## Appendix A – Nominally loaded cases

25%

Tare

A range of nominal cases, i.e. tare (empty) and carrying nominally loaded containers in the range of allowed configurations will be considered. These cases will include the worst combination of laden and tare containers. Tare (empty) condition may not give the highest derailment risk: the worst wagon loadings may be a part-loaded container when the laden springs just come into contact.

**Note 1:** When 3 × 20’ containers are loaded to 100%, the rated load capacity of the wagon is reached. 100% load for the 40’ container is defined as the load to take the wagon to its rated load capacity when also conveying a 20’ container at 100% load as defined above.

**Note 2:** Other loading combinations can be envisaged that are ‘nominal’, but are not included in the list of cases. For example, tare 20’ containers with laden 40’ containers (or vice versa).

**Note 3:** The following vertical position of the container c-of-g height is considered to apply[[1]](#footnote-1):

 -Tare and 25% loading: Vertical c-of-g height of container is ½ container height.

 -50%, 75% and 100% loading percentage values: ¼ container height.

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| **Nominally Loaded cases - Sensitivity of Derailment to Wagon Loading - (Results to be reported with the cases marked ●)** | **Loading diagram (configurations and loadings)** |
| **Case no** | **Description** | **ΔQ/Q** | **Y/Q** | **flange climb (mm)** | **X-factor** | **Trailing** | **Centre** | **Leading** |
| 1 | Tare (no containers carried) | ● | ● | ● | ● |   |   |   |
| 2 | 1×20’ container leading position | ● | ● | ● | ● |   |   | 0% |
| 3 | 1×20’ tare container centre position | ● | ● | ● | ● |   | 0% |   |
| 4 | 1×20’ tare container trailing position | ● | ● | ● | ● | 0% |   |   |
| 5 | 1×40’ tare container leading position  | ● | ● | ● | ● |   | 0% |
| 6 | 1×40’ tare container trailing position  | ● | ● | ● | ● | 0% |   |
| 7 - 11 | Repeat cases 2 – 6 for 25% loaded container  | ● | ● | ● | ● | As cases 2-6 |
| 12 - 16 | Repeat cases 2 – 6 for 50% loaded container (see note 3 – change in CoG height) | ● | ● | ● | ● | As cases 2-6 |
| 17 - 21 | Repeat cases 2 – 6 for 75% loaded container | ● | ● | ● | ● | As cases 2-6 |
| 22 - 27  | Repeat cases 2 – 6 for 100% loaded container | ● | ● | ● | ● | As cases 2-6 |
| 28 | As case 2 but with a 25% loaded 20’ container added at the trailing position  | ● | ● | ● | ● | 25% |   | 0% |
| 29 | As case 3 but with a 25% loaded 20’ container added at the trailing position  | ● | ● | ● | ● | 25% | 0% |   |
| 30 | As case 4 but with a 25% loaded 20’ container added at the leading position  | ● | ● | ● | ● | 0% |   | 25% |
| 31 - 33 | Repeat cases 28 - 30 for 50% loaded container (see note 3 – change in CoG height) | ● | ● | ● | ● | As cases 28-30 |
| 34 - 36 | Repeat cases 28 - 30 for 75% loaded container  | ● | ● | ● | ● | As cases 28-30 |
| 37 - 39 | Repeat cases 28 - 30 for 100% loaded container | ● | ● | ● | ● | As cases 28-30 |

## Appendix B – Unevenly loaded cases

A matrix of simulation cases is defined below to cover the possible range of unevenly loaded cases. The sign convention to be adopted is shown in the figure

Negative

Positive

Leading end

**Note 4:** It is assumed that tare containers generally have little or no lateral offset to their c-of-g, so no tare cases are included in appendix B.

**Note 5:** An upper limit *Ymax* to the possible lateral offset of the container c-of-g will need to be agreed. Large values of c-of-g offset are more likely for low values of load percentage, for example white goods stacked on one side of the container.

**Note 6:** Upper limit of longitudinal offset for a 20’ container is just over 2000mm, representing ⅔ of the distance from centreline to end. The equivalent value for a 40’ container is 4064mm.

**Note 7:** It is not proposed to consider containers with >50% loading and significant longitudinal offsets. See section 4.3.2 for clarification.

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| **Unevenly loaded cases - Sensitivity of Derailment to Wagon Loading - (Results to be reported with the cases marked ●)** | **Loading diagram (configurations and loadings)** |
| **Case no** | **Description** | **ΔQ/Q** | **Y/Q** | **Flange climb (mm)** | **X-factor** | **Trailing** | **Centre** | **Leading** |
| 40 - 74 | As cases 7 - 39, but all laden containers have 100mm lateral c-of-g positive offset (see note 4) | ● | ● | ● | ● |   |   | 25% ↓ |
| 75 - 109 | As cases 7 – 39, but all laden containers have 100mm lateral c-of-g negative offset | ● | ● | ● | ● |   |   | 25% ↑ |
| 110 - 459 | As cases 40 - 109, but all laden containers have 200mm, 300mm, 400mm, 500mm and Ymax lateral c-of-g offset | ● | ● | ● | ● | As cases 40-109 |
| 460 | 1×20’ 25% loaded container leading position with 100mm positive c-of-g offset, 1×20’ 25% loaded container trailing posn with 100mm negative c-of-g offset. | ● | ● | ● | ● | 25% ↑ |   | 25% ↓ |
| 461 | Repeat case 460 but reverse the c-of-g offsets | ● | ● | ● | ● | 25% ↓ |   | 25% ↑ |
| 462-472 | Repeat cases 461 and 462 for 200mm, 300mm, 400mm, 500mm and Ymax offsets. | ● | ● | ● | ● | As cases 460- 461 |
| 473 | 1×20’ 25% loaded container leading position, container c-of-g longitudinally offset by 500mm towards leading end | ● | ● | ● | ● |   |   | 25% → |
| 474-476 | As case 473 but container c-of-g longitudinally offset by 1000mm, 1500mm and 2000mm towards leading end | ● | ● | ● | ● | As case 473 |
| 477 – 480 | Repeat cases 473 – 476 for 1×20’ 50% loaded container (see note 7) | ● | ● | ● | ● |   |   | 50% → |
| 481 - 488 | Repeat cases 473 – 480 for 1×20’ container trailing position with longitudinal offset loads are towards the trailing end. | ● | ● | ● | ● | 25% ← |   |   |
| 489 | 1×40’ 25% loaded container leading position, container c-of-g longitudinally offset by 4064mm towards the leading end (see note 6)  | ● | ● | ● | ● |   | 25% → |
| 490 | Repeat case 490 for 1×40’ 25% loaded container trailing position; longitudinal offset loads are towards the trailing end. | ● | ● | ● | ● | 25% ← |   |
| 491 - 492 | Repeat cases 489 - 490 for 50% loaded containers (see note 7) | ● | ● | ● | ● | As cases 489 - 490 |
| 493 - 613 | As cases 473 - 492 but with simultaneous lateral c-of-g positive offset of 100mm, 200mm, 300mm, 400mm, 500mm and Ymax | ● | ● | ● | ● | As cases 473 - 492 |
| 614 - 734 | As cases 493 - 613 with negative c-of-g offset | ● | ● | ● | ● | As cases 493 - 613 |

1. Where the container is assumed to be 2.9m (9’6”) high [↑](#footnote-ref-1)