

HOW EXPENSIVE IS IT TO BUILD A VISITABLE HOME? A CASE REPORT

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Abstract: Loneliness and social isolation of older people or those with mobility impairments may result from the physical environment not being in correspondence to their degree of mobility. Winter conditions combined with the presence of steps at the entrance to homes are among the obstacles that prevent them from participating in social or community activities necessary for their well-being. The concept of visitability is proposed in order to allow seniors or individuals with mobility impairments to visit their loved ones. The three criteria for achieving the basic visitability of a residence are: 1) an entrance without a step at the front, back or side of the home (located on a path accessible from the street); 2) wide doors on the main floor (minimum 813 mm (32") opening); and 3) an adapted bathroom on the main floor. The objective of this study is to validate whether visitability can be an economically viable solution, through a comparative cost analysis, to enable older people or people with mobility impairments to visit their loved ones. The results of this case study demonstrate that the marginal costs of applying visitability criteria to new construction can be zero or negligible. These results indicate that the approach to visitability, both basic visitability and so-called improved visitability, should be taken into account more systematically by

builders and developers in order to promote the social participation of older people or those with motor disabilities.

Keywords: Visitability; Cost; Building; Older People; Motor Disability; Social Participation.

Introduction

Having a social life and participating in community life are important elements in maintaining quality of life and well-being for all (Holmes & Joseph, 2011; World Health Organization, 2002). This includes, among other things, visiting family and friends, which may seem trivial for some people, but can be difficult for others, such as older persons or those with mobility impairments. While great progress has been made in creating accessible public spaces in Canada, and even elsewhere in the world, this trend does not generally concern the accessibility of private homes (Government of Quebec, 2012). The difficulty, or even impossibility, of people to access or leave their loved ones' homes is a hindrance to their participation in social and community life. In fact, they may prefer to stay in their home rather than leave because of the challenges of visiting the home of a loved one. These barriers to mobility in the built environment mean that they are forced to live in isolation (Edelbrock et al., 2001; Gardner, Brooke, Ozanne & Kendig, 1999). Social isolation has also been associated with other consequences for quality of life, such as depression and suicide (Gutzmann, 2000; Silveira & Allebeck, 2001). In order to remedy the lack of accessibility of homes, a concept has been put forward for some 40 years, namely that of "visitability". Visitability can be defined as the ability of an environment to be visited by the vast majority of the population, based on simple, sustainable, inclusive and affordable criteria (visitablehousingcanada.com, PARA et al., 2006). The aim of visitability is not to make changes to a home in order to satisfy the specific needs of its users. Rather, visitability aims to provide a basic level of accessibility in all new home construction and all new neighbourhood developments, not just for older people or those with motor disabilities, but for the entire population -

Eleanor Smith and her group Concrete Change introduced the concept of visitability to the United States in the mid-1980s. However, the concept was introduced in Europe shortly before. For example, in Sweden, standards ensuring a basic level of accessibility have existed since 1976 (PARA et al., 2006). In 1992, the City of Atlanta (Georgia, USA) was the first city to enact the imposition of basic visitability features in the construction of single-family homes and duplexes using subsidies from the city. In June 2006, 44 states and local municipalities in the United States implemented a visitability program (National Council on Independent Living, 2020). In Canada, a more unified approach to the design of cities and communities is needed to make them more sustainable and inclusive. For example, the Canadian Centre on Disability Studies in Winnipeg, Manitoba, conducted the project Understanding the Status of Visitability in Canada (visitablehousingcanada.com) from August 2006 to 2007, recognizing the need for research to address the issue of visitability (Canada Mortgage and Housing Corporation, 2007). The goal of this project was to develop an understanding of visitability in Canada. The results showed that, while great progress has been made in creating accessible public spaces in Canada, there is a shortage of private homes with minimal accessibility (Government of Quebec, 2012).

A home qualifies as accessible if it meets the criteria set out in Progressive Accessibility Re-form Associates (PARA), including an entrance without steps at the front, back or side of the home (located on a path accessible from the street), wide doors on the main floor (minimum 813 mm (32") door opening), and an adapted bathroom on the main floor (PARA et al., 2007). These three criteria are necessary to achieve basic visitability, thus ensuring that everyone, regardless of their level of mobility, is able to visit someone else's home, use the bathroom, and enter and leave the home without difficulty. Since "visiting" implies a visit lasting from a few minutes to a temporary stay (Maisel, 2006), a notion complementary to basic visitability is put forward in this paper as "enhanced visitability". Enhanced visitability includes all of the criteria of basic visitability, in addition to making certain improvements that allow for greater safety, functionality, comfort and flexibility at relatively low space and cost (PARA et al., 2006). In addition to benefiting older visitors or those with mobility impairments for longer visits, improved visitability allows

the residents of the home to stay longer and grow older. In other words, a home with improved visitability can be adapted more easily to the new mobility needs of its occupants as a normal process of ageing. On the other hand, as it has been argued before in the literature, one of the barriers to implementing visitability may be the associated costs (Maisel, 2006; Truesdale et al., 2002).

Objective

The aim of this study is to explore and explain comprehensively whether visitability can be an economically viable solution to enable older people or those with motor disabilities to visit their loved ones. It will thus be possible to establish if the implementation of the three visitability criteria is cost-effective in a context of increased accessibility of new single-family homes in order to facilitate visits by a majority of the population.

Context of the study

Winter, in Quebec (Canada), makes home entrances the most restrictive areas for adults with motor difficulties (Morales & Rousseau, 2010). In some large urban centres, snow precipitation average is over 3m (9.84') per year (Environment Canada, 2017). These weather conditions have a direct impact on the configuration of residences along with home entrances with snow and ice. Indeed, basements in private homes are very common in Quebec. Due to the cold weather, the foundations must go below the frozen ground layer with reinforced concrete walls to resist the forces caused by frozen ground; otherwise the structure may suffer major damage during the winter period (Régie du bâtiment du Québec, 1995). Meeting these structural constraints therefore requires costly excavation operations (Morales et al., 2014). In order to limit costs, it is often preferable to stop excavation at the minimum depth below the frozen layer of earth. Although this depth varies from region to region depending on the average minimum temperatures recorded, the level of the frozen ground is lower than the average height of a person standing. For example, to create habitable basements, the level of the entire house is often raised above street level, leading to the construction of several ground-level entrances with steps (Ward et al., 2014). The presence of steps at the

entrance to homes is one of the barriers that prevent older people or those with mobility impairments from visiting their loved ones.

Methodology

The study of the economic impact of the adoption of visitability measures for new buildings was carried out using a quantitative approach based on a case study (Mazumdar & Geis 2001; Yin, 2013). A comparative cost analysis was developed in the form of a case study. In order to do this, an architectural project of a rather “representative” modern-single-family home in Quebec, whose does not a priori meet the three basic visitability criteria, was identified. The architectural project is a unit located in a townhouse residential development, the plans for which were provided by a local estate developer. Each house in the building complex has a basement, a garage, a bedroom and a bathroom. On the ground floor, there is a living room, dining room, kitchen and a powder room. Two bedrooms and a bathroom are located upstairs. The cost estimate is based on a single unit.

A cost study of the plans associated with the application of the basic and improved visitability criteria was carried out. The costs are sometimes positive (+), so the modifications increase the cost of the basic construction, or they can be negative (-), so the modifications reduce the cost of construction. For the basic visitability, modifications were made to the entrance, the interior circulation and the bathroom. To do this, the steps of the main entrance were removed, for the development of a visitable main entrance. Different options were analysed in order to identify which modifications could be made along with their associated cost (see Figures 1, 2, 4 and 5). In addition, all doors on the main floor were modified to obtain a minimum opening of 813 mm (32”) (see Figures 7 and 8, element Ci-1). Also, the surface area of the bathroom was increased to obtain a turning area of 1500 mm (5') (see Figures 9 and 10, element Sb-1). Moreover, a cost evaluation of the improved visitability criteria was carried out in addition to the basic criteria (See Figures 3 and 6). Modifications based on improved visitability include, among other things, relocating the counters to allow a 1,500 mm (5') turning area in the kitchen (see Figures 12 and 13, element Cu-1), raising the height of the controls,

electrical outlets and faucets to make them accessible to an elderly population or one with mobility difficulties (see Figure 3, element E1-9; Figure 6, element E2-7 and Figure 8, elements Ci-2 and Ci-3) and adding an accessible room on the ground floor (see Figures 14 to 16). The cost estimate includes materials and labour on an item-by-item basis. The overall estimate was quantified by a professional estimator on the basis of costs recognized in the province of Quebec (Canada) in 2016.

Results

Main entrance

As previously mentioned, the entrance is the most problematic area of the home due to the presence of steps (Morales & Rousseau, 2010). Five options were considered to make it visitable. The first two are to lower the level of the ground floor to the pavement level to eliminate the use of steps and allow an unobstructed entrance (see Figures 2 and 5). This involves eliminating the garage space in the basement (see Figure 2, elements E1-1, E1-2, E1-3 and E1-4). Parking is therefore located at garden level. The window, already present on the initial basement plans, is retained with the addition of a curbstone (see Figure 2, Element E1-5). The front and rear stairs, already present in the initial plans, are removed (see Figure 2, item E1-6). The second option involves lowering the ground floor level while retaining the garage space (see Figure 5, elements E2-1 and E2-2). As in the first option, the window is retained with the addition of a curbstone and the exterior stairs are removed (see Figure 5, elements E2-3 and E2-4 respectively). This second option makes it possible to retain most of the original elements that add value to the house.

Figure 1

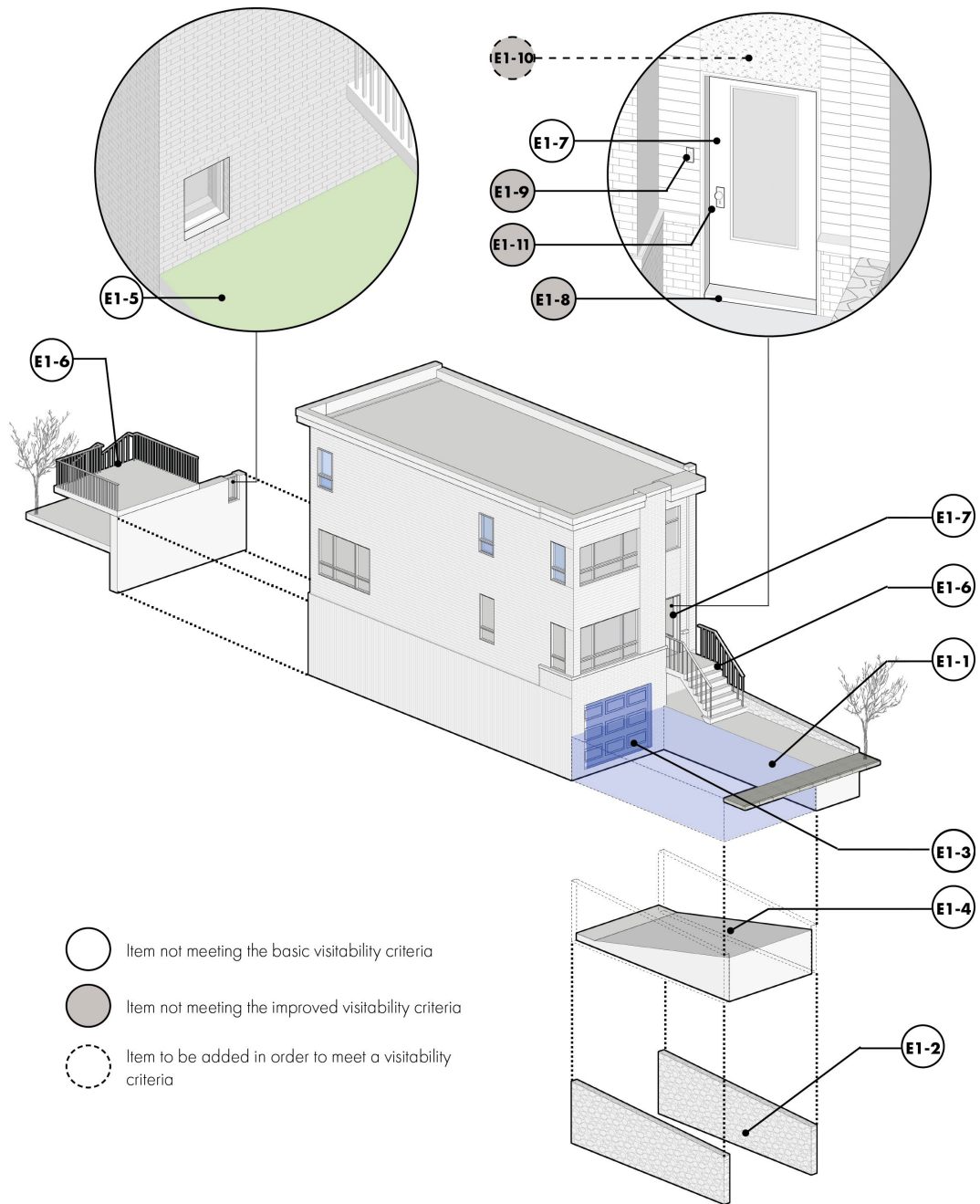


Figure 1. Entrance : Initial plan

Figure 2

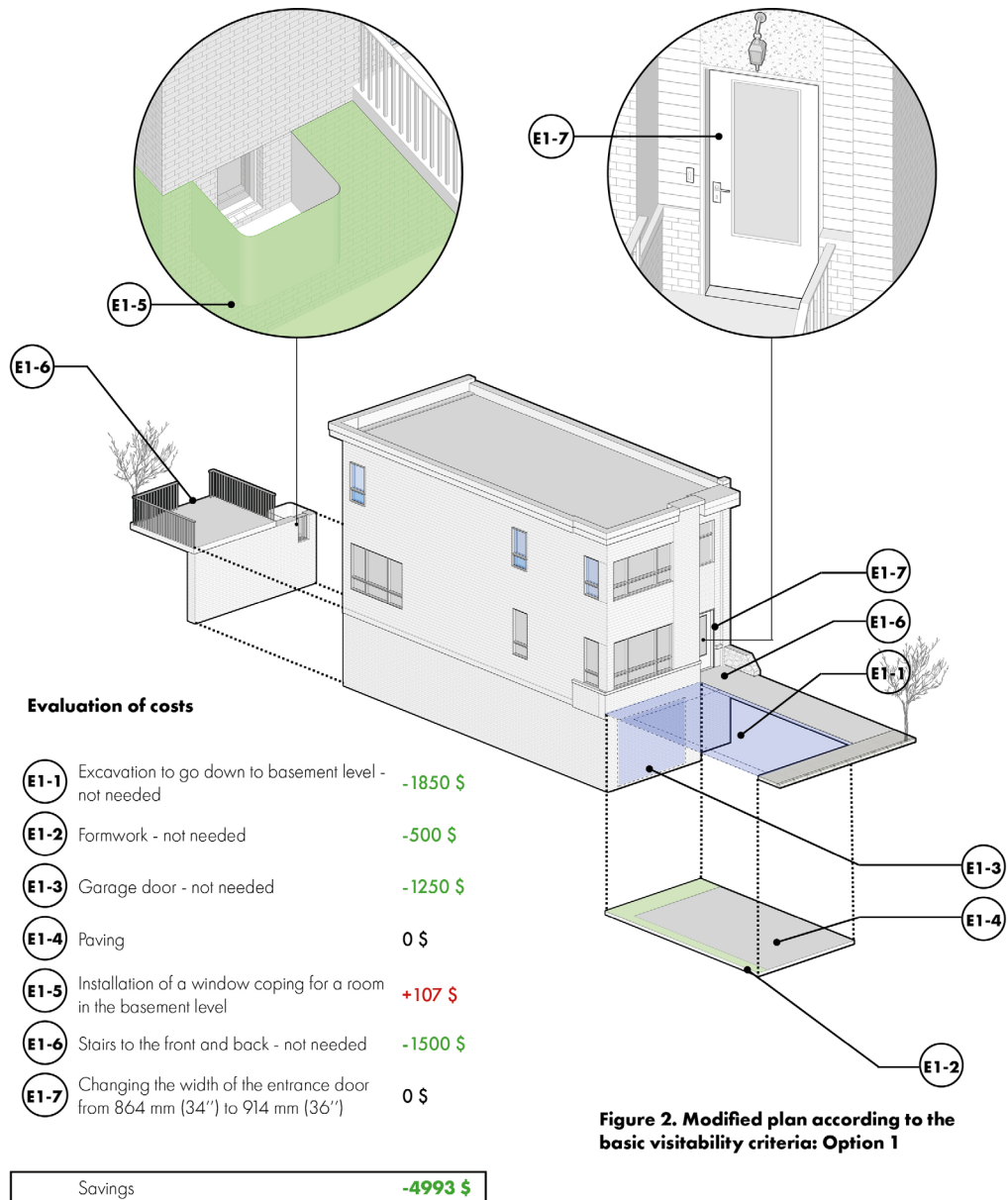


Figure 2. Modified plan according to the basic visitability criteria: Option 1

Figure 4

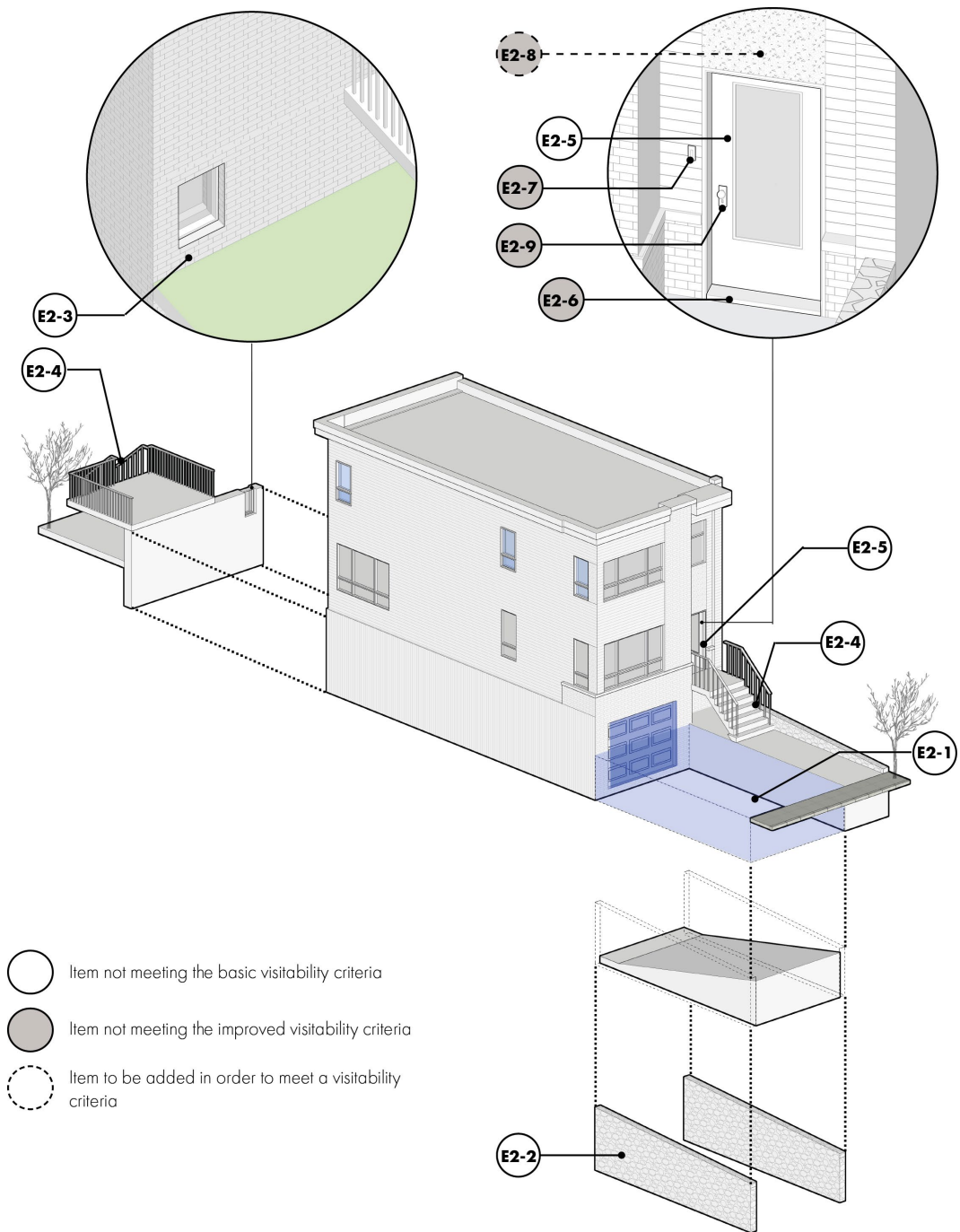


Figure 4. Entrance: initial plan

Figure 5

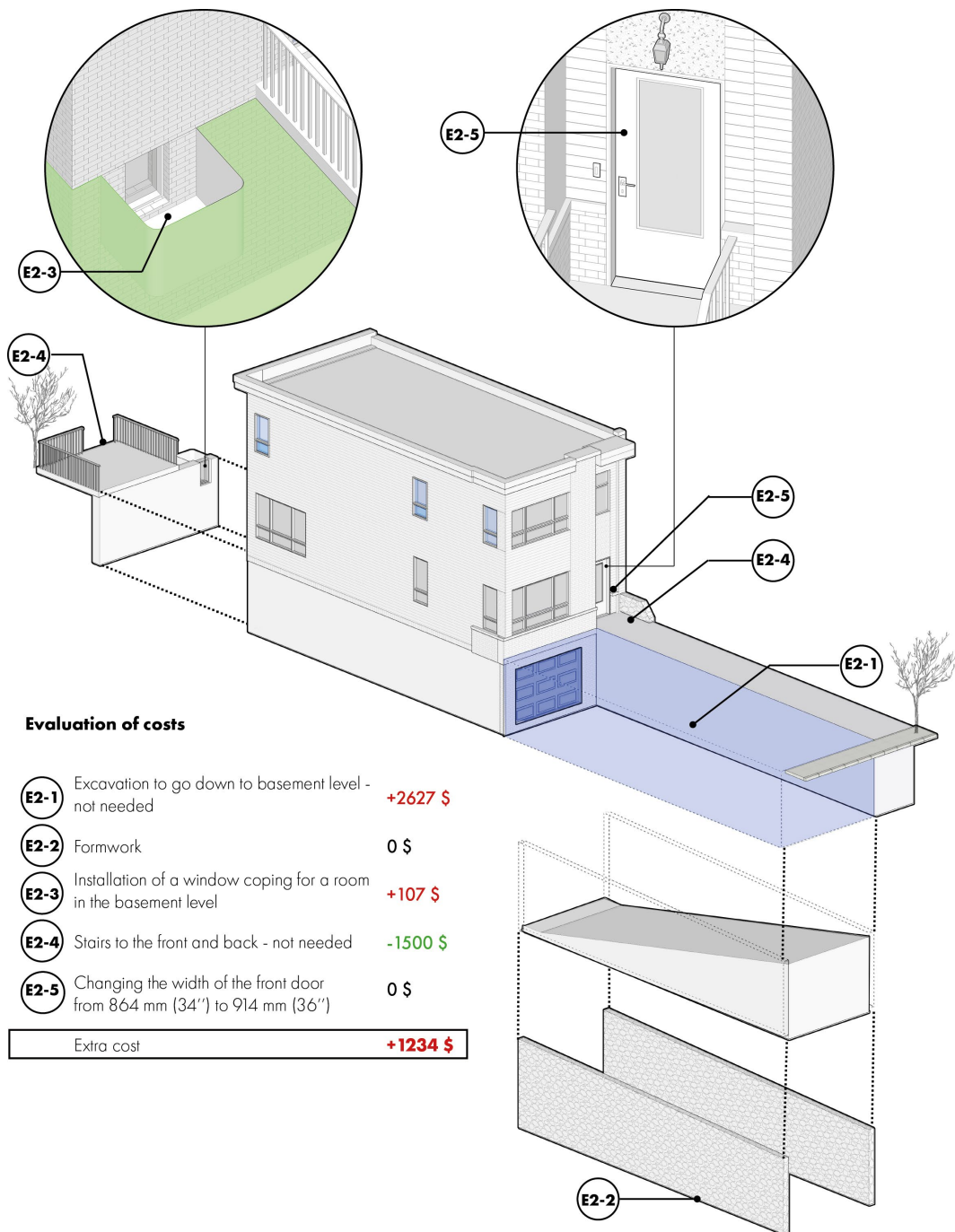


Figure 5. Modified plan according to the basic visibility criteria: Option 2

In addition, for both options, the improved visibility criteria were added such as: 1) the entrance door has been modified to be replaced by a 915 mm (36") door with no threshold (see figure 3, elements E1-7 and E1-8 as well as figure 6, elements E2-5 and E2-6), 2) the controls, such as the doorbell, have been adjusted so that they are no higher than 48" (see figure 3), The door handles have been replaced with a "lever handle" (see figure 3, element E1-

11 and figure 6, element E2-9), and 4) lighting has been added to the entrance (see figure 3, element E1-10 and figure 6, element E2-8).

Figure 3

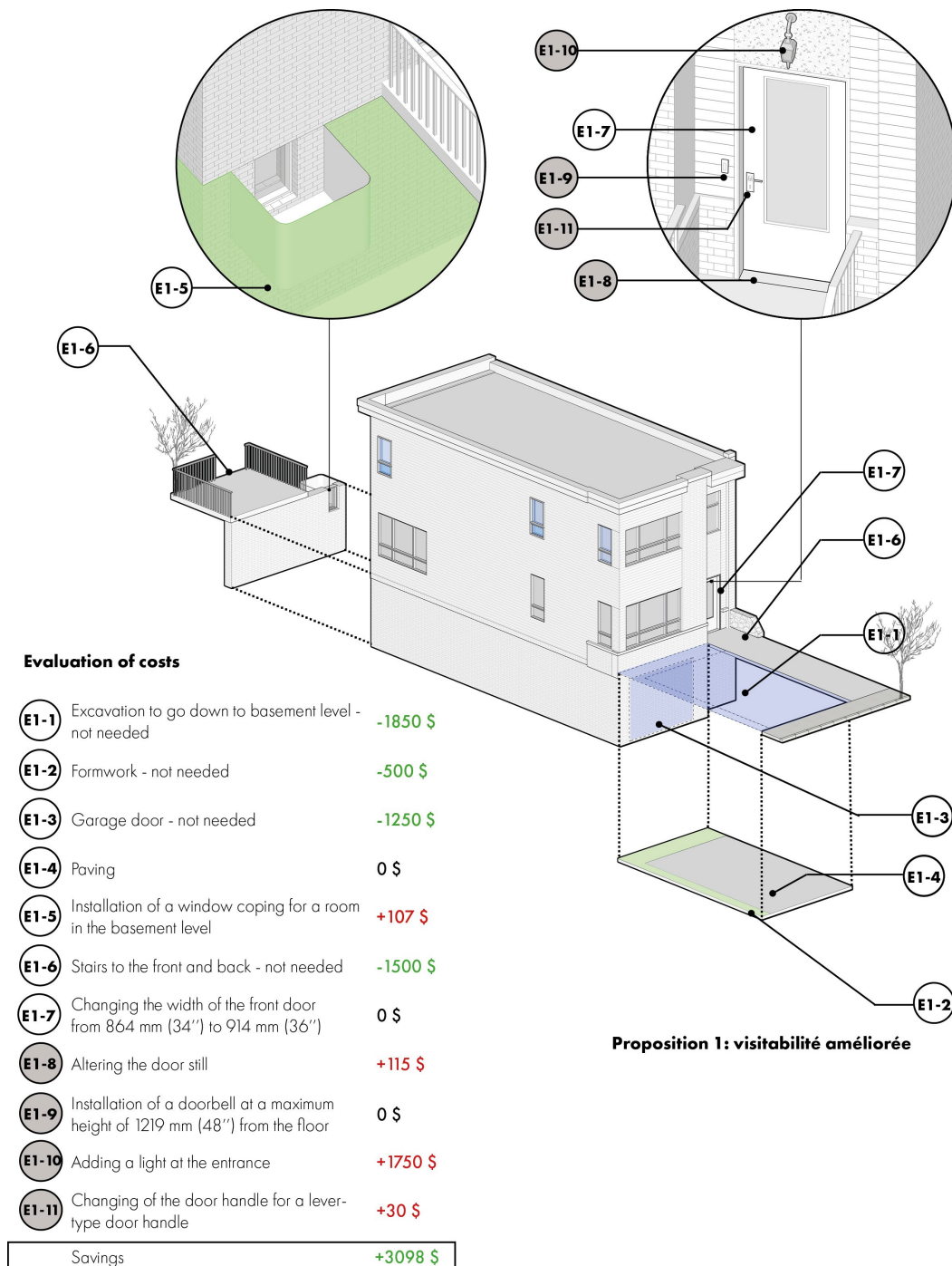


Figure 6

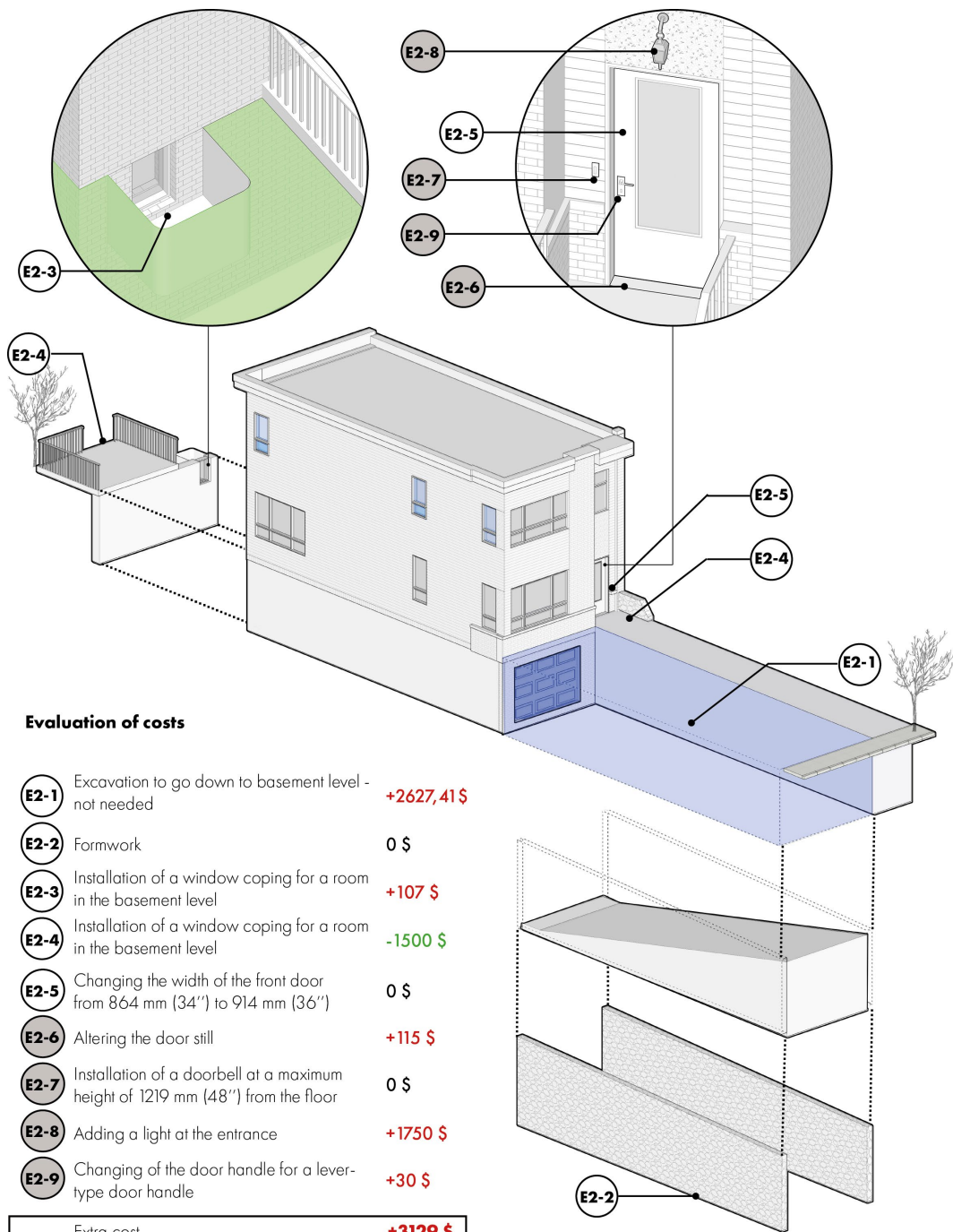


Figure 6. Modified plan according to the improved visitability criteria: Option 2

For the other three options, the financial impact of adding a concrete ramp (option 3), a wooden ramp (option 4) and a lifting platform with and without shelter (option 5) should be assessed. The costs of Options 1 and 2 are therefore compared to the costs of adding a concrete and wooden ramp and a lifting platform with the plans unchanged.

In summary, Option 1 results in a cost reduction of -\$4,990 for the basic visitability and -\$3,100 for the improved visitability. Option 2 results in an additional cost of +\$1,230 or +\$3,130 respectively for the basic and improved visitability. For the last three options: by adding a concrete ramp, the additional cost is +\$6,850, for a wooden ramp, it is +\$10,000, and the addition of a lifting platform at the entrance to the home was also evaluated. This would cost between +\$10,000 and +\$12,000 for the platform itself and would cost approximately +\$3,500 more for the addition of a shelter to protect it.

Interior circulation

The interior circulation in the initial plans already includes visitable elements such as a good width of the corridors and the rooms are open-plan. In order to make the basic visitable circulation, the 762 mm (30") wide bathroom door is simply replaced by an 813 mm (32") door (see Figure 8). To make the horizontal circulation more visitable, in addition to changing the bathroom door, the electrical outlets must be installed at a minimum height of 457 mm (18") and the controls must be installed at a maximum height of 1220 mm (48") (see figure 8, elements Ci-2 and Ci-3 respectively). Also, an electrical receptacle must be added above the entrance door so that the door opening can be made automatic if necessary (see Figure 8, element Ci-4). In summary, a saving of -\$5 would be possible considering the basic visitability and an additional cost of +\$95 would be expected for the improved visitability.

Figure 7

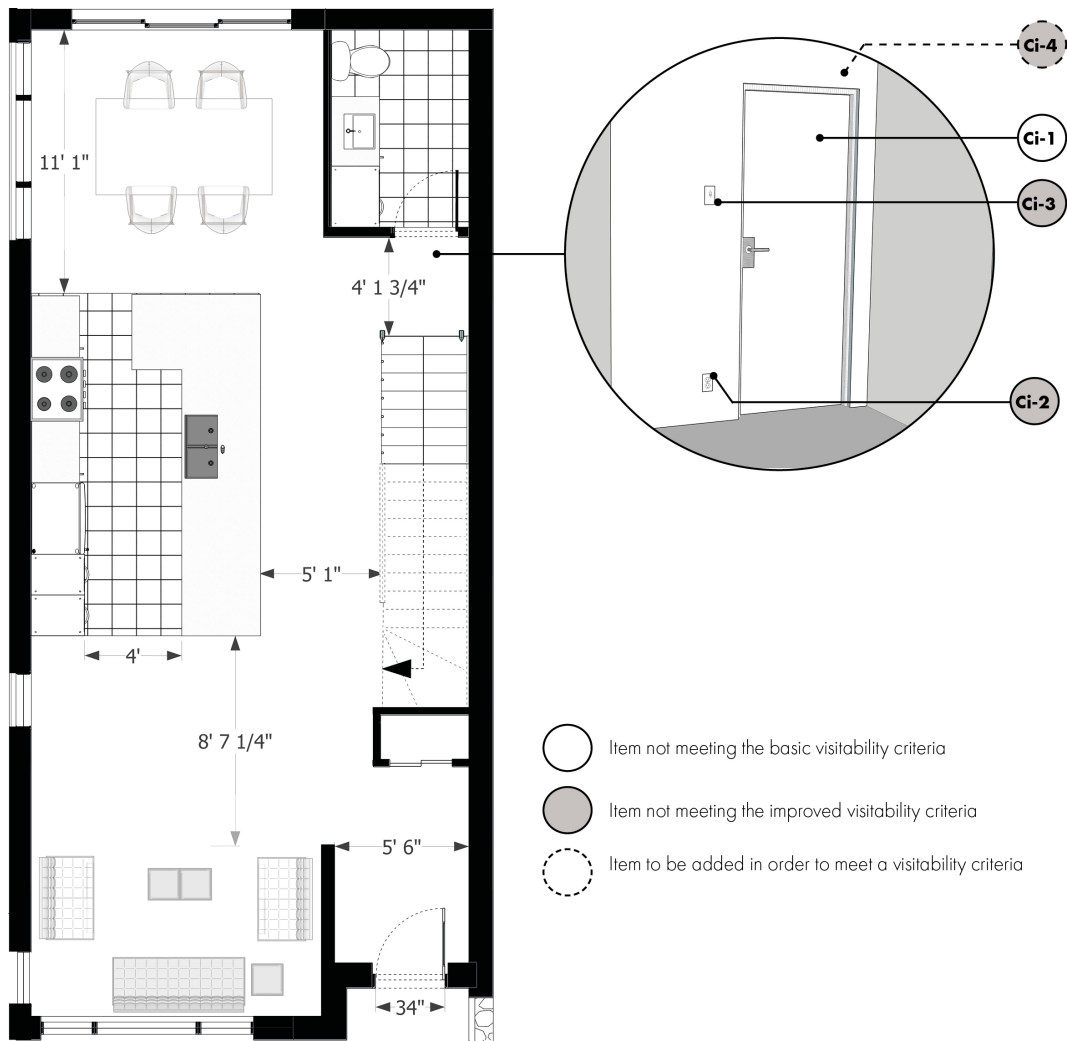


Figure 7. Interior circulation : initial plan

Figure 8

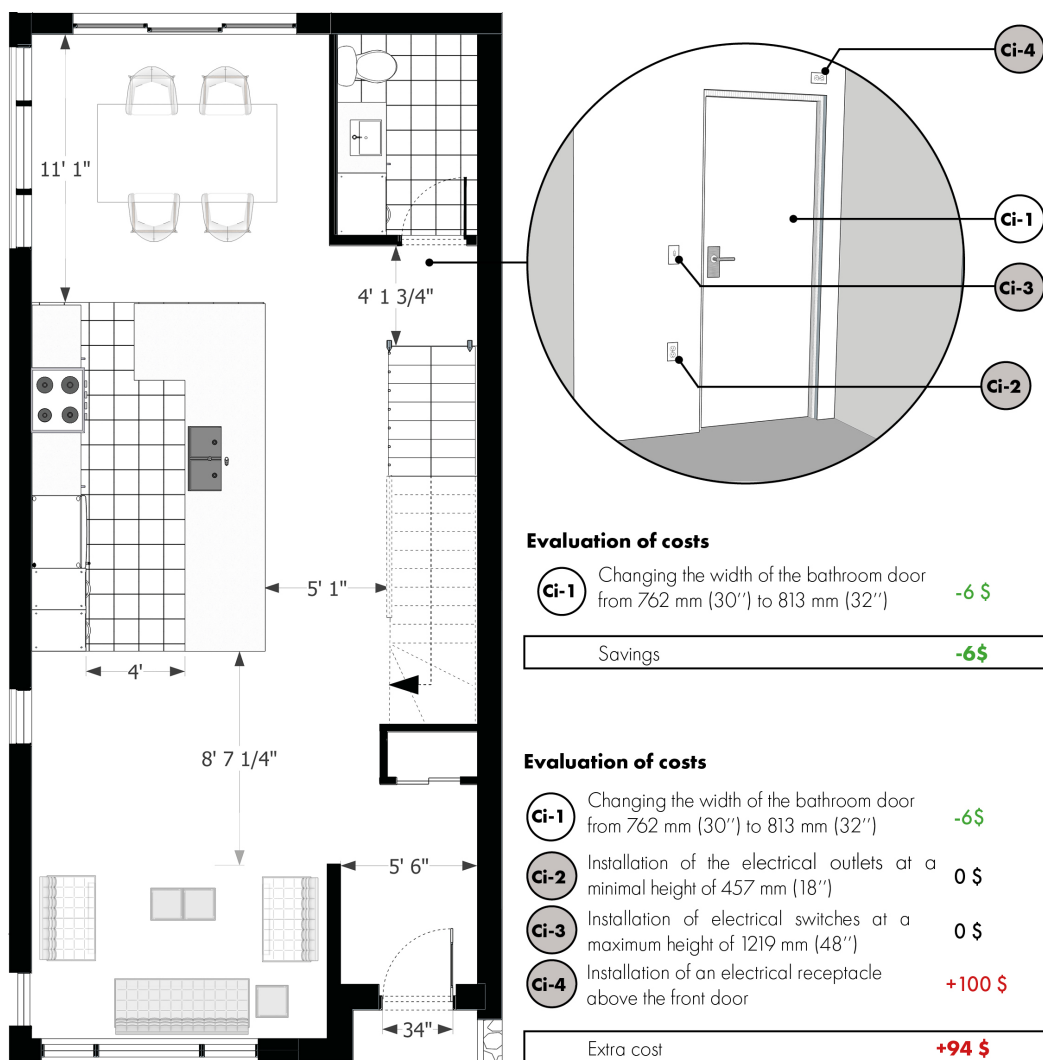


Figure 8. Modified plan according to the basic visitability criteria

Bathroom

The bathroom shown in the developer's plans only meets the criterion that the bathroom must have at least one toilet and one sink. The proposed modifications to meet the basic visitability criteria now offer a bathroom with a 1,500 mm (5') turning area in front of the toilet. To achieve this, the wall adjacent to the dining room was moved 610 mm (2') (see figure 10). This involves reducing the width of the patio door in the dining room in order to rebalance the space (see figure 10, element Sb-2). To meet the criteria for improved visitability, additional wooden plaques are added to reinforce the walls for the installation of grab bars (see Figure 11, element Sb-3). A grab

bar is also added as well as a lever-operated valve (see Figure 11, elements Sb-4 and Sb-5 respectively). A non-slip floor covering must also be installed (see Figure 11, element Sb-6). A cost reduction of \$1,450 and \$1,145 would be considered based on basic visitability and improved visitability, respectively.

Figure 9

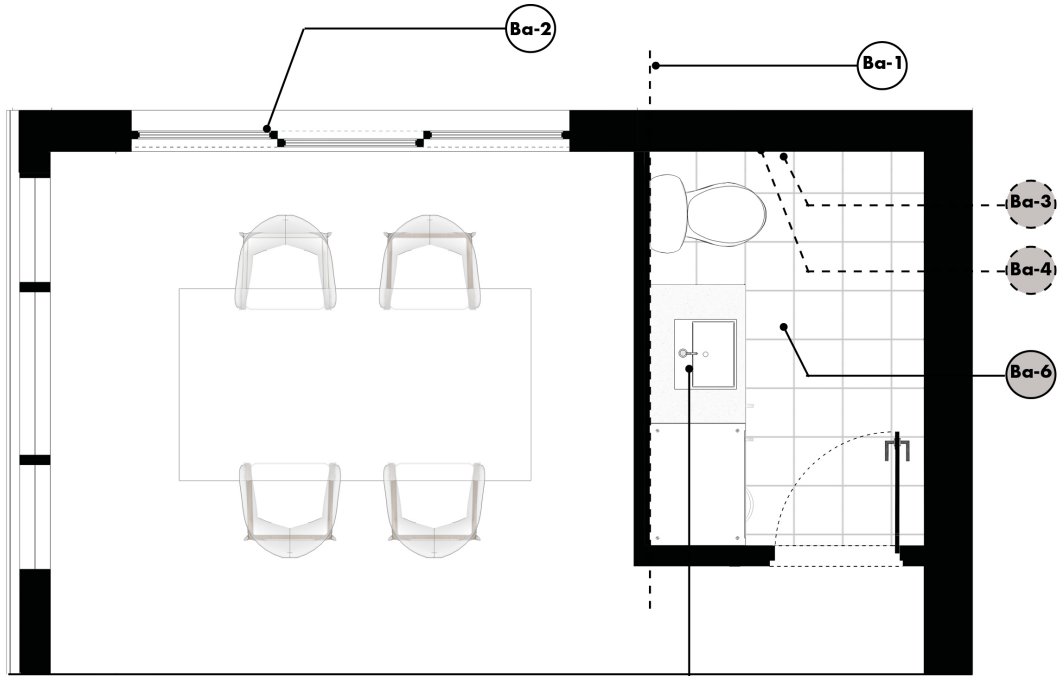


Figure 9. Bathroom: initial plan

- Item not meeting the basic visitability criteria
- Item not meeting the improved visitability criteria
- ⊖ Item to be added in order to meet a visitability criteria

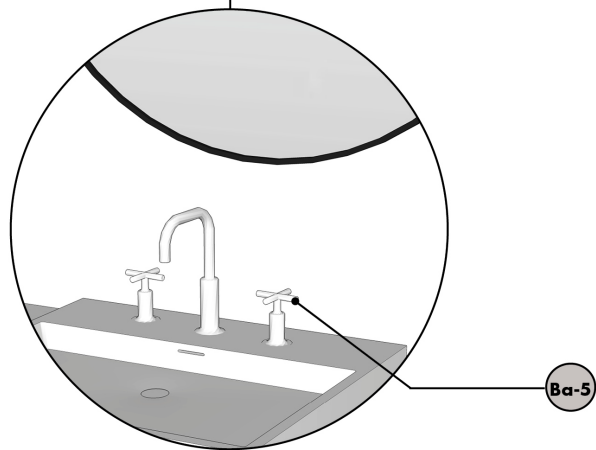


Figure 10

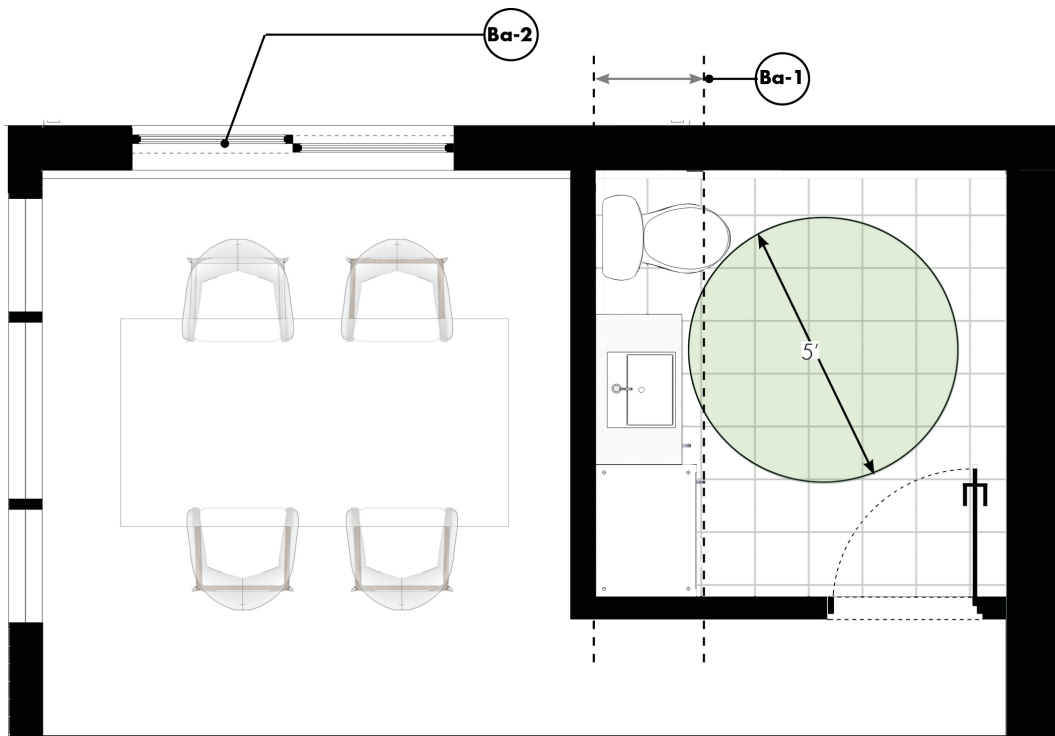


Figure 10. Modified plan according to the basic visitability criteria

Evaluation of costs

- Ba-1** Expansion of the bathroom area +50 \$
- Ba-2** Reduction of the width of the patio door from triple to double panes -1500 \$

Savings	-1450 \$
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Figure 11

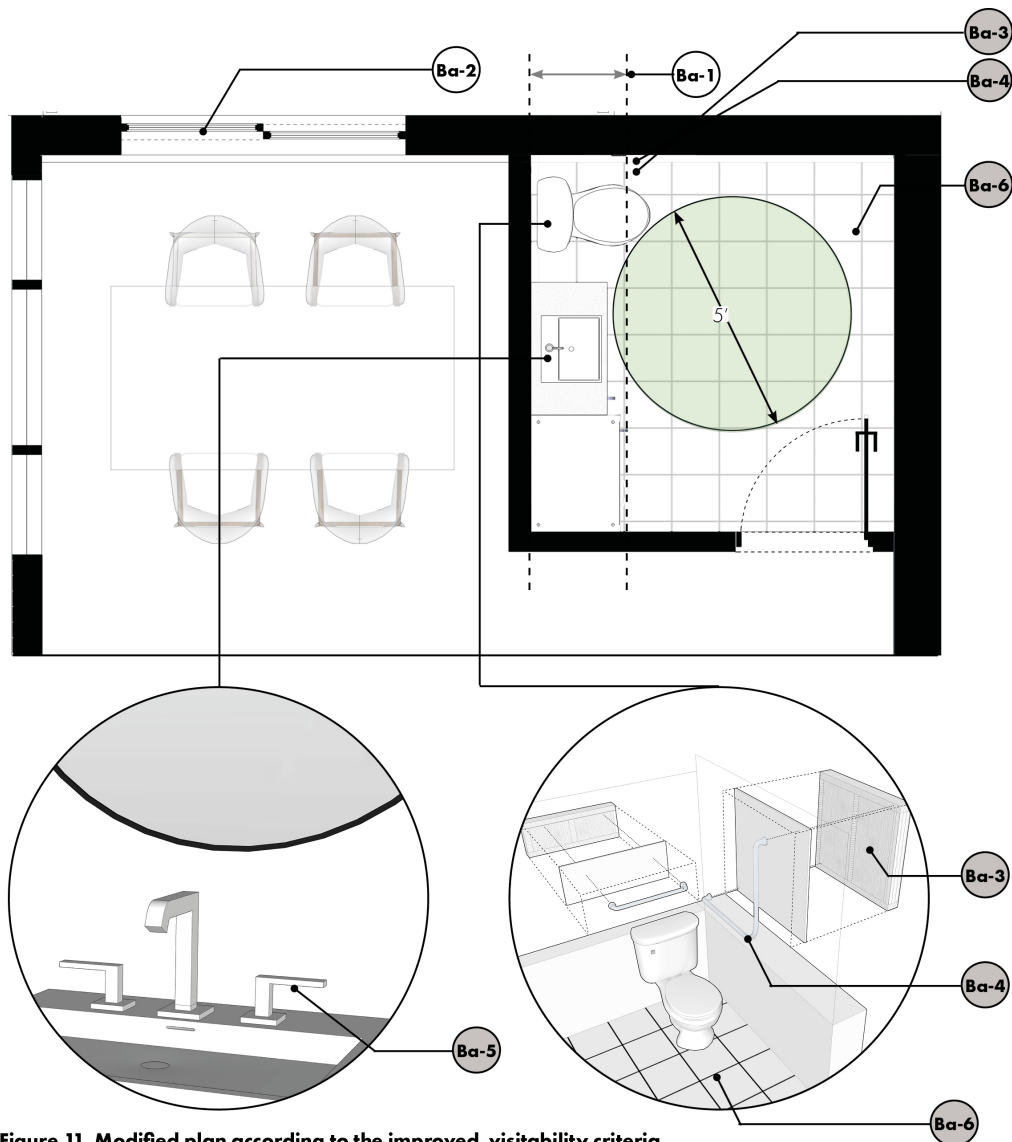


Figure 11. Modified plan according to the improved visitability criteria

Evaluation of costs

Ba-1 Expansion of the bathroom area	+50 \$	Ba-4 Addition of grab bars	+55 \$
Ba-2 Reduction of the width of the patio door from triple to double panes	-1500 \$	Ba-5 Installation of lever-type taps	0\$
Ba-3 Addition of solid batten panels	+250 \$	Ba-6 Installation of non-slip floor covering	0\$
		Savings	-1145 \$

Kitchen

The kitchen presented in the developer's plans offers adequate circulation thanks to its lab-type configuration. Since there are no basic visitability criteria for the kitchen, the modifications made to the plan are based on the enhanced visitability criteria. The space between the two counters is

therefore widened by 305 mm (1') by relocating the island, allowing for an adequate turning area of 1,500 mm (5'). The cost of relocating the island and installing a lever-type faucet is not significant (see Figure 13).

Figure 12

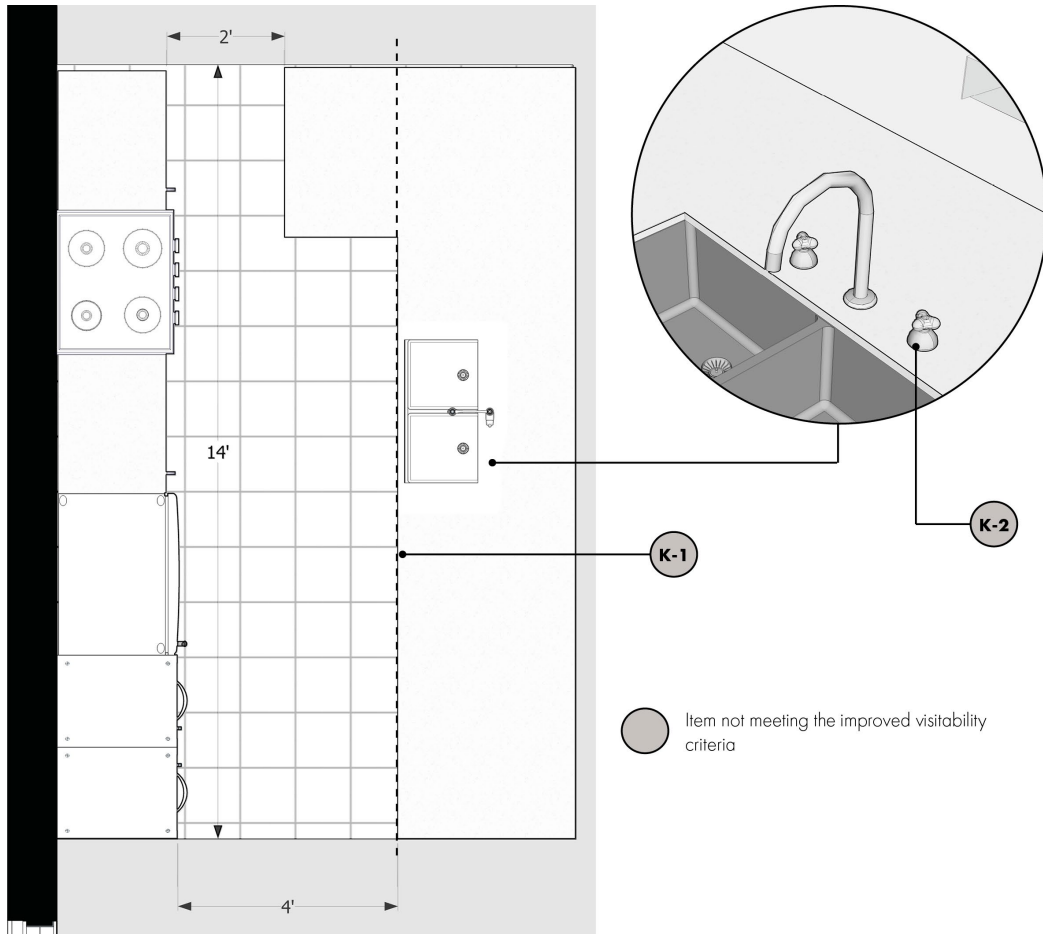


Figure 12. Kitchen: initial plan

Figure 13

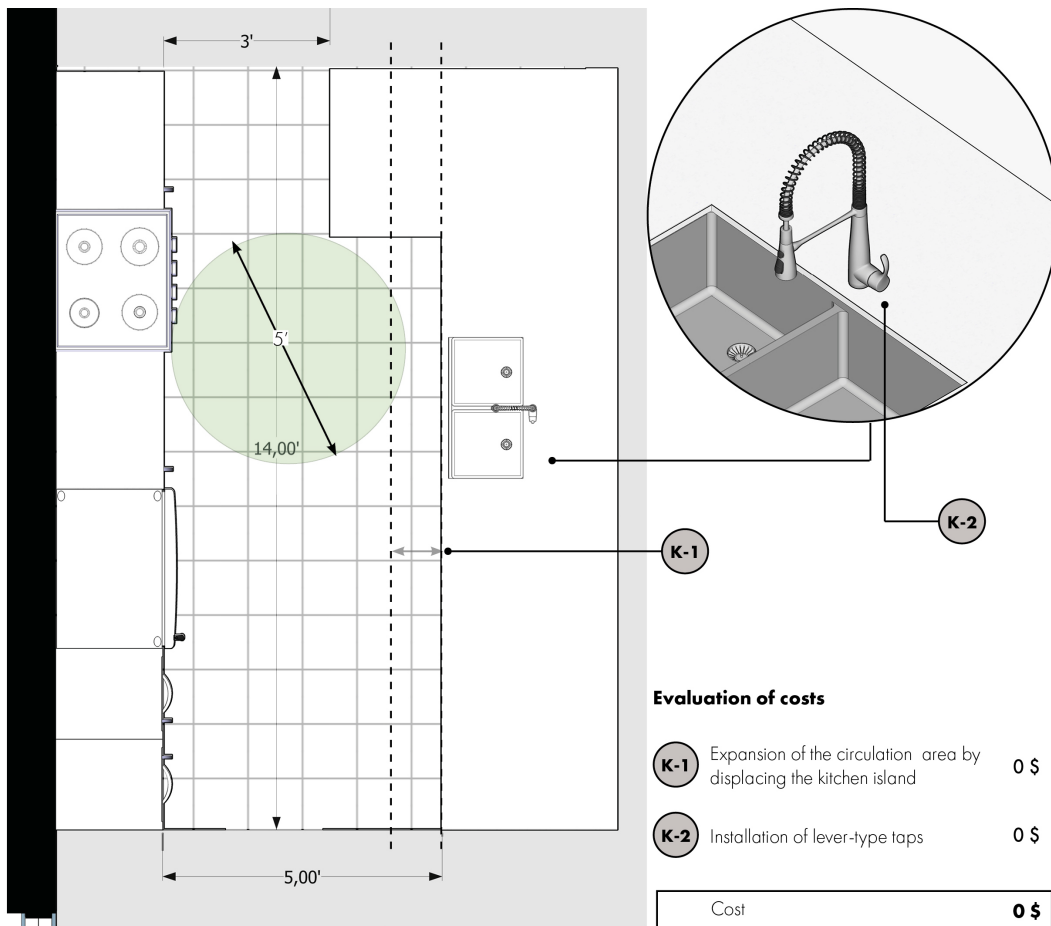


Figure 13. Modified plan according to the improved visibility criteria

Bedroom

The basic visibility criteria do not apply to the bedroom. However, in order to take the criteria for improved visibility further, a bedroom has been added on the ground floor. Since space is limited in its current configuration, it is suggested to increase the main floor area in order to include the bedroom. The bedroom was added at the back of the house next to the bathroom (see Figures 15 and 16). It measures 3,050 mm by 3,960 mm (10'x13') and can accommodate a double bed and small furniture. In order to incorporate it into the house, the patio space is reduced and the patio door is moved. The economic impact of a room that rests on additional space in the basement (see Figure 15) or is erected on piles (see Figure 16) is +\$15,590.

Figure 14

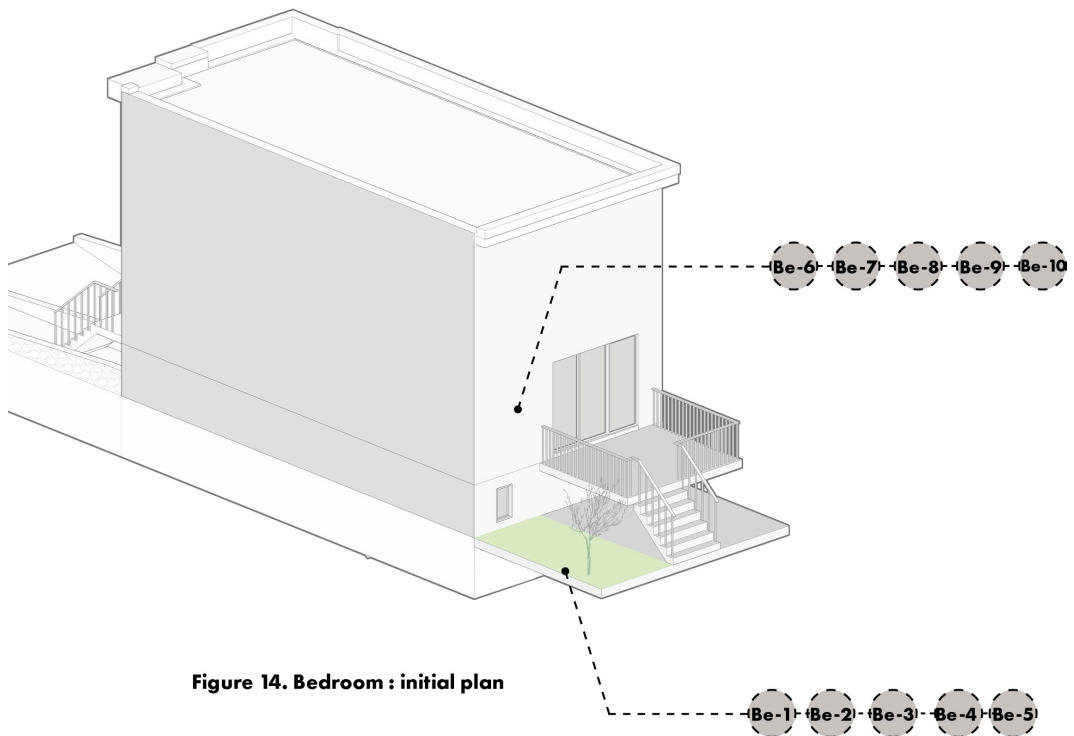


Figure 14. Bedroom : initial plan

- Item not meeting the improved visibility criteria
- Item to be added in order to meet a visibility criteria

Figure 15

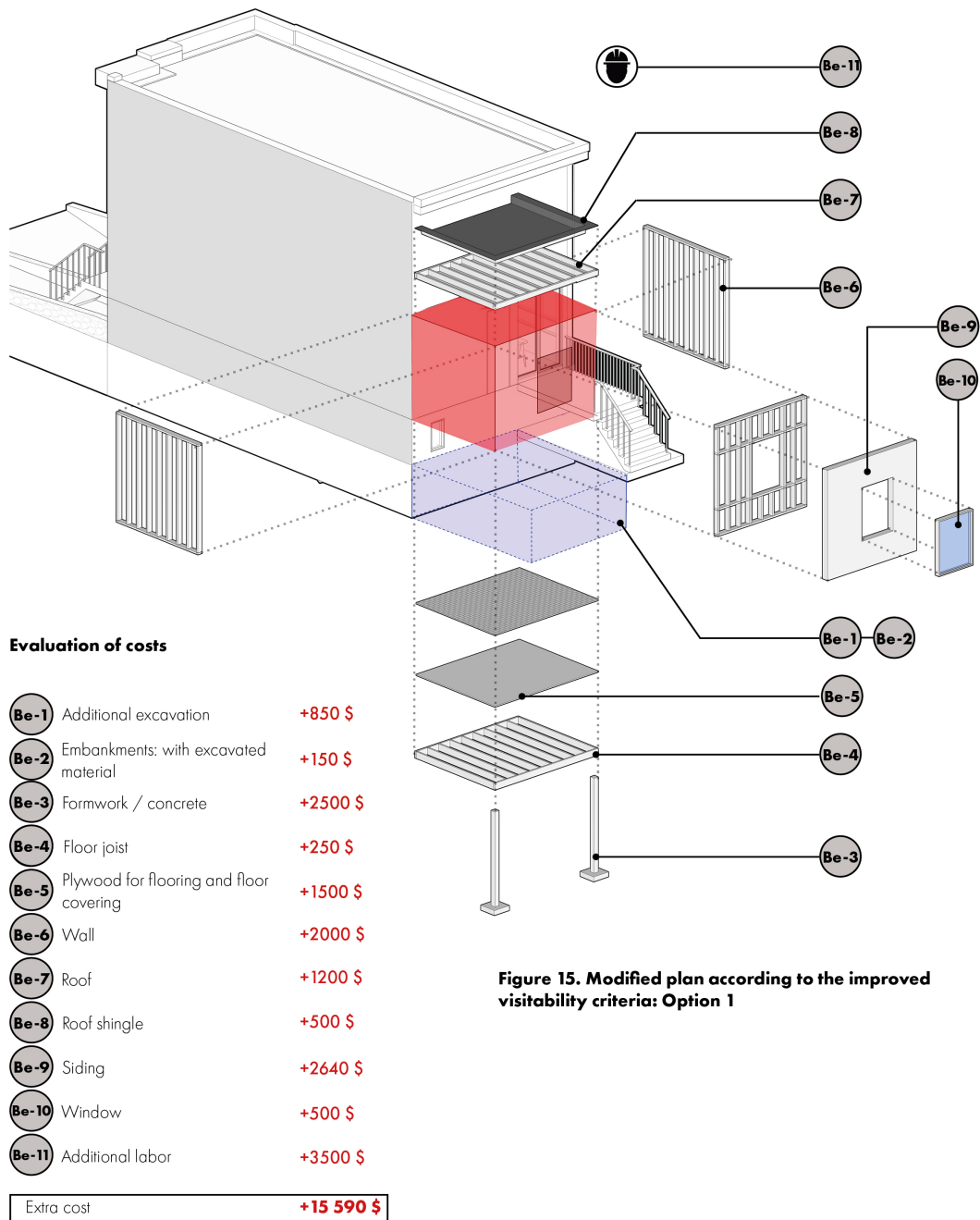


Figure 15. Modified plan according to the improved visitability criteria: Option 1

Figure 16

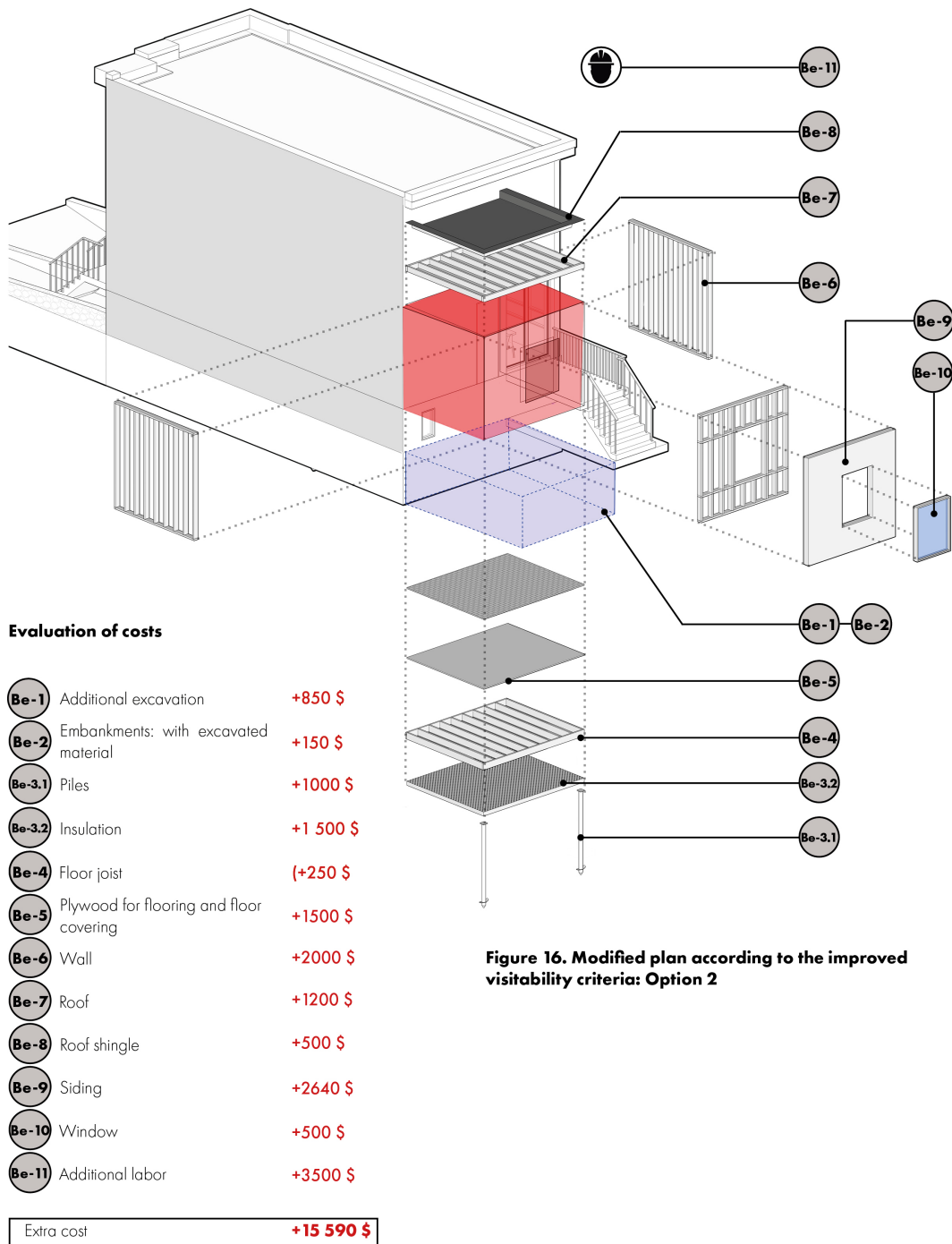


Figure 16. Modified plan according to the improved visibility criteria: Option 2

Discussion

Among the visitability criteria, the modifications that increased the cost of construction are related to the installation of a barrier-free entrance and the additional bedroom on the ground floor, while the modifications made to the interior of the house, such as horizontal circulation, bathroom and kitchen,

the extra costs (or savings generated) are negligible compared to the cost of the house.

Moreover, installing a ramp or a lifting platform in the homes of seniors or those with mobility impairments, these solutions do not allow them to access the homes of their loved ones. Indeed, these accessibility solutions generate construction or installation costs, are less aesthetic and have a negative connotation by focusing attention on motor difficulties. Moreover, unlike a step-free entrance, an access ramp or a lifting platform diminishes the value of a home for a buyer who does not suffer from a motor impairment.

Lowering the level of the ground floor of the home to allow the main and rear entrances without steps had the effect of reducing access to natural light from the living space in the basement. The basement windows that were placed above the garden level have access to natural light, after the plans were modified, only through a curbstone. The reduction in natural light is also noted in the dining room, where the width of the patio door and the patio had to be reduced to make way for a bedroom on the ground floor, in the case of improved visitability.

The changes to the interior configuration of the ground floor of the home bring improvements without incurring costs. This is particularly the case for the bathroom and the kitchen. As a result of the application of visitability criteria, these rooms have become more spacious and even more user-friendly, since they allow for easier circulation even in wheelchairs. In addition to providing added value, modifying the bathroom, kitchen and horizontal circulation generated a credit of \$1,455 for the basic visitability criteria, and a credit of \$1,050 for the improved visitability. It remains to be specified that these gains depend on the choice of materials. Within the framework of this study, the materials provided for in the initial plan were replaced by equivalent non-slip materials in terms of cost.

The modification of the plans did not only have a positive impact on the configuration of the single-family home. Indeed, in order to widen certain spaces and allow adequate turning radii, others had to be narrowed. This is precisely the case of the dining room and the corridor adjacent to the bathroom and kitchen respectively. The addition of the bedroom on the

ground floor had a similar effect by reducing the luminosity of the bathroom and even the dining room due to the width of the patio and patio door, which had to be narrowed. However, providing a room is intended to accommodate visitors who stay for more than one night, but this remains the element that generated the most extra costs, +\$15,590. Since visitability is a first step towards universal accessibility since it reduces the burden of work to be undertaken when needed, this visitable home therefore offers significant gains for ageing or future occupants in terms of accessibility.

Indeed, one of the main barriers in the home environment is the presence of stairs, which is a dangerous place as people age and a predominant barrier for people with mobility impairments (Canadian Centre on Disability Studies, 2013; Stark, 2001). The entrance must therefore generally be adapted first, followed by the bathroom (Johnson & Chen, 2009), being two rooms that are modified with visitability criteria. In addition, by adding the improved visitability criteria, certain elements such as installing a grab bar in the bathroom limit the costs for environmental adaptations since they are already present, along with the main spaces on the same floor to limit the use of stairs.

Adopting these criteria at the design stage of a house suggests better integration of design elements and reduces costs associated with future renovations, mainly because some of the basic features of accessibility are already in place. It could also be said, without being too bold, that visitability features in a house might reduce the risk of step-induced injuries, increase opportunities for interaction with others and contribute to a vibrant community (Maisel, 2006).

Step-induced injuries are particularly important in places such as Canada where winter conditions can be a major accessibility problem (Morales, 2014). For example, fall-related injuries due to ice or snow have been estimated to cost \$ 2.8 billion a year to the Canadian healthcare system (Miller et al., 2009). Unfortunately, this situation goes hand by hand with social isolation as individuals with motor disabilities and seniors might prefer to stay home rather than go out, because of the accessibility challenges and slippery surfaces, which will certainly be encountered (Morales, 2014). Social isolation, in turn, has been associated with other negative consequences such as depression (Gutzmann, 2000; Silveira & Allebeck, 2001) and even suicide (Conwell, 1997).

Considering that the need for accessibility is all the more pressing since 90% of new single-family homes will have to accommodate an inhabitant or visitor with reduced mobility during their lifetime (Smith et al., 2008; Smith, Rayer, Smith, Wang & Zeng, 2012), the implementation of a program requiring the three basic visitability criteria for new constructions would therefore be beneficial for both the population and the government without generating additional costs. In the same vein, Concrete Change (2012), an international network promoting visitability, suggests that providing basic access to a house can cost between \$10 and \$260, when considered and integrated at the beginning of the project. The present study is therefore in line with the conclusions of Concrete Change (2012): indeed, depending on the design option chosen, modifications allowing for visitability can even lead to a reduction in costs. These results also support those obtained by PARA et al. (2007). Finally, another observation is that certain modifications to the plans do not generate any costs, such as the modification of the height of controls and electrical outlets and should be considered in new constructions in order to be accessible to the entire population.

Given that few studies have focused on the economic analysis of the application of visitability criteria, this is innovative work. Only some elements of discussion could be supported by the literature, but this shows that further research could validate the results obtained.

Conclusion

In view of the results obtained, if visitability criteria were adopted during the design phase, a visitable (basic) home with a step-less entrance does not seem to cost more to build. In fact, the marginal costs are zero or negligible. Option 1 allows a credit of -\$4,990 and -\$3,100 for basic and enhanced visitability respectively. However, this was done at the expense of the garage space, which is a major addition to the home. Option 2, which provides for keeping the garage space in the basement, generated additional costs of +\$1,230 and +\$3,130 for basic and improved visitability respectively, in addition to the need to extend the access ramp to the underground parking lot to respect a maximum slope of 15% (which would be required by Quebec City, for

example). Although these two options entail costs, they are less expensive than the construction of access ramps or the installation of a lifting platform (most expensive option, with costs ranging from +\$10,000 to +\$15,000).

There are many limitations of this study. For example, as the evaluation presented is a case study, it remains important to note that the results presented here cannot be generalised to any construction. Since the changes are made after the plans have been designed, the magnitude of the marginal costs depends greatly on the nature of the building and the changes made to it. Since the visitability criteria considered for this study were taken from PARA (PARA et al., 2007), it should be noted that the criterion of a path accessible from the pavement to the entrance door, which is one of the basic visitability criteria, was omitted from this study.

Moreover, this study focused on the economic aspect of visitability, so the point of view of older people or people with motor disabilities was not taken into account.

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