# Avoiding walls – what distance do pedestrians keep from walls and obstacles?

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Motivation

- Pedestrians walking in corridors maintain a clearance from walls and obstacles.

- These separation distances determine the effective width of corridors utilized by pedestrians. This effective width is used in modeling aggregated pedestrian flows.

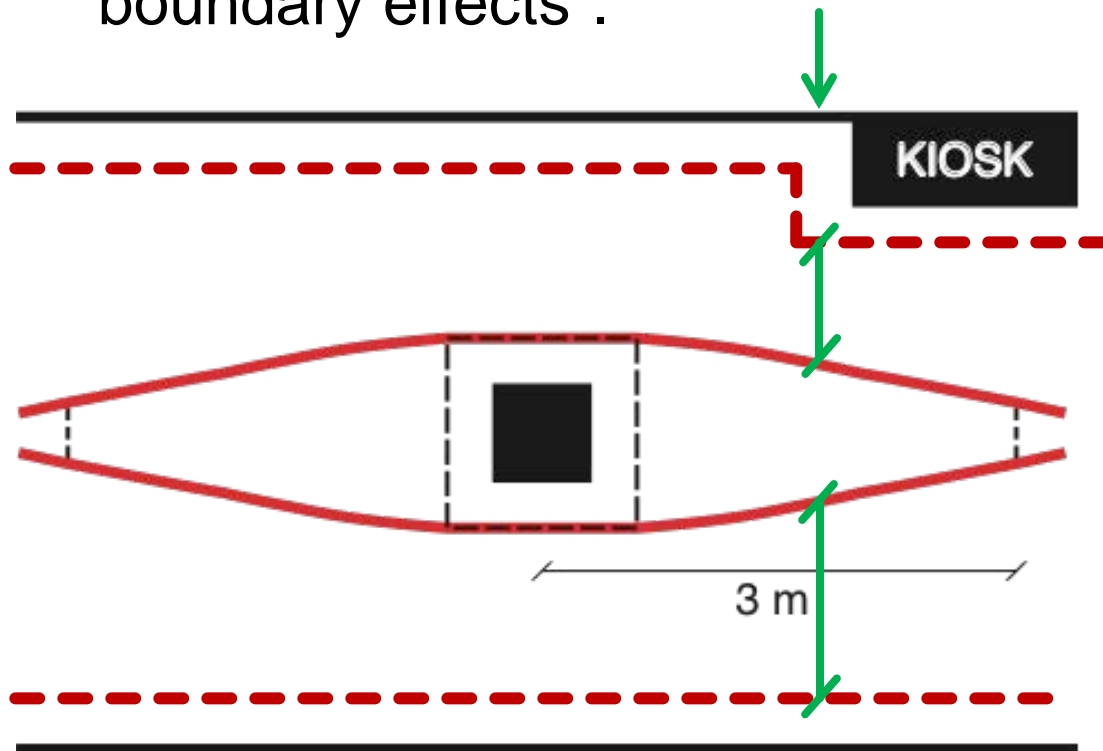- Accurate literature on these distances is scarce.

Pedestrian fundamental diagram
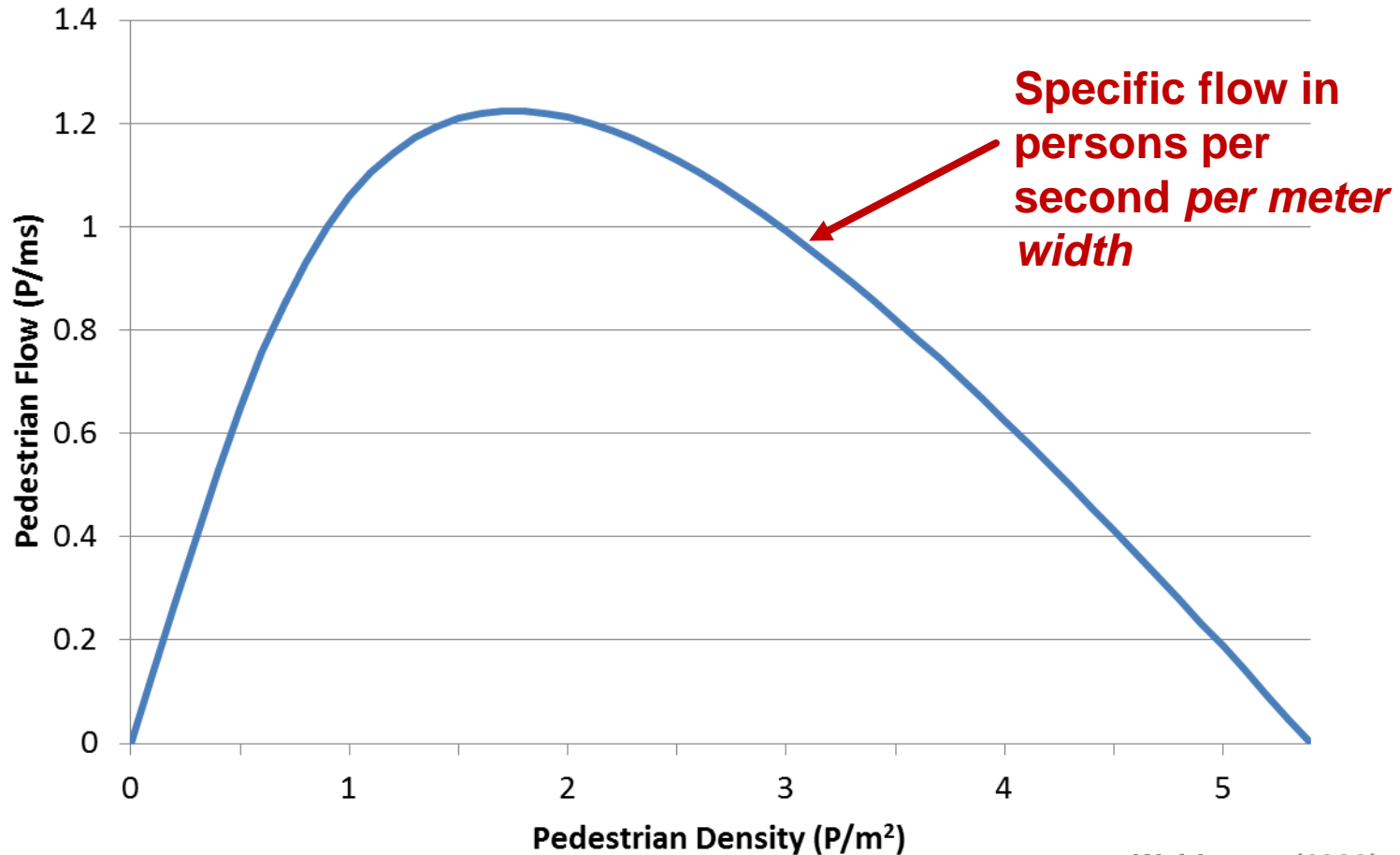
Weidmann (1993)

Effective width of corridors

- Some parts have to be subtracted. Lost width because of "boundary effects".

Literature on separation distances

- Values found in literature are often based on estimations and assumptions. Empirical data is lacking.

- For example for concrete walls:

15	Pauls (1987)
25	Weidmann (1993)
30 - 45	Crow (1998)
40	Van Soeren (1996)
45	De Neufville & Grillot (1982)
50	HBS (2001)

Büchel (2014)

Literature on separation distances

- Habicht and Braaksma (1984) measured the wall clearance distance using overhead video cameras:

TABLE 1.—Effective Width Reduction Due to Walls (Ref. 8)

Type of wall (1)	Level of service (2)	Effective width reduction, in inches (centimeters) (3)	Data base number of pedestrians (4)
Concrete	A	7.91 (20.1)	855
Metal lattice mesh	A	6.48 (16.5)	855
Metal lattice mesh	B	5.51 (14.0)	290
Metal lattice mesh	C	6.02 (15.3)	228

Habicht and Braaksma (1984)

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Many unanswered questions…

- Does the separation distance indeed exist? Can it be measured? Is it constant under equal circumstances?

- Do pedestrians keep a larger distance to walls than to others?

- Does pedestrian behavior around obstacles compare to the behavior near walls?

Ultrasonic sensor measurements

- Measurement of wall clearance distance.
- Ultrasonic distance sensor mounted at 95 cm height
- Perpendicular distance measured as a single scalar value. No geometric information.
- Measurement accuracy: ± 1 cm
- Two locations:
  - Pedestrians move through a 133 cm wide bottle neck.
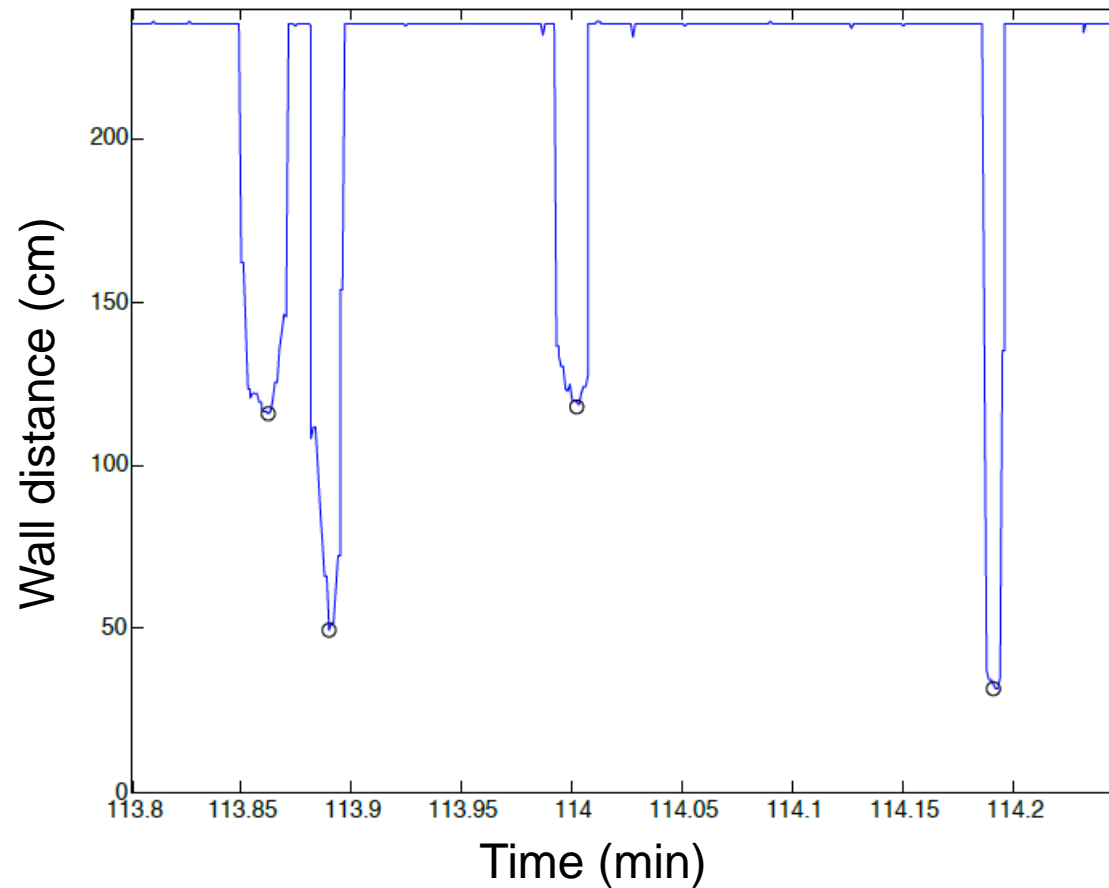 - Pedestrians walking along a smooth concrete wall on a ramp.
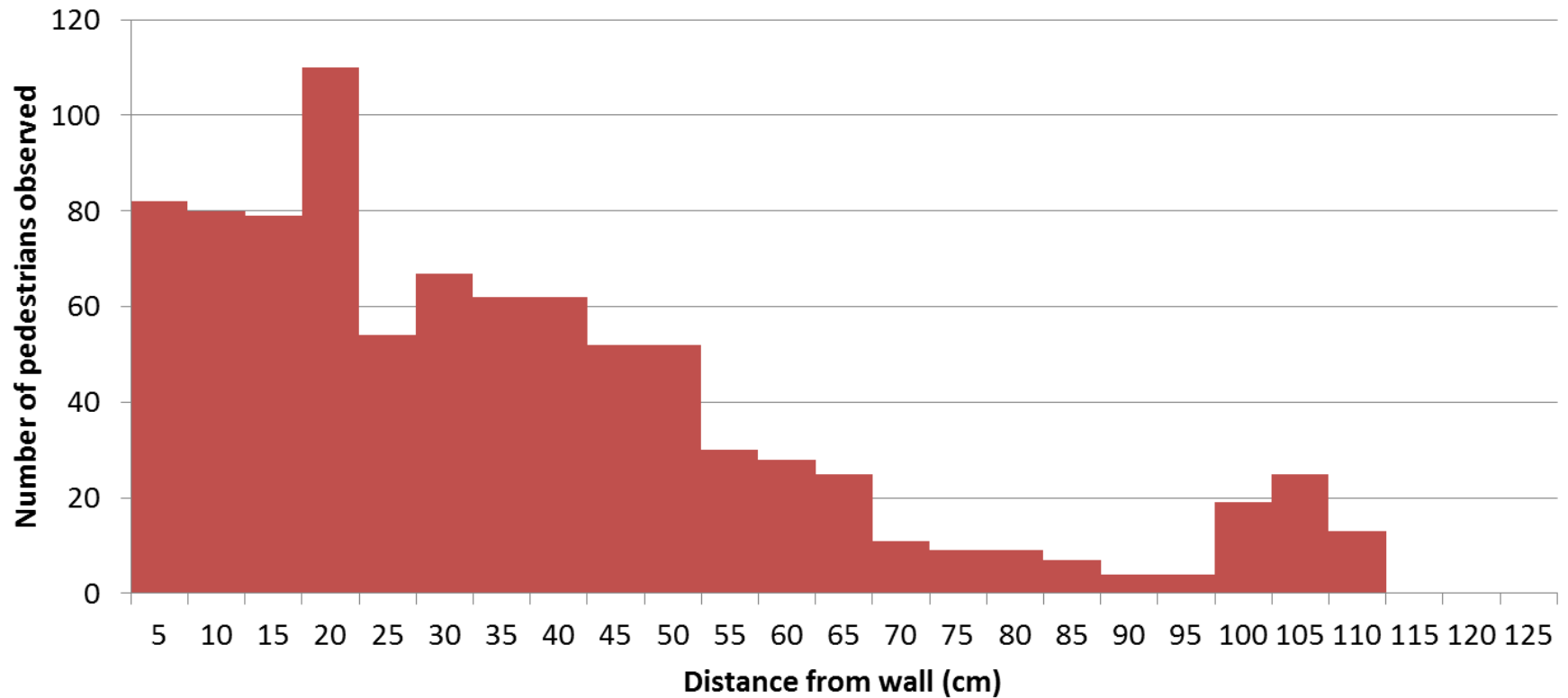
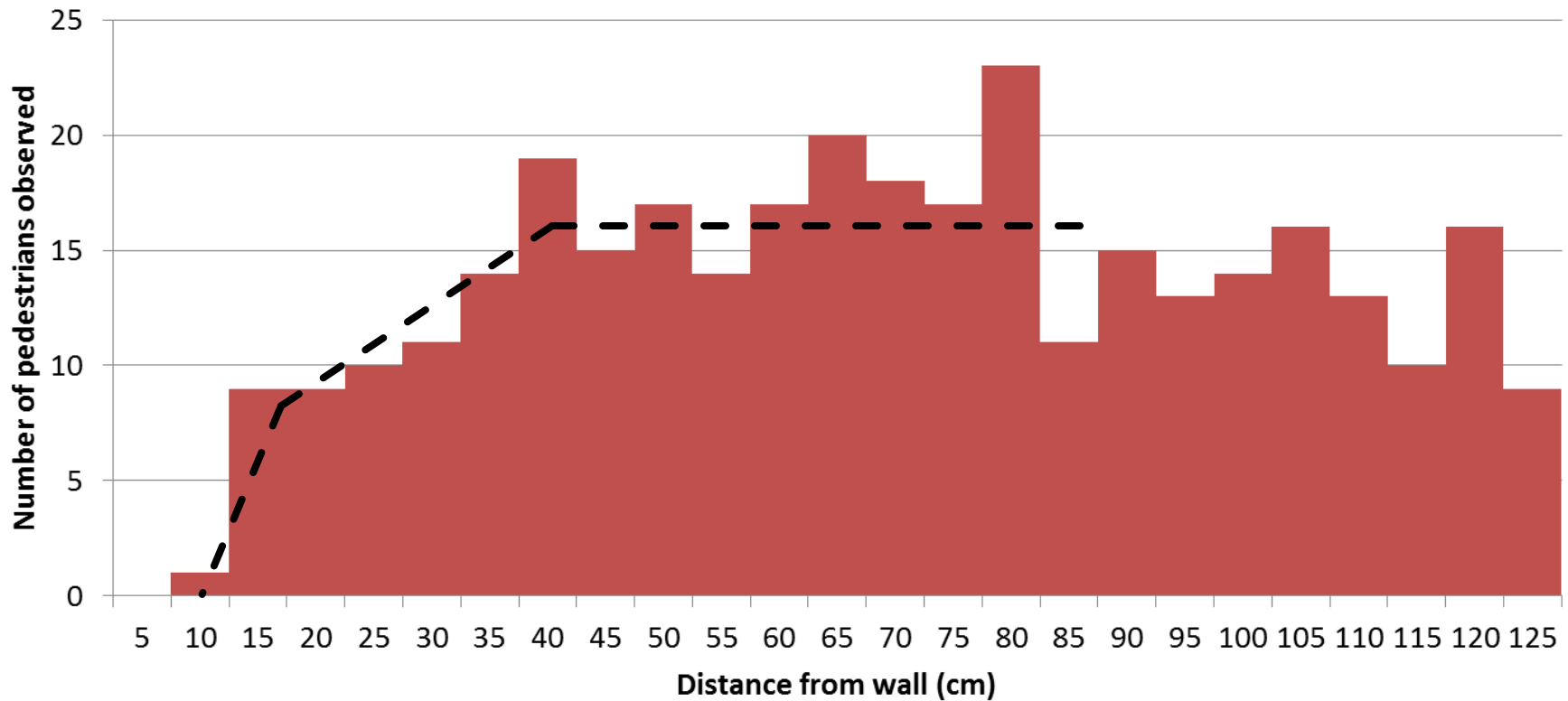# Bottleneck measurements (133 cm width)
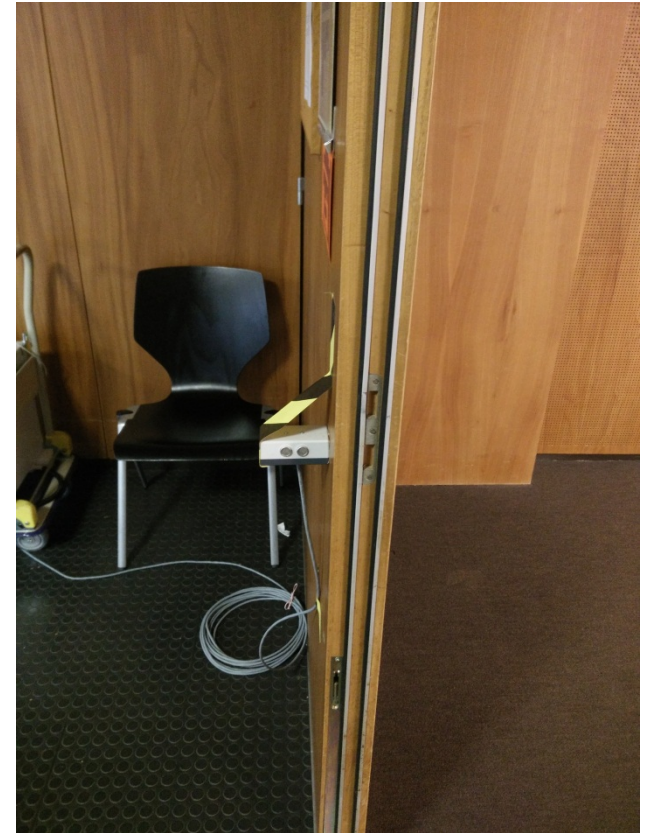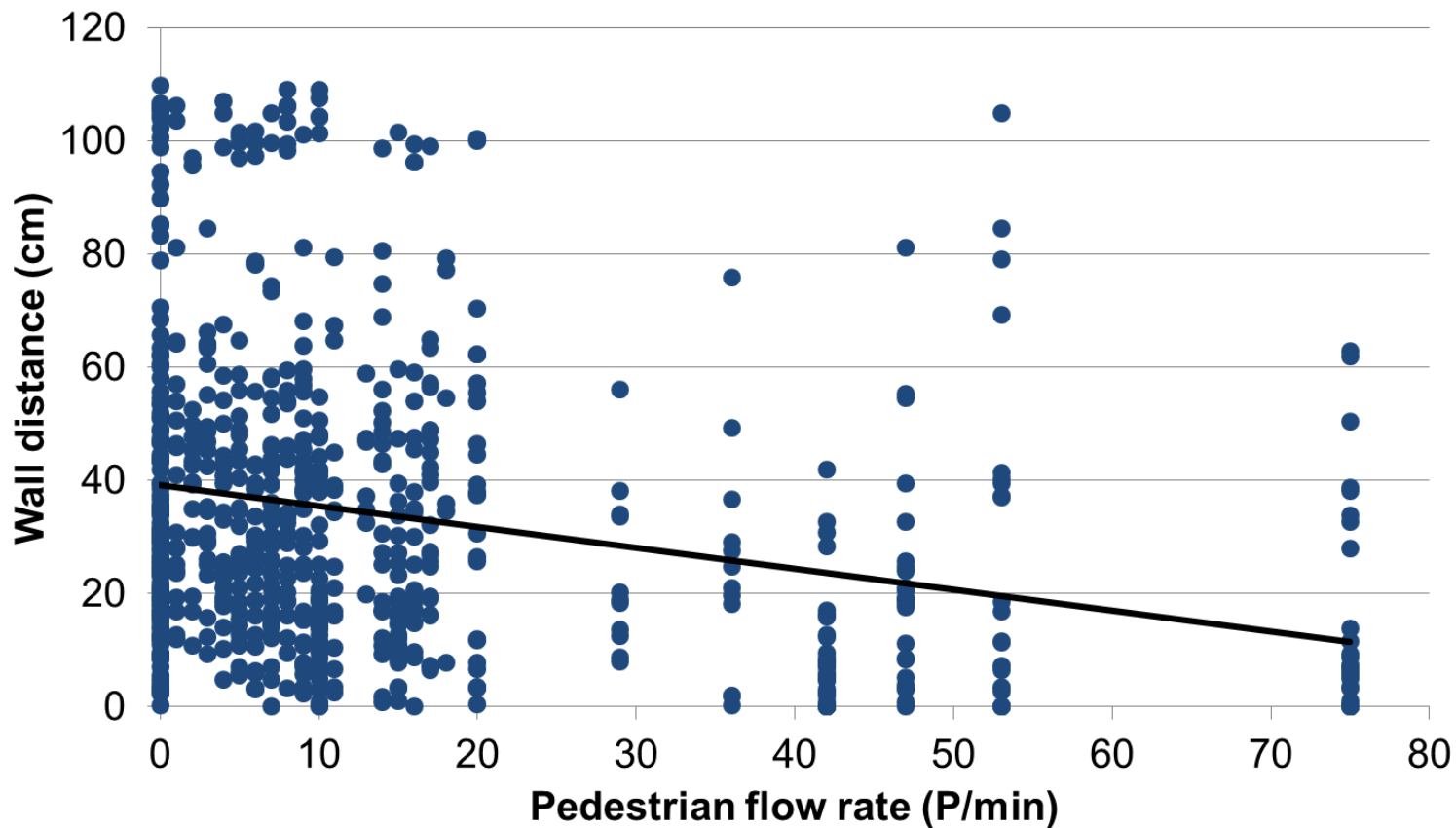
Wall distance measurements

Ultrasonic sensor data

Results: bottleneck

Results: smooth concrete wall

Results: bottleneck

Laser scanner measurements

- Movement of pedestrians around obstacles.

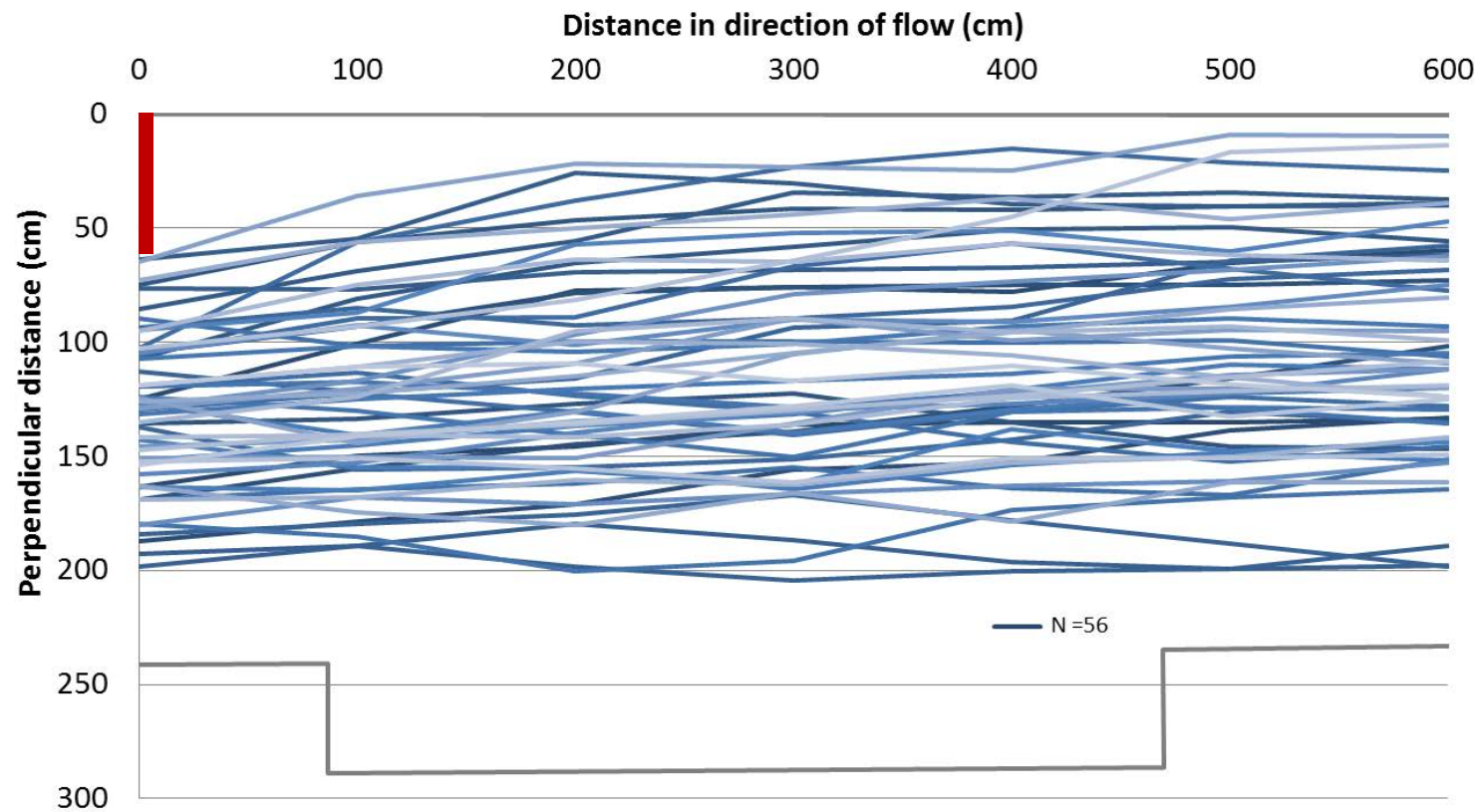- 180° FOV Laser scanner mounted in front of obstacles at 95 cm height.
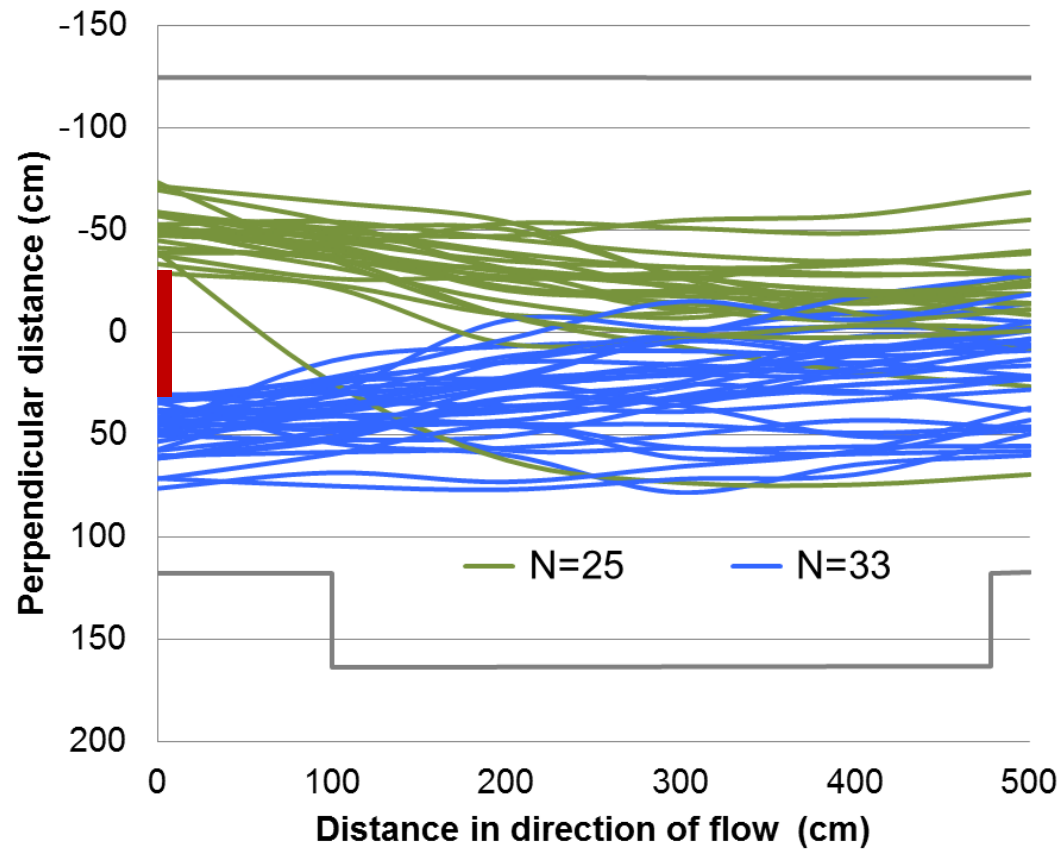
Laser scanner measurements

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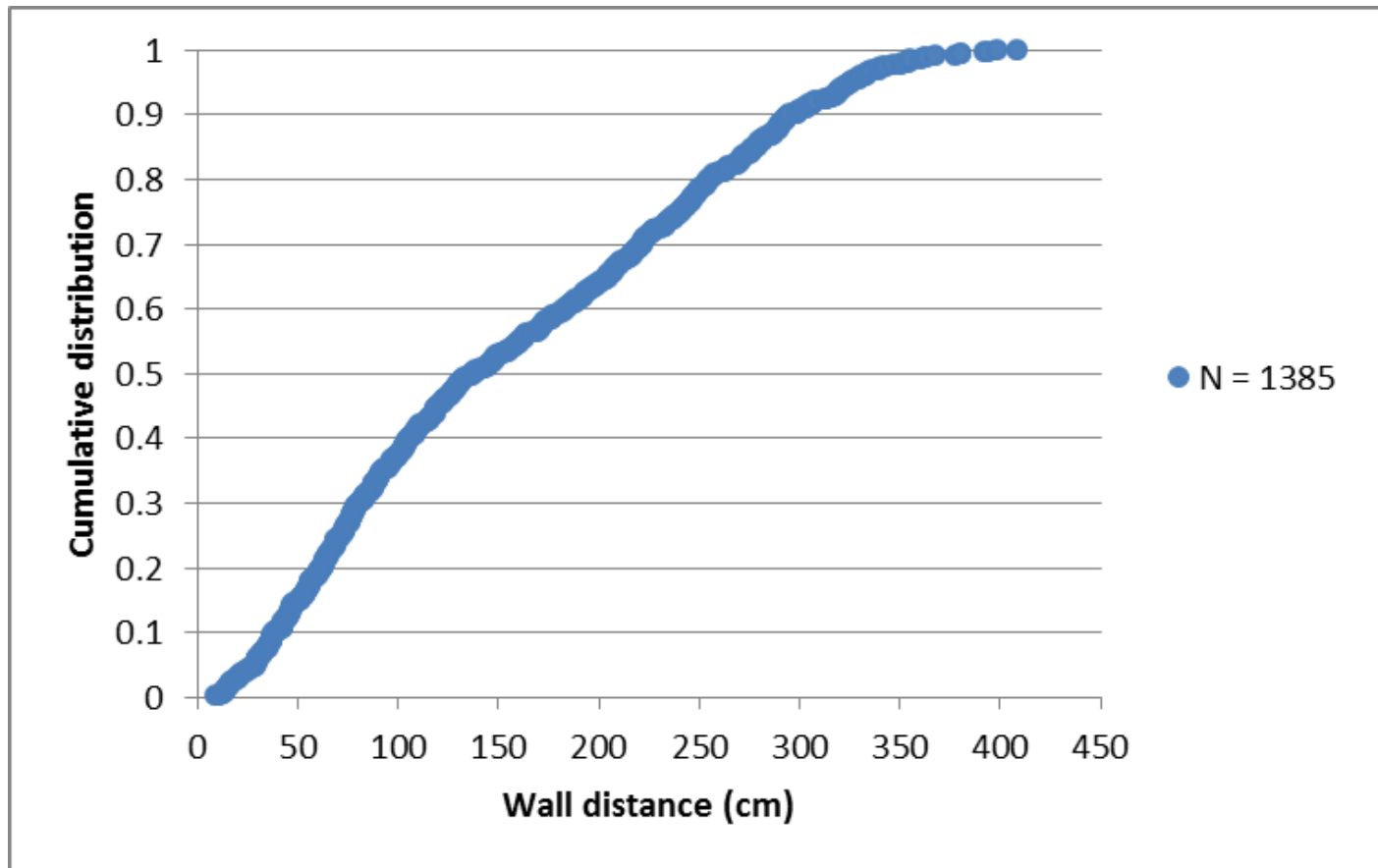# Results (1)

Results (2)

In conclusion

- Pedestrian wall clearance distance can be reliably measured.

- Data seem to suggest the effective width is dependent on the pedestrian density.

- Ultrasonic transducers present a cheap and quick method to count pedestrians and measure certain aspects of pedestrian flows.
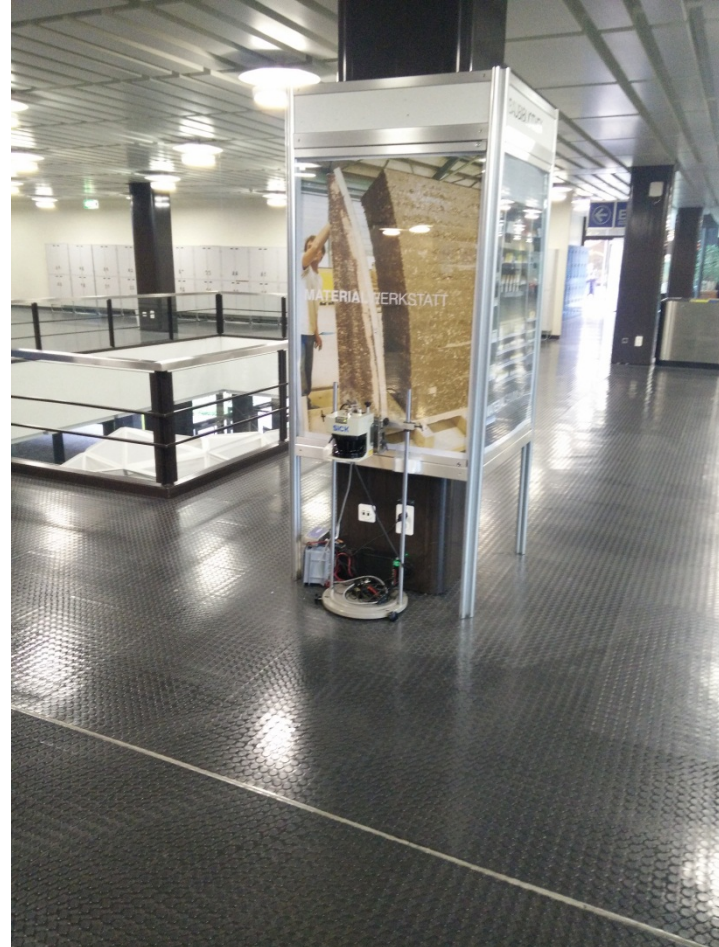
Thanks for your attention!

Wall distance: cumulative distribution

Laser scanner measurements

Distance in the 90° and -90° plane

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