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Anm. Bilagorna 2 och 3 hör till denna rapport (separata dokument).

Ert datum	Er beteckning	Er fax och e-postadress

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SBUF 12311: Optimerade och harmoniserade ljudkrav på flerbostadshus

Delrapport C.
Förslag till enkätmallar, utvecklingsarbetet

Innehållsförteckning

Projektresultat och mål

- Se delrapport A.

Bakgrund

I bilaga 2 finns en enkätmall (på engelska), som är avsedd för skattning av hur boende störs av buller i sin bostad i medeltal med syftet att jämföra störningsgraden med uppmätta ljudisoleringar och bullernivåer.

I bilaga 3 finns en svensk översättning. Vid översättning till andra språk bör den engelska versionen användas i första hand. Enkätmallen är inte avsedd för undersökningar som syftar till att bestämma orsaker till störning som har med deltagarnas personliga livssituation att göra. Den är inte heller avsedd för enkäter om störning av trafikbuller. Dessa avgränsningar beskrivs i de bilagda enkätmallarna.

Urval av försökspersoner ska göras på ett sätt som ger statistiskt stabila resultat, men det finns inte några sådana anvisningar i bilagan. Det ankommer på den som utför enkäten att göra ett representativt urval och analysera resultaten med hänsyn till de osäkerheter som beror på urvalet.

Det pågår ett internationellt utvecklingsarbete (COST TU 0901 2010-2012) med att utveckla denna typ av enkäter, och det är därför lämpligt att undersöka om det finns nyare versioner av denna enkätmall. Bilagorna 2 och 3 visar ’version 1.0’ som antagits i maj 2011 av arbetsgruppen i COST TU0901, med avsikt att samla in praktiska erfarenheter och göra nödvändiga justeringar i början av 2012. Av detta skäl har inte den del som handlar om anvisningar till institutet som ska göra enkäten översatts till svenska ännu. Förslaget kan komma att lämnas till NORDTEST eller til den internationella standardiseringen (ISO) och det kan bli många ändringar innan den är standardiserad.

I arbetet med att utveckla denna enkät har flera personer deltagit aktivt, däribland Pontus Thorson och Pontus Larsson från Chalmers tekniska högskola (AkuLite-projektet) och deltagarna i COST TU 0901. Ett grundläggande undersökningsarbete har utförts av vår examensarbetare Fransisco Javier Andrés Gallego Maj-Augusti 2010 från Universidad de Valladolid, Spanien. Ett sammandrag av utvecklingsarbetet redovisas nedan, men det går bra att kontakta oss för att läsa fler underlagsrapporter från examensarbetet. Synpunkter har lämnats av andra forskare och konsulter. Vi tackar alla för detta stöd.

Simmons akustik & utveckling ab
Christian Simmons

DEVELOPMENT OF A SOCIAL- ACOUSTIC SURVEY QUESTIONNAIRE OF REACTIONS TO NOISE IN DWELLINGS

C. Simmons & F.J. Andrés Gallego, August 2010

1. Introduction

Noise sources of different kinds are problematic: neighbour noise (music, conversation, walking, jumping and running, pet noise), equipment noise, environmental noise (traffic). New and renovated dwellings are expected to provide sufficient sound insulation to allow privacy and reasonable activities without disturbing neighbours. Indeed, exposure to noise can have negative effects on a person's ability to communicate, relax and sleep, and it can generate health troubles, psychological disorders as well as conflicts. Nevertheless, there is a lack of knowledge in the construction sector of the negative effects of insufficient sound insulation on dwelling occupants. In some EU Member States sound insulation in new homes is classified as a "health and well-being" requirement. Sustainable building and urban development should take into account the acoustic and sound insulation aspects.

Based on the results from the “WHO Lares” Survey about European housing (Large Analysis and Review of Housing and Health) carried out in 2002-2003, neighbour noise was identified as a health problem, and reduction of indoor noise exposure was included in the proposesed objectives for a policy with the following recommendation: "Little attention was paid to neighbour noise till now and therefore pathological effects are considerably under-estimated. The health effect of neighbour noise induced annoyance is approximately in the same range as the health effect of traffic noise induced annoyance. The results point out, that it is necessary to improve the sound insulation in residential buildings. The cardio-respiratory system also reacts to neighbour noise with increased relative risks."

Assessing reactions of residents to those sources in a building may therefore be complex due to the multiplicity factors, not only annoyance, like expectations, satisfaction, sensitivity, attitude to noise... that influence in the answers and in the results and many studies are trying to take into account (“Genlyd project”) Furthermore, responses to noise can be increased or decreased by the presence of simultaneous noises, depending on the relative magnitudes of the two stimuli. A questionnaire intended to reveal causes of subjective responses to noise in buildings should be phrased so as to minimise unreliable interpretations of terminology and label or scale errors.

This paper provides the development, structure, and content of a socio-acoustic survey questionnaire designed to obtain responses from the occupants of buildings, for this purpose of correlating these to be combined with airborne sound, impact sound, and equipment sound insulation values and, just for the design of the facade, with road traffic levels from traffic studies. Those measurements would be used to determine dose-response relationships applicable to noise in residential buildings. The various means of perceiving noise, alternative response terminologies and ratings scales, the effects of wording questions, the use of filter questions, the order of questions, the segments of the questionnaire are considered as the relevance of obtaining building data and acoustic building measurements to correlate with.

While a range of international standards defining noise, vibration and other environmental measures have been established, there are no standards or methods for measuring people's reactions to these interior noises. This lack of standards and common methods reduces the comparability of prevalence statistics and dose - response relationships developed by different researchers and it makes almost impossible to compare results from different countries.

Therefore the purposed socio – acoustic survey questionnaire presented here is an effort to establish a standard way of assessing people's judgement or their acoustic sound qualities in their dwellings from interior noise sources coming from neighbours and equipments, and for the design of the facade insulation and be able to establish a relation between countries, especially between European countries.

The development of this questionnaire is carried within the COST Action TU0901 and it will give the opportunity to collect, exchange and disseminate all the information about socio-acoustic surveys, regulatory requirements, construction details and classification schemes for all European countries participating in the network. Also it will provide enough data to harmonize descriptors for airborne and impact sound insulation between dwellings and for airborne sound insulation of facades as well as to prepare a European classification scheme (some countries or E.U. have a sound quality classification scheme) with a number of quality classes.

Last but not least this uniform questionnaire will bring typical question and problems from national levels to the European one and will help to judge the acoustical situation all over the Europe more objectively, because it takes into account the subjective opinion of the habitants and their reaction to noise as well as building data details what will be correlated with.

2. Scope

This document describes the development of the questionnaire, and objective measures, and the output data of socio acoustic surveys judging the acoustic quality in dwellings due to noise caused by interior sources (neighbours and equipment) and one exterior source, road traffic. The main purpose of this socio acoustic survey is:

- To deduce the best correlation between the subjective judgements from habitants of the sound insulation of their dwellings (assessing noise caused by neighbours activities, equipment and road traffic) and their building insulation data and then analyze results and determine the acoustic quality of the dwelling and the best descriptor who characterise it.

- To improve the degree of compatibility between survey results from different studies and purpose using the uniform questionnaire in all countries.

- To be able to establish comparisons between countries using the same questionnaire in order to analyze which descriptors could best meet a set of criteria concerning suitability, applicability and reproducibility with the aim of finding a common sound insulation descriptor for all the European countries and facilitating the exchange of information, experience and development of design tools, exchange of building technology across the national borders etcetera.

3. Field of application

Survey types where the method is applicable

This questionnaire is intended for socio-acoustic surveys, where objective data on the acoustic performance of buildings and service equipments are correlated to the subjective evaluation by the habitants, in order to establish dose-response relationships.

Collecting data: The institute shall collect data on the building constructions and service equipment prior to the enquiry. All questions that are not relevant for the site shall be blocked and painted with a grey shadow. This is to show that such questions are considered in other cases but the institute considers them irrelevant in this specific building. The numbering and order of questions shall not be changed.

Limitations

The questionnaire is not intended for broad prevalence surveys to characterize the general degree of annoyance from noise in the population of a city or a country.
This questionnaire is not intended for a social survey where is not measure data.

This questionnaire is not designed for adding more segments related to other similar studies like traffic, environmental reactions to noise, vibrations from road and trains, due to the meaning of the questions will change and the possibility of getting different results and introducing errors.

The questionnaire is not intended for research on annoyance from traffic noise outdoors. There are other questionnaires designed for this purpose. The questions on façade insulation are only included to assess whether the habitant judge the building elements (wall, window, air inlet etc.) appropriate with respect to their sound insulations.

This questionnaire is not intended for assessing neighbours behaviour. The only purpose of the questionnaire is to evaluate the acoustics conditions of the dwellings.

This questionnaire doesn´t make a difference between day and night annoyances because is designed for looking the average of the whole day annoyance due to the noise sources are inside not outside where the schedule and the intensity varies considerable during the day and the night.

Recommendations:

The questionnaire should be translated keeping the meaning and the wording in the new language as the original in the English version. The ISO/TS 15666 has the main question of the questionnaire translated in several languages which we recommend to use for translations.

It is not recommended to include any other words in the scale except the extreme designed in the questionnaire. Introducing an intermediate word in the numerical scale do not facilitate habitant answers, they confuse them [5,17].

The numbering and order of questions shall not be changed and the layout shall be maintained. Only changes necessary for the translated texts to fit should be made [7, 18,25].

4. Definitions

The next definitions have been made to describe the intended of each word in the present document. The use of these definitions out of this context is not recommended.

Survey terminology

Socio-acoustic survey

Surveys designed to measure people's reactions to noise in buildings from interior sources (neighbours equipment) and traffic noise for different noise exposure situations and/or to establish dose- response relationships.

The main characteristic of socio-acoustic surveys when compared with social surveys is that they provide information about the actual dose-noise each person is exposed to.

Social survey
Social surveys are here defined as general surveys of living conditions or broader environmental studies where responses are not usually linked to objective measures of noise exposure [16].

Noise
Noise is defined as unwanted sound[4].

Tolerance
In this context tolerance is defined as the act or capacity of enduring to noise. In other words we it is the "sensitivity to annoyance from noises", or the risk of annoyance when hearing sounds.

Tolerable noise
Noise that is broadband and stable and seem not to bother habitants too much like noise from remote traffic, heating and ventilation, some equipment [20].

Intolerable noise
Noise that bother or annoy habitants even when their levels are low, e.g. from the WC usage, flushing water through the sewage water pipes, tonal and impulsive noise from the elevator as well as the laundry machines that bothers habitants [20].

Annoyance
"Noise-induced annoyance: a person's individual adverse reaction(The reaction may be referred to in various ways, including for example, dissatisfaction, bother, annoyance, and disturbance due to noise).

> **Global annoyance** is the accumulated specific annoyance integrated over a range of contexts and over a range of locations at home (e.g. at the balcony, in the kitchen, in the bedroom)[4].

> **Specific annoyance**
> ***Accumulated specific annoyance*:** The annoyance for a specified stimulus in a specified context for specified persons integrated over time and experiences.
> The accumulated specific annoyance **is the immediate annoyance and the connected experiences integrated over time.**

- Conversations inside a home affected by traffic noise
- Working next to a noisy printer
- Neighbour usually rehearses drums every evening [7]

***Immediate annoyance**:* The annoyance for a specified stimulus in a specified context for specified persons when the noise actually is present during or immediately before the evaluation of that particular noise. Immediate annoyance may be relevant for the following examples:
- Aircraft passing while you are talking in a phone
- Passing a pneumatic drill on the pavement
- Irrelevant speech while you are working in an office

Noise Annoyance
It is defined as an emotional and attitudinal reaction from a person exposed to noise in a given context [7].
Noise sensitivity
Noise sensitivity is the degree of susceptibility to noise. According to several authors [21, 26] we can find two different concepts of noise sensitivity:
1. Sensitivity to loud noises: Susceptibility to very loud sounds in the distance such as traffic or construction noise.
2. Sensitivity to situations of distraction: susceptibility to lower, but disturbing sounds from the direct vicinity such as rustling paper in the cinema or people talking in the background while watching TV (daily disturbances or sensitivity to noise)

Annoyance question
Question or questions with or without filter questions utilised for eliciting people's annoyance to vibrations including the response that the vibrations are not noticeable [16].

Filter questions
Filter questions are used to select only the people who are affected by hearing the noises and measuring people's reaction to [16].

Judgement
The forming of an opinion, estimate, notion, or conclusion as from circumstances presents to the mind due to an insulation asses of the dwelling.

Behaviour
The actions or reactions of any person under making or receiving noise.

Noise dose accumulated in the human body
Is the amount of noise which stays in the human body after a long exposition and further increase causes symptoms of fatigue and increase irritability.

Modifying factors
Modifying factors are factors that influence the relationship between exposure and effect [16].

Such factors can be
- external (such as the presence of additional environmental problems, smells, air pollutions, visual impact in general, visibility of source from home, size of the source, vibrations, location of the dwelling, home ownership, sound Scape,...)
- internal (such as the degree of sensitivity to noise, expectation, attitude to source, perceived health risks... etc)

Exposure-effect relationships
Exposure-effect relationships describe the proportion of people who report or experience an effect at different values or intervals of the chosen noise exposure measure. Exposure-effect relationships may also be described statistically by means of the estimated relationship between an exposure and an effect based on a stochastic model.

Expectations
Expectation is what is considered the most likely to happen. In the acoustic context the hope of having a good airborne and impact insulation and the hope of living in a good area, good apartment as the interviewed expected. According to the Genlyd Project there are three types of expectation: Expectation to the acoustic Quality, to the noise duration and to the noise increase.

Satisfaction
Confident acceptance of something as satisfactory, dependable, true, etc

Attitude to source
The attitude to the sound source may be seen as a number of reasons each of which may moderate the annoyance. It is chosen to synthesise these reasons into one moderator called attitude. Personal attitudinal factors like attitude to the specific sound source in the specific neighbourhood (Do I want it here?), feeling that the noise annoyance is preventable, did we have influence on the planning process...etcetera [7].

5. Wording questions

Select the wording in questions is complex. There are many factors that influence in the understanding of the questions and in its answer so every word, the way of asking, the type of question and its context introduce an error in the answer. In the questionnaire research we analyse different ways or wording questions and type of questions and it concluded there are three types of wording questions according to the wording and the ratings scale in the documents analyzed:

- **Hear / notice questions**, which can be used for detecting noise through partition walls and used as a filter question before the annoyance or assessment question. It is an objective question. Rating Scale: Yes/No, or asking to select the sources you can notice or hear through a wall or a floor...etcetera. [16] [22].

- **The annoyance question,** what since ISO/TS 15666 many authors decided to follow to be able to make relations with other surveys and we can find it in many of the traffic noise surveys and in vibrational surveys. Quantifying annoyance is indispensable for two tasks: to identify individual levels of noise impacts and to operationalize the noise problem for populations (e.g., "% highly annoyed" in the vicinity of an airport) [17]. It is a subjective question. Rating Scale: Neutral to negative (unipolar). [4][7][16]

- **The assessment or satisfaction question,** who ask about to asses, evaluate, or to rate the insulation or the acoustics qualities of their apartments or dwelling. It is a subjective question but more objective than annoyance one. Rating Scale: Positive to negative and neutral to positive [1, 12].

The questions should use the right words to get the most appropriate answers to describe responses and the effects of noise from habitants. The language barrier and translations play an important role in exporting and importing data from other surveys and it should be taken into account in the selection of the terminology of the questions and the responses scales in the questionnaire.

Some surveys explain [18] who have used combinations of words to cover a wide range of them and to be able to establish comparisons. For example, annoyance or disturbance used in the same question let us to compare with surveys conducted in other languages because the meaning of them are different in those other languages so introducing several words let us to be able cover a wide range of surveys and questions.

What is the best wording or how to assess subjective responses to noise in residential building?. Authors are committed to annoyance as the primary indicator to noise, making a great effort in research and development of questions and their influence on the results [4,7], but the satisfaction or assessment of the acoustic conditions begin to be strong especially in the surveys conducted indoors and in news buildings[1]. However, one of the main reasons authors opt for the annoyance as an indicator is the ease of comparison with other reports and studies which allows to calibrate our survey.

Rest of the terminology used in the question should take into account other factors such as the period of time in the question (It is not the same asked for a period of 12 months than a shorter or longer), the place where the interviewee is asked about, (in his house, inside home, balcony, garden...), and finally what type of noise sources you will ask for. Last the importance of the verbal time (present) and the use of “you”, asking directly to the interviewed [4].

The model question proposed in this study follows the pattern of questions developed by the ISO/TS 15666 [4] who studied the influence of those factors getting the next wording question what will be used in this questionnaire*:

- The right period of time: ***“Thinking about the last 12 months when***
- Person or family reaction asked for: ***you are, your family are....***
- Place*:* ***here at home, in your neighbourhood, outdoors***
- Answer to choose for a degree of response*:* ***how much***
- General noise*:* ***does noise****,*
- Specific noise source*:* ***om (name of the source)***
- Wording for assessing the degree of annoyance*:* ***annoy, disturb, bother,***
- Person evaluation the question*:* ***you”***

See reference [4]

* *Question used in the questionnaire:*
“Thinking about the last (12 months or so), when you are here at home, how much does noise from (noise source) bother, disturb or annoy you?”

6. Type of questions

There are four types of questions: Direct rating question, indirect and comparison questions, and indirect questions via statement. The direct question has been almost universally accepted as the primary measure of relationship between noise and respondent´s subjective reactions. Answers to such direct questions are more explicit and more readily interpreted than indirect questions or comparison questions [4]. Indirect and comparison questions have not

supplanted the direct question as the primary indicators of noise impact because the can only be used to infer indirectly how people fell about noise.

Direct questions are the most used in noise surveys questionnaires, having a good results because in one hand, you are introducing an error because you are inducing people to chose an answer but in the other hand it explain clearly what you are asking for, so there is not too much wide range of interpretations. This questionnaire follows the ISO/TS 15666 recomendation and uses its direct question as explained before.

7. Rating Scales

Two main scales have been considered: verbal and numerical scale. During the preliminary stage of collecting information where several studies were evaluated it was found that most of these studies recommended the use of a verbal scale against a numerical scale, or a combination of both to ensure the accuracy of results [4, 7, 16, 17].They explained verbal scale is needed for the clearest, most transparent communication. The simple task of choosing a word is most likely to be easily performed by respondents of any degree of sophistication in any culture.
The protocol used to choose the answer scale words attempts to ensure that the commonly understood meaning of the word is consistent with its position on the scale [4][16].Other advantages are the easy understanding and the familiarity with the words, in fact most people prefer verbal scales and it also facilitates to capture normative judgments [17].

The disadvantage of using the verbal scale are determined by using the most appropriate term and the standard deviation introduced by it [5, 17], figure 1. Not all the words used have the same meaning and there is the same distance between them if we compare with a numerical scale figure 2.

This disadvantages have made us opt for the numerical scale against the verbal because because the inferior measurement quality, there are some cultural factors might confound the data, and most important, cross national and international comparability it is difficult due to the meaning of the words in different countries and not all words have the same proximity on the scale, e.g. if we use the next five terms [17] "not-at-all, slightly, moderately, very, extremely" appears to be a reasonable solution for a verbal scale however, there is a rather large gap between level "3" and "4", so the distance between 3 and 4 is different than the separations between 1 and 2, getting a scale with not equidistant terms. Several authors try to find the best translations in different languages for a verbal scale and the best equidistant terms introducing mathematical factors, but there are still difficulties and need for further research. It is explained in the document "*On the Meaning of Noise Annoyance Modifiers: A Fuzzy Set Theoretical Approach"* [5] where a five point verbal scale is deducted as the most accurate in several languages thanks to the mathematical model applied, figure 3.

SCALING VERBAL QUALIFIERS: SELECTED RESULTS FOR "INTENSITY"

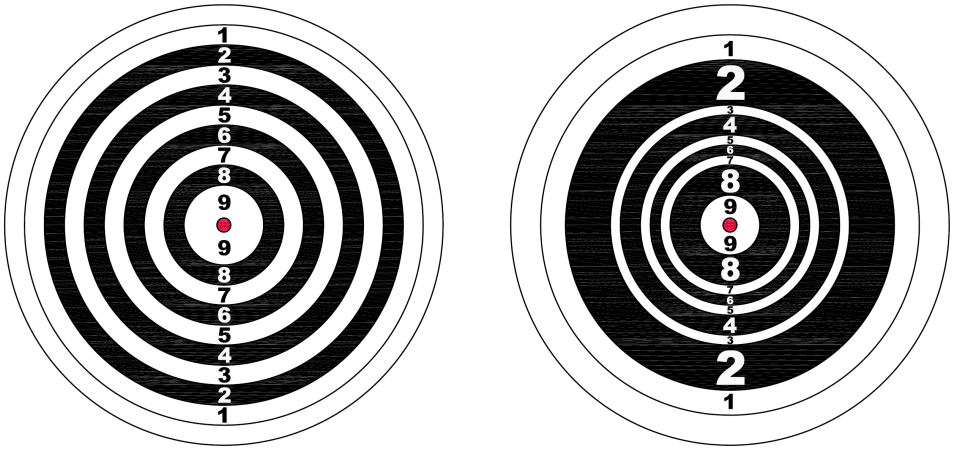
Scaling task	CATEGORIAL (0…10 scale)				MAGNIT -UDE <#>		PREFERED LABEL (% respondents)					FAMILIA -RITY	
Context:	noise		all		all		for annoyance scale level					noise	
	M	*sd*	*M*	*sd*	*M*	*sd*	*1*	*2*	*3*	*4*	*5*	*M*	*sd*
Verbal label													
a little	2.5	1.3	2.5	1.4	10	17		13				7.1	2.7
average	4.7	1.0	4.8	0.9					28			8.8	1.0
completely	9.8	0.6	9.7	0.8	81	161					40	8.5	1.6
considerably	7.5	1.2	7.6	1.1	57	129				21		6.3	1.7
extremely	9.6	0.6	9.6	0.8	76	145					47	8.3	1.4
fairly	5.1	1.3	5.4	1.4	46	113						6.4	1.8
fully	9.2	1.2	9.3	1.3	78	161							
hardly	1.6	1.4	1.7	1.2	9	17		18				7.1	1.8
highly	8.6	0.7	8.6	0.9	68	130						7.4	2.1
mainly	6.4	1.1	6.1	1.4	58	129				18		7.4	1.6
medium	4.8	0.8	4.9	0.8					25			7.3	2.3
moderately	4.9	1.3	5.1	1.1	43	112			37			6.5	2.0
not	0.4	0.5	0.5	0.9	2	3	17					9.4	1.0
not at all	0.1	0.4	0.2	1.0	1	0	70					9.1	1.5
partly	3.5	1.4	3.8	1.4	21	49		14				7.0	1.8
quite	6.1	1.5	5.9	1.5	38	81						6.5	2.4
quite a bit	6.4	1.7	6.5	1.6	45	97							
rather	5.9	1.7	5.8	1.6	46	113						5.7	2.3
slightly	2.5	1.4	2.3	1.5	12	17		27				6.9	1.8
somewhat	4.3	1.7	4.5	1.7	27	49						5.3	2.7
very	8.0	0.9	7.9	0.9	63	129				16		9.2	0.8
very much	8.7	0.7	8.6	1.0	71	145						8.7	1.5

Source: Project VQS, ROHRMANN 1998

The results indicate:

- *for some of the tested VSPLs people differ considerably in their allocation of pertinent intensity levels - see items with high standard deviation sd;*
- *no significant differences between ratings of context-bound (noise) and context-free presented VSPLs;*
- *rank order of main VPSLs very similar in CAT, MAG-N and MAG-L scaling results;*
- *when selecting VSPLs for to-be-labelled 5-point scales, most respondents prefer extreme labels at the end (levels "1" and "5");*
- *most VSPLs are rated as familiar and easy to understand.*

Figure 1: Scaling Verbal Qualifiers: selected results for “Intensity”. B. Rohrmann



Perception of habitants of a numerical Scale

Perception of habitants of a verbal Scale translated to a numerical.

Figure 2: Comparison between a numerical scale and a verbal scale from the point of view of how one habitant may perceive the scale. Wording can make some answers appear more important and with more weight that the rest, distorting the real meaning of each number or word. Also reducing or increasing the gaps between words.

	label 1	label 2	label 3	label 4	label 5
German	nicht	**etwas**, teilweise	**mittelmäßig**	beträchtlich, besonders, stark	völlig
English	insignificantly	**slightly**, partially	**moderately**	very, **strongly**	**extremely**
French	pas	**légèrement**	**moyennement**	**beaucoup**	énormément
Japanese	Hotondo..nai	Amari..nai, Taishite ..nai, Sorehodo..nai	Yaya, **Tashou**, Hikakuteki, Warini	**Daibu**	**Hijooni**
Spanish	insignificantmente	un poco, algo, un tanto	**medianamente**	**muy**, altamente	**extremadamente**
Turkish	degil	hafifce, birazcik, bir miktar, **biraz**, az cok	**orta derecede**	epeyce, cok fazla	**feci sekilde**
Norwegian	minimalt	noe	**middels**	**mye**	alvorlig
Hungarian	**egyáltalán nem**, nem, alig	mérsékelten	**közepesen**	**nagyonna**	**rettenetesen**
Dutch	niet	iets, lichtelijk, **een beetje**, enigzins, matig	matig, **tamelijk**, behoorlijk	**erg**, sterk	**extreem**

Figure 3: Best match with the 5 fuzzy ideal labels in each of the languages considered. Source A. Botteldooren

The questionnaire designed use a 11-point numerical scale (0-to-10 scale would be more readily understood and manipulated than a shorter 7-point, 9-point or 10-point scale [4, 7]) with an explanation of it in the header of the questionnaire, Figure 4, determining the proper use of extremes and its meaning in the analysis of the results.The familiarity with this scale in different countries (most habitants are familiar with base-10 numeric systems) and recommendations for international surveys [4, 7, 16, 18] studies, among others the factors (easy to convert in % and to analyse it), make us to choose this scale in our questionnaire Figure 5.
Next instructions of how to fill the scale with the meaning of the extremes

Instructions:
Choose an answer on the 0-to-10 scale for how much noise bothers, disturbs or annoys you when you are here at home.

if you hear the noise but you are not disturbed by it, ***choose 0***	*if you are extremely bothered, disturbed or annoyed by it,* ***choose 10***	*if you are somewhere in between,* ***choose a number from 1 to 9***	*if you do not hear anything at all, the source does not exist or it is not possible to answer,* ***choose "?"***

Fig 4: Instructions for completing the scale of the questionnaire.

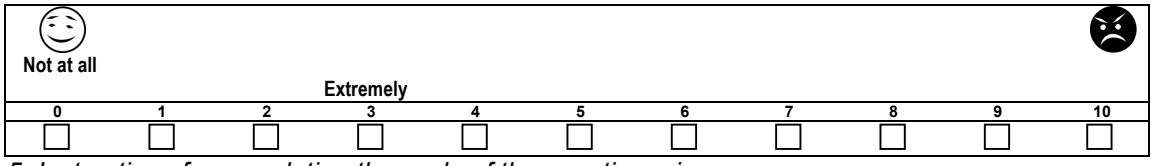


Fig 5: Instructions for completing the scale of the questionnaire.

The scale use words and emoticons in the extremes in order to stress the meaning of the scale and to make respondents see the easy use of it. In the expectations and sensitivity segments, the wording in the extremes is reinforced by adding "important" and "sensitivity" so as to show the question scale asses their personal reactions to noise.

8. Sources list

One of the most important characteristics of this questionnaire is respondents are not asked to determine which are the sources of noise they hear in their buildings, we can determine through other studies or personal o cultural experiences what are the most annoying sources in each type of dwelling and then we save time in completing the questionnaire by respondents, making it shorter.

Each subjective response and each noise source will be correlated with the best parameters of airborne and impact sound insulation. Different studies [11, 24] show an increase in discomfort by certain sources of noise on habitants and give a list of the most heard noise sources and most annoying. In these lists it is found that most countries have the same noise sources and almost the same most annoying sources (loud conversations, music, walking heavily on floors,...). So questionnaire ask about most common noise sources which will be correlated with their airborne or impact sound descriptors.

The next list is the sources most heard and annoying asked in the questionnaire based on the TNO, National Survey Study, Figure 6 and personal experiences on the field.

ANNOYANCE (priority list)	
Netherlands, TNO Study	UK, "*National Survey of Attitudes to environmental Noise"*
1.Playing special popmusic	1.Teenagers' or adults' voices Speaking
2.Noise from TV/radio/audio turned up loud	2.Radio, TV, music
3.Slamming of doors	3.Dogs
4.Sounds from spin drier or washing machine	4.Children
5.walking heavily on floors	5.Cars/motorcycles starting up/leaving, repairs etc.
6.Walking heavily on stairs	6.Burglar alarms
7.DIY sounds	7.DIY (hammering, drilling, etc.)
8.Speaking with raised voices or shouting	8.Doors banging
9.Dog barking	9.Lawnmowers or other garden equipment
10.Flushing sounds from toilet	10.Parties (when held outdoors)
11.Noise from TV/radio/audio at normal volume	11.Parties (when held indoors)
12.Noise of showering and/or taking bath	12.Footsteps
13.Normal" walking on staircase	13.Domestic equipment
14.Sounds from spin drier or washing machine	14.Other animals
15.Speaking normally	15.Electric Switches
	16.Any other kind of noise b (flushing toilets, mobile phones...etc)

Figure 6: Table most heard sources listed by TNO and UK National Survey Studio

9. Segments of the questionnaire

The questionnaire has been designed in order to perform it with the minimum number of questions and segments based on the study of different types of surveys [10, 12, 16, 18, 22, 23] and assessing the most important sources of noise inside dwellings. It also makes a division between the airborne noise transmitted through walls and floors, and the noise produced by vibrations.

The process of selecting the right blocks for this questionnaire started from the analysis of surveys and their segments. For the design of the segments of this questionnaire we devel-

oped a questionnaire including all the questions used in other surveys getting a total of 70 questions. The work consisted in determine which segment and which questions were relevant for the study and then after a deep analysis we were eliminating questions and segments in order to focus in the most relevance items and reducing the number of questions and thus the time for completing the questionnaire [See process of questionnaire developed in paragraph 5.1.1.].

Segments of the questionnaire:

1. ***Introduction and personal data****: The introduction* explain the purpose of the questionnaire and how to rate the answers. The main page contains the address and contact data of the survey institute who will carry out the survey and it will be clearly readable. Also this part include questions on personal data of the interviewed (age, gender, years of residence number of persons in the household... etc), figure 8.

Investigation – purpose

[*THE INSTITUTE*] has been commissioned by [*THE COMMISSIONER / AUTHORITY*] to research whether residential buildings have satisfactory noise conditions. Several buildings have been selected randomly for the survey and this one was included.

Your responses help us define appropriate requirements in the building regulations. The requirements must prevent poor constructions being adopted but also enable cost efficient constructions to be use. Too high requirements would lead to unnecessary costs. For this reason, it is important to ask habitants about their opinions and check whether the noise conditions are satisfactory.

We thank you for taking your time to fill in this enquiry. Your responses will be treated statistically and confidentially at all times. The results and your personal data are only used for this research.

Please leave your form in the [DELIVERY PLACE IN HOUSE XXX].
In case you would like to submit your answers on the internet,
visit our information site www.[SURVEY-WEBSITE].cc
If have any questions or prefer to answer by telephone
call our Help Desk: +cc xxx yyy zzz
e-mail to enquiry@[INSTITUTE-CONTACT].cc
visit www.[SURVEY-INFO-WEBSITE].cc
Thank you for your cooperation!
[Name of responsible part for the enquiry]
[Institute]

YOUR PERSONAL DATA [Filled in by the respondent] . N.B! [THESE DATA ARE ONLY FOR THIS SURVEY AND WILL BE DELETED AFTER ITS ANALYSIS]

Gender:	F:	☐	M:	☐								
Age:	18-25	☐	26-39	☐	40-64	☐	>65	☐				
Working schedule:	Day	☐	Evening / night	☐	Mixed	☐	Not applicable	☐				
Years of residence:	0-1	☐	2-5	☐	6-	☐						
Nº of person in the household:	1	☐	2	☐	3	☐	4-6	☐	6-	☐		

Figure 8 Introduction and personal data

2. ***Instructions***: it explains how to fill the questionnaire and the meaning of the extremes of the scale. Several ways of filling the questionnaire were developed. To try to avoid having a column several options were taken into account like to “make a line through the question in case you do not hear anything or does not exist. At the end, different tries make us real-

ise about the complicity for respondents to remember this answer so a column was introduced and it was labelled with N/A and a "?" to the right of the numerical scale, see fig 4.

3. ***Introductory example*:** An example explaining how to fill the boxes of the scale it is added in order to show the methodology of the questionnaire. In case of mistake it is explained "If you already marked out one box but you want to change your answer, fill the box in black and mark a new X in the new box". Also the position of the main question, the scale and the N/ A column is marked, figure 9.
4. ***General question***. This question is a question recommended by various authors [Truls Gjestland and 4, 7,17] to calibrate you survey with other surveys and as a training question for the respondents because it is the first question ant the first time they will rate in the scale. The general question asks about general noise annoyance, not specifying in detail the type of sources of noise trying to be general (neighbour noises, and technical installations etc). It is not specify either if you are inside or outside your home, so it will let to compare with the next segment where the questions specify it is indoors, figure 9.

*Thinking about the last 12 months here at home, what number from 0 to 10 best shows **how much you are bothered, disturbed or annoyed by***	Not at all										Extremely	
	0	1	2	3	4	5	6	7	8	9	10	N/A
1. Noise in general e.g. from neighbours, technical installations etcetera	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 9 General question

1. ***Questions on noise generated by different noise sources***. This segment contains the main weight of the questionnaire. All the sources evaluated have been chosen according with different studies where the priority of hearing and the annoyance of the sources were listed. It was found most o those sources are common in some countries, so it was decided to ask for the most common sources of noise instead of asking to mark which ones they hear. The answers will be correlated with sound insulation parameters in the analysis of the results, figure 10.

*Thinking about the last 12 months here at home, what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by **these sources of noise?***	Not at all										Extremely	
	0	1	2	3	4	5	6	7	8	9	10	N/A
2. Neighbours; daily living, e.g. people talking, audio, TV through the walls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Neighbours; daily living, e.g. people talking, audio, TV through the floor / ceiling	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Neighbours; Music with bass and drums	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Neighbours; footstep noise, i.e. people walking on the floor	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Neighbours; rattling or tinkling noise from your own furniture when neighbours walk on the floor above you	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Staircases, access balconies etc; people talking, closing doors	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Staircases, access balconies etc; footsteps or other impact sounds	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Water installations; plumbing, using or flushing WC, shower	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Climate installations; heaters, air condition, air terminal devices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Service installations; elevators, laundry machinery, ventilation machinery	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Premises; garages, shops, offices, pubs, restaurants, laundry rooms or other, heard indoors with windows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

13.	Traffic (cars, buses, trucks, trains or aircraft); heard indoors with windows closed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 10 Annoyance questions segment

2. ***Question about expectations***. Among factors that influence in the results, expectations was one of the factors considered in some studies but not studied [7]. From the explanation of some documents and personal experience, expectations play an important role in the answers and they will vary according with respondents expectations. We include this segment in order to see the relation with the answers and with the sensitivity, fitting the annoyance answers, if necessary, and adjusting the slope of the dose-response curve. The question designed it is focus on the expectations to the acoustic quality, not asking about the expectation of duration time of the noise source or expectation to the increase of the noise level.

*Before moving to the apartment, what number from 0 to 10 best shows **how important the sound insulation was to you, with respect to***		**Not at all important**									**Extremely important**
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
14.	Noise in general e.g. from neighbours, technical installa-	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 11: Expectations question.

3. Question about sensitivity. This section contains one of the most important factors who influence in the answers. From all the types of sensitivity questions [7, 21] the questionnaire ask a direct question about if you consider yourself sensitive to noise. It is an inducing question but it is important to know the personal reaction to this question in order to know if the rest of the answers are affected by the respondent sensitivity to noise.

–

How sensitive are you to		**Not at all sensitive**									**Extremely sensitive**
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
15.	Noise in general e.g. from neighbours, technical installations etcetera	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 12: Sensitivity question.

4. ***Notes of application***. They are for the survey institute and it will not be included in the questionnaire format. It shows considerations and recommendations for getting all the purposes of the survey. Also the survey procedure lines is explained for the survey institute.

> *This questionnaire is intended for socio-acoustic surveys, where objective (physical) data on the acoustic performance of buildings and service equipments are correlated to the subjective evaluation by the habitants, in order to establish dose-response relationships. Annoyance is chosen as the measurand according to ISO/TS 15666 since it has proved to reduce the scatter of responses, although the type of question may lead to an apparent over-estimation of the general annoyance. In the course of developing this questionnaire, less inducing questions were considered, but the ISO/TS 15666 question was finally thought to be the best choice for the purpose.The questionnaire is not intended for broad prevalence surveys to characterize the general degree of annoyance from noise in the population of a city or a country, nor its effects on health etcetera.*
>
> *The questionnaire is not intended for research on annoyance from traffic noise outdoors. There are other questionnaires designed for this purpose. The question on façade insulation are only included to assess whether the habitant judge the building elements (wall, window, air inlet etc.) appropriate with respect to their sound insulations.*

This questionnaire is not intended to assess the neighbours behaviour. The only purpose of the questionnaire is to evaluate the acoustics conditions of the dwellings.
The numbering and order of questions shall not be changed and the layout shall be maintained. Only changes necessary for the translated texts to fit should be made.

The institute shall collect data on the building constructions and service equipment prior to the enquiry. All questions that are not relevant for the site shall be blocked and painted with a grey shadow. This is to show that such questions are considered in other cases but the institute considers them irrelevant in this specific building.
Survey procedure:

- *Step 1: Inform the all habitants about a survey being made soon in the house. Explain them the purpose of the survey is research on the building regulations only. Our company [THE HOUSING COMPANY] participates in this survey. You will receive a survey form and an envelope. Please fill in and leave the envelope [DELIVERY PLACE IN HOUSE XXX].*
- *Step 2: Distribute the surveys to all the habitants.*
- *Step 3: Collect the survey forms.*
- *Step 4: Remind respondents twice by post or by one telephone call.*

The institute shall provide instructions to the habitants, including answers to frequently asked questions to the extent judged to be necessary in each case (FAQ).

If the survey is made by telephone the institute shall also provide guidelines for telephone interviewers etc in order to facilitate a smooth and uniform interview. See ISO/TS 15666.

5. ***Personal and Building data***. This part will be filled the institute. It is really important to be able to measure or to know the sound insulation values. For that reason the building data and the building characteristics it is required. The survey should include (when it would be possible) constructions details (with dimensions or scaled), plans and drawings to be able to calculate or estimate through standards or software the sound insulation values in case the measurement were not possible. This is required due to the necessity of correlate the subjective answers with the real or estimated values.
The building data is divided in three sections. Building site plan information contains the urban plans and the relation between the building and the city and surroundings (influence of external environmental sources, high, proximity airports... etc). Building equipment contains the general installations of the building like elevators, general heater or water... etc. Last the dwelling plan information and dwelling information contains the necessary data to classify the dwelling and to be able to get the building data for an estimation or calculation of the insulation. See figure 13.

Survey Information Filled in by Survey Institute							
Form Number	_____						
Respondent:							
Country:	_____		City	_____	Postal Code		
Address:							
BUILDING INFORMATION Filled in by Survey Institute (the purpose it is to allow outdoor calculations in case no measurement data or not Urban noise plans)							
Building site plan information							
Wide site plan: shows the situation of the building with respect to the traffic or other sources of noise. (Urban Plan scale1:5.000 or 1:10.000)							
Street building plan situation: shows the relation with the next buildings and with the street. (Plan scale 1:500 or 1:200)							
Street building cross section: shows the size and position of the windows facing the road							

Distance to (km)	Highways	___	Roads	___	Train / Trams	___	Bus	___	Airport	___	Pub Disco / Music Area	___	Outdoor area	___
Building equipment														
Individual house heat	Heater	☐	Water Heater	☐	Electric Heater	☐	Air conditioner	☐	Cooling unit	☐	None	☐		
Central heating system	Heater	☐	Water Heater	☐	Electric Heater	☐	Air conditioner	☐	Cooling unit	☐	None	☐		
Individual Heater/cooling	Air handling unit(exterior)	☐	Compressor unit(exterior)	☐	Compressor unit (interior)	☐	Other	☐						
Central cooling units	Air handling unit(exterior)	☐	Compressors units(exterior)	☐	Compressor unit (interior)	☐	None	☐						
Central equipment	Laundry	☐	Dryer	☐		☐	Other	☐						
Floor premises:	Gym	☐	offices	☐	Schools	☐	Clinic	☐	Other	☐				
Ground floor premises	Laundry rooms	☐	Garages	☐	Shops	☐	Offices/Clinic	☐	Restaurants /Pub /Discos	☐	Other	☐		
DWELLING PLAN INFORMATION Filled in by Survey Institute (the purpose is to estimate airborne and impact sound insulation, e.g. according to EN 12354)														
Building floor plan: shows whole floor with the dwelling of the study and all the neighbours apartments (Scale from 1:100 or 1:200)														
Dwelling cross section: shows the rooms' situation and the type of room above and below. (Scale from 1:50 to 1:100)														
Floor detail: shows the materials and the layer used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Roof detail: shows the materials and the layer used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Exterior Walls detail: shows the materials and the layers used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Partition wall detail (separating next apartments): shows the materials and the layer to be able to estimate the insulation. (Scale from 1:5 to 1:50)														
Partition wall detail (separating staircases or corridors): shows the materials and the layer to be able to estimate the insulation. (Scale from 1:5 to 1:50)														
Window glass type:	Describe the glass pane													
Window frame type:	Wood or Wood/Aluminium	☐	Steel/Aluminium	☐	PVC	☐	**Window seals ok?**	Yes	☐	No	☐			
Elevators next to room:	Yes	☐	No	☐										
Central Staircases:	Yes	☐	No	☐	**Staircase structure:**	Light (steel, wood...)	☐	Heavy (Concrete)	☐					
OTHER DWELLING INFORMATION														
House type:	Detached house	☐	Terraced housing	☐	Apartment	☐	Villa	☐						
Apartment / Loft Floor:	Basement	☐	Intermediate	☐	Floor Nº	___	N of rooms:____							
Type of Ownership:	Rental	☐	Membership or Self owned	☐										
Extras:	Quiet balcony	☐	Access to quiet Outdoor area	☐	Own garden	☐								
Nº Apartments per floor:	______													
Apartments above floor:	Yes	☐	No	☐										

Figure 13: Building a dwelling data

Sampling

The primary aim of the sampling procedure in socio-acoustics surveys designed for establishing dose-response relationships is to capture a representative sample of habitants. Sample selection will be focus on select the same per cent of people according to age, gender, length of residence and the building age and characteristics for getting and heterogeneous sample which will give us a wide range of the acoustic quality of the buildings in each European countries.

This questionnaire will take next two critters for the sample designs:

a) Sample Selection:
   Respondent sample selection method (probability, judgmental, etc.)
   Respondent exclusion criteria (age, gender, length of residence, etc.)

b) Sample Size and quality
   Response rate
   Reasons for non-response

Measurement verifications

To be able to correlate the noise dose with sound insulation values it is important to make measurements "in situ" (including in the survey the methodology followed, number of measurements and the instrumentation used) or to be able to estimate those values through construction details, building data and traffic noise plans (calculated by computer programs, through laboratory measurement values, etc).

There are two main methods available for obtaining the sound insulation values of constructions solutions of dwellings and correlate them with the subjective responses:

1. Measurements “in situ”, adequately planned were intended to find a correlation between the properties of the construction solutions and the existing sources of noise, as well as subjective evaluation of acoustic quality of dwellings.
2. Estimate the measurements via:
    a. Standards and materials sound insulations data bases.
    b. Acoustic Software: to calculate airborne and impact sound insulations using standardised software (according to Standards).
    c. Laboratory measurements and tests insulations values of constructions solutions.

The table below shows the noise sources and paths and the parameters to correlate with:

SOURCES	LOCATION OF SOURCE					PATH		X PARAMETERS
	NEXT DWE	ABOVE /BELOW	COM SPACES	IND	OUT	WALL	FLOOR /CEILING	
1. Neighbours; daily living, e.g. people talking, audio, TV through the walls	X			X		X		$D_{nT,w} + C$
2. Neighbours; daily living, e.g. people talking, audio, TV through the **floor / ceiling**		X		X			X	$L'_{n,w}+C$ $D_{nT,w} + C$
3. Neighbours; Music with bass and drums		X		X		X	X	$D_{nT,w} + C$ $L'_{n,w}+C$
4. Neighbours; footstep noise, i.e. people walking on the floor	X	X		X			X	$L'_{n,w}+C$
5. Neighbours; rattling or tinkling noise from the furniture when neighbours walk on the floor above you		X		X			X	$D_{nT,w} + C$ $L'_{n,w}+C$
6. Staircases, access balconies etc; people talking, closing doors	X	X	X	X	X	X	X	$D_{nT,w} + C$
7. Staircases, access balconies etc; footsteps or other impact sounds			X	X			X	$D_{nT,w} + C$ $L'_{n,w}+C$
8. Water installations; plumbing, using or flushing WC, shower	X			X		X	X	$D_{nT,w} + C$ LA_{max}
9. Climate installations; heaters, air condition, air terminal devices	X	X	X	X	X	X		$D_{nT,w} + C$ LA_{max}
10. Service installations; elevators, laundry machinery, ventilation machinery	X	X	X	X		X	X	$D_{nT,w} + C$ LA_{max}
11. Premises; garages, shops, offices, pubs, restaurants, laundry room or other spaces, heard indoors with windows closed		X	X	X		X		$D_{nT,w} + C$
12. Traffic (cars, buses, trucks, trains or aircrafts); heard indoors with windows closed	X	X				X		$D_{nT,w} + C_{tr}$

Analysis of the results.

Statistical analyses of responses from the questionnaire can test the reliability of the responses and examine relationships between subjective responses and objective measures of vibration exposure.

In this questionnaire the analysis of the results will be carried out using, as recommended method, linear regression. Other correlation methods maybe considered as well. There are a

lot of methods, depending on each type of survey and the way of treating results [1, 2, 12, 18, and 21]. This questionnaire evaluated the use of some of those methods, including a classification of the sample surveyed in clusters (age, gender, length of residence, and quality of construction, year of the building ...), but it will be too complicated for the analysis of the results. Simplicity and the ease and interpretation of data without complex mathematical operations allow a faster exchange of information and data, without having to convert scales or analysed complex results. If the survey institute would like to make a classification with clustering or introducing other changes everything should be explained in detail and the reasons why has been made, enclosing it in the survey.

The results of the blocks of expectations and sensitivity will be used, if necessary, to adjust the slope of the results obtained in the annoyance block, explaining where and how they will modify the slope of the curve obtained.

Inter-noise 2010 – conference paper and presentation

Revision of sound classification schemes in Sweden

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Abstract
The Swedish sound classification standard (SS 25267) may be revised within a few years on the basis of several types of practical experiences. In this work, several new surveys of habitants annoyance with noise and other indoor clima factors are analyzed and compared to interviews with building developers, contractors and acousticians. The results will be compared to the requirements of the existing standard as well as older building regulations, to find out whether we address the right types of sound insulations (that are important to the habitants) and whether we have the right levels of insulation. This research is coordinated with the EU COST Action TU 0901, which aims for harmonized sound classification schemes, questionnaires, listening test guidelines and catalogues of robust details within the EU member states.

Keywords: buildings, habitants, sound insulation, surveys, questionnaires, requirements, classifications.

Introduction

Acoustical requirements on Swedish residential houses are described by sound class C of the national sound classification standard (SS 25267). However, many developers follow the stricter sound class B (with 4 dB higher insulation values than in class C. Thus, typical requirements are $R'_w + C_{50\text{-}3150} \geq 57$ dB and $L'_{nT,w} + C_{I,50\text{-}2500} \leq 52$ dB. Other developers may require class C but also use “class B as a design goal”, or they specify class B for floors and walls but only class C for noise levels from traffic and service equipment.

It has been questioned, whether these “design goals” result in better subjective sound climates, or if it would be more cost-efficient to design all parts of the building strictly for the same sound class. For this purpose, it is necessary to perform enquiries among habitants, to find their opinions on various sources of noise.

However, the structure of an enquiry may affect the results, which means that both questions and answer categories need to be considered carefully. This paper discusses some experiences of enquiries, but over the coming 2-3 years, a network of European acousticians are going to outline a uniform questionnaire that can be used in future studies. This network is organized in a so called EU COST-activity (TU0901) under lead of the Danish building research institute SBI in Aalborg.

Questionnaires

Questionnaires of different styles have been used since long to measure the habitants subjective judgment of their dwellings. Since these questionnaires did not follow any standard (i.e. the questions and answers are not the same), it is difficult to compare their answers. Some public authorities have made sociological surveys to give a broad view of the status of the Swedish buildings, before and after some substantial changes of the regulations have

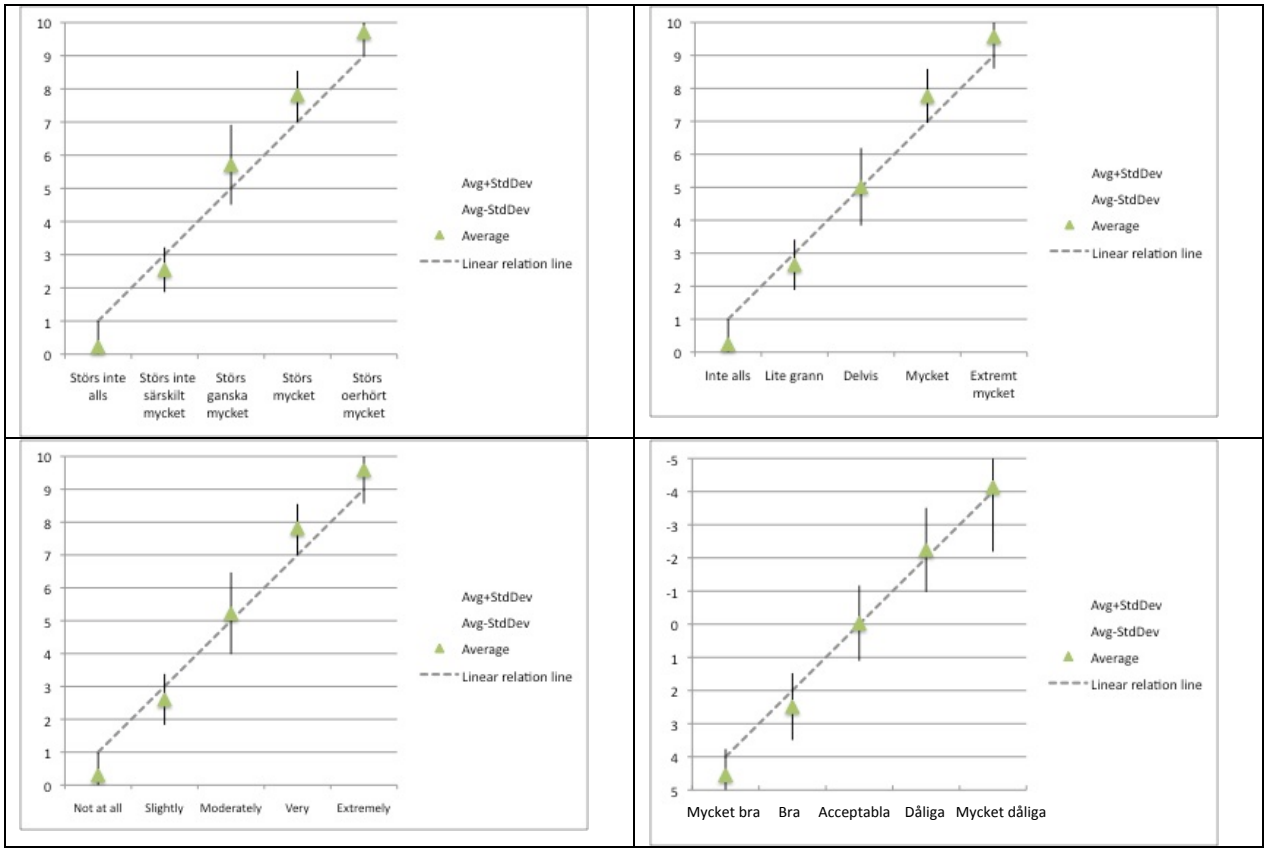
been undertaken. But since there are no data of the buildings themselves, the subjective responses of these studies cannot be related to the properties of the buildings. The same patttern seem to be prevailing in some other EU-member states as well. This calls for some kind of standardization.

Hence, in order to facilitate comparisons of sociological surveys (response of habitants), it would be benefitial to develop a uniform questionnaire. It would also be benefitial to include instructions on how to compare these subjective results to a measured or calculated building performance (i.e. make a combined socio-acoustic surveys). When both subjective and objective data are available, the relation between the quantities can be derived by a correlation function, as is demonstrated in the next clause.

However, practical experiences have revealed several issues that need consideration. The exact formulation of a question influences its answers in a systematic manner (bias error). The method of contacting the respondents, their ability to understand each question and to project these to his or her own experience (of the questioned entity) may lead to additional errors. The respondents may interpretate the verbal or numerical response scales quite differently, which increase the random errors as well. As an example, the meaning of the response “Moderately disturbed” may vary considerably between individuals, as demonstrated by Botteldooren [1]. The type of answers offered by the questionnaire are important as well. The motivation to participate varies and it may be difficult to get answers from more than 2/3 of the habitants. Interviews may be more efficient than posted forms, since the respondent may be more motivated as well as getting some help to interpret the meaning of the questions and answers. There are indications, that a numerical response scale (scores) reduces the variability compared to category answers.

Figure 1 shows the results of a limited study, where 35 respondents of mixed ages and genders were asked to assign one numerical rating (score) 0-10 to each category answer. This was repeated 4 times, where 5 alternative answers were suggested. The average equivalences and the standard deviations of the ratings are shown in Figure 1.

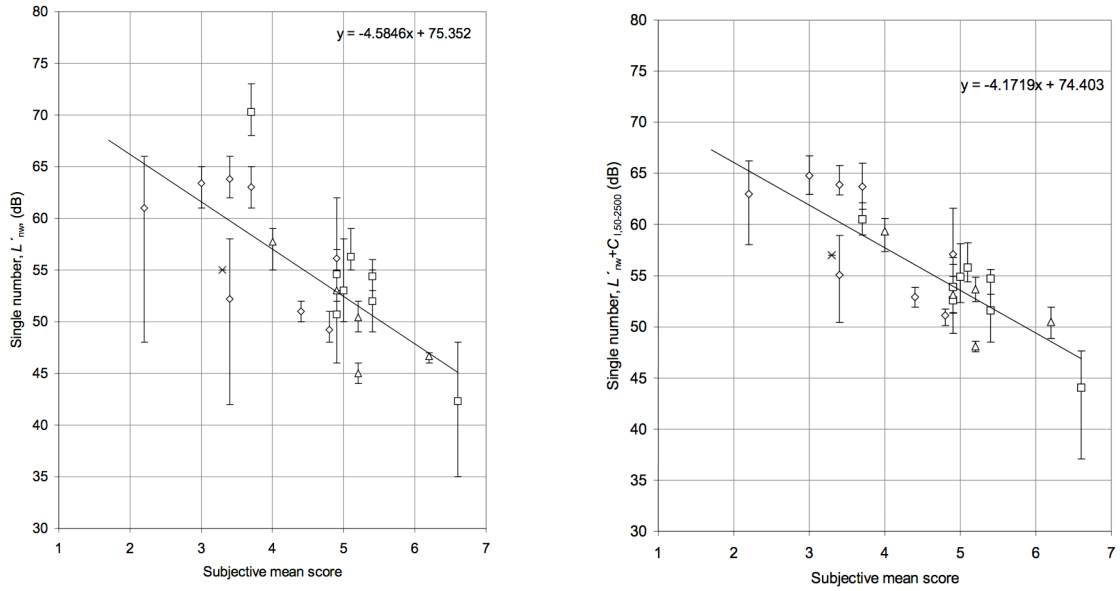
The top left figure shows a scale that has been used widely in Sweden to rate answers to questions on ‘How much does the noise disturb, bother or annoy you?’. It has been questioned, whether the answers would bias the responses, since all of them begin with ‘Disturbs me…’. See the discussion of Figure 5 as well. The top right Figure is a new version with the same question but slightly different answers, that were suggested as a translation of the ISO/TS 15666. The bottom left Figure is from ISO/TS 15666 (in English). The bottom right Figure has a different score, ranging from +5 (best) to -5 (worst) and the question is intended to be neutral - ‘How do you judge the sound conditions of your dwelling?’. The answers are then offered as ‘Very good, Good, Acceptable, Poor, Very poor’.



Figures 1. Conversion of some verbal category answers (ranging from good to poor) to numerical scale values 0-10 (scores). 35 respondents (of mixed ages and genders) were asked to pair all answers with the closest score, in their opinion. The figures show averages and +/- one standard deviation of the scores for each verbal answer. The diagonal lines are plotted to illustrate evenly distributed categories to the scores 1-3-5-7-9 or 4-2-0-2-4.

Example of a socio-acoustic survey and the correlation function

Hagberg [2] made a regression analysis of impact sound insulation on the basis of socio-acoustic surveys, where various measurands ($L'_{n,w}$ and $L'_{n,w} + C_{I,50\text{-}2500}$) were compared to the average subjective score from habitants of each building. The scores offered to the habitants were presented as a numerical scale 1-7, with the labels “Quite unsatisfactory” above the 1-2 scores and “Quite satisfactory” above the 6-7 scores. No more labels were used in this study. (Some enquiries has the label “Acceptable” placed above the score 4 to facilitate interpretation of the scale). The floors were made of solid concrete, hollow concrete, timber or steel. The choice of measurand influence its correlation to the average subjective score, as illustrated by the Figures 2. The results also indicate that the type of building structure influence the subjective score, where floors made of solid concrete tended to have higher (better) scores than estimated by the correlation function. On the contrary, lightweight floors (timber, steel) tended to have less satisfactory scores than anticipated by the correlation function. These results indicate that other factors influence the subjective score, e.g. impact sounds below the frequency range of the measurements, possibly also vibrations of the floors and walls. A new Swedish research project “AkuLite” has been initiated (2009-2012), to find better measurands that are neutral with respect to building construction materials and correlate better with the subjective scores.



Figures 2. Measured impact sound pressure level with two different weightings, correlated to the average subjective scores of each building type. a) $L'_{n,w}$ (r=74%) b) $L'_{n,w}$ + $C_{I,50\text{-}2500}$ (r=84%). From Hagberg [2].

The correlation function displayed in the Figure 2b was applied to the subjective scores of a new set of enquiries made in 7 buildings. The average scores of the habitants were used to estimate the expected weighted impact sound pressure levels for each building, including the spectrum adaption term; normalized to 10 m^2 sound absorption area ($L'_{n,w}+C_{I,50\text{-}2500}$). Two of these buildings were made of timber framed structures, the others were made of prefabricated concrete elements or concrete cast *in situ*. See Figure 3.

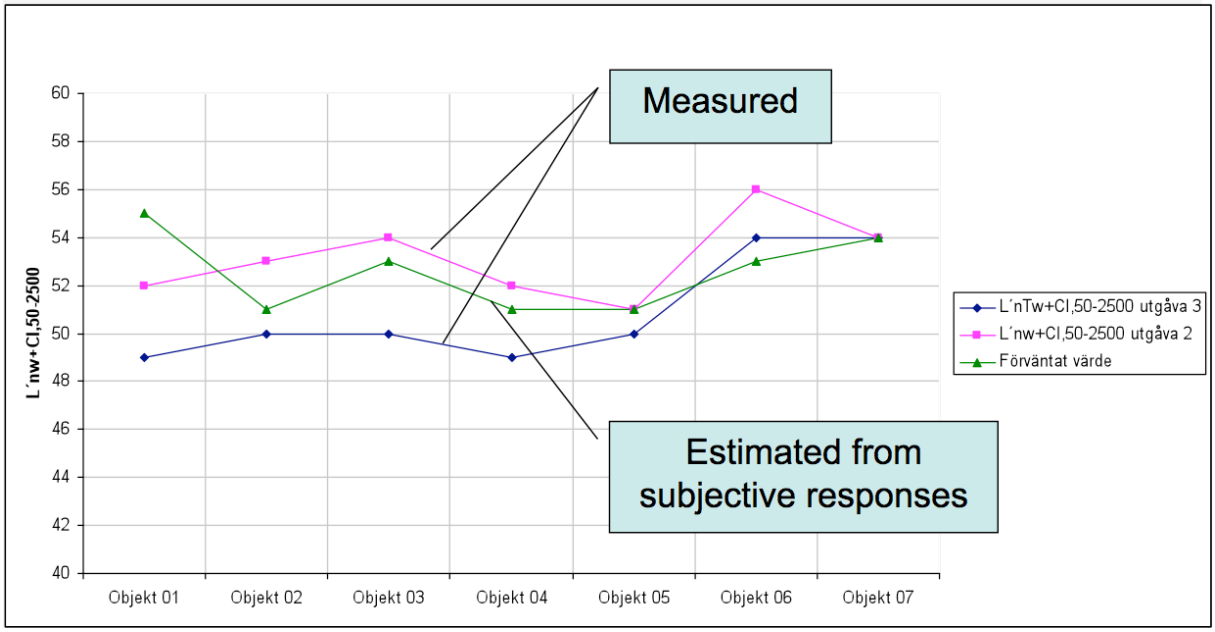
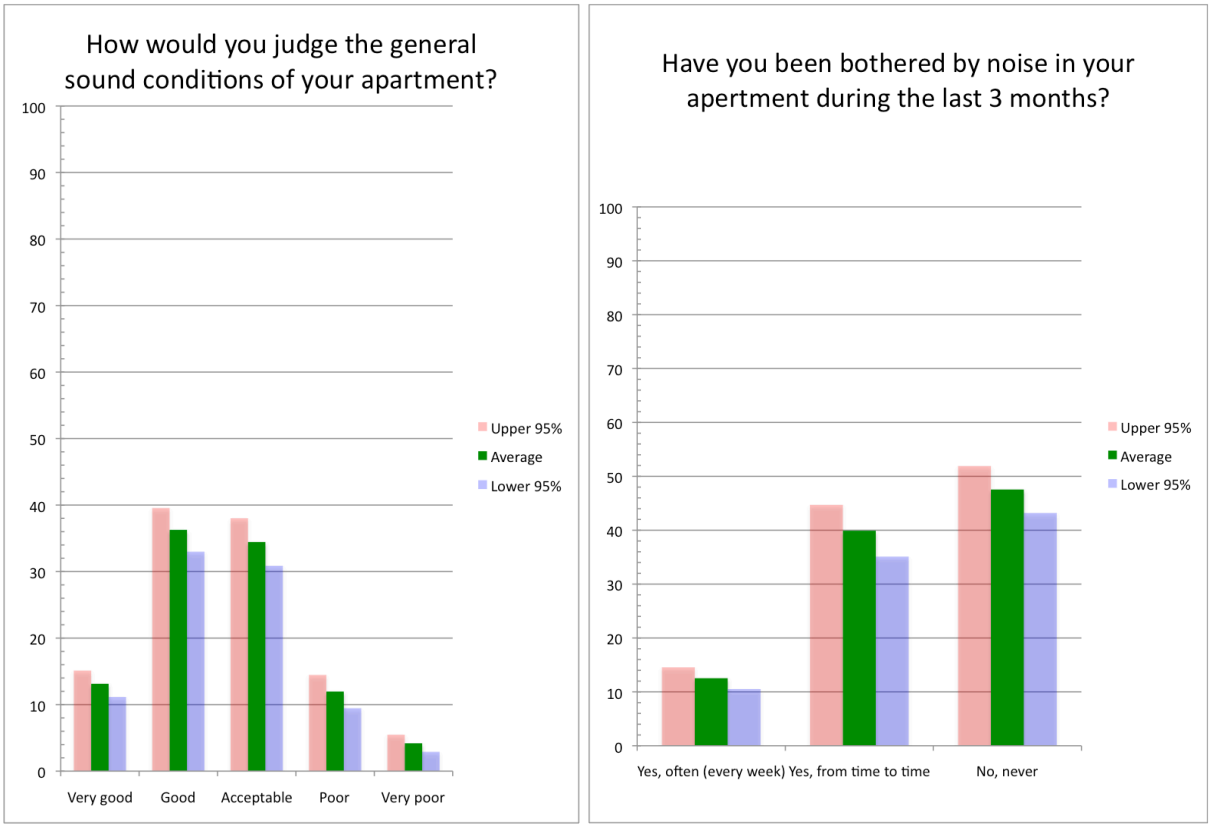


Figure 3: The average subjective scores of 7 new buildings were used to estimate the weighted normalized impact sound pressure levels $L'_{n,w}+C_{I,50\text{-}2500}$. In the lower graph, the measured single number $L'_{nT,w}+C_{I,50\text{-}2500}$ is calculated for comparison, which decreases with increasing room volume and sound absorption area. [3]

BETSI – a national enquiry and building construction survey

The National Board of Housing and Planning (Boverket) performed a survey in 2008, where 550 habitants of multi-family residential houses answered questions on noise annoyance and other indoor clima questions [4]. The available answers were 5 or 3 categories, as showed by Figures 4a and 4b. The bars indicate the uncertainty of the answers with respect to the stratified sampling of habitants from different types of house and parts of the country. They do not reflect the inherent uncertainty in the interpretation of the meaning of the question and the answers.



Figures 4. General assessments of the sound conditions in the BETSI enquiry on indoor clima of Swedish dwellings. a) about the general view of the sound conditions of the apartment, b) about the relative occurrence of noise events. Note: The original Swedish wordings used in the enquiry have been translated by this author for the purpose of this paper only (i.e. they are not authorized by Boverket). Each set of bars indicate the average response, the upper and lower uncertainty limits at a 95% confidence. [4]

During the planning work, the pre-defined answers to some of the questions were criticized because they were considered not evenly distributed along a subjective scale. The average response to these questions indicate that the scale used in the Figure 5 may bias the results. It can be compared to Figure 1 (top left), where the same alternatives are compared to other alternatives.

It is customary to add the three categories to the right (4, 5 and 6) of Figure 5 to calculate the 'percentage of people being disturbed by noise' as well as taking the sum of categories 1 and 2 as the "not-disturbed" ratio. This calculation is however very sensitive to the exact formulat-

ion of alternatives, which is demonstrated by a simple experiment. If the respondents had difficulties to choose between category 2 and 3 and if only 25% chose alternative 2 “not particularly disturbed” because the considered the next category “disturbed to some extent” a too strong judgement, then the ratio of disturbed people would change from 9 to 18%. It would probably have been clearer if the respondents could have choosen from a more or less continous scale.

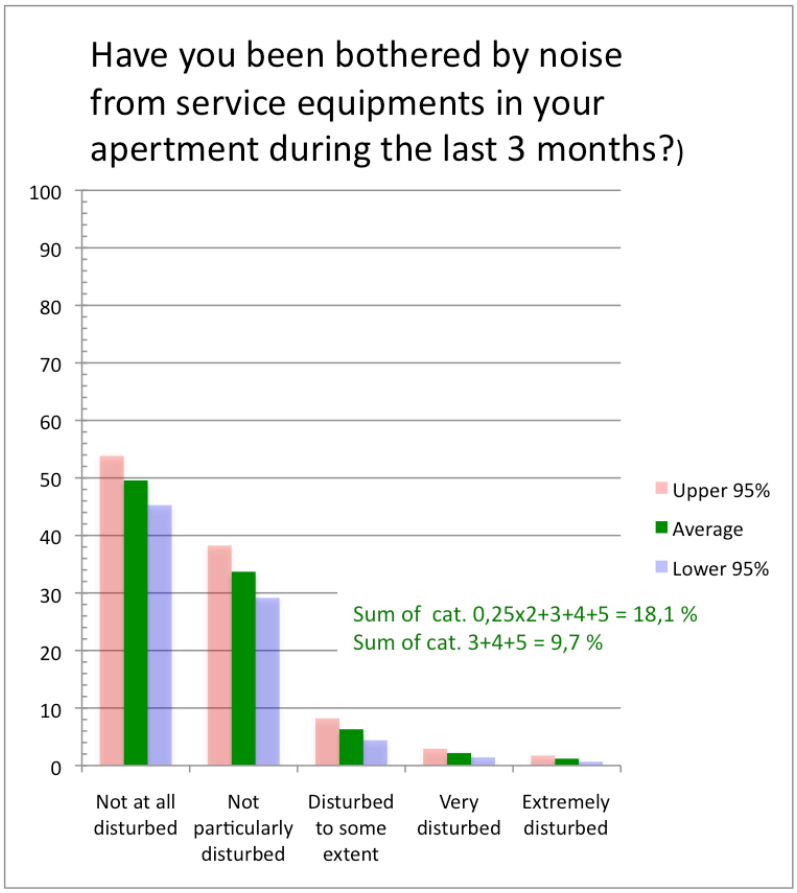


Figure 5. How much noise has bothered the habitant during the last three months. The sensitivity of the choice of category answers is illustrated by moving 25% of the “not particularly disturbed” to the next category“disturbed to some extent”. The simplified result “being disturbed” changes from 9 to 18%. Note: The original Swedish wordings used in the enquiry have been translated by this author for the purpose of this paper only (i.e. they are not authorized by Boverket).

Other studies, for instance the Swedish national surveys on indoor clima factors (NMHI 1999 and NMHI 2007) have revealed similar results and their results may be questioned for the reasons mentioned above. However, they indicate that houses built after 1998 are more satisfactory which may be explained by new sound requirements introduced 1998.

Other surveys in residential houses

In a limited study, habitants of new buildings have been asked about how they perceive the acoustic conditions (in general). They were also asked about how important they judge this property of their dwelling, and the average score was typically 4,5-5,0 on a 5 graded scale, i.e. the habitants consider acoustic conditions as a vital property of their dwelling.

Two developers have contributed their average scores and these were typically about 4,0-4,3 on the 5-grade scale. The developers have concluded that the sound insulation and sound

pressure levels from service equipment are satisfactory from their point of view, although there are always about 5% of the habitants who are not satisfied. This ratio seem to be uncorrelated to the average score. This could be related to a higher sensitivity to noise, higher expectations on the dwelling or the neighbours making more noise than the average. Other factors than noise may influence the results as well. The results also support the concept of using the sound class B for the sound insulation between apartments but class C for the noise levels. This should be investigated further, since there may be differences between different sources of noise.

There are typically some technical problems that need careful planning in each new project. Noise from remote traffic, heating and ventilation that is broadband and stable seem not to bother habitants to much and it could even be considered to relieve the noise limits of class C with respect to these sources by 1 or even 2 dB. This would help lowering the building costs somewhat since ducts and pipes could be made slightly smaller.

Other types of noise are on the contrary considered untolerable even when their levels are low, e.g. from the WC usage, flushing water through the sewage water pipes, tonal and impulsive noise from the elevator as well as the laundry machines. Distinct low frequency traffic noise from trucks or buses or motorcycles passing close to the apartments bother people severly, in particular late in the evening or night. Some types of noise can often be avoided at a very low cost, e.g. by a better floor plan or some vibration insulating inserts applied to the service equipments. Some developers may refer these problems to the habitants being too sensitive to sounds *a priori*, but other developers recognize these problems and try to correct them. They also strive to improve their procedures for verification of the design and external control at the building site, to advoid costly refurbishment measures.

Enquiry among acousticians and building contractors: Some acousticians get a broad view of the prevalence of disturbing sounds. Some of them will be interviewed to get their views on the current requirements. Later this year, there will be two public seminars, where builders, developers etc. can discuss the sound classification standard with members of the technical committee.

COST TU0901 European network of researchers develop new guidelines: As mentioned above, there is a new network of researchers in the field of building acoustics who will try to agree on a new questionnaire or at least describe the state of the art and possible developments in the future. This activity also includes new guidelines on listening tests in the laboratory. Its other working groups will deal with a common scheme for sound classification of buildings (WG 1) as well as a catalogue on robust constructions and building elements (WG 3).

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Are you disturbed by noise in your house?

[*LOGO OF INSTITUTE*]

Investigation – purpose N.B! TEXT IN *ITALICS* SHOULD BE ADAPTED BY INSTITUTE TO THE ACTUAL CONDITIONS, BUT KEEP THE MAIN INFORMATION

[*THE INSTITUTE*] has been commissioned by [*THE COMMISSIONER / AUTHORITY*] to research whether residential buildings in [*THE COUNTRY*] have satisfactory design with respect to their protection against noise. Several buildings have been selected randomly for a survey. This building was included for statistical reasons only.

Your answers to the attached questionnaire help us define appropriate requirements on building constructions [*in the building regulations or equivalent*]. The requirements must prevent poor constructions being adopted but also enable cost efficient constructions to be used. Too high requirements would lead to unnecessary building costs. For these reasons, it is important to ask residents about their opinions and check whether the noise protection within the building is satisfactory.

We thank you for taking your time. Your responses will be treated statistically and confidentially. The results and your personal data are only used for this research and will not be used for any other purpose.

Please fill in your personal data below and the questionnaire on the 2nd page:

YOUR PERSONAL DATA. N.B! [THESE DATA ARE ONLY FOR THIS SURVEY AND SHOULD BE DELETED BY THE INSTITUTE AFTER THE ANALYSIS]

You are:	Female ☐	Male ☐				:
Age:	18-25 ☐	26-39 ☐	40-64 ☐	>65 ☐		
Working schedule:	Day ☐	Evening / night ☐	Mixed ☐	Not applicable ☐		
Years of residence:	0-1 ☐	2-5 ☐	6- ☐			
Nº of person in the household:	1 ☐	2 ☐	3 ☐	4-6 ☐	6- ☐	Apartment ID:: [*FILLED IN BY INST*]

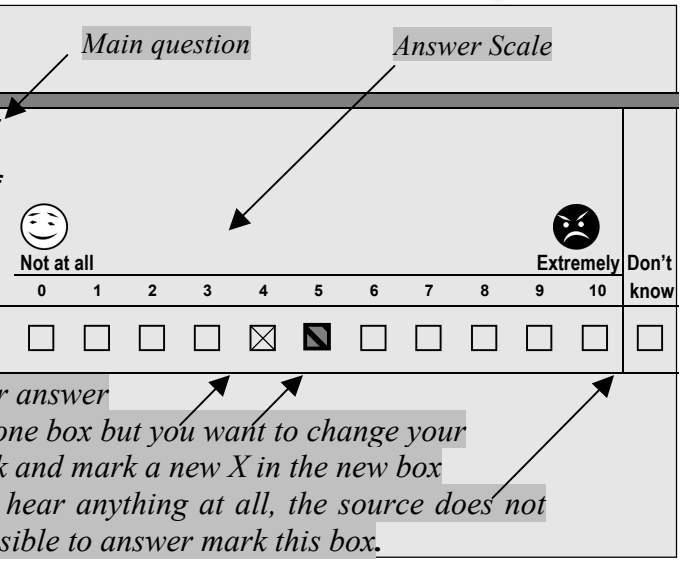
Leave the completed questionnaire in the [*DELIVERY PLACE / post the attached envelope with address & stamps*].

- In case you would like to submit your answers on the internet,
  - visit our information site www.[*SURVEY-WEBSITE.cc*]
- If you have any questions or prefer to leave your answers by a telephone call
  - call our Help Desk: [+*cc xxx yyy zzz*]
  - e-mail to [*enquiry@INSTITUTE-CONTACT.cc*]
  - visit our information webpage www.[*SURVEY-INFO-WEBSITE.cc*]

Thank you for your cooperation!
[*NAME of responsible part for the enquiry*]
[*INSTITUTE*]

Continue on page 2

EXAMPLE: HOW TO ANSWER THE QUESTIONS ON NEXT PAGE:



Thinking about the last 12 months in your house, what number from 0 to 10 best shows how much you are bothered, disturbed or annoyed by ***these sources of noise?*** *...(This could also be if the noise interferes with your own activities, e.g listening, reading etc.)*

1. Neighbours; daily living, e.g. people talking, audio, TV through the **walls** (*you may write what you hear here*__)

Make an ***X*** *in the box with your answer*

- *If you already marked out one box but you want to change your answer, fill the box in black and mark a new X in the new box*
  - *In case you do not hear anything at all, the source does not exist or it is not possible to answer mark this box.*

Instructions: v1.0 2011-05-31

Choose an answer on the 0-to-10 scale for how much noise bothers, disturbs or annoys you when you are in your house.

if you hear a small amount of noise AND you are not at all disturbed by it, ***choose 0***	*if you are extremely bothered, disturbed or annoyed by it,* ***choose 10***	*if you are somewhere in between,* ***choose a number from 1 to 9***	*if you do not hear anything at all, the source does not exist or if you cannot answer,* ***choose "Don't know"***

Thinking about the last 12 months in your house, how much are you bothered, disturbed or annoyed by	Not at all 0	1	2	3	4	5	6	7	8	9	Extremely 10	Don't know
1. Noise **in general** e.g. from neighbours, technical installations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Thinking about the last 12 months in your house, how much are you bothered, disturbed or annoyed by ***these sources of noise?***	Not at all 0	1	2	3	4	5	6	7	8	9	Extremely 10	Don't know
2. Neighbours; daily living, e.g. people talking, audio, TV through the **walls** (what is heard?_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Neighbours; daily living, e.g. people talking, audio, TV through the **floors / ceilings** (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Neighbours; Music with bass and drums	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Neighbours; footstep noise, i.e. you hear when they walk on the floor	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Neighbours; rattling or tinkling noise from your **own** furniture when the neighbours move on the floor above you	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Staircases, access balconies etc; people talking, doors being closed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Staircases, access balconies etc; footsteps or other impact sounds	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Water installations; plumbing, using or flushing WC, shower	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Climate installations; heaters, air condition, air terminal devices (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Service installations; elevators, laundry machinery, ventilation machinery (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Premises; garages, shops, offices, pubs, restaurants, laundry rooms or other, heard **indoors** with windows closed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Traffic (cars, buses, trucks, trains or aircraft); heard **indoors** with **windows closed**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Own family; heard **within your dwelling** with doors **closed**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Before *moving to the apartment, how important was the sound insulation to you, with respect to*	Not at all important 0	1	2	3	4	5	6	7	8	9	Extremely important 10
15. Noise in general e.g. from neighbours, technical installations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Are you tolerant or sensitive with respect to	Tolerant, not at all sensitive 0	1	2	3	4	5	6	7	8	9	Extremely sensitive 10
16. Noise in general e.g. from neighbours, technical installations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments (describe important sources of noise, type of premises, neighbour activities etcetera):

Questionnaire application notes to the Institute

When you use this questionnaire template in your own survey, please consider:

- It is intended for socio-acoustic surveys, where objective (physical) data on the acoustic performance of buildings and service equipments are compared to the subjective evaluation by the residents, in order to establish dose-response relationships. Annoyance is chosen as the measurand according to ISO/TS 15666 (1st ed. 2003) since it has proved to reduce the scatter of responses, although the type of direct question may lead to an apparent over-estimation of the general annoyance. In the course of developing this questionnaire, less inducing types of question were considered, but the ISO/TS 15666 question was finally thought to be the best choice for this purpose.
- It is not intended for broad prevalence surveys to characterize the general degree of annoyance from noise in the population of a city or a country, nor its causes, nor its effects on health, nor to assess the neighbours attitudes, neighbours behaviour etcetera.
- The institute may also interview the residents after the survey if it is important to understand the reasons for poor performance of the building e.g. when planning for refurbishments. It may then be practical to keep asking whether residents reporting disturbance could hear shouting, talking, low-mid-high pitch sounds, any particular room etc etc. This leads to a fairly well grounded best guess about which paths to look into and whether the neighbour or the building needs corrections. However, this is not the main focus of the questionnaire and should not be a part of broad surveys.
- If it is more relevant for your purpose of the survey, you should make minor changes to the questions, e.g. types of service equipments, ask for other periods than 12 months etc, but they should preferably be expressed in a similar manner as the above template suggests in order to get results that can be compared to other surveys (which is a main purpose of this questionnaire).
- It is not intended for research on annoyance from traffic noise outdoors. There are other questionnaires designed for this purpose. The question on façade insulation is only included to assess whether the habitant judge the building elements (wall, window, air inlet etc.) appropriate with respect to their sound insulations.
- Translations into other languages should be 'blind tested' such that groups of bilingual persons give similar answers to both versions. ISO/TS 15666 give advice and examples. The numbering and order of questions shall not be changed and the layout shall be maintained as close as possible. Only changes necessary for the translated texts to fit should be made.

The institute shall collect data on the building constructions and service equipment **prior to** the enquiry. All questions that are not relevant for the buildings shall be blocked (strike-through texts) and painted with a 50%-grey shadow. This is to show that such questions are considered in other buildings but the institute considers them irrelevant in this specific building. This is to avoid leading questions in the form.

Survey procedure:

Step 1: Inform all habitants beforehand about a survey being made soon in the house, e.g. according to the first page. Explain the purpose of this survey is research on the building regulations only. Our company [THE HOUSING COMPANY] participates in this survey. You will receive a questionnaire and an envelope. Please fill in and leave the envelope according to the instructions, see page 1.
Step 2: Distribute the questionnaires to all habitants.
Step 3: Collect the questionnaires.
Step 4: Remind habitants (who did not yet answer) once by post or by one telephone call, not more.

The institute shall provide instructions to the residents, including answers to frequently asked questions to the extent judged to be necessary in each case (FAQ).

If the survey is made by telephone the institute shall also provide guidelines for telephone interviewers etc in order to facilitate a smooth and uniform interview. See ISO/TS 15666.

(This page is for the institute only. Do not include in the survey)

Building data – to be collected prior to the enquiry.

The purpose of collecting building data is to allow an acoustician to estimate the sound pressure levels from technical equipment and sound insulations to neighbouring apartments.

Note on the application of these building data: The data facilitate comparisons to other buildings and theoretical calculation of sound insulation between rooms and to the outside (wall, window, air inlet etc.).

When building information indicates a question in the questionnaire be irrelevant, 'block' this question.

Survey Information Filled in by Survey Institute													
Form Number													
Building ID:													
Country:			City			Postal Code							
Address:													
BUILDING SITE PLAN AND INFORMATION Filled in by Survey Institute (for outdoor noise calculations)													
Wide site plan: shows the situation of the building with respect to the traffic or other sources of noise. (Urban Plan scale1:5.000 or 1:10.000)													
Street building plan situation: shows the relation with the next buildings and the street. (Plan scale 1:500 or 1:200)													
Street building cross section: shows the size and position of the windows facing the road													
Distance to (km)	Highways		Roads		Train / Trams		Bus		Airport		Pub, Disco, Music Area	___	Recreation, sports area
Building equipment													
Individual heater/cooler	Special heater * ☐	Water Heater ☐	Electric Heater ☐	Air conditioner ☐	Cooling unit ☐	None ☐							
Central heating /cooling	Special heater * ☐	Water Heater ☐	Electric Heater ☐	Air conditioner ☐	Cooling unit ☐	None ☐							
Machinery room/outside	Air handling unit ☐	Compressor unit (exterior) ☐	Compressor unit (interior) ☐	Other ☐									
Central equipment	Laundry ☐	Spin Dryer ☐	☐	Other ☐									
Floor premises:	Gym ☐	offices ☐	Schools ☐	Clinic ☐	Other ☐								
Ground floor premises	Laundry rooms ☐	Garages ☐	Shops ☐	Offices/Clinic ☐	Restaurants /Pub /Discos ☐	Other ☐							
DWELLING PLAN INFORMATION Filled in by Survey Institute (to estimate airborne and impact sound insulation)													
Building floor plan: shows whole floor including the dwelling of the survey and its neighbouring apartments (Scale from 1:100 or 1:200)													
Dwelling cross section: shows the rooms' position with respect to the rooms above and below. **Indicate heavy and light walls**. (Scale from 1:50 to 1:100)													
Floor detail: shows the materials and the layers used, from top-bottom. State the thicknesses and surface weights (Scale from 1:5 to 1:50)													
Ceiling detail: shows the materials and the layers used, from bottom-top. State the thicknesses and surface weights (Scale from 1:5 to 1:50)													
Exterior Walls detail: shows the materials and the layers used, outside to inside. State the thicknesses and surface weights (Scale from 1:5 to 1:50)													
Partition wall detail (separating apartments): shows the materials and the layers, thicknesses and surface weights. (Scale from 1:5 to 1:50)													
Partition wall detail (facing staircases or corridors): shows the materials and the layers. (Scale from 1:5 to 1:50)													
Window glass type:	Describe the glass panes, from outside to the inside: e.g. 4 float, 36 air, 4 float-9 gas-laminate 4/0,76/4. | **Gross surface**:____ m2												
Window frame type:	Wood or Wood/Aluminium ☐	Steel/Aluminium ☐	PVC ☐	**Window seals ok?**	Yes ☐	No ☐							
Elevators next to room:	Yes ☐	No ☐											
Central Staircases:	Yes ☐	No ☐	Staircase structure:	Light (steel, wood...) ☐	Heavy (Concrete) ☐								
OTHER DWELLING INFORMATION Filled in by Survey Institute													
House type:	Highrise ☐	Detached, >1 apts ☐	Detached, 1 apt ☐	Terraced house ☐	Villa ☐								
Apartment / Loft Floor:	Basement ☐	Intermediate ☐	Floor Nº _	N of rooms:____									
Type of Ownership:	Rental ☐	Membership or Self owned ☐											
Extras:	Quiet balcony ☐	Access to quiet Outdoor area ☐	Own garden ☐										
Nº Apartments per floor:	_____												
Apartments above floor:	Yes ☐	No ☐											

**) Note: Specifications to the categories may be given on a separate sheet.*

Störs du av buller i din bostad?

[*LOGOTYPE FÖR INSTITUTET*]

Syfte med undersökningen OBS! *KURSIVERADE TEXTER* BÖR ANPASSAS AV INSTITUTET TILL AKTUELLA FÖRHÅLLANDEN. BEHÅLL HUVUDDELEN AV INFORMATIONEN OM SYFTEN MM

[*INSTITUTET*] gör en undersökning på uppdrag av [*UPPDRAGSGIVAREN*] om bostadshusen har ett tillfredsställande skydd mot buller. Flera byggnader har valts ut slumpmässigt för en enkätundersökning. Denna byggnad har valts ut enbart av statistiska skäl.

Era svar på det bifogade frågeformuläret hjälper oss att ställa rätt ljudkrav på bostadshusen [*i byggreglerna*]. Ljudkraven måste utformas så att olämpliga konstruktioner inte kommer till användning, men samtidigt måste man få lov att använda kostnadseffektiva konstruktioner. Alltför hårda krav skulle driva upp byggkostnaderna. Därför är det viktigt att fråga boende om deras uppfattningar och om byggnadens bullerskydd är tillfredsställande.

Vi tackar för att ni tar er tid att fylla i enkäten. Era svar behandlas statistiskt och konfidentiellt. Resultaten och era personuppgifter används bara i denna undersökning och kommer inte att användas på något annat sätt.

Vänligen fyll i några uppgifter om er själv och besvara därefter frågeformuläret på nästa sida.

DINA PERSONLIGA UPPGIFTER. OBS! [DESSA DATA ÄR ENBART FÖR ENKÄTEN OCH SKA INTE ANVÄNDAS PÅ ANDRA SÄTT]

Du är:	Kvinna ☐	Man ☐	Lägenhetsnummer: *[SKRIVS IN I FÖRVÄG AV INST.]*		
Ålder:	18-25 ☐	26-39 ☐	40-64 ☐	>65 ☐	
Arbetstider:	Dagtid ☐	Kväll eller Natt ☐	Växlar ☐	Inte aktuellt ☐	
Hur många år har du bott här:	0-1 ☐	2-5 ☐	6- ☐		
Antal personer i hushållet:	1 ☐	2 ☐	3 ☐	4-6 ☐	6- ☐

Vänligen lämna det ifyllda formuläret i [*UPPSAMLINGSSTÄLLE, HUS XX / i bifogat frankerat svarskuvert*].

- Om ni skulle vilja svara via internet istället,
  - besök vår hemsida www.[SURVEY-WEBSITE].cc
- Om ni har några frågor eller om ni föredrar att lämna era svar på telefon,
  - ring Kundmottagningen på telefon: +cc xxx yyy zzz
  - sänd e-mail till enquiry@[INSTITUTE-CONTACT].cc
  - besök vår informationshemsida www.[SURVEY-INFO-WEBSITE].cc

Tack för er medverkan!
[*NAMN PÅ ANSVARIG FORSKNINGSLEDARE*]
[*INSTITUTET*]

Fortsätt till sidan 2

EXEMPEL: HUR MAN SVARAR PÅ FRÅGORNA I ENKÄTEN:

Huvudfråga *Svarsalternativ*

Hur mycket har du störts i din bostad under de senaste 12 månaderna på grund av ***följande bullerkällor***	Inte alls 0	1	2	3	4	5	6	7	8	9	10 Oerhört mycket	Vet ej
– Grannar; vardagliga ljud från samtal, telefon, radio, TV genom **tak eller golv** (*skriv gärna vad som hörs här:__*)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
– Grannar; musik med bas och trummor	☐	☐	☐	☐	☒	■	☐	☐	☐	☐	☐	☐

Detta kan också vara om bullret stör dina egna aktiviteter, t.ex. lyssning, läsning

- *Markera svaret med **ett** tydligt X*
- *Om du vill ändra ditt svar, stryk över hela kryssrutan och sätt ett nytt X för det nya svaret*

Om du inte kan höra något buller alls, ljudkällan inte finns, eller du inte kan svara, sätt ett X längst ute till höger.

Instruktioner: v1.0 2011-05-31 SWE

Välj en siffra på skalan 0-10 för hur mycket du besväras, störs eller irriteras av buller i din bostad:

Om du hör lite buller OCH inte alls störs av det, ***svara 0***	*Om du upplever att bullret stör oerhört mycket,* ***svara 10***	*Om du störs till viss del av bullret, svara med en siffra* ***mellan 1 och 9***	*Om du inte hör något buller, eller bullerkällan inte finns, eller du inte kan svara på frågan, svara "****Vet ej****"*

Hur mycket har du störts i din bostad under de senaste 12 månaderna på grund av	Inte alls 0	1	2	3	4	5	6	7	8	9	Oerhört mycket 10	Vet ej
1. Buller från grannar, tekniska installationer med mera	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Hur mycket har du störts i din bostad under de senaste 12 månaderna på grund av ***följande bullerkällor***	Inte alls 0	1	2	3	4	5	6	7	8	9	Oerhört mycket 10	Vet ej
2. Grannar; vardagliga ljud från samtal, telefon, radio, TV genom **väggarna** (vad hörs?:_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Grannar; vardagliga ljud från samtal, telefon, radio, TV genom **taket eller golvet** (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Grannar; musik med bas och trummor	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Grannar; stegljud, dvs. du hör när de går på golvet	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Grannar; det skallrar eller klingar i **dina egna** möbler när folk rör sig i lägenheten ovanför	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Trapphus, loftgångar; samtal, dörrar som stängs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Trapphus, loftgångar; stegljud, slag mot trappräcke	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Vatten- och avloppsrör; användande eller spolning i WC, dusch (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Värme, kyla och luftbehandling; radiatorer, luftkonditionering, till- och frånluftsdon (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Maskiner; hissar, tvättmaskiner, värmepumpar, fläktar (____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Lokaler; garage, affärer, kontor, pubar, restauranger, tvättstugor o dyl, som hörs **inomhus** med **stängda fönster**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Trafik; bilar, bussar, lastbilar, tåg eller flyg, som hörs inomhus med stängda fönster (_____)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Egna familjemedlemmar; ljud som hörs **inom din egen bostad** med **stängda** dörrar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Innan *du flyttade till din nuvarande bostad, hur viktig ansåg du* ***då*** *att ljudisoleringen var mot*	Inte alls viktig 0	1	2	3	4	5	6	7	8	9	Oerhört viktig 10
15. Buller från grannar, tekniska installationer med mera	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Har du överseende med, eller är du känslig för	Överseende med, inte alls känslig 0	1	2	3	4	5	6	7	8	9	Oerhört känslig 10
16. Buller från grannar, tekniska installationer med mera	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Kommentarer (beskriv bullerkällor, typ av lokaler, grannars aktiviteter med mera):

Kommentarer till institutet för användning av frågeformuläret

När ni använder detta formulär, vänligen tänk på följande:

- Detta frågeformulär är avsett för socio-akustiska undersökningar där objektiva (fysikaliska) data rörande byggnaders och installationers akustiska kvalitet jämförs med de boendes subjektiva uppfattning för att kunna fastställa dos-responssamband. Störning är vald som primär mätstorhet enligt ISO/TS 15666 eftersom det begreppet har visats minska spridningen i svaren, även om de resulterande frågorna kan leda till en skenbar överskattning av den allmänna störningen. Andra former av frågor som skulle vara mindre ledande prövades tidigt i utvecklingsarbetet med detta formulär, men slutligen visade det sig att en frågeställning enligt ISO/TS 15666 verkade mest lämpad för formulärets syfte.
- Frågeformuläret är inte avsett för breda undersökningar om generellt upplevda bullerstörningar inom en stads eller ett lands befolkning, och inte heller för att undersöka bullrets hälsoeffekter, inte orsaker till bullret, grannarnas attityder eller uppförande med mera.
- Institutet kan intervjua de boende efter att frågeundersökningen har genomförts, om det är viktigt att förstå orsaker till eventuella ljudproblem, t.ex. i samband med renoveringsarbeten. Det kan därvid vara praktiskt att fråga de boende vad de hör, skrik, samtal, höga eller låga frekvenser, vilka rum det gäller m.m. Svaren kan ge en bra uppfattning om vilka ljudkällor det handlar om, vilka skiljekonstruktioner som bör granskas eller om störningen beror på grannarnas beteende snarare än på byggnaden. Emellertid är dessa frågor inte prioriterade i enkätmallen och bör inte vara en direkt del av en undersökning där mallen används.
- Om det är nödvändigt att göra ändringar för syftet med en undersökning kan man göra mindre justeringar av frågorna, t.ex. typ av ljudkällor, annan tidsperiod än 12 månader m.m. Men frågorna bör formuleras så att de har en likartad karaktär som enkätmallen för att det ska gå att jämföra resultaten med andra undersökningar. Detta är syftet med enkätmallen.
- Frågeformuläret är inte avsett att användas vid forskning om störningar av trafikbuller utomhus. Det finns andra formulär som är bättre utformade för detta. Frågan om fasaders ljudisolering är endast medtagen för att utröna om de boende bedömer byggnadsdelarna (vägg, fönster, ventilationsdon etc.) som tillfyllest med avseende på deras ljudisolering.
- Översättningar till andra språk bör göras av tvåspråkiga översättare direkt från den engelska mallen. ISO/TS 15666 ger råd och exempel. Frågornas nummer eller inbördes ordning skall inte ändras och layouten skall behållas så långt som möjligt.

Institutet skall samla in data om relevanta byggnadskonstruktioner och tekniska installationer **innan frågeformuläret sänds ut**. De frågor som bedöms som irrelevanta för den aktuella undersökningen skall strykas igenom med en linje och mörkas med grå färg. Detta för att visa att dessa frågor används i andra fall men att institutet bedömt dem som irrelevanta i den aktuella byggnaden. På detta sätt undgås att man måste ställa frågor i flera steg i enkäten.

Undersökningsgång:

Steg 1: Informera alla boende om att en undersökning kommer snart att göras i byggnaden. Förklara att undersökningens syfte enbart är forskning om byggregler. Vårt företag [UPPDRAGSGIVAREN] deltar i detta projekt. Du kommer att få ett frågeformulär och ett kuvert. Var vänlig och fyll i formuläret och lämna det i bifogat kuvert [UPPSAMLINGSSTÄLLE, HUS XXX, frankerat svarskuvert e dyl].
Steg 2: Distribuera formulären till alla boende.
Steg 3: Samla in formulären.
Steg 4: Påminn svaranden en gång per post eller en gång med telefonsamtal, inte mer.

Institutet skall förse de boende med instruktioner, inklusive svar på vanliga frågor i en utsträckning som bedöms lämplig för varje enskilt fall (FAQ).

Om undersökningen görs via telefon skall institutet tillhandahålla riktlinjer för intervjuarna så att samtalen löper smidigt och på ett likartat sätt, se ISO/TS 15666.

Denna sida följer t.v. det engelska originalet, målet är att översätta texten till svenska när malldokumentet är färdigt).

(This page is for the institute only. Do not include in the survey)

Building data – to be collected prior to the enquiry.

The purpose of collecting building data is to allow an acoustician to estimate the sound pressure levels from technical equipment and sound insulations to neighbouring apartments.

Note on the application of these building data: The data facilitate comparisons to other buildings and theoretical calculation of sound insulation between rooms and to the outside (wall, window, air inlet etc.).

Survey Information Filled in by Survey Institute														
Form Number	____													
Respondent:														
Country:	__________		City	__________			Postal Code							
Address:														
BUILDING INFORMATION Filled in by Survey Institute (the purpose it is to allow outdoor calculations in case no measurement data or not Urban noise plans)														
Building site plan information														
Wide site plan: shows the situation of the building with respect to the traffic or other sources of noise. (Urban Plan scale1:5.000 or 1:10.000)														
Street building plan situation: shows the relation with the next buildings and with the street. (Plan scale 1:500 or 1:200)														
Street building cross section: shows the size and position of the windows facing the road														
Distance to (km)	Highways	_	Roads	_	Train / Trams	___	Bus	___	Airport	___	Pub Disco / Music Area	___	Outdoor area	_
Building equipment														
Individual house heat	Heater	☐	Water Heater	☐	Electric Heater	☐	Air conditioner	☐	Cooling unit	☐	None	☐		
Central heating system	Heater	☐	Water Heater	☐	Electric Heater	☐	Air conditioner	☐	Cooling unit	☐	None	☐		
Individual Heater/cooling	Air handling unit(exterior)	☐	Compressor unit(exterior)	☐	Compressor unit (interior)	☐	Other	☐						
Central cooling units	Air handling unit(exterior)	☐	Compressors units(exterior)	☐	Compressor unit (interior)	☐	None	☐						
Central equipment	Laundry	☐	Dryer	☐		☐	Other	☐						
Floor premises:	Gym	☐	offices	☐	Schools	☐	Clinic	☐	Other	☐				
Ground floor premises	Laundry rooms	☐	Garages	☐	Shops	☐	Offices/Clinic	☐	Restaurants /Pub /Discos	☐	Other	☐		
DWELLING PLAN INFORMATION Filled in by Survey Institute (the purpose is to estimate airborne and impact sound insulation, e.g. according to EN 12354)														
Building floor plan: shows whole floor with the dwelling of the study and all the neighbours apartments (Scale from 1:100 or 1:200)														
Dwelling cross section: shows the rooms' situation and the type of room above and below. (Scale from 1:50 to 1:100)														
Floor detail: shows the materials and the layer used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Roof detail: shows the materials and the layer used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Exterior Walls detail: shows the materials and the layers used to be able to estimate the insulation. State the thickness (Scale from 1:5 to 1:50)														
Partition wall detail (separating next apartments): shows the materials and the layer to be able to estimate the insulation. (Scale from 1:5 to 1:50)														
Partition wall detail (separating staircases or corridors): shows the materials and the layer to be able to estimate the insulation. (Scale from 1:5 to 1:50)														
Window glass type:	Describe the glass pane													
Window frame type:	Wood or Wood/Aluminium	☐	Steel/Aluminium	☐	PVC	☐	**Window seals ok?**		Yes	☐	No	☐		
Elevators next to room:	Yes	☐	No	☐										
Central Staircases:	Yes	☐	No	☐	**Staircase structure:**		Light (steel, wood...)	☐	Heavy (Concrete)	☐				
OTHER DWELLING INFORMATION Filled in by Survey Institute														
House type:	Detached house	☐	Terraced housing	☐	Apartment	☐	Villa	☐						
Apartment / Loft Floor:	Basement	☐	Intermediate	☐	Floor Nº	_	N of rooms:____							
Type of Ownership:	Rental	☐	Membership or Self owned	☐										
Extras:	Quiet balcony	☐	Access to quiet Outdoor area	☐	Own garden	☐								
Nº Apartments per floor:	_____													
Apartments above floor:	Yes	☐	No	☐										

When building information indicates a question in the questionnaire be irrelevant, this question should be marked to indicate it should not be answered, e.g. by a dark grey shadow. It shall not be deleted from the form.