



भारतसरकार- रेल मंत्रालय Govt. of India – Ministry of Railways

भारतीय रेल सिगनल इंजीनियरी और दूरसंचार संस्थान

Indian Railways Institute of Signal Engineering and Telecommunications
तारनाका रोड, सिकंदराबाद Tarnaka Road, Secunderabad – 500017 (भारत) (INDIA)

IRISET/CoE/Kavach/Misc

Date: 18.12.2023

PCSTE**South Central Railways****Secunderabad**

विषय: Kavach – Issue of Early Transition to Limited Supervision (LS) mode.

सन्दर्भ: Loco 16703 (HBL) at ZB & SSPD of SCR On 26.09.2023 (Trip no.69).

During the SCR Kavach performance review meeting held on 31.10.2023 at CoE(Kavach)/IRISET, SCR has raised the issue that on 26.09.2023(Trip no. 69), Locomotive 16703 (HBL) was approaching Gate Signal 101 (LC-33) in DN direction (from MTV station) at ZB station. According to the NMS log, the locomotive entered Limited Supervision (LS) mode due to communication loss from 14:08:29 hrs to 14:08:37 (for a duration of 10 seconds).

Date	Time	StnCode	StnFrameNum	PacketType	LocoFrameNum	AbsLoc	LocoSpeed	LocoMode	RFID	BrakeMode	LocoRandNum	FrameOffset	TypOfSignal	CurSigA	NxtSigA	MA
26-09-23	14 : 08 : 23	ZB	50903	Regular	50903	64991	83	Full Supervision	916	No Brakes	-	1	Gate-Dist	Green	Green	4057
26-09-23	14 : 08 : 25	ZB	50905	Regular	50905	64944	84	Full Supervision	916	No Brakes	-	1	Gate-Dist	Green	Green	4011
26-09-23	14 : 08 : 27	ZB	50907	Regular	50907	64897	84	Full Supervision	916	No Brakes	-	1	Gate-Dist	Green	Green	3964
26-09-23	14 : 08 : 39	ZB	50919	AccessControl	50915	64700	84	Limited Supervision	916	No Brakes	781B	-	-	-	-	-
26-09-23	14 : 08 : 41	ZB	50921	Regular	50921	64567	85	Limited Supervision	916	No Brakes	-	1	Gate-Dist	Green	Green	3635

Post meeting, CoE analysed the case in detail and observed the following by the time Loco Kavach entered to LS mode.

- Loss of communication packets from On-board to Station = 10 Seconds
- Loss of communication packets from Station to On-board = 30 Seconds

As such the transition to LS mode was after 30 seconds since onboard received last update and is as such in order as per the Spec. Further analysis is as under:

- At Zaheerabad (ZB) station Stationary Kavach of M/s Kernex make has been installed.
- The Station Kavach received Access request data packets from the Loco during the time stamp from 14:07:47 to 14:07:59 hrs.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Date	Time	StnCode	LocoID	StnFrameNum	PacketType	LocoFrameNum	AbsLocation	TrainLen	LocoSpeed	LocoDir	EMRStatus	LocoMode	RFID	TIN	BrakeMode	LocoRandNum
5140	26-09-23	14 : 03 : 41	MTV	16703	50621	Regular	50621	69402	500	68	Reverse	Regular Packet	Full Supervision	922	123	No Brakes	-
5141	26-09-23	14 : 03 : 43	MTV	16703	50623	Regular	50623	69364	500	68	Reverse	Regular Packet	Full Supervision	922	123	No Brakes	-
5142	26-09-23	14 : 07 : 47	ZB	16703	50867	AccessControl	50865	65826	500	72	Reverse	Regular Packet	Full Supervision	917	123	No Brakes	3BAF
5143	26-09-23	14 : 07 : 51	ZB	16703	50871	AccessControl	50865	65826	500	72	Reverse	Regular Packet	Full Supervision	917	123	No Brakes	3BAF
5144	26-09-23	14 : 07 : 55	ZB	16703	50875	AccessControl	50873	65645	500	75	Reverse	Regular Packet	Full Supervision	917	123	No Brakes	3BAF
5145	26-09-23	14 : 07 : 59	ZB	16703	50879	AccessControl	50873	65645	500	75	Reverse	Regular Packet	Full Supervision	917	123	No Brakes	3BAF
5146	26-09-23	14 : 08 : 01	ZB	16703	50881	Regular	50881	65490	500	78	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-
5147	26-09-23	14 : 08 : 03	ZB	16703	50883	Regular	50883	65446	500	78	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-
5148	26-09-23	14 : 08 : 05	ZB	16703	50885	Regular	50885	65402	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-
5149	26-09-23	14 : 08 : 07	ZB	16703	50887	Regular	50887	65357	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-
5150	26-09-23	14 : 08 : 09	ZB	16703	50889	Regular	50889	65313	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-

- c) The station has sent the Access Authority Packet at 14:07:57 hrs and same was received by Loco Kavach. After receipt of one regular packet from Loco at Station Kavach followed by one regular packet with SSP from Station, communication session is established as per the logic of the OEM HBL.

1	Type	Length	FrameNo	StnId	Ver	Abs Lctn	Dest LocId	FreqPr	TdmaSlot	RS	MAC	CRC	Time stan
62	StnAccessResp	19	49149	536	1	90930	16703	2	7	1A87	1F1F	2C2D	13:39:09
63	StnAccessResp	19	49151	536	1	90930	16703	2	7	1A87	4433	2136	13:39:11
64	StnAccessResp	19	49151	536	1	90930	16703	2	7	1A87	4433	2136	13:39:11
65	StnAccessResp	19	50295	535	1	71770	16703	1	40	226B	22C8	BBF7	13:58:15
66	StnAccessResp	19	50295	535	1	71770	16703	1	40	226B	22C8	BBF7	13:58:15
67	StnAccessResp	19	50297	535	1	71770	16703	1	40	226B	6C9D	4.00E+03	13:58:17
68	StnAccessResp	19	50297	535	1	71770	16703	1	40	226B	6C9D	4.00E+03	13:58:17
69	StnAccessResp	19	50877	534	1	59500	16703	2	18	ED52	4B49	CA0F	14:07:57
70	StnAccessResp	19	50877	534	1	59500	16703	2	18	ED52	4B49	CA0F	14:07:57
71	StnAccessResp	19	50917	534	1	59500	16703	2	18	ED52	2.00E+00	67BC	14:08:37
72	StnAccessResp	19	50919	534	1	59500	16703	2	18	ED52	5A8B	A8E7	14:08:39

- d) Station has received regular packets from Loco Kavach from 14:08:01 hrs to 14:08:27 hrs. with Frame offset = 1.

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Date	Time	StnCode	LocoID	StnFrameNum	PacketType	LocoFrameNum	AbsLocation	TrainLen	LocoSpeed	LocoDir	EMRStatus	LocoMode	RFID	TIN	BrakeMode	LocoRandNum	FrameOffset
5146	26-09-23	14 : 07 : 59	ZB	16703	50879	AccessControl	50873	65645	500	75	Reverse	Regular Packet	Full Supervision	917	123	No Brakes	3BAF	-
5146	26-09-23	14 : 08 : 01	ZB	16703	50881	Regular	50881	65490	500	78	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5147	26-09-23	14 : 08 : 03	ZB	16703	50883	Regular	50883	65446	500	78	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5148	26-09-23	14 : 08 : 05	ZB	16703	50885	Regular	50885	65402	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5149	26-09-23	14 : 08 : 07	ZB	16703	50887	Regular	50887	65357	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5150	26-09-23	14 : 08 : 09	ZB	16703	50889	Regular	50889	65313	500	80	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5151	26-09-23	14 : 08 : 11	ZB	16703	50891	Regular	50891	65267	500	81	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5152	26-09-23	14 : 08 : 13	ZB	16703	50893	Regular	50893	65222	500	82	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5153	26-09-23	14 : 08 : 15	ZB	16703	50895	Regular	50895	65176	500	83	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5154	26-09-23	14 : 08 : 17	ZB	16703	50897	Regular	50897	65130	500	83	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5155	26-09-23	14 : 08 : 19	ZB	16703	50899	Regular	50899	65084	500	83	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5156	26-09-23	14 : 08 : 21	ZB	16703	50901	Regular	50901	65037	500	83	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5157	26-09-23	14 : 08 : 23	ZB	16703	50903	Regular	50903	64991	500	83	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5158	26-09-23	14 : 08 : 25	ZB	16703	50905	Regular	50905	64944	500	84	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5159	26-09-23	14 : 08 : 27	ZB	16703	50907	Regular	50907	64897	500	84	Reverse	Regular Packet	Full Supervision	916	123	No Brakes	-	1
5160	26-09-23	14 : 08 : 39	ZB	16703	50919	AccessControl	50915	64700	500	84	Reverse	Regular Packet	Limited Supervision	916	123	No Brakes	781B	-

- e) But Loco Kavach did not receive regular packets from Station Kavach which was expected from 14:07:59 hrs.

1	Type	Length	FrameNo	Stn-Id	Stn-Ver	Abs Lctn	Gen SOS	LocoCoun	Crc	TimeStamp	Locold	FrameOffset	Loco-Sos	TL Ref Fnc
19014											16703	1	0	-
19015	StnReg	33	50623	535	1	71770		0	1 7CF0	14:03:43				
19016											16703	1	0	-
19017	StnReg	12	50851	534	1	59500		0	0 DF3C	14:07:31				
19018	StnReg	12	50851	535	1	71770		0	0 E0DB	14:07:31				
19019	StnReg	12	50851	535	1	71770		0	0 E0DB	14:07:31				
19020	StnReg	33	50915	534	1	59500		0	1 78D5	14:08:35				
19021											16703	4	0	-
19022	StnReg	12	50917	534	1	59500		0	0 2A5D	14:08:37				
19023	StnReg	33	50933	534	1	59500		0	1 4.60E+01	14:08:53				

- f) Hence, after 15 cycles for non-receipt of regular packets from Station Kavach, Loco mode was transited to Limited supervision (LS) from Full Supervision (FS) mode at 14:08:29 hrs. In the LS mode loco's random number was also changed to new one.

Type	Length	FrameNo	Locold	Abs Locati	Train Len	Train Spee	Dir	Mode	Tag-Id	TIN	HlthBits	RL	CRC	Time stamp
LocoAccessReq	20	50877	16703	65538	500	77	R	FS	916	123	2	3BAF	B384	14:07:57
LocoAccessReq	20	50879	16703	65503	500	77	R	FS	916	123	0	3BAF	9A71	14:07:59
LocoAccessReq	20	50881	16703	65459	500	78	R	FS	916	123	0	3BAF	F1EF	14:08:01
LocoAccessReq	20	50883	16703	65442	500	79	R	FS	916	123	20	3BAF	02C5	14:08:03
LocoAccessReq	20	50885	16703	65397	500	80	R	FS	916	123	2	3BAF	1F73	14:08:05
LocoAccessReq	20	50887	16703	65353	500	80	R	FS	916	123	0	3BAF	5BEF	14:08:07
LocoAccessReq	20	50889	16703	65308	500	81	R	FS	916	123	0	3BAF	BA29	14:08:09
LocoAccessReq	20	50891	16703	65258	500	81	R	FS	916	123	20	3BAF	BCC6	14:08:11
LocoAccessReq	20	50893	16703	65213	500	83	R	FS	916	123	2	3BAF	B622	14:08:13
LocoAccessReq	20	50895	16703	65148	500	83	R	FS	916	123	0	3BAF	A4DC	14:08:15
LocoAccessReq	20	50897	16703	65102	500	83	R	FS	916	123	0	3BAF	2.00E+02	14:08:17
LocoAccessReq	20	50899	16703	65056	500	83	R	FS	916	123	20	3BAF	62FE	14:08:19
LocoAccessReq	20	50901	16703	65009	500	84	R	FS	916	123	2	3BAF	6AB5	14:08:21
LocoAccessReq	20	50903	16703	64958	500	84	R	FS	916	123	0	3BAF	781E	14:08:23
LocoAccessReq	20	50905	16703	64911	500	84	R	FS	916	123	0	3BAF	D2E1	14:08:25
LocoAccessReq	20	50907	16703	64892	500	84	R	FS	916	123	20	3BAF	96A3	14:08:27
LocoAccessReq	20	50909	16703	64846	500	84	R	LS	916	123	2	781B	6FA1	14:08:29
LocoAccessReq	20	50911	16703	64799	500	84	R	LS	916	123	0	781B	500	14:08:31
LocoAccessReq	20	50913	16703	64751	500	84	R	LS	916	123	0	781B	546B	14:08:33

- g) During this duration, Station Kavach also did not receive packets from Loco after 14:08:27 hrs to 14:08:37hrs. However, communication lost for duration of 30 seconds completed at 14:08:07 hrs, hence, Loco Kavach transited from to Limited supervision (LS) from Full Supervision (FS) mode at 14:08:29 hrs.

Date	Time	StnCo	StnFrameNum	PacketType	LocoFrameNum	AbsLocati	LocoSpeed	LocoMode	RFID	TIN	BrakeM	LocoRandNum	FrameOffset
26-09-23	14 : 08 : 23	ZB	50903	Regular	50903	64991	83	Full Supervision	916	123	No Brakes	-	1
26-09-23	14 : 08 : 25	ZB	50905	Regular	50905	64944	84	Full Supervision	916	123	No Brakes	-	1
26-09-23	14 : 08 : 27	ZB	50907	Regular	50907	64897	84	Full Supervision	916	123	No Brakes	-	1
26-09-23	14 : 08 : 39	ZB	50919	AccessControl	50915	64700	84	Limited Supervision	916	123	No Brakes	781B	-
26-09-23	14 : 08 : 41	ZB	50921	Regular	50921	64567	85	Limited Supervision	916	123	No Brakes	-	1
26-09-23	14 : 08 : 43	ZB	50923	Regular	50923	64520	85	Limited Supervision	916	123	No Brakes	-	1
26-09-23	14 : 08 : 45	ZB	50925	Regular	50925	64473	85	Limited Supervision	916	123	No Brakes	-	1

- h) Station received the packets from Loco at 14:08:39hrs with LS mode correctly. Hence, from station side it appeared that the transition to Limited Supervision (LS) mode was happened due to communication loss 14:08:29 hrs to 14:08:37 (for a duration of 10 seconds)
- i) After receiving SSP packet from Station at 14:08:51hrs, Loco mode has been transited to Full Supervision (FS) from Limited supervision (LS) mode at 14:08:53 hrs.

From the above analysis, it is reiterated that, as operation modes of Kavach are governed by Loco Kavach, Loco mode was correctly transited to Limited supervision (LS) mode from Full Supervision (FS) mode for loss of data packets from Station Kavach for 15 cycles from 14:07:59 hrs to 14:08:27 hrs as per para 6.5.1.3 of Kavach specifications (V3.2).

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