## Run-a-Way Speed and Ballast Drag Length Calculator Tools User Guide ESI-06-05

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## **Table of Contents**

Table	e of Co	ontents		2
1	Intro	duction		3
	1.1	Purpose	э	3
	1.2	Backgro	bund	3
	1.3	Referen	ce Documents	3
	1.4	Definitio	ns	3
2	Desc	ription o	f the Run-a-Way Speed Calculator	4
	2.1	Open R	un-a-Way Speed Calculator	4
	2.2	Data En	itry	5
		2.2.1	Data Inputs Entry	5
		2.2.2	Signal Designer Details	6
		2.2.3	Results	6
3	Desc	ription o	f the Ballast Drag Length Calculator	8
	3.1	Open Ba	allast Drag Length Calculator	8
	3.2	Data En	itry	9
		3.2.1	Data Inputs Entry	9
		3.2.2	Signal Designer Details	10
		3.2.3	Results	10
4	Appe	ndix A –	Worked Examples	11
	4.1	Example	e 1	11
	4.2	Example	e 2	12
	4.3	Example	e 3	13

## 1 Introduction

## 1.1 Purpose

This user guide describes how to use both the Run-a-Way Speed Calculator tool and the Ballast Drag Length Calculator tool. The tools are often used in combination: for calculating runaway wagon speed at a particular point on the track and calculating the associated length of a ballast drag trap to safely arrest the runaway wagon.

## 1.2 Background

During the signalling design process in areas of falling gradients, catch points or derailers are often required to be positioned on the track to provide controlled derailment of runaway rolling stock to prevent it fouling other train movements which may be taking place in the vicinity. This controlled derailment is also required to limit damage to the runaway vehicles to a degree.

The Run-a-Way Speed Calculator tool allows the designer to predict the speed of runaway vehicles at a particular point and then determine whether a derailer (and type) or set of catch points should be provided.

The Ballast Drag Length Calculator tool allows the designer to calculate the minimum length of a ballast drag required to arrest runaway vehicles derailed by set of catch points, travelling at various speeds.

## 1.3 Reference Documents

The following documents should be read in conjunction with this guide:

• ESD-06-02 Catchpoints

## 1.4 Definitions

The following terms and acronyms are used within this document:

Description
Is a device used to derail unauthorised movements of trains or unattended movements of rolling stock to prevent it fouling the track. There are a number of types of derailer, which can be used for derailing vehicles at various ranges of speed.
Run-a-Way Speed Calculator Excel Tool
Ballast Drag Length Calculator Excel Tool

## 2 Description of the Run-a-Way Speed Calculator

The Run-a-Way Speed Calculator (ESI0605-T01) is an Excel program, which runs on a Windows based PC. It is important to ensure the most current approved version is being used for calculating runaway vehicle speeds.

Refer to ARTC Engineering Extranet for the most current version.

## 2.1 Open Run-a-Way Speed Calculator

Open Run-a-Way Speed Calculator the same way as any regular excel file. The file should open on the main page, the "Rolling calcs" worksheet, as shown in Figure 1 below.

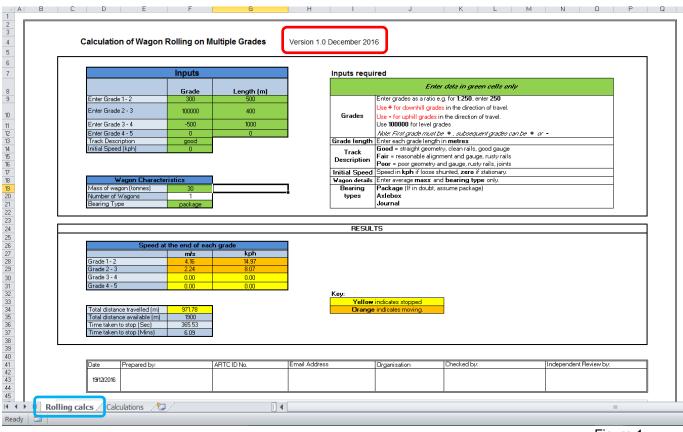


Figure 1

The "Rolling calcs" worksheet (*highlighted blue*) is the only worksheet used for data entry to calculate the rolling stock rolling speeds. All other worksheets are for information only.

Note: Before performing any calculations, check the version being used is the current version (highlighted red).

Description of the Run-a-Way Speed Calculator

## 2.2 Data Entry

The active cells are the *Green* cells. Values and text data must only be entered into active cells.

## 2.2.1 Data Inputs Entry

	Inputs		
	Grade	Length (m)	
Enter Grade 1 - 2	300	500	
Enter Grade 2 - 3	100000	400	
Enter Grade 3 - 4	-500	500	
Enter Grade 4 - 5	0	0	#
Track Description Initial Speed (kph)	good r		
		Select from d	rondown list
Wagon Character	ristics		iopuolin ilot
Mass of wagon (tonnes)	30		
Number of Wagons Bearing Type	1 package		

The above tables are used to enter the data for the speed calculation results. Working back from the end point, up to 4 variable gradient changes over the section of the network being considered can be accommodated in the calculation.

Note #: For grade sections not required for a calculation, ensure the "Grade" and "Length" cells are zero.

Explanatory notes for entering the input data are included in the worksheet as shown below.

#### Inputs required

	Enter data in green cells only					
	Enter grades as a ratio e.g. for 1:250, enter 250					
C	Use + for downhill grades in the direction of travel.					
Grades	Use - for uphill grades in the direction of travel.					
	Use 100000 for level grades					
	Note: First grade must be + , subsequent grades can be + or -					
Grade length	Enter each grade length in <b>metres</b>					
Track	Good = straight geometry, clean rails, good gauge					
Description	Fair = reasonable alignment and gauge, rusty rails					
Description	<b>Poor</b> = poor geometry and gauge, rusty rails, joints					
Initial Speed	Speed in <b>kph</b> if loose shunted, <b>zero</b> if stationary.					
Wagon details	Enter average mass and bearing type only.					
Bearing	Package (If in doubt, assume package)					
types	Axlebox					
	Journal					

IMPORTANT: For this tool and unlike other calculation tools, use + numbers for DOWNHILL grades, – numbers for UPHILL grades and 100,000 for level grades.

Some worked examples of values entered in the tables are shown in Appendix A.



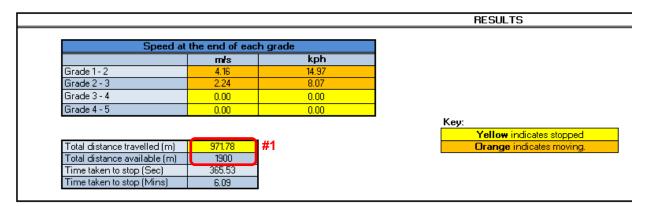
## 2.2.2 Signal Designer Details

Date Prepa	ared by:	ARTC ID No.	Email Address	Organisation	Checked by:	Independent Review by:
7/12/2016						

For each calculation which provides the source data for a signal design, the Signal Designer must complete the above table. The information required is self-explanatory.

The calculation information must then be produced as a PDF, printed and included as supporting information in the design pack for verification and recording purposes.

#### 2.2.3 Results



The results of the calculations automatically appear in tables of the RESULTS window (see above). As described in the key, the resultant values are automatically indicated:

- Yellow for runaway vehicle which is stopped, and
- Orange for runaway vehicle which is moving

Note #1: If the Total Distance Travelled resultant value is less than the Total Distance Available, the distances will be shown as calculated with the Total Distance Travelled value text highlighted yellow (as per example shown above).

This means that the distance available for a runaway vehicle is adequate and protection will not be required.

Description of the Run-a-Way Speed Calculator

			RESULTS
Canadas	the end of each g		
Speeu al			
	mis	kph	
Grade 1-2	4.16	14.97	
Grade 2 - 3	2.24	8.07	
Grade 3 - 4	2.08	7.49	
Grade 4 - 5	0.00	0.00	
			Кеу:
			Yellow indicates stopped
Total distance travelled (m)	1050.40 #2		Orange indicates moving.
Total distance available (m)	910		
Time taken to stop (Sec)	505.12		
Time taken to stop (Mins)	8.42		

Note #2: If the Total Distance Travelled resultant value is greater than the Total Distance Available, the distances will be shown as calculated with the Total Distance Travelled value text highlighted orange.

This means that the distance available for a runaway vehicle is inadequate and some form of protection will be required (eg a derailer or set of catch points). The selection of protection will depend on the calculated speed the runaway vehicle is travelling at when passing the location being considered.

## 3 Description of the Ballast Drag Length Calculator

The Ballast Drag Length Calculator (ESI0605-T02) is an Excel program, which runs on a Windows based PC. It is important to ensure the most current approved version is being used for calculating runaway vehicle speeds. *Refer to ARTC Engineering Extranet for the most current version.* 

## 3.1 Open Ballast Drag Length Calculator

Open Ballast Drag Length Calculator the same way as any regular excel file. The file should open on the main page, the "D – Rolling Drag" worksheet, as shown in Figure 1 below.

A	B	C	D	E	F	G	H		
		Rolling Drag Ca	alculation	Ballast Drag I	_ength)	Version 1.0 De	cember 2016		
				-					
						Inputs require	ed		
			Inputs					een cells only	
			· ·						
		Enter entry speed (kpł	l)	15				ph) to Ballast Drag	
		Enter axle load (t)		30		Axle and		wheel parameters, else use	
		Enter depth of wheel (		300		Wheel	default values		_
		Enter radius of wheel (		457		Wagon		ngth in metres and number of	
		Enter wagon length (m		30		Parameters		se default values	<u> </u>
		Enter number of wago		1		Ballast Drag	II –	itio e.g. for <b>1:250</b> , enter <b>250</b>	
		Enter grade of runoff (	%]	0		Grade	Use - for down	hill grades	
							Use + for uphil	l grades	
							Use 0 for level	grades	
								· · · · · · · · · · · · · · · · · · ·	1
					Results	5			
			hlumbar	Decel Date				Number of warmen	
		Distance (m)	Number Bogies off	Decel Rate (m/s²)	V²	Speed (m/s)	Time (sec)	Number of wagons derailed	
						4.17			
		0	0	0.00	17.36	4.17	0.00	0	
		10	0	0.00	17.36	4.17	2.40	0	1
		15	1	1.28	4.52	2.13	1.59	0	
		20	1	1.28	0.00	0.00	1.66	0	
		25	1	1.28	0.00	0.00	0.00	0	
		30	2	2.57	0.00	0.00	0.00	1	
		35	2	2.57	0.00	0.00	0.00	1	
		40	2	2.57	0.00	0.00	0.00	1	
		45	3	2.57	0.00	0.00	0.00	1	
		50	3	2.57	0.00	0.00	0.00	1	
		Average	Deceleration	1.67		Total Time	5.64		
				© Austral	ian RailTrack Corpor	ation Li mited 2013			
					Disclaimer:				
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		<u> </u>							
•	🕨 🛛 🗖 🗖 🕨 🖿 🕨 🕨	ing Drag 🖊 Calcul	ations 🖉 T	abulation01 🦯	2				
dy	2								
9	-							<b>F</b> ' -	
								Figure	1

The "D – Rolling Drag" worksheet (*highlighted blue*) is the only worksheet used for data entry to calculate the length of a ballast drag necessary to arrest runaway wagon(s). All other worksheets are for information only.

Note: Before performing any calculations, check the version being used is the current version (highlighted red).

Description of the Ballast Drag Length Calculator

## 3.2 Data Entry

The active cells are the *Green* cells. Values and text data must only be entered into active cells.

## 3.2.1 Data Inputs Entry

	Rolling Drag Calculation	(Ballast Drag Length			
	Inputs				
	Enter entry speed (kph)	15			
	Enter axle load (t)	30			
#	Enter depth of wheel (mm)	300			
#	Enter radius of wheel (mm)	457			
	Enter wagon length (m)	30			
	Enter number of wagons	1			
	Enter grade of runoff (%)	0			

The above table is used to enter the data for the ballast drag length calculation.

Note #: Normally, the input data would be selected and entered in accordance with the parameters for each design. However, the values "300' and "457" can be considered as default values if the actual wheel parameters are unknown.

Explanatory notes for entering the input data are included in the worksheet as shown below.

Version 1.0 De	ember 2016					
	_					
nputs required						
1	Enter data in gr	een cells only				
Forward Speed	Entry Speed (kph) to Ballast Drag					
Axle and Wheel	Enter axle and wheel parameters, else use					
Parameters	default values					
Wagon	Wagon Enter wagon length in metres and number of					
Parameters	ameters wagons, else use default values					
Ballast Drag	Enter grades ratio e.g. for 1:250, enter 250					
Grade	Use - for down	Use - for downhill grades				
	Use 🕇 for uphi	ll grades				
	Use 0 for level	grades				

IMPORTANT: For this tool, use + numbers for UPHILL grade, – numbers for DOWNHILL grade and zero for level grade.

Some worked examples of values entered in the tables are shown in Appendix A.



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## 3.2.2 Signal Designer Details

Date	Prepared by	ARTC ID No.	Email address	Organisation	Checked by:	Independent Review	ру:
19/12/2016							

For each calculation which provides the source data for a signal design, the Signal Designer must complete the above table. The information required is self-explanatory.

The calculation information must then be produced as a PDF, printed and included as supporting information in the design pack for verification and recording purposes.

### 3.2.3 Results

	Results									
	Distance (m)	Number Bogies off	Decel Rate (m/s²)	<b>V</b> ²	Speed (m/s)	Time (sec)	Number of wagons derailed			
					4.17					
	0	0	0.00	17.36	4.17	0.00	0			
	10	0	0.00	17.36	4.17	2.40	0			
1	CI	1	1.28	4.52	2.13	1.59	0			
	20	1	1.28	0.00	0.00	1.66	0			
-	20	1	1.28	0.00	0.00	0.00	0			
	30	2	2.57	0.00	0.00	0.00	1			
	35	2	2.57	0.00	0.00	0.00	1			
	40	2	2.57	0.00	0.00	0.00	1			
	45	3	2.57	0.00	0.00	0.00	1			
	50	3	2.57	0.00	0.00	0.00	1			
	Average D	eceleration	1.67		Total Time	5.64				

The results of the calculations automatically appear in the table of the RESULTS window (see above). The resultant values are automatically highlighted:

- Yellow for stopped runaway vehicle(s) and the minimum length of the ballast drag
- Orange for moving runaway vehicle(s)

Note #1: In the example shown above, the minimum length of a ballast drag to arrest a single 30m long and 30T wagon travelling at 15 kph is calculated to be 20m.

## 4 Appendix A – Worked Examples

The following are some worked examples on 1500m of a variable gradient track.

## 4.1 Example 1

			Runaway end point	
	Grade 1-2	Grade 2-3	Grade 3-4	Ń
Runaway start point>	+80	Level	-50	
	500m	300m	700m	
<	7	Total Distance Avail	able	$\rightarrow$

#### Calculation of Wagon Rolling on Multiple Grades Version 1.0

	Inputs	
	Grade	Length (m)
Enter Grade 1 - 2	80	500
Enter Grade 2 - 3	100000	300
Enter Grade 3 - 4	-50	700
Enter Grade 4 - 5	0	0
<b>T</b> 1 <b>B</b> 1 2		
Track Description	good	
Track Description Initial Speed (kph)	good 0	
	0	
Initial Speed (kph) Wagon Characte	0 eristics	

	m/s	kph	
Grade 1 - 2	10.35	37.28	
Grade 2 - 3	9.90	35.64	
Grade 3 - 4	0.00	0.00	
Grade 4 - 5	0.00	0.00	
Total distance travelled (m)	1031.59	€	
Total distance travelled (m) Total distance available (m)	1031.59 1500	4	
		Ł	

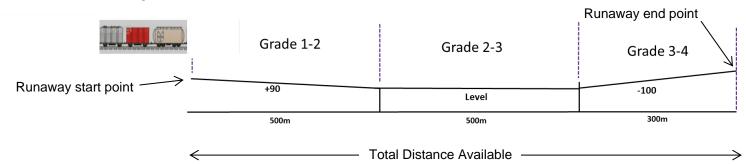
Yellow highlight indicates vehicle will stop within the grade 3-4 section

In this example, it is calculated that the runaway vehicles would take 1031.59m to stop in the Grade 3-4 area. Therefore there is adequate distance available for the runaway vehicles to stop before the end point.

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Appendix A – Worked Examples

## 4.2 Example 2



## Calculation of Wagon Rolling on Multiple Grades Version 1.0 (

Inputs				
	Grade	Length (m)		
Enter Grade 1 - 2	90	500		
Enter Grade 2 - 3	100000	700		
Enter Grade 3 - 4	-100	300		
Enter Grade 4 - 5	0	0		
Track Description	good			
Initial Speed (kph)	0			

Wagon Characteristics				
Mass of wagon (tonnes)	30			
Number of Wagons	1			
Bearing Type	package			

m/s         kph           Grade 1 - 2         9.67         34.83           Grade 2 - 3         8.49         30.58           Grade 3 - 4         2.01         7.23           Grade 4 - 5         0.00         0.00           Total distance travelled (m)         1630.68           Total distance available (m)         1500	Speed at	the end of each <u>c</u>	grade	
Grade 2 - 3     8.49     30.58       Grade 3 - 4     2.01     7.23       Grade 4 - 5     0.00     0.00		mis	kph	
Grade 3 - 4     2.01     7.23       Grade 4 - 5     0.00     0.00       Total distance travelled (m)     1630.68     still moving beyond the end point of the end p	Grade 1-2	9.67	34.83	
Grade 4 - 5 0.00 0.00 Orange highlight indicates vehic Total distance travelled (m) 1630.68 Still moving beyond the end point	Grade 2 - 3	8.49	30.58	
Total distance travelled (m) 1630.68 Orange highlight indicates vehicles till moving beyond the end point	Grade 3 - 4	2.01	7.23	
Total distance travelled (m) 1630.68 still moving beyond the end poi	Grade 4 - 5	0.00	0.00	
	<b>-</b>		0	Prange highlight indicates vehic
Total distance available (m)	l otal distance travelled (m)		st	till moving beyond the end poin
	<b>T F F F F F F F F F F</b>	4500		
Time taken to stop (Mins) 6.13	Time taken to stop (Sec)	1500 367.78		

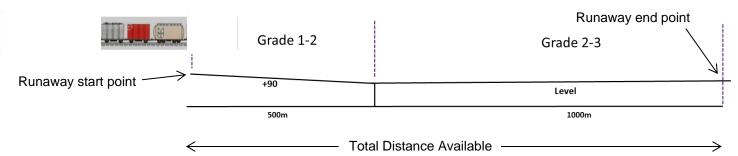
In this example, it is calculated that the runaway vehicles would take 1630.68m to stop beyond the Grade 3-4 area (provided the -100 grade continues). Therefore there is not adequate distance available for the runaway vehicles to stop before the end point.

The speed the runaway vehicles are calculated to be travelling at the end point is 2.01m/s (7.23Kph). Therefore appropriate protection will be necessary to prevent it fouling other train movements which may be taking place in the vicinity of the end point. Refer to type approved derailer/crowders which could be applied (eg Aldon, Siemens, etc).

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Appendix A – Worked Examples

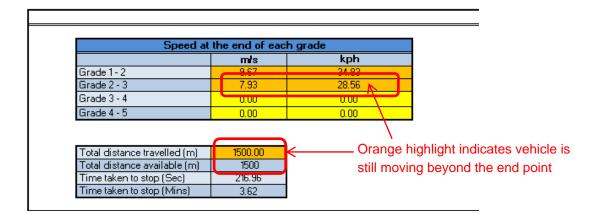
## 4.3 Example 3



### Calculation of Wagon Rolling on Multiple Grades Version 1.0

	Inputs	1
	Grade	Length (m)
Enter Grade 1 - 2	90	500
Enter Grade 2 - 3	100000	1000
Enter Grade 3 - 4	0	0
Enter Grade 4 - 5	0	0
Track Description	good	
Initial Speed (kph)	0	

Wagon Characteristics				
Mass of wagon (tonnes)	30			
Number of Wagons	1			
Bearing Type	package			



In this example, there are only 2 grade sections. It is calculated that the runaway vehicles would still be moving beyond the Grade 2-3 area end point.

The speed the runaway vehicles are calculated to be travelling at the end point is 7.93m/s (28.56Kph). Therefore appropriate protection will be necessary to prevent it fouling other train movements which may be taking place in the vicinity of the end point. With this speed, a set of catch points would be necessary. Depending on the situation, a ballast drag may also be required which would be correctly sized by using the Ballast Drag Length Calculator tool. Refer example below...

Appendix A – Worked Examples

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Enter entry speed (kph)       28.56       Forward Speed       Entry Speed (kph) to Ballast Drag         Enter ade load (t)       30       Axle and       Enter ade and wheel parameters, else use         Enter adjus of wheel (mm)       30       Wheel       Enter add and wheel parameters, else use         Enter adjus of wheel (mm)       30       Parameters       Enter wagon length in metres and number of wagons, else use default values         Enter grade of number of wagons       3       Ballast Drag       Enter grades and set of set of the set of						Inputs require	ed		
Enter ade load (I)       30       Axte and Enter depth of wheel (mm)       300       Axte and Wheel       Enter ade and wheel parameters, else use default values         Enter adguing of wheel (mm)       457       Wagon       Enter wagon length in metres and number of wagons, else use default values         Enter adjust of wheel (mm)       30       Parameters       wagons, else use default values         Enter number of wagons       3       Ballast Drag Grade       Enter rule and wheel parameters, else use default values         Enter number of wagons       3       Ballast Drag Grade       Enter rule and wheel parameters, else use default values         Enter grade of runoff (%)       0       0       0       Grade       Use + for downhill grades Use 0 for level grades         Use 0       0       0.00       62.94       7.83       Use 0       0         0       0       0.00       62.94       7.83       0.00       0         15       1       0.43       58.66       7.66       0.64       0         20       1       0.43       54.38       7.37       0.67       0         30       2       0.66       4153       6.44       0.74       1         35       2       0.86       32.97       5.74       0.82			Inputs			En	oter data in gr	een cells only	
Enter depth of wheel (mm)       300       Wheel       default values         Enter radius of wheel (mm)       457       Wagon       Enter wagon length in metres and number of wagons, else use default values         Enter mumber of wagons       3       Ballast Drag       Enter wagons, else use default values         Enter grade of runoff (½)       0       Ballast Drag       Enter grades ratio e.g. for 1:250, enter 250         Use of runoff (½)       0       0       Ballast Drag       Enter grades ratio e.g. for 1:250, enter 250         Use of for downhill grades       Use of for downhill grades       Use of for downhill grades       Use of for level grades         0       0       0.00       62.94       7.93       0.00       0         10       0       0.00       62.94       7.93       1.26       0         20       1       0.43       58.86       7.86       0.84       0       0         20       1       0.43       59.10       7.86       0.84       0       0         21       0.43       50.10       7.08       0.63       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <td></td> <td>Enter entry speed (kpł</td> <td>1)</td> <td>28.56</td> <td></td> <td>Forward Speed</td> <td>Entry Speed (</td> <td>(ph) to Ballast Drag</td>		Enter entry speed (kpł	1)	28.56		Forward Speed	Entry Speed (	(ph) to Ballast Drag	
Enter radius of wheel (mm)       457         Enter wagon length (m)       30         Ballast Drag       Ballast Drag         Enter unmber of wagons       3         Enter grade of runoff (%)       0         Ballast Drag       Grade         Briter grade of runoff (%)       0         Ballast Drag       Grade         Ballast Drag       Ballast Drag         Briter grade of runoff (%)       0         Distance (m)       Number         Distance (m)       Number         0       0         0       0         0       0         0       0         10       0         0       0         10       0         10       0         10       0         10       0.00         20       1         10       0.43         25       1         30       2         20       1         30       2         20       1         30       2         31       128         329       126         33       128 <t< td=""><td></td><td>Enter axle load (t)</td><td>-</td><td></td><td></td><td>Axle and</td><td>Enter axle and</td><td>wheel parameters, else use</td></t<>		Enter axle load (t)	-			Axle and	Enter axle and	wheel parameters, else use	
Enter wagon length (m)         30         Parameters         wagons, else use default values           Enter number of wagons         3         Baliast Drag         Enter grade ratio e.g. for 1:290, enter 250           Liner grade of runoff (2)         0         Grade         Enter grades ratio e.g. for 1:290, enter 250           Lise - for downhill grades         Use - for downhill grades         Use - for downhill grades           Use - for downhill grades         Use - for downhill grades         Use - for downhill grades           Use - for downhill grades         Use - for downhill grades         Use - for downhill grades           Use - for downhill grades         Use - for downhill grades         Use - for downhill grades           Use - for downhill grades         Use - for downhill grades         Use - for downhill grades           Use - for down of down of for down of the for down of d		Enter depth of wheel (r	mm)	300		Wheel	default values		
Enter number of wagons         3         Ballast Drag Grade         Enter grades ratio e.g. for 1:250, enter 250 Use - for downhill grades Use - for downhill grades Use 0 for level grades           Distance (m)         Number Bogies off         Decel Rate (m/s²)         V²         Speed (m/s)         Time [sec)         Number of wagons derailed           0         0         0.00         62.94         7.93         0.0         0           10         0         0.00         62.94         7.93         1.26         0           20         1         0.43         58.86         7.86         0.64         0           20         1         0.43         54.38         7.37         0.67         0           30         2         0.86         41.53         6.44         0.74         1           35         2         0.86         41.53         6.44         0.74         1           40         2         0.86         42.97         5.74         0.82         1           41         1.28         11.57         3.40         1.20         1         1           50         3         1.28         10.00         0.00         2.65         1         1           6         0.0		Enter radius of wheel (	mm)			Wagon	Enter wagon le	ngth in metres and number of	
Enter grade of runoff (%)         0         Grade         Use - for downhill grades Use + for uphill grades Use 0 for level grades           Distance (m)         Number Bogies off         Decel Rate (m/s)         V2         Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93         0.00         0           10         0         0.000         62.94         7.93         1.26         0           15         1         0.43         58.66         7.66         0.64         0           20         1         0.43         54.38         7.37         0.67         0           30         2         0.86         4153         6.44         0.74         1           35         2         0.86         29.97         5.74         0.82         1           40         2         0.86         24.41         4.94         0.34         1           45         3         1.28         0.00         0.00         2.65         1         1           Generation 0.64         Total Time         9.60									
Distance (m)         Number Bogies off         Decel Rate (m/s)         Yz         Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93         0         0           10         0         0.000         62.94         7.93         0         0           115         1         0.43         58.66         7.66         0.64         0           20         1         0.43         54.38         7.37         0.67         0           20         1         0.43         50.10         7.08         0.63         0           30         2         0.86         115.7         3.40         1.20         1           35         2         0.86         29.7         5.74         0.82         1           35         2         0.86         29.7         5.74         0.82         1           40         2         0.86         24.41         4.94         0.94         1           45         3         1.28         10.00         0.00         2.65         1         1           Geneal colspan="2">Colspan="2">Colspan="2"Colspan="2">Colspan="2"Colspan="2"Colspan="2"Colspan="2"Co							Enter grades r	atio e.g. for <b>1:250</b> , enter <b>250</b>	
Use 0 for level grades           Distance (m)         Number Bogies off         Decel Rate (m/s <sup>2</sup> )         V <sup>2</sup> Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93		Enter grade of runoff (	%)	0	ļ	Grade	Use - for down	hill grades	
Use 0 for level grades           Distance (m)         Number Bogies off         Decel Rate (m/s <sup>2</sup> )         V <sup>2</sup> Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93				^			l lse 🛨 for unbi	II grades	
Distance (m)         Number Bogies off         Decel Rate (m/s <sup>2</sup> )         V <sup>2</sup> Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93         0.00         0           10         0         0.000         62.94         7.93         1.26         0           115         1         0.43         58.66         7.66         0.64         0           20         1         0.43         54.38         7.37         0.67         0           25         1         0.43         50.10         7.08         0.63         0           30         2         0.86         41.53         6.44         0.74         1           35         2         0.86         32.97         5.74         0.82         1           40         2         0.86         24.41         4.94         0.94         1           50         3         1.28         11.57         3.40         1.20         1           Geaustralia RailTrack Corporation Limited 2013 Disclaimer:           Subject to the terms of the relevant contract with ARTC.           and tis employeesshall have no liability to unauthorised use								-	
Distance (m)         Number Bogies off         Decel Rate (m/s <sup>2</sup> )         V <sup>2</sup> Speed (m/s)         Time (sec)         Number of wagons derailed           0         0         0.000         62.94         7.93         0.00         0           10         0         0.000         62.94         7.93         1.26         0           11         0.43         58.66         7.66         0.64         0         0           20         1         0.43         54.38         7.37         0.67         0           25         1         0.43         50.10         7.08         0.63         0           30         2         0.86         41.53         6.44         0.74         1           35         2         0.86         32.97         5.74         0.82         1           40         2         0.86         24.41         4.94         0.94         1           45         3         1.28         11.57         3.40         1.20         1           50         3         1.28         0.00         0.00         2.65         1 <td artc's="" colspany="" consent.="" other="" parky="" prior="" td="" use<="" without="" written=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td>	<td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
Distance (m)         Bogies off         (m/s²)         V²         Speed (m/s)         Ime (sec)         derailed           0         0         0.00         62.94         7.93         0.00         0           10         0         0.00         62.94         7.93         1.26         0           15         1         0.43         58.66         7.66         0.64         0           20         1         0.43         54.38         7.37         0.67         0           20         1         0.43         54.38         7.37         0.67         0           30         2         0.86         41.53         6.44         0.74         1           35         2         0.86         32.97         5.74         0.82         1           40         2         0.36         24.41         4.94         0.94         1           45         3         1.28         10.57         3.40         1.20         1           50         3         1.28         0.00         0.00         2.65         1         0           Okastralian RailTrack Corporation Limited 2013           Disclaimer:					Result	ts			
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In this example, the entry speed is 28.56 Kph as calculated with the Run-a-Way Speed Calculator and the number of wagons is 3. The minimum length of the ballast drag is calculated to be 50m.