

**APPLICATION OF COST ENGINEERING PRINCIPLES  
IN TRANSPORT ENGINEERING**

BY

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**INSTITUTE OF APPRAISERS AND COST ENGINEERS**

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## **ABSTRACT**

Mobility of urban or local population is contingent upon efficient and cheap public transportation. Transportation fulfils one of the basic needs of humanity.

Many planners and policy makers see public transportation as the solution to congestion environmental problems.

Transportation creates both enormous benefits and enormous costs.

Travel demand has far outstripped the construction of new transportation infrastructure.

The challenge in transportation engineering is to address the associated problems our mobile society has created and optimize the cost engineering savings/benefits obtained from the application of fundamental application of cost engineering principles in the design, planning, management, maintenance and operations of transports.

Sound application of cost engineering principles in the design of intelligent transportation system (ITS) by the use of control, communication and sensor technologies as well as intelligent to make existing transportation facilities more efficient is one of the 21<sup>st</sup> Century technological current transportation systems from congestion, underutilization and high operating and maintenance cost.

The application of good cost engineering principles via the investment of good transportation engineering design has been shown to generate economic and social value.

Before I start this lecture, I would like to thank the executives of our honoured Professional Society – The Institute of Appraisers and Cost Engineers (IA &CE) a division of the Nigeria Society of Engineers and the organisers for the honour they have done to me by inviting me to present this lecture. In all humility, may I affirm that I fully appreciate your esteem.

## **INTRODUCTION**

It is vital to note that our lives are connected through our common built environment transportation systems therefore have our buildings and transportation engineering systems are designed and built has an impact on how we live, how we work and how we feel.

Transportation engineering design and construction represents a huge investment, both by Government and private or individual organizers and involves a broad range of professional skills and financial resources with the transportation engineering sector alone employing a reasonable percentage of Nigeria's Gross Domestic Product (GDP).

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## **What is Transport Engineering?**

Transport Engineering is the application of technology and scientific principles to:

- Planning
- Functional design
- Operation and Management of facilities for any mode transportation in order to provide for:
  - \* Safety
  - \* Rapid movement
  - \* Comfortability
  - \* Convenience
  - \* Economical and
  - \* Environmentally compatible movement of people and goods.

## **Diverse Characteristics of Transportation Engineering.**

The characteristics of transportation system are as follows:

1. **Multi-modal**  
Covering all modes of transport; • air • land and sea for both passenger and freight.

2. **Multi-sector**  
Encompassing the problems and viewpoints of government, • private industry and public
3. **Multi-problem**  
Ranging across a spectrum of issues that includes national and international policy • Planning of regional system • The location and design of specific facilities • Carrier management issues • Regulatory • Institutional and financial policies.
4. **Multi-objective**  
Aiming at national and regional economic development • urban development • environment quality • social quality • service to users • financial and economic feasibility.
5. **Multi-disciplinary**  
Drawing on the theories and methods of engineering economics (analyses, options and optimization) • operations research • political science • Psychology • other natural and social sciences • management and law.

**Transport Engineering is a Sub-discipline of civil engineering.**

Divisions of transport engineering includes but not limited to the following:

- Air Transportation – Aerospace
- Highway
- Rail road
- Pipe line
- Waterway
- Port
- Costal
- Ocean and
- Urban transport.

**Transportation engineering practice includes but not limited to:**

- Transportation planning
- Geometric design
- Pavement design
- Traffic engineering
- Construction

- Maintenance and
- Operation of transportation facilities.

### **What is Intelligent Transportation System (ITS)**

Intelligent transportation system (ITS) is the use of advanced technologies and automation coupled with advanced cost engineering optimization, design principles technologies and software tools to offer strong potential for freeing the current transportation systems from conjunction and inefficiency which cut across:

- Surface transportation
- Air transportation
- Marine transportation

### Inventory for Transportation Engineering Planning

This inventory or data basic includes but not limited to:

- Population
- Land use
- Economic activity
- Transportation facilities and services
- Travel patterns and volumes
- Ordinances and laws
- Financial resources
- Community values
- Expectations
- Traffic engineering.

### **WHAT IS COST ENGINEERING?**

**Cost engineering** is an area of engineering practice concerned with the "application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling.

The Cost engineer is a qualified professional dedicated to total cost management over the life cycle of a project, facility or manufacturing operation.

## **WHY COST ENGINEERING IS IMPORTANT**

Transportation Engineering Sector may be classified in economic terms as a capital goods industry because the benefits of its products cut across all spheres of human endeavours.

No one who has responsibility for managing major, complex, high-tech programmes with a high development content will dispute the importance of the cost and financial aspects of the work, or the particular difficulty of assessing and controlling costs.

Cost remains a constant source of concern in virtually all engineering or construction projects as shown thus:

- When considering different technical options.
- In establishing budgets
- In conducting cost/technical trade-offs
- In the submission and evaluation of price proposals
- In preparing for contract negotiations and
- In assessing the cost impact of introducing changes to existing designs.

It is vital to understand that the huge investment on transportation engineering sector demand reliability, economy and Total Cost Engineering Management (TCM) from initial conception to final completion. This is to ensure that as far as reasonably practicable that the project is realized with Quality, Time and Cost targets with associated returns on investment.

## **THE FUNDAMENTAL TASKS**

These are fundamental tasks which may be undertaken by different groups in different organisations but the term cost engineering implies that they are undertaken throughout the project life-cycle by trained professional utilizing appropriate techniques, cost models tools and databases in a rigorous way, and applying expert judgement with due regard to the specific circumstances of the activity and the information available. In most instances, the output of a cost engineering exercise is not an end in itself but rather an input to a decision making process.

## **ENGINEERING ECONOMY**

Engineering economy is the study of analytical approaches to economic decisions (selection from two or more courses of action) based on certain concepts and factors, evaluated in line with the defined goals and need necessitating such decision, and

evaluation of such decisions over time until the goal is achieved. In a nutshell, it is science of formulating, estimating and evaluating the economic outcomes of alternatives.

## **ENGINEERING ECONOMIC DECISIONS**

Engineering economic consists of techniques for assessing the worth of prospective projects, investment opportunities or design choices. The reason for worth assessment is to support decisions.

Engineering Economics principles + Technical Knowledge = Engineering Economic Decisions.

## **CRITERIA FOR COST EFFECTIVENESS**

Stakeholder wants their project to be cost effective. Every client and every project will have different criteria for cost- effectiveness. These criteria engender a relationship between the underlisted factors:

- Design
- Material
- Quality
- Expenditure
- Time
- Special Requirements of the project

## **LIFE CYCLE COSTING**

The 21st century engineering design concept is now based on the economic life cycle cost, in preference to the cheapest possible constructional design, hence Cost Engineers must give careful consideration to the underlisted three “Rs”

- ❑ Running Cost
  - ❑ Repairs Cost
    - ❑ Replacement Cost

In terms of life cycle costing, for transport engineering to function effectively and efficiently over time, careful consideration must be given at the design stage for the need to maintain and replace installations.

## **EXAMPLES OF APPLICATION OF COST ENGINEERING PRINCIPLES IN TRANSPORTATION ENGINEERING**

Thorough cost planning, sound engineering thinking and the appropriate prioritization of resources from initial conception of the project, through design to final completion will make for effective realization of cost engineering principles in the underlisted transportation engineering services:

### **Transportation Planning**

- Development of transport model for current and future transportation system.

### **Geometric Design**

- Physical proportioning of other transportation facilities in contract the structural design of the facilities.
- Horizontal alignment
- Vertical alignment / intersections
- Cross sectional features

Core emphasis is given to the cost engineering principles applied for the geometric design of roads.

### **Pavement Analysis and Design.**

This deals with the fundamental application of cost engineering principles with respect to the design of paving materials, determination of the layer thickness, construction and maintenance procedures.

The design covers structural aspects, functional aspects and drawings.

### **Traffic Engineering**

Traffic engineering comprises the analytical application of cost engineer principles to the follows:

- Traffic flow behaviour and characteristics
- Traffic flow data and analysis
- The optional usage of transport infrastructure
- Preserves scarce resources while assuring economic activity and safety security to people and vehicles.

### **Green Transportation Engineering**

Green Transportation Engineering system will reduce emissions and generate cost savings with little or no impact adverse impacts on operations.

**THANK YOU AND GOD BLESS YOU ALL.**

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