

# Universal Design as a Booster for Housing Quality and Architectural Practice

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**Abstract.** Norwegian central government has for the last decade increasingly focused on universal design. Fundamental changes in the Norwegian building code and corresponding regulations in 2010 give an apparently clear framework for the implementation of accessibility and universal design. However, it seems that neither increased awareness of accessibility requirements and universal design, nor compliance with the building code guarantees improvement of housing quality and usability. The Norwegian regulations have gone further in the direction of performance requirements than most other countries. This applies to all types of requirements, including requirements for usability, functionality and accessibility. Hardly any specifications are to be found in the regulations. Ideally, this lack of specifications should give designers the opportunity to develop innovative answers and hence to respond to different contexts and needs. Still, many architects and builders ask for clear specifications, in order to simplify and speed up design processes and make control of solutions easier. Many architects understand guidelines as minimum requirements, and are thus reproducing the identical solutions without considering the context and the needs of the users. They see accessibility as another regulatory pressure and requirements as restrictions rather than positive incentives. However, there are examples of designers who have internalised the regulatory framework and thus are able to create and integrate inclusive design in their daily work. Based on recent research conducted by SINTEF Building and Infrastructure and financed by the Norwegian State Housing Bank, this paper presents examples of practice where dwellings have been developed within a framework of universal design. Focus of the research has been on the approach of the design team and their understanding and use of the regulatory framework in order to create better homes in dialogue with the building authorities. Main objectives are to:

- Contribute to better understanding of universal design as a tool and a method to improve housing quality and usability
- Investigate the conditions for developing dwellings with innovative and functional solutions in compliance with the building code
- Discuss challenges in interpreting the requirements and in taking the needs of various resident groups into account

**Keywords.** Housing, accessibility, regulations, universal design, architectural practice

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## 1. Introduction

### 1.1. Background

There is by now an undersupply of homes in Norway. As an answer to that, the Norwegian government has set up aims to build more, faster and cheaper [1]. For the first time since the introduction of statutory requirements for accessibility, the regulations may be eased merely on demand of housing developers and builders. This happens while architects and researchers are pointing out severe quality flaws in the market driven residential architecture [2] [3]. Consistent trends in new housing have been shrinking space standards. Housing qualities that are under pressure include daylight, spatial configurations and room sizes ; living rooms are tiny and resemble passageways, cramped bedrooms, too little storage space, and impractical design and location of kitchens.

The building policy has increasingly focused on universal design during the last decade. Fundamental changes in the Norwegian building code and corresponding regulations in 2010 requires universal design in the built environment in general and accessibility in a large part of new housing. All flats in apartment buildings of more than two storeys have to comply with accessibility specifications. These changes have triggered a heated discussion among some stakeholders in the construction industry. Many of them are unhappy with what they fear will lead to increased use of floor space, and thus to increased costs, especially in the smaller units. Many architects are critical of what they see as rigid minimum requirements. Some of them believe that accessibility thus threatens other essential housing qualities.

Many architects are by now able to create accessible solutions that are at once functional and architecturally satisfying without being overpriced. New housing projects usually fulfil accessibility requirements, but challenging and unconventional solutions are few. Existing and well-known layouts seem to be adapted to the new requirements, with pathways getting wider and bedrooms a little larger. The dwellings generally lack storage space, even though the building regulations are very clear on that point [4]. In housing smaller than 50 m<sup>2</sup>, the average area increase caused by the 2010 amendment is found to be less than three m<sup>2</sup>, [5] which is in line with our findings [6]. Surprisingly, the changes have not been as foreseen by some builders: bedroom size has increased by one m<sup>2</sup> and the bathroom only by than 0, 5 m<sup>2</sup> in average. The most pessimistic guess was that the increase would cause even smaller living room spaces, but Ryhl & Frandsen found a 0, 8 m<sup>2</sup> average increase.

This paper addresses the issue regarding better home design from a Universal Design approach and is based on recent research conducted by SINTEF Building and Infrastructure and financed by the Norwegian State Housing Bank. The project aims to identify and describe approaches that strengthen universal design beyond accessibility requirements. To do so, one intermediate goal is to understand how the participants in the design process read and use the building requirements in order to achieve housing quality. How do the changes affect the ways in which architects work? What about the user perspectives? Do the regulations support universal design and contribute to housing with good overall usability as an essential part of the architectural concept?

## 1.2. Regulatory Framework

Norway has a system of building code and regulations supplemented by recommendations and guidelines. These form the basic framework for accessibility and universal design, within which architects have to design the built environment in general and housing in particular. Compliance with the code is a matter for the firms/architects who apply for building permission.

The building regulations refer to guidelines, to Norwegian standards and to descriptive series published by the Norwegian Building Research Institute. These series or planning leaflets contain detailed specifications and advices, but none of them are to be understood as requirements. They show solutions which satisfy the requirements, and which in direct translation from Norwegian are called “pre-accepted solutions”. The building regulations allow other solutions than the pre-accepted ones but most of the time we find that architects use guidelines and pre-accepted solutions as if they were requirements. Some minimum requirements are however specified in objective terms, as e.g. specific heights or widths etc. In fact, and because development of alternative solutions often means complications and delays, many architects and builders are looking for clear specifications, which they believe make design and control easier.

The trend is likely to move in direction of more specifications, as the development of self-service building applications and automatization goes on (BIM). The rules have to be precise and easy to check (compliance: yes or no) with little opportunity for assessment. Non-measurable qualities may suffer under that.

## 1.3. Universal Design and Accessibility/Usability

In the field of architectural theory most of the work has concentrated on creating a basis for the understanding of Universal Design principles and combating negative attitudes. Design methods based on creative discourse and user involvement, empathy creation and simulation exercises form the pillar of Universal design teaching, seemingly all over the world [7]. Taking the needs and preferences of the residents into consideration, through user-centered design, is the core of universal design.

Universal design is largely associated with regulations and standards. Camilla Ryhl [8] notes that universal design still is defined in relation to disability and accessibility, and not as a distinct part of the academic discussion about quality in architecture.

Its dimension as an aim and a method for improved and sustainable building quality is unfortunately largely absent in the public consciousness. The structure and terminology used in the Norwegian regulations contributes to this (mis)understanding of universal design as a higher level of accessibility. Many contributors to the design process understand universal design just as a set of requirements beyond accessibility. Housing shall be accessible whereas public buildings shall be universally designed. Dimensions such as understanding the relationship between people and their built environment are often missing.

A previous evaluation of residential developments that had a particular focus on universal design and accessibility during the design process [9], showed that they were more accessible than the regulations required at the time they were built. Even if plan layouts do not comply with the requirements of today, the residents, wheelchair users included, were satisfied with the functionality. An early ambition of universal design among the stakeholders in those projects and the way this ambition had been handled

during the construction process, greatly contributed to the satisfying overall housing quality.

#### 1.4. Sustainable Housing Qualities

The focus of housing research in Norway and Scandinavia has long been on the functional properties of the home. In Norway, The State Housing Bank has played an important role in both financing housing with long term loans as well as securing a minimum quality standard. Liberalization of the housing market changed this approach. However, the bank has continued to be a central promoter for housing quality. In the eighties the guidelines “Good Housing” [10] highlighted adaptability, possibilities for zoning, securing privacy and social activities and accessibility as important qualities. The loan has by now its basis in the standard for universal design NS 11001-2 [11].

Many qualities are not easily measurable, but might be more valuable in everyday use than the measurable ones. Internal spaces and layout that allow for adaptation or conversion without adjustment to the way they are built is such a quality, so are the option to furnish and thereby use the rooms in different ways, spatial form (volume and proportions) and organization, or inventive use of daylight.

## 2. Methodological Approach

This paper is based on qualitative case study methodology. Multiple approaches to qualitative methods have been used. We initially conducted in-depth studies of accessibility requirements and different types of guidelines, as well as a simple literature study of recent research relevant to the analysis. In order to study the practitioner's perspectives, we have conducted semi-structured interviews with architects in three offices, and examination of architectural drawings in different stages of residential projects. In addition, we have inspected documentation produced by the architects to show how solutions that are not pre-accepted (e.g. set out in standards or other guidance material) satisfy performance requirements. The architectural practices have been selected on basis of known concern for universal design or/and architectural and housing quality. All three are small (less than 10 employees, owners included), so that we could expect an easy flow of information within the office.

In research and evaluation projects, the researcher usually interviews the stakeholders when the building is completed. They will then be more likely to assess the results, and the design process will be referred more overall. In this project, we wanted to highlight the immediate issues and trade-offs that occur during design stages. Observing and following the design process by attending meetings and building site visits gives the opportunity to get valuable information about negotiations between architects, builders and the authorities. This method is unfortunately time-consuming and participating in meetings and site inspections has only been possible in one of the selected offices. In the two others, only in-depth interviews and document analysis have been conducted.

In order to investigate the building authorities' perspectives, we have conducted interviews in two large Norwegian municipalities. These have been chosen because of their long and focused effort to implement universal design in their community. These are the municipalities where the selected offices have designed most of their housing projects.

We regularly do inspections of new housing projects. These are not a part of the cases, but we do use findings from those inspections in the following discussion. Two of the offices usually design housing constructed with a system of stacked timber modules on concrete foundations. This form of housing production is often characterized by mass production and standardized low-cost solutions. In those projects, the clients have been willing to invest time and resources to achieve a higher functionally and technically quality. The third office designs housing using traditional on-site construction techniques. The dwellings have been sold after completion, which is extremely unusual these days. Dwellings are usually sold in advance, long before they are built. The Norwegian State Housing Bank has been involved in all the projects in the selection.

### 3. Findings and Discussion

#### 3.1. Innovation and Documentation

If architects choose not to follow the descriptions included in the guidelines, the Norwegian Building Research Institute or the standards, they have to document that the chosen solutions comply with the regulations and are accessible. Both local authorities and architects seem to lack routines for assessing these types of solutions. The following advice has been given in internal guidelines for officials in charge of building applications: "*There has to be very strong reasons not to follow the specifications given in the guidelines.*" Statements of this sort do not invite innovation and shows that pre-accepted solutions function effectively as norms.

Ideally, performance requirements should give designers the opportunity to develop innovative solutions concerning universal design, but uncertainty about the possible interpretations is an additional difficulty during the design process. The designers clearly state that reading and understanding the requirements is a difficult exercise. It takes a considerable amount of time and energy from other activities. The complexity of the procedures related to accessibility can therefore be an obstacle to its implementation.

The architects depend on consultants who are inventive and able to understand the regulations freely. All the architects in the cases have e.g. experienced the importance of an early and open dialogue with the fire consultant to document unusual solutions. Consultants who have the capacities to innovate in collaboration with the architects are in demand.

Architects consider accessibility as a natural part of their skills/know-how, and are thus less likely to ask for assistance from accessibility experts, unless the building authorities ask for it. Sharing the tasks of documentation and control with an accessibility expert could be recommended for many reasons but is a long way off yet, and will not normally happen unless the firm has run into trouble with the municipality or an association of users.

According to our informants from the local building authorities, few architects have changed their overall attitude to universal design. The municipal officers have not seen changes in the architects' approach to design, neither greater focus on residents needs or increased use of analyses to document that accessibility requirements are met.

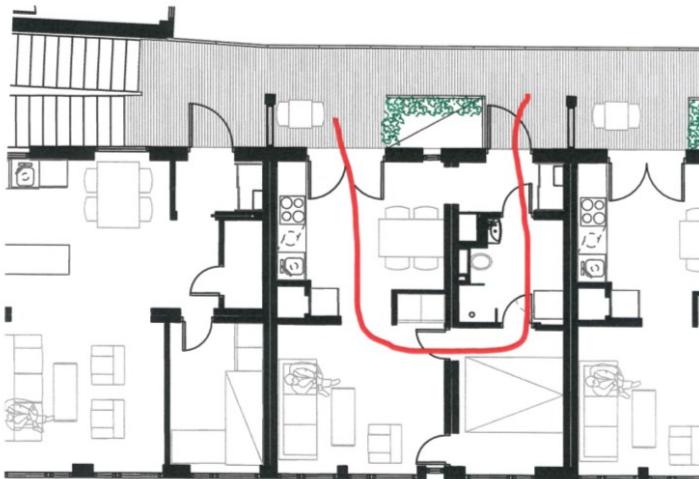
The municipal officers spend a lot of time explaining what universal design is all about. They are aware that this is a question of values. They want to contribute to change the attitudes of the practitioners.

The architects in the case studies have for their part largely changed attitude and deliver not only interesting layouts, but improved methods for design and documentation too. An example has slanting walls to fit wheelchairs circle in corridors (Figure 1). The architects did not search for a formal expression, but for a solution to a particular issue (the adaptation to a wheelchair), which in turn revealed spatial qualities too. They could have designed slanting walls anyway, e.g. to create better communication spaces, but this particular design was triggered by the accessibility requirements.



**Figure 1.** The introduction of slanting lines could be a track to renew spatial configurations and produces optical illusions that may make the solutions look larger than their actual size.

In Case 2 (Figure 2), the architects emphasise the social qualities of the dwellings. The accessibility to wheelchair-user is achieved only in a few apartments, the project having been approved before 2010. The project is composed of two slender volumes to avoid the drawbacks that follow deep buildings. Galleries screen the apartments and openings in the floor allows daylight through. The layout allows a circular movement (a "ring") through the hall and the dining room and out again, through a double door. Roof terraces are accessible for the residents.



**Figure 2.** Case 2

The design of the galleries reduces undesirable views, and provides better acoustics and daylight to the apartments. Fire safety was a difficulty, but they could apply for an exemption and propose a sprinkler as a compensation. In another similar and more recent example, they no longer had the opportunity to do so. The regulations had changed and a sprinkler was required anyway. They had to rely on an experienced fire consultant, who developed a "non-pre-accepted" solution and produced the adequate analyse and documentation.

The impression of the municipal officers is that the requirements are fulfilled in new buildings, but that there is little knowledge of the background for the requirements and universal design as a method. Designers generally lack the necessary overview on legislation, regulations, standards, guidelines and recommendations and interaction between those. According to the architects in the cases, a thorough knowledge of the regulatory frameworks is needed to understand their creative potential.

A broad knowledge of regulations and the connection between these and various guidelines and standards and responsibilities are indispensable as a basis for creative and new concepts. A challenge is that different persons in the team hold this expertise: some of them are experts in building regulations, and follow the requirements to the letter; and some others prefer not to and may be the creative part. The first have valuable competence, but need to be confronted. The latter get the innovative ideas but may need to be controlled. The two of them cannot do without each other. This highlights main drivers to universal design in the offices: 1) being aware of the

necessity to master both approaches, and 2) facilitating discussions and cooperation within the office.

Housing projects include many participants with different attitudes, goals and knowledge on accessibility and universal design. They are unlikely to understand each other and communicate effortless unless they have a plan for it. In two of the case studies, the builder and the architect had known each other for a long time and could trust in each other, which was a success factor. They had an informal and good dialogue, which allowed them to solve problems easily and to improvise if necessary.

### *3.2. Interpretation and Control*

The main issue concerns interpretation. Performance based requirements are by definition open to interpretation. This, in fact is the main reason why they are performance based. The intention is that the designer should have freedom to create new and responsive solutions. UD is precisely about modeling solutions that are adapted to each new context, responsive to the needs of the users, through a questioning and open minded design process. The designer should not take for granted that he or she has the answer. Discussions about the understanding of accessibility requirements, especially during the development of the architectural concept, are crucial. It is useful to approach the following question with an open mind: "How does this solution satisfy the intentions of the regulations?"

Many struggle to interpret the building code. Understanding the way to use the regulations requires efforts and is time-consuming. In the largest practices, there are architects specially dedicated to this task.

Inconsistent rules arouse frustration among architects. The inconsistencies cause unnecessary questioning and paper work. An example is the free space at the side of door handles required to achieve accessibility for wheelchair users although the bathroom does not have to be accessible. The architects in the case studies feel they have to solve many minor details, at the expense of overarching qualities. Solutions that can easily be changed after the building is completed take more attention than needed in the design stage. Still, the building requirements do not guarantee for ordinary usability. One of the informants wonders why the regulations do not accept adaptations after the dwelling is taken in use; why cannot doors be reversed, or walls and cupboard removed as long as it is possible to remove bathtubs and showers afterwards? It happens they adapt fittings to the requirements, thus reducing the usability of the room: e.g. removing a cabinet in the kitchen to show sufficient free space at the side of door handles. There is a contradiction between leaving space for builders and architects to innovate on universal design and providing clear specifications in this area.

Architects need not only tools to discuss usability and accessibility at every level of design, but the opportunities to do so as well. Since the accessibility requirements came into effect, tools to control the design have been developed at either office level or organization level. They often appear as check-lists, based on the building regulations and including every level of drawing, general outlines as well as details. The architectural concept is rarely included in the control, even if it has great consequences on the accessibility and the overall usability of the housing project.

The building authorities are concerned with the requirements, even though the responsibility is on the architects. They expect planners to take care of the accessibility. Even though, they look at plans, but do not conduct any supervision. It happens they

question the architect if they notice solutions that do not comply with the regulations. They pay particularly attention to the bathrooms. Sometimes they ask their colleagues to conduct a subject-specific control and supervision, or an independent control of accessibility design and construction. One difficulty could be that municipalities who are conducting control or supervision are dependent on architectural competence to assess any analysis that planners provide in relation to unconventional solutions.

It happens they give exemptions under certain conditions. The planners have to argue well and provide compensatory measures or qualities. This could e.g. be higher ceiling or more daylight.

The municipalities have produced different types of guidelines that may give a part of the answer and simplify the tasks of interpretation and analysis. In the largest municipality, the building department is concerned by offering an identical practice in order to provide predictability for the parties. The department treats many housing applications in the inner city. These encounter particular challenges due to the density. The department has therefore developed a guide on compact housing, a policy for best practice for design of small homes. An unintended consequence could however be that planners will use the given solutions directly and thus refrain from innovation.

Our informants in one of the municipalities consider that some types of guidelines are too "rule-governed". When the designers have to think out of the box to find solutions, they cannot reuse well-known solutions. We find clear indications that guidelines may prevent the development of new solutions 1) because they show particular solutions, often in a fragmented way, and detached from their context and 2) because they often interpret the requirements literally.

### *3.3. User Needs – How Are They Taken into Account?*

The basic dimension is the turning space needed by a wheelchair-user. Some practitioners are able to challenge the basic and functionalist concept of the generic user, but there are few opportunities to do so during a conventional design process without having a supportive developer. An effective partnership between housebuilder and architect plays a central part in finding good solutions for accessibility and universal design that should ideally be based on the users' needs and preferences. Empathy and understanding of residents' different needs seems necessary, but there are few opportunities to elaborate the required evidence.

There is currently no lack of reference material. Making sense of the knowledge base means that the architects have an extensive mass of publications to investigate. Guidelines with design solutions, examples and presentations of best practice or advices in compliance with the building code are the dominating type of resources. Most of them are dealing with mobility impairments, almost to the exclusion of solutions for people with sensory or cognitive problems.

Rethinking may have significance for the quality of architecture and is an important contribution to development of better solutions that include everybody equally. However, since houses are built at volume, the quality has to be consistent and designing each from scratch is not feasible. Builders understanding of user needs seem still to be based to a large extent on own experiences and recommendations or instructions from the estate agent. In general, new housing is being both designed and built by highly skilled professionals. Little seems to be known about their intentions and priorities and how these are formed. Most will state that they follow market trends closely and provide that which the market demands.

User involvement is often mentioned as a method to ensure the resident's needs. This appears to be a demanding method, partly because the knowledge of architecture is disparate and partly because the intentions of the participants can be contradictory. In the case studies, involvement was reduced to some few simple options, and far away from a real process. Anyway, just asking the future residents what they want, without engaging an in-depth process, would probably only reproduce well-known solutions.

#### 4. Conclusion

Architects are more than any other group within the construction industry trained to break the conventional frameworks. Shall homes be innovative and sustainable, must the regulatory framework follow. Social sustainability needs a holistic approach.

It may have been too high expectations about what building regulations can accomplish for housing quality. They are a tool for a minimum overall standard of housing quality and for safety specially. As most tools, they are very dependent on the user, how he uses them and for what goal. There is a clear need to demystify the technical specifications and the use of them – making them an ally and not an enemy.

The architects in the case-studies experience the requirements are bureaucratic and time-consuming to meet, even though they master the art of interpretation and documentation. They are more than willing to innovate and to reduce their use of pre-accepted solutions. It happens they invest in development of new solutions, but this is often at a high cost and depends largely on the good will of the client. One chief intention of the building code is to promote universal design in the built environment. It seems that the appending regulations may not follow up the intention as it could be expected. Amendments are probably needed and should be done on basis of a broader view on the design process. Other instruments like grants and architectural competitions dedicated to promote universal design could be drivers for the development of both methods and solutions.

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