Fly Ash Products (FAP)

• FAP Overview
  – Types
  – Ingredients
  – Manufacturing Process
  – Technical Specifications

• User Benefits
• Initiatives & Recommendations
• Business Challenges
• Solutions & Way Forward
Types of FAP

- Bricks (Standard and Modular)
- Blocks (Solid and Hollow)
- Tiles (Roofing and Floor)
- Pavers (Moderate and Heavy Load)
- Kerb Stones

Other Precast FAP Shapes

- Wheel Stopper
- Drain Cover
- Fence
- Beams and Columns
- Gully Cover

... and many more up to the level of customization
FAP Ingredients

Blocks, Pavers, Kerb Stones and Thick Precast Shapes
• Fly Ash + Coarse Aggregate + Bottom Ash / Sand / Stone Dust + Lime / Cement + Gypsum + Curing

Bricks, Hollow Blocks, Tiles and Thin Precast Shapes
• Fly Ash + Bottom Ash / Sand / Stone Dust + Lime / Cement + Gypsum + Curing

Ultra Light-weight Products (AAC and CLC)
• Fly Ash + Bottom Ash / Sand / Stone Dust + Lime / Cement + Gypsum + Aluminium Oxide + Steaming
Manufacturing Process

• Chemistry behind FAP is the Pozzolanic reaction between Fly Ash and binder materials such as Lime /Cement

• Coarse Aggregate, Bottom Ash, Sand and Stone Dust act as filler material to reduce net surface area

• Gypsum is used for initial hardness and hydration of Lime /Cement

• FAP are made using following technologies:
  - **Vibrating Bed**: Used for FAP having Coarse Aggregate
  - **Hydraulic Press**: Used for FAP having fine particles such as Bottom Ash, Sand and Stone Dust
  - **Vibro-hydraulic Press**: Uses a combination of pressure and vibration based on the ingredients, to achieve maximum compaction
  - **Steamed Baking and Autoclaving for Ultra Light-weight Concrete**
# Technical Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (mm)</th>
<th>No. per m³</th>
<th>Weight (kg)</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Bricks</strong></td>
<td>230X110X70 230X110X75 230X110X80</td>
<td>565 528 495</td>
<td>2.5-2.8</td>
<td>• Non-load bearing Bricks (wall between 2 beams): 50-70 kgf/cm² (M5-M7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Load bearing Bricks (wall without beams), Boundary wall and Parapet: 70-100 kgf/cm² (M7-M10)</td>
</tr>
<tr>
<td><strong>Modular Bricks</strong></td>
<td>190X90X90</td>
<td>650</td>
<td>2.1-2.4</td>
<td></td>
</tr>
<tr>
<td><strong>Indian Blocks</strong></td>
<td>290X140X190</td>
<td>130</td>
<td>11-14</td>
<td>• Load bearing Blocks: 100-150 kgf/cm² (M10-M15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Heavy Duty Blocks and Precast Shapes: 150-250 kgf/cm² (M15-M25)</td>
</tr>
<tr>
<td><strong>EU Blocks</strong></td>
<td>390X190X190</td>
<td>71</td>
<td>20-26</td>
<td></td>
</tr>
<tr>
<td><strong>Tiles</strong></td>
<td>25mm</td>
<td>Measured in m², e.g. 22 Milano design pavers in a m²</td>
<td>Varies based on length and breadth (1800-2000 kg/m³)</td>
<td>• Tiles, Pavers &amp; Kerb Stones: 300-350 kgf/cm² (M30-M35)</td>
</tr>
<tr>
<td><strong>Pavers</strong></td>
<td>Medium duty: 60mm Heavy duty: 80mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kerb Stones</strong></td>
<td>290X125X300 &amp; 75mm round curve</td>
<td>Measured in running meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Precast shapes</strong></td>
<td>Customised</td>
<td>As per customisation</td>
<td></td>
<td>• Precast Columns &amp; Beams: 250-300 kgf/cm² (M25-M30)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Special Precast Forms: &gt;350 kgf/cm² (Above M35)</td>
</tr>
</tbody>
</table>
Fly Ash Products (FAP)

- FAP Overview

- **User Benefits**
  - Quality, Strength and Sustainability
  - Cost Effectiveness

- Initiatives & Recommendations
- Business Challenges
- Solutions & Way Forward
Quality, Strength and Sustainability

While Burnt Clay Red bricks deteriorate over time, Fly Ash bricks gain strength, making them a more sustainable building solution.

Strength of FAP doubles over a period of 6-7 years.
## Cost Effectiveness

<table>
<thead>
<tr>
<th>Burnt Clay Red Bricks</th>
<th>Fly Ash Bricks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Red bricks shrink unevenly in the brick kilns depending on the heat exposure</td>
<td>• 10% less Fly Ash bricks required due to standard size achieved using machines</td>
</tr>
<tr>
<td>• 23% mortar required in red bricks due to irregular shape</td>
<td>• 15% less mortar needed due to smooth orthogonal shape</td>
</tr>
<tr>
<td>• Cannot sustain wall putty without plaster</td>
<td>• No plaster required, and wall putty can be directly applied</td>
</tr>
<tr>
<td>• 8-10% breakage due to labor handling &amp; 3-4 qualities at brick kilns</td>
<td>• 2-3% breakage due to mechanized production process</td>
</tr>
<tr>
<td>• DPC required for water exposure</td>
<td>• No DPC required</td>
</tr>
</tbody>
</table>
Fly Ash Products (FAP)

• FAP Overview
• User Benefits

• Initiatives & Recommendations
  – Center Initiatives
  – Center Recommendations
  – State Recommendations

• Business Challenges
• Solutions & Way Forward
## Center Initiatives

<table>
<thead>
<tr>
<th>No.</th>
<th>Initiative</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hon’ble Prime Minister Narendra Bhai Modi</td>
<td>PM praised and recommended Fly Ash bricks while inaugurating Baroda and Kochi Airports</td>
</tr>
<tr>
<td>2</td>
<td>NITI Aayog Government of India</td>
<td>NITI Aayog constituted Mission Fly Ash. Also, developing real-time Fly Ash utilization App, along with MoP, via GIS mapping of 400+ thermal plants and 20,000+ Fly Ash Product industries</td>
</tr>
<tr>
<td>3</td>
<td>Ministry of Power Government of India</td>
<td>MoP has proposed to use existing land of Fly Ash mounds and rail network to make Fly Ash cluster and PoS throughout India; Planned INR 10 cr for promotions</td>
</tr>
<tr>
<td>4</td>
<td>Ministry of Road Transport &amp; Highways Government of India</td>
<td>MoRT&amp;H has promoted Fly Ash products in its all highways and expressway projects</td>
</tr>
<tr>
<td>5</td>
<td>Ministry of Environment, Forest &amp; Climate Change Government of India</td>
<td>MoEF&amp;CC made Fly Ash Products mandatory in 300 km radius of thermal power plants, which covers all of India except Ladakh, and some part of North-east</td>
</tr>
<tr>
<td>6</td>
<td>National Green Tribunal</td>
<td>NGT has banned burnt clay red bricks in Agra and Mumbai, due to pollution – same expected for NCR and major metropolitan cities</td>
</tr>
<tr>
<td>7</td>
<td>Central Pollution Control Board</td>
<td>CPCB categorized Fly Ash Products in the “White Industry”, and burnt clay earthen bricks in “Red Industry”, along with MoEF&amp;CC</td>
</tr>
</tbody>
</table>
Center Recommendations

- **NITI Aayog**: Lower GST & Mandatory Use
- **MoP**: Lower GST & Mandatory Use
- **MoRT&H**: Lower GST
- **MoEF&CC**: Lower GST & Mandatory Use
- **MoH&UPA**: Lower GST & Mandatory Use
- **NGT**: Banned Red Bricks in Agra & Mumbai
- **MoEF&CC / CPCB**: White Industry
- **MoEF&CC**: 300km Radius

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State Recommendations

G.O. UP Govt.

Chief Secretary, UP Govt.

UPPCB

CDO Letter for Noida

CDO Letter for GNIDA

... and the necessary action is use of Fly Ash Products
Fly Ash Products (FAP)

• FAP Overview
• User Benefits
• Socio-economic Benefits
• Initiatives & Recommendations

• Business Challenges
  – End-user Challenges
  – Administrative Perception Challenges
  – Administrative Violations

• Solutions & Way Forward
End-user Challenges: Testing at Site

| Size          | • Check the dimensions of the product to get the number of FAP required per m³, with a tolerance of +2%  
|              | • 1m³ of brick work consists of 0.8 m³ of bricks and 0.2 m³ of mortar |
| Shape        | • Orthogonal shape with smooth faces and sharp edges, with bonding frogs/ grooves |
| Colour       | • Whether coloured or not coloured, tone shall be uniform throughout the product |
| Marking      | • Each brick shall be marked in a suitable manner with the manufacturer’s identification mark or initials |
| Water Absorption | • Check the difference between the weight of a wet and a dry brick to get water absorption (should be 10-20%) |
| Strength     | • CTM Test: Fill the frog with cement mortar (1:3) 24 hours before testing  
|              |   o Divide maximum load at failure with total area of the bed face to get the FAP strength  
|              | • Drop Test: FAP should not break when dropped from a height of 4 ft on flat surface |
Administrative Perception

Maharatna PSU NTPC used this logo in their User Meet dated 31 Aug 2017

No paver block possible with Geo-polymerisation, as it needs abrasive resistance and fatigue strength

Fly Ash bricks consume more than 70% of Fly Ash, while Refractory bricks consume only 7%

A detailed policy and right kind of marketing, is required for proper Fly Ash utilization
Administrative Violations ...

CGEWWHO (Central Government Employees Welfare Housing Organization)

City Bus Terminal, Sector-82, Noida
Administrative Violations ...2 of 2

Multi-purpose Indoor Stadium, Sector 21A, Noida

Sewage Treatment Plant, Greater Noida

Shilp Haat, Noida

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Fly Ash Products (FAP)

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• User Benefits
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• Business Challenges

• Solutions & Way Forward
  – Proposed Solutions
  – Recent FAP Projects
  – GIS TPP Mapping
Barriers & Solutions Ahead

**Barriers**

1. Least awareness in construction engineers, monitoring agencies and end-users about the qualities of FAP and how to test FAP at site
2. Mandate from Environmental Ministry regarding use of Fly Ash Products in 300km radius of thermal power plants, not obeyed
3. No Railway Fly Ash cluster available to supply Fly Ash as a raw material to high demand areas

**Proposed Solutions**

1. Promotion programs and workshops to educate
2. Updation of BIS standards
3. Updation of existing Center / State notifications

1. Make Fly Ash Products mandatory for all projects including PMAY. Make utilization certificate compulsory
2. Fix District Magistrate / Collector as a nodal agency to ensure mandatory use of Fly Ash products

1. GIS mapping of thermal power plants and Fly Ash Product factories
2. Existing land of Fly Ash mounds and rail network to be used to make Fly Ash cluster and PoS
Recent FAP Projects

Baroda Airport

Kochi Airport

Metro Stations

GNIDA

Affordable Housing

... and many more

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Thank You

Though

Yesterday was

Red, But

Tomorrow

must be Green

Together We Can and Together We Will...
References

- IS 3115:1992 – Specification for lime based blocks
- IS 10049: 1981 (Reaffirmed 2009) – Code of Practice for Manufacture of Lime Based Blocks
- IS 4098:1983 – Specification for lime-pozzolana mixture
- IS 10359:1982 – Code of practice for manufacture and use of lime- pozzolana concrete blocks for paving
- IS 10772:1983 – Specification for quick setting lime pozzolana
- IS 12654:1989 – Code of practice for use of low grade gypsum in building industry
- IS 12679:1989 – Specification for By-product gypsum for use in plaster, blocks and boards
- IS 3495:1992 – Compressive Strength of Brick