International Journal of Research in Engineering, Science and Management
Volume-2, Issue-9, September-2019
www.ijresm.com | ISSN (Online): 2581-5792

A Study on Indian Railways Initiates "Project Utkrisht (उत्कृष्ट)" Regarding Safety Concern

Ankit Kumar[1], Ashish Kumar Bhateja[2]
[1]*Research Scholar, Mechanical Department, Gulzar Group of Institutes, Ludhiana, India*
[2]*Faculty Convener, Institution Innovation Council (IIC), Gulzar Group of Institutes, Ludhiana, India*

***Abstract*: This work aims to identify the Root cause of failures and to prevent the occurrence of same in future we can use CBC instead of screw coupling in Utkrisht type of coach. To this end following research work is also carried out with the proposed safe model of implementation and improvement of train number 12311/12312 Howrah-Kalka Mail of Eastern Railway and also for the other existing trains which are decided to upgrade under this scheme.**

***Keywords*: LHB, ICF, Coupling, CBC, Screw Coupling, उत्कृष्ट, Utkrisht Coach, MLR, Indian Railways, Railway Accidents**

1. Introduction to Project Utkrisht (उत्कृष्ट)

According to the government of India, ministry of railways, railway board reference no. 2017/M(C)/11137/15 dated on 03.04.2018. The Principal Chief mechanical engineers have issued one notice in order to improve the condition of running coaches in Mail/ Express trains; it has been decided to upgrade 66 pairs of trains having 140 rakes. For this purpose, an RSP for up-gradation of 66 pair of the train (140 rakes) has been included in the Pink Book 2018-19 at Rs.60 lakhs per rake (RSP P.B. Item No.1206/18-19 under Head of Allocation 'CAP'). It has also been decided to name this Endeavour as project Utkrisht [1].

Since 1955 production of ICF (Integral Coach Factory) coaches were started and screw couplers including buffers used for connecting rakes of the train. These types of screw coupling are not safe for the passenger. The breaking of screw or buffer is their during the accident which causes the derailment of trains & major casualties. However, from 2000 onwards, LHB (Linke Hofmann Busch) coaches were introduced, this type of coaches having CBC (centre buffer coupling).

This type of coupling considered to be "anti-telescopic", which means they do not get turned over or flip in case of a collision which reduces the no. of casualties during the accident. According to notification of government of India, Ministry of Railways, Railway Board reference no .2017/M(C)/142/4, dated: 16.03.2018. The PCME's /All Zonal Railways & PU's. PCME/COFMOW issued a notice on Retro fitment of CBC on ICF design coach following instruction was issued. This is to concern for the safety of passengers [2].

Under the slow process of LHB fication in Indian Railways. IR has come up with another initiative to provide equal facility and amenities that are traveling in ICF type's coaches. The initiative name is "Project Utkrisht" which will upgrade the existing Mail/Express ICF type rake to provide better onboard experience, clean and hygiene bathroom with attractive vinyl wrapping.

This initiative is planned to be done in two phases including 640 rakes which are going to be upgraded. In the 1st phase, there are 66 pairs of the train including 140 rakes. Kalka Mail (12311/12312) HWH-Howrah - KLK- Kalka is IR 1st train having all Utkrish type rakes. The first Rake was put to service on its maiden journey on 02nd October 2018 on the auspicious occasion of 150th Birth Anniversary of Mahatma Gandhi. Add on features in Utkrisht type rakes are:

- Renovated furnishing in coach with glossy, attractive and colorful vinyl wrapping for an aesthetic look.
- All fluorescent light is changed to LED giving better illumination.
- Stainless steel paneling and anti-skid flooring, stainless steel dustbin, better quality, and larger mirrors, etc. have been provided for better user experience.
- "Swachh Rail Toilet" (SRT) - A Hybrid Design Bio Toilet innovated by Indian Railway has been fitted in all coaches, giving odorless experience.
- A toilet is provided with improved Health faucet, taps, stainless steel basins, etc.
- The coach exterior is repainted with a new color scheme
- The rake has been upgraded at a cost of approximately Rs. 60 Lakhs.

The life of an ICF coach is 25 years. During this period, it undergoes various maintenance procedures at prescribed intervals like IOH & POH. A Periodic Overhaul (POH) is done after 2year of new ICF coach and every 18 months of old ICF coach. Some coaches with an age of around 20 years get converted into NMG (New Modified Goods) coach during POH. This is used to carry cars and other such goods. In this case, its life is extended to 30 years.

Mid Life Rehabilitation (MLR) is a period where major structural repair and refurbishing of the interior are done after a period of 12 to 15 years [3].

2. Literature review

A. Types of coupling systems used by "Indian Railways" (Broad Guage)

A coupling (or a coupler) is a mechanism for connecting rolling stock in a train. Coupling facilitates interconnection of rolling stock to form a train. The design of the coupler is standard. The connection between two adjacent train set is done by a coupler system consisting of coupler itself and draw and buffing gear.

Table 1
Different types of coupling used various types of coaches in Indian railways

Type of Coupling	Types of Coaches
Screw coupling	ICF Coaches
AAR E type CBC	Locomotive
AAR F type CBC	Wagons
AAR(H) type Tight lock CBC	LHB/ICF Coaches
Dellner Coupler	Metro
Rigid Type Schaku coupler	DMU/Emus.
Hook type	MG/NG Stocks.

Screw coupling: Screw coupling and the side buffers serve the aforesaid purpose in case of the draw and buffing gears respectively in case of ICF coaches. Screw coupling not only gives the boost but also let two coaches connect in the formation of a continuous rake. The two jaws of the screw on both sides are guarded with spring and rubber to minimize the vibration the hauling force produces. They are called the Draft Gears. (Figure 1).

Fig. 1. Illustration of Screw coupling of ICF Coaches

Center buffer coupling: Due to certain limitations of the age-old screw coupling system, CBC becomes the most useful & viable choice. There are certain features of CBC which makes it a unanimous choice & extensively used in most of the freight cars, & all of the LHB coaches of Indian Railways. The centre buffer couplers used on LHB coaches are tight lock centre buffer couplers of AAR type H. The centre buffer coupler combines the draw and buffering gear in one. It is able to transmit both the tensile and the compressive forces, further the tight lock coupler by its special design hinders the climbing of the vehicles in case of an accident. [4], [5]. There are certain features of CBC which makes it a unanimous choice & extensively used in most of the freight cars, EMU coaches & all of the LHB coaches of Indian Railways. (Figure 2).

Fig. 2. Illustration of AAR (H) type Tight Lock Center Buffer Coupling of ICF Coaches

Salient features of CBC: It transmits both draft & buffing load between vehicles and to/ from under-frame. It absorbs high-frequency forces during impact & dissipates low-frequency forces to protect the vehicle from damage. It has got multifunctional units like Draft + Buffing & Automatic FP + BP (Pressure Gauge) connections.

Couplers have adequate strength for:

- Satisfactory hauling of a train of 26 coaches at 110 km/h
- Satisfactory hauling of a train of 18 coaches at 160 km/h

Table 2
Components of CBC Type

S. No.	Part Name of CBC	No of Parts
1	Bolt	1
2	Bush	4
3	Coupler Head Body	1
4	Grease Nipple	1
5	Knuckle	1
6	Knuckle Pivot Pin	1
7	Knuckle Spring	1
8	Knuckle Thrower	1
9	Lock	1
10	Lock Lift Lever	1
11	Nut	1
12	Rotor	1
13	Split Pin	1
14	Telltale	1
15	Washer	1

3. List of Indian Rail Accidents

Rail Accident can't be prevented be it in India or in any part of the world as the reason of rail accident can include,

- Mechanical Failure
- Communication Gap
- Human Error
- Level Crossing
- Misuse
- Natural Calamities

But when these accidents occur, people are often seriously injured even lead to loss of life.

There can be a variety of different reasons in which some are mention below,

- Loco pilot or station master negligence\
- Improper maintenance of train track

Table 3
Observation Table of Accident Details of Indian Railway in the month of October 2018

Date of Accident	Accident Details
18/ Oct /2018	Two coaches of Thiruvananthapuram Rajdhani (TVC-Thiruvananthapuram Central to NZM-Hazrat Nizamuddin) (Train no.12431) derailed on the morning when it was hit by a truck at the level crossing between Meghnagar and thandla rail section of Ratlam division. A total of 48 passengers were sitting in these two coaches. However, none of them is injured.
Observation of 18/Oct/2018	It is observed that Rajdhani train running at speed more than 100 km/hr and Collision with a truck trying to cross train track and Due to this Train derailment happened of two AC coaches in which total of 48 passengers was sitting in AC Compartment and all life is saved. Because of one of the reasons for life-saving of 48 passengers was CBC. This is one of the best example of CBC that it prevented huge damage of coaches even after collision & the coupling was also not broken (due to Jerk) which also leads to the survival of life of 48 Individuals passenger travelling on 18/Oct/2018.
10/ Oct/ 2018	New Farakka Express (MLDT-Malda Town to NDLS-New Delhi) (Train no.14003) accident: 7 were killed &, 9 Coaches Derail near Raebareli, Uttar Pradesh.
Observation of 10/Oct/2018	It is observed that New Farakka express train running an accident happened may be due to Improper maintenance of the train tracks or lack of signal communication by controller due to this reason derailment in 5 coaches happened Because of the breakdown of coupler after that the coach was lying out of the track and collision among the coaches happened. In this accident total, 7 people were killed and 40 passengers were injured. If the train would have CBC coupling then there wouldn't be many casualties in terms of loss of life and damage of coaches.

- Collision with road vehicle trying to cross the level crossing
- Train derailment
- Faulty equipment
- Collapsed bridges

The table 3 shows an incomplete chronological List of Indian Railway accident [6].

Fig. 3. Illustration of Thiruvananthapuram Rajdhani (Train No.12431, Thiruvananthapuram to Hazrat Nizamuddin) derailed on 18th/Oct /2018 [6]

Fig. 4. Illustration of New Farakka Express (New Delhi to Malda Town) (Train No. 14003), derailed on 10th/Oct/2018 [6]

4. Root Cause Analysis of failure of screw coupling and preventive measures

There are several root cause of failure with the use of screw coupling in ICF Coaches is as following below:

- Haulage of the longer train is not possible in freight.
- Climbing of coaches in collisions and derailment.
- While accidental case due to sudden jerk, buffer get broken and the coach is found far away from the accident position due to the weaker joint between rakes, which again lead to more no. of casualties.
- Shunting Staff at Risk.
- Higher maintenance staff requirement
- During the running time of a train, there have been many instances where the screw is broken or the buffer itself broke. At that time that coach needs to be de-attached from the rake as the coach is not safe for run & this causes delay

To prevent this kind of failure implementation of CBC required instead of screw coupling in ICF Coaches.

Table 4
Technical Data of Center Buffer Coupler [7]

Material	High tensile Steel Grade "E" as per AAR Spec. M – 201 Q & T
Pattern	20140
Operation	Double rotary
Compressive strength (yield strength)	2000 kN
Tensile strength (yield strength)	1000 kN
Coupler length (from face to pivot)	1030 ± 5 mm
Weight of Coupler (approx.)	231.4 Kg
Maximum horizontal swing of Coupler	± 17.85°

Percentage by weight of different elements in Grade E steel of specification M-201.

Table 5
Chemical Composition of Center Buffer Coupler [7]

Carbon (Max %)	0.32
Manganese (Max %)	1.85
Phosphorus (Max %)	0.04
Sulphur (Max %)	0.04
Silicon (Max %)	1.50

Interval Maintenance Trip/Weekly Schedule

- Visual inspection of coupler head for damage.
- Inspection of knuckle for damage.
- Checking of coupler operating mechanism for damage/ loose bolts etc.

- Greasing of glide rod of coupler operating mechanism (once in 3months).
- Checking of telltale recess, for ensuring proper coupling.
- Inspection of coupler carrier/supporting device and its springs for cracks and breakage.
- Inspection of loose / broken / missing nuts and bolts (M-16) of coupler pin support plate and draft gear support plate.

5. Safety concern due to notification of Retro -fitment of CBC on ICF design coach

After the introduction of LHB coaches CBC was the feature added in it. Railway started changing the ICF coach screw coupling to CBC under the subject retro fitment of CBC on ICF design. In this railway has changed 1600 coach of ICF design screw coupling to CBC.

Table 6
Illustration of CBC Type in ICF Coaches

S. No.	Train Number	Train Name
1.	12565/12566	Bihar Sampark Kranti Express
2.	12621/12622-	Tamil Nadu Express
3.	12615/12616	Grand Trunk Express
4.	12639/12640	Brindavan Express
5.	12842/12841 12839/12840	Coromandel Express RSA with Howrah Mail
6.	12737/12738	Gowthami Express
7.	12403/12404	Allahabad-Jaipur SF
8.	12445/12446	Uttar Sampark Kranti Express
9.	12717/12718	Ratnachal Sf Express
10.	12711/12712	Pinakini Express
11.	12759/12760	Charminar Express
12.	15209/15210/ 15211/15212	Jan Sewa RSA with Jan Nayak Express
13.	12237/12238	Begampura Express
14.	18501/18502	Gandhidhan Express

Fig. 5. Kalka Mail (Train Number: 12311 /12312) Upgraded ICF Coaches under Utkrisht Project with Interior, Washroom, Color Modification [8]

After this railway has stopped this scheme. There are many important trains left in India which are still using ICF Screw coupling type coaches. Now under Utkrisht scheme where the interior, washroom, color is going to be changed only there is not any provision of improvement in safety concern in terms of usage of coupling.

Table 7
Illustration of Trains coming under project Utkrisht without proposal of CBC in ICF Coaches

S. No.	Train Number	Train Name
1	13329/13330	Ganga Damodar Express
2	12111/12112	Amravati SF Express
3	11301/11302	Udyan Express
4	12125/12126	Pragati Express
5	12231/12232	Lucknow SF Express
6	12919/12920	Malwa Express
7	12647/12648	Kongu SF Express
8	15905/15906	DBRG-CAPE Vivek Express
9	12663/12664	Howrah Tiruchchirappalli SF Express
10	16589/16590	Rani Chennamma Express
11	12533/12534	Puspak Express

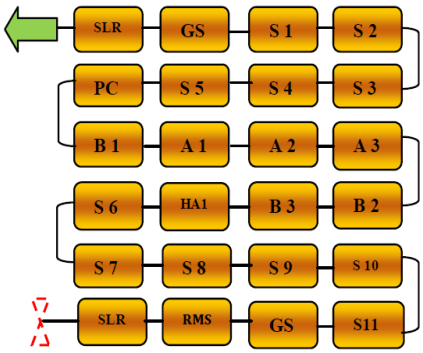

Fig. 6. Investigated Unsafe Model of Kalka Mail (Train Number: 12311/12312) Upgraded ICF Coaches under Utkrisht Project without consideration of Safety measures

Symbol	Description
	WAP-7 (locomotive)
	Screw Coupling
	LV (last vehicle) board

6. Proposed safe model for implementation and improvement for ICF type coaches regarding safety concern

After modification of Kalka Single rake under Utkrisht scheme as a NEW LOOK where the interior, washroom, color is going to be changed only there is not any provision of improvement in safety concern in terms of usage of coupling.

Table 8
Estimation of Daily Passenger Travelling in Kalka Mail
(Train Number: 12311 /12312)

S No.	Type of Coach	Total no. of coach	Seats Per Coach	Estimate Total No. of Passenger
1	HA 1	1	10+20	30
2	AC 2 TIER (A1 TO A3)	3	48	144
3	AC 3 TIER (B1 TO B3)	3	64	192
4	SLEEPER (S1 TO S11)	11	72	792
5	GENERAL (GS)	2	110	220
6	RMS (RAILWAY MAIL SERVICE)	1	40	40
7	SLR (SLEEPER CUM LUGGAGE)	2	50	100

Table 9
Estimation of Running Staff of Indian Railway in Kalka Mail
(Train Number: 12311 /12312)

S. No.	Running Staff	No. of staff
1	Loco-Pilot ,Assistant Loco-Pilot & Guard	3
2	Travelling Ticket Examiner	5
3	Attendant in AC coach	6
4	Pantry Car Workers	15
5	Cleaning Staff	2
6	Technical Staff	2

As per average estimation of all running staff such as Loco-Pilot, Assistant Loco-Pilot & Guard, Travelling Ticket Examiner, Attendant in AC Coach, Pantry Car Workers, Cleaning Staff & Technical Staff Minimum Total of 33.

As per average estimation of all passengers in HA1, AC-2 Tier, AC-3 Tier, Sleeper, General Coach, Railway Mail Service (RMS), Sleeper Cum Luggage (SLR) minimum total of 1518.

Total Human Life in one Kalka Mail One Rake	Daily Passenger + Running Staff	= 1518 + 33 = 1551 (Approximate Grand Total)

In case rest of 3 rakes upgrades without safety then this estimation human life security is added up three times more as given below.,

Total Number of Proposed Rake of Kalka Mail = 4

Total Human Life in Four Kalka Mail Four Rake	No of Rake * (Daily Passenger + Running Staff)	= 4 * 1551 = 6204 (Approximate Grand Total)

In case of all 140 Rakes are upgraded under Project Utkrisht then without safety this estimation human life security is added up multiple times more as given below.

Total Human Life in Under Total 66 Pair of Trains (140 Rakes) under Project Utkrisht	140 Rakes * (Daily Passenger + Running Staff)	= 140 * 1551 = 217140 (Approximate Grand Total)

In regard to the safety concern for the passenger this research work propose model is mention below for Kalka Mail 12311/12312 & Other 66 Pair of Trains (140 Rakes) under Project Utkrisht as given below:

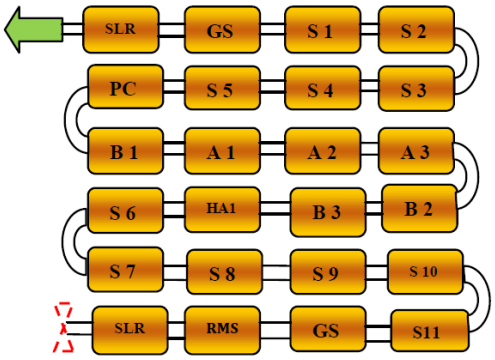

Fig. 7. Proposed Safe Model of Kalka Mail (Train Number: 12311/12312) Upgraded ICF Coaches under Utkrisht Project with use of CBC for consideration of Safety measures

Symbol	Description
	WAP-7 (locomotive)
	Center Buffer Coupling
	LV (last vehicle) board

7. Conclusion

This paper conclude that Project Utkrisht is very good scheme for railways as well as for the passenger. This project is giving a new experience to the passenger as railway is providing good quality seat, Renovated furnishings in coach with glossy and colorful vinyl wrapping for aesthetic look including everything which a passenger require for a comfortable journey but this project will be more effective when railway will use CBC as it is safer than screw coupling. CBC absorbs high frequency forces during impact & dissipates low frequency forces to protect the vehicle from damage & also life under CBC is far better and safer from screw coupling. This research work may not work to reduce accidental case in railways as there are various causes of accident but with this proposed implementation reduction of losses of human life (Passengers and Running staff of Indian Railway) may be possible and also reduced no. of major casualties happened during accident.

References

[1] http://www.indianrailways.gov.in/railwayboard/uploads/directorate/mec_engg/downloads/Coaching/2018/29_%20upgradation%20of%20trains%20project%20utkrisht.pdf
[2] http://www.indianrailways.gov.in/railwayboard/uploads/directorate/mec_engg/downloads/Coaching/2018/3_%20%20Retrofitment%20of%20CBC%20on%20ICF%20design%20coaches%2016_03_18.pdf
[3] http://railanalysis.in/rail-news/railways-initiates-project-utkrisht-upgradation-mailexpress-rakes/

[4] https://en.wikipedia.org/wiki/Railway_coupling
[5] http://railmaniac.blogspot.com/2015/08/types-of-coupling-systems-used-by.html
[6] https://en.wikipedia.org/wiki/List_of_Indian_rail_accidents#2018
[7] https://rdso.indianrailways.gov.in/works/uploads/File/RDSO_2010_CG_12_R.pdf
[8] Indian Railways gives Mail/Express trains swanky revamp under Project Utkrisht
[9] https://www.financialexpress.com/infrastructure/railways/indian-railways-gives-mail-express-trains-swanky-revamp-under-project-utkrisht-check-images-of-upgraded-train/1334477/