

Control Period 5 (CP5) Variable Usage Charge (VUC) guidance document

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Version 1.3



CONTENTS

CONTENTS	2
1. Control Period 5 Variable Usage Charge guidance	3
1.1. What is the purpose of this document?	3
1.2. How is this document structured?	3
1.3. Who may find this document useful?	3
1.4. What is the VUC?	3
1.5. What is the background to this document?	4
1.6. In what situations should a new VUC rate be calculated?	4
1.7. When should an operator request a new VUC rate?	5
1.8. What is the process for calculating and agreeing a new VUC rate?	5
1.9. What will happen if a VUC rate is not agreed for a new vehicle type?	8
1.10. What is the CP5 VUC calculator?	9
1.11. How do I calculate a new passenger VUC rate?	9
1.12. How do I calculate a new freight VUC rate?	14
1.13. Who should I speak to in Network Rail about this document?	20
1.14. What about version control?	20
APPENDIX 1 – NEW VUC RATE LETTER TEMPLATE	21
APPENDIX 2 – VERSION CONTROL	24

1. Control Period 5 Variable Usage Charge guidance

1.1. What is the purpose of this document?

The purpose of this document is to set out the process for the calculation and approval of new Variable Usage Charge (VUC) rates in Control Period 5 (CP5). By new VUC rates we mean rates not on the CP5 Track Usage Price List published on 20 December 2013 and available [here](#). This price list is shown in 2012/13 prices, however, updated versions of the price list reflecting the impact of inflation are also provided on our website [here](#).

This document also details the information required in order to calculate new VUC rates and how to use the CP5 VUC calculator, a spreadsheet tool, available to interested stakeholders that will be used to calculate new VUC rates in CP5.

1.2. How is this document structured?

The remainder of this document is structured as follows:

- Who may find this document useful?
- What is the VUC?
- What is the background to this document?
- In what situations should a new VUC rate be calculated?
- When should an operator request a new VUC rate?
- What is the process for calculating and agreeing a new VUC rate?
- What will happen if a VUC rate is not agreed for a new vehicle type?
- What is the CP5 VUC calculator?
- How do I calculate a new passenger VUC rate?
- How do I calculate a new freight VUC rate?
- Who should I speak to in Network Rail about this document?
- What about version control?
- Appendix 1 – New VUC rate letter template
- Appendix 2 – Version control

1.3. Who may find this document useful?

Anyone who is interested in the process regarding the calculation and approval of VUC rates for new or modified vehicles may find this document useful. Potential interested parties may include colleagues at train operating companies (passenger, freight and open access), vehicle owners, vehicle manufacturers, the Office of Rail Regulation (ORR) and Network Rail.

For charter train operators, whose VUC rates are less disaggregated than VUC rates for other operators, this document may be less useful since it would not be necessary to calculate new VUC rates if a new charter train vehicle type were to be introduced during CP5.

1.4. What is the VUC?

The VUC is one of a range of track access charges payable by train operators to Network Rail for use of its infrastructure. The purpose of the charge is to allow

Network Rail to recover its efficient operating, maintenance and renewal costs that vary with traffic (e.g. track 'wear and tear' costs).

The charge is designed to be cost reflective and as a result 'track friendly' vehicles which cause less 'wear and tear' to the network are subject to lower VUC rates than vehicles which are more damaging. Theoretically, levying the charge should mean that, from a 'wear and tear' perspective, Network Rail is not disincentivised from accommodating additional traffic (i.e. it is recompensed for the 'wear and tear' resulting from more trains on the network).

1.5. What is the background to this document?

As part of the 2013 Periodic Review (PR13) the VUC was re-calibrated for CP5 to take account of new vehicle information and our latest understanding of the drivers of 'wear and tear' on the network. The CP5 VUC rates were determined following significant industry consultation and are published on our website¹. The documents published in relation to the VUC as part of the PR13 consultation process are also available on Network Rail's² and ORR's³ website, including non-confidential responses received from stakeholders to the various PR13 consultations.

As part of the PR13 consultation process, Network Rail proposed developing, for CP5, a guidance document in relation to the VUC. This document fulfils that proposal and hopefully provides useful guidance with respect to the calculation and approval of new VUC rates.

1.6. In what situations should a new VUC rate be calculated?

A new VUC rate should be calculated in any of the following scenarios:

- Where a vehicle type due to begin operating on the network is not on the CP5 Track Usage Price List;
- Where a vehicle type is already operating on the network but is not on the CP5 Track Usage Price List; or
- Where a vehicle type has been modified following the publication of the CP5 Track Usage Price List on 20 December 2013 and as a result the vehicle characteristics (discussed in more detail, below) which determine the VUC rate have changed.

With the exception of the above instances, the Track Usage Price List published on 20 December 2013 will apply for the whole of CP5 and only be adjusted annually for inflation. Indeed, to reinforce the intention that the Track Usage Price List should not be re-opened during the control period (even in the event that errors are subsequently identified), ORR determined that the provision to change VUC rates in light of "*manifest errors*" should be removed from passenger track access contracts for CP5. The same provision did not exist in freight track access contracts.

¹ Available at: <http://www.networkrail.co.uk/using-our-network/cp5-access-charges/>

² Available at: <http://www.networkrail.co.uk/publications/delivery-plans/control-period-5/periodic-review-2013/pr13-closed-consultations/>

³ Available at: <http://www.rail-reg.gov.uk/pr13/publications/index.php>

1.7. When should an operator request a new VUC rate?

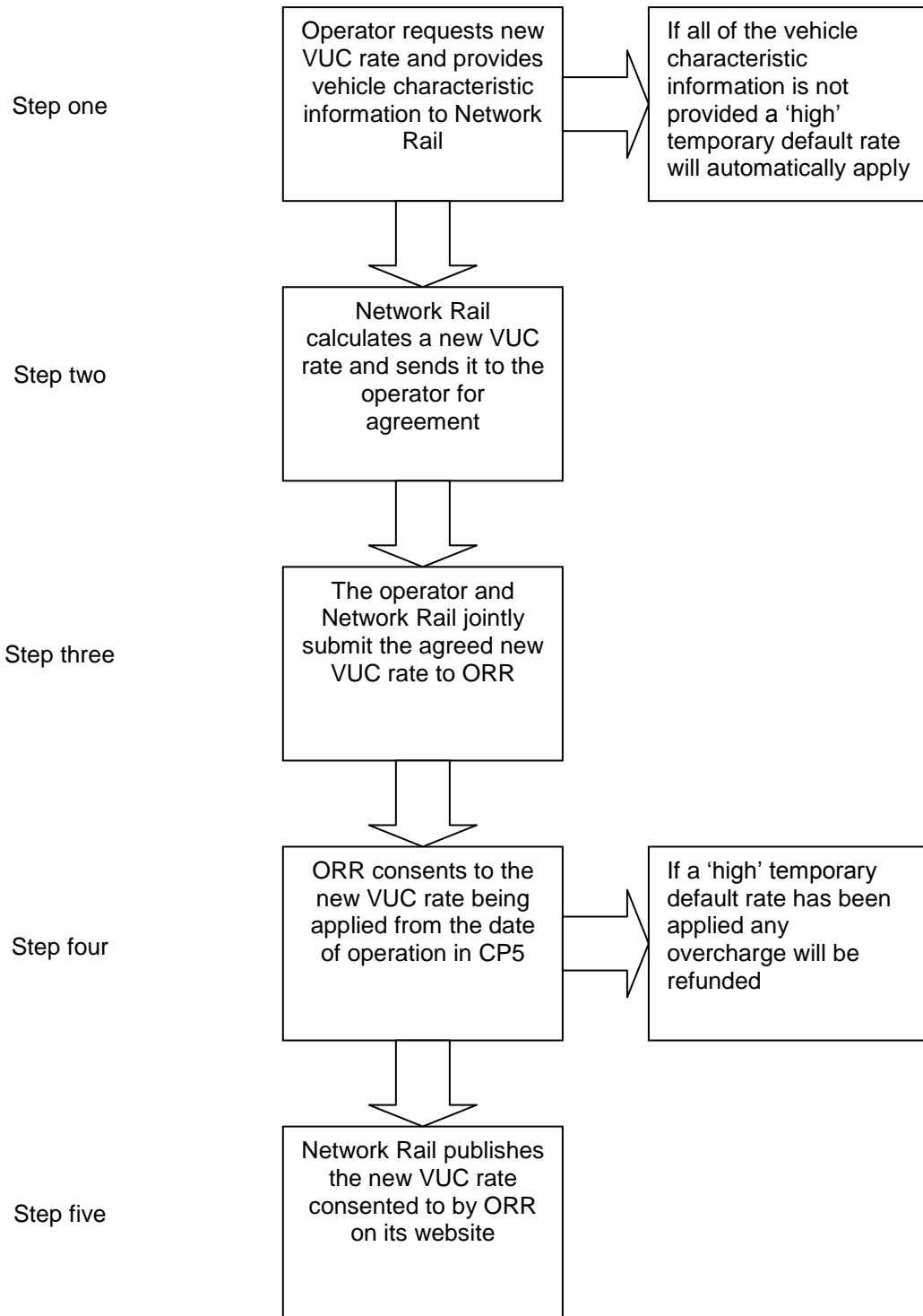
In order to help ensure that an appropriate VUC rate is available from the date that the relevant vehicle begins operating on the network, we suggest that as soon as the necessary vehicle characteristic information (discussed in more detail, below) is available the operator initiates the process set out in Figure 1, below.

For new vehicles, most of the vehicle characteristic information necessary to calculate a new VUC rate is likely to form part of the overall suite of information prepared prior to obtaining a Statement of Compatibility (the document confirming that the vehicle is compatible with our infrastructure) from Network Rail. Therefore, we would encourage all parties involved in the vehicle compatibility process to be cognisant of the need to identify this information for charging purposes and, if possible, share it with the relevant train operator as early as possible. In particular, it is likely to be more efficient at this stage of the process to supply any information which, although not required to demonstrate compatibility with the infrastructure, is necessary to calculate the VUC rate. For example, information about the primary yaw stiffness or the results of vehicle dynamics modelling necessary to determine the vehicle 'curving class' (discussed in more detail, below) and / or establish a freight vehicle's Ride Force Count (also discussed in more detail, below). Information in relation to the unsprung mass of a new vehicle may also be more easily obtained from the relevant party at this stage in the process.

1.8. What is the process for calculating and agreeing a new VUC rate?

The high-level process for calculating and agreeing new VUC rates is set out in Figure 1, below. As discussed in more detail in Section 1.9, below, if a new VUC has not been agreed by ORR prior to the vehicle operating on the network a 'high' temporary default rate will automatically apply.

Figure 1: High-level process for calculating and determining new VUC rates



Step one – requesting a new rate

- The *pro forma* setting out the vehicle characteristic information that the operator should provide to Network Rail in order to calculate a new VUC rate is available from Network Rail's website [here](#). This information is also set out in Sections 1.11 and 1.12 of this document for passenger and freight vehicles, respectively.
- The completed vehicle characteristic information *pro forma* should be sent by the operator to the Network Rail CRE. The CRE will then forward this information to the Network Rail Track Access Billing team who will calculate the VUC rate.
- Requests for a new VUC rate and the provision of vehicle characteristic information should be made in writing (email is acceptable). Network Rail also has the option to propose a new VUC rate, if it considers this to be appropriate.
- As discussed in more detail in Section 1.9, below, if all the relevant vehicle characteristic information is not provided a 'high' temporary default rate will automatically apply.

Step two – calculating a new rate

- The operator may wish to use the CP5 VUC calculator in order to calculate the new VUC rate itself and provide this information to Network Rail alongside the vehicle characteristic information. In this situation Network Rail would audit the operator's calculation in order to confirm that the correct rate has been calculated. The CP5 VUC calculator can be downloaded from our website [here](#), further guidance in relation to using the calculator is provided, below. This is a link to the 'official' version of the CP5 VUC calculator which should always be used to calculate rates for submission to ORR in 2012/13 prices. A version of the CP5 VUC calculator which allows VUC rates to be calculated in current prices is also available on our website, however, this is provided for information only.
- The new VUC rate calculated by the Network Rail Track Access Billing team will be sent to the operator by the operator's Network Rail CRE for agreement.

Step three – submitting a new rate to ORR

- If Network Rail and the operator agree the new VUC rate a joint submission should be made to ORR in writing requesting it consents to this new rate. A template letter for this submission is provided in Appendix 1. The Network Rail CRE, with support from other Network Rail colleagues as appropriate, should work with the train operator in order to populate the template before submitting it to ORR.
- If Network Rail and the operator agree an appropriate VUC rate this will, generally, result in the VUC rate being consented to by ORR in a timelier manner than when both parties are unable to reach agreement. Therefore, it is in both parties' interest to work collaboratively to agree a new VUC rate.

- In the event that Network Rail and the operator cannot agree a new VUC rate either party has the option to refer the issue to ORR for determination. This referral to ORR must be made in writing at least 45 days after the new VUC rate was proposed by one of the parties.

Step four – ORR determination

- If the vehicle type has not yet began running on the network it will pay the new VUC rate consented to by ORR from the date of operation in CP5 and no re-charge will be required.
- If the new VUC rate is consented to by ORR after the new vehicle type begins operating on the network a re-charge will be required. The reason for this is that, as discussed in more detail in Section 1.9, below, prior to the determination of a new VUC rate the vehicle type will automatically be subject to the relevant temporary default rate. Because this default rate is set at the highest relevant rate on the price list it is likely that the operator will be due a rebate equal to the difference between the agreed VUC rate and the default rate. Network Rail will issue an adjusting invoice or credit note in relation to any money due / owed within 28 days of ORR consenting to the new VUC rate.
- Where a new VUC rate has been calculated to reflect a vehicle modification, the operator should provide its Network Rail CRE with a schedule setting out the date it expects each vehicle be modified. This should allow the new VUC rate to be applied to individual vehicles as they are modified. If it becomes apparent that the modification date of a vehicle will vary from that set out in the schedule provided to Network Rail it is the operator's responsibility to inform Network Rail so that this can be appropriately reflected in charges.
- If ORR does not initially consent to the VUC submitted by Network Rail and the operator, it may be necessary to provide additional supporting information and / or make a new joint submission, as required by ORR.

Step five – publication of the new rate

- Following ORR consenting to a new VUC rate, within 28 days, Network Rail will publish on its website⁴ details of the new VUC rate alongside other new CP5 rates. Network Rail's Regulatory Economics team will be responsible for the publication of this information.

1.9. What will happen if a VUC rate is not agreed for a new vehicle type?

If in CP5 a vehicle type operates on the network without a new VUC rate consented to by ORR it will be charged the relevant VUC default rate, set out on the Track Usage Price List and shown, below.

Passenger Variable Usage Charge default rates

Vehicle Type	Pence per vehicle mile (2014/15 prices)
Locomotive	66.15
Multiple unit (motor)	29.45

⁴ Available at: <http://www.networkrail.co.uk/using-our-network/cp5-access-charges/>

Multiple unit (trailer)	13.84
Coach	12.18

Freight Variable Usage Charge default rates

Vehicle Type	£/kgm (2014/15 prices)
Locomotive	5.7866
Wagon (laden)	4.0395
Wagon (tare)	2.0761

These rates will be charged, uplifted annually for inflation (RPI), until such a time that a specific CP5 VUC rate is consented to by ORR. The CP5 VUC default rates are set at the highest rate on the CP5 Track Usage Price List for each type of vehicle and thus provide a strong incentive to operators to provide the information necessary to calculate the correct VUC rate. However, once a bespoke VUC rate is agreed all journeys charged at the default rate will be refunded and recharged at the newly agreed CP5 rate (i.e. the net impact will be that all of the journeys will be charged at the cost reflective bespoke VUC rate rather than the potentially higher default rate).

1.10. What is the CP5 VUC calculator?

In order to calculate VUC rates for vehicle types not initially on the CP5 price list we have developed a CP5 VUC calculator - a spreadsheet tool which, when input with the relevant vehicle characteristic information, will calculate a new VUC rate using the same engineering methodology that underpins the published price list. This rate can then be submitted to ORR for approval before being applied in CP5.

The calculator has been provided to interested stakeholders and can also be downloaded from our website [here](#). This is a link to the 'official' version of the CP5 VUC calculator which should always be used to calculate rates for submission to ORR in 2012/13 prices. A version of the CP5 VUC calculator which allows VUC rates to be calculated in current prices is also available on our website, however, this is provided for information only.

1.11. How do I calculate a new passenger VUC rate?

Figure 2 shows the input screen used for calculating new passenger VUC rates.

Figure 2: VUC calculator passenger input screen

VUC Calculator - vehicle data

Existing vehicle

New vehicle name Price base

Vehicle type

Passenger Freight

Locomotive/coach/MU

Locomotive Coach or multiple unit

Motor/Trailer

Motor vehicle Trailer vehicle

Vehicle weight (tonnes) Total number of seats

(For passenger vehicles, weight should be the vehicle tare weight)

Number of axles

Unsprung mass (kg/axle)

Maximum speed (mph)

User calculated operating speed?

Curving class

Loco2_50
Loco3_50
Class_60
Class_66
Pacer_10
Coach_8

User-defined TGamma table

Calculate VUC rate Close this window Further information

As shown in Figure 2, above, in order to calculate a new passenger VUC rate it is necessary to populate certain vehicle characteristic input fields. These fields allow an assessment of the vehicle type's 'track friendliness' to be made and a cost reflective VUC rate to be calculated. Below, further explanation and guidance is provided in relation to each of the vehicle characteristic input fields that need to be populated. As noted, above, the Network Rail Track Access Billing Team will perform this calculation prior to submission to ORR for approval. However, the operator may also wish to calculate the new VUC rate itself and provide this information to Network Rail alongside the relevant vehicle characteristic information (the passenger vehicle characteristic *pro forma* can be downloaded from our website [here](#)).

- **Vehicle type:** Prior to calculating a passenger VUC rate you should ensure that the passenger option is selected so that the appropriate input fields are displayed.
- **Existing vehicle:** If you wish to calculate a VUC rate for a vehicle type included on the CP5 VUC price list it is possible to automatically populate all of the input fields by selecting the existing vehicle type from this drop down list. To determine the VUC for an existing vehicle which has been modified it is possible to select the existing vehicle from this list and then update the appropriate parameters that have changed as a result of the modification. For the avoidance of doubt, the only parameters that should be changed are those that have changed directly as a result of the modification. For example, if due to the modification the vehicle weight has changed then this is the only parameter that should be changed in the calculator, above. Please note that if an existing passenger coach or multiple unit is selected the "Total number of seats" field will display a zero value. However, this is not because the vehicle is assumed to have zero seats, rather the weight associated with passenger loading (which is derived from the number of seats that the vehicle has) has been included in the "Vehicle weight" value for the vehicles on the published CP5 price list.

- **New vehicle name:** If a vehicle type is not selected from the existing vehicle drop down box, the name of the vehicle should be input into this field so that it is clear to which vehicle type the new rate would apply. Generally, passenger vehicles use the following naming convention:
 - **Locomotive:** XX/X (e.g. 43/0);
 - **Multiple Unit Motor:** XXX/M (e.g. 139/M)
 - **Multiple Unit Trailer :** XXX/T (e.g. 315/T)
 - **Coach:** X (e.g. 1 for a Mk1 coach)
- **Price base:** This drop down box should be used to select an appropriate price base. VUC rates increase annually for inflation and this functionality allows you to see the applicable VUC rate in either the current or previous years. Rates submitted to ORR for approval should always be calculated in 2012/13 prices using the 'official' version of the CP5 VUC calculator, published in April 2014, and available [here](#). A version of the CP5 VUC calculator which allows VUC rates to be calculated in current prices is also available on our website, however, this is provided for information only.
- **Motor / trailer:** The appropriate option should be selected confirming for multiple units whether the vehicle is a motor or trailer vehicle. This selection does not impact the level of the VUC rate but clarifies whether the proposed rate will apply to the motor or trailer vehicle.
- **Locomotive / coach or multiple unit:** The appropriate option should be selected confirming whether the vehicle is a locomotive, coach or multiple unit. All other things being equal, coaches and multiple units pay lower VUC rates than locomotives, reflecting the lower traction forces that each wheel imposes on the track.
- **Number of axles:** The number of axles that the vehicle has should be entered into this field. Together with the vehicle weight this value is used to calculate the average axle load of the vehicle.
- **Vehicle weight:** The weight of the vehicle in tonnes should be entered into this field. This should be the tare weight of the vehicle in serviceable condition (i.e. the weight of the vehicle with no passengers). Where multiple variants of a vehicle type exist, and will be subject to the same new VUC rate, a weighted average of the vehicle weight should be calculated based on a typical train set formation. As noted, above, if an existing passenger coach or multiple unit is selected, this value will include passenger loading and the "Total number of seats" field will display a zero value.
- **Total number of seats:** The total number of passenger seats in the vehicle should be entered here. Where multiple variants of a vehicle type exist, and will be subject to the same new VUC rate, a weighted average of the number of seats should be calculated based on a typical train set formation (fractions of a seat are permissible).

For multiple units and coaches the VUC is calculated for the weight of the vehicle with 50% of seats full (assuming 75kg per passenger). The calculator will therefore take the total number of seats entered, multiply it by 75kg and multiply by 50%, before adding it to the tare weight to determine the total

vehicle weight for the VUC calculation. Hence, the number of seats entered should be the total for the vehicle.

As noted, above, if an existing passenger coach or multiple unit is selected this field will display a zero value. However, this is not because the vehicle is assumed to have zero seats, rather the weight associated with passenger loading is included in the “Vehicle weight” value.

- **Unsprung mass:** The unsprung mass per axle should be entered into this field in kilograms. The unsprung mass is determined as the mass of equipment which is not separated from the track by the primary suspension and a proportion of any mass that is partially separated from the track by the primary suspension (e.g. bogie trailing arms and traction linkages). Therefore, the unsprung mass comprises the masses of the wheelset, axle boxes, brake gear, any axle-mounted gearbox or final drive, and any other equipment which may be mounted on the wheelset or axleboxes. If the unsprung mass is not the same for every axle then it is permissible to take an average for that vehicle.
- **Maximum speed:** The maximum speed of the vehicle type should be entered into this field in miles per hour. If the ‘user calculated’ operating speed field (see, below) is left blank, this maximum speed value will be converted into an ‘operating’ speed to be used for charging purposes using the standard formula⁵. The operating speed of a vehicle is a representative ‘average’ speed at which the vehicle type typically travels on the network and is used for charging purposes. The vast majority of vehicle operating speeds are calculated formulaically based on the vehicle’s maximum speed. The maximum speed entered into the field should be the lowest of:
 - the maximum speed specified when the vehicle type was built, assuming that this continues to be a physical constraint which the vehicle type cannot exceed; or
 - the maximum speed specified by the operator, assuming this is a physical constraint which the vehicle type cannot exceed.

For the avoidance of doubt, by physical constraint we mean a vehicle-based constraint which limits the maximum speed of the vehicle, irrespective of where it operates on the GB rail network. The line-speed on a particular route is not considered to be a physical constraint for charging purposes.

- **User calculated operating speed:** If an operator considers that the standard formula⁶ used to estimate a vehicle’s operating speed, based on its maximum speed, gives rise to a result that is not a reasonable estimate of the vehicle’s true operating speed it has the option to calculate an operating speed based on the published timetable. If an operating speed based on the timetable is entered into the user calculated operating speed field, this value will be used in the VUC calculation rather than the operating speed derived from the vehicle’s maximum speed.

When calculating an operating speed based on the timetable, the operator should take a weighted average of the relevant journeys and exclude stopping

⁵ Operating Speed = 0.021.Max. Speed^{1.71} (e.g. 55mph = 0.021*100mph^{1.71})

⁶ Operating Speed = 0.021.Max. Speed^{1.71} (e.g. 55mph = 0.021*100mph^{1.71})

time at stations. Where a new vehicle type is used by more than one operator on more than one route, it would need to be agreed between the relevant parties that the user calculated operating speed is a reasonable assumption for all operators. Without such agreement the operating speed should be derived from the maximum speed as set out above. If an operator wishes to use an operating speed based on its analysis of the timetable it should provide sufficient supporting information to Network Rail / ORR demonstrating that this speed is appropriate.

- **Curving class:** The specified 'curving class' is a way of categorising vehicles according to the rail surface damage (wear and rolling contact fatigue) that they generate. Operators have the option to calculate a bespoke curving class (see 'user defined TGamma', below). However, they also have the option to select the most appropriate generic curving class from the existing list in the calculator. If a generic curving class is selected from the list in the calculator it is not necessary to complete the user defined TGamma fields. The generic passenger curving classes in the calculator typically use the following naming convention "Coach_XX_YY", where "XX" is the primary yaw stiffness (in MNm/rad) and "YY" is the weight in tonnes. To determine the nearest curving class for a vehicle both the primary yaw stiffness and vehicle weight should be rounded up
- **User defined TGamma table:** As noted, above, rather than specify one of the existing generic curving classes included in the calculator the operator has the option to manually input bespoke TGamma values determined from vehicle dynamics modelling of the vehicle over a specified range of curves. To do this the user defined TGamma box should be selected and TGamma values for each axle and curve radii entered. If an operator chooses to use this it is not necessary to select one of the generic curving classes from the list provided in the calculator. Carrying out vehicle dynamics modelling in order to generate a bespoke curving class, rather than selecting a generic curving class, will result in a more cost-reflective VUC rate but will mean that further analysis has to be carried out. A guidance note can be downloaded from our website [here](#) setting out the process for conducting the vehicle dynamics modelling. Network Rail would also be happy to assist with this modelling if the operator considers that this would be helpful.

For the avoidance of doubt, where a vehicle has been modified a new vehicle sub-class should be created, rather than a revised calculation of the original rate based on the new weighted average vehicle characteristics across the relevant fleet.

Once the relevant vehicle characteristic information set out, above, has been entered into the calculator the user should click the "**Calculate VUC rate**" button and a new passenger VUC rate will be calculated and displayed as shown in Figure 3, below.

Figure 3: VUC calculator passenger output screen

CP5 VUC Calculator: Passenger vehicles
V6g: April 2014



Vehicle data		
Vehicle name/class	350/M	Motor
Vehicle type	Coach or Multiple Unit	
Number of axles	4	
Speed (max, mph)	100	
Speed (operating, mph)	55.24	(Calculated)
Tare weight (t)	54.925	Seats 0
Operating weight (t)	54.925	
Unsprung mass (kg)	1909	
Curving class	Coach_24_50	
Ct factor	0.89	

Calculate another vehicle VUC rate

Calculated VUC	
All values in pence/vehicle-mile (p/vm)	2014/15 prices
VUC	11.87
VUC Breakdown	
Track	6.96
Structures	1.35
Signals (variable)	0.28
Signals (fixed)	0.26
Surface damage	3.01

As shown in Figure 3 above, the output sheet from the VUC calculator sets out:

- The calculated VUC rate, broken down by asset type; and
- the vehicle characteristic information underpinning the VUC rate.

A copy of this output screen should be annexed to the Network Rail / operator joint submission to ORR (template letter provided in Appendix 1) requesting the determination of a new VUC rate. It is possible to convert the output sheet to PDF by selecting the “Convert to Adobe PDF” option in the workbook. Alternatively, a print screen of the output screen could be taken.

1.12. How do I calculate a new freight VUC rate?

Figures 4 and 5, below, show the input and output screens used when calculating new freight VUC rates.

Figure 4: VUC calculator freight input screen

As shown in Figure 4, above, in order to calculate a new freight VUC rate it is necessary to input certain pieces of vehicle characteristic information. This allows an assessment of the vehicles ‘track friendliness’ to be made and a cost reflective VUC rate to be calculated.

Further explanation and guidance is provided, below, in relation to each input field. As noted above, the Network Rail Track Access Billing Team will perform this calculation prior to submission to ORR. However, the operator may also wish to calculate the new VUC rate itself and provide this information to Network Rail alongside the relevant vehicle characteristic information (the freight vehicle characteristic *pro forma* can be downloaded from our website [here](#)).

- **Vehicle type:** Prior to calculating a freight VUC rate you should ensure that the freight option is selected so that the appropriate input fields are displayed.
- **Existing vehicle:** If you wish to calculate a VUC rate for a vehicle type included on the CP5 VUC price list it is possible to automatically populate all of the input fields by selecting an existing vehicle type from this drop down list. To determine the VUC for an existing vehicle which has been modified it is possible to select the existing vehicle from this list and then change the appropriate parameters. For the avoidance of doubt, the only parameters that should be changed are those that have changed directly as a result of the modification. For example, if due to the modification the vehicle weight has changed then this is the only parameter that should be changed in the calculator, above.
- **New vehicle name:** The name of the vehicle should be entered into this field so that it is clear to which vehicle type the new rate would apply. Generally, freight vehicles use the following naming convention:
 - **Locomotive:** XX/X (e.g. 66/0);

- **Wagon (laden):** XXXX (L) (e.g. FRAA (L))
 - **Tare Wagon (tare):** XXXX (T) (e.g. FRAA (T))
 - **Coach:** X (e.g. 1 for a Mk1 coach)
- **Price base:** This drop down box should be used to select an appropriate price base. VUC rates increase annually for inflation and this functionality allows you to see the applicable VUC rate in either the current or previous years. Rates submitted to ORR for approval should always be calculated in 2012/13 prices using the 'official' version of the CP5 VUC calculator, published in April 2014, and available [here](#). A version of the CP5 VUC calculator which allows VUC rates to be calculated in current prices is also available on our website, however, this is provided for information only.
 - **Locomotive/wagon:** This option should be selected to confirm whether the vehicle is a locomotive or a wagon. If the locomotive option is selected the load condition and suspension band boxes will disappear and be automatically populated by the model (a locomotive will always operate in a tare condition and attract a locomotive suspension band).
 - **Load condition:** This option should be selected to confirm whether the rate being calculated will apply when the wagon is tare or laden. If both a tare and laden rate is required the calculation process should be performed twice with appropriate input data. As noted, above, this box will disappear if the locomotive option is selected.
 - **Number of axles:** The number of axles that the vehicle has should be input into this field. Together with the vehicle weight this value is used to calculate the average axle load of the vehicle.
 - **Vehicle weight:** The operating weight of the vehicle, in tonnes, should be entered into this field. The operating weight is the weight at which the vehicle will typically operate and thus could be less than the gross laden weight of a wagon, for example. For laden wagons, if more than one commodity type is selected, an average operating weight across the different commodities should be entered. Alternatively, the user may wish to calculate VUC rates for different commodity types separately and enter an appropriate operating weight each time. We consider that the latter approach is more appropriate where the laden weight is likely to vary materially across commodities.
 - **Unsprung mass:** The unsprung mass per axle should be entered into this field in kilograms. The unsprung mass is determined as the mass of equipment which is not separated from the track by the primary suspension and a proportion of any mass that is partially separated from the track by the primary suspension (e.g. bogie trailing arms and traction linkages). Therefore, the unsprung mass comprises the masses of the wheelset, axleboxes, brake gear, and any other equipment which may be mounted on the wheelset or axleboxes. If the unsprung mass is not the same for every axle then it is permissible to take an average for that vehicle.
 - **Curving class:** The specified 'curving class' is a way of categorising vehicles according to the rail surface damage (wear and rolling contact fatigue) that they generate. Operators have the option to calculate a bespoke curving class (see 'User defined TGamma table', below). However, there is also the option to select the most appropriate generic curving class from the existing

list in the calculator. If a generic curving class is selected from the list in the calculator it is not necessary to complete the 'user defined TGamma' fields. The generic freight curving classes in the calculator are based on the vehicles suspension type (e.g. "Y25_loaded" or "Y25_empty").

- User defined TGamma table:** As noted, above, rather than specify one of the existing generic curving classes included in the calculator the operator has the option to manually input bespoke TGamma values determined from vehicle dynamics modelling. To do this the 'user defined TGamma' tick-box should be selected and TGamma values for each axle and curve radii entered. If an operator chooses to do this it is not necessary to select one of the generic curving classes from the list provided in the calculator. Carrying out vehicle dynamics modelling in order to generate a bespoke curving class, rather than selecting a generic curving class, will result in a more cost reflective VUC rate but will mean further analysis has to be carried out. A guidance note can be downloaded from our website [here](#) setting out the process for conducting the relevant vehicle dynamics modelling. Network Rail would also be happy to assist with this modelling if the operator considers that this would be useful.
- Suspension band:** The suspension band reflects the suspension/bogie type of the wagon. Wagons with 'track friendly' suspensions/bogies will pay a lower VUC than wagons with suspensions/bogies that impose higher forces on the track, all other things being equal. Only freight wagons registered in the Rolling Stock Library (RSL) prior to 1 April 2014, and not on the CP5 price list, have the option to select one of the existing suspension bands in the VUC calculator. For CP5 this part of the VUC calculation has been replaced by the Ride Force Count (RFC) methodology, described, below. The new RFC methodology is also available to operators whose wagons were registered in the RSL before 1 April 2014 and are not on the published price list, should the operator wish to utilise this approach rather than selecting one of the existing suspension bands. For wagons registered in the RSL prior to 1 April 2014 and where an operator does not wish to use the RFC methodology, they may select a suspension band from the list included in the calculator. The available suspension bands are described below.

Suspension band	Vehicle type
0	All locomotives
1	4-wheel wagon with pedestal type suspension
2	4-wheel wagon having leaf springs, friction damped
3	Bogie wagon with three piece bogie
4	Bogie wagon with enhanced three piece bogie e.g. "swing motion", and parabolic 4-wheel wagon
5	Basic bogie wagon with primary springs, e.g. Y25
6	Bogie wagon with enhanced primary springs – low track force bogies, TF25, "axle motion" (like HV primary sprung bogies)
7	Bogie wagon with enhanced primary springs and steering

As noted, above, this box will disappear if the locomotive option is selected.

- **Ride Force Count (RFC) value:** The RFC is a metric developed in CP4 to provide a quantitative assessment of the ‘track friendliness’ of a wagon’s suspension/bogie type, following vehicle dynamics modelling. As noted above, for CP5 this approach to measuring the ‘track friendliness’ of a wagon’s suspension/bogie type replaces the previous suspension banding approach, which was based on a qualitative description of the wagon’s suspension/bogie type and was arguably quite subjective.

As stated, above, if a new freight wagon was registered in the RSL on or after 1 April 2014 the operator should calculate an RFC value to be input into this field. As noted, above, this box will disappear if the locomotive option is selected.

The methodology for estimating a freight wagon’s RFC value is set out in a user guide available from our website [here](#). The *RFCpro* software is required in order to calculate the RFC value from the results of vehicle dynamics modelling, and can also be downloaded from our website [here](#) (32 bit version) or [here](#) (64 bit version).

- **Freight commodity:** The user should select from the list of commodities in the calculator the ones for which it requires a VUC rate and for which the vehicle parameters that have been entered are applicable. There is an option to select all commodities which, for example, may be appropriate when calculating a new VUC for a commonly used freight locomotive. However, if a vehicle can carry a range of commodities, and the laden weight of the vehicle varies materially for different commodities, then a separate calculation for each vehicle weight and pertinent commodity should be performed in order to calculate an appropriate VUC rate for each commodity.

For the avoidance of doubt, where a vehicle has been modified a new vehicle sub-class should be created, rather than a revised calculation of the original rate based on the new weighted average vehicle characteristics across the relevant fleet.

Once the relevant vehicle characteristic information set out, above, has been entered into the calculator the user should click the “**Calculate VUC rate**” button and a new freight VUC rate will be calculated and displayed as shown in Figure 5, below.

Figure 5: VUC calculator freight output screen

CP5 VUC Calculator: Freight vehicles

V6g: April 2014



Vehicle data	
Vehicle name/class	JNAA
Load condition	Laden
Number of axles	4
Weight (t)	86.9814
Unsprung mass (kg)	1310
Curving class	Y25_loaded
Suspension band	Y25-2
RFC value?	N
Suspension factor	0.898
Ct factor (structures)	1

Calculate another vehicle VUC rate

Calculated VUC						
All values in £/kGTM		2014/15 prices				
Existing CP4 rate?		2014/15	2015/16	2016/17	2017/18	2018/19
Coal other Y		2.2183	2.2183	2.2569	2.3339	2.4108

As shown in Figure 5, above, the output sheet from the VUC calculator sets out:

- The calculated VUC rates for each year of CP5; and
- the vehicle characteristic information underpinning the VUC rates.

The “Existing CP4 rate?” flag on the output screen (see in Figure 5, above, next to the commodity type) indicates whether a VUC rate existed in CP4 for this vehicle/commodity combination. Where a “Y” is displayed in this field it indicates that a CP4 rate did exist for this vehicle/commodity combination and, consistent with ORR’s determination, this rate will be applied in 2014/15 and 2015/16 before the updated CP5 rate is gradually phased in. Furthermore, where a “Y” is displayed in this field, it indicates that the vehicle characteristics underpinning the rate that has been calculated are the same as those underpinning the rate on the published price list. Therefore, one would expect the rate that has been calculated to be consistent with that set out on the published price list.

If an “N” is displayed in this field it indicates that a VUC rate did not exist for this vehicle/commodity combination in CP4. In this situation the calculator will use the CP4 charging methodology to calculate a charge rate to be applied in 2014/15 and 2015/16 (as if a rate did exist for this vehicle/commodity combination during CP4) before the updated CP5 rate is gradually phased in.

A copy of this output screen should be annexed to the Network Rail / operator joint submission to ORR (template letter provided in Appendix 1) requesting a new VUC rate is approved. It is possible to convert the output sheet to PDF by selecting the “Convert to Adobe PDF” option in the workbook. Alternatively, a print screen of the output screen could be taken.

1.13. Who should I speak to in Network Rail about this document?

We would be happy to discuss any aspect of this document or the process more generally in relation to the calculation and determination of new VUC rates. Depending on the nature of your query you should contact one of the, below, Network Rail colleagues in the first instance.

Person	Area	Contact Details
Paul Bragg Rates Analyst	Billing and rate calculation issues	Paul.Bragg@networkrail.co.uk 0161 880 3440
Mark Burstow, Principal Vehicle Track Dynamics Engineer	Engineering and technical issues	Mark.Burstow@networkrail.co.uk 01908 782491
Ben Worley, Senior Regulatory Economist	Policy and periodic review issues	Ben.Worley@networkrail.co.uk 0203 356 9322

1.14. What about version control?

The date this document was published and its version number are shown on the cover page. This document is intended to be a ‘living’ document and updated from time to time so that it includes additional guidance, where appropriate, based on the industry’s experience of the VUC rate calculation and approval process in CP5. Appendix 2 details the iterations made to this document.

APPENDIX 1 – NEW VUC RATE LETTER TEMPLATE

[Insert Network Rail CRE name]
Customer Relationship Executive
Network Rail
[Insert first line of address]
[Insert second line of address]

[Insert ORR representative name]
[Insert job title]
The Office of Rail Regulation
One Kemble Street
London, WC2B 4AN

[Insert operator representative name]
[Insert job title]
[Insert train operator name]
[Insert first line of address]
[Insert second line of address]

[Insert date]

Dear *[Insert name of the appropriate member of the ORR Track Access team, consistent with the address line, above]*

Proposal to supplement the Track Usage Price List

The purpose of this letter is to propose a supplement to the Track Usage Price List, consistent with Schedule 7 of *[insert train operator name]* Track Access Contract. In particular, a new Variable Usage Charge (VUC) rate for the *[insert vehicle name]* vehicle type operated by *[insert train operator name]*.

This supplement to the Track Usage Price list has been agreed between Network Rail and *[insert train operator name]*. It is required because *[Insert relevant background information e.g. whether the new rate is required due to the introduction of a new vehicle type, the modification of an existing vehicle type and when the new vehicle type is due to begin operating on the network]*

The new VUC rate proposed in this letter was calculated using the agreed Control Period 5 (CP5) VUC calculator developed by Network Rail (the 'official' 2012/13 prices version). The output sheet from the calculator which sets out the proposed new rate and input information is appended to this letter.

If you have any queries in relation to the calculation of the proposed new VUC rate, or the content of this letter more generally, we would, of course, be happy to discuss this with you in more detail.

Yours sincerely

[Insert Network Rail CRE name]
Network Rail

[Insert operator representative name]
[Insert name of train operator]

[Attach output sheet(s) from the official 2012/13 prices version of the CP5 VUC calculator in 2012/13 prices setting out the proposed new rate and input data]

APPENDIX 2 – VERSION CONTROL

Version number	Description of change	Date	Author
1.0	Original version created.	30 April 2014	Ben Worley (Senior Regulatory Economist, Network Rail)
1.1	Original version updated to correct error in the presentation of the freight suspension band table and to make clear that rates should always be submitted to ORR in 2012/13 prices using the 'official' version of the VUC calculator.	20 April 2015	Ben Worley (Senior Regulatory Economist, Network Rail)
1.2	Original version updated to clarify the definition of maximum speed and make clear that line-speed is not a 'physical constraint' for charging purposes.	13 May 2016	Ben Worley (Regulatory Economics Manager, Network Rail)
1.3	Version 1.3 updated to clarify that when a modification to an existing vehicle is made only the parameters which have changed directly as a result of the modification should be changed in the VUC calculator. Also, a clarification that when a vehicle is modified a new vehicle sub class should be created rather than reopening the existing vehicle fleet's weighted average.	02 Nov 2017	Simon Yates (Planning and Regulation Assistant)