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Public passenger transport and integration with cycling

The access and egress of public transport system

The duration of individual time intervals in transit system operation or in passenger travel are referred to as travel times.

Passenger travel time is the travel of passenger on an origin-destination path, including the approach to a transit stop or station, travel on the line, a transfer between lines if it is necessary, and departure from a stop to the destination [1].

All trips can be analysed as a chain of trips. The simplest chain has three links: a walking to the stop/station, taking a vehicle of public transport system, a walking to the final destination. All public transport users have to travel from their origin to the public transport stop and at the end of the trip from the public transport stop to their destination. This means that their access and egress trips are necessary part of their journeys. But not only walking but also cycling is the way how the passengers can reach the places where they access ore egress the system of public transport.

Cycling's advantage over walking is that it increases the catchment area, the area served by a particular public transport access point.

The figure 2 shows the cumulative access and egress time distributions for the work trip associated with slow modes as walking and cycling for trips to and from the train station and bus, tram and metro stops, respectively for the latter the bicycle and walking are combined because of the few cases for bicycle access/egress. The probability of users reaching the system or their final destination from the public transport system has been known to fall off roughly in line with a normal distribution as distance to/from the stop increase [2].

Considering the train access time with the bicycle and walking run alongside. Taking into consideration the requirement to park and lock the bicycle at the station, access time to the train station is very similar for these two modes. On the egress side the bicycle is used for slightly longer travel times. The 10 min dotted line shows that only 30% of people walk or cycle longer than 10 min on the access side. On the egress side 70% cycle longer and 40% walk longer than 10 min to their destination. Assuming a mean access/egress speed of 4 and 12 km/h for walking and cycling, respectively 50% of people are willing to walk ± 550 m or cycle 1.8 km to the station. The respective distances on the egress side is 600 m and 2.4 km. The longer cycling time for both the access and egress sides implies that the bicycle is not simply a substitute for walking when the stage time becomes excessive. Rather travellers are willing to accept longer access and egress times with a faster access/egress mode [2].

Cycling dramatically increases the catchment area of public transport and it is an effective and efficient mode of transport which with combining public transport enables people to travel door-to-door over longer distances without relying on the private motor vehicle. This broadens the potential of both cycling and public transport.

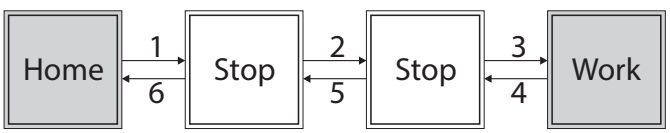

Figure 1. *Journeys of public passenger transport user without transfer: 1 – walking from home to stop, waiting time, 2 – journey by bus/train journey , 3 – walking to work, 4 – walking from work to stop, 5 – journey by bus/train, 6 – walking to home.*

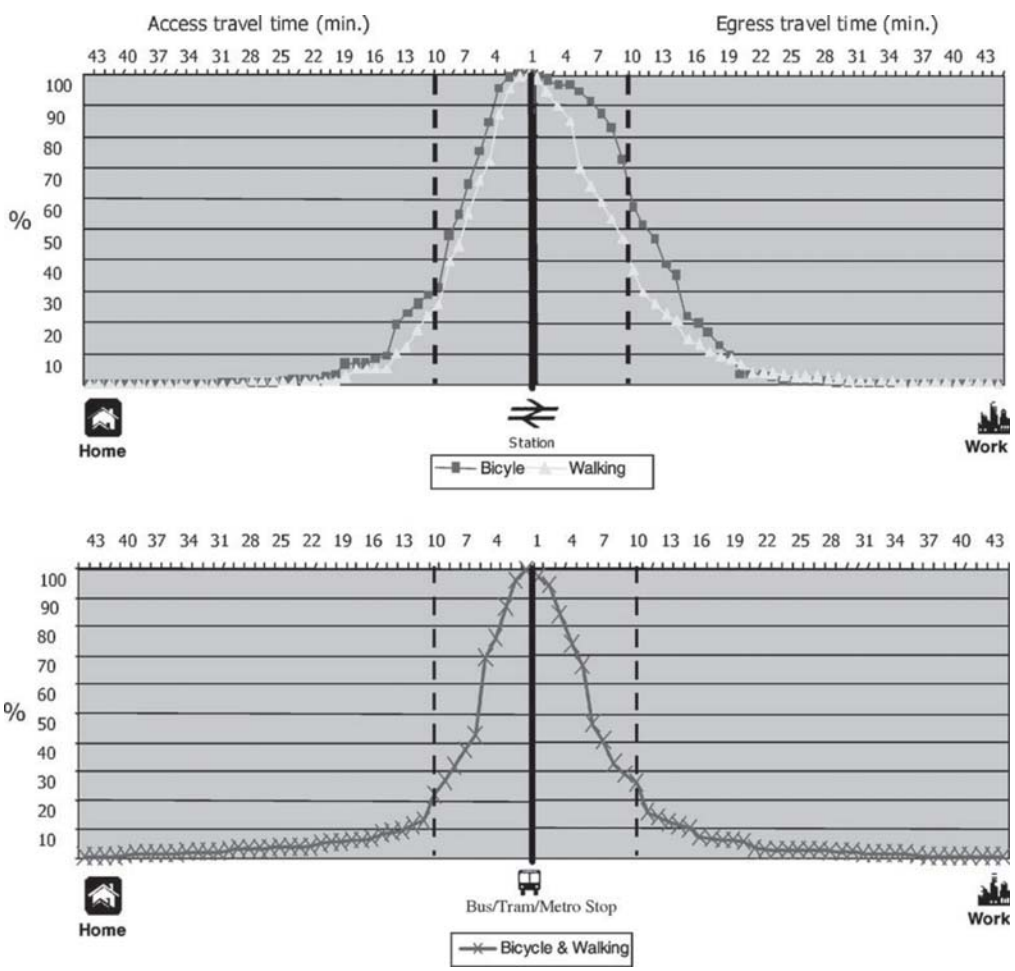

Figure 2. *Cumulative frequency distributions of access and egress time, home-based work trips [2]*

Figure 3. *Lane for cyclists [7]*

Figure 4. *Bicyle parking garage at Amsterdam Central Station [10]*

When the integration of cycling and public transport is considered the characteristics of both modes has to be taking in to the account:

Cycling system characteristics:

- flexible,
- high penetration ability (access to individual addresses),
- fast on short distances,
- uses little space for parking,
- limited radius of action.

Public transport system characteristics:

- high people carrying capacity,
- proper for longer trips,
- space efficient,
- inflexible,
- low penetration ability,
- requires feeder systems.

Integration of cycling and public transport brings these complementary modes together and this combination can compete with primate motorised traffic [3].

Integration of bicycles into multi-modal transport chains, particularly with public transport modes may contribute to a more efficient and environmentally sustainable transport system. But integration does not always mean bringing more people into the system. It can also mean a better distribution of users and more efficient use of infrastructure. The key point is that integrating cycling into the system makes for better distribution of passengers across the different transport modes, optimizing bus, car, cycling, walking, road infrastructure and other transport and traffic-related systems and investment. This is a more productive point of view than perceiving cycling as just a feeder to a public transport [8].

The infrastructure for cycling-public transport integration

The success of integration of cycling and public transport depends strongly on the infrastructure for cyclists. It includes the routes and parking facilities, or the facilities for taking the bicycles into the vehicles of different public transport modes.

The integration is implemented in the different ways:

- access trip – in order to allow a safe ride to the public transport system the network must be optimised. This essentially involves making access to transfer modes easier for those using bicycles.
  - the transfer from bicycle to public transport – in this transfer the following components are useful:
  - bike parking,
  - bike stations.
- during the public transport ride – in some cases bicycle riders are allowed to take their bicycles during the trip on the public transport vehicle.

Network for access/egress public transport

It is often forgotten that the provision of bicycle routes that provide easy access/egress to/from public transport stations or stop is very important part for integration.

Bicycle routes need to be convenient, connected, coherent, safe and attractive.

When considering how best to provide bicycle routes to and from public transport nodes and destinations, the following principles are necessary. Bicycle routes should:

- be as direct as possible,
- include safe and convenient road crossings,
- be clearly signed,
- not be congested with other cyclists or pedestrians,
- terminate with well designed and conveniently located bicycle parking and ent-of-trip facilities [7].

Integration at the network level should fulfil the following requirements for cycling infrastructure:

1. Consistency: the cycle infrastructure should be an uninterrupted consisten whole, connecting points of departure and destination.
2. Directness: cycle tracks are preferably the shortest possible routes between points of departure and the destinations (public transport stations).
3. Attractiveness: lighting, shelter, traffic signs, intersection priorities, etc. should be well designed and operational.
4. Road safety: smooth pavements, lighting and removal of dangerous junctions (accident hotspots) to ensure safer routes to the stops.
5. Convenience: preventing steep slopes, dangerous curves, open drainages, street hawkers and parked vehicles on the bike lines [4].

Bicycle parking facilities

The bicycle parking facilities are the key part to any proposal for modal integration. Quality, secure bicycle parking encourages people to cycle to transit stops and stations and thus complete their trip on public transport.

Bus stations, railway stations, ferry stops and major public transport nodes require secure, sheltered and high quality bicycle parking facilities but also other busy public transport stops.

Individual bicycle lockers are preferred for long-term parking at major bus and railway stations as they offer the highest level of security. Access to lockers should be managed to give priority to regular users in accordance with an overarching management policy.

Bicycle parking racks are generally sufficient for short-term parking and occasional users. They should allow the bicycle frame to be easily secured to provide good security without the risk of damaging the bike.

Figure 5. *Bus with bicycle rack in Chicago, USA [11]*

Figure 6. *Folding bike on train in Stuttgart, Germany [12]*

Facilities must be sited appropriately to suit the needs of the user. Long-term parking can be located au to 100 m from a bus interchanges. Short-term parking should be located close to or inside the public transport node. They need to be will lit, visible to passers-by or public transport staff and signposted if necessary. They should also be loacated to minimise conflicts with pedestrians and motor traffic. They are best places undercover and on a sealed ground surface with adequate drainage.

So called bike stations, which may be a concession, publicly operated or run by pro-cycling civil society groups, offers additional services, such as repairs, rentals, showers, sales of accessories, maps, guided tours, and so on. This approach may help to offset bicycle parking costs [6, 7, 8].

Bicycle transfer in public transport vehicles

Often the riders prefer to carry their bicycle on public transport rather than parking them prior to boarding. On-board carriage allows for bicycle travel at both ends of the journey. It is particularly useful for bicycle tourists, but also for commuters.

For carrying bicycles on buses a variety of methods can be used:

- front-mounted racks,
- rear-mounted racks,
- bike trailers pulled along by buses,
- removable or folding seats to allow bikes to be carried on board, bicycle storage under buses [6, 7, 8].

For carrying bicycles on trains the following techniques can be used:

- dedicated bicycle storage space in carriages with modified seating arrangements,
- policies that allow bicycles to be carried „contra-flow" (in the opposite direction of high-volume peak-hour travel),
- policies that promote and encourage the carriage of folding bicycles [6, 7, 8].

The picture – figure 6 – shows the project in the Stuttgart Germany for encouraging the use of folding bikes with area buses and trains to alleviate bicycle parking congestion in front of train stations. The projects provides a discount prices for journey with folding bicycle.

Conclusion

Integration of cycling and public transport can provide an additional transport modal choice and can compete with individual transport. By providing good infrastructure and parking facilities it can increase the number of users of bicycles and public transport. Also it is still more common to provide the transfer of bicycle on train or bus.

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