Screen Efficency In Crushing Plants

By Charles Hillmann

QUARRY ACADEMY

Improving Processes. Instilling Expertise.

DYNO Dyno Nobel

SCHOOL OF MINES 1874 COLORADO

SANDVIK

Costs Optimization

6 % Drill Diameter / Pattern

18 % Explosive type / Ignition Type

24% Haulage / Load / Conveyor

12 % Scalp / Load / Primary Type / Energy Cost

12 % Size / Distribute / Secondary Type / Convey / Scalp / Energy Cost

16 % Size / Distribute / Thirtary Type / Weigh / Convey / Stock pile/ Clean / Energy Cost

12 % Haulage / Load / Re-Handle / Distribute / Weigh

40%

In Crushing = 1/3 rd Screening !

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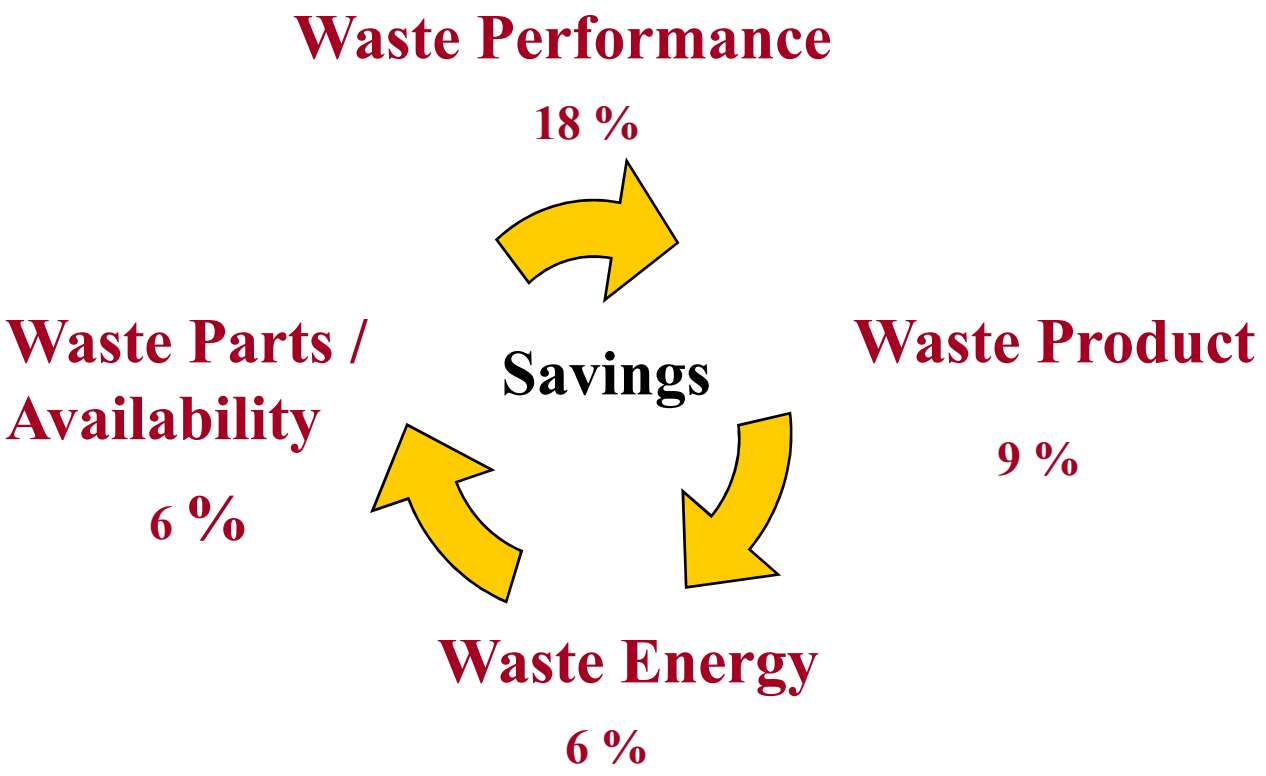
Potential Savings



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Why is Screening Important !

- **VGF Scalp - Separate Dirty Material from Valued Material**
- **Primary Scalper - Size Primary Material for Secondary reduction**
- **Secondary Screen - Size / Separate material for Tertiary Feed**
- **Tertiary Screen - Final Size & or Separate for Quaternary**
- **Final Screens – Open circuit**

  - ✓ Increase Plant Capacity
  - ✓ Decrease Blockage In Plant Ahead / Belts / Crushers / Screens / Chutes
  - ✓ Reduce Wear at All Crushing Stages
  - ✓ Send the Split off to prepare Product reduction by type / And Sales requirement
  - ✓ Send material In the right amounts to the right Piles Inventory Management
  - ✓ Setup Material for Particle Shape & Quality Finish product
  - ✓ Separate Clean Material for Future reduction

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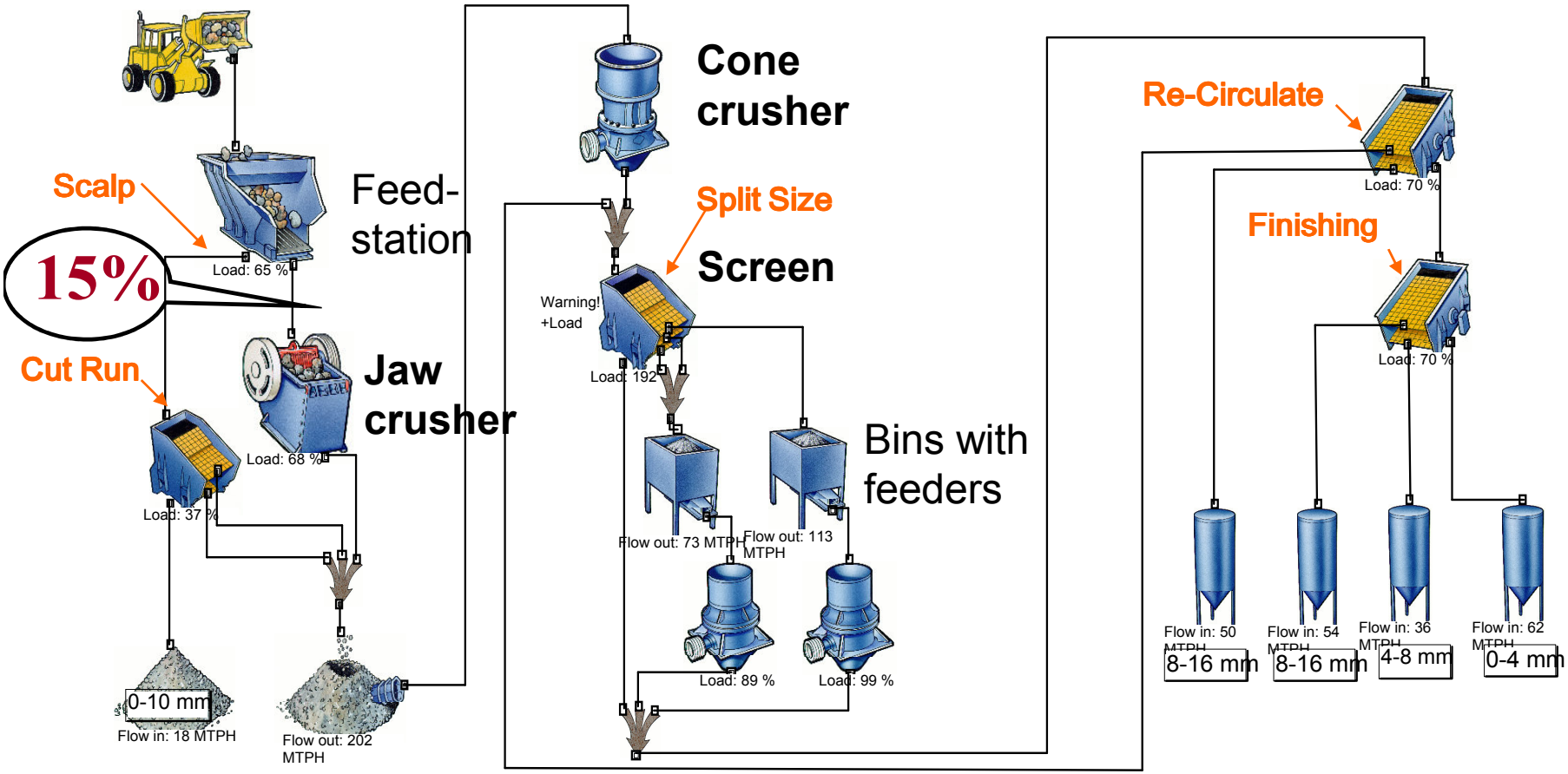
Screen Roles In Plants

Screening "Is the second " the Most Economical form of Crushing



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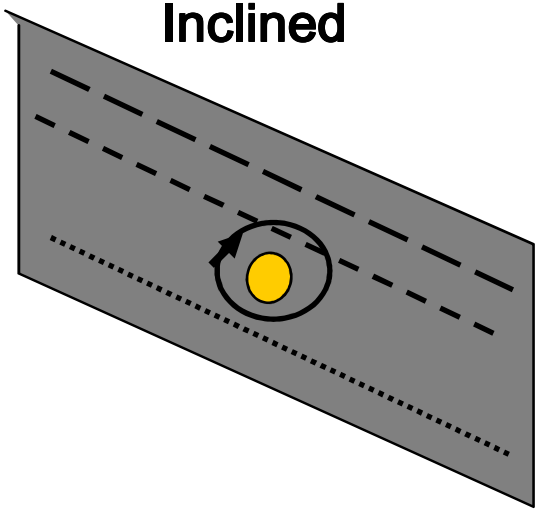
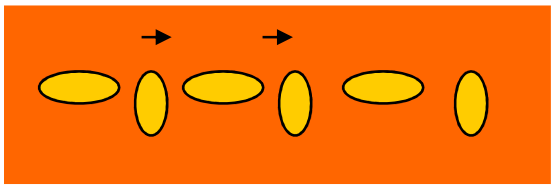
Screen Variations

Circular

Inclined

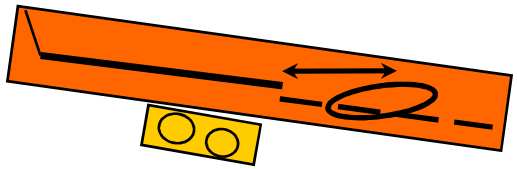


Wobbler

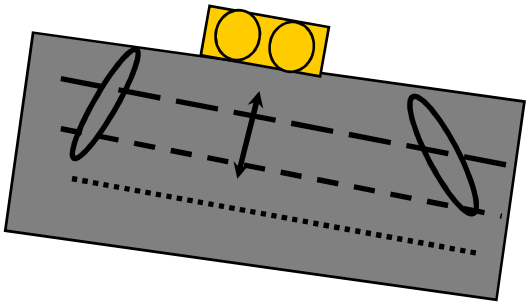


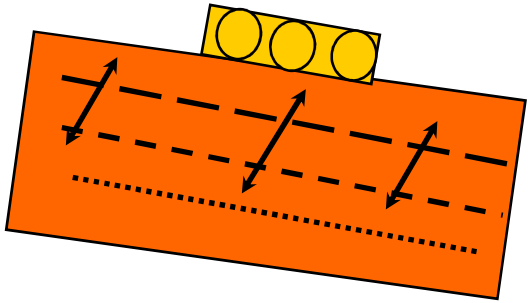
Linear

VGF

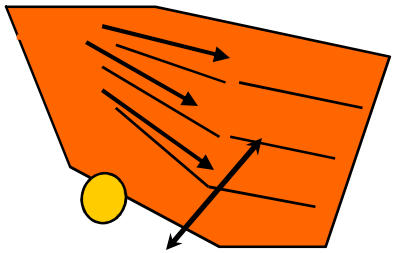


Horizontal





Multi-slope



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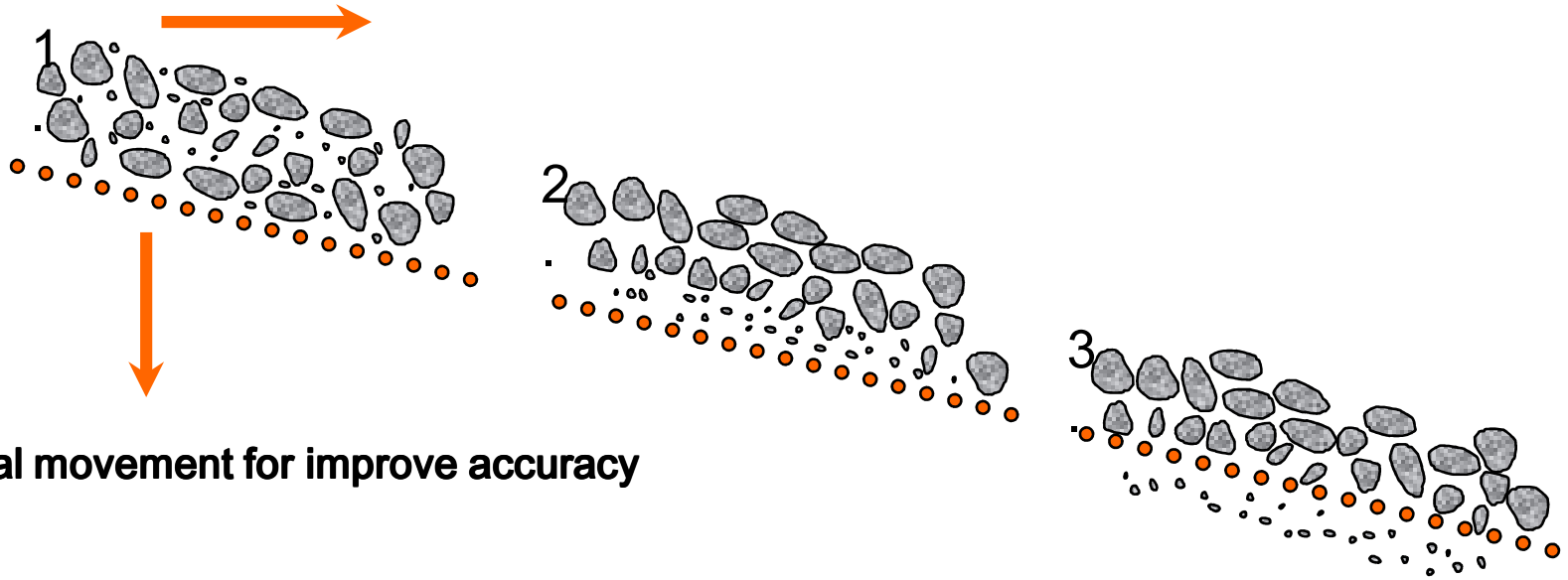
What is Screening by Stratification ?



Vertical movement for improve accuracy

- Vibrations (acceleration = G-forces) create a fluid state in bed
- Small particles sift between large one - stratification
- Small particles fall through - selection based on probability

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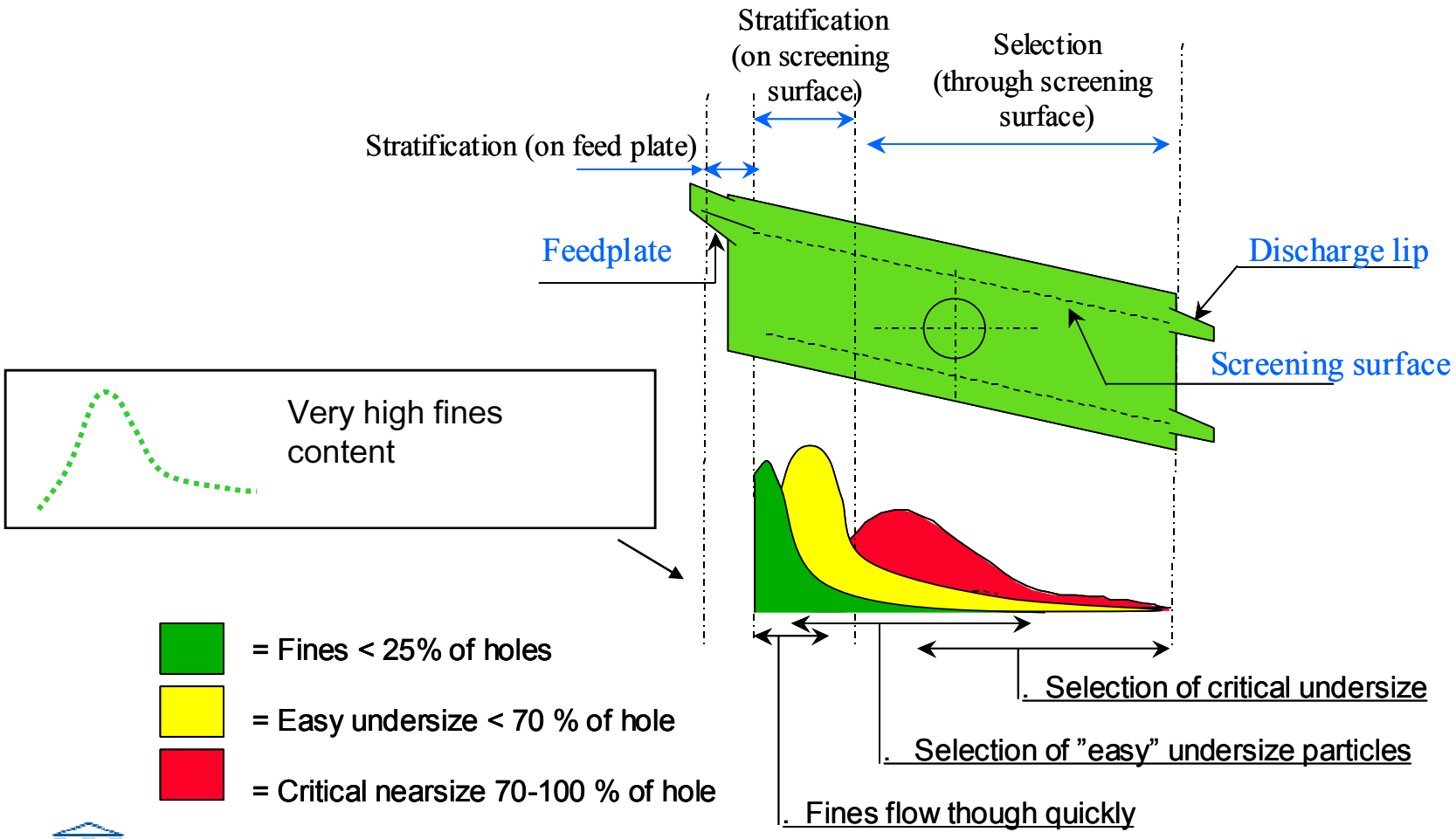
Basics of screening

Throughput along the length of a screen



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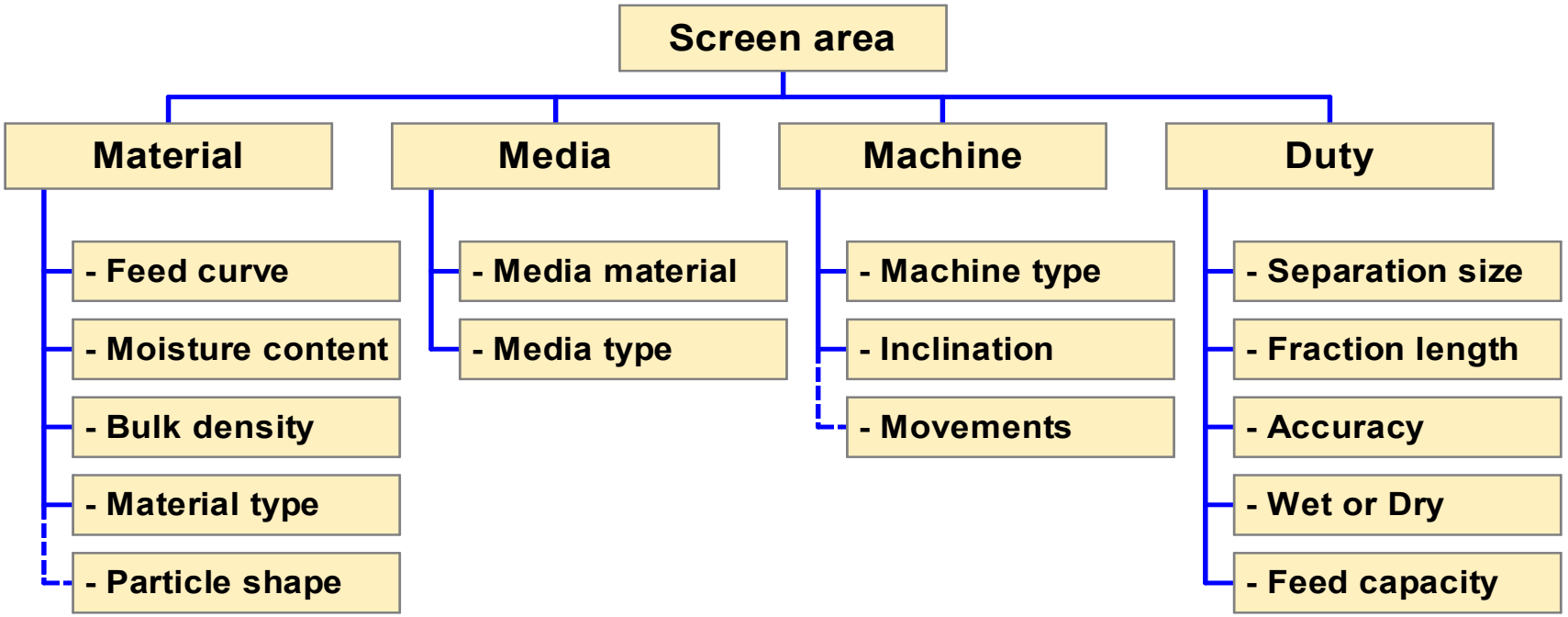
Screening Area Factors



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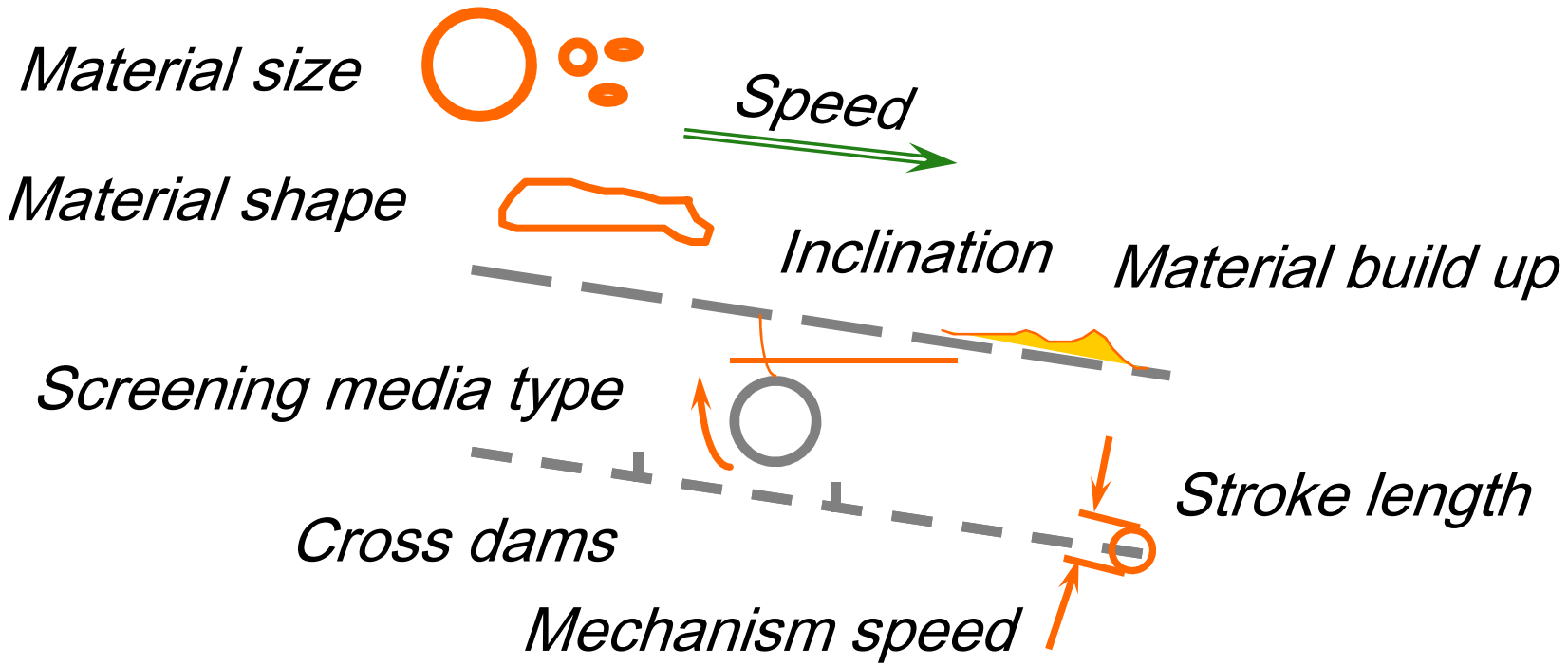
Factors affecting material speed



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What bed depth is right for stratification?

- *A thin bed:*

  - Becomes easily fluid, helps stratification
  - Means shorter distance for fine particles to sift down to the deck
  - Means less pegging tendensy, stones are not pressed down
  - Slower speed gives more time on screen and more time for selection
  - Sufficient bed prevents bouncing

- *A thick bed:*

✓Max bed depth at discharge is 3 - 5 times separation

✓Min bed depth is 1 time separation

✓Thick Bed all stones have probably not had enough chances to pass

✓Thin bed, material will bounce which destroys the stratification & accuracy

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Screening area calculation

- Basic formula for through put in conventional screening (*t/h per m²*):

$$Q_{through} = A \times B \times C \times D \times E \times F \times G \times H \times I \times J \times K \times L$$

- Q : Throughput capacity (*t/h per m²*)

- A: Nominal capacity for separation
- B: Oversize
- C: Halfsize
- D: Type of material
- E: Bulk density
- F: Moisture
- G: Type of screen
- H: Wet screening
- I: Deck position
- J: Screening element
- K: Fraction length
- L: Accuracy demands

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Carrying capacity

$$\text{CARRYING CAPACITY} = \frac{m \times v \times s^2 \times n^2}{C \times l}$$

- m = moving mass in screen body
- v = speed of material over the deck
- s = stroke length
- n = stroke frequency (rotation speed)
- l = length of screen
- C = constant derived from performance data

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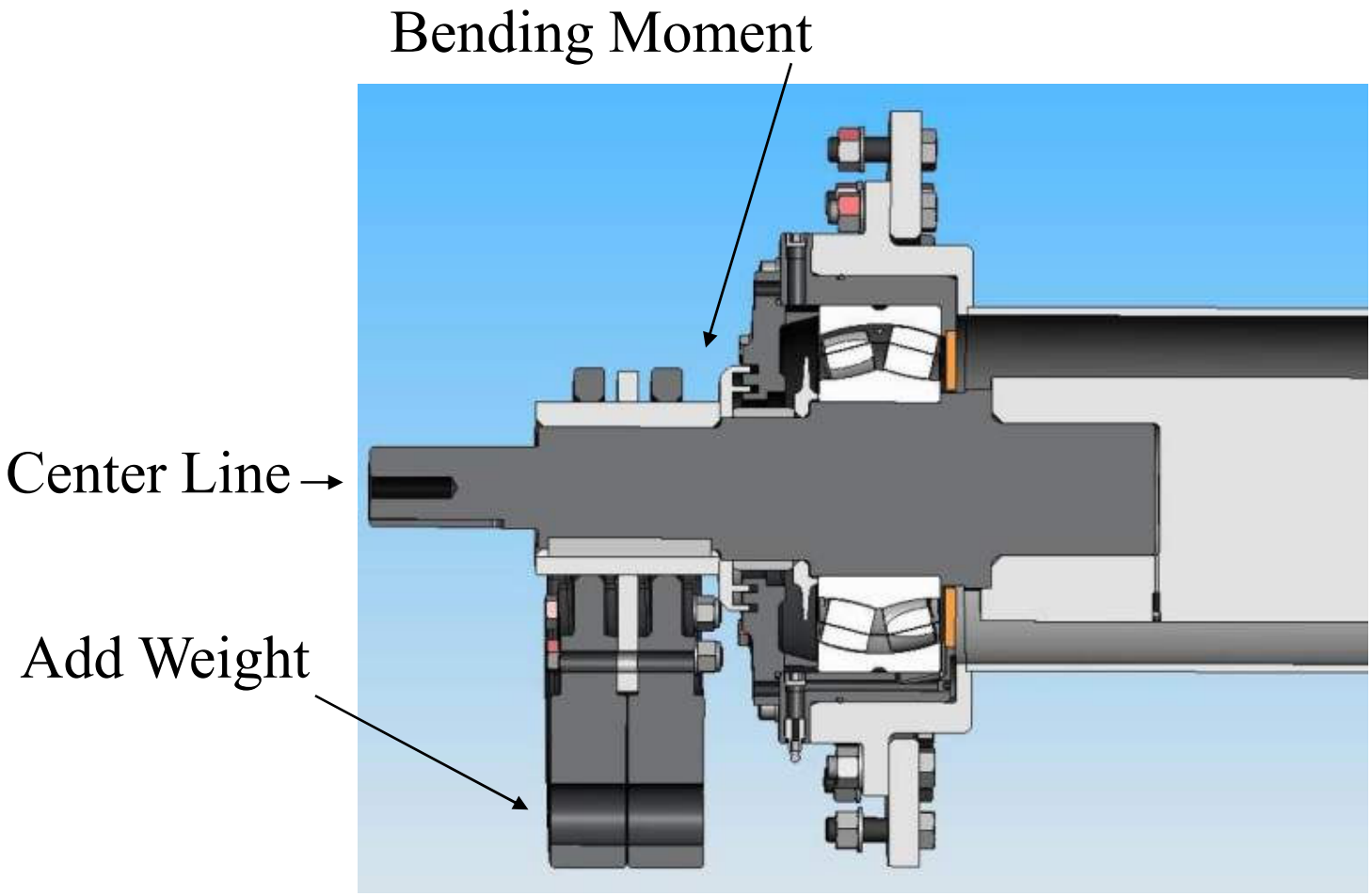
Most Things In life are Balanced "NOT SCREENS"



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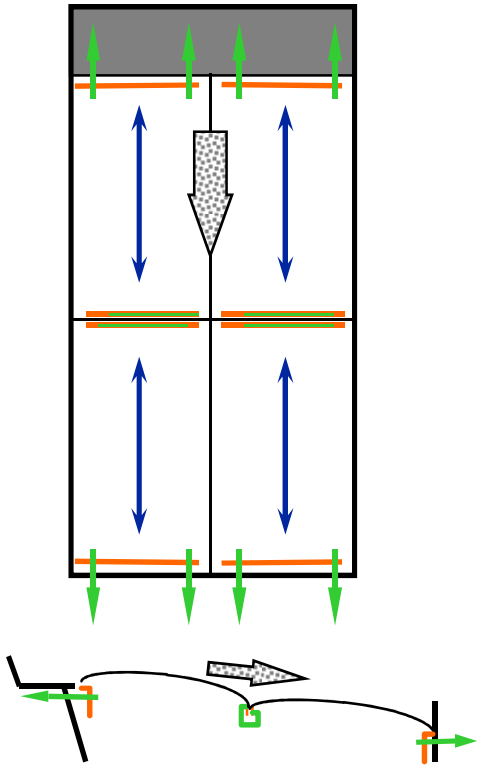
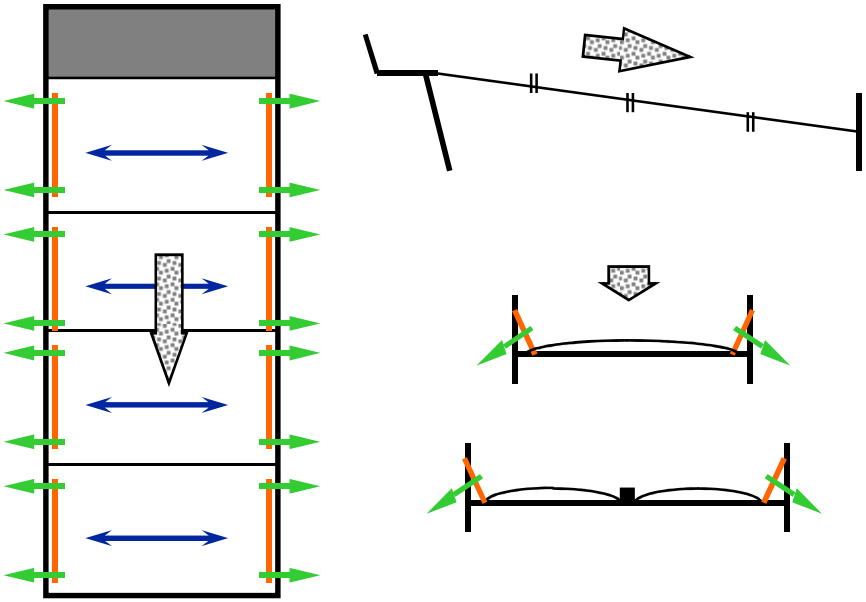
Tensioning types End / Side

END TENSION



SIDE TENSION



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Factor's often Overlooked !

Type of Material	Factor: D
Normal crushed stone	1.0
Cubical crushed stone	1.1
Uncrushed sand and gravel	1.2

Deck Position	Factor: I
1	1.0
2	0.9
3	0.8
4	0.7

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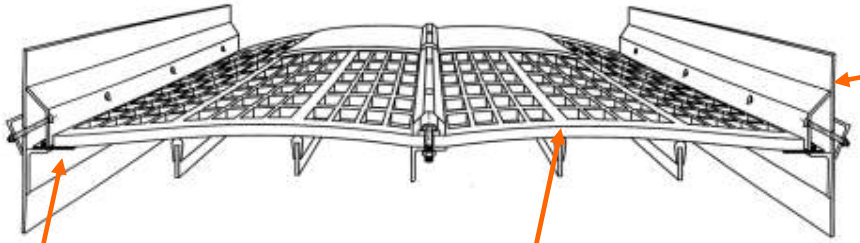
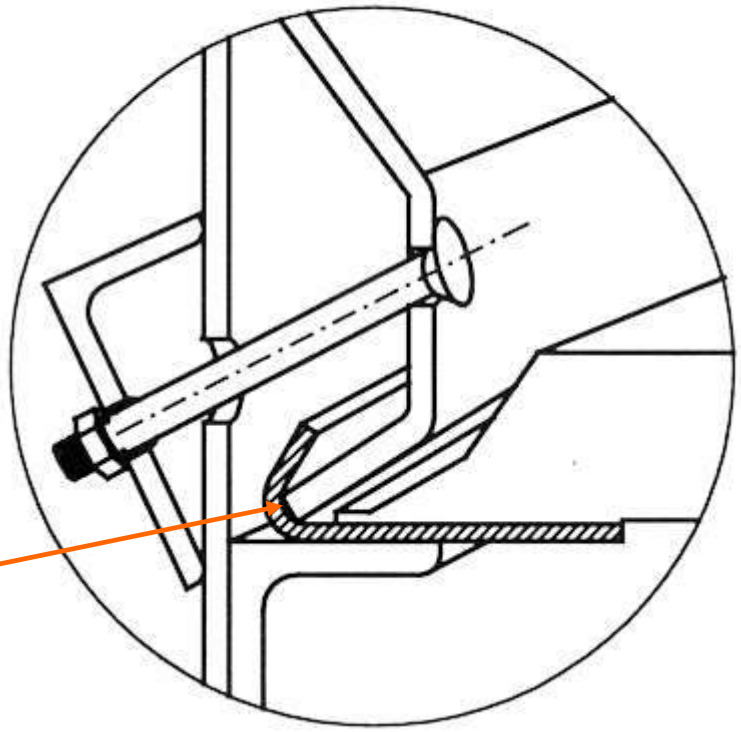
Media Installation Do's & Dont's

Poor installation of Clamp rail



Poor Alignment open area

Improper media length or hook



Poor alingment clamp rail

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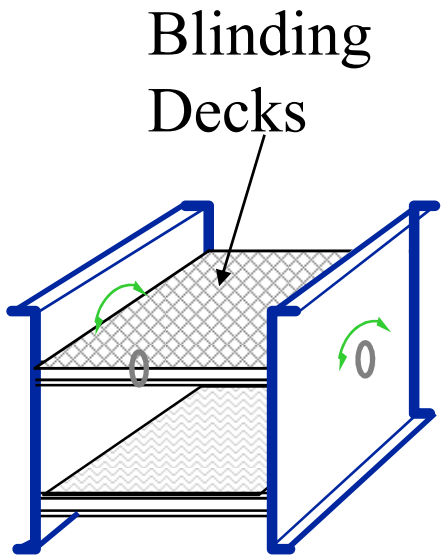
Moisture problems and solutions



- **Use maximum stroke**
- **Use flexible media such as:**
  - ✓ Flexible rubber/polyurethane
  - ✓ Thin wire mesh, piano wire/harp screens
  - ✓ Cloth Which Can Move & Maintain Aperture.
- **Water sprays**
- **Ball decks**
  - ✓ Works on screens with low inclination

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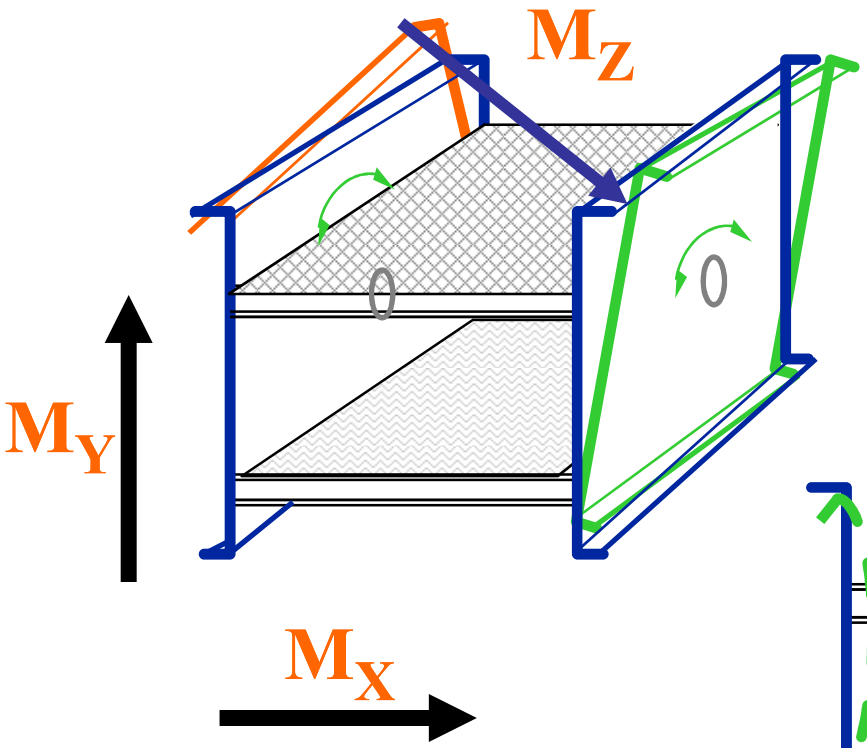
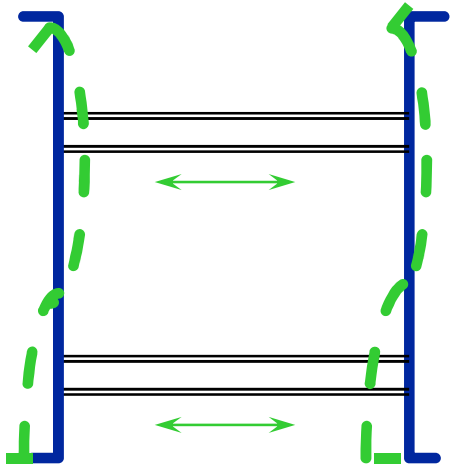
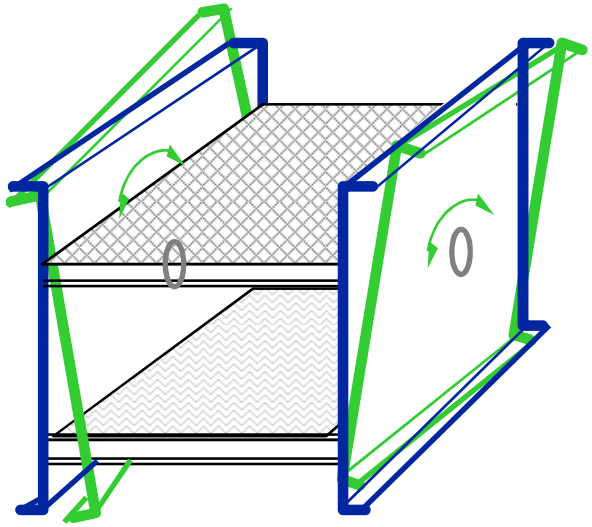
Critical Criteria Torsional / Side Frame Movement





✓Stiffer sideplates in vertical direction will help !

✓ Diagonally stiffer frames will help !



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Things to Improve Your Plant

- Know your screen Efficency ! Should be + 90 %

✓ Efficency Unders In overs

- Know your Real Open Area !

✓ We “THINK” we know our open area but what do we really have !

- How Much IS JUST Running Around ?

✓ Get the material out of the system or where they should be in the system As Soon As You Can !

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