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SOUND INSULATION IN REHABILITATION TENEMENTS, GLASGOW

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INTRODUCTION

Glasgow in common with other cities has gone through a phase of demolition of tenement properties in the sixties to a current phase in recent years of rehabilitating them. There are some 25 housing associations within Glasgow and they along with the District Council and other agencies are extensively involved in rehabilitation work.

With regard to sound insulation, the main concern during rehabilitation is in achieving a reasonable performance of separating floors for airborne and impact sound, these floors traditionally being of timber joist construction.

During the past eighteen months the Building Acoustics Group at the College has been working with several of the local housing associations on this problem. A range of options has been explored in an endeavour to determine appropriate specifications for floors which have been treated, partly or wholly, during the rehabilitation process and also for floors which are found to be sub-standard after reoccupation.

This paper reviews and appraises the work carried out over this period.

TYPICAL LAYOUT OF TENEMENT FLATS

Whilst there are variations on the theme, Figures 1, 2 and 3 are generally representative of the arrangements and layout of Glasgow tenement flats. There are relatively few problems of complaints arising from horizontal sound transmission via the party walls, the majority of complaints from tenants arising from vertical sound transmission through timber joisted floors and supporting structure. A typical example of the traditional specification for timber joisted floors in tenement properties is indicated in Figure 5. This is similar to the deemed to satisfy specification of the Scottish Building regulations [1] but without the resilient layer between flooring and joists. It is interesting also to note the use of tongued and grooved flooring which is prevalent in Scotland.

THE SOUND PROBLEM

During the rehabilitation process rotwork in joist ends is often identified, which requires total or partial replacement of the timber joisted flooring. In many cases the rotwork is confined to areas close to bay windows or adjacent to other outside wall areas.

At the time when the Building Acoustics Group became involved with this problem the widely used solution was to remove the appropriate ash deafening, deal with the rotwork and replace the removed portion of ash deafening with dry sand. In some cases replacement of ash with sand was over a small area while in extreme cases there was total replacement of ash with sand. The sand was laid on a pvc membrane on the deafening boards to a nominal 50 mm fill between the joists. Perimeter sealing problems arose particularly where the joists run parallel to the walls and there was a small gap between the wall and the adjacent joists which in many cases was 'sealed' by packing glasswool or mineral wool in the gap.

The Group tested several sand or sand/ash specifications and generally found them to be unsatisfactory. Several of these test results are identified in Figure 6.

WHICH STANDARD?

The Scottish Building Regulations [1] allows scope for Building Control officers to treat rotwork to floors as an alteration or repair which requires the sound insulation to be 'no worse than existing'.

In Glasgow at the present time the broad rules being applied (partly as an informal arrangement) by Building Control are:

(i) less than 50 percent floor repair - no tests required. Accept replacement with similar materials,
(ii) 50 percent and above floor repair - pretest and retest to attain a 'no worse than before' condition.

In cases where the pretest Aggregate Adverse Deviations (AAD's) are high the client is advised by Building Control that means should be sought to get the retest figures closer to 23dB AAD.

In one sense this seems very arbitrary with a moveable standard influenced by the pretest results. In practice it usually means requesting that AAD's are maintained about 40 dB. [4] [5]

DISTURBED FLOORS

The Group has tested a small number of ash deafened floors, (deep-joisted) with lathe and plaster ceilings and deep cornices, in situations where there has been little or no disturbance to the floors, mainly in residential property. Sound insulation performance on both airborne and impact tests has been good as can be seen with reference to Figure 6.

Tests have also been undertaken in tenement properties on ash deafened floors in situations where floorboards had been lifted some years ago to allow the upgrading of electrical and sometimes gas and plumbing services. Figure 6 shows a cluster of airborne/impact points indicating poor performance of such floors.

The Group has found that where floors are disturbed for rotwork replacement and sand is used to replace ash over that portion of the floor, the impact/airborne performance (again see Figure 6) has been poor.

In cases where the floor is completely disrupted and 100 percent replacement of ash with sand has been carried out the results (Figure 6) have once again been disappointing.

These experiences led the Group to seek alternative solutions for the timber joisted floor in a rehabilitation situation including top surface [2] and underceiling treatments [2] [3].

ALTERNATIVE SOLUTIONS

<u>The Independent Ceiling</u>
This broadly has taken the form specified in the literature [3] and also in

Figure 8. In many apartments 100 mm by 50 mm joists will suffice for the under ceiling. Windows can be a constraint on the depth of the cavity but generally in tenements, ceilings are high and often a depth of 300 mm or more is available. The major disadvantages appear to be the amount of disruption to the tenant and the cost of installation. The Independent Ceiling has proved to be the most successful solution for the tenement timber floors, as indicated in Figure 7.

The Suspended Ceiling

This option was explored as an alternative to the independent ceiling in terms of cost savings for timber. Typically the 100 mm by 50 mm joists are replaced by a 50 mm by 50 mm frame which is suspended from the existing ceiling. Care must be taken with resilient disconnection on the support (see Figure 9). The disruption is about the same as for independent ceiling and from a buildability point of view it is not so good. The results (Figure 7) are good but not so dramatic as the independent ceiling.

Top Surface (Sand)

This broadly has taken the form specified in the literature [2] and also in Figure 8. It is more suited to the rehabilitation rather than the maintenance process and has been reasonably successful as indicated in Figure 7. It adds mass and resilience to the floor and may well improve edge sealing and hence air tightness. The major disadvantage is that the floor is raised and this involves adjustments of skirtings and doors.

More recently the Group was called by a local housing association to pretest 7 floors in two sets of flats with traditional ash deafened floors, then return to retest after modifications involving a range of specifications had been carried out. Despite the limitations imposed on this exercise by the variability of 7 different room configurations some useful information was gleaned from the project. Room plans and floor specifications are shown in Figure 8 and the airborne and impact data are included in Figure 7.

Comments are as follows:

Top Surface (Detail 2)

Similar to the Top Surface Sand Specification in that resilience is added and air tightness improved with a small addition of mass. The same constructional disadvantages apply as with sand but there could well be circumstances where this solution would be preferred to that employing sand between the battens.

Top Surface (Detail 4)

The same beneficial mechanisms appear to be at work here as with Detail 2.

Top Surface (Detail 5)

This was a proprietary material consisting of two thin boards separated by a viscoelastic layer, laid on top of the existing floor. The advantage is that there is little increase in floor thickness and the disadvantage is that little mass has been added to the floor. There is little significant reduction in the airborne AAD but significant reduction in the impact AAD.

Top Surface (Detail 6)

Comments as per Top Surface Sand still apply here.

CONCLUSIONS

With regard to the sound insulation of timber joisted floor in tenements in

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Glasgow:

As yet, there has been no satisfactory 'between the joist' solution.

Independent ceilings are the most effective.

Suspended ceilings, with careful attention to resilient connections are reasonably effective.

Top surface treatments involving the fitting of a floating floor are beneficial in terms of additional mass, resilience and air tightness although creating some constructional difficulties by raising the floor.

Top surface viscoelastic solutions are mainly beneficial in cases where there are impact problems.

REFERENCES

[1] Buildings Standards (Scotland) Regulations 1981.

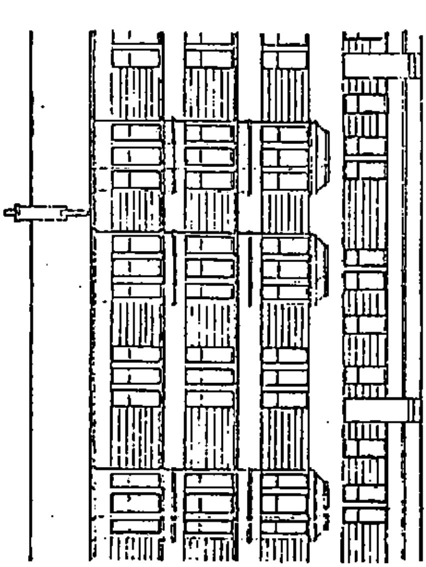
[2] Methods for improving the sound insulation of existing simple wood-joist floors. BRE CP 27/77.

[3] A method for improving the sound insulation of existing floors between two dwellings. Building Research Advisory Service, TIL 68, October 1982.

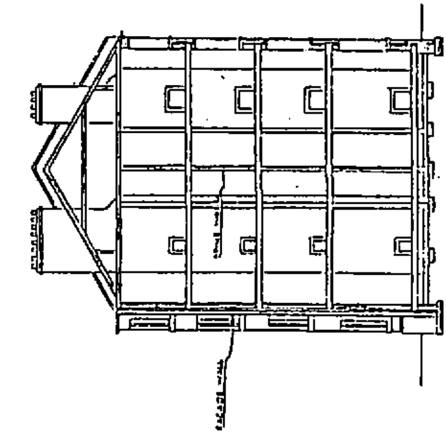
[4] Sound Insulation performance between dwellings built in the early 1970's. BRE CP 20/78.

[5] Noise from neighbours in multi-storey flats. Langdon, Bullen, Scholes. BRE News 60 Summer 1983.

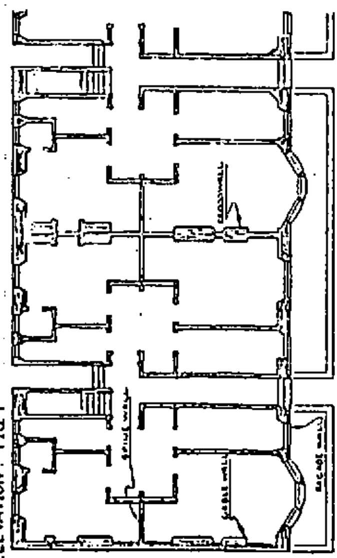
SOUND INSULATION OF REHABILITATED TENEMENTS, GLASGOW



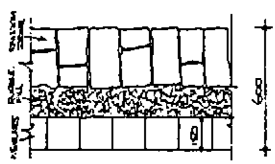
ELEVATION : FIG 1



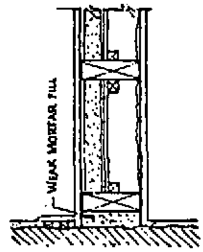
TYPICAL CROSS SECTION FIG 2



PLAN LAYOUT - FIG 3



SECTION THRO' FACADE WALL FIG 4



ASH DEAFENING FIG 5

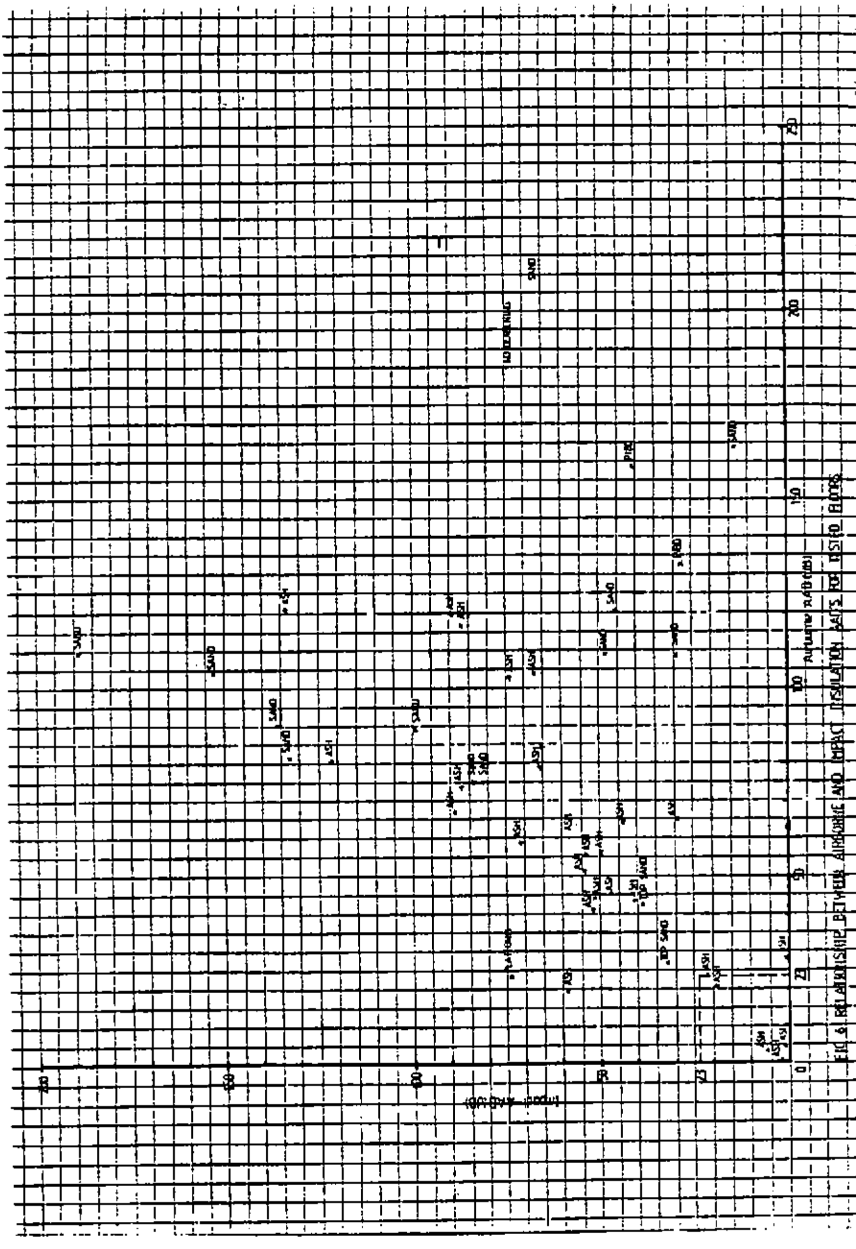


FIG 6 RELATIONSHIP BETWEEN AIRBORNE AND IMPACT INSULATION RATINGS FOR TESTED FLOORS

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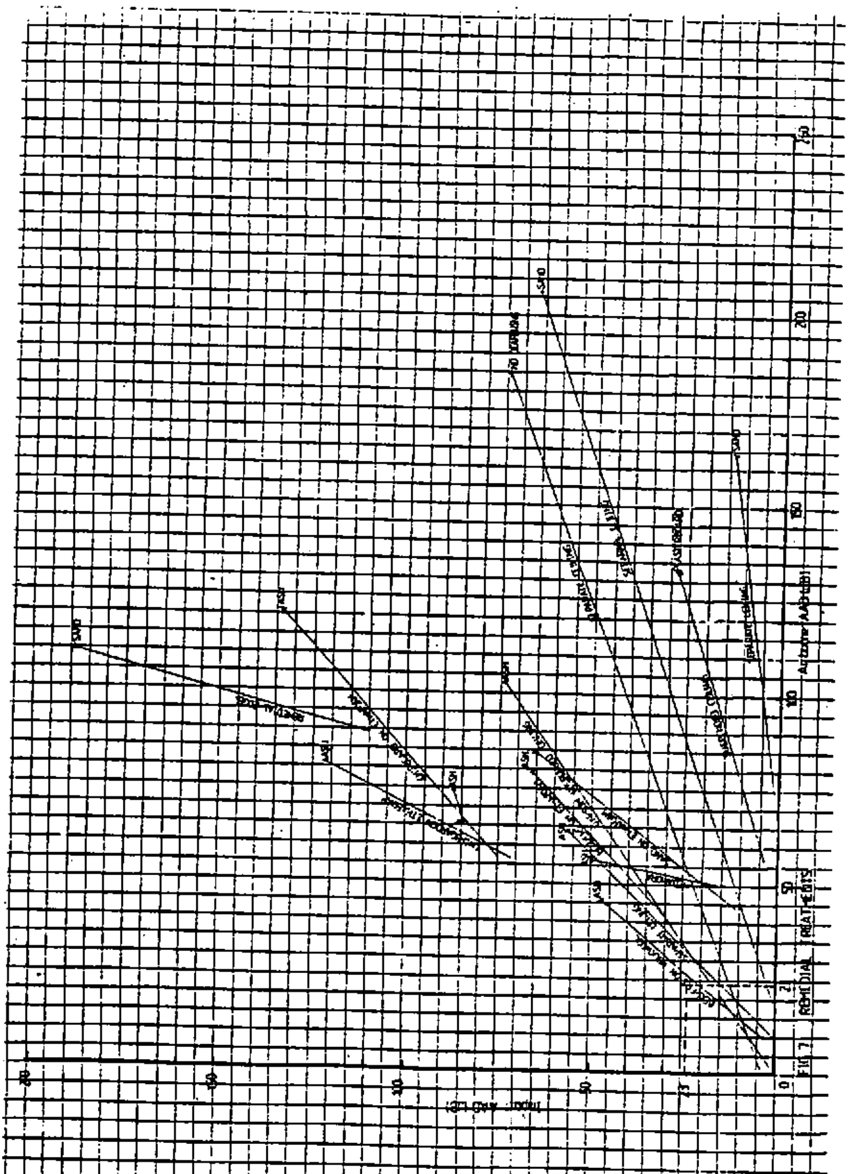


FIG 7 REMEDIAL TREATMENTS

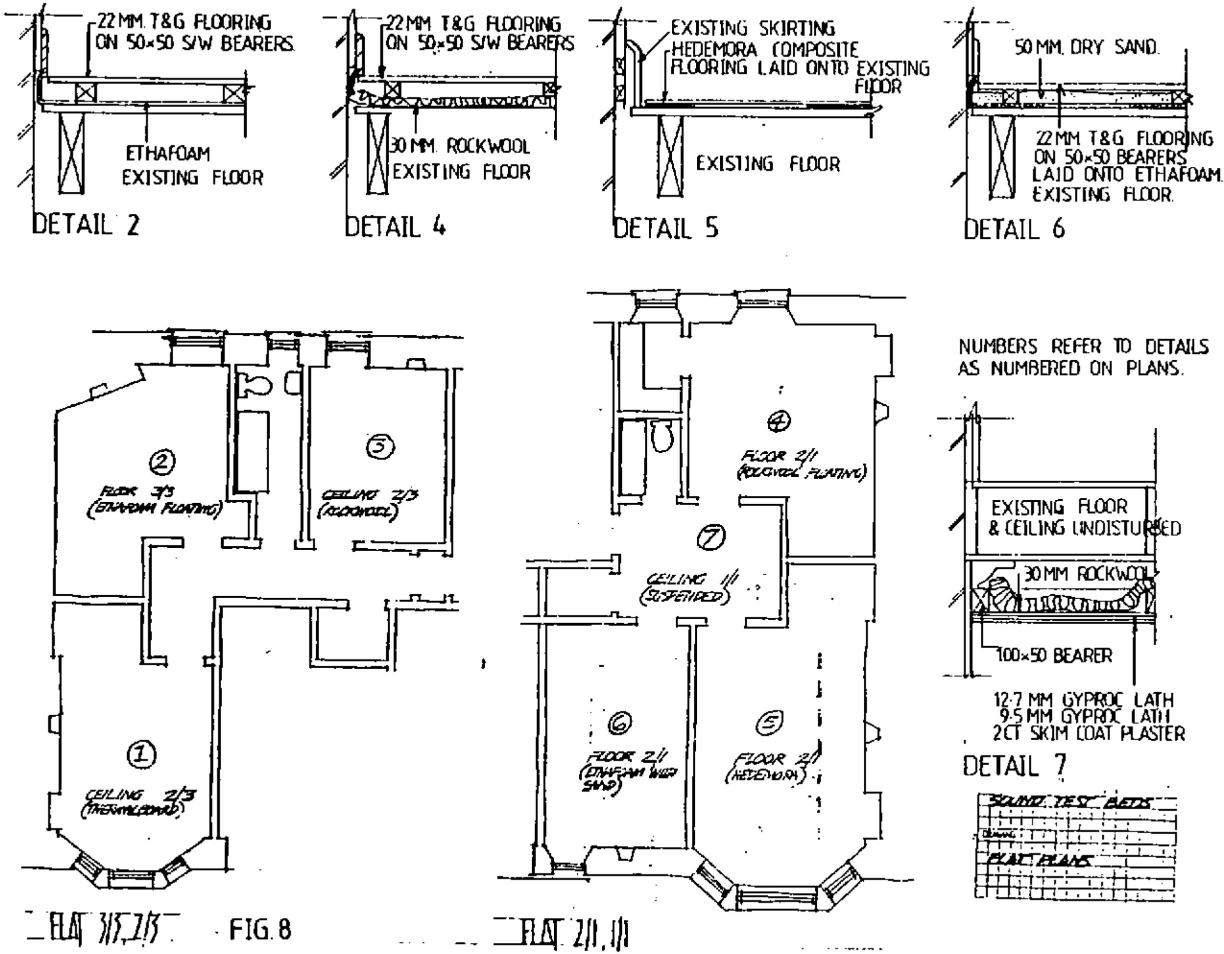
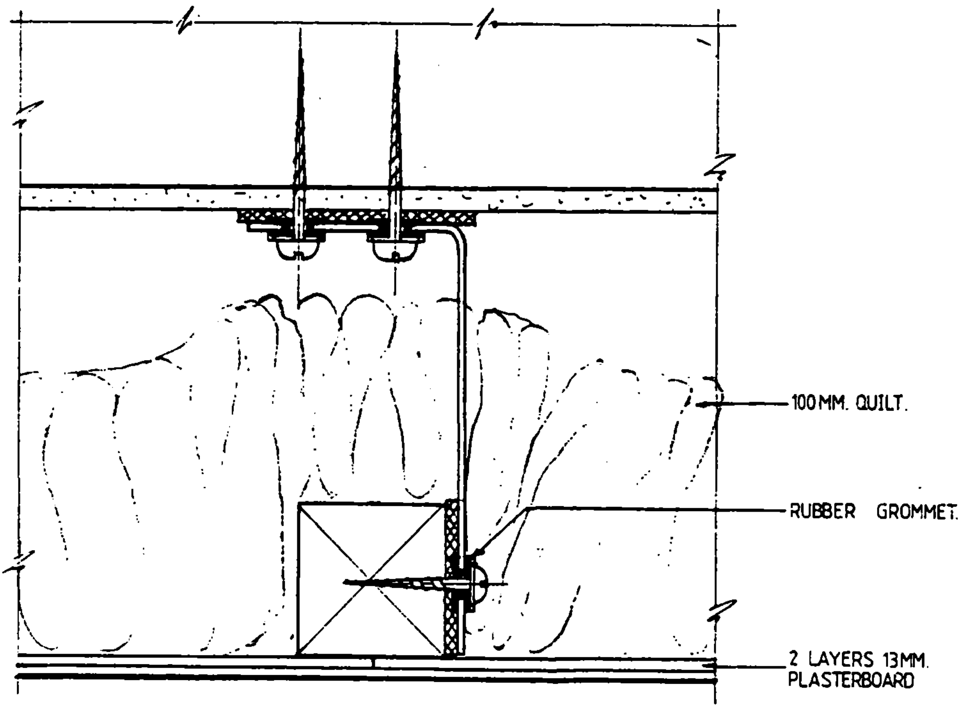

22 MM T&G FLOORING ON 50×50 S/W BEARERS
ETHAFOAM
EXISTING FLOOR
DETAIL 2
22 MM T&G FLOORING ON 50×50 S/W BEARERS
30 MM ROCKWOOL
EXISTING FLOOR
DETAIL 4
EXISTING SKIRTING
HEDEMORA COMPOSITE FLOORING LAID ONTO EXISTING FLOOR
EXISTING FLOOR
DETAIL 5
50 MM DRY SAND
22 MM T&G FLOORING ON 50×50 BEARERS LAID ONTO ETHAFOAM.
EXISTING FLOOR
DETAIL 6
NUMBERS REFER TO DETAILS AS NUMBERED ON PLANS.
EXISTING FLOOR & CEILING UNDISTURBED
30 MM ROCKWOOL
100×50 BEARER
12·7 MM GYPROC LATH
9·5 MM GYPROC LATH
2CT SKIM COAT PLASTER
DETAIL 7
FLOOR 3/3 (ETHAFOAM FLOATING)
CEILING 2/3 (ROCKWOOL)
CEILING 2/3 (THERMALBOARD)
FLOOR 2/1 (ROCKWOOL FLOATING)
CEILING 1/1 (SUSPENDED)
FLOOR 2/1 (ETHAFOAM WITH SAND)
FLOOR 2/1 (HEDEMORA)
FLAT 3/3, 2/3
FLAT 2/1, 1/1

FIG. 8



SUSPENDED CEILING.

FIG. 9