Transport Policy 31 (2014) 1–9

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Policies for synchronization in the transport–land-use system

Bert van Wee [a,*], Wendy Bohte [a], Eric Molin [a], Theo Arentze [b], Feixiong Liao [b]

[a] Delft University of Technology, Transport and logistics group, PO Box 5015, 2600 Delft, The Netherlands
[b] Eindhoven University of Technology, Urban Planning Group, Faculty of the Built Environment, The Netherlands

ARTICLE INFO

Available online 22 November 2013

Keywords:
Synchronization
Land use
Infrastructure
Evaluation
Model
CBA

ABSTRACT

This paper presents an overview of options for synchronization in the transport and land-use system. We distinguish between synchronizing (a) transport networks, (b) activity locations, (c) transport networks and activity locations, and (d) ICT-based decoupling of activities from time and/or locations. Synchronizations in both time and space apply to these four forms of synchronizing, resulting in eight synchronization options. These eight synchronization options were then linked to different categories of policy options: (a) regulation, (b) pricing, (c) land use planning (d) infrastructure planning, (e) specific public transport policies, (f) marketing and communication, and (g) time related policies. We explain the relevance of these policy options for synchronization. Next we apply our structured overview to a case study, the redevelopment of the Rotterdam Soccer stadion of Feyenoord. Finally we discuss the relevance of Cost-Benefit Analysis and Multi-Criteria-Analysis for the evaluation of policy options, concluding that CBA is the preferred method of evaluation in most but not all cases.

1. Introduction

The transport system allows people to carry out activities in different places. Together with the land use system it is of paramount importance for accessibility. Following Geurs and Van Wee (2004) as a point of departure we define accessibility in the case of passenger transport as 'the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)'.

Increasingly researchers and policy makers are aware of the notion that accessibility can be further improved by synchronizing distinguished components of the transport system, as well as the transport and land use system. Limiting ourselves to academic literature, recent examples of papers include Guihaire and Hao (2008) and Guo and Wilson (2011) on synchronization of public transport networks, Levine (2005) and Bertolini et al. (2012) on the integration of land use and transport planning, Mokhtarian (2002) on telecommuting and travel, Farag et al. (2007) on e-shopping, and Lyons and Urry (2005) on conducting activities while traveling.

Synchronization between transport networks and/or activity locations can have important accessibility benefits for individuals. Because the trips and activities that people undertake during a day are interdependent, the synchronization of activity locations and transport networks often affects more than just one trip or activity. Trips may be chained or several activities may be carried out at one location or whilst traveling. Moreover, other travel modes may become attractive. For example if childcare becomes available near a railway station, people may choose to cycle to the childcare and travel to their work by train, instead of using the car for both activities. These benefits of synchronization are especially important as far as travel is a derived demand. Note that this does not apply to all travel; sometimes people travel for the fun of it (Mokhtarian and Salomon, 2001).

To optimally synchronize the transport and land use system dedicated transport and spatial policies are of great importance. Examples of such policies are decisions on roads and the connections between roads of different types. In addition, public transport is subsidized in many countries, and subsidies often depend on the level of service characteristics and/or travel demand, which both depend on, for example, connectivity between modes. In addition to policies focusing on the transport networks, several land-use policies can increase synchronization. For example, local municipalities play a key role in the activities that can be located near railway stations, resulting in not only the accessibility of these activities by rail being influenced but also the trip-chaining options for rail passengers. Furthermore, time-related policies can induce the synchronization of transport networks and activity locations. Examples are policies which determine the opening hours of shops and services and flexible working times. Policies may also simultaneously influence temporal and spatial accessibility. In particular ICT related policies, such as the stimulation of teleworking and teleshopping, influence both dimensions of accessibility. Several of the above-mentioned policy options have

* Corresponding author. Tel.: +31 15 2781144.
E-mail address: g.p.vanwee@tudelft.nl (B. van Wee).

0967-070X/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.tranpol.2013.10.003

an impact on accessibility, but in this paper we focus on synchronizing and related policies.

To the best of our knowledge there is no systematic overview in the literature of the policy options for synchronization. This paper aims to fill this gap. We do this by developing a conceptualization of synchronization options (Section 2), and linking this conceptualization to distinguished categories of options for public policies (Section 3). Section 4, as an example of current synchronization policies, presents a case study from Rotterdam, The Netherlands. Section 5 discusses how policy options for synchronizing could be evaluated. Finally Section 6 summarizes the main conclusions and discusses the implications of our paper.

2. Conceptualization of synchronization in time and space

In this paper, synchronization options refer to spatial and/or temporal synchronizations between locations of activities and/or transportation networks. Synchronizations can increase the accessibility of individuals by decreasing travel distances and the travel time between successive activity locations, or by enabling the performance of multiple activities at the same location or even at the same time.

This section first discusses the distribution of activity locations and transport networks over time and space. Next this positioning is related to synchronization options by distinguishing eight spatial and temporal dimensions that can be included in policies.

2.1. Activity locations and transport networks in time and space

The ease with which individuals can perform their daily activity patterns strongly depends on the distribution of activities and transport networks over time and space. Firstly, a 'favorable' spatial and temporal distribution of activity locations and transport networks leads to improved accessibility. Travel distances, travel times, travel costs, and effort to reach activity locations depend on the locations and availability in time of activity locations and transport networks. The spatial and temporal connections between activity locations, between transport networks, and between activity locations and transport networks have great influence on accessibility, particularly for performing multiple activities. The synchronization of activity locations and transport networks in space and time therefore increases the accessibility of individuals.

Secondly, if activities can be allocated more flexibly in time and space, people can arrange their own activity schedule according to their particular preferences and minimize travel disutilities. The spatial and temporal flexibility of activities depends on the level to which other people, goods, facilities and space are needed to carry out their activities and how unique these requirements are. For example a social meeting with a friend requires a specific person, whereas for buying groceries several supermarkets may provide reasonable alternatives. Also some activities have very strict time frames (e.g. taking an exam) while others can be performed within a larger time slot (e.g. shopping or fitness). Currently the development of ICT increasingly weakens the need for synchronization of activities in time and place, because activities become more and more flexible within or even independent of space and time. For example, talking on the phone is more or less independent of place, but depends on time while email is also largely independent of time. When activities can be performed anywhere and anytime this may increase accessibility and decrease the demand for travel. People can shop on the Internet from their office, or work in the train and video conferencing may decrease the need to travel for business meetings. The increased flexibility of activities also increases options to combine activities and travel, such as working in the train.

2.2. Synchronization options

Most activities are still framed in time and space, albeit to a varying degree. Therefore synchronizing times and locations of activities and transport networks would enable individuals to execute their daily activity programs more easily. Policies which aim to make activities independent of time and or space also enable people to transfer more easily from one activity to another. For activities which can be performed anywhere and anytime the demand for adapted spaces such as shops and offices decreases (Couclelis, 2009).

Table 1 categorizes the synchronization options. Such a categorization enables researchers to study synchronization in a structured way, and policy makers to systematically design synchronization policies. It shows that synchronizations are possible along the dimensions space and time. The components that can be synchronized include (a) transport networks, (b) activity locations, (c) activity locations and parts of transport networks, and finally (d) that activities can be decoupled from space and/or time. Table 1 links these dimensions and components.

Below we give some examples of options for synchronization categories as presented in Table 1:

1. Spatial synchronization between transport networks, e.g.: park and ride facilities.
2. Temporal synchronization between transport networks, e.g.: synchronizing the timetables of either different public transport modes or within one mode (e.g. different lines of a railway network).
3. Spatial synchronization of activity locations, e.g.: mixing use categories such as houses, shops, health services and schools.
4. Temporal synchronization between activity locations, e.g.: the opening of health care services after regular working hours at offices.
5. Spatial synchronization between transport networks and activity locations, e.g.: building offices or high density residential areas near railway stations.
6. Temporal synchronization of (parts of) transport networks and activity locations, e.g.: matching the hours when bus services are provided and the temporal component of activities such as concerts.
7. Decoupling activities from place, e.g.: offering services through telecommunication, such as allowing people to telework, offering the possibility to teleshop and having a helpdesk by phone.
8. Decoupling activities from time, e.g.: using email, flexibility of office hours, teleshopping 24/7.

In Section 3 we present policy options for synchronization following this categorization.

3. An overview of policy options for synchronization

Section 2 discussed options for synchronization (*what* is possible?). This section links policy options to these options for

Table 1
A categorization of synchronization options.

Dimensions \components	Between transport networks	Between activity locations	Between transport networks and activity locations	Decoupling of activities
Space	1	3	5	7
Time	2	4	6	8