

c2c recently achieved a UK rail industry high of 96.7% for Public Performance Measure punctuality for the year ended 1 May 2010. A brace of Class 357s await departure from Fenchurch Street on 15 July 2009. Brian Morrison



Making the most of existing capacity

Good operating is the key

With money for capacity expansion tight, Piers Connor considers what we can do to make the best of what we have

Everybody knows the economy is in trouble. After many of us believed that 2009 was as bad as it was going to get, in 2010 reality has finally set in. The Treasury, which asked for departments to make 25% budget cuts immediately after the election, now wants them to offer 40% slashes.

Given all the public concern about how much Network Rail is costing the taxpayer, we would be naïve if we did not expect the railways to suffer.

In the capital, in a desperate effort to convince the Treasury that he's doing something, Transport for London's Commissioner, Peter Hendy, has issued a 'no spend' diktat, telling staff that even stationery mustn't be purchased except on the MD's signature. The Piccadilly and Bakerloo Line upgrades have been deferred, bidders have been told, for eight years.

Across the country, there's very little money for new projects and cuts for existing ones are likely unless they can show exceptional value for money. The National Audit Office, in its report 'Increasing passenger rail capacity' published in June, said that it doubted that money earmarked by the Department for Transport would provide as great an increase in capacity as hoped for. Improvements to ease overcrowding are likely to see the axe and I doubt we'll see any digging started for High Speed 2 for many years to come. And as for Labour's electrification plans...

In spite of all this doom and gloom, most train operating company (TOC) revenues seem to be holding up remarkably well. The Association of Train Operating Companies reported that passenger numbers turned the corner and started rising again last October (p11, last month) - in many parts of the country, they remain at levels

that still generate plenty of complaints about overcrowding.

It is unlikely that enough new vehicles to reduce overcrowding will appear anytime soon. So now is a good opportunity to look at other ways of easing the problem, which means using the current assets more efficiently and increasing capacity without huge capital input.

Under-utilised assets

In considering railway assets, I noticed that, near where I live, the Midland main line weaves its way gently through middle England with four tracks, two slow and two fast. If you wanted to build that today, it would cost about £80million a mile. Network Rail's recent figures suggest it is costing £200,000/mile a year to maintain.

This is an asset with high value, but its usage is low. In an average hour, a total of 12 trains pass over this route in both directions, freight and passenger. That is three per track per hour. Given that, with four-aspect signalling, each path will be occupied at any one point for about 3-4



A busy scene outside the EMT platforms at St Pancras on 27 July 2010. Paul Bigland

minutes, it means that, each day, we are getting 20% efficiency out of the route. If we can't use it more effectively than that, people will say, 'Why give more money to the railways for infrastructure when they don't use what they've got?' Use it we must and we must use it more effectively.

Time is of the essence

In the railway business, we are selling the most perishable product in the universe – time. If we lose a unit of production, a train path, we can't get it back. Yes, we can run late but our unit of production is the train path and this is a time-based product. It is what the TOCs pay for and it is what the passengers judge us by. Every second in a train path vanishes as soon as it appears. If we have not used it, we can never get it back. We cannot even deliver it later. Once it has gone, it has gone, along with the passengers' good will. This is why accurate timekeeping is the essential element in the transport production process.

If we accept time as our most valuable asset, we should be considering our on-time performance in seconds rather than in 5- or 10-minute blocks. Seconds have a real value. If, on a 30-station trip, the train stands six seconds longer

than it needs to at every station, it will consume three extra minutes by the end of its journey. Considering that the average route with four-aspect signalling will support a three-minute headway, this represents a whole path. We should be thinking how much this is costing us in lost production. It is actually 5% per hour.

What is 'headway'?

Let's be clear what we mean by 'headway'. In essence, it is the time elapsed between the passing of the front of one train and the passing of the front of the next. The problem is that it can be applied in different circumstances. If we consider a 100mph, four-aspect route, the green-to-green time for a train running at line speed will be 90 seconds. This is the signalled headway and will include a 10-sec signal sighting allowance.

With fluctuations in speed limits, variable signal spacing for sighting, station or junction purposes and variations in driving techniques, we have to add a margin. 30% is recommended by the UIC (International Union

of Railways) for planning purposes. This gives us 120 seconds, the full speed operating headway.

Then we insert stations. With the braking into and acceleration out of the station, plus the dwell time in the platform, we generate the 'platform re-occupation time' and put this into our timetable to get the 'timetabled headway'. With smart platform work giving a 60-sec dwell, it would be a brave planner who would timetable trains over the route at less than a 240-sec headway. This is the timetabled headway. Then, if there are constraints at junctions or terminal layouts, there may be further increases in the possible headway.

Capacity to spare: the Midland main line. With Ratcliffe-on-Soar cooling towers dominating the background, Class 222 Meridian No 222018 passes East Midlands Parkway station at speed on 31 January 2010, forming the 14.02 service from Nottingham to St Pancras International. Brian Morrison



Today, we plan to lose production. Timetables are designed for 'robustness'. This is just another word for 'slack' or, put more kindly, recovery time. Because our Public Performance Measure (PPM) model has taught us that accurate timekeeping is not a necessary part of most operators' work plan, we design timetables with lots of slack – too much in many people's view. For example, when South West Trains recast its timetable in 2004, it added 3-6 minutes to most trips (that's up to two paths) and, on the London to Leicester route, running times have increased by about 7.5% over the last 10 years.

A good time spoilt

There are examples of excellent practice. East Midlands Trains' departure management at St Pancras is one. There is a pro-active approach to right time operation. Whistles start blowing up to two minutes before train departure. This makes passengers get a move on.

A platform supervisor stands at the doorway nearest to the gateline and directs latecomers through this doorway to eliminate the 'seat seekers'. Once on the train, they can hunt for seats as it leaves. Doors are closed and locked



and the right away given so that the train starts as the platform clock reaches 00 seconds on the departure minute.

So why is the good timing 'spoilt'? It is ruined simply by the inability of the infrastructure manager to make the clocks on the station all tell the same time. You have to feel sorry for the staff who get regularly abused by irate passengers complaining that the train 'left two minutes early'. Any railway organisation that cannot get all its clocks synchronised to tell the correct time, is not doing the job properly. Memo to Station Manager: 'Action this minute!'

Are there lessons we can learn?

Since the introduction of urban electric railways over a century ago, a new form of railway has developed – the metro. This introduced multiple-unit traction, fixed unit formations, automated signalling, short headways and rapid turnarounds.

The multiple-unit made train operation more efficient and early concepts of automatic signalling were developed to a fine art by metros like the New York Subway, the Boston Elevated and London Underground and this quickly

evolved into automatic train protection and eventually automatic driving.

The main line railways were slow to catch on. Indeed, many took more than 60 years to catch

up but today, multiple-unit operation for main line passenger trains is the rule rather than the exception and automated signalling and train protection are almost universal in the UK. But



Watching the second hand: a 500 Series Shinkansen awaits departure from Shin-Osaka with Nazomi 13 from Tokyo to Hakata, Japan, in November 1998. railphotolibrary.com



there are still lessons to be learned from metro operation.

First and foremost is the short dwell. This is not just the time the passengers board and alight. It includes the whole cycle from wheel stop to wheel start. This can add up to 20 seconds on top of the time spent unloading and loading.

Most of this time is mechanical – the irritation of the slowness of the plug door operation on the Voyager/Meridian range is only exceeded by the

discomfort of the ride. It takes at least seven seconds from wheel stop to door fully open, if the conductor releases the doors promptly (and not all of them do). Add another seven seconds for closing. On the trip between London and Derby, this adds 2½ minutes to the trip – almost a whole path.

A metro operating at a two-minute headway cannot afford to have dwell times of longer than 40 seconds, ie wheel stop to wheel start. On a

suburban route with a 75mph speed limit, to get a three-minute headway, dwell times at stations would have to be limited to 50 seconds. This can be achieved with the right equipment and platform management. The latest rolling stock for the Underground has door opening times of two seconds and closing times of 2.5 seconds. This needs to be adopted as the standard for new trains everywhere.

On top of the dwell is the platform re-occupation time. This must be as short as possible to maximise the efficiency of the path. It means full use of the train's braking and acceleration capabilities. 'Defensive driving' is all very well under unusual conditions but it wastes a very expensive asset if drivers are taught to crawl into every station at 20mph, effectively doubling the run-in time. An increase of just 0.2m/s² in the braking rate gives another train per hour.

Countdown clocks

Some metro systems use countdown clocks to manage dwell time. These are provided in driving cabs or on platforms to indicate to the crew that the booked dwell time is being used up and that it is time to go. They are a great incentive to accurate timekeeping and can be driven off the train control system and used in combination with platform describers to encourage passengers to board quickly.

Dwell times are not helped by SDO (Selective Door Operation). Longer trains may reduce overcrowding but the infrastructure needs to match. Since our Network Rail-provided infrastructure is so expensive, SDO is being used



SDO for ever: lush vegetation at Hanwell on the Great Western main line, where platforms will not be lengthened for Crossrail services following pressure from residents. The 12.37 First Great Western service from Oxford to Paddington passes at speed on 31 August, led by Class 165/1 Network Turbo No 165122. Brian Morrison



as a palliative for short platforms. If 12-car trains are operated but eight-car platforms remain at some stations, the delay incurred in relying on SDO may negate a large part of the gain in train capacity by increasing dwell times and thus reducing available paths. We should remember that SDO is a temporary solution to an infrastructure problem, not a design option in its own right.

Regrettably, Crossrail has fallen into this trap and is using SDO as part of its design philosophy in order to avoid platform lengthening works at difficult locations. In one case, SDO will be used because of an undertaking in the hybrid Act to 50 local residents not to extend the platforms at Hanwell, where, according to their petition to Parliament, it will interfere with vegetation on the embankment! We should not tolerate such inequality.

Pinch points

Another issue we should not forget is the 'pinch point' and how it can act as a constraint on a whole route. An interesting example is London Underground's Victoria Line. Although it is capable of providing a 120-sec operating headway along most of its route, the principal constraint is the terminus at Brixton. The problem is the long, high speed crossover, where the headway calculates at 126 seconds, which is equivalent to 28.5 trains per hour. This is why the present timetable is designed for this level of service. The new signalling installed by Invensys will reduce this problem once all the new trains are in service.



Smart platform working is essential for getting trains away on time. 'Right away' at Newport, 29 June 2007. Paul Bigland

For main line examples of pinch points, you only have to look at the effect of the two-track Welwyn viaduct and tunnel, beloved of Captain Deltic, which restricts the possible throughput over 100 miles of the Great Northern main line, to see that signalling layout and train performance is not the constraining factor on this route, it is the infrastructure. At the rebuilt St Pancras, the provision of only four platforms for Midland main line services has created another pinch point. The expansion that will come to the route by electrification will be constrained by this layout and it will require some creative timetabling, rapid turnrounds and even sharper departure management if the TOC is ever to get more trains running.

Imaginative thinking is needed to improve the effectiveness of the infrastructure. Some significant improvements could be generated by New York Subway-style segregation. On a four-track route, eliminating many crossovers and nominating one pair of tracks an 'express' route and the other a 'local' or all-stations service with cross-platform interchange and without the constant switching of trains from one side to the other, can offer a step change in frequency, regularity and reliability.

Incentives

Change will not come without incentives. Whilst we are driven by such targets as the much-pilloried PPM, there will be little incentive for operators to tighten their operations or for Network Rail to reduce sectional running times to more challenging levels. Currently, where the infrastructure and trains are capable of running at a three-minute headway, a train which arrives 4min 59sec late gets its tick in the box for 'on time' arrival - but it has actually used its own path and swallowed up 40% of the next. It has also lost its credibility with its passengers.

With a price tag of over £4 per train km on the busiest routes, this excess consumption represents a significant loss. It is time to scrap

the PPM and use on-time at each timetabled point (the TIPLOC) – to the second. This would sharpen many minds and please all the passengers. It may not be achievable in the short term but it must be a long-term goal.

In the short term, we must evaluate our performance in train paths. That means penalties should kick in when a train occupies another path. Our measure of on-time performance target today should be no more than three minutes late for all routes, and this includes freight. We can't go on letting freight trains run as and when they feel like it. We must enforce the discipline of accurate timekeeping on all trains, freight and passenger, long distance and suburban. This is the only way capacity can be managed and used effectively. There is no room for mavericks.

Leadership

Like any meaningful and lasting corporate change, the need for accurate timekeeping and on-time performance has to come from the top and it has to be inculcated throughout the business. It has to become embedded in the consciousness of every member of the team from the day they start work.

Some human resources departments – even those in TOCs – are notoriously bad at this, often allowing staff induction days to be casual and rather disorganised affairs, with people drifting in and out of the room where the new arrivals gaze in bewilderment at the comings and goings. Good timekeeping must be a part of everyday life. Any railway enterprise that holds a meeting where staff stroll in 15 minutes after its start time, needs to look carefully at its core purpose and its staff discipline. After all, if they can't be bothered to move from their desks to the meeting room on time, what hope is there for their poor customers?

Piers Connor is an independent railway systems consultant and lecturer on railway operations and engineering.