

# CTV Building Collapse Investigation



# How and Why?

- How it Collapsed
  - Engineering
  - Witnesses
  - Debris
- Why it Collapsed

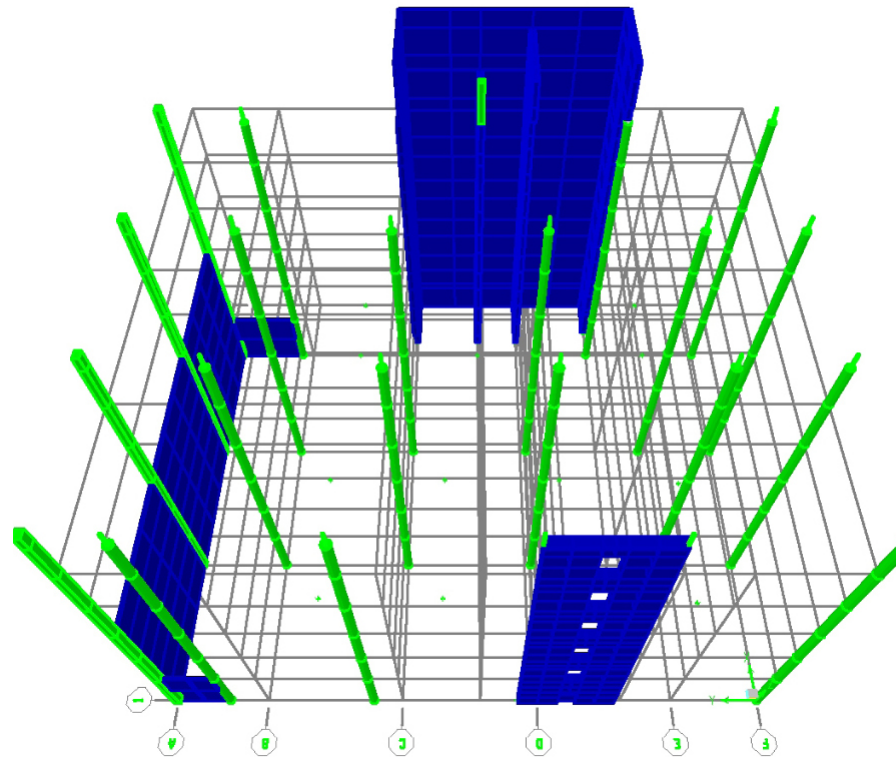


Canterbury Television Building in 2004 (Photo credits: [Phillip Pearson](#), derivative work: [Schwede66](#) )

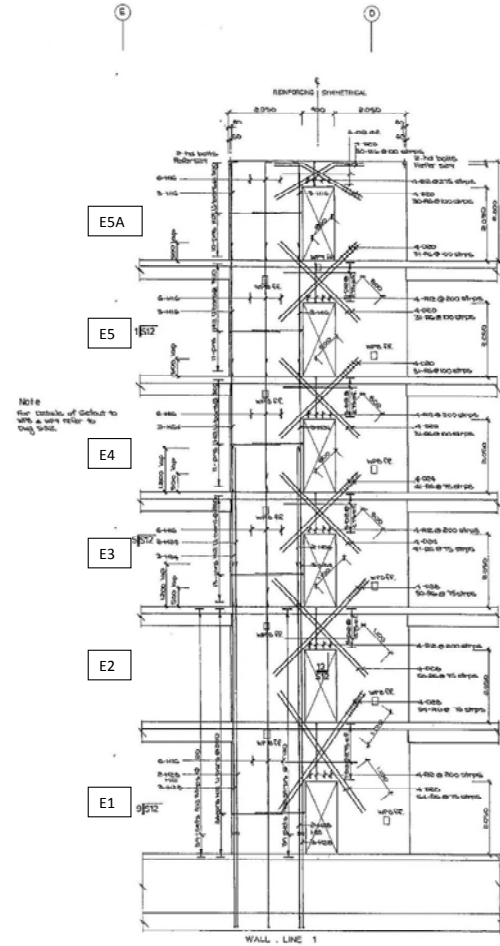
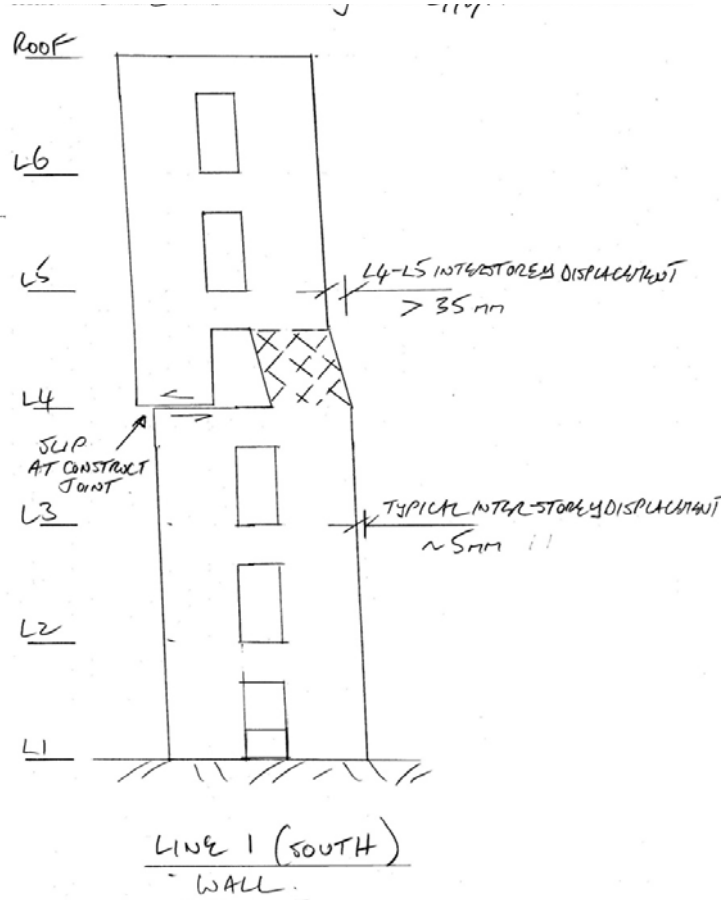
# Engineering Analysis

- Torsional soft storey Level 4 to 5
- Madras St column collapse Level 4 to 5
- Interior column collapse Level 1 to 4
- Slab and beam failure Level 2 to 4
- Level 5, 6 & Roof drop together

# Walls and Columns



# Torsional Soft Storey L4 to L5



# Damage to Wall 1 L4 to L5



# Damage to Line 1 Wall L1 to L2

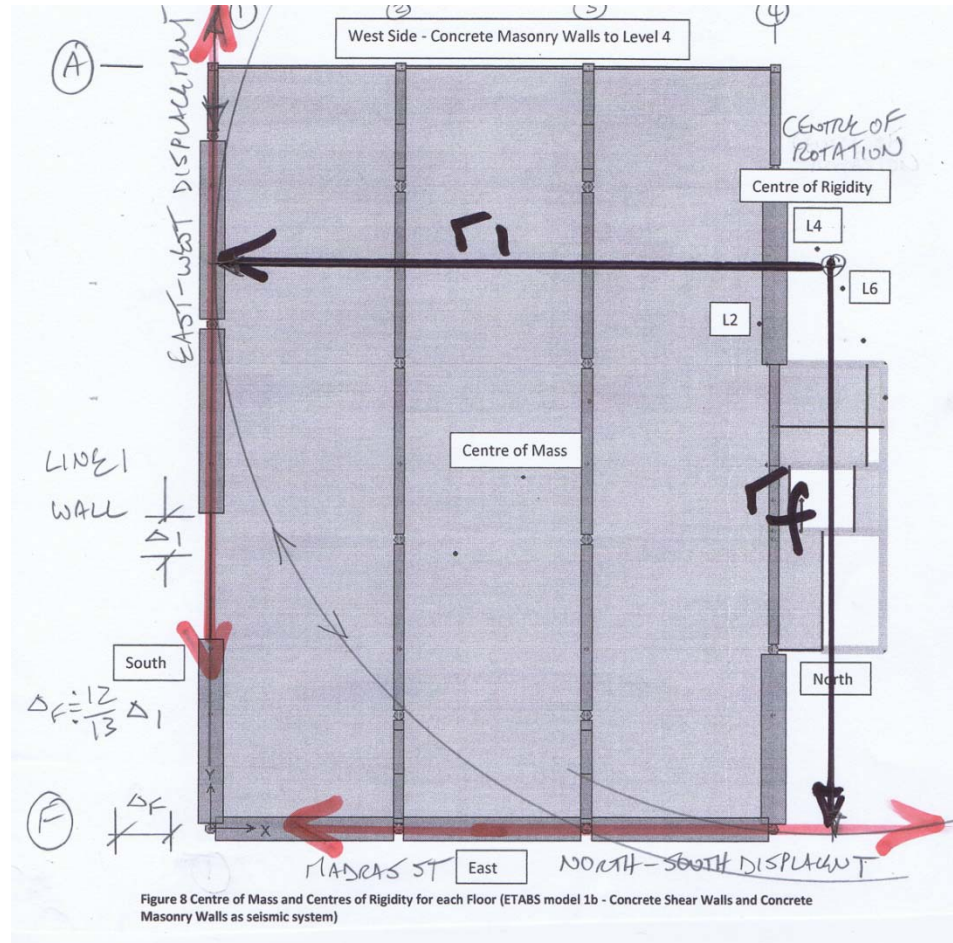


# Torsional Soft Storey L4 to L5

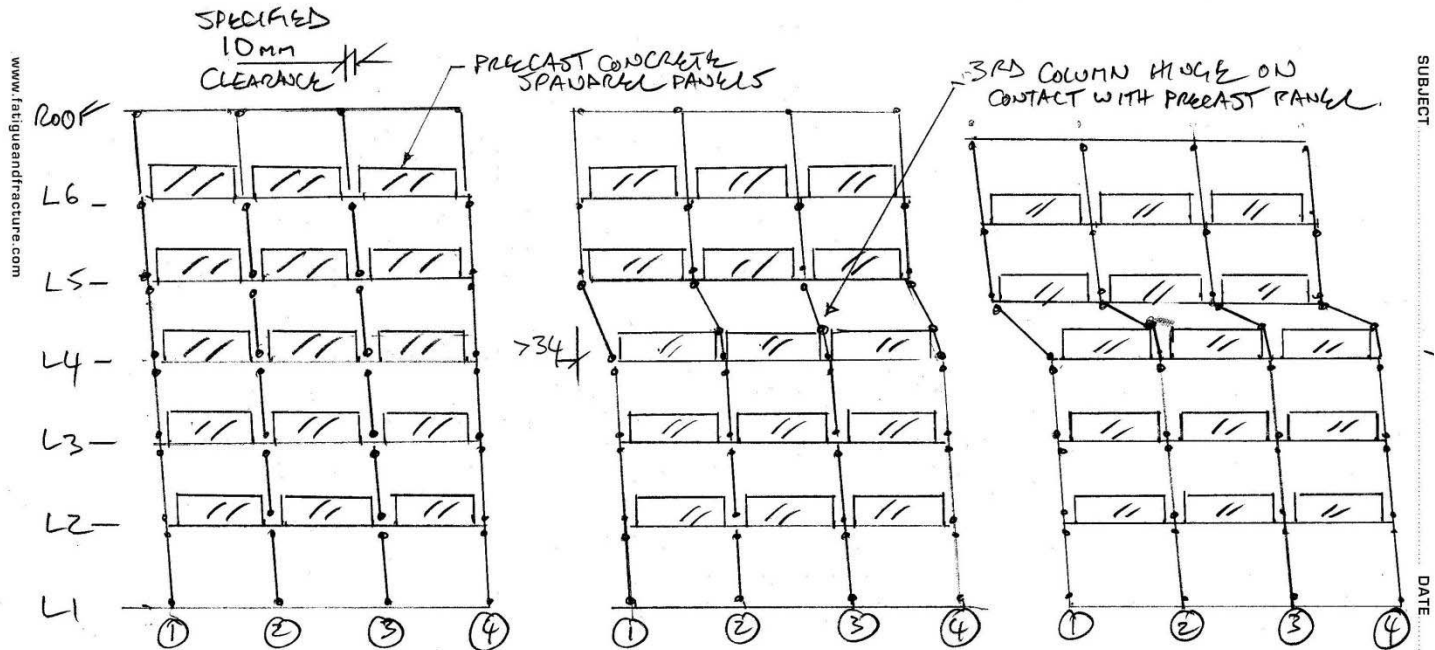
- Sliding shear failure in South Wall (Line 1)
  - West panel construction joint slip
  - East panel takes double shear
  - East panel yields, elongates and loses strength in shear
  - L4 to L5 Inter-storey displacement increases
  - Shear demand below L4 capped



# Rotational Displacements



# Madras St Columns Collapse



(A) INTERSTOREY DRIFTS  $< 34\text{mm}$  COLUMN HINGES TOP & BOTTOM



(B) SOFT STOREY DRIFT  $> 34\text{mm}$   
 3RD HINGE DEVELOPS AT L4 TO L5 COLUMNS ON CONTACT WITH SPANDREL PANELS

(C) COLLAPSE INITIATES IN LEVEL 4 TO 5 COLUMNS

LINE F - MADRAS ST (EAST)

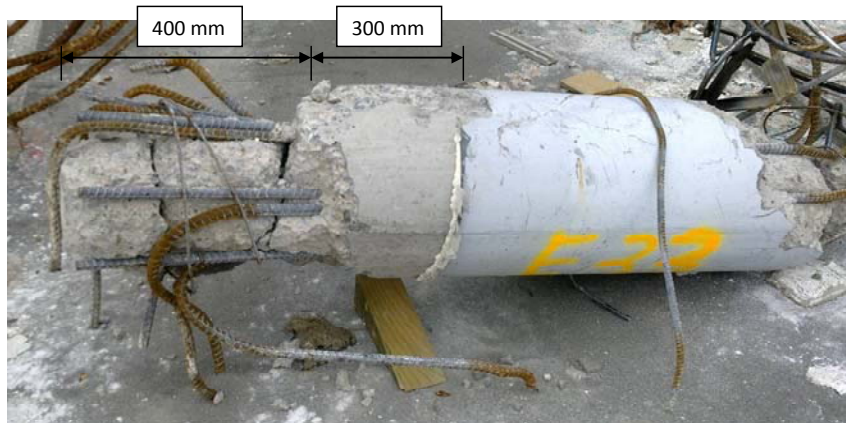
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SUBJECT

DATE

BY

# 3 Hinged Columns

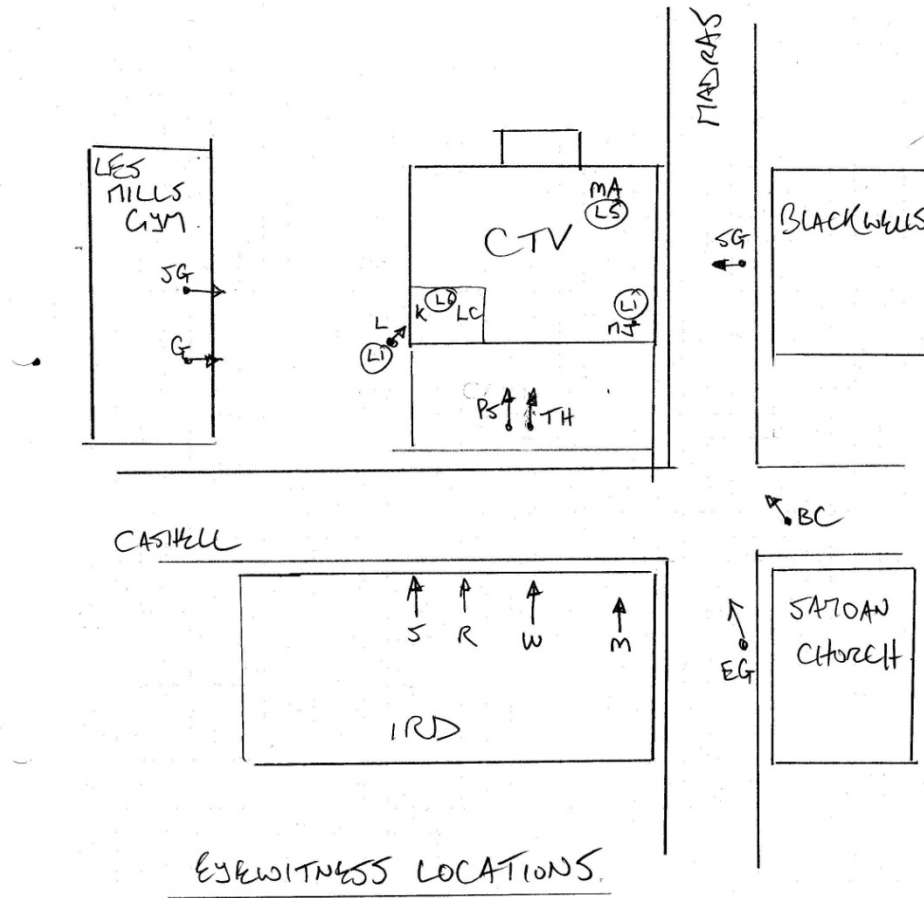




# Madras St Columns Collapse L4 to L5

- Many columns form 2 flexural hinges
  - Top and bottom
  - Won't collapse if axial capacity adequate
  - Shear demands redistribute to shear walls
- Madras St columns for 3 hinges at L4 to 5
  - Rotational displacement effect
    - Displacement east-west on South wall (Line 1)
    - Same displacement north-south on Madras St (Line F)

# Witness Map



# Witness Photos



# Why it Collapsed

- Unroughened concrete construction joints
- Susceptible to progressive collapse
- Masonry wall not isolated as required
- Panels to columns gap insufficient
- Low strength concrete
- Low concrete confinement in columns
- Fragile slab / beam/ beam column joints