

Steam Locomotive Tuning – from Working Timetable (WTT)

Introduction

When a locomotive is initially configured it is generally configured as a BASIC unit, and then if desired it can be setup with an ADVANCED configuration.

BASIC – standard locomotive design parameters without addition of any ADVANCED parameters.

ADVANCED – one or more of the ADVANCED configuration parameters (as referenced on CTN website) will be used to tune the locomotive as close as possible to the relevant locomotive test.

The tuning of a steam locomotive against a test report tends to be relatively easy as the test report typically specifies all of the relevant parameters required for testing and setting.

However the tuning of a locomotive against a WTT tends to be a lot more speculative as some of the test parameters, such as the reverser setting, is not specified, and thus requires the modeller to assign some “speculative” values to the locomotive configuration.

When testing the following thoughts should be borne in mind:

- i) If a change does not have the desired effect, try changing that parameter in the opposite direction, and see the outcome. Alternatively if that doesn't work, then remove the parameter, and move onto another one that may have a similar impact.
- ii) The test process described below is iterative. In other words, a small change is applied, and this is then confirmed to be correct.

The process primarily focuses on ensuring that the locomotive has sufficient pulling power for the load and conditions defined in the performance test. Initially the first iterations should be on adjusting the pulling power (IHP) of the locomotive. If this cannot be achieved because of poor steaming, then the next iteration should look at sorting out any steaming issues. Once these have been adjusted, then further iterations can be considered for the pulling power.

It is very difficult to achieve a 100% accurate representation of a particular steam locomotive operation, the tuning process aims to achieve the following outcome:

“Locomotives be able to keep booked time over particular routes with specified trailing loads, ideally with a small margin in hand for recovery from service slacks etc.”

Test Steps

- i) Define performance test set points and track section – ideally it should be over a consistent grade for the whole section to ensure the most consistent outcome. Using a WTT define the following performance criteria.
 - a. Distance
 - b. Time to travel section
 - c. Load and ruling gradient for section
 - d. Av speed – calculated from above

- e. Max speed – this is probably going to be a few mph higher than the average speed, but will not be sustainable over the full section
 - f. Throttle setting – typically 100%
 - g. Reverser setting – initially aim for a setting of approx. 50% This may vary slightly as testing proceeds.
- ii) Set up a test consist to the load identified above, and ensure all resistance values in the test stock and locomotive have been set correctly.
 - iii) Select a test route which accurately reflects the gradients in the test track section selected for the performance criteria in item i) above. Bear in mind that some routes may not accurately model the track sections in terms of gradients and distances.
 - iv) Configure locomotive with a BASIC configuration and undertake a test run over test section. During the test run maintain BP as close as possible to max boiler pressure, if necessary use the AI fireman override control to build up BP at a reasonable point. Ensure Steam consumption does not exceed steam production for long periods of time, and similarly ensure that boiler heat out does not exceed boiler heat in for long periods of time.
 - v) Once the run has been stabilised to the relevant reverser setting check performance of locomotive.

Read the Steam Locomotive Setup flowchart and identify which parameter appears to need adjustment. Make small adjustments, one at a time until the locomotive performance is met. Initially focus on tractive effort/IHP, and only make adjustments to steam production related parameters if the tractive effort/IHP is unable to be maintained for the relevant performance speed.

Testing is an iterative process and a new test should be run after each individual change.