FIRST STEPS IN SCHEDULE COMPILING

UNDERGROUND

DAVID ALLEN

Contents

Foreword

Schedule Compiling - the work of a Schedule Compiler. In this context a Schedule Compiler compiles Working Timetables for the Underground railways. What is a Working Timetable? - It is essentially a base document, similar to an ordinary timetable but with additional information and used by all staff concerned with operating the railway. It is used either to extract specific information for their needs or as a general reference book.

A good Working Timetable will provide the correct level of service in an efficient and workable manner. It will contain sufficient (but not excessive) information to be clearly understood; it will be well presented and above all it will be accurate.

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Some people refer in conversation to the 'art' of schedule compiling. Well it may not be an art but it is without doubt a very specialised skill which takes time to acquire. Old hands will tell you that they never stop learning and, of course, the criteria are continually changing. A Compiler's life is not a bed of roses - he may spend weeks compiling a timetable which never operates. On the other hand, he will find the work fascinating and often rewarding.

Each line is individual - it has its own particular problems and special features; the timetable will need to reflect these peculiarities. There cannot, therefore, be one blanket instruction book which can adequately cover all features of the Lines.

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The following notes set out to provide a trainee Compiler with a little background information as a foundation upon which, with suitable instruction and help he can build up his own store of knowledge and expertise.

A word of advice - never rush things - ask questions if you are uncertain and check, check, check - everything!

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Finally, I must record my thanks to Geoff Bassett who gave me so much helpful advice and assistance in the writing of these notes.

David Allen

December 1981

First Steps In Schedule Compiling

CHAPTER I

What a Compiler Must Know

A Compiler cannot put pencil to paper (Note that W.T.T.'s are always compiled in pencil - much use will be made of a rubber before a respectable timetable emerges!) unless he has knowledge of the three sets of basic information around which the timetable will be written:

These are:
- (a) The GEOGRAPHY of the line
- (b) TIME ALLOWANCE; and the
- (c) SERVICE FREQUENCIES required to be operated.

(a) **GEOGRAPHY**

Firstly, the Compiler must learn the geography of the line. He should study a track diagram and, if possible, visit the railway. He should make a mental note of the general layout of the line - where the branches are (if any), the length and relative importance of these branches and whether there are any single track sections.

REVERSING FACILITIES

These are provided at three types of location:-

(i) Termini - The end of the line (i.e. the last point where passenger trains operate) is known as the terminus. At a terminus trains will generally be reversed at the platforms.

(ii) Intermediate Reversing Points - A point where passenger trains are reversed other than at the end of the line. At these places, the usual method of reversal is by means of a siding(s) beyond the station although sometimes 'bay' platforms are provided.

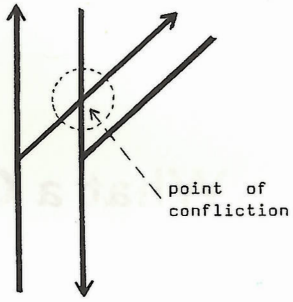
(iii) Emergency Reversing Points - Reversing facilities at these points will usually be limited to a trailing crossover. The Compiler will not normally be concerned with these locations.

Most lines are divided into sections based on the normal reversing points. The section over which the maximum level of service operates is known as the 'trunk section'.

JUNCTIONS

A junction is a point where tracks diverge. On the simplest lines they occur where there are links to sidings or other lines. Much more important are the junctions where passenger routes diverge and these occur on the bigger lines where there are branches.

The divergence in itself is not a problem; the difficulty arises where a track on which trains move in one direction crosses the track for the opposing direction. Sometimes this point of confliction is removed by carrying one track over the other by means of a bridge-this is known as a 'flying junction'.



The junction illustrated here is a 'flat junction'; the point of confliction presents a real hazard to the Compiler and it needs his special attention.

STABLING FACILITIES

Although a Compiler will expect to have this information before commencing the timetable; it is not needed in the early stages of compilation.

I have therefore delayed the explanation until Chapter IV where provision of Rolling Stock is fully covered.

(b) **TIME ALLOWANCES**

RUNNING TIMES

Start to stop running times for each section of the line are calculated by the Rolling Stock Engineer based on:

- The performance characteristics of the rolling stock.
- The length of the section.
- Gradients.
- Curvature.
- Permanent Speed Restrictions.

Station stop times are then added and a small 'make-up' or recovery allowance is also included.

Off-Peak (Basic) running times are tabulated in the front of every Working Timetable. Extra time (i.e. longer station stop allowance) is given on busy sections during peak periods.

LAYOVER TIMES

Layover time is the length of time taken for a train to reverse at a terminal station, i.e. from the time of arrival in one direction, to the time of departure in the opposite direction.

Minimum layover times are agreed for each terminal based on the method of reversal (i.e. at a platform or via a siding), the length of the train and, for a siding reversal, the running time to and from the siding. Normally compilers will allow an 'optimum' layover which is a few minutes longer than the minimum.

AN EXAMPLE OF BASIC RUNNING TIMES QUOTED IN THE FRONT PAGES OF WORKIN TIMETABLES

DISTANCES BETWEEN STATIONS AND APPROXIMATE INTERMEDIATE RUNNING TIMES

DISTANCES		STATIONS	OFF-PEAK RUNNING TIMES			
			Eastbound		Westbound	
Miles			Minutes		Minutes	
	.79	Cockfosters and Oakwood		3†		2
1.16	2.37	Oakwood and Southgate	2½	5	2½	5
1.21		Southgate and Arnos Grove	2½		2½	
.78	1.73	Arnos Grove and Bounds Green	2½	5	2	4½
.95		Bounds Green and Wood Green	2½		2½	
.61		Wood Green and Turnpike Lane	2		1½	
1.44		Turnpike Lane and Manor House	3		3	
.65		Manor House and Finsbury Park	1½		1½	
.43	5.18	Finsbury Park and Arsenal	1½	14	1½	13
.46		Arsenal and Holloway Road	1½		1½	
.37		Holloway Road and Caledonian Road	1½		1	
1.22		Caledonian Road and King's Cross	3		3	
.57		King's Cross and Russell Square	2		2	
.45		Russell Square and Holborn	1½		1½	
.37		Holborn and Covent Garden	1½		1½	
.16	2.87	Covent Garden and Leicester Square	1	10½	1	10½
.31		Leicester Square and Piccadilly Circus	1½		1½	
.35		Piccadilly Circus and Green Park	1		1	
.66		Green Park and Hyde Park Corner	2		2	
.32		Hyde Park Corner and Knightsbridge	1		1	
.76		Knightsbridge and South Kensington	2½		2½	
.44	3.02	South Kensington and Gloucester Road	1½	9	1½	9½
.49		Gloucester Road and Earl's Court	1½		1½	
1.01		Earl's Court and Barons Court	2½		3	
	.42	Barons Court and Hammersmith		1½		1½
	2.74	Hammersmith and Acton Town (non stop)		5		5
.58		Hammersmith and Ravenscourt Park	1½		1½	
.48		Ravenscourt Park and Stamford Brook	1½		1½	
.34	2.74	Stamford Brook and Turnham Green	1½	8	1½	8½
.59		Turnham Green and Chiswick Park	1½		2	
.75		Chiswick Park and Acton Town	2		2	
1.37	1.61	Acton Town and South Ealing	3	4	3	4
.24		South Ealing and Northfields	1		1	
.62	2.13	Northfields and Boston Manor	1½	4½	2	5
1.51		Boston Manor and Osterley	3		3	
.60		Osterley and Hounslow East	1½		1½	
.46		Hounslow East and Hounslow Central	1½		1½	
.91	7.60	Hounslow Central and Hounslow West	2½		2	15½
1.81		Hounslow West and Hatton Cross	4	12½	3½	
1.14		Hatton Cross to Heathrow Terminal 4	—		2½	
2.68		Heathrow Terminal 4 to Heathrow Terminals 1, 2, 3	—		4½	
	1.34	Heathrow Terminals 1, 2, 3 (direct) and Hatton Cross	3		3	3
	.64	Acton Town and Ealing Common		2		2
.59		Ealing Common and North Ealing	2		2	
.66		North Ealing and Park Royal	2		1½	
1.23		Park Royal and Alperton	2½		2½	
.98	5.34	Alperton and Sudbury Town	2	13	2½	13½
1.03		Sudbury Town and Sudbury Hill	2½		2½	
.85		Sudbury Hill and South Harrow	2		2½	
	1.18	South Harrow and Rayners Lane		3		2½
1.07		Rayners Lane and Eastcote	2		2	
.71	2.23	Eastcote and Ruislip Manor	2	5½	2	5½
.45		Ruislip Manor and Ruislip	1½		1½	
1.15		Ruislip and Ickenham	2½		2½	
.63	3.08	Ickenham and Hillingdon	2	7	1½	8½
1.30		Hillingdon and Uxbridge	2½		•4½	
	.38	Holborn and Aldwych		1½		1½

† — Temporary increase from 2 to 3 minutes.
• — Temporary increase from 2½ to 4½ minutes.

CLEARANCE TIMES

All lines will have points where trains running in one direction will conflict with trains moving in the opposite direction. This occurs at all reversal points and whenever there are flat junctions. It is vital that the Compiler is aware of the confliction areas and knows the clearance times to be allowed at each location.

The illustration overleaf shows how clearance times are calculated at a typical two platform terminal.

HEADWAYS

A 'headway' may be described as the distance **in time** between trains running on the same track.

The Compiler must know what the **minimum** signalled headway is for each section of the line. On the Underground, a trunk section will usually be signalled for 90 second headways (i.e. trains can run 1½ minutes apart) and outer sections for 2 minute headways.

Normally, the Compiler will aim to keep scheduled headways wider than signalled headways whenever he can do so.

(c) **SERVICE FREQUENCY**

The final set of information a Compiler must have will be the level of service which is required to be operated over each section of the line. This is referred to as the service remit. The service frequency will vary for different days of the week and different times of the day.

A remit will often be quoted as the number of trains to be run over each section per hour - "trains per hour" (t.p.h.). This can easily be converted to service frequency, i.e.:

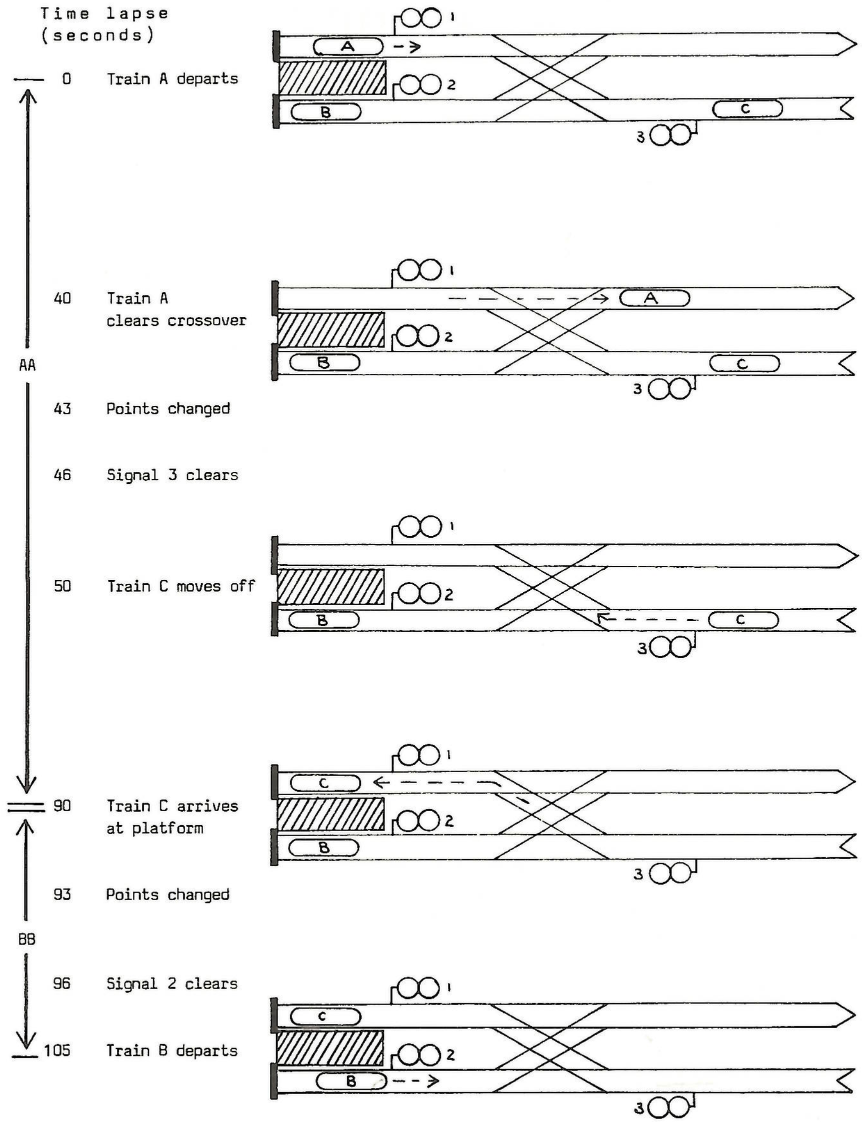
4 t.p.h.	-	15 minutes frequency
6 t.p.h.	-	10 " "
8 t.p.h.	-	7½ " "
12 t.p.h.	-	5 " "
20 t.p.h.	-	3 " "
30 t.p.h.	-	2 " "

London Transport Working Timetables do not allow for timings of less than ½ minute. Sometimes the remit calls for a frequency to a finer fraction than this, e.g.

16 t.p.h. - 3¾ minutes frequency

In this case the timetable must compromise and show a varying frequency to produce the correct number of trains per hour. A 3¾ minute service would therefore be compiled as 3½ and 4 minute intervals alternately.

SEQUENCE OF MOVEMENTS AT A TYPICAL TERMINUS



AA - Platform empty time = 1½ minutes.
BB - Signal clearance time = 15 seconds (½ minute allowed).

CHAPTER II

The Standard

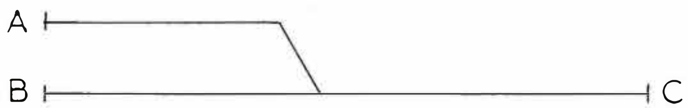
A Working Timetable can generally be divided into several periods of time. Within each 'period' trains run at constant intervals - to a pattern, or cycle, which is repeated for as long as it is required. Ideally the cycle time will be divisible into 60 minutes (e.g. 10, 12, 15, 20 or 30 minutes) which allows the service to repeat each hour. This is known as a 'clock face' interval service.

The compilation of these patterns is the first task to be undertaken when commencing work on a new timetable - they are generally displayed for a span of one hour unless the cycle time is longer than this, when the complete cycle is shown. These patterns are called 'standards' and each of these 'periods' mentioned above requires its own standard.

The quality of the timetable will very much depend on the quality of its standard patterns. Thus it is most important that the compiler takes time at this stage to be absolutely certain that he has produced the best possible standard - he must be sure that he has allowed correct time allowances (outlined in chapter 1), that any other requirements are catered for (e.g. connections with other lines) and that he has the best possible utilization of trains.

SELF CONTAINED SERVICES

On lines which have branches it is normal practice to design the standard so that trains continue to run to and fro on the same branch throughout the period of the standard.



On the above diagram for example, one set of trains will run between A and C whilst another set will work between B and C.

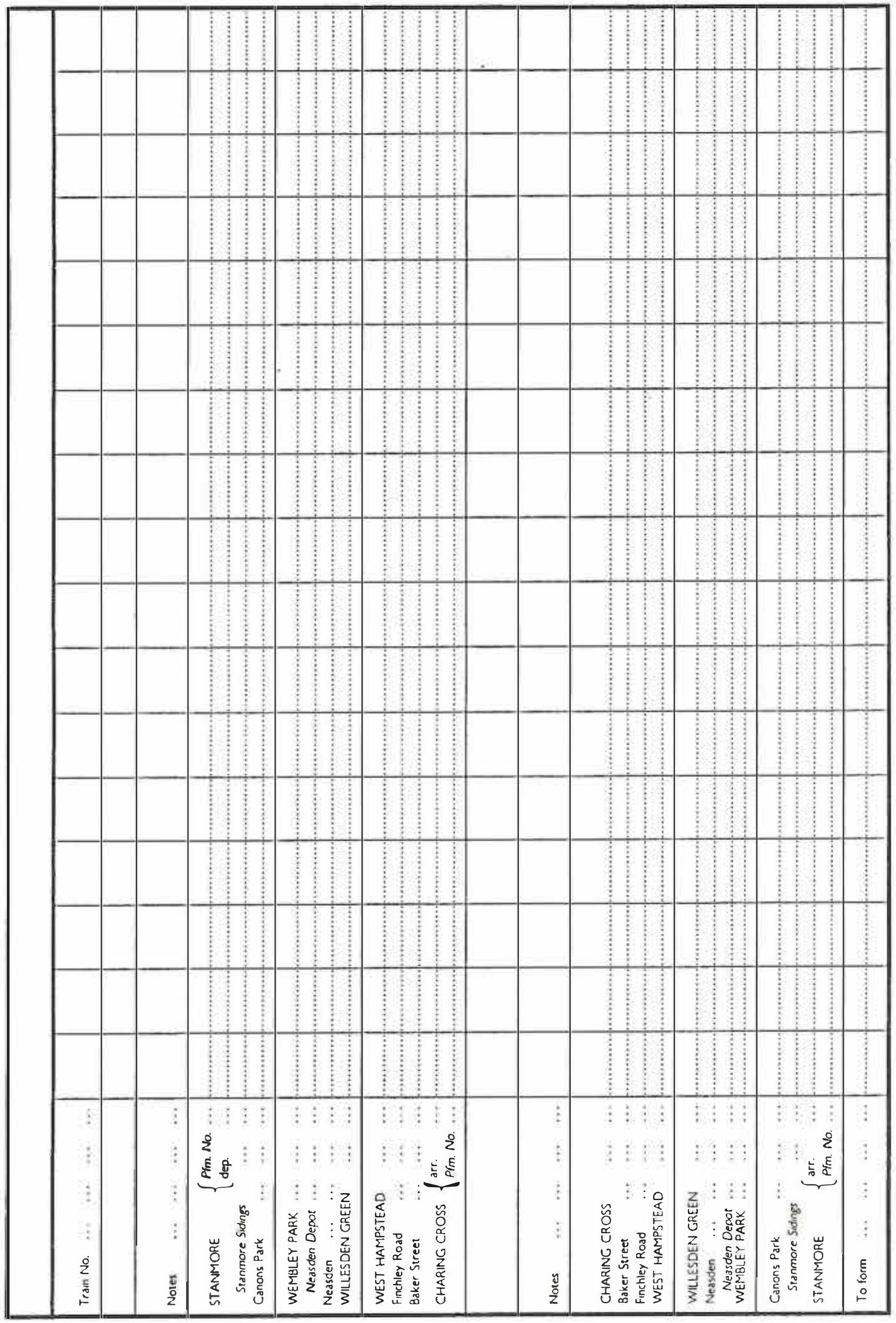
This method is known as 'self contained services' and is much favoured by the Traffic Controllers since it ensures that the effect of delays to the service is kept to a minimum. For instance, a delay occuring at station B will effect trains operating to and from that station but trains working between A and C will continue to run, largely unaffected; thus the Controller will have to attend to only half the total service.

THE GALLEY SHEET

Working Timetables and their standards are normally compiled on special pre-printed sheets, known as 'Galley Sheets'. The list of stations down the left-hand side is called the 'station name bank'. Sometimes a special layout is required and blank galley sheets are available for this purpose.

The sample galley sheet shown herein uses what is known as a 'folded format' style of presentation. In a folded format timetable, both directions of service are contained in one galley. This style is only possible when there is a common reversing point for all trains at one end of the line. The more usual method is to use a directional format where the two directions of service are shown on separate galleys.

A 'FOLDED FORMAT' STYLE GALLEY SHEET FOR THE JUBILEE LINE

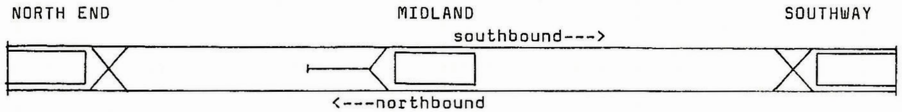


COMPILING THE STANDARD - WHERE DO WE START?

There may well be outside factors (e.g. connections or interworking with other lines) which will dictate the times of trains at certain locations but if this is not the case, the simplest answer is; you can start where you like. Select a time and a location and work from there. The recomended method if to set down the service in one direction only which can be regarded as 'fixed'. In the opposite direction times can then be juggled around until a suitable pattern is found but service intervals must, of course, adhere to the remit.

The aim is to provide optimum layovers at all points. An optimum layover is essentially the most suitable layover for the service being operated. At one extreme it will be the minimum layover (when the service frequency is so great that the minimum is also the maximum workable layover which can be allowed). Otherwise it will range up to double the minimum. Where service intervals are wide, longer layovers may be unavoidable. Avoid making layovers so generous as to incur the unnecessary use of extra trains.

Check all clearances (not forgetting any flat junctions) - allow more than the minimum clearance time if you can. Let us take a simple railway by way of illustration:



Running Times	-	North End - Midland	15 minutes (each direction)
		Midland - Southway	22½ " (" ")
Clearance Times	-	North End and Southway	1½ minutes (departure - arrive)
			½ minute (arrive - depart)
Minimum Layovers	-	North End and Southway	4 minutes
		Midland	6 minutes
Service Frequency	-	North End - Midland	10 minutes
		Midland - Southway	5 minutes

As recomended we will start by setting out our service pattern for one direction which we will call southbound:-

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½

That's one direction done already!

Looking at the northbound, we must pitch the timings to produce suitable layovers and clearances at each point. Since all trains reverse at Southway it is a good idea to look there first. If we start by applying the minimum layover to the first train, it would depart at 41½ - this gives insufficient clearance time before the second train arrives at 42½. Therefore the departure of the first train must be delayed until after the second train has arrived. Because there are only two platforms available, it must leave at least 1½ minutes before the third train is due. Thus, in this case there is a "window" of 4 minutes during which time the first train must leave (i.e. 43 to 46 inclusive). The range of this "window" will vary acccording to the level of service being reversed.

Suppose we start by timing the first train to leave at the earliest time (43); we can then set down a northbound service from Southway to the furthest point where all trains run (i.e. Midland). Therefore, for this particular pattern of service, the stretch of line between Southway and Midland becomes the 'trunk section'.

Our service is beginning to take shape, and will now look like this:-

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	43	48	53	58	03							
Midland	05½	10½	15½	20½	25½							

(Note that only a few northbound trains have been inserted at this stage - they may need to be altered later.)

Now we must decide which trains to reverse at Midland.

Looking at the first train, it would have to depart again going south at 10 or 20, having reversed via the siding beyond the station. The layover would be too short for it to depart at 10 and if it were held back for the 20 departure, the siding would not be clear for the following terminating train arriving at 15½. The second train (10½ arrive) is much better - it would have a layover of 9½ minutes, departing southbound at 20 and leaving the siding clear for the next reverser arriving at 20½. This is very satisfactory and we can now project the remaining trains to North End.

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	43	48	53	58	03							
Midland	05½	10½	15½	20½	25½							
North End	20½		30½		40½							

Now we are in trouble!

The 20½ arrival at North End clashes with the 20 departure. The arrival time must be at least 1 minute later to provide the minimum 1½ minute clearance.

So, can we retime the whole northbound service 1 minute later? We know already that this can be done at Southway - what about Midland? No problem, the layover is simply reduced to 8½ minutes. (There are no junctions to worry about but if there were they should be checked for clearance at this time.)

So let us assume that all northbound times are one minute later and look at the layovers and clearance time at all three points.

	Layover	**Clearance**
Southway	6½	3½
Midland	8½	-
North End	8½	1½

The service is workable, the layovers are good but only the minimum clearance time is allowed at North End. Another ½ minute delay to the northbound service would give optimum allowances for all layovers and clearances.

So we should retime the northbound service 1½ minutes later than was originally put down. We can then complete our standard hour by inserting the 'to form' times (i.e. the time of departure in the opposite direction).

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	44½	49½	54½	59½	04½	09½	14½	19½	24½	29½	34½	39½
Midland	07	12	17	22	27	32	37	42	47	52	57	02
North End	22		32		42		52		02		12	
To Form	30	20	40	30	50	40	00	50	10	00	20	10

This standard has been compiled using a 'folded format' style of galley. It could equally well have been written out using directional galleys:

viz

Southbound

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
To Form	44½	49½	54½	59½	04½	09½	14½	19½	24½	29½	34½	39½

Northbound

Southway	44½	49½	54½	59½	04½	09½	14½	19½	24½	29½	34½	39½
Midland	07	12	17	22	27	32	37	42	47	52	57	02
North End	22		32		42		52		02		12	
To Form	30	20	40	30	50	40	00	50	10	00	20	10

ADVANCE OR DELAY?

Sometimes it is just not possible to compile a satisfactory standard using the basic running time throughout. In other words a train, or trains must be delayed en route in order to give satisfactory working over a flat junction or at a terminal.

For illustration we will return to the stage where we first set down northbound times to North End and found we had clearance problems:

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	43	48	53	58	03							
Midland	05½	10½	15½	20½	25½							
North End	20½		30½		40½							

Now let us assume that the timings at Southways are fixed and cannot be altered at all. We now have two options open to us:

1 to DELAY northbound trains at Midland so that they arrive at North End one minute later.

2 to ADVANCE southbound trains to run one minute earlier from North End to Midland.

With both these options, trains must STAND for one minute at Midland. This is achieved by use of a 'stand code' (in this case a small letter 'b' signifying a one minute hesitation) which is placed in front of the 'minute' figures. A list of these codes is shown in the front pages of all Working Timetables.

Stands cause delay to passengers; they should not be used unnecessarily. When they are used and there is a choice of position or direction, they should be placed where they are likely to delay as few passengers as possible.

Check that the stand does not cause the minimum headway to be violated.

Our 'exercise' standard can be completed using the advance or bend technique.

Thus if the heaviest traffic flow is Northbound; the **advance** method is used viz.

North End	59		09		19		29		39		49	
Midland	b15	20	b25	30	b35	40	b45	50	b55	00	b05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	43	48	53	58	03	08	13	18	23	28	33	38
Midland	05½	10½	15½	20½	25½	30½	35½	40½	45½	50½	55½	00½
North End	20½		30½		40½		50½		00½		10½	
To Form	29	20	39	30	49	40	59	50	09	00	19	10

If, on the other hand, the traffic flow is Southbound, we would use the **delay** method viz.

North End	00		10		20		30		40		50	
Midland	15	20	25	30	35	40	45	50	55	00	05	10
Southway	37½	42½	47½	52½	57½	02½	07½	12½	17½	22½	27½	32½
Southway	43	48	53	58	03	08	13	18	23	28	33	38
Midland	b06½	10½	b16½	20½	b26½	30½	b36½	40½	b46½	50½	b56½	00½
North End	21½		31½		41½		51½		01½		11½	
To Form	30	20	40	30	50	40	00	50	10	00	20	10

Remember that a stand increases journey time for the passenger. It is always better to adjust layover times if you can.

PEAK STANDARDS - MAXIMUM TERMINAL THROUGHPUT

Sometimes, especially on a long line, the peak period will not last long enough to utilize a complete standard. However, it is usually worthwhile to produce a standard for reference purposes.

On lines where the trunk section ends at a terminus (as at Elephant & Castle) it may not be possible to reverse the required frequency of service unless the terminal throughput is increased in some way.

At a platform terminus, the most frequent service which can reqularly be reversed there (i.e. the maximum throughput) can generally be calculated by use of the following formula.

$$\frac{\text{Layover Time + Platform Empty Time}}{\text{Number of Platforms}} = \text{Maximum Service Frequency}$$

For example; at a 2 platform terminal with a platform empty time of $1\frac{1}{2}$ minutes and a minimum layover of 4 minutes, the formula will read:

$$\frac{4 + 1\frac{1}{2}}{2} = 2\frac{3}{4}$$

Therefore, rounded up to the nearest $\frac{1}{2}$ minute, the maximum service frequency would be 3 minutes.

The throughput of a terminal can be increased by reducing the layover time below the normally accepted minimum using a process known as 'stepping-back' of train crews.

An additional crew is used for **each platform** at a terminus where stepping-back is to take place (e.g. at a 2 platform terminal, **two** additional crews are required to operate stepping-back). This crew will be deployed on the platform ready to take over the train as soon as it arrives. The crew of the arriving train will leave their train and 'change ends' on the platform ready to join the next train at that platform. This process is repeated for as long as stepping-back is required. In this way the minimum layover time can be reduced to $2\frac{1}{2}$ minutes and the terminal throughput formula would now read:

$$\frac{2\frac{1}{2}\ \text{(minimum layover)} + 1\frac{1}{2}\ \text{(Platform empty time)}}{2\ \text{(platforms)}} = 2\ \text{(service frequency)}$$

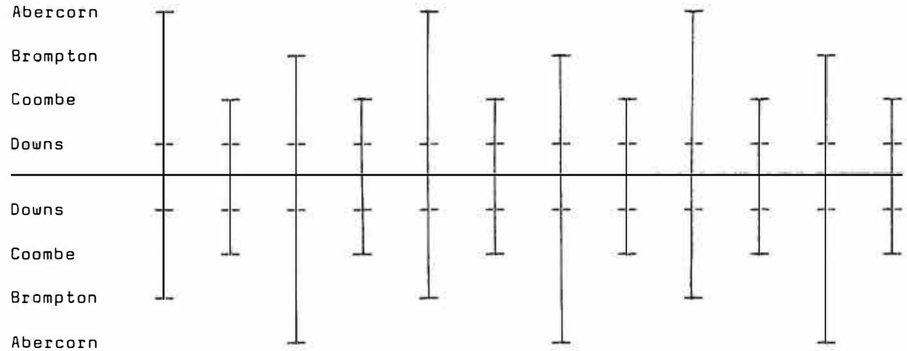
So, the best service which could operate, at peak times through this example terminal would be 2 minutes.

A special symbol '∇' is used in the timetable to indicate that stepping-back is to take place.

HOW MANY TRAINS?

When a standard is completed it is a good plan to calculate the number of trains required to work that standard. Sometimes, particularly for research projects, this information is vital in order to evaluate the 'cost' of the service being considered.

A standard will normally contain a number of self-contained service patterns and each train will work continuously on one of these patterns. We must identify the patterns and calculate the cycle time for trains on each pattern.



The above illustration indicates patterns on a folded format timetable. There are two patterns - one simple and one complex. The simple pattern provides the service between Coombe and Downs. Trains on this pattern work only to and from these points. The cycle time for this simple pattern will be the total time taken for a train to complete one round trip - including layovers. The second, more complex pattern concerns the service between Abercorn, Brompton and Downs.

Trains from Abercorn to Downs return to Brompton, thence back to Downs before completing the cycle by working to Abercorn. In this case the cycle time will be the total time taken, by a train, from departure Abercorn until its next departure from Abercorn.

For each pattern, calculate the cycle time - then find the number of trains required to work the pattern by dividing the cycle time (in minutes) by the interval between trains on **that** pattern.

The formula for this calculation is:

$$\frac{\text{Cycle time (in minutes)}}{\text{Cycle interval (in minutes)}} = \text{Number of trains}$$

Do this calculation for each pattern and the sum of the results will be the total number of trains required to work the standard.

The process will be clarified if we put some times on the illustration.

Abercorn	00				30				00
Brompton	15		30		45		00		15
Coombe	21	28½	36	43½	51	58½	06	13½	21
Downs	30	37½	45	52½	00	07½	15	22½	30
Downs	35	42½	50	57½	05	12½	20	27½	35
Coombe	44	51½	59	06½	14	21½	29	36½	44
Brompton	50		05		20		35		50
Abercorn			20				50		
To Form	00	58½	30	13½	30	28½	00	43½	00

First, the trains working between Coombe and Downs. Take any departure from Coombe - say the 43½. This train returns to Coombe and is ready to depart on its next trip at 13½ (30 minutes later). Thus the cycle time for the simple pattern is 30 minutes. The interval between trains on this cycle is 15 minutes. So the formula will read:-

$$\frac{30 \text{ (minutes)}}{15 \text{ (minutes)}} = 2 \text{ trains required}$$

For the second cycle, take the train departing Abercorn at 00, follow it through its cycle and it will depart Abercorn next at 00 (120 minutes later). In this case the interval between trains on the cycle is 30 minutes.

$$\frac{120 \text{ (minute cycle)}}{30 \text{ (minute interval)}} = 4 \text{ trains required}$$

So the whole standard service will require 6 trains.

CHAPTER III

The Train Service

FIRST AND LAST PASSENGER TRAINS

It is important to understand what is meant by First and Last trains. Briefly, a first train will be the first **passenger** train to serve **part** of the line - maybe only one station. Likewise, a last train will be the last **passenger** service to **part** of the line. Thus a large line will tend to have several first trains and several last trains.

All first trains and **all** last trains have been carefully timed to provide connections with other lines and sometimes B.R. services and buses as well. Station duty rosters will have been compiled to suit these times. It must be understood therefore that THE COMPILER MUST NOT ALTER TIMES OF FIRST AND LAST TRAINS WITHOUT SPECIAL AUTHORITY.

NOTE: First and Last trains - will not necessarily be the first and last **movements** on a section of a line. They will often be preceded or followed by empty trains or staff trains (these will be explained later on).

THE PASSENGER SERVICE

The first task is to set down on our galley sheets the full passenger service we are required to provide.

Taking the same simple railway that we used for standard compilation, let us imagine that we have given the following remit:-

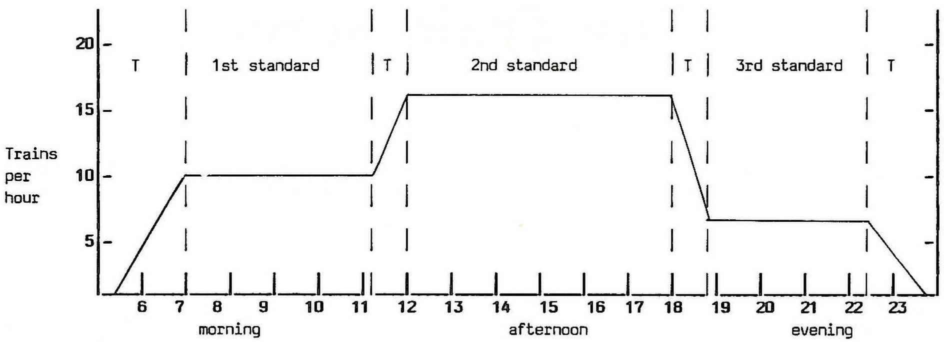
	North End - Midland	Midland - Southway
Before 12.00	6 t.p.h.	12 t.p.h.
12.00 - 18.00	8 t.p.h.	16 t.p.h.
After 18.00	4 t.p.h.	8 t.p.h.

This can easily be converted to service frequency, thus:-

Before 12.00	10 mins.	5 mins.
12.00 - 18.00	7½ mins.	3¾ (3½ - 4) mins.
After 18.00	15 mins.	7½ mins.

Standards will have been compiled for each of the three service levels and they can readily be expanded to cover the periods when they are required to operate. However, they remain three unconnected services which have to be welded smoothly together. This is achieved by introducing a short period between the standards where the service is gradually altered from the old pattern to the new. This is known as the transition period. The length of the transition period will depend on the degree of change in the service levels but it will generally be around 15 to 30 minutes. Similarly, a standard pattern cannot start with a bang immediately after the 'fixed' first trains or be cut off at last trains - thus transition periods will be required to link the standards to first and last trains.

Our sample timetable can therefore be divided into a number of clear periods which are best displayed in a diagrammatic form:-



Time (hours)

T = Transition periods

When changing from one standard to another it is always policy to allow the more frequent standard to operate for its full period and the transition time is allowed to 'eat into' the period of the lesser standard. Note that the time quoted in the remit for a change in service level should normally be taken at the point where the passenger traffic is heaviest - this is usually in the Central area.

Ensure that no interval in the transition period is wider than the less frequent standard. (It is particularly important to check this on branches where the wider intervals can make a smooth change of standards rather than tricky.)

Compilation of the timetable can now proceed taking one direction at a time in a similar manner to compiling a standard. At this stage, there is **no** need to form trains up **unless** the line has a trunk section terminal (e.g. Elephant & Castle on the Bakerloo Line) where trains must be formed up as the service is compiled.

Continue until the passenger service is set down for the complete day.

STAFF TRAINS

The next stage is for staff trains to be added - like first and last trains they are rarely altered and should be copied from the existing timetable.

Staff trains are part of an integrated network of staff facilities which includes staff buses and staff taxis as well as staff trains. All are linked to staff booking on or booking off times and the Compiler must not alter their times without seeking further advice.

In a working timetable all trains are passenger unless shown otherwise so all staff trains should have the word 'staff' entered on the notes line.

When all staff trains have been entered, the embryo timetable will contain every train which is **needed** to provide the service and it is ready to be 'formed up'.

FORMING UP THE SERVICE

Sometimes the process of forming up the service is combined with the starting and stabling procedure (explained in the next chapter). More frequently a particular line will require the service to be formed up in a particular order. The new Compiler should seek guidance as to which course to take for a particular timetable.

Generally, each terminal is taken, one at a time. Form arriving trains onto suitable departures (note that staff trains can form passenger trains and vice versa) and tick the top of the column of each departure as it is formed. Allow sufficient layover time and clearance times and do not use more platforms or sidings than you have available!

During transition periods the rate of trains arriving will not match the rate of departures; if the service frequency is being increased there will be a number of departures which cannot be matched by arrivals - these will be identified by their columns remaining unticked. Conversely, as the service is reduced there will be arrivals which are not wanted for return trips - there will be no time indicated in their 'to form' space. Later these trains will have to be worked to or from a depot, so allow sufficient space at your terminals, for these trains to reverse.

This is the first reference we have made to a depot, so we will leave our timetable for the moment and discuss this new subject more fully.

CHAPTER IV

Rolling Stock

PROVIDING TRAINS FOR THE SERVICE

On each line there are a number of places where trains are stabled when they are not required for service. These locations fall into three categories:-

(a) Depots - Usually fairly large. Some covered accommodation will be provided where the Rolling Stock Engineer's staff can examine and service the trains. There will also be siding roads, under cover or in the open, where trains not requiring attention are stabled.

(b) Sidings - These are roads, usually in the open, where trains are stabled away from the running lines. Only the minimum of safety checks and cleaning will take place at these points.

(c) Outstabling Points - A term used when trains are stabled away from normal Depot and Siding locations. Outstabling points can be at platforms or on normal reversing sidings. They are used on lines where Depot and siding capacity is short and are generally only suitable for overnight stabling and are regarded as undesirable.

Each stabling point has a nominated number of trains which are required for service. In the case of Depots this number is normally less than the actual holding of trains at that Depot (to allow for trains being serviced or repaired by the Engineers).

As with cars (automobile variety!) trains need to be thoroughly examined and serviced at stipulated intervals. Since a large number of trains are stabled at locations other than Depots (i.e. in categories (b) and (c)) where there are no servicing facilities, provision must be made to get these trains to a depot eventually. This could be arranged by simply transferring trains by special trips from one point to another.

A much better method is to design the timetable to achieve this. This is called 'rotation of stock' which simply means that the timetable provides for some of the trains starting from each siding location to stable later in the day at a Depot and vice versa.

Some stabling locations will have a very limited capacity; often only sufficient to start some of the trains needed at a local reversing point, thus a certain amount of surplus journeys will be necessary to move trains to the point where they are required for service. Avoid running these journeys very early in the morning or late at night and **never** run before or after first and last trains or staff trains, without authority.

EXTRA INFORMATION THE COMPILER NEEDS

In Chapter I we learnt what information we needed to compile the standards and to set down the basic timetable. Now we need to know all about our stabling facilities, as follows:-

(a) The location of each stabling point on the line and into which of the three categories each falls (i.e. Depot, Sidings and Out-Stabling points).
(b) The track layout at each location - in particular how the stabling point is connected to the running lines.
(c) The number of trains available for service at each location.
(d) The running time between each stabling point and the nearest timing point on the running lines.

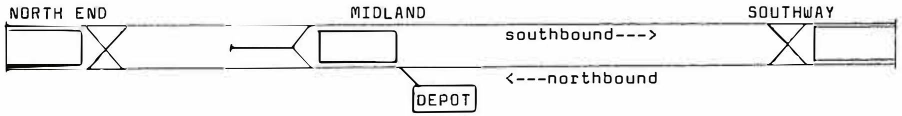
BACK TO THE TIMETABLE - GETTING TRAINS STARTED

The timetable as it has been compiled so far will indicate a number of trains required to start at each reversing point.

In many cases there will be a nearby stabling point from which to take trains but sometimes there will be insufficient trains stabled there to meet our requirements. If the nearest stabling location is remote or there are not enough trains available locally, additional trips will be necessary to bring trains to the terminal where they are needed. These additional journeys will run as passenger trains, additional to the basic service, unless they are outside the traffic day (i.e. earlier than first or later than last passenger trains) when they must run empty.

Sometimes this process can produce a rather untidy situation whereby the timetable includes a number of abutting short journeys. To explain this further we will refer again to our simple railway.

Let us assume that there is a Depot at Midland:-



This Depot has to supply all trains required to enter service at Midland and at North End. Those for North End must run as additional trips from Midland.

Now, the remit we have been using for our sample timetable provides for half the service to terminate at Midland. Referring back to Chapter III we can see that there will be a point in the timetable when the northbound service at Midland and North End is working to the first standard whilst the southbound service has reached the second standard viz:-

Southbound					
North End	11.37½		11.45		11.52½
Midland	11.52½	11.56½	12.00	12.04	12.07½
Southway	12.15	12.19	12.22½	12.26½	12.30
Northbound					
Southway	10.54½	10.59½	11.04½		
Midland	11.17	11.22	11.27		
North End	11.32		11.42		
To Form	11.37½	11.34	11.52½		

The service has been formed up and the trains which are required to start will remain unticked at the top of the column.

An additional train is required to run from Midland to North End to form the 11.45 departure:-

Northbound

Notes			Start 11.21 ex	
Southway	10.54½	10.59½	Depot	11.04½
Midland	11.17	11.22	11.24	11.27
North End	11.32		11.39	11.42
To Form	11.37½	11.34	11.45	11.52½

Note that we have written in the time the train leaves the Depot and put the word 'start' on the notes line - this is always inserted when a train starts.

Sometimes the Depot is included in the station name bank and our timetable could equally well incorporate this as shown in the final galley lower down.

Now consider the situation at Midland, northbound. A train from Southway arrives at 11.22 and terminates. Two minutes later another train departs for North End having started from the Depot. This means that through passengers have been forced to change trains quite unnecessarily. This is overcome quite simply, as follows:-

Extend the 11.22 train to North End and reverse the following starting train at Midland. This small adjustment to the timetable incurrs no additional costs at all but gives the passenger a better deal.

To summarise then, make it a policy to avoid running two short trips when they could equally well be combined into one long journey.

We must now adjust our timetable accordingly:

Northbound

Notes			Start Ety	
Southway	10.54½	10.59½		11.04½
Midland Depot	-	-	11.21	-
Midland	11.17	11.22	11.24	11.27
North End	11.32	11.37		11.42
To Form	11.37½	11.45	11.34	11.52½

A new feature has now been included, i.e. the note 'Ety' (short for empty) on the notes line. This is inserted whenever a complete trip runs empty. (Remember that all trains shown are assumed to be passenger unless they are indicated otherwise.)

As each train gets formed up, remember to tick the top of the column.

When starting up trains, each terminal point should be tackled in turn but they should be tackled in a certain order to avoid too much adjustment later on. In the illustration used above, North End should be completed before working on Midland since most if not all the trains required to form unticked trips in the opposite direction at North End can be found by extending Midland reversers.

Generally, terminals which do not have nearby stabling accommodation are tackled first, then locations with a very limited supply of 'local trains' and finally points near the larger depots. Remember to use locally stabled trains for the early morning starts. Keep a note of the number of trains you have started from each point - don't use more trains than are available!

STABLING TRAINS

Stabling is very much a reversal of the start up procedures with important exceptions.

On a Monday to Friday timetable most of the trains stabled after the morning peak will be required to be placed in a Depot where they can receive maintainance.

Evening stabling should be tackled in reverse order. Late night trains should be stabled first using local stabling points as far as possible (this avoids running unnecessary additional mileage late at night). This done you will know the capacity left at each stabling point and you can proceed with the early evening trains.

As each train is stabled, the word 'Stop' is written on the 'to form' line at the foot of the column.

When all trains have been stabled a good check through the timetable should be made. Firstly, check that every column is ticked or contains the note 'start'. Secondly, check that the 'to form' line shows a time, or the word 'stop' for every column.

DEPOT WORKING

A Depot Working is simply a list showing, in time order, all trains which start and finish at each depot.

A rough Depot Working should be prepared in stages as you complete each section of your timetable viz:-

(a) The morning start-up.

(b) The mid-day stabling (after the morning peak).

(c) Afternoon starts for the evening peak.

(d) The night finish.

(e) The evening stabling (after the evening peak).

When you have completed stage (e), each location should balance (i.e. the number of trains stabled at that point must equal the number of trains which started there).

Stage (f) - the addition of train numbers will be done later - so leave room for them!

A stage by stage example of a Depot Working preparation is illustrated overleaf.

DEPOT WORKING - STAGE BY STAGE ILLUSTRATION

(a) First, the morning start up

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
	05 09 S		
	05 11 N		
	05 37 N		
	06 03 N		
	06 12 N		
	06 26 N		
	07 31 N		
	07 43 N		
	07 57 N		
	08 09 N		

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
	06 42		
	06 52		
	07 00		
	07 08		
	07 20		
	07 33		
	07 45		
	08 01		
	08 29		

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
	06 10		
	06 25		
	06 31 BB		
	06 49 BB		
	07 05 BB		
	07 24 BB		

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
	05 28 Pfm		
	05 36 Sdg		
	05 46 Sdg		

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
	07 11		
	07 29		
	07 44		
	07 55		

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
	05 27 23		
	05 47 21		
	06 25 22		
	06 40 S		
	07 05 S		
	07 18 S		
	07 37 S		

(b) The morning stablers are added

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
	05 09 S		09:44 N
	05 11 N		09:55 N
	05 37 N		10:06 N
	06 03 N		10:17 N
	06 12 N		10:26 N
	06 26 N		10:38 N
	07 31 N		10:41 N
	07 43 N		10:47 N
	07 57 N		11:06 N
	08 09 N		11:18 N

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
	06 42		
	06 52		
	07 00		
	07 08		
	07 20		
	07 33		
	07 45		
	08 01		
	08 29		

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
	06 10		
	06 25		
	06 31 BB		
	06 49 BB		
	07 05 BB		
	07 24 BB		

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
	05 28 Pfm		
	05 36 Sdg		
	05 46 Sdg		

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
	07 11		
	07 29		
	07 44		
	07 55		

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
	05 27 23		09 28 S
	05 47 21		09 48 S
	06 25 22		10 10 S
	06 40 S		
	07 05 S		
	07 18 S		
	07 37 S		

(c) Then the afternoon starters

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
	05 09 S		09:44 N
	05 11 N		09:55 N
	05 37 N		10:06 N
	06 03 N		10:17 N
	06 12 N		10:26 N
	06 26 N		10:38 N
	07 31 N		10:41 N
	07 43 N		10:47 N
	07 57 N		11:06 N
	08 09 N		11:18 N
	15 13 N		
	15 25 N		
	15 36 N		
	15 43 N		
	15 54 N		
	16 01 N		
	16 07 N		
	16 19 N		
	16 31 N		
	16 43 N		

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
	06 42		
	06 52		
	07 00		
	07 08		
	07 20		
	07 33		
	07 45		
	08 01		
	08 29		

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
	06 10		
	06 25		
	06 31 BB		
	06 49 BB		
	07 05 BB		
	07 24 BB		

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
	05 28 Pfm		
	05 36 Sdg		
	05 46 Sdg		

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
	07 11		
	07 29		
	07 44		
	07 55		

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
	05 27 23		09 28 S
	05 47 21		09 48 S
	06 25 22		10 10 S
	06 40 S		
	07 05 S		
	07 18 S		
	07 37 S		
	16 19 S		
	16 31 S		
	16 46 S		

(d) Followed by night finishes

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
	05 09 S		09:44 N
	05 11 N		09:55 N
	05 37 N		10:06 N
	06 03 N		10:17 N
	06 12 N		10:26 N
	06 26 N		10:38 N
	07 31 N		10:41 N
	07 43 N		10:47 N
	07 57 N		11:06 N
	08 09 N		11:18 N
	15 13 N		
	15 25 N		
	15 36 N		
	15 43 N		
	15 54 N		23:53 N
	16 01 N		00:13 N
	16 07 N		00:26 N
	16 19 N		00:33 N
	16 31 N		00:59 N
	16 43 N		01:25 K

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
	06 42		
	06 52		
	07 00		
	07 08		
	07 20		
	07 33		
	07 45		23 25
	08 01		23 31
	08 29		00 33

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
	06 10		
	06 25		
	06 31 BB		
	06 49 BB		23 14 BB
	07 05 BB		23 21 BB
	07 24 BB		00 26

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
	05 28 Pfm		00 30 Sdg
	05 36 Sdg		00 40 Sdg
	05 46 Sdg		00 42 Pfm

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
	07 11		
	07 29		
	07 44		
	07 55		

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
	05 27 23		09 28 S
	05 47 21		09 48 S
	06 25 22		10 10 S
	06 40 S		
	07 05 S		22 57 S
	07 18 S		23 38 S
	07 37 S		00 01 23
	16 19 S		00 26 S
	16 31 S		00 34 22
	16 46 S		00 52 21

(e) And the last of the time entries; the evening finishes

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
	05 09 S		09:44 N
	05 11 N		09:55 N
	05 37 N		10:06 N
	06 03 N		10:17 N
	06 12 N		10:26 N
	06 26 N		10:38 N
	07 31 N		10:41 N
	07 43 N		10:47 N
	07 57 N		11:06 N
	08 09 N		11:18 N
	15 13 N		18:17 N
	15 25 N		18:30 N
	15 36 N		18:45 N
	15 43 N		18:54 N
	15 54 N		23:53 N
	16 01 N		00:13 N
	16 07 N		00:26 N
	16 19 N		00:33 N
	16 31 N		00:59 N
	16 43 N		01:25 K

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
	06 42		17 53
	06 52		19 05
	07 00		19 18
	07 08		19 29
	07 20		19 41
	07 33		19 59
	07 45		23 25
	08 01		23 31
	08 29		00 33

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
	06 10		18 31 BB
	06 25		19 26 BB
	06 31 BB		19 38 BB
	06 49 BB		23 14 BB
	07 05 BB		23 21 BB
	07 24 BB		00 26

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
	05 28 Pfm		00 30 Sdg
	05 36 Sdg		00 40 Sdg
	05 46 Sdg		00 42 Pfm

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
	07 11		18 36
	07 29		18 57
	07 44		19 12
	07 55		19 26

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
	05 27 23		09 28 S
	05 47 21		09 48 S
	06 25 22		10 10 S
	06 40 S		19 26 S
	07 05 S		22 57 S
	07 18 S		23 38 S
	07 37 S		00 01 23
	16 19 S		00 26 S
	16 31 S		00 34 22
	16 46 S		00 52 21

(f) Finally (at a later stage) train numbers will complete the Depot Working

NEASDEN DEPOT

Train No.	Start	Train No.	Finish
111	05 09 S	120	09:44 N
112	05 11 N	121	09:55 N
113	05 37 N	122	10:06 N
114	06 03 N	135	10:17 N
115	06 12 N	162	10:26 N
116	06 26 N	155	10:38 N
117	07 31 N	152	10:41 N
120	07 43 N	166	10:47 N
121	07 57 N	117	11:06 N
122	08 09 N	151	11:18 N
162	15 13 N	120	18:17 N
155	15 25 N	121	18:30 N
152	15 36 N	122	18:45 N
166	15 43 N	130	18:54 N
151	15 54 N	165	23:53 N
135	16 01 N	111	00:13 N
117	16 07 N	143	00:26 N
120	16 19 N	162	00:33 N
121	16 31 N	164	00:59 N
122	16 43 N	126	01:25 K

STANMORE SIDINGS

Train No.	Start	Train No.	Finish
125	06 42	117	17 53
126	06 52	160	19 05
127	07 00	134	19 18
130	07 08	146	19 29
131	07 20	112	19 41
132	07 33	125	19 59
133	07 45	133	23 25
134	08 01	161	23 31
135	08 29	153	00 33

LONDON ROAD DEPOT

Train No.	Start	Train No.	Finish
141	06 10	116	18 31 BB
142	06 25	151	19 26 BB
143	06 31 BB	131	19 38 BB
144	06 49 BB	163	23 14 BB
145	07 05 BB	144	23 21 BB
146	07 24 BB	166	00 26

ELEPHANT & CASTLE

Train No.	Start	Train No.	Finish
151	05 28 Pfm	114	00 30 Sdg
152	05 36 Sdg	115	00 40 Sdg
153	05 46 Sdg	145	00 42 Pfm

CROXLEY GREEN DEPOT

Train No.	Start	Train No.	Finish
155	07 11	141	18 36
156	07 29	132	18 57
157	07 44	155	19 12
160	07 55	152	19 26

QUEENS PARK DEPOT

Train No.	Start	Train No.	Finish
161	05 27 23	156	09 28 S
162	05 47 21	145	09 48 S
163	06 25 22	146	10 10 S
164	06 40 S	157	19 26 S
165	07 05 S	113	22 57 S
166	07 18 S	167	23 38 S
167	07 37 S	142	00 01 23
156	16 19 S	127	00 26 S
145	16 31 S	135	00 34 22
146	16 46 S	156	00 52 21

CHAPTER V

Train & Crew Numbers

TRAIN NUMBERS

On Underground lines, each train is given an identification number which it retains throughout the day. This applies even if a train is stabled and re-starts later the same day but there is, of course, no continuity overnight. The Compiler is responsible for nominating these numbers which are at the top of each column in the timetable. Each line is allocated a block of train numbers which does not conflict with any other line using common control areas. Use of the digits 8 and 9 in a train number is forbidden on most lines because the 'automatic' point and signal control installed on some lines is incapable of handling these digits. Thus a block of numbers allocated to a line would, for example, look like this:-

1 to 7, 10 to 17, 20 to 27, 30 to 37 and 40 to 47. This block provides for a maximum of 39 train numbers.

The application of these numbers to the timetable conforms to one of two distinct methods:-

METHOD 1 - is used on lines where the off-peak pattern provides for trains on each route to follow one another around in order. The method is known as sequential numbering; a group of numbers will be used on each route and will be related to the standard which operates for the greater part of the daytime service. Thus, during this period the trains will follow each other in numerical order. When numbering up his timetable, the Compiler will commence at a point where the service is running on the selected standard and, taking each train in turn, number backwards to the start of the train, then forwards to the finish.

METHOD 2 - is adopted when the first method is unsuitable. Each stabling point is allocated a group of numbers and these are applied to trains in starting time order. In this case a Compiler will take each stabling location in turn and number each train forward from the start.

When you have numbered up a timetable be sure to check that every train trip has been given a number.

CREW RUNNING NUMBERS

On lines where stepping back occurs, another set of numbers is used - known as crew running numbers. These are in a completely different range from the train numbers and, because these numbers are not identified by any signalling equipment, the 8 and 9 restriction does not apply. Crew numbers are applied to the timetable in exactly the same way as train numbers **except** that when a train arrives at a terminal where stepping-back is occurring, the number follows the crew and is stepped back to the next train to reverse at that platform.

Because an additional crew is used at a platform where stepping-back takes place, it follows that an additional crew number will also be needed. This number will be applied to the first departure to be involved in the stepping-back process.

Note that with the usual 2 platform terminal, 2 stepping back crews are used - thus two additional crew running numbers are required - appled to the first two departures involved in stepping-back (one from each platform). The following illustration may help to clarify the process.

An illustration of Stepping-Back at a 2 platform terminal:

Train No.	3	12	17	4	21	22	26
Crew Running No.	101	103	114	121	102	117	108
TERMINAL ARRIVE	08 00	08 03	08 06	08 08½	08 11	08 13½	08 16
Platform No.	1	2	1	2	1	2	1
			▽	▽	▽	▽	▽
Train No.	3	12	17	4	21	22	26
Crew Running No.	101	103	141	142	114	121	102
Platform No.	1	2	1	2	1	2	1
TERMINAL DEPART	08 04	08 07	08 09½	08 12	08 14½	08 17	08 19½

In this case, stepping-back starts with train 17 at platform 1 and train 4 at platform 2. Note the allocation of new crew running numbers (141 and 142) for the departure of these two trains.

CHAPTER VI

The Finishing Touches — Timetable Related Items

At this stage the timetable is essentially complete but there are a number of additional jobs to be done which are associated with the timetable. One of these - the Depot Working was explained in in Chapter IV and should by now, be completed. Here is a brief look at the remainder.

ROLLING STOCK WORKING

This is a list, in train number order, showing where and at what time each train starts and stables during the course of the day. It shows the same information as the Depot Working but arranged in a different way. Many Compilers will prepare this document in parallel with their numbering of the timetable.

MAXIMUM ROLLING STOCK REQUIRED FOR SERVICE

This is a small tabulation which shows the **maximum** number of trains and cars which the rolling stock staff are required to provide for the service from each stabling point.

Examples of the above two tables are illustrated overleaf and, together with the Depot Working are included in the front pages of the timetable when it is published.

TRAIN RUNNING SCHEDULES

These are known colloquially as 'boards'.

A Train Running Schedule is written after the timetable is completed, for each train shown in that timetable. It follows the course of the train, trip by trip, throughout the day. An example of train boards for the Northern Line is shown overleaf.

Boards are used by the Duty Sheet Officer to assist them in compiling the crew duty sheets, and by the Railway Mileage Office in the calculation of scheduled train miles. For the Compiler, writing them is a rather boring clerical operation - but they are very important to the offices which use them. Thus their accuracy is as important as in the timetable itself.

On lines where stepping-back of crews occurs, it is necessary to prepare another set of boards - known as Crew Boards. These are exactly the same as train boards except that they follow the crews (more accurately - the crew running numbers) through the timetable.

EXAMPLES OF A ROLLING STOCK WORKING AND A MAXIMUM ROLLING STOCK REQUIRED FOR SERVICE

ROLLING STOCK WORKING

Train No.	Start Morning	Finish Morning	Start Afternoon	Finish Evening	Finish Night
111	N (S) 05 09	—	—	—	N (N) 00 13
112	N (N) 05 11	—	—	St 19 41	
113	N (N) 05 37	—	—	—	Q (S) 22 57
114	N (N) 06 03	—	—	—	ECS 00 30
115	N (N) 06 12	—	—	—	ECS 00 40
116	N (N) 06 26	—	—	LR (BB) 18 31	
117	N (N) 07 31	N (N) 11 06	N (N) 16 07	St 17 53	
120	N (N) 07 43	N (N) 09 44	N (N) 16 19	N (N) 18 17	
121	N (N) 07 57	N (N) 09 55	N (N) 16 31	N (N) 18 30	
122	N (N) 08 09	N (N) 10 06	N (N) 16 43	N (N) 18 45	
125	St 06 42	—	—	St 19 59	
126	St 06 52	—	—	—	N (K) 01 25
127	St 07 00	—	—	—	Q (S) 00 26
130	St 07 08	—	—	N (N) 18 54	
131	St 07 20	—	—	LR (BB) 19 38	
132	St 07 33	—	—	CG 18 57	
133	St 07 45	—	—	—	St 23 25
134	St 08 01	—	—	St 19 18	
135	St 08 29	N (N) 10 17	N (N) 16 01	—	Q (22) 00 34
141	LR 06 10	—	—	CG 18 36	
142	LR 06 25	—	—	—	Q (23) 00 01
143	LR (BB) 06 31	—	—	—	N (N) 00 26
144	LR (BB) 06 49	—	—	—	LR (BB) 23 21
145	LR (BB) 07 05	Q (S) 09 48	Q (S) 16 31	—	ECP 00 42
146	LR (BB) 07 24	Q (S) 10 10	Q (S) 16 46	St 19 29	
151	ECP 05 28	N (N) 11 18	N (N) 15 54	LR (BB) 19 26	
152	ECS 05 36	N (N) 10 41	N (N) 15 36	CG 19 26	
153	ECS 05 46	—	—	—	St 00 33
155	CG 07 11	N (N) 10 38	N (N) 15 25	CG 19 12	
156	CG 07 29	Q (S) 09 28	Q (S) 16 19	—	Q (21) 00 52
157	CG 07 44	—	—	Q (S) 19 26	
160	CG 07 55	—	—	St 19 05	
161	Q (23) 05 27	—	—	—	St 23 31
162	Q (21) 05 47	N (N) 10 26	N (N) 15 13	—	N (N) 00 33
163	Q (22) 06 25	—	—	—	LR (BB) 23 14
164	Q (S) 06 40	—	—	—	N (N) 00 59
165	Q (S) 07 05	—	—	—	N (N) 23 53
166	Q (S) 07 18	N (N) 10 47	N (N) 15 43	—	LR 00 26
167	Q (S) 07 37	—	—	—	Q (S) 23 38
Depot					
Neasden	10	10	10	4	6
Stanmore	9	—	—	6	3
London Road	6	—	—	3	3
Elephant & Castle	3	—	—	—	3
Croxley Green	4	—	—	4	—
Queens Park	7	3	3	1	6
TOTAL	39	13	13	18	21
TRAINS IN SERVICE	39	26	39	21	—

MAXIMUM NUMBER OF TRAINS AND CARS REQUIRED FOR SERVICE

DEPOT	No. of Trains	No. of Cars
Neasden Depot	10	70
Stanmore Sidings	9	63
London Road Depot	6	42
Elephant & Castle	3	21
Croxley Green Depot	4	28
Queens Park Depot	7	49
Total	39	273

TRAIN RUNNING SCHEDULE - NORTHERN LINE

Timetable Number 32 MONDAYS TO FRIDAYS/~~SATURDAYS/SUNDAYS~~ TRAIN No. 51

START FROM MORDEN DEPOT AT 06.39

Edgware								1804	1943½					
Colindale														
Golders Green			Ety							2107½	2219½	Ety		
Golders Green Depot														
High Barnet		0802½	0940				1626½					2339		
Mill Hill East			to									to		
Finchley Central			depot									depot		
East Finchley			arr											
Archway			0946											
Euston (City)														
Kennington		0846					1710½	1842½	2019½	2131½	2243½			
Tooting Broadway	ex													
Morden	depot													
Morden	0645½													
Tooting Broadway														
Kennington		0851½					1716½	1856	2032	2144	2254			
Euston (City)						Ety								
Archway														
East Finchley						1612								
Finchley Central						ex								
Mill Hill East						depot								
High Barnet	0750½	0934½				1618					2334			
Golders Green Depot														
Golders Green									2057	2209				
Colindale														
Edgware							1757½	1933						

FINISH AT High Barnet DEPOT AT 23.45

409/8 (4)
(20/100 11/73 200)

Conclusion

I implied at the very beginning that no book, paper or whatever, could ever claim to be a 'Teach Yourself Schedule Compiling'. Indeed, I never intended that this rather extended set of notes should include anything more than the most basic of background information.

More knowledgeable readers will be aware that many subjects have been omitted altogether but I have tried to include most of what a new Compiler is likely to encounter during their first few weeks of training. Beyond this stage the variations from a standard course - both in line peculiarities and in different methods used by experienced Compilers become numerous. I do not propose to take that path.

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Finally, if you have read this far - well done and thank you.

THE END