

Ipswich-Cambridge Line Capacity

**Timetabling scenarios for increasing
capacity between Ipswich and Cambridge**

Peter Cogar

December 2016

Introduction

The railway line connecting Ipswich and Cambridge has seen very high growth in recent years such that there are now significant capacity issues, primarily at the Cambridge end in peak periods. It is normal for the 06:16 and 06:54 Ipswich to Cambridge trains on weekdays to have standing room only on arrival at Cambridge, with similar over-crowding on the 16:44 and 17:44 return services. All these trains are scheduled to be operated by 3-car class 170 dmus, which are the longest trains permissible because of platform lengths. However, due to the shortage of dmu rolling stock in East Anglia, the trains are frequently formed of trains with only two carriages with consequent severe over-crowding.

The number of passengers, as recorded by the ORR 2015/16 station usage statistics, for the stations which are solely served by Ipswich to Cambridge or Peterborough trains are shown in the following table:

Station	Usage per annum
Needham Market	88,242
Elmswell	71,498
Thurston	71,930
Bury St Edmunds	603,518
Kennett	35,692
Newmarket	324,592
Dullingham	45,812

The cumulative growth over the preceding six years for these stations has been 58%, which is considerably in excess of the growth at Ipswich (18%), Stowmarket (26%) and even Cambridge (43%). Indeed, even in the past year when growth across East Anglia has been fairly static, Dullingham, Newmarket and Kennett have seen growth percentages of 16%, 12% and 12% respectively.

Further growth in the next few years can be expected due to:

- (1) The opening of Cambridge North station in 2017
- (2) The start of new Thameslink services in 2018 enabling easier access to a range of destinations including Gatwick Airport
- (3) The introduction of new trains in 2019 as a result of the new Greater Anglia franchise
- (4) The further development of the Cambridge Biomedical Campus next to Addenbrookes hospital, especially if a new station is opened alongside
- (5) The major growth in homes, jobs and education that is envisaged in Cambridge and its environs

The end result is that all routes into Cambridge are likely to see further significant growth, but the Ipswich-Cambridge route is less able than other routes to accommodate extra passengers as it is already running virtually at capacity in the peak periods due to the single line sections and short platforms.

This document examines ways of providing additional capacity through timetable interventions. Looking forward to the December 2019 timetable when most services in the Greater Anglia franchise will be operated by new trains with accelerated schedules, five possible timetable scenarios are examined. Scenario A presents a possible timetable structure based on hourly frequencies between Ipswich and Cambridge, and between Ipswich and Peterborough. Scenarios B and C examine the practicality of increasing the frequency on the Ipswich-Cambridge route with the current infrastructure. Scenarios D and E examine further enhancements that would require some infrastructure investment.

Current infrastructure

Between Ipswich and Haughley Junction, the route is shared with the London-Norwich main line and the maximum line speed for passenger trains is generally around 100mph. Haughley Junction is a single lead turnout with a speed restriction of 30 mph, which means up and down Bury line trains cannot pass each other at the junction.

Between Haughley Junction and Chippenham Junction where Peterborough and Cambridge lines diverge, the maximum line speed is mostly 75 mph.

After Chippenham Junction the Cambridge line is single track with a passing loop at Dullingham. The maximum line speed is 60 mph with lower speed limits in the Newmarket area and a particularly restrictive 10 mph level crossing just before Coldham Lane Junction where the line joins the London-Kings Lynn main line.

The Peterborough line has a maximum line speed of 75 mph between Chippenham Junction and Soham where it reduces to 50 mph or 60 mph through to Ely. It is single track between Soham and Ely.

Current timetable

The Ipswich-Cambridge train service runs mostly at hourly intervals and can be operated by 3 trainsets, though in practice the trains interwork with Ipswich-Lowestoft and Ipswich-Felixstowe trains. Most trains are scheduled to be operated by 3-car class 170 dmus.

The Ipswich-Peterborough train service is two-hourly and requires two trainsets, both of which are scheduled for 2-car class 170 dmus.

The basic off-peak pattern on the Ipswich-Cambridge route is dictated by the single track section at the Cambridge end. Trains are timed to pass each other just west of Haughley Junction and just east of Chippenham Junction. Thus a late-running Ipswich to Cambridge train can delay an eastbound service at Haughley Junction, whilst a late-running Cambridge to Ipswich train can delay a westbound service at Chippenham Junction.

The Ipswich-Peterborough timetable used to be dictated by platform availability at Peterborough until December 2013 when a new island platform was opened which enabled eastbound departure times at Peterborough to be scheduled five minutes later. The main timetabling constraint on the route is now the limited capacity between Ely North junction and Ely station.

Limited platform availability at Ipswich is also a constraint at certain times. Generally Cambridge and Peterborough trains use platform 4 which is shared with stopping services to London. At peak hours some stopping trains are formed of 12 carriages, forcing the weekday 16:00 Ipswich-Peterborough and the 19:13 Ipswich-Cambridge to share platform 1 with Lowestoft trains. It is also noteworthy that although both the 19:13 Ipswich-Cambridge and the 19:17 Ipswich-Lowestoft are scheduled to be operated by class 170 dmus, they can't both be formed of the 3-car versions because of the limited length of platform 1 at Ipswich. The introduction of the new, longer trains in 2019 will prohibit the dual use of platform 1.

The working timetable shows that the journey time from Chippenham Junction to Cambridge and back inclusive of Dullingham stops in both directions, obligatory recovery time allowances and a minimum of 5 minutes turnaround time at Cambridge, is 57½ minutes. Given that the normal time allowance between conflicting moves at junctions is 3 minutes, it is not currently possible to schedule a Dullingham stop for every train on the route, irrespective of the potential demand at Dullingham. Hence the normal service pattern has each train stopping at either Dullingham or Kennett, but not both. During the evening peak

period, passenger demand means that stops at Dullingham and Kennett are necessary for trains from Cambridge, and as a result no Cambridge-bound trains stop at Dullingham for a 4-hour period.

Future timetable

The introduction of new trains in 2019/20 will be accompanied by a comprehensive rewrite of the existing timetable, which will take advantage of the characteristics of the new trains. The construction of a new timetable will normally start with the creation of a standard hour timetable, which represents a repeating pattern of train times that is representative of the service that would operate in the majority of hours in the operating day. Adjustments are then made to accommodate particular requirements, e.g. to accommodate extra passenger demand in the peak periods.

Five standard hour timetable scenarios are presented in the Appendix. For each scenario, a timetable graph has been drawn which includes all passenger trains between East Suffolk Junction and Coldham Lane Junction. The schedules shown are based arbitrarily for departures between 10:00 and 11:00. Journey times in these schedules are based on a spreadsheet analysis of the performance of the new trains, making reasonable assumptions with respect to the normal acceleration and deceleration rates.

Assumptions have been made in respect of future schedules for London-Norwich trains. Intercity trains have been assumed to depart from both London and Norwich at 00 and 30 past the hour. In each direction, the 00 is assumed to be non-stop between Ipswich and Norwich, and the 30 is assumed to call at both Diss and Stowmarket. The third stopping service between London and Norwich is assumed to be timed at 02 from London and 07 from Norwich.

Colchester-Peterborough trains have been assumed to arrive and depart Peterborough at close to existing times, but now running hourly instead of two-hourly. A question arises as to whether there is sufficient demand at Manea and Whittlesea to justify having all trains stop at these stations. For the scheduling in this document, stops have been included for all trains (except in scenario C). An additional allowance of 2 minutes has been included between Bury St Edmunds and Ely to accommodate a possible stop at a new Soham station in the future. The rolling stock requirement for this service is 4 trainsets (which is the same for each scenario).

The Ipswich-Ely line is also an important artery for freight traffic. Currently there are around 10 freight paths scheduled in each direction between the hours of 06:00 and 22:00. In the graphs, an indicative freight path is shown between Europa Junction and Chippenham Junction in each hour, giving a total of 16 paths in each direction.

The schedules have taken into account potential conflicts at Haughley Junction and Chippenham Junction. Between Coldham Lane Junction and Cambridge, there are potential conflicts with Cambridge-Ely trains, which, without knowledge of the Thameslink 2018 timetable, it has not been possible to access. It is recognised that the increased frequency of trains following the opening of Cambridge North station will make pathing of Cambridge-Ipswich trains more difficult.

For each scenario, the pros and cons have been bulleted.

Scenario A (Red)

This timetable is based on an hourly Colchester-Peterborough and hourly Ipswich-Cambridge train service. The latter can now include stops at both Dullingham and Kennett due to the

improved acceleration/deceleration of the new trains. The traffic potential at both these stations should justify hourly frequencies.

The rolling stock requirement for the Ipswich-Cambridge service is 3 trainsets.

Compared with the current timetable:

Pros:

- Faster schedules
- Hourly Peterborough trains (instead of 2-hourly)
- Extra stops at Dullingham and Kennett

Cons:

- Lack of peak hour capacity at Cambridge end

Scenario B (Blue)

The improved capabilities of the new trains make it just possible to increase the frequency of Ipswich-Cambridge trains to 2 trains per hour. This provides the opportunity to introduce a fast Ipswich-Cambridge service stopping only at the three busiest stations – Stowmarket, Bury St Edmunds and Newmarket. Journey time for this faster service is around one hour.

Trains will pass in the Dullingham loop, and between Coldham Lane Junction and Cambridge. Conflicts at Haughley Junction cause a problem with the scheduling of the eastbound stopping service which unfortunately necessitates an extended dwell time at Bury St Edmunds.

Compared with Scenario A:

Pros:

- Increased frequency should provide adequate extra capacity for Cambridge peak traffic
- Introduction of a fast Ipswich-Cambridge service

Cons:

- Tight scheduling on single track section
- Requires 6 trainsets

Scenario C (Green)

This is a development of scenario B whereby the increased frequency is restricted to the Bury St Edmunds-Cambridge section. This requires the regular reversal of trains in the down platform at Bury St Edmunds, which may require a modification to the signalling.

To maintain a faster service between Ipswich and Cambridge, the stops at Needham Market, Elmswell and Thurston have been transferred to the Peterborough service. However the extended journey times mean that these trains cannot stop at both Manea and Whittlesea, and it is suggested that stops at these stations could alternate, thus reducing the frequency to 2-hourly (which is the current situation).

The passing of two trains at Dullingham requires at least one of the two trains to have a scheduled stop at Dullingham of 2½ minutes. Scheduling difficulties mean that the fast Cambridge-Ipswich service needs to stop additionally at Dullingham.

Compared with scenario B:

Pros:

- Requires one less trainset
- Reduces potential conflicts at Haughley Junction

Cons:

- Reduced frequency between Ipswich and Cambridge
- Reversal at Bury St Edmunds blocks the down line
- No through trains between Needham Market/Elmswell/Thurston and Newmarket/Cambridge
- Slower journey times for Ipswich-Peterborough

Possible Infrastructure Improvements

It is theoretically possible to schedule 2 trains per hour between Ipswich and Cambridge with the existing infrastructure, but the scheduling is probably too tight to be practical.

Nevertheless, the future peak demand at Cambridge may well be too high to be accommodated by just an hourly service, so it is pertinent to examine the scope for some infrastructure improvements so that a more frequent service can be provided.

Possible improvements are:

- (1) Raising the speed limit west of Dullingham from 60 mph to 75 mph provides a potential journey time reduction of up to 110 seconds
- (2) Raising the speed limit across Laundry Lane level crossing from 10 mph to 20 mph provides a potential journey time reduction of about 25 seconds
- (3) Double tracking between Dullingham and Fulbourn – relatively easy as the route was double-track, and indeed some redundant track is still in situ
- (4) Provision of a dedicated single track between Coldham Lane Junction and platform 8 at Cambridge to eliminate conflicts with other train services

Scenario D (Purple)

This scenario assumes that a conservative journey time improvement of 1½ minutes is achievable primarily by implementation of improvement 1, possibly with the help of improvement 2. This enables an Ipswich to Cambridge train to be scheduled to arrive at, say, platform 5 just before a Cambridge to Ipswich is scheduled to depart from platform 6. (Note that the extension of the Norwich-Cambridge service to Stansted Airport means that both platforms 5 and 6 are generally available for Ipswich line services). This improvement should provide sufficient leeway to make the 2 trains per hour service feasible.

Compared with Scenario B:

Pros:

- Makes 2 trains per hour more feasible

Cons:

- Costs involved in raising line speeds

Scenario E (Gold)

Improvement 3 enables a significant rescheduling that permits a 2 trains per hour service but reduces the rolling stock requirement to 5 trainsets. The timetable is based on the existing 60

mph speed limit, though an upgrade to 75 mph would enable a possible new station at Cherry Hinton.

Unlike scenario D, this scenario can also take advantage of improvement 4. This requires shared use of platform 8 with some Cambridge-Liverpool Street trains, and it requires the latter trains to be formed by just a single 5-carriage emu, though platform 7 would remain available for 10-carriage trains.

Compared with scenario D:

Pros:

- Makes 2 trains per hour more reliable
- Uses one less trainset

Cons:

- Substantial costs involved in double-tracking
- Use of platform 8 is less convenient for passengers

Conclusions

To summarise:

- Scenario A does not provide the necessary extra capacity.
- Scenario B provides the extra capacity but without sufficient spare time in the scheduling.
- Scenario C is no improvement and provides a worse service compared with Scenario B – its only significant advantage is the use of one less trainset.
- Scenario D is a more robust version of Scenario B.
- Scenario E provides the best timetable, but at the highest capital cost.

All the above scenarios assume no other infrastructure improvements on the route. However, it is believed that reconstruction of Haughley Junction is probable within the next few years which will reduce potential scheduling conflicts and may also enable some journey time improvements, particularly for freight trains.

Short-term

December 2019 is a long time to wait for a solution to the peak capacity issues at Cambridge. In the short term, it should be investigated whether it is possible for additional trains to be inserted into the current timetable at about 07:20 from Ipswich to Cambridge and about 17:00 from Cambridge to Ipswich (the latter passing the 16:20 Ipswich-Cambridge in the Dullingham loop). An additional dmu would be necessary for these additional trains.

Author

This document has been prepared and written by Peter Cogar who has 40 years professional experience in transport planning including in particular cost benefit analysis. Peter is also a committee member with East Suffolk Travellers' Association.

The author acknowledges the use of working timetables, the Sectional Appendix and the Timetable Planning Rules documents as available on the Network Rail website.

Mr Peter E. Cogar CMILT
3 Bury Hill
Woodbridge
Suffolk
IP12 1LF

Email: peter.cogar@btinternet.com

APPENDIX

		SCENARIO A	SCENARIO B			SCENARIO C			SCENARIO D			SCENARIO E		
Colchester	dep	09:48	09:48			09:48			09:48			09:48		
Ipswich	dep	10:05 10:35	10:05	10:26	10:46	10:05	10:26		10:05	10:26	10:46	10:05	10:20	10:46
Needham Market	dep	10:42	19:53			10:12			10:53			10:53		
Stowmarket	arr	10:13% 10:45%	10:13%	10:34%	10:56%	10:15%	10:34%		10:13%	10:34%	10:56%	10:13%	10:28%	10:56%
	dep	10:14% 10:46%	10:14%	10:35%	10:57%	10:16%	10:35%		10:14%	10:35%	10:57%	10:14%	10:29%	10:57%
Haughley Jn	pass	10:17 10:49	10:17	10:38	11:00	10:19	10:38		10:17	10:38	11:00	10:17	10:32	11:00
Elmswell	dep	10:53%	11:04%			10:23%			11:04%			11:04%		
Thurston	dep	10:59	11:10			10:29			11:10			11:10		
		[1] [1]	[1]	[1]	[1]	[1]	[1]		[1]	[1]	[1]	[1]	[1]	[1]
Bury St Edmunds	arr	10:29 11:04%	10:29	10:50	11:15%	10:34%	10:50		10:29	10:50	11:15%	10:29	10:44	11:15%
	dep	10:30% 11:06	10:30%	10:51%	11:17	10:36	10:51%	11:17	10:30%	10:51%	11:17	10:30%	10:45%	11:17
Kennett	dep	11:15%	11:26%			11:26%			11:26%			11:26%		
Chippenham Jn	pass	10:41% 11:18%	10:41%	11:02%	11:29%	10:47	11:02%	11:29%	10:41%	11:02%	11:29%	10:41%	10:56%	11:29%
Newmarket	arr	11:22%	11:06%	11:33%		11:06%	11:33%		11:06%	11:33%		11:00%	11:33%	
	dep	11:23%	11:07%	11:34%		11:07%	11:34%		11:07%	11:34%		11:01%	11:34%	
			(%)			(%)			(1%)					
Dullingham	arr	11:27%	11:38%			11:38%			11:38%			11:38%		
	dep/pass	11:28	11:11%	11:41		11:11%	11:41		11:12%	11:41		11:05	11:39	
Fulbourn	pass											11:12	11:46	
		[1]	[1]	[1]		[1]	[1]		[1]	[1]		[1]	[1]	
Coldham Lane Jn	pass	11:41	11:24%	11:54		11:24%	11:54		11:24	11:52%		11:18	11:52	
			(1%)			(1%)								
Cambridge	arr	11:44	11:29	11:57		11:29	11:57		11:27	11:55%		11:21	11:55	
Soham	pass	10:47%	10:47%			10:53			10:47%			10:47%		
		[2]	[2]			[2]			[2]			[2]		
Ely	arr	10:56%	10:56%			11:02			10:56%			10:56%		
	dep	10:58	10:58			11:03%			10:58			10:58		
Ely North	pass	11:00%	11:00%			11:06			11:00%			11:00%		
Manea	dep	11:09	11:09			11:14%			11:09			11:09		
March	arr	11:15	11:15			11:20%			11:15			11:15		
	dep	11:16	11:16			11:21%			11:16			11:16		
Whittlesea	dep	11:25%	11:25%						11:25%			11:25%		
		[2]	[2]			[2]			[2]			[2]		
Peterborough	arr	11:35	11:35			11:38%			11:35			11:35		
Peterborough	dep	09:49	09:49			09:45			09:49			09:49		
Whittlesea	dep	09:56%	09:56%						09:56%			09:56%		
March	arr	10:05	10:05			09:59			10:05			10:05		
	dep	10:06	10:06			10:00			10:06			10:06		
Manea	dep	10:12%	10:12%			10:06%			10:12%			10:12%		
		[2]	[2]			[2]			[2]			[2]		
Ely North	pass	10:22%	10:22%			10:16%			10:22%			10:22%		
Ely	arr	10:25	10:25			10:19			10:25			10:25		
	dep	10:26%	10:26%			10:20%			10:26%			10:26%		
		[2]	[2]			[2]			[2]			[2]		
Soham	pass	10:35%	10:35%			10:29%			10:35%			10:35%		
Cambridge	dep	10:50	10:26	10:54		10:26	10:54		10:28	10:57		10:26	11:02	
			(%)			(%)								
Coldham Lane Jn	pass	10:52%	10:28%	10:57		10:28%	10:57		10:30%	10:59%		10:28%	11:04%	
Fulbourn	pass											10:33%	11:09%	
Dullingham	arr	11:05	11:09%			11:09%			11:10%			11:17		
	dep	11:05%	10:40%	11:12		10:40%	11:12		10:41	11:13		10:40%	11:17%	
Newmarket	arr	11:10	10:44%	11:16%		10:44%	11:16%		10:45	11:17%		10:44%	11:22	
	dep	11:11	10:45%	11:17%		10:45%	11:17%		10:46	11:18%		10:45%	11:23	
			(1)											
Chippenham Jn	pass	10:41% 11:14%	10:41%	10:49	11:21	10:35%	10:50	11:21	10:41%	10:49%	11:22	10:41%	10:49	11:26%
Kennett	dep	11:18%	11:25			10:54			11:26			11:30%		
		[1] [1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
Bury St Edmunds	arr	10:53% 11:28%	10:53%	11:01%	11:35	10:47%	11:04	11:33%	10:53%	11:02	11:36	10:53%	11:01%	11:40%
	dep	10:55 11:30	10:55	11:03	11:42	10:49	11:35		10:55	11:03%	11:42	10:55	11:03	11:42
Thurston	dep	11:35	11:47			10:54			11:47			11:47		
Elmswell	dep	11:40%	11:52%			10:59%			11:52%			11:52%		
			(%)							(%)			(%)	
Haughley Jn	pass	11:05% 11:44%	11:05%	11:13%	11:57	11:03%	11:45%		11:05%	11:14	11:57	11:05%	11:13%	11:57
Stowmarket	arr	11:08 11:47	11:08	11:16	11:59%	11:06	11:48		11:08	11:16%	11:59%	11:08	11:16	11:59%
	dep	11:09 11:48	11:09	11:17	12:00%	11:07	11:49		11:09	11:17%	12:00%	11:09	11:17	12:00%
Needham Market	dep	11:52	12:04%			11:11			12:04%			12:04%		
		[1] [1]	[1]	1	[1]	[1]	[1]		[1]	[1](%)	[1]	[1]	[1]	[1]
Ipswich	arr	11:19 12:01	11:19	11:29	12:13%	11:19	12:00		11:19	11:29	12:13%	11:19	11:28	12:13%
Colchester	arr	11:38	11:38			11:38			11:38			11:38		

[5] Indicates the number of minutes allowed for temporary speed restrictions and engineering work.

(5) Indicates the number of minutes given for pathing requirements.

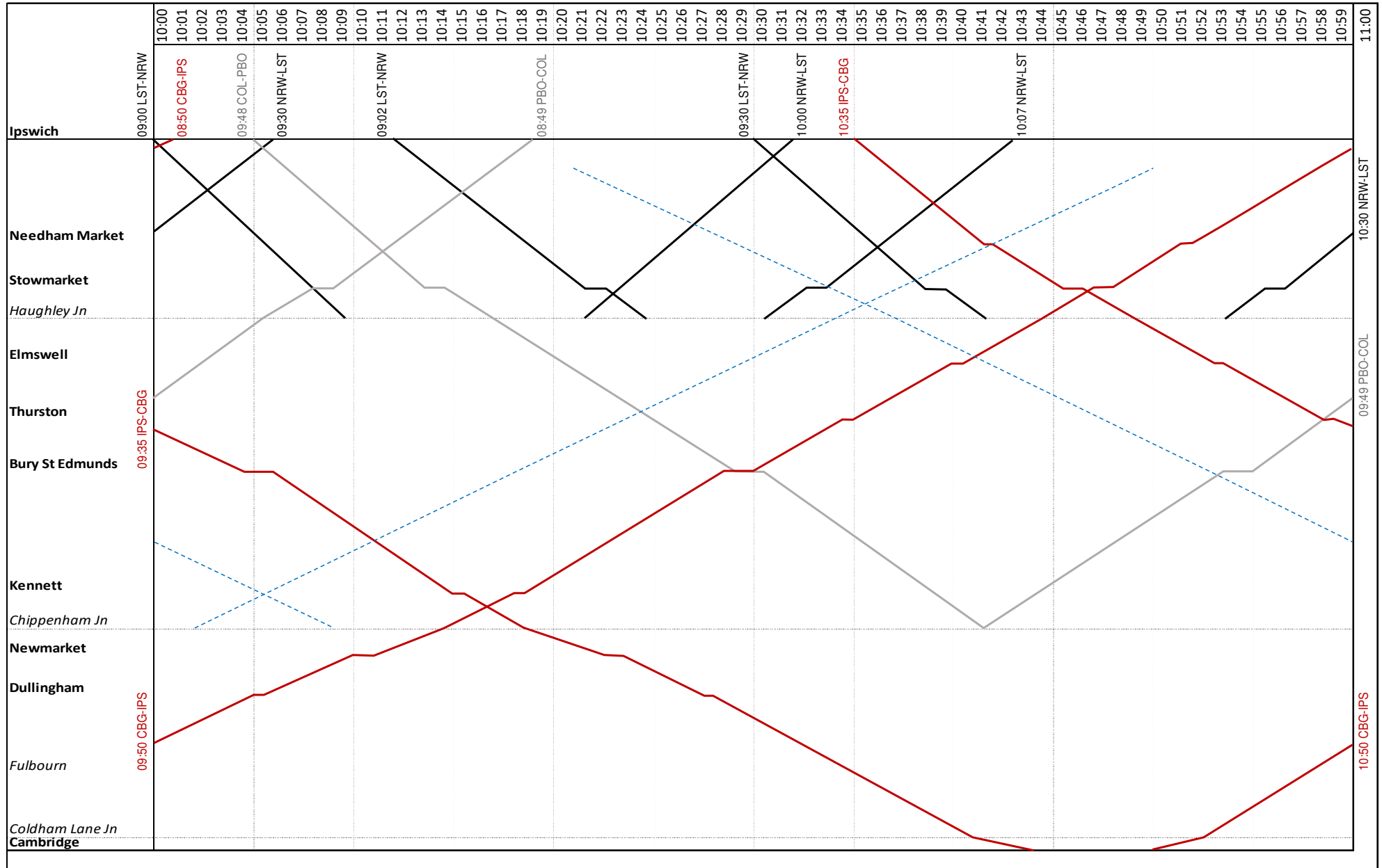
<5> Indicates the number of minutes given for performance allowance.

Dwell time at stations is ½ minute unless otherwise shown.

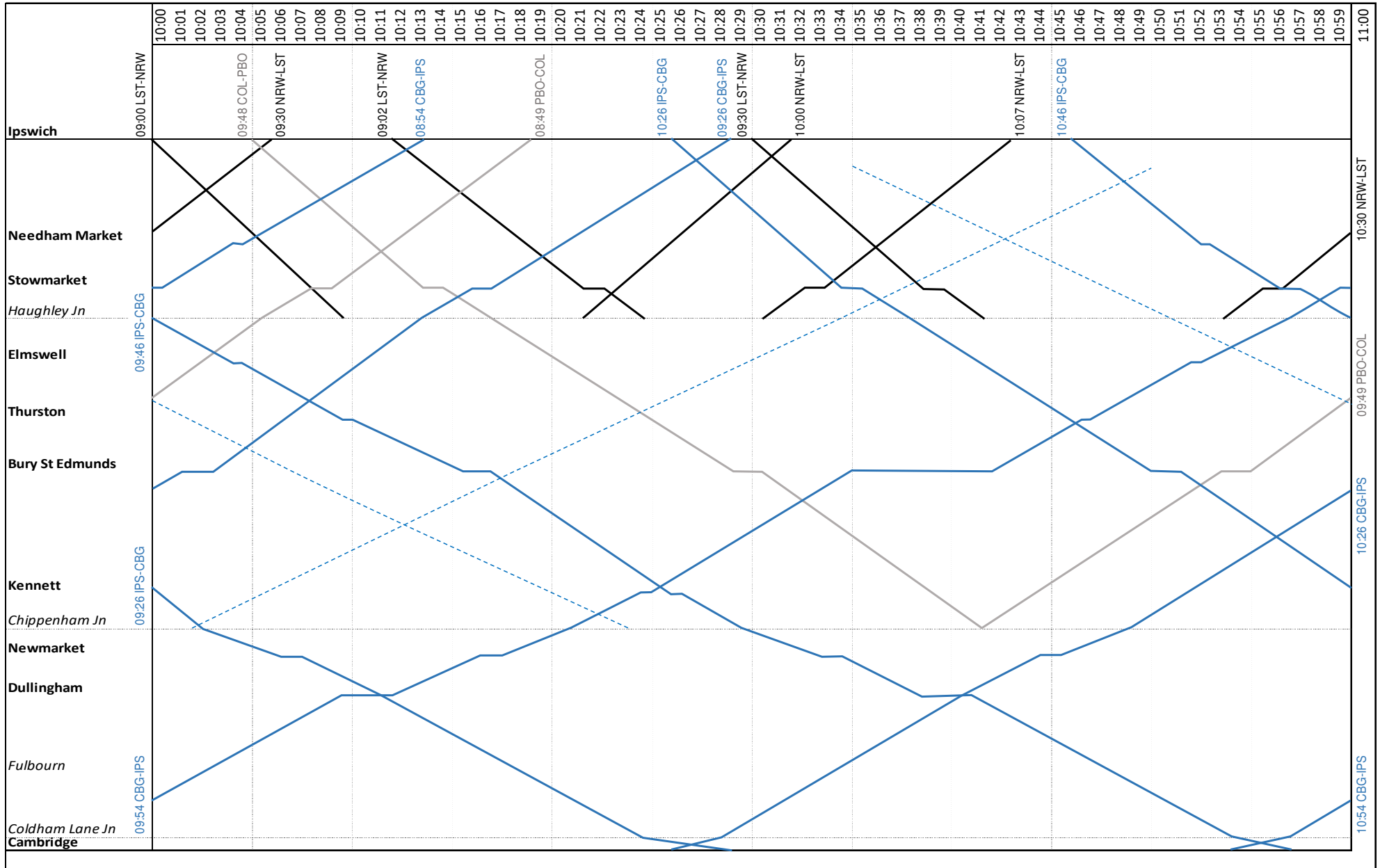
Timetable graph conventions

- Stations/junctions shown in the first column are spaced in proportion to the distance between them
- Westbound trains are denoted by lines angled backwards (\)
- Eastbound trains are denoted by lines angled forwards (/)
- London-Norwich passenger trains are shown by a black line
- Colchester-Peterborough passenger trains are shown by a grey line
- Ipswich-Cambridge passenger trains are shown by the corresponding scenario colour (red, blue, green, purple, gold)
- Indicative freight paths are shown by a dashed light blue line

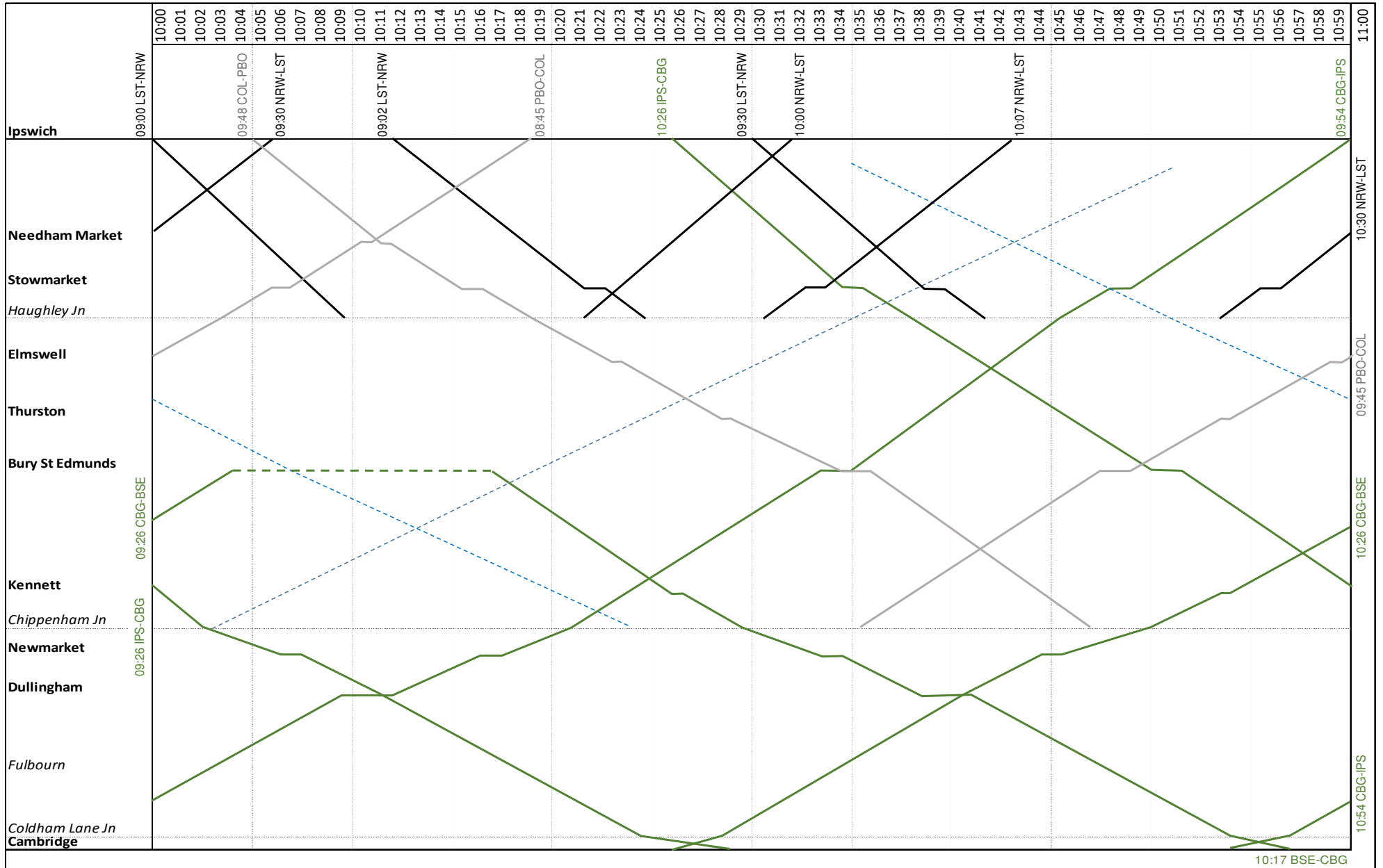
Scenario A



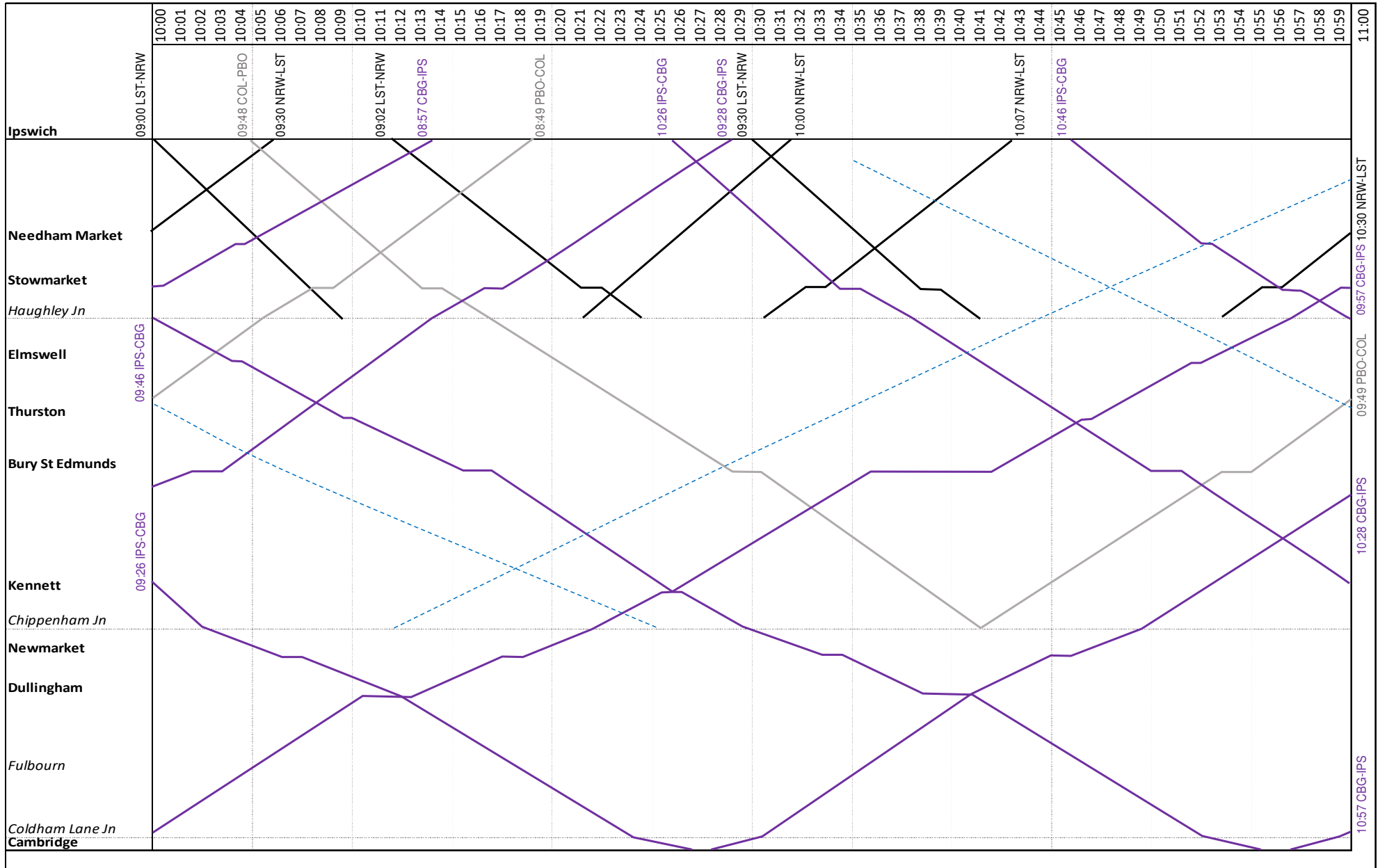
Scenario B



Scenario C



Scenario D



Scenario E

