



Pergamon

Futures 32 (2000) 275–287

FUTURES

www.elsevier.com/locate/futures

On transport integration: a contribution to better understanding[☆]

Stephen Potter^{*}, Martin J. Skinner

Energy and Environment Research Unit, Open University, Milton Keynes MK7 6AA, UK

Abstract

Over the years there have been many forecasts of transport futures. Most have taken a technological perspective, but this paper differs. Our perspective, linked to current transport policy debates, concerns the processes, institutions and structures within which transport technologies develop. ‘Integration’ is taken as our focus, because the concept of ‘integrated transport’ has become an important guiding principle for transport policies’ institutional and structural development in several countries.

Much has been talked about the need to reduce significantly the environmental impact of transport. While technical solutions that reduce the impact of individual journeys have a place, it is unlikely that they alone can reduce the impact of transport to a sustainable level. Only the development of highly integrated strategies have the potential to improve sustainability. Such strategies involve areas of activity that are not traditionally considered part of the transport planning process, such as health, urban regeneration, and education.

There is no widely accepted definition of what Integrated Transport means. It is to help clarify such ambiguities that this paper has been written. This paper explores the meaning of *Integrated Transport* and considers whether such strategies will contribute to sustainability.

Using examples from photography and computer system design the paper shows that there is a need to develop a better understanding of the meaning of *Integrated Transport*, outlining a typology developed to classify various definitions of Integrated Transport. Integrated Transport is viewed as scalar in nature, with higher levels incorporating lower, or narrower, understandings of the term Integrated Transport. Points on this scale include:

- *Functional or Modal Integration*, which is part of...

[☆] This paper is part of a research degree project being undertaken by Martin Skinner in the Energy and Environment Research Unit at the Open University, looking at understanding the meaning of integrated transport in the context of surface transport in the United Kingdom.

^{*} Corresponding author: tel: +44-908-652634. Dr Stephen Potter is a Senior Research Fellow in the Department of Design and Innovation, at the Open University.

E-mail address: s.potter@open.ac.uk (S. Potter)

- *Transport and Planning Integration*, which is part of...
- *Social Integration*, which is part of...
- *Environmental, Economic and Transport Policy Integration*

Transport Integration may be considered as a series of steps, with an incremental approach leading to higher levels of both Integration and Sustainability. Only by commitment, and allocation of resources, to the highest levels, will issues of sustainability be properly addressed. © 2000 Elsevier Science Ltd. All rights reserved.

1. Introduction: transport futures

Over the years there have been many forecasts of transport futures. Most of these have taken a technological perspective (and most have been badly wrong!). In the 1930s there were forecasts of rocket trains and skies filled with aerocars, somehow avoiding each other as they criss-crossed each other in the morning commute.

The agenda has changed over the years, and more recent future visions explore the potential of clean technologies. An example is Tickell and Wright's 2030 Vision, which accepts that the traffic jam is with us forever, but that:

the jams of 2030 are tolerable enough compared to the late 1900s. They're close to clean and all but silent: as fuel cells, batteries and flywheels replace petrol and diesel engines. [1]

The purpose of this paper is to take a different angle on the exploration of transport futures, linked to current transport policy debates taking place in the UK and elsewhere in Europe. These debates are largely about the processes, institutions and structures within which transport technologies develop. Looking at what sets the framework for technologies could help identify which technologies and proposals represent a relevant approach to future needs, and which are likely to go the same way as the rocket train of the 1930s.

In this approach, the meanings of 'integration' is taken as a focus, because the concept of 'integrated transport' has become an important guiding principle for transport policies' institutional and structural development in several countries. The problem is, what is meant by 'integrated transport' seems ill-defined. There is a story—probably apocryphal—that when representatives of a major environmental pressure group went to lobby Dr Brian Mawhinney [2], then the UK Secretary of State for Transport, he listened to them carefully with eyes closed—as he frequently did. When they had finished he opened his eyes and said "Yes, but what do you mean by an 'Integrated Transport Strategy'?" They had no answer. The expression has never, so far as we are aware, been formally defined, despite it being frequently used, and, perhaps, just as often abused. Confusion has been caused by it meaning different things to different people—and then it being taken up without thought about what it actually does mean. To some extent the vagueness and variability of meaning

is a political advantage. Its use has the potential to produce apparent agreement despite actually meaning quite different things.

It is now widely recognised that policies that allow for increased mobility, especially by car are manifestly unsustainable [16–18]. The adverse impacts of road travel include: congestion; noxious emissions and air quality deterioration; global warming (CO₂ emissions); use of non-renewable resources; road casualties; health and safety; noise and vibration; social polarisation; and public expense.

Today there are about 550 million vehicles in the world. This averages out at 115 vehicles for every 1000 people. In the UK the ratio is 481 per 1000, in Japan 535 and in the USA 767. Africa averages a mere 22, Latin America 90 and Eastern Europe 128. If historic rates of growth are maintained, the global vehicle population will exceed one billion before 2020. According to the World Health Organisation, traffic fumes now kill more people than traffic accidents and transport is the fastest growing source of carbon dioxide (CO₂) emissions. Wary of interfering with people's freedom to use their cars, the longstanding response has been to reduce emissions from vehicles and, in a few countries such as the USA, Denmark and Italy, to encourage fuel efficiency. The last ten years has seen the recognition that policies to manage the volume of car travel are inevitable. The OECD [3] states that "technological improvements and innovation must be pursued, but alone are not the solution".

A paradoxical dilemma thus exists. It would be economically debilitating and environmentally disastrous for the nations of the 'south' to develop transport systems and behaviour in the same way as the 'north' has done. Equally, for many of the developed countries of the north, it is now physically and economically impossible to continue current transport intensive trends. We cannot go on as we are, yet we know of no other model or alternative. If technology alone is not a solution, can an Integrated Transport Strategy provide the way out of the transport paradox? (Fig. 1).

To answer this, it is necessary to establish if:

- Integrated Transport can be usefully defined?; and
- In what way will it make life more sustainable?

We accept that Sustainable Development means "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [4] or promoting stewardship of our planet so that our activities do not degrade our children's future. However, such definitions are difficult to implement via specific actions. Integration is much harder to define as it can encompass so many different things, many different actions can be thought of as representing an integrated approach.

Whether 'An Integrated Transport Strategy' has the potential to deliver a more sustainable pattern of transport appears to be almost unquestioned accepted wisdom. However, almost every transport indicator shows that present practice is unsustainable—and that the trends are not going in the right direction [18]. Historically, as economies develop their demand for transport has increased. As we enter the new millennium we should be aware that many countries are expecting their economies to expand. With that comes the expectation of increased transport activity. This has



Fig. 1. Traffic congestion: no way out of the transport paradox?

a particularly severe impact on energy use, emissions of local pollutants and on CO₂ emissions.

2. Integration

The meaning of ‘Integration’ can usefully be illustrated by drawing on other areas where the concept is viewed as important.

Photographers and image analysts sometimes consider photographic images by looking at three main elements. First, the visual content. What is in the photograph? How are the elements placed? What kind of composition has been used? Second, the technical aspects. Has the right camera and film been used? Is it sharp where it should be sharp? Is exposure correct? Finally, the philosophical. Why was the photograph taken? How does the image convey the message intended by the photographer? Only when these three elements come together in an integrated way can a photograph be considered successful or as photographers say ‘works’.

Analogies can also usefully be drawn from the computer world. In the past many large organisation ended up with a number of different computer systems. These may have been developed on different machines at different times, for seemingly unrelated purposes, resulting in disjointed systems. Many organisations aim to integrate these various systems, so that for instance, payroll and pensions would operate in the same way and use common payment methods. This involves analysing the component parts of the system to consider how they could be made to work together. Integrating systems that had been built at different times by different people with different methods was rarely straightforward. The desired benefits of system integration could often only be achieved with high levels of effort and expense.

How do these analogies relate to transport? Transport can be viewed in system terms: to describe it in terms of how it operates, and its boundary systems. The use of ‘integration’ in transport, in practice, is at an earlier stage of development, compared, for example to computer systems understanding. Having considered that some linking of computer systems might suffice, it was eventually realised that a radical approach to integration was required to obtain the ambitious financial and performance targets. This seems to be the key problem facing the meaning and consequences of integration for transport policy today. We seem to be trying to achieve much with just a minor linking of disjointed (and often incompatible) systems.

3. An integrated transport policy

A surprisingly early use of the phrase ‘Integrated Transport Policy’ was in the 1981 BBC Television political comedy *Yes Minister*. In an episode entitled ‘The Bed of Nails’ [5] an Integrated Transport Policy is mooted. The main problem is to find a sufficiently gullible minister to front such a politically thankless task with so many risks and little potential for immediate reward. Thus a buck-passing plot unfolds with, eventually, the Integrated Transport Policy being shelved in a return to the party’s core approach to transport of the comfortable ‘our policy was not to have a policy’.

This comedy fiction reflected fact, not only in the UK, but in many other nations also. With road building a simple response to growing market demands, privatisation and disposal of state transport operations, government transport policy appeared to be little more than disengagement of the state from any strategic transport role. By the early 1990s, with congestion and transport’s environmental and health impacts rising rapidly up the national and international agenda [14,15], such a stance was

untenable. With the election of a Labour Government in 1997 the phrase ‘Integrated Transport Policy’ shifted firmly from the realms of fiction to fact; transport integration, following the example of several mainland European countries, is intended to be the mechanism to move towards a more sustainable future. Its purpose is:

To provide access to goods, resources and services, while reducing the need to travel, so that economic, environmental and social needs can be met efficiently and in an integrated manner [6].

The OECD has developed a definition of sustainable transport that includes some more precise criteria. This is transport that “does not endanger public health and ecosystems and meets needs for access to people, goods and services consistent with (a) use of renewable resources at below their rate of regeneration, and (b) use of non-renewable resources at below the rate of development of renewable substitutes.” They go on to say that achieving a sustainable transport system will require reductions of up to 50% of CO₂ emissions.

Such national and international definitions have come to be reflected in the rhetoric and goals of local transport strategies. For example, Milton Keynes Council [7], in their Sustainable Integrated Transport Strategy, included the following Vision Statement:

We aim to open up Milton Keynes by making it a place where everyone can afford to move around conveniently, where economic, social and cultural life can flourish, whilst damage to our environment is minimised.

Stirling Council [8], in their Local Transport Strategy, made the following statements (amongst others) in their objectives for Public Transport:

To provide a range of appropriate services, supporting infrastructure and information to meet the diverse needs of all people who rely on public transport and provide an attractive, sustainable alternative for car users;

Stirling Council is committed to a holistic approach to improving all aspects of public transport as resources allow.

This was one of a number of statements, which together, provide a statement of how Stirling Council intend to develop an Integrated Transport Strategy in the coming years. Similar statements are made about the need to provide for and promote walking and cycling. Note the use of the word *holistic*. “The Integrated Approach is not just about being able to cycle to the railway station or park and ride. It is about solutions or series of solutions which try to solve several issues at once” provides another useful definition of Integrated Transport.

One view of such a strategy is that it provides a hierarchy of choice, ideally making the first choice for a journey the most environmentally benign, such as walking and cycling, through public transport options, and finally use of a car when there is no practical alternative.

It is when such a statement is operationalised into practical specifications that difficulties arise. For example, an integrated policy, which is intended to improve sustainability, will be one that provides travellers with choices that:

- provide an alternative to travelling;
- increase opportunities for making journeys on foot or by bicycle;
- improves public transport options;
- and finally, if a journey can only be made by car to reduce the environmental impact of that journey (for example by promoting cleaner vehicles, vehicle sharing and opportunities to cut journey lengths).

Alternatives that might be adopted to meet these include:

- improved telecommunication, goods delivery and postal services;
- improved urban design to promote travel on foot and by bicycle;
- improved public transport options;
- improved vehicle and traffic management technologies to reduce the impact of car journeys.

A particular initiative would be to discourage use of cars with a single occupant in congested urban areas.

One key idea that has already developed is the need to think in terms of a *holistic objective-led* systems approach to transport planning since it is only by considering transport as a response to a problem, and within wider planning and social contexts that effective long-term solutions be developed. Analysis of the problem is necessary to help identify solutions, but it is also important to work towards solutions. Technology can play an important role. However, much of this paper concentrates on managing and reducing the demand for travel, and utilising the opportunities available to ensure that those journeys made are made in less environmentally damaging ways than car or aircraft.

4. A typology for integrated transport

At this point it is worthwhile to consider different approaches to Transport Integration. First, we consider what exactly is integrated with what? Rather than attempt a single definition, Integrated Transport is better viewed, we argue, as scalar in nature, with higher levels incorporating lower, or narrower, understandings of the term Integrated Transport.

Points on this scale from lower to higher are:

- *Functional or Modal Integration*, which is part of...
- *Transport and Planning Integration*, which is part of...
- *Social Integration*, which is part of...
- *Environmental, Economic and Transport Policy Integration*

We have constructed these ‘nested’ definitions of Integrated Transport from reviewing available literature. The list is not intended to be exhaustive, but to indicate some of the points on a scale of meaning. In summary, these points are:

- **Functional or Modal Integration:** A policy enabling different travel modes to complement each other, making multi-modal journeys easier.
- **Transport and Planning Integration:** Land use and transport are closely linked in that patterns of land use and facilities are direct influences on travel generation. Such a policy employs land use policy as a means of managing and reducing travel demand.
- **Social Integration:** At this level, all those who have a stake in transport have their needs considered. Adoption of such a policy would involve those who use and provide transport services, and others such as organisations that are major trip generators (shops, schools, employment etc.) and those involved through suffering noise and vibration from transport.
- **Environmental, Economic and Transport Policy Integration:** Essentially, all the above policies are combined in a holistic way. This has the effect of maximising the benefits from the transport system, providing the best opportunity for more sustainable transport.

We consider these scalar levels in more detail below.

4.1. Functional and modal integration

Functional or Modal Integration is intended to make travel easier by a better combination of different modes during one journey. This may involve combining different modes of public transport, or private and public transport. This is the first level, or narrowest definition, of integration. Integration at this level will have one or both of the following characteristics.

Functional Integration involves ticketing arrangements to enable multi-modal journeys. Examples of this include the ‘Carte Orange’ in Paris and the London Travel Card, which covers bus, underground, light and heavy rail, and soon tram, within the Capital Region. In some countries, functional integration is very advanced. In the Netherlands, for example, there is a single ticketing system (the ‘Nationale Strippen Kaart’) for all local transport systems throughout the whole country. Such functional integration is leading to innovative ticketing systems, including the use of stored value and smart card systems.

Modal Integration enables easy transfer between different modes because of their close physical location and integrated timetable planning. Examples include bus–rail interchange points and rail-link bus services to meet trains. The latter include Amtrak’s well developed ‘Thruway’ buses and Dutch railway’s innovative shared ‘Train Taxi’. In the UK a notable development is the demand responsive ‘Wigglybus’ rural bus service. Because this serves a sparsely populated area where people may need to cycle to catch the bus, there is space for bikes on the buses themselves.

Facilities which enable private transport users to use public transport for part of their journey may also be included, for example Park and Ride, or Bike and Ride.

The European Union's Citizen's Network concept [9] is essentially a logical development of the functional and modal integration concepts. The network concept is that public transport systems across the whole EU should be as easy to understand and use as road systems are to motorists.

4.2. Transport and planning integration

A higher stage of transport integration would typically involve consideration of land use and transport as a single entity. Essentially, this type of policy seeks to employ land use planning as a tool to reduce demand for travel. Such policies are most common at a local level, but under national or state planning guidance (e.g. Bucks [10] or in the zoning regulations in the USA). However, Netherlands has a national framework known as the 'ABC' system. Under this, locations are classified according to their accessibility. 'A' locations are those with good public transport access and car commuting is not expected to exceed 20%. 'B' locations are those with good public transport and car access (e.g. where ring roads cross a public transport route), but where car commuting should not exceed 33%. 'C' locations are those which have good access only by road. Businesses are classified by their mobility profile and planning permission for developments are given accordingly. Shops and offices are only permitted in A or B locations and activities such as warehousing in C locations.

While such a policy is to be welcomed, there is a risk that it can only be made to work over periods of years or decades, and that the consequent growth in traffic will overwhelm any benefits such a strategy could bring. Such integration was well established in the town planning of the 1970s, but became unfashionable under the market-led ethos of the 1980s. Its role was re-recognised in the UK with the publication of Planning Policy Guidance Note 13 in 1994 to encourage local planners' planning decisions to reduce travel, especially by car, and to encourage more environmentally-friendly travel methods.

In the longer term better integration of transport decisions and land use planning has the potential for major benefits by promoting more appropriate land use patterns for public transport, walking and cycling. These would stand in stark contrast to, for example, the development of city fringe shopping, leisure and business parks at motorway junctions.

4.3. Social integration

A further development would be to integrate transport policy into key social policy areas to include those who use and provide transport systems, and others with a stake in transport who are not usually involved, such as those who suffer transport generated noise and vibration. Also involved would be those who operate trip-generating sites, who would be asked to consider the travel impact of their operations. Employers, schools and shopping centres for example, would be expected to

implement Green Transport Plans (called Transportation Demand Management in the USA or Mobility Management by the European Commission).

Particular examples, within the public sector, include health and education services. For example, as health services have been centralised into larger units little consideration has been given to access to health facilities. Sometimes, new facilities, which are out of town, can only be reached easily by car and only with great difficulty by public transport. While there may be very good reasons for moving a hospital to a new site, one must ask how often is the access issue, particularly, for those without cars properly considered, and adequate transport arrangements put in place. This is part of the *ownership* of both the transport problem and an acceptance of responsibility to contribute towards its solution.

A social integration strategy would also cover travel substitution and reinventing the mechanisms and processes involved in obtaining motorised mobility. Examples of this include web-based shopping home delivery services, or car clubs, which are well established in Switzerland, the Netherlands and some parts of Germany. In the latter case, the shared use of cars leads to less use than if a car is owned, while ensuring car access when necessary. Changing the way car use is obtained and paid for results in its more rational use.

There would also be a much clearer view of the external costs of motoring, and ways of recovering that cost. Increasing the cost of motoring is unlikely to be politically easy, but there is now a widespread acceptance that when all the external costs are taken into account motorists do not pay their way, and effectively receives a subsidy from the rest of society. This is behind the European Commission's desired aim for 'fair and efficient' pricing of transport.

This higher level of meaning of the term integrated transport has radical implications if taken to its logical conclusion.

4.4. *Holistic (environmental, economic and transport policy) integration*

Essentially the highest level holistic strategy may be described as one which brings together all of the above in a coherent way. While such a strategy contains little that is new, the high level of integration between different policy strands would be an important development. The aim is to ensure that environmental, fiscal and social measures are working in harmony to reduce the need for travel, and reduce the impact of journeys made. All of the many elements in social, economic, environmental, transport and land use policies are integrated in such a way that the whole system has a greater value than the sum of the parts. This is a systems led or holistic approach [11]. This level provides the best opportunity for a more sustainable transport system and is the benchmark against which all integrated transport strategies should be tested.

Drawing on the parallel of developing large computer systems, once more, it is interesting and useful to observe the many similarities. Change however small is fraught with risk, and there is always a political dimension. Just as in transport, disconnected computer systems operate with no relationship to each other, or to the overall operation of the organisation. It is only when integration is pursued with

adequate resources over a period of time can the systems begin to deliver the full benefits expected.

5. An integrated response

Each of the above levels of ‘understandings’ of Integrated Transport makes sense in its own right, but clearly the ‘lower’ level understandings and the actions they represent make less of an impact upon travel patterns and behaviour. The transport challenge is a major one; for example the International Panel on Climate Change has indicated the need for a cut in global CO₂ emissions to 40% of their current level. To achieve this, and allow for expanded transport use in developing countries, would require developed countries such as Britain to cut transport’s environmental impacts by something like an order of magnitude. Related research to that reported in this paper [12] suggests that the sort of policies capable of achieving such a performance would involve measures such as at least a 10% cut in journey lengths combined with 40% of trips shifted from car to other modes, plus a 60% improvement in average fuel economy as well as a substantial increase in cleaner-fuelled vehicles.

This conclusion is consistent with that of an OECD/G8 study [2] exploring the reduction of all environmentally damaging emissions from transport to sustainable levels by 2030. This study concluded that only 30–40% of the reduction could be achieved by technical measures and the remainder would have to result from demand management. ‘Political, cultural and social innovation is therefore also required’.

The ‘lower’ understandings of integration and the sort of actions that stem from them are clearly unable to deliver anything like the order of magnitude change that such studies show are needed. Only the holistic meaning has any chance of addressing the problem. The situation is essentially equal to that faced by computer integration; ad-hoc attempts at linking systems were inadequate and the problem had to be tackled holistically.

Yet the meanings of ‘integration’ in use today are not at this highest level. In general we have only ‘lower level’ meanings and actions. The UK Transport Policy White Paper [13] addressed Transport Integration very much in terms of modal integration. For instance, making ticketing between different modes more straightforward was mentioned several times. However, travel demand management was rarely referred to. There was certainly a consideration of some transport and planning and social integration issues. A major part of Chapter 4 (Making it Happen) focussed on the role of planning. Thinking in the European Commission is more advanced, combining the modal integration of the ‘Citizens’ Network’ with economic reforms in the ‘Fair and Efficient pricing’ Green Paper.

Overall, although the focus in the UK White Paper is at the lowest level of meaning, there is evidence that understanding is beginning to move to a higher scale of integration. The White Paper represents a pragmatic and sensible strategy; ‘lower level’ integrative actions can act as stepping stones towards eventual action at a higher, even holistic level. As was pointed out above, the levels are progressive and

lower meanings are needed as foundations for an eventual holistic approach. Are we seeing foundations for such a progression? This may be so, but there is a serious danger that actions and measures do not have enough ‘stretch’ to deliver holistic integration or that they are used to freeze the political process at the lowest level.

This takes us back to the ‘Bed of Nails’ in *Yes Minister*. In 1981 even the lowest level of integration was seen as a political graveyard. We may have progressed beyond that. We now have a transport policy headed up by the Deputy Prime Minister, but the scale of change and acceptance required for holistic integration mean that we may be stuck at a lower and ineffectual level for a long time. One question is how committed the government is to such a strategy, given the political difficulties they will face—as forecast in *Yes Minister!* Recent stories in the media suggest that the government has become well aware of the political difficulties of tackling what is seen by many as a developing crisis.

6. Conclusion

This paper has taken a futures perspective on transport and sustainability, drawing attention to the vagueness in the use of the term *Integrated Transport*, and to assess whether implementing an integrated transport strategy could help create a more sustainable society. As with any realistic consideration of the future, no firm conclusion can be drawn. Much is dependent on what is integrated with what. It is argued by many that technology will resolve the issue of transport unsustainability. While we agree that it will have a role, it is our contention that a major contribution to sustainability in the first decades of the twenty first century will come from demand management strategies. This exploring and understanding changes in the process of achieving access and mobility needs more emphasis in futures studies.

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