CONFIDENTIAL

SCOSS
Standing Committee On Structural Safety

SCOTCROSS FINAL REPORT

Scottish Building Standards Agency
Denholm House, Livingston, EH54 6GA

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sbsa
SCOTTISH BUILDING STANDARDS AGENCY

SABSM
Incorporating SACBCO

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ACRONYMS

CIC	Construction Industry Council
CROSS	Confidential Reporting on Structural Safety
SABSM	Scottish Association of Building Standards Managers
SBSA	Scottish Building Standards Agency
SCOSS	Standing Committee on Structural Safety
SCOTCROSS	Scottish version of CROSS
UKCIP	United Kingdom Climate Impact Programme

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1. EXECUTIVE SUMMARY

This report concerns work carried out between August 05 and August 07 in collecting information from Local Authorities in Scotland on materials and debris that has fallen from buildings, and concerns about materials or components that might fall. The project follows a recommendation by the Construction Industry Council for Scotland in their 2003 report 'Risks to Public Safety from Falling Masonry and Other Materials'.

Twenty five Local Authorities provided 1,275 reports giving a wealth of data. Short descriptions of incidents are given in many of the reports. These range from simple statements such as 'loose slates' to more lengthy descriptions of collapses. Some examples, such as falls of masonry were potentially serious, and illustrate the risks of personal injuries or deaths to passing members of the public. There were twelve reports, or 1% of the reported incidents, of pedestrians being struck by falling masonry or other debris. Fortunately their injuries were described as 'slight'.

Data has been analysed for correlations between categories. In some instances there have been no discernable relationships but elsewhere significant similarities have been found. The age of buildings was an important feature with over 80% being estimated as at around 100 years old.

There was a standard list of categories for materials concerned, and the largest single category is for masonry at 40% of the total. Coupled with the age data it is shown that the greatest number of reports concern old buildings with external walls built from masonry. Next highest for specific materials is roofing, which is mainly concerned with slates, followed by render, and chimneys. Half of the incidents concern walls, a quarter roofs, and the remainder are concerned with glazing, fittings and the like.

Identifying buildings where there are risks of falling debris is an important next step and this is considered in discussion on the findings.

It is concluded that there are risks to the Scottish public from objects falling from buildings and to the buildings themselves as the fabric, and particularly facades and roofs, deteriorates with consequential costs being incurred for maintenance and repair. Buildings most at risk of deterioration have been found to be: 100 or more years old, built with stone walls and a slate roof, have 3 or 4 storeys, and be in private or shared ownership.

A significant finding is that a peak in reports coincided with a period of unusually wet and windy weather in the winter of 06-07. As the global climate changes such weather is predicted to increase. Old buildings may become more vulnerable and the risk of damage, including falling materials, may increase. This effect must be considered as part of any programme to protect and improve buildings.

There is a contribution to be made to the sustainability of the existing building stock by devising inspection and maintenance regimes to reduce degradation, increase life, and help to meet demand for affordable housing. When damage does occur to the envelope of a building, the energy performance of the building may be reduced, but opportunities could be taken with repair and maintenance programmes to install energy improving measures.

Building owners should be reminded of the need to inspect and maintain their properties, and the results from this study should by publicised by Government and industry. There should be a review of existing legislation, such as defective building notices under the Building (Scotland) Act 2003, and "maintenance orders" and "planned maintenance" powers implicit in the Housing Scotland Act 2006 to require and encourage building owners to take care of their properties.

Consideration should be given by Government and local authorities to continuing with a system for recording falls, and incipient falls, of materials, which could be a valuable indicator of the resilience of buildings to climate change. The use of SCOSS's Confidential Reporting on Structural Safety (CROSS) should be encouraged for reporting other concerns about structural safety.

This report should be made available to Local Authorities and Government departments in Scotland who have a responsibility for buildings, major building estate and property owners, professional designers and construction organizations, and others within the construction industry who have an interest in older buildings.

The report should raise awareness of both safety and environmental issues and encourage the maintenance of the older building stock. The findings should also be made available to interested bodies elsewhere in the UK and Europe.

2. INTRODUCTION

This is the second, and final, report to the Scottish Building Standards Agency (SBSA) after two year's operation of SCOTCROSS. The Agency commissioned SCOSS, the Standing Committee on Structural Safety, in 2005 to conduct a pilot study to record incidents of falling masonry and near misses. CROSS - Confidential Reporting on Structural Safety, was launched by SCOSS in June 05 to help the construction community to provide structures that are safer at all stages of their lives. Part of this scheme, SCOTCROSS, is being used to furnish the information for SBSA.

In 2003 the Construction Industry Council for Scotland published their report 'Risks to Public Safety from Falling Masonry and Other Materials'. It recommended that a standard format for recording dangerous building incidents should be introduced by local authorities across Scotland to enable improved data collation and analysis. This followed the findings in February 2002 by Sheriff Charles Stoddart concerning the Fatal Accident Inquiry into the death of Christine Foster who had been killed by coping stones falling from the gable of a building onto an Edinburgh street.

Twenty five of the thirty two Local Authorities in Scotland provided 1,275 reports and their contributions are gratefully acknowledged. Edinburgh was particularly prolific with half of the total. Nil reports from other authorities may indicate that there were no significant incidents in their localities.

The quality of data is very good. A spreadsheet was updated as reports were received and the data has been analysed to produce the figures and charts given in this document.

Many reports describe actual falls of stone and debris whilst others describe concerns which, had they not been addressed, would have resulted in falls. The terms 'collapsed, 'dangerous', and 'fallen' have been used in nearly half of the reports.

Some incidents could have led to fatalities or serious injury because of the size and weight of the material which fell. There were several near misses and twelve injuries, which fortunately were slight, which is surprising given the size of the falling missiles and the heights from which they fell.

Data from each of the questions asked has been reviewed to give a picture of what buildings, and under what circumstances, pose risks. The most significant relationship is that occupied buildings around 100 years old and built of masonry are the most likely to shed parts of their facades or roofs onto streets below. Intuitively this is what might be expected but here is the data to prove it.

Severe weather in the winter of 2006/2007 with rain and high winds was linked to a significant increase in the number of reports received.

Undoubtedly the quality of inspection and maintenance are important features in minimizing the associated risks. Maintaining old buildings is beneficial in terms of sustainability as well as helping to prevent casualties from falling objects.

This work is complementary to the CIC report by their Skills and Training Working Party on 'Risks to Public Safety from Falling Masonry and Other Materials' published in 2003.

3. RESPONSES

3.1 Local Authorities

Of the 32 Local Authorities in Scotland 25 provided responses in the 2 year period with a total of 1,275 reports as shown below.

	Name of Council	reports to SCOTCROSS
1	Aberdeen City Council	0
2	Aberdeenshire Council	51
3	Angus Council	72
4	Argyll and Bute Council	1
5	City of Edinburgh Council	691
6	Clackmannanshire Council	0
7	Comhairle Nan Eilean Siar	0
8	Dumfries & Galloway Council	52
9	Dundee City Council	24
10	East Ayrshire Council	25
11	East Dunbartonshire Council	0
12	East Lothian Council	39
13	East Renfrewshire Council	0
14	Falkirk Council	2
15	Fife Council	0
16	Glasgow City Council	117
17	Highland Council	2
18	Inverclyde Council	10
19	Midlothian Council	25
20	Moray Council	3
21	North Ayrshire	1
22	North Lanarkshire Council	14
23	Orkney Islands Council	1
24	Perth and Kinross Council	6
25	Renfrewshire Council	1
26	Scottish Borders Council	45
27	Shetland Islands Council	0
28	South Ayrshire Council	54
29	South Lanarkshire Council	12
30	Stirling Council	6
31	West Dunbartonshire Council	12
32	West Lothian Council	9
	total to August 2007	**1,275**

The number of reports is a measure of the interest that the scheme has attracted and the number of participating authorities has risen in the second year. The many local authority officials who have participated are to be thanked once again for their valuable contributions. Their reports have been acknowledged but it is recommended that the present report is circulated to them so that the result of their work can be seen. If an authority has not submitted any reports this may be because there were no

relevant incidents during the period and not because the authority was not participating in the scheme.

The reports are mostly about dangerous or fallen objects but some refer to other types of structural incident as shown below. The non-core incidents concerning fires, scaffolds, vandalism and vehicle impact have not been included in the analysis.

	category of report	number of reports
1	Dangerous or fallen objects	1,186
2	Fire damage	29
3	Scaffolding incidents	27
4	Vandalism	14
5	Vehicle impact	19

3.2 Quality of data

With such a large number of reports in hand the consistency of data could be assessed. Different reporters use somewhat different descriptions for similar circumstances because the questions asked give scope for variation. This was minor but some editing of brief summaries of the reports has been done to give consistency. However the original reports, in full, have been retained in the data base.

About half the reports were sent by spreadsheet, although these are mainly from Edinburgh, and the rest by using the standard forms. The original form was revised after a few months but some reporters continue to use the original. The forms were further revised at the end of the first year to provide additional data on previous repairs, but often these were not used by reporters who kept to the originals. This has resulted in a small proportion of reports not being as comprehensive as others.

The option of using the spread sheet as a method of reporting was encouraged as it saved work both for the reporters and for SCOTCROSS. The web site had a facility for downloading a spreadsheet but this was not widely used.

The appendices give examples of the input form and extracts from the spreadsheet.

Information requested from reporters includes the headings given below. Also shown are comments on how these questions have been answered.

Heading	Comment
Local authority name	Essential and always given
Contact name and details	Always given and important for queries and acknowledgements.
Date of report	Always given and kept on file but not used in analysis.
Date of incident	Used to see if there is any co-relation between events and the seasons or extreme events such as storms. Dates rationalised to the first of each month for conformity.

Heading	Comment
Post code	Usually given and although it is not used at present it may be in the future by other researchers.
Number of storeys above ground	Usually but not always given and used to find out if there is a correlation between events and building heights. Some reporters gave height from which an object fell rather than the overall height of the building.
Exposure conditions	A subjective assessment by the reporter to see if there is a relationship between events and the degree of exposure of the building concerned.
Facing direction	Usually given but sometimes with more than one direction. The intention is to determine if there is a relationship with prevailing weather conditions.
Ownership/use	Important category which is given by all reporters.
Type of roof including parapet	Not always given and not always relevant but potentially useful. Data on parapets is not often given, probably because they are not common.
Casualties/injuries	Always given.
Approximate age of structure	Responses to this question vary but generally there are estimates which mean that approximate ages can be assessed.
Weather	This question is intended to see if there is a relationship between severe weather and the occurrence of incidents.
Building occupation	Answer states whether a building is occupied, vacant, or being demolished.
Previous repairs to stonework	This was introduced after the first year to see if previously repaired stonework was involved in failure. Not all reporters used the modified form however and the results are incomplete.
Building type	An important category to determine the type of building affected eg domestic (low rise), tenement (usually 3 or more storeys), or commercial.
Material involved	This was an important multiple choice question listing the most common categories of material or component that has been involved in an incident. It was always completed.

Heading	Comment
Description of event or reason for concern	Some reporters give no description, most give a two or three line description, and some give very detailed information. The most useful are the short descriptions. All are kept on file but for analysis a standard list of headings was used.

In the spread sheet version of the report form most of the questions were in the form of drop down menus which simply had to be selected with the click of a mouse and the completed local spread sheet was emailed to CROSS. It was then pasted into the main spreadsheet on which the data is kept.

3.3 Spread of responses

As noted in the first SCOTCROSS report by far the largest number of reports has come from Edinburgh where there is already a system for monitoring events such as falls of masonry. Edinburgh accounted for half of all the submissions whilst, in comparison, Glasgow sent in 10% of the responses. This large difference is due to the culture of reporting in Edinburgh and the fact that the Council there actively ask building owners to report the occurrence of problems, and anything that looks dangerous. There are also unique bye-laws in Edinburgh that aid the reporting process and have been in place for many years. The figure below shows how many reports have been made from each of the local authorities who have responded.

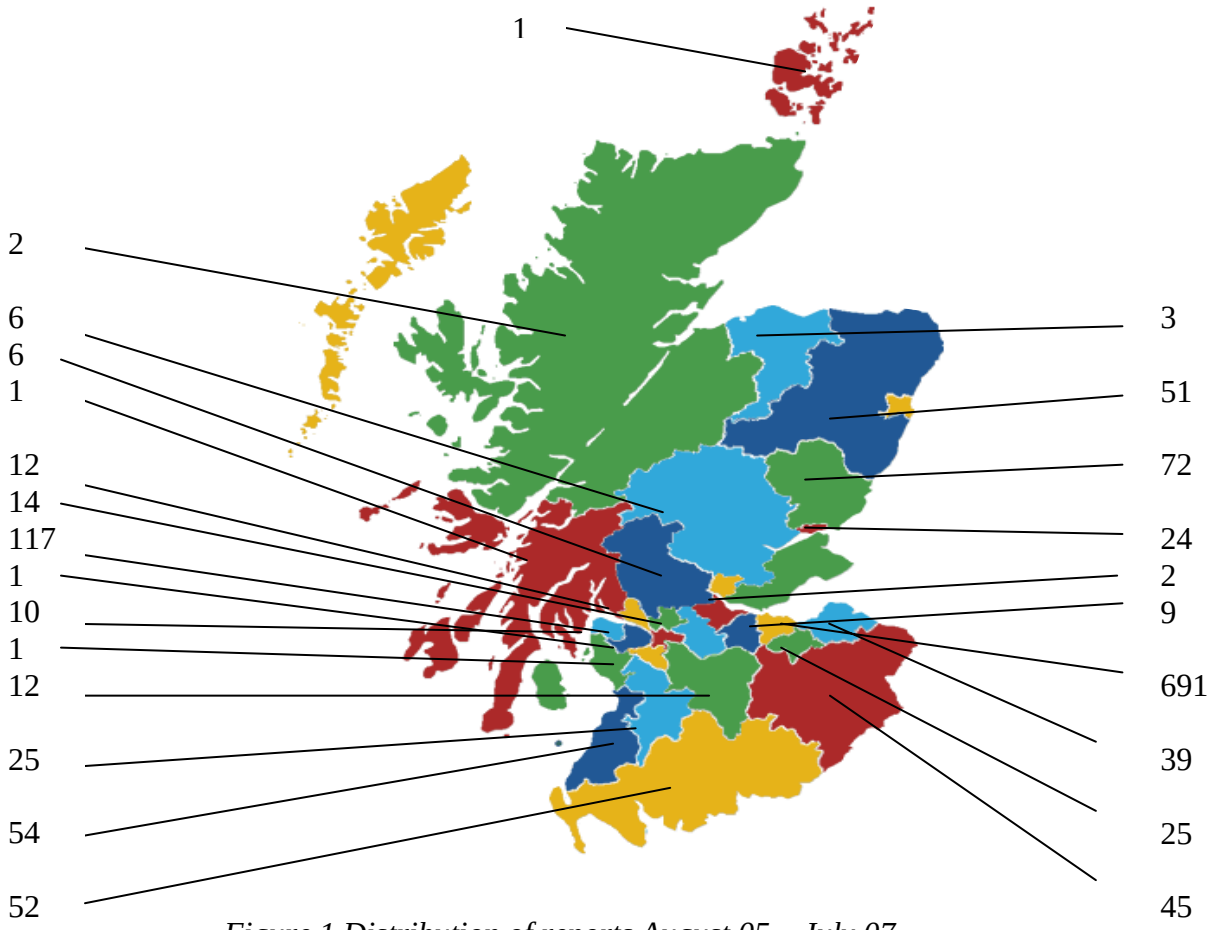

Figure 1 Distribution of reports August 05 – July 07

4. DESCRIPTIONS OF INCIDENTS

4.1 General

Of the 1,186 relevant reports, almost all include short descriptions of incidents whilst 800 have fuller descriptions. These range from simple comments such as 'loose slates' to comprehensive statements.

Below are some photographs of damage which illustrate the type of problems that have been encountered. Figures 2 – 11 are courtesy of the City of Edinburgh and, whilst typical, do not necessarily show reported incidents.

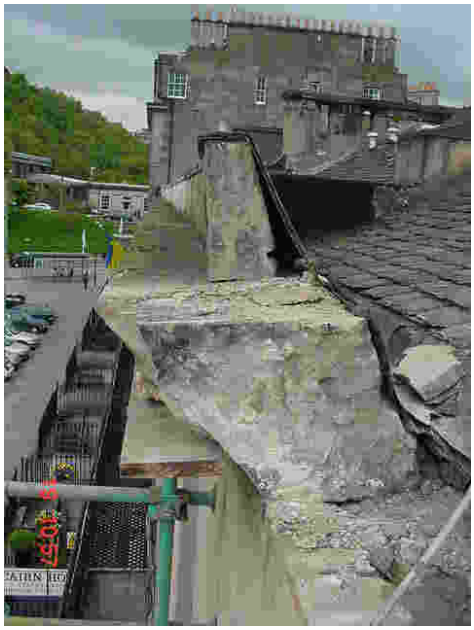

Figure 2 Unsafe pediment

Figure 3 Decaying stonework

Figure 4 Dangerous slates

Figure 5 Cracked stonework

Figure 6 Loose downpipe

Figure 7 Fallen chimney pots

Figure 8 Spalling render

Figure 9 Slipping tiles

Figure 10 Plastic repairs

Figure 11 Debris from failed plastic repairs

Figure 12 Large scale failure of stone façade

Figure 13 Stonework collapse

Figure 14 Gable collapse in high winds

Figure 15 Masonry failure due to pipe corrosion

In the next section are examples of incidents, any one of which could have had serious consequences. They demonstrate the risks of personal injuries or deaths caused by objects falling from buildings.

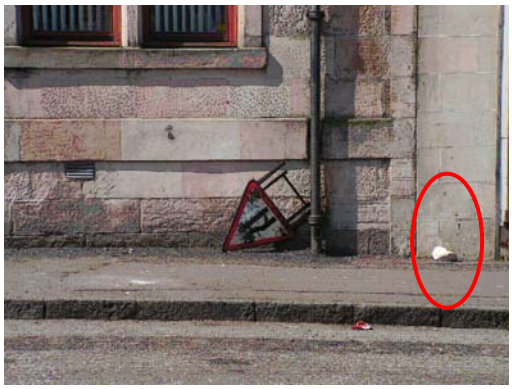

Figure 16 Debris from above

4.2 Extracts from reports

The following 20 quotations are from taken from reports to illustrate the range and severity of the incidents that were recorded.

1. *Projection above first floor window lintel measuring approximately 1.0m wide sheared off flush with wall and half the length of the projection and fell onto the pavement below.*

2. *Crumbling stonework on gable wall of two storey building stonebuilt property adjacent to public footpath and stonework falling onto adjacent roof of single storey house.*

3. *Falling stonework and loose stonework and pots on chimney head of two storey tenement type dwelling.*

4. *Loose rain water cast iron down pipe on high rise tenement building has potential to fall onto public footpath.*

5. *A piece of decorative sandstone (approximate weight 0.75kg) de-laminated and fell from first floor of building onto pavement below narrowly missing pedestrians.*

6. *Wall mounted air conditioning plant at risk of falling due to bracket failure.*

7. *Stone cladding panel, about 600mm square and secured only by mortar dabs, dislodged from elevation above a shop and slightly injured passer by.*

8. *Take down loose/dangerous sections of masonry balustrade on front elevation, at roof level in the interest of public safety.*

9. *Piece of stone fell from property and hit lady walking on pavement - not seriously injured.*

10. *Previous cement repairs to haunching of chimney pots leading to deterioration of the sandstone copes and chimneys.*

11. *Cast iron downpipe unsupported due to total failure of support brackets - extremely dangerous.*

12. *Loose pointing between wallhead and slated roof on north gable. A section of this became detached and fell onto the street below.*

13. *Portion of rear wall collapsed. Note this incident followed a period of heavy rain.*

14. *A TV aerial had broken off from its fixings on the chimney and was lying precariously on the roof of the building above public footpath.*

15. *Partial collapse of gable of wall & chimney of flats leaving a hole in wall at apex of gable wall and remaining chimney head unstable. Weather at time of incident: severe winds & rain.*

16. *Boundary wall collapsed adjacent to public footpath during strong winds*

17. *Collapse of north gable wall to three year old block of flats.*

18. *Large section of brickwork boundary wall collapsed adjacent to road.*

19. *Wrought/cast iron work fell from roof. Pedestrian hit but not injured.*

20. *Fairly large piece of stonework fell from property and narrowly missed lady walking past. Other areas of de-laminating stonework require to be removed for public safety.*

5. ANALYSIS OF DATA

5.1 Frequency of reports and weather

The data that has been collected has been used to create statistics to help to identify common features or relationships. First amongst these are the dates of incidents and these are shown in Figure 17 below.

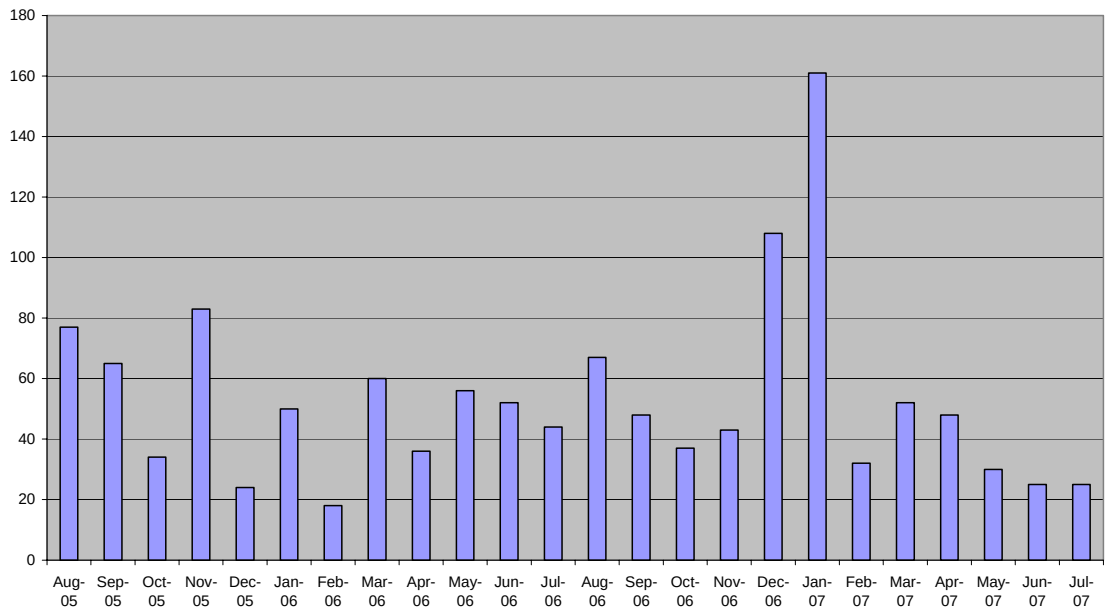

Figure 17 Reports submitted over the two years

There is a distinctive peak in December 2006 and January 2007 and the weather during this time was particularly wet and windy which appears to have influenced the number of incidents. Certainly there were reports of problems during, or soon after, severe weather including wind damage leading to dangerous situations.

The Met office provides a wealth of historic data on weather conditions on their site www.metoffice.gov.uk/climate/uk and extracts from this show the patterns during December 2006 and January 2007 when reports were at their highest levels.

Scotland diary of highlights December 2006 from the Met Office

Mean temperatures again above average. Also a very wet month for much of Scotland, most of the rain concentrated in the first fortnight and lasted a few days. A drier month across the north-east, and also exceptionally sunny. Aberdeen Airport smashed their December sunshine record with around 90 hours.

A summary of the accompanying text is: *At the start of the month there was heavy rain in the west producing 40 mm at Tyndrum during the day then*

another 87 mm overnight. The river Tay burst its banks. Mid December brought more rain particularly in the west with over 50 mm at Glasgow on one day. The end of the month saw more wind, with gales in places, and more rain

Scotland diary of highlights January 2007 from the Met Office

A very mild month overall, but with a spell slightly below normal between 16th and 26th. A very wet month across western Scotland, although some eastern areas recorded below average rainfall.

A summary of the accompanying text is: *As various fronts tracked eastwards there were spells of rain and some high winds. In mid January there was a very wet and windy spell with severe gales in the places. Recorded wind speeds were up to 80 mph in the north west. At the end of the month there more of the stormy conditions.*

The significance of weather on the performance of old buildings is important and likely to increase as the effects of climate changes become more pronounced. This is discussed later.

5.2 Number of storeys

A change to the report form after the first year was for free standing walls to be included as a separate building type. There are reports for 1, 2, 3 and 4 storey buildings with 4 as the largest single category and very few with more than storeys. These are shown in Figure 18 and the conclusion is that most reports are concerned with medium rise buildings. In a large number of cases no information on the number of storeys was given. The largest numbers of four storey buildings were reported to be in Edinburgh, Glasgow and other cities.

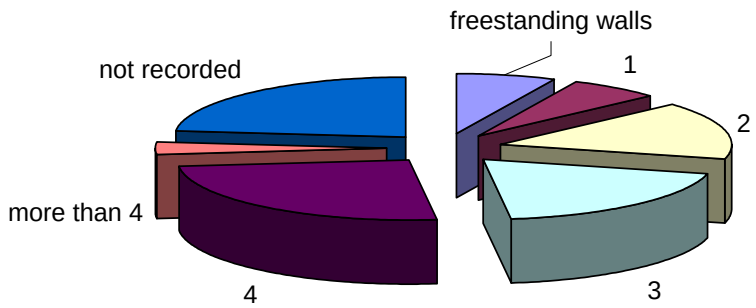

Figure 18 Number of storeys

There does not appear to a co-relation between height of building and category of event or concern. All had common forms of failure such as spalling masonry and roof defects. Obviously however the risk of potential damage is higher when caused by objects falling from greater heights.

5.3 Facing direction and exposure

The facing direction given in reports was extremely evenly distributed as shown in the table below. It may be that local analyses with more detailed results on a GIS system might show some relationship between direction and incidents but the present level of analysis the facing direction does not appear to be significant

A further question is degree of exposure and most buildings were categorised as being moderately exposed to the elements. Reviewing the type of incident against exposure condition does not show any discernable relationship but exposure generally is significant in terms of damage. In stormy periods exposed locations will certainly suffer more.

Figure 19 Weathering

Figure 20 Wind damage to leadwork

Relationships between facing directions, and between exposure conditions are shown in Tables 1 and 2 below.

Table 1 Facing direction

Facing direction	Number of reports
North	261
South	257
East	226
West	239
not recorded	203

Table 2 Exposure conditions

Exposure category	Number of reports
sheltered	164
moderate	874
severe	58
not recorded	90

5.4 Roof types and parapets

Data on roofs shows that pitched roofs with slates are the most common, and that these provided the most reports concerning roof problems. Parapets did not feature

amongst the reports except in one case where dangerous balustrades were mentioned. The statistics are given in Table 3.

Table 3 Roof types

roof type		roof covering		parapets	
pitched	824	slated	684	has parapet	75
flat	56	tiled	73	no parapet	372
not recorded	187	steel sheets	15	not recorded	656
not applicable	119	not recorded	288	not applicable	83
		not applicable	126		

5.5 Casualties

Fortunately almost all reports were of no injuries sustained but there were twelve reports of minor injuries. There were two reports of death but both were due to vehicle impacts and subsequent structural collapse. There were also two reports of serious injuries with one due to a vehicle impact and the other due to a scaffold collapse. These four incidents, whilst of course very serious, were discounted as not being primarily due to building defects.

The twelve cases of minor injuries due to falling debris amount to 1% of the reports. This is the same percentage as found in the first year of the scheme. Surprisingly there were no serious injuries given the mass of the falling objects. There may have been more falls of materials than have been reported, and possibly more casualties so this figure is a minimum. Any fatalities however would have been given prominence in the press, and Local Authorities would have been aware of such events, so it probable that there were no deaths due to materials falling from buildings during the period.

5.6 Age of buildings

Data on the ages of buildings is, as already mentioned, not complete in many cases. In Figure 21, the chart representing age, about a quarter are 'not known' while the proportion in the range of 80-100 year is nearly a third, and a further third are over 100 years. If it were assumed that most in the 'not known' category are around the 100 year mark, the total of buildings about a century or more old would be around 60%. This is 10% higher than was reported in the first year and possibly indicated that more old buildings suffered damage during the last year. Adding in the 80-100 year old category gives over 80% of buildings being more than 80 years old, and probably nearer to 100 years old. At the other end of the range incidents concerning buildings less than 50 years old represent only a small proportion of the total. This quantifies the apparently obvious fact that old buildings present the greatest risk and hence are the ones which should be monitored.

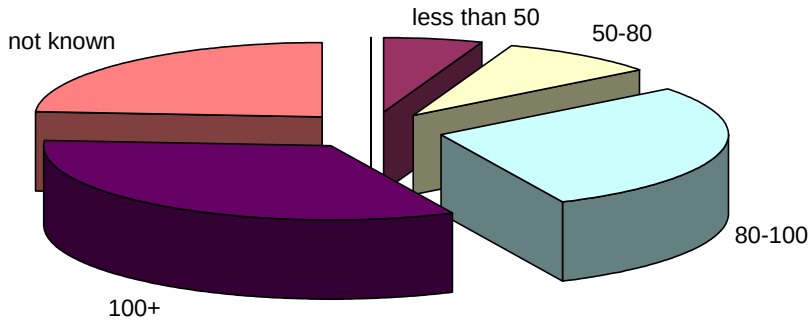

Figure 21 Age of buildings

5.7 Ownership and occupancy

The great majority of buildings are either privately owned or in shared ownership as seen from Table 4. 'Shared ownership' probably means sharing between a number of private owners rather than between local authorities and private individuals. Only 3% of the buildings whose ownership was recorded belong to local authorities. This may indicate that local authority buildings are better maintained than those in private ownership.

Table 4 Ownership

Owner	Number of reports
local authority	33
private	522
shared	444
not known	162

The great majority of buildings were occupied, as shown in Figure 22, but this was no guarantee that there would not be failures and incidents. Indeed there were proportionately less events reported on vacant buildings but this may be because such properties are less likely to attract attention and dilapidation may go un-noticed. Other factors are that derelict buildings may be isolated or in less populated areas and, importantly, may have had no maintenance to the fabric for many years.

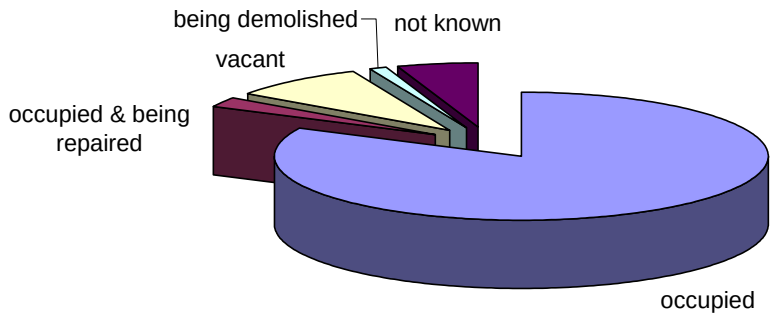

Figure 22 Occupancy of buildings

5.8 Building type

Figure 23 shows the proportions of building type where the 'domestic low rise' category represents a quarter while 'tenements' represent over a third of the total. Domestic low rise and tenement together are about 60% of the buildings in the data base. Care is needed however as some buildings described by reporters as 'domestic' may be 'tenements'.

Section 26(1) of the Tenements (Scotland) Act 2004 has the following definition for "Tenement":-

"tenement" means a building or a part of a building which comprises two related flats which, or more than two such flats at least two of which -

(a) are, or are designed to be, in separate ownership; and

(b) are divided from each other horizontally,

and, except where the context otherwise requires, includes the solum and any other land pertaining to that building, or, as the case may be, part of the building; and the expression "tenement building" shall be construed accordingly.

It is interesting to note that no mention is made here of the number of storeys although the common perception is of a tenement as a multi-storey building, or at least one with three storeys.

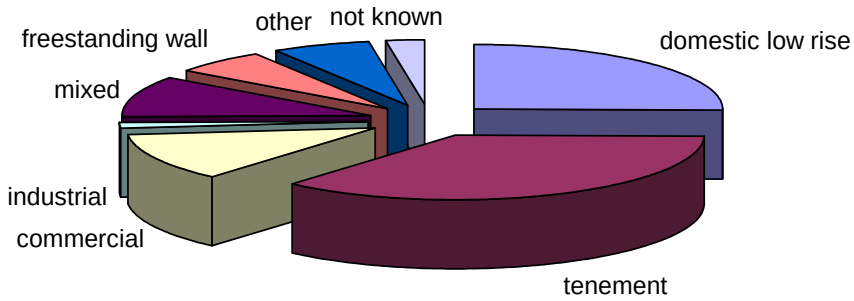

Figure 23 Building type

During the second year data was collected on free standing boundary walls and data from the first year was reviewed to identify these structures. CROSS has received a number of reports on the collapse, usually without warning, of such walls and, in at least two recent cases children have been killed and in another case there was severe injury. Six percent of SCOTCROSS reports, or 75 in number, concerned freestanding walls and indicates the risk associated with them. An example is shown in Figure 24.

Figure 24 Collapse of free standing wall

5.9 Materials

Figure 25 shows the distribution of materials involved in reported concerns. There is some ambiguity in that many reports are about 'masonry' and it is not always clear whether this refers to stonework or to brickwork. However since most reports relate to old buildings, many of them tenements, it is considered that 'masonry' in the data is in fact 'stonework'.

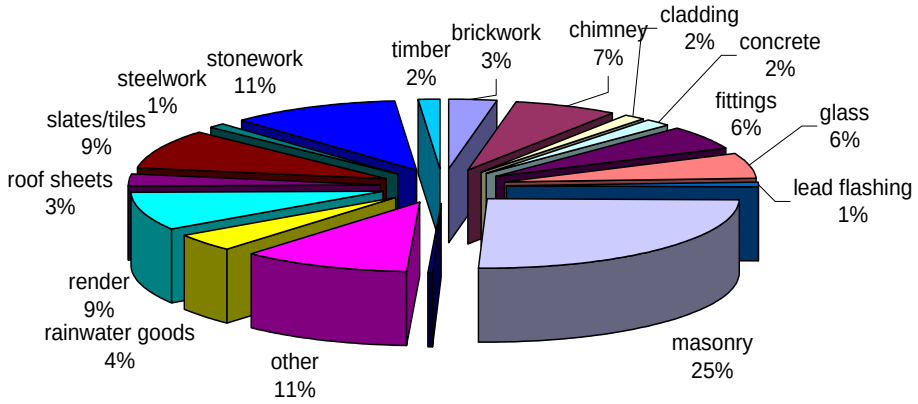

Figure 25 Materials concerned

By adding these sub-categories of 'masonry', 'brickwork' and 'stonework', the major sector for masonry at nearly 40% of the total Coupled with the age data in Figure 21 this shows that the greatest number of reports concern old, around 100 years old, buildings with external walls built from masonry.

Next highest for specific materials is roofing at 13%, which is mainly concerned with slates, followed by render at 9%, and chimneys at 7%. All of these materials become potentially lethal missiles when falling from height.

'Fittings', at 6% of the total, compose a miscellaneous group of components or elements that are attached to buildings such as aerials and signs. In these cases it is usually the fixings that fail or the material of the fitting corrodes. Glass failures are mostly from broken windows. By aggregating some of the categories a simplified chart is created as shown in Figure 26. Consolidating the data even further shows that half of incidents are from facades, a quarter from roofs, and the rest from a variety of causes.

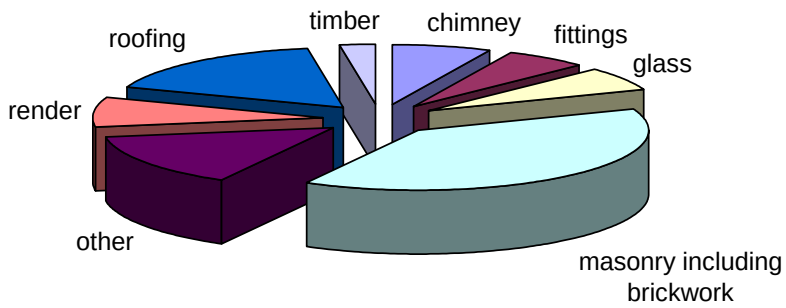

Fig 26 Summary of combined materials

6. Discussion

6.1 General SEE INTRODUCTION

A quarter of reports are concerned with material that has actually fallen, a further quarter relates to loose objects, and another quarter use the word 'dangerous' in the description. The proportions are the same as was found for the first year. These remain sobering facts, and considering that the incidents have been reported from cities, towns, and urban environments, it is clear that there is a potential risk to persons from falling debris almost anywhere.

The Construction Industry Council Scotland (CIC) report 'Risks to Public Safety from Falling Masonry and Other Materials' published in 2002 said:

> *A large number of incidents, involving masonry and other materials falling onto public footpaths and other pedestrian spaces, have been reported to local authorities during each year of the study. Since 1988 at least one person has been killed or injured each year in Scotland as a result of masonry or roofing materials falling from buildings. When discussing such incidents with those responsible for public safety in local authorities comment is frequently made regarding the number of near misses that also occur.*

The present scheme confirms this and indeed may show a worse situation. There have been almost 1,200 reports of falling objects, loose materials, and dangerous situations, with twelve instances of pedestrians being hit, and some near misses. Not all of Scotland has been covered so the actual numbers almost certainly even higher. Reported injuries were slight which is remarkable considering the size of the missiles with which the victims were struck and the height from which they fell.

The CIC report 'RISKS TO PUBLIC SAFETY FROM FALLING MASONRY AND OTHER MATERIALS' in December 2003 said there are many reasons why buildings become dangerous. Some of these have been described by the Standing Committee on Structural Safety (SCOSS is the parent body for CROSS and SCOTCROSS) in a Topic Paper issued in February 2003. In addition to deterioration from age or neglect there can be other reasons including deficiencies in design, poor workmanship and lack of supervision.

The peak in reports from December 06 and January 07 coincided with unusually wet and windy weather. Anecdotal observations from building surveyors are that old buildings suffer in very wet weather, and wind is an obvious mechanism for dislodging weakly held materials. Frost and freeze/thaw cycles play an important role in the weathering of materials but frost was hardly ever mentioned in the reports.

The issue of decay has previously been seen to be linked by the British Geological Survey to the stones' quality and characteristics and the exposure of the stone or the building to the weather. Further details can be found in the 2004 Research Report 'The Performance of Replacement Sandstone in the New Town of Edinburgh' by EK Hyslop, published by Historic Scotland.

Predictions from UKCIP in 2002 (to be updated in 2008) about climate change are for:

- warmer, wetter winters
- hotter drier summers
- rising sea levels
- more extreme events.

Damage to old buildings might be expected to increase as a consequence of increases in driving rain and other factors. The process will be affected by the fact that the buildings are getting even older as the weather gets worse. This aspect deserves serious consideration by:

- Building owners
- Construction professionals
- Facilities managers
- Maintenance contractors
- Builders

6.2 Risk analysis

Risk may be defined as the expectation of loss. It is a function of the probability of an event occurring and the consequences of harm if it should do so. A risk assessment shows strengths, vulnerabilities, likelihood of damage, estimates of the costs involved if harm occurs, possible defensive measures and their costs, and estimated probable savings from better protection.

The risks here are to both people and property. Quite rightly the reporters are concerned with the dangers of harm to people as are the regulations governing buildings and their use. Quantifying risks of injury from falling debris could be done by assessing the magnitude of the damage and its consequences.

In a risk profile the elements of structure and the condition of the fabric need to be considered. It is clear that different elements present different risks and consequently different solutions. In essence the risks may be broken down as follows:

The public interest:

- Danger of injury from the roof, wall, and other elements which become insecure and are at risk from falling.

The private interest:

- Detrimental defects leading to consequential damage to structural elements and decorative finishes both internal and external, such as damaged gutters and downpipes leading to water penetration.
- Defective fittings and fixtures such as windows and other joinery elements which can contribute to danger and to consequential damage if not remedied.
- Reductions in energy performance as building fabric is damaged.
- Increases in costs and the un-necessary use of additional materials if essential repairs are neglected.

Analysis of the data indicates that the risks presented within these definitions are not significantly different. If a building has been neglected it is likely that all elements have suffered deterioration and need attention. The variation in terms of a remedy lie more with the urgency of the solution rather than the need for a solution.

The public interest risks are, in general terms, the more urgent and can fall to be dealt with through enforcement powers under the Building (Scotland) Act 2003, many of which, but not exclusively, are vested in Building Control to control and eliminate dangerous conditions. Such cases can result in the Council taking “direct action” to have such works carried out because an owner has defaulted or because the owner cannot be located. In such cases the responsibility vested in Building Control extends only to the removal of danger and does not normally extend to remedial repairs.

The private interest risks can also involve Building Control through powers under the Civic Government (Scotland) Act 1982, Edinburgh Corporation Acts and others and the Building (Scotland) Act 2003). As with the dangerous building cases mentioned above the powers relating to defective buildings can also generate the need for direct action by a Council should an owner default. In these cases there is a need to render a building fit for purpose and generally the works include remedial repairs and reinstatement works.

Any involvement by a Council to seek to eliminate the risk does not only involve Building Control. The challenge presented by the survey results lies in defining and distinguishing between:

- the "public safety role of building control",
- "the assistance role" through the Private Sector Housing Grant system to aid "common repairs" and "tolerable standards", in appropriate cases,
- professional advice and assistance from the Council,
- expertise in the private sector through factoring arrangements or through direct professional assistance in managing repair and maintenance contracts, and
- involvement with the Housing Strategy Team through the Private Landlords Forum to raise further awareness.
- involvement with panning authorities when listed buildings are involved.

6.3 Monitoring

As stated before, the reasons why materials had fallen or were loose have not asked for in this scheme, but in relation to masonry it may be deduced that failure is mainly due to the effects of age and weathering coupled with a lack of maintenance. An additional question to identify concerns with failures of previous repairs was added to the report form for the second year and several falls of material were said to have been where there had been earlier repairs to stonework.

What could or should be looked for, and by whom, to give early warning of failures?

As was pointed out by CIC, adequate and timely maintenance would do much to alleviate the problem. What remains to be determined is how this should be managed in terms of:

- Frequency of inspection
- Responsibility for inspection
- Responsibility for initiating maintenance
- Selection of suitable contractors
- Issues of supervision, quality control, and health and safety
- Liabilities
- Contributions to cost.

Some other jurisdictions require building owners to periodically have surveys carried out of their properties.

In the United States there are over 15,000 buildings currently subject to local municipal laws in various cities that require periodic inspection of building facades. These local laws are typically known as facade ordinances. The purpose of these ordinances is to identify unsafe conditions — loose facade components or materials — that may fall and cause damage to property, or injury and possibly death to pedestrians. These ordinances have come about because of previous damage to property, injury to pedestrians, and loss of life suffered in some cities.

In New York a Local Law requires that the exterior facades of all buildings within the City of New York be inspected every 5 years by a Licensed Professional Engineer. In Singapore the general structures of buildings have to be surveyed regularly - every 10 years for apartments and 5 years for other buildings.

In Belgium the 'Monument Watch' scheme promotes the preservation of historic buildings and monuments by arranging for inspections by specialists to help owners and managers. In Scotland identifying structures where there are risks of falling debris could be a part of the process to enhance the safety of old buildings and protecting the public from the type of incidents reported here.

There are therefore precedents for formal inspections of facades and, bearing in mind the number of reported falls there may be case for introducing a scheme in Scotland. The resources to do this exist in the form of experienced surveyors and structural engineers.

In addition to safety considerations sustainability is of critical importance. The re-use of existing buildings promotes the sustainability of communities and limits demands for materials. As part of the sustainable use of existing buildings it is clear that the external fabric of the building must be maintained in good condition.

The buildings most at risk of not having been maintained are, on the evidence gained, likely be:

- be 100 or more years old
- built with stone walls and a slate roof
- 3 or 4 storeys high
- in private or shared ownership

7. CONCLUSIONS AND RECOMMENDATIONS

1. There are risks to the Scottish public from objects falling from buildings and to the buildings themselves as the fabric, and particularly facades and roofs, deteriorates with consequential costs being incurred for maintenance and repair.

2. Buildings most at risk of deterioration have been found to be: 100 or more years old, built with stone walls and a slate roof, have 3 or 4 storeys, and be in private or shared ownership.

3. The number of reported incidents increased during winter periods of wet and windy weather.

4. The impact of predicted climate change on the existing building stock is likely to result in further deterioration and may accelerate the rate of deterioration, and must be considered as part of any programme to protect and improve buildings.

5. There is a contribution to be made to the sustainability of the existing building stock by devising inspection and maintenance regimes to reduce degradation, increase life, and help to meet demand for affordable housing. When damage does occur to the envelope of a building, the energy performance of the building may be reduced, but opportunities could be taken with repair and maintenance programmes to install energy improving measures.

6. Building owners should be reminded of the need to inspect and maintain their properties, and the results from this study should by publicised by Government and industry. There should be a review of existing legislation, such as defective building notices under the Building (Scotland) Act 2003, and “maintenance orders” and “planned maintenance” powers implicit in the Housing Scotland Act 2006 to require and encourage building owners to take care of their properties.

7. Consideration should be given by Government and local authorities to continuing with a system for recording falls, and incipient falls, of materials, which could be a valuable indicator of the resilience of buildings to climate change. The use of SCOSS’s Confidential Reporting on Structural Safety (CROSS) should be encouraged for reporting other concerns about structural safety.

8. This report should be made available to Local Authorities and Government departments in Scotland who have a responsibility for buildings, major building estate and property owners, professional designers and construction organizations, and others within the construction industry who have an interest in older buildings. The report should raise awareness of both safety and environmental issues and encourage the maintenance of the older building stock.

9. The findings of this report should also be made available to interested bodies elsewhere in the UK and Europe.

8. APPENDIX

SCOTCROSS REPORT FORM

1. This form can be downloaded and printed out for manual completion, or copied and completed using MS Word and then emailed to the address given at the bottom of the form.
2. There is also an on line form on the SABSM web site which can be used instead.
3. Two new questions are included: whether there have been previous repairs to stonework, and whether a free standing wall is involved.

Local Authority			
contact name		**position**	
telephone number		**email**	
date of report		**date of incident/concern**	
building data	**location by post code**		**number of storeys above ground**

exposure - check	severe		moderate		sheltered		not known				
facing – check	North		South		East		West		not known		
ownership/use - check	private		local authority		shared		other		not known		
type of roof - check	flat		pitched		slated		tiled		parapet		no parapet
Casualties/injuries - check	fatal		serious		minor		none				

approximate age of structure		**building occupation (predominant)**		**building type**		**material involved**	
less than 50 years		occupied		domestic building		brickwork	
50-80		occupied and being repaired		tenement		chimney	
80-100		vacant		commercial building		cladding	
more than 100		vacant and being repaired		industrial building		concrete	
not known		being demolished		mixed use		fittings	
		not known		free standing wall		glass	
Weather				other		lead flashing	
seasonably normal		**Previous repairs to stonework**				not known	
severe rain						rainwater goods	
severe wind		evidence seen				render	
frosty		no evidence seen				roof sheets	
						slates/tiles	
						steelwork	
						stonework	
						timber	
						other	

This tick can be copied and pasted to put checks in ✓ the boxes

Description of event or the reason for concern