

DAMAGE IN NELSON AND MURCHISON

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1. Area surveyed

The area in which damage was examined extended from Murchison Township, some 20 miles East of the Epicentre to Nelson City, some 80 miles North East of the Epicentre. The area included the Boroughs of Richmond and Motueka and the Waimea County.

2. Felt intensity

Residents in the Nelson District were awakened by a strong and prolonged motion. There were instances of stock being toppled from shelves and of fallen chimneys.

The Accelerometer located in Nelson Post Office registered a peak acceleration of 0.08g in nearly every horizontal direction. Calculations of acceleration based on cracking of well constructed walls at ground level would suggest twice this value in some areas. Movement is recorded of eleven large copper water tanks on copper trays on the roof of a 5 storey building. In their final positions the tanks had been displaced up to three inches in various directions but predominantly North (short axis of building). Cracking of walls and parapets in Nelson showed a predominance of damage in the North/South direction.

In the Murchison area the forces toppled chimneys and stock on shelves and moved a heavy steel safe across a lino covered floor.

3. Damage suffered

| | | |
|-----|-------------------------|------|
| (a) | <u>Claims</u> | |
| | Nelson, Stoke, Richmond | 1100 |
| | Motueka District | 48 |
| | Murchison District | 100 |
| | Total: | 1200 |

| | | |
|-----|------------------------|-----|
| (b) | <u>Types of Damage</u> | |
| | Chimneys | 77% |
| | Damage to Structures | 8% |
| | Others | 15% |

| | | | | |
|-------------------|----------------------------------------|---------------------------------------|-------------------|--|
| (c) | <u>Type and Location</u> | | | |
| | Structural Damage (Numbers) | | | |
| | Public Buildings, Hotels, Churches. | Commercial & Industrial Buildings. | Private Homes. | |
| Nelson - Stoke | 6 | 42 | 6 | |
| Murchison | 2 | 4 | - | |
| Motueka | - | 2 | - | |

+ Consulting Engineer, Nelson

++ City Engineer, Nelson

4. Age of damaged buildings—Nelson/Stoke

| <u>Age</u> | Public Buildings, Hospitals, Schools, Hotels, Churches. | Hotels, Offices Retail | Industrial | Private |
|------------|---------------------------------------------------------------|---------------------------|------------|---------|
| Pre 1939 | 3 | 25 | 3 | 3 |
| Post 1939 | 3 | 11 | 3 | 3 |

The Pre-1939 Buildings are characterised by:-

1. Brick walls, lime mortar: Timber floors and some timber frames.
2. High unsupported walls and parapets without bands and few ties.

5. Description of damage

(a) Pre 1939 Buildings:

A number of parapets were cracked and horizontal displacements on mortar of up to 2 inches were noted. Instances of bricks falling were isolated.

Lack of seismic gaps between buildings or gaps which were incomplete or had subsequently been partially bridged resulted in impact damage.

Brick buildings that were symmetrical or walls free to move suffered very little damage.

(b) Post 1939 Buildings

Unreinforced block walls have developed failures at jointing. Filled block walls reinforced vertically at 16" centres but with horizontal steel located at beam and sill levels have developed vertical cracks due to horizontal flexure.

The predominant form of cracking in modern reinforced concrete construction has been movement on horizontal construction joints. Buildings with 6" centrally reinforced panel walls have developed vertical flexural cracks about mid-span. Cracks of this type may also occur in and extend through narrow beams.

Flexural cracks in the form of an inverted Y with the vertical leg at mid panel have developed in walls pierced by windows at higher levels. These panel walls have been centrally reinforced with trim rods round openings.

Damage has been recorded due to inadequate provision for torsional stresses.

(c) Non Structural Damage

There was a considerable amount of damage to plate glass. Some has been found to be due to inadequate clearance in flexible buildings. No analysis attempted.

Counter weights on lifts are recorded as having broken loose and put lifts out of action.

Water from ceiling service tanks without covers spilled and put lift services out of action.

Untied service tanks moved and broke attached pipes.

A lift motor on rubber bushes lifted vertically off dowels.

Stucco homes with stucco on diagonal sarking showed a greater tendency to crack than did stucco on netting and paper.

(d) Chimney Damage

Predominant damage in Nelson was cracking of chimneys. In Murchison area there were more instances of fallen chimneys.

No analysis has yet been attempted.

(e) Bridges

There was no reported damage to bridges in the Nelson area. In the Murchison area one bridge of substandard construction suffered structural damage; other bridges showed some minor movement on bearing pads. Approach fillings settled.

(f) Roads

There was no reported damage to roads in the Nelson area. From the vicinity of the Owen River South slips, settlements of fillings and cracking of surface occurred with damage on an increasing scale in the South direction.

6. Foundations

We have been unable to relate damage to foundation conditions except in isolated claims where slips have occurred but the following observations are recorded.

(a) There was no recorded structural damage to the new buildings of the reclaimed harbour area.

(b) There was no reported damage to Commercial or Industrial buildings in the Stoke/Richmond area where foundations are firm clay bound gravel. There are few older brick buildings in this area and modern buildings are mostly single storey concrete or concrete block.

(c) The predominant foundation material of the City Area is a soft to plastic saturated marine clay with intrusions of areas of firm river gravels. This is the area in which damage was suffered but it is the only area in which are concentrated the older Commercial Buildings.

7. Seismic Hazards

Inspection of Commercial Buildings after the event revealed a surprising number of potential Seismic Hazards on the older buildings of Nelson. That many of these buildings did not suffer actual damage is fortuitous.

Some of the older brick buildings without bond beams or ties withstood the shock without sign of visible cracking.

Inspection has shown that there are a number of structures that should be partially demolished or strengthened.

There does not appear to be the necessary authority to deal with potential seismic hazards. Building owners on the whole have been receptive to suggestions that works be undertaken in the interests of safety to themselves and the Public.

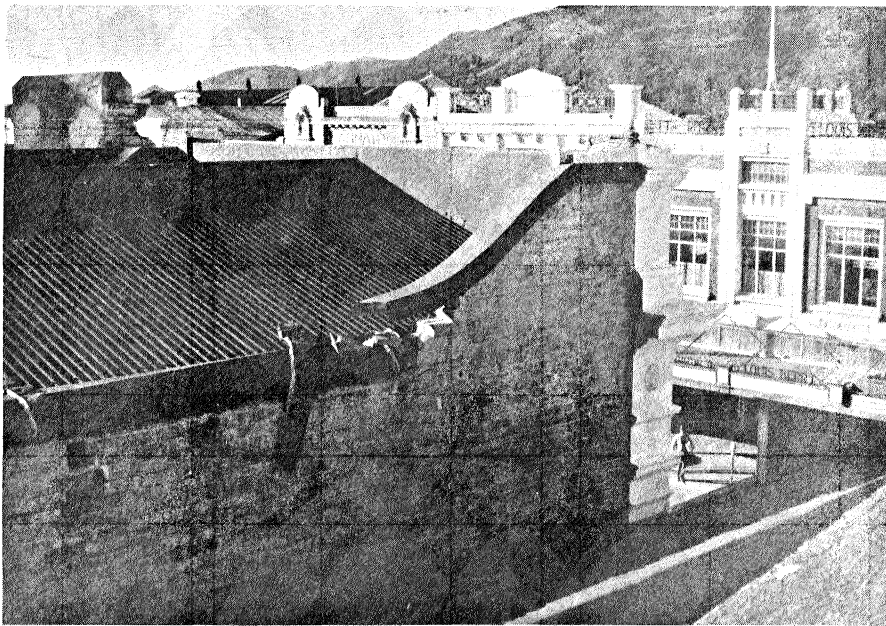


Fig. 1 Damaged Parapet to unreinforced Masonry building - parapet partly removed.

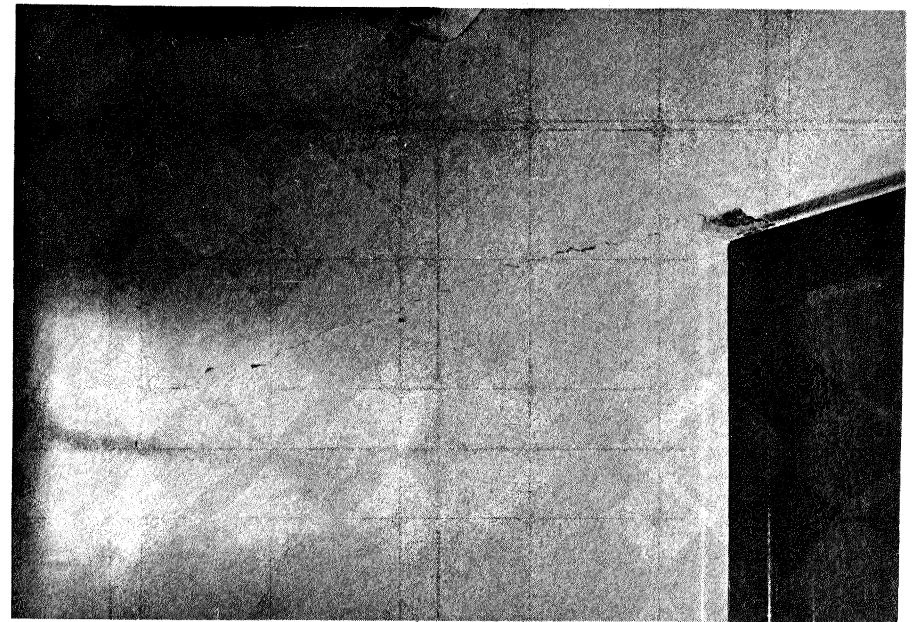


Fig. 3 Reinforced concrete wall showing movement on construction joint.



Fig. 2 Unreinforced concrete and masonry construction showing cracking of walls.

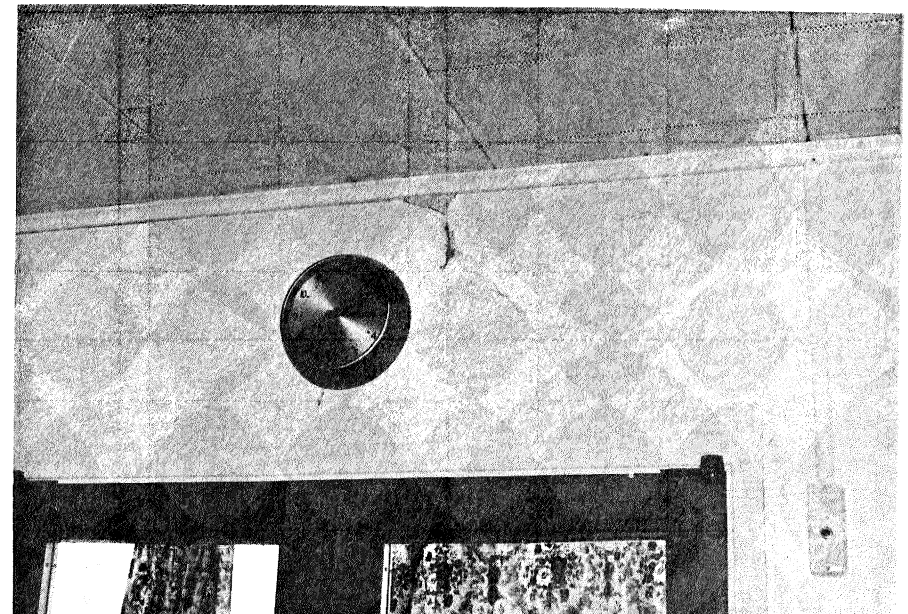


Fig. 4 Reinforced concrete shear wall showing crack pattern over large opening.