

Walkability- Developing Pedestrian Friendly Livable Streets/Cities



Prof. Saman Bandara

Stakeholder Dialogue on
Improving Environmentally Sustainable Transport
in Sri Lanka

Hotel Taj Samudra

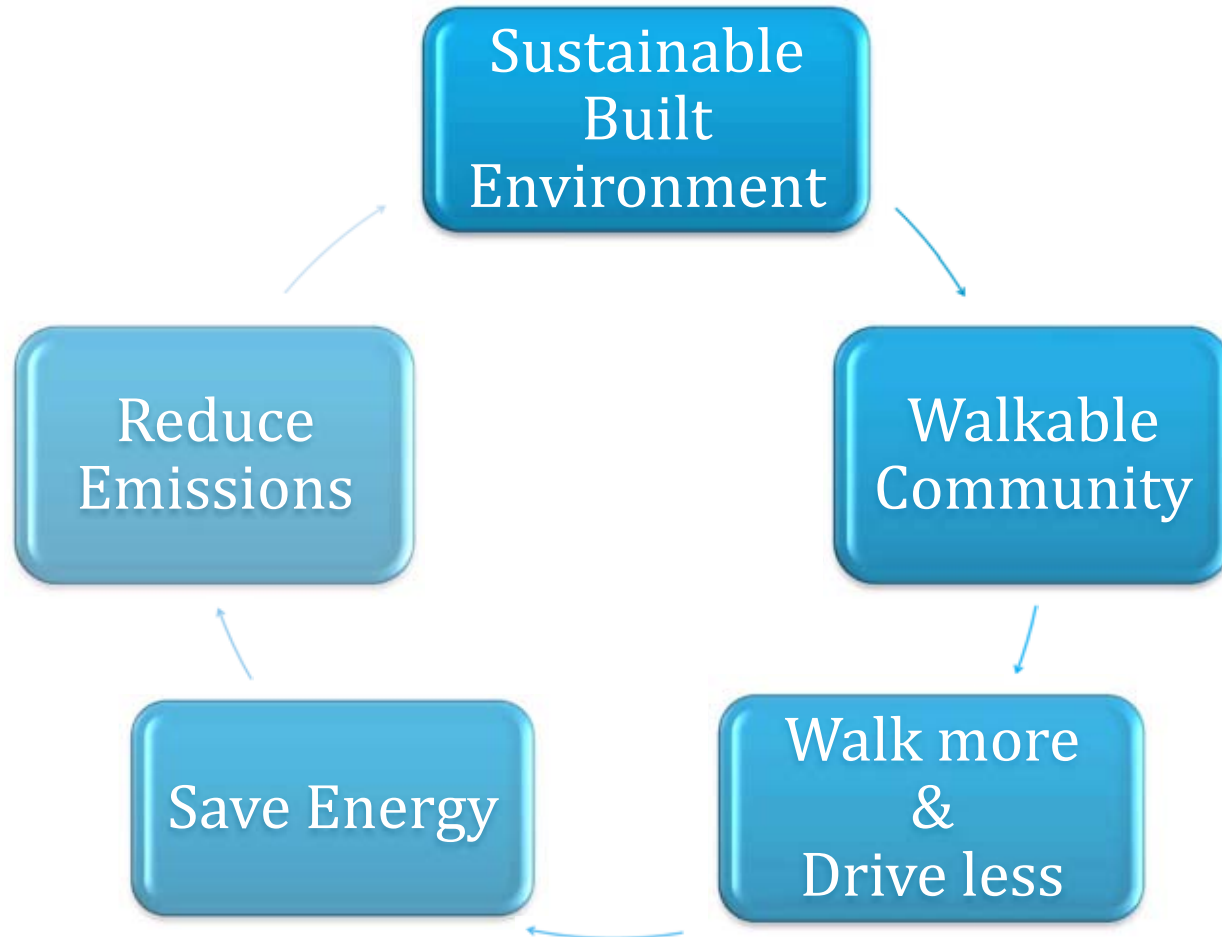
10th December 2013

Walking

- Reduces unnecessary traffic on road
- Promotes social harmony
- Reduces air pollution in the long run
- Least discriminative mode of transport
- Makes healthier



Sustainable Cities





Walkability

- Extent to which the built environment is friendly to the presence of people living, shopping, visiting, enjoying or spending time in an area

Global Walkability Index

Holly Krambeck (1996)

GLOBAL WALKABILITY INDEX
FIELD DATA COLLECTION

City: _____

Survey Area Name _____ Survey Area # _____ Peak Hour ☐ Yes ☐ No

Survey Team Names: _____

Surveyed Road Stretch	1	2	3	4	5	6	7	8	9	10	$(\sum(x \times \text{length} \times 10 \times \text{count})) / \# / 10$
1) Walking Path Modal Conflict	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2) Security from Crime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3) Crossing Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4) Motorist Behavior	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5) Amenities (Cover, benches, public toilets, street lights)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6) Disability Infrastructure and Sidewalk Width	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7) Maintenance and Cleanliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8) Obstructions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9) Availability of Crossings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10) Pedestrian Count	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11) Length of Surveyed Stretch (km)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Disability Infrastructure
The following diagrams provide some guidance on how to judge disability infrastructure provision. Acoustic pedestrian signals might also be considered.

① No infrastructure for disabled persons is present.

② Limited infrastructure for disabled persons is available, but is not in usable condition.

③ Infrastructure for disabled persons is present but in poor condition and not well placed.

④ Infrastructure for disabled persons is present, in good condition, but poorly placed.

⑤ Infrastructure for disabled persons is present, in good condition, and well placed.

NOTES

Walkscore



Walk Score®

Find a Walkable Place to Live.

[Rankings](#) | [Walkable Neighborhoods](#) | [How It Works](#) | [Walk Score On Your Site](#) | [Blog](#)

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Type an address to get your Walk Score

Address

Walk Score Methodology

We like to be transparent about how Walk Score works — and we love hearing from you.

What

We hear

1. Try

Street
88

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The Walk Score Algorithm



Walk Score
area is for w

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The Walk Sco

category. If a

number of poi

(or 1.6 km)—no points are awarded

normalized to yield a score from 0-

whether people walk. ¹

For a sneak peek at the future of Walk Score, see how our data sources are updated or as we in

How Walk Score Doesn't Work

There are a number of factors (pedestrian safety, etc.) that are difficult to measure with an algorithm.

How It Doesn't Work: Known Issues with Walk Score

We'll be the first to admit that Walk Score is just an approximation of walkability. There are a number of factors that contribute to walkability that are not part of our algorithm:

- **Street width and block length:** Narrow streets slow down traffic. Short blocks provide more routes to the same destination and make it easier to take a direct route.
- **Street design:** Sidewalks and safe crossings are essential to walkability. Appropriate automobile speeds, trees, and other features also help.
- **Safety from crime and crashes:** How much crime is in the neighborhood? How many traffic accidents are there? Are streets well-lit?
- **Pedestrian-friendly community design:** Are buildings close to the sidewalk with parking in back? Are destinations clustered together, especially if you're carrying groceries.
- **Topography:** Hills can make walking difficult.
- **Freeways and bodies of water:** Freeways can divide neighborhoods. Swimming is harder than walking.
- **Weather:** In some places it's just too hot or cold to walk regularly.

As [Marlon Bain](#) said, "You should use the Web 3.0 app called going outside and investigating the world for yourself" before deciding whether a neighborhood is walkable! And if you can't go there in person, Walk Score includes [Google Street View](#) so you can use your own eyes to evaluate the walkability factors that our algorithm doesn't yet include.

Walk Score Improvements

We are developing a "Street Smart" Walk Score that takes walking distances, intersection density, block length, etc. into account when calculating Walk Scores.

Walk Score now shows [Transit Score](#)™ and public transit where [public Google Transit Feeds](#) are available.

Visit [WalkScore.org](#) to discuss other Walk Score improvements.

Other Issues

National Support: Walk Score is officially supported in the United States, Canada, Australia, and the United Kingdom. We've heard from many other countries looking for open source developers to help add support for their countries.

<http://www.walkscore.com>

Design Guidelines

Pedestrian Design Guidelines

Best Practices



New Delhi

Frontage
Zone

Pedestrian
Zone

Planting/
Furniture
Zone

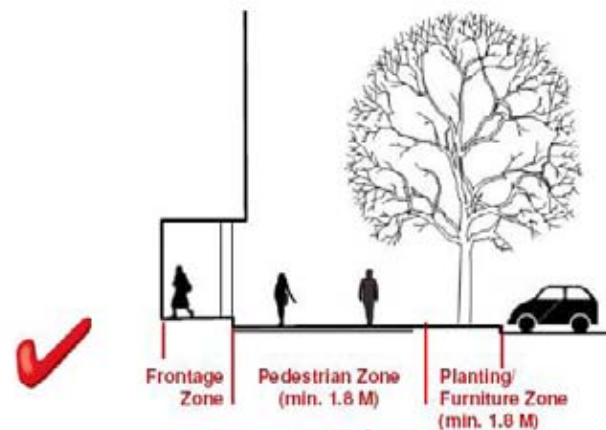


Vancouver

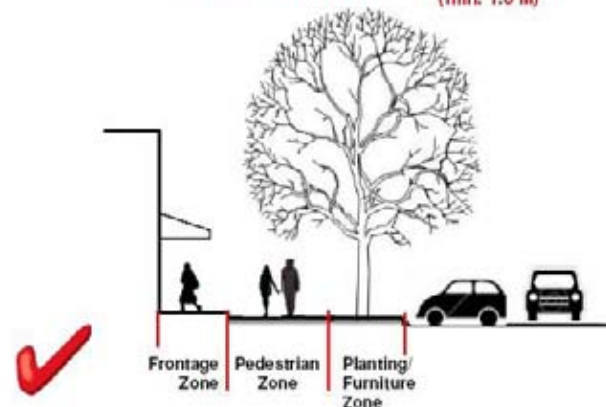
Frontage
Zone

Pedestrian
Zone

Planting/
Furniture
Zone



Commercial:



Residential:



Need For Improvements

Existing walkability measures either

- Rank roads based on a level of service criteria using qualitative measures that are very subjective or
- Uses few land use parameters only, disregarding the quality of the facilities available.



Need today

- Encourage pedestrian traffic
- Encourage the improvements in pedestrian facilities
- Identifying deficiencies in existing pedestrian facilities
- Improving the presently used evaluation criterion



Requirements

- Identification of all relevant parameters
- Methodology without subjective judgments
- Consistency and transferability
- Possibility to identify shortcomings in existing facilities
- Ability to identify remedial measures
- User friendliness



Walkability and Energy Saving

- Two different areas with two different walkability conditions were located
 - A complete walkability survey was not carried out
 - Suitable walkability parameters were considered
 - Areas were selected by simple observation



Methodology

- The trip patterns and selection of mode was found out
 - Via household surveys
 - First mode of the trip was concerned more
 - convenient maximum walking distance was found out
 - If current facilities are not improved, what will happen??



Community 1:

Walkable

- Sufficient walking space
- Less traffic flow
- Slow speeds
- Well maintained and clean roads
- Good land use mix
- Secure neighborhood
- Shady roads
- Reliable public transport



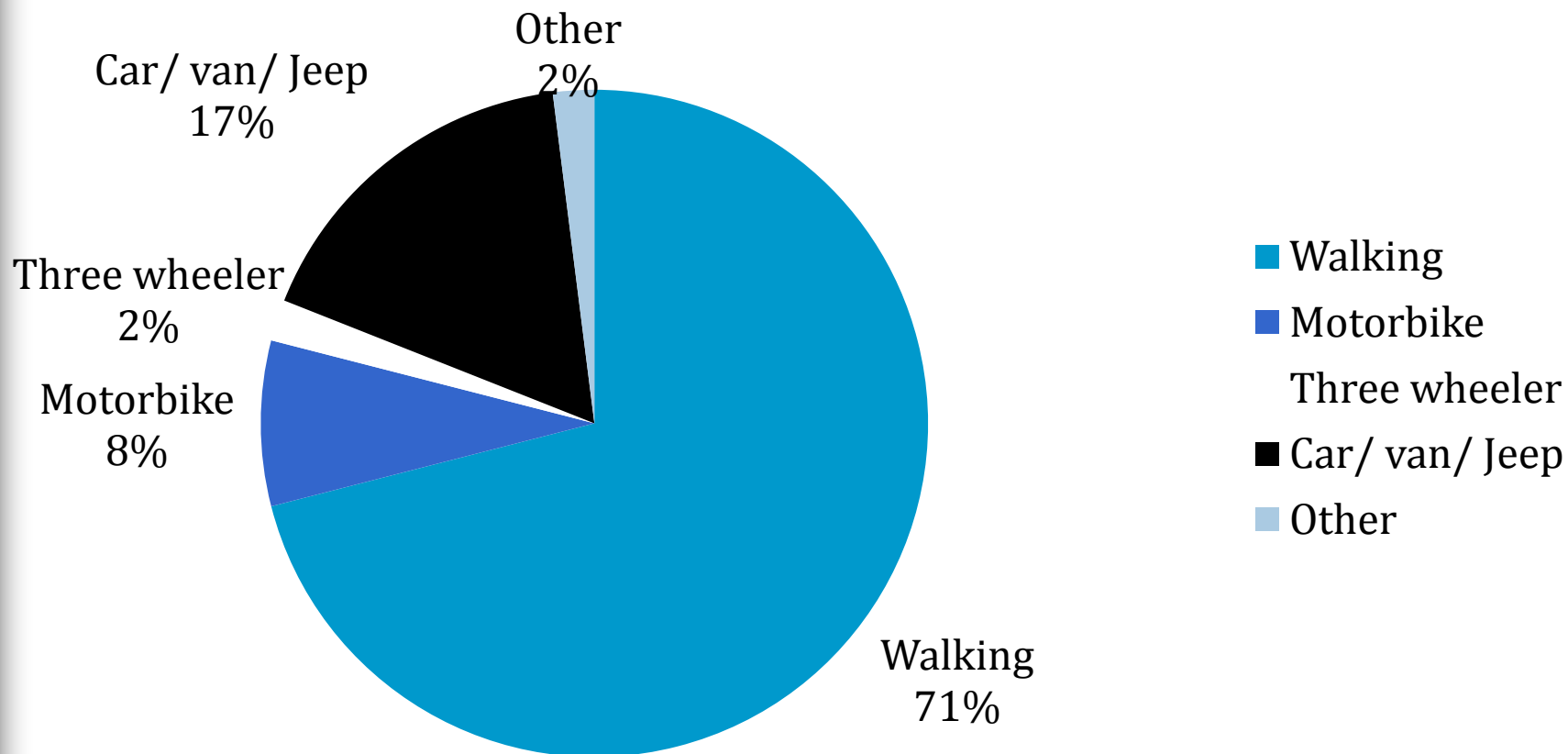
Community 2:

Less walkable

- Insufficient walking space – no shoulder
- Speeding vehicles
- Poor maintenance and Dust
- Blind walls
- Improper street lighting
- Services are not located at close proximity
- Unsecure from crimes

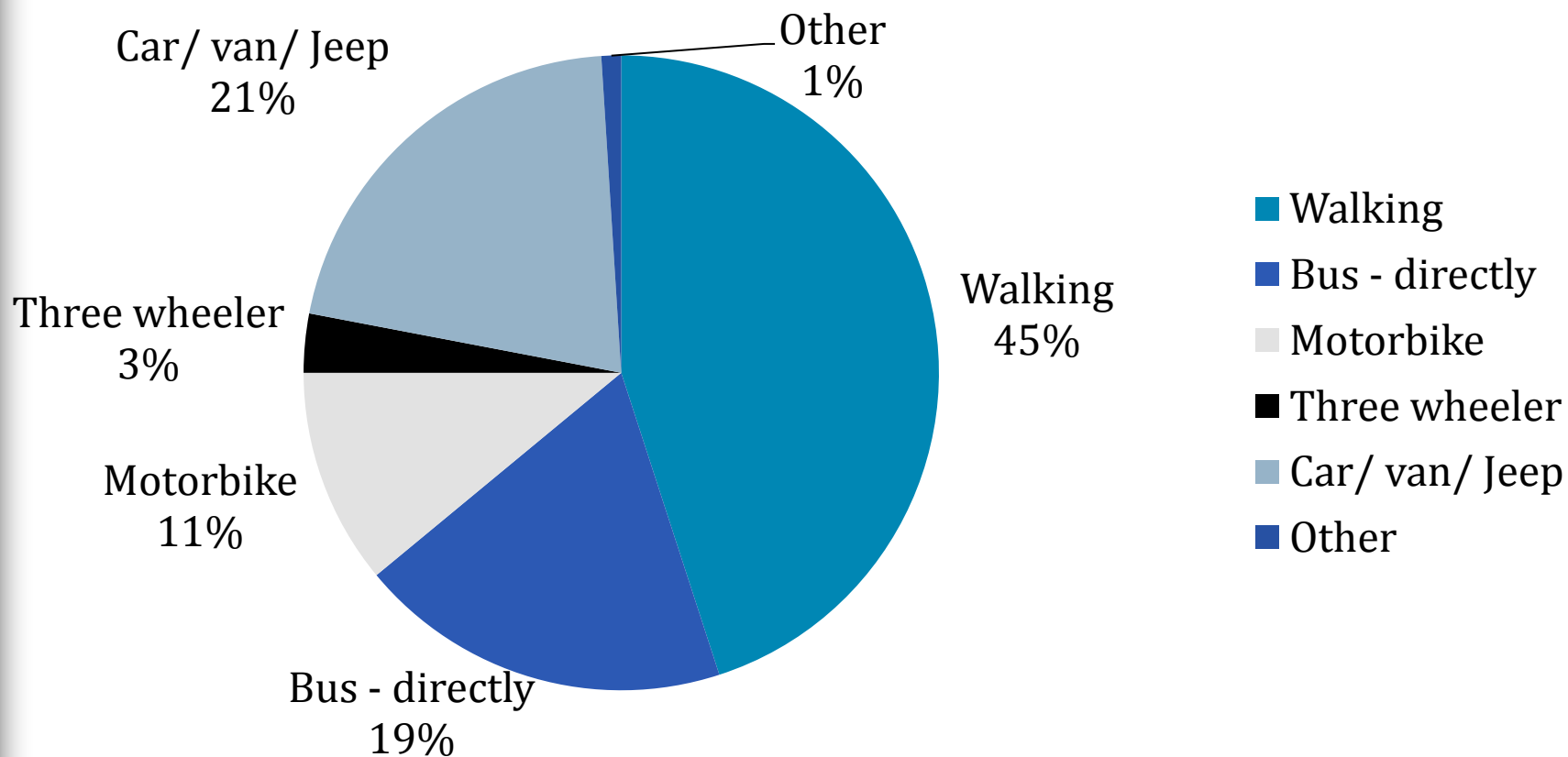
Results

Mode selection in a Walkable community

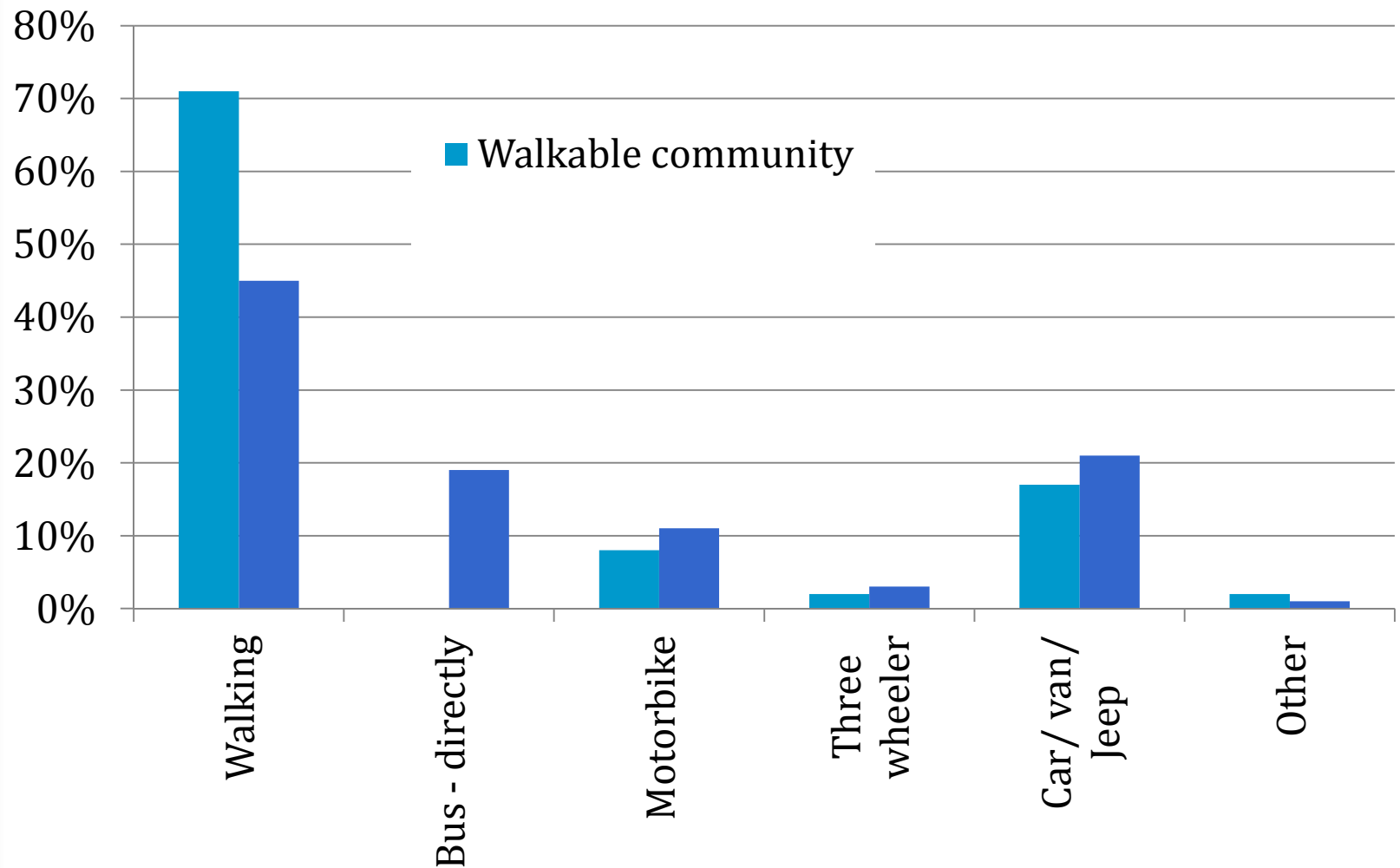


Results

Mode selection in a less walkable area



Results - First mode of travel





Quantifiable measures of walkability

- The walkability models so far developed have been reviewed
- A set of six measures have been identified due to their consistent emphasis in the research literature.
 1. Connectivity measures
 2. Proximity measures
 3. Density measures
 4. Infrastructure measures
 5. Land use measures
 6. Environmental & Safety measures



Measures to be used to develop the model

- By considering those measures and the need for a developing country, parameters to be used were narrowed down to three

1. Pedestrian Flow
2. Shortest path link with major links
3. Minimum pedestrian facilities



Parameters to be considered under pedestrian facilities

1. Presence and continuity of sidewalks
2. Effective width of sidewalks
3. Surface condition of sidewalks
4. Albedo (solar reflection ability)
5. Modal conflict
6. Availability of crossings
7. Delay at crossings
8. Amenities & aesthetics
9. Disability infrastructure
10. Pedestrian security

Sidewalks



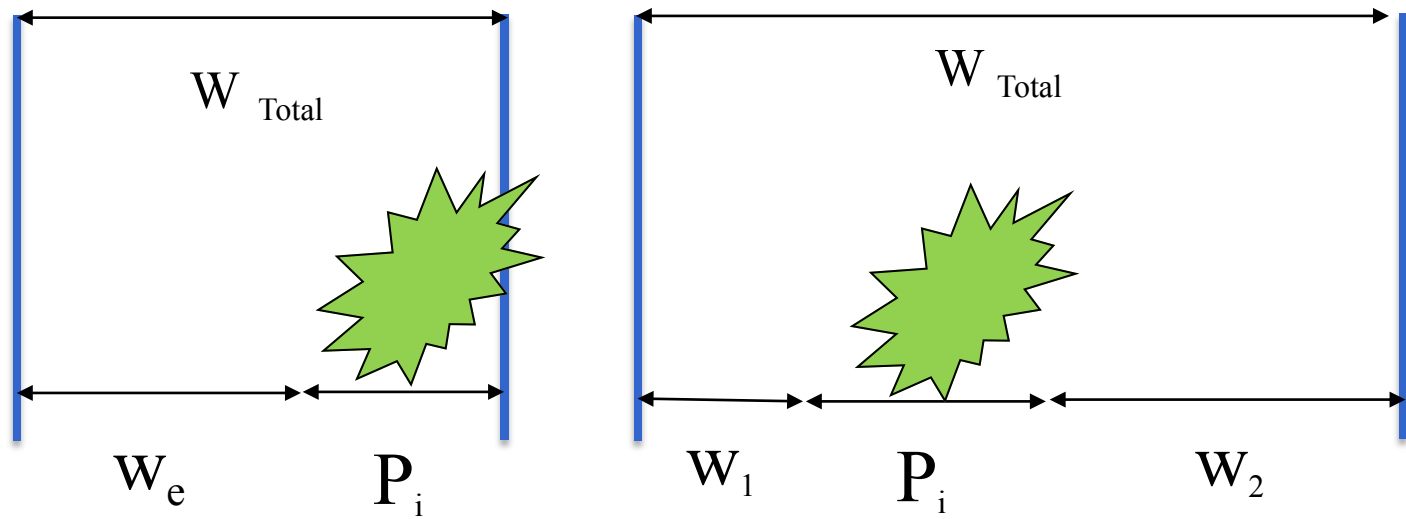
Sidewalks – presence



Sidewalks – effective width (w_e)



Effective width measurement





Sidewalks – effective width (w_e)

Residential	1.5 m
Industrial or mixed	2.0 m
Commercial	2.5 m
Commercial nodes	3.0 m

Modal conflict





Modal conflict

- Determine possible modal conflict
- Evaluate current facilities to reduce modal conflict
 - Raised sidewalk
 - Buffer

Sidewalks – elevation difference

Land Use		Hourly Volume	Height
Residential	&	< 400	Zero
Residential		> 400	100 ~ 150 mm
Commercial or other		> 400	100 ~ 150 mm
Commercial		> 200	100 ~ 150 mm
Commercial		< 200	Zero



Buffer



Buffer



Sidewalks

– surface



- Changes in level
 - Becomes a tripping hazard
- Damages
- Improper disposal of garbage

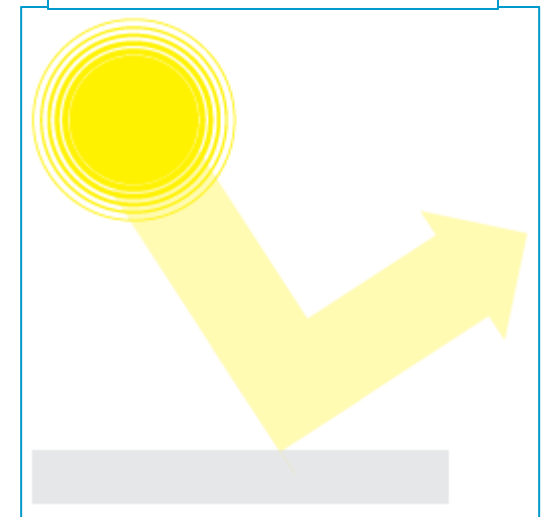
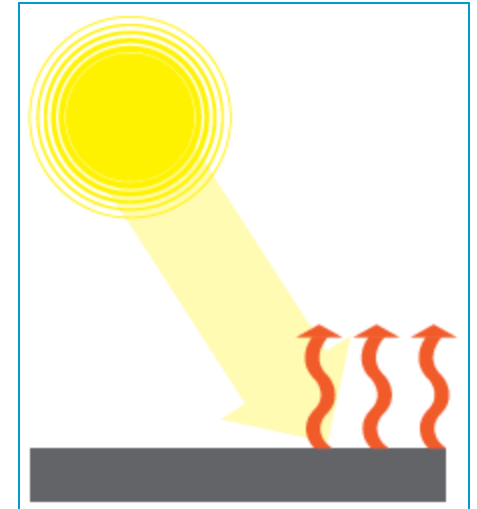
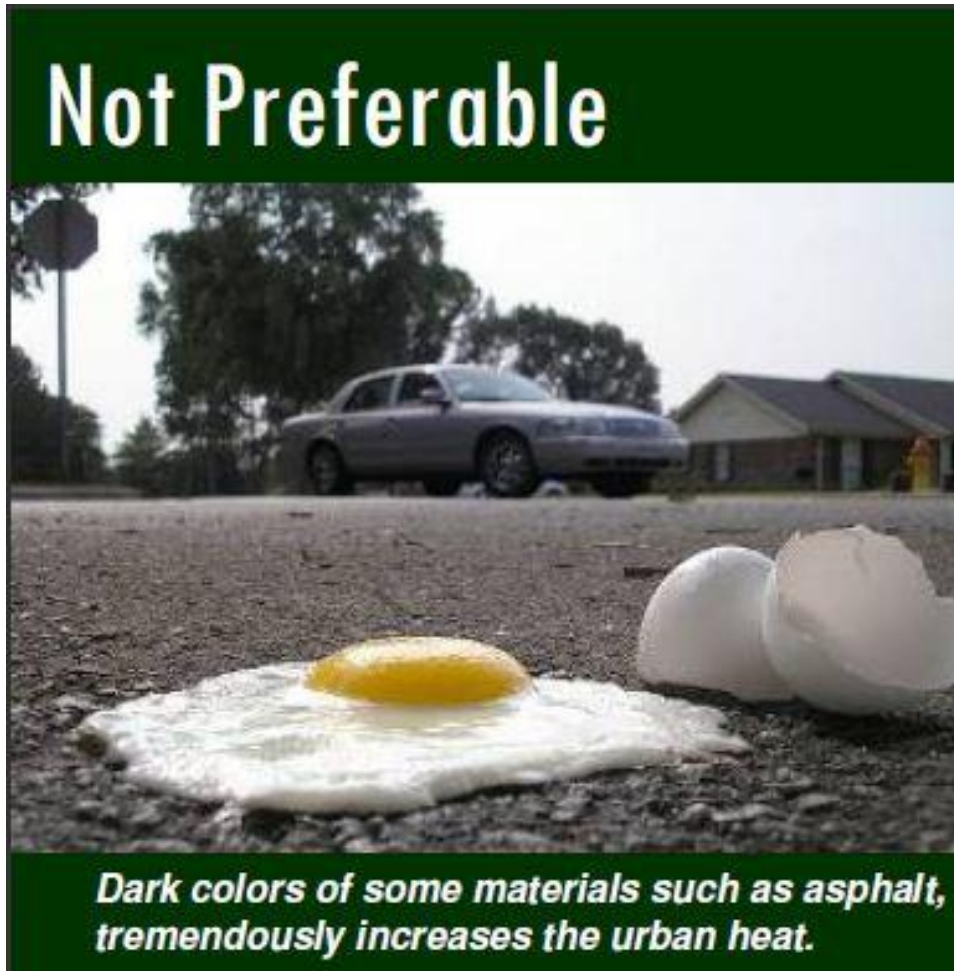
Sidewalks – surface condition

- Firmness

- Sidewalk space covered with grass or just remains as soil or sandy - is not firm
- Where cover slabs (drains) present - it is not stable



Sidewalks – paving materials



Sidewalks – paving materials

- Albedo - Solar reflection
 - ratio of reflected solar radiation to the total amount that falls on that surface
- High albedo materials for paving reduce urban heat island effect. Thus improves climate comfort of walkways





Sidewalks – paving materials

ID	Paving material	Albedo	Score
1	Cement	0.55	100%
2	New concrete	0.43	74%
3	Dry sand	0.31	51%
4	Red Brick	0.28	45%
5	Old concrete	0.22	31%
6	Grass	0.20	28%
7	Macadam	0.18	23%
8	Worn asphalt	0.14	15%
9	Soil	0.08	2%
10	Fresh asphalt	0.07	0%



Crosswalks – presence

- A pedestrian should reach a pedestrian crossing at 150m walking distance(depend on the region)
- Then, gap between two pedestrian crossings should be 300 m or less.

Crosswalks – delay

- Signalized crosswalks

$$d_p = \frac{0.5(C - g)^2}{C}$$

Where, d_p = Average pedestrian delay (s)

g = Effective green time (for pedestrians) (s)

C = Cycle length (s)

Score related to the delay at signalized intersection

Score %	d_p (s/p)
100	< 10
83	10 – 20
67	20 – 30
50	30 – 40
17	40 – 60
0	> 60



Crosswalks – delay

- Un-signalized crosswalks

- Consider an event A

- A = Being able to cross the road within a gap

- Score = $P(A)$; as a percentage

- Gap = $1/\text{flow}$

Aesthetics & Amenities



Charlottesville, Virginia

Pedestrian amenities

Table 3.16 Pedestrian amenities evaluation section – proposed survey form

5	Pedestrian amenities		
	Benches/ seating facility	YES	NO
	Bus halts with seats	YES	NO
	Bus halts with shelter	YES	NO
	Information boards/ Road maps	YES	NO
	Properly placed Bollards	YES	NO
	Public toilets	YES	NO
	Sufficient shade	YES	NO
	Sufficient lighting	YES	NO
	Trees	YES	NO
	Drinking water facilities	YES	NO

$$\text{Score} = (x/10) \times 100\%$$

Where, x = Number of “Yes” entries



Aesthetics

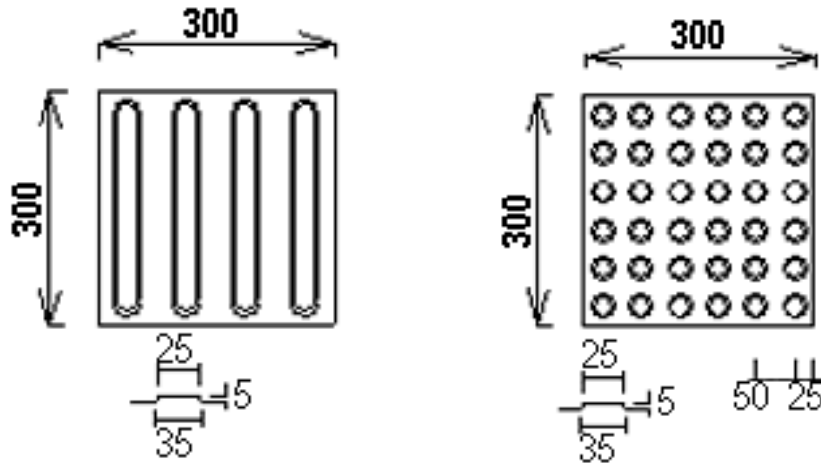
- This is measured qualitatively with a score from zero to 100%.
- Contribution 50% aesthetics and 50% pedestrian amenities

Facilities for the disabled



Vision impaired

- Tactile tiles should have a color (preferably canary yellow), which contrasts with the surrounding surface.
- Tactile Paving should be **minimum 300 mm wide** so that someone cannot miss it by stepping over it.



"Go" - Guiding Tile "Stop" - Warning Tile

Overhead obstructions



Security from crimes

- Eyes to watch
 - Transparent boundary



Security from crimes



X



✓



Concluding to a final score

- Final score for a road can be the simple average of the ten elements.
- A weightage could be given (More research is required)
- This is a percentage where a road with great pedestrian facilities will score 100% and roads those are not pedestrian friendly at all, get 0%
- Can identify deficient areas and pay attention for improvements



Thank you

