

Track Handbook 18

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Managing track quality

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1 Purpose

The purpose of this handbook is set out practical guidance on how to plan and achieve the desired quality of work carried out on the track asset.

2 Scope

This handbook covers the following topics:

- ◆ what track quality is: the reason for track maintenance and the resources provided to undertake it
- ◆ achieving track quality.
- ◆ planning for quality: how a quality plan needs to be approached in the track environment
- ◆ executing work: putting the plan into action including responsibilities and supervision
- ◆ quality through people: the need for properly trained people with whom we maintain good communications in order to achieve the track quality we are seeking
- ◆ material quality
- ◆ procedures and how they are part of the quality process
- ◆ quality checking: how to ensure that quality has been achieved and is being maintained.

3 Introduction

This handbook is one of a series intended to help those responsible for maintaining the track asset achieve standards and meet LU corporate objectives. This handbook offers:

- ◆ guidance on choices and alternatives
- ◆ 'do's and don'ts' for use on site e- technical data and illustrations e- material to use in staff training.

Before you first use this handbook, you should familiarise yourself with its contents. These are set out on the following page under the heading 'What this handbook covers'.

To help you make the best use of the handbook the front pages also include a quick reference guide to topics and page numbers that tells you where you can find information directly on particular items.

You will find in this handbook notes and comments based on the day-to-day experience of staff, outlining methods they have found successful in particular conditions as well as points not to be overlooked in carrying out the work.

In the event of any conflict between this handbook and referenced LU standards, the latter shall prevail.

4 What is track quality?

4.1 What is quality?

Firstly we need to ask ourselves what is meant by quality. To some it means a standard or grade of excellence but in reality it means something more specific. In fact one might well define it as fit for the purpose which the customer has specified.

Try this example for yourself:

- ◆ What is a quality pen? Is it a "Bic" ballpoint or a "Parker" fountain pen?

Yes, you agree, it depends what you need it for.

4.2 Track quality

The LU aspiration is a "decently modern metro".

Putting that into context we are not talking about InterCity travel, i.e. it is the comparison used above: what is fitness for purpose? What does our customer look for in track quality?

4.2.1 Customer perception

In relation to what we in the track environment can provide we understand that the customer expects:

- ◆ train availability
- ◆ reliability of service
- ◆ safety during their journey
- ◆ a price they can afford
- ◆ comfort - the longer the journey, the more comfort they seek.

These are effectively identified in the Company Management System within the Key Performance Indicators (KPIs). Apart from the travelling customer we effectively have other internal customers within LU:

- ◆ train operators
- ◆ rolling stock
- ◆ signals
- ◆ electrical
- ◆ civil engineers
- ◆ other or third parties.

Taking some of the principal features of the track:

- ◆ ride quality
- ◆ environment including noise
- ◆ conductor rail
- ◆ vegetation
- ◆ fencing
- ◆ drainage
- ◆ clearance

we can examine, in the form of a matrix, the effects on the range of customers, the shortfalls in quality of the track asset. See table 1.

Table 1: Track feature/customer interface								
Customer → Feature ↓	Travel- ling customer	Track	Train Op	Rolling Stock	Signals	Elec- trical	Civil Engi- neers	Others
Ride quality	c	m	c	m	x	x	x	x
Environment	a + s	m	s	x	f	f	m	a
Conductor rail	d	m	x	m	f	f	x	x
Vegetation	a + s	m	s	x	s	x	m	a
Fencing	s	m	s	x	x	x	m	s
Drainage	d	m	x	x	f	f	m	x
Clearances	d + s	m	x	m	x	x	m	x
a = aesthetic c = comfort d = delay f = failure m = maintenance s = safety x = not relevant								

It should be noted that reference has been made in the table to features other than the track itself. Whilst this handbook may, for obvious reasons, direct its attention to the four foot, the maintenance approach to quality applies equally to all track issues from operational boundary fence to operational boundary fence.

4.2.2 The track structure

The configuration of track is defined in S1157 (and S1162 for conductor rail). These cover different types of track for different locations. The track itself is, unlike its name “the permanent way”, far from permanent. In fact it is deteriorating constantly as a result of the train dynamic loading and the effects of the environment.

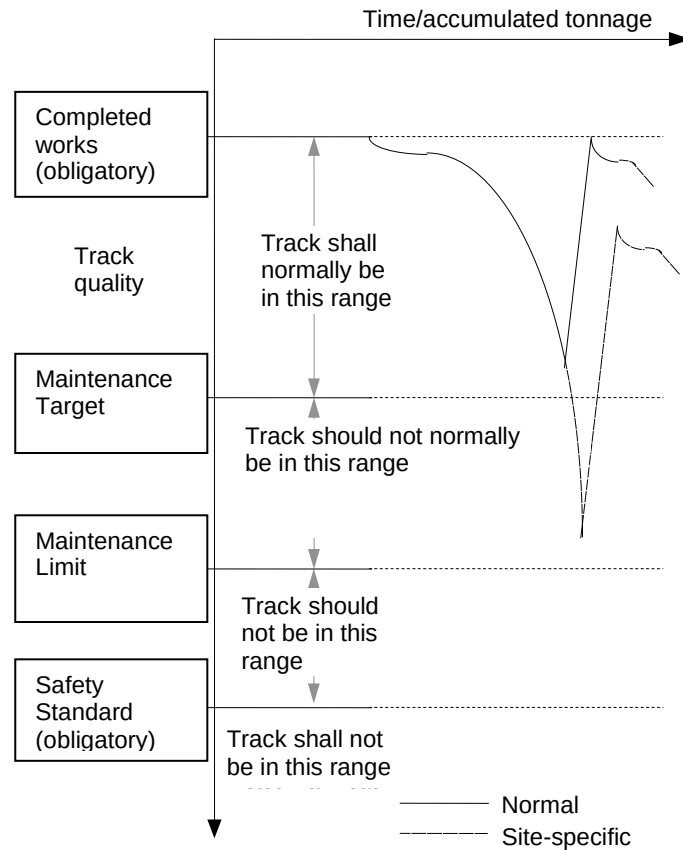
When track relaying takes place the measurable quality of the track is required to be to a high standard. This is referred to in S1159 (and 1 164 for conductor rail).

4.2.3 Quality thresholds

For each track parameter and for each track category (as defined in S1158) S1159 and 1-164 set out three values representing progressive **thresholds** of deteriorating track condition, namely:

- ◆ the Maintenance Target;
- ◆ the Maintenance Limit;
- ◆ the Safety Standard.

Figure 1 shows the application of these **thresholds** to the maintenance process.



Track beyond the Safety Standard threshold is generally subject to special risk mitigation.

Fig. 1 Track quality maintenance thresholds

The figure above diagrammatically presents a picture of the track quality deteriorating from its new condition as a result of the tonnage and speed of trains, the passage of time including effects of the environment and effectiveness of original installation/previous maintenance.

With time the track quality falls to a level set as the **maintenance target** at which time work should be undertaken to restore it to the installation level. Failure to do the work at the appropriate time will allow the track quality to deteriorate to the **maintenance limit** or eventually to the **safety standard**.

It goes without saying that the better the quality on completion of the work the longer the interval between successive work programmes at that location. It is best therefore to put it right first time round.

4.2.4 Factors affecting track quality

The principal factors affecting the track quality and influencing the deterioration cycle can be summarised as follows.

- ◆ **Geometry**
Commonly referred to as the top and line but including cross levels and twist.
- ◆ **Component condition**

The wear and tear of each individual component part, rails, sleepers, fastenings including ballast and formation.

◆ **Train service**

The service itself affects the track through the dynamic loading, the constituent parts being:

- **suspension characteristics**
Different generations of rolling stock have more rigid bogies than others which affect ride characteristics. Track quality needs to cater for these differences.
- **tonnage**
The train dead load, the volume of customers and the number of trains per day equate to the tonnage normally taken as an annual figure.
- **speeds**
The faster the trains travel the greater the effects of dynamic loading.

4.2.5 **Track type**

Track type is related to the location, i.e. tube section, sub-surface section, open section, but also due consideration should be given to the train service planned which leads to a track category.

4.2.6 **Track categorisation**

The track category being related to the density of traffic gives the basic guide to the maintenance planning needs.

4.3 **Summary**

- ◆ The track needs to be managed from a maintenance point of view as a complete system and structure to achieve quality.
- ◆ Track quality deteriorates with the passage of time and to a greater or lesser degree dependent upon the type and level of train service.
- ◆ As track quality deteriorates the rate of decline in quality accelerates.
- ◆ The environment affects quality by causing decay, degrading the foundation, and generating variable stresses in the rails.
- ◆ A key feature of track quality is to meet our customer expectations of a metro system, i.e. available, reliable, safe, affordable, comfortable.
- ◆ A further aspect is to ensure that any reduction in quality does not cause our colleagues in other sections additional work (e.g. damaged rolling stock).
- ◆ Better quality = longer lasting track condition = cost benefit.

5 **Achieving track quality**



As indicated previously there is a wealth of information available in other handbooks to assist the track teams to achieve quality. Examples of such detail are included in the following sub-headings which also introduce the following sections of this handbook.

5.1 **Inspections**



Handbook 10 *Inspecting the track* covers the variety of planned inspections, each of which in its own way is designed to assess the quality of the track, its component parts and associated features at the time of the inspection. Where a sub-standard track condition is identified an assessment needs to be made of the work required to achieve the desired quality.

5.1.1 Dynamic inspections

Some of the inspections are undertaken dynamically (under train load conditions), e.g. Track Recording Vehicle, video runs, clearance gauging or cab riding, and can therefore give a better picture of the actual effects of the passage of trains or the ride comfort.

5.1.2 Static inspections

These are manual inspections undertaken 'on the ground'. They supplement the dynamic results by providing useful information on component parts and their wear and tear.

Careful observation both visually and audibly where trains pass over the site of manual inspection will help in locating reported faults and highlight track defects which may not have been reported already.



Inspections form the very basis of a track maintenance strategy. Make the most use of every available means of inspection. Ensure that the inspection is undertaken by a properly trained person and that the style of the reporting mechanism meets your objectives.

5.2 Monitoring

Why not also utilise inspections to monitor performance? The before and after work effects will give you a good indication of how well the work was done. Periodic inspections will allow you to build up a pattern of deterioration (and highlight a particular poor piece of track where more work may be necessary).

Monitoring is also a useful tool in the achievement of quality, whether it is the measuring of output and performance or the effects of a variable train service; observation and records will provide useful data for planning work to achieve quality.

5.3 Planning resources

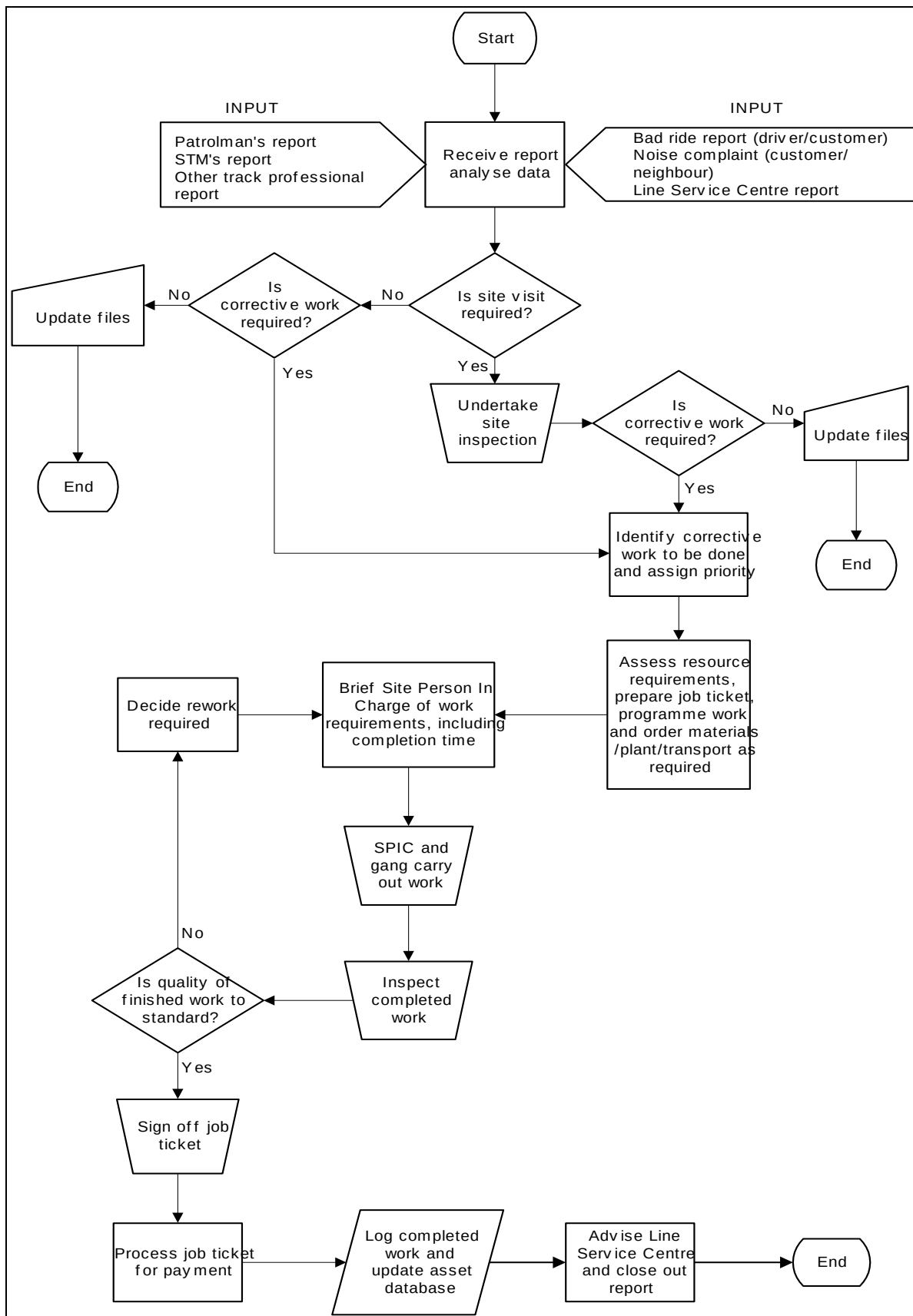
Section 6 of this handbook will deal with planning in more detail since without proper planning the achievement of quality would be unlikely.

Planning maintenance resources is covered in Handbook 21 which deals with the key resources or people and skills, material and transport, plant, tools, equipment as well as time and finance.

5.4 Work

S1159 and Track Handbooks 1 *Maintaining plain line track* and 19 *Managing the critical aspects of track* provide detail on when maintenance work is necessary. Depending upon the track category and the deterioration rate together with the actual condition, a priority of action can be assigned to the work.

Figure 2 depicts the various stages in getting work done which incorporates the important stage of checking to ensure the appropriate quality has been achieved.



Fig, 2 Track work execution process flowchart