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TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

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This paper outlines some of the development and testing work carried out by British Gypsum Ltd. during the period 1980 to 1984 in respect of our general research work on matters concerning the sound insulation of separating walls. It is well known that timber framed separating walls in timber framed houses and flats can be almost guaranteed to provide a satisfactory performance when compared against the 1976 Building Regulations G2 Performance Standard,[1] whereas some masonry walls in traditional houses have been shown to be likely to fail to meet the standard.[2] When compared with other methods of rating of sound insulation, for example, BS 5821 where the standardized level difference is aimed at D_{nTw} = 52 dB, a failure rate in excess of 50% for lightweight blockwork could be expected.[3] We decided, therefore, to investigate the possible hybridisation of a timber framed separating wall into a house type where the structure, otherwise would be traditional brick and block.

A project was, therefore, set up which had the following objectives:

(a) To prove the structural viability of this solution.

(b) To determine whether the proposal would be viable as an on-site practical method of building.

(c) To find out whether the solution would be cost competitive when compared with a typical traditional brick and/or block 'deemed to satisfy' separating wall.

(d) To persuade a builder to co-operate with us to construct one or more pairs of houses so as to carry out acoustic testing in accordance with BS 2750[4] and Regulation G2[5] on at least four walls of common area > 7 m² between rooms where volumes were > 25 m³.

Structural Analysis

The structural problems associated with the substitution of timber for masonry in separating walls are minimal in the case of a semi-detached house. In terraced houses there is a need to apply additional bracing to the wall frames to ensure that the front and back walls of the house are stiffened so as to resist racking loads. The proposed design solution was checked by independent structural engineers.[6]

Gas Fire Flue

As a prerequisite to the main objectives of this development work it was necessary to make contact with British Gas in order to develop a twin wall metal gas flue system meeting the following requirements:

(1) The starter boxes to be back to back.

(2) The whole system to be contained in a 300 mm depth and a 560 mm width.

(3) The system to comply with Building Regulation L 'chimneys, flue pipes, hearths and fireplaces' whilst having no consequential detrimental effect on Regulations D - Structural Stability, E - Safety in Fire and G - Sound Insulation.

The prototype metal flue system was designed by the West Midland Gas Board and manufactured by Williams Chimneys Ltd.[7]

Preliminary Acoustic Testing

A timber separating wall containing the Williams system was constructed in the horizontal test chamber of the British Gypsum Acoustics Laboratory. At first, there was some flanking due to structural linkage of the back to back starter boxes. These were, therefore, re-designed and re-tested. The test results indicated that there would be no difficulty in achieving separating wall performance standard.[8] The results for walls with and without gas flues are shown in Figure 1.

This system was then tested in two pairs of totally timber framed houses constructed by Bryant Homes Ltd. at their site at Burberry Grange, Tipton, Walsall.[9] The results are shown in Figure 2.

The overall performance of the separating wall (with and without gas flues) was lower than expected. Nevertheless, the system, including the gas flues and fires achieved a 'pass' result when compared with the Building Regulations performance standard.

Fire Tests

The flue system and starter boxes were fire tested in a typical timber separating wall construction under normal top load design pressure.[10] The structure achieved one hour in accordance with BS 476 Pt.8 test method.[11]

Design Details

Some of the detailed drawings which were used during the site trial are shown in Figures 3, 4, 5 and 6.[12] In principle these would apply to almost any design of two storey house type with minor modifications to cover differing floor spans and plan/layouts.

Typical Details

On the ground floor (see Figure 3) dividing the living room and kitchen was 100 mm blockwork. It was tied into the timber frame with galvanised steel straps. The Gyproc plank was, however, continuous across the face of the separating wall. The same applies on the first floor except that the wall between bedrooms 1 and 2 was non-loadbearing. The inner leaf blockwork was discontinuous where it joined each wall frame.

An isometric drawing of the Williams gas flue and box is shown in Figure 5.

Typical junction details are shown in Figure 6. Stainless steel ties were used to join the timber frame to the blockwork.

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

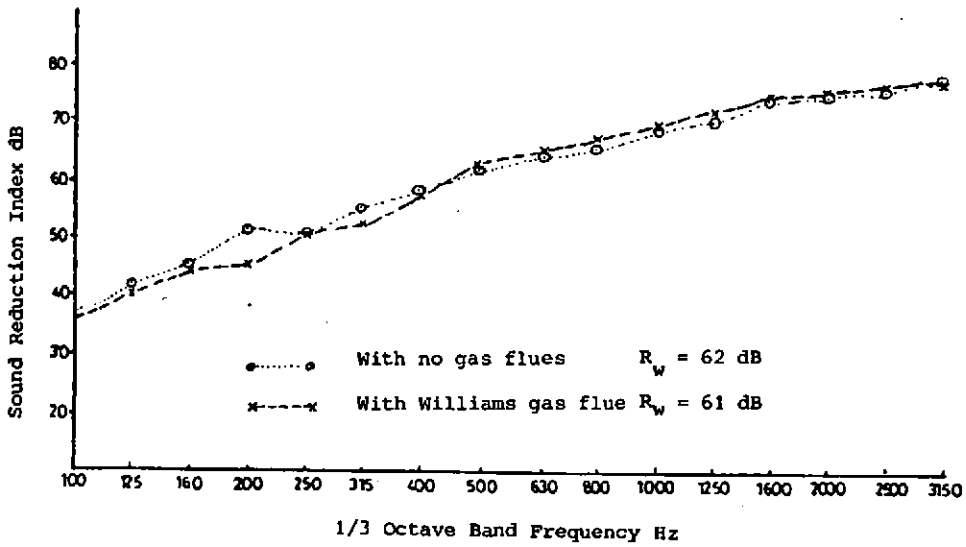


FIGURE 1 - LABORATORY MEASUREMENTS OF SOUND INSULATION ON TIMBER SEPARATING WALLS ACCORDING TO BS 2750 PT. 3.

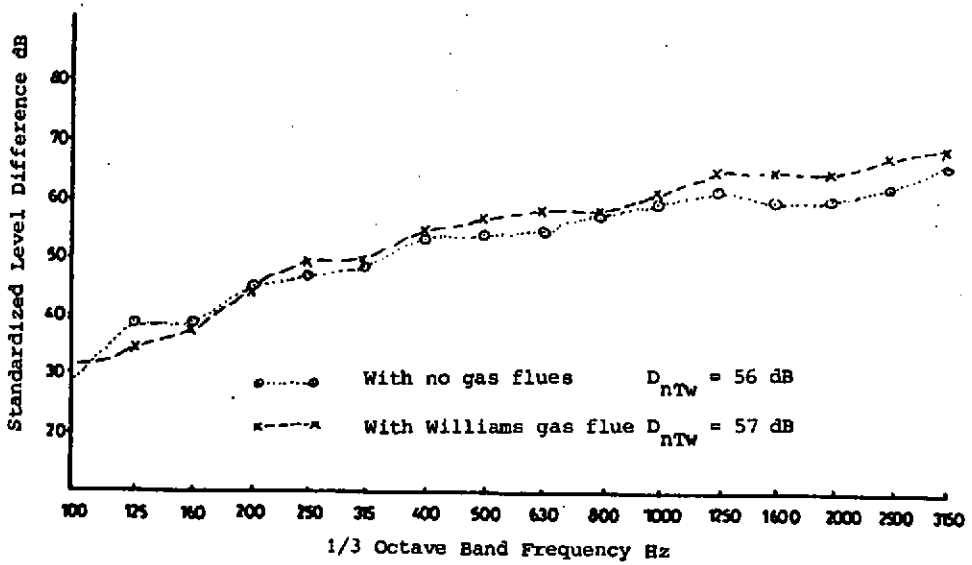


FIGURE 2 - SITE MEASUREMENTS OF SOUND INSULATION ON TIMBER SEPARATING WALLS ACCORDING TO BS 2750 PT. 4.

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

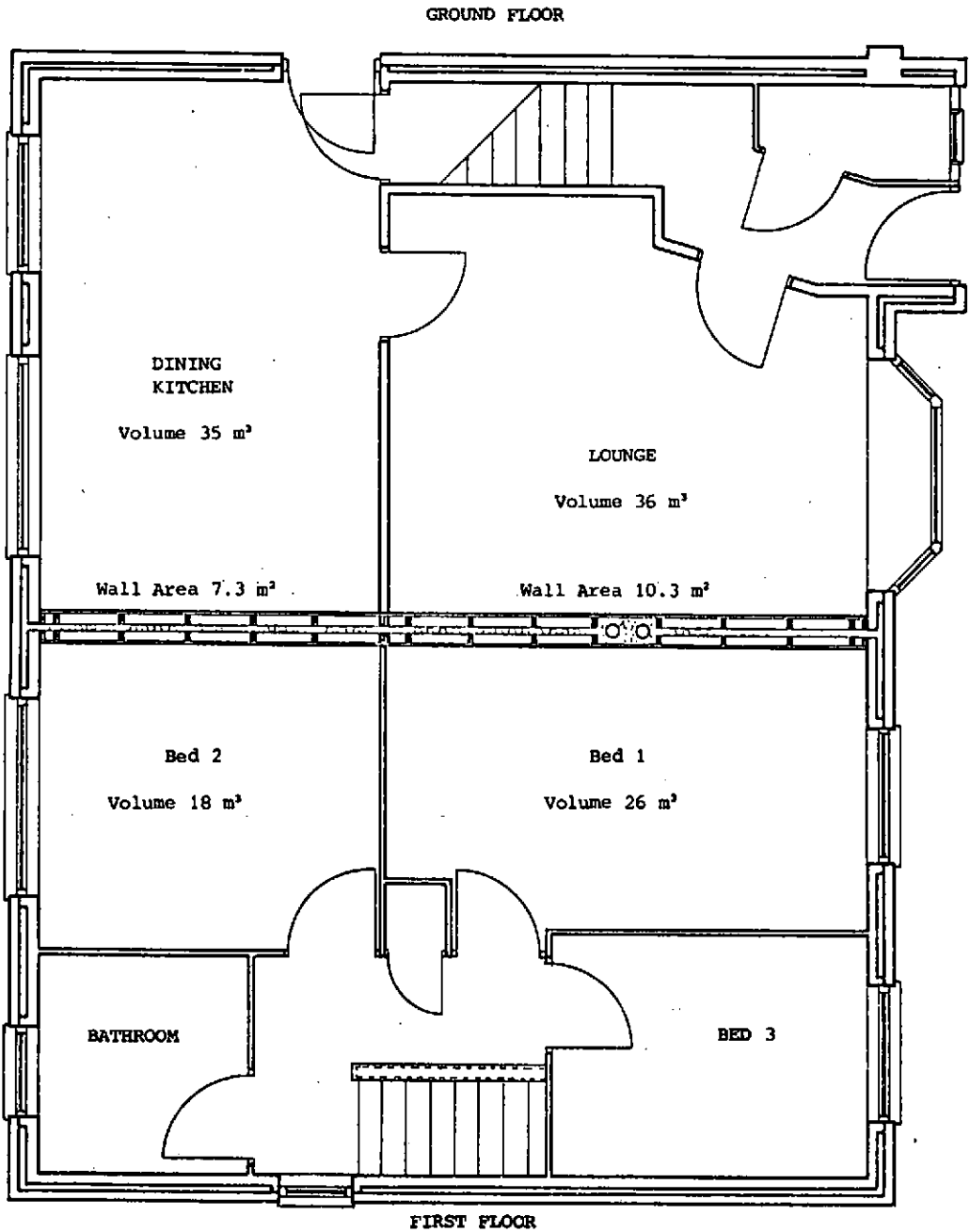


FIGURE 3 - PLAN OF TYPICAL SEMI-DETACHED HOUSE PAIR SHOWING POSITION OF TIMBER SEPARATING WALL AND GAS FIRE FLUES.

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

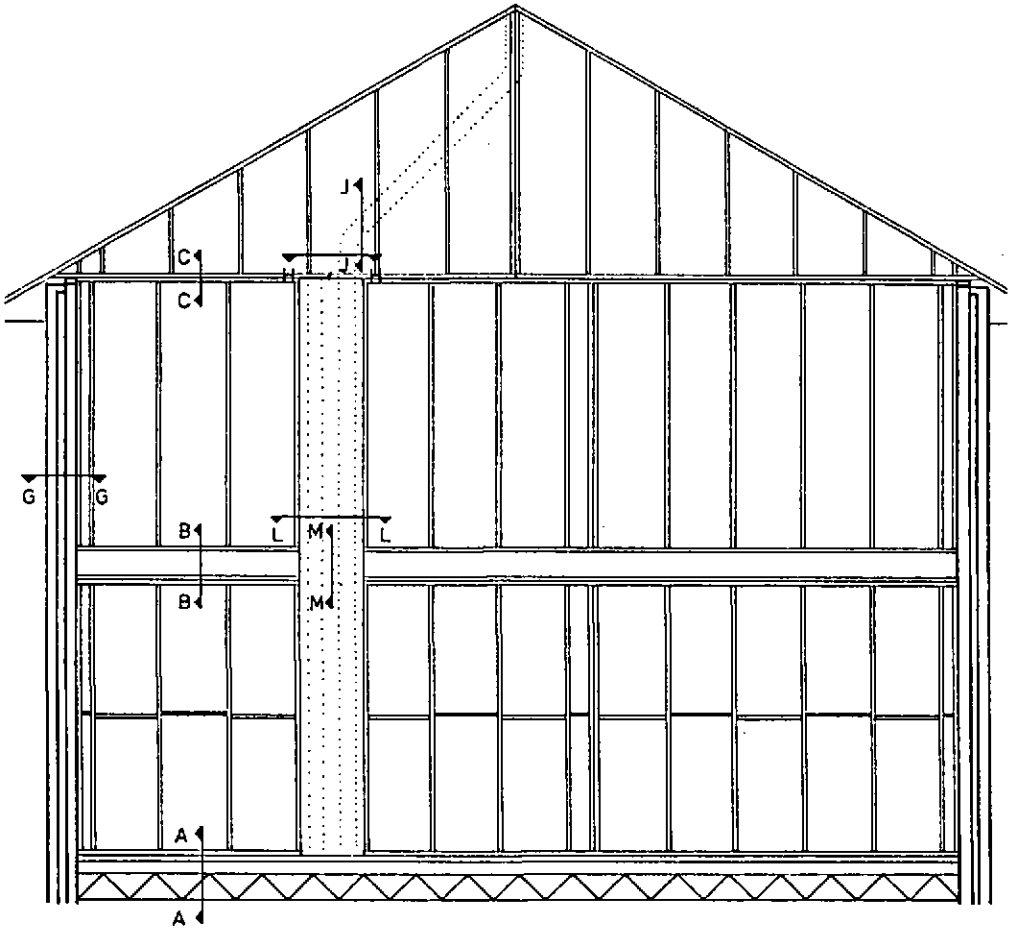


FIGURE 4 - ELEVATION THROUGH CENTRE OF SEPARATING WALL SHOWN IN FIGURE 3 SHOWS 8 FRAME PANELS PER HOUSE WITH 90 mm x 40 mm STUDS AT 600 mm CENTRES

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

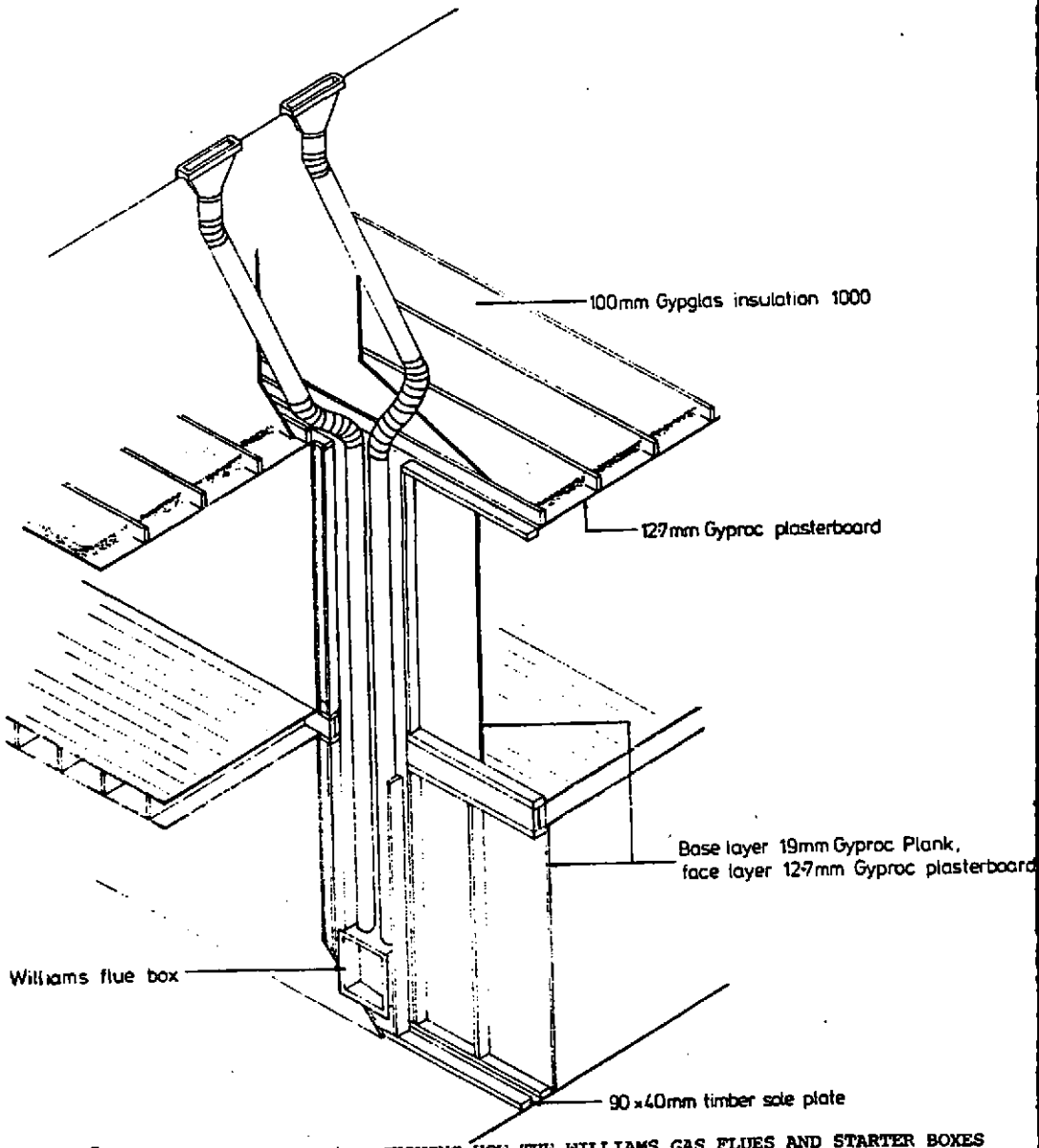
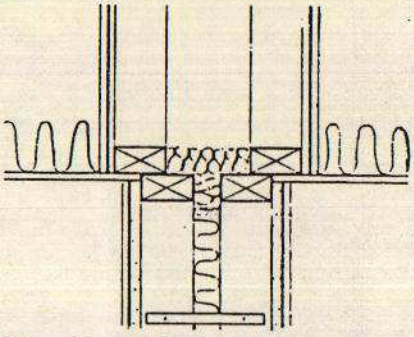
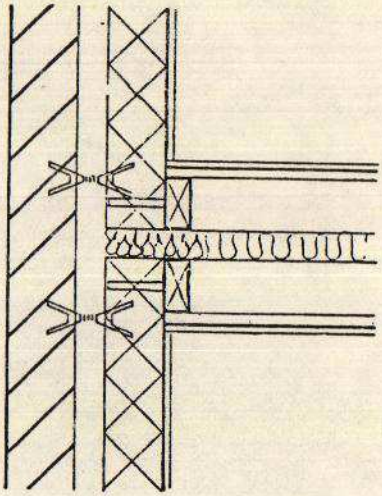


FIGURE 5 - AN ISOMETRIC DRAWING SHOWING HOW THE WILLIAMS GAS FLUES AND STARTER BOXES ARE INCORPORATED INTO THE PARTY WALL.

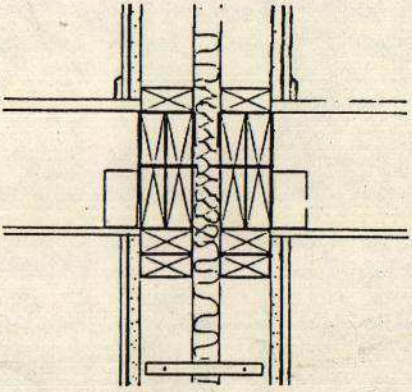
TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES



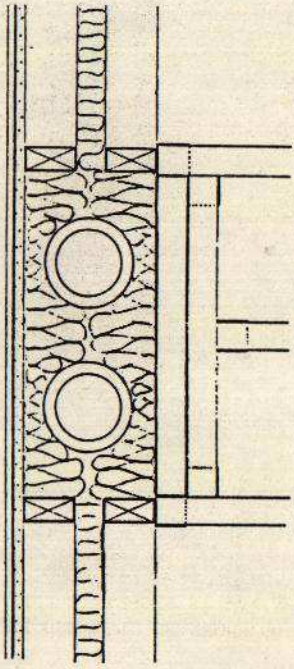
Section C-C Roof Space



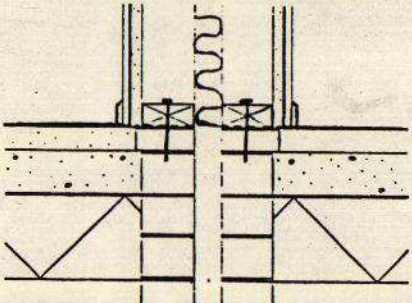
Section G-G External Wall



Section B-B Intermediate Floor



Section L-L Flue Duct

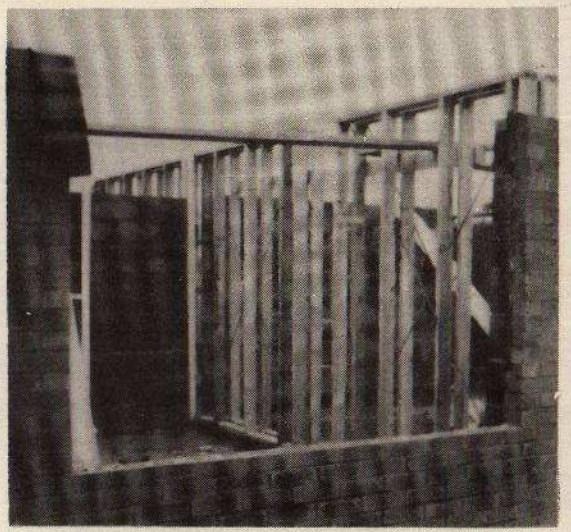


Section A-A Ground Floor

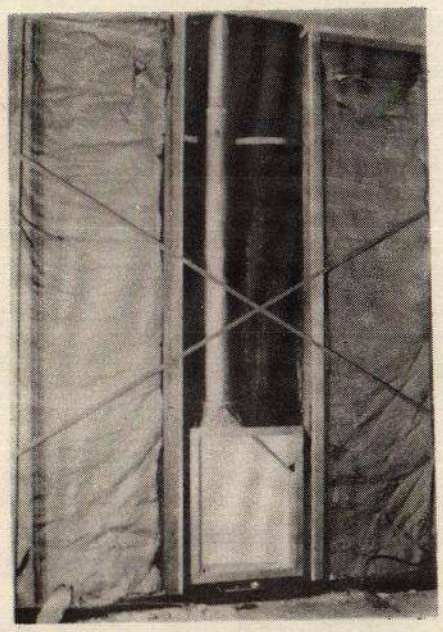
FIGURE 6 - TYPICAL JUNCTION DETAILS REFERRED BACK TO FIGURE 4

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

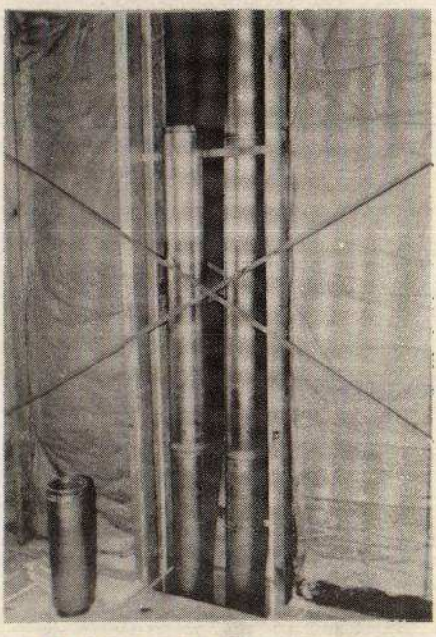
A Bryant Semi-detached House - Grafton Type



Ground Floor Frames in Place and Propped.



Gas Flue and Starter Box on Ground Floor.



Twin Wall Gas Flue Pipes on First Floor.

TABLE 1 - AIRBORNE SOUND INSULATION ON SITE AT HILLFIELD, SOLIHULL

Standardized Level Difference DnT dB

1/3 Octave Band Centre Freq.Hz	First Pair of Houses				Second Pair of Houses				Mean	AD
	Lounge to Lounge	Kitchen to Kitchen	Bed 1 to Bed 1	Bed 2 to Bed 2	Lounge to Lounge	Kitchen to Kitchen	Bed 1 to Bed 1	Bed 2 to Bed 2		
100	24	34	36	36	24	33	30	36	32	8
125	29	36	40	38	31	39	41	43	37	4
160	32	39	40	42	36	44	37	38	39	4
200	37	44	46	43	42	47	42	44	43	1
250	47	47	52	48	47	47	54	45	48	0
315	47	47	55	49	48	47	52	52	50	0
400	52	54	55	52	52	52	48	54	52	0
500	52	55	60	56	54	57	57	55	56	0
630	54	59	63	59	55	60	59	61	59	0
800	58	62	63	61	59	61	59	62	61	0
1000	60	63	66	64	60	60	64	62	62	0
1250	60	63	68	65	60	61	63	64	63	0
1600	61	63	66	60	60	62	67	61	63	0
2000	63	65	71	61	59	60	64	60	63	0
2500	63	67	69	62	57	62	64	62	63	0
3150	64	69	69	67	59	64	62	67	65	0
Mean DnT (100-3150)	50	54	57	54	50	54	54	54	54	
DnTw (BS 5821)	52	57	60	57	54	58	57	58	57	
AAD	46	15	8	9	35	9	18	9	17	

TIMBER FRAMED SEPARATING WALLS IN TRADITIONAL HOUSES

Site Acoustic Test Results[13]

The results of the tests on all eight wall areas in the completed houses are shown in Table 1.

Taking the mean of eight walls the results were:

Mean D_{nT}	=	54 dB
D_{nTw} (BS 5821)	=	57 dB
AAD	=	17 dB

The target results prior to commencement of the trial were:

Mean D_{nT}	>	52 dB
D_{nTw} (BS 5821)	>	53 dB
AAD	<	23 dB

Conclusions

The objectives outlined in the introductory part of this paper were achieved in that a viable method of construction of traditional two storey houses having timber framed loadbearing separating walls has been developed and tested. The acoustic test results show compliance with the G2 1976 Building Regulations.

As part of this project, a metal gas flue system was developed and tested and this system is now commercially available to all timber framed house builders.

A separate costing exercise has shown that the structure described and tested here is cost competitive with traditional masonry.

References

(1) E. C. SEWELL and R. S. ALPHEY 1977 'Field Measurements of Sound Insulation of Party Walls in Timber Framed Dwellings'. BRE current paper 39/77.

(2) BRE DIGEST No. 252 1981 'Sound Insulation of Party Walls'.

(3) F. J. LANGDEN, I. B. BULLER and W. E. SCHOLES 1982 'Noise from Neighbours and the Sound Insulation of Party Walls in Houses. BRE Information Paper 13/82.

(4) BRITISH STANDARD 2750 1980 'Measurement of Sound Insulation in Buildings and of Building Elements'.

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(6) PETER H. HILL AND PARTNERS 1981 Structural Engineers Report to British Gypsum Ltd. Internal Document.

(7) WILLIAMS CHIMNEYS LTD., Berry Hill Industrial Estate, Droitwich TFG 316 'Flue System for Timber Framed Houses'.

(8) P. E. JONES 1982 Acoustic Test Report Nos.680 and 681. British Gypsum Ltd. Internal Document.

(9) P. E. JONES 1982 Acoustic Test Report Nos. 710 and 711. British Gypsum Ltd. Internal Document.

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(11) BRITISH STANDARD 476 PART 8 1972 'Fire Resistance Tests on Building Materials and Structures'.

(12) M. STILL 1984 Detailed Drawings for Composite Party Wall. Central Technical Services Department, British Gypsum Ltd.

(13) P. E. JONES 1984 Acoustic Test Report No. 822 British Gypsum Ltd., Internal Document.