CONFIDENTIAL

INTEGRATED TRANSPORT BIKE SHARE

(ITBS)

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Charles Carey

Summary

This document outlines a product aimed at opening up a hitherto unexploited transport market, namely, integrated transport between bicycle and train, metro, or bus. The product aims to make significant advances in this transport concept, bringing both business benefit to transport operators together with a step change in the customer experience of multi-modal travel.

'Last mile' bike share solutions are not new. OVFiets in the Netherlands demonstrates this solution in cities and towns across the country; train travellers avoid taking their bike on the train and pick up a bike share bike for the day between their arrival station and their place of work. This model has a significant impact in reducing operational costs of bike share schemes but wider deployment has been prevented by the high capital costs of existing systems.

In the UK the story is different: bike share has not been deployed as an integrated solution and outside of London, there is little evidence that train users use bike share as part of their regular train journey. Bike&Go and Brompton Bike Lockers have the potential to address this problem although they appear expensive solutions which are not aimed at the 'integrated journey'.

Biella Research*, based in the West Midlands, has developed Stack Rack Bicycles which is specifically aimed at this market , one which is expected to grow as car congestion becomes an increasingly challenging problem for towns and cities across the country. The concept is based on a modular docking station which provides unique high density docking of bicycles for space constrained areas such as station forecourts.

The design brings about capital cost reductions of over 50% compared to existing solutions and is supported by a seamless customer interface to make the integrated transport experience both simple and pleasurable.

The concept has been successfully proven in 2017 with Dept for Transport funding and is now ready to be demonstrated as part of a wider integrated transport solution.

* See Annex A

Overview

Bike share schemes are in essence automated bike hire schemes where users can independently take and return bicycles without engaging operational personnel. By using electromechanical technology supported by IT systems, a process of payment and authorisation allows users to take and return bikes from the scheme automatically.

Almost all bike share schemes allow users to return a bike to locations which do not correspond with the original starting point of their journey. While this 'free flow' model offers convenience for the user, it significantly adds to the operational cost of any scheme since bicycles 'drift' to locations that prevent many users accessing them and thus operational personnel are required to redistribute the bicycles to improve accessibility.

Bike share schemes are further characterised by whether they have docking stations or are 'dockingless'. This latter category has been a recent introduction over the last two years where a number of companies, particularly from China, have introduced schemes where users can leave the bicycle more or less anywhere they want rather than at fixed location docking stations. This significantly reduces the capital cost of such schemes although the operational costs that include bicycle maintenance and redistribution, remain relatively unchanged. Furthermore the business model underlying these dockingless systems seeks to cover costs purely based on user ticket revenue and this has been severely challenged with many schemes closing after barely a year of operation (cf Sheffield, Norwich, Manchester).

Other than one example in the Netherlands, bike share has never been demonstrated as a targeted part of an integrated transport solution. It is true that in large cities like Paris and London, users will take a bike as part of their journey to work from a train station, but this is not the same as the Netherlands OV Fiets solution where users take a bicycle from a railway station and have the bicycle all day (predominately at their place of work), on the condition that the bike is returned to the railway station in the evening. This model instantly reduces operational costs, requiring no redistribution of bikes (they are always returned to the railway station), and considerably reducing bike maintenance (the bike gets used twice a day compared to 5-10 times a day in 'free flow' bike share schemes). Annex B outlines the potential cost savings of this concept compare to traditional bike share systems, and Fig 1 shows a schematic of the concept.

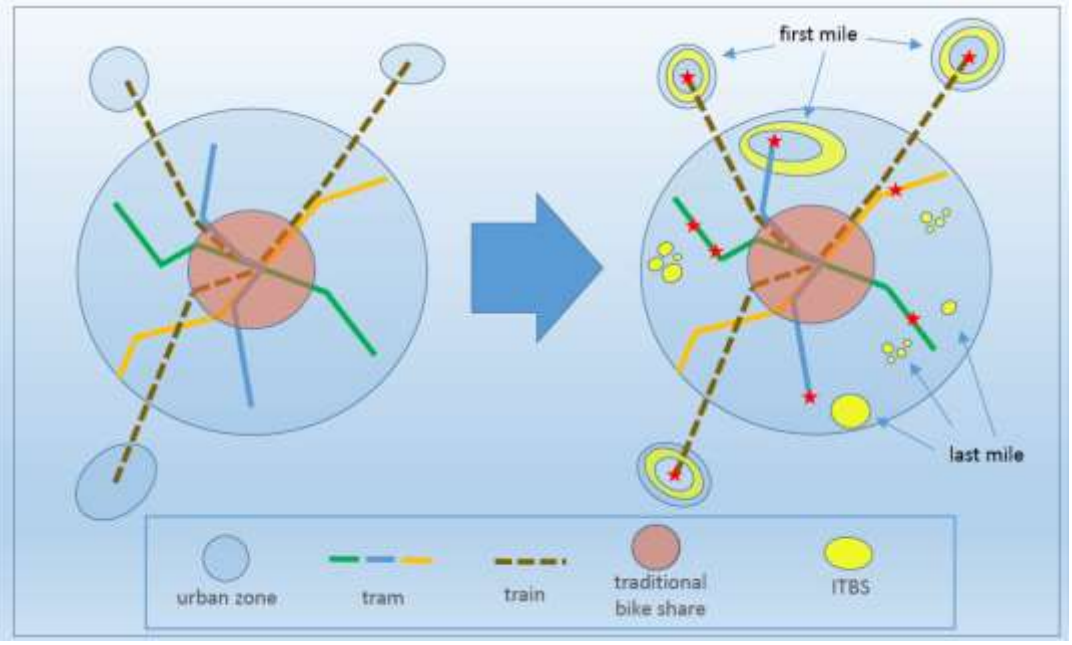


Fig 1: Schematic of Integrated Transport Bike Share (ITBS)

So why is this model not more widely used?

For dockingless solutions the model directly impacts the business model significantly reducing ticketing revenue. Furthermore the uncontrolled parking of bicycles, even if geofenced, is both messy and particularly inappropriate for station forecourts where there is a high risk of bikes interfering with passenger pedestrian flow.

For docking station based models where the business model is not solely dependent on ticketing revenue but also sponsorship advertising, and subsidy, there is no technical reason why existing companies cannot modify their platforms (eg Smoove, Nextbike, etc). Likely reasons that prevent this include the high capital cost of the equipment together with development required to modify their IT platforms. Furthermore, for an integrated bike/train solution to be effective a significant number of bikes need to be provided at station forecourts and current docking station designs take up a large amount of space which prevents this.

Market size

There are currently over 800 cities across Europe with more than 50k inhabitants, 700 of these having populations between 50k and 250k (‘Cities in Europe’ Netherlands Environmental Agency 2016). An established Integrated Transport System should readily support 30 bikes per 50k inhabitants suggesting a market size of over 100k bikes. As a comparison, the Netherlands operates ca16000 bikes across 300 stations (grown from 9500 bikes in 2016): for a population of 17 million this is just under 1000 bikes per million inhabitants which would equate to well over 300k bikes for an urban European population of 300 to 400 million. This is considerably higher than the initial estimate of 100k bikes and possibly reflects the fact that there are many opportunities to install Integrated Bike Share solutions to train stations serving smaller towns eg with 20k -50k inhabitants. If the traditional bike share market is also included, then a market size over half a million bikes would be a reasonable estimate in Europe alone. This could be considered overly conservative when we see cities in China supporting over a million bike share bikes per city.

Stack Rack Bicycles

A high density modular docking station has been developed by Biella Research which has been successfully demonstrated with the support from the Department of Transport. Both the Rail group and Cycling group within the DfT are keen to see the product developed further as it meets their wider strategic needs in improving the UK's transport infrastructure.

Fig 2: Two Stack Racks; 12 bike docks in under 5m.

Promotional video (30s): https://youtu.be/t2AEPseSL1Q

The docking station comprises a modular 2m long rack which holds six bikes (Fig 2). A feature of the design is that it can be very quickly installed requiring only four bolts: no external electric power is required as the units are battery powered and this permits simple and quick installation with the capability for easy site relocation and low decommissioning costs. The rack can be supplied with a range of finishes that permit low visual intrusion for sensitive conservation areas: there are also good mounting surfaces for advertising and sponsorship decals.

The docking station can accept a wide range of bicycle designs including e-bikes and this has a direct impact in lowering capital costs since multiple bike manufacturers can be approached for more competitive sourcing. Users can use a travel card, employee ID card, or smart phone. With the latter, travellers can pre-book a bike, a UK 'first' for this type of integrated journey.

Key advantages of the design are:

1. Half the space required for bike parking compared to any other design (including dockingless).

2. Less than half the capital and operational costs of existing schemes (see Annex B).

3. Multiple opportunities for generating revenue in addition bike ticket revenue:
   - sponsorship by destination organisations (university, business/industrial park company)
   - housing property developers meeting their sustainable travel Committed Obligations
   - increased train ticket sales

4. Improved customer experience with:
   - a flexible IT platform providing a consistent experience with other bike share schemes (eg embedded with Train Company website or redirected to bike share website)
   - unique pre-booking facility to ensure a seamless integrated transport experience
   - simple easy to use smart phone app for the latest Android and Apple phones
   - reduced requirement for transporting personal bicycle on train

ANNEX A

BIELLA RESEARCH

Biella Research was formed by Dr Charles Carey following a career in the automotive industry working at Lotus Engineering and Fiat Research in Italy. The company comprises prototype manufacturing facilities including CNC machinery, and was formed to offer agile, practical design and testing services to encourage rapid development in the automotive powertrain sector.

With the downturn in the automotive sector in the 1990's, the company was mothballed and senior posts were taken in the R&D sector. These included:

- Director of a 100+ team at Warwick University delivering a £58M programme funded by Advantage West Midlands assisting Jaguar Land Rover and its regional supply base.
- Head of R&D at SSE, one of the UK's major energy companies, managing and directing a wide range of energy projects across the supply and generation sectors.

In 2015, Biella Research took up development in the Bike Share sector. Initially, studies were undertaken for Barcelona and London's bike share scheme operators (Clear Channel and Transport for London). This was followed by the design and development of the Stack Rack which culminated in a successful proof of concept trial funded by the Department of Transport.

Presentations have been given at the UK's first bike share conference in 2015 and at the DfT sponsored 'Cycling and Walking' Conference in 2017. More recently, Stack Racks were presented at the University of Amsterdam's 1st Annual Meeting of the Cycle Research Board in November 2018, where proposals were put forward to expand the OV fiets model beyond train stations to other transport modes such as the metro.

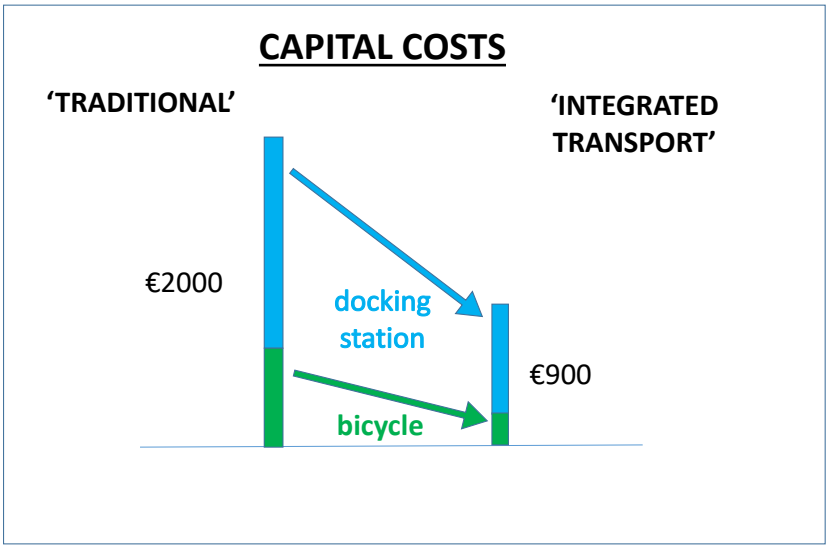
The Railway Development Group's Integrated Transport Committee has also been engaged with a view to further encouraging the take up of innovative integrated bike/train transport solutions.

ANNEX B

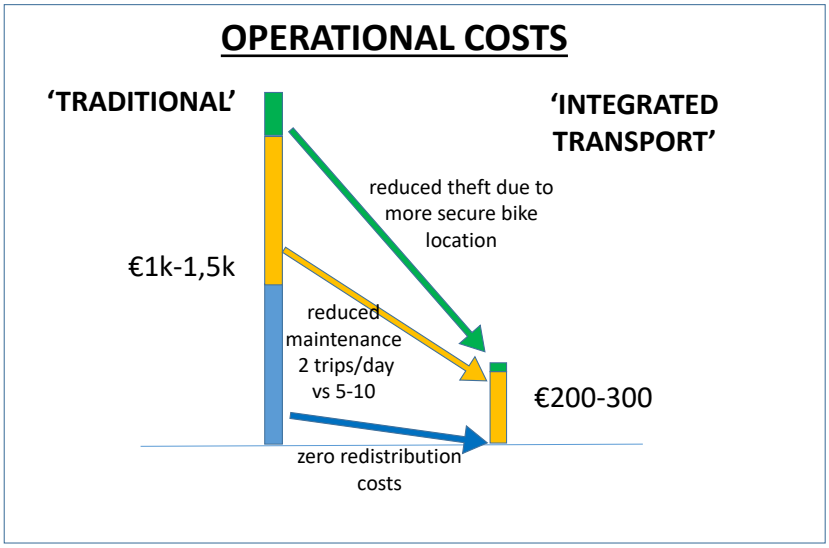
CAPITAL & OPERATIONAL COSTS

All figures are indicative based on detailed knowledge of specific cities (cf Barcelona, London, Liverpool, etc), together with discussions with suppliers and bike share operators.

Capital costs are dominated by the docking station and its associated installation. Stack Rack's reduced component count and innovative design for low volume batch production, significantly reduce these. The use of off the shelf bikes with minor modifications further brings notable reductions in individual bike cost.



The fundamental nature of integrated bike share eliminates distribution costs which contribute 30- 40% of city wide free flow bike share schemes. The low daily usage together with placement of bikes in relatively secure environments further reduces costs to a few hundred pounds a year. Customer support and IT costs are minimal and amortisation costs are also reduced.



For a well used scheme, it is essential to keep ticket pricing competitive with other public transport modes eg bus. Integrated transport bike share will depend heavily on regular season ticket holders and the low usage per day will reduce ticket revenue compared to free flow schemes. Sponsorship becomes the major contributor and the low overall costs means a cost neutral scheme is a realistic proposition.