

MATROX

High Performance Polymer Flow Promotion Lining for
Bulk Solids Material Handling





Matrox is a family of polymer alloys that solve flow and wear problems across many industry sectors.

Matrox offers exceptionally low friction surface, outstanding wear resistance, high impact strength, excellent chemical resistance and superior performance in demanding applications.

About the Manufacturer - Rochling

Rochling Engineering Plastics is a world-wide leader in the development and production of semi finished engineering plastic products. Capitalising on over 90 years of experience, Rochling has worked with end-users to develop a range of Matrox grades specially designed to meet the individual needs of specific lining applications.

Rochling has an excellent reputation, highly qualified staff, superior material development, state of the art production facilities, laboratories and certified quality management systems to provide quality products and economic efficiencies.

Matrox

Matrox has been specially developed for bulk solids handling and mining industries to reduce existing or expected flow problems in the bulk handling and mining industry to reduce typical flow problems of bulk solids in bins, hoppers, chutes, truck beds and other applications. However, every application makes its own demands on the lining material.

Our Matrox range combines the best surface friction qualities with abrasion resistance, not only to promote bulk material flow but also to withstand the abrasion of flowing bulk materials in rugged applications under different environmental conditions.

Matrox grades are based on a specific formulation of Ultra-High-Molecular Weight Polyethylene (PE-UHMW/PE 1000) that has been developed for use as a lining material either in new construction or retrofit applications.

Economical Advantages

Compared to steel, Matrox has considerable economic benefits:

- Lower cost - The labour cost for lining an existing bin with Matrox is only about one third of the cost for construction steel.
- Lower weight - Matrox has a specific gravity of 0.93 vs 7.85 for steel. Matrox reduces the load on the structure, and makes installation work much simpler.
- Longer life span - The life span of Matrox is substantially longer than that of conventional construction steel. In the sand-slurry wear test, Matrox achieved a value of 80 which is 46% better than that of steel at 150 (S235JR).

	Material Thickness	Specific Gravity Thickness g/cm ³	Weight for 200 m ² (kg)
Steel	3 mm	7.85	4,710
Matrox	10 mm	0.93	1,860

Weight reduction with Matrox 2,850 kg ~ 60%

Relative Volumetric Wear According to the Sand-Slurry Test Method

In the sand-slurry test method, a mixture of sand and water is used to test the resistance to abrasion of a test sample compared to a defined reference material of PE-UHMW with a molecular weight of 9 million g/mol to which a fixed value of 100 is assigned,

The volume lost by the test sample during the test is then stated as an index compared with that of the reference material. The lower the value achieved, the better the resistance to abrasion.

Typical Applications

Matrox is used in a wide variety of industries handling bulk solids from mining through to processing concentrates and handling the final product.

Changes in moisture and particle size can affect the product's flowability. Traditional steel surfaces become rough or corroded, causing the bulk material to stick to the steel.

Ultimately, productivity and quality control are compromised.

Mining

- Off-road truck body liners
- Hoppers
- Scrapers
- Stackers/reclaimer bucket liners
- Shovels
- Chutes
- Dragline buckets
- Front-end loaders

Transportation

- Ship holds
- On-road truck body liners
- Railcars
- Loader buckets

Storage and Handling

- Silos, bins, bunkers
- Truck dump hoppers
- Vibratory feeder pans
- Skirting
- Tail hoppers
- Reclaim hoppers
- Rail dump hoppers
- Receiving hoppers
- Slider beds
- Belt scrapers

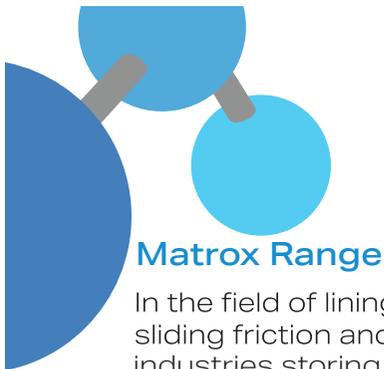
Processing

- Day bins
- Batch hoppers
- Hoppers
- Feeders
- Surge bins
- Storage silos and bins
- Chutes
- Screw conveyors

Bulk Materials Handled

- Coal
- Copper concentrate
- Limestone
- Chemical powders
- Synthetic gypsum
- Kaolin clay
- Salt
- Soap detergent
- Zinc concentrate
- Dust
- Bauxite
- Iron ore
- Clay
- Soda ash
- Nickel ore
- Peat
- Potash
- Silica sand
- Wood chips
- Phosphate
- Talc





Matrox Range

In the field of lining technology, the name Matrox stands for highest quality with regard to low sliding friction and resistance to wear. In order to meet the demanding requirements of industries storing and transferring bulk solids, Rochling Engineering Plastics KG has worked with bulk goods experts and users in developing additional lining materials ideal for use in many different fields of application. Members of the Matrox product family are: Matrox Classic, Matrox X, Matrox U 110.

Technical Data	Test Method	Unit	Value
Specific Gravity	ISO 1183	g/cm ³	0.93
Ambient Temperature		°C	-260 to +90
Tensile Strength Yield		MPa	>20
Tensile Strength Break		MPa	>40
Impact Resistance Notched Impact Strength	DIN 53505	MJ/mm ²	No Break
Co-efficient of Thermal Expansion		mm/(mmxK) x 10 ⁻⁶	180
Relative Abrasion loss by Sand-Slurry			80

	Matrox Classic	Matrox X	Matrox U 110
Resistance to Wear	●	●	◐
Impact Strength	◐	◐	◐
Sliding Characteristics	●	◐	◐
Antistatic Properties	○	○	○
UV Resistance	●	◐	◐
Service Temperature °C Continuous	-250 to +80	-250 to +80	-250 to +110
Service Temperature °C Briefly	-250 to +130	-250 to +130	-250 to +190
Delivery Program	Ex Stock	On Request	On Request

● very good ◐ good ◑ satisfactory ◒ moderate ○ not good

Dimensions	Common Thickness	Availability
2000mm x 1000mm	12mm - 25mm	Ex Stock
3000mm x 1000mm		Ex Stock
3000mm x 2000mm		Ex Stock
3050mm x 1250mm	6mm - 50mm	On Request
4000mm x 2000mm		On Request
6000mm x 2000mm		On Request
6000mm x 2500mm (Mega Sheet)		On Request

If required, also available in thicknesses from 3mm to 200mm



Matrox Classic

Matrox Classic is the original lining material in the range, and has general characteristics of a very high standard. Matrox has a very low co-efficient of sliding friction which is particularly important for the transferring and storage of glutinous and tacky bulk solid materials

Characteristics

- Very low co-efficient of sliding friction
- Very high resistance to wear and abrasion
- High notched-bar impact strength
- Very low water absorption
- High resistance to chemicals
- High resistance to temperature

Fields of Application

- Transport industry
- Truck bed linings
- Bin and hopper linings



Matrox X

Coarse-grained solids with sharp edges make extreme demands on the lining material, thus the development of Matrox X. This is our premium product and possesses, at optimum sliding properties, the highest hardness and resistance to wear of all the Matrox products.

Characteristics

- Excellent resistance to abrasion
- Very high surface hardness
- Good sliding characteristics
- High impact strength
- Very good resistance to chemicals

Fields of Application

- Mining
- Truck beds
- Hopper linings



Matrox U 110

Matrox U 110 contains a number of additives that allows the material to be used for longer periods of time at temperatures up to 190°C, such as when transporting hot bulk goods like tar or asphalt. When planning linings for bulk solids with temperatures as high as this, the thermal expansion of the material must be taken into account at the design stage.

Characteristics

- Very high temperature stability
- Low co-efficient of sliding friction
- High resistance to abrasion
- Contains additives which inhibit oxidation
- Good resistance to chemicals
- Very low moisture absorption

Fields of Application

- Truck beds
- Bulk-solid containers
- Bin linings
- Conveyor ducts
- Hoppers





Truck and Loader Bucket Lining Applications

Matrox is perfect for lining dump truck bodies and loader buckets quickly and easily. Material hang up, especially with older worn mobile plant, results in discharging inefficiencies and carry-back. It may also be more dangerous in truck bodies if the load does not move until the tipping angle is very high and slips out of the bed suddenly and rapidly. Lining with Matrox ensures reliable discharge - the load can slide out of the truck body or bucket at lower tipping angles without leaving any significant residue. This shortens the time required to unload, reduces carry back and makes the process safer.



Installation of Matrox Truck Flow Promotion Lining

Matrox sheet for off-road dump truck body





Side tipper truck tray before installation of Matrox lining



Side tipper truck tray after installation of Matrox



Discharge Reliably with Matrox

Understanding Flow Problems

Cohesive or adhesive bulk solid materials do not flow easily during transfer in mobile or fixed plant. They stick to the walls and will negatively affect productivity. This is a common problem as most equipment is designed without a thorough understanding of the bulk material being handled. Moisture content storage time and physical properties, among other factors, affect the flow properties of bulk solids.

Arching and ratholing are two common problems that typically develop when either the outlet is too small or when the hopper lining material does not promote flow. This may be due to shallow wall angles or rough wall conditions caused by corrosion or incorrect liner selection.

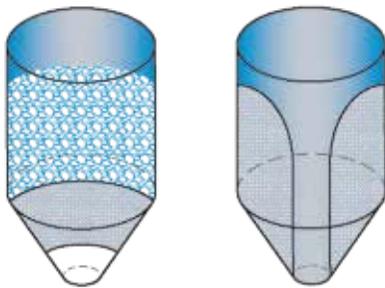
Segregation will occur if material discharges from the bin in a funnel flow pattern. The centre portion of the bin empties first, followed by the material along the walls. This creates segregation because as the bin was loaded, the finer particles collect in the centre of the bin under the charging point while the coarse particles migrate to the periphery of the bin along the walls in order to remix the materials during discharge, to minimize or eliminate segregation during discharge, a mass flow condition is required.

Matrox reduces the boundary friction between the bulk solid and the walls of the hopper, thus allowing the material to flow out and to empty the hopper completely in a uniform and predictable manner of first in, first out.

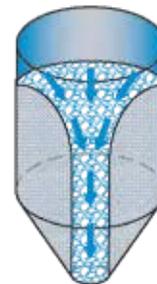
Typical Flow Patterns

Funnel Flow or Ratholing is the description for First-in- Last-out condition (FILO) and is suitable for free flowing bulk materials. The bulk material discharges from the bin through a central void above the outlet and the material along the wall remains stagnant.

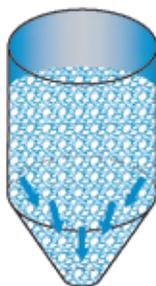
Mass flow is referred to as first-in-first-out (FIFO) and is suitable for cohesive or adhesive bulk solid material. All the material is in motion whenever any is withdrawn.



Typical problems: Arches (left) and Ratholes (right) occur when the lining material does not promote the bulk material flow.



Funnel Flow: The flowing material (blue) is forming a funnel, while the rest (grey) is sticking to the walls of the bin.



Mass Flow: All the material is in motion. Optimum flow is achieved.



Rathole: The centre portion of the bin empties first in the form of a funnel.

Results of Flow Problems

- Delayed start-up and increased cost
- Limited live storage
- Spontaneous combustion (stagnant coal)
- Quality compromised
- Segregation
- Silo vibrating or shaking
- Silo structural failure
- Wear of equipment
- Unpredictable flow
- Operator intervention



Matrox was tested against various grades of coal with different moisture contents and time at rest (> 72 hours). The wall angles required to achieve mass flow vary according to the surface friction of the lining material on the hopper wall.

In order to create mass flow, the hopper walls must be smooth and steep enough and the outlet must be large enough to prevent arching. The following chart shows the different wall angles required to create an optimised mass flow for different lining materials.

Recommended cone wall angles to achieve maximum mass flow for different wall materials					
Bulk Material	Diameter of Cone Outlet	Flow Rate	Wall Material		
			Polystone® Matrox	Stainless Steel acc. DIN 1.4301	UHMW-PE
PRB Coal with 29% moisture	2ft. / 610mm	continuous	56°	81°	62°
		after 3 days rest	60°	81°	63°
	8ft. / 2,440mm	continuous	55°	78°	60°
		after 3 days rest	59°	78°	62°
PRB Coal with 36% moisture	2ft. / 610mm	continuous	59°	88°	64°
		after 3 days rest	65°	90°	68°
	8ft. / 2,440mm	continuous	57°	76°	58°
		after 3 days rest	62°	78°	63°

Summary of wall friction test results from Jenike & Johanson, Inc.. PRB is a sub-bituminous coal mined in the USA. Degrees measured from horizontal.

Estimated Wear Life (Based on USA Test Case)

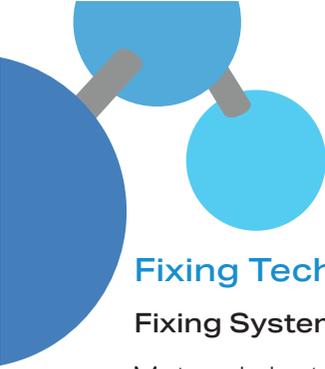
The following chart shows the estimated life expectancy of a 1/2" (12.7mm) thick Matrox liner in a mass flow circular bin having the following dimensions:

Total silo height of 65ft. / 1,981.2cm

Hopper section vertical height of 25ft. / 762cm

25ft. Diameter with a 2ft. / 60.96cm diameter outlet

Coal Handled	Estimated Life in Years
Bituminous	> 17
Sub-Bituminous	> 35
Lignite	> 50



Fixing Technology

Fixing Systems

Matrox is installed by mechanically fastening it to the substrate using stud welded or Polystone Matrox capped bolt fasteners. Both fastening methods are recommended by the manufacturer and are usually chosen based on structure design, access or skill and equipment availability. Dotmar installation technicians understand the complex field of bulk material handling. Installations conforming to the manufacturers standards are critical to attaining the life expectancy and performance of the system.

Fixing System: Stud Welding

In order to fix lining in position, the sheet is pre-drilled at recommended fixing centres using a special drill or CNC Router. The distance between the individual fixing points depends on the substrate geometry, material thickness, operating conditions and access to fasteners if bolt through option is employed.

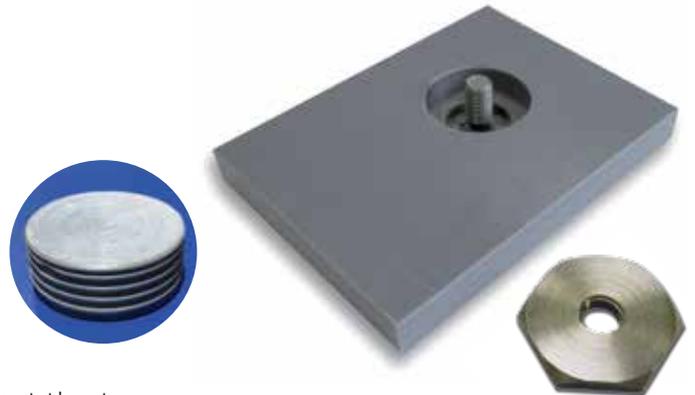
When panels are fastened in position with welded studs and nuts, we recommend drilling holes 50mm from all edges and at a nominal distance of 250mm centres throughout the panel.

Pre-drilled lining panels are used as templates inside the substrate to locate and mark positions for stud welding. Marked locations are then ground to clean steel prior to welding studs.

An M8 stainless steel nut is then screwed onto the drawn arc stainless steel stud. Our drawn arc studs have a thread extension with a predetermined break-off point to enable fixing to uneven or curved surfaces. The thread extension is removed after the nut is tensioned. A Matrox plug is used to cap the stud and nut and seal the counterbored hole for uninterrupted flow.

Advantages

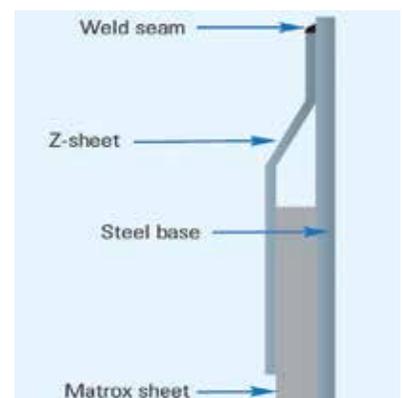
- Easy removal of worn Matrox panels
- No need to drill through the substrate
- All installation work conducted internally (no external access/scaffolding required)
- Shorter installation times, i.e. less down-time
- For sheets \geq 12mm



Edge Protection

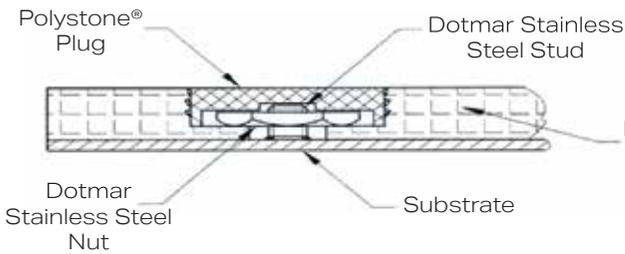
Stainless steel Z-section capping strips are used to protect the top edge of the liner from material fines ingress and to reduce the presented edge to minimize build-up. Z-section capping strips are used in Bin, chute and hopper applications. When fixing the strips, ensure that the material can expand and contract freely due to thermal effects.

A mild steel flat bar of equal thickness to that of the liner is used to "frame" the liner perimeter of dump truck and loader bucket installations.

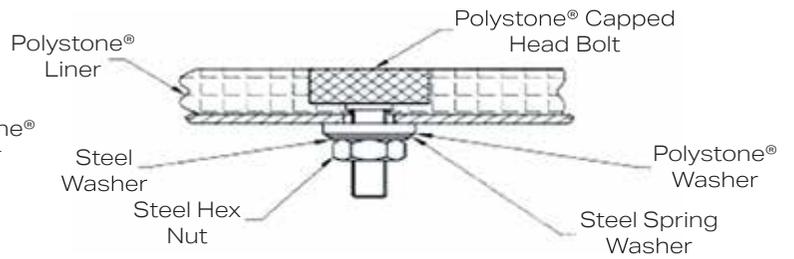


Did you know? Dotmar offers a high level of applications advice, technical support and end to end project management and installation globally?

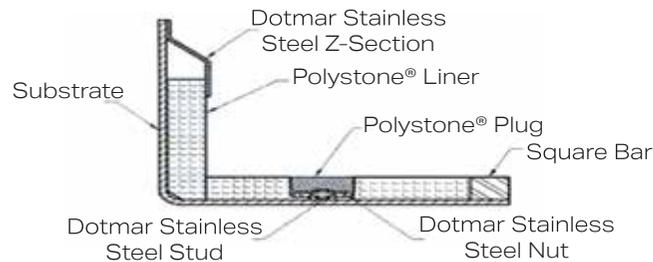
Dotmar Stainless Steel M8 Stud, Nut and Polystone® Plug: Installation System



Polystone® Capped Head Bolt: Installation System



Polystone® Matrox: Installation System

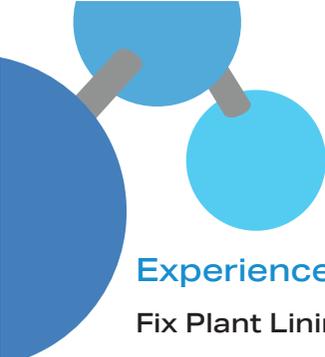


Liner Joints: Fusion Welding

Dotmar strongly recommends fusion welding of the joints between sheets. If the joints are not welded they will open and close due to thermal expansion and contraction of the liner material. Fusion welding provides a totally sealed liner and eliminates ingress of material behind the liner. Material build up between the joints or behind the liner will result in lifting of the liner, thus exposing the liner to premature wear and a shorter service life.

Material caught between the joints can also cause hang up and interrupted flow, defeating the purpose of lining. Joints to be welded are prepared prior to the panels being fastened to the substrate. Welds can be ground, planed or polished flush with liner for fine powder applications.





Experience Matters

Fix Plant Linings

The choice of lining material depends on a number of factors such as the type of bulk solid, the geometry of the object being lined, as well as other factors affecting the flow of material and the amount of wear. Dotmar has a wealth of experience in lining technology, dating over 50 years. This experience is at your service. We can advise you on the right type of lining material and fixing technology for your application. Our priorities are the durability and efficiency of the lining.

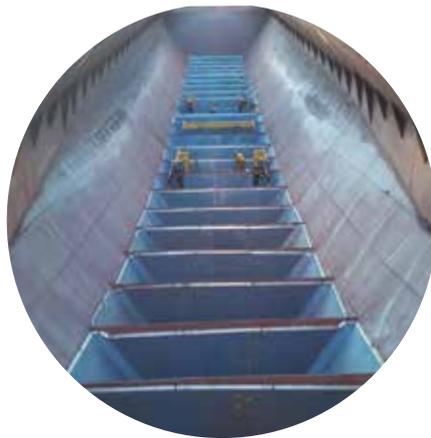
Truck Bed Linings

Depending on their shape, truck beds have a number of different problem areas. When installing a Matrox Classic or Matrox-X liner, the following considerations are made: bed geometry, product lump size, method of loading and temperature of the bulk solid. Depending on the design of the bed, the shape, particle size, moisture content and temperature of the bulk solid, we recommend **Matrox Classic** and **Matrox X**.

For applications involving heavy impact stresses, we can also supply a combination of Matrox and polyurethane.



Comparison between Matrox and steel. The material adheres to large areas of the unlined steel surface. The area lined with Matrox is virtually completely free.



Matrox Barge Lining



Matrox Off-road truck lining



Loader bucket lined with Matrox Classic

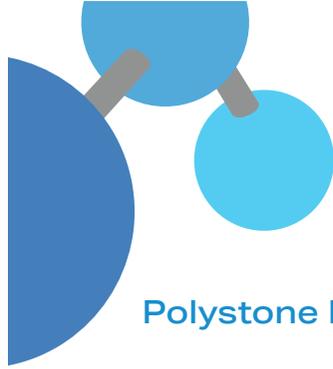


Matrox-X lined Mine Truck hauling ROM ore in Australia

Bin and Hopper Linings (remove silo)

Accelerated wear can occur from impact in bins or hoppers that are not continuously charged, similarly, wear is pronounced at the discharge due to high through-put. These two conditions can be addressed with an increase in liner thickness or change in liner material in localized areas. Conical designs can be affected by funnel flow, ratholing or arching, causing difficulties in achieving mass flow. Special safety regulations or the handling of foodstuffs can create additional demands, such as the use of an FDA approved liner.





Polystone Matrox Installation Request

Client contact details

Company: _____ Date: _____

Address: _____ Phone: _____

Contact: _____ Fax: _____

Email: _____ Mobile: _____

Mining applications Please tick appropriate boxes

- | | |
|---|---|
| <input type="checkbox"/> Belt scrapers | <input type="checkbox"/> Reclaimer buckets |
| <input type="checkbox"/> Bunker liners | <input type="checkbox"/> Screw conveyor liners |
| <input type="checkbox"/> Chain conveyor flights | <input type="checkbox"/> Self-unloading ships |
| <input type="checkbox"/> Chute liners | <input type="checkbox"/> Silo liners |
| <input type="checkbox"/> Conveyor skirting | <input type="checkbox"/> Slider beds |
| <input type="checkbox"/> Cyclones | <input type="checkbox"/> Storage bin liners |
| <input type="checkbox"/> Drag chain conveyor liners | <input type="checkbox"/> Transfer chute liners |
| <input type="checkbox"/> Dust collection hopper liners | <input type="checkbox"/> Under chain guides |
| <input type="checkbox"/> Front end loader bucket liners | <input type="checkbox"/> Wear strips |
| <input type="checkbox"/> Hopper liners | <input type="checkbox"/> Vibrating bin discharges |
| <input type="checkbox"/> Off-road truck liners | <input type="checkbox"/> Vibratory feeders |
| <input type="checkbox"/> Pugmill paddles | |
| <input type="checkbox"/> Railear liners | |

General questions Please tick appropriate boxes

Is the problem:

- Flow
 Wear
 Other _____

Does the problem cause:

- Stoppages
 OH&S Issues
 Environmental Issues
 Labour Issues
 Mechanical Issues

Action required:

- Send bulk solids handling data sheet
 Organise site visit
 Other _____

Polystone Bulk Solids Handling Information

Client contact details

Company: _____ Date: _____
 Address: _____ Phone: _____
 Contact: _____ Fax: _____
 Email: _____ Mobile: _____

General questions, common to all applications

Material being handled: _____
 Characteristics: Sharp Angular Hard Soft Other _____
 Mixture percentage, if applicable: _____% Particle size: _____ Moisture content _____
 Material mass _____ kg/m³
 Temperature range expected during application _____ °C to _____ °C
 Tonnes per hour _____
 What is the present liner? (be specific and include original thickness) _____
 How long has the liner lasted? _____, if other liners have been used in this application, what were they?
 _____ and how long did they last? _____
 What problems exist in this application?
 Sticking _____% Corrosion _____% Other _____

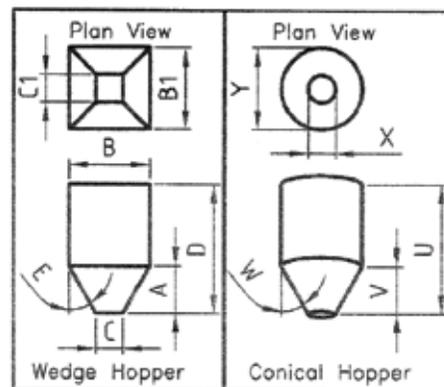
Specific questions, do not proceed unless the above section is complete

Chutes
 Width: _____ Length: _____ Tonnes per hour: _____
 Velocity: _____ m/sec Belt speed: _____ m/sec
 Incline angle: _____ ° from horizontal
 Is chute straight or change direction? _____
 How does material enter chute? _____
 What is the angle of impact from the horizontal? _____ °
 Draw a sketch for additional information.

Trucks
 Distance of drop into the bed: _____ m
 Approx number of loads per day: _____
 If hauling overburden, what is the largest rock size expected to be hauled? _____
 What is the percentage of rock compared to dirt? _____ %
 Is the bed heated? _____
 Can the heat be diverted? _____
 Do they haul asphalt? _____
 What is the bed made of? _____

Other applications
 Type of equipment: _____
 Description: _____
 Draw a sketch on separate sheet of paper if necessary.

Hopper dimensions
 Wedge Type:
 A: _____ B: _____ C: _____ C1: _____ D: _____ E: _____ °
 Conical Type:
 U: _____ V: _____ W: _____ ° X: _____ Y: _____
 Angle measured from the vertical _____ °
 Does hopper remain full most of the time? _____
 Is there a constant impact area during charging? _____
 Explain problems that occur during operation or discharge of the hopper: _____



MATROX

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