

Train Braking Application Design

ESD-05-03

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1.1	21 Aug 18	1.3, 2.1 & Table 2	Removal of Table 2 and all reference to it, and minor editorial changes.

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Table of Contents

Table of Contents2

1 Introduction.....4

1.1 Purpose4

1.2 Scope4

1.3 Document Owner4

1.4 Responsibilities4

1.5 Reference Documents4

1.6 Definitions.....4

2 Braking Distance5

2.1 Determining Braking Distances (Signal Spacing) for Signalling Design5

2.2 Applicable Tables for Signalling Design.....5

2.2.1 Brake Tables by Train Types..... 5

2.3 Further Considerations when determining Braking Distances6

2.3.1 Multiple types of trains on a section of line 6

2.3.2 Multiple gradients 6

2.3.3 Braking distance Calculations for Long Trains..... 6

3 Records of Calculations and Design Verification7

3.1 Records of Calculations7

3.2 Design Report7

3.3 Signal Design Check.....7

3.4 Signal Design Verification7

4 Compliance Indicators7

5 Competency requirements7

6 Appendix A – Train Brake Tables8

6.1 Introduction.....8

GW-40 Superfreighter for Defined Interstate Rail Network9

HSP – 160 High Speed Passenger Train.....10

HSP – 160 High Speed Passenger Train (Continued)..... 11

MSP – 120 Self Propelled Passenger Train.....12

GW-10 Loaded Coal Train.....13

GW-11 Empty Coal Train14

GW-16 Superfreighter15

GW-30 Superfreighter16

GW-50 3/4 Loaded Container (1800m)17

1 Introduction

1.1 Purpose

This standard specifies requirements for train braking used in the design of signalling.

1.2 Scope

This standard covers the various standard types of train classes that operate on the ARTC network. It specifically identifies the types of trains and the nominal train braking distances for those trains. These are the default values to be used in the design of signalling. The standard also details which of those train classes operate on that section of the ARTC network.

1.3 Document Owner

The Manager Standards is the Document Owner and is the initial point of contact for all queries relating to this standard.

1.4 Responsibilities

The signals design manager for any new or amended design is responsible for the implementation of this standard. This manager shall be able to demonstrate how the requirements have been applied. This includes liaison with operations representatives to determine and document the train operating requirements for scope of work for the design.

The signal design engineer or signal designer is responsible for implementing the requirements into the signalling designs.

1.5 Reference Documents

The following documents support this standard:

- ESD-05-01 Common Signal Design Principles: S1 - Signalling Locking and Train Dynamics Section 5
- ESD-32-01 Signals Rolling Stock Interface
- ESI-05-12 STOPDIST Train Braking Distance Calculation Tool User Guide
- ESD0503F-01 Signalling Braking Distance Calculations – Summary Record

1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Brake Table	A table of predetermined braking distances for a particular type of train travelling at multiple speeds, on multiple gradients. The full suite of Brake Tables for the different types of trains are included in Appendix A.
STOPDIST	The STOPDIST calculation tool calculates stopping distances for the different types of trains. It must be used for determining the actual braking distances for all future signal design.

2 Braking Distance

Refer to Section 5 of ESD-05-01 Common Signal Design Principles: S1 - Signalling Locking and Train Dynamics for the concepts and definitions of braking distance and the principles of determining braking distance and longest braking distance.

2.1 Determining Braking Distances (Signal Spacing) for Signalling Design

The first step in determining braking distances for a signalling design is to establish which train types shall use the part of the network to be signalled and therefore which Brake Tables apply. For this, Table 1 shall be used.

Train lengths shall be derived from the Route Access Standard, General Information, Table on Train lengths.

For reference, the actual Brake Tables for each type of train are included in Appendix A of this standard.

The STOPDIST calculation tool (Refer ESI-05-12) must be used for determining the actual braking distances (signal spacing) for the respective signal design.

2.2 Applicable Tables for Signalling Design

2.2.1 Brake Tables by Train Types

Brake Table	Train Type
GW 16 max	Superfreighter braking (680 m train) 115 km/h
GW 10 max	loaded coal train braking 80 km/h
GW 11	empty coal train braking
GW 50	1800 m long Superfreighter braking 115 km/h max
GW40	1500 m long Superfreighter braking 115 km/h max (4x81 class + 3480 tonnes) (26/10/93)
GW30	1200 m long Superfreighter 115 km/h max (4x81 class + 2760 tonnes) (29/6/93)
MSP 120	Self-Propelled Passenger Train that operates up to 120km/h
HSP 160	XPT braking 160 km/h max

Table 1

Should trains with poorer braking, or higher attainable speeds than those listed for the Brake Tables be required to operate on the line, then an analysis and safety assessment of the resulting effects on infrastructure and the train operations must be conducted.

2.3 Further Considerations when determining Braking Distances

2.3.1 Multiple types of trains on a section of line

Where multiple train types are specified for particular sections of lines, STOPDIST calculations need to be made for each of the specified train types that adequate braking distances are provided. As an example, a line requiring braking to GW10, GW16, HSP160 tables is likely to be constrained by the GW10 Brake Table below 80 km/h and the GW16 Brake Table around 100–115 km/h. Should XPT speeds generally exceed 140 km/h then the HSP160 Brake Table may become the critical factor.

2.3.2 Multiple gradients

Where a section of line has multiple gradients on approach to a signal, then averaging of the gradients is not permitted as a way of determining the braking distance. The STOPDIST calculation tool will calculate the progressive braking distance for each line section gradient.

2.3.3 Braking distance Calculations for Long Trains

For trains longer than 200 metres, the position of the train relative to the gradient will affect the results in calculation of braking distance. For example, a 1500 metre long train may have a different gradient under the front and the rear of the train. The STOPDIST calculation tool will calculate the braking distance and allow for long trains and any changing gradients.

3 Records of Calculations and Design Verification

3.1 Records of Calculations

The signal designer shall keep a record of each calculation performed and ensure the designer details and associated signal details are included on each record. The signal designer shall print to 'pdf' the STOPDIST START Form report and its corresponding Results report of each calculation that is to be used as the basis for the actual signal arrangement plan design. This applies to the calculation for each train type, although only one train type will normally be the limiting factor for the design.

3.2 Design Report

As described in section 3.1, all of STOPDIST 'pdf' reports for each signal on the associated signal arrangement plan design shall be included in the Design Report.

The signal designer shall provide a complete summary of all the final calculated braking distances to be used to determine the signal positioning and spacing of all the relevant signals on a revised signal arrangement plan, using the Summary Record (ESD0503F-01) template. This Summary Record along with all the relevant STOPDIST 'pdf' reports shall form the Design Report.

3.3 Signal Design Check

The signal design checker shall review all the calculation parameters included in the 'pdf' reports in the Design Report.

3.4 Signal Design Verification

The signal design verifier shall check all the input parameters, the resultant outputs and their application to signal spacing on the signal arrangement plan.

4 Compliance Indicators

The following items are indicators of non-compliance with this standard. They may be used by auditors or managers when reviewing performance:

- a. Signals Functional Scope document or Operations Requirements Scope document for a project does not reference this standard and does not list the applicable types of trains for the respective section of the network.
- b. Signal designer does not use the signed printout from the STOPDIST calculation tool for calculating the braking distance from a signal when determining the signal spacing.
- c. Signal designer does not produce a design report detailing the required braking distance for every signal.

5 Competency requirements

The signal designer shall have an ARTC Signals Statement of Competency for design activities.

The signal designer shall have a level 2 or higher competency for Signal Arrangement Plans to undertake the design of signal spacing in accordance with the train braking requirements.

6 Appendix A – Train Brake Tables

6.1 Introduction

The following are the standard train Brake Tables to be used by ARTC in the design of the signalling infrastructure for the network. At some locations, multiple tables may be applicable due to the type of trains operating. The tables include a 15% allowance over the train braking distances used by the train operators. This allowance covers that in-service trains may have up to 10% of wagons with brakes cut out. There may also be issues that affect the adhesion between wheel and rail.

The GW40 table is the default Brake Table for the Defined Interstate Rail Network (DIRN).

These tables are provided for reference only. The STOPDIST calculation tool uses these Brake Tables data as its reference when calculating braking distances.

GW-40 Superfreighter for Defined Interstate Rail Network

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

	Rising							GRADE (1 in X)					Falling			
	33	40	60	100	200	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10 km/h	14	16	23	30	39	43	48	53	59	64	72	100	158	278	397	
20	52	59	76	95	116	123	132	143	153	164	177	224	313	485	647	
30	108	123	153	186	220	232	245	260	277	294	313	382	504	734	948	
35	144	162	200	240	279	294	312	329	348	369	392	471	613	873	1111	
40	184	206	251	300	347	365	384	405	428	452	477	569	730	1018	1283	
45	228	254	308	366	420	440	463	486	513	540	569	673	852	1170	1469	
50	276	307	370	436	498	522	547	575	603	635	668	783	980	1332	1667	
55	328	363	436	512	582	608	637	667	699	734	770	898	1113	1504	1880	
60	383	425	507	591	670	699	731	765	800	838	879	1018	1255	1687	2109	
65	443	490	582	676	764	796	830	867	906	949	992	1144	1404	1883	2356	
70	507	559	661	766	861	897	935	975	1018	1064	1112	1276	1561	2091	2622	
75	574	632	744	859	964	1003	1044	1088	1134	1184	1236	1416	1726	2314	2908	
80	644	708	833	958	1072	1113	1158	1205	1256	1310	1366	1562	1901	2551	3218	
85	719	789	925	1060	1183	1229	1278	1328	1383	1441	1502	1715	2086	2803	3552	
90	796	873	1020	1167	1301	1349	1402	1457	1516	1578	1644	1874	2280	3073	3915	
95	877	960	1120	1279	1421	1474	1531	1590	1654	1720	1793	2042	2486	3363	4301	
100	963	1052	1224	1395	1548	1604	1665	1730	1797	1870	1948	2220	2704	3672	4672	
105	1051	1148	1332	1515	1679	1740	1805	1874	1948	2026	2110	2405	2932	3977	5051	
110	1143	1247	1443	1640	1816	1881	1952	2025	2104	2190	2280	2599	3172	4284	5437	
115	1237	1349	1561	1769	1957	2027	2102	2183	2268	2360	2458	2800	3411	4597	5834	

HSP – 160 High Speed Passenger Train

High speed passenger trains that operate up to 160km/h

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

Km/h	Rising							GRADE (1 in X)					Falling			
	33	40	60	100	150	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10	8	9	9	9	9	10	10	10	10	10	10	10	11	12	13	
20	24	25	26	27	28	28	29	29	30	30	31	32	34	38	41	
25	34	35	37	39	41	42	42	43	43	44	45	47	51	57	61	
30	47	48	51	54	56	57	58	59	60	61	62	65	70	79	86	
35	61	63	67	71	74	75	76	77	79	80	81	86	93	105	114	
40	77	80	85	90	94	95	97	99	100	102	104	110	120	135	147	
45	95	98	105	111	117	118	120	122	125	127	129	137	149	169	185	
50	114	119	127	135	142	144	146	149	152	155	157	167	182	207	227	
55	136	141	151	161	169	172	175	178	181	184	188	200	218	248	272	
60	159	166	178	189	198	202	205	209	213	217	221	235	257	293	322	
65	184	192	206	220	231	235	239	244	248	253	258	275	301	343	377	
70	212	221	238	253	266	271	276	281	286	292	298	317	348	397	438	
75	242	252	271	289	305	310	316	322	328	335	342	364	400	458	505	
80	274	286	308	328	346	352	359	366	373	381	389	415	456	523	579	
85	308	322	347	371	391	399	406	414	423	431	440	471	519	596	661	
90	345	361	390	417	440	448	457	466	476	486	496	531	586	675	749	
95	384	402	434	465	491	500	510	521	532	543	555	594	657	759	844	
100	425	445	482	516	546	556	567	579	591	604	617	662	733	849	946	
105	469	492	532	571	604	616	628	642	655	670	685	735	815	946	1057	

HSP – 160 High Speed Passenger Train (Continued)

	Rising							GRADE (1 in X)				Falling			
Km/h	33	40	60	100	150	300	600	Level	600	300	200	100	60	40	33
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance
110	515	541	586	629	666	679	693	708	723	739	756	812	903	1051	1176
115	564	592	642	690	731	746	761	778	795	813	831	894	995	1161	1301
120	615	646	701	754	799	816	833	851	870	890	911	980	1092	1278	1435
125	668	701	762	820	870	888	907	927	948	970	993	1069	1193	1399	1573
130	723	760	826	890	944	964	985	1007	1030	1054	1079	1163	1300	1527	1720
135	780	820	893	962	1022	1043	1066	1090	1115	1141	1169	1261	1410	1660	1873
140	840	884	963	1038	1103	1126	1151	1177	1204	1233	1263	1363	1527	1800	2034
145	902	949	1035	1116	1186	1212	1239	1267	1297	1328	1360	1470	1647	1945	2202
150	967	1017	1110	1197	1274	1301	1331	1361	1393	1427	1462	1580	1774	2098	2378
155	1038	1093	1194	1290	1373	1403	1435	1469	1504	1541	1580	1710	1923	2282	2594
160	1113	1173	1282	1386	1477	1511	1545	1582	1620	1661	1703	1846	2081	2479	2827

MSP – 120 Self Propelled Passenger Train

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Self-propelled passenger trains that operate up to 120km/h

Full service brake application applied to locomotives and train until point of stop

	Rising							GRADE (1 in X)					Falling			
	33	40	60	100	150	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10 km/h	6	6	6	7	7	7	7	7	7	8	8	8	9	10	11	
20	19	20	22	23	24	25	25	26	26	27	27	29	32	36	40	
25	29	30	33	35	37	38	38	39	40	41	42	44	49	57	63	
30	41	43	46	50	52	53	54	56	57	58	59	64	70	82	92	
35	55	58	62	67	71	72	74	75	77	79	80	86	96	112	126	
40	71	74	81	87	92	94	96	98	100	103	105	113	126	148	166	
45	89	94	102	110	116	119	121	124	127	130	133	143	160	189	213	
50	110	115	126	135	144	147	150	154	157	161	165	178	199	235	267	
55	132	139	152	164	174	178	182	186	191	195	200	216	243	288	327	
60	157	166	181	195	208	213	217	222	228	233	239	259	291	346	394	
65	184	194	212	230	245	250	256	262	268	275	282	306	344	410	468	
70	214	225	247	267	284	291	298	305	312	320	328	356	402	480	548	
75	245	259	283	307	327	335	343	351	360	369	378	411	464	556	636	
80	279	295	323	350	373	382	391	400	410	421	432	469	531	637	730	
85	315	333	365	395	422	432	442	453	465	477	489	532	602	724	831	
90	353	373	409	444	474	485	497	509	522	536	550	598	678	816	937	
95	393	415	456	495	529	541	554	568	582	598	614	668	758	913	1050	
100	435	460	505	548	586	600	614	630	646	663	681	741	842	1014	1168	
105	479	507	556	604	646	661	678	695	712	731	751	818	929	1121	1291	
110	525	555	610	663	709	726	743	762	782	802	824	898	1020	1231	1419	
115	573	606	666	723	774	792	811	832	853	876	900	980	1114	1345	1550	
120	623	658	723	786	841	861	882	904	927	952	978	1066	1211	1462	1685	

GW-10 Loaded Coal Train

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Note that maximum speed of the coal wagons with 25 T axle load is 80 kph and maximum speed with 30 T axle load is 60 kph.

Full service brake application applied to locomotives and train until point of stop

	Rising							GRADE (1 in X)			Falling				
	33	40	60	100	150	300	600	Level	600	300	200	100	60	40	33
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance
10 kph	14	16	23	30	39	41	47	52	57	63	70	95	150	261	375
20	51	59	75	94	113	121	129	139	150	160	172	216	301	469	644
30	108	122	152	184	215	228	241	255	271	289	307	374	496	739	1012
35	143	161	198	237	276	291	307	324	343	363	386	465	607	902	1221
40	182	205	250	297	343	361	381	400	422	446	473	565	733	1071	1454
45	227	253	306	362	417	438	460	484	509	537	567	673	864	1258	1715
50	274	306	368	434	497	520	545	573	603	634	668	787	1004	1460	2007
55	327	362	435	511	581	608	637	668	702	736	774	908	1155	1686	2340
60	383	424	507	592	672	702	734	768	805	844	887	1037	1318	1934	2717
65	443	490	583	678	767	800	836	874	914	959	1006	1175	1494	2208	3153
70	507	560	662	769	867	904	944	986	1032	1081	1134	1324	1685	2513	3656
75	575	634	749	866	973	1014	1058	1105	1155	1210	1268	1481	1891	2852	4245
80	646	711	837	967	1084	1130	1178	1230	1286	1347	1412	1650	2114	3229	4946

GW-11 Empty Coal Train

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

	Rising								GRADE (1 in X)				Falling			
	33	40	60	100	150	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10	14	15	20	26	31	36	38	40	43	47	51	63	87	132	170	
20	47	53	64	77	90	95	100	106	110	117	123	146	184	248	302	
30	97	107	128	150	168	175	182	191	199	208	218	250	304	391	461	
35	128	140	166	191	213	222	231	240	250	261	271	310	370	469	549	
40	161	176	207	236	263	273	283	294	306	317	330	374	443	554	639	
45	198	216	251	286	316	328	340	353	366	379	394	443	520	639	734	
50	238	259	300	339	374	386	400	415	429	445	461	514	599	729	830	
55	281	306	352	396	435	450	465	480	496	513	531	590	682	822	931	
60	327	354	406	455	499	514	531	549	566	584	604	668	767	920	1035	
65	376	407	463	519	566	583	601	620	639	660	681	750	857	1019	1143	
70	428	462	524	584	636	656	674	695	715	737	760	835	950	1124	1256	
75	482	520	588	653	708	729	750	772	795	819	843	922	1045	1230	1373	
80	538	580	654	724	785	807	829	852	877	903	928	1014	1144	1342	1495	

GW-16 Superfreighter

For secondary lines with passing loops less than 900 metres

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

	GRADE (1 in X)														
	Rising							Level	Falling						
Speed	33	40	60	100	200	300	600	Level	600	300	200	100	60	40	33
10 km/h	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance
10	13	15	18	25	29	31	34	37	39	41	46	54	72	105	131
20	46	51	61	72	83	86	90	94	99	105	109	128	155	205	246
30	93	101	120	138	153	159	166	172	179	186	193	221	262	335	398
35	121	132	154	176	195	202	210	218	225	235	244	275	325	412	490
40	153	167	193	220	243	250	259	268	278	289	299	335	394	499	592
45	189	205	236	266	292	302	312	323	335	346	359	400	470	592	702
50	227	246	282	316	347	358	369	382	394	408	422	470	552	693	821
55	268	290	330	370	405	417	430	444	459	474	490	546	638	802	951
60	313	337	383	428	466	480	494	511	527	545	564	627	733	920	1094
65	359	386	438	488	531	547	564	582	600	621	641	713	833	1048	1249
70	409	440	497	552	600	619	637	658	678	700	724	805	941	1187	1418
75	461	496	559	620	674	695	715	738	761	787	813	903	1057	1336	1602
80	516	554	624	692	752	775	798	823	849	877	906	1007	1181	1497	1802
85	575	616	693	768	835	859	885	913	943	974	1006	1120	1313	1671	2019
90	635	681	766	849	922	950	979	1009	1041	1076	1112	1239	1455	1858	2256
95	699	749	842	934	1014	1044	1076	1111	1147	1184	1225	1364	1607	2061	2513
100	766	821	922	1022	1112	1144	1180	1217	1257	1300	1343	1498	1769	2279	2794
105	836	896	1006	1117	1214	1250	1289	1329	1373	1420	1470	1640	1940	2514	3102
110	910	974	1095	1214	1322	1362	1404	1449	1497	1548	1602	1792	2124	2765	3414
115	986	1056	1188	1318	1435	1479	1525	1574	1626	1682	1742	1950	2316	3018	3734

GW-30 Superfreighter

for lines with Loops less than 1300 metres

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

	Rising								GRADE (1 in X)				Falling			
	33	40	60	100	200	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10 km/h	14	16	23	29	37	40	43	48	52	59	63	85	128	210	291	
20	49	57	72	89	106	113	120	128	136	145	155	192	259	383	496	
30	105	117	144	174	200	210	222	235	247	261	277	330	423	593	751	
35	139	155	187	223	256	269	282	297	313	329	347	409	519	715	892	
40	176	197	236	278	317	332	348	366	384	404	423	497	622	842	1042	
45	218	243	290	339	384	402	420	440	461	484	507	590	729	974	1202	
50	264	292	347	405	457	476	497	520	543	568	595	688	842	1117	1374	
55	314	346	409	474	534	555	578	604	630	658	688	790	960	1267	1559	
60	367	404	475	547	614	638	665	692	721	753	785	898	1087	1431	1759	
65	423	465	545	627	699	727	756	785	819	852	889	1012	1220	1603	1976	
70	483	530	619	708	789	819	851	883	919	957	996	1130	1362	1789	2208	
75	546	599	697	796	883	915	950	987	1025	1065	1109	1257	1511	1986	2460	
80	614	670	779	887	982	1018	1055	1094	1135	1180	1227	1389	1670	2199	2732	
85	684	746	865	981	1084	1122	1164	1206	1251	1300	1351	1529	1838	2426	3026	
90	758	826	953	1080	1191	1233	1278	1324	1373	1426	1482	1676	2016	2669	3345	
95	835	908	1046	1182	1304	1349	1396	1447	1501	1557	1619	1831	2203	2929	3691	
100	914	994	1143	1289	1420	1469	1520	1575	1634	1696	1763	1993	2402	3207	4053	
105	998	1083	1244	1401	1542	1595	1650	1710	1773	1841	1914	2164	2613	3499	4408	
110	1084	1176	1348	1517	1670	1726	1787	1850	1919	1993	2071	2345	2836	3788	4769	
115	1174	1273	1457	1638	1802	1864	1929	1998	2072	2152	2237	2533	3060	4080	5142	

GW-50 3/4 Loaded Container (1800m)

for lines with standing room for 1800m long trains

STOPPING DISTANCE TABLE (distances in metres) (Includes 15 % allowance in distances only)

Full service brake application applied to locomotives and train until point of stop

	Rising								GRADE (1 in X)				Falling			
	33	40	60	100	200	300	600	Level	600	300	200	100	60	40	33	
Speed	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	Distance	
10 km/h	14	16	23	31	41	47	52	59	64	72	82	117	192	358	529	
20	52	61	78	100	123	133	144	155	168	182	199	258	373	605	835	
30	112	128	161	198	236	251	267	285	305	327	350	435	593	903	1193	
35	148	168	209	256	302	320	339	361	384	409	437	536	719	1064	1383	
40	190	214	264	320	375	396	419	444	471	500	532	646	853	1232	1587	
45	236	264	325	391	454	478	506	534	565	599	635	764	992	1406	1802	
50	285	320	391	467	539	567	598	630	665	703	743	887	1137	1593	2033	
55	339	381	461	547	630	661	696	731	770	813	858	1015	1289	1789	2282	
60	398	444	536	634	726	761	798	839	882	928	979	1151	1449	2000	2547	
65	461	513	616	726	828	866	907	951	999	1050	1104	1293	1617	2222	2832	
70	527	585	702	821	934	976	1021	1071	1122	1178	1236	1440	1792	2458	3139	
75	598	662	790	923	1046	1092	1142	1194	1250	1310	1374	1595	1977	2709	3470	
80	672	744	884	1029	1163	1213	1266	1324	1385	1449	1518	1756	2171	2976	3826	
85	750	829	982	1140	1285	1339	1397	1458	1524	1594	1669	1924	2376	3261	4214	
90	833	918	1084	1256	1411	1470	1533	1598	1670	1745	1824	2101	2591	3565	4626	
95	918	1011	1191	1375	1543	1607	1673	1745	1820	1900	1986	2285	2818	3889	5023	
100	1007	1107	1303	1501	1681	1749	1820	1896	1977	2063	2155	2477	3056	4223	5421	
105	1099	1209	1419	1631	1824	1895	1972	2054	2140	2232	2332	2678	3307	4547	5826	
110	1197	1313	1539	1765	1971	2048	2130	2217	2309	2408	2515	2890	3565	4875	6241	
115	1297	1423	1663	1904	2124	2207	2293	2386	2486	2592	2707	3107	3820	5210	6667	