

Universal Design, but at What Cost? A Case Study on Lifts in Norwegian School Competitions

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Abstract. In a larger perspective, this paper investigates architects' and contractors' attitude towards universal design in the competition phase of the largest school building projects. Three Design Build school competitions with negotiations and one limited architecture competition are examined in terms of to what degree the competitors are willing to invest in lifts. The Norwegian Building Code requires a lift in all public buildings with two or more storeys, and the lift should be easy to locate with its access close to the main entrance. However, a school building often has more main entrances, as the different age groups each tend to have their own entrances. This seems to put the competitors in a dilemma concerning the correct interpretation: Is it sufficient with simply the one lift at the official main entrance, or is it necessary with more lifts in connection with the entrances for the different age groups? The results show that despite the requirements in the Building Codes and the competition briefs, the competitors tend to prioritize lower bids in favor of optimal universally designed buildings. The results also show that any school design, with some reasonable effort, could reach a lift detour of maximum three minutes when using the calculation model applied in this research. However, from a lift user's point of view, any kind of detour may be experienced socially excluding and unacceptable.

Keywords. Universal Design, Lift, Elevator, Architectural School Competition

1. Introduction

Firstly we will look into the building legislation and other relevant measures on integrating universal design in buildings. The Act on Prohibition of Discrimination based on Ethnicity, Religion, etc, the so-called Anti-Discrimination Act, came into force in 2008 [1]. This act defines "universal design" as a design where the main physical solutions can be used and accessed by as many as possible". The act was replaced by a new comprehensive act against discrimination coming into force January 2018 [2]. The new act defines "universal" as a design or facilitation of the main physical solution such that the ordinary functions can be used by as many as possible, independently from any impairment. However the obligations to fulfill the universal design requirements do no

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not apply if this is a disproportionate burden to the organization. The following aspects should therefore be taken into consideration: the effect of not removing the barrier for persons with disabilities, the cost, the organization's resources, security reasons or as well as any possible conservation aspects.

In the year 2009, Norway got its first standard concerning universal design, the NS 11001 Universal Design of building works, Part 1: Buildings open to the public [3]. Universal Design has been a clearly integrated part of the Norwegian Code since 2010 in the so called "TEK 10" [4], where most regulations concerning universal design relied upon the recent developed standard. Later these regulations have been revised to some degree in "TEK 17" [5]. Both regulations requires lift for any public building more than one floor. In the guidance to these requirements, it says that an lift should be part of the "main solution". Also the guidance allows for simpler hydraulic lifts if the number of users is less than 12.

When it comes to school buildings with two or more floors, and where the students' entrances and wardrobes are separated from the building's main entrance, the question arises whether there should be additional lifts at each student entrance. Obviously, in a school building, they should be considered the main users. Hence, the entrances to their wardrobes in practice serve as their main entrances, and therefore is the main solution for them. Also, the common school administration view is that students need to be physically active and so will not allow the students to use the lift as the general vertical transport solution, unless it is really necessary for any particular students. Therefore, despite an entrance serving e.g. 120 students or more on the second floor or higher, it is disputable what number of users should be the base basis for the choice of lift. An investigation of 17 architectural school competitions showed that the number and position of lifts was one of the parameters that architect juries commented on when evaluating universal design [6].

The Norwegian Building Authority (*Direktoratet for byggkvalitet, DiBK*) has received inquiries about whether it is mandatory to have lifts at the students' entrances or not [7]. Their clarification on this is that if the distance between classroom and the lift compared to the distance between classroom and the staircase natural to use is considered not equitable, only one lift is needed. Then DiBK writes: If using an lift means that the students require only one minute more to get to the out-door recess area, for a 15-minute break, this should be considered as equitable. But if students using the lift require five minutes more than the ones using the stairs, then the solution is not equitable. DiBK leaves the question partly open as to what an equitable solution is, and says that more factors will play a role in such a consideration, e.g. whether the lift requires a key, and to what extent the chosen solution would be beneficial to the individual user, to the general community and to future generations.

In their book "Universal Design - Creating Inclusive Spaces", Steinfeld and Maisel discusses the different definitions of the terms "Universal Design", "Design for All" and "Inclusive Design". The authors propose the following definition: "Universal Design is a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation" [8]. Lid more specifically describes "Universal Design" on three levels, using the terms "macro", "mezzo" and "micro level" [9][10]. Lid's approach to look at universal design at different levels, from strategic to instrumental, is useful in the discussion of on what level universal design should be solved in architectural competitions.

An architectural competition for the building of schools in Norway will have to be executed in accordance with EU legislations current regulations. New EU directives on

public procurement (2014/23/EU, 2014/24/EU and 2014/25/EU) have resulted in new laws and regulations in Norway since January 1, 2017 [11]. The regulations give two options for awarding the contract: (1) lowest price or (2) the best price-quality ratio. For projects with an estimated cost above the EU threshold of NOK 51 m, the Norwegian Public Procurement Act [12] only allows for negotiation if the task cannot be described clearly, or if the project is of a certain complexity. Cases 1,2 and 3 in this study follow this set of rules, as they are design-build competitions/PPP competitions. In case 4, the client only asks for architectural services, the cost of which is significantly less, and therefore the building code regulations will be less complex. The Norwegian Public Procurement Act has its own set of rules concerning limited architecture competitions. Any competition needs a competition brief describing the task. It is essential that the client has competence in the development of the brief and has a clear understanding of the users' needs to ensure that the final building meets these requirements [13].

Understanding the dynamics and characteristics of architectural competitions is an ongoing field of study and research. How juries work and what qualities they are looking for have been subject to several studies [14][15][16][17][18]. One of Kreiner's studies shows that innovative solutions in universal design in an architecture competition may not be understood by the jury due to the lack of expertise in the field [19]. Kreiner also shows how competitors make strategic choices as to what degree they should fulfill or not fulfill all requirements in the competition briefs [15].

2. Research question and method

In this study the competition entries in four school competitions were investigated in regards with regard to their number and positioning of lifts. The author has himself acted as jury member in all four competitions, and this is how it has been possible to both gain access to the competition documents, and also how it has been possible to not only observe, but also actively participate in the evaluation and negotiation processes. In cases 1 and 2, the author was also partly responsible for the competition briefs. The method used consisted of a document study of the complete competition documents and design entries. Also a quantitative study was carried out where all the competition entries were compared in terms of the extra distance the users of the lifts have to cover to reach from their respective wardrobes to their outdoor recess area. The lift detour issue was discussed with one 20-year-old adult wheel chair user, and one adult person and another adult of 21 years who was missing the left leg and arm, and therefore in need of crutches. Only two interviews, of course, results in a low reliability as to how potential users of lifts think in general.

As is seen in Table 1), the same contractors and architecture firms participate in the different competitions. In all of the competitions, Universal Design had a headline in the competition brief. In cases 1 and 2, Universal Design was part of the evaluation criteria. Also in cases 1 and 2, the NS 11001 "Universal Design of building works, Part 1: Buildings open to the public" was set as a requirement. Cases 1,2 and 3 had extensive competition briefs, whereas case 4 only had a 5-page document without any given gross area limit, and also with very few room area sizes given.

Table 1. The four competition cases

Case Competition year Client	Competitors Contractor/architect w = winner	Competition form/Procurement UU as an award criterion UU in the competition brief
Case 1 Rykkinn Elementary School 2015 Bærum Kommune	Veidekke, Lillefrøen Arkitekter (w) Tronrud Eiendom, Planforum Arkitekter Skanska, Link Backe Gruppen, Dyrø & Moen	UU as award criterion UU in the competition Brief: 57 words. Requirements: TEK 10 and NS11001- 1:2009 115 page competition brief
Case 2 Levre Elementary School Spring 2017 Bærum Kommune	Veidekke, Lillefrøen Arkitekter (w) Tronrud Bygg, L2 Hent, Arkitema	UU as award criterion UU in the competition Brief: 220 words Requirements: TEK 10 and NS11001- 1:2009 211 page competition brief
Case 3 Ullerås Elementary School Fall 2017 Hønefoss Kommune	Tronrud Bygg, L2 (w) Hent, Lillefrøen Arkitekter Veidekke, Hus Arkitekter	UU not mentioned in the award criteria UU in the competition Brief: 152 words Requirements: TEK 17 75 page competition brief
Case 4 Nysæter Middel School 2017/18 Stord Kommune	Arkitektene VIS-A-VIS AS (w) L2 Arkitekter AS Arkipartner AS ABO plan- og arkitektur AS/JK-arkitektur Og Arkitekter AS, Bergen	UU not mentioned in the award criteria UU in the competition Brief: 36 words UU according to regulations 15 page competition brief

- Case 1, Rykkinn Elementary School, 2015: The procurement was a competitive procedure with negotiation. The contract would include both the designing and building, as well as the operating (20 years) and financing of the project, in other words a so-called Private Public Procurement. The evaluation team commented on the designs in two phases, and the participators had the possibility to improve their projects, both in terms of design quality and cost. Rykkinn Elementary School was planned as a 3-parallel, grades 1-7 school, for about 600 students and an estimated gross area of 7,000 m² covering 2 to 3 floors.
- Case 2, Levre Elementary School, 2017: Competitive procedure with negotiations. To describe the type of procurement, the term Price with Design was used, meaning that prequalified contractors with complete project teams should both develop a design, as well as a bid, including the costs of the proposed design. Two years of operation should also be included in the offer. There were two rounds of negotiations, where the vendors both received feedback on the design as well as the costs. The Levre Elementary School was planned as a 4-parallel, level grades 1-7 school, intended for about 800 students and with an estimated gross area approximately 9,000 m² covering 3 to 4 floors.
- Case 3, Ullerås Elementary School, 2017: Competitive procedure with negotiations. The competition teams would offer a design and a cost. There were two rounds of negotiations, and the competition teams improved their

offers and designs twice. However, one competition team chose not to improve their design, as they were given strong signals that their design would have a poor chance of winning. The Ullerås Elementary School was intended to be a 3 parallel, grades 1-7 school for 590 students, with a gross area of approximately 8,500 m².

- Case 4, Nysæter Middle School, 2018: This was the only competition with only prequalified architects competing, a so-called limited architectural competition.. There were no negotiations. The school was to be a 2 parallel, grades 8-10 school for about 360 students, with a gross area of 7,300 m².

Due to the Norwegian Building Authority's focus on time as the most measureable and adequate factor in which to consider whether an lift solution is sufficiently universal-designed or equated, it has been necessary to estimate the extra time a lift needs to spend. In this research the time spent has been calculated. The speed of a mobility-impaired person may range from fairly fast to very slow. However, based on an article examining wheelchair users, the speed of 1 meter per second is used [20]. Opening and pushing doors is set to 10 seconds, while every 90 degree turn makes the transport and orientation more confusing and is estimated to cost another 5 seconds. Then there is the travel speed of the lift itself, where the lift could be on ground floor, and the user on floor 2. Given an hydraulic lift with having the speed of 0.15 meters per second, this means a 25 second waiting time per floor. Additionally, the user will have to wait for the doors to open. In this study the waiting time for the lift is set to 30 seconds, and the transportation time is set to 30 seconds, regardless of whether the wardrobe happens to be located on the first or second floor. The higher a school building is, the more significant the parameter of the lift speed becomes.

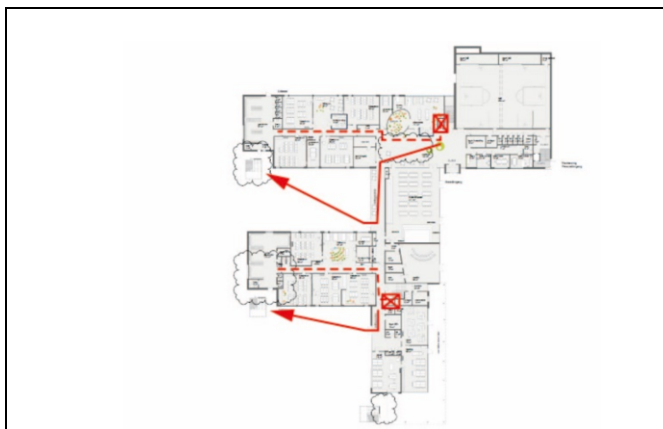


Figure 1: Detour distance from the students' wardrobes to the outdoor recess area shown on the winning project of case 2, prior to negotiations. Detour distance first floor: Dotted line. Detour distance ground floor: Solid line.

3. Results and discussion

Generally, there were only 2, maybe 3 competition entries which had convincing lift solutions with an equated effective distance from the wardrobe to the outdoor recess area as the staircase users. A good time-effective distance also increased the possibility for social interaction. Figure 2 shows an example of the positioning of lifts before negotiations in case 2, Levre Elementary School. Project 2.1 has a total of four lifts, and there are lifts adjacent to the students' wardrobes. The extra time spent on using the lifts is therefore close to zero, depending on the speed of the lift. In the project 2.2, there are two lifts placed in the central indoor passageway. The wardrobes are placed close to the inn-door school passageway, and the average distance from the different wardrobes to the lift, and further to the respective outdoor recess area, is 35 meters. This project was however criticized for putting the wardrobes as a barrier between the general teaching area and the common and specialized functions areas. Also, the solution resulted in 448 students having to enter into a rather narrow area of the project. After the negotiations, the wardrobes with integrated lifts were moved out to the end of each lateral wing. The winning project 2.3 had an average distance between the wardrobes, lifts and outdoor recess area of 85 meters in the original design. During the negotiations, this was improved upon partly by an additional lift located in the wardrobe in one of the lateral wings with general teaching areas.

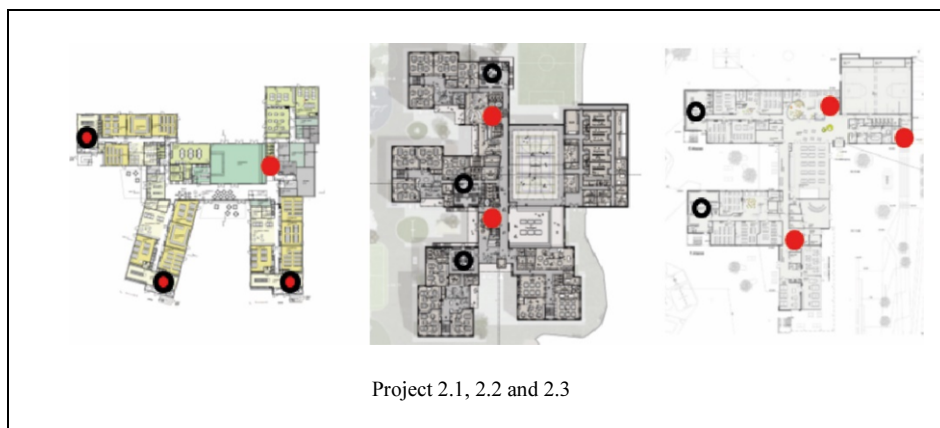


Figure 2: Competition entries in case 2, Levre Elementary School prior to negotiations. Red dots without black ring: Lifts. Black ring: Students' wardrobe. Red dot with black ring: Lift integrated in the students' wardrobe.

3.1. The clients', juries' and competitors' attitude towards universal design and lifts

In cases 1 and 2, the client had a clear, positive attitude towards universal design in general. Also, as a part of a learning process from case 1, user representatives for universal design were included in the development of the competition brief for case 2. In both case 1 and 2 the competitors handled the lift question differently, and the client used

the negotiation phase to specify the need for more lifts to reduce the detour distance from the students' wardrobes to the outdoor area. These negotiation requirements were then met by the competitors. This resulted in a significantly reduced detour time, but still the winner projects did not offer a lift at each student entrance. In case 3, the client had no opinion on the positioning and number of lifts, and the jury chairman did not think it was appropriate nor necessary to require lifts at each of the student entrances. However, the solution agreed upon was to remind the competitors of their responsibility to fulfill the TEK 17 requirements, and that any lack of lifts would be a matter of their own responsibility. As a response to this, one competitor moved one lift to a more central position. The competitor ending up winning, established lifts at each student entrance. In case 4, there were no negotiations. In general, the client representatives in the jury saw the need for a design allowing for short distances between the students' wardrobes, the lift and the outdoor recess areas. The winner project had an estimated detour of less than three minutes. The detour times in the architectural competition, in case 4, are closer among the competitors, i.e. around three minutes. In the competitions with involving a contractor, cases 1, 2 and 3, we find the highest values for detour times, and these are always in the winning projects. Thanks to the negotiations, these detour values are minimized. There may therefore be reason to query whether the pressure to economize in the design build tends to affect the architects' ability or willingness to design optimal universally designed buildings.

Of the 15 competition entries, only Skanska/Link in case 1 and Tronrud Bygg/L2 in case 2 propose lift solutions undoubtedly within the building code requirements. However, this quality is neither repeated by Tronrud/L2 in case 3 or nor by L2 in case 4. The winner in case 1, Lillefrøen, was pushed to improve the lift situation through the negotiations in that case. Nevertheless, however, Lillefrøen fails to improve their lift solution in case 2, despite an all the increased focus on universal design in the competition brief and their knowledge of the client's clear preference to universal design. It is difficult to recognize any kind of general improvement in the competition entries from cases 1 to 4, although many of the participators remain the same.

During the jury meetings, the following factors concerning the positioning of lifts were mentioned scrutinized; these could serve as general advice for improving work future projects:

- The distance from wardrobe to lift, and from lift to the outdoor recession area should be minimized
- The detour route should be intuitive, rational and of high architectural standards, both indoors and outdoors
- The number of doors to pass through and corners to turn should be kept to a minimum
- The lift should be visible from a distance
- Avoid forcing students to pass through the teaching areas, wardrobes or outdoor recess areas of other student groups
- It may be a negative factor for students to have to pass the windows of the administration, any classrooms involving students from other grades, or to have to find themselves in remote areas without adult supervision

seem to believe that the juries will look for projects with low costs in favor of projects with a high standard of non-discrimination – or in the words of Steinfeld and Maisel: “improving human performance, health and wellness, and social participation” [8]. Likewise, the competitors cannot feel confident about what exactly the client is asking for, and whether the juries would be capable of properly assessing the value of non-discriminatory student entrances. This could especially be the case where universal design is not part of the evaluation criteria per se as was also found in the author’s previous research [6]. Competitors will normally carry out strategic choices to optimize their competition entries. This means that qualities outlined in a competition brief will not be treated equally, but will be interpreted in terms of to what degree they appear to be emphasized [15].

4. Conclusions

The results show that despite the requirements specified in the building legislation code, the Anti-Discrimination and Accessibility Act, requirements in the competition-briefs, and despite universal design as an assessment criterion, the competitors tend to prioritize lower bids in favour of universally designed vertical logistic solutions for the students. Only two, or in part three, of the 15 competition entries offered lift solutions undoubtedly within the building code, as interpreted by the Norwegian Building Authority. Whereas the competitors in the architectural school competitions appear to have adequate knowledge as how to solve universal design on an operational level, they appeared to either be lacking or not willing to address universal design on a strategic level. Based on the investigated cases, the contractors seem to believe that the juries will look for projects, with low costs in favour of projects with a high standard of equivalence. The results also show that any school design, with some reasonable effort, could reach a lift detour of maximum three minutes when using the calculation model applied in this research. However, from a lift user’s point of view, any kind of detour may be experienced socially excluding and unacceptable.

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