

PLANT PROCESS & AGGREGATE GRADATIONS

What is an aggregate gradation and why is the aggregate gradation so important in our industry?

What is Aggregate Gradation?

Aggregate gradation refers to the distribution of particle sizes within a sample of aggregate. Essentially, it measures the range of sizes that make up the material, ensuring that a proper balance of fine and coarse particles is achieved.

PLANT PROCESS & AGGREGATE GRADATIONS



Product Pile - Indiana DOT - 11

Grading	%Pass	%Min	%Max	%Ret	TPH
1/2		100	100	0	0
3/8		75	95	0	0
#4		10	30	0	0
#8		0	10	0	0
	0	0	0	100	0
Total		--	--	100	0

PLANT PROCESS & AGGREGATE GRADATIONS

Why is the gradation of aggregate important?

- **Compaction and Density:** A well graded aggregate mix can be compacted to a higher density, reducing air voids and improving structural integrity.
- **Workability:** The right gradation improves workability, reducing cement/asphalt consumption and ensuring the final product performs well under load
- **Stability and Strength:** Gradation affects the structural integrity of materials like concrete or asphalt. Well graded aggregates contain a balanced mix of particle sizes, create stronger, more stable mixes. Well graded mixes reduce voids and improve interlocking between larger and fine particles, resulting in higher compressive strength and reduced shrinkage.

3

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

Unbalanced Plant

- **Mismatched primary, secondary, tertiary crushing stages.**
 - Down stream crusher can not keep up with the upstream station and its volume. Causing stopping and starting of the upstream station.
 - Black belt situations occur
 - Crushers run empty, then choke feed, then empty
 - Many solve this issue by running the crushers at a lower percentage of their “full” capacity to keep the entire plant under some type of load. Therefore, some crushers are only seeing 80% or 70% of their designed capacity.

4

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?



5

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

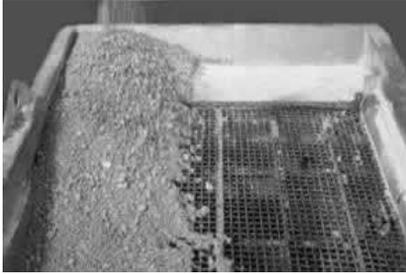
Inefficient Screening

- Open area of the screen is not sufficient for the feed gradation.
- Worn springs on screen. Springs too stiff for the mechanical design of the screen.
- Wrong speed and stroke combination for the application
- Media-fatigue. Improper Installation of the media.
- Worn v-belts (or not running proper quantity of v-belts)
- Failing motor
- Unbalanced screen
- Loose anchor bolts—action of the screen is being absorbed by movement in the structure
- Improper feeding (feed distribution) onto the screen

6

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?



7

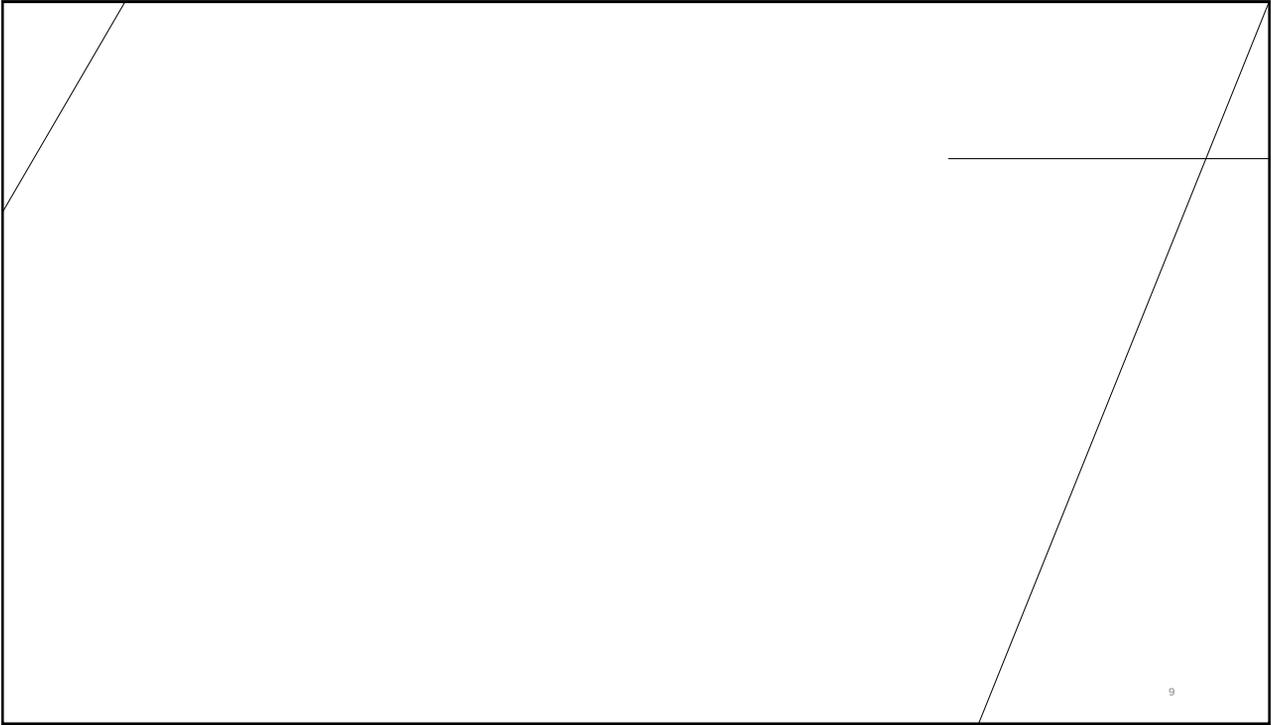
PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

Contamination by spillage

- Belt scrapers-You might have one but is it even contacting the belt.
 - “my belt scraper lasts a long time, no issues”
- Skirting-skirting systems
- Torn or off-track belting
- Transfer point containment

8



PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?



PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?



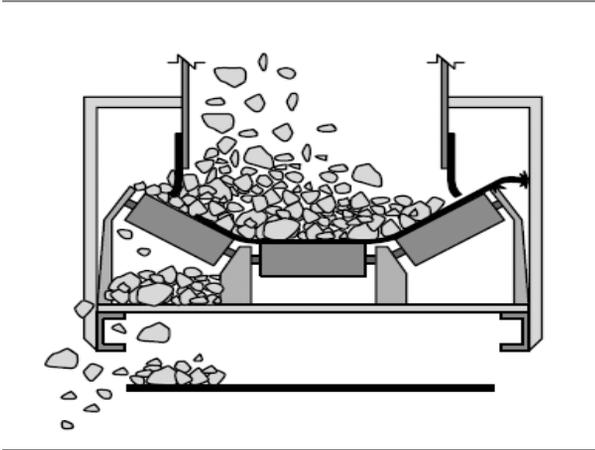
11



12

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?



13

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

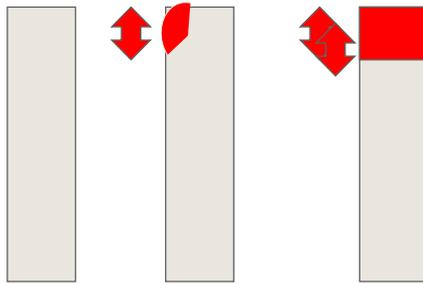
Wear parts in crushing chambers

- Cone liners (mantle and concave) need to be changed and maintained.
 - “you should not use a worn liner with a new liner”
- Impactors—are you crushing with impact or grinding. Just because the blow bar is square doesn't mean it isn't worn
- Maintaining proper crusher settings as manganese wears—proper jaw adjustment

14

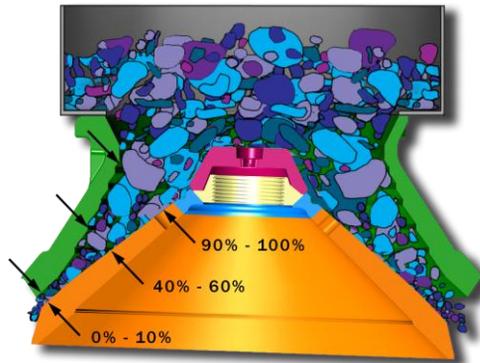


ONE EXAMPLE: UNDERSTANDING BLOW BAR WEAR, SPEED, SETTING



15

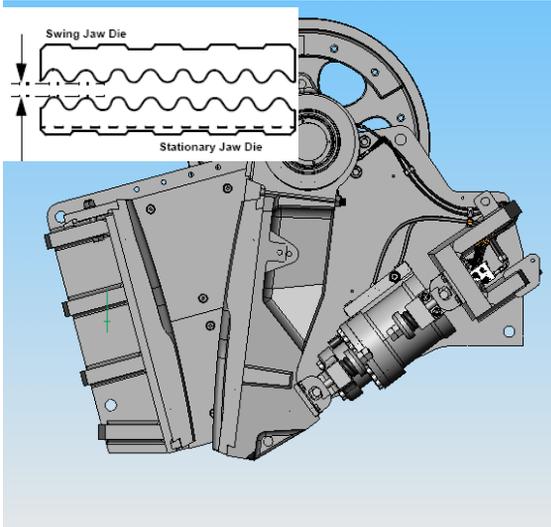
PICK THE CORRECT LINERS, THEN FEED CORRECTLY. EVENLY GRADED FEED



- Well Graded Feed:
 - 90 to 100 percent passing the closed side feed opening.
 - 40 to 60 percent passing the mid point of the crushing chamber.
 - 0 to 10 percent passing the crusher setting.

16

CSS – CLOSED SIDE SETTING JAW CRUSHER



- 3.5" – 7.0" at Rest
- Less 1" (mfg specific)
- = 2.5" – 6.0" CSS

17

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

Dust and moisture

- If dust is not contained it will get into other products in your system
- Dust control-some operations run more water at certain times than other times. There are various reasons for this but inconsistency in moisture of material is a factor that needs to be managed when dealing with gradations. (scrapers, carry back, screen blinding etc.)

18



19

PLANT PROCESS & AGGREGATE GRADATIONS

What plant processes affect aggregate gradation?

Conveyor transfer points

- The height and design of transfer points can either cause contamination or further breakage of the material after screening
- Stacker height
 - coarse particles roll to the pile edges while fines concentrate in the center.
 - Large particles travel farther while smaller particles drop sooner.

20

PLANT PROCESS & AGGREGATE GRADATIONS

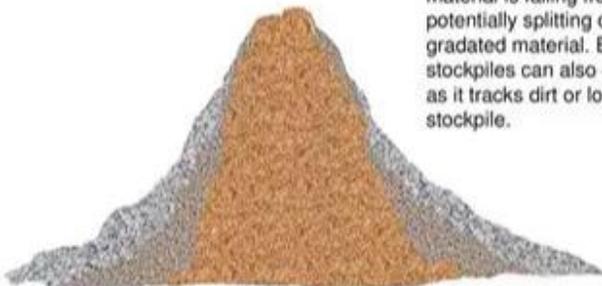
What plant processes affect aggregate gradation?

Loader Operator

- Loading customer trucks
- Loading haul trucks

21

Stockpiles that stack traditionally can segregate, with **coarser material falling to the bottom/outside, and finer material remaining in the center and top**. Degradation can occur if loaders or dozers drive onto the stockpile, or if material is falling from a great height — potentially splitting or crushing the gradated material. Equipment driving on stockpiles can also cause contamination, as it tracks dirt or loose material onto the stockpile.



22



BREAKING DOWN OF THE MATERIAL BY LOADER/DROP HEIGHT

