2) Functional analysis for Plaster-The functional analysis is nothing but the functions ensured by each components. a. Functions of Brick Masonry- Load transfer and Partition Purpose, b. Function of Mortar- Decorative and Protection to interior material, c. Function of Paint- Decorative and Protection to interior material.
3) Process analysis- The process analysis is to determine all the errors, defects, damages, degradation that could occur to the product during its construction process. Following are the process defects in Plaster. a. Poor quality of materials, b. Bad Workmanship, c. Rich mix of mortar, d. Less thickness of plaster, e. Faulty construction, f. Improper curing of Plaster.

### 4.1. Data Collection

Data collected through eight building was studied and overall of failure modes were observed to represent both the components. Various defects found and coupled from all these 8 buildings are as follows;

**For External Plaster:**

1. Surface Cracks
2. Dampness
3. Paint Flaking
4. Efflorescence
5. Mosses
6. Black Patches
7. Expansion

Degradation Block Diagram for Plaster

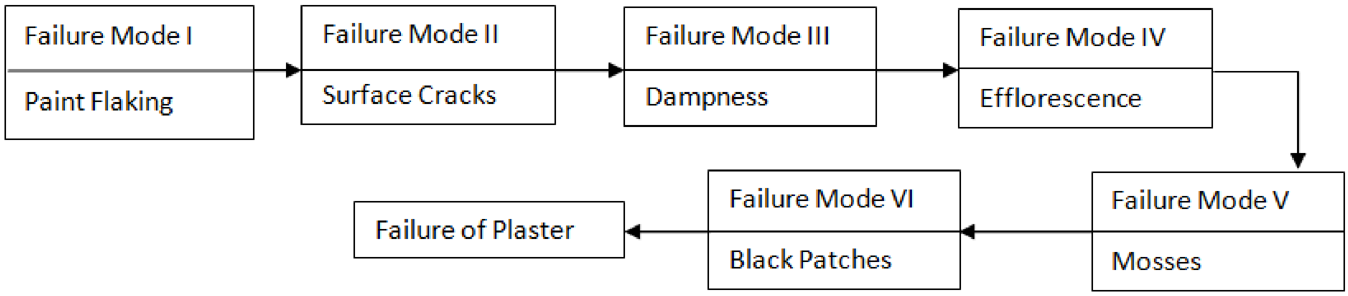


**Table 2:** Failure Mode Effect Analysis for External Plaster

| Failure Mode Effect Analysis | | | | | |
|---|---|---|---|---|---|
| Function | Component | Mode | Causes | Direct Effect | Indirect Effect |
| Decorative and Protection to Interior Materials | Paint | Hair line Cracks | Cracks in Mortar | Cracks in Paint Film | Percolation of Moisture |
| | | | Variation in Temperature and Moisture [5] | | |
| | | Lifting | Moisture | Debonding of Paint Film | Exert Pressure on Bond |
| | | Blistering | Moisture[5] | Small Bubbles Occurs on Paint | |
| | | | Lack of Bond [5] | | |
| | | Flaking | Moisture [5] | Paint Flak | Bad Aesthetic view |
| | | | Freeze and thaw action | | |
| Decorative and Protective to Interior Materials | Mortar | Surface Cracks | Shrinkage [4] | Surface Cracks | Percolation of Moisture |
| | | | Moisture Change [4] | | Cracks width increases |
| | | | Growth of vegetation | | Crack width increases |
| | | | Thermal Expansion and Contraction [4] | | |
| | | | Poor quality of Maintenance | | |
| | | Dampness | Moisture in Mortar | Dampness | Crack Width increases |
| | | | Leakage of water from Sewer Pipes [6] | | Water Percolation on Mortar |
| | | | Faulty Maintenance of Joint [6] | | |
| | | | Leakage of water from Bath and Toilet | | |
| | | | Rain Water | | |
| | | Efflorescence | Temperature[3] | Small White Patches | Bad appearance of Plaster |
| | | | Moisture in Mortar [3] | | |
| | | | Salts [3] | | |
| | | Mosses | Water from Roof | Mosses Production on Mortar | Bad Aesthetic view |
| | | | Leakage of water from Bath and Toilet Block | | |
| | | | Humidity in mortar | | |
| | | | Temp or Heat | | |
| | | | Bacteria | | |
| | | Blacks | Moisture | Black Patch | Bad appearance of |


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| | | | | | |
|---|---|---|---|---|---|
| | | Patches | Temperature | | Plaster |
| | | Expansion | Poor Quality of Work [4] | Plaster Falls | |
| | | | Weak mix of Mortar | | |
| | | | Rich Mix of Mortar | | |
| | | | Moisture [4] | | |
| | | | Weak Bond [4] | | |
| Load Transfer and | Brick Masonry | Dampness | Moisture from Septic Tank | Dampness in Masonry | Helps to Form the Efflorescence, Mosses |
| | | | Water from Bath | | |
| | | Cracks | Plant Growth in Plaster | Cracks | |

Table No 2 shows the Failure Mode Effect Analysis for External Plaster. The table shows the various failure modes of External Plaster and there causes and the direct and indirect effects of that cause the defects in External Plaster.

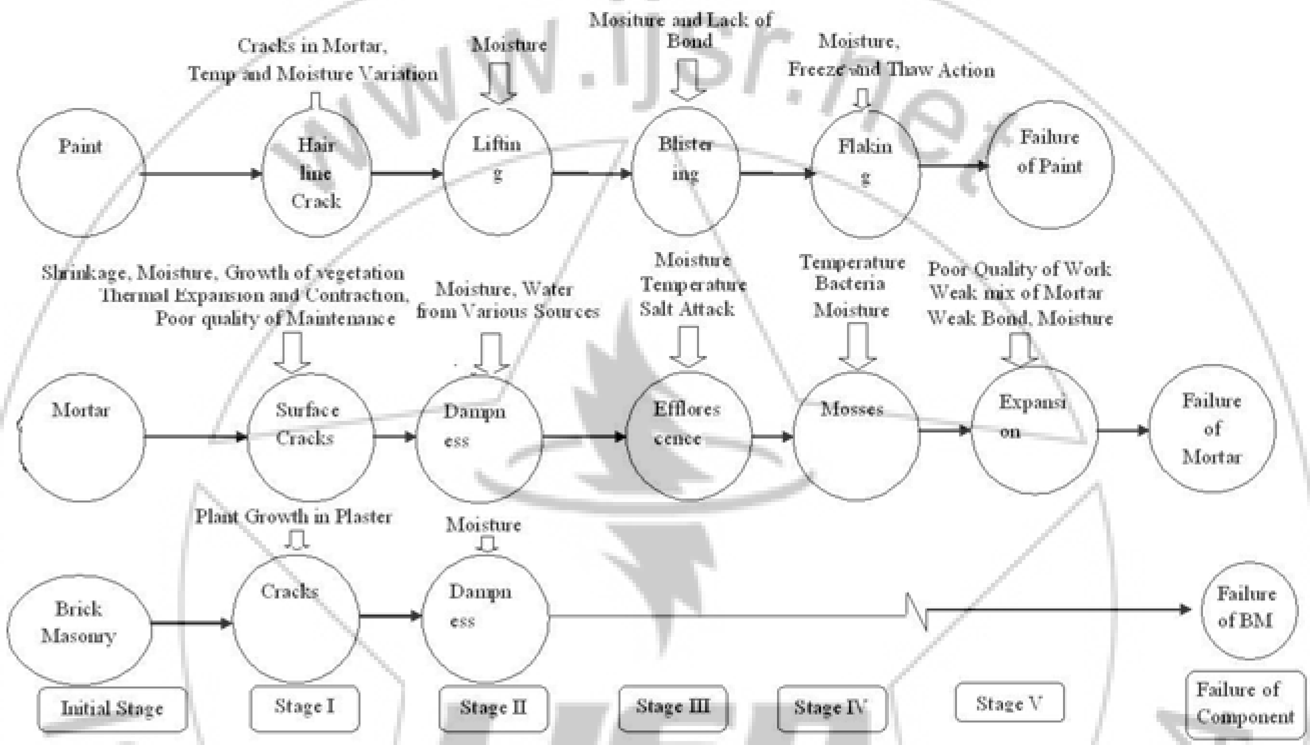


**Figure 1:** Event Driven Graph for External Plaster [2]

The above figure shows that the process of degradation and various causes for failure modes of External Plaster. The sequence of failure for paint was Hair Line Cracks, Lifting, Blistering and Flaking. The sequence of failure for mortar was Surface Cracks, Dampness, Efflorescence, Mosses and Expansion. The sequence of failure for Brick Masonry was cracks and Dampness

**For Internal Plaster:**
1. Surface Cracks
2. Dampness
3. Paint Flaking
4. Efflorescence
5. Mosses

**Table 3:** Failure Mode Effect Analysis for Internal Plaster

| Failure Mode Effect Analysis | | | | | |
|---|---|---|---|---|---|
| Function | Component | Mode | Causes | Direct Effect | Indirect Effect |
| Decorative and Protection to Interior Materials | Paint | Hair line Cracks | Cracks in Mortar [5] | Cracks in Paint Film | Percolation of Moisture |
| | | | Variation in Temperature and Moisture | | |
| | | Lifting | Moisture [5] | Debonding of Paint Film | Exert Pressure on Bond |
| | | Blistering | Moisture [5] | Small Bubbles Occurs on Paint | |
| | | | Lack of Bond [5] | | |
| | | Flaking | Moisture | Paint Flak | Bad Aesthetic View |
| | | | Freeze and thaw action | | |
| Decorative and Protection to Interior Materials | Mortar | Surface Cracks | Moisture | Surface Cracks | Dampness |
| | | | Thermal Expansion and Contraction in Joints [4] | | |
| | | | Faulty Construction Joint | | Moisture enters in Mortar |
| | | | Defective External Plaster [4] | | |
| | | | Lack of Maintenance [4] | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | Poor Quality of Work | | |
| | | | Shrinkage [4] | | |
| | | Dampness | Water from Roof | Dampness | Increases the Crack Width, Helps to generation of Mosses, Efflorescence and, Bad Aesthetic View |
| | | | Water from Construction joint | | |
| | | | Moisture in Masonry [6] | | |
| | | | Water from OTS | | |
| | | | Poor Quality of Work[6] | | |
| | | | Bad Workmanship | | |
| | | Efflorescence | Temperature or Heat [3] | Small White Patches | Bad Aesthetic View |
| | | | Moisture in Mortar [3] | | |
| | | | Salts [3] | | |
| | | Mosses | Moisture in Mortar | Mosses | Bad Aesthetic View |
| | | | Temperature change | | |
| | | | Humidity in Rooms | | |
| | | | Bacteria or Fungi | | |
| Load Transfer and Partition Purpose | Brick Masonry | Cracks | Defective External Plaster | Water percolates | Water percolation |
| | | Dampness | Moisture | Dampness in Plaster | Increase Dampness in Mortar |

Table No 3 shows the Failure Mode Effect Analysis for Internal Plaster. The table shows the various failure modes of Internal Plaster and there causes and the direct and indirect effects of that cause the defects in Internal Plaster.

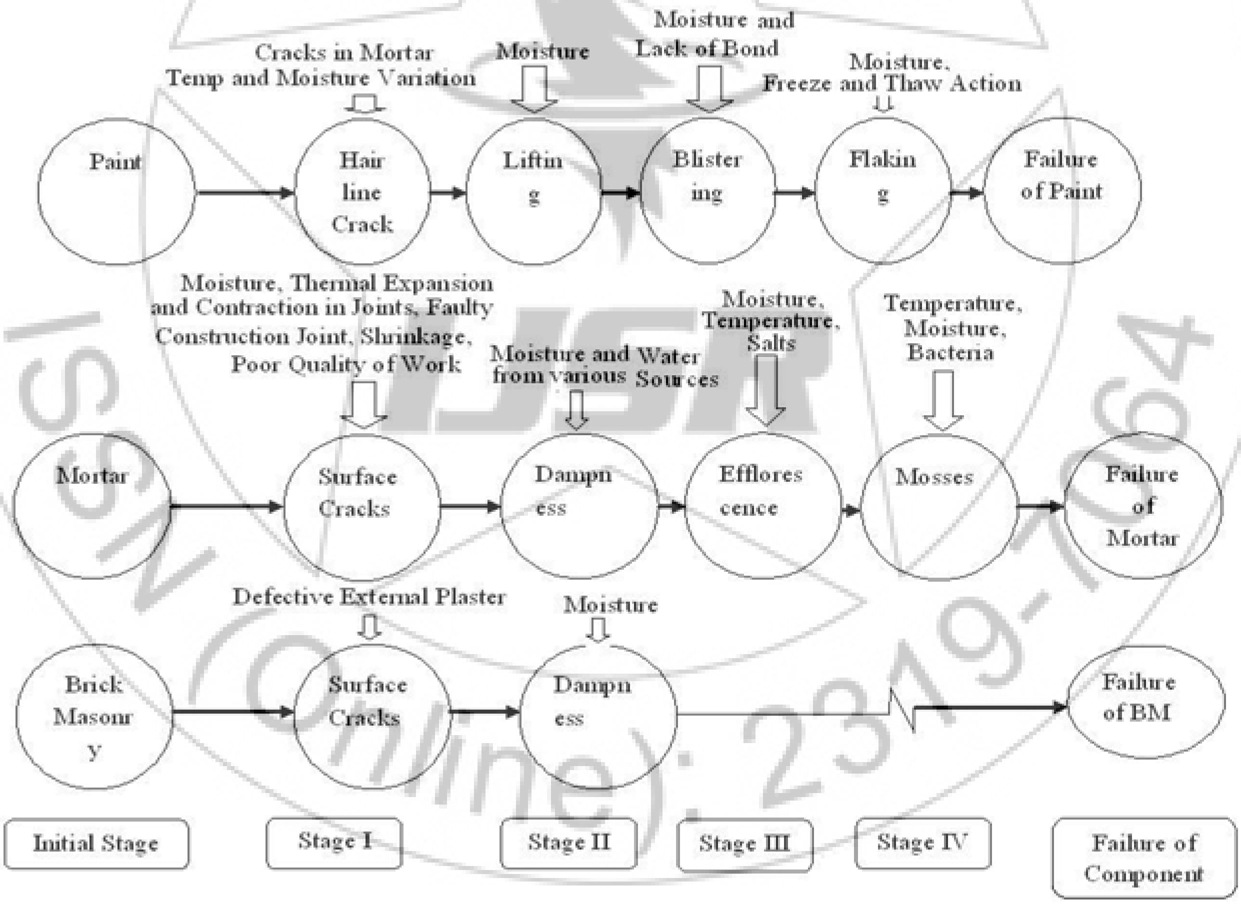


**Figure 2:** Event Driven Graph for Internal Plaster [2]

The above figure shows that the process of degradation and various causes for failure modes of Internal Plaster. The sequence of failure for paint was Hairline Cracks, Lifting, Blistering and Flaking. The sequence for failure of Mortar was Surface Cracks, Dampness, Efflorescence and Mosses. The sequence of failure for brick masonry was Cracks and Dampness.


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## 5. Conclusion

From above study the following conclusions are derived

1) After inspection of the case studies following failure modes were observed in External and Internal Plaster Surface Cracks, Efflorescence, Dampness, Mosses, Black Patches, Paint Flaking and Expansion.
2) After doing Failure Mode Effect Analysis following major defects and their causes were observed
   a) Surface Cracks are occurs regularly on the plaster. When cracks occur immediately after construction they are due to shrinkage in cement. There are also causes for surface cracks like moisture in mortar, unwanted growth of vegetation on plaster. The thermal expansion and contraction is also causes the cracks.
   b) Dampness is also major defect in plaster. The causes of dampness are moisture and water percolation through sewer pipes and rain water pipes.
   c) Mosses is also major defect in plaster occurs near the sewer pipes due to the moisture, temperature and various biological agents such as fungi and algae.
   d) The causes of paint flaking are moisture, freeze and thaw action and lack of bond between mortar and paint.

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