Proceedings of The Institute of Acoustics

SOME ECONOMIC AND LEGAL CONSIDERATIONS OF IMPROVING THE SOUND OF PARTY FLOORS IN CONVERTED DWELLINGS

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1. INTRODUCTION

Over the last 10 years the inadequacy of sound insulation in converted dwelling has become increasingly apparent. Problems generally arise as a result of the original partition structures becoming party structures between the new dwellings. Such structures, if unmodified, invariably provide inadequate sound insulation for the proper separation of rooms and spaces in difference occupation or use. Initially there was reluctance to deal with the situation in any systemmatic or coherent manner, in fact in many cases there was even reluctance to accept that a problem existed at all. The inertia was compounded by a widespread misunderstanding, even ignorance, of sound insulation principles; effectiveness of remedial techniques; financial viability and legal necessity.

The scale of the problem also gave rise to concern, both in respect of the number of households affected and the likely financial implications of any remedial measures. In one London Borough there was an estimated 4,000 conversions in public ownership and 1,000 in the private sector in 1981, the total increasing by 150 or so dwellings per year. From the late 1970s Council committees began to accept that solutions had to be sought and some authorities; either on their own or in conjunction with other organisations, began a more systemmatic investigation into the problem and its possible solutions. Since that time steady progress has been made; techniques have been developed which satisfy both the acoustic and constructional requirements, and there has been significant increases in the understanding and general awareness of sound insulation principles. However many local authorities, council officers, developers and landlords have still require convincing of the financial and legal obligations of adopting such techniques. In order to overcome these reservations it has proved necessary to collect and collate this information and to argue the non-acoustic aspects of sound insulation.

2. ECONOMIC CONSIDERATIONS

The two techniques must widely adopted, the secondary independent ceiling (SIC) and lightweight slag wool pugging (SWP) have reasonably predictable acoustic performance and costings. The cost differential between the basic techniques is not great, typically 10%, however the cost variation between different situations is significant and can lead to confusion. Although most experience has been gained through work with traditionally constructed party floors the costing trends can be applied to walls or other constructional elements. The costing given in the sections that follow are the Unit Cost (UC) in £M^{-2} and Dwelling Cost (DC) in £. Dwelling Cost is based on a single property converted into two dwellings having a party floor area of 80m^2. All costs have been quoted at mid-1985 prices or their equivalent.

Basic Cost

This can be obtained from any estimation or priced schedule book by breaking the technique down into standard trades and operations.

	UC	DC
SIC	32	1280
SWP	30	1200

It should be noted that the SIC has been costed to retain the existing ceiling, with repairs, and the SWP has been costed for replacement of approximately 10% of the existing floor boarding.

Remedial Works

When assessing the likely cost of remedial works there are three main factors which may modify the basic cost. Scale if dealing with a single, or several small, contrants the costing will be considered as small works. In accordance with current practice an increase of approximatley 15% must be added to the basic cost to maintain acceptable profit margins for contractors.

	UC	DC
SIC	36.80	1472
SWP	34.50	1380

Occupied Properties

Remedial works are likely to be carried out in occupied properties, in such situations contractors typically add 30% to costings to allow for difficulties and delays that usually arise. This increase has been added to the small works supplement.

	UC	DC
SIC	47.84	1913.60
SWP	44.85	1794

Decant Costs

In some cases it may be desirable or even necessary to decant the dwellings for the duration of the works. Additional costs may include; the provision of temporary accommodation, removal expenses, storage of effects and even loss of rent. It is difficult to give a costing for all possible situations however, for a temporary decant a cost of £600 per dwelling is not unreasonable. In situations where access is necessary to both sides of the floor structure decants of both dwellings will be required. The costs of decanting occupants can be offset against the additional costs of working in occupied property.

	DC
SIC	1772
SWP	1980

Sound Insulation in Conjunction with Full Rehabilitation

When sound insulation is provided whilst a full rehabilitation is being carried out the economics change significantly. This is a result of several factors, such as;

Builder already on site
Similar materials already in use
Easier access to both site and structure
Elements of the works have to be carried out anyway.

In such cases the exact additional cost of providing the sound insulation will depend on the extent and nature of the other works. However, it has been found that reductions of the order of 15% on the basic cost of the SIC and 20% on the SWP can be expected.

	UC	DC
SIC	27.20	1088
SWP	24.00	960

Where the property requires extensive works of a general nature the additional costs of the sound insulation will be comparatively lower. Where contractors already have been awarded the "main" contract some unbelievably low costs have been quoted for the addition of sound insulation.

In two particular instances, both involving two 2-bed conversions with a party floor area of 60-65m^2, an additional cost of £800 was quoted for SIC and £650 for SWP. Giving a dwelling cost (DC) of £553 and £430 respectively.

Economics of Scale

If considering a contract that covers several dwellings then some saving should be expected. In practice a saving of 5% per £10,000 is realistic, giving the basic cost rate for contracts of £30,000. An additional 5% saving should also be applied to contracts £50,000+. It is unlikely that any further reduction for scale of works could be justified.

Property Values

Speculative developers rehabilitate properties and then usually sell the flats on long leases for owner occupation. Of interest to the developer is whether or not the provision of sound insulation is reflected in the property value. The additional cost per dwelling is of the order of £1,000, about 2-4% of the property value in the London area. Developers have not found any difficulty in recovering the cost of the works in the sale price of the dwellings, some developers highlighting the fact that improved sound insulation has been provided. An additional benefit that some developers

have found is that such dwellings tend to sell faster, there is therefore a saving in interest charges for the developer.

Losses

The most obvious potential loss is that incurred as a result of having to remedy inadequate sound insultation after a property has been occupied. A good approximation would be the cost differential between installing sound insulation as remedial works and in conjunction with a full rehabilitation scheme. In addition the owner or freeholder could be liable to claims for damages from the occupiers.

Several Local Authorities, and Housing Associations have conversions in their housing stock where the sound insulation is so inadequate that the units are considered as unlettable. This loss of housing accommodation, and rental income whilst still making capital and interest repayments, is frequently overlooked but should be considered as a loss resulting from inadequate sound insulation.

3. LEGAL CONSIDERATIONS

The main legal considerations fall into one of two areas of interest; those relating to the prevention of the potential problems; and those relating to the remedy of known problems.

Prevention

All conversions involve reconstruction works, and usually a change of use under Planning Law as well. Proposals to redevelop by conversion therefore require permissions under both the Building Regulations 1985 and the Town and County Planning Act 1971.

The Building Regulations seek to control the manner in which construction works are carried out, the quality of materials used, and the design of building. The Regulations, old and new, include a specific section on sound insulation and it seems appropriate to use these provisions to prevent inadequate sound insulation in conversions. However, whilst the Regulations in their entirity apply to new buildings there are many exemptions from works in existing buildings. The provisions relating to sound insulation are one of these exemptions, even when the constructional element changes from a partition to a party structure or is reconstructed.

When a development proposal requires planning permision the local authority can apply relevent conditions that the developer must comply with. Local authorities that have policies on sound insulation in conversions usually use planning conditions to implement the requirements of their policies. The intentions of the conditions will be the provision of adequate sound insulation between the new dwellings, but there are a number of options open to the local authority as to the exact wording of the conditions. Some authorities require a performance standard, others require specific construction techniques; a third option is a requirement for the developer to

submit an acceptable scheme of sound insulation before development commences. There are pros and cons to each option, however the "scheme of insulation" condition certainly appears to be the most advantageous. It can encompass layout, service design, as well as the detailed construction of party structures, it allows the developer to make his own decisions on what techniques to use and to incorporate those techniques is the overall scheme of works. It is also important that local authorities are prepared, and able, to give assistance and guidance on what would be acceptable or effective. If local authorities act in a negative role, when unacceptable or inadequate proposals are submitted, then the cooperation of developers in achieving improved sound insulation is invariably prejudiced.

These policies and procedures have been successfully adopted by many local authorities since the early 1980s, and hundreds of converted dwellings have improved sound insulation as a result. Although there has been problems, at least two successful appeals against such conditions have been taken, most authorities have continued to enforce existing policies and some authorities have even adopted substantialy similar provisions, since the appeals. However it must be stated that several authorities have dropped plans to introduce sound insulation policies whilst others bring the problems of inadequate sound insulation to the attention of developers by "information clauses" rather than conditions on planning permissions.

No doubt the legality of these procedures and requirements will be tested in the High Court and the doubts resolved once and for all. Only after such a test case, and probably guidance from the Department of the Environment, will a more consistent approach be seen from all local authorities. It seems likely that when such a decision is taken to the high court the use of Planning law in this way should be upheld. Certainly the inspectors comments in the two appeal cases appear to be at variance with the DOE's circulars Planning and Noise (circular 10/73) and Planning Conditions (circular 1/85). The former clearly making the prevention of noise problems a valid planning issue, the latter recommending a wording for a standard planning condition substantially the same as those used by local authorities who require a performance standard. In addition all available legal advice, at least to the author, indicates that the two appeal decisions referred to, and any others relating to sound insulation between conversions would be reversed if taken to the High Court.

Remedy

Assuming that there is no unreasonable behaviour by adjacent occupiers, and that the noise problem can be attributed to inadequate sound insulation, there are three possible bases for liability and action, namely;

Common law for Nuisance
Defective Premises Act 1972
Control of Pollution Act 1974

Common Law

The essence of nuisance is that it is a condition or activity which unduly or unreasonably interferes with an individuals rights, use, or enjoyment of land. There is no doubt that making unreasonable noise can constitute nuisance at common law. Furthermore there is also no doubt that a landlord or owner can be liable for a nuisance arising from the condition of premises if he retains a measure of control over the premises. When a landlord or owner is under a duty to keepthe structure in a state of repair he would be liable if he allowed the condition to continue after he has knowledge of its existance. A landlord would also be liable if, by virtue of an agreement or lease, he had covenanted to ensure the occupiers rigth to "quiet enjoyment". All these points are clearly made in the case of SAMPSON v HODSON-PRESSINGER and another. In addition the judgement in this case makes several other points which are relevant. First, where the occupier if the flat is acting in a reasonable way then they cannot be liable for the nuisance even though their activities are the source of the noise.

Second, where the current owner has been made aware of the existance of the problem he has no defence in the argument that the actual conversion works were carried out by a previous owner. (But also see below under Defective Premises.)

Third, that an appropriate award for damages, the plaintiff was a tenant under a 99-year lease, was the estimated decrease in value of the flat as a result of the noise problem. In this case £2,000 which at the time of the award 1980, was probably in excess of the cost of remedial works.

Defective Premises Act

Under this act a person responsible for work or arranges for another to undertake work, in connection with the conversion of premises, owes a duty to every person who acquires an interest in the dwelling to see that the works are done in a workmanlike or professional manner with proper materials so that the property is fit for habitation. In a case where inadequate sound insulation is a result of improper materials or inadequate workmanship then this duty would have been broken and a claim for damages could be made against the person responsible for the works. The Act applies to all forms of tenancy and there can be no agreement to contract out. Claims for damages can be made against the landlord, if he has the duty, and against third parties including the builder and architect. However the Act has built-in time conditions which limit the liability of the person who authorised the works, and action must be taken within six years of the dwelling being completed. In most cases an action for nuisance would be the chosen procedure to obtain a legal remedy; the case law is more explicit, the evidence is probably easier to obtain and present, and the person responsible more readily identifiable. But in certain situations, providing the necessary evidence is available, an action under the Defective Premises Act may have advantages. Take, for example, the rare situation where there is no separate freeholder or landlord, the leaseholder also hold a share in the freehold, any action for nuisance would effectively be against themselves.

The Act would then be used to secure an award against the person who was responsible for the conversion works.

Control of Pollution Act 1974

The principle that there can be a nuisance at common law has already been established. Accordingly the statutory nuisance provision of the Control of Pollution Act, sections 58 & 59 are also available.

Under section 58 it is the local authority that takes action if it is satisfied of the existence, or likely existance, of a nuisance. Section 59 establishes a procedure by which an aggrieved occupier cna take a complaint of noise nuisance direct to the courts. In both instances action is taken against the person responsible for the nuisance, the landlord or freeholder, who is made subject of either a notice (section 58) or an order (section 59). The notice or order should contain specific requirements to abate the nuisance and a time limit for compliance.

If the requirements remain uncomplied then an offence will have occurred, the courts can then fine the person responsible. Alternatively, the abatment works can be carried out by the local authority in default; but it should be noted that there is no provision for damages.

For private sector tenants, and certain catagories of leaseholders, action under section 58 would be the most appropriate procedure to obtain a remedy. A complaint to the localauthority should initiate the procedure; local authorities have a duty to both inspect and to take the prescribed action if a nuisance exists. If they do not they will have broken their duty and will be exposing themselves to either legal action or an investigation for maladministration. In many instances freeholders have the ability to recover the costs of any works carried out from leaseholders. Any remedial works obtained by statutory action would therefore be paid for by the leaseholders, ie the complainants. It would seem advisable in this situation to consider taking common law action for damages as well as any statutory action. A common law action could be taken at the same time as the statutory action and the request for damages could be based on the actual costs of remedial works. The remedial works would then have been carried out at zero net cost to the occupiers.

For public sector tenants section 58 is effectively unavailable, local authorities cannot serve a notice on themselves. Section 59 action therefore becomes the main statutory provision for public sector tenants to secure remedial works. Actions of this kind have been taken, however, the problems are usually resolved before the matter is taken before the courts. In one recent case which was heard the local authority admitted liability, pleaded guilty, and agreed to undertake a scheme of remedial works. Whilst, not necessarily setting any precedent this demonstrates the marked change in attitude in some local authorities to the problem.

Authors Note: the views expressed in this paper are those of the author and do not necessarily represent the views of the authors employers, past and present, or any other organisation with which the author is associated.

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PLASTER BLOCK-WALLS : A NEW DEPARTURE ?

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GENERAL HISTORY

Actually great interest of architects for plaster block-walls :
- in order to reduce total costs (speedy finishing) [fast assembly
  [minimum finishing
- in order to reduce construction delays (rapid drying)

ACOUSTICAL HISTORY

Initially : laboratory tests.
Good, but not excellent : sound frequencies of material centred on mean frequencies,
- thus, weakness in a very sensitive area of the hearing, though rarely predominating for understanding (250 to 500 Hz).

Achieved values : 4A for a single wall of 10 cm and
3B for a double wall of 2 x 7 cm
3A for a double wall of 7 cm and 10 cm.

Initially on site :

Based on this experience, setting up on construction sites (whatever the environment), resulting in values inferiour of 3 to 5 dB, compared to values measured in laboratory and thus not resulting in the usual reduction of 2 dB (see also Standards), between Dn and R indications, for secondary transmission paths (categories 2 and 3 Belgian Standards).

Other consequences

Another embarrassing (and consistent) consequence is the considerable transmission of acoustical energy in all directions and that transmission, due to the plaster wall edges does transmit to not necessary contiguous premises.

TYPE OF BUILDING

The building is a standard construction with the usual demand of proper isolation. The levels of external noise and internal privacy being considered, an acoustical isolation of NBN (Belgian Standard) 2b (R 43dB) is required, or at all events, an isolation better than NBN 3a (R 40dB). The structure is of whole heavy concrete, with pillars and monolithic slab construction of 25 cm. Classic external walls of heavy concrete blocks and window frames between concrete pillars.
Finishing provided for : hinge and carpeting, no false ceilings. For above-mentioned reasons, the master-builder decided in favour of tile plaster-walls. The encouraging results obtained by the CSTC brought us to examine this possibility and guided our choice towards heavy plaster blocks of 100 mm, 50 mm gap (filled with absorbing material) and normal blocks of 70 mm (standard dimensions of 50 x 66 cm), thus a category of NBN 2a to 3a (following lateral transmission conditions).

- heavy corresponds to 1200 kg/m3 (1100 to 1250 kg)
- normal corresponds to 950 kg/m3 (870 to 980 kg)

On weight and manipulation grounds, the blocks of 10 cm will be of reduced dimensions (one normal block of 10 cm would have weighed approximately 40kg!). Consequently, one had to decide in favour of a 2/3th unit of 24 kg a block.

REASONS OF CHOICE

What are the principles leading us to accept the present system ?

a) Assuredly, the results of the measurements in the CSTC's laboratory, constructed according to new standards (not anymore excluding any transmission by lateral transmissions).
b) The visual examination bringing us to the conclusion :
   - of a better lateral isolation (thus less transmission by lateral paths),
   - of an internal damping due to the use of lateral edging stripes in material promoting the attenuation of the effects of edge propagation,
   - a damping of the walls due to the use of an absorbing material (heavier) leading to a better internal damping of the wall.

WORKS SITE PROBLEMS

A difficulty was to obtain a fine workmanship. The constant intervention of the acoustical consultant is fundamental during the study and the effective control on building site.
The edge-stripes where not always well fixed, and consequently a certain lack of continuity of the stripes was encountered, especially by the beginning of the building site (on walls and ceiling).
An adequate width of the stripe may establish a greater contact with the structure, hence a decrease of the acoustical isolation. Using broken blocks can endanger also the acoustical isolation. Finally, the absorbing material may not be compressed between the two sides of the wall ; if this material is compressed, the force pushing between the two walls is such that if one of the walls is in resonance, the other will also, and inevitably this will result in a decrease of the effectiveness (especially in the low frequencies).

RESULTS OF MEASUREMENTS

Measurements

The measurements are well beneath the results of the laboratory, but nevertheless show the same improvement in insulation on the earlier measurements in laboratory and in situ. All walls achieve a mean category of NBN 3a, and R ISO 44.5 (very near 2b). Table 2 shows the measured results (excluding the walls having problems occurring by doors or other).
This is an average improvement of about 3.5dB on the measurements obtained in similar circumstances without lateral precautionary measures and without heavier absorbing material in core. Our standard falls short of an accuracy in categories ; the wall remains 3a.

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TYPE DE MURS

	Constr.	Finit.	Séchage	Is. Ac.	
Lourds	x	x	x	excellent	]
Légers [tradit.	x	x	x	bon	] Appartements
[plâtre	x	-	court	-	]
Légers (démont.	(-)	-	-	faible	→ uniquement bureaux

Fig. 1. - Historique Générale.

Murs lourds : béton, briques pleines, blocs lourds

Murs légers traditionnels : Ytong, briques perforées,

Murs blocs de plâtre : Prosonts & Isolava

Murs légers (et démontables) : Gyproc, cloisons démontables.

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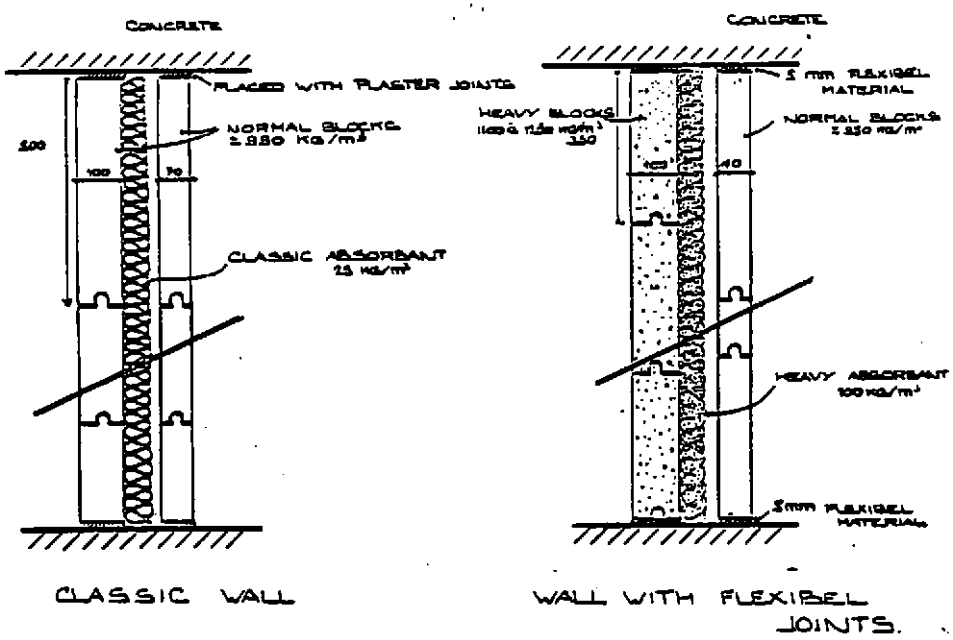

CLASSIC WALL

WALL WITH FLEXIBEL JOINTS.

TABLEAU DE MESURES IN SITU (1 module est ≃ 65 m³)

N° mesure	Emissions (module)	Réceptions (module)	Colonne	Jonction	Porte	Valeur ISO R	NBN-Cn	Remarques
1	1/2	2	N	O	P	41	3b	porte
2	1/2	2	O	O	L	40	3b	Jonct.cloi.int
3	1	2	N	N	L	43	3a	
4	1	2	O	N	P	37.5	3b	porte
5a	1	2	O	N	L	46	2b	
5b	2	1	O	N	L	44.5	3a	
6	2	1	O	N	L	46	3a	
7a	1	1	N	N	P	42.5	3a	porte
7b	1	1	N	N	P	40.5	3b	porte
8	1	2	O	N	L	43	3a	
11	1	1	-	-	-	47.5	2b	ancienne méthode
12	2	2	-	-	-	51.5	2a	avec precautions actuelles.

Légende

O : oui présent
N : non
T : jonction T
P : portes rapprochées
L : portes lointaines.

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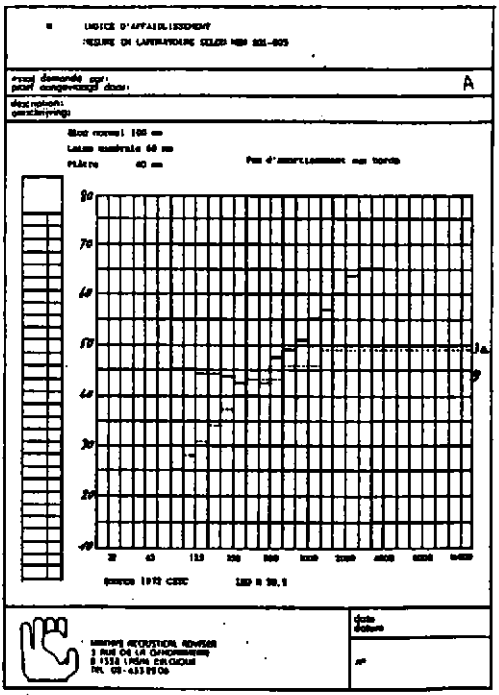

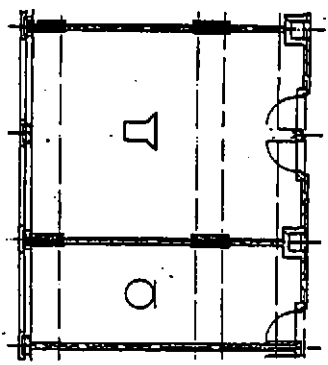

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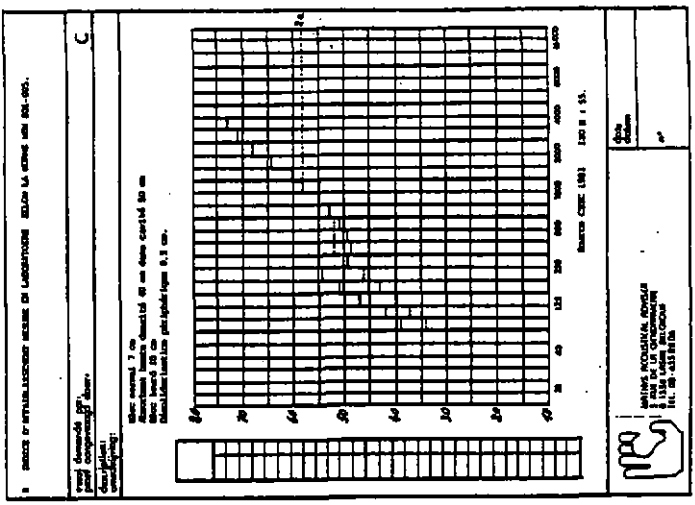

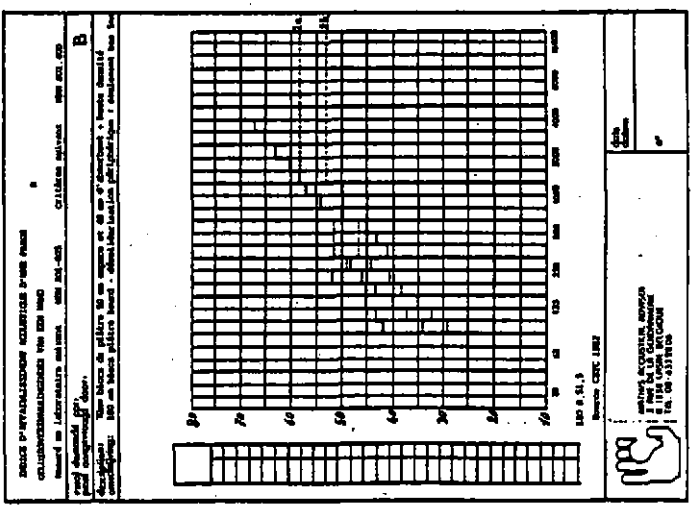

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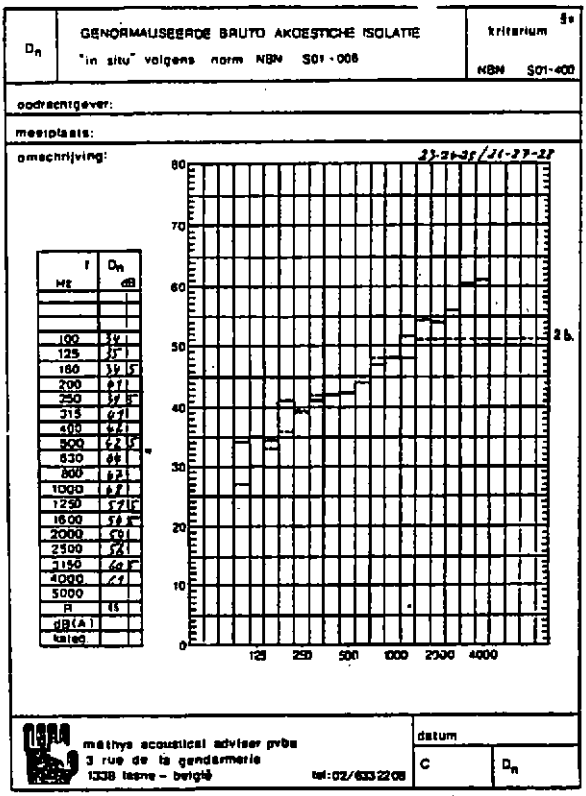

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Average octave

The weakness remains centred on mean frequencies and the difference between the octave of 250/500 Hz and 1000 Hz is often of >5dB, thus allowing to skip a category (in Belgian Standard). Please note that the walls have been heavily holed by electricians who made them look, in some places, similar to a gruyère cheese.

Reminder : NBN R (2a) = 48dB
NBN R (2b) = 43dB
NBN R (3a) = 40dB
NBN R (3b) = 35dB

PROBLEMS THAT RAISED AFTER THE BUILDING OF THE WALL

The influence on acoustical insulation loss is difficult to evaluate, due to the multiple holes in the thickness of 1/2 walls. This is a point that asks for a further research (example : by laboratory tests). Some contact points between room walls impaired the results (ventilation casings/sanitary/doors, bridging transversal walls).

PECULARITIES OF THE BELGIAN STANDARD NBN S01-005

The lesson drawn from the present series of measurements is that we see differences between measurement according as we measure out of a small room toward a large one, and vice versa.
The differences are systematically of 1.5dB R ISO (fig. 5a and 5b), for example NBN 3a - 2b. The newer standard ISO 717 specifies the corrective factor S/A standing instead of A/Ao. The Belgian Standard (NBN S01-006) should perhaps be re-examined (also the NBN S01-400 that permits with less of 1 dB, in 1/3th octave, to jump from 2b to 3a and thus a global difference of 0,06dB (R ISO). This gives an inaccuracy of ISO 3 or5dB, which is huge).

IMPROVEMENT OF THE TRANSMISSION BY LATERAL PATHS

fig. 11/12

CONCLUSION

The plaster block-walls score favorably with the new lateral striping of the wall-edges and using an anti-reverberation absorbing material in the core. Good results are prone to be damaged. This is caused by carelessness (omission of lateral stripes, stripes not large enough, etc.).
Erecting a plaster block-wall with a reasonable amount of success will depend on :

- the conception of the wall
- the material used = heavy block + normal block and peripheral flexibel joints
- the persistent and important control on building site.

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