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Building a semi-anechoic Chamber

Setting out the specification for a noise suite

The key factors determining the type and hence the costs of construction are:-

1. The intended operating range of the chamber; how quiet must it be inside the room and what is the upper and lower cut off frequencies?
2. What is the acoustic environment likely to be outside the chamber walls i.e. how noisy will it be outside?
3. What will the likely level of vibrations on the when the building is in use?
4. What will be the size of the device(s) to be measured?
5. What frequency range is to be measured and with what accuracy?

Clearly for most customers there will also be issues of cost, space and disruption caused during any construction process. These last factors can turn a design that makes initial financial sense, into a project that never starts.

Historically the cost of construction of acoustic facilities has been high, perhaps too high. The high prices have reflected the high performance goals set by the designers and engineers involved. The desire to provide the best has not always been tempered by the need to build what the client can afford or what is strictly necessary. The acoustic facilities proposed by BAY Systems aim to deliver the acoustic performance that is needed within a budget that makes sense for the clients business. By careful attention to detail by the constructors the acoustic performance will normally comfortably exceeds the agreed specification. This bonus is due to the allowed margins for building errors and leaks do not occur and so a gain over specification of between 6 and 10 dB occurs.

The discussion with the client on what their business needs to achieve and the possible roles that the acoustic facility will take on typically reveals insights that significantly enhance the utility of the planned facility while reducing the costs. It is not unusual to encounter a client that has gone out for a semi-anechoic room but really wants a quiet room in which to work. The difference in price can be a factor of two!

Building the Noise Suite

As in most projects two weeks spent planning and scheduling deliveries properly can save two months on site.

In this project the factory unit was being refitted as a test laboratory and we were able to gain unrestricted access. The materials shown were delivered the previous day. This picture was taken at 2.00 p.m. on the first day of work on site.



The orientation of the chamber and its associated control room with access doors etc can normally be arranged so as to fit the eccentricities of the building that must accommodate it.

The accurate laying of the heavy block work and the skill level of the building workers will eventually be key to the finished performance of the room. Work can proceed at a fast rate with no interference from the weather because we are inside an already finished building.

Two weeks after work started the client can begin to see what the noise suite will look like.

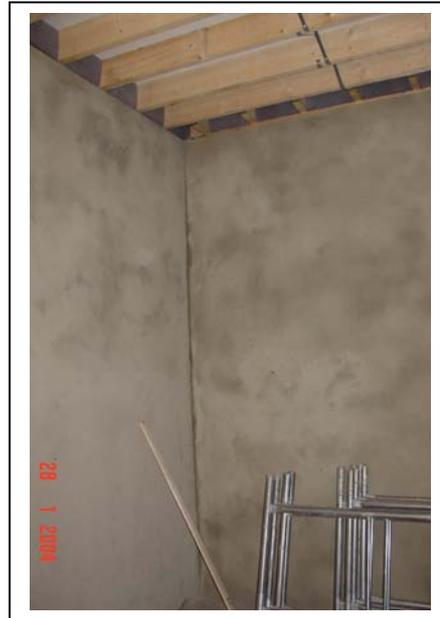


The completion of this phase also gets rid of most of the bulky and unsightly building materials.

Inside the noise suite the semi-anechoic room, typically the part the clients wants, is now ready for inspection by the client managers who are typically nervous of the outcome of any building project. This may be due to bad personal experiences with conservatories.



The rate of progress appears to slow when the block laying gives way to the finishing processes. The noise suite design begins to show some character beyond that of a concrete bunker.



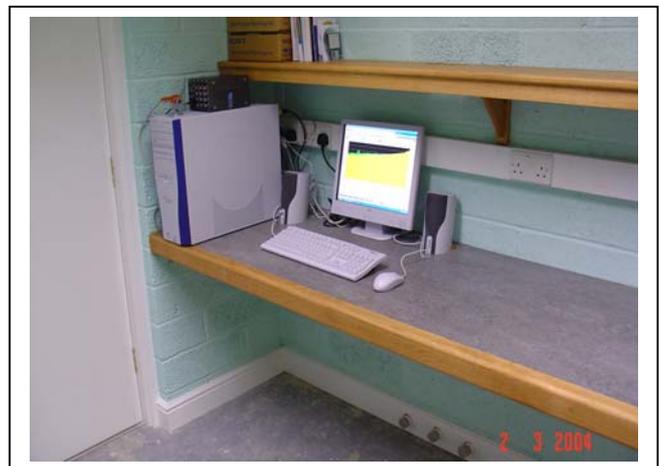
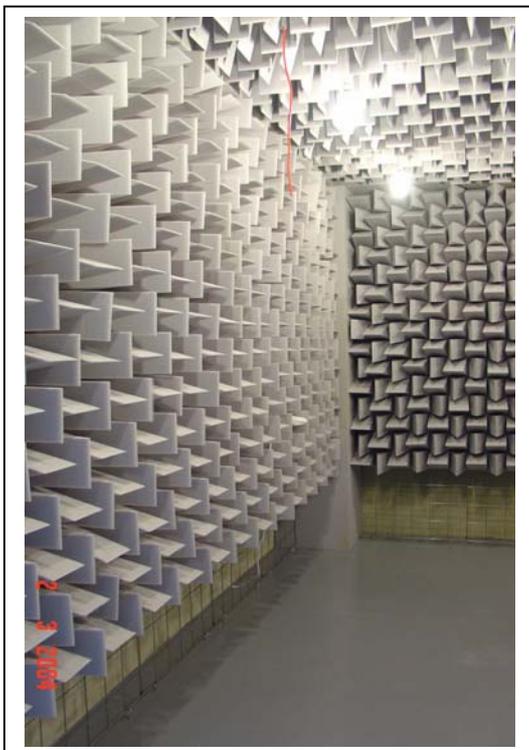
With ceilings installed and doorframes in place the three rooms comprising this facility are now becoming recognisable as such. Anyone on the outside of the Noise Suite will now find that communication with a colleague inside the semi-anechoic room is much more difficult. The isolation between the outside and inside of the semi-anechoic room, currently masquerading as a fully reverberant room due to lack of absorbent wedges, is now only being degraded by the open doorways.



The shell is now complete and the task of fitting out begins.



Installing the last few items is always likely to delay a project but in this case we were finished in 8 weeks with the client so keen to use the facility that he took over the final job of painting the floor himself!

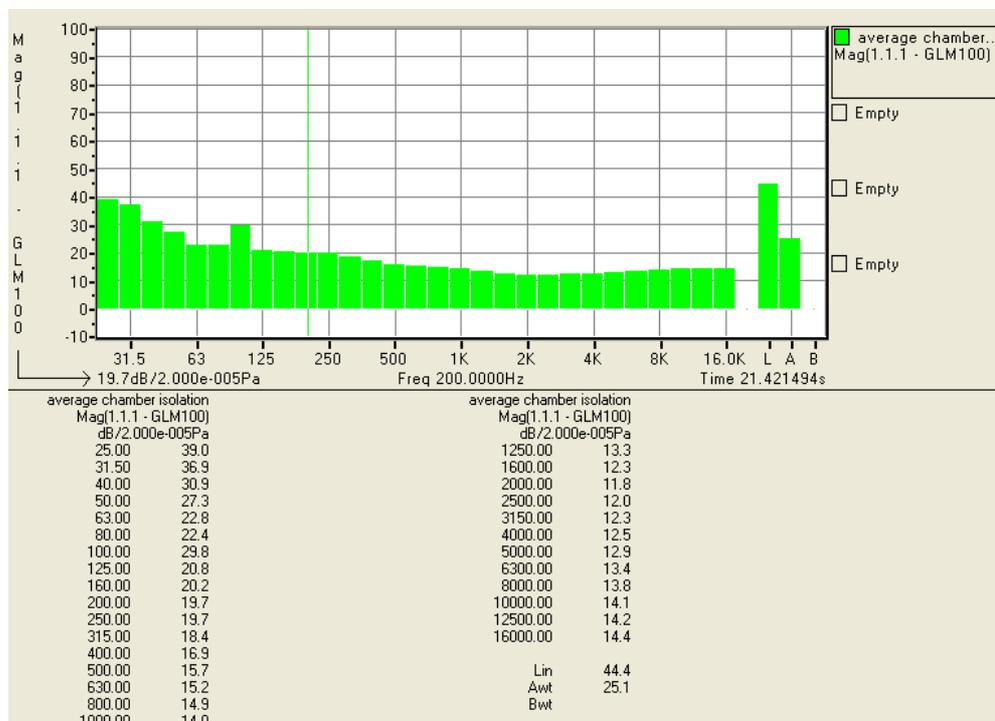


Acoustic Performance.

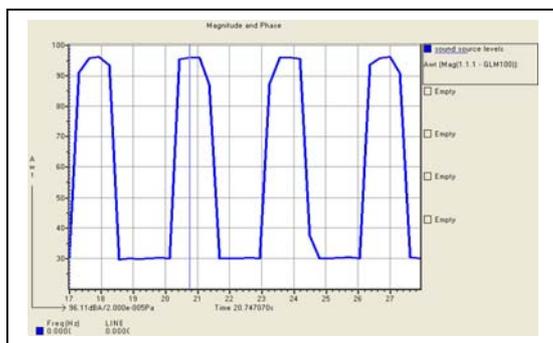
The NR curve used as the target for the project was NR30. The projected factory noise environment immediately outside the chamber was 70+dB(A). Normal construction materials and building standard would in most cases yield an approximate 40dB reduction. This we planned to comfortably exceed by enforcing a very high build quality and attention to detail; our non-contracted target was to meet NR20.

The result has been a very satisfying performance equal to the NR12 curve measured when the outside factory level was well in excess of 70dB(A).

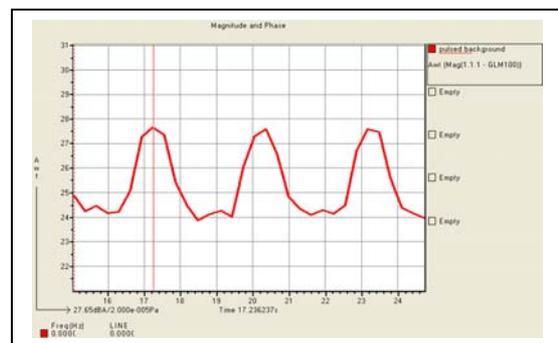
The internal noise curve shown below was measured when an exterior noise source was generating burst of white noise at 96dB(A). The level of isolation was 68dB(A) and the RT60 reverberation time 50 msec.



Noise spectrum inside chamber.



Noise level outside chamber.



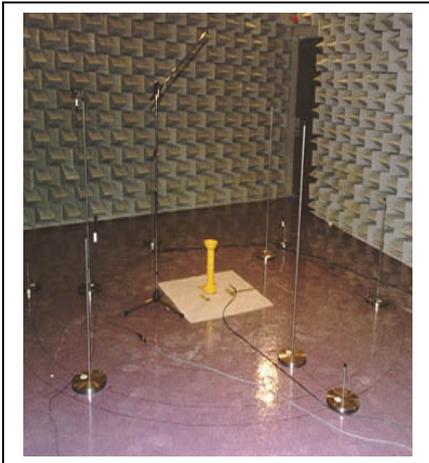
Noise level inside chamber

Other sound rooms



This installation has a unique feature of five movable fully anechoic screens that allow the large roller door at one end of the chamber to be opened. Once any large test object e.g. a car has been brought into the chamber the roller door can be closed and the screens positioned in front of it.

The room was a conversion of concrete garage into an effective semi-anechoic test room.



An 8 x 10 metre semi-anechoic room with 0.5 metre wedges. The room shown forms part of a purpose built noise suite. The suite was constructed inside a modern factory with relatively high (70dBA) levels of background noise. The semi anechoic room achieved a noise room curve of 19dB. Measurements made within this room have been proven to agree with a reference test site to within 0.5dB.



This is a tyre test facility that has been modified with absorbing foam material (not wedges). The purpose of the project was to allow the room to be used for noise measurement. The untreated room was semi-reverberant making any directional noise measurements impossible. After the modification tyre tread noise was measured to within 1dB of the levels measure on the vehicle.