A reconstruction of a typical structure frame for the upper floors of the building showing the typical connections between the cast iron columns and the timber beams was set out on the ground at the site. This served to demonstrate how the cast iron columns and timber beams were connected.

A number of the timber beams were examined by specialists in this subject from the Building Research Establishment (BRE) and a report prepared. The report concludes that the timber was of good quality with no evidence of any long-term deterioration.

Extensive damage was evident to the structural steelwork flooring and its supporting components above the basement area and to the suspended reinforced concrete slab. The damage was consistent with an upward pressure having been applied to this floor. For example, the tack welded connections of the steel floor plate to the supporting beams had failed in the majority of the floor and the welded/bolted connection of the supporting box sections columns to the floor beams had failed and deformed.

Evidence was also uncovered of brickwork partitions walls having existed within the basement of the building. These walls, one of which incorporated a steel door, appeared to have been blown over rather than knocked down.

The structural steel sections from the floor between the basement and the ground floor and the associated supporting steel columns were removed from site and taken to HSL for detailed examinations and investigation.

Structural Alterations

From records found in photographic and drawing form and given the age of the original construction of the mill building (1878) it is clear that some structural alterations have been undertaken to the original form of construction. This has included the addition of the stair tower at the Hopehill Road end of the building; the removal of the pitched roof to the mill building and replacement with a flat roof and the installation of a structural steelwork and reinforced concrete floor between the basement and ground floor in the dispatch area.

Comment and opinion will be prepared on any possible effects that these structural alterations had on the overall strength of the structure.

Further Investigations

Detailed investigation of the damage to structural steel elements recovered and taken to HSL will enable an assessment to be made of the likely pressures that were applied to the steel to cause such failures and distortions of the steelwork and its connections.

Having determined, as far as practicable, a value of the overpressure that was present in the basement area of the structure, further reporting and opinion will be prepared. This will include an opinion on the mechanism of the collapse and whether the damage to the structure was consistent or disproportionate with such an overpressure having been applied within the basement of the building.

Opinion will also be sought on the building standards applicable to buildings of this type and in particular the robustness of this type of building and its ability to resist the effects of accidental forces.

Mike Thompson
HM Specialist Inspector of Health and Safety (Construction Engineering)

December 2004"

APPENDIX C: SCHEDULE OF PHOTOGRAPHS FROM HSE

Tabular Information on Relevant Photographs from draft Version 2 of Factual Structural Report by M Thompson

SECTION IN FACTUAL STRUCTURAL REPORT	SUBJECT	PHOTO REFERENCE
3.0 Site Observations during recovery phase 3.1 General	Strathclyde Police Aerial Photographs taken shortly after incident	Duplicate Copy reference 104/8116/1/0. Images numbered: DSC_0003.JPG DSC_0004.JPG DSC_0013.JPG DSC_0014.JPG DSC_0015.JPG DSC_0017.JPG DSC_0018.JPG
3.2 Damage to Mill Building	• Extent of collapse of mill building. • Spread of debris close to the original footprint of the building. • Extent of collapse of external masonry • Parts of mill building structure remaining	Police Aerial Photographs (reference as above) HSL:0405-048/8:12/05/04 HSL:0405-048/12:12/05/04 HSL:0405-048/13:12/05/04

	• Displacement of roof structure	HSL:0405-048/33:12/05/04 HSL:0405-049/22:13/05/04 HSL:0405-055/12:15/05/04 HSL:0405-055/13:15/05/04 HSL:0406-066/60:17/06/04
3.3 Damage to Fabrication Shop		HSL:0405-048/34:12/05/04 HSL:0405-076/51:20/05/04
3.4 Damage to Main Yard and Gate	• Perimeter walls • Gate Structure	HSL:0405-076/23:20/05/04 HSL:0405-077/52:21/05/04
3.5 General Spread of Debris and Dust	• LIDL retail complex area • Gaels car park • Steel plate in Gaels Access road	Police Aerial Photographs (reference as above) HSL:0405-048/14:12/05/04 HSL:0405-049/64:13/05/04 HSL:0405-050/20:14/05/04 HSL:0405-056/3:16/05/04
3.6 Damage to Surrounding Properties	• LIDL retail complex area • Gaels Premises	HSL:0405-049/21:13/05/04 HSL:0405-050/20:14/05/04 HSL:0405-056/3:16/05/04 HSL:0405-057/1:18/05/04
4.2 Demolition of Remains of Building		Included in Section 3.2
4.3 Damage to External Masonry		Included in Section 3.2
4.4 Damage to Timber	Intact and damaged sections	HSL:0405-056/19:16/05/04 HSL:0405-056/20:16/05/04 HSL:0405-056/21:16/05/04 HSL:0405-091/4:25/05/04
4.5 Damage to Cast Iron Columns	Extent of Collapsed columns	HSL:0405-087/39:24/05/04 HSL:0405-091/46:25/05/04 HSL:0405-091/47:25/05/04 HSL:0406-081/18:25/06/04
4.6 Damage to Structural Steel Floor Structure	• In-situ location • Connections	HSL:0405-060/1:19/05/04 HSL:0405-060/7:19/05/04
4.7 Damage to Reinforced Concrete Floor Structure		HSL:0405-056/18:16/05/04 HSL:0405-056/20:16/05/04
4.8 Secondary Structural Elements	• Steel Supports to Concrete Floor • Strengthening to 1st Floor	HSL:0405-091/44:25/05/04 HSL:0406-079/34:22/06/04
4.9 Damage to Internal Partitions		HSL:0405-091/51:25/05/04
4.10 Damage to Fabrication Shop		HSL:0405-050/6:14/05/04 HSL:0405-055/17:15/05/04
4.11 Damage to Main Yard	Entrance gate and Perimeter Walls	HSL:0405-076/23:20/05/04

		HSL:0405-077/52:21/05/04
5.0 Detailed Description of Mill Building 5.1 General		'Dispatches' videotape RCAHMS images
5.2 External Brickwork	Wall and Opening Details	HSL:0406-016/15:04/06/04 HSL:0406-016/19:04/06/04 HSL:0406-055/56:16/06/04
5.3 Timber Beams and Floors	• Flooring materials • Floor Joists • Main Timbers	HSL:0405-050/11:14/05/04 HSL:0405-050/25:14/05/04 HSL:0405-087/35:24/05/04 HSL:0406-007/22:01/06/04 HSL:0407-048/22:06/07/04
5.4 Roof Details	Flat roof detail and drainage	HSL:0405-048/11:12/05/04 HSL:0405-048/27:12/05/04 HSL:0405-049/28:13/05/04 HSL:0405-050/02:14/05/04
5.5 Cast Iron Columns	Details	HSL:0405-091/26:25/05/04 HSL:0406-007/24:01/06/04 HSL:0406-007/25:01/06/04 HSL:0407-049/1:07/07/04 HSL:0407-049/2:07/07/04 HSL:0407-049/13:07/07/04 HSL:0407-049/14:07/07/04
5.6 Cast Iron Column Connections	Base and Head Details	HSL:0405-091/22:25/05/04 HSL:0405-091/26:25/05/04 HSL:0405-091/49:25/05/04 HSL:0406-066/5:17/06/04 HSL:0406-066/7:17/06/04 HSL:0406-066/8:17/06/04 HSL:0406-078/24:21/06/04 HSL:0407-048/24:06/07/04 HSL:0407-048/15:06/07/04 HSL:0407-049/10:07/07/04 HSL:0407-049/15:07/07/04
5.7 Ground Floor- Dispatch and Coating Shop 5.7.1 General	• Ramp Area • Paint Colour	HSL:0405-055/8:15/05/04 HSL:0406-079/34:22/06/04
5.7.2 Concrete Floor – Ground Bearing		HSL:0406-078/24:21/06/04 HSL:0406-078/28:21/06/04 HSL:0406-095/35:29/06/04
5.7.3 Suspended Concrete Floor	Details	HSL:0407-047/8:05/07/04 HSL:0407-047/10:05/07/04 HSL:0407-047/12:05/07/04

5.7.4 Steel Floor Structure	• In-situ location • Details • Reconstruction	HSL:0406-003/45:27/05/04 HSL:0406-004/07:28/05/04 HSL:0406-004/09:28/05/04 HSL:0406-053/6:14/06/04 HSL:0406-053/15:14/06/04 HSL:0406-080/1:24/06/04 HSL:0407-047/15:05/07/04 HSL:0407-047/20:05/07/04 HSL:0407-047/23:05/07/04 HSL:0407-047/28:05/07/04 HSL:0407-047/33:05/07/04 HSL:0407-047/36:05/07/04 HSL:0407-047/37:05/07/04 HSL:0407-047/42:05/07/04 HSL:0407-047/47:05/07/04
5.8 Basement Layout	• Wall details • Internal Walls • Stone Pillar Supports • Detail at LPG pipe entry	HSL:0405-050/37:14/05/04 HSL:0405-055/09:15/0504 HSL:0405-077/10:21/05/04 HSL:0406-003/19:27/05/04 HSL:0406-040/18:09/06/04 HSL:0406-040/20:09/06/04 HSL:0406-041/09:10/06/04 HSL:0406-054/12:15/06/04 HSL:0406-054/31:15/06/04 HSL:0406-054/33:15/06/04 HSL:0406-055/13:16/06/04 HSL:0406-055/26:16/06/04 HSL:0406-055/27:16/06/04 HSL:0406-055/36:16/06/04 HSL:0406-055/37:16/06/04 HSL:0406-066/1:17/06/04 HSL:0406-044/53:30/06/04 HSL:0406-044/54:30/06/04
5.9 Main Stair Tower	Details	'Dispatches' video HSL:0405-049/2:13/05/04 HSL:0405-087/09:24/05/04 HSL:0405-087/10:24/05/04 HSL:0405-087/11:24/05/04
5.10 Upper Floor Partitions	Form of Construction	HSL:0405-055/13:15/05/2004
5.11 Ground Floor Partition Walls	Locations	'Dispatches' video
6.0 Fabrication Shop	Structural Details	HSL:0405-048/34:12/05/04
7.0 Main Yard	Details	HSL:0405-087/28:24/05/04 HSL:0406-015/01:03/06/04

Mike Thompson
HM Inspector of Health and Safety (Construction Engineering)

14 July 2005

APPENDIX D: DISPROPORTIONATE COLLAPSE – SCOTLAND, 2005

"standard

1.2

mandatory

Every *building* must be designed and *constructed* in such a way that in the event of damage occurring to any part of the structure of the *building* the extent of any resultant collapse will not be disproportionate to the original cause.

1.2.0 Introduction

This standard was introduced in the United Kingdom following the disaster at Ronan Point on 16 May 1968. Disproportionate collapse does not normally apply to most non-domestic *buildings* however, designers should consider accidental overloading and the possibility of progressive collapse in nondomestic *buildings* of five or more *storeys*.

Conversions

In the case of *conversions*, as specified in Regulation 4, the *building* as *converted* must be improved to as close to the requirement of this standard as is *reasonably practicable*, and in no case worse than before the *conversion* (Regulation 12 Schedule 6).

1.2.1 Disproportionate collapse

Buildings with 5 or more *storeys*

The structural design and *construction* of a *building* having five or more *storeys* should take account of the recommendations on ties and on the effect of misuse or accident, in accordance with the following:
a. for structural *work* of reinforced, prestressed or plain concrete, BS 8110: Part 1: 1997 and BS 8110: Part 2: 1985;

b. for structural *work* of steel, BS 5950: Part 1: 1990 (the accidental loading referred to in clause 2.4.5.5 of the British Standard shall be chosen having particular regard to the importance of the key elements and the consequences of failure, and the key element shall always be capable of withstanding a load of at least 34 kN/m2 applied from any direction);
c. for structural *work* of masonry, BS 5628: Part 1: 1992 and BS 5628: Part 2: 1995.

Maximum area of collapse

When applying the recommendations given in the British Standards mentioned in a, b, and c above, the maximum area of collapse in a *building* with 5 or more *storeys* should be restricted to the lesser of:
• 70 m2 in any *storey* and 70 m2 in each of the adjoining *storeys* above and below; or
• 15% of the area of any *storey* and 15% of the area in each of the adjoining *storeys* above and below."

APPENDIX E: STRUCTURAL EUROCODES – SCOTLAND 2005

The following paragraphs are reproduced from the SBSA Technical Handbook, 2005, Part 1, Structures:

"introduction

1.0

1.0.4 Alternative approaches
Where alternative approaches to the structural design are proposed other than using the guidance contained in this section, the structural design should take account of all of the factors identified in clause 1.0.1 above. For example, care should be taken where alternative numerical values are placed on factors of safety as this may have a detrimental affect on the overall stability of the structure.

Structural Eurocodes

As part of the European Union's desire to remove technical barriers to trade, a series of European Codes of Practice in the field of civil and structural engineering is being published by CEN, the Standards body for Europe. Like other harmonised European standards, each member of the European Union can set their own "nationally determined parameters". This means that the

use of Structural Eurocodes within the United Kingdom should only be considered as an alternative to the traditional British Standards where the "National Annex" which contains these parameters, has been agreed and published.
There will be a period of transition during which time Structural Eurocodes and national codes (e.g. British Standards) should be considered equally acceptable. This period of co-existence should last not more than 5 years from the date the last package of standards (i.e. concrete, steel, timber, masonry etc) is made available from CEN to the British Standards Institution. This is known as "the date of availability" and on expiry of the 5 year period from this date, it is expected that the existing national standards will be withdrawn.

Implementation of
Structural Eurocodes
in the UK

For more detailed guidance on the use of Eurocodes, see 'Implementation of Structural Eurocodes in the UK' (February 2003) produced by the Office of the Deputy Prime Minister on behalf of the United Kingdom."

End of Report