Stockpile Sampling

THEORY ABOUT FORMATION OF STOCKPILES

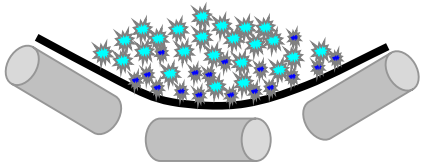


Figure 1

① Vibration causes fines to settle on belt, causing coarser material to be thrown farther by head pulley. (See Fig. 1)

② Coarse material segregates and rolls to outside and bottom of pile.
Fines tend to fall straight down and travel a shorter distance as they fill in voids between coarse particles. (See Fig. 2)

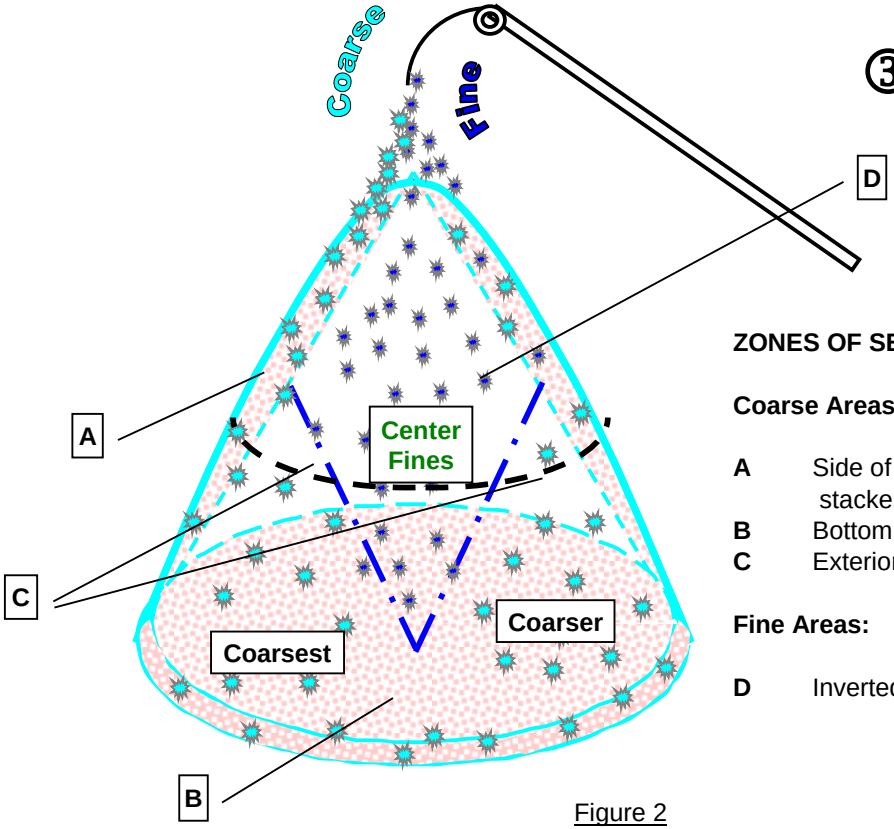


Figure 2

③ As the pile grows in size, the fines continue to accumulate at the center of the pile, in the form of an inverted cone. (See Fig. 3)

ZONES OF SEGREGATION:

Coarse Areas:

A Side of stockpile farthest from stacker (in this case left side).
B Bottom of pile.
C Exterior surface of pile.

Fine Areas:

D Inverted cone within center of pile.

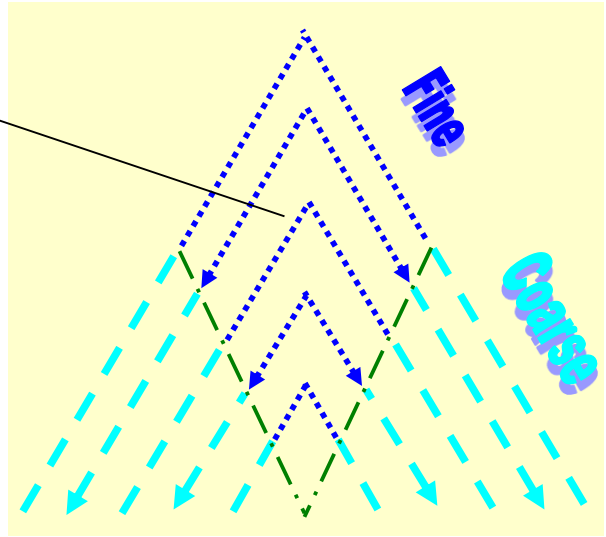


Figure 3

Stockpile Sampling

GOALS OF SAMPLING:

A. Choose sampling locations that are representative of area being sampled, such that composite sample is representative of overall pile.

B. Avoid sampling areas that are highly segregated

C. Meet requirements of AASHTO T2.

OBJECTIVES IN SAMPLING:

Choose representative locations:

1. Select sampling location perpendicular to the direction of the stacker. (See Fig. 4)

Common Error: Opening the face while the stacker is still depositing material.

Face must be in-active during sampling, in order to obtain a representative sample.

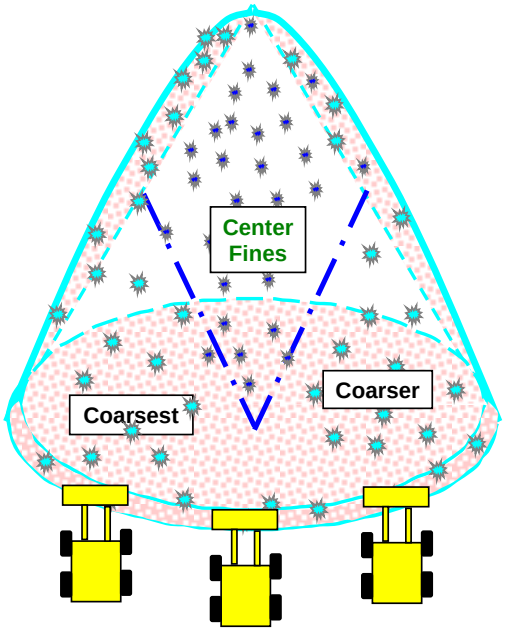


Figure 5

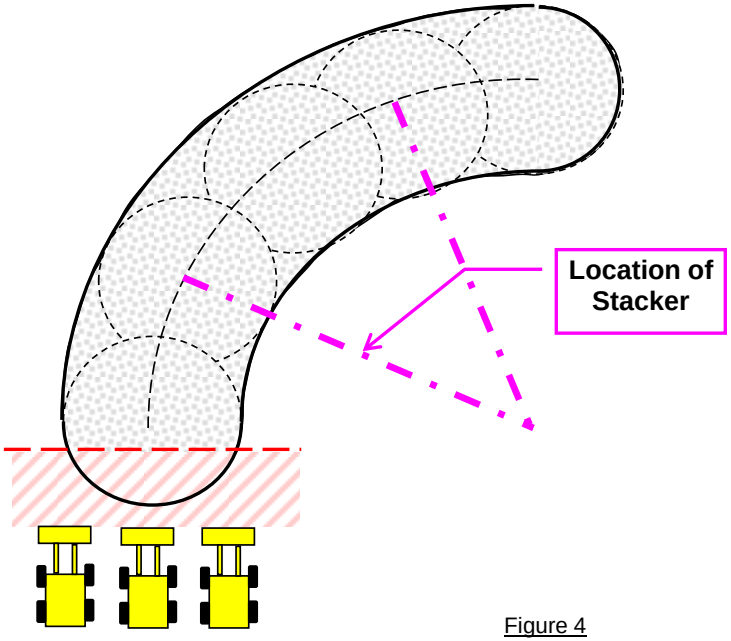


Figure 4

2. Remove material from bottom of the pile, across the entire cross-section of the stockpile. (See Figs. 4 & 5)

Common Error: Only removing material from the three areas to be sampled.

This allows material to flow from surrounding area into the area to be sampled. If the size of the pile prohibits opening the entire face, the inspector should have enough area removed (minimum 2 bucket widths) so that surrounding area does not flow into area to be sampled.

Common Error: Placing discarded material in way of area to be sampled.

Material may be set off to side or loaded into trucks as face is opened.

Stockpile Sampling

OBJECTIVES IN SAMPLING:

Choose representative locations: (continued)

3. Repeat **Step 2** - Remove a second bucket of material from the bottom of the pile, across the entire cross-section. (See Fig. 6)

Common Error: Only removing one bucket of material from the face before taking the sample.

A minimum of two buckets must be removed to assure a representative sampling location.

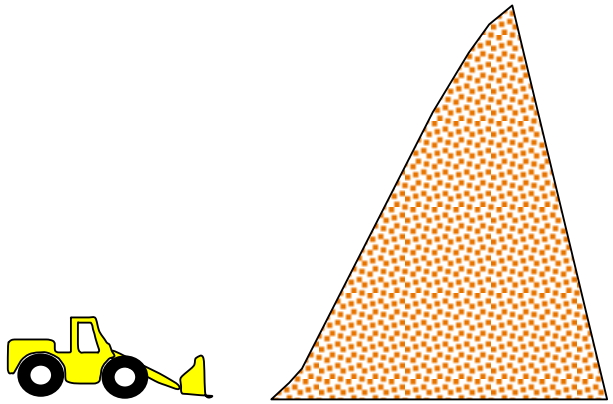


Figure 6

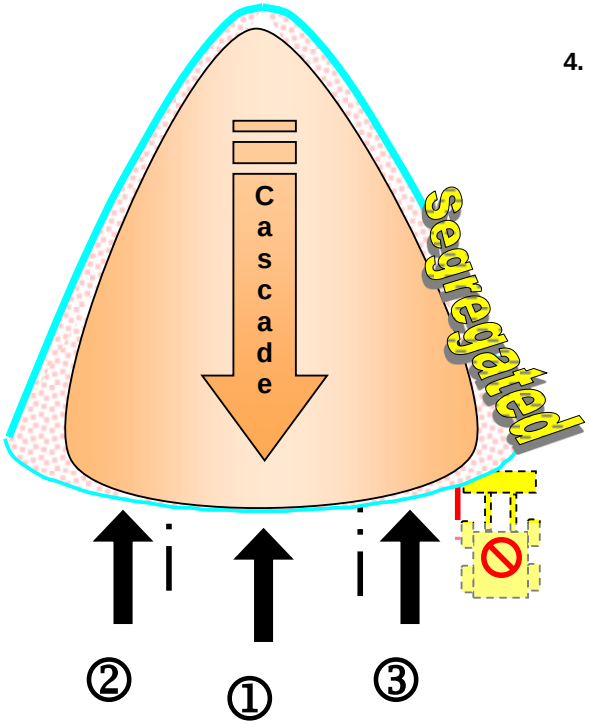


Figure 7

4. Continue to remove material from across the entire face, as necessary, to cause material from the top of the pile to cascade down to the bottom. (See Fig. 7)

Common Error: Only removing the minimum number of (two) buckets, even though the material has not cascaded.

The initial removal of material is to remove the exterior surface of the pile. However, it is still necessary for the material to cascade, so that the sample will include material from top, middle and bottom.

5. Select location of sampling points - middle, left and right. (See Fig. 7)

Use the following guidlines when picking sampling locations:

A. Sample middle location first - it will define limits of remaining areas.
B. Avoid area within one bucket width of outside edge of pile - this area is highly segregated.
C. Sampling points on left and right sides should be as close to the center of the outer one-third sections as possible, without getting into segregated material.

Common Error: Sampling off to one side of center, or sampling from same section more than once.

Both of these situations can generally be avoided by sampling the center of the stockpile first.

Stockpile Sampling

OBJECTIVES IN SAMPLING:

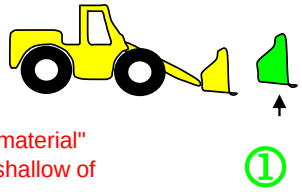
Obtain a representative portion of material:

6. Have front end loader take out one bucket from each location.
Loader operator should: (See Fig. 8)

① Raise bucket approximately 1 1/2 feet above ground.

② Drive straight in to pile.

③ Scoop up material parallel with face.



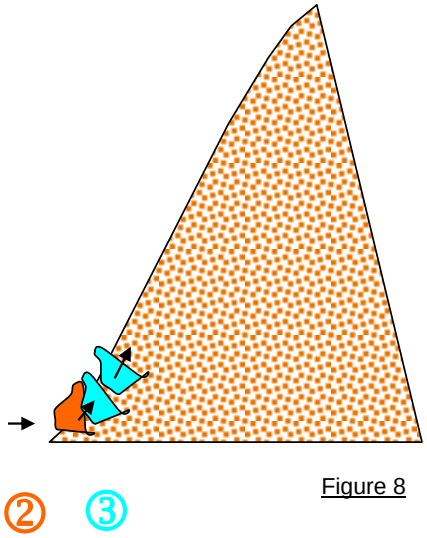


Figure 8

Common Error: Loader operator does not raise the bucket up 1 1/2 ft, causing bucket to fill with "toe material" prior to getting to the sample area, or causing to shallow of a scoop while lifting the bucket.

Preparing the sampling pads:

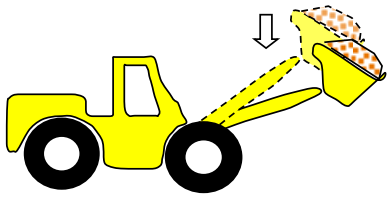


Figure 9

7. Loader operator backs away from pile and lowers bucket as low as possible. (See Fig. 9)

Common Error: Poor positioning of bucket either allows too high a drop, or a bucket position that does not allow the operator to see what he is doing.

It is very important that the loader operator be able to determine when the following procedure is being performed correctly.

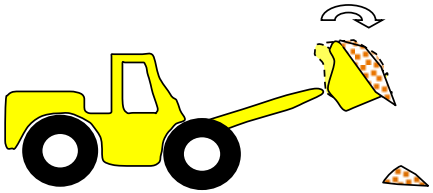


Figure 10

8. Operator stops loader and **slowly** tilts bucket until material begins to fall. (See Fig. 10)

Common Error: Loader is still moving as material is dumped and/or bucket is dumped too quickly.

This is the most common problem with creating the sampling mini-stockpiles. This sampling theory assumes that the center of the pile is built-up over time and is representative of the bucket's contents. Any momentum will tend to segregate the material from its desired make-up.

Stockpile Sampling

OBJECTIVES IN SAMPLING:

Preparing the sampling pads: (continued)

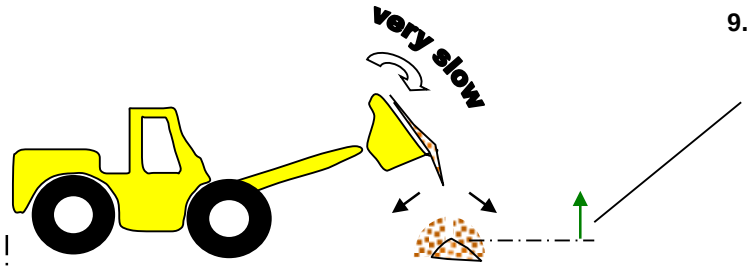


Figure 11

9. From here, the loader operator must dump the material so that it slowly breaks, equally, to both sides of the mini-stockpile. **This allows the center of the pile to build up over time.** (See Fig. 11)

Common Error: Material is dumped so that it falls primarily to one side.

The inspector can assist the operator by standing to the side of the pile and giving him feedback when the material is falling correctly.

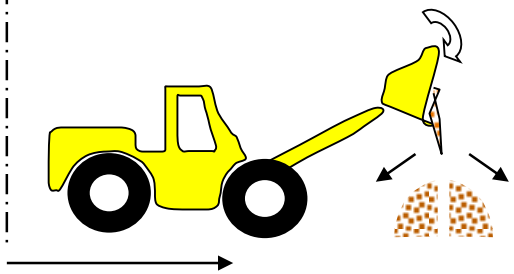


Figure 12

10. As the material is dumped, the loader operator must pull forward to keep the material falling over the center of the pile. (See Fig. 12)

The inspector can assist the operator by standing to the side of the pile and giving him feedback when the material is falling correctly.

Figure 13a

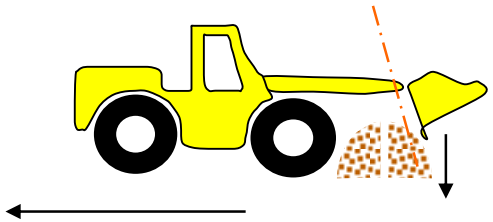


Figure 13

11. Operator pulls forward and turns bottom of bucket as close to "straight down" as possible. Operator then "back-blades" pile, at about knee height, to expose "center of mass" to be sampled. (See Fig. 13)

Common Error: Cutting pile too low, or not positioning bottom of blade in vertical position.

Cutting the pile too low causes the representative material that was built up over time to be moved away and exposes the non-representative material which was dumped in the first few moments. (see step 8, Fig. 10)

Back-blading with the bottom of the bucket at a flat angle will force material (that is supposed to be removed) down into the sampling surface. (See Fig. 13a)

Stockpile Sampling

OBJECTIVES IN SAMPLING:

Shape of mini-stockpiles before and after back-blading:

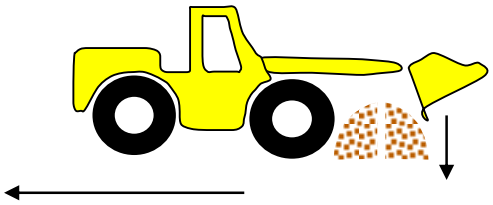


Figure 14a

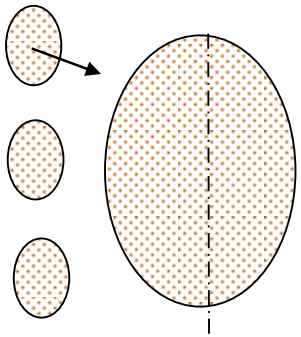


Figure 14b

11a. Operator lays out three piles, side by side. (See Fig. 14a)

This diagram shows the shape of the piles, prior to back-blading. (See Fig. 14b)

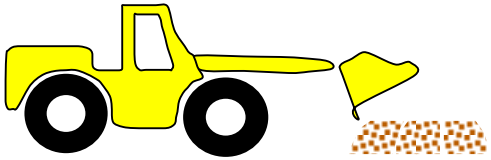


Figure 15a

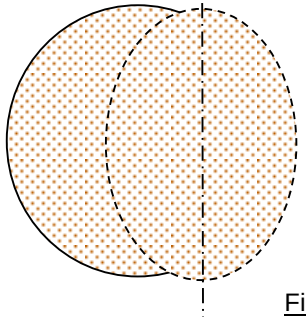


Figure 15b

11b. Operator "back-blades" each pile at approximately knee height. (See Fig. 14a & 15a)

This diagram shows the shape of the piles, after back-blading. Note the center-line of the original pile. (See Figs. 14b & 15b)

Sampling a mini-stockpile:

Sample at three locations along center-line of original piles.

Exterior sample points should be a minimum of 1 foot from edge of pile.

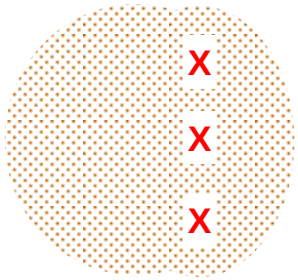


Figure 16

12. Inspector samples each mini-stockpile as follows: (See Fig. 16)

1. Insert square tip shovel vertically to its full depth at each location.
2. Pry up shovel, being careful to retain as much material as possible.
3. Combine the material into one composite sample.

Common Errors: Use of round-tip shovel; not inserting shovel vertically to its full depth; loss of material from shovel; not sampling along center-line of original piles.

Stockpile Sampling

OBJECTIVES IN SAMPLING:

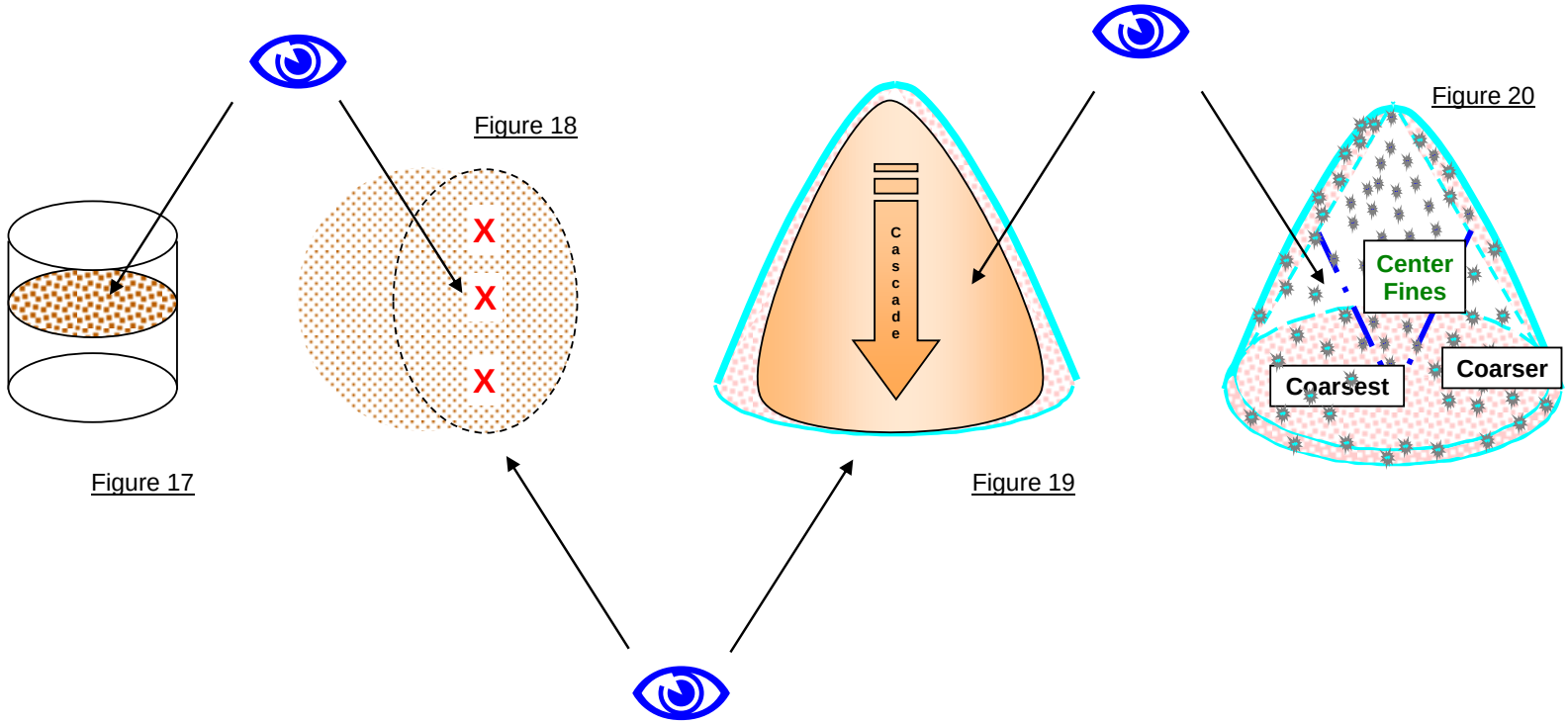
Assuring that the sample is representative.

13. Inspector reviews appearance of material sampled.

Does each shovel full of material appear representative of its location within the mini-stockpile? (See Figs 17 & 18)

Does each mini (sampling) stockpile appear representative of its location in the face of the aggregate stockpile? (See Figs 18 & 19)

Does the face appear representative of the overall stockpile? (See Figs 19 & 20)



Common Error: Inspector does not make visual determination as to whether he has been successful in obtaining a "representative" sample. The decision regarding whether a sample is representative must be made at the time of sampling.

Stockpile Sampling

FREQUENTLY ASKED QUESTIONS:

1. Why should the front-end loader take the sample 1 1/2 feet high, rather than at ground level?

   This method of sampling is used in sampling undisturbed "production faces".
   It is recognized that the outside, and especially the ouside bottom of an undisturbed pile is highly segregated.
   Taking the sample 1 1/2 feet high avoids this area and is believed to be more representative of the overall pile.

2. If I am pulling shipping samples from an **active** shipping face, should I sample at 1 1/2 feet high?

   Shipping samples are most representative of **material shipped** by having the front-end loader pull the sample the same way it is loading out trucks.
   If the front-end loader enters the pile at the bottom, the samples should be pulled at the bottom.

3. Why does this method prescribe back-blading the pile?

   Back-blading the pile exposes the material that was built-up, layer upon layer, at the center of the pile as it slowly increased in height.
   The material at the very top is the last material out of the bucket, which is also probably some of the first material in to the bucket.
   This material is not believed to be as representative as the material built up over time.

4. How can I tell if I am back-blading the pile at the correct height?

   A pile that is back-bladed correctly should generally have small peaks (less than 2" above back-bladed surface)
   at the very ends of the pile. (See Fig. 21)
   These peaks are where the loader bucket cut across the top of the pile.
   These peaks also help to define the centerline of the original pile.

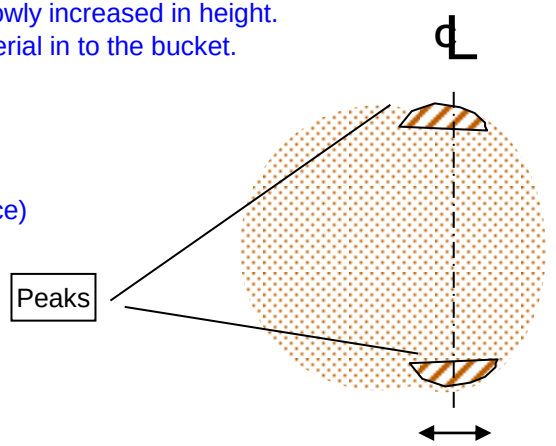


Figure 21

5. What if there are no peaks on my back-bladed pile?

   Optimal height may not have peaks.
   A back-bladed pile should allow a full shovel width of material to be taken at three locations along the original center-line of the pile.
   This generally requires that the exposed surface be a minimum of 2 feet wide at the outside sampling points.

6. Why do I need to sample material a minimum of 1 foot from the ends of the mini-stockpile?

   Material at the outside edges of the mini-stockpile are subject to segregation and should be avoided.

FREQUENTLY ASKED QUESTIONS (Continued):

7. How can I tell whether a radial stockpile is being load-outed out 90° to creation?

Two rules of thumb can be used to determine if a radial stockpile is being loaded out at 90° to creation.

(a) Rule of Thumb #1 - On a radial stockpile (Figure 22) being loaded out at 90° to creation, the load-out face will be parallel with but offset from a straight line between the pivot point of the stacker and the peak of the pile at time of creation.
Step 1: Draw a line in the ground between the pivot point of the stacker and the estimated location of the peak of the pile at time of creation.
Step 2: Stand off to the side and look across pile in line with the face.
Step 3: If the lines are approximately parallel, the face is being loaded out at 90°.

(b) Rule of Thumb #2 - Checking symmetry of a stockpile - A radial stockpile (Figure 22) being loaded out at 90° to creation is generally symmetrical in appearance about the peak of stockpile as shown in Figure 22a.

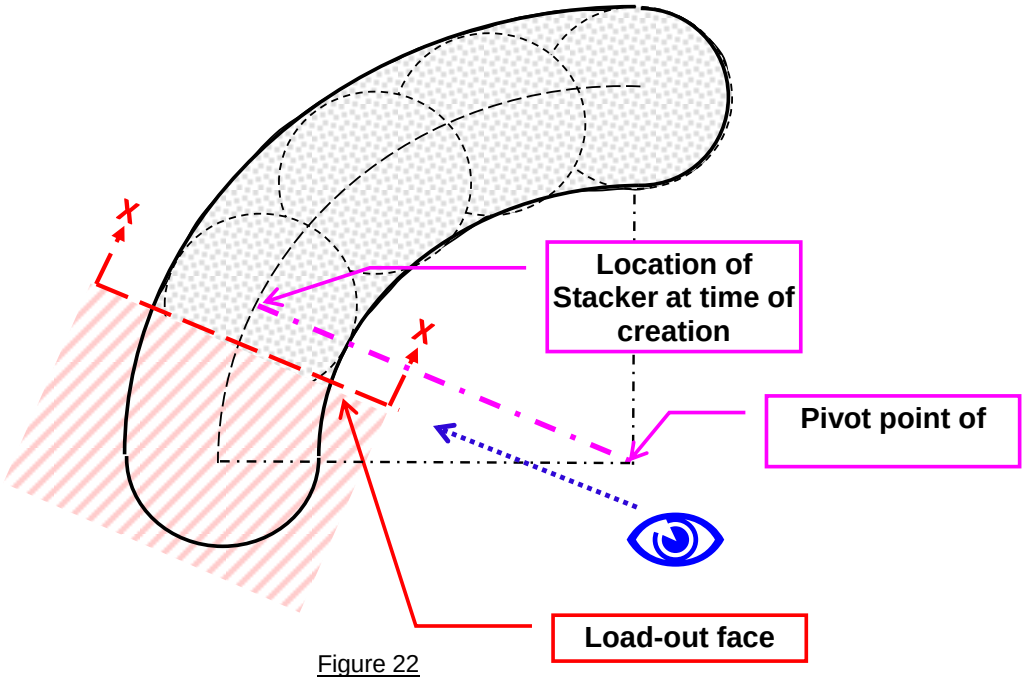


Figure 22

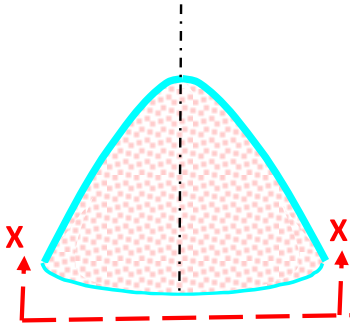


Figure 22a

FREQUENTLY ASKED QUESTIONS (Continued):

7. How can I tell whether a radial stockpile is being load-outed out 90° to creation? (Continued)

(b) Rule of Thumb #2 - Checking symmetry of a stockpile (Continued)

When the stockpile is loaded-out more from one side of the pile than the other (Figure 23), the load-out face is spun into the peak.

Looking straight into the face, the peak appears off-center, closer to the side being loaded out more.

The stockpile appears elongated, with a tail being left behind on the end not loaded-out as much.

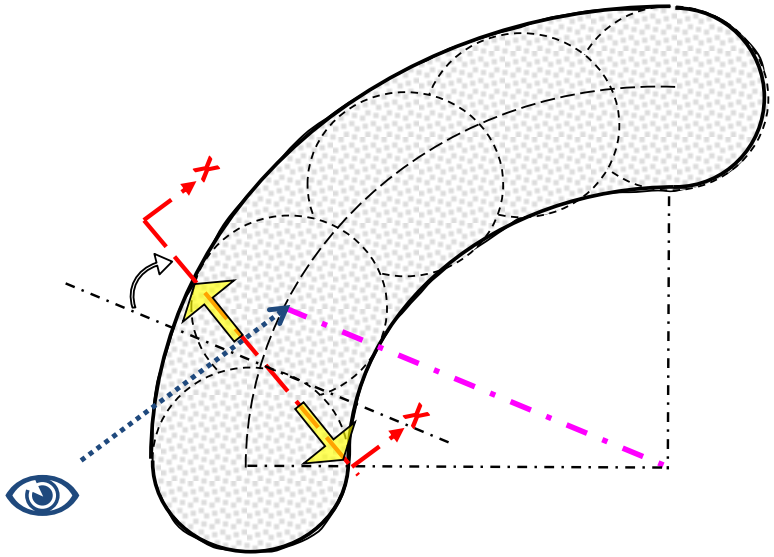


Figure 23

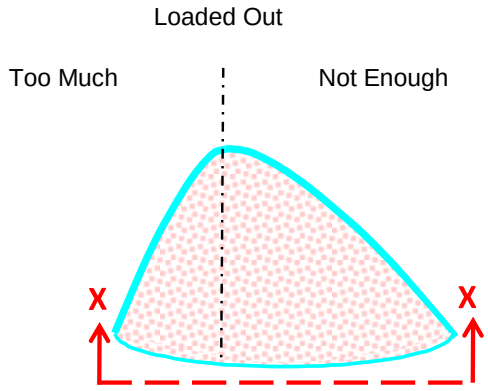


Figure 23a

When determining if the loadout face of the stockpile is symmetrical perform the following steps:

Step 1: Stand in front of the loadout face of the stockpile.

Step 2: Determine if the stockpile is relatively symmetrical or has an offset peak and corresponding tail.

Step 3: The side with the higher peak is the side being loaded more - the side with the tail is the side being loaded out less.

Step 4: Use the procedure described under Rule of Thumb #1 to verify whether the stockpile is being loaded out 90°.

8. Are there exceptions to the guidelines for determining whether a radial stockpile is being load-outed out 90° to creation?

Yes. Shipping faces in which part of the face is supported by either by discard piles, bridged material or other obstructions may not show the expected symmetry.

Screenings stockpiles, weathered piles with bridged crusts, and piles with back-stacked material preventing free cascading of material are typical examples.