

TRANSPORT POLICY AND RAILWAY TIMETABLING : TAKING THE CONNECTION SERIOUSLY

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1. INTRODUCTION

1.1 A personal note

Early in 1970 Bill Oxburgh, the founder of PTRC, discovered me exploring demand models in a garret at the old British Rail [BR] Headquarters at 222 Marylebone Road in London and invited me to present a paper at his forthcoming symposium in Amsterdam. That I did ¹, the paper gave needed credibility to the work, and my phrase “a 1% increase in speed yields a 1% increase in traffic” became a handy rule-of-thumb ². In due course the calculations helped to make the business case for the High Speed Trains [HSTs], the *InterCity 125* fleet that remains one of BR’s success stories. *In recognition of his role this paper is dedicated with gratitude to Bill’s memory*³.

Three years later I gave a definitive account of the research at what had by then become the PTRC Annual Meeting ⁴. It was 30 years before I reported on passenger modelling again ⁵, this time from the perspective of seeking to understand the impact of timetable design ⁶. And now in this paper I want both to record further studies from a still-large agenda and to reflect on the challenges ahead. I concentrate on the passenger railway.

1.2 Themes

The first part of the paper explains the author’s work on designing timetables in the context of the railway in Britain. Results of audits of timetables are reported. There then follows an explanation of the planning of a revised timetable for the East Coast Main Line, including a discussion of the interaction between satisfying demand and optimising the use of capacity. In the second part the relationship between timetabling and broader issues such as its function in integrated planning will be reviewed, and the case for a *National Timetabling Authority* will be put.

Non-British readers may find it strange that matters which they take for granted should be analysed in this manner. The explanation is found in the particular form of administration of public transport adopted in Britain. Insofar as the paper identifies weaknesses it can therefore be read as a warning of what not to do, but it does propose remedies.

The final chapter urges consideration of a range of social and economic scenarios to replace the single (and dangerous) assumption of indefinite material growth, and hence of the impact radical changes will have on the expectations of public transport – and its timetabling.

2. AUDITING THE TIMETABLE

2.1 The importance of the timetable

The essence ⁷ of public transport is its timetable. An operator makes an *offer* to convey potential travellers from A to B (and B to A) at specified times of departure and arrival. Their response will be determined by their flexibility, which spans a continuum from barely any (where the demand for transport is derived from some event over whose timing the traveller has no influence) to plenty (when the journey-purpose is itself flexible and plans are malleable, including by pricing inducements). Limits of acceptability exist in respect of journey-times, appropriate frequencies and time at destination, even in the latter case. And although all the other elements of the service – quality of vehicles, helpfulness of staff, crowding, ancillary facilities, price, methods of revenue-protection – are important and may influence choice (often prejudicing habitual car users against trains and buses), the timetable is the *product* on which modal decisions ultimately rest.

This central point has to be stressed because it appears neglected in Britain – in contrast with much of mainland Europe. Government and industry documents barely mention the timetable ⁸, and train companies do not make it a principal feature in their marketing ⁹. No one has argued convincingly for legitimate difference derived from insularity or that timetables are no longer relevant ¹⁰. Institutional and technical explanations are proposed below [§2.2], and a hypothesis to explain the contemporary context may be helpful here.

Apart from routes with only occasional runs serving very specific requirements¹¹ the structure of railway timetables is generally shaped by the complexity of networks and the pressure to employ capacity efficiently. In the *public-service model* the plan is relatively rigid, aiming to connect every location with an even quality of service. It is offered to the community as the means by which their aspirations for mobility can be satisfied. In the *supermarket model* more variation occurs to meet identifiable demands, but the emphasis is on selling the commodity produced, including the stimulation of fresh demand. These are nuances, and no sharp differentiation is being suggested, but the supermarket style that is currently dominant in Britain undoubtedly diminishes the status of the timetable ¹². We shall return to the policy implications ¹³.

Terms in this field are often ill-defined. We take it as axiomatic that ‘the timetable’ refers to the timings of a chain of services, by any public mode, that a traveller may use in the course of a journey. ‘Coordination’ means the task of optimising these timings so that intervals between services along each section are as regular as possible and so that interchanges at junctions and between modes are as brief as is sensible in the local circumstances. ‘Integration’ then refers to the broader task of creating a system in which physical arrangements and ticketing schemes as well as timetables afford travellers a seamless journey regardless of mode and operator (it does not presume a single delivery organisation, only unified planning) ¹⁴. By definition the market alone cannot achieve integration, since each player will prioritise its own interests.

2.2 Timetabling in Britain

In Britain timetables for public transport services have probably never had the status or attention that is commonplace in some European countries. Numerous private companies built and operated its railways without any significant element of state planning, and people complained and joked about poor services from early in railway history¹⁵. Even after they were compulsorily grouped into four large companies in 1923, and again after nationalisation in 1948, coordination remained patchy¹⁶. There was certainly no concept of a coherent national network of the kind first formulated in The Netherlands in the 1930s¹⁷. Moreover, the benefits of the overarching Swiss *Taktfahrplan* have not yet been recognised, despite routine references in political and popular discourse to the idea of integrated transport¹⁸.

The European Union [EU] adopted the principle of the separation of infrastructure and operations in terms of management and accounting in 1991. The intellectual roots of this concept of the railway lie in EU concern that lumbering state railways were proving no match for an agile road freight industry: guaranteed access for and competition between rail freight companies would enable rail to recover some of its lost market share. This was underpinned by an ideological belief that drew easy parallels with air and sea, where the infrastructure is open to all and capacity at terminals is allocated competitively.

These analogies are false. Most railways in Europe are diverse mixed-traffic networks. This fact, together with their fundamental technical characteristics, results in more physical conflicts than ever occur at sea or in the air. The confusion is epitomised in the replacement of the descriptive railway word 'path' for the complex space-time movement of a train by the word 'slot' derived from the simpler case of ships berthing or aircraft taking off and landing. It is also telling that legal documents now commonly refer to a 'quantum' of trains or station-calls, a phrase that says nothing at all about the structure and relative timings of services in a network.

At a General Election in 1992 the Conservative Party was unexpectedly returned to power but lacked a strong programme. British Rail was the only remaining large state-owned industry¹⁹. Free-market ideologues spotted their opportunity and persuaded the Government to interpret separation more rigorously than the EU Directive required²⁰. Coordination of timetables therefore continues to be discouraged by factors peculiar to Britain.

BR was fragmented. Infrastructure was vested in a shareholder-owned company, Railtrack. Passenger services were divided between 25 geographic companies, each franchised to a private operator. The freight business was sold piecemeal. Engineering work was handed to contractors, and ancillary activities were either closed or auctioned. Established brands, notably *InterCity*, were destroyed. A valuable corpus of archive material and human experience was dispersed. Henceforth Britain was to have a contractualised railway: every task that could not be done by one company would involve contracts between two or more players: given the nature of a railway, this meant multiple legal interfaces.

The government ministry, the Department for Transport [DfT], would provide no more than a policy framework, since the market would resolve every issue, although, as a monopoly, Railtrack necessitated supervision by an Office of Rail Regulation ²¹ [ORR]. An independent agency would manage franchising. The story of the way in which this structure evolved is complicated, troubling and still unsettled. Here we focus on the specific matter of operations planning.

Responsibility for designing the timetable is dispersed, and no single body is charged with the task. DfT now manages franchising. It continues to adhere to market doctrines, treats each franchise as a self-contained entity and has not developed a timetabling strategy. ORR does have two statutory duties that can be construed as requiring it at least to encourage coordination, but it has chosen instead to pursue its (not-readily-compatible) duty to promote competition ²². The infrastructure manager, now Network Rail [NR], fits the pathing proposals of train companies into an operational plan, but it has no commercial incentive to devise an ideal structure of services and is largely divorced from direct involvement with passengers (or freight shippers) ²³.

One might imagine that the Train Operating Companies [TOCs] would have an incentive to collaborate ²⁴. They do not obviously do so, and the reasons are interesting, though speculative. First, a large proportion of the income of long-distance operators is generated by a small number of traffic flows. These understandably attract most managerial attention and promotion, while improving and then marketing journeys involving other operators requires effort for modest returns ²⁵. Second, the companies holding the regional franchises that need substantial public subsidy concentrate on securing profits by meeting the contract terms, controlling costs and developing services in their own sphere rather than venturing into problematic joint exercises ²⁶.

A third reason is even more detrimental to coordination. One of the alleged failings of British Rail which it was presumed private management would correct was poor reliability and punctuality. Measurement of performance thus became a touchstone of the new regime. Monitoring was reinforced when the failings of Railtrack led to more rigorous regulation, and it is now a key component of ORR's relationship with Network Rail. Statistics are processed in intricate detail, including allocating blame for delay between the various players ²⁷.

This preoccupies managers to the point where no one analyses the quality of the timetable offer at the network scale but everyone computes 'success' in running trains to time. Reviews of timetabling connections so as to optimise journey times are coloured by concern that it may adversely affect the timekeeping of each separate service. Moreover, it has become normal practice not to hold onward trains in the event of late running ²⁸. To a degree this is legitimate in the interests of the majority of users and the stability of the network, but travellers are sufficiently aware of apparently perverse decisions to have lost confidence in interchanges.

Britain also has a history of fragmented provision of bus services and of antagonism between rail and bus operators. Coordination has been neglected, and no sustained national policy has been set to improve matters^{29,30}. London and the large provincial conurbations do have planning

authorities, but even there development of integrated networks has been hampered by the fact that delivery of services is in the hands of private operators with their own agendas³¹. A rail+bus link may involve different owning groups that are disinclined to cooperate, or the rail and bus divisions of the same group whose cultures have never been brought together³².

2.3 The auditing exercise

Modification of the timetable is evaluated with the aid of software known as *MOIRA*. This compares an existing and a proposed timetable in terms of generalised journey times, applies elasticities derived from empirical research and presents estimates of the increase or decrease in the number of journeys and the revenue generated. The methodology is established as an industry standard for limited changes, but it is being refreshed and is known to be inadequate where substantial redesign is envisaged. Importantly for this discussion, it highlights the revenue flows that interest one profit-maximising player and does little to encourage a network perspective.

Passenger Transport Networks [PTN] was therefore invited by the Association of Train Operating Companies [ATOC] to examine ways in which an audit of the timetable might be conducted³³. Although the results are no more than tentative we would argue that the issue now merits resources and commitment equal to those devoted to measuring performance.

Two analytical approaches appeared fruitful. One devises heuristic metrics that will facilitate understanding of those characteristics of a service that influence decisions to choose rail. If the results reported here are credible a second step would be automated calculation across a large set of place-pairs (*relations*) to provide data for parameters to be tested in demand models³⁴. The other approach addresses the issue of the timings of services at interchanges. Both are computationally straightforward, using standard *Excel* spreadsheets.

For the main exercise the timetable offer for each selected pair of places was entered into a template. Each Opportunity to Travel [OTT] is defined by its departure time, its arrival time and the times at any intermediate station where a change of train is necessary. We derived the data from the National Rail on-line journey planner, supplemented by reference to the printed timetable book. Because some timetables include OTTs that are atypically slow and/or require an exceptional number of changes provision was made for excluding them from the analysis on the grounds of marginal relevance for travellers between that pair³⁵.

A set of formulae were then written into the spreadsheet. Among the measures were:

- number of OTTs,
- mean journey time and speed,
- first departure and last arrival,
- the coefficient of variation of journey time,
- mean number of changes,
- mean duration of waits, wait time as a proportion of journey time,

- percentage mean time saving if interchange times were reduced,
- mean departure and arrival intervals,
- variation of intervals,
- an index of timing variation derived from the minutes used for departure and arrival times,
- ratio of rail time : road time, and
- indicators of directional differences (since many timetables are not symmetrical).

Table 1 presents an extract of the results, with exceptional values colour-coded.

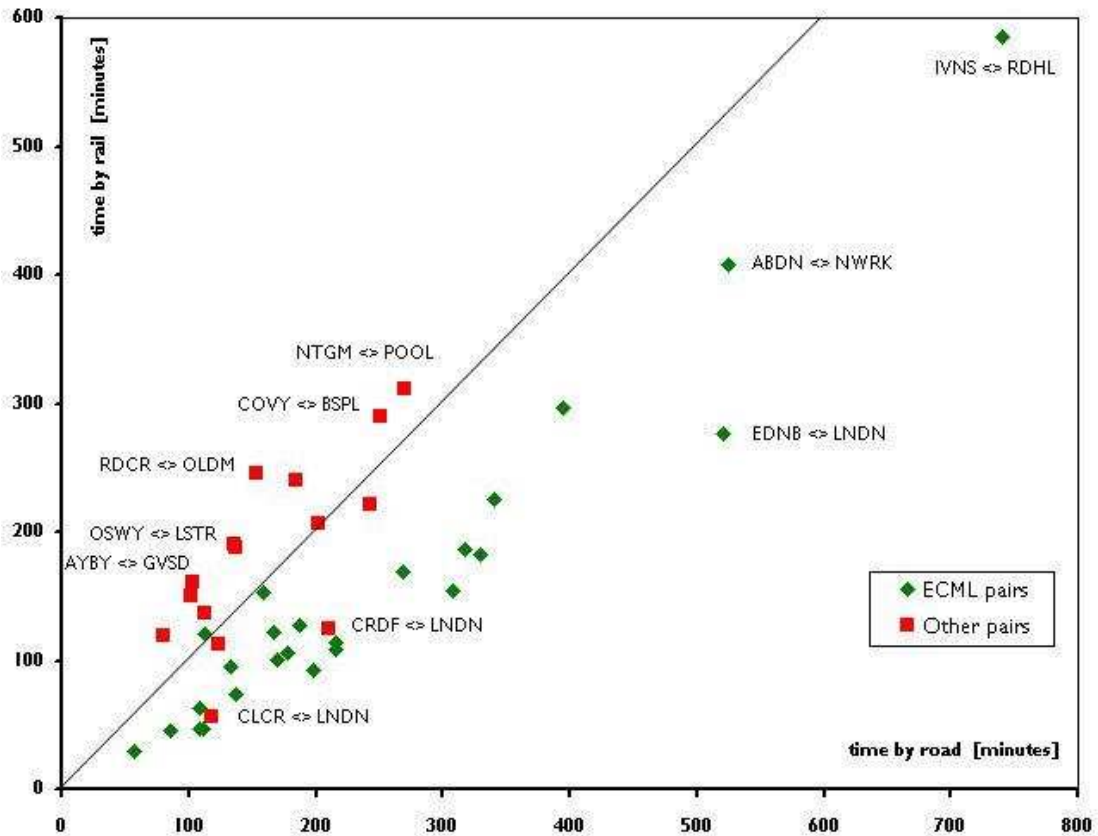
Few people would consciously perceive the timetable in these terms. However, they do reflect specific features of the offer that will evoke responses, especially where a traveller has an alternative mode available or may be considering whether to make the journey at all. One sub-set of combinations was drawn from the East Coast Main Line [ECML] in order to identify issues for redesigning its timetable. The other was a (tiny) illustrative random sample from an approximate matrix of inter-urban flows by all modes across Britain. This wants considerable refinement, but the point to bear in mind is that while each relation may only generate a trivial flow it represents a large number of flows that collectively make up a substantial volume of mobility ³⁶.

The dominant impression from the analysis is how variable the offer is. ECML London flows and many of its intermediate pairs have fast and frequent services, although others, while still fast, are characterised by erratic provision because the timetable is not a repeating standard hour and bunching of departures reduces effective frequency ³⁷. By contrast the general sample displays a huge range, from the high-frequency regional links in South East England and other main lines connecting major cities with London to cross-country routes involving capricious running times, poor coordination at interchanges ³⁸ and sometimes much slower trains ³⁹.

At the top end journey-times are comfortably superior to what is possible by road. At the bottom end mean times are well below the road time – see Figure 1. What is more, many place-pair timetables contain unattractive intervals and variable interchange schemes or have weaknesses such as late first or early last trains. The mean duration of interchanges is 19 minutes. If systematic timetabling could bring that value closer to European norms perhaps 6% of journey-time could be saved – at rather less cost than through engineering solutions. The findings plainly derive from relative unconcern about the timetable and a lack of interest in establishing and applying consistent quality, both reinforced by fragmentation. This should prompt a debate about the implications for railway investment priorities.

Two incidental findings also throw light on attitudes within the industry. When preparing the data for relations involving an inter-terminal transfer across London we found not only that the journey-planner presents the timings in a strange manner but also that it incorporates a generous allowance. The former may discourage the traveller unfamiliar with the transfer, the latter certainly undersells the offer for the majority of people ⁴⁰. This has been

Figure 1 : Relative times by rail and road for inter-urban journeys



explained, including tests of more realistic timings⁴¹, but no one has yet responded – which may again suggest that the timetable is not perceived as important.

A second finding is equally significant. Analysis of interchange timings must build in the standard minimum allowance for the physical transfer and the agreed margin for slight disruption. These values are however larger in Britain than elsewhere in Europe, and some, rather than reflecting typical circumstances, are notoriously extended in order to cover the railway against most eventualities. In one by no means unusual case the journey-planner directs passengers to an appreciably slower service than that in the timetable plan. And as with the cross-London transfers it has proved difficult to interest the TOC in the issue: the exchange of letters highlighted its concern for performance rather than for selling an excellent service⁴².

Organisation of interchange times at a junction reflects the attention paid to optimising the offer⁴³. Hence the audit also included a methodology for evaluating the arrival and departure times of supposedly connecting services at any station. A spreadsheet records those pairs that provide a transfer opportunity, as well as any additional trains that form part of either service. Inbuilt expressions then calculate not only the mean transfer time but also the extent of failures to connect, together with various derivatives. Readers familiar with structured timetables devised by institutions imbued with a sense of network connectivity may find it difficult to comprehend the call for this

analysis, but it is imperative in illustrating what non-integrated planning can lead to.

Table 2 and Figures 2 and 3 demonstrate the problem. The combination of independent operators, unpatterned timetables with random arrivals and departures, the disjunction between timetabling and the interchange allowances that can exacerbate the problem and the absence of any policy to improve planning – all this creates outcomes that are sometimes acceptable but more often are indifferent and may be indefensibly bad. Admittedly the case-studies chosen include some notorious locations, but these are among the busiest in Britain – and everyday experience in planning journeys often reveals OTTs made mediocre by lengthy transfers (and just-missed trains), despite all the evidence about the perceived time-penalty for extended waits.

Table 2 : Analysis of connectional timings at interchange stations : summary of results

interchange station	connectional allowance	flow	timetable period	direction	arrivals	departures	OTTs	CER *	waiting times in excess of allowance										failure to connect net of allowance		
									minimum	median	mean	maximum	coefficient of variation	0 to 4 min	5 to 9 min	10 to 19 min	20 to 29 min	>= 30 min	1 to 5 min	6 to 10 min	x
									min.	min.	min.	min.		-	%	%	%	%	%	%	%
York	8	ECML north <=> Harrogate	06/07	south	36	18	18	100	0	9	8	16	26	17	39	44	0	0	61	22	17
		Durham <=> Harrogate	06/07	north	17	33	17	100	0	2	4	20	49	64	18	12	6	0	53	35	12
				south	35	18	18	100	5	22	17	28	27	0	17	28	55	0	33	33	34
Hull	5	Bridlington <=> Leeds	06/07	north	16	33	16	100	0	7	11	36	60	30	31	13	13	13	50	44	6
				west	25	16	13	81	3	7	13	39	69	15	55	0	15	15	23	15	62
				east	15	24	13	87	4	13	19	66	79	8	39	15	23	15	0	0	100
			09	west	25	17	13	76	4	7	13	42	71	15	47	15	8	15	38	0	62
				east	15	25	13	87	3	12	19	64	79	8	39	15	23	15	0	0	100
Peterborough	8	ECML north <=> East Anglia	1996	south	33	34	25	76	0	13	11	26	46	32	16	32	20	0	32	44	24
				north	33	36	27	82	0	10	10	44	49	30	15	44	7	4	33	33	34
			09	south	46	42	33	79	0	6	7	25	40	33	46	12	9	0	43	36	21
				north	40	50	34	85	1	11	12	35	45	29	18	24	26	3	82	15	3
Carlisle	8	Cambridge > Leeds	09	north	35	31	27	87	0	22	17	35	40	19	11	19	47	4	74	19	7
		Tyne Valley <=> Cumbrian Coast	09	west	15	14	12	86	5	26	30	60	48	0	8	25	25	42	17	0	83
				east	15	15	11	73	4	31	30	50	41	9	0	18	18	55	0	18	82
Preston	10	Blackburn <=> Birmingham NS	06/07	south	31	16	15	94	2	8	9	43	47	7	79	7	0	7	0	0	100
				north	16	32	15	94	3	8	12	44	57	13	60	7	7	13	13	13	74
	8		09	south	33	16	15	94	0	9	8	19	23	13	80	7	0	0	0	0	100
				north	18	35	15	83	23	23	24	46	18	0	0	0	93	7	93	0	7
	10	Blackburn <=> London Euston	06/07	south	31	15	13	87	5	7	11	34	46	0	77	0	15	8	31	8	61
				north	17	34	15	88	6	6	7	13	13	0	87	13	0	0	0	13	87
	8		09	south	33	19	14	74	12	18	16	23	12	0	0	93	7	0	21	79	0
				north	18	33	15	83	0	8	11	46	69	27	53	7	0	13	13	0	87
Birmingham New St	12	Nottingham <=> Bristol Temple M.	09	south	33	31	29	94	4	6	5	7	6	45	55	0	0	0	3	0	97
				north	30	32	28	93	9	11	12	51	31	0	4	88	4	4	0	14	86
Derby	10	Sheffield <=> Stoke-on-Trent	06/07	south	36	16	15	94	3	16	15	35	28	7	7	72	7	7	74	13	13
				north	16	34	16	100	0	24	20	31	31	13	6	6	69	6	87	0	13
			09	south	36	15	15	100	0	4	3	6	10	80	20	0	0	0	0	0	100
				north	15	34	15	100	2	10	9	11	11	7	27	66	0	0	13	67	20

* CER = Connectional Efficiency Ratio [OTTs / lower of arrivals and departures, as a percentage]

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>> average average << average

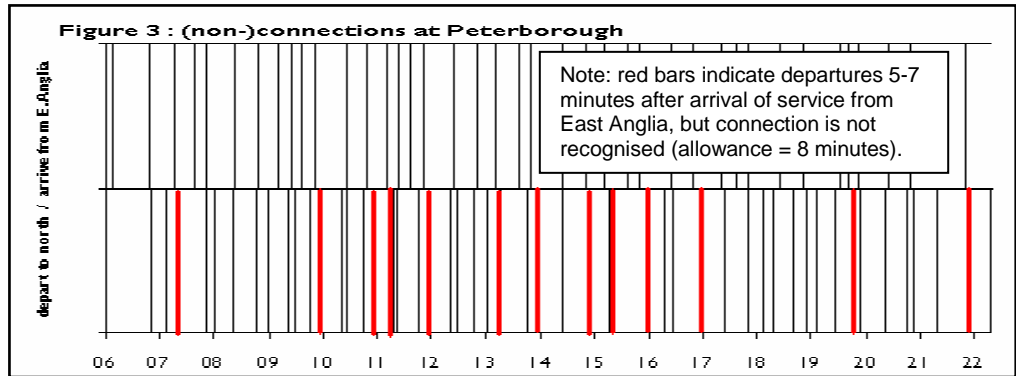
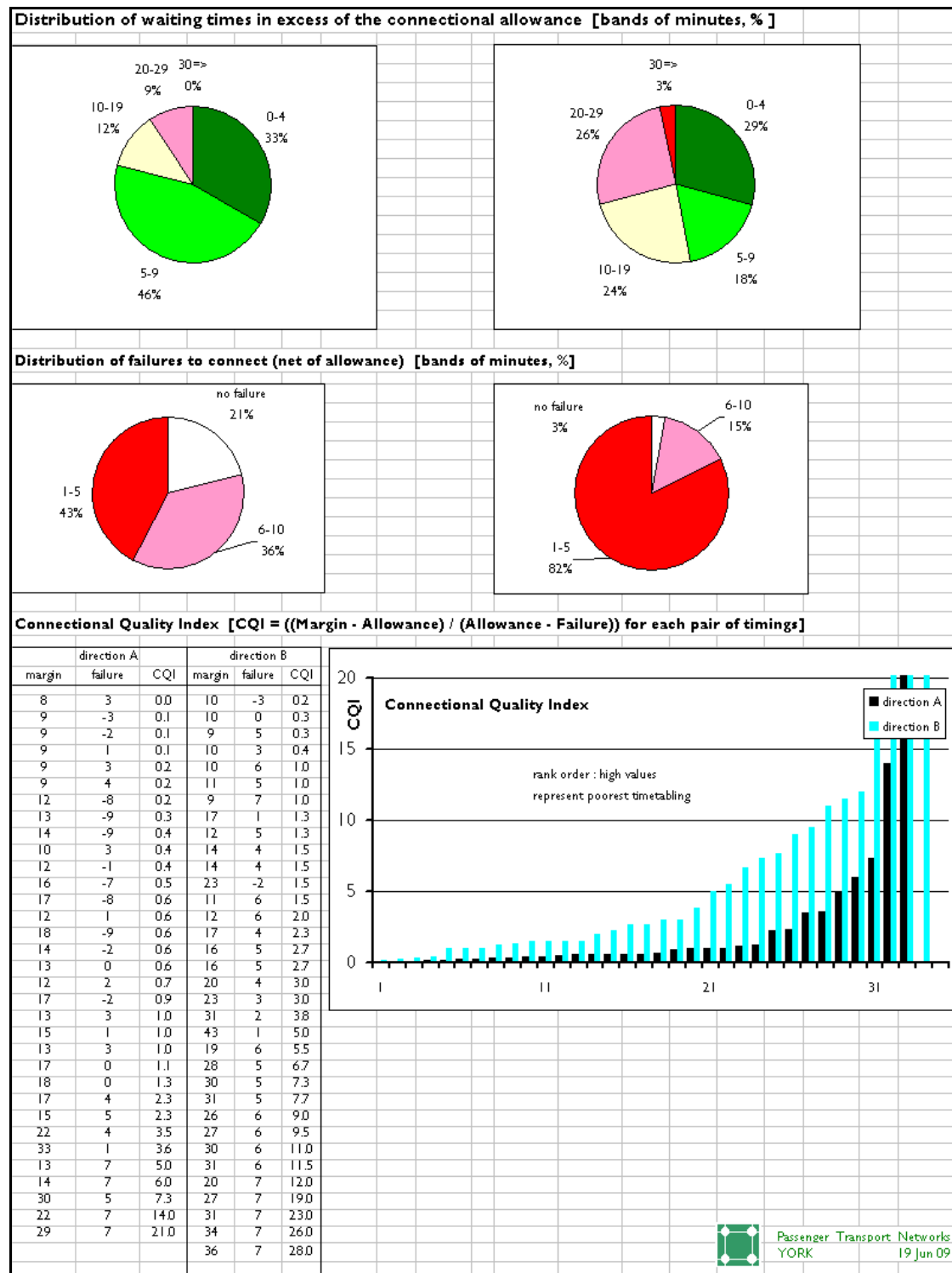


Figure 2 : Analysis of connectional timings at interchange stations																		
Station :		Peterborough																
Interchange :		ECML north > East Anglia										Interchange : East Anglia > ECML north						
Connectional allowance :		8		NRT Tables : 26 + 17 (also 14)														
southbound		connectional		distribution							northbound		connectional		distribution			
train arrives	train departs	notes	margin min	failure min	margins			failures	train arrives	train departs	notes	margin min	failure min	margins		failures		
06:58	07:10	d06:27	12	-8	8	arrivals	-9		06:08	06:51		43	1	9	arrivals	-3		
07:18	07:35	a06:37	17	-2	9	46	-9		06:50	07:06		16	5	9	40	-2		
07:37	07:46		9	1	9	departures	-9	net of		07:21				10	departures	0	net of	
07:45					9	42	-8	allowance	07:16		a07:25			10	50	1	allowance	
08:03	08:18		15	1	9	OTTs	-8	1 to 5	07:39	07:51		12	5	10	OTTs	1	1 to 5	
08:32	08:54		22	4	9	33	-7	14	07:51	08:01		10	0	10	34	2	28	
08:50	08:59		9	4	10	CER [%]	-3	6 to 10		08:21				11	CER [%]	3	6 to 10	
	09:18				12	79	-2	12	08:23	08:46		23	-2	11	85	3	5	
09:26	09:40		14	-2	12				08:49	08:59		10	-3	12		4		
	09:45				12	net of	-2	net of	09:11	09:21		10	3	12	net of	4	net of	
09:47					12	allowance	-1	allowance		09:28				14	allowance	4	allowance	
10:05	10:18		13	3	13	min	0	17	09:25					14	min	4	11	
10:15					13	-0	0	17	09:37	09:47		10	6	16	1	5	10	
10:36	10:44		8	3	13	median	0	17		09:57				16	median	5	8	
	10:58				13	6	1	16	09:51	10:21		30	6	17	11	5	7	
10:57					13	mean	1	16		10:27				17	mean	5	7	
11:06	11:18		12	2	14	7	1	15	10:26	10:45		19	6	19	12	5	6	
11:16	11:38		22	7	14	max	1	11		10:56				20	max	5	5	
11:31	11:45		14	7	14	25	2	10	10:50	11:17		27	6	20	35	5	5	
11:48	12:18		30	5	15	cv	3	10	11:11	11:23		12	6	23	cv	5	4	
12:13					15	40	3	10	11:24					23	45	6	4	
12:28	12:43		15	5	16		3	9	11:37	11:46		9	5	26		6	4	
12:46	12:55		9	-3	17	count	3	8		11:56				27	count	6	4	
13:05	13:18		13	7	17	net of	3	8	11:51	12:21		30	5	27	net of	6	3	
13:11	13:40		29	7	17	allowance	4	8		12:27				28	allowance	6	3	
	13:45				17	0 to 4	4	7	12:24	12:47		23	3	30	0 to 4	6	3	
13:42		a14:02			18	11	4	7	12:50	13:01		11	6	30	10	6	3	
14:09	14:18		9	3	18	5 to 9	5	7		13:17				31	5 to 9	6	3	
14:40					22	15	5	7	13:11		a13:25			31	6	7	3	
14:42	14:52		10	3	22	10 to 19	7	6	13:37	13:46		9	7	31	10 to 19	7	3	
14:49					29	4	7	5		13:58				31	8	7	3	
15:05	15:18		13	3	30	20 to 29	7	5	13:51	14:25		34	7	34	20 to 29	7	2	
15:22	15:35		13	0	33	3	7	5	14:25	14:56		31	6	36	9	7	2	
	15:45					>= 30		5	14:50	15:16		26	6	43	>= 30	7	2	
15:45						0		5	15:11		a15:25				1		2	
16:01	16:18		17	0				4	15:37	15:57		20	7				2	
16:18	16:36		18	0				4	15:50	16:17		27	7				2	
16:47		a16:51						4		16:26							2	
17:04	17:18		14	-9				3	16:25	16:56		31	7				2	
17:27	17:45		18	-9				3	16:49	17:25		36	7				1	
18:01	18:18		17	-8				1	17:21		a17:27						1	
18:26	18:42		16	-7				1	17:37	17:51		14	4				1	
	18:59							1	17:50	18:07		17	1				1	
19:06	19:18		12	-1				1		18:17							1	
19:19						equiv			18:25	18:39		14	4				1	
19:25	19:37		12	1		pre-allow				18:54								
	19:46					ranges			18:50	19:07		17	4					
19:45	20:18		33	1		8				19:25								
20:27						12			19:31	19:47		16	5					
20:46	20:59		13	-9		13			19:42	19:53		11	5					
21:09	21:18		9	-2		17			19:51	20:22		31	2					
21:20	21:37		17	4		18			20:26	20:46		20	4					
	22:18	d22:05				27				20:53								
22:14						28			20:49	21:20		31	5					
22:58						37				21:54	a21:58							
						38			21:49	22:17	d22:47	28	5					

Source : NRT (MP version) dated 17 May 09 to 12 Dec 09
Arrivals : all ICEC services north of PTRB
Departures : all services via ELY
Notes : includes additional XC services shown in NRT but not in fact operating

Arrivals : all services via ELY
Departures : all ICEC services north of PTRB

Figure 2, continued



3. CHANGING THE EAST COAST MAIN LINE TIMETABLE

3.1 History and process

The East Coast Main Line connects Edinburgh, Newcastle, York, Leeds and London. As a function of its geography it carries fewer passengers than the West Coast Main Line but more passenger-kilometres⁴⁴. It has a long history

of fast running. Unlike the West Coast, which was rebuilt and electrified in two big stages in the mid-1960s and mid-1970s, ECML was improved incrementally, first when diesel locomotives replaced steam, then, dramatically, when a fleet of powerful purpose-built diesels was introduced, then again with the advent of 200-km/h diesel unit trains and finally with the electrification completed in 1991. Each stage was accompanied by infrastructure works to facilitate sustained running at line speed.

In 1991 a recast timetable made the best use of the new electric trains and of the HSTs retained to serve places off the electrified core. Since then the London service has been augmented to cater for a growing market while the associated services north of Doncaster have been progressively expanded, partly in response to demand but also in recognition of the importance of frequency. Yet none of these changes has precipitated a comprehensive overhaul, and many have eroded the original pattern⁴⁵. The result is a timetable universally acknowledged to be poor as an offer and inefficient in deploying capacity. The saga of attempts to change it is an object-lesson in how not to run a railway.

First, the players. The InterCity East Coast [ICEC] service to/from London forms one franchise⁴⁶. A second covers the (outer) suburban trains that share the tracks into London⁴⁷. Two more provide inter-regional services that link north-east England and Yorkshire with the cities west of the Pennines and with the Midlands and southern England respectively⁴⁸. A fifth runs local trains across northern England⁴⁹, a sixth most trains in Scotland⁵⁰, and two more cross the ECML at the important junction of Peterborough⁵¹. Several freight operators also use the route.

DfT specifies the terms of each franchise and lets it for a given period. Franchises are not agreements to deliver products or services to controlled standards under a common brand, in the manner of some well-recognised retail and service-sector chains. DfT does lay down standards, but they are selective, do not include the key feature of the timetable and presume that the winning bidder will impose its corporate image to add to an ever-changing patchwork. Equally, franchises are not management contracts, since both cost and revenue risk remains in theory with the franchisee⁵² and since some aspects are left to the company's discretion.

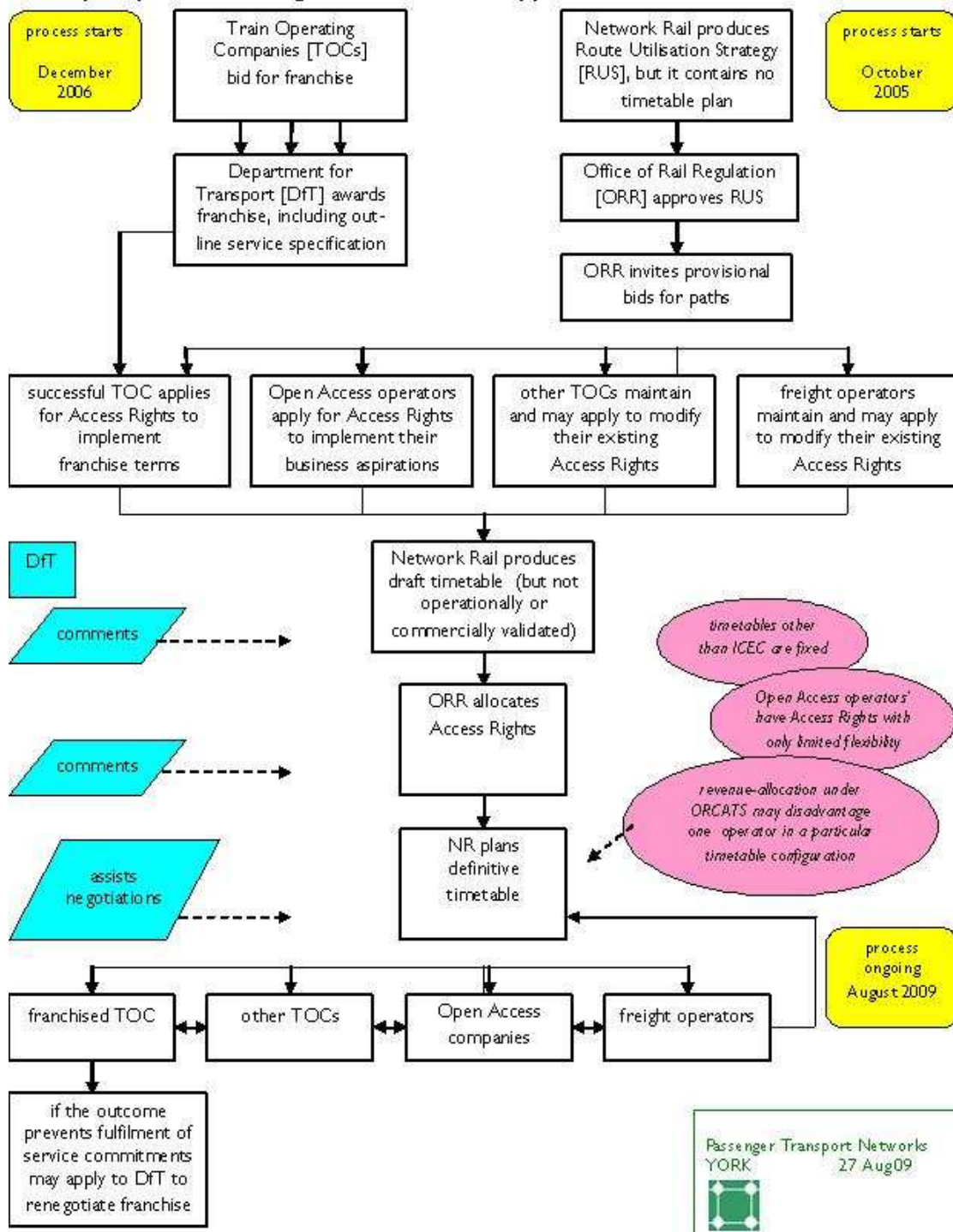
In respect of timetabling the role of ORR then makes these somewhat unusual agreements even odder. The theory of the separation of track and trains is that independent operators bid for the paths they deem necessary for their respective businesses, that ORR determines whether capacity is available (and what action should ensue if it is not) and grants access rights accordingly, that Network Rail must meet 'reasonable requirements' and turn these rights into a timetable, and that ORR acts as the referee in the (likely) event of disputes. Users, local governments and the public at large have virtually no role in this process.

Initially it worked passably well. Changes did occur, some non-franchise passenger operations were approved, and competition developed between freight operators. However, it became increasingly apparent that its intensely legalistic structure inhibits recasting of services⁵³ while rising demand highlighted shortfalls in capacity. These issues coincided on ECML. Earlier

recasts had been on largely self-contained sub-networks such as the South West services centred on London Waterloo, but here there were interactions between ICEC and six other passenger operators. And ECML has longstanding deficiencies in its infrastructure.

These were identified in 2005⁵⁴ and confirmed in 2008 by a Route Utilisation Strategy [RUS] conducted by Network Rail, but NR was so sensitive about usurping ORR's functions that the RUS was devoid of timetable studies⁵⁵.

Figure 4 :
The capacity-allocation regime as it has been applied on the East Coast Main Line



ORR then invited “anyone with intentions to apply for new access rights or the extension of existing access rights” to provide appropriate information in order to enable Network Rail to undertake a “capacity and performance assessment”⁵⁶. The franchisee specified its mandated obligations, and three open-access operators applied⁵⁷, along with the other TOCs and the freight companies. Figure 4 outlines these and subsequent stages.

NR’s assessment was not deemed to entail an operationally- and commercially-validated timetable and what was produced was barely credible⁵⁸. Following less-than-transparent analysis⁵⁹ ORR awarded access rights. Only then did serious timetable planning begin. Because rights are not necessarily compatible⁶⁰ and because the rules do not allow the pre-existing paths of the other franchisees to be changed other than marginally, the task is proving difficult⁶¹. It is not certain that a new timetable of any distinction will materialise by the target change-date of December 2010⁶².

The alternative to this convoluted process, of which this is merely a simplified account, is to acknowledge the fundamental status of the timetable. At the strategic level the concept of the service-offer that will be required at some horizon-date drives the planning system and infrastructure priorities, as it appears to have done successfully in Switzerland for several decades⁶³. And at the operational level detailed planning responds to both market and capacity-utilisation factors without being bound by arbitrary constraints arising from a legal straightjacket. To complement the audit exercise PTN was asked to demonstrate this approach. The work was undertaken with the *Viriato* software that underpins the *Taktfahrplan*⁶⁴.

3.2 Measuring capacity : theory and reality

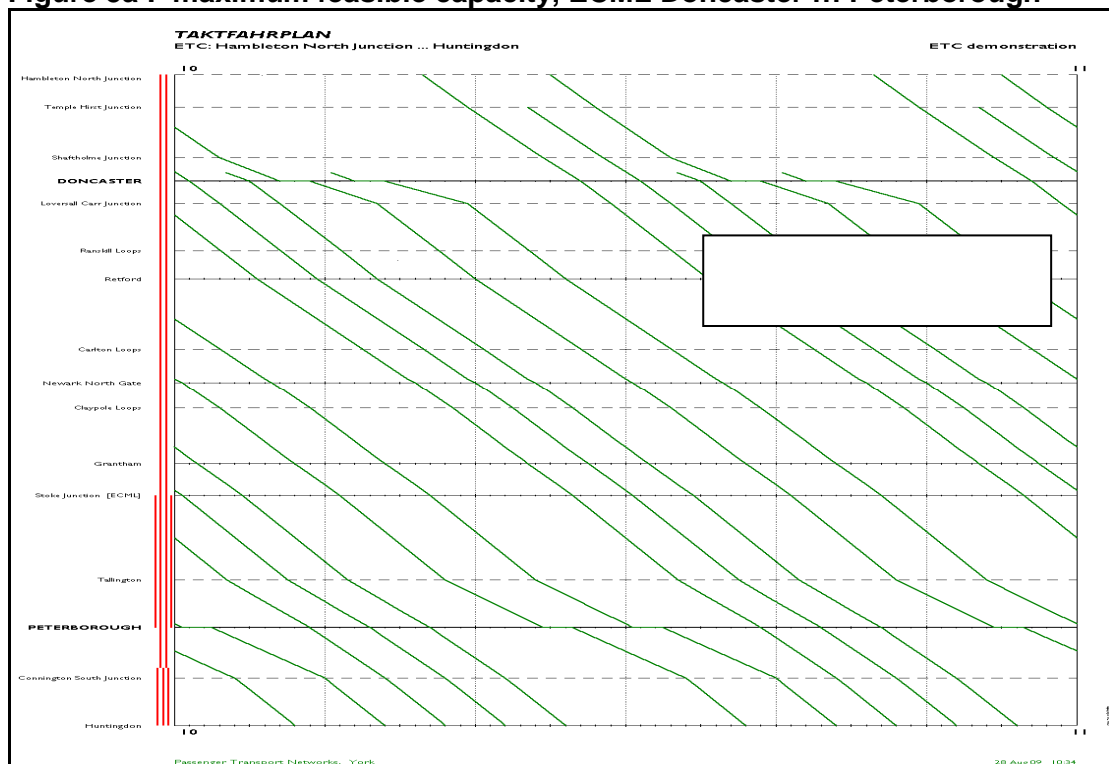
Separation of infrastructure and operations within regulated regimes has spawned a mini-industry dedicated to measuring the ‘capacity’ of a railway: in theory, free markets guided by regulators will achieve optimal use of numerically-defined capacity⁶⁵. Simple lines with homogeneous traffic – urban metros and specialised freight routes – may yield unambiguous data, but most lines are elements of networks with junctions and stations that complicate flows and cause conflicts, and many carry a mix of traffic⁶⁶. This makes it difficult to conceive, let alone calculate, numbers remotely comparable with airport slots. And the preoccupation deflects attention from the fact that nominal paths have little value unless they offer users an acceptable service⁶⁷.

This is illustrated by an example from the ECML case-study. For passenger trains the 128-km section between Doncaster and Peterborough is essentially a 2-track railway. Its topography rules out any overtaking by one long-distance train of another⁶⁸. The headway between trains for planning purposes is 4 minutes⁶⁹, giving a notional throughput of 15 express passenger trains per hour. That cannot be realised because of two limitations: the configuration of a junction at Doncaster and the platforms at Peterborough⁷⁰ (where all or most trains must stop⁷¹). Together these extend the achievable headway to 6 minutes, ie. 10 trains/hour (Figure 5a). Another critical matter then has to be considered.

Three intermediate stations serve medium-sized towns. Their needs and the traffic they generate are modest compared with the dominant long-distance flows, but neither are they trivial ⁷². The trunk flows presently support four trains/hour. Inserting selective stops in these trains at the three stations (as now) secures fast London timings but haphazard links with other places, while longer-distance travellers typically have 5 minutes added to journey-times for each stop and some trains become overcrowded. Eight paths/hour are available in total (Figure 5b).

In demand terms a more logical scheme is to introduce two additional services (which volumes now or soon probably justify) calling every half-hour at all three stations. Provided that these are carefully timed relative to the primary services this would optimise connectivity for the three towns. It is a quite different plan from a succession of non-stop trains and necessarily eliminates paths, but it is well-attuned to demand with four fast, two stopping and two spare paths (and possibly space for one freight per hour, unlike the selective solution) (Figure 5c).

Figure 5a : maximum feasible capacity, ECML Doncaster ... Peterborough



Now obviously the infrastructure could be rebuilt (at considerable cost) to remove or ameliorate the constraints, but, if an economic case existed for more paths, planning issues on other sections would also have to be recognised. On the ECML the layout south of Peterborough has a section that can only pass 8 long-distance services in a peak hour, since 10 outer-suburban trains take up the other available paths ⁷³ – and removal of that bottleneck would be expensive. In other words, this account of market requirements and real limitations demonstrates that abstract numbers

measuring capacity are of little value. What matters is the interplay between them that leads, on the basis of planners' best evaluations and judgments, to a particular service structure. The number of paths is then merely a derivative.

Figure 5b : capacity with selective intermediate stops, Doncaster Peterborough

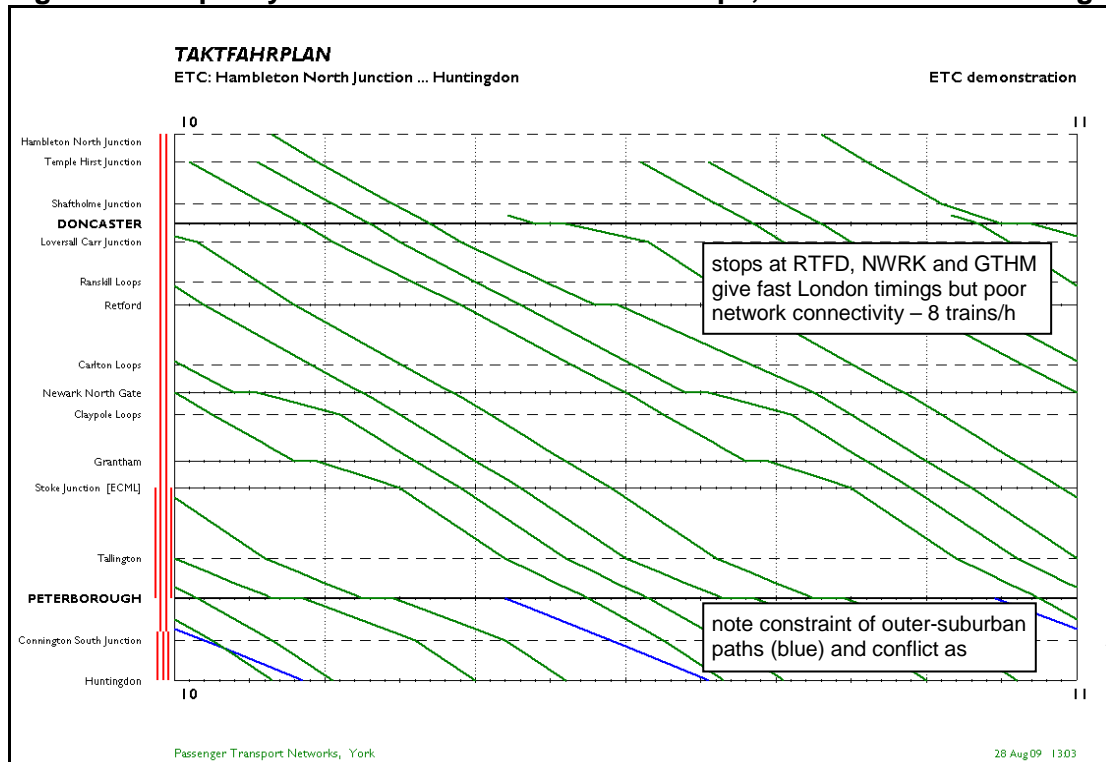
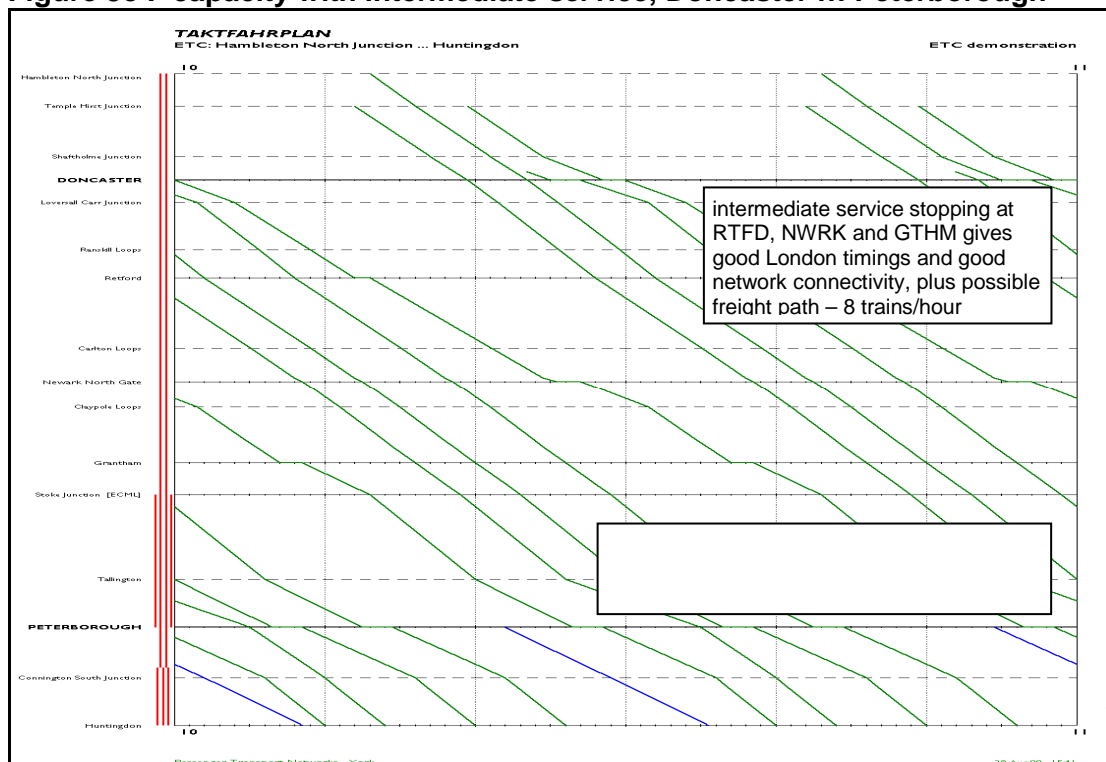


Figure 5c : capacity with intermediate service, Doncaster ... Peterborough



3.3 A *Taktfahrplan* for the East Coast Main Line

Taktfahrplan refers to the offered service itself, but the word also expresses the underlying concept of an ideal timetable. This comprises three principles:

- optimised connectivity achieved by means of a highly articulated network;
- each direction timed as the mirror-image of the opposite direction; and
- adherence to standard patterns repeating every hour ⁷⁴.

An ECML timetable was constructed according to these principles (and assuming a clean sheet) ⁷⁵.

Current expectations and volumes justify two trains/hour between Newcastle and London. Some pattern and capacity considerations indicate them having identical timings, but the weightier consideration is that one should have few stops and that the other should provide direct links for intermediate places. The faster train is the hourly Edinburgh <> London service ⁷⁶. Similar reasoning leads to a few-stops and several-stops alternation of the 2 trains/h Leeds <> London service. Given the relationship with the half-hourly cycle of the outer-suburban service ⁷⁷ it is then logical that the two faster trains should have identical paths 30 minutes apart over their common section, and likewise the two slower trains. Moreover there are both track-utilisation and connectional benefits in running a fast and slow pair close together ⁷⁸. The intermediate-stations service is timed around the four core trains.

Connectivity goals next compelled careful disposition relative to the ICEC services of two regional services on the Birmingham route and four on the trans-Pennine route: the challenge was to secure both attractive interchange timings and a balanced frequency on shared sections ⁷⁹. It is accepted that paths that optimise ECML may not be compatible with other paths at major stations such as Manchester Piccadilly and Birmingham New Street, but this is a matter of coverage and feedback-loops rather than an inherent weakness of the methodology. Finally, local services were revised to standardise their timings and improve connections with the main line ⁸⁰.

The work rigorously followed NR's operational rules ⁸¹ and accepted running times determined by the existing rolling-stock. Paths were arranged for open-access operators, although suggestions were made about how their trains could complement the franchise services rather better than they do at present⁸². The resulting timetable was therefore comparable with that prepared to assist ORR in its access decisions. In many respects it was sounder.

Both were evaluated through the standard *MOIRA* procedure. The PTN timetable showed an annual revenue advantage of at least £15-20 million ⁸³. Yet it has been ignored. DfT is so preoccupied with managing the franchises and so reluctant to challenge ORR that it is slow to interest itself in researching the timetabling component of integration. ORR has no thought for networks, since its mindset emphasises competition and perceives services, or even individual trains, as self-contained entities ⁸⁴. It also jealously guards its role in determining access rights, although its processes are cumbersome and demonstrably do not maximise the public interest.

Network Rail converts access rights into a workable plan but has no standing as a visionary leader in timetabling philosophy⁸⁵. Each train company has its own interests to pursue and franchise commitments to fulfil, and few senior managers have the time, incentive, scope or status to conceive a better *national* network. ATOC is primarily a trade association administering routines such as revenue-sharing and technical cooperation: it has shown little inclination to put pressure on its constituents to integrate services. The possibility of *Taktfahrplan Britain* therefore languishes for lack of a champion, its potential benefits denied by institutional paralysis.

4. WHY TIMETABLING MATTERS

4.1 Current issues

We now switch lines to address some fundamental concerns about the future of the railway to which we believe timetabling is highly relevant. In this chapter we assume acceptance of the contemporary social and, above all, environmental justification for promoting public transport. In the following chapter we take a more radical stance still. It is clear to us that this fluid context should be shifting the ethos of planning, and thus of timetabling, back from the 'supermarket' model toward the 'public service' model and the aim of creating a transport system that attracts a fast-rising modal share through its spread, cohesion and quality⁸⁶.

the timetable and modal choice

The first concern is the interaction between the timetable perceived by the traveller and their modal choice. Plainly that perception varies greatly as a function of personal circumstances and the nature of the particular journey. Regular passengers will typically expect frequent services that secure convenience and flexibility, and those who have to travel at short notice will be frustrated by infrequency or irregularity⁸⁷. Customers committing discretionary spending to an occasional journey may be influenced by bargain fares to select specific departures, with the overall timetable having limited significance. On most routes, though, the need for frequent departures is paramount, given the 'frequency' of the ever-ready car for the majority of users.

Although the number of trains on many lines has increased, bunched departures, odd gaps, evening variations and poorly-arranged connections often weaken the effect. Britain has no policy on frequency⁸⁸, and competitively-unattractive hourly services still exist. Rail's market share appears to be singularly low on most non-London flows, in great contrast to its share of London flows⁸⁹. The evaluation tools are applied to scattered initiatives but have never been used for a systematic review across the country to build desirable patterns⁹⁰: references to 'regular intervals', 'standard hours' and 'clockface'⁹¹ timings are commonplace and believed to attract customers⁹², but they have not become firmly embedded in the culture and are often neglected in practice⁹³.

fragmented presentation and marketing

Sequentially reviewing each franchise as it comes up for renewal reinforces the fragmentation of the railway. Each TOC tends to be preoccupied with 'its' customers. There is little sense of the wider network⁹⁴, and the operating groups treat their own branding as a hallmark of entrepreneurial qualities⁹⁵. This has led to a confusing plethora of graphic styles, to single-operator timetables that do not display the complete service on shared sections, and to parsimonious reference to connecting services. Equally, almost all marketing, whether it be of the timetable itself, or of special offers or of ideas for trips, is focussed on within-route travel⁹⁶. Even quite substantial flows involving more than one operator get little attention⁹⁷.

timetabling strategy as the key to integrated, multi-modal public transport

Better integration between rail and bus is commonly proposed in Britain. Three aspects merit consideration. First, a dedicated effort needs to be made to improve arrangements wherever significant interchange occurs: sometimes infrastructure alterations could enhance the physical transfer and often day-to-day management could be improved, but neither is worthwhile unless timetable planning achieves brisk (but realistic) connections. However, reliance on local initiatives will fail to deliver much unless it takes place within a strong national framework⁹⁸.

Second is the issue of network structure. The rail network has missing links⁹⁹, the express coach network partly competes with rail and partly complements it but as a separate entity, and bus services are distinct again¹⁰⁰, though patchily complementary to rail. This is no way to give people confidence in the capability of *public transport* as a convenient means of making many, let alone the majority of their longer-distance journeys. Multi-mode journeys involve too much organisation and research to attract any but the dedicated¹⁰¹. A single mode-neutral network would give meaning to the concept of integration, even though it might well continue to be delivered by different operators.

Third, for a number of reasons – affection for railways rooted deep in the psyche, the apparent permanence of rail compared with the bus, historic differences in comfort and performance, political pusillanimity – rail lines and stations are fiercely protected. Even when on any rational assessment buses could provide a superior service¹⁰² at a lower cost, closure of a line or station is blocked. Joint planning for public transport might assist in achieving more sensible outcomes than perpetuating the past, especially where selective station closures would enable a line to concentrate on its principal markets¹⁰³.

timetabling as a tool in long-term planning

Although a funding crisis may curtail it an immense infrastructure programme for Britain's railway has been agreed between the Government, ORR and Network Rail¹⁰⁴. In addition, large new fleets of rolling stock are being commissioned, and a fresh wave of electrification is now planned. Evaluation of each project involves some concept of the timetable it will facilitate but not necessarily much detail, and proposals may develop in parallel but not always consistently¹⁰⁵. There is no equivalent of the Swiss *Bahn 2000* timetable-driven masterplan¹⁰⁶. On the East Coast Main Line any number of ideas exist

for enhancing infrastructure yet some are being progressed and others set aside without any firm idea of a future timetable. This creates the risk of misplaced investment, both on a grand scale and in respect of the layouts of stations to be rebuilt ¹⁰⁷.

4.2 A National Timetabling Authority

On all these counts, taken together with the institutional flaws, the findings of the audit and the ECML exercise, there rests the case for a National Timetabling Authority [NTA]. Its immediate purpose would be to correct the failure of the present process to create a 'good' timetable for every route and a truly coordinated timetable at the network level. In the longer term it would conceive, research and implement a vision for a comprehensive, high-connectivity system of trains and buses capable of striking popular imagination. It would gradually create so much more positive a perception that substantial shifts away from pro-car presumptions really would occur ¹⁰⁸. No lesser an ambition is acceptable in the face of contemporary challenges.

An NTA would resolve a principal weakness in the prevailing franchise model. In theory a franchisee has the freedom to apply the competencies of a private company to the development of the business. Practice has belied this. Rather more probably turns on the quality and attitudes of management and the scope it is accorded than on whether the organisation is a private company or in the public sector. Furthermore, preoccupation with shareholder-value and big-company politics has sometimes (and inevitably) got the better of responsibility toward customers or the wider interests of stakeholders. Thus the story of change is mixed. And the nature of a railway as a complex system properly inhibits actions that could have a disproportionate impact on the whole. It would be an act of candour to admit that the simplistic approach is obsolete.

In any event the reality is that the DfT specifies franchises in great detail. 'Micro-management' is much criticised, but DfT has not adopted this position solely because ministers and civil servants seek to control. It has done so because large sums of taxpayers' money are at stake, because the record of companies in achieving more loosely-specified objectives was unimpressive, and because the role of the timetable in determining costs, the interest of many parties in what is offered and the interactions with other services all predicate a high degree of specification. Yet DfT never sets out a precise timetable since the notion has to be maintained of a commercial transaction between the entrepreneurial TOC and Network Rail, overseen by ORR ¹⁰⁹.

Practice varies from franchise to franchise, but the tensions to which the process has given rise, the uncoordinated results and the ECML debacle indicate the desirability of modifying the model. A single authority specifying the timetable would codify what DfT comes close to doing but never quite does, with the potential advantage of a unifying theme, greater clarity and a greatly improved *network*. It would also be able to address the problem that the present process is not conducive to impartial analysis of priorities and trade-offs in deploying scarce capacity.

The effect would be that a franchise would become a contract to deliver a specified service to the standard required. Other benefits could follow, for example the establishment of a national brand ¹¹⁰, an end to the distracting and unproductive upheavals that occur every time a franchise changes hands, and the opportunity to break the contracts down into smaller units so that the range of bidders is widened ¹¹¹.

This may be an idea whose time has come for other reasons. Belief that lightly-regulated markets will necessarily deliver optimal outcomes in the communal interest has been undermined both by global economic events and by growing awareness of their inadequacy in the face of coming problems ¹¹². In the case of the railways any unprejudiced balancing of the gains and losses from privatisation does not unequivocally find in its favour ¹¹³. Meanwhile the fragility of franchises in the financial turmoil is prompting various players to ponder the delivery-contract model, since it leaves the risk of fluctuating demand for an essential public service with the state while encouraging companies to perform well in respect of the quality of travellers' experience ¹¹⁴. It is unlikely that there would not be beneficial competition for the concessions¹¹⁵.

Another perceived defect is the short term of most franchises ¹¹⁶. The fashionable response is to argue for longer terms, perhaps twenty years, thereby giving the franchisee a sounder basis for investment. This appears to have merit, but it does presuppose that the investments that a private company will make will automatically be for the public good. That does not follow, and indeed they could be undesirable ¹¹⁷. Regularly-renewed management contracts, with their holders supervising projects designed as components of a national plan, seem more likely to achieve the best result for the community.

There are precedents for the proposed scheme. It is similar to that used successfully for bus services in London ¹¹⁸, to the concessions under which buses and some trains are operated in a number of European countries, and to the form of the Merseyrail and London Overground franchises. The Scottish Government is responsible for the ScotRail franchise: this has enabled it to determine services in detail and to insist on a Scottish identity ¹¹⁹. Above all, centralised planning is effectively adopted for rail services throughout mainland Europe in recognition of the intrinsic characteristics of a railway system.

In Switzerland the state railway leads a consensual process of timetable planning that involves numerous small operators and collaborates with government at national and cantonal level ¹²⁰. Services in the German *Länder* are prescribed by their governments and delivered under contract. In The Netherlands a consortium comprising the infrastructure owner and the principal passenger company together with the holders of regional concessions and the freight operators recast the national timetable in what they identified as the balanced interests of all parties and then sought and won government approval ¹²¹. And positions are changing even in France, which has long been considered antipathetic to pattern and regularity in its timetables ¹²².

EU rules cannot, it would seem, be construed as preventing comprehensive planning of the timetable to make optimal use of capacity and secure a service in the overall public interest ¹²³. It was Britain's choice to create a disjointed market-driven structure whose drawbacks are now apparent. If it is failing that decision can be reversed. It is not immutable.

Whether an NTA would need primary legislation is a moot point, but one which should be examined in the light of the potential benefits ¹²⁴. Since DfT could presumably choose to be more dirigiste in how it specifies the timetable when inviting franchise bids the principal question would be the role of ORR. That body already has to have regard to the Government funds available for the railway. In addition, the Secretary of State has the power to give it general guidance about railway services ¹²⁵. In the current version, for example, ORR is reminded that the Secretary can specify objectives and standards during the quinquennial review of access charges and is asked to assist the franchising regime with regard to access rights ¹²⁶. Such clauses could be strengthened in respect of timetable planning. It is also germane that ORR has a duty to contribute to the achievement of sustainable development, which should surely be taken to include the enhancement of rail's market share through better timetabling ¹²⁷.

Setting up an NTA would need care. It must be independent of all the actors, while taking their interests and purposes into account: those of DfT in respect of policy, of Network Rail in regard to operating discipline, capacity utilisation and performance, and of the TOCs and freight companies in respect of their aspirations ¹²⁸. It would take over the scarce timetabling expertise presently scattered across the industry and commonly wasted on duplicated work and aborted schemes. The emphasis would be on consensus, but visionary leadership would be essential to secure the right balance between stability and innovation. Its governance should be inclusive, with participation not only from the railway actors but also from local government, user groups and (non-parochial) campaigners for better public transport. And ideally it should facilitate coordinated timing with and within the coach and bus industry (and ferries) ¹²⁹.

A complementary role for an NTA should be to improve timetable information in both traditional media and in websites. The former would benefit from fresh thinking by competent graphic designers, and the task would of course be easier if timetables really did have sustained standard patterns with a minimum of exceptions. Education in reading timetables is also vital in influencing behaviour in favour of trains and buses ¹³⁰. As for websites, lazy assumptions about the undoubted wonders and extensive use of the new technology have led to journey-planners becoming cluttered with excessive detail and not always being easy to read. Moreover, most planners only display the options for the requested journey and thus fail to market the service as a whole: how much better if they explained that a pattern repeats throughout the day or engaged in cross-selling by showing the range of destinations available from the user's origin station ¹³¹.

5. THE *DEEP GREEN* FUTURE AND PUBLIC TRANSPORT'S TASK

5.1 Green perspectives

We introduce here some doubts about the railway's green claims and suggest some other scenarios that must be considered. It has become commonplace to boost the case for investment and expansion by accentuating rail's environmental credentials. Comparisons between trains on the one hand and cars, planes and lorries on the other are fraught with technical difficulties, but it is probably fair to say that – in whole-life terms for existing lines and measuring per passenger- or tonne-kilometre by properly correcting for load-factors – the balance of evidence does indeed favour rail in respect of many external factors and particularly of climate-changing emissions. However, though that is what rail proponents choose to stress, it is not the full story.

First, averages must not conceal cases where rail's advantage is lost in poor utilisation, for example the almost-empty train whose customers would be better served by a more frequent bus, or the local train catering for discretionary trips at low fares whose operation blocks a path for a heavy freight train. Second, that heavy freight may itself be suspect in a broader framework of environmental concern, even if it is well-justified as an alternative to a fleet of lorries, for example if it is conveying coal to a carbon-intensive power station, if it is stuffed with short-life goods produced in cheap-labour countries in an unsustainable mode of resource-hungry production, or if it is conveying water in plastic bottles, the long-distance movement of which will be seen by future generations as one of the most symbolic ecological irresponsibilities of late consumerism.

A still larger challenge to cherished assumptions is already apparent. A growing body of data suggests that the practicable production of oil may be peaking and going into decline. In the context of a way of life dependent on oil and a continuing upward trend in world consumption that trend foreshadows upheaval on a scale that technological fixes and government action will struggle to contain¹³². At the same time alarm about the impact of anthropogenic changes in the climate seems likely to grow, resulting in ever-tighter restrictions on the burning of fossil fuel (or dire consequences if they are not enforced). And it is obvious that the planet does not have the ecological resilience or the material resources to sustain ever-expanding consumption *and* a growing population. Humans have already exceeded its sustainable carrying capacity.

It is not difficult to construct from these fundamental factors a grim scenario of collapse and chaos. Nonetheless, it is imperative to believe that such outcomes can be averted. There are countless ways in which that will be achieved, but the volume of resources that transport absorbs, the central role of personal mobility and the mass movement of goods must mean that re-planning transport systems will be a principal task. Uncertainty will not make it easy, but to work exclusively with business-as-usual scenarios would surely be a profound mistake.

5.2 Deep green scenarios and future timetables

What might be called a 'deep green' future will lead to a contraction in mobility arising from direct economic effects and from wider social transformations. Cities will change ¹³³. As the rising price of energy influences life-decisions about homes, schools and jobs commuting journeys will shorten. Business travel will be reduced as costs encourage greater use of telecommunications. And leisure journeys will perforce be curtailed in frequency and length. Among the effects could be the demise of short-haul flights (because volumes will no longer support the business model), and a growing demand for improved rail services for short- and medium-distance journeys. Car-ownership may fall, as the cost of use rises and makes the overhead charges less bearable, resulting in higher expectations of the opportunities to travel by bus and train.

In parallel the freight market could change dramatically. The global dispersal of production and the cheap bulk transport on which it depends will become increasingly untenable ¹³⁴. However, more localised production in smaller units would favour the ever-flexible lorry over the volume-hungry train. The run-down of coal-burning and the elimination of environmentally unsustainable products could further erode the railfreight business. Planning that builds on a single, growthist trajectory is likely to fail. For this reason the preoccupation of the EU and of some British interests with reordering the railway to accommodate long-haul freight that is a function of a discredited economic model is misguided ¹³⁵. Indeed, it can be argued that the railway should concentrate on delivering a quality passenger service.

These trends counsel caution about the enthusiasm for building high-speed lines. Multiple constraints on extravagant lifestyles will curtail demand for the type of journey for which they are designed. The demise of air services would remove the impetus toward high speed itself and make present norms of fast running more acceptable. Nor is a scheme that will absorb large quantities of energy in its construction and only deliver substantial energy-saving and emission-reductions more than a decade ahead relevant to the call for urgent action now ¹³⁶.

Changes in the structure of the market will place more emphasis on superior everyday connectivity across regional sub-networks than on big-city links at high speed – again, rediscovery of the public service model. A complementary study is needed of the benefits of a programme to greatly narrow the differences in quality that contribute to the wide variation in rail's modal share noted earlier ¹³⁷, and in particular of the sustainability gains in transferring car journeys rather than stimulating new travel ¹³⁸. A range of scenarios should be created and analysed ¹³⁹ before Britain rushes headlong into high-speed strategies built on obsolete assumptions ¹⁴⁰.

This is where we come back to timetabling. It would be thoroughly hubristic to suggest that better timetabling can solve the world's problems, but it would also be negligent to ignore its role in transport planning. As our Swiss colleagues have shown, a precise concept of a timetable can both shape positive attitudes to public transport and give structure to a development programme. The same approach is practised to a greater or lesser extent in other countries in mainland Europe. It is absent in Britain, and that is one part

of the explanation for the low regard with which trains and buses are still held and the continuing disarray in transport policy.

In a truly sustainable economy and way of life the recent accent on individualism, consumption and choice will perforce give way to collaboration, resource-prudence and an acceptance of shared services. The communal modes of transport will be called upon to provide basic mobility for journeys beyond the reach of walking and cycling. Travel will be constrained by comparison with what we have become accustomed to, but it need not be a grey and parsimonious business. Among many other tasks ahead a clear philosophy of 'the good timetable' and a committed strategy to research, design and implement it could be an effective mechanism for shaping thought on what the transformation is going to mean and for examining the implications of various scenarios. Work should start now. Complacent statements that all is well will not do, and nor will insular reluctance to learn from Europe.

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NOTES

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³The story was told in a footnote to the obituary of Bill Oxburgh in *The Guardian*, 4 and 27 July 2009.

⁴Tyler, J & Hassard, R (1973). Gravity/elasticity models for the planning of the inter-urban rail passenger business. PTRC Annual Meeting, University of Sussex. Reprinted in: Nash, C, Wardman, M, Button, K & Nijkamp, P (eds.) (2002). *Classics in Transport Analysis: Railways*. Cheltenham: Edward Elgar.

⁵There was a digression into freight matters: Tyler, J (1995). Railfreight in Britain: beyond the wishful thinking. PTRC European Transport Forum, University of Warwick.

⁶Tyler, J (2003). Designing a better timetable for Britain's railway. Wardman, M, Shires, JD, Lythgoe, W & Tyler, J (2003). The benefits and demand impacts of regular train timetables. Both at European Transport Conference, Strasbourg.

⁷*Essence*: the indispensable and necessary attributes of a thing as opposed to those which it may have or not [Oxford English Dictionary, 2nd Edn.]; the most important ingredient, the crucial element [thefreedictionary.com].

⁸Little can be found on the Department for Transport website. The White Paper *Delivering a Sustainable Railway* and its supporting documents contain scattered references to the operational role of the timetable, but there is no discussion of its marketing function or any sense of its strategic potential [DfT (2007). Cm7176. See www.dft.gov.uk/about/strategy/whitepapers/whitepapercm7176/]. Eddington discusses bus timetabling (for the context see note 115) but does not examine integrated timetabling in general [HMSO (2006). The Eddington Transport Study. The case for action: Sir Rod Eddington's advice to Government. See www.dft.gov.uk/about/strategy/transportstrategy/eddingtontstudy/]. At the start of the Periodic Review 2008 (note 104, letter of 29 September 2006) ORR invited TOCs to consider whether "there [is] scope to deliver more from the existing network ...through radical approaches to demand management, capacity management and timetabling", but nothing of substance appears to have followed. In the final document the references to timetabling are purely technical and without any analysis of strategic objectives [ORR (2008). Periodic Review 2008 : Determination of Network Rail's outputs and funding for 2009-14. See www.rail-reg.gov.uk/server/show/nav.2106].

Passengerfocus, the 'independent passenger watchdog', has made sensible comments on specific timetable proposals but has not conducted a broader review. A recent document from NR and ATOC has stated that "it is important to look at the whole rail 'product' from the passenger's perspective, designing the full door-to-door journey and improving interchange and service integration to ensure that rail is easy to use and progressively becomes the mode of choice compared with air and road. Our vision thus includes journey time improvements [and] higher frequencies" [NR & ATOC (2009). Planning Ahead: Control Period 5 and beyond – Britain's railway from 2014. §2.2]. This is welcome, but it is not explicit about the function of the timetable and indeed it looks forward to it being redundant on high-frequency lines, which can only ever form part of the network.

⁹The basic facts of the timetable are of course published. However, the design of literature, posters, diagrams, electronic screens and websites conveying information about the service is often poor and shows little sign of being led by senior managers. Simple messages promoting the memorability of regular departure times are rarely seen even on lines where they exist, and the layout and distribution of the national timetable book is a monument to inertia and muddle. Many Continental railways have a strong tradition of clear, unified presentation of information in all media. No recent developments in Britain have been treated to anything matching the diagrammatic summary that *Neue Zürcher Zeitung* issued for the Swiss recast in 2004, and the British press shows little interest in what the railway offers as a public service (but an accident or scandal, a fares increase or financial crisis, a strike or a jobsworth story will quickly win attention).

¹⁰Plainly as frequencies rise the timetable becomes less relevant and the service is perceived as ‘turn-up-and-go’, but planning still matters since poor connections between frequent services can add disproportionately to overall journey times. The argument is sometimes made that real-time electronic communications are rendering timetables less important. This is a fallacy: devices are not always available, nor yet to everyone, they only help with certain types of travel, and no amount of technology can make up for inadequate content.

¹¹Such as the market-day bus from a village to the nearest town, or services for schoolchildren.

¹²Because marketing, and especially the design of websites, is focussed on a particular journey rather than on how a set of services can underpin each citizen’s lifestyle. Train companies are selling seats in fixed-formation, fixed-interval trains. A typical personalised message from a TOC reads “Who says all good things must come to an end ? Now you can carry on the summer fun with great value fares from just £6.25. Plus you could win a family trip to London’s West End for curtain-up at a dazzling musical, or even experience travel with a twist on our train driving simulator. So take your chance and plan autumn in advance !”. The company never presents the speed and frequency of its complete timetable as a ready alternative for trips that people assume they will make by car, even though there is at least anecdotal evidence of widespread ignorance of how good many railway services are. See www.dft.gov.uk/pgr/sustainable/travelplans/ptp/areviewoftheeffectivenessofp5773?page=8 for some other suggestive evidence. The supermarket analogy is valid despite the impression such firms like to give of adaptation to customer demands: in practice their offer is primarily determined by the economics of what large-scale logistics can supply.

¹³See ¶4.1.1 and note 86.

¹⁴The Commission for Integrated Transport was established following the 1998 White Paper entitled *Integrated Transport* “to provide independent advice to Government on the implementation of integrated transport policy”. It has produced important work but has not achieved a breakthrough to European standards of integration in the delivery of public transport services. It does not appear to have specifically studied timetabling.

¹⁵*Bradshaw’s Guide*, the collected timetables of all the companies, became a national institution but was also lampooned [Lee, CE (1961). Farewell to “Bradshaw”. *Railway Magazine*, 107, 308-312. And Esbester, M (2009). Nineteenth-Century Timetables and the History of Reading. *Book History*, 12, pp. 156-185]. A cartoon from *Punch* of 1882 is reproduced at www.wandleys.demon.co.uk/punch11.htm (passengers could be troublesome too !).

¹⁶There was a lively debate on timetabling and related issues in *British Transport Review*, a quasi-academic journal published by the British Transport Commission in the 1950s. It is disheartening to read the articles now since so little happened.

¹⁷*Nederlandse Spoorwegen* [NS] developed a plan for their main lines in 1934 (including a rationalisation of intermediate stations), with a hierarchy of trunk expresses, *stoptreinen* on the main lines and branch services, coherent cycles (2-hourly, hourly, ½-hourly) and tight connections. Alternating pairing of paths either side of major junctions such as Amersfoort and Utrecht gave passengers the choice of through trains or changing but with identical journey times [Betlem, HPB (1953). Recasting of timetables. *British Transport Review*, vol. 2, pp. 510-519 (the article contains an early attempt to show a complex pattern of interlocking services in a single diagram)].

¹⁸It is no accident that Germany, The Netherlands and Switzerland account for nearly half the members of the International Association of Railway Operations Research [IAROR]. Britain does rank fourth, but only two of its members are from a TOC and none is from Network Rail.

¹⁹And ironically by that time probably among the most efficient of European railways.

²⁰The changes were implemented by the Railways Act 1993. The Council Directive was 91/440/EEC.

²¹Originally the Office of the Rail Regulator – the renaming reflected changes in its structure introduced by Part 2 of the Railways and Transport Safety Act 2003.

²²ORR has “a duty to exercise [its] functions ... in the manner which [it] considers best calculated” [to fulfil specified objectives] [Railways Act 1993, 4(1)]. This wording has the effect that the statutes do not lay down any priority among the objectives and that ORR has discretion in balancing them. They include “to promote measures designed to facilitate the making by passengers of journeys which involve use of the services of more than one

passenger service operator” [1993, 4(1)(e)] and “to contribute to the development of an integrated system of transport” [4(1)(ba), added by the Transport Act 2000, 224(2)(c)]. It is not clear how these are to be reconciled with the 1993 objective “to promote competition in the provision of railway services” [4(1)(d)], although “for the benefit of users of railway services” was pointedly appended in 2000 [224(2)(d)].

²³Its charging structure is based on train movements, and it cannot discriminate between operators.

²⁴The Network Code governs the bilateral access contract between Network Rail and a holder of access rights [see www.networkrail.co.uk/asp/116.aspx]. It is overseen by ORR. Part D covers Timetable Change. Under Conditions D2A.1.3 “Network Rail shall facilitate and co-ordinate dialogue with all Bidders in order to identify opportunities to develop strategic initiatives and to promote network benefits such as connections, complementary service patterns and efficiency of operation” (the wording is repeated at D3.1.1(c) except for the last phrase). Condition D6 covers the ‘decision criteria’ to which NR is required to have regard when planning the timetable; they are explicitly not prioritised. Clause (f) refers to “maintaining and improving connections between railway passenger services”. No evidence has been found of significant or sustained application of these clauses, and a search of the ORR website yielded no reference to any initiative or enforcement action on timetabling.

²⁵When it held the ICEC franchise GNER took the (probably correct) view that no business case could be made for extending its operations to off-route centres (its rolling stock would for example have not been the most suitable). However it conspicuously failed to work with related operators to offer joint arrangements through well-managed interchanges, even running road coaches in competition with them. It is likely that this helped to pave the way for open-access companies, particularly since they could trade on communities’ sense that the principal operator had ignored them. Contributing to the problem is the fact that information systems highlight station <> station flows and do not contain a standard zoning process to aggregate the many small flows. Analysis of the 1999 CAPRI ticket database [held by PTN from the project reported in 2003, see note 6] shows that sales of simple Newcastle to London tickets only account for 60% of the revenue accruing from journeys from Newcastle and the local stations that feed it to or via London (using informed judgments about routing). About two-thirds of the other 40% is explained by zonal add-on tickets for which the aggregation process is not known. The feeder stations add 4.4% to the total Newcastle revenue, and the via-London travel adds 11.5% to the London revenue (these are minima since some travellers hold separate tickets for each leg rather than through tickets).

²⁶Revenue from a multi-operator ticket is distributed between TOCs through the ORCATS [*Operational Research Computer Allocation of Tickets to Services*] process roughly in proportion to the passenger-km of each segment. The return to a long-distance operator from an increase in journeys from and to a feeder line may be useful but is dwarfed by the income from its principal inter-city flows. The return to the feeder operator may be small and hence seem not worth the organisational effort. No one is responsible for the whole-railway benefits.

²⁷The cost of the bureaucracy is unknown but is believed to be high. On a railway laden with interactions the results can never be at all precise, although that does not inhibit cash flows in compensation that can be large enough to influence managerial priorities. The rules are also open to abuse: in order to ‘improve’ the statistics train companies and NR add extravagant allowances for delays, especially to the section-time approaching the final destination at which alone punctuality is measured. This practice is operationally unsound too, and it offsets the gains from expensive schemes designed in part to accelerate services.

²⁸Because performance analysis is driven by ORR’s scrutiny of NR and by DfT interest in franchisees’ operational competence it is focussed on recording the timekeeping of trains. It does not sample the experience of passengers: lateness at intermediate stations and the consequences of broken connections are not analysed.

²⁹NR and ATOC agree that “there is need to plan integration [of the complete end-to-end journey] in a more active, systematic way than has sometimes been the case in the past”, but they go on to say that at a local level, “integration is about more than linking bus and train timetables” – as though that job were complete [NR & ATOC (2009), op. cit., §4.6]. See also notes 8, 30 and 98.

³⁰In 1999 the six main passenger transport groups, supported by many other bodies, formed the *Journey Solutions* [JS] partnership to improve integration between bus and train services. It has achieved a national through-ticket facility (*PlusBus*), but that has taken ten years and

no data appears to have been published on the crucial test of whether it has persuaded people out of their cars, either in place of a local bus trip or for the whole journey. With support from ATOC and DfT JS has published a report that recognises that “timely connections” are one of the “four main components to a successful multi-modal journey” and that passengers expect “timetables to provide reasonable connections between each mode”. However the report has nothing to say about the prevalent impression of poor timings and no proposals to address the issue (the one quoted ‘good-practice’ example is pathetically limited). This is a curious omission in an otherwise thorough review: perhaps a fractured industry has pushed timetable integration into the too-difficult box [Journey Solutions & ATOC (2009). *Door-to-door by public transport: improving integration between National Rail and other public transport services in Britain*].

³¹For example, some refuse to facilitate data-collection on their vehicles, and allegations of actions contemptuous of local opinion are often heard. Legislation to give local authorities some control of bus services has been dogged by restrictions imposed at the behest of the operators, with little progress relative to the effort expended. Better timetabling is an objective often cited, but few improvements are attributable to such interventions. Following the Local Transport Act 2008 no less than three schemes – namely voluntary partnership agreements, quality partnerships and quality contracts – are now available to local councils, but they also have to take into account complex competition law that can have perverse effects on timetable planning in the public interest. For the official position see the guidance and consultations at www.dft.gov.uk/pgr/regional/localtransportbill/.

³²Buses between Redruth Station and Helston were promoted by the independent *Truronian* as the *Helston Branch Line*. Now worked by First Devon & Cornwall [routes 33/34] the just-revised timetable relates poorly to the First Great Western trains, chiefly because they are irregular but also because of schoolday bus variations.

³³A senior manager commissioned the project, but it was not endorsed by the individual companies and it was somewhat overshadowed by the major effort devoted to the ECML, as described in the next chapter.

³⁴As in the earlier work, see Wardman et al. (2003), op. cit., §4.3 onwards.

³⁵It is acknowledged that ultimately this had to be subjective. In the work reported in the 1973 paper [*supra*] the author postulated the ‘rooftop’ algorithm in an attempt to remove the subjectivity. This continues to underpin both MOIRA and ORCATS, but it allocates some journeys even to the slowest OTT (whose trains usually have other functions unconnected with the place-pair under review) and is thus unsuitable in the present context.

³⁶For example, in broad terms the relation Coventry <> Barnstaple stands proxy for all travel between the West Midlands and all stations on the Barnstaple line that requires a change at Birmingham New Street. In 1999 the total volume was 1762 single-direction journeys, of which Coventry <> Barnstaple generated 399 (New Street generated 2726, to make a total of 4488) [source: CAPRI, see note 25]. This compound relation, having been selected at random, in turn stands for many similar relations (assuming sound selection). The numbers are of course small, but that begs the question of the historic effect of poor timetables on modal shares (see note 89).

³⁷As for example, southbound from Edinburgh with London departures at xx.00 and CrossCountry at xx.05.

³⁸Preston is an important junction on the West Coast Main Line [WCML]. To the east the towns of Blackburn, Accrington and Burnley have a population of about 300,000 served by an hourly regional service (York <> Blackpool North) and an hourly all-stations service (Colne <> Blackpool South). For historic and geographic (but no irremediable) reasons these towns have no through trains to/from Birmingham or London. Connections at Preston are therefore important. Before the complete recast of the WCML timetable in December 2008 median waits were acceptable though hardly ideal (6-8 minutes beyond the 8-minute allowance), although the non-mirror-image pattern meant that travellers used the regional train in one direction and the poor-quality stopper in the other. That anomaly has been removed, but median waits have become 8-9 minutes in one direction and 18 or 23 minutes in the other. Northbound the train from Birmingham arrives 3 minutes before the stopper leaves.

³⁹On the ECML mean station-to-station speeds all exceed 90 km/h (and the fastest 130 km/h). By contrast the mean for some cross-country timetables is around 50 km/h, with some flows across London being even slower.

⁴⁰The departure time from the London Underground [LU] platform at the arrival terminus is the same as the main-line arrival time, and arrival at the LU platform at the departure terminus may be the same as or only a few minutes before the main-line departure time. Enquirers are not advised what this means, and they have only a limited option for choosing a quicker transfer. The allowance protects the companies from charges of misleading the minority who may face impediments or be delayed.

⁴¹For King's Cross to Victoria the allowance between main-line arrival and first possible main-line departure is 41 minutes, with an option of 37 minutes. In normal circumstances a traveller reasonably familiar with the system can readily make the transfer in 25 minutes. It would be more positive marketing to apply shorter transfer times and to display a sequence of departures so that a user can judge the consequences of delay. Even for a long-distance trip the offered journey-time can be markedly reduced (eg. York to Sheerness-on-Sea by 10%).

⁴²The time at Sittingbourne between the arrival of a fast train from London and the departure of the branch train to Sheerness-on-Sea is an adequate 3 minutes and was so arranged when the Kent Coast pattern was last revised in 1993. Subsequently a 4-minute allowance was imposed and the 'connection' is now with the preceding semi-fast, which adds 24 minutes to an 80-minute journey (the layout of the junction is such that the branch train cannot leave until the fast has arrived – presumably regular travellers know that !). For London-bound journeys the fast (mirror-image) connection is slightly tighter because passengers have to cross a bridge, but it is normally achieved. It took several exchanges before Customer Relations at Southeastern even understood the point that a carefully-constructed and entirely-workable standard pattern can be nullified by its presentation in journey-planners. In December 2009 the timetable will be completely recast following the introduction of St Pancras services using High Speed Line 1. The journey-time between London and Sheerness will be faster than that now offered but 12-15 minutes slower than with the brisk connection planned in 1993. [National Rail Timetable, Table 212.]

⁴³No one seems to have produced a reliable estimate for the proportion of journeys that require a change of train, and in the absence of data issues tend to be overlooked. Modelled estimates from ticket sales [ORR (2009). Station usage data. See www.rail-reg.gov.uk/server/show/nav.1529] show that the total number of interchanges amounts to 14% of all 'entries' to the rail system, but this figure includes transfers to/from London Underground services for local journeys; without these it may be nearer 10%. Since about 35% of journeys involve a change require two (including cross-London transfers) and 5% three (using a guess from ticket data), the proportion of *journeys* that require a change is about 7%. However the Newcastle sample (note 25) indicates 15% (excluding local London transfers), and a small random sample drawn from CAPRI (note 25) suggests 11% (and maybe as high as 24% for longer-distance journeys). Outside South East England and the large conurbations the primary interchanges look after substantial numbers of transferring passengers: for example, Crewe 172/hour, Preston 159, Cardiff Central 149, Bristol Temple Meads 146 and York 131. All these figures will be underestimates since the division into distinct companies and the way the fares system works encourages purchase of separate tickets for each stage. This also distorts origin/destination data, making construction of a matrix of real flows difficult. And we do not know how many people reject rail because of negative perceptions of interchange (for a typical comment see Janet Street-Porter's column, *Daily Mail*, 10 August 2009, www.dailymail.co.uk/femail/article-1205413/).

⁴⁴National Express East Coast attracted 18.8 million journeys and 4695 million passenger-km in 2008-09, Virgin West Coast 23.0 and 4452. Mean journey lengths were 250 km and 194 km respectively. The mean train-load was 235 on the East and 150 on the West [ORR. National Rail Trends 2008-2009 Yearbook. Tables 8.13 and 8.19].

⁴⁵This was not notably regular, chiefly because intermediate calls varied. However, whereas 26 southbound departures from York ran at 15 different minutes past the hour, now the 31 departures use 20 different minutes.

⁴⁶ICEC was franchised to Great North Eastern Railway [GNER] in 1996. This was extended in 2003 and renewed in 2005, but GNER faced financial difficulties and withdrew in December 2006. The franchise was re-let from December 2007 to National Express. Its bid rested on optimistic growth forecasts that have not materialised, and the company has stated its intention to surrender the franchise later in 2009. The 'ICEC' phrase was used for the 2007 refranchising but has been misleadingly replaced by the more general 'ECML' in the 2009 statements.

⁴⁷First Capital Connect [FCC] operates between Cambridge and London (the Cambridge line joins the ECML at Hitchin) and Peterborough and London. These services might more properly be called regional, but they are here classified as suburban because of their large commuting flows. FCC also works an inner-suburban route.

⁴⁸TransPennine, another FirstGroup company, and CrossCountry, part of the Arriva Group.

⁴⁹Northern Trains, a partnership of the facilities group SERCO and NedRail, part of Nederlandse Spoorwegen.

⁵⁰First ScotRail. Anglo-Scottish trunk services are the main exception.

⁵¹CrossCountry (Cambridge <> Birmingham) and East Midlands Trains (Norwich <> Liverpool).

⁵²This is now being modified with so-called 'cap and collar' terms that provide for sharing of unforecast profits or losses between DfT and the franchisee after a given number of years.

⁵³At the start the Government's fear of the political reaction if companies reduced, decelerated or otherwise compromised services led to the imposition of Passenger Service Requirements [PSRs]. These specified minima, were based on the Summer 1994 timetable and ossified it until such time as a major project (for example the cross-country revision in 2002) or in some cases a new franchise created a momentum for change. On some lines it may be said that the service remains ossified – having been subjected to no radical reappraisal of purpose and priorities.

⁵⁴See www.rail-reg.gov.uk/upload/pdf/ECML_Review.PDF.

⁵⁵And even of any serious analysis of traffic flows [Network Rail (2009). East Coast Main Line: Route Utilisation Strategy. See www.networkrail.co.uk/asp/4449.aspx].

⁵⁶The documents are at www.rail-reg.gov.uk/server/show/nav.1993. Those from the earlier granting of paths for Grand Central's Sunderland service are at www.rail-reg.gov.uk/server/show/ConWebDoc.9364.

⁵⁷One of these was Platinum Trains. Its credentials were dubious, its funding was obscure, its plan was flawed and it had no operator's licence or safety case, yet such are the rules and ORR's welcome for challenges to the incumbent franchisee that its application for paths was treated with due solemnity. Unsurprisingly it was rejected, and the company has disappeared without trace.

⁵⁸Many timings were commercially undesirable, and paths contained excessive margins to make them fit at all. NR had allocated exiguous resources to the task, as though it was not its highest priority, yet it spent disproportionate effort on assessing the likely performance of this artificial construct. For an account of the process and the plan's failings see: Tyler, J (2008). Where next for the East Coast timetable? *Modern Railways*, December, pp. 51-53 (with an update in March 2009, pp. 12-13). ORR responded in a letter, April, p.32.

⁵⁹The 1993 Act established both the franchise scheme and open (ie. non-franchise) access, and neither then nor subsequently has there been any definitive resolution of the tension between them. ORR, being required to be mindful of DfT's finances, balances the revenue abstracted from a franchisee by a new open-access service against the generation of new business by the latter. The calculations are mechanistic and arcane and sometimes resemble angels-on-a-needle debates. By isolating selected flows for analysis the procedure lacks any vision of a collective offer for all the relations on a route (see also notes 62, 82 and 84). Some data is redacted before publication.

⁶⁰After some obfuscation and with some conditions ORR granted the rights needed by the franchise to fulfil its commitments (which had been designed more for tactical reasons to stave off competing applications than in accord with a coherent strategy for the route), but it also granted rights for four additional services to the Grand Central [GC] open-access company (some will run as Grand Northern). The ultimate owner of this company and its rolling stock is Sula Investments Ltd, registered in the British Virgin Islands. In its first full year of operation on the Sunderland route GC had a turnover of £7.15 million, operating expenses of £14.73 million and net interest charges of £1.20 million [details from Companies House, company no. 03979826]. Unlike the franchised companies open-access companies only pay variable charges to NR, despite the fact that paths are at a premium on ECML. The average load of their trains is also believed to be lower than that of the franchised services.

⁶¹It is also complicated by the way in which the ordering of trains on the graph can sharply affect the allocation of revenue between franchise and open-access operators. This is not the

first occasion on which train planning has been distorted by companies seeking to manipulate ORCATS to their financial advantage.

⁶²In a letter to the author dated 28 July 2009 Lord Andrew Adonis, the Secretary of State for Transport, wrote that "... living in York, you see a prime example of a disjointed timetable, and I agree that neither Network Rail nor the Office of Rail Regulation has achieved the necessary breakthrough to achieve the best use of the available capacity on the East Coast Main Line. The problem we now have to tackle is that too significant a proportion of the capacity has been allocated to open-access operators, making it difficult to timetable trains for the franchised operator that will deliver the accelerated journey times to Leeds, York, Newcastle and Edinburgh that we seek without damaging the frequencies to the intermediate stations on the route."

⁶³*Taktfahrplan* was conceived by three young operators in Swiss Federal Railways [SBB] in the late 1970s and implemented (after opposition from senior managers) in 1982. In 1987 a national referendum approved *Bahn 2000*, a plan to create six major interchange nodes with coordinated arrivals and departures, to achieve ideal timings between them through successive infrastructure enhancements and new rolling-stock (notably reducing the Zürich <> Bern transit to just less than 60 minutes) and to reconstruct the national timetable around this core. This was achieved in December 2004. Between 1995 and 2005 rail travel (excluding metros) increased by 38% in Switzerland (from a high base) compared with 44% in Britain. Swiss use of trains, coaches and buses in 2005 was 2907 km/person x year, compared with 1568 in Britain (1626 in The Netherlands and 1746 in Germany). The transport-policy reasons for this difference (and the associated higher modal share for public transport) need to be disentangled from undoubted socio-cultural reasons. [Source: DfT. Transport Statistics Great Britain. 2008 edition, Tables 10.1 and 10.6.] The SBB Group received CHF 2603.6 million (about £1505 million) in public funds in 2008, Britain's railway £6338 million in 2006-07: this equates to about £9.5 and £12.1 / train-km respectively [mct.sbb.ch/mct/en/konzernberichterstattung.pdf, p.2; ORR National Rail Trends, Table 6.2a; UIC Synopsis].

⁶⁴*Viriato* has been developed by SMA of Zürich. The author is immensely grateful to its staff for their training not just in using the program but also in Swiss thinking and methodology since becoming a licensee in 2000.

⁶⁵At the 3rd International Seminar on Railway Operations Modelling and Analysis [International Association of Railway Operations Research, Zürich, February 2009] five out of 35 papers were devoted to measuring capacity.

⁶⁶The Alpine Tunnels in Switzerland have a degree of homogeneity, since they have long sections without stations and a relatively limited range of train characteristics. Since trans-Alp freight traffic is of special concern to the EU and the subject of an important agreement with Switzerland it may be that this case coloured thinking. Certainly one of the principal functions of *trasse.ch* (see note 128) is to allocate the standard freight paths.

⁶⁷The Rail Technical Strategy [DfT (2007), Glossary] defined network capacity as "the number of trains that can operate on a rail network in a given time period, reflecting factors such as junction interactions, terminal capabilities, the mix of train speeds and the number and order of trains of different speed capabilities and stopping patterns called for by commercial or regulatory requirements". It also quoted The Institution of Railway Operators' definition: "The number of trains that can be incorporated into a timetable that is conflict-free, commercially attractive, compliant with regulatory requirements, and can be operated whilst meeting agreed performance targets in the face of anticipated levels of primary delay". These reflect real life. Network Rail has used a 'Capacity Utilisation Index' [CUI], described as "a measure of how much of the available capacity on a section of line is used by the train service", but not with much conviction for it goes on "whilst CUI is a useful measure, it is of limited value as a planning tool since it does not include all the factors that need to be considered to make a timetable work" [Network Rail (2008). ECML, op. cit., pp. 59-60]. In the latest RUS [Yorkshire and Humber (2009)] CUI only appears in the Glossary of Terms.

⁶⁸For the 38 km south of Stoke Junction there are four tracks, but the slow lines are only marginally relevant for passenger trains. There are up and down passenger loops at Retford, an up loop at Newark Northgate, a down loop at Grantham and separate through and platform lines at both Doncaster and Peterborough, but their configuration means that none can be used for a non-stop train to overtake a stopping train without a time penalty.

⁶⁹The signalling allows closer headways but conventionally a margin is built in to allow for perturbations.

⁷⁰At Marshgate Junction just north of Doncaster up (London-bound) trains from Leeds cross the path of down trains towards York; if they are stopping at Doncaster they also conflict with up trains from York that are not stopping. At Peterborough the twofold problem is that the two up platforms are not the sides of an island, thus making interchange less convenient if they are used alternately, and that while the down platform is an island it has to be shared with the east <> west trains.

⁷¹The crossing of the ECML with a primary east ... west route at Peterborough makes it about the eighteenth most important interchange in Britain outside South East England, with approximately 55 transfer-passengers per hour x direction. The transfer between ECML stations north of Peterborough and East Anglia is of roughly the same magnitude as the number of journeys to/from Peterborough itself [sources: see notes 43 and 25].

⁷²The three together generated 2.3 million trip-ends (entries and exits) in 2007-08; the figures for Doncaster and Peterborough were respectively 2.9 and 4.1 million [ORR (2009), see note 43]. The picture is different for journeys to/from London: Doncaster generates 193,000 return trips, Newark and Grantham about 215,000 each, Retford 43,000 and Peterborough 872,000 [Network Rail (2008). ECML, op. cit., p.29]. This is however misleading since the proportion of commuter travel increases with proximity to London (hence Doncaster originates rather more London journeys not on season tickets than Grantham).

⁷³The 4-track main line reduces to two tracks for 4.2 km between 38.4 and 34.2 km north of London, through the Welwyn tunnels and across a viaduct; Welwyn North station lies in the section. Effective capacity is deemed to be 16-17 trains/hour, but our analysis demonstrated that 18/h would be feasible with a more ordered sequence than now exists (the NR Rules of the Plan would not be infringed southbound and only to a marginal extent that ought to be acceptable, given the signalling, northbound). Resistance to 18 trains/h on performance grounds needs to be weighed against the huge cost and environmental sensitivity of 4-tracking at this location, bearing in mind too the fact that other major works would be necessary to take advantage of the capacity created. There is probably scope here for the real-time micro-management techniques that the Swiss Federal Railways are experimenting with on the difficult approaches to Luzern Hauptbahnhof. Dutch researchers are also exploring this idea, and Clive Roberts at the University of Birmingham has tentatively studied Cambridge Junction at Hitchin.

⁷⁴Connectivity is optimised by timing every service to be symmetrical around the zero-minute and by minimising interchange times at each node in the network in proportion to its importance for transfer passengers. Thus for any departure time D the arrival time A in the opposite direction will be (60 - D), eg. xx:04 and xx:56 or xx:15 and xx:45. At key nodes all-ways interchange is minimised by arranging for services to have D small and A large, whereas a secondary train feeding a departure at xx:15 will mean a long wait for those going forward on the service arriving at xx:45. This explains why Swiss timetablers stress that timings should be "as fast as necessary, not as fast as possible". The more frequent the services the more nodes will provide additional interchanges around xx:30 or even xx:15 and 45. In this scheme it is essential that services run at frequencies of 120 / 60 / 30 / 15 / 7.5 minutes, for otherwise meets become inconsistent. As far as is practical additional peak trains are overlain on the standard hour rather than an altogether different pattern being introduced. To the Swiss the logic and benefits of this concept are so patently significant that planning is entirely guided by these principles (see note 63).

⁷⁵Pathing of freight trains was examined, but doubts about the forecasts and a paucity of reliable information about their running characteristics made it difficult. In any case, it is economically and environmentally essential to ensure that the ECML fulfils its primary function as a trunk passenger route. PTN's analysis suggests that that would be compromised by attending to the more demanding expectations of freight interests for day-time paths.

⁷⁶Because of (self-inflicted) constraints on pathing NR is proposing that the Anglo-Scottish trains should take the slower Newcastle path. This is unacceptable to the franchisee and to Transport for Scotland, and it may be covered by Condition D6(g) of the Network Code which excludes 'material deterioration' of service patterns.

⁷⁷Between Cambridge and London and Peterborough and London intermediate stations are served by 2 trains/hour, one 'semi-fast' and the other a 'stopper'. They are arranged so that

southbound the Cambridge semi feeds at Stevenage into the Peterborough stopper and the Peterborough semi into the Cambridge stopper (and mirror-image northbound). Each pair of semi-fast or stopper paths is spaced at exact 30-minute intervals (except for some historic detailed variation and modified arrangements in the peak periods). This gives a half-hourly frequency between station-pairs such as Royston <-> Welwyn Garden City, alternating through or with an easy change but similar journey-times. There is also a half-hourly non-stop train between Cambridge and London. The layout of the Cambridge line means that the relationship between the six trains in every hour is highly constrained: this has a major, but not always understood, impact on the pathing of ICEC services.

⁷⁸A spreadsheet was devised to find the best practicable spread of the departure and arrival times for each geographic pair in order to retain the appeal of a half-hourly frequency despite the running-time difference.

⁷⁹In the Summer 2009 timetable 5 trains/hour (from three TOCs) run from York to Newcastle upon Tyne, but they are so arranged as to leave a 30-minute gap in every hour (that would weaken marketing as a 'turn-up-and-go' service if the industry would but think in such terms). Similarly the standard hours of two operators serving the York <-> Leeds flow (one of the largest outside the London area) are so placed as to give westbound intervals of 12, 4, 14 and 30 minutes. It is not suggested that all such anomalies could be removed by central planning, but the ECML case-study has unequivocally demonstrated that many can be. Unless this is grasped and TOCs stop thinking in 'silos' Britain will not have a timetable that maximises the potential of the train-kilometres being run.

⁸⁰For an account of this exercise see: Tyler, J (2008). Perfect timing: an East Coast *Taktfahrplan*? *Rail Professional*, July, pp. 24-26.

⁸¹With a few defined exceptions. Field observation of everyday operations revealed cases of excessive and capacity-wasting caution in certain margins (for example, of a fast train following a train stopping at Huntingdon). We also showed that although the proposed timetable would work with four tracks between Alexandra Palace and Finsbury Park it would work a great deal better with six (as is now planned by upgrading two non-passenger lines).

⁸²The approach that ORR has chosen to adopt for approving access rights for open-access services (see notes 22 and 59) leads to decisions that make no sense in terms of the convenience of the network. Hull Trains [HT] needed to bolster its business case by adding to the revenue it would generate from providing through Humberside <-> London trains a certain amount abstracted from the incumbent franchisee on the ECML. ORR therefore decreed that HT could stop at Doncaster, Retford and Grantham but not at Newark and Peterborough. This creates numerous anomalies. Our proposal is that a half-hourly train should call at all five stations, of which one every two hours should be operated by HT. Eleven diagrams (rosters) for train-sets would cover the draft service with rapid turnrounds at London King's Cross, but should these be judged too short, solutions would be resource-inefficient with two operators.

⁸³This represents 2% net growth on all affected flows; on some non-London relations and on feeder services growth would exceed 10% - a much-needed boost to their fortunes. Social benefits would also accrue.

⁸⁴A classic of this genre is the 29-page letter that ORR wrote to Hull Trains giving approval for an increase from four to five trains/day [see www.rail-reg.gov.uk/upload/pdf/Hull_Trains_8th_SA-declet.pdf].

⁸⁵Its outline timetable for its version of a high-speed line between Scotland and London is impeccable in pattern and regularity, although the persistent failure to understand the mirror-image principle means that connectivity with other services would be impaired [see www.networkrail.co.uk/documents/About%20us/New%20Lines%20Programme/5886_NewLineStudy_synopsis.pdf].

⁸⁶See ¶2.1.3 and note 12. The tension between these models lies at the heart of the controversy over fares policy. DfT has chosen whenever possible to extract premium payments from franchises in order to offset support payments for other franchises and the direct grant to NR. That has encouraged companies to maximise revenue by developing sophisticated yield-management pricing tools and hence to behave increasingly in supermarket mode. There are two downsides. One is that profits from busy inter-urban lines that could enhance their services are being transferred to maintain marginal lines whose social and environmental benefits are modest – an economically-arguable transfer that has never been properly examined. The other is that it is counter-productive to bolster

convenience by raising frequencies and then to negate it by making 'turn-up-and-go' fares expensive, the cheapest being elusive and only available on inflexible terms well in advance. That situation too has crept in without debate on its merits. There needs to be a policy review of the alternative public-service model. It should consider its implications for funding, pricing and timetabling and include informed inputs about the European comparators.

⁸⁷Managers seem passive even where a well-structured pattern exists: the operator's own pocket timetables for the King's Cross outer-suburban services (described in note 77) do not show the connectional opportunities that effectively double the frequency. Its route diagram also fails to draw attention to the alternation of options.

⁸⁸In Switzerland minimum provision and coordination of services is written into Federal law: see for example 742.101.6, article 6, and 742.151.4, article 8 [these can be accessed at www.admin.ch/ch/f/rs/74.html or at www.lexfind.ch]. Similar assumptions appear to be made in countries such as Austria, The Netherlands and Belgium, and in the Länder in Germany. On the Dutch system nearly all services operate at least half-hourly.

⁸⁹Commercial secrecy in a privatised environment prevents data on flows of rail traffic from being made available to facilitate proper scrutiny. This is compounded by a strange lack of government and industry interest in examining differential modal shares and their implications. Hence very limited evidence requires us to say 'appears'. However NR has recently published modelled data which shows that rail has about 30% of the rail + air + car market on the ECML, WCML and Midland (and thus probably more than 50% on the London flows) but less than 10% on two important regional corridors (which have better-than-average services) [Network Rail (2009). Network RUS: Scenarios & Long Distance Forecasts. ¶3.2.1]. This is consistent with previous occasional evidence from route surveys, with the fact that a national share of 7% of passenger-km must mean very low shares outside South East England and London-centric journeys, and with patently low numbers for inter-urban flows in ticket data (see also note 36).

⁹⁰This should include the contentious question of the respective values of regular through trains, occasional through trains and well-organised regular connections. The open-access operators trade on public dislike of changing (attitudes to which may have been coloured by poor arrangements), but franchisees have recently withdrawn several marginal through services. Moreover the present pattern may owe too much to history.

⁹¹'Clockface' has two meanings, either timings at any minutes past the hour that repeat every hour, or timings at round-number minutes (notably xx:00 and xx:30). Because the latter is a constraint on pathing and of only limited marketing value it is not a principle of *Taktfahrplan*. To avoid misunderstanding we prefer not to use the word.

⁹²A typical example was the recent statement by the independent operator Western Greyhound on winning Cornwall County Council contracts for bus routes: "We will be rolling out our successful formula of even headway simple clock-face timetables, bags of publicity, reliable services, small rotas of polite friendly drivers and modern low-floor easy access buses. Our team will be working hard to achieve significant patronage growth. We have carefully designed the new routes to integrate with our existing network and, for example, the frequency on the St Austell to St Dennis corridor will be clock-face half hourly rather than the hodgepodge that exists now." Similarly a Google search produced "A 'clock-face' approach to timetabling ICEC Franchise services would greatly improve the train travel experience for many people both within and outside of the North East. A 'clock-face' timetable would make it easier for passengers to remember service patterns, making train travel more attractive to the public and most likely resulting in increased patronage (especially outside peak periods). Furthermore, it is recommended that any future timetable changes are carried out with a strong commitment to integration between franchises. A 'clock-face' service pattern should not be confined solely to the ICEC Franchise, rather, it should be integrated with the service patterns of the Cross Country and Trans Pennine Express Franchises to ensure the best possible outcomes for rail passengers are delivered." [Government bodies in North East England responding to the ICEC consultation in 2007, see www.northeastcouncils.gov.uk/global/assets/documents/asset20070216103358.pdf].

⁹³They do not figure much on the ORR website. The forms that TOCs must use when applying to ORR for track access rights [Forms 17, 18, 22, 22A] contain a clause [¶4.7] requiring justification of, for example, 'regular service intervals' or 'clockface departures' because they may place 'restrictive obligations' on Network Rail. This is the precise opposite of the working assumption in other countries and needs to be reviewed.

⁹⁴This is also apparent during serious disruptions when companies discourage people from travelling at all rather than recommending alternative, albeit slower, routes using other TOCs' trains. This is sometimes made worse when those TOCs refuse to accept tickets issued by the disrupted company for exclusive use on its trains.

⁹⁵*Superbrands* judges products and services across all sectors on the basis of reputation, competitive advantage, quality, consistent delivery and differentiation. In the 2009-10 table National Express Group (including its coach and bus companies) does rank 78th, but FirstGroup, Stagecoach, Arriva and GoAhead do not make the top 500. See www.superbrands.uk.com/about/selectionProcess.php. A survey of 21 companies in Switzerland placed SBB fourth (after two supermarket chains and a bank and just ahead of Nestlé) [Reputation Institute (2006). See www.reputationinstitute.com/press/06-04-06_Swiss_Reprtrak_pr.pdf]. NS stands at 30th of 30 in a similar listing for The Netherlands, and the five large British transport groups at between 35th and 131st among 140.

⁹⁶In the 1980s the state-owned British Rail mounted at least two nationwide and hugely popular token promotions, one with Kelloggs breakfast cereals and one with Boots the Chemist. Now the only national special offers available on the trains of any operator are those for some attractions in London. The Swiss Federal Railways have a continuous programme of special deals that encourage travel starting anywhere in Switzerland.

⁹⁷At www.nationalexpresseastcoast.com/Our-Destinations/ all the stations displayed are on the ECML – or reached via Eurostar. There is no clue about the East Anglian connections at Peterborough, and in the pocket-timetable, although Cambridge appears, Norwich does not. It is also well known that the fares shown for through journeys do not necessarily incorporate the cheapest for each segment. Those familiar with the system get their bargains by buying separate tickets, which may be satisfying but is certainly time-consuming and does the collective railway no credit (there is a website that calculates where best to divide the journey – see www.splitfare.co.uk/). Timetables for Virgin Trains on the West Coast offer no off-route connectional information at all.

⁹⁸Four examples from the author's own experience illustrate the problem. The afternoon coach from Skye arrives at Inverness 2 minutes before the overnight sleeper to London leaves. The mean interchange time at Alnmouth between Northumberland Coast buses and ECML trains is 30 minutes, with great variability and several absurdities. Timings are similarly poor at Thirsk, where the town lies at some distance from the station. And in the National Rail timetable the bus service from/to Hunstanton that is run by a rail company in connection with its trains at Kings Lynn is shown without any clue as to how long the walk takes between the separately-located bus and rail stations (the margin implied by the timetable is probably inadequate). Only regular patterns promoted by a body with some clout can begin to deal with cases like these – which are legion. Compare notes 8, 32 and 100.

⁹⁹Research is needed into perceptions of public transport where geography makes rail particularly unattractive, and if they are indeed poor, into what measures might be taken to remedy the situation with joint road and rail services (which could be introduced sooner than closed railways could be reopened). Examples are large towns that are not on the rail network at all, such as Bury (except via the tram connection with Manchester), those that have a suburban link with their upper-order centre but no links in other directions (Redditch, with Birmingham and the South West respectively), and the missing east <> west connections north of London.

¹⁰⁰They hardly comprise a network since operators behave largely independently of each other. Local councils with limited budgets are left to publish joint maps and comprehensive timetable information, and some take no action. It is common for a company running a daytime commercial service not to mention council-supported evening or weekend services worked by another company (under tender) on the same route, and *vice versa*, and for each company not to accept the other's tickets. The No.10 Nether Poppleton <> Stamford Bridge route in York is a typical example, involving FirstGroup and York Pullman – even though both are members of the York Quality Bus Partnership ("Bus operators and City of York Council working together to improve the quality of bus travel").

¹⁰¹One product of the present Government's early (but not sustained) commitment to integrated transport (see note 14) is the Transport Direct website www.transportdirect.info that does provide multi-modal information. Given the technical challenges it represents a considerable achievement, but it is not particularly easy to use, is not as well known as it

should be and suffers from the fact that users cannot presume a meaningfully-integrated system.

¹⁰²Always assuming that it would be sensibly linked with the trains.

¹⁰³The Barnstaple branch in North Devon has 11 intermediate stations, exactly as built in the nineteenth century. The demography is such that Barnstaple accounts for 76% of all joinings and alightings while four stations have fewer than 3 passengers/day (for source, see note 43). Persistent opposition to any closures has left the sizeable population in the Barnstaple catchment with a slow service to the regional centre at Exeter and mediocre connections there with main-line trains – and merely token services at the minor halts. A Ministerial Advisory Group on Transport recently recommended to the Welsh Assembly Government that “consideration ... should be given to replacing socially necessary [rural] rail services by high quality bus services”. The suggestion was brusquely dismissed [National Assembly of Wales Finance Committee, 23 July 2009, item 6.5].

¹⁰⁴This process was established by the Railways Act 2005. The Act abolished the Strategic Rail Authority set up by the Transport Act 2000 and distributed its functions between DfT, ORR and NR.

¹⁰⁵East of Leeds three routes share a two-track section, namely the line from the northern ECML and York, the main line from Hull and a spur from the ECML at Hambleton South Junction that is an alternative to the normal ICEC route via Wakefield. The section is running almost at capacity and has the classic problems of flat junctions and a stopping service that cannot be looped in a 15.6-km stretch. The holders of three franchises all wish to add services. CrossCountry seeks to improve its pattern (and correct weaknesses in a major change in 2008), TransPennine wants to add a fifth train in each hour on its core section west of Leeds (which would fit uncomfortably with 30 / 15 cycles), and ICEC has been granted an access right in fulfilment of franchise commitments. Each has major timing constraints elsewhere. The only way in which they can be accommodated is by replacing one of the two hourly locals with the extra CrossCountry service (a truly messy scheme), and the performance risks are high. *MOIRA* estimates an annual increase of 243,000 journeys, but the disadvantages are such that 132,000 would be lost. The recent study was inconclusive, partly because the issues really are complex but partly because the ECML timetable conundrum remains unresolved. One cannot help feeling that a national timetabling strategy might be worth testing alongside the ‘gap analysis’ and balancing of compartmentalised interests employed by NR. [Network Rail (2009). Yorkshire and Humber Route Utilisation Strategy, especially pp. 66-108. See www.networkrail.co.uk/asp/4449.aspx].

¹⁰⁶The next phase, taking the plans forward to 2030, was approved by the Federal Parliament on 20 March 2009. Article 1 of the *Bundesgesetz über die Zukünftige Entwicklung der Bahninfrastruktur / Loi fédérale sur le développement de l'infrastructure ferroviaire* stresses that the object is to establish new nodes (bringing the total to 19) as well as to reduce journey-times. The law includes a precise list of the projects that will accomplish this. See www.parlament.ch/e/dokumentation/dossiers/do-zeb/pages/default.aspx.

¹⁰⁷The redundancy of London Waterloo International and its access route and the near-abandonment of the expensive layout serving Ashford International are lessons in disorganised infrastructure planning. On the ECML a commitment to upgrade the alternative freight route via Lincoln (the ‘Joint Line’) has been made on the basis of probably-optimistic forecasts by the freight interests and without a clear plan of the works needed (which will be difficult, disruptive and controversial), while a different strategy altogether – to divert freight to an enhanced Midland Main Line – has since become a distinct possibility. Proper economic analysis of the issue is confounded by the fact that freight only pays marginal-cost charges yet these are expensive schemes. Peterborough is the station where planning without timetabling could most go awry (the previous rebuilding included a fine alignment of through lines, but the number of trains requiring to stop has steadily increased – while approach-control restrictions on the less well-aligned platform lines have imposed a time-penalty).

¹⁰⁸The railway industry is entitled to be pleased with the growth in passenger-kilometres since 1993, although the common assumption of a direct correlation with private management is erroneous, given the (artificial) buoyancy of consumer spending, changes in urban economies and reactions to road congestion, and probably a new sense of environmental responsibility. It should also be noted that, while passenger-km by rail (including metros and trams) grew by 59% between 1993 and 2007, those by internal flights grew by 86% (those by private road vehicles and by coach and bus both grew by 14%). More significantly still, rail’s modal share

only rose two points to 7%, while the proportion of people who report that they use rail less than once a year or never remains at 47%, only 4 points down over the eight years to 2007. It is this that must change if government and societal objectives are to be met. [Sources: DfT. Transport Statistics Great Britain. 2008 edition, Table 1.1. And DfT. National Travel Survey: 2007 – interview data. Table 3.1.] Good timetabling and modal transfer matters more than may appear from the small number of long-distance trips. NR has drawn attention to the fact that while journeys of over 80 km account for only 2% of all journeys by all modes, they account for about 30% of all passenger-km [Network Rail (2009). Network RUS: Scenarios & Long Distance Forecasts. ¶3.2.1].

¹⁰⁹Service Level Commitments [SLCs] list in excruciating detail what a TOC can and cannot do in constructing its timetable. Some items patently reflect existing features of a timetable for which the rationale may no longer exist, and instead of a presumption of regularity there are elaborate formulae to control irregularity. The language is legalistic, each route is treated as self-contained, and there are few references to connections, let alone to the functions of a network. SLCs have superseded PSRs (see note 53). The documents for each TOC (under varying titles) can be found at www.dft.gov.uk/pgr/rail/passenger/publicregister/current/.

¹¹⁰The existing *National Rail* brand has little exposure and virtually no meaning.

¹¹¹Of the 19 franchises the incumbents at 15 are, or include, one of the five transport groups with extensive bus interests. Taken with the high cost of bidding this may be restricting market-entry, and it certainly gives them disproportionate influence. Smaller units could also open opportunities for local operators to run ‘community’ lines.

¹¹²In two recent announcements the Government has acknowledged that changing circumstances justify strategic intervention. On 15 July 2009 the Secretary of State for Energy and Climate Change (Ed Miliband), in a statement to the House of Commons about the Low Carbon Transition Plan, expressed his intention to reform energy regulation: reducing carbon emissions will be explicitly set out in Ofgem’s guiding mission, and consumers will be protected from failures of competition. Similarly, documents on food security at least begin a move from confident dependence on open global markets toward action by Government [Department for Environment, Food and Rural Affairs (2009). UK Food Security Assessment: Our approach].

¹¹³Opinion polls regularly record substantial support for renationalising Britain’s railway. In a poll taken in the aftermath of the announcement about the ECML franchise failure 51% of respondents favoured a fully-nationalised railway and another 18% ‘more government involvement’. This suggests that, despite memories of BR’s failings, the organisations that replaced it have not won public confidence or respect. A sense that the structure is flawed may also be in the background when people state that they do not obtain value-for-money from rail journeys: in the National Passenger Survey the proportion of people satisfied on this count has been stubbornly fixed in the range 39 to 46% for the last five years (and of course this is only the attitudes of existing passengers – those of non-users may be even more sceptical). [See Passengerfocus (2009). National Passenger Survey, Spring 2009. Chart 5.7a; page.politicshome.com/uk/majority_of_public_support_full_railway_nationalisation.html].

¹¹⁴One example, though admittedly directed primarily at conurbation services, was: “some are asking whether greater consideration should be given to developing a contractual regime which does not leave the travelling public vulnerable to rash franchise bids and incentivises operators to put higher priority on customer service and value for money. Privately, some senior rail industry executives who have previously argued forcefully for operators to retain maximum commercial freedoms are now acknowledging that in some circumstances it would make sense for franchises to be let more as management contracts” [Dark, J (2009). Do passengers risk being squeezed to death as operators fight the recession? *New Transit*, 001, July, p.15]. In Parliament, MPs have picked up another proposal springing from disquiet about franchising in its present form: “The Government should be willing to attempt different forms of franchising. Now is an ideal opportunity to keep the lucrative East Coast franchise in the public sector. The service could then be used as a comparator for other types of franchises, both in terms of financial viability and passenger service quality” [House of Commons Transport Committee (2009). Rail fares and franchises. Eighth Report of Session 2008–09 (HC 233), ¶16].

¹¹⁵The Eddington Transport Study (published in 2006) discusses at length the model of on-road competition *in* the market and concludes that there is a strong argument for experimenting with the alternative of competition *for* the market, ie. for concessions [see

www.dft.gov.uk/adobepdf/187604/206711/volume4.pdf, Chapter 4.3]. Five years ago the Commission for Integrated Transport drew attention to the benefits of coordination in the car-versus-public-transport market [CfIT (2004). Competition in the Passenger Transport Industry].

¹¹⁶Typically they run for about seven years, with options to extend for up to another four. A useful table of the current franchises is at: Glover, J (2009). The franchised railway. *Focus* [the Journal of the Chartered Institute of Logistics and Transport (UK)], 11, no.8 (August), p.29].

¹¹⁷Virgin Trains has been particularly vociferous about this [see for example: House of Commons Transport Committee (2009), op. cit., ¶18]. However Virgin's sweetheart deal with Railtrack in 1996 that largely ignored the interests of other operators and a business style that is decidedly 'supermarket' (see ¶2.1.3) highlight the risk of distorted priorities. Chiltern Railways, which holds an exceptionally long franchise, is also cited in this debate for the scope that that period gives it and for what it has achieved, but this may not be transferable since the sub-network was comprehensively overhauled by BR, is relatively self-contained and runs through prosperous territory.

¹¹⁸Contracts are on a 'gross' basis, ie. Transport for London takes the revenue risk but offers the holder a system of rewards and penalties related to various measures of the quality of the service provided.

¹¹⁹Thereby avoiding frequent changes at re-franchising (but the logo *ScotRail / Scotland's Railway* does seem a little prolix). The Welsh Assembly Government has similar powers but has not introduced its own branding.

¹²⁰It cannot be said that this is an easy task. SBB runs on average 112 passenger trains/day on each section of line, compared with 79 on Britain's railway (making it, according to SBB, the busiest railway in the world when its substantial freight operation is included). Moreover, each train carries an average of 134 passengers, compared with 110 in Britain. [Sources: UIC Statistical Synopsis for 2008 at www.uic.org, SBB website and ORR Rail Trends Yearbook.] SBB is in no doubt of the necessity of an integrated railway: "Operating the SBB network without intensive joint planning on the development of the system and daily coordination between the different traffic sectors and infrastructure ... would greatly impair efficiency and quality and ultimately also increase costs. Given the pressing need for harmonisation and coordination over the entire planning and operation process, this process could not be divided up without a significant loss of quality and performance" [SBB Annual Report 2008, Group Report, p.22. See mct.sbb.ch/mct/en/konzernberichterstattung.pdf].

¹²¹The change was introduced overnight in December 2006. It included moves toward simplifying types of service by transferring the functions of semi-fast trains to intercity and/or stopping trains. Inevitably some stations were downgraded, but this seems to have been handled constructively within the consultative process. ProRail (the infrastructure manager) explains that it and the operating companies "sit around the table" in order to determine "the basic hour patterns". Operators thereby "acquire better insight into the (im)possibilities relating to commercial needs involved in contracting of own clients, personnel and equipment planning, etc. The result of this process is a (set of) agreement(s) ...". "The parties will strive to arrive at a coordinated set of annual timetable applications" [ProRail. Network Statement 2009. ¶4.2.2 and 4.4.1.1. See www.prorail.nl/SiteCollectionDocuments/Vervoerders/Doc/Netv/20646544v1NV2009EN.pdf].

¹²²"... many railway companies in Europe have changed their service to a clockface timetable. An exception are large and centrally structured countries like France and Spain, where the traffic between the capital city and the provincial towns is dominating. Railway companies of these countries have developed a profitable business based on new lines and high speed trains. The reduction of the travelling time and the increase in the number of trains has naturally lead to a systematisation of the timetable. As an example, the departures in Paris and in major provincial cities are in a fixed interval. However, as the stops in-between are different for each train, the arrival times spread. The most important element of a clockface timetable, the symmetry of trains in both directions does not exist and makes a systematic coordination with regional clockface timetables impossible. Many regions, nowadays responsible for the regional rail traffic, are asking for a clockface timetable and a better coordination The results in demand growth of the first realisations ... have exceeded the expectations. ... The infrastructure manager RFF has begun a study for a national clockface

timetable. The motivation is different, as the goal is the maximisation of the line capacity.” [See www.sma-partner.ch/, search for ‘Clockface timetables in France’.]

¹²³This point does have to be qualified in one respect. From January 2010 international passenger services will be opened to full competition (under directive 2007/58/EC of the Third Railway Package). Because the EU tends to be most influenced by industrial and big-city interests this seems likely to favour fast connections between metropolitan areas over regional services, as has already happened in France where the resources poured into the *Lignes à Grande Vitesse* have starved other lines of support for brisk and frequent services, except where local governments have stepped in. The more egalitarian approach adopted in Switzerland and The Netherlands, to a great extent as a function of their political characteristics, may face challenges. The managing director of the Franco-Swiss high speed train operator *Lyria* has warned that “‘wild competition’ between low-cost carriers (air or rail), traditional railways and high speed operators could lead to ‘a drastic reduction of customer service, or minor OD pairs would no longer be served’” [*Railway Gazette*, 2 April 2009].

¹²⁴Because of the frequent changes during and since privatisation the Government is reluctant to institute another major rearrangement, despite the patently unsatisfactory organisation of the railway (which it acknowledges). The big transport groups are exerting influence to protect the system in order to suit their interests. It may not be possible to maintain the Government position much longer and in any case a General Election is due in 2010, but we respect it in proposing changes that may not need an upheaval. If nonetheless a change is to be made it must be open for wide public debate because its ramifications could be profound.

¹²⁵Which may be related to those of ORR’s duties referred to in note 22, together with “to promote improvements in railway service performance (which includes ... journey times that are as short as possible)” [clause 4(1)(zb), introduced by the Railways Act 2005, 3(11)(b)] and “to promote the use of the railway network” [1993 Act, 4(1)(b)]. The funding responsibility is now defined in section 3(8)(d) of the Railways Act 2005. The guidance powers are in section 4(5)(a) of the Railways Act 1993, as amended by section 224(6) of the Transport Act 2000 and further amended by section 3(8) of the 2005 Act.

¹²⁶The two examples are in ¶13 and ¶20 of: Secretary of State for Transport (2007). Guidance to the Office of Rail Regulation [see www.rail-reg.gov.uk/upload/pdf/sos-guid20rr-may07.pdf]. The quaint phrase ‘is asked’ and the quotation at note 62 neatly encapsulate the ambiguities in the prevailing institutional scheme.

¹²⁷Section 4(1)(bb) of the 1993 Act, inserted by the 2000 Act, 224(2)(c).

¹²⁸A model worth considering is *trasse.ch* in Switzerland (which adopts EU legal practice in respect of transport). This is “a legally independent wholly owned subsidiary of the three railway companies SBB, BLS and SOB [the national system and two important regional companies] together with the Swiss Public Transport Operators’ Association [*Verbandes öffentlicher Verkehr, or VÖV*]. Each of the four shareholders owns a quarter of the capital.” It is “responsible for the discrimination-free train path allocation process for the annual timetable”, although the planning task itself remains with SBB [see the website trasse.ch and particularly the explanation of the statutory basis at www.trasse.ch/doc/en_Leitfaden_10.pdf]. Within this process Swiss law protects the concept of the *Taktfahrplan*, including the essential features of its pattern and the chain of connections at interchange nodes [*Eisenbahngesetz / Loi fédérale sur les chemins de fer*, 742.101, articles 9a and 33 – see note 88].

¹²⁹This would need a review of the application of competition law to the provision of bus services. The Office of Fair Trading [OfT] focusses (because that is what it is for) on competition *within* the industry and has strong evidence of market failures, but it cannot see that the prime competitor is the private car or that the concessions model might be more appropriate. This is neatly illustrated in a consultation paper in which OfT deplores the perfectly understandable fact that “Bus users do not appear to ‘shop around’ [and] are most likely to get on the first bus that appears at the bus stop going to the destination they want” [OfT (2009). Local bus services: report on the market study and proposed decision to make a market investigation reference. ¶1.11].

¹³⁰A campaign of public education about the creation of timetables would also not come amiss. People are vaguely aware that it is difficult (in fact it is probably one of the most difficult problems known to man because of the sheer number of variable and constraints), but that does not discourage them from having unreasonable expectations or not appreciating the interactions. There are remarkably few published descriptions of timetabling.

¹³¹The one-dimensional nature of the exchange between a potential customer and a journey-planner website can be misleading. For example, if a service is diverted on the requested day the user may get the impression that a journey regularly takes, say, an hour longer than is actually the case. Some means of explaining the exceptional time is desirable (see also notes 40 to 42). Clutter includes advertisements for hotels and repetitive text. On the SBB and NS websites one can call up a (selective) display of a station's planned departures and destinations.

¹³²Copious articles debating this theory can be found on the Web, although it is still a long way from entering the political mainstream – probably because if the peak-oil protagonists are right governments will be forced to intervene in markets and behaviours to an unprecedented degree. Rationing would be unavoidable, and probably also absolute prohibitions on certain uses of oil. The British Government continues to follow the conventional view that reserves are ample and that technology and market mechanisms together will resolve all difficulties. DfT does recognise a scenario of sustained high prices but rests most of its forecasting on a gentle rise from a base that is below contemporary world prices. For comment and references by an outspoken analyst of the oil industry see www.jeremyleggett.net/, particularly his 'Triple Crunch Log' entries for 29 July and 3 and 5 August 2009.

¹³³This was discussed in a recent address to the International Union of Public Transport [UITP]: Marzloff, B (2009). The challenges of new mobilities. www.uitp.org/news/pics/pdf/keynote%20speech%20Marzloff_UITP.pdf.

¹³⁴The *Financial Times* has picked up early indications of a retreat from global to regional supply-chains by leading manufacturers sensitive to energy prices and security [10 August 2009, p.1].

¹³⁵See www.dft.gov.uk/consultations/closed/competitivefreight/ for the documents on this. The responses to the consultation in Britain nicely reflect different institutional positions. ATOC is quite clear about the threat to the passenger business.

¹³⁶There may be a case for extra capacity to relieve the southern end of the West Coast Main Line. Making the solution a new high-speed line would seem rational, but it would yield only a small time-saving between Birmingham and London. Even were the line later extended to North West England the time-savings would still be small, and by the time a line could make large savings on journeys between Scotland and London global circumstances may be sharply limiting demand. High speed is of course energy-intensive, and it is only comparison with aeroplanes that makes rail appear impressive. In an absolute sense it is not certain that very high speeds will be justifiable.

¹³⁷In the audit results at ¶2.3.7-8, and also at ¶4.1.4 and note 108.

¹³⁸Even if rail is always likely to have a higher share of journeys to/from London than of non-London journeys the capture of car-trips ought to be easier on relations where the share is presently low than where only marginal advances can now be made on much larger existing shares, ie. where intrinsic limits are being approached.

¹³⁹Network Rail has recently published some innovative and interesting results for a range of scenarios that do break away from the easy assumption of uncomplicated growth. They include the possibility of strong influences from the sustainability agenda. Even in that constrained case they envisage rail taking a higher share of a larger market, which may not represent the outer reaches of plausible scenarios [NR (2009), op. cit.].

¹⁴⁰There is more than a modicum of politics in the debate, as the parties seek to outdo each other, regional cities campaign for their status in the network and normally sane voices argue for action regardless of evidence [letter in *The Guardian*, 20 August 2009]. The fact that other countries have more high-speed lines than Britain is not a valid point, and while years of neglect seemingly justify haste it risks bad decisions. It is disturbing how quickly the message of the Eddington Transport Study has been forgotten (it is still invoked when it suits): the Study demonstrated that the geography of Britain (like that of much of Germany, northern Switzerland, northern Italy and the Low Countries) is quite different from that of France and Spain (and eastern Europe) in respect of the separation of major cities. High-speed lines would therefore be of arguable economic advantage compared with enhancing the already-decent existing network [see Figure 2.1 and Chart 2.4 in Volume 2 and the magisterial paragraphs ¶1.33-34 in Volume 3, at www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/].