Enabling active travel for people who experience mobility impairments

(and thoughts on the boom in little vehicles)

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Why should you care?

- >1 million wheelchair users in UK
- c.500k power wheelchairs and mobility scooters
- Rapid annual sales growth of mobility scooters
- Mobility impairments generally a function of age-related conditions
- Ageing of UK means there could be over 2 million wheelchair & mobility scooter users before 2050

Why should you care about little vehicles?

- Hundreds of millions of dollars invested by companies like Uber, Lyft, and Lime in electric push scooters, devices capable of travelling at up to 15mph
- Popular in USA (particularly California) as well as mainland Europe
- Almost complete lack of research on their use, and legislators are scrambling to keep up

Why should you care about little *autonomous* vehicles?

- Significant investment into small delivery robots by companies like Starship (from the founders of Skype) and Marble
- These wheelbarrow to mobility scooter-sized devices have already been tested in over 100 cities, but all testing has so far been on footways.
- …Imagine our overcrowded pavements carrying hundreds of Amazon deliveries currently delivered by road…

The ideal…

The ideal…

The reality…

The reality…

What problems do you see here?

…and here?

…and here?

My MSc Dissertation:

MSc Dissertation				
Timescale	10 months, April 2014 – February 2015			
Literature review	119 Journals, reports, books and articles referenced			
Questionnaires returned	223 in total:	54 UK	108 Netherlands	61 Canada

Project Partners

UNIVERSITY OF Southampton

UNIVERSITÉ DE SHERBROOKE

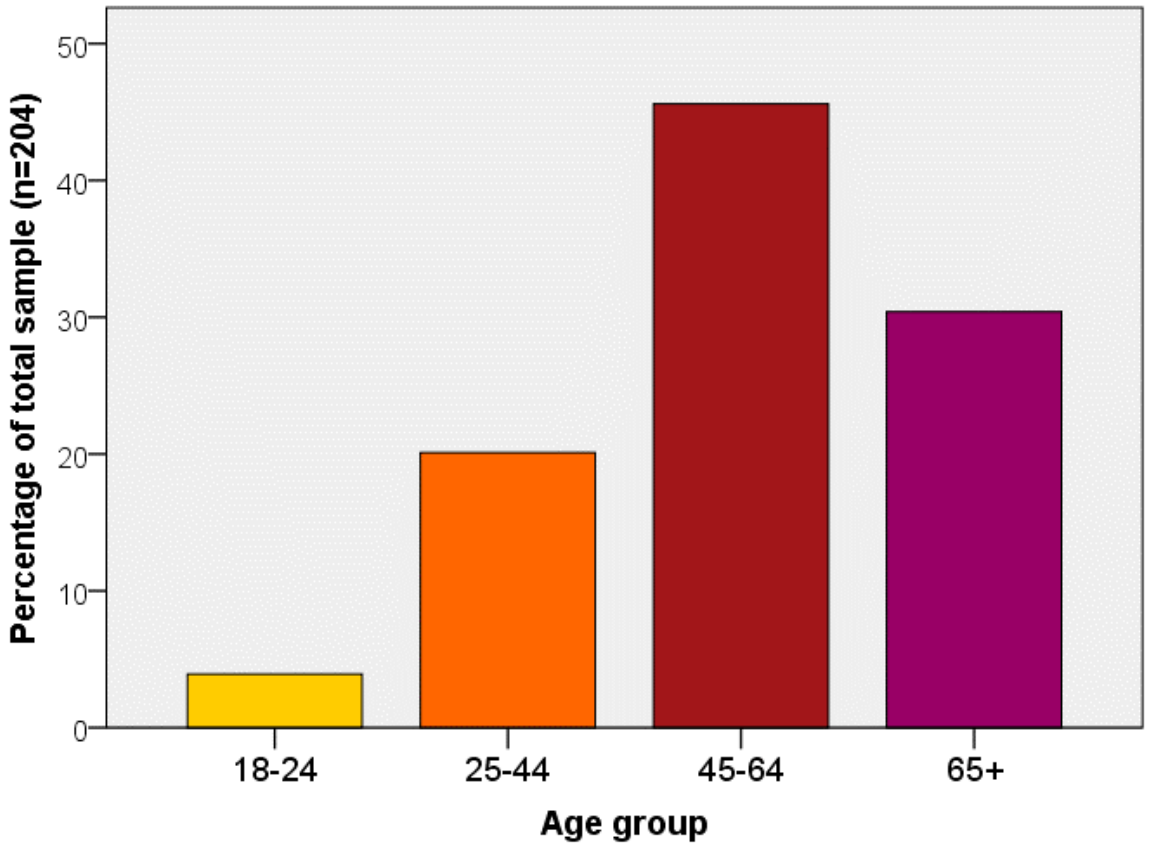
nivel

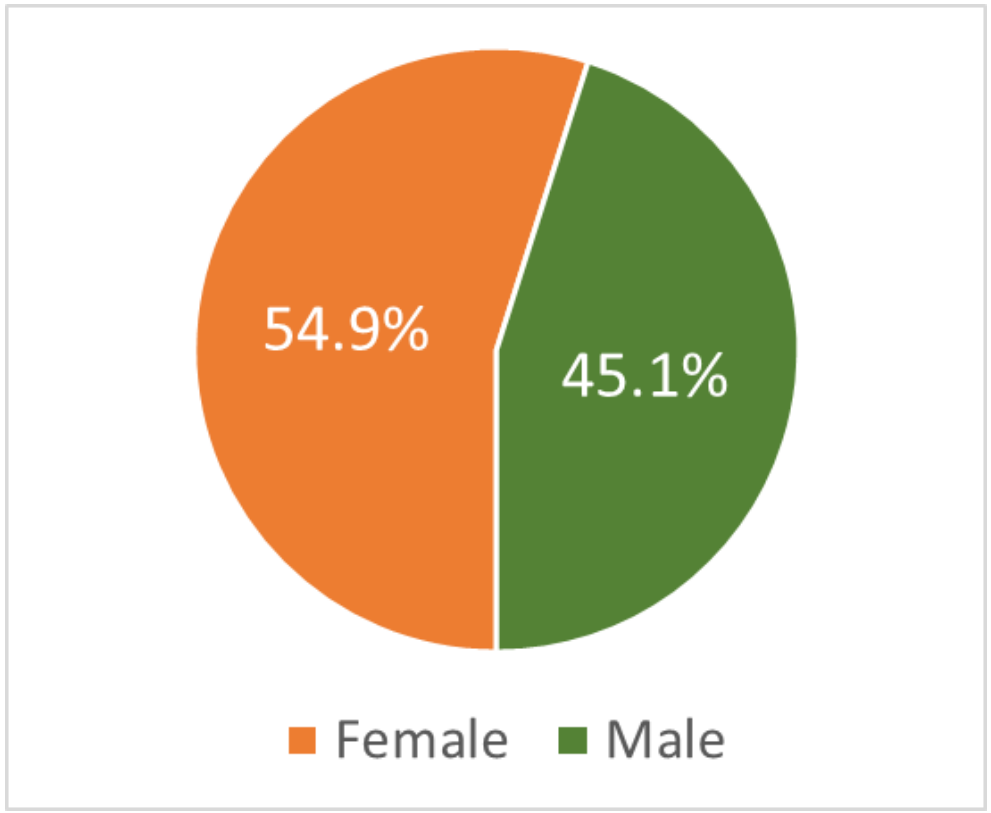
Harrogate and District NHS Foundation Trust

Royal Berkshire NHS Foundation Trust

Questionnaire – Sample Group

- The sample age was a little bit younger than the average PMA-using population
- A fairly typical break-down in terms of male/female

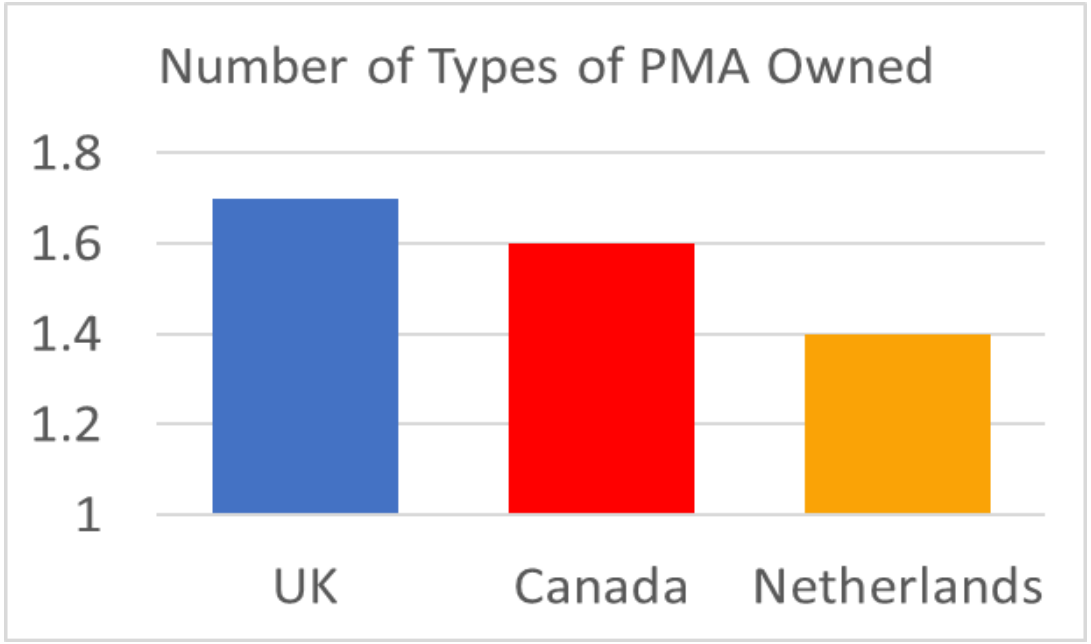




Questionnaire – Sample Group

- Over 1/3 of the sample said that they lived by themselves, highlighting the **importance of independent mobility**
- Around 20% owned a mobility scooter in UK/Canada, compared to ~60% in the Netherlands

- 89% of Dutch sample happy that they own all the mobility aids or cars they wanted; only 56% in UK/Canada satisfied

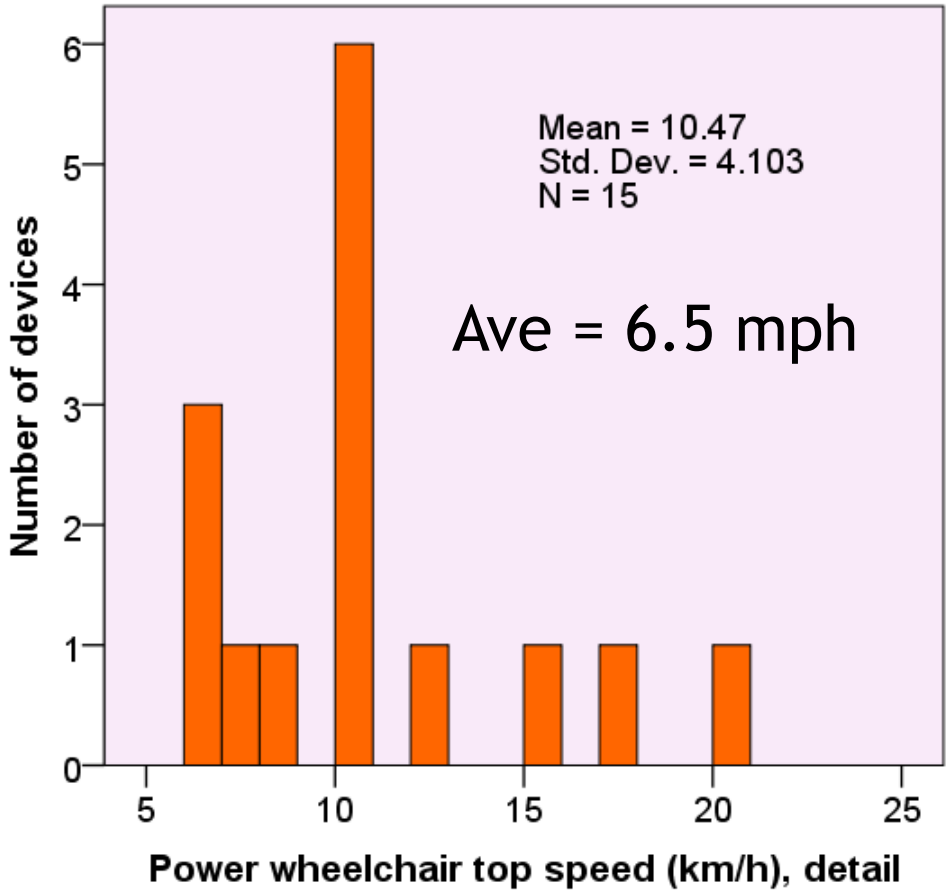


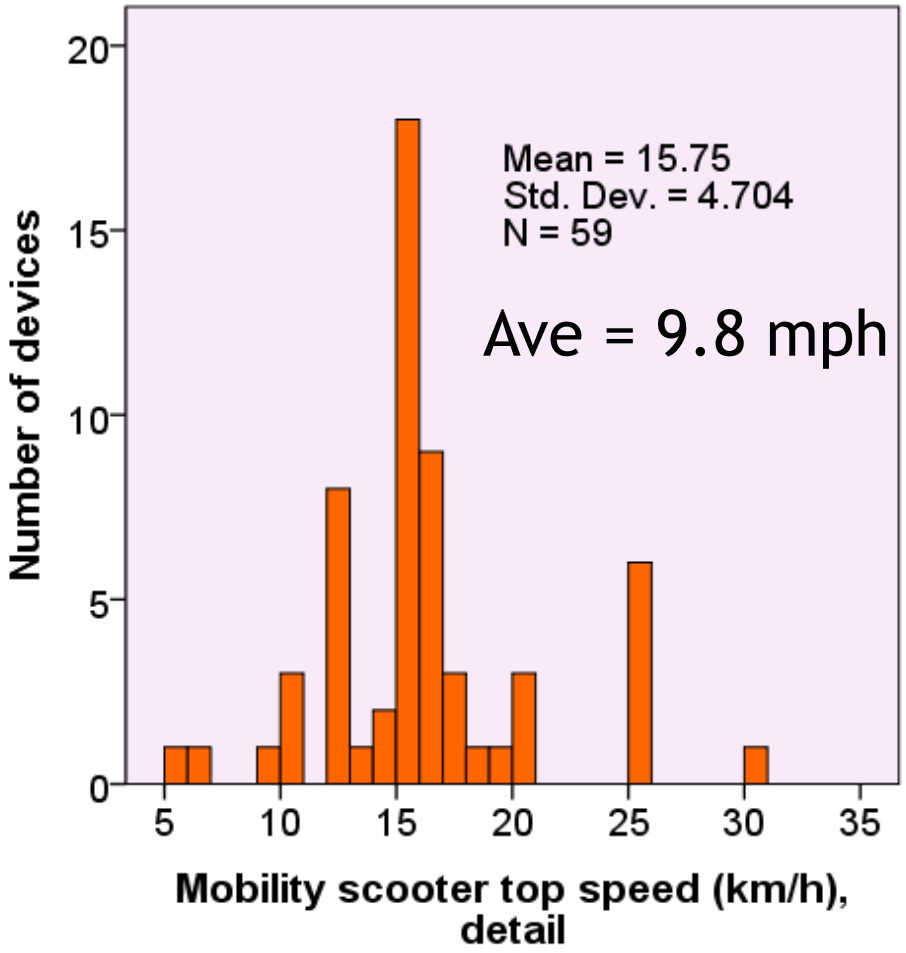
Device Speed

- UK device classes:
  - Class 1 – manual device
  - Class 2 – up to 4mph
  - Class 3 – up to 8mph (only on road)
- In the UK sample, most (>70%) of the PMAs owned were Class 2
- For the Canadian sample, 6mph wheelchairs and scooters were as popular as 4mph devices.

Device speed - Netherlands

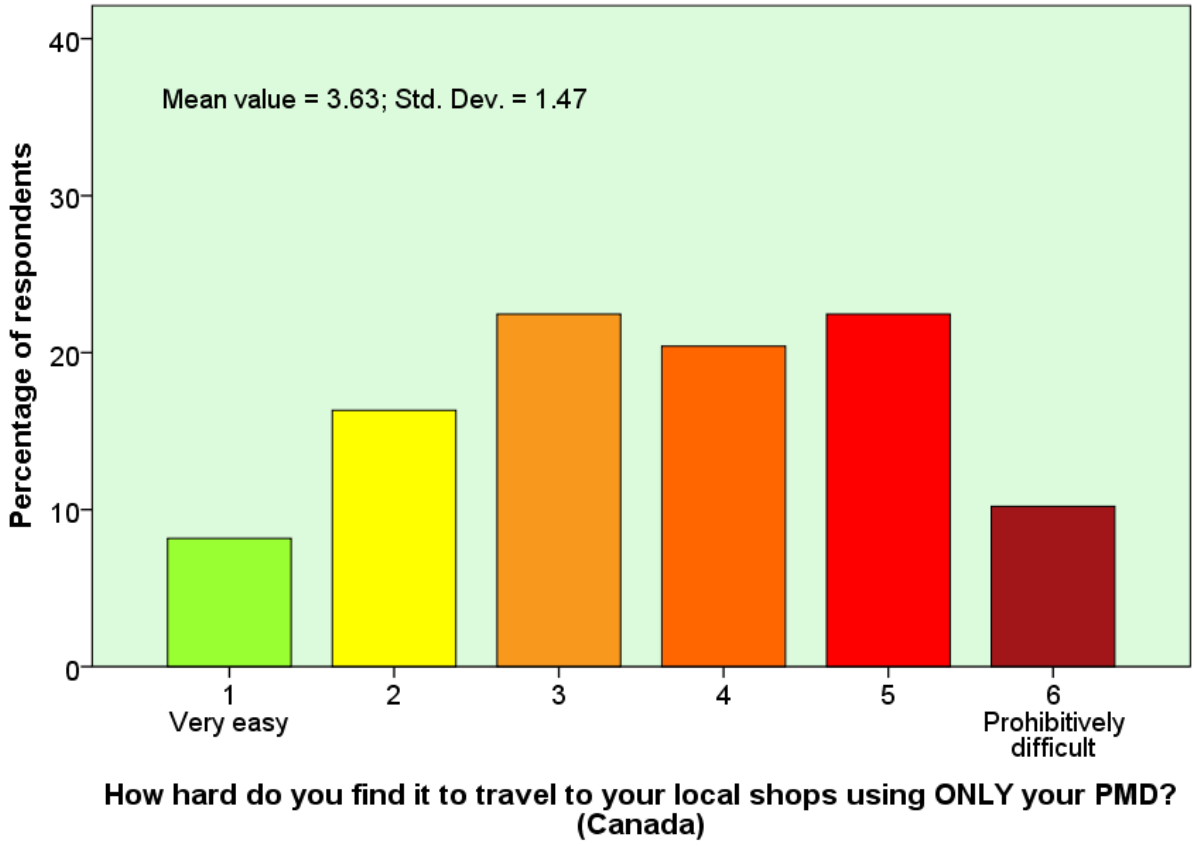
- PMAs owned by the Dutch sample were capable of much higher speeds, particularly the mobility scooters





Difficulty of getting to shops using PMA

UK

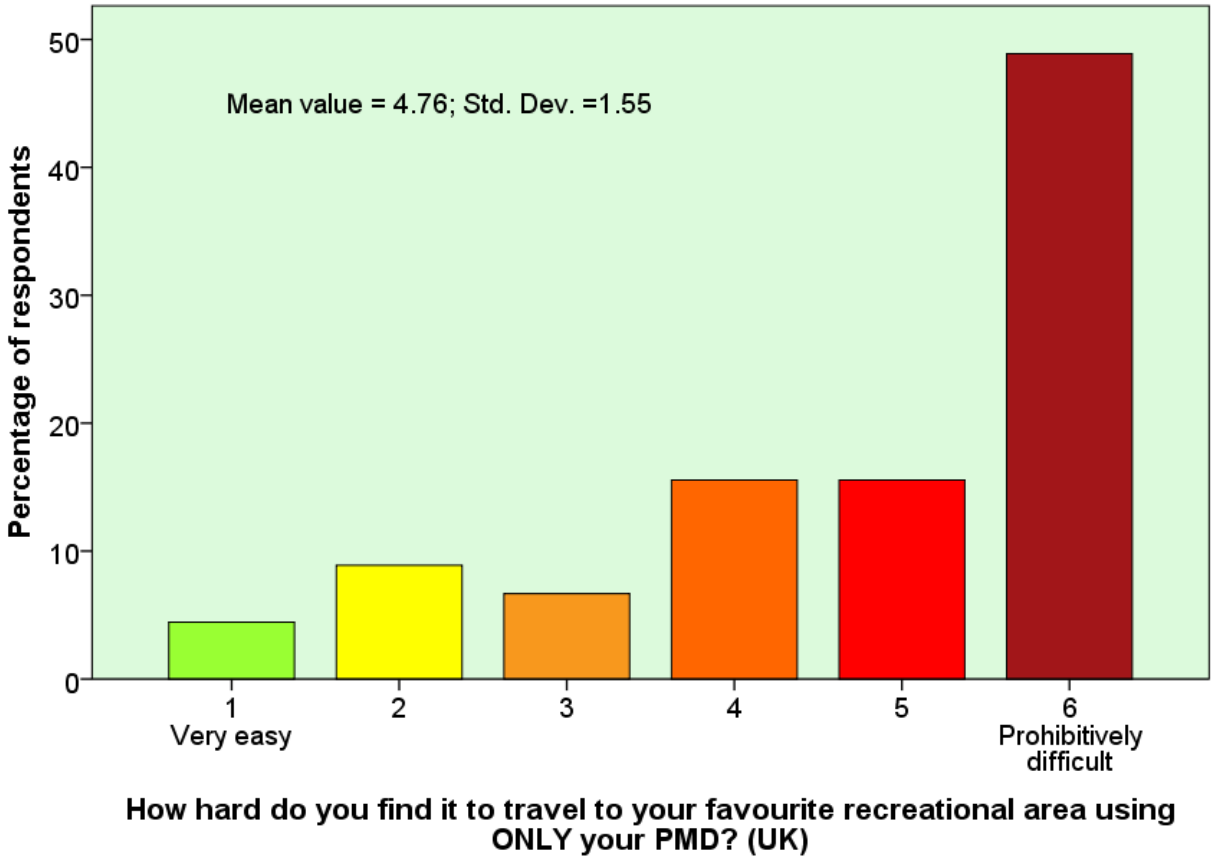


Canada

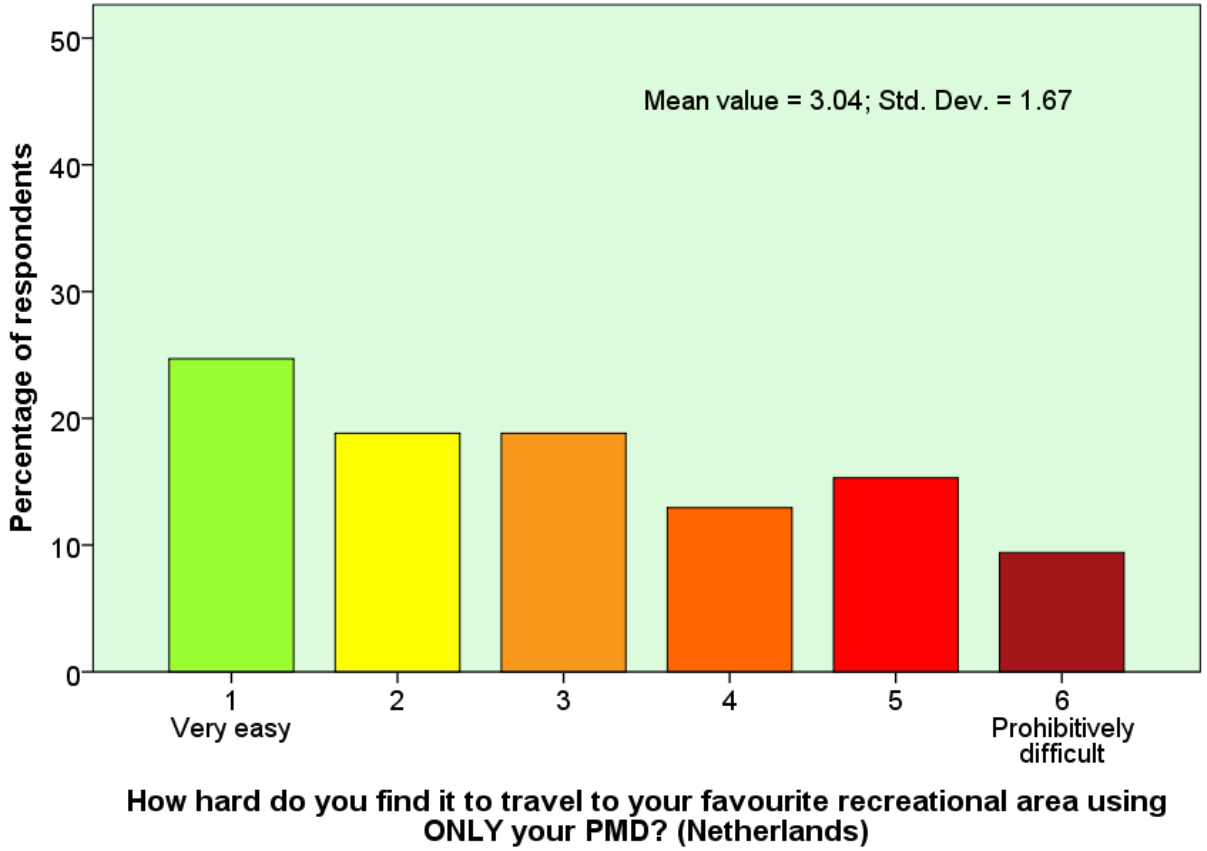
Difficulty of getting to shops using PMA

Netherlands

Difficulty of getting to rec. area using PMA

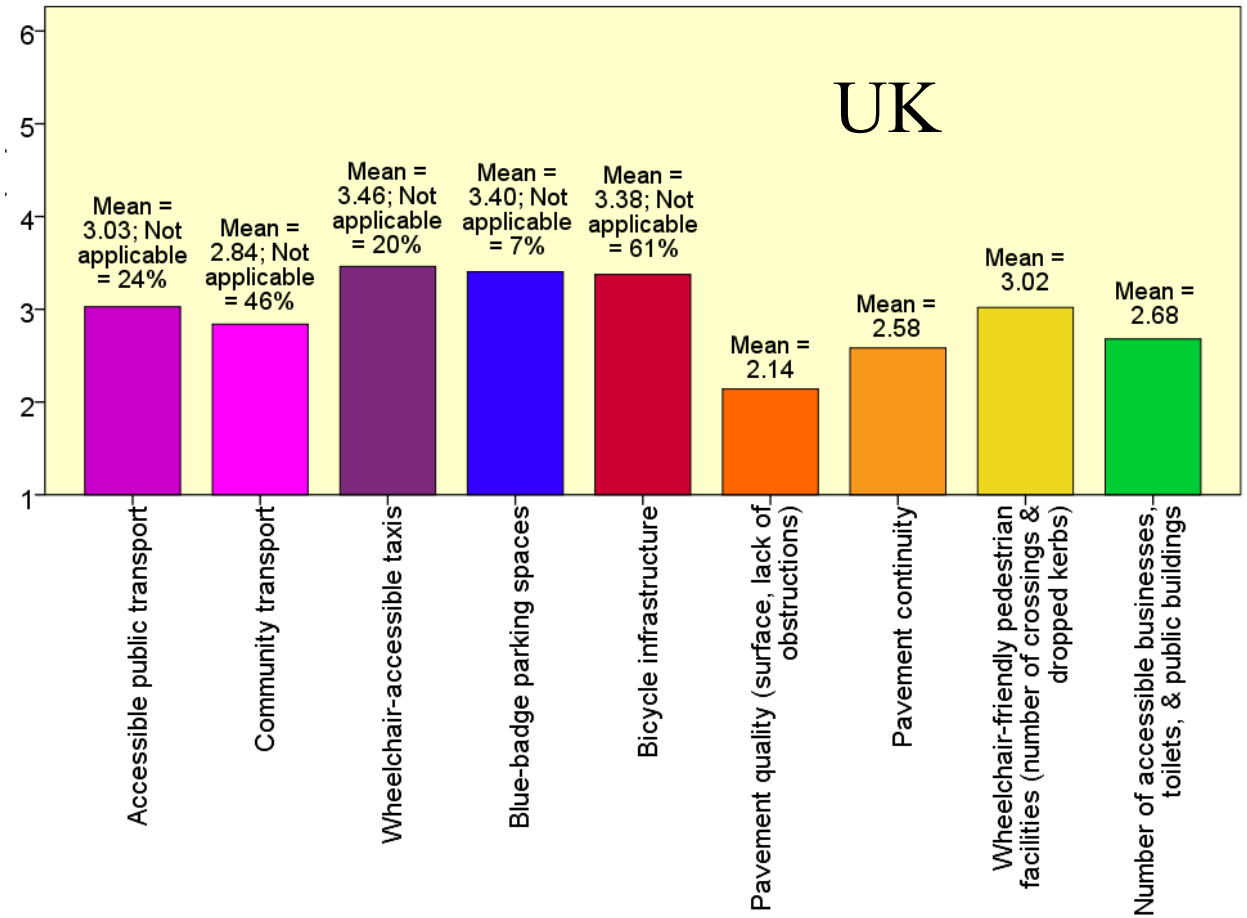


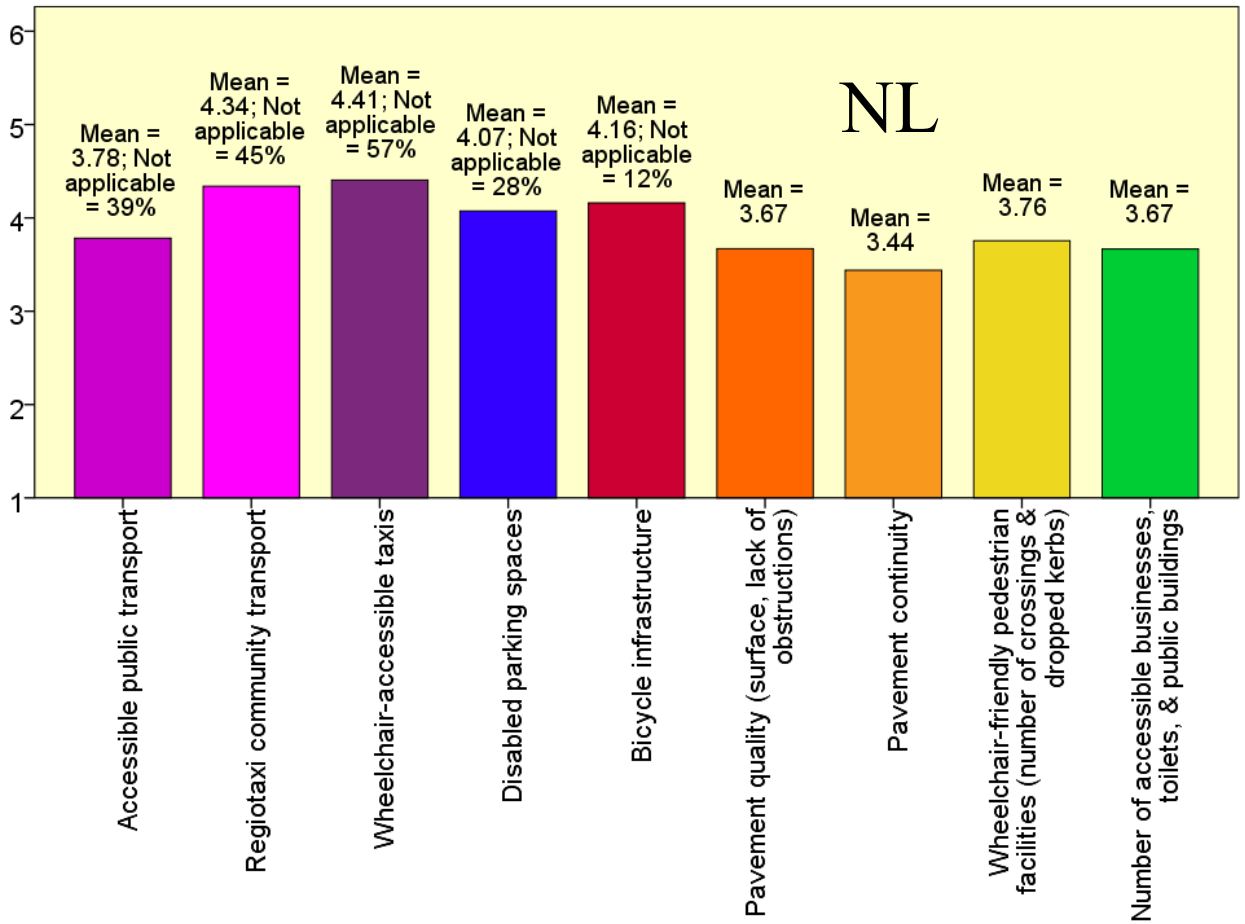
UK



Netherlands

Rating Infrastructure Quality





% of PMA users citing barrier would be experienced on a PMA-only trip to shops, rec. area, or employment:

Barrier	UK	Netherlands
Poor quality footways	89%	39%
Insuff./poorly placed dropped kerbs	75%	43%
Distance too great	69%	51%
Footway too narrow	60%	18%
Cars parking on footway	56%	37%
Footway obstructed (signs, bins, etc)	44%	32%
Would have to ride on road (intimidating)	42%	23%
Fear of footway cyclists	15%	9%
Fear of collision using cycle infrastructure	10%	9%

A few quotes, UK/Canada:

- *"Poor pavements cause leg spasms when using power chair" (Female, aged 45-64, UK)*
- *"[I prefer] the manual chair, as my husband drives the car and he can't get my electric chair in the boot, so he pushes me around town." (Female, aged 65+, UK)*
- *"[I take the manual wheelchair] because I can then go in a bathroom, which I can't do in a scooter... unless the bathroom is very big. Otherwise, I would take the scooter." (Female, 45-64, Canada)*

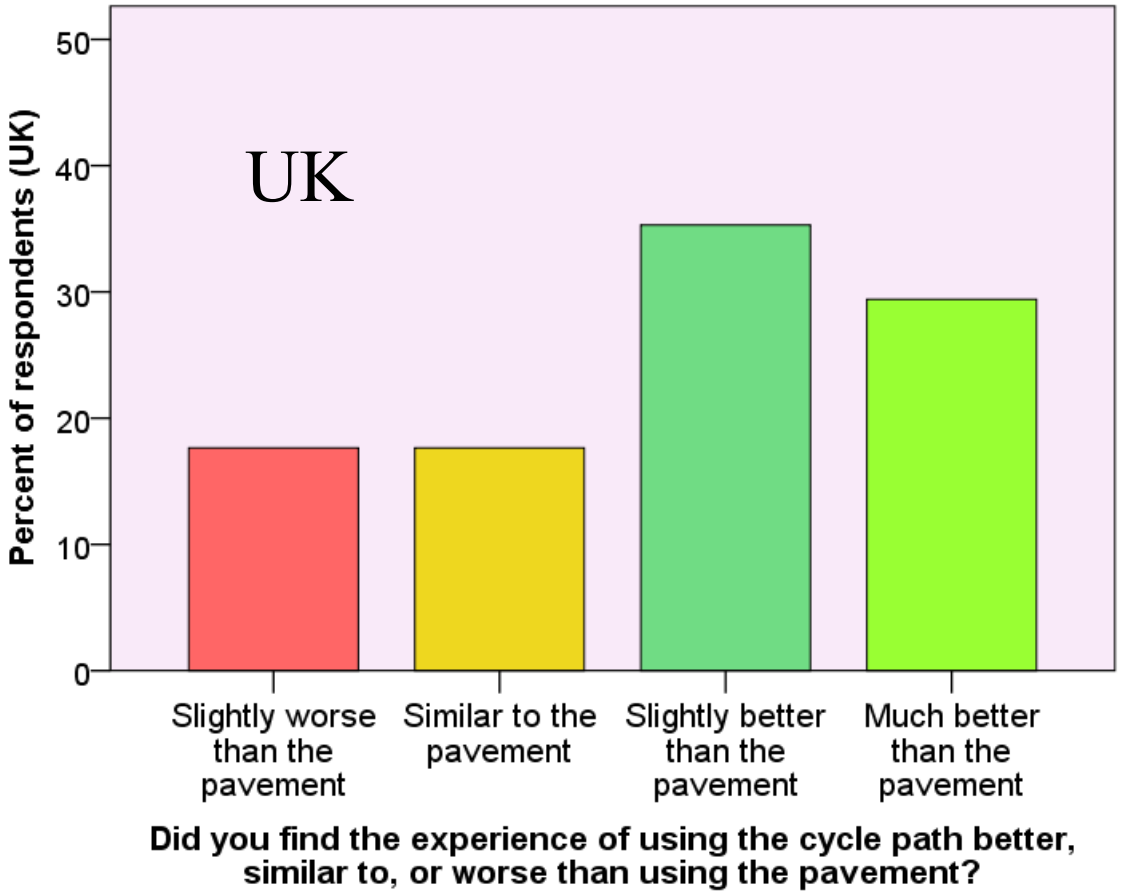
A few quotes from the Netherlands:

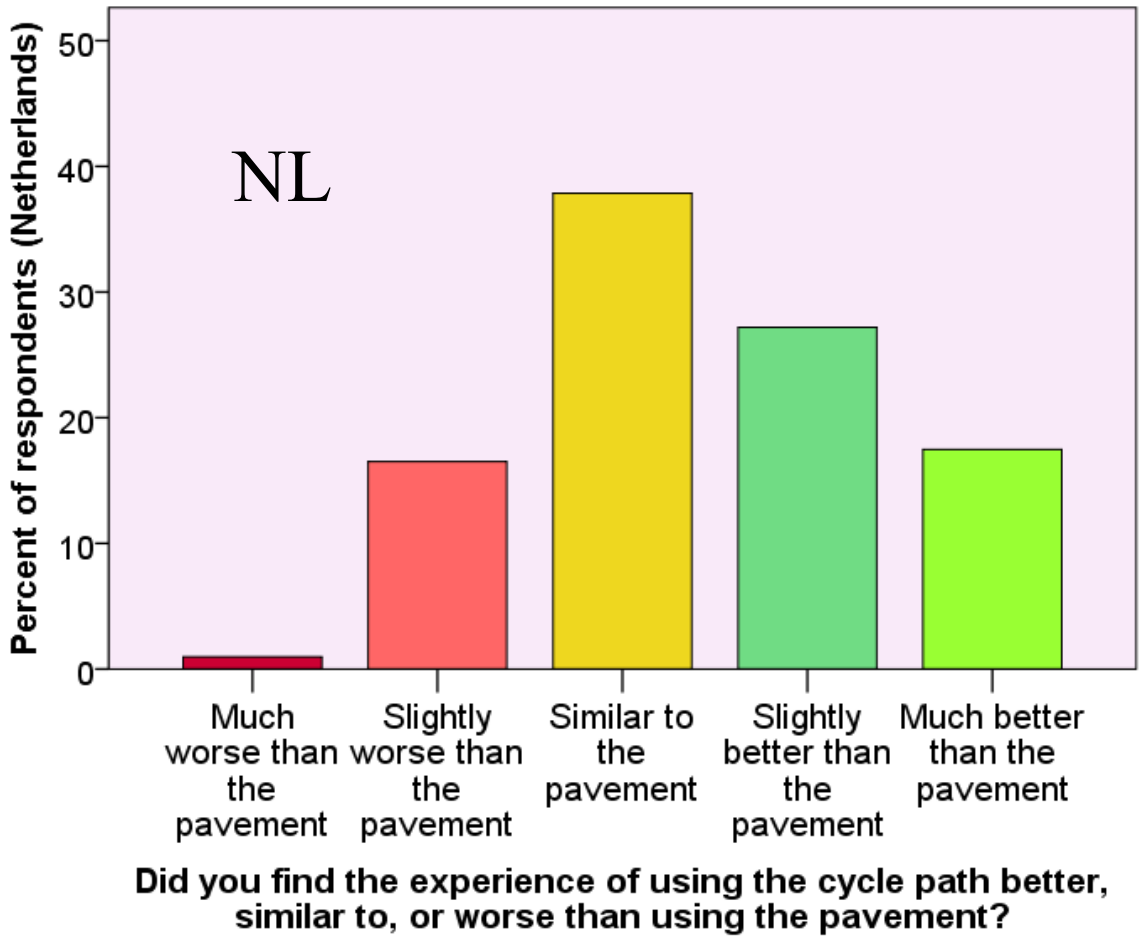
- *"I live in a remote village and this [a mobility scooter] is the only possibility for transport outside the village" (Female, aged 45-64, using 15km/h mobility scooter)*

- *"I can control how, where and when I want to go somewhere" (Female, aged 45-64, preferring their mobility scooter)*

- *"Without my mobility scooter I would be helpless and not be able to go places near my house or to go shopping." (Female, aged 65+)*

Experience of cycle path compared to footway:





Other findings:

This photo was shown to the UK and Canadian sample groups, who were asked whether they were more likely to use the cycle path than the footpath.

75% in UK indicated they would prefer to use the cycle path, and 89% in Canada.

Other findings:

The Dutch sample group provided comments on using cycle paths compared to footways:

- Preferred cycle paths, especially for their better surface
- Few reported issues, and these typically related to poor maintenance, or the inconsiderate attitude of some youths riding too many abreast

63% of all respondents in the Netherlands said that half (or more) of their journeys involved the use of bicycle infrastructure; only 10-15% rarely or never used it.

The boom in little vehicles

Lime scooter, USA

Lime scooter, Zurich
(image courtesy Jake Collett)

Voi scooter, Stockholm
(image courtesy Jun'ichi Miyazaki)

The boom in little vehicles

- There has been a sudden and rapid rise in the use of shared mobility devices, both bikeshare schemes and also shared **dockless kick scooters**
- California seems to be the epicentre for these scooters, with operators including Jump (**Uber**), **Lyft**, Lime, Bird, and Skip, who have raised **hundreds of millions of dollars** of venture capital between them
- Most of these kick scooters are electric-assisted, such as the model used by Lime, which has a top speed of **15mph** and a range of over **20 miles**
- The increase in the number of these devices has led to **problems** such as obstruction of the footway with parked devices, as well as reports of people riding them on the footway
- Some towns have implement total **bans** on dockless shared mobility devices, while others have restricted use to certain operators under a **temporary scheme**
- Evidently, **bicycle infrastructure offers an optimal solution for**

The rise of *autonomous* little vehicles

Starship Personal Delivery Device (PDD)

Marble delivery robot

The rise of *autonomous* little vehicles

- The pursuit of automated technology to lower labour costs has led to the development of small **automated delivery vehicles**, known as personal delivery devices (**PDDs**)
- Able to carry small payloads at **pedestrian-like speeds** for a distance of up to two or three miles, **utilising footways** to get about
- There are around ten companies testing these cargo robots, the largest of which is Starship, whose PDD weighs 20kg, has a payload of 10kg, and travels 4mph. To date, Starship have **tested in over 100 cities, covering over 100,000km**, and encountering over 12 million people along the way

- Issues with **legislation**: within the UK, the only mechanical devices allowed to use the footway are PMAs. Starship has been permitted to conduct trials in London and in Milton Keynes, having partnered with Just Eat and Hermes. In the USA, legislation allowing the use of PDDs has already been passed in >7 states.
- Questions remain over how they will be treated in law in terms of liability, speed, and weight restrictions.

- Perhaps the greater concern is that of infrastructure use. The PDDs being tested are exclusively using footways. One report notes that PDD use will eliminate many delivery van trips, thus reducing congestion. Considering that some footways are already overcrowded, **transferring hundreds of van trips to the footpath seems problematic**, especially when some PDDs are about the size of a mobility scooter

Recap:

- PMAs in NL had higher top speeds, often similar to that of bicycles.
- Majority of Dutch users said easy to reach shops or recreational using just their PMA; the majority of British users indicated these trips would be very/prohibitively difficult.
- Dutch respondents rated all aspects of built environment and transport services more highly than British; in particular, quality and continuity of footways and provision of Council-funded disability transport was rated much higher.

Recap/Conclusion

- Percentage of those citing barriers such as poor quality footways, narrow footways, and being forced to ride on the road was 2-3x higher in the UK than the Netherlands
- Majority of respondents in all three countries showed preference for using bicycle infra over footways, citing **surface quality**, **lack of kerbs**, **speed & directness**, and **greater safety** as primary benefits
- **More bike paths → greater levels of independent mobility for PMA users → societal, economic, and health & wellbeing benefits**

Key Message:

- If it’s good for cyclists… it’s probably good for users of mobility scooters and wheelchairs…
- …and for kick scooters and PDDs!

Recommendations

- Create a British equivalent of Dutch National Panel of People with Disabilities and Chronic Illness, to facilitate disability research
- Educate & engage planners, officials, and lawmakers. Involve PMA users earlier in the planning stage of infrastructure and building projects
- Allow PMAs legal right in the UK to use bicycle infrastructure
- Ban “pavement parking” nationwide
- Mandate minimum PMA-friendly design standards for all new pedestrian & cycle infrastructure / road projects, rather than merely having *recommended* standards

What next?

- Further research to more comprehensively understand infrastructural and mobility requirements of PMA **users**– most guidelines at present primarily focus on minimum widths and maximum cross-slopes/ramp angles.

- Research could incorporate things such as surface quality, frequency of kerbs/crossings, and travel speed / infrastructure design speed.

- This greater understanding could lead to creation of a new "Level of Service" indicator, such as Wheelchair Level of Service (WLOS) or PMALOS. New infrastructure could then be built to new standards that incorporate these requirements, while priority for replacing old infra could be decided based on these new scores.

What next?

- Research on infrastructure design and capacity, safety risks, and societal impacts of small personal mobility devices (e.g. kick scooters) and PDDs is urgently needed
- Risk of legislation yielding to devices, rather than the other way around, if governments and academics don’t work with device manufacturers and operators

PMA design standards (for reference):

Specification description:	Specification:	Report:
Minimum clear floor area to accommodate a single stationary powerchair or scooter and occupant	1,300x800mm	CHRC, 2007
Minimum clear width for pedestrian paths (protruding objects shall not reduce clear width)	1,500mm	CHRC, 2007, DfT, 2002
Minimum clear width in high traffic areas	1,830mm	CHRC, 2007
Minimum clear width for two wheelchairs to pass	1,800mm 2,000mm	CHRC, 2007 DfT, 2002
Recommended minimum clear width by shop-fronts	3,500mm	DfT, 2002
Minimum clear width adjacent to dropped kerb/ kerb ramp	1,200mm	CHRC, 2007
Maximum (absolute/preferred) slope of dropped kerb/kerb ramp	1:12/1:16 1:12/1:20	CHRC, 2007 DfT, 2002
Minimum width of dropped kerb/kerb ramp	1,000mm	CHRC, 2007
Dropped kerbs shall be:	Aligned	CHRC, 2007
Minimum diameter for clear turning space at toe level for a power wheelchair to turn 180°/360°	2,250mm 2,420mm	CHRC, 2007 DfT, 2002
Minimum diameter for clear turning space at toe level for a scooter to turn 180°/360°	3,150mm 4,350mm	CHRC, 2007 DfT, 2002
Allowable height range above the ground for controls (e.g. pedestrian crossing button)	400-1,200mm 750mm	CHRC, 2007 DfT, 2002
Maximum side-reach (@90°) for controls	310mm	DfT, 2002
Cross-slope should not exceed ratio of:	1:50 1:40	CHRC, 2007 DfT, 2002
For a vertical rise of over 13mm:	Consider as a ramp - maximum slope of 1:12	CHRC, 2007
Gratings	Perpendicular to direction of travel; maximum spacing of 10mm 13mm	CHRC, 2007 DfT, 2002
Joint width between pavers	Min. 2mm, Max. 5mm	DfT, 2002
Minimum clear headroom	2,030mm 2,300mm (incl. cycle paths)	CHRC, 2007 DfT, 2002
Distance between bollards	See minimum clear device width	CHRC, 2007
Resting areas for wheelchair users provided every	150m, off the path of travel	DfT, 2002
Minimum parking space width, including access aisle	4,100mm (standard), 3,900mm (parallel parking)	CHRC, 2007

Questions? Comments? Criticism?

Feel free to share your views…