

Renewing infrastructure

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It is now hard to believe that in the United States, there was no interstate highway system prior to 1957. America moved west from the original settlements on the east coast founded from European immigration as soon as colonization began in earnest in the 17th-century, but it was not until the invention of the telegraph by Samuel Morse in 1837 that there was any sense in which America and its economy would ever be integrated. The telephone and then radio and television accelerated this integration and despite there being continual improvement in the road system, it was the railroads that really served to tie the continent together during the late -19th to the mid-20th-century. To an extent, individual mobility in the form of the car did not really take off until the 1930s and only by the 1950s was there enough momentum and demand to consider such an ambitious plan to link the states and their cities with high-speed highways segregated from the local and state road systems that had developed in an *ad hoc* manner.

Echoing the infrastructure provision which began with the New Deal in the 1930s and which had propelled America out of its worst ever recession, the Federal-Aid Highway Act of 1956 signed by President Dwight D. Eisenhower led to a massive highway building project in the US which was called by some ‘the greatest public works project in history’ (FHWA, 2018). Yet at much the same time, ambitious road projects began in other countries. In the UK, various schemes laid the groundwork for a national system of motorways beginning with the construction of a small section of the M6 around Preston. By the mid-1960s, extensive construction began of the national system, somewhat akin, but on a smaller scale, to that of the US Interstates.

In many developed countries, the experience of large-scale highway development has been similar. Sixty years on, however, the social and economic context has changed radically and the renewal of both road and rail is now at the top of the agenda. Although roads have been improved and maintained fairly conscientiously, vehicles have changed, becoming more flexible, more powerful, and in general, larger. There have been even more dramatic changes in rail, particularly with the power and speed of trains, thus raising the demand for new track and faster journey times as well as more comfortable travelling experiences. Both modes – road and rail – are being enhanced by new information technologies at the present time, and this is changing the focus from one of simply replacing old infrastructure anew with considering how this replacement might be made flexible enough to embrace new ways of travel. In fact, in the UK, the rail system that began to be developed almost 200 years ago has been virtually untouched in terms of its track during most of this time and it is of little surprise that it is so outdated that none of the current generation of trains are able to run on it. Moreover, since the original infrastructures of national rail and road were put in place in many developed countries, the city systems that these infrastructures keep connected have also changed, often dramatically. In the North America, the west and

south have grown fastest while the north and east have suffered decline and this has changed the pattern of connectivity and accessibility in quite radical ways. In the UK, there has been much less change largely due to the limits on the pattern of settlement in a geographically contained island, but like the US, the south and the west have grown with the north and east declining.

The renewal of infrastructure in the US and UK has become a political agenda item with the slow realisation that much of our communications infrastructure is out-of-date largely due to our inability to improve travel times in the face of every increasing costs due to breakdown. It is not simply what we can see above the ground as in highway and railway systems but it is the hidden infrastructure of utilities, buried in the ground and often only maintained when the system, be it sewage, water and even electricity, breaks (The Economist, 2013). There is no real national plan in any developed country for the renewal of this kind of infrastructure. But comparisons with the provision of state-of-the-art communications infrastructure in the rapidly growing economies of Asia-Pacific have raised awareness that if we are to compete economically, a much more even playing field is required and this will depend on our abilities to communicate in effective and rapid ways. This inevitably involves new infrastructure, in fact infrastructure which is no longer simply considered as providing better physical means of communication but more intelligent, as well as more resource efficient and sustainable. In the US, infrastructure is one of the new administration's major policy initiatives (Bradley, 2016), while in the UK, the National Infrastructure Commission (NIC, 2018) is charged with advising where our national infrastructure which is mainly transport and digital needs to be developed anew or through renewal.

In all these policy discussions, there are at least three kinds of uncertainty that make infrastructure provision very different from its simple replacement. First, infrastructure of the kind alluded to here – road and rail and to some extent utilities – was originally provided and financed when government and the public sector had a much higher profile in the past and were prepared to underpin such investments. This traditional financial model – business model if you like – is broken and unlikely to return. New methods of financing are required and there is no agreement on what this might be; public-private partnerships seem badly flawed and have become a drain on the public purse. Raising monies through markets now appears to be out-of-the-question as markets veer towards ever more short-term gains. The second key issue is that the new infrastructure must take account not only of developments in new technologies of the traditional mechanical kind such as high-speed train drives but of new automated and thus intelligent software. The big question is 'does this imply new road and rail systems that have such intelligence built in?' New kinds of intelligent vehicle, for example, will be able to connect up with other vehicles on the same system but does this mean developing systems where cars can hook up to each other, thus moving autonomy in the vehicle through connectivity in the entire system which in turn relates to the track or network used to make the system operational. In short, should we plan for automated highways or what? The third key issue involves the kinds of organizational basis for future transport. Integrating modes is often raised as a key issue but there are few methods for organising such integration. It requires linking different technologies, organisations, customers, governments and embedding traditionally different elements of each of these into one another.

There are many other aspects of this process of renewal that need to be considered. The models that we have are hard enough to integrate, and once new patterns of connectivity are considered, these models which simulate physical flows need to be linked to economic activities. The provision of new infrastructure generates such new activity while changing

existing patterns in ways that are not immediately predictable. Embedding the use of these models into the process of designing, organising and building such infrastructures is a difficult process with little agreement about how best one might fit such tools together. This is another area in the study of cities where the reality of the systems that we are dealing with are getting more complex at a faster rate that we can keep up with, that is, with respect of the models that enable us to understand these processes. As ever in these editorials, new infrastructures and their simulation, the impacts that they will have on the future city, and organisational issues involving in coupling models and methods are key ideas which this journal would welcome in terms of future publications.

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