16th Urban Mobility India Conference & Expo 2023

Research Symposium

"Integrated and Resilient Urban Transport"

Title: Implementing Access-Controlled footpaths in urban roads with consideration for Universal Design Principals

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Problem Statement – Part I

Encroachments on the footpath

Static

- Parked vehicles
- Shop extensions
- Kiosks/Street Vendors
- Hawkers
- Misplaced Signages
- Misplaced physical infrastructure – electric poles, Transformers etc.

Dynamic

- Two-Wheelers
- Cyclists

These encroachments hinder the hassle free movement of pedestrians on the footpaths

Also, **49% of all road traffic deaths** occur among pedestrians, cyclists and motorcyclists. – Global Mobility Report 2017, UN

Note: Both the types of encroachments can be addressed through policy and design interventions

Fig 1: Dynamic encroachments on footpaths, by two-wheelers, meant otherwise for pedestrians
Source : Author

Problem Statement – Part II

Pedestrians!

"A person travelling on foot rather than using any vehicle" – Collins Dictionary

"People who walk, sit, stand in public spaces, or use a mobility aid like walking stick, **crutches or wheelchair**, be they children, teenagers, adults, elderly persons, **persons with disabilities**, workers, residents, shoppers or people-watchers." – IRC: 103-2012

↓

Universal Accessibility!

"to create an **obstacle-free environment**. It encompasses broad-spectrum ideas to create accessible streets, buildings, and environment to the maximum extent possible." - IRC: SP:117-2018

Challenges:

- to control the access of two- wheelers on footpaths either we fail to achieve universal accessibility i.e. the wheel chair users are also deprived of the facilities

or

- to provide universal accessibility or free movement to wheel chairs the two-wheelers can easily maneuver and entre the zones reserved for pedestrian use

Source : Author

Source : ToI city

Market Solutions :

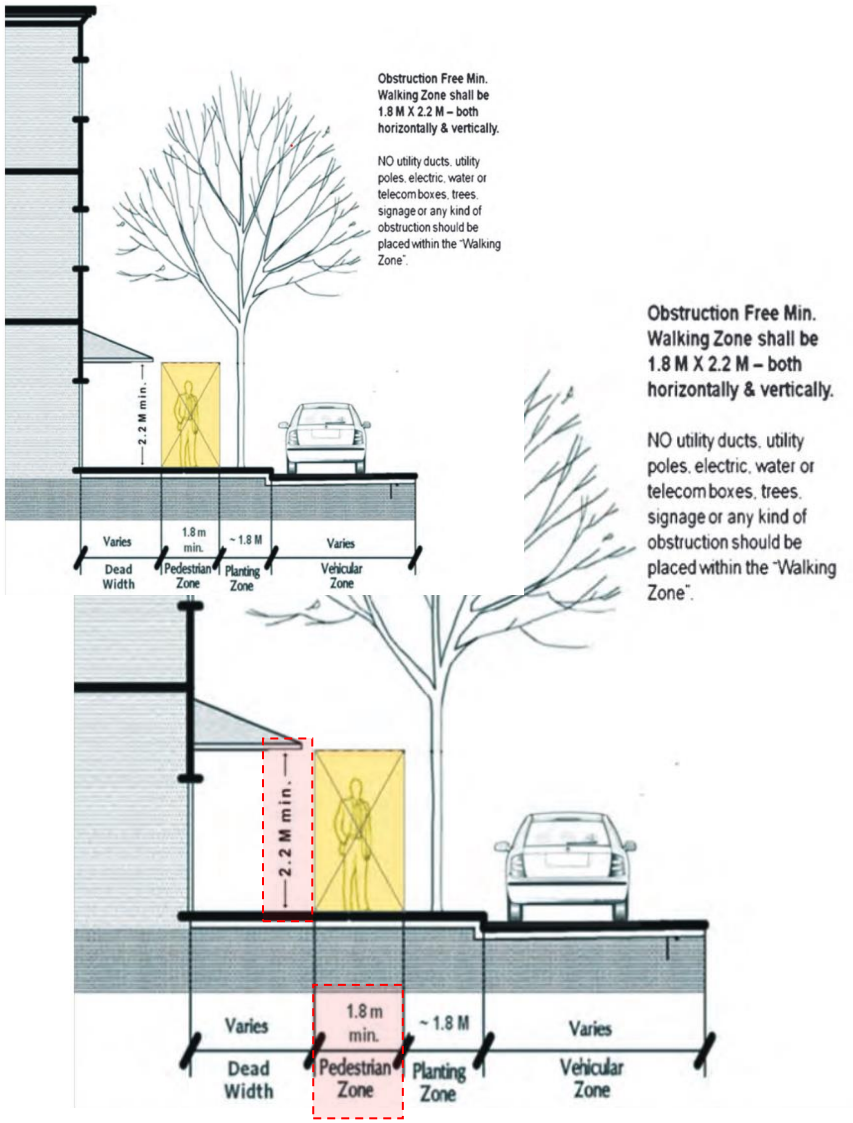
Bollards

Chicane Barriers

K- Barriers/ A-Frame Barriers

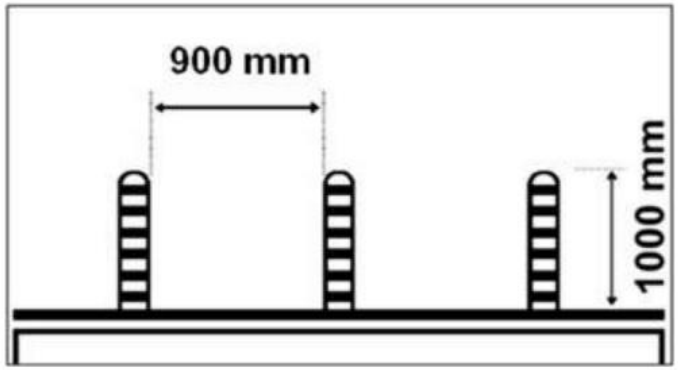
Composite Barriers

Conclusion:
These industrial solutions for access control intend to constrain the movement of four-wheelers and hawker carts on the footpaths and other pathways but fail to regulate the movement of two-wheelers while allowing smooth movement for wheelchairs and pedestrians.



Minimum requirement of Clear Pedestrian zone in an urban street. - IRC:103-2012

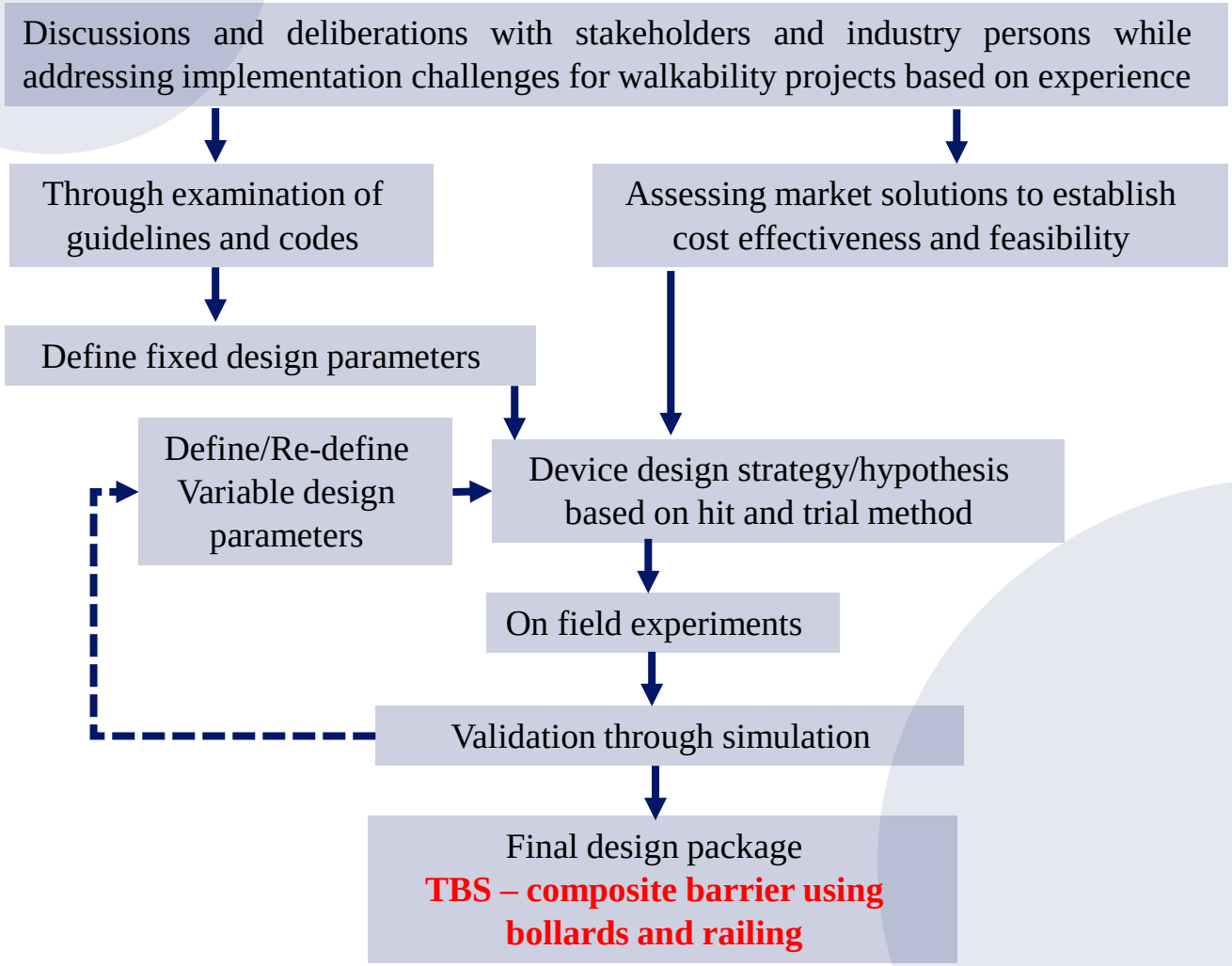
The codes acknowledges the use of **Bollards and Railing** as the means to stop vehicles from mounting the footpath and emphasises the possibility of them becoming an obstacle for wheelchair users, if not installed judiciously



Minimum gap between two bollards for smooth pedestrian flow. - IRC: SP:117-2018

The research focuses on the dynamic encroachments and proposes a design package, for various footpath widths, in the form of "Triple Bollard System (TBS)", which keeps in mind the Universal Design Principals through access control of Two- wheelers

Triple Bollard System – Design methodology



Triple Bollard System – Design parameters and strategy

Fixed design parameters based on IRC - Codes

- The minimum distance between two sets of bollards to be 600 mm based on human anthropometrics, to facilitate straight movement of one person, walking/cycling
- Minimum distance between one set of the bollards in a row to be 900mm, to facilitate movement of the Wheelchair

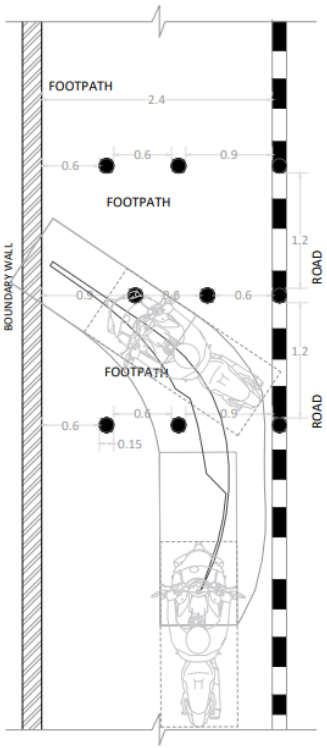
Variable design parameters based on experiments

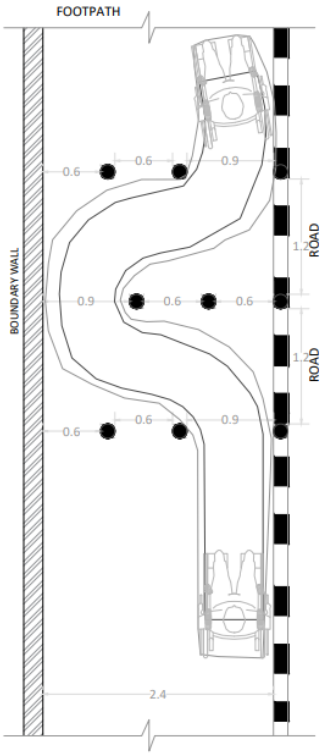
- Number of rows of bollards; Two rows of bollard was unsuccessfully experimented on the field; three rows of bollards were successfully incorporated
- Placement of the staggered bollards to allow access of wheelchairs within one row; maximize the distance of the staggered 900 mm gap between the subsequent row of bollards
- Distance between two rows of bollards keeping in consideration the turning radius of the standard wheelchair; 1200 mm between two rows of bollards was the optimum distance, allowing the wheelchair while inhibiting the two-wheeler.
- Height of Bollard; fixed at 750 mm to allow the movement of cyclists but restrict the movement of two-wheelers
- Height and location of railing; fixed at a height of 1000 mm based on the height of the handle of the two-wheeler for restricting the overhang of the vehicle

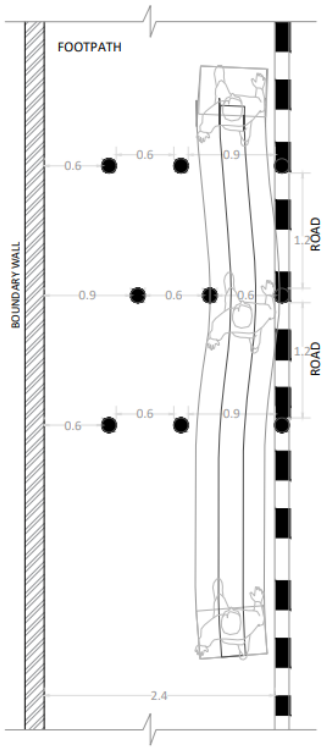
Triple Bollard System – Experiments

On field experiments were conducted using temporary stumps in order to check various permutations and combinations of spacing among the bollards

The minimum spacing between the subsequent rows of bollards and placement of railing was validated through simulation on tools like Vissim to extract the exact swept path of two-wheelers, and pedestrians both wheel chair bound and otherwise

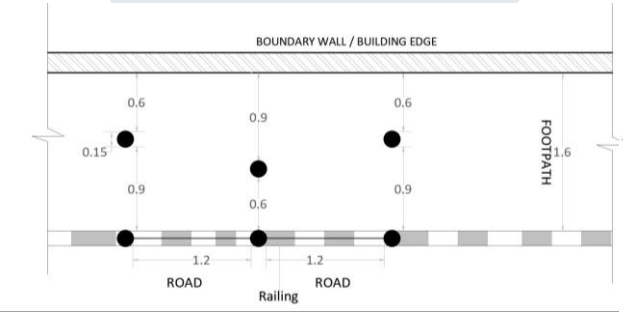




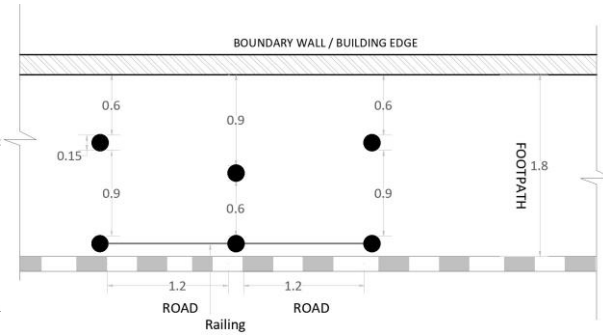


Triple Bollard System – Final Design Package

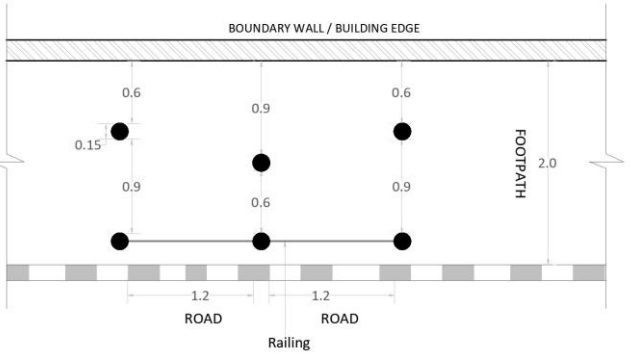
The final design package consists a set of detailed drawings which highlight the position of Bollards and Railing for footpath widths ranging from 1600 mm – 3400 mm



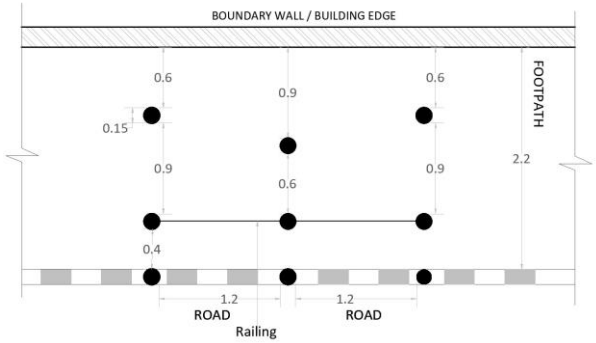
Footpath width 1600 mm



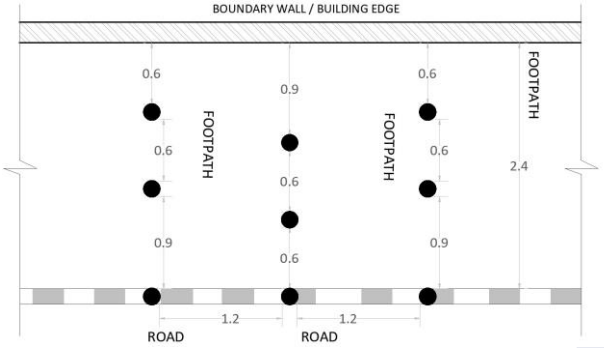
Footpath width 1800 mm



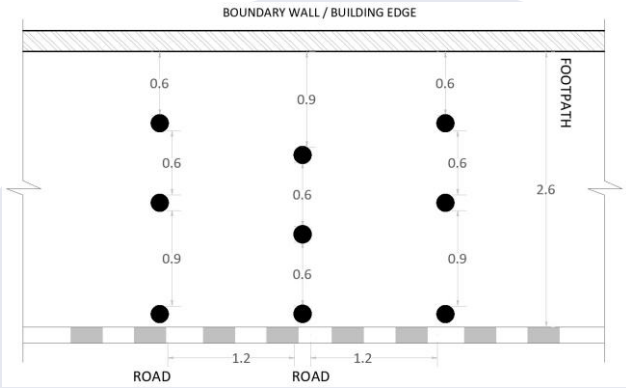
Footpath width 2000 mm



Footpath width 2200 mm

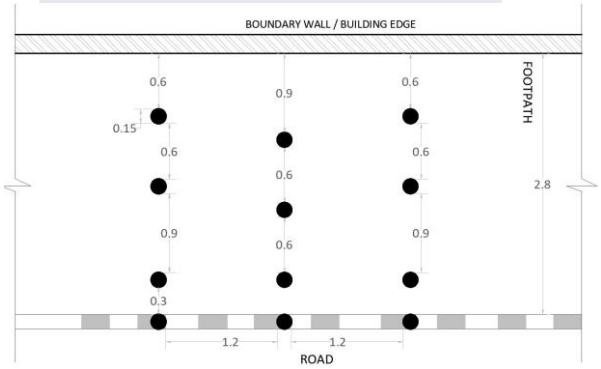


Footpath width 2400 mm

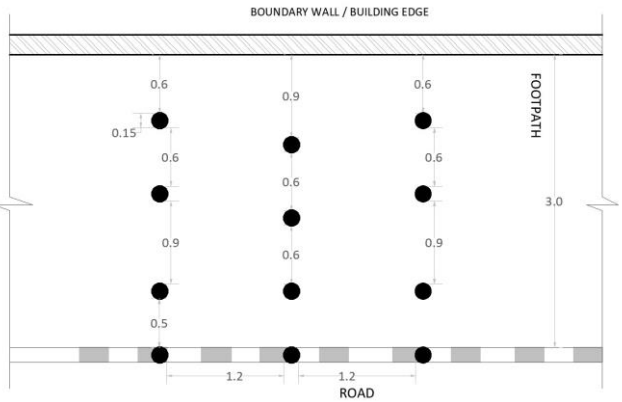


Footpath width 2600 mm

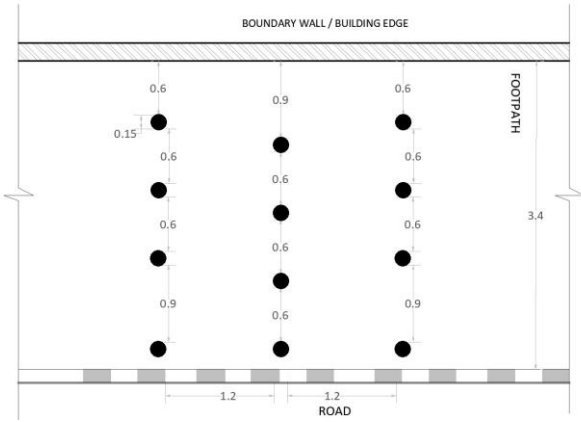
Continued…..



Footpath width 2800 mm



Footpath width 3000 mm



Footpath width 3400 mm

Link of all drawings with swept path : Click Here

Key recommendations and considerations

- To apply the solution selectively in specific locations where instances of violations by two-wheelers are prominent such as busy intersections where there is tendency to defy waiting at the signals by two-wheelers.
- Formulate policies to mandate the minimum width of motorized two-wheelers including overhangs and leg-guards used in bikes in order to make this solution workable.
- The heigh to bollards and railing has been worked out based on the height of handles and overhangs of standard two-wheelers and cycles, in order to deter two- wheelers but enable the cyclist to use dedicated lanes along footpaths.

Way forward :

The research and experiments conducted so far and presented in this paper are part of an ongoing experiment and will be further validated in due research findings. The team is in discussion with the **implementation agencies and authorities where the design solution** will be further validated on-site using sensors and video graphics recording to understand the nature of Pedestrian traffic flow and change in the behaviors, pre-and post-installation.

QR code to Google Drive Link with all drawings of possible footpath options based on the TBS design strategy, field experiments recorded videos and simulation videos.

Thank you!

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