

>> The Office of Rail Regulation

Timetabling on the East Coast Main Line

Passenger Transport Networks [PTN] has considerable experience in developing integrated, operationally-efficient timetables using Swiss software and planning techniques. A number of projects have illustrated the significant revenue and social benefits that could result from adopting this approach.

PTN has therefore followed recent developments on the East Coast Main Line [ECML] with great interest, including the actions that the Office of Rail Regulation [ORR] has taken in response to applications for new and revised access rights. In particular we noted phrases in the letter to Network Rail on 27 June that raised the possibility of potential benefits accruing from a truly comprehensive recast of the ECML timetable.

In the hope of assisting the process PTN has pleasure in submitting proposals for an integrated timetable for the ECML. This extends work that started in a project sponsored by the Department for Transport [DfT] and has been revisited for the Association of Train Operating Companies [ATOC].

The timetable is built around six Long Distance High Speed Passenger Trains per hour. By differentiating the six services and carefully arranging them relative to each other and to other services on the route significant improvements in journey times are achieved for the principal markets. In parallel, the optimisation of connections would hugely enhance journey opportunities for a wide range of flows. Frequency and a regular pattern have proven advantages for travellers, while such a timetable would be expected to improve reliability and efficiency. With certain defined exceptions the timetable complies with the Rules of the Plan.

A bold recast on the ECML would in our view not only greatly benefit existing and new users but also set a precedent for a progressive uplift in the quality of the offer nationally. That goal is fully consistent with the statutory duties of ORR and with the objectives of DfT and Network Rail.

The paper below summarises PTN's methodology and judgments and is accompanied by technical documents specifying the timetable. A full report is being prepared for ATOC and can be shared with you in due course.

We hope that this independently-compiled timetable will assist ORR in its deliberations. We would naturally be delighted to have an opportunity to explain our work further to you.

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The Swiss experience : an alternative model for timetable planning in Britain ?

a submission to the Office of Rail Regulation [ORR]

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Background

The attached documents describe a timetable scheme for the East Coast Main Line [ECML]. It has been produced as an independent contribution to the debate about the strategy for the route and about the allocation of scarce capacity in particular. The graphs and spreadsheets illustrate the potential benefits of adopting the approach to timetabling used by many railways in mainland Europe, notably in Switzerland, The Netherlands and the German Länder.

The author has worked for the railway industry for 47 years, starting as a Traffic Apprentice and including periods as a BR-sponsored University Lecturer and latterly as a consultant (trading as *Passenger Transport Networks* [PTN]). Since 2000 he has specialised in strategic timetable planning. From 2000 to 2003 he managed a consortium project supported by the Department for Transport [DfT] and railway organisations in conjunction with the University of Leeds. That research included a case-study of the application of Swiss concepts to the ECML (a summary can be found at: <http://www.dft.gov.uk/pgr/scienceresearch/technology/transportlink/futureintegratedtransportpro1937>).

Following a seminar at the Swiss Embassy in 2004 Network Rail commissioned PTN to examine the issues as applied to a dense suburban operation. At the same time the East Coast work was developed for GNER in conjunction with its bid for the franchise. The latter material was subsequently used by Professor Nash at Leeds in a study for ORR: it provided a real example in support of a theoretical discussion of the use of scarcity charges to guide the deployment of capacity (see: http://www.rail-reg.gov.uk/upload/pdf/its_uleeds_app2.pdf).

In 2006 the Association of Train Operating Companies [ATOC] invited PTN to analyse timetable patterns and connectivity across the national network and to revisit the ECML studies. A report on this work is presently being prepared. The documents now attached form the final output, and the detailed technical description that will follow will be part of the ATOC report. *It must be stressed however that the production and dissemination of the material at this stage is entirely the responsibility of PTN, and it is not formally endorsed by ATOC.* The author would nonetheless like to thank many colleagues in the industry who have assisted the project over the last eight years.

The Swiss model

The integrated national timetable for all modes of public transport in Switzerland was developed from first principles by three young managers. The concepts were adopted in a thoroughgoing revision of services in 1982 and have been progressively refined, most recently in a comprehensive recast in 2004. The timetable vision shapes investment policies, so much so that a detailed plan already exists for the network for 2030. Very similar ideas were developed rather earlier in The Netherlands, but it is the German term *Taktfahrplan* that has come to represent the idea. In the absence of an unambiguous English term we use it to characterise our proposals, accompanied by the descriptive strap-line “an integrated cyclic timetable for Britain's Railway”.

The principal objective is to maximise connectivity across the network. Services are built around interchange at strategic nodes. Together with a logical arrangement for each line and a commitment to maintaining the standard pattern throughout the operating day, this ensures for almost every A to B pair consistently high standards of frequency, speed and convenience. The *Taktfahrplan* has become embedded in Swiss life, and each successive enhancement has yielded significant increases in the use of the system.

Detailed planning is guided by principles and arithmetic rules. These will be explained in the technical report. Suffice it to say here that PTN's proposals have been structured according to those principles and rules, albeit with some slight modification for British circumstances. This task has been aided by the use of the Swiss *Viriato* timetabling software for which PTN has held a licence since 2000.

Setting the framework

The ECML exercise has three deliberately distinctive features.

First, it starts with a clean sheet. It takes no service, path, access right or franchise commitment as given. We are of course aware of their practical and legal status, but our purpose is to design a timetable based on an alternative approach, the merits of which can then be compared with whatever emerges from the normal processes. (It was found early in these studies that any attempt at compromise quickly degraded the principles.) We note that ORR specified in its letter to Network Rail on 9 July that its analysis “should not be constrained by the exact timings of any current services”, a phrase adopted from the DfT letter to ORR of 27 June.

Second, the structure seeks to make the best use of the available capacity while optimising the service-offer. An external consultancy obviously does not have access to all the relevant information, but our judgments have been informed by data and understanding built up over eight years of studying the route and from many discussions with the parties involved.

Third, it follows that the planning is operator-neutral. No assumption is made about what company will operate each service. Rather, the aim has been to produce a timetable that is likely to maximise the return to the industry as a whole, and in particular to provide the style of service that will be most capable of capturing business from private cars and from planes. ATOC is carrying out MOIRA analysis of the PTN timetable, and on the strength of previous tests we expect very positive outcomes to be demonstrated.

As in the earlier exercises we specified some working rules.

- In general Sectional Running Times, headways, junction-margins and platform-reoccupation times conform to the 2009 Rules of the Plan [RoP] except in a few cases where strong evidence exists for derogation. We have scrupulously checked the timetable but remain open to correction. We are also aware of some unresolved infringements in the peak period or off the ECML proper for which timetables have only been specified in approximate terms.
- The plan includes platforming arrangements and rolling-stock diagrams, since to ignore those would be to omit key aspects of performance and cost.
- Paths are designed in such a way as to enable the standard pattern to be maintained through the peak periods, with the additional services being overlain in pre-planned paths (and some modification of calling points on the Cambridge line).

- The plan is conceived as being operable from December 2009. It therefore presumes the existing infrastructure, with the exception that the layout at the south end of York station is so inhibiting that the committed four-tracking of Holgate Junction is incorporated. If this work cannot be completed by December 2009 then interim adjustments would be unavoidable.
- As far as we are competent to judge the proposals meet performance objectives. In some cases, however, we have pushed track utilisation beyond what is presently operated, the justifications for which will be explained in the technical report.

Conformance with ORR's duties

In adopting the Swiss approach we have endeavoured to ensure that it is consistent with, and may significantly support, the duties laid upon ORR by statute. At the same time it should meet the objectives of the Department for Transport and Network Rail.

The proposals respond to ORR's duties in the following manner.

To promote improvements in railway service performance (including reliability (and punctuality), the avoidance or mitigation of passenger overcrowding, and journey times that are as short as possible).

PTN believes, along with experienced operators, that a cyclic timetable freed from the instability caused by variation and excessive pathing allowances will of itself promote disciplined working and thus enhance everyday performance. (We note the DfT view [in its 27 June letter] that in off-peak periods "the performance impact of [additional trains] can be largely off-set by improvements to the structure of the timetable, including adopting a regular repeating service pattern".) The plan will relieve overcrowding not only by increasing the quantum of trains but also by their better relationship to each other, while differentiation between services can cut journey times for the great majority of travellers.

To protect the interests of users of railway services.

This general duty is best met by planning a timetable that carefully balances the requirements of all the users. It seeks to make good use of each path, to ensure appropriate frequencies and links for every station and to optimise interchange. For example, although the benefits of through trains are recognised, frequent and brisk connections may (provided they are managed well) be a more satisfactory solution in many circumstances.

To promote the use of the railway network for the carriage of passengers and goods.

It is well established that frequent and fast train services attract passengers and commonly agreed that memorable timetables further promote positive perceptions of the railway offer. The latter was demonstrated by attitudinal studies in the collaborative project described in the introduction, is implied in the widespread adoption of 'standard hours' by Train Operating Companies and is regarded as self-evident in much of mainland Europe. The question of goods traffic is discussed later in the descriptive notes.

To contribute to the development of an integrated system of transport.

By its very nature the proposed timetable integrates services. Each is placed in the best possible relationship to other services in terms of even spacing and of connections. In particular, the

application of logical rules optimises interchange arrangements at principal junction stations, and although not part of this exercise that will also aid links with bus services.

To contribute to the achievement of sustainable development (there is in addition a requirement “to have regard to the effect on the environment of activities connected with the provision of railway services”).

A timetable that deploys every train-kilometre to maximise effective frequency and the perceived convenience of the service will be more likely to attract travellers from alternative modes than a less coherent timetable that merely assembles the plans of individual operators. In broad terms that is deemed to be desirable for sustainability. Moreover, transfers from other modes measurably reduce carbon emissions whereas stimulated journeys that would not otherwise have taken place have a more ambiguous effect.

To promote efficiency and economy on the part of persons providing railway services.

PTN is not in a position to make any great claims in respect of this duty. However, we can point out that operator-neutral timetable planning is inherently likely to optimise both the utilisation of track capacity (including platform occupation) and the diagramming of rolling stock. This provides a reference point against which to measure the consequences of modifications designed to meet the efficiency and economy objectives of individual players.

To promote competition in the provision of railway services for the benefit of users of railway services.

European timetabling methodology stresses integration. Its operational advantage lies in the optimal use of resources, and for travellers the paramount benefit is the holistic (and patently popular) convenience of the service. In Switzerland the national railway is partnered by numerous smaller semi-private operators, but they all participate in the unified timetable scheme because they deem it to be to their mutual advantage to do so. Competition that introduces restrictions on the use of particular trains is limited to premium services and specific circumstances. But even if on-track competition were to be restricted the way would remain open to introduce a market for concessions to deliver services within the overall plan, thereby securing competition in productivity, the quality of the customer experience and innovative features.

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.

Analysis of the national timetable reveals countless examples of poor coordination of the standard-hour timetables of different operators and of badly-organised connections. The performance regime exacerbates the problem by focussing on each operator’s targets rather than on the real experience of individual passengers. Moreover, it is important to note that marketing of journeys involving more than one operator is very limited compared with that devoted to journeys wholly within one TOC’s territory. This is quite unlike what is found in Switzerland, where the emphasis is on ‘any A to any B’, and if, for example, a special event is happening at B, wherever it is located and however modest its normal status, the national railway and its affiliates will market travel by rail from all As across the country.

While the timetable is not the only consideration in respect of multi-operator journeys we hold it to be fundamental. It follows that our proposals are not only operator-neutral but also that the detailed planning rests on securing as high a standard of service for each (potential) flow of passengers as is appropriate to its relative size. This contrasts with simply arranging a set of unrelated trains. In particular it means that the ECML timetable should be designed around the timings at the key interchanges – Edinburgh, Newcastle upon Tyne, York, Doncaster and

Peterborough. (A necessary consequence of this is abandonment of ‘round-number’ departure times, which have value but should not be treated as a fetish.)

To enable persons providing railway services to plan the future of their businesses with a reasonable degree of assurance.

An agreed timetable planned to balance all the aspirations for access to an over-subscribed and operationally-difficult railway will provide stability. Its adoption would enable ORR to meet this duty. Furthermore, we would argue that coherent planning of this kind will assist in the prioritisation of enhancement projects, and in turn that will assure the players in their own planning.

Conformance with DfT and NR objectives

In respect of the position of the **Department for Transport**, as set out in its letter to ORR on 27 June, PTN’s proposals meet the objectives in the following manner.

Maintaining a balance between the various uses of the route that reflects the importance of the different types of traffic.

A *Taktfahrplan* inherently achieves this objective more readily than a method that aggregates separate plans, with their common consequence of sub-optimal pathing, inconsistent provision and often significant gaps in the offer.

Maintaining a balance between service levels and performance.

Any competent timetable planning must do this, but a *Taktfahrplan*’s emphasis on providing for flows of traffic will tend to secure the balance rather more effectively than a system that concentrates on making space for trains.

Accommodating forecast growth in passenger and freight traffic so far as practicable.

Maintaining and improving journey times, particularly for major long distance passenger flows between London and Leeds, York, Newcastle and Edinburgh.

Maintaining and, where appropriate, improving service frequency at intermediate stations.

The proposed timetable achieves all three of these objectives (except possibly in respect of freight). Specifically, and unlike some of the alternatives put forward, its service specification attends to the first two while ensuring that the structure does not leave intermediate stations with inadequate frequencies and poor connectivity. Longer-distance services are accelerated while at the same time dramatic improvements are realised in the organisation and timing of connections.

Securing delivery of franchise commitments, including agreed premium and support payments.

As far as we are aware the proposals are consistent with this objective, and their facilitation of better connections can be expected to increase journeys and revenue. The only exception is that we have not included a direct service for Lincoln, for reasons explained in the notes below.

A regular repeating service pattern of six long distance passenger trains per hour, specified minimum numbers of calls per hour at intermediate stations with calls positioned as close as possible to even intervals, calling patterns the same in each direction, a similar range of intermediate journey opportunities to those available at present and a sequence of trains that provides as closely as possible even interval departures from Edinburgh, Newcastle, Leeds and King’s Cross [detailed text paraphrased].

The *Taktfahrplan* accords with the spirit of these objectives, but its own principles necessarily mean that they are interpreted in a distinctive and, we contend, superior manner.

The current quantum and pattern of First Capital Connect Services should be assumed. Adjustment of clockface times and other detailed timetabling changes may be necessary.

The present structure of the London regional services, including the fast Cambridge trains, is excellent, and we have taken it as a key factor in planning the sequence of trains through the Welwyn area, albeit with a move around the clockface and some consequential effects for stock diagrams. The timetable also benefits from the removal of erratic variation.

East Midlands, Cross Country, Northern and TPE services

Detailed points about the timing of these services are inconsistent with the clean-sheet approach and have been put to one side. However, the spirit of the specifications is met in terms of standard-hour provision, “removal of unnecessary pathing time and excess station dwell time”, “a sensible combined calling pattern” and “good connections with the regular repeating service pattern on the ECML”.

As for **Network Rail** the East Coast Main Line Route Utilisation Strategy [RUS] includes several highly relevant paragraphs.

“The pattern and timetable spread of services [on the ECML north of Doncaster] has been identified as sub-optimal. The need for an appropriate level and timetable spread of services over both the York – Newcastle and Newcastle – Edinburgh sections of route have been highlighted, particularly with respect to the interaction between the London and cross country services and how best to serve stations such as Northallerton, Morpeth, Alnmouth and Dunbar.” [¶6.2.4].

Later the RUS notes that the mix of services and operators “results in a frequent but irregular service pattern, exacerbated by the London services not being in a standard hour pattern. For example, although there are typically 4tph from Newcastle to Durham, there are long gaps of up to 35 minutes between services. The North East RPA recommended that consideration be given to improving the spread of these services, and to provide a ‘turn up and go’ service between key locations”. It is recognised that the “timing of cross country services through this area is dependent on national timetable issues, primarily determined by paths available in the Birmingham New Street area. ... The critical section is the mostly two-track section between Northallerton and Newcastle. Passenger services are often “flighted” through this area. This optimises the use of available capacity and, in particular, provides paths for freight services, but leads to a poorer service for passengers making intermediate journeys. ... A standard hourly pattern for the London services would allow a regular pattern of passenger and freight services on this section.” [¶6.8.2].

The RUS also refers to “optimum provision of connections” for “locations off the main route” [¶6.2.3, ¶6.7.1]. A further option review [¶6.7.7] discusses the relative merits of through trains and good connections.

It is our contention that problems of this kind can only be resolved by a more unified and collaborative approach to timetabling. Our proposal for the ECML passenger services shows what could be delivered were a clean sheet to be taken. Specifically we have identified a considerable improvement in corridors such as Newcastle ... York and York ... Leeds. This has been achieved not only by virtue of standard-hour regularity but also by emphasising logical relationships between services as prime considerations when weighing options.

We fully recognise that in this exercise we have only optimised the ECML, and that only for the principal passenger services, in order to provide a reference timetable with which the current timetable and the various developments of it can be compared. Even within that limited scope the constraints are such that it would be difficult to comprehend further optimisation.

That implies that the remaining decisions are second- or third-order matters. This seems reasonable in respect of local services, especially since the concepts provide a framework into which they logically fit. It may raise some difficult issues in respect of freight [see below]. It certainly raises issues about pathing in other critical areas of the network, notably at Manchester Piccadilly and Birmingham New Street. We simply argue that, if a European style of timetable is demonstrably beneficial for the ECML then it is probable that it would be so too for Britain's national railway, in which event a national optimisation would be called for.

Key features of the proposed timetable

The attached technical documents include train-graphs for sections of the route, two 'netgraphs' summarising the standard-hour service, respectively for the main line and for the London suburban and regional services, a 'public' timetable (which also includes some 'working' detail) and spreadsheets describing the proposed platforming plans and stock diagrams.

The key features of the timetable are as follows.

- Four core long-distance inter-city services are arranged in two pairs with identical pathing south of Peterborough in each half-hourly cycle. This secures near-even spacing between Newcastle / Leeds and London King's Cross and close-headway running between Doncaster and Peterborough. Stops by all four at Peterborough give the best possible connections for East Anglia, Stevenage and other intermediate stations toward London. The Scottish train runs non-stop between York and Peterborough, the faster Leeds between Wakefield and Peterborough and the Newcastle and slower Leeds between Doncaster and Peterborough.
- Standard timings of 265 minutes are achieved between Edinburgh and London, 115 or 122 minutes by alternating trains between York and London, and 122 or 132 minutes between Leeds and London.
- Two inter-urban trains/hour run between Doncaster and London, calling at Retford, Newark, Grantham and Peterborough. This first secures a clear and consistent service for the three intermediate stations. One of the pair runs from/to York and is so arranged as to give excellent connections between North East England and West Yorkshire and Retford, Newark and Grantham, which are supplemented by similar connections at the other half hour. Extension of the second train beyond Doncaster is left open, except that in alternate hours it is clearly appropriate for it to run from/to Hull. A number of possible routes (including further extension of the York train) are obviously available for consideration, especially if joining/splitting units at Doncaster were deemed to be feasible. None of these trains are diverted to serve Lincoln since to do so would have a disproportionately detrimental effect on connectivity. Their timings at Newark would afford brisk both-ways connections with a cost-efficient shuttle service for Lincoln.
- The two cross-country trains are then arranged in the right relationship with each other and so positioned as to complement and interact with the London trains. Similarly, the four trans-Pennine trains are timed to provide the important 15-minute frequency between Leeds and Manchester while also having significant connectional and intermediate functions on the East Coast (this involves extended dwells at York that are deemed beneficial to the overall plan). In both cases the resultant paths are incongruent with existing and planned paths off the ECML.

- Analysis of what should happen north of Newcastle upon Tyne is incomplete. Our preference in earlier studies was for an hourly regional EMU-operated service between Glasgow Central and Newcastle, with the London and cross-country trains normally starting from / terminating at Edinburgh (except for the Aberdeen and Inverness extensions, and once the West Coast was ready to serve the Glasgow <> London business with fast trains) and only calling intermediately at Berwick-upon-Tweed. If that is not justifiable then the next best option, illustrated here, might be to run a similar service as an extension of the cross-country Newcastle trains.
- The three London trains in each half-hourly cycle are wholly compatible with the London regional services, and indeed have much-improved connections with them.
- As part of the overall structure it is proposed that the Inner service between Welwyn Garden City and London Moorgate should be increased from three to four trains an hour (a mix of 20- and 30-minute frequencies is anathema in a *Taktfahrplan*), although an adjustment will be needed until such time as there is a six-track passenger railway between Alexandra Palace and Finsbury Park
- Overlaying additional peak services brings the total number of trains to 18/hour through the Welwyn two-track section. This is one (or two) more than at present, but we believe it to be perfectly feasible given the regularity of the pattern and hence the better presentation of services at Woolmer Green Junction (southbound) or Digswell junction (northbound). A detailed technical analysis will be provided later. Given the pressures for increased capacity for passengers we judge this level of services on the existing infrastructure to be highly desirable since any substantial enhancement of the infrastructure is plainly some years away and very expensive.
- If eight longer-distance services can be operated in the peak in theory eight paths are available off-peak too. In practice, even without any freight trains, the eighth path is tight (there is a slight difference because the Scottish train has to be timed for an HST and is therefore a few minutes slower than the matching Leeds train), while it may be prudent to leave the seventh path vacant in some hours as a performance reserve. The *Taktfahrplan* is essentially therefore a 6-trains/hour scheme, but its disposition of paths and stops differs from that of the various alternatives under discussion.
- The Newcastle and the two Leeds services are timed for electric sets and the two inter-urban services for Class 180 or Class 22x diesel units. The total number of sets required is in line with that of other plans. Turnround times were considered as a factor in the overall optimisation, although some tightening up is assumed. The turnround for the inter-urban trains is relatively short but above the minimum specified in some circumstances in RoP.
- Routeing and platforming at Newcastle, York, Doncaster, Peterborough, King's Cross and Moorgate has been carefully checked and is believed to be wholly consistent with the signalling and largely consistent with the Rules of the Plan.
- There are no significant conflicts at Cambridge Junction, although the number of movements is obviously approaching the limit.

This structure yields an integrated and coherent timetable that optimises the frequency, speed and flexibility of journey opportunities. We believe that it does this more comprehensively than any of the alternative approaches – and without doubt relative to the profoundly unsatisfactory existing timetable.

Freight services

In principle a *Taktfahrplan* readily contains freight services within its hourly cycles, as is apparent in Switzerland and The Netherlands. Although this point is recognised in the ECML RUS [¶6.7.3] there is a lack of clarity in Britain about the extent (if any) to which contractually-agreed freight paths can be flexed, adjusted for lighter loads but greater frequency, retimed to run at night or even re-routed for the greater good of capacity utilisation – possibly with the incentive of financial compensation mechanisms. The problem is compounded by considerable differences between the number of freight trains that actually run, the number of paths reserved for them and the large numbers expected from the growth forecasts.

Since PTN does not have access to all the relevant information on these matters and since our primary purpose was to illustrate the passenger benefits of a *Taktfahrplan* we have not considered provision for freight in any depth (and at this stage not at all north of Doncaster). Nonetheless we have undertaken detailed analysis of the interaction with the passenger objectives, and we are satisfied that capacity for freight during the day is extremely limited between Doncaster and Peterborough in any conceivably-acceptable passenger scheme.

Paths are only available for Class 4 freights for short, fast runs between loops, with lengthy dwells at each successive loop and the necessity of precision running, and even they would disappear in any hour in which the ‘seventh’ path was taken up by a passenger train. A better option for Class 4s (and all Class 6s) would be to use the route between Doncaster and Newark via Gainsborough. The further diversion via Spalding (ie. the Joint Line, with some scheme to avoid the ECML altogether) is in our view the only feasible long-term option. It should have been taken up some time ago, and it should now be pursued with urgency.

We would add that our analysis (and we suspect that of other players) has been rendered difficult by doubts about the quality of the data. The quoted SRTs for Class 4 freights seem slow and do not imply running at anywhere near the permitted 120 km/h. Either there are unspecified practical problems or the capability of the locomotives and rolling stock is not being properly exploited. We have failed to obtain any clarification of this issue or to discover what happens in real time. On a route where the detailed timing of freight paths is critical both to freight capacity and to the structure of the passenger service this is a serious weakness.

As it stands our timetable creates a framework in which realistic freight paths can (or cannot) be planned. By its very consistency it would also highlight the consequences of any modification to accommodate particular freight trains, thus facilitating economic analysis of possible courses of action.

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