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Sound insulation requirements for new psychiatric hospital building at Tønsberg hospital

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Sound insulation requirements for the new Psychiatric building at Tønsberg hospital are presented and discussed. The building consists of a lower part with about 50 bed units and a higher polyclinic part, both connected to the main entrance. The project has a performance target to build faster than other comparable hospitals, with extensive use of prefabricated items. Psychiatric patients and treatment can be sensitive to noise from other patients and might not respond as well to treatment in case of lack of privacy. The Norwegian standard NS 8175 on acoustic conditions in buildings does not deal with specific requirements for psychiatric user areas or rooms, but has some requirements for hospitals and care institutions in general. The project specific sound insulation requirements are designed based on NS 8175, technical requirements from the hospital owner and requirements used in other reference projects in Norway. The acoustic design approach was to balance the need for sound insulation and privacy, employment of prefabricated building elements and special requirements for safety and robustness in use.

1 Introduction

A new Psychiatric building at Tønsberg hospital is a part of a development project, "Tønsbergprosjektet" (TP), for expanding and renewing Tønsberg hospital. The building consist of 50 bed units, 10 of which are sheltered units with extra focus on safety and robustness. The building also consist of examination/treatment rooms, consultation rooms, activity rooms and other administrative and secondary rooms. The main focus of this paper is the airborne sound insulation for the bed units and the examination rooms. Sound insulation requirements for this project is based on a compromise from requirements from the government, hospital owner, users and building method.

2 General requirements

2.1 Regulatory requirements

Regulations on technical requirements for construction works ("Byggeteknisk forskrift - TEK17") [1] defines all requirements for buildings, and also sound insulation. The requirements in TEK 17 are general, and declares that acoustic conditions shall be satisfactory for people inside construction works and outside amenity areas designated for recreation and plan. Requirements can be met by ensuring compliance with defined numerical values for sound class C in Norwegian Standard NS 8175:2012 [2]. Relevant requirements for health buildings are shown in Table 1.

Table 1: Air born sound insulation requirements for health buildings from NS 8175:2012

Type of area	Sound class C R'_w [dB]
<i>In hospitals</i>	
Between bed or patient rooms.	48
Between bed or patient rooms and other rooms without door connection.	
Between treatment rooms and other rooms without door connection.	
<i>In care institutions</i>	
Between bed or patient rooms.	52
Between bed or patient rooms and common areas without door connection.	
<i>Both</i>	
Between bed or patient rooms, common areas, etc. and commercial and business areas.	60
Between bed or patient rooms or treatment rooms and common areas with door connection with door threshold.	39
Between bed or patient rooms or treatment rooms and common areas with door connection without door threshold.	34

NS 8175:2012 does not have specific requirements for all types of buildings, in example psychiatric hospital buildings. The need for sound insulation in a psychiatric building may be different from regular hospital buildings and care institutions.

2.2 Hospital requirements

Technical program [3] describes technical requirements from the hospital to the project team, and relevant specific numerical requirements for air born sound insulation from appendix 13.2.2 is shown in Table 2.

Table 2: Air born sound insulation requirements from technical program.

Room	R'_w towards other rooms [dB]	R'_w towards other rooms with door connection [dB]	R'_w towards corridor with door connection [dB]
Bed or patient rooms	50	42	39
Office with treatment	52	40	38
Examination and treatment rooms	52	40	38
Psychiatric examination and treatment rooms	55	45	45

The requirements was made in an early stage of the project, and does not separate between somatic and psychiatric use of rooms for bed or patient rooms or offices. There are some difference between examination and treatment rooms, with a little higher requirements for psychiatric room.

2.3 User requirements

The acting-out behavior of patients in some of the treatment areas of the psychiatric building causes high requirements considering safety and robustness of constructions and furnishing. In example the walls needs to be robust to withstand hits from objects or persons, which excludes the normal wall type with double gypsum boards. This robustness requirement is not all negative for the acoustic properties, but combination of weight and stiffness needs to be evaluated to find materials that ensures both requirements.

Another example is the need for anti-barricade doors for safety. If the door is blocked by objects or a person has fallen there is a need to being able to open the door from the corridor. The anti-barricade doors have limited sound insulation, and the best door found so far can guarantee $R'_w = 30$ dB. Combined with limited amount of fixed wall around the door, the total sound insulation for the partition might be less than required.

2.4 Building method

The project goal for TP is – faster (50 % faster than average for comparable projects), cheaper (10 % lower cost than comparable hospital projects) and better quality than comparable projects (zero building faults). As a result of this the project strives for a high degree of industrialization and prefabrication of items outside construction site. Sound insulation requirements might cause in some more work on site than wanted to ensure a good result for flanking transmission or closing a missing part. Here are some examples of challenges that might appear with high degree of prefabrication:

- Prefabricated light weight inner walls. Low weight is an advantage for building fast, but might make it difficult to achieve high values of sound insulation.
- The same prefabricated wall type used for all walls. This might result in overqualified walls regarding sound insulation for some areas or walls.
- Prefabricated facade elements and flanking transmission. Requires good design of elements and demands for precision, or more work and time on site if splitting the installation process in several subtask, in example to build an inner part of the facade to reduce flanking transmission.
- Prefabricated bathroom cabins. This might not be a problem itself, but in combination with prefabricated inner walls, it might be difficult to mount the continuous inner wall behind or between the already installed cabins. This might result in mounting of several small wall parts in difficult positions to make the separating wall complete.
- To save time there might be a wish for a continuous concrete work in one operation for the screed. It might be difficult to achieve high sound insulation requirements with continuous screed/floor (floating floor, massive floor, etc.) without splits or additional floorcovering. Depending on the floor construction it might be necessary to spend some time on site creating separate screeds based on the sound insulation requirements. This will normally be dimensioned by the requirement for weighted normalized impact sound pressure level.

3 Requirements for new psychiatric hospital building at Tønsberg hospital

The mutually agreed requirements for bed and patient rooms and treatment rooms for TP are shown in Table 3. The requirements are generally higher or in line with standard requirements from NS 8175:2012 for hospitals and care institutions, and the requirements from the hospital from the technical program. The requirements are comparable with other recent built psychiatric buildings in Norway, and even higher than some of these for the sheltered units.

Table 3: Air born sound insulation requirements for psychiatric building at Tønsberg hospital

Rooms in psychiatric building	Sound class C R'_w [dB]
<i>Standard units:</i>	
Between bed or patient rooms.	52
Between bed or patient rooms and other rooms without door connection.	
Between bed or patient rooms and common areas with door connection.	39
<i>Sheltered units:</i>	
Between bed or patient rooms.	60
Between bed or patient rooms and common areas without door connection.	
Between bed or patient rooms and common areas without door connection	39-45
<i>Treatment and examination rooms:</i>	
Between treatment rooms in bed unit section and other rooms.	55
Between treatment rooms in bed unit section and other rooms with door connection.	45
Between treatment rooms in polyclinic section and other rooms.	52
Between treatment rooms in polyclinic section and other rooms with door connection.	40

There is an ongoing process for designing the details with prefabricated wall and bathroom cabin, and it looks like the project is going to achieve the requirements with some local measures.

Corridor outside of the standard units have been designed with separation doors, which makes it possible to separate the corridor in to smaller areas with 2-6 patient rooms. This might compensate for the possible weakness with relative low sound insulation for anti-barricade doors, since there will be a limited amount of involved rooms and patients.

The requirements for sheltered units have been set higher because of possibly higher noise from the unit, and the sensibility of noise from other rooms. The units have been designed with a small entrance/hall, and this two door solution makes it possible to achieve the relative high sound insulation requirement between the unit and the corridor.

Requirements between treatment and examination rooms are considerably higher than requirements for treatment rooms in standard somatic hospital. The feedback from the user group have been that patients might not respond as well to treatment if they can hear other people or fear that other people can hear them. This is one of the reasons for the relative high requirements. The requirements are a bit lower in the polyclinic section with voluntary treatment, than in the closed section with forced treatment.

4 Summary

The Norwegian standard NS 8175 on acoustic conditions in buildings does not deal with specific requirements for psychiatric user areas or rooms, but has some requirements for hospitals and care institutions in general. Psychiatric buildings might need high levels of sound insulation, and for future work it is important to find a sufficient level of sound insulation for these kind of areas and rooms.

A combination of high sound insulation requirements and prefabricated building constructions are possible with good design and planning, but there are some limitations.

We are looking forward to the feedback from the users when this project is finished and in use.

References

- [1] Ministry of Local Government and Modernisation, *FOR-2017-06-19-840 Forskrift om tekniske krav til byggverk (Byggteknisk forskrift – TEK 17), last changed FOR-2017-07-07-1164*, Oslo, Norway, 2017.
- [2] Standard Norge AS, *NS 8175:2012, Acoustic conditions in buildings - Sound classification of various types of buildings*, Norway, 2012.
- [3] Hospital in Vestfold HF (SiV), *700-90-00-8100-SP-0001 Technical program*, Norway, 2016