BR(W) 4073 'Castle' Class Locomotive

Release Version 1.0

1 Background

1.1 Castle Class Steam Locomotive

The origins of this highly successful design date back to the Star Class of 1907 which introduced the basic 4-cylinder 4-6-0 layout with long-travel valves and Belpaire firebox that was to become synonymous with the GWR. The Star class were built to take the top express trains on the GWR with 61 in service by 1914, but after World War 1 there was a need for an improved design of express locomotive, and to meet this need Chief Mechanical Engineer GJ Churchward had in mind an enlarged Star class design with a standard No.7 boiler. However, the combination would have taken the axle load of such a design over the 20 ton limit set by the civil engineers, and in the end nothing came of the idea.

History

C.B. Collett succeeded Churchward as Chief Mechanical Engineer of the GWR in 1922 and immediately set about meeting the needs for a new locomotive design that would both supplement the Stars and replace them on the heaviest expresses. Collett's solution was to take the basic layout of the Star and add the larger but lighter No.8 boiler, the increased amount of steam that this produced allowing an increase in the cylinder diameter from 15" to 16". Along with an increased grate area, the result was an increase in tractive effort to 31,625 lb, and a locomotive that looked attractive and well proportioned while remaining within the 20 ton axle limit.

The first 10 locomotives were built in 1923, and numbered 4073 - 4082, the number series continuing unbroken from the Star class. The last 12 Star class locomotives, which were built in 1922-23, had been given names of Abbeys that were located in the region served by the GWR, and the new locomotives were named after castles within the same geographic area.

When introduced they were heralded as Britain's most powerful express passenger locomotive, being some 10% more powerful than the Stars. The first, No. 4073 Caerphilly Castle, made its debut at Paddington station on 23 August 1923. The choice of 4082 as Windsor Castle proved fortuitous as this locomotive was used to haul the royal train when King George V and Queen Mary visited Swindon Works in 1924, and much publicity was gained when the king was permitted to drive the engine back from the works to the station before the return journey, with the Queen and several high-ranking GWR officers also on the footplate.

During 1924 4073 Caerphilly Castle was exhibited at the British Empire Exhibition at Wembley, alongside Sir Nigel Gresley's Flying Scotsman. The Great Western declared their engine to be more powerful than its bigger LNER rival, and in terms of tractive effort alone they were entitled to do so. As a result of this GWR General Manager Sir Felix Pole proposed to LNER Southern Area General Manager Alexander Wilson that a trial of the two types should take place via an exchange arrangement. The resulting trials commenced in April 1925 with 4079 Pendennis Castle representing the GWR on the Great Northern main line and 4474 Victor Wild representing the LNER on Great Western tracks. On the first morning Pendennis Castle was to work a 480 ton train from King's Cross to Doncaster, and LNER officials fully expected the smaller, lighter engine to encounter problems climbing Holloway Bank. However railway writer Cecil J. Allen records that the GWR locomotive made a faster start from King's Cross to Finsbury Park than any LNER pacific he had recorded up to that time and over the trail Pendennis Castle kept well within the scheduled time and used less coal, considerably denting LNER pride. For the LNER Victor Wild was compared on the Cornish Riviera Express to 4074 Caldicot Castle and although it kept to time the longer wheelbase of the pacific proved unsuited to the many curves on the Route. Again the GWR took the honours with Caldicot Castle burning less fuel and always ahead of time, this being

illustrated on the last 2 days of the trial by gaining 15 minutes on the schedule in both directions.

In 1926, number 5000 Launceston Castle was loaned to the London, Midland and Scottish Railway where it ran trials between London and Carlisle. The locomotive fulfilled the LMS requirements so well that the latter first requested the GWR to build a batch of Castles for use on the West Coast Main Line, and, failing that, a full set of construction drawings. Both proposals were rejected by the GWR Board of Directors. The LMS eventually succeeded in gaining access to the design by recruiting William Stanier, the GWR's Works Manager at their main Swindon railway works to become the new Chief Mechanical Engineer for the LMS.

So successful was the Castles' design that construction continued at intervals until 1950, by which time 171 had been built. This included 15 converted from the Star class, plus the rebuilding of The Great Bear, the Great Western's only Pacific locomotive.

In 1946 Frederick Hawksworth, Collett's successor, introduced a higher degree of superheat to the Castle boiler with resulting increased economy in water consumption. From 1956 the fitting of double chimneys to selected engines, combined with larger superheaters, further enhanced their capacity for sustained high-speed performance. In 1958 No. 7018 Drysllwyn Castle, fitted with a double chimney and a four-row superheater, hauled 'The Bristolian' express at 100 mph at Little Somerford.

1.2 Design & Specification

Builder	Swindon Works
Locomotive Weight	79tons 17 cwt
Vehicle Length	19.86m
Fuel Capacity	7tons of coal, 4000 Gallons of water
Top Speed	108 mph recorded
Brake Types	Vacuum
Tractive Effort	31,625lbf

2 Rolling Stock

2.1 BR(W) Castle Class locomotive

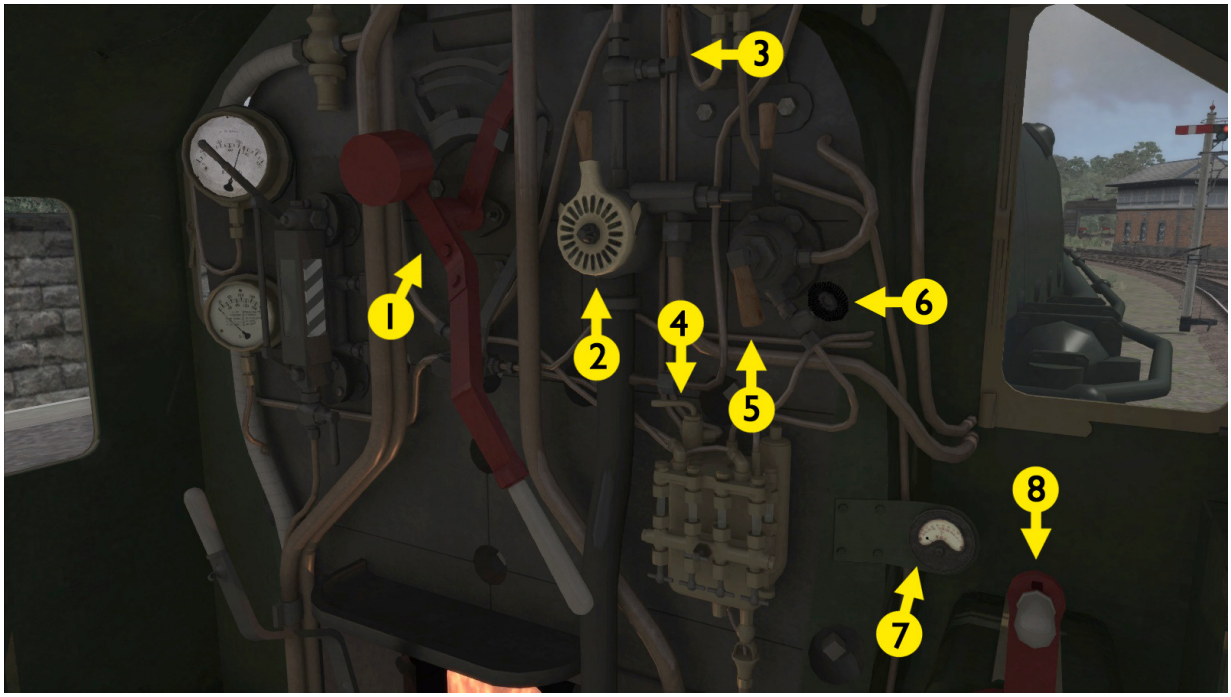
2.2 Collett 4000 Gallon Tender in Early BR and Late BR liveries

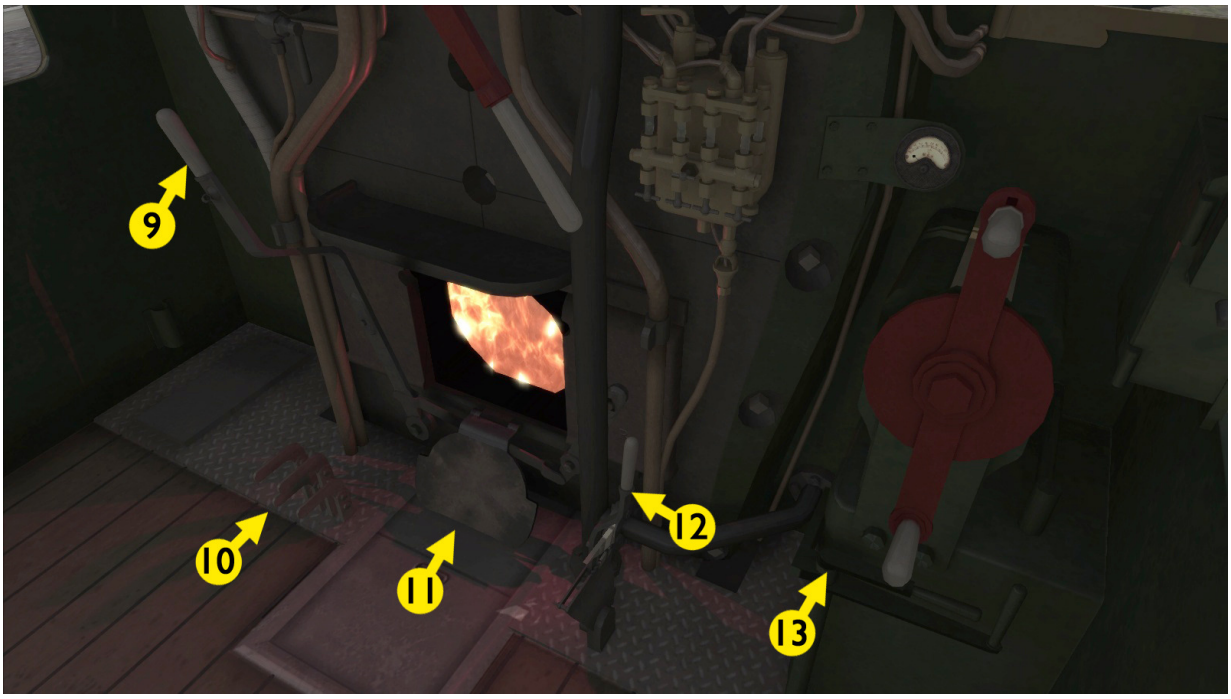
2.3 Mk1 Coaches in Chocolate & Cream Livery

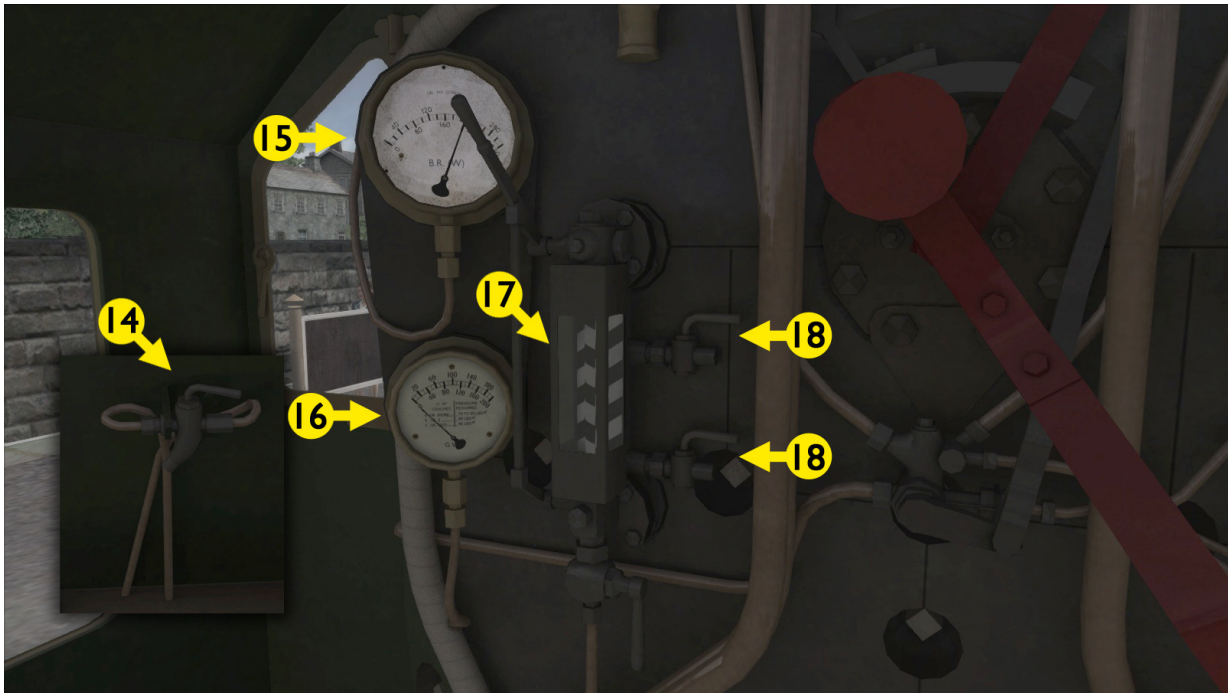
3 Driving the Castle Class

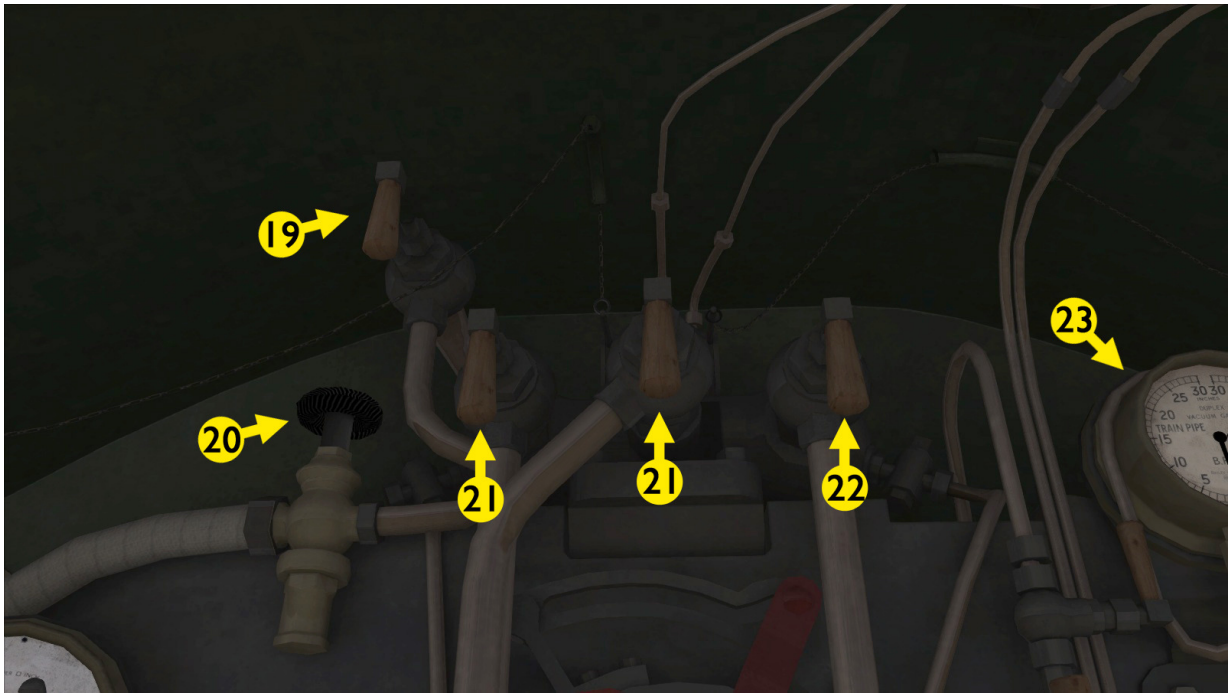
3.1 Cab Controls

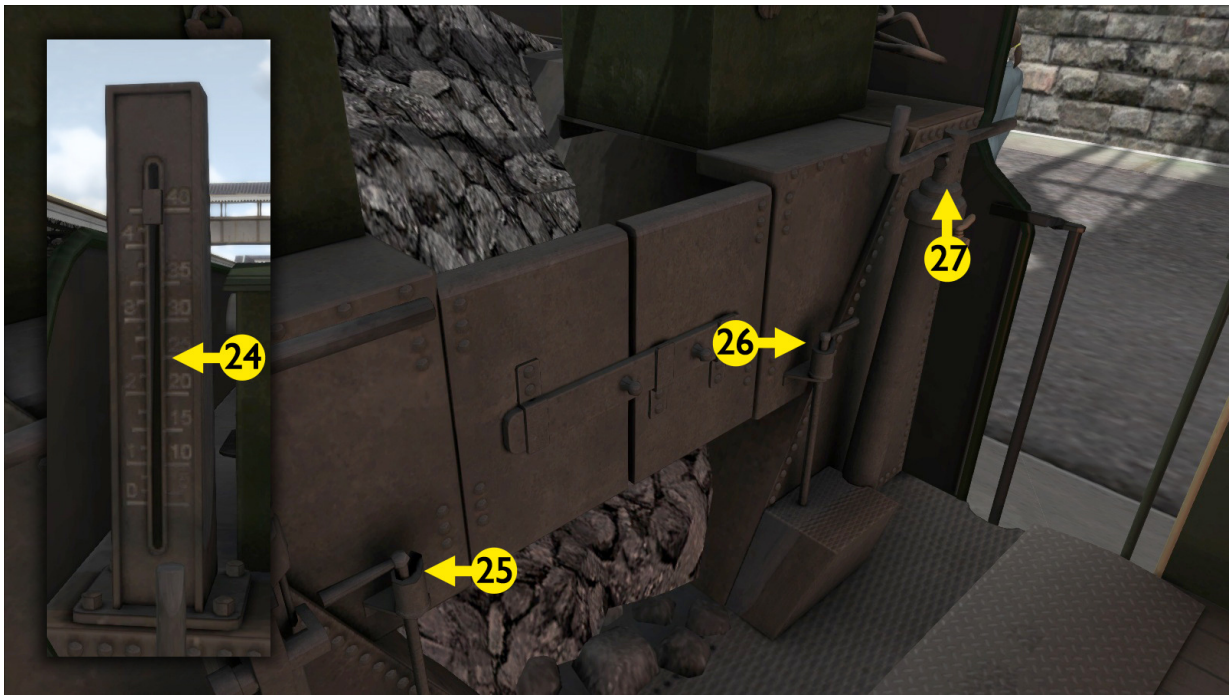
1	Regulator (A + D)
2	Train Brake (; + ')
3	Small Ejector (J)
4	Hydrostatic Lubricator on/off
5	Blower (N / SHIFT+N)
6	Lubricator Warming Cock
7	Speedometer
8	Reverser (W + S)
9	Firebox Doors (F / SHIFT+F)
10	Dampers (M / SHIFT+M)
11	Firehole Flap (CTRL+SHIFT+F)
12	Cylinder Cocks (C)
13	Sander (X)
14	Ashpan Sprinkler
15	Boiler Pressue
16	Steam Heat Pressure
17	Water Gauge
18	Water Gauge Test Cocks
19	Steam Heat Master Cock (Y / SHIFT+Y)
20	Mason's Valve (adjusts steam heat pressure) (U / SHIFT+U)
21	Exhaust Injector Steam Valves (I)
22	Live Injector Steam Valve (O)
23	Vacuum Gauge
24	Tender Water Gauge
25	Live Injector Water Valve (L)
26	Exhaust Injector Water Valve (K)
27	Handbrake (/)











3.2 Injectors

Injectors use steam from the boiler or cylinders to force water into the boiler via a series of cones. These cones increase the velocity of the steam/water mixture to overcome the boiler pressure fighting against it, thus increasing the water level in the boiler.

When do I use the Injectors?: Injectors are used to top up the water in the boiler. When stationary or coasting the Live Steam Injector can be used to top up the boiler and also to avoid blowing off steam from the safety valves. When the locomotive is in motion with the regulator open it is more efficient to use the Exhaust Steam Injector as this uses steam

which has already been used in the cylinders; this injector can be left on for most of the time the engine is in motion, with occasional use of the Live Steam Injector to add more water to the boiler if needed.

Live Steam Injectors: The controls for the Live Steam Injector are situated on the Driver's side of the footplate (right-hand side). This injector uses steam directly from the boiler. To operate the Live Steam Injector open the Live Injector Water Valve (25) (key to open: L, key to close: SHIFT+L) and then open the Live Injector Steam Valve (22) (key: O). When you have finished using the injector, close the steam valve and then close the water valve on the tender so as not to waste water.

Exhaust Steam Injectors: The controls for the Exhaust Steam Injector are situated on the Fireman's side of the footplate (left-hand side). This injector uses steam which has already been used in the cylinders. It is more efficient to use this injector whilst on the move. To operate the Exhaust Steam Injector open the Exhaust Injector Water Valve (26) (key to open: K, key to close: SHIFT+K) and then open the Exhaust Injector Steam Valve (22) (key: I). When you have finished using the injector, close the steam valve and then close the water valve on the tender so as not to waste water.

As you use the injectors you will notice the water level on the tender (24) begin to decrease. Make sure you don't run out!

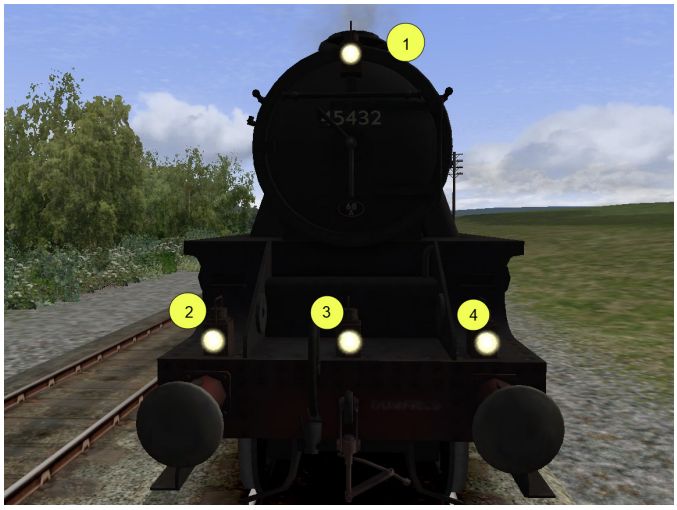
Steam Heating

Most passenger engines in the UK were fitted with steam heating to provide heating to the coaches. GWR Castles were fitted with steam heating at the rear only as it was very rare that these locos would haul a train tender first in service.

To operate the steam heating, open the Steam Heat Master Cock fully (19)(key to open: Y) and then slowly open the Mason's Valve (20) (Key to open: U) until you begin to see the pressure on the Steam Heat Gauge (16) begin to increase. You will also notice the coaches will begin to leak steam. On the gauge it states how much pressure is needed for the amount of coaches you are pulling. To regulate the pressure use the Mason's Valve using U to increase and SHIFT+U to decrease. Make sure the pressure doesn't get to high! To switch it off close the Mason's Valve and shut the Steam Heat Master Cock (key: SHIFT+Y).

4 Lamps & Headboards

4.1 Lamp Codes



In Steam days, the lamps on the front of the locomotive weren't used to shine the way ahead for the driver as they were far too dim. Instead, they were used to indicate to others both the presence of the train and the nature of the train (was it a fast passenger or a slow unfitted freight for example).

The Castle locomotive in this product contain lamps on the front of the locomotive that can be toggled on and off by using the key combinations **CTRL+1** thru **CTRL+4**. The number corresponds to the lamp position as shown in the image on the left.

For those creating their own scenarios, it is also possible to set the head code formation by changing the 9th character of the the locomotive number with the appropriate letter within the scenario editor.

For example, if the locomotive is to be numbered 4082 and it is a class A train, then the value to set in the loco number is 4082a##0A.

These codes can be set up for both AI (computer controlled) trains and for the player train. The player will still be able to change their lamp configuration using the above key combinations during the scenario if they wish, the setting in the loco number only affects the initial lamp configuration.

Class A Express Passenger, Breakdown Train or Snow Plough en-route to a job	

Class B Stopping Passenger, Rail Motor or a Breakdown Train returning from a job	
Class C Parcels, fish, Livestock, Milk, Fruit or perishables, all fitted stock.	
Class D Express freight or livestock with at least 30% fitted stock connected to the loco.	
Class E Express freight with at least four fitted vehicles connected to the loco, or a short unfitted express freight.	

Class F Express freight all unfitted stock.	
Class G Light engine, or engine with one or two brake vans attached.	
Class H Through Freight or Ballast train	
Class I NOT USED	
Class J Through mineral or empty wagon train	

Class K Pick-up or Branch freight, or mineral or ballast train on a short haul run	

4.2 Headboards

As well as lamps, this loco also has headboards which can be changed either during gameplay or in the Scenario Editor. Using the key combinations **CTRL+6** and **CTRL+5** you can cycle through the headboards. Each headboard has a corresponding Train Reporting Number, one for the Up Direction (travelling towards London) and one for the Down Direction (travelling away from London).

For those creating their own scenarios, it is also possible to set the headboard by changing the 8th character of the locomotive number with the appropriate letter within the scenario editor.

For example, if the locomotive is to be numbered 4082 and it is a class A train with the Torbay Express headboard for a Up Train, then the value to set in the loco number is 4082a##2A. If the locomotive is to be numbered 5089 and it is a class A train with the Capitals United Express headboard for a Down Train, then the value to set in the loco number is 5089p*#DA.

Headboard Name	Direction	Number
No Headboard	N/A	0
Torbay Express	Down	1
Torbay Express	Up	2
The Mayflower	Down	3
The Mayflower	Up	4
Cornish Riviera Express	Down	5
Cornish Riviera Express	Up	6
The Inter-City	Down	7
The Inter-City	Up	8
Cathedrals Express	Down	9
Cathedrals Express	Up	A
The Bristolian	Down	B
The Bristolian	Up	C
Capitals United Express	Down	D
Capitals United Express	Up	E

5 Names & Numbers

27 examples of the Castle Class have been included in this pack:

Number	Name	Loco Number for Scenario Editor
4082	Windsor Castle	4082a##0G
5006	Tregenna Castle	5006b##0G
5015	Kingswear Castle	5015c##0G
5029	Nunney Castle	5029d##0G
5031	Totnes Castle	5031e##0G
5051	Earl Bathurst	5051f##0G
5071	Spitfire	5071g*#0G
5076	Gladiator	5076h*#0G
5080	Defiant	5080i*#0G
5073	Blenheim	5073j*#0G
5051	Drysllwyn Castle	5051k##0G
7007	Great Western	7007l*!0G
7017	G.J. Churchward	7017m*#0G
7037	Swindon	7037n*?0G
5070	Sir Daniel Gooch	5070o*#0G
5089	Westminster Abbey	5089p*#0G
5085	Evesham Abbey	5085q*#0G
5055	Earl of Eldon	5055r##0G
5020	Trematon Castle	5020s##0G
4097	Kenilworth Castle	4097t##0G
5017	St Donats Castle	5017u##0G
5045	Earl of Dudley	5045v##0G
5054	Earl of Ducie	5054w##0G
5083	Bath Abbey	5083x*#0G
5066	Sir Felix Pole	5066y*#0G
5028	Llantilio Castle	5028z##0G
5068	Beverston Castle	5068&##0G

6 Scenarios

6.1 Training: Castle Class Simple Controls

Learn to drive the Castle Class using simple controls.

6.2 Training: Castle Class Expert Controls

Learn to drive the Castle Class using expert controls.

6.3 Cornish Castle

Low water and bad weather spoil Beverston Castles Rail tour. Can you make it to Exeter on time?

6.4 The Torbay Castle

The Dawlish Sea wall gives a good chance to try out Nunney Castles new livery. But can you cope with the pressures of scheduling on the modern Railway?

7 Acknowledgements

Dovetail Games would like to thank the following people for their contribution to the development of the Castle Class.

Beta Testing Team