KAMENGO SPECIALIZES IN THE STORAGE AND FEED OF DIFFICULT FLOWING BULK MATERIALS
**Fibrous:**
- Hog fuel
- Wet corn fiber
- Poultry litter fuel
- Processed pulp
- Wood chips

**Cohesive:**
- Wet bottom and fly ash
- Recycle gypsum
- FGD gypsum
- Coal
- Smelt

**Fine/Abrasive:**
- Dry fly ash
- Grain screenings
- Sawdust
- Potash
- Dry milled corn
- Phosphate rock

**Pellets:**
- Canola
15 years of research:

Why Do Bins Plug?
Why Do Bins Plug?

1. Poor bin geometry
2. Compaction of the stored material by the discharge feeder
3. Uneven discharge from the discharge outlet of the bin
Outcome #1: Science has a lot to say about what will work
Material Flow Properties: What do they tell you?

- Piping
- Funnel Flow
- Bridging
- Uninterrupted Mass Flow
Outcome #2: The Feeder is the big culprit
OPERATION OF A CONVENTIONAL FEEDER

STAGNANT MATERIAL AT FRONT GAINS IN STRENGTH

HIGH COMPACTION AT FRONT WALL PROVIDING A SHELF FOR MATERIAL HANG-UP

FLOW MAINLY FROM REAR

OPERATION OF THE KAMENGO FEEDER

MATERIAL IS NEVER STAGNANT

FLOW IS EVEN FROM TOP TO BOTTOM
Features of the **KAMENGO** Feeder

- **Feed Evenly from the Entire Opening of Bin**
- **First-In, First-Out Flow Pattern**
- **No Material Compaction**
- **Consistent Material Metering**
- **No Shearing of Material**
- **Use Gravity to Discharge**
- **Low Power Low Wear**
- **Flexible Design**
Short and wide Hog Fuel Feeder

Narrow and long Ash Feeder

Nine 100 ft long feeders - Self-unloading Cargo Ship, Various Cargoes
Mass Flow and Funnel Flow

First-in, Last-out

Bin Outlet **MUST** Exceed Piping Dimension

First-in, First-out

Bin Outlet **MUST** Exceed Bridging Dimension

α

β

UNINTERUPTED MASS FLOW

PIPING

FUNNEL FLOW

BRIDGING

KAMENGO
Mass Flow Vs Funnel Flow

**Funnel Flow**

**Advantages:**
- Lower Bin Height
- Lower Bin Wall Pressures
- Little abrasion on bin walls

**Disadvantages:**
- First-in, Last-out
- Susceptible to rat-holing and build-up of stagnant material
- Must be completely emptied
- Required geometry can be unreasonable

**Mass Flow**

**Advantages:**
- First-in, First-out
- Required geometry is reasonable

**Disadvantages:**
- Requires a higher bin for same storage volume
- Higher bin wall pressures = more stiffening
- Abrasion on bin walls = thicker walls
Case Study #1:
Retrofit of Hog Fuel Day Bin
Good Bin and Feeder Design

- Determine material flow properties
- Select bin geometry that will self-empty under gravity
- Choose feeder that will withdraw material evenly without putting energy into the material
- Size feeder to deliver required capacity and handle range of likely materials
Port Townsend, Washington State
Port Townsend, Washington State
Before Retrofit
- 24’ diam, 6,000 cu-ft silo
- 60-deg cone
- Vibratory feeder
Port Townsend, Washington State
Case Study #2: Retrofit of Hog Fuel Boiler Feed
Why Do Bins Plug?
Hog Fuel Boiler Storage and Feed Retrofit (2015)
Port Angeles, Washington, USA
Hog Fuel Boiler Storage and Feed Retrofit (2015)
Port Angeles, Washington, USA
Hog Fuel Boiler Storage and Feed Retrofit (2015)
Port Angeles, Washington, USA
Case Study #3:
Retrofit of Hog Fuel Pile Reclaim Feeder
Kamloops, British Columbia
Kamloops, British Columbia
Kamloops, British Columbia
Kamloops, British Columbia
Ask tough questions

- Why have you chosen this bin shape? Why is it appropriate for my material and my application?
- What is the bin wall material? Why have you chosen that material?
- What is the angle of the bin wall? Are you delivering mass flow (first-in, first-out) or are you giving me funnel flow (first-in, last-out)? How do you know?
- Is my bin properly stiffened?
- What is the opening of the bin and does it exceed the bridging dimension of my material? Does it exceed the piping dimension? By how much? Is the feeder pulling material from the full opening, or just part of the opening?
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