

# Significance of QA/QC for Hybrid Annuity Model (HAM) Road projects

**Mr. Kapil P. Hugar<sup>1</sup>, Prof Ashish P Waghmare<sup>2</sup>**

1. ME (Construction Management), DYPSOET Lohegaon Pune.  
kapil.hugar@gmail.com
2. Asst. Professor ,DYPSOET Lohegaon Pune.  
Ashishwaghmare1986@gmail.com

## **Abstract: -**

*A developed country is marked by the efficiency and feasibility of the road network. India has one of the world's largest road networks which has expanded significantly at a distance of 5.3 million kilometers from the capital. Many Private companies are investing in this development by private-public-public partnership (PPP3). The key to success of this investment is Quality Assurance, quality Control And quality Audit. Here an attempt is made to understand these concepts with The Hybrid Annuity Model (HAM) model for road project.*

**Keywords:-** Hybrid Annuity Model (HAM), Quality assurance, audit Quality Control

## **I. Introduction:-**

A developed country is marked by the efficiency and feasibility of the road network. India has one of the world's largest road networks which has expanded significantly at a distance of 5.3 million kilometers from the capital. There has been a large amount of funding for road construction projects in India. Many countries across the world have also invested in expanding their road networks to the highest possible quality standards, which has led to the improvement of the country's competitiveness. In the late 1990s a new method of private-public-public partnership (PPP3) was tried in order to aid economic growth and provide a face lift to the country's road network. Many Private companies took responsibility for improving underdeveloped road networks in developing countries, and prefer it due to the economic benefits. The phrase PPP describes long-term controlled public-private sector partnership to aligning and sharing resources over time with projects. PPP-based research has aroused wide interests in recent decades [6, 7]. Both developing and developed countries have actively been inviting private sectors to be involved in constructing infrastructure projects [8, 9].

Three different models – PPP Annuity, PPP Toll and EPC (Engineering, procurement & construction) were followed by the The revised Model Concession Agreement (MCA), now called as Hybrid Annuity Model (HAM) is a welcome change over all the previous Build Operate Transfer (BOT) model of Public Private Partner-ship (PPP). In January 2016 the GOI has introduced, HYBRID ANNUITY MODEL (HAM) to rejuvenate PPP. The most demanding feature from all projects is Quality. Quality or total quality starting from Project

Planning to Construction to Operation and Maintenance. The Quality of the projects/works should be such that the performance of road is according to the specified standards during the design life. Quality is essential so that

- i) users enjoy safe and comfortable riding quality throughout the design life and
- ii) vehicle operating costs are minimised and
- iii) resources of the nation are otherwise efficiently utilised.
- iv) It also ensures enrichment of knowledge in the industry, lower bid prices and faster completion of projects

Quality is the key of success for any project. It is conducted at various stages. This paper gives an idea about Quality assurance, quality control and Quality audit for the Hybrid Annuity Model (HAM) road project.

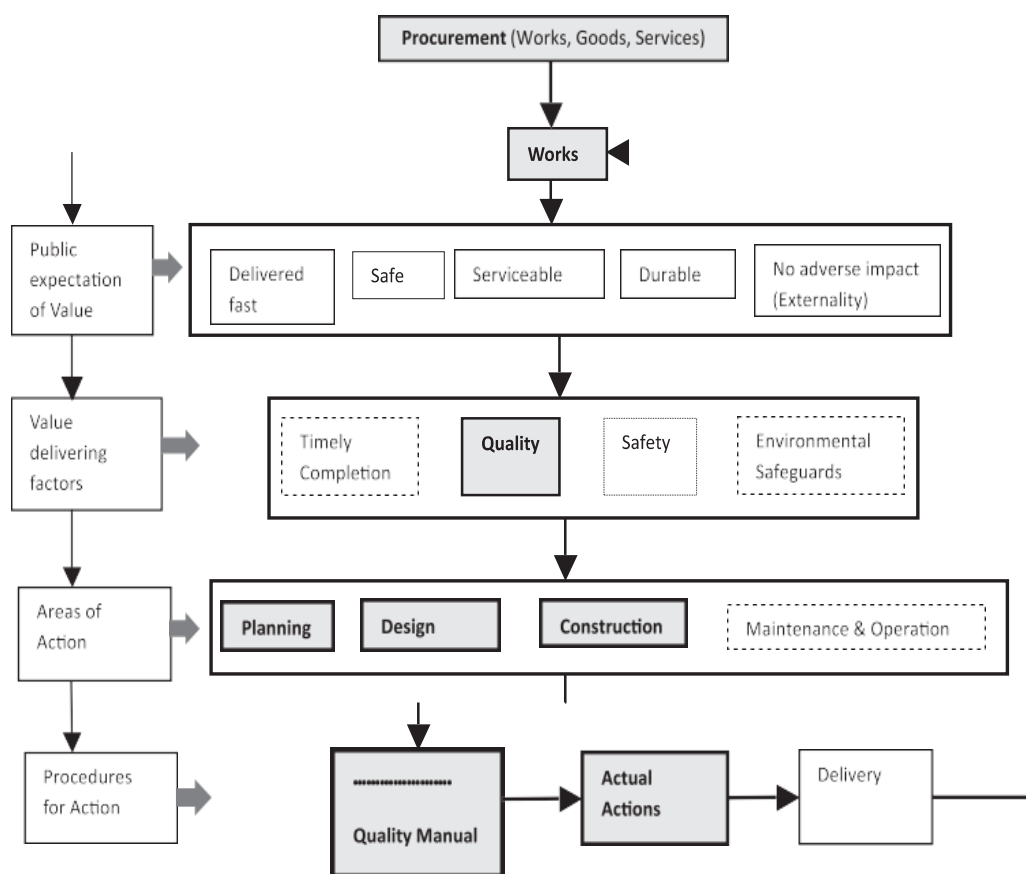


Fig: Stage influencing Quality in a Project

## II. LITERATURE REVIEW

**2.1 Quality Control:** It is a system of routine technical activities, to measure and control the quality of the construction activities happening on the site. The QC system is designed to provide routine and consistent checks to ensure integrity, correctness, and completeness of the elements, material, or service. Identify and address errors and omissions. The field of quality control is multi-directional like testing of materials to be incorporated, field and laboratory tests on mixed materials, proper knowledge of methods/techniques to executive

staff/contractor Precautions to be taken and periodicity of various tests Firstly, materials to be incorporated in works should be confirming to specifications required. The important step towards improving the quality of work is to ensure that all materials and fittings incorporated in the work are up to the standards laid down in the contract and (Bureau of Indian Standards) BIS specifications mentioned therein. As far as possible materials approved by BIS should be incorporated in works. If BIS standards do not exist for a particular material, the same should be purchased from some standard manufacturer and got tested from approved test laboratories.

The Quality Control process includes quality planning, training, providing clear decisions and directions, constant supervision, immediate review of completed activities for accuracy and completeness, and documenting all decisions, assumptions and recommendations.

**2.2 Quality Assurance:** Quality Assurance (QA) is a series of arranged and methodical exercises that are spread out before a project begins. The point of this plan is to give certainty that quality necessities will be satisfied throughout until the end of the construction project. In simpler words, QA is the process of planning to do the right things in the right way to achieve the desired quality at the end of the construction project. In the subsequent section, the difference between the two is outlined along with the need to understand this difference. The QC part through the DigiQC is applied through a smartphone app that is effectively functioning for controlling the quality on site. DigiQC app works on real-time data that is to be entered on site. This ensures that the correct process is followed at the time of construction and the desired quality is achieved. Within the construction industry it is recognized that an increasing amount of time is being spent in the preparation or examination of contractual claims. A key to this is the increased sophistication of clients in applying the requirements of the standard forms of building contract. These contracts clearly place the burden of proof on the contractor. The task of providing this proof, often in the form of documentary evidence, is frequently complicated by a lack of pertinent records. Therefore to make things worse economic loss is often accompanied by loss of good will Examination of project records shows that questions have not been asked when they should have been, problems are not seen until after they have occurred. It is typically not the case that the individuals involved lack expertise or initiative. It is more often the case that they are pressed for time by other concerns resulting in them giving these issues scant attention. A further difficulty arises where an individual's lack of experience limits their personal horizon and dims their

**2.3 Quality Audit:** To ensure adherence to the highest quality standards during construction of projects, NHAI has decided to launch a drive for Independent Inspection of its ongoing National Highways projects across the country, by involving reputed retired government officials. This will be a significant step towards construction of world class highways. 51 of such projects have been identified so far.

As a part of routine quality checks, Authority Engineers/ Independent Engineers/ Supervision Consultants along with Project Directors from NHAI have been carrying out regular inspection of the projects. In order to reinforce the Quality Audit Mechanism, periodic independent inspection of the projects will also be carried out in addition to the existing arrangement.

The broad objective is to assess the quality system put in place by the Contractors/ Concessionaires and its implementation. The quality inspections will not only ensure adherence to standards but will also verify compliance to specific contractual requirements and good engineering practices with reference to procedures formulated as per approved Quality Assurance Plan by NHAI.

In order to achieve this, different Quality Inspection teams have been formed for inspection of National Highway Projects. Retired officers from Central / State government departments of the rank of Chief Engineers are engaged as team leaders, along with associating technical officers from NHAI. For transparency and regular monitoring, all correspondence and dashboards will be made available through NHAI's Artificial Intelligence powered Big Data Analytics platform – Data Lake.

The Quality Inspection comprises of three stages. First, the team will review all project related documents like contracts, specifications, project specific approvals etc. The second stage will be of site inspection for assessment of quality systems placed by the Contractor / Concessionaire and its level of implementation, supervision and control. The last stage will be of follow-up inspection to review the corrective action taken for non-conformities. Suitable penal action will also be taken against defaulters if there are any lapses found in construction standards of the projects.

As an added measure to ensure quality of projects, periodic inspection at an interval of 2-3 months shall be held by the team where quality issues have been found on previous inspections. Also, special emphasis on quality checks shall be made for the projects where NHAI has received Abnormally Low Bids.

The inspection of Quality of Construction of National Highway projects will not only increase the accountability of Contractors / Concessionaires to deliver good quality projects but will also go a long way to ensure safe, smooth, and seamless travel experience on the National Highways.

The items to be audited and its acceptable limits are shown in the following table

S. No.	Test	able Code ofPractice	Acceptance Criteria
<b>A</b>	<b>Pavement investigations</b>		
1	Visual Condition Survey	IRC:81	IRC:81
2	Bump Integrator	IRC:SP:16; IS:3073	IRC:SP:16; IS:3073
3	BBD	IRC:81	IRC:81
4	FWD	IRC:115	IRC:115
5	Subgrade Strength	IS:2720, Part-16	IRC:37 & CA
6	Pavement Composition	ASTM C 174/ 174M & MS 23 Manual	
<b>B</b>	<b>Sub-Soil Investigations</b>		
1	Collection of UDS	IS:1892 & 2132	MORTH Specifications for Road & Bridge Works
2	Standard Penetration Test	IS:2131	

3	Triaxial Test	IS:2720, Part-11 & Part -13	
4	UCS	IS:2720, Part-10	
5	Consistency limits	IS:2720, Part-5	
6	Classification of Soils	IS:1498	
7	Silt factor	IS:2720, Part-4 & IRC:78	
8	Direct Shear Test	IS:2720-13	
<b>C</b>	<b>Borrow Areas (Soil)</b>		
1	Sieve Analysis	IS:2720, Part-4	MORTH Specifications for Road & Bridge Works
2	Atterberg's Limits	IS:2720, Part-5	
3	Compaction Test	IS:2720, Part-7 & 8	
4	CBR	IS:2720, Part-16	
5	Free Swell index	IS:2720, Part-40	
<b>D</b>	<b>Quarries (Aggregate)</b>		
1	Sieve Analysis	IS:2386, Part-2	MORTH Specifications for Road & Bridge Works Section 1000
2	Impact Value	IS:2386, Part-4 or IS:5640, Part-4	
3	Abrasion Value	IS:2386, Part-4	
4	Soundness	IS:2386, Part-5	
5	Stripping Value	IS:6241	MORTH Specifications for Road & Bridge Works Section 500
6	Water absorption	IS:2386, Part-3	MORTH Specifications for Road & Bridge Works Sections: 400, 500, 600 & 1000
7	Polished Stone Value	BS 812 Part-114	MORTH Specifications for Road & Bridge Works Section 500
8	Sand Equivalent value	IS:2720, Part-37	MORTH Specifications for Road & Bridge Works Section 500
S. No.	Test	Applicable Code of Practice	Acceptance Criteria
9	Ten percent Fines value & Crushing value	IS:2386, Part-4	MORTH Specifications for Road & Bridge Works Section 400
<b>E</b>	<b>Cement</b>		
1	Consistency	IS:4031, Part-4	MORTH Specifications for Road & Bridge Works Section
2	Setting Time	IS:4031, Part-5	

3	Compressive Strength	IS:4031, Part-6	1000
4	Fineness	IS:4031, Part-1	
5	Soundness	IS:4031, Part-3	
<b>F</b>	<b>Bitumen</b>		
1	Penetration	IS:1203	IS:73
2	Softening Point	IS:1205	
3	Ductility	IS:1208	
4	Viscosity	IS:1206 (Part II & III)	
5	Specific Gravity	IS:1202	
<b>G</b>	<b>Concrete Mix Design</b>		
1	Sampling	IS:10262	MORTH Specifications for Road & Bridge Works Section 1700
2	Mix Design	IS:10262 IRC:SP:23 & IRC:112	
3	Workability	IS:1199	
4	Compressive Strength	IS:516	
5	Flexible Strength	IS:516	
<b>G</b>	<b>Asphalt Mix Design</b>		
1	Mix Design	MS-2	MORTH Specifications for Road & Bridge Works Section 500
2	Stability testing		
3	Void Analysis		
<b>I</b>	<b>RE Wall</b>		
1	Fill	IS:2720,Part-13, Part-4 & Part-5	MORTH Specifications for Road & Bridge Works Section 3100

### III. ROLE OF INDEPENDENT ENGINEER TOWARDS QUALITY ASSURANCEAs per the MCA (NHAI, 2006),

The Independent Engineer has the following obligations:

- To review the Drawing and Document submitted by the Concessionaire.
- To review, inspect and monitor the progress of Construction Works as per the MCA.
- Conducting Tests on completion of construction and issuing Completion / Provisional Certificate.
- Undertaking all other duties and functions in accordance with the MCA.
- The Independent Engineer shall discharge its duties in a fair, impacy in and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice

### IV.. MORTH/ IRC have mentioned the areas of concern for various items.

1. Inadequacy in thickness of granular/bituminous/ concrete layers.
2. Quantity of bitumen as per design mix

3. Grade of specified grade of bitumen
4. Depression/cracks in concrete slabs
5. All the test required for soil & aggregates
6. Test on various ingredients and mixes at the specified frequency
7. Bitumen is to be purchased from oil refineries rather than private agencies.
8. Third party audit for bitumen, cement, steel, aggregate etc & property items
9. Quality tests and checks ,as specified in contract agreement to be witnessed by the authority's/ Independent Engineer.

## **V. Conclusion:-**

The process of implementing Quality Assurance and Quality Control System & Quality Audit is fairly understood . Quality has to be managed at every stage of the product. A quality system is a mechanism by which a company can organize and manage its resources to achieve, sustain and improve quality economically. Quality Systems are analogous to financial control systems, information technology systems and personnel management systems. Having Quality assurance, Quality Control & Audit will ensure the commencement of the project with a promising and quality output. This increases the PPP in road projects. The ensured quality endorses and encourages the PPP in Hybrid Annuity model leading to the progress of the nation.

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