Uttar Pradesh Expressways Industrial Development Authority
[Govt. of Uttar Pradesh]

Agra - Lucknow Access Controlled Expressway Project
Contract Packag-01





INVESTIGATION REPORT
FOR
BREACH IN SERVICE ROAD AT KM 16+300

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1. INTRODUCTION

1.1 Project Background

The Uttar Pradesh Expressways Industrial Development Authority (UPEIDA) have developed Agra to Lucknow Access Controlled Expressway (Green Field) Project 302 km long aiming at reducing traffic in already congested roads and also reducing pollution and carbon footprint.

The Expressway is connected with Yamuna Expressway (Greater Noida to Agra) through Agra Ring Road duly providing an express link between Greater Noida, NCR to Lucknow via Agra. The Expressway is starting at village EtmadpurMadra near Agra and traverse through places like Firozabad, Mainpuri, Etawah, Kannauj and Unnao and finally end at village Sarosa Bharosa near Mohan Road, Lucknow.

1.2 Project Setup

1.2.1 DPR Consultant

M/s Feedback Infra Private Limited, Gurgaon was the Consultant to prepare Detailed Project Report (DPR) for the Expressway on behalf of UPEIDA.

1.2.2 Contract Packaging

The Contract Packaging of Expressway Project is as tabulated below:

Package No.	Project Stretch	Length (km)	Name of EPC Contractor
1	Agra to Firozabad (km 0+000 to km 56+200)	56.134	M/s PNC Infratech Ltd.
2	Firozabad to Etawah (km 56+200 to km 118+200)	62.00	M/s AfconsInfratech Ltd.
3	Etawah to Kannauj (km 118+200 to km 175+200)	57.00	M/s NCC Ltd.
4	Kannauj to Unnao (km 175+200 to km 239+200)	64.00	M/s AfconsInfratech Ltd.
5	Unnao to Lucknow (km 239+200 to km 302+288)	63.088	M/s L&T Ltd.

1.2.3 Authority's Engineer

UPEIDA appointed M/s Ayesa Ingenieria Y Arquitectura S. A. U. in JV with Arvee Associates as Authority's Engineer for all five packages during construction and defect liability/maintenance period since 13th Mar 2015 i.e. from the beginning of the construction at site by the EPC Contractors till completion of DLP period.

1.2.4 External Technical Auditor

UPEIDA appointed M/s RITES Ltd as External Technical Auditor (ETA) for the construction period since 01st Jun 2016 and till 15th Dec 2017 for Pkg-01, till 30th Apr 2018 for Pkg-02, till 15th Nov 2017 for Pkg-03, till 31st Jan 2018 for Pkg-04 and till 30th Apr 2018 for Pkg-05.

1.3 Defect Liability / Maintenance Period

The construction of all the five contract packages have been completed and UPEIDA on the recommendation of Authority's Engineer has issued Provision Certificate / Completion Certificate to the Contractors.

In terms of EPC Contract Agreement, the Contractors have to maintain the Expressway including Service Road and other allied facilities constructed along Expressway for five years from the Provisional Completion Date under the supervision of Authority's Engineer.

2. INVESTIGATION

2.1 Purpose of Investigation Study

CEO/UPEIDA vide letter No. 1924/UPEIDA/18/340-X/Tech, dated 01 Aug 2018 has informed about the breach in Service Road at Ch. 16+300 in Package-1 during recent rains and asked RITES to conduct an investigation and submit a detailed report indicating the followings:

i) Extent of damages,

ii) Cause of damages, and

iii) The remedial measures.

2.2 Investigation by RITES Ltd:

RITES Ltd has no presence of its team on the project and the Contractor has been maintaining the Expressway under the supervision of Authority's Engineer. Immediately on receipt of above letter, RITES Ltd. deputed a team consisting of senior Highway and Bridge Engineers on site between 02 to 06 Aug 2018 from its Head Office to assist UPEIDA.

1. Sh. Vijay Kumar, Addl. General Manager and Sr. Bridge/Hydrology Engineer
2. Sh. Manirul Islam, Addl. General Manager and Sr. Highway Engineer,
3. Sh. Rajvir Jain, Addl. General Manager and Team Leader/ETA
4. Sh. Manish Mishra, Sr. Dy. General Manager and Sr. Highway Engineer.

The team conducted field visit for detailed visual investigation of damage to service road at Km 16+300. The investigation report has been prepared and presented in the following paragraphs.

2.3 Details of Investigations

2.3.1 Breach of Service Road at Ch. 16+300

Extent of Damages

It was observed that the Service Road at Ch. 16+300 (RHS) has collapsed upto the bottom of box culvert towards Agra end of retaining wall resulting in formation of about 6m deep cavity. However, the cavity was filled up before inspection of RITES team and the sand bags were kept to retain earth of service road. **(Fig.-1 to 4)**

Longitudinal lined drain and water collection chamber (to drain out water of this drain to culvert at the bottom of the retaining wall) constructed in between the main carriageway of Expressway and Service Road was found damaged at several places. However, no damage was observed on the Expressway Pavement.

Stone pitching done on side slope of main carriageway of Expressway was also damaged at some locations on both side of this chainage.

Reasons of Damages

The longitudinal lined drain was constructed between main carriageway and service road to take the rain water from the right carriageway of about 500m length from Ch. 16+100 to 16+600 through chute drains. A collection chamber had been constructed at Ch. 16+300, being the lowest point, and one hume pipe of 600mm dia had been laid crossing the Service Road, which is insufficient to cater the runoff for a catchment area of approximately 500x20=10,000 sqm at this location.

Being ravine area, a Retaining wall of about 7m high has been constructed on the right side of service road, with top of the retaining wall about 1m below the service road. The retaining wall on Agra end has not been embedded in the virgin soil.

Due to the insufficient water carrying capacity of the longitudinal drain, collection chamber and 600mm dia pipe water overtopped the service road to reach the box culvert inlet. This overflowing water made its own course first by eroding the soil upto the top of retaining wall and thereafter by eroding soil towards Agra side beyond retaining wall upto the bottom of box culvert that resulted in formation of a large cavity of about 6m depth.

Due to the water accumulation and overflowing, the longitudinal drain and collection chamber near inlet of 600mm dia pipe got badly damaged and broken at several locations.

Thus, the main reason of this failure is adoption of insufficient cross sectional area of longitudinal drain, collection chamber and of 600mm dia pipe to take away the water of main carriageway and service road to cater to water flowing in a length of about 500m.

Remedial Measures

Immediately the cavity has been filled up by the EPC Contractor. It is learnt that two pipes of 1200mm dia has now been provided in lieu of 600mm dia pipe provided earlier. However, as long term measures, it is proposed that:

i. Longitudinal drain in between main carriageway and service road shall be designed hydraulically/structurally.

ii. Properly designed collection chamber of sufficient capacity should be constructed to collect water from drains on either side of collection chamber.

iii. Two numbers 1200mm diameter of pipes have been provided now. The same shall have to be checked by the Design Consultant of EPC Contractor and approved by Authority's Engineer to ensure safe discharge of collected water to box culvert.

iv. The retaining wall shall be embedded sufficiently in virgin soil or a separate splayed wing wall from retaining wall needs to be constructed whose one end will be flushed to existing retaining wall and other end to be embedded sufficiently in virgin soil.

v. The existing retaining wall shall have to be raised upto the top of Service Road.

vi. Service Road shall be rebuild in layers as per Specifications and approved by Authority' Engineer.

2.4 Conclusion

In terms of Contract Agreement, the Contractor is liable for maintenance of the Expressway including Service Road and Allied facilities for five years from the date of provisional completion to the required Specifications & Standards under supervision of Authority's Engineer. **As such EPC Contractor has to rectify all the damages at its cost.**

Regarding the damages that occurred to Service Road at Ch. 16+300, the Contractor is required to carry out the rectifications in consultation with their Design Consultant to satisfy the design requirements under supervision of Authority's Engineer.

Further, this section of Expressway (Package-01) is passing through ravines and the characteristic of soil is silty / sandy, which eroded easily with the flow of water. Therefore, the Contractor has to keep a proper vigil during Monsoon to ensure that there is no accumulation of water at any point which may erode the embankment or damage the CD works.

3. SITE PHOTOGRAPH



Fig.1: 600mm dia pipe provided at Ch. 16+300 below Service Road



Fig. 2: Damaged Lined Drain and Manhole & 600mm dia Cross pipe at km 16+300 (RHS)



Fig. 3: Retaining Wall, 600mm dia Cross pipe and Box Culvert (2x2m) at km 16+300 (RHS)



Fig. 4: Retaining Wall not embedded in virgin soil caused erosion of Service Road at km 16+300 (RHS)