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NEW DESIGN OF MEDIUM-SIZED CONCERT HALLS

H Möller Akukon Oy Consulting Engineers, Helsinki, Finland
T Lahti Akukon Oy Consulting Engineers, Helsinki, Finland
A Ruusuvuori Akukon Oy Consulting Engineers, Turku, Finland

1. INTRODUCTION

It seems that usually the definition of a "concert hall" applies to a hall with an audience of at least 1200. However, most of the halls built in the Nordic Countries typically have a seating capacity of 500 to 900. A problem is that many of these halls are required to house a full symphony orchestra. In this paper, the acoustic design of two medium-sized concert halls, those of the Helsinki Conservatory of Music and the Promenade Center in Pori, is presented. The halls seat some 500 and 700 persons and should by usual convention be referred to as recital halls. However, both halls will mainly be used for symphonic music and have therefore been designed as "large halls". The Helsinki Conservatory was inaugurated in September 1999 and the Promenade Center will be completed in November 1999. The presentation will focus on the design details of the halls, especially the reflecting and diffusing wall surfaces and structures.

2. HELSINKI CONSERVATORY OF MUSIC

The new building for the Helsinki Conservatory of Music is situated in the new Ruoholahti residential district in the former harbour area of Helsinki. It consists of the main hall (nominally 470, max 574 seats), a smaller approx. 100-seat hall and practising classes for the Conservatory. The 470-seat hall is actually the first hall dedicated to acoustic music built in the city of Helsinki in more than 30 years. In this paper, only the main hall is discussed.

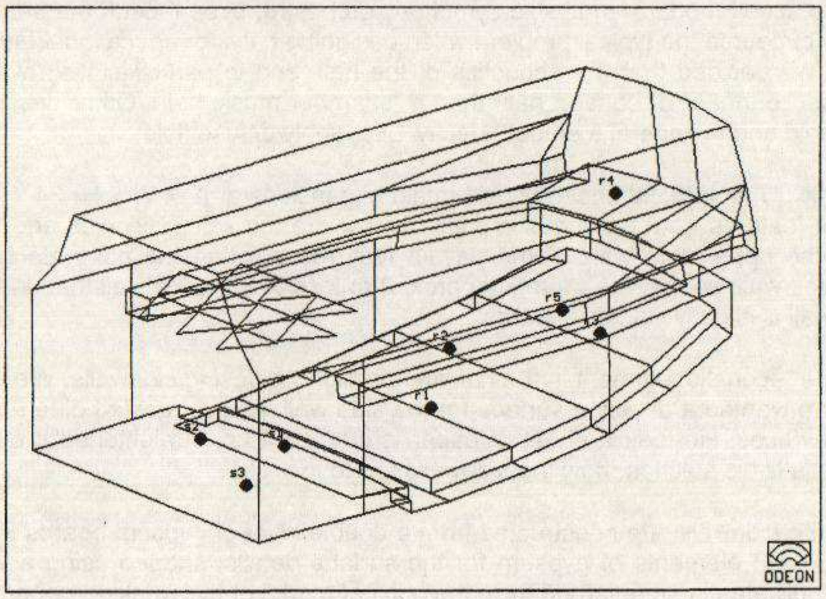

Figure 1. An early ODEON model of the Helsinki Conservatory hall.

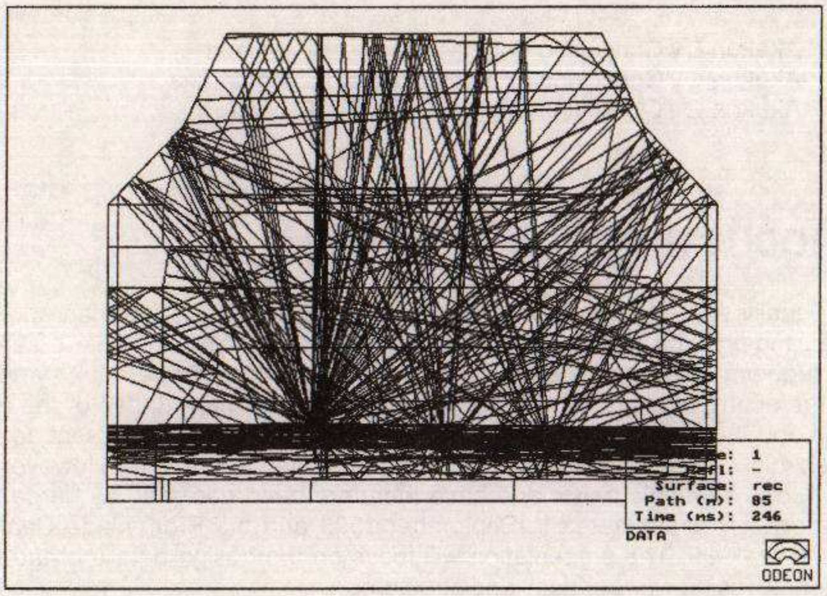

Figure 2. Cross section of the Helsinki Conservatory hall. The tilted, tent-like upper side walls emphasise strongly the lateral character of the sound field.

The primary design criterion for the hall was to provide "best possible acoustics for acoustic classical music". All other uses were considered as having lower priority. The hall is mainly used for student concerts, it being the place where the students learn to perform in a "real hall". Other possible events may be small-scale opera and dance performances. For this reason an orchestral pit was included in the design.

The hall was to accommodate a full-size symphony orchestra, even though the seat count is small for this. This is of course the typical problem when designing halls for educational facilities. Together with the client we decided that the acoustics of the hall, and in particular the reverberation time, should be closer to that of a "concert hall" than a "chamber music hall". Other design goals were a strong lateral field and in general a smooth decay, of a highly diffuse field.

The hall is basically a classical shoebox, with main dimensions of (L x W x H) 34 x 18 x 14 m. The most important features from an acoustic point of view are the side balconies and the strong tent-like shape of the upper side walls. Other layout features are that the hall gets slightly narrower towards the back wall, so that the width is approx. 2 m less at the back wall than in the middle, and that the back wall is slightly slanted inwards.

The most visible "acoustic" element in the hall are the highly diffusing sidewalls. We explained to the architect that we wanted a diffusing surface for the side wall, and suggested different kinds of QRD and random surfaces. He took a sheet of paper, crumpled it up, straightened it out a bit and announced that this is his solution, how the sidewalls are to look like.

In actual fact, the sidewalls are constructed from a double layer of gypsum boards to give the gross shape and moulded elements of gypsum for the surface details, shaped using a wrinkled copper sheet, which duplicates in an enlarged form the original model of the wrinkled paper. Other acoustic features of the hall are tilted glass plates on balcony fronts and a reflector cloud array of glass panels above the stage.

The first measurement in the hall showed that most of the goals have been achieved. The reverberation time is slightly too long. As the second balcony is not yet furnished, there are about 50 seats still missing. We are now discussing with the client whether these seats could be installed. In the meantime, extra absorbtion will be brought in for temporary compensation. But otherwise the sound of the hall is excellent with an extremely smooth decay, very spacious, enveloping sound and still with sufficient definition of the different instruments.

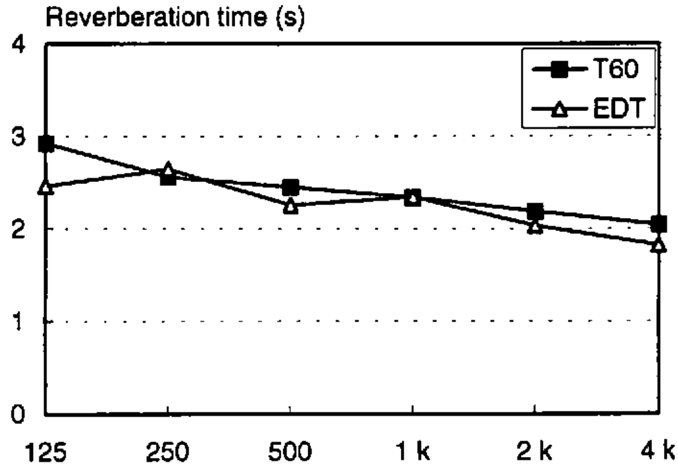

Figure 3. Reverberation and early decay times measured in an empty hall, Helsinki Conservatory.

3. PROMENADE CENTRE, PORI

The Promenadikeskus (Promenade Centre) in Pori on the west coast of Finland is a new type of cultural house. The building consists of a 714-seat concert hall and five THX-type cinema theatres. The concert hall is a multi-purpose with an emphasis on classical acoustic music. But as Pori hosts one of the biggest jazz festivals in Europe, it should also be possible to use the hall for reinforced music.

By the time we got involved in the project, the basic dimensions of the hall had been fixed to 35 x 25 m, the width being clearly quite wide for a 700-seat hall. Another problem was that the roof had to be curved, so that the available ceiling height above the stage was only about 13 m and the maximum height about 16 m.

Due to these "facts of life", we suggested that the general layout of the hall should be a sort of a combination of a vineyard and shoebox. We designed side balconies to run along the whole hall, thus narrowing the stage and stalls area to 17 m. Furthermore, the back of the hall is raised slightly above the stalls level.

In order to increase laterally directed energy, huge reflector panels were designed to cover the whole length of the upper side walls. The ceiling was made section-wise flat, stepping up from the back of the stage. The ceiling is horizontal from the stage front onwards. As was the case with the Helsinki Conservatory hall, basically all surfaces are highly diffusing, using a combination of MLS diffusors and other non-regular surfaces. The hall will be completed in November 1999. First measurement results of the nearly finished hall will be shown at the conference.

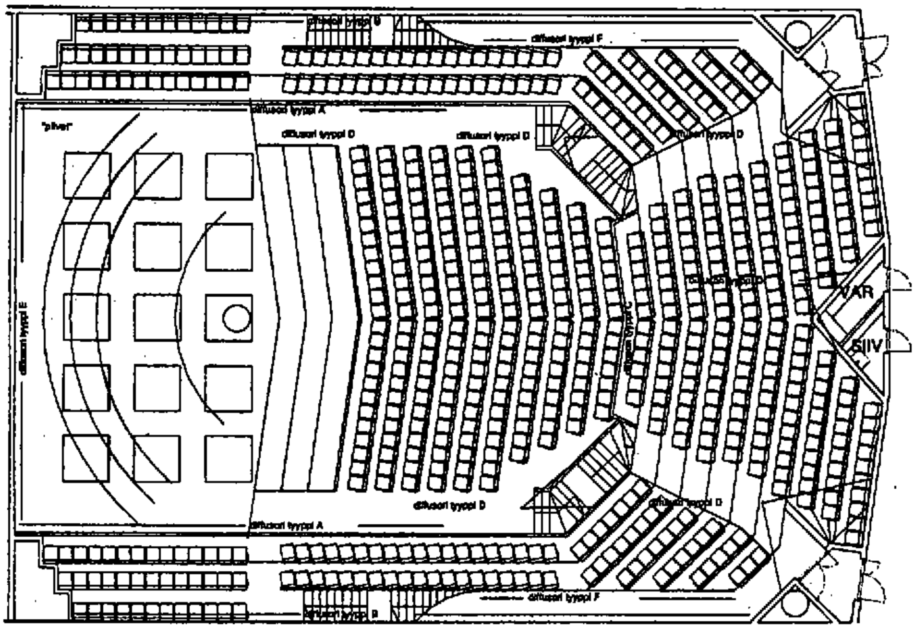

Figure 4. Pori Promenade Centre hall, plan.

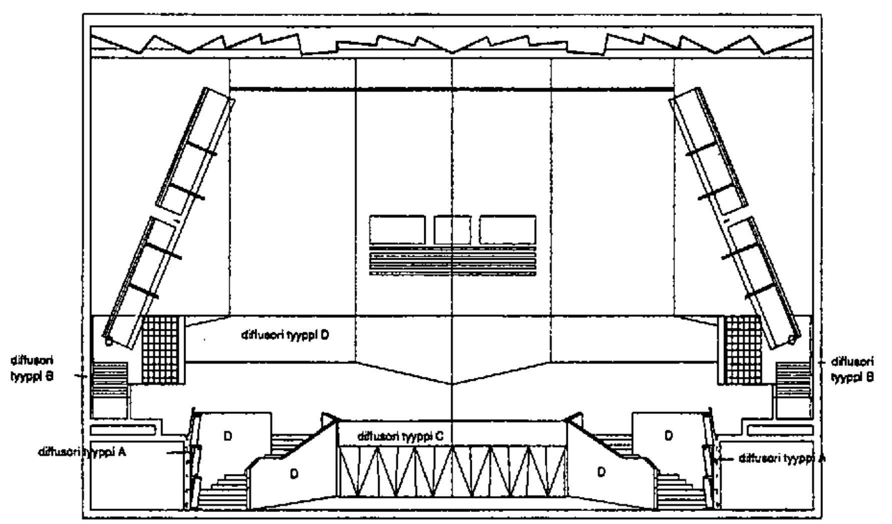

Figure 5. Pori hall, cross section.

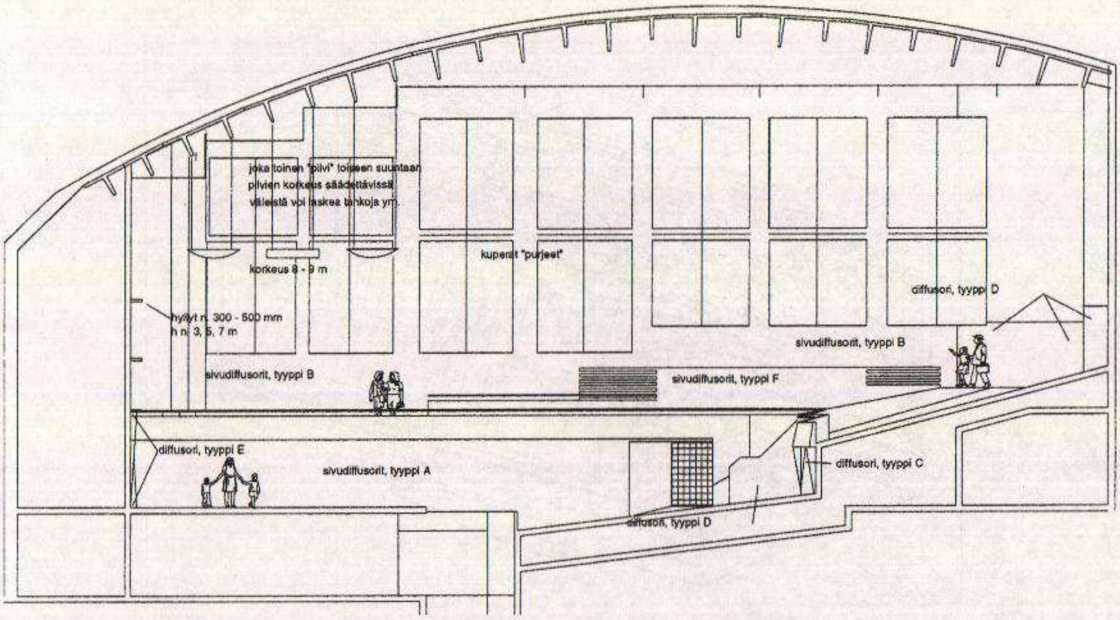

Figure 6. Pori hall, long section.

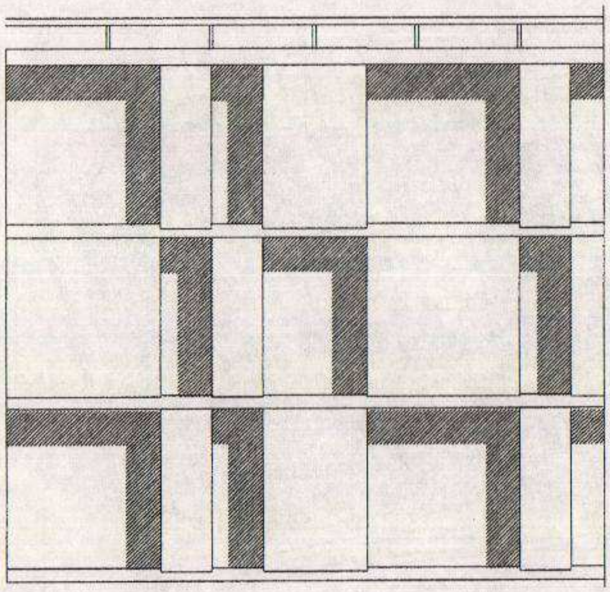

Figure 7. An example of lower side wall diffusors, Pori hall.

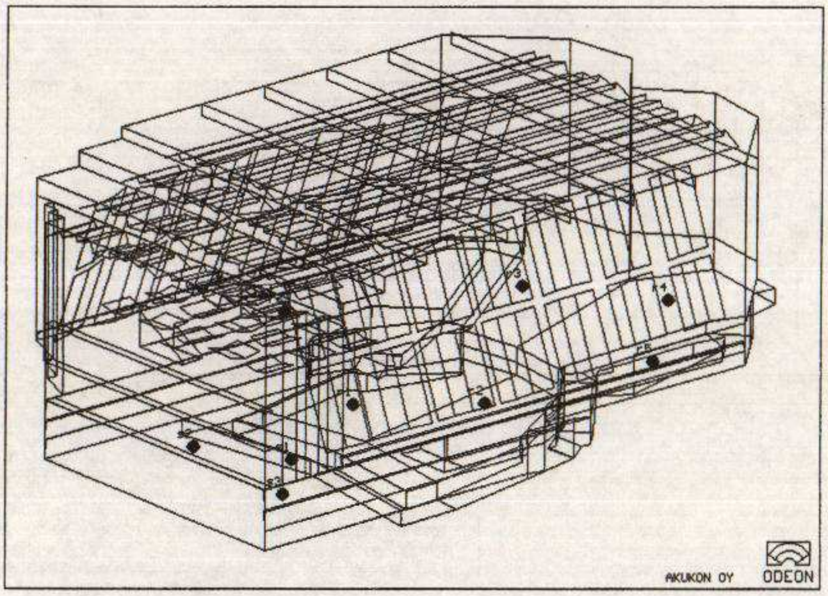

Figure 7. Pori hall, one of the ODEON computer model versions.

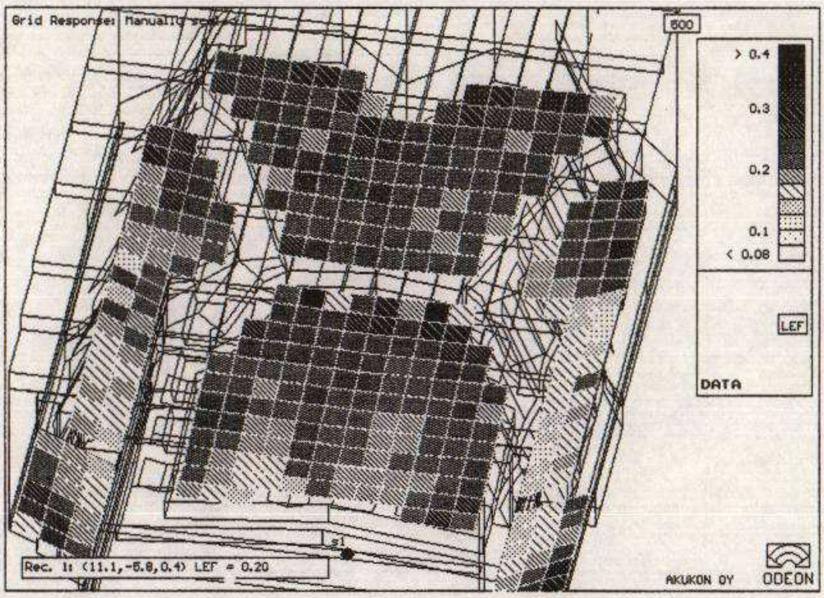

Figure 8. Pori hall, computed lateral energy fraction LEF at 500 Hz.