Japan – the world’s leading transport technology test-bed

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Located to the south-east of China, Japan has a population of 127 million, nearly half of whom live within the three ‘megacities’ of Tokyo, Osaka and Nagoya which are strongly linked together in a crescent along the Pacific Coast. This is because while only slightly smaller than France in area, less than a fifth of this is suitable for development and agriculture due to the mountainous terrain which limited early road development and aided rail development. This reliance on rail was also strongly influenced by historical factors. Specifically, the rule of the Tokugawa Shogunate from 1600-1868 cut off contact with outside world; allowed only the Emperor to travel by wheeled vehicles and restricted bridge construction. Thus, the country was opened to new ideas just when rail technology was in the ascendancy while road construction remained a low priority activity until after the Second World War.

As elsewhere though, car use is now becoming increasingly widespread. Economically, Japan grew very strongly from the 1950s to the late 1980s (with blips during the 1970s due to the oil crises) until a major recession in the 1990s, although it is now growing again. Within this, the motor industry and other strong technology industries played a key role such that Japan now has the third largest economy in the world.

In addition, Japanese politics has long been dominated by the so-called ‘iron triangle’ of the Liberal Democratic Party (in power for almost all of the last fifty years), Government Officials and Big Business. Interestingly, this position has been partly underpinned by a cultural tendency to respect collectivism, consensus and hierarchy, although this tendency is now slowly beginning to change.

As a consequence of the above influences, Government power has been concentrated at the national level and favoured large scale infrastructure projects. It has also meant new schemes are introduced efficiently and effectively, yet from a functional perspective policy seems fragmented and lacking in strategic vision. It is also increasingly the case that there is now some pressure from tax payers and others to oppose such moves on environmental as well as on security and economic grounds – Japan remains heavily reliant on energy supplies from abroad.

Finally, such factors have also resulted in a whole range of transport modes being designed, implemented and operated in megacities, towns and villages across the country. These range right from the huge reliance of the rail commuting population on the bicycle, through various types of car, bus and rail-based modes, to the adoption of Maglev and other new technological solutions. It is this variety of modes that provides the transport technology test-bed that this photo feature aims to explore.

Transport in Japan is characterised by high rail use (modal share of 27% compared to 7% in the EU-25) and relatively low car use and car ownership (61% compared with 77% and 413 vehicles per 1000 people compared to 468 vehicles per 1000 people), despite a slightly higher per capita GDP. Bus use and domestic air modal shares meanwhile are broadly comparable (6% in Japan compared with 8% in EU-25 for both modes). In addition, Japan is widely perceived to effectively operate an incredibly complex transport system. One area of particular interest, is that a unique combination of contextual factors has led to a whole range of innovative technological solutions being designed, implemented and operated and it is these transport modes that this feature aims to explore.

References
the world’s leading technology test-bed

Clockwise from top left: (A) Transport policy in Japan has long been dominated by a strong philosophy of predict-and-provide, which is only now being challenged. (B) Rail use is particularly high in major urban centres. (C) Space is at a premium in Japan such that roads as well as buildings are often multi-storied. (D) Despite high levels of traffic congestion in larger urban areas, the public’s reaction to congestion charging schemes remains hostile. (E) Road junction and pedestrian crossing phases tend to be far longer than in the UK so as to minimise vehicle-vehicle and vehicle-pedestrian conflicts.

2 See Enoch and Nakamura (2008) for further information on transport policy and organisation in Japan.
Low capacity transport modes in Japan include: (A) Conventional taxis. (B) Shared taxis that operate on fixed routes rather like a bus. (C) Demand Responsive Transport System (this one is ‘booked’ by a push button). (D) Japan enjoys a high level of cycle use, specially as a feeder mode. (E) But illegal cycle parking, particularly at rail stations, is perceived as being a major problem. Hence there are a series of campaigns to encourage people to improve their behaviour (see inset). Institutional factors pushed policy makers away from traditional light rail/tram systems because they required permission from both Ministry of...
Construction and Ministry of Transport. Instead bus-based Rapid Transit (this page) and rail systems (overleaf) were pursued. (F) Traditional tram systems are now being phased out. (G) Guided Light Transit (electric 3rd rail, rubber tyred, single central guideway, horizontal guide wheels. H) Guided Light Transit (electric 3rd rail, rubber tyred, kerb guided with horizontal guide wheels. (I) Kerb Guided Busway (diesel vehicles, rubber tyred, kerb guided with horizontal guide wheels.
Rail-based Systems
Rail-based systems in Japan include, clockwise from top left: (A) The standard track gauge on most of the rail system is 1 metre. (B) The first Shinkansen ‘bullet train’ began operating in 1964 and is totally separate from the rest of the rail system and from road traffic. As a consequence it has a strong reputation for reliability and punctuality. (C) The Linimo service in Nagoya applies Maglev technology to a local transport system. (D) Women only carriage on the Tokyo Metro system. (E) The Tsukuba Express opened in the summer of 2005, financed entirely by the private sector. (F) Monorail systems (running either astride or underneath the rail) are common in Japan, especially in space-constrained locations.
Japanese experience also provides some pointers for transport systems in the future, clockwise from top left: (A) Car sharing (car club) schemes are now beginning to take off in Japan, some of which are trialing electric vehicles. The purpose of such systems is to increase the efficiency with which each vehicle is used. (B) The Intelligent Multimode Transport System operates in platoons of three unmanned, CNG powered, vehicles that are guided by magnets placed in a dedicated track.

Similar technology could conceivably be applied to units smaller than the 50 people ‘buses’ to replace cars in future. (C) Toyota is currently trialing a new vehicle of the future – a concept not dissimilar to an electric wheelchair. (D) Parking is an acute problem in urban areas of Japan. Real time information systems have been deployed as part of the approach to solving these problems. Thus far, however, experience suggests that drivers find them too confusing to be helpful. (E) A second approach to solving the parking problem has been to construct mechanical systems which, by use of a turntable, can store vertically around 30 vehicles on a site which would normally accommodate up to perhaps eight cars.

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