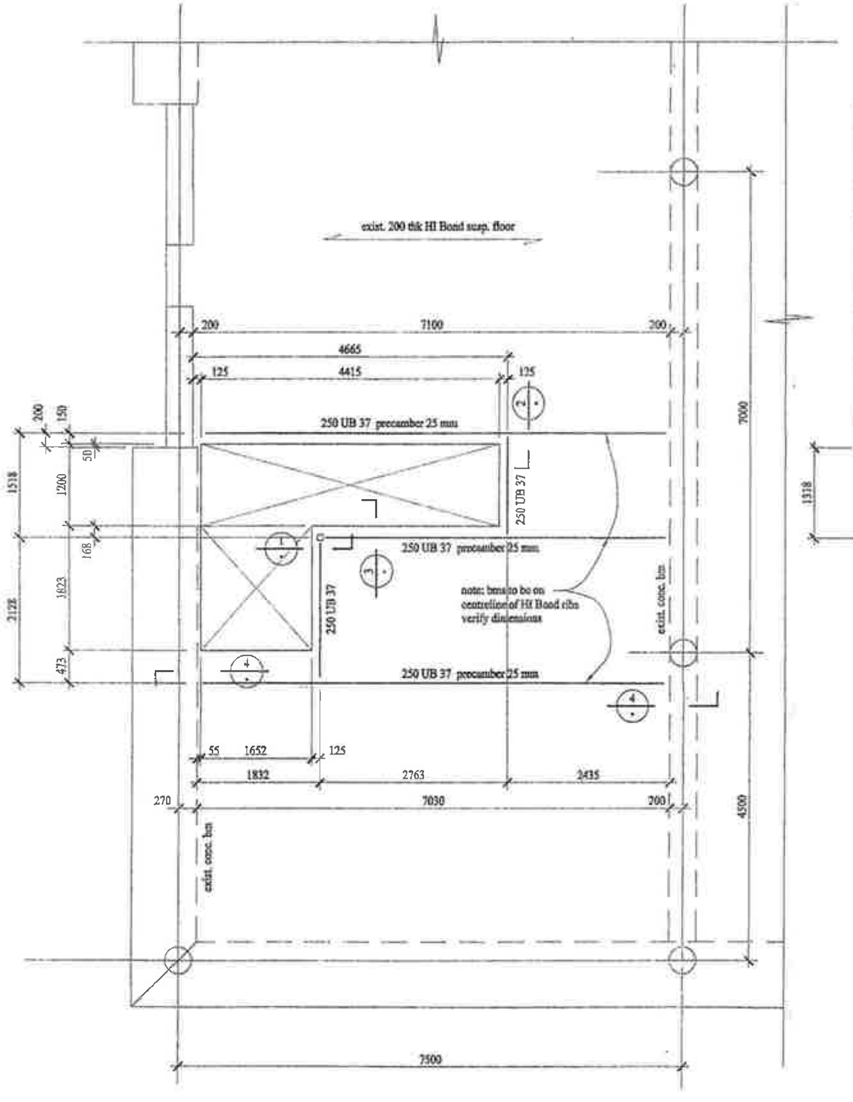
ORIGINAL SIZE -10 0 10 20 30 40 50mm

No	DATE	REVISION

©DESIGN EDGE
REPRODUCTION BY SPECIFIC CONSENT ONLY.

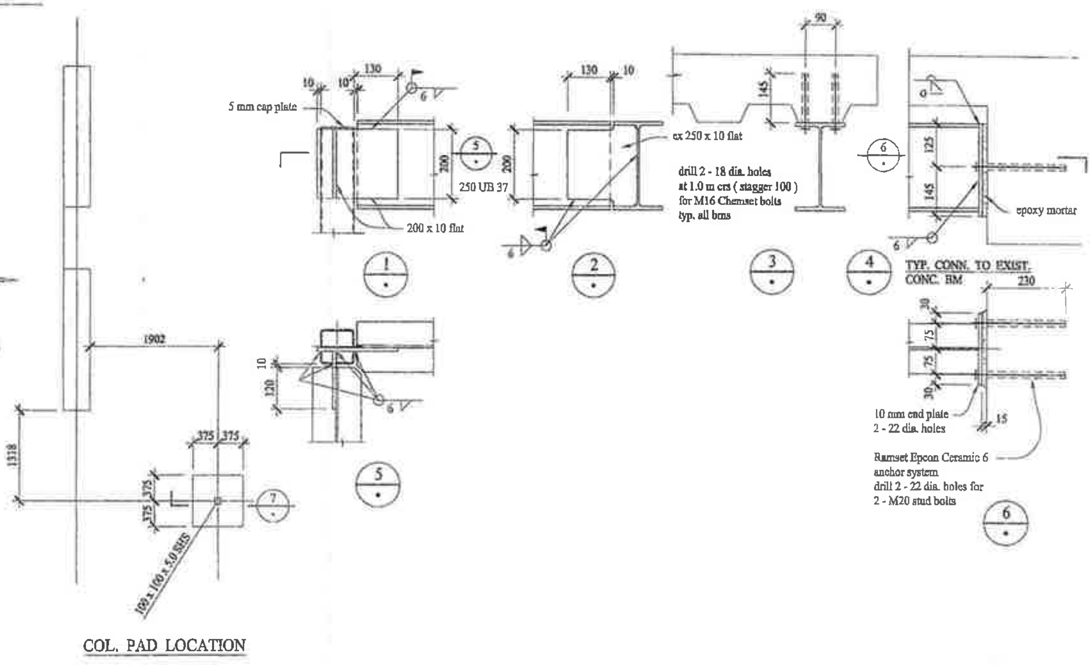
DRAWN	KAT	DESIGN	MARK
DRAWN SCALE	1:100	REV	SHEET No. A01
DATE	14.05.01		OF 4 SHEETS

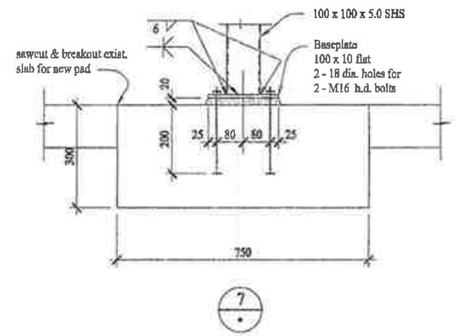
PN811442 – BCP – 10013756 – 1809582



PARTIAL FIRST FLOOR FRAMING PLAN AT NEW STAIR OPENING

SITE MEASURE BEFORE FABRICATION





Level 2 - CTV
New Internal Stair Opening

STRUCTURAL NOTES

- Concrete compressive strength (f'c) shall be 25 MPa at 28 days. Materials & workmanship to be in accordance with NZS 3109.
- Steel workmanship to be in accordance with NZS 3404.
- Flats shall comply with AS 3679, grade 250.
- Sections shall comply with AS 3679.1 grade 300.
- Hollow sections shall comply with AS 1163 grade 350.
- Steelwork to be powerwire brushed to remove all loose mill scale & rust prior to the application of zinc chromate priming paint.
- Propping and maintenance of stability of the existing structure shall be the contractors responsibility at all times.
- Refer to Architects drgs for fire protection requirements to bms and posts.
- The structural drawing shall be read in conjunction with the architectural drawings.

CHRISTCHURCH CITY COUNCIL
CONSENT DOCUMENT
10 MAY 2000
All building work shall comply with the New Zealand Building Code notwithstanding any inconsistencies which may exist in the drawings and specifications.

Falloon & Wilson Ltd claim authorship of this work & retain intellectual & artistic copyright

contractor shall verify all dimensions before commencing work

ALTERATIONS TO BUILDING AT 245 - 249 MADRAS STREET - CHRISTCHURCH

NEW FLR OPNG FOR STAIR
PARTIAL FIRST FLR FRAMING PLAN
DETAILS

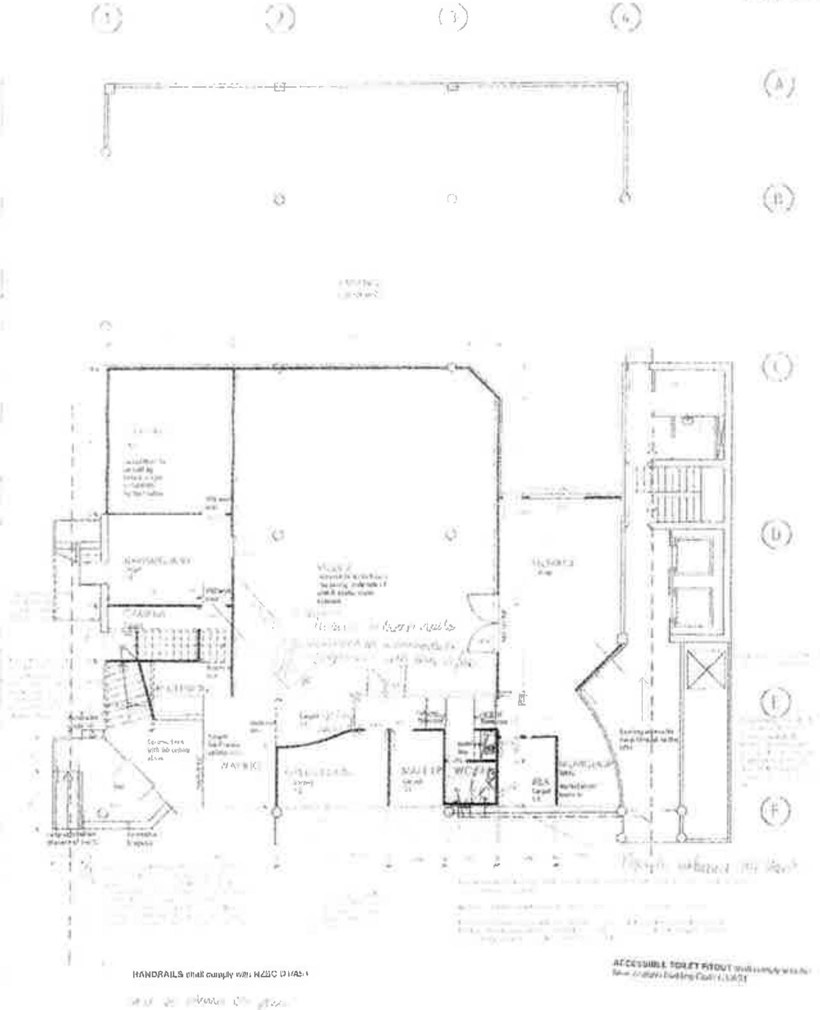
FALLOON & WILSON LTD
CIVIL & STRUCTURAL
CONSULTING ENGINEERS

61 Kilmore Street
P.O. Box 2867 Christchurch
New Zealand
Telephone (03) 379-7260
Fax (03) 365-4146
Mobile 021 342-247

issue	date	amendment	
drawing status :		CONSENT	
designed :	CWT		sheet
drawn :	GWL	5/2000	S1
checked :			
scale :	1:50, 1:10		
file :	2774		rev :

TN811144 - BCP - 10013756 - 180955

CTV – LATEST FLOOR LAYOUTS FROM CCC FILES.



NEW GROUND FLOOR PLAN LEVEL 1 (CTV)
includes Plumbing & Drainage information

NEW FIRST FLOOR PLAN LEVEL 2 (CTV)
includes Plumbing & Drainage information

PN811144-BCT-10013756-1809551

B.C. REVISED DRAWINGS 5.5.00

CHTV FITOUT
245-249 MADRAS STREET
CHRISTCHURCH
NEW FLOOR PLANS

WARBURTON
TEAM ARCHITECTURE

0027 A A004

S T R U C T U R A L   S P E C I F I C A T I O N .

I N D E X .

1. EXCAVATION AND HARDFILL.

1.1 GENERAL

Refer to the General and Special Conditions of Contract Clauses which shall apply to all work in this section of the Specification.

1.2 SCOPE

This section of the Specification includes:-

1. Excavation for foundations.
2. Excavation under ground slabs.
3. Backfill around foundations.

1.3 NATURE OF THE SITE

The Contractor shall visit the site to confirm details shown on the drawings. The site is generally level with a surface layer of hardfill, and is being used as a car park.
Beneath this level there are varying layers of silt and sand overlying gravel at various depths.
The foundation beams are to be poured in the silt layers.
The water table at the time of excavation was about 2.8 metres below ground level.

1.4 EXCAVATION FOR FOUNDATIONS

Excavation may be by bulk excavation over the building area or excavation for each footing. Batter or shore faces of excavation as necessary.
Allow for formwork for full depth of all footings.
Consolidate bases of all excavations to the Engineer's approval, using suitable mechanical equipment.

1.5 INSPECTION

No reinforcing or site concrete shall be placed in foundations until they have been inspected by the Engineer.
No backfilling shall be placed against reinforced concrete footings until they have been inspected by the Engineer.

1.6 DEPTH OF EXCAVATIONS

Any soft spots found in excavations shall be reported to the Engineer. Should it be found necessary to excavate toa greater depth than shown on the drawings, the Contractor shall be paid for such greater excavations at a rate approved by the Engineer in writing, before such additional work is carried out.

1.7 MAINTAIN EXCAVATIONS

Secure and maintain excavations free from slips, erosion, water and other fluids or fallen materials.
Provide and maintain all shoring, strutting, sheet piling, planking, pumps, and other materials or plant necessary for carrying out and maintaining excavations and remove them when no longer necessary.

1.8 BACKFILLING

Backfill around foundations and thoroughly consolidate. Remove all timber, rubbish and other loose material before backfilling. Backfill and consolidate in 300mm layers using suitable mechanical equipment to the Engineer's approval. Backfilling material shall be pitrun hardfill as described in 1.10 or where approved by the Engineer excavated material such as sand or gravel with limited clay content. Material approved for backfilling shall be carefully stockpiled and kept free from soil, clay, peat, or other unsuitable material. Material used from stockpiles shall not be excessively wet, but shall, if necessary, be allowed to dry out to the satisfaction of the Engineer before use.

1.9 SURPLUS MATERIAL

Remove from site and dispose of all surplus material from the excavations.
Take every precaution to minimise dust nuisance from stripping loading and transporting surplus material.

1 10 HARDFILL

Supply, lay and consolidate and hardfill layers beneath all floor slabs against ground.
Hardfill shall be wet graded sand and gravel river-run, free of stones larger than 65mm, blinded with sand ready to receive dampcourse.
The minimum consolidated depth of the hardfill shall be 200mm.
Consolidate hardfill thoroughly in 200mm layers with vibrating steel roller or similar approved.

1.11 CO-OPERATION

Co-operate with drainlayer and plumber who will be laying drains and pipes and wastes, and with concretor who will be laying site concrete and constructing all concrete work.

2. CONCRETE & REINFORCING STEELWORK.

2.1 GENERAL
Refer to the General and Special Conditions of Contract Clauses which shall apply to all work in this section of the Specification.

2.2 SCOPE
This section of the specification includes the supply, forming and casting of all cast-in-place, plain and reinforced concrete including all items necessary to complete the work indicated on the drawings and not specifically described elsewhere in this Specification. This section of the Specification includes the supply, erection, reinforcing and casting of the components of the approved proprietary floor system specified in Clause 2.16 of this Specification.
This section of the Specification includes the erection of all precast concrete. The PRECAST CONCRETE section includes manufacture of precast concrete units as detailed and delivery to the site if necessary.

2.3 MATERIALS AND WORKMANSHIP
The Contractor shall comply with all requirements of NZS 3109:1980 except where specified otherwise herein or instructed otherwise by the Engineer. A copy of this standard shall be kept on the site and relevant parts read with the following clauses of the Specification.

2.4 CONCRETE
Site concrete and concrete required to make good excavations shall be 10 MPa at 28 days or better. All other conrete shall be SPECIAL ro HIGH GRADE, from an approved ready-mix plant, and as defined in NZS 3109: Clause 6.2 and of the following strengths:-

Foundation beams and pads	20 MPa
Columns at Level 1	35 MPa
Columns at Level 2	30 MPa
Columns at Level 3	25 MPa
All other structural concrete including floors and walls	25 MPa

The maximum aggregate size shall be 19mm.

2.5 CONCRETE TESTS
The ready-mix supplier shall make control tests in accordance with NZS 3104, and shall pay the costs of such tests. Tests shall be made either at the ready-mix plant or at the site, except that if the Engineer specifically calls for tests at the site as a result of any dissatisfaction with the plant testing procedure, these shall be done by the ready-mix supplier.

2.6 REINFORCEMENT

All reinforcement shall comply with NZS 3402 (1973). Bars prefixed with a 'D' on the drawings shall be deformed Grade 275 steel.
Bars prefixed with a 'R' on the drawings shall be plain Grade 275 steel.
Bars prefixed with an 'H' on the drawings shall be deformed Grade 380 steel.
Mesh shall be hard drawn steel wire fabric to NZS 3422 (1972). All reinforcement and workmanship shall conform to the requirements of NZS 3109:1980.

2.7 FAIRFACE FINISHES

All concrete surfaces that will be visible in the finished job, or covered with paint, Enduit plaster, or tiles, shall be finished fairface.
All concrete required to have a fairface finish shall be cast to a high standard using accurately constructed form work and to a high standard of workmanship. In addition to surface tolerances specified ~~below,~~ the finished surface shall conform for blowholes with illustration 4 in the NZ Standard NZS 3114:1980 "Specification for Concrete Surface Finishes." Refer to the Architect's drawings for the finish required on concrete surfaces.

2.8 SLAB FINISH

Except as specified below, all slabs have a steel trowelled finish. Screed off and lightly wood float. Finish slabs with approved power floating and compacting machines to leave a dense, level surface which does not vary more than 6mm from a 3 metre straight edge, and not more than ± 15mm from true level.

2.9 SITE CONCRETE

Form and cast 50mm site concrete beneath main foundations and elsewhere as necessary to provide a clean, dry working platform. Ensure ground surface is clean and dry and there is no evidence of soft spots.

2.10 FOUNDATIONS

Form and cast main foundation beams as detailed. It is envisaged that the beams will be cast in stages with construction joints.
Allow to scrabble or green cut the faces of these joints. The exact location and details of all construction joints are to be agreed with the Engineer before pouring concrete.

2.11 LIFT PIT

Form and cast lift pit walls and floor with sump as detailed. Build in PVC 140mm HYDROFOIL waterstop or similar to all construction joints in floor and walls. Waterproof the concrete with SIKA Plastocrete-N-Waterproofer or approved equivalent.

2.12 GROUND FLOOR SLAB

Form and cast ground floor slab on damp proof course on compacted hardfill. Cast in strips and sawcut into panels where agreed by the Engineer on site. The maximum spacing of sawcuts or construction joints shall not exceed 3.75 metres.

2.13 PROPPING OF PRECAST BEAMS

Precast beams shall be propped to support the dead weight of the beam until the floor concrete has reached 20 MPa.

2.14 CHASES, HOLES AND NIBS

Form all chases, holes, upstands and nibs as shown on the drawings or required by other trades. Chases and holes shall be accurately positioned and formed at the time of casting the concrete.
Set concrete shall not be hacked unless specific approval is obtained from the Engineer.

2.15 BUILDING IN

As the work proceeds, build in all necessary bolts and other fixings. The Concretor shall ascertain from all other sub-contractors all particulars relating to their work with regard to order of its execution and details of all such provisions of fixings sleeves, chases, holes, etc., and of all necessary items to be built into concrete and shall ensure that all such items are provided for and/or positioned.

No claim will be recognized or allowed for at extra cost of cutting away or drilling concrete work already executed in consequence or any neglect of the Contractor to ascertain these particulars and make the necessary provision beforehand.

2.16 FLOOR SLABS

Concrete floors have been detailed to use the 'DIMOND HI-BOND H.S.' composite steel/concrete floor system. This has a profiled metal deck of 54mm overall depth, made from G500 steel, 0.75mm thick.

The floor shall be handled, laid, and fixed in accordance with the manufacturer's written "laying instructions".
Provide temporary propping to floors as shown on the drawings, with an upward camber to the propping lines as detailed. Floors shall be constructed of a uniform thickness, so that slab surfaces as constructed shall follow the cambered profile of the floor decking.
Propping shall extend over at least three levels at all times, to distribute the weight of the floor being poured into three lower floors, and to support mobile scaffolds being used to erect precast floor beams.

3. PRECAST CONCRETE

3.1 GENERAL
Refer to the General and Special Conditions of Contract clauses which shall apply to all work in this section of the Specification.

3.2 SCOPE
This section of the specification includes the manufacture and supply on site of the following precast units:-

1. Precast beams
2. Precast wall panels

The work includes the fabrication and supply of all structural steel fittings to be built into the units as detailed on the drawings.

3.3 MATERIALS AND WORKMANSHIP
All formwork, concrete and concreting and finishing shall be in accordance with the relevant clauses of Concrete and Reinforcing Steelwork Specification except where noted otherwise in this section.

3.4 CONCRETE
All concrete shall be HIGH or SPECIAL GRADE complying with NZS 3109 Clause 6.2.Concrete for all precast work shall be 25 MPa at 28 days with 18mm maximum size aggregate.

3.5 TOLERANCES
All precast units shall be manufactured to the following tolerances unless stated otherwise on the drawings:

- Length	± 6 mm
- Cross Section	± 3 mm
- Squareness (of cross section and ends)	± 3 mm
- Twist (dimensions from plane containing the other three corners	± 3 mm
- Built in Items	± 5 mm

The above tolerances are given as a guide. Their application in any particular case shall be subject to interpretation by the Engineer.

3.6 FINISHES
All precast concrete exposed in the finished building shall be cast to a high standard using accurately constructed formwork and a high standard of workmanship. Precast items that do not meet the required standard to the satisfaction of the Engineer will be rejected. Formwork shall be such as to produce a high quality fair face finish on all exposed surfaces. Formwork shall be made from sheet steel or dressed plywood treated with a polyurethane finish to a high quality smooth surface, or similar.

In general finished surfaces shall be smooth and formed with moulds or by careful trowelling. Surfaces shall be free from honeycombing, grout loss, excessive air holes or other imperfections. Arrises shall be straight clean and sharp and free from spalling or damage.
All exposed surfaces shall have a similar appearance and standard of finish. Surfaces finished by trowelling shall be finished to the same standard and uniformly match surfaces against formwork.
Formwork shall be sealed at all corners, joins and inserts to prevent all grout loss.
All surfaces against which concrete is later to be cast shall be left roughened by brooming the poured face while the concrete is still plastic. Clean surfaces thoroughly from all laitance and loose concrete.

3.7 HANDLING

A high standard of finish is required and handling shall be such as to prevent any damage to units.
Approved lifting devices or hooks shall be provided in all precast units and these shall be made available to the Contractor for erection purposes and removed cleanly after use. Units shall be handled only by the hooks or devices provided. They shall be loaded and transported so that no forces are applied in excess of those occurring during normal lifting. Twisting forces shall not be permitted to occur. Units shall be strapped and secured to prevent movement or damage during transportation.

Details of lifting hooks and devices, and their positions, shall be submitted to the Engineer for approval before manufacture commences. Care shall be exercised at all times, that hooks or devices suffer no bending or other damage. Lifting hooks or devices set permanently in the units shall have a safety factor of at least 4 and for repetitive use shall have a safety factor of at least 6.

3.8 STACKING

Units shall be stacked on timber dunnage and suitable soft packing placed under the lifting points. Stacking shall at all times be such as to minimise the effects of creep and to avoid undue distortion of units.
Stacking of units shall be carried out on an area capable of withstanding the bearing pressures involved and in such a way that damage to units, lifting hooks, and to other embedded fixtures and to other units shall not occur.

3.9 MARKING

Mark all units with a mark number, orientation in finished job, and date of casting. The marking shall not be permitted to affect the fairface finish.

3.10 INSPECTION

The Engineer or his representative will inspect the precast units at all stages of manufacture to ensure conformity with this specification. Units which do not conform to the required tolerances, which shown grout leakage, which have been damaged, or which are otherwise defective shall be liable to rejection and may be used in the structure only at the Engineer's discretion.

No repair work shall be done without specific instruction from the Engineer.

3.11 BUILDING IN
Supply and fix all lifting bolts, cast in sockets, timber grounds and other fixings as shown on the drawings or as required for the proper erection of the units in the finished work.

3.12 PRECAST SHELL BEAMS
Form and cast the beams as detailed including all reinforcing starters, structural steel fixings, holes for services, rebates, etc, as detailed.
The beams have been detailed to minimise their weight and hence crane capacity. The surface of the beams inside the stirrups shall be roughened to ensure good bond to the infill concrete. Outside the stirrups the surface shall be straight and level to receive the proprietary floor system.

Sides and soffits shall be finished as clause 3.6 where exposed in the completed building, otherwise to a reasonable fairface finish.

4. STRUCURAL STEELWORK

4.1 GENERAL
Refer to the General and Special Conditions of Contract clauses which shall apply to all work in this section of the Specification.

4.2 SCOPE
This section of the specification includes the following:-

(i) Supply, fabrication and erection of the main roof steelwork, machine room beams and posts, stairs, and other miscellaneous items.

4.3 WORKMANSHIP AND MATERIALS
The Contractor shall abide by all relevant requirements of NZS 3404:1977 "Code for Design of Steel Structures", and to NZS 4701 "Metal Arc Welding of Steel Structures".

4.4. STEEL
Steel shall be mild steel of approved origin and conforming to BS 4360:1979. The Contractor shall ascertain, at the time of tendering, whether the steel sizes detailed on the drawings will be available to do the job. The Contractor shall supply with his tender, the source of supply, price list and substitute sizes for those detailed where shortage of supply is anticipated. Extra cost of substitute sizes required, but not notified at the time of tender, will be borne by the Contractor.
Butt welding of lengths will be permitted only with the approval of the Engineer.

4.5 CONNECTIONS
All connections shall be shown on the drawings. In general these are to be welded. Welding shall be done by qualified operators and strictly according to NZS 4701:1981. Preparations of any butt joints shall be discussed in advance. Welds exposed in the finished building and in particular butt welds of stock length shall be neatly finished.

4.6 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.
The Contractor shall supply all necessary facilities, ladders and light scaffolding necessary for adequate access, and he shall arrange his sequence of work to allow inspections and testing to be carried out.
Testing may include radiographic and ultrasonic testing.

4.7 WELDING DEFECTS
Welding defects disclosed by radiography or other investigation shall be assessed by the Engineer and if he so instructs to be cut out and remade. Joints cut out shall be examined and passed by the Engineer before rewelding. Welds will not be expected to attain an unreasonably high standard of perfection, but the weld metal, as deposited, shall be free from cracks, slag inclusion, gross porosity, cavities, and incomplete penetration. The weld metal shall be properly fused with the parent metal without serious undercutting or overlapping at the toes of the weld. The visible surfaces of all welds shall be clean, regular, and of consistently uniform colour.
When welding defects are disclosed, testing of further welds may be ordered at the Contrator's expense. If stiffeners or other concealing details have been added, these may be required to be removed to permit this additional testing.

4.8 SITE WELDING
Where site welding is required facilities shall be provided to obtain the same standard or workmanship here as in the shop. Welding in air shall be reduced to a minimum by assembly and erection procedure. All welding in the air shall be designed to avoid overhead welding. Parts to be welded shall be firmly held in jigs or clamps. Tacking bolts or cleats, other than those detailed, shall be provided as needed but only after discussion with the Engineer. If required, tacking cleats shall be removed after erection and bolt holes filled by welding.

4.9 BOLTS
Holes for bolts shall be drilled or punched and NOT gas cut. Bolts shall be of the correct length and with a flat or tapered washer under the nut.
Supply all bolts, nuts and washers for fixing steelwork and precast concrete including those to be built in by concrete subcontractors.

4.10 ERECTION
Erection procedure shall be agreed in advance with the Engineer. The Contractor shall provide temporary bracing as necessary to stabilise the structure until all permanent bracing and associated elements of the structural system such as purlins, are completed.
Every effort shall be made to keep steelwork true to dimension, plumb, and level. Final welding of erection connections shall be delayed until each section of the structure is proved true. Final welding up of all steelwork shall be completed before any further loads are added to the structure.
Packing under steel bases shall be steel.

4.11 STEELWORK FINISHES

All structural steel work exposed to the weather in the finished building shall be galvanised as specified in clause 4.12. All other steelwork shall be thoroughly cleaned by power wire brushing and hand scraping to remove all mill scale and rust in preparation for priming as in NZS 1900 Clause 9.4.69. Paint in all steelwork except weldplates and where built into concrete more than 5mm with two coats of primer in the shop, to a thickness of at least 0.1mm (4.0 thou). After erection all damaged areas shall be cleaned and painted with two coats of primer.

Primer shall be Dulux Red Zinc Chromate Primer applied in accordance with their recommendations. The first coat shall be applied in accordance with the makers' instructions and to the satisfaction of the Engineer. Avoid spills and runs. Where timber members are fixed during the erection of the steelwork the STRUCTURAL STEELWORKER shall ensure that any cleats of steelwork inaccessible after such fixing are clean and ~~primed~~ under the timber.

4.12 GALVANISING

Where indicated on the drawings, steelwork shall be hot dip galvanised. Clean by sand or grit blasting to Swedish Standard S.A.2½ and dip to leave a zinc coating of 600gm/m^2. Any galvanising subsequently damaged by welding or gas cutting shall be cleaned as above and primed with inorganic zinc silicate or similar.

4.13 MAIN ROOF FRAMING

Supply fabricate and erect the roof steelwork complete with all necessary cleats, holes and fixings as detailed on the drawings.

Allow to camber rafters as dimensioned. Ensure that the mortar packing has gained sufficient strength to fully tighten holding down nuts before any loads other than the purlins are applied.

4.14 PURLINS

Purlins are to be Fletcher GKN Brownbuil~~t~~ members prepunched for bolt fixings and brace channels to standard details. All purlins shall be of 450 MPa galvanised steel.