Proceedings of the Institute of Acoustics

NOISE IMPLICATIONS OF CITY CENTRE REGENERATION

Dr Raymond BW Heng
Sheffield Hallam University, School of Engineering, Pond Street, Sheffield S1 1WB

INTRODUCTION

Sheffield City Centre like many other city centres of its size in the United Kingdom is currently undergoing considerable regeneration. This has has in general been very welcome as some parts of the city centre had been left vacant by the closure of shops and factories due to the demise of Sheffield's traditional industries and the development of out of town shopping facilities. Some parts of the city centre had already been left empty for some time and had deteriorated significantly and in some cases became considerably rundown and an eyesore.

The regeneration has led to many exciting new commercial and recreational developments in the city centre and many of a type not found in the past. This has however led to new problems and also not previously encountered such as higher noise levels for longer hours of the day. Previously there was quiet when the offices and shops emptied after the usual working day comes to an end. The new developments has led to cases where noise may be emitted often into the late evenings and in some cases even into the early hours of the morning. New themed public houses, coffee houses, restaurants, health clubs and recreational centres are taking over redundant city centre shops and banks. Many have long opening hours sometimes into the late evenings. This has led to more noise complaints from residential areas in the city centres.

At the same time there has been an ever increasing demand for residential accommodation. Recent residential trends include a desire to live in the city centres where traditionally the city centre had not been considered a desirable location which is even considered. The new trend is for sophisticated city centre living in high density high rise luxury developments. The noise problems associated with high density living had already been studied previously [1].

In recent years there has also been an increase in the student population in the Universities in Sheffield. At the same time there have been opportunities for student residence developments between the Universities and partnerships with private landlords which have led to a massive increase of student housing in the city centre. This has provided an opportunity for noise studies without much of the access and security problems often encountered with such long term daily evaluations. Recent developments in Sheffield include Bramall Court on Bramall Lane, Cavendish House on West Street, Kings Chambers near Castle House, Halford House on Sheaf Street, the developments on London Road, Phoenix Court on West Street, the Old Bank on Ecclesall Road, and Truro Court and Truro Works on Fornham Street.

This paper reviews the results of a 10 year study carried out in the area around Sheffield City centre near the Sheffield Hallam University (Figure 1). It was originally based on environmental noise studies undertaken by students studying for the Acoustics unit in the final year of their Engineering degree of Sheffield Hallam University as well as by those studying for the IOA Diploma in Acoustics and Noise Control and extended to include noise studies around the new city centre student residences.

CITY CENTRE DEVELOPMENTS

One of the earliest developments in recent years in this vicinity is that now known as the Cultural Industries Quarter. This began with the construction of the Red Tape Recording Studios at the old Kennings motor showroom between Brown Street and Shoreham Street [2]. The area is typically densely built up and often busy with heavy road traffic including a high content of buses and heavy goods vehicles during the daytime hours (Figure 2). It is on the main arterial route of the A61 passing through Sheffield City Centre leading to the A57 and the M1 and is located near both the bus as well as the railway stations. Other earlier developments in this area included the Ponds Forge Sports facilities built for the World Student Games hosted by Sheffield in 1991 as well as developments due to the gradual expansion of Sheffield Hallam University facilities.

Other major developments in the city centre around this time included the closing of the roundabout at Arundel Gate known famously as the Hole in the Ground and reduction of road traffic on Arundel Gate. This has reduced access to the city centre considerably but also resulted in a significant reduction of daytime noise levels. This development was followed by the Sheffield Supertram [3] contruction works which occupied many of the major city centre roads for months causing much difficulties to local businesses. Apart from the construction noise during this time, daytime road traffic noise was again significantly reduced. Previous fears of noise from the new Sheffield Airport [4] were unfounded and scheduled flights do not fly over the city centre.

At present the city centre development projects include several involving new commercial and recreational premises as well as private housing provisions. The latter are of concern together with that already mentioned for student housing. Construction is under way for a new development including housing on the old Royal Hospital site on West Street (Figure 3), extensive refurbishment for new housing near the Peace Gardens, the Sheaf River, developments in and around St Mary's Church and on Bramhall Lane including the home of Sheffield United Football Club. Apart from the construction noise experienced now, the future impact of noise on these and others must be considered.

NOISE PROBLEMS

As discussed previously the regeneration of Sheffield City Centre is highly desirable and has led to many worthwhile benefits to the area. However it has been found that the resulting noise levels has been gradually creeping up in recent years. In one of the developments mentioned previously on West Street there is some potential concern regarding the noise from road traffic including cars, buses and HGV which all run on the same stretch of road together with the Sheffield Supertram (Figure 4). A further concern is that whilst these quieten down after daytime hours, the other developments like the public houses and restaurants go on into the evenings. This has associated with it the effect of noise from the public who use the establishment around it and entering and leaving from it at closing time.

There are also several nightclubs in the city centre like Eyre Street, London Road, Division Street, the Leadmill on Leadmill Street and the Republic on Arundel Street. High internal sound levels and insufficient attention to noise insulation often result in noise annoyance to their neighbours and residents. Some also have very long hours of opening often extending into the early hours of the morning (Figure 5).

It has been noted that several new student residential developments have taken place near some locations where previously were only offices and commercial properties and disused factory spaces such as Castle Square (Figure 6) and the Truro Works. Another development is on a busy road near the local football ground (Figure 7).

METHODOLOGY

The method used in this study follows that given under the guidance of BS 7445 - Description and measurement of Environmental Noise, using a Type 1 precision integrating sound level meter and other associated instrumentation. The measurements were taken at various locations around the City Campus of Sheffield Hallam University (Figure 1) and other locations and private and student residences, where secure facilities were available for long duration measurements. Day, evening and night, manual as well as automatic measurements were taken and DAT recordings were made where appropriate. This was found to be useful as an additional check on the types of sounds being measured.

The LAeq unit is used throughout. L5, L50 and L95 levels were determined. For the discussion the day-time period is taken as the twelve hours from 0700 to 1900 hours, evening period the three hours from 1900 to 2200, and night-time period the nine hours from 2200 to 0700 hours.

Measurements were taken wherever appropriate for the accurate and representative assessment of prevailing noise levels and with due consideration to safety constraints and security of the instrumentation. Measurements were taken at ground level 1.2m above ground and at least 1m from the kerb and 1m from the facade of the nearest building. In other cases measurements were taken at various building floor levels outside livingroom or bedroom window where available 1m from the building facade using an extension microphone cable.

RESULTS

The typical variation of measured noise levels between some of the various locations in the city centre area as well as the variation according to the time classified as day, evening or night is shown below:

Sound Pressure Level LAeq for typical locations in city centre	Day	Evening	Night
A	65.8	62.4	58.3
B	62.5	56.4	54.2
C	69.1	65.8	62.9
D	50.2	44.5	40.1
E	56.1	48.7	40.2

The bi-hourly variation of sound levels over the day and the ambient, average and peak levels for a typical location are shown below:

Variation of Sound Pressure Level LN dB(A) over times of day and night	L5	L50	L95
7.00	71.2	59.8	54.3
9.00	80.1	66.9	57.9
11.00	77.5	68.7	62.4
13.00	76.1	69.7	65.7
15.00	76.2	70.6	66.9
17.00	78.1	71.2	65.8
19.00	81.3	72.3	66.7
21.00	80.8	71.6	62.1
23.00	80.6	69.8	58.2
1.00	60.7	49.8	44.6
3.00	50.1	42.1	40.8
5.00	48.7	43.6	41.2

DISCUSSION

The general noise levels in the city centre is understandable high. In some areas the daily variation of noise levels in general at the various locations in the city centre is also found to be large. This is usually due to high levels of road traffic noise as well as noise from users of the city centre during the day-time and which falls off at night-time. There is also considerable variation in the variablilty in noise levels between the various locations observed.

The usual sources of daytime noise include the noise of people using the city centre workers as well as shoppers and road traffic noise increase as the working day starts. This followed by a gradual increase in number of cars coming into city centre for the morning shopping. A notable result of city centre development is the source of noise complaints coming from early morning noise from street cleaning and noise from deliveries to commercial facilities and supermarkets in the area. This was found to be attributed to either a new resident in the area, a new facility or an existing facility that has expended due to city centre regeneration. Higher noise levels were also found due to the new facilities provided by the regeneration. It was found that this was not a source of annoyance as the facility was enjoyed and the noise was generally masked by the higher day-time noise levels.

Night-time noise of the same level was not tolerated to the same extent due to the lowever background noise levels as well as the expectation which led to such as the 10 dB weighting of the Lden unit. Noise from clubs and pubic houses were found to affect residents living around, or in some developments, above them. A new residential development was found to be affected in the evenings by the noise from the public houses across the road from them.

The city centre generally has very high levels of day-time road traffic noise and very much less traffic at night. This leads to a much quieter background noise levels at night-time compared to day-time. This difference is often noticed by newer city centre residents who often complain of night-time noise. This often occurs at pub closing time and when the weather turns warmer.

In some locations studied, the hourly noise levels measured do not fall off as in other similar city centre locations but remains high as it is replaced by these and other sources of noise due to the new establishments and facilities brought into the city centre by the regeneration programmes.

Another major source of noise complaints is that from noise from late night revellers and from the night clubs mentioned previously. This is more noticeable after normal pub opening hours and often into the early hours of the mornings.

A good acoustic environment in city areas would be where the noise level is not to exceed Lden 45. A level of Lden 55 corresponds to a situation where 5% of the population is highly annoyed by noise. Average levels found at present in Sheffield City centre are around Lden 65 and more in some of the locations studied.

It is evident that guidance on noise limits must be a major residential requirements due to the background noise levels residents expect. This must take account of day-time, evening or night-time hours. One approach is to specify satisfactory internal noise levels to ensure residents enjoy the quiet use of their homes and to produce sleep criteria.

In Sheffield this is achieved by the adoption of a design criteria standard based on the World Health Organisation Standard for sleep disturbance. The developer is required to submit planning application which includes a noise survey and a scheme of works which will ensure an internal noise level of 35 dBA Leq 2300 - 0700 hours. However in some cases in warm weather measures such as double glazed window would not give the acoustic insulation claimed). It may be preferable to aim at environmental noise levels as well. For example for areas where quiet is necessary such as hospitals or convalescent homes, guidance should be given such as daytime noise levels should not exceed 50 dB LAeq and nighttime noise levels not to exceed 40 dB LAeq. Special treatment should be put in place where daytime levels exceed 60 dB LAeq and nightime levels exceed 50 dB LAeq.

CONCLUSION

The present work has included measurements and preliminary views of the users and residents in city centre developments. This has indicated problems which were to be generally expected as well as some new ones. This has been found to agree with a general increase of noise related problem complaints to the authorities in recent years. City centre regeneration has been much valued but has led to a gradual deterioration of the noise climate in the area over recent years. Further work will be necessary to look at additional planning guidance to future city centre developers to ensure the much needed regeneration without further loss of the quality of the environment in the city centre.

REFERENCES

1. The Noise Problem in High Density Living in Singapore, Institute of Acoustics Spring Conference, Cambridge, 1978

2. The Acoustics of the Red Tape Studios, International Conference on Acoustics, Singapore, 1989

3. A Study of the Noise of Sheffield Supertram, Conference Proceedings, InterNoise 96, Liverpool, UK, 1996

4. The Noise Impact of Preliminary Trial Flights at the New Sheffield Airport, Conference Proceedings of the International Conference of Western Pacific Region, Hong Kong, China, 1997

Figure 1. Sheffield City Centre

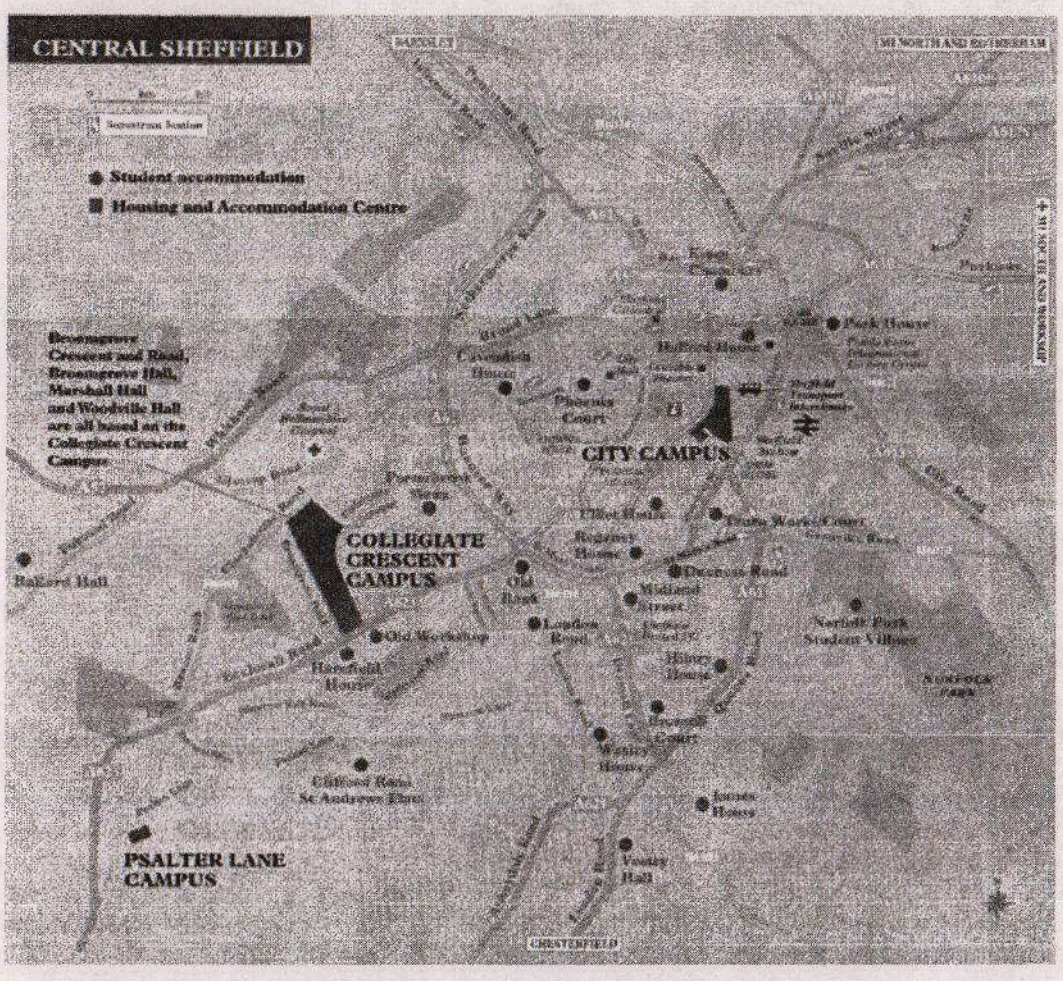

Figure 2. Traffic on Shoreham Street beside new Residential development

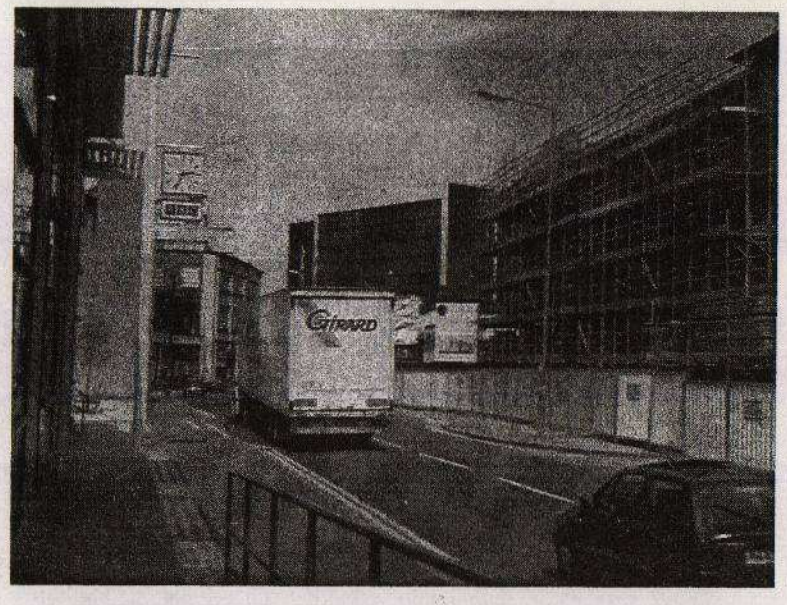

Figure 3. Development on West Street

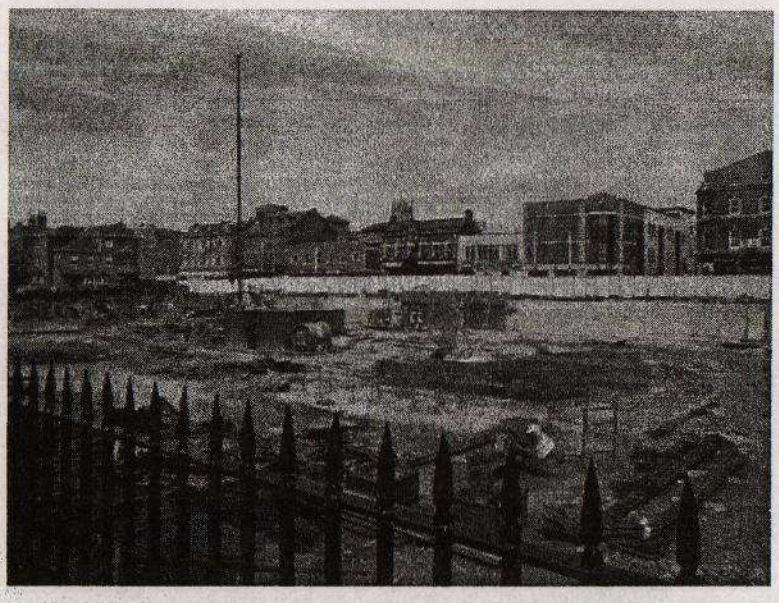

Figure 4. Traffic on West Street

Figure 5. Long nightclub opening hours

Figure 6. New student residential development at Castle Square

Figure 7. New student residential development on Bramall Lane