5 Decision Tools

Determining which tools and strategies are most context appropriate is often the most challenging component of integrating modes successfully. As the University of Victoria has many pedestrian focused spaces, viewing the challenge as integrating bicycles into a pedestrian priority environment is helpful to facilitating the decision process.

Both the Netherlands and the UK have conducted extensive research of how cyclists behave in pedestrian environments and whether they can be integrated successfully.

The first decision is to determine if the traffic (people in cars, on bicycles or walking) are 'through traffic' or 'destination traffic'. This is an important distinction because it has a significant influence on the mindset and the behaviour of users: their willingness to adapt and to show social behaviour. Through traffic, regardless of mode, is often less likely to adapt their behaviour to the environment, than 'destination traffic'.

Secondly, based on the findings of the studies, a series of guidelines based on pedestrian volumes have been established. The core of the findings suggests that as pedestrian volumes increase (measured in pedestrians/hour/metre of width[1]) cyclists are increasingly unable to operate safely and courteously. Table 6-1 outlines the values and corresponding facility type determined for the level of separation required for cyclists (Fiets Beraad , 2005; Godefrooij & van Hal Waneer, 2005; Michels, 2017).

Table 5-1: Decision table for cycle facilities in pedestrian environments

Pedestrian Volume	Appropriate Cycle Facilities
<100 ped/hr/m	Completely shared space
100→160 ped/hr/m	Visually delineated cycle space
160→ 200 ped/hr/m	Physically delineated cycle space
>200 ped/hr/m	Separate bicycle ROW (alternate route)

Finally, the decision process should also consider the temporal dispersion of traffic at the University. Dissimilar to traffic in a city, the University has multiple brief peaks throughout the day during class changes. In applying this decision tool, the peaks throughout the day should be considered carefully as to their impact, as well as the intended role and demand for bicycles on campus. The following questions should be considered:

- Are bicycles a practical means of transport within campus or only as access to campus?
- Do pedestrian volumes at peak periods prevent the use of bicycles?
- Are there alternative routes for cycling during peak periods that maintain sufficient access?

[1] Volume measurements should be for a frequent peak honr (multiple times per week) rather than average volumes.

Bicycle Dominant Routes

Dissimilar to many parts of the campus that are clearly pedestrian focused, some access routes to campus may develop a mode share that favours cyclists. In the case where cyclists are the dominant mode, it may be preferable to designate pedestrian space as part of these facilities. This can improve the user experience for both users, with minimal spatial impact.

6 Design Tools

6.1 Self-Explanatory Design

Part of the principle of recognizability is a focus on self-explanatory design. In its simplest term, this speaks to designs that use their physical form to express to users the behaviour that is allowed and expected of them. Under this approach, signage to designate expected behaviour is seen as superfluous.

Each road class or facility type should be easily recognizable by users. For instance, a local road is narrow while an arterial is wide. A local road might use paving stones, while an arterial is asphalted, etcetera. Establishing a set of criteria to reflect each typology is important to the effectiveness of this approach.

6.2 Toolbox

Effectively creating self-explanatory designs requires an assortment of design tools to be used in conjunction with one another in order to adapt to unique contexts, as well as convey a clear and consistent approach. The tools listed provide the foundation of this toolbox, which can help achieve the desired effects.

Colour

The use of colour is an important tool in creating clear and recognizable traffic spaces. Colour can be used in three primary ways:

- To consistently delineate between facility types.
- To dictate preference of priority at intersections. When two facilities intersect, the continuation of one facilities colour over the other can help designate priority. Similarly, the use of a unique colour in an intersection may be used to draw attention to it as a location of potential conflict.
- To visually narrow or direct a facility to encourage desired behaviours. This can serve as a valuable speed-calming tool or to help direct traffic flows.

Figure 6-1: Mixed traffic road using colour for visual narrowing

Texture

Similar to colour, texture is a practical and diverse tool to help shape traffic behaviours. The following are the most important application of texture:

- **Speed control. Smooth surfaces encourage higher speeds for vehicles and bicycles. The auditory and tactile stimulation provided by a textured surface helps limit speed. Applied consistently this also becomes a visual clue for users.**
- **To consistently delineate between facility types or highligbting the presence of intersections.**
- **To visually narrow or direct a facility to encourage desired behaviours. This can serve as a valuable traffic-calming tool or to help direct traffic flows.**

Figure 6-2: Mixed traffic environment using colour and texture to narrow and separate direction

Side Friction

Side friction is the creation of visual texture (friction) adjacent to a traffic facility. A typical example of this is trees lining the sides of a roadway.

As with several other tools, the primary desired outcome with employing side friction is speed management. Reducing speeds, especially at conflict points is an important strategy to conflict management.

Side friction, like Shared Space, relies on risk compensation for its effectiveness. Increased side friction, increases the perceived speed of users, which makes slower speeds feel more comfortable. Therefore the presence of side friction is inversely related to speed: the greater the friction, the lower the speed.

Figure 6-3: Roadway with effective side friction from street trees and shrubs

Separation

The level of separation employed in facility design has the potential to have significant effects on user behaviour. Largely, the level of separation is correlated to two behaviours: speed and scanning.

Speed – the level of separation (mode and direction) has a positive correlation with the speed of users. Increases in separation are likely to increase the speed with which users operate.

Scanning – Conversely to its effect on speed, increased separation has an inverse relationship with scanning behaviours. This is to say; increased levels of separation (mode and direction) reduce the levels of scanning behaviour from users. Users are less likely to scan for other users or unexpected events when the level of separation is high. This is a particularly important phenomenon to take into account when two separated facilities intersect.

Figure 6-4: Cycle path with directional separation to improve comfort

Spatial delineators

In a Shared Space environment, spatial delineators are important tools to help shape behaviour within the space. Features such as light posts, trees, planter boxes, or other architectural features can be strategically used to help delineate different spaces. This can be applied in many ways, such as creating a protected zone around the entrance to a building, or delineating 'pedestrian only' spaces along the edges of a wider corridor.

Figure 6-5: Shared Space using trees and planter poles to delineate pedestrian spaces along the edges

Transition Zones

The identification of transition zones is an important tool to managing conflicts. This is especially the case when transitioning from a designated facility to a Shared Space. It is important that transitions are designed in a way that makes it clear to all users that they are entering a space that may require extra attention or a different behaviour. This is often accomplished through changes in both surface material and colour. Slight grade differences are also a useful tool to accomplish this.

Figure 6-6: Street with change in texture and colour to highlight a transition zone from higher to lower speeds

Parking

Bicycle parking can be a valuable tool in shaping behaviour; this is especially the case for shared space designs. In a space where cycling is allowed, it is not logical to ban bicycle parking, similarly in spaces where cycling is not allowed, bicycle parking should be discouraged. Strategically placing hicycle parking that is well served by bicycle facilities is a valuahle tool in discouraging the use of routes where hicycles are not desirable. Properly facilitating the desired behaviour is often more effective than banning an undesired one.

7 Summary

The challenge of effectively integrating bicycles into the University of Victoria campus is one that requires a multitude of approaches. One of the key elements of this challenge is how to manage conflicts between cyclists as well as with other modes. The nature of the traffic environment and layout of the campus prioritizes pedestrians, which results in bicycle/pedestrian interactions being at the forefront of the discussion.

Underpinning this exploration of conflict management is the principle of Sustainable Safety. Developed in the Netherlands in the 1990's as a comprehensive systems approach to tackling traffic safety, it relies on five core principles:

1. **Functionality**: Every street has an identified primary function (ex: local access road, main shopping street, regional highway, etc.).
2. **Homogeneity**: Differences in speed and mass should be minimized between users that share space.
3. **Recognizable**: Users should be able to easily recognize and understand the function of a road and the behaviour expected of them and others.
4. **Forgiving**: Everyone makes mistakes. The system should accommodate mistakes in a way that does not result in severe outcomes.
5. **Awareness**: The ability to assess one's own capacity to operate in the environment.

In order to better understand the potential for conflict between pedestrians and cyclists, it is important to understand the uniqueness of their behaviour. Unlike motor vehicles, both cyclists and pedestrians are more nuanced in their movements, which allows them to more effectively navigate space and therefore conflicts. What has been found from studies across the UK, the Netherlands and Canada are two key points:

- In pedestrian environments, cyclists are self-regulating.
- Pedestrians do not adapt their behaviour in the presence of cyclists.

This manifests in cyclists adjusting their behaviour to the density of pedestrian. Increased pedestrian densities result in slower cycling or cyclists dismounting and becoming pedestrians themselves. Resultantly, objective safety between cyclists and pedestrians is rarely an issue, despite the presence of frequent minor conflicts in dense shared environments.

While objective safety is not shown to be a measurable concern, the subjective safety and user experience is still of strong consideration. In order to manage minor conflicts as well as create spaces that serve the needs of users, a series of conflict management strategies should be employed when facilitating for the use of bicycles on campus. The three key strategies to be employed are:

- Mixed Environments (Shared Space)
- Separated Facilities
- Network Segregation

Each of these strategies relies on differing principles to manage conflicts and therefore result in a range of opportunities and limitations. While there does not exist one ideal strategy to manage conflicts and optimize user experience, the strategic and collaborative application of these strategies will yield a context sensitive solution.

An important factor in determining the appropriate strategies employed is the presence of pedestrian activity. Research across the Netherlands has led to the development of a decision tool to aid this process. The core of the findings suggests that as pedestrian volumes increase (measured in pedestrians/hour/metre of width[2]) cyclists are increasingly unable to operate safely. The table below outlines the values and corresponding facility type determined for the level of separation required for cyclists.

Pedestrian Volume	Appropriate Cycle Facilities
<100 ped/hr/m	Completely shared space
100→160 ped/hr/m	Visually delineated cycle space
160→ 200 ped/hr/m	Physically delineated cycle space
>200 ped/hr/m	Separate bicycle ROW (alternate route)

The effective implementation of the appropriate facilities is largely design reliant. In order to create traffic environments that adhere to the principles of functionality and recognizability, a series of design tools should be employed to help communicate the expected behaviour for users. A primary set of tools was identified along with the functions they serve. Used strategically the following tools are capable of encouraging desired behavioural outcomes:

- Colour
- Texture
- Side Friction
- Separation
- Spatial Delineators
- Transition Zones
- Parking

Integrating bicycles as a practical means of transportation around campus is reliant on all of the factors discussed. A framework, such as Sustainable Safety, should be identified as the foundation for change. Context sensitive strategies should be employed to structure traffic flows throughout campus. Finally, thoughtful design elements should be used strategically to ensure desired behaviours are encouraged and clear to users.

[2] Volume measurements should be for a frequent peak hour (multiple times per week) rather than average volumes.

8 Works Cited

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