

# Functions of Forensic Engineering Investigator in India.

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## Abstract:

This paper will indicate the function of forensic engineering investigator in India. It will also give an idea how to investigate and apply their engineering knowledge to the matter of law.

**Keywords —Failure Analysis, Root Cause Analysis, Codes, Classification of Product, Eyewitness Information's, Applying Scientific Method to Forensic Engineering, Applying Scientific Method of Forensic Engineering to Legal System, Reporting the Result of Forensic Engineering Investigation**

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## I. INTRODUCTION

As we know forensic engineering is the application of engineering principles and methodologies to answer questions of facts which are usually associated with accidents, crime, and various types of failures. A duty of a forensic engineer is to gather evidence to reverse engineer to analyse how the failure occurred. Upon the successful explanation of the failure, it can be said that the failure has been reconstructed.

With respect to the science and engineering methodologies we can denote two type of analysis:

- ◆ Failure Analysis
- ◆ Root Cause Analysis

## II. FAILURE ANALYSIS

Failure analysis determine how a specific part or components has failed. The aim of failure analysis investigation is to take correct action to fix the problem and mitigate against future failures. This process involves data collection to ascertain whether failure occurred due to manufacturing, material defects or misuse. Some of the examples are given below: -

- ◆ Product Design
- ◆ Manufacturing Process
- ◆ Contamination of Source Materials
- ◆ Product Packing & Storage
- ◆ Improper Handling

## III. ROOT CAUSE ANALYSIS

Root cause analysis determine more emphasis on the managerial aspects of failures. It is more associated with the analysis of system failure rather than the failure of specific parts or components, and to aim how procedures and managerial techniques can be improved to prevent problem from reoccurring in the future. Some of the examples are given below :-

- ◆ Power Plants
- ◆ Construction Projects
- ◆ Manufacturing Facilities
- ◆ Hazardous Industries (Chemical, Biological Etc)
- ◆ Heavy Industries (Ship Building, Aircraft, Automotive)

## IV. CODES

- ◆ National Building Code of India 2016 –It is a comprehensive building code providing guidelines in India. It is a model code adapted by all the agencies involving in building construction work. This code mainly contains administrative, regulations, development, control and rules.
- ◆ Code of Practice for Fire Safety in Building (IS:2–1960)-A series of Indian Standards covering fire safety of buildings in general principles of fire grading details of construction, exit requirements and exposure hazards have been formulated. This Indian Standard covers general principles of fire grading and classification, which has been adopted in various Indian standards in respect to fire safety aspects. General Classification are made according to the use or the character of occupancy in one of the following groups :
  - i. Group A – Residential – Lodging for rooming houses, Family Private Dwelling, Dormitories, apartments houses (Flat), Hotels.
  - ii. Group B – Educational – Schools, Collage, Day Care.
  - iii. Group C – Institutional – Hospitals, Sanatoria, Custodial Institution, Penal and Mental Institution.
  - iv. Group D – Assembly - Theatres, Motion Picture Houses, Assembly Halls, Auditoria, Exhibition Halls, Museums, Skating Rinks, Gymnasiums, Restaurants, Places of Worship, Dance Halls, Club Rooms, Passenger Stations and Terminals of Air, Surface and Marine Public Transportation Services.
  - v. Group E – Business - Offices, banks, professional establishments, like offices of architects, engineers, doctors, lawyers, Laboratories, Research Establishments, Tent House.
  - vi. Group F – Mercantile – Shops, Store, Markets, Underground Shopping Centres, Departmental Stores.
  - vii. Group G – Industrial – Assembly Plant, Laboratories, Dry Cleaning Plants, Power Plants, Pumping Stations, Smoke Houses, Gas Plant, Refineries, Dairies, Mills.
  - viii. Group H – Storage – Warehouses, Cold Storages, Fright Depots, Transit Sheds, Storehouses, Marine Garage, Hangars.
  - ix. Group J – Hazardous – Storage Under Pressure More Than 0.1 N/mm<sup>2</sup> of Hydrogen, Natural Gas, Acetylene, Ammonia, Sulphur dioxide, Rocket Propellent, Explosive Materials, Fireworks, Ammunitions,
- ◆ Indian Electricity Grid Code (under clause (h) of sub- section (1) of Section 79 read with clause (g) of sub-section (2) of Section 178 of the Act) - Indian Electricity Grid Code (IEGC) lays rules, guidelines and standard which is to be followed by specific person and must participate in the system to plan, develop, maintain and operate the power system in most secure, reliable, economic and efficient manner while facilitating health competition in the generation and supply of electricity.

#### V. CLASSIFICATION OF PRODUCT

Standard National Classification of product is required to study the flow of output through the

economic system, input out transactions & inter industrial relationship. There are three main organizations: -

- Directorate General of Commercial Intelligence and Statistics (DGCIS)
- Central Board of Excise & Customs (CBE&C)
- Department of Revenue, Government of India

All these three organization make use of Indian Trade Classification for transportable goods undertaken by Directorate of Systems, Customs and Central Excise. Below Table (1.1) are some examples of Product classification for service sector.

Class	Sub Class	Product Code	Service Product Description
Heading No. 9953	Constructions		
<b>Group 99531</b>	<b>Building</b>		
<b>995311</b>	<b>Residential Building</b>		
	<b>9953111</b>	<b>99531110</b>	<b>1 or 2 dwelling residential building</b>
	<b>9953112</b>		<b>Multi dwelling residential building</b>
		99531123	Hostels
		99531124	Orphanage
		99531125	Homeless Shelter
<b>995312</b>			<b>Non-Residential Buildings</b>
	<b>9953121</b>		<b>Industrial Buildings</b>
		99531211	Building used for production
		99531212	Workshops
		99531213	Storage Buildings
	<b>9953122</b>		<b>Commercial Buildings</b>
		99531221	Buildings used for primary trade
		99531222	Exhibition Halls
		99531233	Office Buildings
		99531224	Air, Rail or Road Transport Terminals

	<b>9953129</b>		<b>Other Non-Residential Building</b>
		99531291	Hotels, Motels, Restaurants, & Similar Buildings
		99531292	Schools, Colleges, Universities, Libraries, Archives & Museums
		99531293	Hospitals, Clinics, & Sanatoria & Veterinary Clinics
		99531294	Cinemas, Theatres, Concert Halls, Dance Halls, & Night Clubs
		99531295	Convention Centres, Religious Buildings, Prison Buildings & Law Courts, Parliament Buildings
<b>Group 99532</b>			<b>Civil Engineering Works</b>
<b>995321</b>			<b>Highways (Except Elevated Highways)</b>
		<b>9953211</b>	<b>Highways, Streets &amp; Roads</b>
		99532111	Highways (Expect Elevated Highways)
		99532112	District Roads
		99532113	Village Roads
		99532114	Safety Installations for Highway Roads Etc
	<b>9953212</b>		<b>Railways</b>
		99532121	Broad-gauge
		99532122	Meter gauge
		99532124	Metro Railways
<b>995326</b>			<b>Mines And Industrial Plants</b>
	<b>9953261</b>		<b>Mining Constrictions</b>

		99532611	Mine Loading and Discharging stations
		99532612	Winding shafts associated with mining operations
		99532613	Towers associated with mining operations
		99532619	Mining Constructions n.e.c
	9953262		<b>Power Plants</b>
		99532621	Hydro electric power plants and equipment's
		99532622	Coal based thermal power plants and equipment's
		99532623	Gas based thermal power plants and equipment's
		99532629	Power Plants n.e.c

(Table 1.1)

## VI. EYE WITNESS INFORMATION APPLYING

Eyewitness are important source of information as it is the most convincing forms of evidence in criminal trials. But being convincing is not as been accurate, Eyewitness testimony is more fallible than many people assume.

The invention of DNA analysis in late 1980 revolutionized forensic science a unprecedented level of accuracy about the identity of the actual culprit vs innocent people falsely accused of crime. Sometimes eyewitness form their own opinions and conclusions about the incident occurred, they might be relatives, friends or enemies of the person involved in an incident. so therefore, skillful questioning of eyewitness can sometimes be useful to separate the real observation from the personal assumptions.

## VII. SCIENTIFIC METHOD TO FORENSIC ENGINEERING

Laboratory settings is used to design experiments where the elements studied is not obscured or complicated by other effects simultaneously, The elements are singled out to be free from the samples. Many experiments are conducted to determine what occurs when the element is changed. The effect of changing the element provides a statistical basis for concluding how the elements work and predicting what will happen under other circumstances. In this same way any accidents, failures or events can be experimentally reconstructed, the elements would be simply be changed or combined until the right combination is found and is been reconstructed again.

## VIII. APPLYING SCIENTIFIC METHOD OF FORENSIC ENGINEERING TO LEGAL SYSTEM

As we know forensic engineering is a branch of forensic science such as physics, chemistry, biology, computer science and engineering which can be scientifically applied to the matter of law. This technique will connect science and law which will further provide new ways and methods for discovering the reality. Forensic engineers can provide important source of information for criminal proceedings. Therefore, professionals should be equipped with the knowledge necessary to fully apply the potential of science in civil, criminal, and family legal matters. Some of the important laws a forensic engineer should have knowledge in India are: -

- Indian Evidence Act, 1872
  - a) Chapter I: Preliminary
  - b) Chapter II: of The Relevancy of facts
  - c) Chapter III: Facts Which Need Not Be Proved
  - d) Chapter IV: of Oral Evidence
  - e) Chapter V: of Documentary Evidence
  - f) Chapter VI: of The Exclusion of Oral by Documentary Evidence
  - g) Chapter VII: of The Burden of Proof

- h) Chapter VIII: Estoppel
- i) Chapter IX: of Witnesses
- j) Chapter X: of The Examination of Witness
- k) Chapter XI: of Improper Admission and Rejection of Evidence
- The Information Technology Act 2000
  - a) Chapter I: Preliminary
  - b) Chapter II: Digital Signature
  - c) Chapter III: Electronic Governance
  - d) Chapter IV: Attribution, Acknowledgment and Despatch of Electronic Records
  - e) Chapter V: Secure Electronic Records and Secure Digital Signatures
  - f) Chapter VI: Regulation of Certifying Authorities
  - g) Chapter VII: Digital Signature Certificates
  - h) Chapter VIII: Duties of Subscribers
  - i) Chapter IX: Penalties and Adjudication
  - j) Chapter X: The Cyber Regulations Appellate Tribunal
  - k) Chapter XI: Offences
  - l) Chapter XII: Network service Providers Not to Be Liable in Certain Cases
- Indian Penal Code (IPC)
  - a) IPC Section 279 – Rash Driving or Riding on A Public Way
  - b) IPC Section 337 – Causing Hurt by an Act Endangering Life or Personal Safety of Others
  - c) IPC 408 – Criminal Brach of Trust by Clerk or Servant
  - d) IPC 409 – Criminal Breach of Trust by Public Servant, or by Banker, Merchant or Agent
  - e) IPC Section 324 – Voluntarily Causing Hurt by Dangerous Weapons or Means
  - f) IPC 326 – Voluntarily Causing Grievous Hurt by Dangerous Weapons or Means
  - g) IPC Section 353 – Assault or Criminal Force to Deter Public Servant from Discharge of His Duty
  - h) IPC Section 300 – Murder
  - i) IPC Section 307 – Attempt To Murder
  - j) IPC Section 201 – Causing Disappearance of Evidence of offence, or Giving False Information to Screen Offender
  - k) IPC Section 378 – Theft
  - l) IPC Section 390 – Robbery
- Code of Criminal Procedure, 1973 (CRPC)
  - a) CrPC Section 154 – Information in Cognizable Cases
  - b) CrPC Section 156– Information as To Non-Cognizable Cases and Investigation of Such Cases
  - c) CrPC Section 156 – Police officers To Investigate Cognizable Cases
  - d) CrPC Section 160 - Police Officers Power To Require Attendance of Witness
  - e) CrPC Section 161 – Examination of Witness by Police
  - f) CrPC Section 162 – Statement to police not to be signed: Use of Statement in evidence
  - g) CrPC Section 164 – Recording of Confessions and Statements
  - h) CrPC Section 243 – Evidence For Defense
  - i) CrPC Section 313 – Power to Examine Accused
  - j) CrPC Section 200 – Examination of Complainant

- k) CrPC Section 474 – Appeals from Convictions
- l) CrPC Section 293 – Reports of Certain Government Scientific Experts

	explanation for the data and discuss it in the report	the opinion supports the data rather than the other way around
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**IX. REPORTING THE RESULTS OF A FORENSIC ENGINEERING INVESTIGATION**

Format of forensic engineering investigation can be described in chronological order. The report can be prescribed daily or something when important is occurs during an investigation. Forensic investigation reports usually influence the court’s decision. The report should therefore be written with clarity and accurate to best assist the court. Below Table (1.2) are some of the Do’s and Don’ts of writing forensic engineering reports

Sn	Do	Don’t
1	Present the information in logical sequence so that the report presented should build upon itself and the does not need to refer to later of sections report	Don’t Overwhelm the reader with needless information
2	Do write reports so they can be easily understood by audiences	Don’t use overly technical language
3	Make sure that the type and source of information are clear to the reader	Don’t include embarrassing or incriminating data’s
4	Do the test that is valid and reliable	Don’t use test that is not understandable by court
5	Spend the most time on opinion section of the report	Don’t provide opinion without articulating the basis of opinion
6	Do look for other	Make sure that

**X. CONCLUSION**

From this paper we come to know the function of forensic engineer investigator’s in India. The paper also explains the importance of investigators to have knowledge on types of failures, codes with classification of products, eyewitness information’s, applying forensic method to scientific engineering and to the legal system with reporting the result of forensic engineering investigation to the court.

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