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भारत सरकार – रेल मंत्रालय
 अनुसंधान अभिकल्प और मानक संगठन
 लखनऊ – 226011
 Government of India - Ministry of
 Railways
**Research, Designs & Standards
 Organization, LUCKNOW - 226011**

EL/3-1-39/1

Date: 20-6-2008

Chef Electrical Engineer

- 1- Central Railway, Mumbai CST - 400001
- 2- Northern Railway, Baroda House, New Delhi - 110001
- 3- Eastern Railway, Fairlie Palace, Kolkata- 700001
- 4- Southern Railway, Park , Chennai -600003
- 5- South Central Railway, Rail Nilayam, Secunderabad -500071
- 6- Western Railway, Church Gate, Mumbai - 400020
- 7- South Eastern Railway, Garden Reach, Kolkata - 700043
- 8- East Central Railway, Hazipur, Bihar - 844101
- 9- West Central Railway, Jabalpur - 482001
- 10- South East Central Railway, Bilaspur- 495004
- 11- East Coast Railway, Bhubneshwar- 751016
- 12- North Central Railway, Hasting Road, Allahabad- 211001

Technical Circular No: RDSO/2008/EL/TC/0097, Rev '0' Dt. 20-6-2008

Sub: Haulage capacity of Freight AC locomotives in run through conditions on different gradients.

Ref: Railway Board's letter no. 2005/Elect. (TRS)/440/17Pt. dated 21.5.2008.

Lengths of negotiable stretches of rising gradients in run through conditions for various loads and locos at different attacking speeds were advised to Railways from time to time through Technical circulars as under.

□

Sr No	TC No	Loco Type	Load	Negotiable stretches mentioned for rising gradients	Remarks
1	TC-22	WAG7	58 BOXN , 4700 t	1:150,1:100	Loco can start and haul 4700 t load on 1:200 rising gradient.
2	TC-23	WAG5 (TAO)	58 BOXN , 4700 t	1:200,1:150	
			40 BCN, 3300 t	1:150,1:100	Loco can start and haul 3300 t load on 1:200 rising gradient.

3	TC-24	WAG9	58 BOXN , 4700 t	1:150,1:100	Loco can start and haul 4700 t load on 1:200 rising gradient.
4	TC-26	WAG5H	58 BOXN , 4700 t	1:200,1:150	Loco can start and haul 4700 t load on 1:360 rising gradient.
			40 BCN, 3300 t	1:150,1:100	Loco can start and haul 3300 t load on 1:200 rising gradient.
5	TC-86	WAG7	58 BOXN(CC+6) 5062 t	1:150,1:100	Loco can negotiate 5062 t load on 1:200 rising gradient with speed more than 20 kmph.
			58 BOXN (CC+10) ,5294 t	1:200,1:150,1:100	
6	TC-87	WAG5 (TAO)	58 BOXN(CC+6) 5062 t	1:200,1:150,1:100	
			58 BOXN (CC+10) ,5294 t	1:200,1:150,1:100	
7	TC-88	WAG9	58 BOXN(CC+6) 5062 t	1:150,1:100	Loco can start and haul 5062 t on 1:200 rising gradient.
			58 BOXN (CC+10) 5294 t	1:150,1:100	
8	TC-89	WAG5H	58 BOXN(CC+6) 5062 t	1:200,1:150,1:100	
			58 BOXN (CC+10) ,5294 t	1:200,1:150,1:100	
9	TC-95	WAG5 (TAO)	40 BCN(CC+6), 3491t	1:200,1:150,1:100	Loco can start and haul 3300 t on 1:200 rising gradient.
			40BCN(CC+6+2) 3571t	1:200,1:150,1:100	
			48 BTPN(4000t)	1:200,1:150,1:100	
			58 BOXN(4714t)	1:100	
			58 BOXN (CC+6+2),5178t	1:200,1:150,1:100	
		WAG5H	40 BCN(CC+6), 3491t	1:200,1:150,1:100	Loco can start and haul 3300 t on 1:200 rising gradient.
			40 BCN (CC+6+2),3571t	1:200,1:150,1:100	
			48 BTPN(4000t)	1:200,1:150,1:100	
			58 BOXN(4714t)	1:100	
			58 BOXN (CC+6+2),5178t	1:200,1:150,1:100	
		WAG7	40 BCN(3300t)	1:100	Loco can start and haul 3300 t on 1:150 rising gradient.
			40 BCN(CC+6), 3491t	1:100	Loco can start and haul 3491 t on 1:150 rising gradient.
			40 BCN (CC+6+2),3571t	1:100	Loco can start and haul 3571 t on 1:150 rising gradient.
			48 BTPN(4000t)	1:150,1:100	Loco can start and haul 4000 t on 1:200 rising gradient.
58 BOXN(CC+6) 5062 t	1:200		Loco can start and haul 4714 t on 1:200 rising gradient.		
58 BOXN (CC+6+2),5178t	1:200,1:150,1:100				

		WAG9	40 BCN(3300t)	1:100	Loco can start and haul 3300 t on 1:150 rising gradient.
			40 BCN(CC+6), 3491t	1:100	Loco can start and haul 3491 t on 1:150 rising gradient.
			40 BCN (CC+6+2),3571t	1:100	Loco can start and haul 3571 t on 1:150 rising gradient.
			48 BTPN(4000t)	1:100	Loco can start and haul 4000 t on 1:150 rising gradient.
			58 BOXN (CC+6+2),5178t	1:200,1:150,1:100	Loco can start and haul 5062 t on 1:200 rising gradient.
			58 BOXN (CC+10),5294t	1:200	
		2WAG5 (TAO) MU	40 BCN (CC+6+2),3571t	1:100	Loco can start and haul 3571 t on 1:150 rising gradient.
			48 BTPN(4000t)	1:100	Loco can start and haul 4000 t on 1:150 rising gradient.
			58 BOXN(4714t)	1:100	Loco can start and haul 4714 t on 1:150 rising gradient.
			58 BOXN(CC+6) 5062 t	1:100	Loco can start and haul 5062 t on 1:150 rising gradient.
			58 BOXN (CC+6+2),5178t	1:100	Loco can start and haul 5178 t on 1:150 rising gradient.
			58 BOXN (CC+10),5294t	1:100	Loco can start 5294 t on 1:150 rising gradient.
		2WAG5H MU	48 BTPN(4000t)	1:100	Loco can start and haul 4000 t on 1:150 rising gradient.
			58 BOXN(4714t)	1:100	Loco can start and haul 4714 t on 1:150 rising gradient.
			58 BOXN(CC+6) 5062 t	1:100	Loco can start and haul 5062 t on 1:150 rising gradient.
			58 BOXN (CC+6+2),5178t	1:100	Loco can start and haul 5178 t on 1:150 rising gradient.
			58 BOXN (CC+10),5294t	1:100	Loco can start and haul 5294 t on 1:150 rising gradient.

However, Railway Board has advised vide letter no. 2005/Elect.(TRS)/440/17Pt. dated 21.5.2008 on different lengths of negotiable stretches of rising gradients for various loadings i.e. CC+4+2 and CC+8+2 and various locos at different attacking speeds for trains with 59 BOXN and 41 BCN formation. Computer simulations have been done at RDSO for following combinations to arrive at the lengths of stretches which can be negotiated in run through conditions at various attacking speeds are given in table No. 1 to 14 at Annexure-I for Single WAG7 Loco and table No. 15 to 26 at Annexure-II for Single WAG9 Loco.

Loco	Grade	Loads					
		41BCN +1BV (CC+6) 3593t	41BCN +1BV (CC+6+2) 3675t	41BCN +1BV (CC+10) 3757t	59BOXN +1BV (CC+6) 5164t	59BOXN +1BV (CC+6+2) 5164t	59BOXN +1BV (CC+10) 5164t
WAG7	1:200	Loco can start and haul			Table No. 1	Table No. 2	Table No. 3
	1:150	Loco start and haul	Table No. 4	Table No. 5	Table No. 6	Table No. 7	Table No. 8
	1:100	Table No. 9	TableNo. 10	TableNo. 11	TableNo. 12	TableNo. 13	TableNo. 14
WAG9	1:200	Loco can start and haul			Table No. 15	Table No. 16	Table No. 17
	1:150	Loco can start and haul			Table No. 18	Table No. 19	Table No. 20
	1:100	Table No. 21	TableNo. 22	TableNo. 23	TableNo. 24	TableNo. 25	TableNo. 26

Railways are requested to conduct field trials on the above guidelines in different sections. Based on such trials, you may issue guidelines to Loco pilots to enable them negotiate such stretches successfully without causing stalling and overloading of electrical equipments. RDSO may be kept apprised of the developments

(Ganesh)
For Director General/Elec.

Encl: Annexure – I & II

Distribution: As per standard mailing list no. EL/M/0019 Amendment-3.

(Ganesh)
For Director General/Elec.

Annexure-I**Negotiable length of stretches on various rising gradients with single WAG7 loco**

TABLE-1		
Grade: 1:200 Compensated Load: 59BOXN+1BV (CC+6), 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	3.5	19.0
30	5.0	26.0
40	6.0	33.0
50	7.0	37.5
60	8.5	40.0
70	9.0	40.5

TABLE-2		
Grade: 1:200 Compensated Load: 59BOXN+1BV (CC+6+2), 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	3.0	17.5
30	4.5	24.0
40	5.5	31.5
50	6.5	36.5
60	8.0	37.5
70	8.5	40.0

TABLE-3		
Grade: 1:200 Compensated Load: 59BOXN+1BV (CC+10), 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	2.5	16.0
30	4.0	22.0
40	5.0	30.0
50	6.0	35.5
60	7.5	37.0
70	8.0	39.5

TABLE-4		
Grade: 1:150 Compensated Load: 41BCN+1BV (CC+6+2), 3675T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	4.0	20.0
30	8.0	30.0
40	8.5	40.0
50	9.0	42.5
60	9.5	43.0
70	10.0	43.5

TABLE-5		
Grade: 1:150 Compensated Load: 41BCN+1BV (CC+10), 3757T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	4.0	20.0
30	6.0	30.0
40	8.0	40.0
50	8.5	41.0
60	9.0	42.0
70	10.0	42.5

TABLE-6		
Grade: 1:150 Compensated Load: 59BOXN+1BV (CC+6), 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR	--
30	1.0	22.0
40	2.0	26.5
50	3.0	30.0
60	3.5	36.0
70	4.75	34.0

*NR means "Not Recommended"

Negotiable length of stretches on various rising gradients with single WAG7 loco

TABLE-7		
Grade: 1:150 Compensated Load: 59BOXN+1BV (CC+6+2), 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	1.0	21.5
40	2.0	25.5
50	2.5	33.0
60	3.5	35.0
70	4.5	36.0

TABLE-8		
Grade: 1:150 Compensated Load: 59BOXN+1BV (CC+10), 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	1.0	21.0
40	1.5	29.0
50	2.5	32.0
60	3.5	33.5
70	4.5	34.5

TABLE-9		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+6), 3593T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	12.0
30	0.75	21.5
40	1.25	28.0
50	2.0	31.5
60	2.75	33.5
70	3.5	35.0

TABLE-10		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+6+2), 3675T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	11.5
30	0.75	21.0
40	1.25	27.0
50	2.0	30.5
60	2.75	32.0
70	3.5	33.5

TABLE-11		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+10), 3757T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.75	20.0
40	1.25	26.0
50	2.0	29.0
60	2.5	34.0
70	3.0	38.0

TABLE-12		
Grade: 1:100 Compensated Load: 59BOXN+1BV (CC+6), 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	18.0
40	0.75	26.5
50	1.25	29.75
60	1.75	33.0
70	2.0	40.5

*NR means "Not Recommended"

Negotiable length of stretches on various rising gradients with single WAG7 loco

TABLE-13		
Grade: 1:100 Compensated		
Load: 59BOXN+1BV (CC+6+2), 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	17.5
40	0.75	26.0
50	1.25	28.75
60	1.75	32.0
70	2.0	40.0

TABLE-14		
Grade: 1:100 Compensated		
Load: 59BOXN+1BV (CC+10), 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	17.0
40	0.75	25.5
50	1.25	28.0
60	1.75	31.5
70	2.0	39.5

*NR means "Not Recommended"

Annexure-II**Negotiable length of stretches on various rising gradients with single WAG9 Loco**

TABLE-15		
Grade: 1:200 Compensated		
Load: 59BOXN+1BV(CC+6) 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	4.0	20.0
30	8.0	30.0
40	17.0	40.0
50	26.0	45.0
60	28.0	47.0
70	30.0	48.0

TABLE-16		
Grade: 1:200 Compensated		
Load: 59BOXN+1BV (CC+6+2) 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	4.0	20.0
30	8.0	30.0
40	12.0	38.0
50	23.0	40.0
60	25.0	42.0
70	27.0	43.0

TABLE-17		
Grade: 1:200 Compensated		
Load: 59BOXN+1BV(CC+10) 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	4.0	20.0
30	7.0	29.0
40	8.0	36.0
50	16.0	38.0
60	20.0	39.0
70	21.0	40.0

TABLE-18		
Grade: 1:150 Compensated		
Load: 59BOXN+1BV(CC+6) 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	1.0	12.0
30	2.0	17.0
40	3.5	20.0
50	5.5	20.5
60	7.0	23.5
70	8.0	27.0

TABLE-19		
Grade: 1:150 Compensated		
Load: 59BOXN+1BV (CC+6+2) 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	16.5
30	1.5	20.0
40	3.0	21.5
50	5.0	21.0
60	6.5	23.5
70	7.5	27.0

TABLE-20		
Grade: 1:150 Compensated		
Load: 59BOXN+1BV(CC+10) 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	15.5
30	1.5	18.5
40	3.0	19.5
50	4.5	22.0
60	6.0	24.0
70	7.0	27.5

Negotiable length of stretches on various rising gradients with single WAG9 Loco

TABLE-21		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+6), 3593T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	15.0
30	1.25	18.0
40	2.0	24.5
50	3.5	25.0
60	4.5	27.5
70	5.5	29.0

TABLE-22		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+6+2), 3675T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	14.0
30	1.25	16.5
40	2.0	22.5
50	3.5	22.0
60	4.5	24.0
70	5.5	25.0

TABLE-23		
Grade: 1:100 Compensated Load: 41BCN+1BV (CC+10), 3757T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	0.5	13.0
30	1.25	15.0
40	2.0	20.5
50	3.5	18.5
60	4.5	20.5
70	5.5	21.0

TABLE-24		
Grade: 1:100 Compensated Load: 59BOXN+1BV(CC+6) 5164T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	19.75
40	1.0	22.5
50	1.25	32.5
60	2.0	33.0
70	2.5	38.0

TABLE-25		
Grade: 1:100 Compensated Load: 59BOXN+1BV(CC+6+2) 5282T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	19.25
40	1.0	21.5
50	1.25	31.5
60	2.0	32.0
70	2.5	37.0

TABLE-26		
Grade: 1:100 Compensated Load: 59BOXN+1BV(CC+10) 5400T		
Attacking Speed (KMPH)	Max.length which can be negotiated (Km.)	Exit Speed (KMPH)
20	NR*	--
30	0.5	18.75
40	1.0	20.5
50	1.25	30.5
60	2.0	31.0
70	2.5	36.0

*NR means "Not Recommended"