CAMPUS BICYCLE-PARKING FACILITY SITE SELECTION: EXEMPLIFYING PROVISION OF AN INTERACTIVE FACILITY MAP

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ABSTRACT

On campus (all education levels) attendance generates surges in road use. To some extent this can be diminished through provision of friendlier public transport and bike paths. This is especially so with regard to the traffic in and out of Universities. Accordingly, and in recognition of the merit in adhering to the Talloires Convention, many Universities are initiating bike-friendly measures: bike parking, and support for designation of bike paths on median strips and through park lands as well as in the form of dedicated road lanes. Over the life-time of any facilities provided, successive campus users can be expected to include distinct bike-riding cohorts of the population, all likely to seek input to campus planning decisions, including site selection for bicycle-parking. We report here on the deployment of a campus asset inventory in building an interactive campus bicycle-parking map. Given the nature of university traffic flow (based on class schedules rather than business hours), the many directions from which students and staff travel to campus, the campus size and teaching venue distribution, not to mention the challenge of inserting bicycle parking facilities among buildings and campus plans that date from before cycling became popular enough to be touted as a sustainable transport option, the mapping and user-interfacing tasks are surely less than trivial. We exemplify this statement with the intention of outlining a generic model for facility retrofit that can be used on other university campuses.

INTRODUCTION

Australian universities are major trip generators, with a large proportion of their population travelling by car. University campuses usually have a student and staff population in the thousands, and can also attract a large number of daily visitor trips in addition to staff and students (ATRF. 2004). In general, any travel pattern is affected by its location, as well as the surrounding land and transport choices available. Travel patterns to a university, are further complicated by their extended hours of operation, fixed lecture timetables that create morning and afternoon peaks, and staff schedules that can vary every day. This is reinforced by Toor (2003) who also found that many staff and students were often 'time poor', and that student travel was often constrained by cost and influenced by work and family commitments. Diversity of ages, lifestyle, cultures and occupations can also contribute to complex university travel patterns and is

Leigh, C., Peterson, J. and S. Chandra (2009). Campus Bicycle-parking facility site selection: exemplifying provision of an interactive facility map. In: Ostendorf B., Baldock, P., Bruce, D., Burdett, M. and P. Corcoran (eds.), Proceedings of the Surveying & Spatial Sciences Institute Biennial International Conference, Adelaide 2009, Surveying & Spatial Sciences Institute, pp. 389-398. ISBN: 978-0-9581366-8-6.

a special challenge to implementing any change (Balsas. 2002). De-emphasising reliance on cars by encouragement of walking, cycling and public transport is a major task for university managers. Achieving reductions in car trips also requires that staff and students be aware of alternate travel modes, and how to use those modes. Cycling is one of the transport modes that universities have a larger degree of control over, so it has been targeted as the focus of this paper.

To effect substantial change in travel modes towards cycling, it requires the creation of an environment in which people can cycle safely and comfortably. To support cycling to university, three main types of infrastructure are required on campuses; cycling networks (paths and road lanes), bicycle parking, and end-of-trip facilities. Due to the fact that many Australian universities were designed and built before cycling became popular enough to be touted as a sustainable transport option, insufficient priority was, and continues to be given to the design and location of bicycle parking installations and the facilities they are housed in. This can result in under-utilisation of some bicycle parking due to theft of bicycles or accessories, vandalism not to mention the inconvenience of some site locations.

A common issue campus planners and policy makers face, is whether staff and students will use the bicycle parking facilities if they are built. Evidence suggests that latent demand for bicycle parking facilities can be tapped by providing bicycle facilities (ACT. 2006; Dill and Carr. 2003; Queensland Transport. 2002; UNC. 1994). In the words of Nelson and Allen (n.d:82) "if you build them, commuters will use them". Given this kind of encouragement, should campus planners and policy makers risk financial loss if they install facilities at an inappropriate site, or should they only install facilities if/where success is ensured. This is an unfortunate case of circular cause and consequence (a catch twenty two), where campus planners and policy makers want to see the demand for bicycle parking facilities before they commit finances to a project, and cyclists will only commute if parking facilities are already in place. Even if the campus planners and policy makers recognise the many benefits of increasing the number of bicycle parking facilities on campus, they face the difficulty in deciding how many bicycle parking installations are required, where they should be located, and what type of facility should be installed.

Recently, Monash University has decided to replace *ad hoc* site selection with one based on Australian Standards (AS 2890.3, 1993: part 3 of the greater Australian Standards of Parking Facilities) for Bicycle Parking Facilities. The Australian Standards describes the type of facilities that will provide safe, secure, convenient parking for bicycles in any location where they are likely to be left.

Using Monash University as a case study, the first part of this paper will report on the use of GIS in the deployment of campus asset inventory in building an interactive campus-bicycle parking map. This first process in necessary not only for the university to have a comprehensive list of its current bicycle parking facilities, but also necessary in assessing the suitability of these current parking facilities against the Australian Standards for bicycle parking. The second part of this paper aims to outline a generic model for bicycle parking facility retrofit that can be used on other university campuses.

Even though location studies need not involve the use of GIS, there is much to be gained (eg in asset inventory and site selection work) by taking advantage of the functions that are available in GIS software (Church. 2002). By storing such information in a GIS, the data collected and stored there for one purpose can be easily made available to a number of applications, including locational modelling, thereby sharing the cost of data collection and storage (GIS Development. 2008).

BICYCLE PARKING ASSETT INVENTORY AND SITE MAP

Creating an asset inventory of bicycle parking facilities through a GIS for a university campus, allows attribute data to be directly attached to features (parking sites) when collecting the data in the field with a GPS. Ultimately the final map output will provide the user with an aerial view of the physical geography of the campus, as well as the current state of the campuses bicycle parking availability, and in particular the location of these sites in regards to their physical location to buildings and university entrances. By including a hyperlinked photograph of each site, a current view of the site in questions condition, type of rack/facility, and where possible the immediate surrounding environment is possible.

Storing this type of data in a GIS, allows the user to update the information periodically to reflect any changes in the current state of the campuses bicycle parking facilities. A GIS stores information about the world as a collection of thematic layers that can be used together. A layer can be anything that contains similar features such as customers, buildings, postal codes, or as in this case, bicycle-parking facilities. All the data layers used must match up correctly to be drawn on top of each other, which means they must be in the same map projection and coordinate system. Figure 1 shows the data and information flowpath followed for the creation of all six Monash University Bicycle Parking Facility Site Maps. An example of the type of map created can be seen in Figure 2.

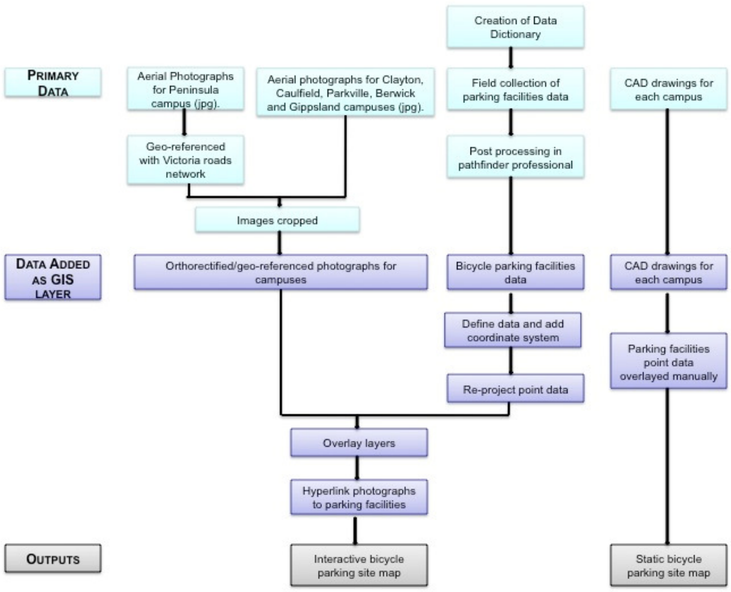

Fig. 1: Current Facility Data Information Flowpath

Figure 2: Overview of Monash University Caulfield campus, Victoria, Australia – **a)** Site locations of current bicycle parking facilities at Caulfield campus. Blue coloured circles represent bicycle lockers, red squares represent bicycle hoops and the green pentagon represents bicycle wheel racks. **b)** Example of typical attributes recorded for each bicycle parking facility. **c)** Example of an hyperlinked photograph of a bicycle parking facility attached to each site location.

GENERIC MODEL FOR FACILITY RETROFIT

Regardless of an existing bicycle parking facility map being available to the university, the process outlined in Figure 3 allows the creation of a bicycle parking site suitability map relating to the Australian Standards on bicycle parking. The following are the criteria/constraints set by the Australian Standards (1993) that are used to create the generic model for the retrofitting of bicycle parking facilities at university campuses;

- <u>Floor Slopes</u>: max slope of 1 in 20 (5%), and where necessary, a minimal slope equal to that needed for the surface to drain successfully
- <u>Clearance from Kerb</u>: parking facility must be 600mm from kerb (bike rack must be parallel to kerb unless footpath extension is provided)
- <u>Clearance from Fencing/Perimeter Barrier</u>: parking facility must be ~900mm from wall/fence
- <u>Clearance from car lane/roadway/parking lane:</u>
    - Parking facility must be min 600mm from edge if speed limit less than 60km/hr
    - Parking facility must be min 1000mm from edge if speed limit greater than 60km/hr
- <u>Clearance at footpath/walkway for pedestrians:</u> minimum of 1200mm required for pedestrians between a parked bicycle and other obstruction
- <u>General requirements of parking facilities:</u>
    - Lighting: Area needs to be well lit
    - Clear of exits/entrances
    - Clear of car parking
    - Clear of street furniture, loading zones, public transport stops and pedestrian crossings
    - Must not hinder pedestrian movement.

The degree of conformity of existing bicycle parking facilities with Australian Standards (AS 2890.3. 1993) can be assessed by spatial query. Inevitably, some sites well used to be modified or replaced by alternative parking facilities. The site selection process for such retrofit would need to follow the data and information flows depicted in Figure 3.

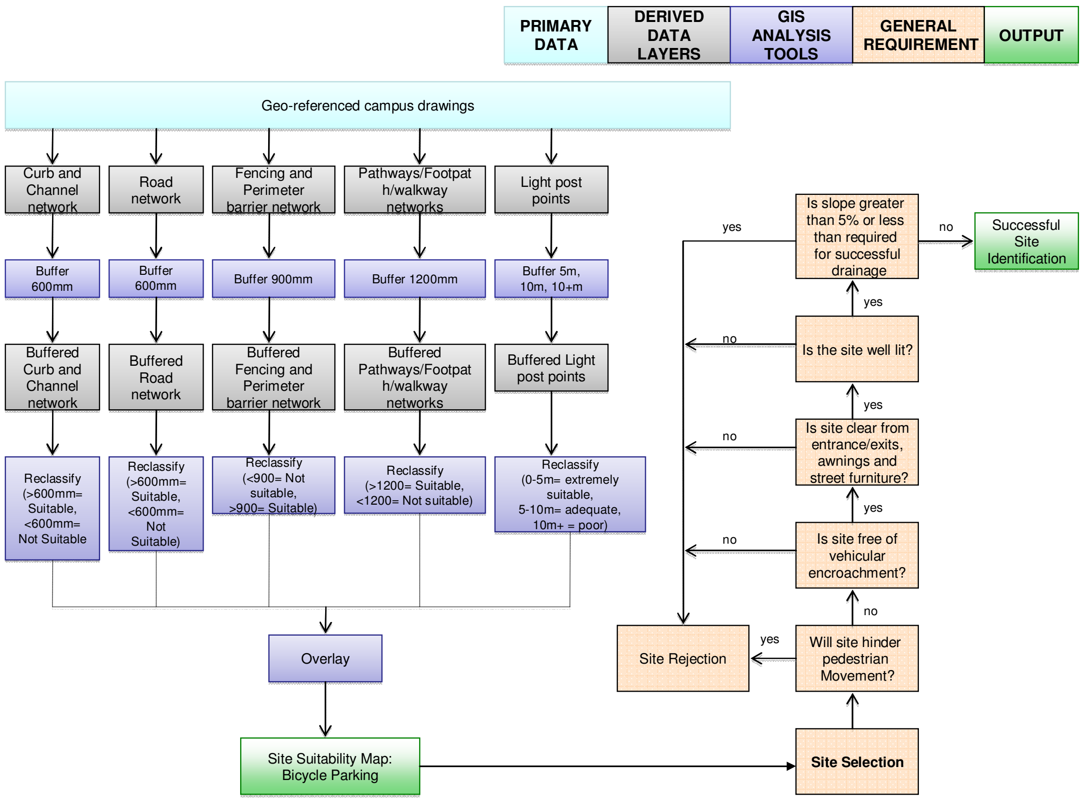

Fig. 3) Flowpath diagram representing the data layers and GIS processes required for successful bicycle parking site selection.

Application of the generic site selection process may reveal abundance or a scarcity of sites on any one campus. In regards to the former, the final selection could be made after consideration of long-term strategic campus development plans. In the case of security a further site selection process is called for. One approach to this could consist of relaxing standards until the required number of sites had been found and then culling those that cannot be brought up to standard, even after expensive re-engineering.

CONSTRAINTS

From Jankowski (1995) we know that there was a time when dreams of access to a decision making module that ‘reasons’ a decision was just that: a dream. The processing of multiple criteria and conflicting objectives was not offered. It is common practise for researches to utilise both a site suitability map and a multiple-criteria decision making (MCDM) approach, such as in assessing housing site suitability (AL-SHALABI *et al.* 2006) or assessing land suitability for wind turbines in Malaysia (Bennui *et al.* 2007). GIS approaches to decision making can also be limited according to Malczewski (1999), by not being very good at integrating geographical information with subjective values/priorities imposed by the decision maker. Some campus information “shadows” date from these times, or from even before then.

A generic model for retrofitting a campus for bicycle parking site selection, based on Australian Standards for assessment of potential sites for development would not take into account a number of other factors that may influence a sites location. This includes the omission of information relating to the total number of staff and students at each university, or what percentage of this number cycles to the campus on a regular basis. It is acknowledged that only bicycle parking facilities are discussed in this paper, and that they represent only one aspect of the infrastructure required to facilitate an increase in bicycle commuting to university, and that discussion does not go beyond that in regards to assessing the adequacy of cycling networks to any of the campuses. Each campus is also located in a different demographic area and served by their unique transport network (combination of road and rail, footpath and bike track), so different pressures may be at work in the mind of cyclists, depending on the length of the journey to work as well as the nature of destination campus facilities.

MONASH UNIVERSITY CASE STUDY

Monash University has a network of eight campus's world wide, with six campuses in Australia. The Australian campuses are all located in Victoria (Figure 4), and although overlapping occasionally, each Monash campus specialises in different university courses, and thus attracts different types of students and staff alike. As with its courses available, each campus can be defined by its location in regards to its level of accessibility. Parkville campus is a City campus, located 3km north of Melbourne (Monash University. 2008), and is characterised by limited on-site parking with little space for expansion, yet it has the best accesses to public transport and infrastructure for walking and cycling. Both Caulfield Campus which is located 10km east of Melbourne, and Clayton campus which is located 20 km south east from Melbourne (Monash University. 2008), are located in the suburbs, and can be characterised by well serviced roads (including road-based public transport) though for Clayton not as much so. Surrounding major roads such as Caulfield's Dandenong Road and Clayton's Wellington Road's carry high peak traffic volumes, which can discourage pedestrians and cyclists, delay bus services, all of which affect transport choices. The remaining rural campuses of Berwick campus (40km south-east of Melbourne); Peninsula (43 kilometres south of Melbourne); and Gippsland (160 kilometres east of Melbourne) (Monash University. 2008), can be defined by well-serviced roads, ample parking available and (usually) access to sufficient land to meet foreseeable parking demand. However, travel distances can generally be longer and facilities in support of walking and cycling to and from campus are limited.

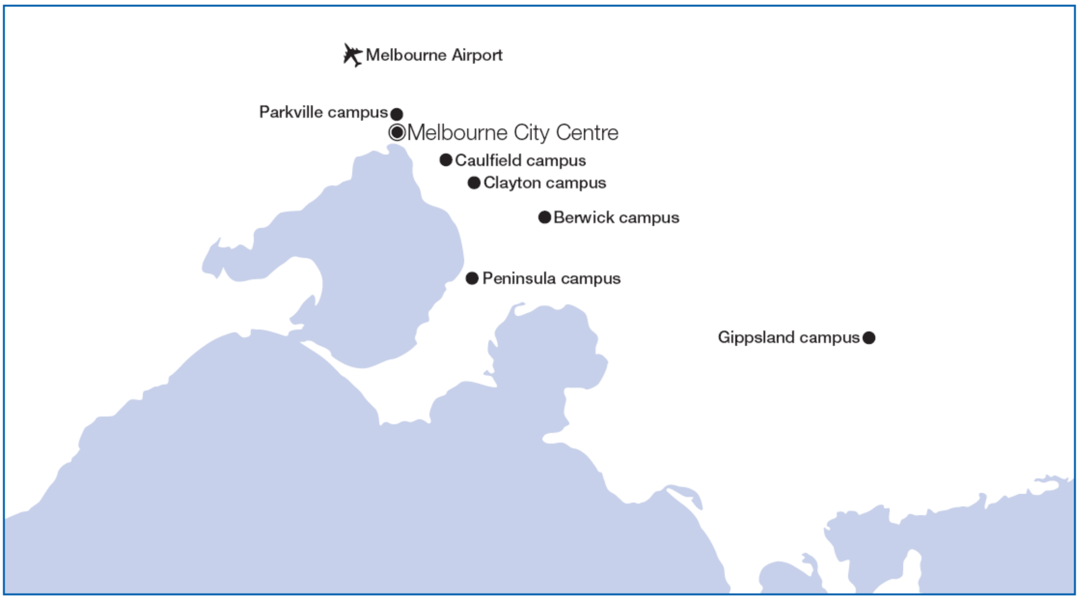

Figure 3. Location of Victorian based Monash University campuses (http://www.monash.edu.au/campuses/maps/australia.html).

Each campus has some level of pre-existing bicycle parking facilities located on site, demonstrating that at some point, the campus planners and policy makers recognised that there was a demand for such facilities. However, until recently there was no official record of these facilities existing as part of each campuses asset inventory. As these facilities did not previously exist on record, they did not have a financial value associated with them. Despite this, bicycle parking facilities at each one of the campuses are expected, as according to Purcher *et al* (1999) as cited in Balsas (2003, p.38) "university student's cycle at much higher rates than the general population, as students are usually more environmentally conscious and receptive to new ideas, as well as being more physically fit, have restricted budgets, live close to campus and already own a bicycle". Staff and faculty members share some of these characteristics and many are influential members of the local community. Thus, as potential bicycle advocates, they can help persuade city officials and campus administrators to implement policy geared towards cycling (Trolly. 1996).

According to the ATRF (2004), universities located on suburban sites are experiencing growing parking demands. Therefore it would be expected that the surrounding road networks of both Caulfield and Clayton campus would suffer even higher traffic volumes during peak hours that delay public transport services and discourage walking and cycling. Staff, student and employees lacking adequate transport alternatives will commute by car, a practice that contributes to congestion during peak hours, and creates a significant demand for on-site parking. (ATRF. 2004). All Monash campuses have seen an increase in enrolment numbers in the past few years, and as the staff and student numbers increase, there will be an increasing need for building improvements and supply, in which case there may not necessarily be an equivalent increase in car parking spaces.

By complying with the Australian Standards in the future and assessing the site locations of the existing facilities, Monash university campus planners and policy makers will be able to assess the likelihood of a site being successful or not, and especially reduce the chance of constructing facilities in inappropriate locations that will need to be removed at a later date, causing both a financial loss, but inconvenience to cyclists who may have relied on that facility to park their bicycle in the most convenient location for themselves.

CONCLUSION

The well-established link between increased levels of physical activity such as cycling and improved physical and mental health leaves authorities keen to encourage the use of bicycles.. In support, the provision of parking spaces for bicycles, needs to be part of workplace transport planning and integration

Direct institutional benefits can accrue if more campus users adopt the bicycle as a means of commuting to work/study. They include cost savings on car-parking infrastructure and scope for finding extra open or building space. Establishment of the Australian Standard in bicycle parking facilities in 1993 and adoption of digital spatial data handling in facilities management opens the way to formalisation of bicycle-parking facility site selection. The generic model presented here as being prepared for application on the Monash University campuses supports implementation of the Australian standards but could be applied in the same way if other standards had to be imposed on site selection. Both retrofit and *ab initio* site selection is supported by the model.

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BRIEF BIOGRAPHY OF PRESENTER

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