

# 246: HMA, Aggregate & Concrete Batching



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**Course Overview: Aggregate Plants**

- ◆ Introduction
- ◆ Emissions and Health Impacts
- ◆ Aggregate Industry
- ◆ Aggregate Process
- ◆ Engineering Evaluation
- ◆ Inspection Procedures



A smaller black and white photograph of an aggregate plant, similar to the one in the first image, showing the conveyor system and structural framework.

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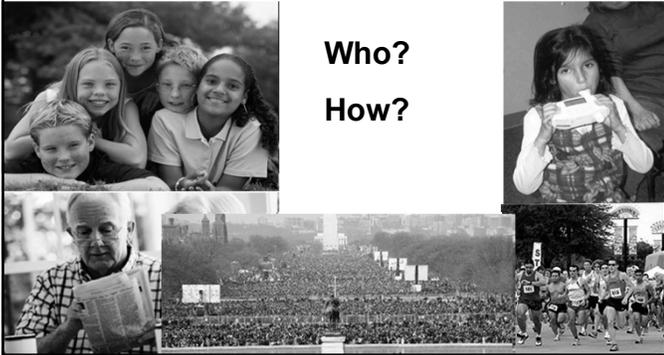
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# 246: HMA, Aggregate & Concrete Batching

## Emissions and Health Impacts



Who?  
How?

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## Emissions from Nonmetallic Mining

- **Particulate Matter**
  - PM, PM10 & PM2.5



- **Gases**
  - Toxic, Reactive,
  - CO, NOx & SOx

- **Asbestos & Heavy Metals**

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## Emissions from Nonmetallic Mining in California (tons/day)

Toxic Organic Gases (TOG)	0.22
Reactive Organic Gases (ROG)	0.15
Carbon Monoxide (CO <sub>2</sub> )	0.05
Oxides of Nitrogen (NOx)	0.10
Oxides of Sulfur (SOx)	0.01
Total Particulate Matter (PM)	25.19
Particulate Matter PM10	11.73
Particulate Matter PM2.5	4.46

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## How Small is PM?

Human Hair (60  $\mu\text{m}$  diameter)

Hair cross section (60  $\mu\text{m}$ )

$\text{PM}_{10}$  (10  $\mu\text{m}$ )       $\text{PM}_{2.5}$  (2.5  $\mu\text{m}$ )

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Hair	11 Microns and larger
Skin	7 to 11 Microns
Pharynx	4.7 to 7 Microns
Trachea	3.3 to 4.7 Microns
Primary bronchus	2.1 to 3.3 Microns
Secondary bronchi	1.1 to 2.1 Microns
Bronchioles	0.65 to 1.1 Microns
Alveoli	0.43 to 0.65 Microns

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## Health Effects of PM

The Filial have been damaged from particulate exposure

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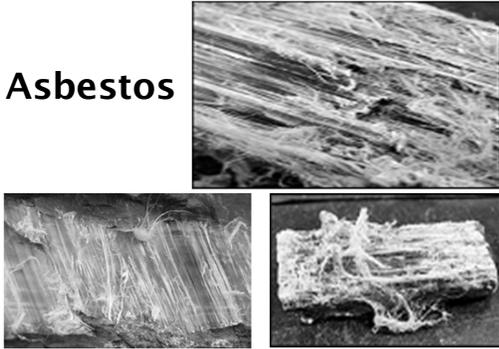
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## Emissions/Health Impacts

Asbestos



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## *Emissions/Health Impacts*

X-ray of a lung exposed to asbestos

Result:

Mesothilaoma



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## Health Effects of PM/PM2.5

- Aggravated asthma
- Respiratory Distress
- Decreased Lung Function
- Chronic Bronchitis

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# 246: HMA, Aggregate & Concrete Batching



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Aggregate, Mining, Industrial and Recycling

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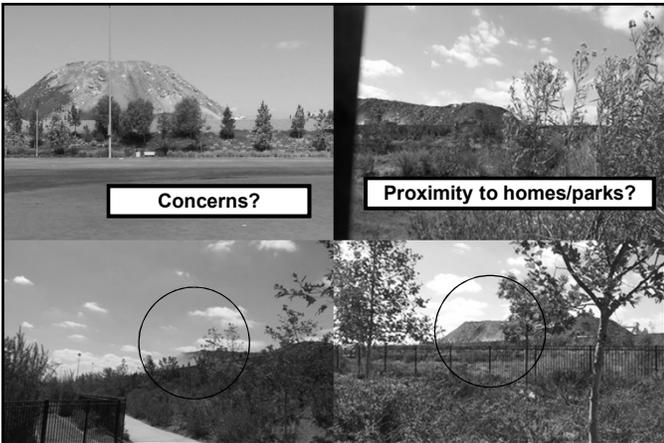
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**Concerns???**



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**Concerns???**



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**NOV?**



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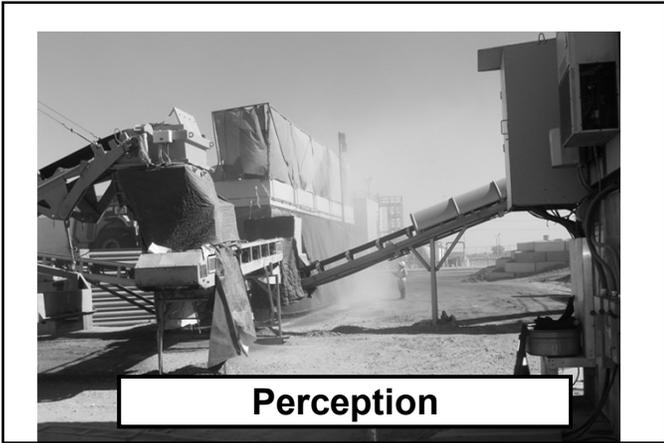
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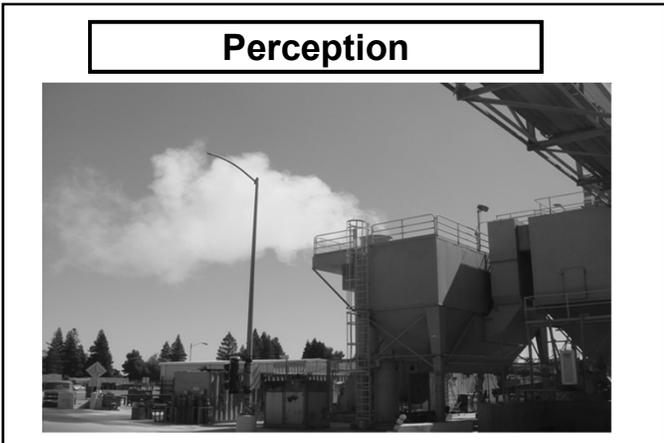
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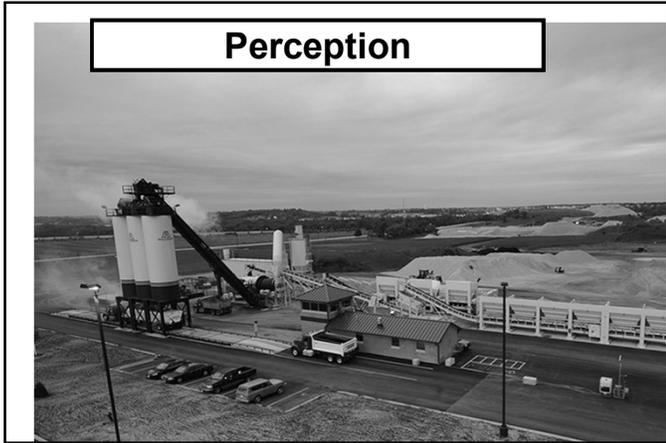
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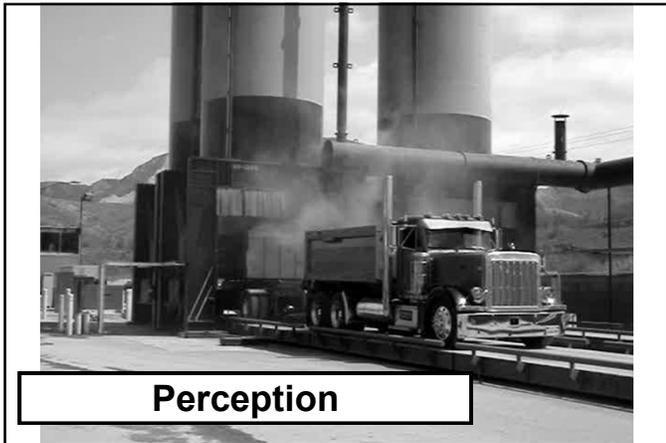
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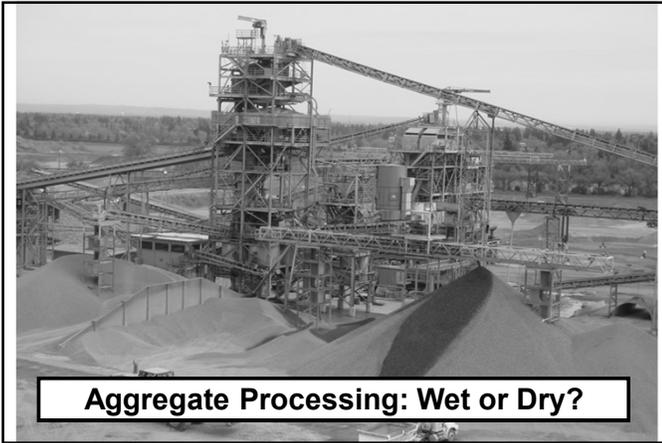
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**Aggregate Industry**



Definition of Natural Aggregate:

A material composed of rock fragment (sand, gravel, and crushed stone) that may be used in its natural state or crushed, washed and sized.

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## Aggregate Industry



### Sand and Aggregate are:

- Loose mineral and rock particles
- Transported by water and erosion

### Key Differences:

- Aggregate...passes through 2 inch screen
- Sand...passes through 1/4 inch opening (retained on a 200 mesh per square inch screen)

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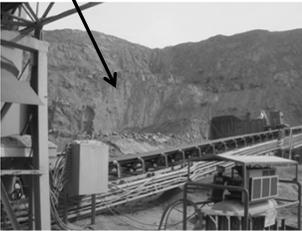
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## Aggregate Industry Type

Natural



Crushed by Mechanical Means



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Over the top??



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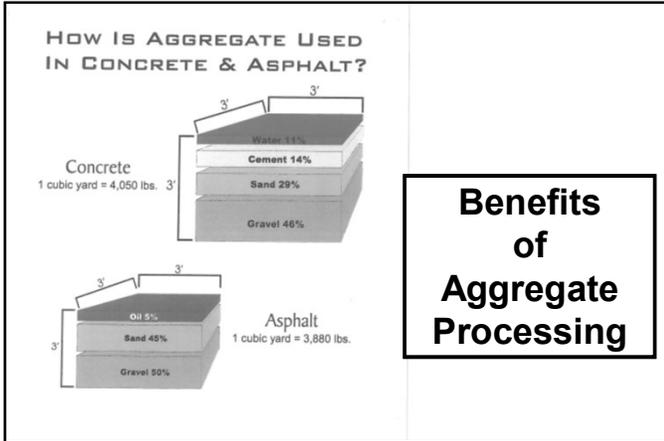
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# 246: HMA, Aggregate & Concrete Batching



Lack of Controls??

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## Emission Sources

### • Plant Generated Dust

- Drilling
- Crushing
- Conveying
- Screening
- Stockpiling



### • Fugitive Dust

- Geologic material generated by:
  - Wind
  - Human activity

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## Process & Controls

Emissions are measured by knowing

- How much aggregate is processed over time?
- How much moisture is in the material being processed?
- The control efficiency of the air pollution control device...

Resulting in:

- Total Emissions (mass based...pounds/day or tons/year)

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## Calculating Emissions

General equation from EPA AP-42 is:

$$E = A \times EF \times (1 - ER/100)$$

**where:**

- E = emissions
- A = activity rate
- EF = emission factor
- ER = % overall emission reduction efficiency



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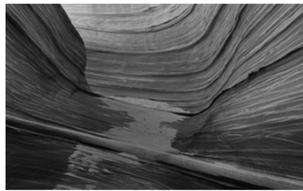
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## Aggregate Mining

- Two General Types:
  - Sand and Gravel & Crushed Stone



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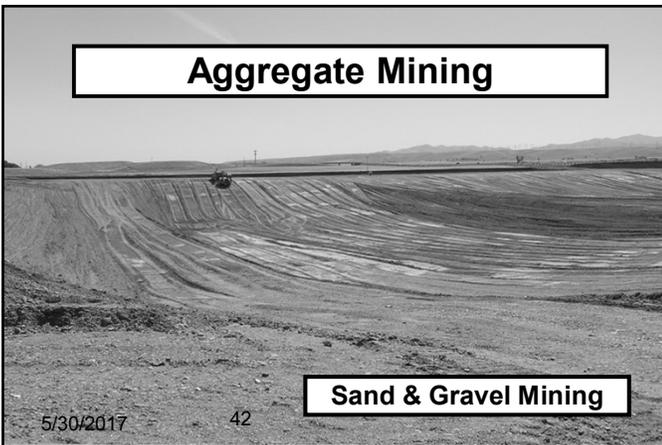
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## Aggregate Mining

**Sand & Gravel Mining**



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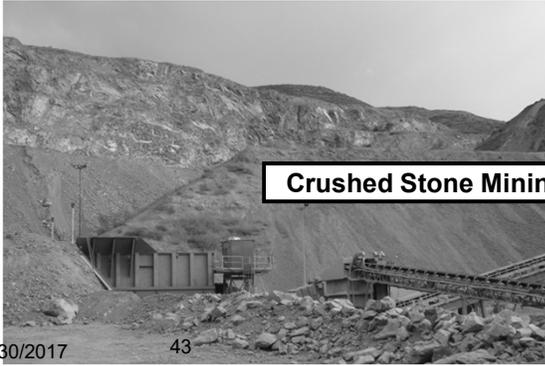
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## Aggregate Mining



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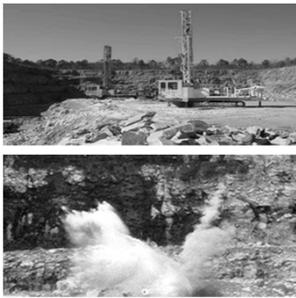
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## Crushed Stone Mining



• Drilling

• Blasting

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## Heavy Metals



- Associated with quartz or volcanic deposits
- Metals include nickel, cadmium and antimony
- Become airborne during blasting or crushing
- Questionable sources should be sampled for presence of heavy metals

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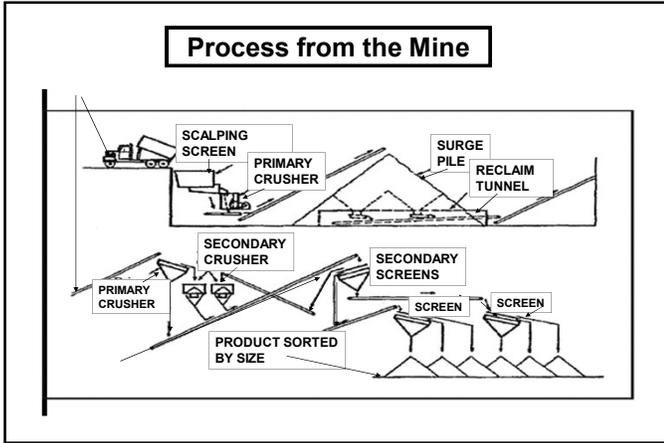
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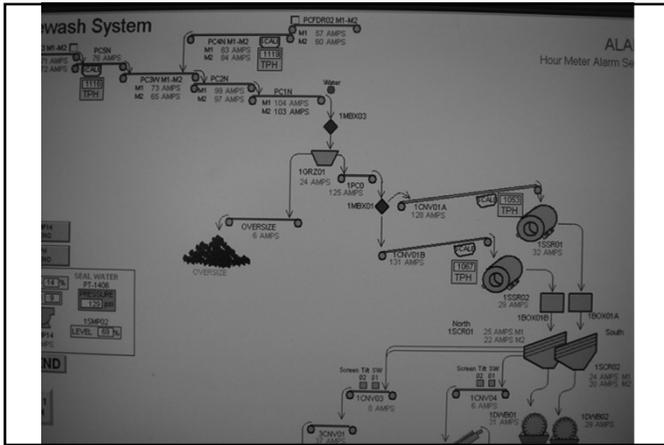
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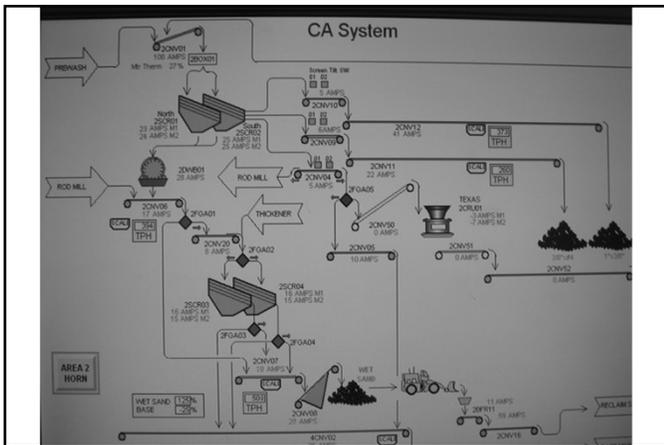
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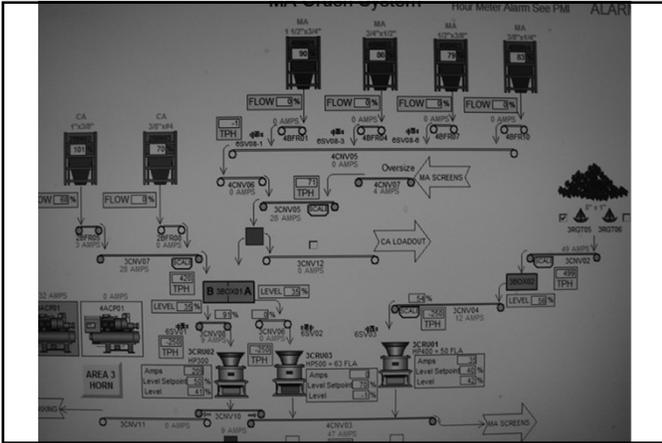


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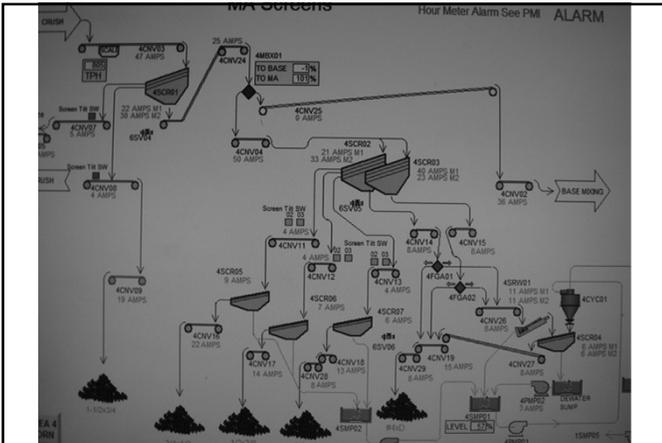
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# 246: HMA, Aggregate & Concrete Batching

## Aggregate Mining



Wash Plant with trommel screen

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## Aggregate Mining



Recycled Water from Wash Plant

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Wash Plant Screens & Truck Loadout

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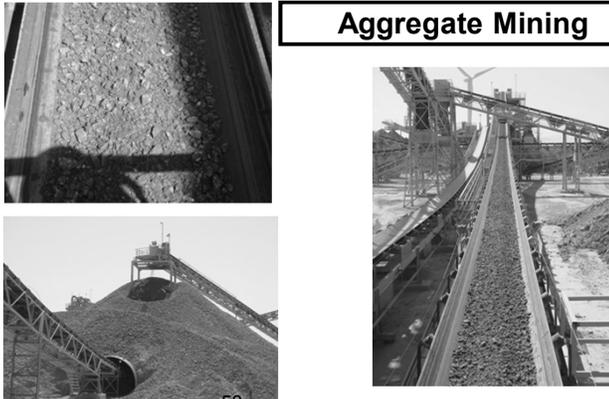
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**Aggregate Mining**



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**Process/Control, Crushing, Screening & Transfer Points**

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**Materials Handling**

- **Feeders/Conveyors**
  - Primary
  - Secondary
- **Crushers**
  - Primary
  - Secondary
  - Tertiary



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# 246: HMA, Aggregate & Concrete Batching

## Feeders

**Feeders are used to:**

- Absorb the impact from dumping large quarried stone
- Feed the plant with a controlled, steady stream of raw material Used to handle muddy or sticky material
- They are located ahead of large, stationary primary crushers




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## Application of Feeders

APPLICATION OF FEEDERS TABLE – 2A

DUTY	RECOMMENDED TYPE
Truck dumping or direct loading by Dozer, Shovel or Dragline. Maximum lump size not to exceed 75 percent of feeder width.	Super Heavy-Duty Apron Feeder with manganese flights.
Under hopper or bin, handling non-abrasive material. Maximum lump size not to exceed 75 percent of feeder width.	Super Heavy-Duty Apron Feeder with pressed steel flights.
Truck dumping or direct loading by Dozer, Shovel or Dragline. Maximum lump size not to exceed 75 percent of feeder width.	Heavy-Duty Apron Feeder
Under hopper or bin, handling non-abrasive material. Maximum lump size not to exceed 30 percent of feeder width.	Heavy-Duty Apron Feeder
Under Primary Crusher to protect belt conveyor.	Vibrating Feeder or Grizzly Feeder.
Under bins, hoppers or storage piles. Maximum lump size not to exceed 30 percent of feeder width.	Belt Feeder
Under Large Primary Crushers.	Heavy-Duty Apron Feeders

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## Feeders & Conveyors




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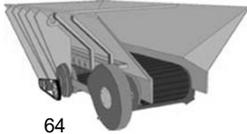
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## Apron Feeders

Apron feeders are used where:

- Extremely rugged machines handling large feed are required
- Used to handle muddy or sticky material
- They are located ahead of large, stationary primary crushers



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## Vibrating Feeder & Vibrating Grizzly Feeders

These feeders are used where:

- Used where a compact feeder with variable speed control is required
- Vibrating Grizzly feeder is similar plus grizzly bars for separating fines the crushed feed
- They help bypass fines around the primary crushers increasing production & reduces crusher liner wear.



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## Vibrating Grizzly Feeders

- Grizzly
  - Vibrating Grizzly



- Step deck Grizzly



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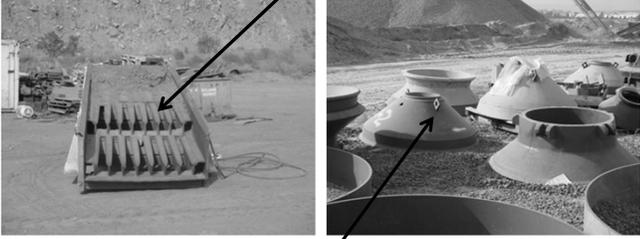
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**Vibrating Grizzly Feeders**



**Reduces crusher liner wear**

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**Grizzly Feeder**



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**Grizzly Feeder**



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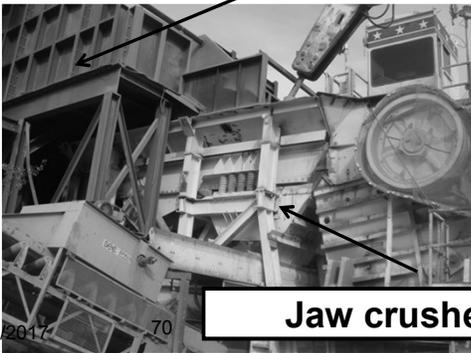
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## Vibrating Grizzly Feeders



Jaw crusher

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## Belt Feeders

**Belt feeders are used:**

- Under a hopper or trap with 6" maximum feed size
- They have an infinite variable speed control for optimum plant feed rate



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## Belt Feeders & Conveyors



Feeder with Spray bar

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# 246: HMA, Aggregate & Concrete Batching

**Vibrating Pan**



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**Primary Conveyor**



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**Wobble Feeder**

- Combined feeder and scalper
- Effective in handling clay or fine sticky feed material



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# 246: HMA, Aggregate & Concrete Batching

**Wash Plant**



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**Wash Plant**



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**Wash Plant w/trommel screen**



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# 246: HMA, Aggregate & Concrete Batching

**Recycled Water from Wash Plant**



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**Wash Plant Screens & Truck Loadout**



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**Wash Plant**



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# 246: HMA, Aggregate & Concrete Batching

**Secondary Wash**



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**Conveyors**



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**Conveyors**



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# 246: HMA, Aggregate & Concrete Batching

**Conveyor with Baghouse**



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**Conveyor Baghouse**



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**Conveyor Belt Feeder**



• Conveyor Belt



• Belt feeder with adjustable feed gate

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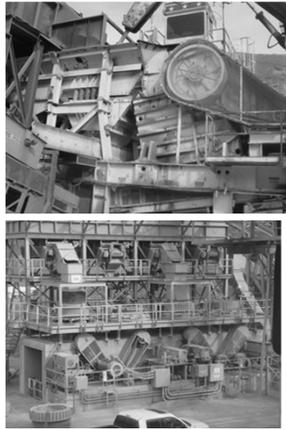
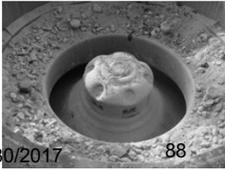
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# 246: HMA, Aggregate & Concrete Batching

## Crushing

- Fracture Mechanisms
- Crushing Equipment
- Factors Influencing Crushed Product



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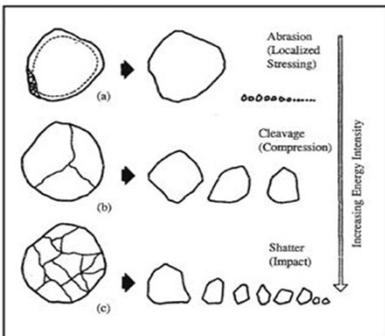
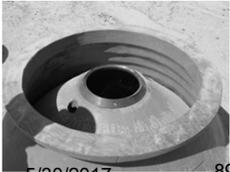
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## Fracture Mechanisms

### Particle Breaking:

1. Abrasion
2. Cleavage
3. Shatter



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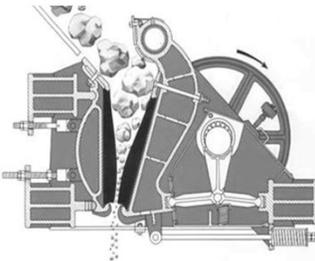
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## Primary or Jaw Crusher



### Jaw Crusher



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## Jaw Crusher



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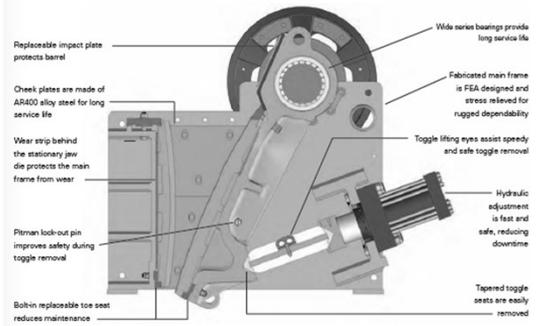
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## Jaw Crusher



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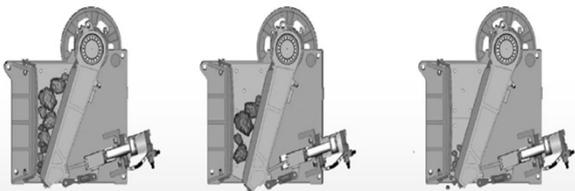
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## Jaw Crusher



During normal crushing, hydraulic cylinders hold the toggle beam forward.

Clearing is achieved using push button controls. Cylinders retract the toggle beam and pitman, allowing the stone to fall.

Cylinders push the toggle beam and pitman forward, crushing the remaining tone. Cycling through this process a few times clears the chamber.

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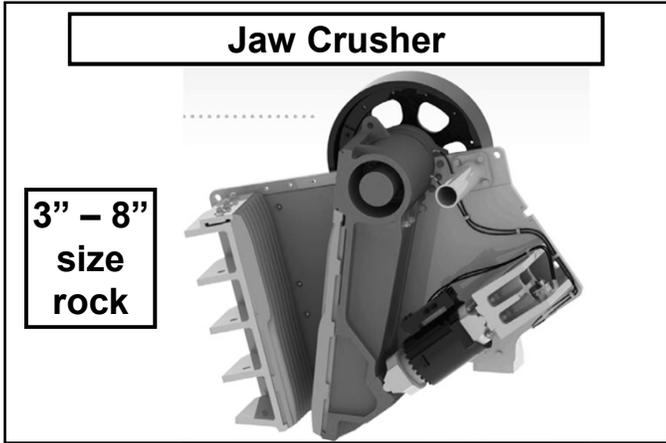
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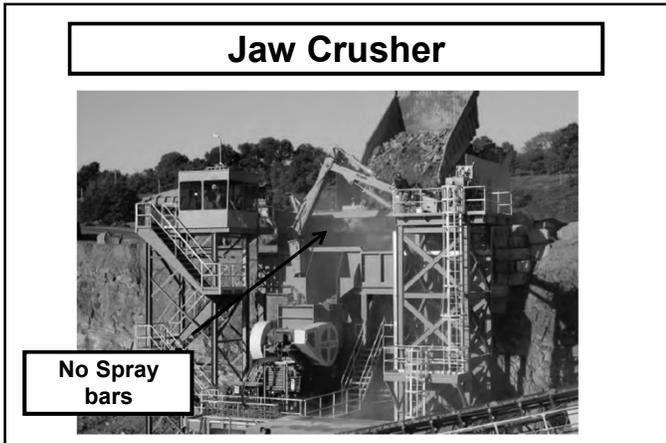
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# 246: HMA, Aggregate & Concrete Batching

**Jaw Crusher**



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**Cone Crusher**



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**Cone Crusher**



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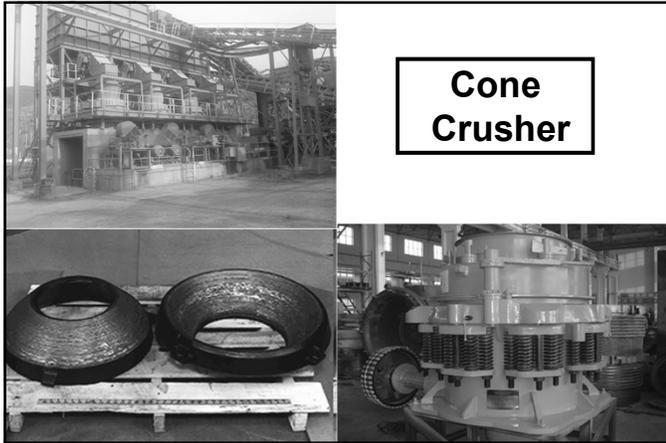
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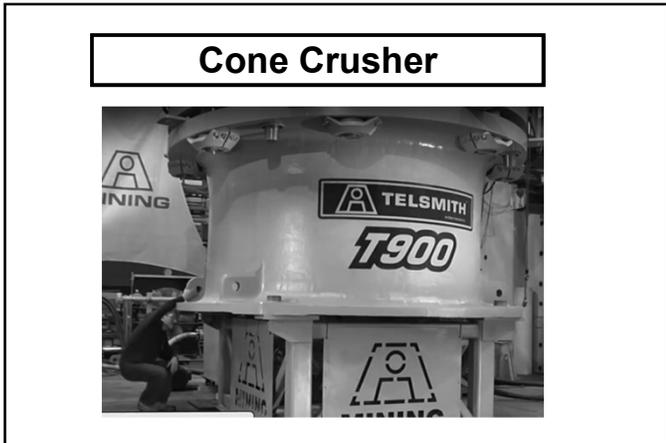
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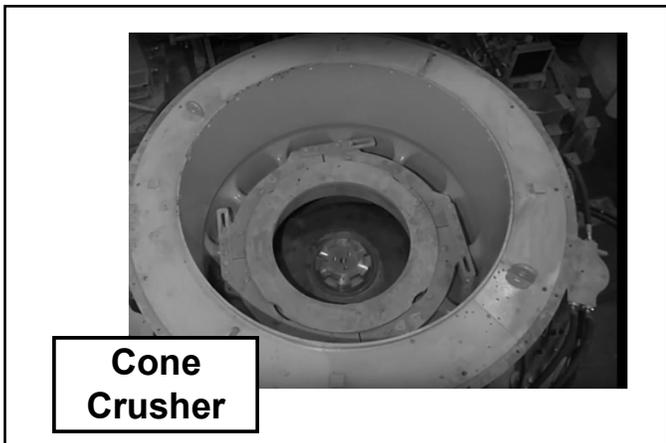
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# 246: HMA, Aggregate & Concrete Batching

## Cone Crusher

**2"**

**1 3/4"**

**1 1/2"**

**1 1/4"**

**1"**

**3/4"**

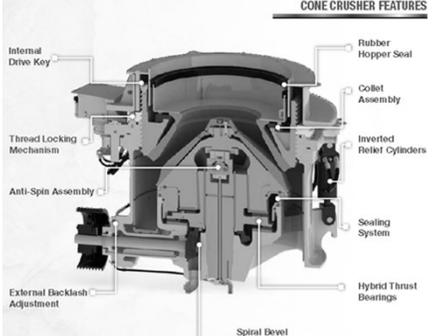
**5/8"**

**1/2"**

**3/8"**

**size**

**rock**



CONE CRUSHER FEATURES

- Internal Drive Key
- Rubber Hopper Seal
- Thread Locking Mechanism
- Collar Assembly
- Anti-Spin Assembly
- Inverted Relief Cylinders
- External Backlash Adjustment
- Sealing System
- Spiral Bevel Gear & Pinion
- Hybrid Thrust Bearings

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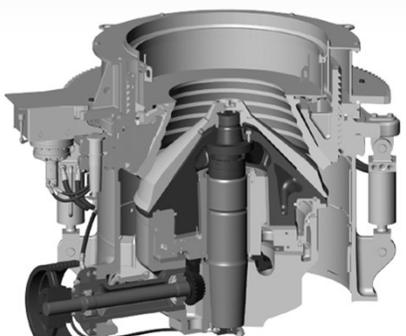
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## Cone Crusher



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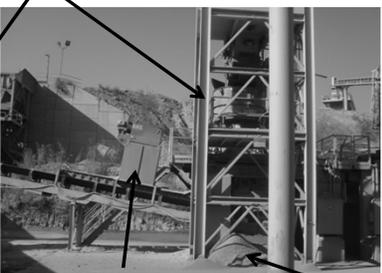
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## Cone Crusher

**Baghouse**

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# 246: HMA, Aggregate & Concrete Batching

## Impact Crusher



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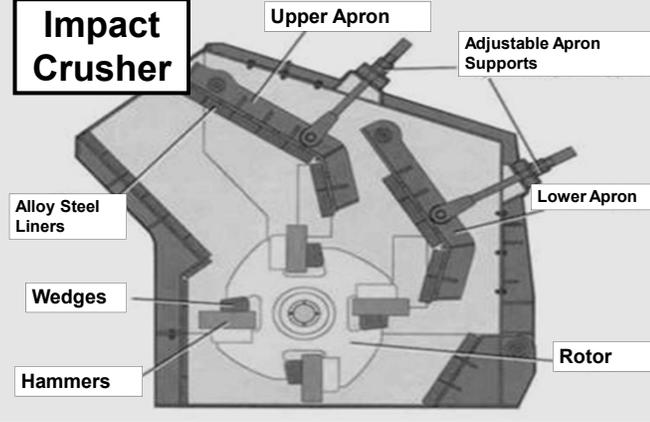
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## Impact Crusher



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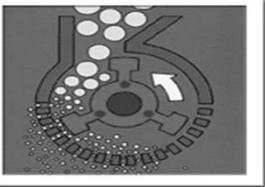
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## Tertiary Crusher

### Hammer Mill



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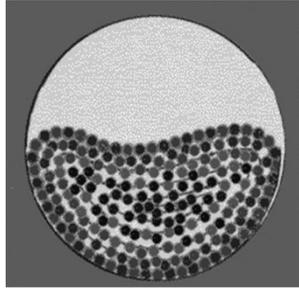
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# 246: HMA, Aggregate & Concrete Batching

## Grinding Mill or Ball Mill

- Dry ball mills most popular, due to economics
- Used for finer material separation



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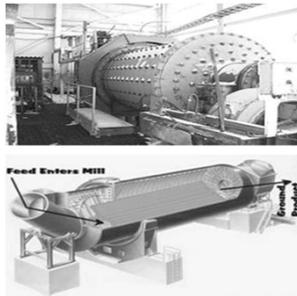
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## Grinding Mill or Ball Mill

- Media are rods or balls
- Rods are for coarse-like manufactured sand or cement klinker



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## Screening Operations

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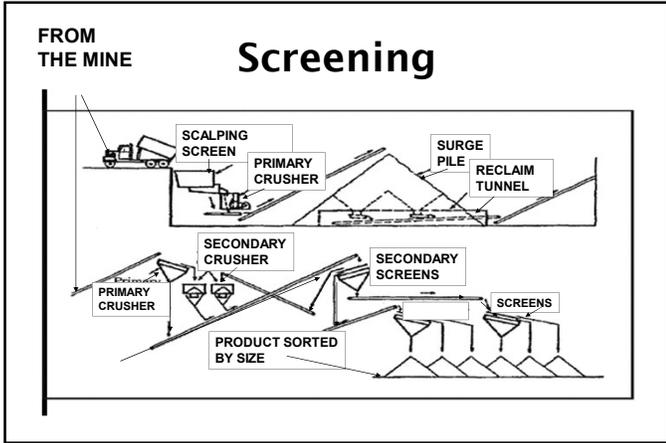
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# 246: HMA, Aggregate & Concrete Batching



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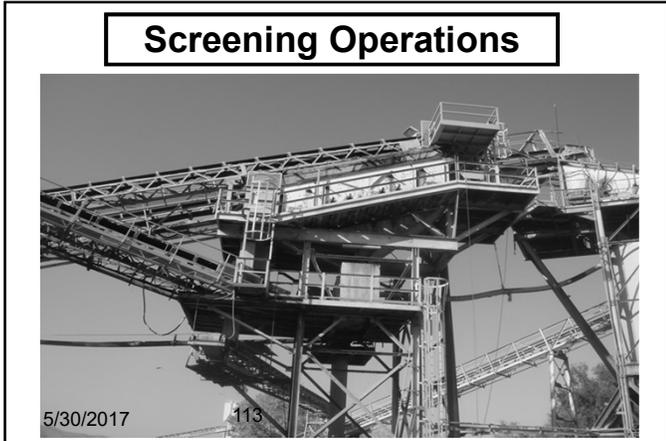
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# 246: HMA, Aggregate & Concrete Batching

## Screening Operations



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## Screening Operations



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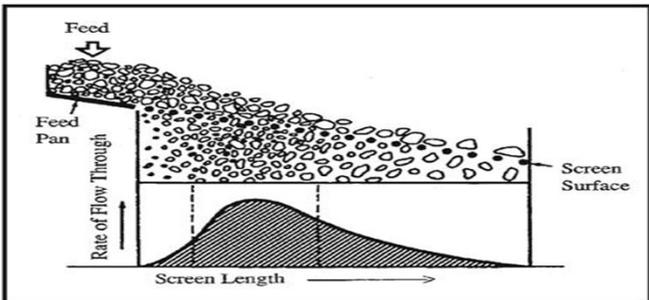
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## Screening Surface



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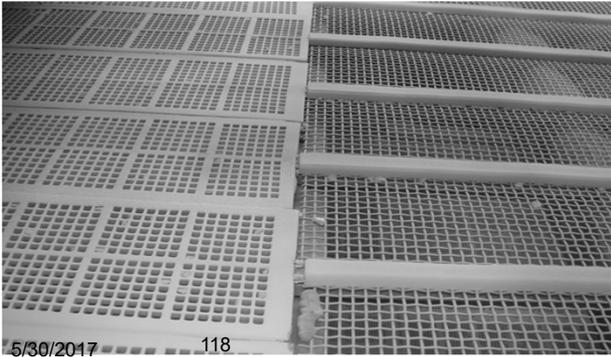
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# 246: HMA, Aggregate & Concrete Batching

**Screening Operations**



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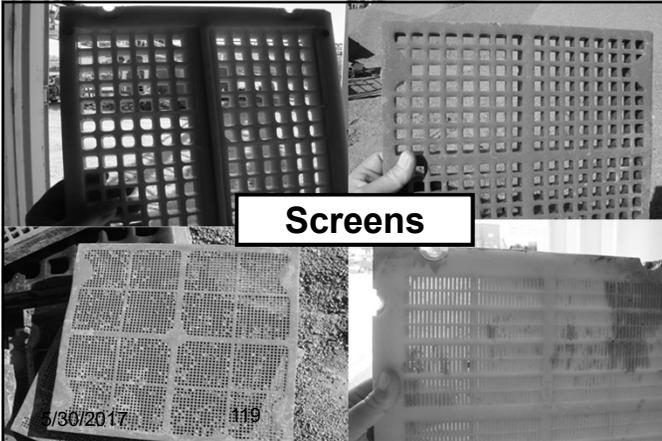
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**Screens**



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**Screening Operations**



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# 246: HMA, Aggregate & Concrete Batching



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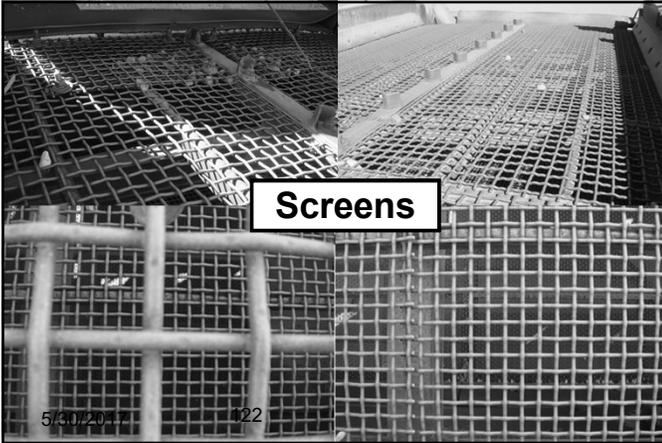
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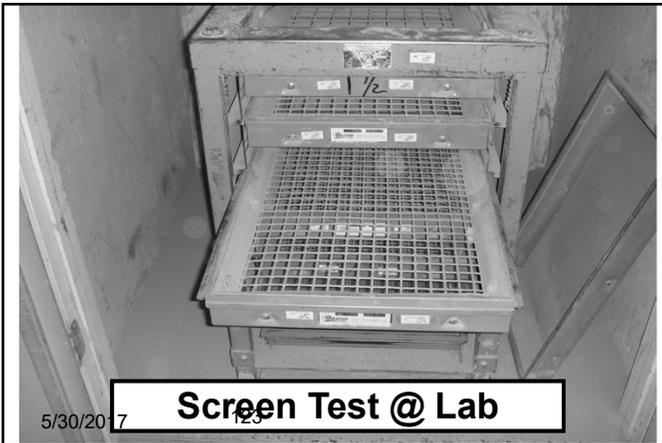
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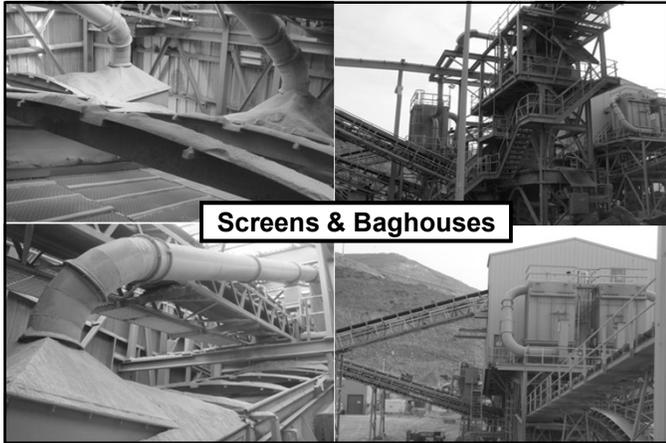
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# 246: HMA, Aggregate & Concrete Batching



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## Point Emissions

- **Point emissions originate from stacks**
  - Control Devices
  - Where aggregate is dried
- **Stack emissions**
  - Moisture
  - Gases
  - PM/PM10/PM2.5
  - All of the above



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## Point Emissions



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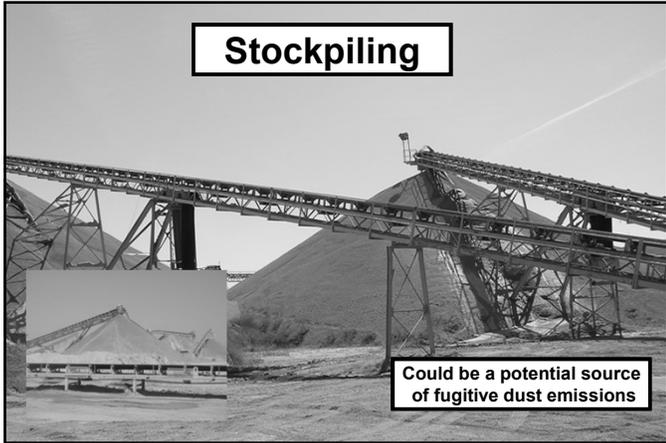
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# 246: HMA, Aggregate & Concrete Batching



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# 246: HMA, Aggregate & Concrete Batching

## Air Pollution Control Measures

- **Preventative Measures**
  - Passive Enclosures
  - Wet/Chemical Suppression
  - Paved Surface/Cleaning
- **Dry Collection Systems**
  - baghouse
  - cyclone



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## Process & Control Measures

### Control

Moving conveyors  
or trucks (Passive  
control is wind  
screens

### Operations

Crushing (active control  
is water)

Transfer (active control  
is water)

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## Air Pollution & Control Measures

- Water sprays
- Enclosure or cover at transfer points and screening operations
- Maintaining good housekeeping
- Exhausting air to air pollution control systems
- Covers

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# 246: HMA, Aggregate & Concrete Batching

## Preventative Measures

- Passive enclosures
- Wet suppression
- Stabilization of unpaved surfaces
- Minimizing drop height
- Paved surfaces cleaning
- Work practices
- Housekeeping



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## Preventative Measures



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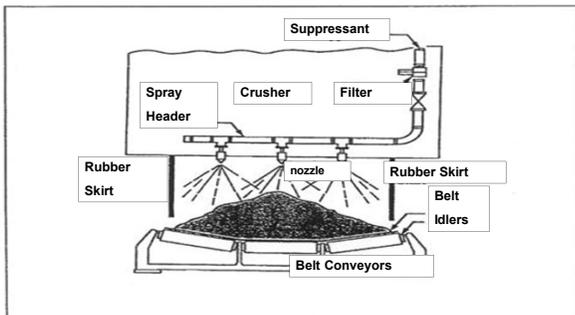
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## Preventative Measures



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# 246: HMA, Aggregate & Concrete Batching



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## Dry Collection Systems



Baghouses are regulated in terms of:

- Grains/cubic foot or air emitted (gr./dscf)
- Pounds/Ton of Aggregate produced
- Opacity

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**Baghouse  
in  
Disrepair**

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# 246: HMA, Aggregate & Concrete Batching

## Combination Systems

- **Dry collection and wet suppression**
  - When fine particulates have an economic value in addition to meeting air pollution control laws
  - Due to screen blinding
  - Due to plant location or local pollution control codes, which is not economically feasible

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## Other Processing Equipment

- Rock Breaker
- Magnets
- Metal Detectors
- Pugmills
- PERP Equipment
- Washing equipment
- Rotary Scrubber
- Wet Classifiers
- Pumps
- Grinding Mills

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## Inspection Objectives

Determine compliance with:

- ◆ District regulations & permit conditions
- ◆ Fugitive dust
- ◆ Visible emissions
- ◆ Oxides of nitrogen (for fuel burning equipment)
- ◆ Control devices

## Pre-Inspection

- Regulation Review
- Equipment Check
  - Safety goggle and earplugs
  - Safety shoes, hard hat, and gloves
  - ID and business cards

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# 246: HMA, Aggregate & Concrete Batching

## Pre - Inspection File Review

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1. Permit application             | 6. NTC/NOV                   |
| 2. Approved permit                | 7. Compliance action         |
| 3. Equipment                      | 8. Complaints                |
| 4. Permit condition for each unit | 9. Variance history          |
| 5. Previous inspection reports    | 10. Abatement orders         |
|                                   | 11. Date of last source test |

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## Pre - Entry & Entry

- Observe the site
  - Note odors or visible emissions
  - Size and layout
  - Environmental demeanor
- ID potential problem areas
- Enter through normal public access
- Introduce yourself, ask to see contact listed in file, & present business card



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## Pre - Inspection Meeting

- |   |  |
|---|--|
| • State purpose of inspection and identify equipment to be inspected  | • Date of last breakdown   |
| • Obtain: <ul style="list-style-type: none"><li>- company name, ownership, address, contact name</li><li>- operating schedule, date of last source test, fuel usage</li></ul> | • Status of: <ul style="list-style-type: none"><li>- dust suppression equipment</li><li>- Air pollution control equipment</li><li>- Monitoring and recording devices</li></ul> |
| • Discuss any outstanding business  | • Check Permit   |

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# 246: HMA, Aggregate & Concrete Batching

## Non - Compliance

A NTC/NOV is issued when the permit is not:

1. Current or no permit
2. Posted properly
3. Or conditions on permit are not followed
4. Blatant disregard



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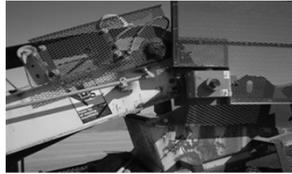
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## Post - Inspection

- Make compliance determination
- Inform site of inspection (NOVs, and advise on areas of concern
- Document pending NOVs due to additional info request etc.



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## Safety



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