भारत सरकार (GOVERNMENT OF INDIA)
रेल मंत्रालय (MINISTRY OF RAILWAYS)
रेलवे बोर्ड (RAILWAY BOARD)

No. 2023/S&T/Dev/Kavach.Corres.-Part (1) **Dated: 11.04.25**

PCSTEs
All Zonal Railways

Sub: Implementation of Measures Related to *Kavach* System

Ref: NCR's Joint Procedure Order (JPO) no. NCR/JPO-Kavach/01-25 dated 05.04.25 (Copy enclosed)

North Central Railway (NCR) has issued a detailed Joint Procedure Order (JPO) outlining streamlined practices for the effective trials for successful implementation and operation of the Kavach.

These proactive measures may serve as a reference framework for implementation across all Zonal Railways.

You are, therefore, advised to study the NCR JPO on Kavach trials and implementation and adopt similar procedures in your respective zones, with necessary adaptations suited to local conditions.

A standardized approach to implementation and operation is essential for ensuring the safe and reliable rollout of Kavach across Indian Railways.

Officers and staff at the divisional level involved in the Kavach roll-out may be instructed to strictly adhere to the prescribed procedures.

A confirmation should be sent to the Railway Board at the earliest after the implementation of the above.

V.B. Mathur
11.04.25

(V.B. Mathur)
Executive Director/S&T(Dev)-I
Railway Board

Copy to:

- PED/S&T, RDSO, Lucknow, ED/Tele-II, RDSO, Secunderabad; For any inputs, modifications or suggestions on this matter to Zonal Railways.

JOINT PROCEDURE ORDER FOR KAVACH TRIALS OVER NCR

A. References used in drawing this Joint Procedure Order: -

1. Railway Board's L No. 2023/S&T/Dev/Kavach Corres. Dt 09.08.2024, regarding "Implementation of KAVACH on Indian Railways in mission mode".
2. RDSO specification RDSO/SPN/196/2020(Ver-4.0)– "Specification of KAVACH (Indian Railway ATP)" with amendments upto 10th February 2025.
3. SEM Para 7.8.9 – "Important minimum signalling features"
4. SEM Para 9.2.2 (j). "Provision of Automatic Train Protection system at Station/IBS/LC Gates/ABS huts etc. subject to certification by an Independent Safety Assessor."
5. RDSO-SIG0TCAS(KERX)/1/2023 dated 13.09.2024, regarding "RDSO's letter permitting passenger trials equipped with Onboard Kavach of M/s Kernex in BDNP-KSQ section of NCR.
6. No. E(MPP)/2023/3/2/8 by Training Directorate Dt 19/12/2024. "Training contents on KAVACH Training of CLIs & LPs /ALPs".

B. This JPO is drawn to carry out Kavach Trials on NC Railway, which is applicable on all trains, including Vande Bharat. Trains except following types of Trains

1. MEMU/EMU Trains
2. DEMU Trains

C. Installation and commissioning of KAVACH (Indian Railway's Indigenous Automatic Train Protection system) is currently underway across the entire NCR currently in Prayagraj (CPYZ to DDU) and in Agra Division (PWL to DHO) and will shortly start on Jhansi Division(DHO to BINA). As per the Railway Board's L No. 2023/S&T/Dev/Kavach Corres. Dt 09.08.2024, the implementation of Kavach is to be done in Mission Mode on Indian Railways.

To ensure the successful Implementation and integration of KAVACH into Railway operations within North Central Railway (NCR), it is crucial to conduct a comprehensive series of trials after the commissioning of Kavach Equipment's.

The trial(s) shall be started subject to completion of following stages: -

1. FAT (Factory Acceptance Test) and SAT (Site Acceptance Test) of ON-Board Kavach and Station Kavach shall be completed for the desired section, where trial(s) has to be done.

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c) During the test, the KAVACH system will operate with the Brake Interface Unit (BIU) in a working condition, i.e. KAVACH will apply brakes. The primary objective of this test is to observe the functioning of the entire KAVACH system.

d) The following tests will be conducted in this trial phase
   1. SPAD prevention testing on Main line and Loop Line.
   2. Loop line Speed Control test.
   3. PSR monitoring.
   4. SOS Generation.

e) The Procedure for carrying out above tests are detailed in *Annexure-1*.

f) For conducting this trial BIU selector switch position will be "1 (enable)" and EP switch position will also be "1(enable)". This will be done by S&T official under supervision of Loco Crew.

g) The Loco Crew should be advised that the Kavach braking is enabled and they are required to carry out the scenario tests as per the authorization.

h) The L/E to be used in controlled speed ***(Not more than 50 Kmph)*** in this trial for all the *Loop lines speed test, SPAD test and SOS test*.

i) The scenarios as mentioned in the RDSO L No.: RDSO-SIG0TCAS(KERX)/1/2023 dated 13.09.2024 to be tested for every station.

j) The S&T official will request two days prior to the test day to Divisional TLC that a suitable Loco and crew with required working OnBoard Kavach to be provided.

k) The Section Controller should provide a suitable path for these L/E trials for every station in the section for which trial is to be done.

l) SPAD test must be done at Home Signal, starter or any stop signal except the last stop signal, as per guidelines mentioned in *Annexure-1* , which are to be followed by SM/ASM.

m) The Loco crew (LP / Co-LP / ALP) shall always keep the train in his control, the Kavach brake activation speed and distance chart for various load combinations is given in *Annexure-2*, The loco crew will take control of the train brakes immediately thereafter (This can also be seen on the DMI).

n) Availability of LI/TI/S&T official along with authorised OEM representative to be ensured.

2. KAVACH LOCO TRIALS USING PASSENGER CARRYING TRAIN HAVING KAVACH FITTED LOCOMOTIVE WITH INACTIVE BRAKE INTERFACE UNIT (WITHOUT BRAKING).

a) These trials are to be done in section(s) where the Preliminary Loco Trials have been done successfully, which will be certified by competent S&T official.

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c) S&T official along with authorised OEM representative will upload the suitable software for testing in the onboard Kavach system.

d) **No scenarios will be tested in this trial**. The train will run as per the scheduled timetable. The Loco Pilot will operate the train, following standard procedures and at the designated speed, applying brakes as required to regulate speed according to operational needs. KAVACH will intervene and apply brakes which will be independent to brake application by LP and based on Kavach algorithm.

e) In the event of an undesired brake activation by KAVACH, causing the train to stop and resulting in operational delays, the system will be isolated by the S&T official on board to prevent disruptions and restoring normal operation. **After this no testing will be done and the S&T officials will keep the Kavach system isolated**.

f) For the entire duration of the test, the presence of Railway officials consisting of a Loco Inspector, Traffic Inspector, and Signal Supervisor, along with authorised OEM staff, **is mandatory** to oversee the trial and ensure coordination.

g) This trial should be carried out on **passenger carrying trains with more stoppages**, such as **15003/15004 or 12419/12420** etc.

4. KAVACH TRIALS USING LE/EMPTY RAKE/EMPTY RAKE FORMATION, HAVING KAVACH FITTED LOCOMOTIVE WITH ACTIVE BRAKE INTERFACE UNIT (BRAKING ENABLED)

a) This will be done only after approval of RDSO for conducting trials upto maximum permissible speed (MPS)of the section.

b) Before conducting this trial at MPS, the trial shall be conducted at 75 Kmph, then at 100 Kmph and then finally at MPS.

c) The Loco crew (LP / Co-LP / ALP) shall always keep the train in his control, the Kavach brake activation speed and distance chart for various load combinations is given in *Annexure-2*, The loco crew will take control of the train brakes immediately thereafter (This can also be seen on the DMI).

d) S&T official will request to Divisional TLC and Divisional coaching control for suitable loco and rake formation for the train in which onboard Kavach is fitted and working. S&T official will upload the suitable software for testing in the onboard Kavach system.

e) The rake formation will be as per the advice of S&T officials. The tests may also be joined by ISA officials for assessment.

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Annexure-1

METHODOLOGY TO BE FOLLOWED FOR SPAD, LOOP LINE SPEED TEST & SoS

a) SPAD Prevention Testing:

1. TCAS is meant primarily for on-board assistance to Loco Pilots by displaying various information etc. It shall normally not apply the brakes etc. to affect train running if the operating rules are properly observed. Therefore, in order to test these functionalities, it is planned to purposefully make deliberate mistake such as scenario in which Loco Pilots of train approaching signal at Danger does not apply brakes.
2. The predetermined list of tests at stations will be handed over to Control, TLC and Loco Crew. It is advisable to have Kavach Trained Crew for this test. The movements of Loco / Empty rake and station at which the SPAD test to be conducted is decided by S&T official and the same will be informed to SM of concerned station where SPAD Prevention test will be conducted as well as to SM of rear station.
3. SPAD (Signal Passed at Danger) testing will be conducted at Station A, specifically at the home signal (FSS). Before initiating the test, the home signal at Station A will be cleared for the main line, ensuring that all necessary conditions, including the required overlap, are met. Once the signal is set to proceed, it will then be cancelled, reverting to the "ON" aspect while keeping the route and overlap intact. No train to be received from the opposite direction even if the interlocking permits (usually done after the Overlap distance). The Station Master of concerned station shall ensure that all the conditions for taking off the concerned Signal, such as LC Gates are closed & locked, Route is set & locked, Line is free from obstructions. Point indications are proper, have been fulfilled. The route shall be set to mainline only.
4. The SM of rear station, before starting the Loco / Empty rake, will convey the message to Sectional Control and SM of concerned Station at which SPAD Prevention Test to be conducted.
5. Before authorizing the SM of rear station to issue T-369(1) the SM of concerned station should ensure the conditions for taking OFF Home Signal are fulfilled. Only after ensuring above, the SM of concerned station shall authorize the SM of the Station in rear to issue T-369(1) to the Loco Pilot for passing Home Signal of his station at ON position for SPAD Prevention Test. Thereafter the SM of rear station shall issue the T-369(1) to Loco Pilot of Loco/Empty rake for SPAD Prevention Test
6. The Loco Pilot shall follow the instructions or authority for testing of Director/Sig/RDSO, or Project Unit Official (Not less than JAG/SG) or any

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b) Loop Line Speed Restrictions Test:

1. The predetermined list of tests at stations will be handed over to Control, TLC and Loco Crew. It is advisable to have Kavach Trained Crew for this test. The movements of Loco /Empty rake and station at which the Loop Line test to be conducted is decided by S&T Official on-board and the same will be informed to SM of concerned station where Loop line speed test will be conducted.
2. As part of the testing, speed restrictions of 30 km/h or 15 km/h in the point zones for Loop Line movements will be evaluated and tested. The KAVACH system is designed to automatically apply the brakes, ensuring that the locomotive's speed is reduced to below 30 km/h or 15 km/h, as per the designated speed limit for the specific point zone, before entering the Loop Line.
3. If KAVACH fails to initiate braking, the loco pilot must promptly intervene and manually apply the brakes to ensure that the locomotive speed is reduced to the prescribed limit (30 km/h or 15 km/h) before entering the point zone.
4. ***No onboard official will intervene in the working of Loco Crew while testing.***

c) SoS Test:

1. The predetermined list of tests at stations/sections will be handed over to Control, TLC and Loco Crew. The train/rake formation will be in controlled speed in the section/station at which SOS to be done.
2. No SOS to be done without information to On-Board official.
3. ***The testing at stations to be done in the presence of Sectional TI/SI/SI (PU) and assurance of training of SM/ASM will be recorded in Assurance register.***

04/4/25		05/04/2025
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Loco : 1WAP7 (conv.) Type of braking : Emergency Braking Distancing

Consist: 1 WAP7 with 8 ICF AC 3 tier coaches & 2 SLR

Brake build up time components used for calculations Brake development (establishment) time for EBD with 1.5 kg/cm2 BP drop for the given train (i.e Full service brake) Loco: 13 sec, 1st Coach: 5 Secs, Last coach (10th): 6 Secs.

Maximum Loco BC Pressure: 2.5 kg/cm^2 , Maximum Coach BC pressure: 3.5 kg/cm^2

Percentage operative cylinder in train: 95%

Type of Brake Block: Loco: 'Cast Iron' type, Coaches: 'K' type brake

Gradient: Level

Initial speed while commencing brake command		Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in kmph		130 Kmph	120 Kmph	110 Kmph	100 Kmph	90 Kmph	80 Kmph	70 Kmph	60 Kmph	50 kmph	40 Kmph	30 Kmph	20 kmph	10 Kmph	0 Kmph	Max. Retardation (in m/s2)
140	Distance	375	509	633	745	895	962	1058	1124	1180	1225	1260	1293	1303	1304	0.66
	Speed	130	120.8	111.3	101.6	87.5	78.1	68.7	59.4	50.1	40.8	31.6	17.7	8.5	3.9	
130	Distance		347	470	583	685	819	895	961	1016	1061	1096	1121	1138	1139	0.66
	Speed		120.1	110.9	101.4	92	77.8	68.5	59.2	49.9	40.6	31.3	22.1	8.3	3.7	
120	Distance			320	432	534	625	743	808	863	908	943	967	984	985	0.66
	Speed			110.2	101.1	91.7	82.2	68.2	58.9	49.6	40.3	31.1	21.8	8	3.4	
110	Distance				292	393	484	601	666	721	765	800	824	840	841	0.65
	Speed				100.3	91.3	81.9	67.8	58.5	49.2	40	30.7	21.5	7.7	3.1	
100	Distance					264	355	435	536	590	634	668	691	704	707	0.65
	Speed					90.4	81.4	72.1	58.1	48.8	39.5	30.3	21.1	11.9	2.7	
90	Distance						237	316	386	470	513	547	569	582	585	0.65
	Speed						80.5	71.6	62.3	48.3	39.1	29.8	20.6	11.4	2.2	
80	Distance							209	278	361	404	437	459	471	473	0.65
	Speed							70.6	61.7	47.8	38.5	29.3	20.1	10.9	1.7	
70	Distance								162	239	306	338	360	371	373	0.64
	Speed								60.7	51.8	38	28.7	19.5	10.3	1.1	
60	Distance									154	200	251	272	283	284	0.64
	Speed									50.8	41.9	28.1	18.9	9.7	0.5	
50	Distance										126	162	186	206	207	0.64
	Speed										40.8	32	18.2	9	4.4	
40	Distance											99	123	141	142	0.64
	Speed											30.9	22.1	8.3	3.7	
30	Distance												71	84	88	0.64
	Speed												20.9	12.1	3	
20	Distance													43	46	0.63
	Speed													10.9	2.2	
10	Distance														16	0.6
	Speed														1	
			** Distance in Meter													

Loco : 1WAP7 (conV) Type of braking : Emergency Braking Distancing

Consist: 1 WAP7 with 16 ICF AC 3 tier coaches & 2 SLR

Brake build up time components used for calculations: Brake development (establishment) time for EBD with 1.5 kg/cm2 BP drop for the given train (i.e Full service brake) Loco: 13 sec. 1st Coach: 5 Secs. Last coach (18th): 18 Secs.

Maximum Loco BC Pressure: 2.5 kg/cm^2, Maximum Coach BC pressure: 3.5 kg/cm^2

Percentage operative cylinder in train: 95%

Type of Brake Block: Loco: 'Cast iron' type, Coaches: 'K' type brake

Gradient: Level

Initial speed while commencing brake command		Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in kmph		130 Kmph	120 Kmph	110 Kpmh	100 Kpmh	90 Kpmh	80 Kpmh	70 Kmph	60 Kmph	50 kmph	40 Kmph	30 Kpmh	20 kpmh	10 Kmph	0 Kmph	Max. Retardation (in m/s2)
140	Distance	449	582	705	816	918	1009	1127	1192	1247	1282	1327	1351	1370	1371	
	Speed	129.1	119.6	110.2	100.7	91.4	82	68.1	58.9	49.7	40.5	31.4	17.7	8.6	4.1	0.66
130	Distance		416	538	650	751	842	959	1024	1079	1124	1158	1183	1200	1201	
	Speed		119.2	109.6	100.4	91.1	81.7	67.8	58.6	49.4	40.3	31.1	22	8.3	3.8	0.65
120	Distance			383	494	595	686	766	867	921	965	1000	1024	1041	1041	
	Speed			109.4	100.1	90.7	81.4	72.1	58.2	49.1	39.9	30.7	21.6	8	3.4	0.65
110	Distance				350	450	540	620	720	774	818	852	875	889	892	
	Speed				99.5	90.3	80.9	71.7	57.8	48.6	39.5	30.3	21.2	12.1	3	0.65
100	Distance					317	406	485	554	638	682	715	738	751	753	
	Speed					89.6	80.4	71.2	61.9	48.1	39	29.8	20.7	11.6	2.5	0.64
90	Distance						284	362	431	489	556	589	611	624	626	
	Speed						79.8	70.6	61.4	52.2	38.4	29.3	20.1	11	1.9	0.64
80	Distance							251	318	376	442	474	496	507	509	
	Speed							69.9	60.7	51.5	37.8	28.6	19.5	10.4	1.3	0.64
70	Distance								218	274	321	371	392	403	404	
	Speed								60	50.9	41.7	28	18.9	9.7	0.8	0.64
60	Distance									185	230	265	300	310	311	
	Speed									50.1	41	31.8	18.1	9	4.5	0.64
50	Distance										151	186	210	228	229	
	Speed										40.1	31.1	22	8.3	3.7	0.63
40	Distance											118	142	155	158	
	Speed											30.2	21.2	12.1	2.9	0.63
30	Distance												85	97	100	
	Speed												20.2	11.2	2.1	0.63
20	Distance													52	53	
	Speed													10.3	1.3	0.63
10	Distance														8-Jan	
	Speed														0.3	0.62
			** Distance in Meter													

Loco : 1WAP7 (Conv.) Type of braking : Emergency Braking Distancing

Consist: 1 WAP7 with 8 LHB AC 3 tier coaches & 2 LWLRRM

Brake build up time components used for calculations: Brake development (establishment) time for EBD with 1.5 kg/cm2 BP drop for the given train (i.e Full service brake) Loco: 13 sec, 16t Coach: 5 Secs, Last coach (5th): 6 Secs.

Maximum Loco BC Pressure: 2.5 kg/cm^2 , Maximum Coach BC pressure: 3.0 kg/cm^2

Percentage operative cylinder in train: 100%

Type of Brake Block: Loco: 'Cast Iron' type, Coaches: 'K' type disc brake

Gradient: Level

Initial speed while commencing brake command		Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in kmph		130 Kmph	120 Kmph	110 Kpmh	100 Kpmh	90 Kpmh	80 Kpmh	70 Kmph	60 Kmph	50 kmph	40 Kmph	30 Kpmh	20 kpmh	10 Kmph	0 Kmph	Max. Retardation (in m/s2)
140	Distance	372	438	560	669	719	808	885	949	975	1020	1051	1062	1074	1075	0.83
	Speed	127.6	121.9	110.2	98.3	92.4	80.6	68.9	57.2	51.4	39.8	28.2	22.4	10.8	5.1	
130	Distance		344	405	516	615	659	738	804	856	878	912	932	940	940	0.82
	Speed		117.7	112	100.4	88.6	82.7	71	59.3	47.6	41.8	30.2	18.7	7.1	1.3	
120	Distance			316	372	472	560	634	667	722	764	780	803	814	814	0.81
	Speed			107.8	102.2	90.6	78.8	67.1	61.3	49.5	38	32.2	20.6	9.1	3.3	
110	Distance				289	399	428	505	569	596	640	672	683	695	696	0.81
	Speed				97.9	92.3	80.8	69.1	57.4	51.6	39.9	28.4	22.6	11	5.2	
100	Distance					261	305	384	450	503	525	558	579	587	587	0.81
	Speed					88.1	82.5	71	59.3	47.6	41.8	30.2	18.7	7.1	1.3	
90	Distance						234	272	340	395	437	454	476	488	486	0.81
	Speed						78.2	72.5	61.1	49.5	37.9	32.1	20.5	8.9	3.2	
80	Distance							206	239	296	340	371	382	394	395	0.81
	Speed							68.2	62.7	51.3	39.6	28.1	22.3	10.7	4.9	
70	Distance								178	231	252	285	306	311	312	0.81
	Speed								58.3	47.1	41.4	29.8	18.2	12.5	0.9	
60	Distance									151	192	208	239	239	239	0.8
	Speed									48.4	37.2	31.5	19.9	8.4	2.6	
50	Distance										123	153	164	175	175	0.8
	Speed										38.5	27.3	21.6	10	4.3	
40	Distance											95	115	120	120	0.8
	Speed											28.5	17.4	11.7	0.1	
30	Distance												68	76	76	0.8
	Speed												18.5	7.6	1.7	
20	Distance													40	40	0.78
	Speed													8.6	3.1	
10	Distance														15	0.75
	Speed														4	

** Distance in Meter

Loco : 1WAP7 (Conv.) Type of braking : Emergency Braking Distancing

Consist: 1 WAP7 with 16 LHB AC 3 tier coaches & 2 Power cars LWLRRM

Brake build up time components used for calculations. Brake development (establishment) time for EBD with 1.5 kg/cm2 BP drop for the given train (i.e Full service brake) Loco: 13 sec. 1st Coach: 5 Secs. Last coach (18th): 14 Secs.

Maximum Loco BC Pressure: 2.5 kg/cm^2 , Maximum Coach BC pressure: 3.0 kg/cm^2

Percentage operative cylinder in train: 95%

Type of Brake Block: Loco: 'Cast iron' type, Coaches: 'K' type disc brake

Gradient: Level

Initial speed while commencing brake command		Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in kmph		130 Kmph	120 Kmph	110 Kmph	100 Kmph	90 Kmph	80 Kmph	70 Kmph	60 Kmph	50 kmph	40 Kmph	30 Kmph	20 kmph	10 Kmph	0 Kmph	Max. Retardation (in m/s2)
140	Distance	378	510	630	686	784	870	908	974	1027	1048	1081	1101	1105	1107	0.85
	Speed	131.1	120.1	107.9	101.8	89.6	77.5	71.5	59.4	47.4	41.4	29.5	17.6	11.6	5.7	
130	Distance		349	471	580	630	719	794	827	882	824	940	963	972	972	0.85
	Speed		121.6	110.3	98.1	92.1	79.9	67.9	61.8	49.8	37.9	31.9	20	8.1	2.1	
120	Distance			321	433	531	575	653	718	745	790	821	832	844	844	0.84
	Speed			111.6	100.5	88.4	82.3	70.2	58.2	52.2	40.2	28.3	22.3	10.4	4.4	
110	Distance				294	394	482	520	588	642	664	697	718	724	726	0.84
	Speed				101.7	90.7	78.6	72.6	60.5	48.5	42.5	30.6	18.6	12.7	0.8	
100	Distance					286	356	432	466	522	565	582	605	615	615	0.84
	Speed					91.8	80.8	68.8	62.8	50.8	38.8	32.8	20.9	9	3	
90	Distance						239	317	383	435	456	488	507	512	513	0.84
	Speed						81.9	71	59	47	41	29	17.1	11.2	5.2	
80	Distance							211	279	333	376	380	412	420	420	0.83
	Speed							72	61.1	49.1	37.2	31.2	19.3	7.3	1.4	
70	Distance								183	240	284	314	324	335	335	0.83
	Speed								62.1	51.2	39.3	27.3	21.4	9.5	3.5	
60	Distance									156	201	234	254	258	260	0.83
	Speed									52.2	41.3	29.4	17.5	11.5	5.6	
50	Distance										128	163	184	193	193	0.83
	Speed										42.2	31.4	19.5	7.6	1.6	
40	Distance											100	124	135	135	0.83
	Speed											32.3	21.5	9.6	3.6	
30	Distance												73	85	87	0.83
	Speed												22.3	1.5	5.6	
20	Distance													45	47	0.82
	Speed													12.3	1.6	
10	Distance														17	0.68
	Speed														2.4	

** Distance in Meter

Loco : 1WAP7 (Conv)		Type of braking : Emergency Braking Distancing														
Consist: 1 WAP7 with 22 LHB AC 3 tier coaches & 2 Power cars LWLRRM																
Brake build up time components used for calculations: Brake development (establishment) time for EBD with 1.5 kg/cm2 BP drop for the given train (i.e Full service brake) Loco: 13 sec, 1st Coach: 7 Secs, Last coach (24th): 22 Secs.																
Maximum Loco BC Pressure: 2.5 kg/cm^2 , Maximum Coach BC pressure: 3.0 kg/cm^2																
Percentage operative cylinder in train: 95%																
Type of Brake Block: Loco: 'Cast Iron' type, Coaches: 'K' type disc brake																
Gradient: Level																
Initial speed while commencing brake command		Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in kmph		130 Kmph	120 Kmph	110 Kpmh	100 Kpmh	90 Kpmh	80 Kpmh	70 Kmph	60 Kmph	50 kmph	40 Kmph	30 Kpmh	20 kpmh	10 Kmph	0 Kmph	Max. Retardatio
140	Distance	451	584	704	759	859	945	983	1049	1101	1122	1154	1165	1177	1178	0.86
	Speed	130	120.4	108.2	102	89.7	77.4	71.3	59.2	47	41	28.9	22.9	10.8	4.8	
130	Distance		418	540	650	699	788	864	896	951	993	1009	1030	1039	1039	0.86
	Speed		120.2	110.6	98.4	92.3	80	67.8	61.8	49.6	37.5	31.5	19.4	7.4	1.4	
120	Distance			385	496	595	639	717	782	809	854	885	895	906	907	0.85
	Speed			110.4	100.8	88.7	82.6	70.4	58.2	52.1	40	28	21.9	9.9	3.9	
110	Distance				352	452	540	579	646	700	722	756	776	782	783	0.85
	Speed				100.5	91	78.9	72.8	60.7	48.5	42.5	30.4	18.3	12.3	0.3	
100	Distance					318	408	485	549	575	618	635	658	668	668	0.85
	Speed					90.6	81.2	69.2	57	50.9	38.8	32.8	20.7	8.7	2.7	
90	Distance						285	364	430	483	504	536	555	560	561	0.84
	Speed						80.7	71.3	59.4	47.2	41.2	29.1	17.1	11	5	
80	Distance							252	320	376	417	433	454	462	462	0.84
	Speed							70.9	61.5	48.6	37.4	31.4	19.3	7.3	1.3	
70	Distance								219	276	320	351	361	372	372	0.84
	Speed								60.9	51.6	39.7	27.6	21.6	9.6	3.5	
60	Distance									186	232	265	285	290	291	0.84
	Speed									51	41.7	29.8	17.8	11.8	5.7	
50	Distance										153	188	210	219	219	0.84
	Speed										41.1	31.8	20	7.9	1.9	
40	Distance											120	144	155	155	0.84
	Speed											31.2	21.9	10.1	4	
30	Distance												86	99	101	0.84
	Speed												21.2	12	0.1	
20	Distance													53	55	0.81
	Speed													11.3	2	
10	Distance														20	0.58
	Speed														1.3	
			** Distance in Meter													

Digitally Signed by Vijay Kumar Goel
Date: 07-11-2022 14:35:07
Reason: Approved