Enhanced rail share for fly ash transport

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Currently, most of the fly ash movement in India is accounted for by road transport, and the rail share is substantially low with the railways' modal share 1.7% in 2011–12, declining to 1.4% in 2017–18. In absolute terms the by-rail tonnage had increased from 1.5 million tonnes in 2011–12 to 1.8 in 2017–18. Fly ash rail rake movements have increased from 507 trips in 2011–12 to 856 trips in 2016–17 while net tonne-km (NTKm) has also increased from 866 million to 1403 in this period. The average lead by rail (between 550 and 600 km) has stayed almost constant over the past few years.

IR relies predominantly on BCN wagons for fly ash movement, with around 67% of the by-rail bulk transported in 2016-17 in the general purpose covered wagons, class BCN. For this, the fly ash is bagged and then loaded into wagons. Specialized fly ash wagons are used on only a few circuits such as Raichur and Ramagundam. Some cement manufacturers have procured BCCW and BCFC wagons, which are used to transport fly ash from thermal power plants in Raichur and Ramagundam: 31% of the total fly ash was transported in these special purpose BCCW wagons, with the BCFC wagons contributing merely 1.4% during 2016-17. There is a need for better rail participation, and key enablers will be more special purpose wagons and terminal infrastructure

Focus on the cement industry

The Energy Research Institute (TERI) has analysed the demand for the cement industry for fly ash and the feasibility of improving rail transport. Fly ash can also be added as an admixture while mixing concrete. Fly ash finds several applications in agriculture, cement manufacturing, brick industry, construction of road and rail embankments, reclamation of low-lying areas, mine fillings, etc. The pozzolanic property of fly ash/lime reactivity makes it suitable for use in the manufacturing of cement and concrete. In the cement industry, fly ash is usually blended with cement at the time of production for Portland pozzolana cement.

The study reveals that IR should focus on fly ash movement to cement plants from the thermal power plants (TPP) as around 50 mt (2017-18) fly ash is used by cement plants. It is important to relate the patterns of fly ash production with the consumption centres and understand the logistical requirements for fly ash in bulk, to establish better rail share. TERI has analyzed several clusters of cement and TPPs where the movement of fly ash could be implemented in close circuit operation.

With a coal-based share of over 60% in electricity generation, the fly ash generated by the TPPs in India is significantly high. Fly ash, a by-product of coal-based power generation, is a fine hazardous powder. Besides disposal in ash ponds, its transportation has many challenges as the particles are lightweight that get airborne easily and pollute the environment. Safe transportation and disposal become critical.

An analysis of the origin-destination of fly ash movement indicates that majority of the originating trips is accounted by states like Bihar, Jharkhand, Karnataka, and West Bengal, whereas Assam and Karnataka serve as the major destination zones for rail transport. The investigation also indicated that around 97% of originating tonnage is contributed by just six stations, while 94% of the destined traffic is accounted for by 11 stations.

In an analysis by TERI, movement patterns in the Singrauli

THE BOTTLENECKS

Indian Railways	• Lack of adequate wagons – pneumatic hopper wire type wagons • Lower density than cement, but charged as same tariff class (120) • Concessions under wagon investment scheme not matched with the life of specialised wagons
Thermal power plants	• Rail rake availability • Lack of loading infrastructure for environmentally sound operations
Cement manufacturers	• Unavailability of rake unloading facility • Volatile rates offered by power plants • Lack of long-term agreement regarding the supply

Available wagon types for fly ash transport					
Parameter/wagon class	**BTAP**	**BCCW**	**BCFC-A**	**BCFC-E**	**BCFC-D**
Tare weight t	27.3	23.0	22.0	22.1	23.5
Max payload t	60	67.3	67.3	69.5	68.1
Throughput per rake t	2984	3904	3904	4031	3405
Wagons per IR rake	51	58	58	58	50
Discharge system	Air assisted side @2kg / mm²	Air assisted bottom gravity @ 0.2kg / mm²			
Volumetric capacity m3	64	67	75	79	101

region were studied, considering the locations of cement plants and TPPs as well as connectivity between these. Cement plants located in the Rewa-Satna region are major consumers available from the power plants in this region. If all the demand must be met through the fly ash available in the region, structured investments in circuit logistics are required. It would make economic sense to use railways as the preferred mode of transport. It was found out that had there been adequate infrastructure and rolling stock available, better use of available stock and outputs could be achieved. From the emissions point of view also, rail-based transportation involves saving of a significant volume of carbon emissions on account of lesser heavy-duty vehicles/bulkers deployed.

Not short on guidelines

Clearly, all the fly ash generated is not disposed of, and it keeps getting accumulated at the originating points, causing grave environmental distress. The Central Electricity Authority, which has been monitoring the status of fly ash generation and its utilization since 1996, reports that fly ash generation had increased from 69 mt in 1996–97 to 196 mt in 2017-18, its utilization during the same period has also been increasing – from 6.6 mt to 132 mt.

Two major government guidelines for fly ash utilization and transportation, issued by the Central Pollution Control Board, 2013 involve safe handling of fly ash in loading, unloading, utilization, and nuisance-free transportation of all types (dry fly ash and bottom ash). The Ministry of Environment, Forests and Climate Change has issued several notifications (the latest in Jan 2016) to enhance such utilization in various sectors. Somehow since these are just guidelines, adoption has been tardy in the business-as-usual scenario, especially while handling of fly ash is concerned. Interactions with the stakeholders indicate that specialised wagons or trucks are not deployed; compliance is optional and not implemented in several parts of the country. Although some initiatives are being undertaken to ensure environment-friendly handling, the high cost of adoption of such measures become a challenge for wider acceptance.

The need of the hour

Developing rail infrastructure – indicative investment costs, unloading point Cement plant infrastructure			
Item	Cost per unit (₹)	Comments	Total (₹)
Laying railway line	6 Cr per km	Additional siding	6 Cr
Material cost for pneumatic system + laying cost + support structure	4800 per m	400 mm diameter pipe for 200 m	2.4 Cr
OR / AND			
Fly ash pit + bucket elevator		2.4 Cr	
3000 t silo	1.8 Cr	1x1500 silos needed (additional)	1.8 Cr
Opportunity cost	2.4 Cr	For shutting down plant for 5 days (approx. ₹ 600/ton)	2.4 Cr
Total approx. cost			15 Cr
Time frame	9-12 months		

Loading point investment (indicative)

Item	Cost per unit (₹)	Comments	Approx.cost (₹)
Laying railway line	6 Cr per km	Approx. 1 km additional length	6 Cr
Material cost for pneumatic system pipe for + laying cost + support structure	4800 per m	400mm diameter 1000 m	2.4 Cr
Positioner	To move wagons before / after filling		12 Cr
3,000 ton silo	1.8 Cr	2x1500 t silos needed	3.6 Cr
Compressors	30 lacs		1.2 Cr
Total Approx . Cost			25 Cr
Time frame		9 – 12 months	

Clearly, there is a need to foster inter-agency collaboration between IR, TPPs, and cement manufacturers.

IR needs to take the lead in bringing all the stakeholders such as power plants and cement plants together to devise a strategic action plan. The first objective would be to identify circuits based on logistics and cost viability for future fly ash movement. Some concerns for construction of loading/unloading infrastructure and rail lines, availability of rolling stock, etc. could be resolved through discussions.

Development of loading/unloading infrastructure at the TPP and cement plants is of utmost importance for increasing long-term movement by rail. At present, only a few power plants have developed rake loading facilities: e.g., NTPC plants at Ramagundam and Rihand and Adani Power Plant in Tirora. The creation of such infrastructure would encourage the bulk movement.

Another key area of improvement is the availability of specialised wagons, at present restricted to a few circuits. Promoting the use of high-capacity wagons will help in transporting fly ash in an efficient and environment-friendly way and also reduce the loading and unloading times.

needed for better investor returns in this low margin business. The concession period under IR's wagon investment scheme should match the life span of the wagons and IR should provide 15% concession on freight for 20 years. Since the lifespan of a wagon is 35 years, increasing the concession period to cover the lifespan would further incentivize users to procure their own wagons and shift bulk movement towards railways.

(Adopted from a presentation by Sharif Qamar, Associate Fellow, TERI on research on increasing freight rail share in India.) RB

Parameter	Specified design
Design speed kph	200
Max speed (Passenger) kph	160
Max speed (Freight) kph	120
Maximum axle load t	35
Rail	60 kg/m UIC for 25 t
Sleepers type, length, spacing	PSC ≈ 280 kg, 2.60 m, 1,667 /km
Ballast thickness ,	300 mm , 400 mm 2.50 m^3/m min
shoulder width, volume	
Track	Continuously welded rails with flash-butt in workshop and Thermit (on site)
Main line and siding turnouts	1:24 60 UIC , 1:9 60 UIC
Max vertical grade	1.6%
Max track cant value , deficiency	120 , 75 (mm)

Ambitious plans for the African SGR

Passenger trains at 160 kph, 2 km long freight trains at 120 kph, track structure that may upgrade later to 35 t axle load, 1900 m max horizontal curves, grade separation and fencing in urban areas. In fact, the under planning and construction African Standard Gauge Railways (SGRs) seem to have nothing than the best , except guaranteed traffic. Funding for the first lines may be by unsustainable Chinese debt , but expansions as planned to these cost-full specifications appears unlikely.