

ACCESSIBILITY BY MEANS OF RAMPS - SOME RESEARCH DATA FROM THE NETHERLANDS

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One of the most important design decisions in making ramps is the choice of the gradient. A very gentle gradient takes much space and means a lot of ground transport. On the other hand, very steep ramps require too much effort so that it is impossible for many people to use them. In the literature there is no consensus on the maximum gradient with a view to use by handicapped people. The figures vary from 1 : 8 to 1 : 25 and are - as far as we know - not based on systematic empirical research. For that reason an inquiry into user experiences on ramps was made by Chris Heimessen. These experiments were continued by Dr. Job Kroon with the assistance of the author. This research note presents a brief summary of the results.

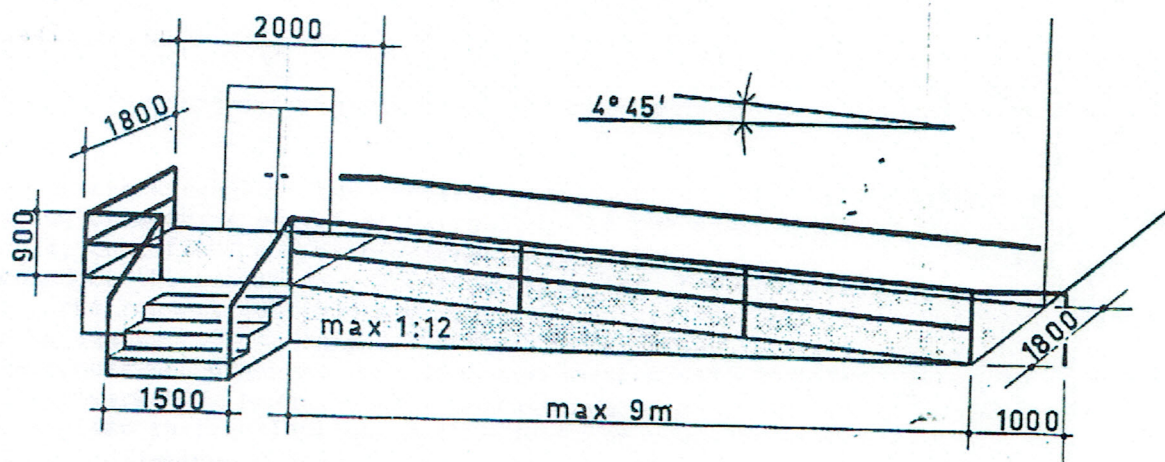


fig. 1 The Dutch norm for ramps

Gradients of 1:10 versus 1:20 and 1:12 versus 1:18

As a first test case two ramps were tested with a gradient of resp. 1:10 and 1:20 and a difference in level of 750 mm. This study showed that 1:10 is too steep for wheel-chair users because of their fear of falling over. Almost 80% of the subjects in the experiments preferred the longer but gentler slope of 1:20. In the next study a comparison was made between ramps with inclines of 1:12 and 1:18 and a difference in level of 1500 mm, with a flat platform half-way.

Among the 486 subjects in the experiment were independent wheel-chair users, ambulant handicapped people and non-handicapped persons, just walking or pushing a wheel-chair or a pram. These subjects were asked to test the two ramps and to give their opinion about how tiring, strenuous, difficult etc. they found both ramps. The experiments showed that able-bodied subjects have no problem at all, even in pushing a wheel-chair. Only 35% of them judged the ramp with slopes 1:12 as rather tiring, but none of them had to break off the test. For the handicapped people the picture is quite different: 10% of the ambulant handicapped persons and 21% of the wheel-chair users could not achieve one or more of the tests (table 1). However, it is not clear if the gradient of the slope is responsible for this result.

Table 1: Number of people who did not achieve some of the tests

		ambulant handicapped, walking (N = 93)	wheel-chair users (N = 53)
flat pavement		5	3
h = 1500 mm, gradient 1:12	up	7	11
	down	9	10
h = 1500 mm, gradient 1:18	up	5	11
	down	7	11

Most of these subjects had problems with 1:18 too. For some of them even walking or driving on a flat pavement (with the same length as the gentle slopes, that is 31 m) was problematic. Only three wheel-chair users did succeed on the gentle ramp and did not on the steep one. Of all independent wheel-chair users 48% judged driving up on 1:12 as rather difficult and tiring against 38% on ramps 1:18. Still we may say that for most of the wheel-chair-bound subjects in the experiment a ramp with an incline of 1:12 is workable. Nevertheless, considering people's preferences (table 2) it is clear that an incline of 1:18 is to be preferred to 1:12.

Besides subjective judgements as people's preferences or scores on scales (tiring/not tiring, difficult/not difficult, long/short, steep/gradual) we looked for a more objective indication for measuring the difficulty and exertion of walking or driving up and down. For this reason the frequency of the heart-beat was recorded before and after the tests. However, there is no correlation between the (increase in) frequency and subjective judgements! Subjects who judged the tests as rather easy showed the greatest increase. In retrospect this might be explained by people's behaviour. Especially young and not severely handicapped persons try to walk or drive very quickly, which leads to a great increase in frequency of the heart-beat. For that reason, in later experiments the registration of this frequency was omitted.

Table 2: People's preferences (1:12 versus 1:18, h = 1500 mm)

	activity	number of persons	preference for 1:12 / 1:18		no preference
1. <u>able-bodied people</u>	just walking up	(N = 169)	42%	25%	31%
	walking up, pushing a pram	(N = 69)	38%	26%	30%
	walking up, pushing a wheel-chair	(N = 102)	23%	46%	26%
	walking down, pushing a pram	(N = 69)	30%	39%	26%
	walking down, pushing a wheel- chair	(N = 102)	20%	53%	22%
2. <u>ambulant disabled people</u>	just walking up	(N = 93)	10%	66%	20%
	just walking down	(N = 93)	14%	56%	25%
3. <u>wheel-chair-bound handicapped people</u>	driving up	(N = 53)	15%	66%	15%
	driving down	(N = 53)	21%	37%	37%

Gradient 1:12, h = 3000 mm

In the final experiment 46 handicapped people tested a ramp with an incline of 1:12 and a horizontal section after each rise of 750 mm. For independent wheel-chair users such a ramp proved to be too difficult. Of 16 wheel-chair users 11 had to break off the test and the other 5 subjects in the experiment succeeded only with a very great effort. It should be questioned, however, if the incline is responsible for this result. The observations suggest that even with a more gentle gradient such a great difference in level will lead to many problems for wheel-chair-bound people. Most of the ambulant disabled subjects did not show many problems in walking up or down. Only 3 of 23 had to break off. Especially people with walking aids need much time, almost two minutes (against an average of 47 sec. for ambulant handicapped people without walking aids). The subjects using an electric wheel-chair had no problem at all, apart from some bumping now and then against the railing, owing to a lack of training. All ten subjects completed the test, with an average time of 92 sec. for going up and 98 sec. for descending. One person needed a great deal of time, respectively 232 sec. (up) and 198 sec. (down).

Conclusions

To overcome a difference in level of 1500 mm by ramps, the Dutch norm - a maximum incline of 1:12 with a horizontal interval - seems quite reasonable. For some wheel-chair-bound handicapped persons such a ramp requires too much effort, it is true, but most of these people also have problems with an incline of 1:18. However, people's preferences made it clear that with respect to usability 1:18 is much better than 1:12.

Whether the Dutch norm is adequate in situations with a difference in level of 3000 mm has not been shown irrefutably. For most ambulant handicapped persons, and for those using an electric wheel-chair, a gradient of 1:12 is hardly problematic, but most wheel-chair-bound people cannot use such a ramp independently. Because some tests with non-handicapped persons pushing a wheel-chair did not show any problem at all, we may conclude that with some help wheel-chair drivers can easily go up and down too. More experiments are needed to test this statement, especially among elderly people pushing a wheel-chair. Actually it is these people that often accompany wheel-chair-bound handicapped persons. Unfortunately the Dutch experiments were discontinued, because of lack of time and funds.

As a final conclusion we would like to suggest that, if it is at all possible, very great differences in level should be avoided. If strictly necessary, they should be made accessible by other means (such as elevators).

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