

Core Storage and Preservation

Sampling and drilling is a key part of mining exploration. Core and subsequent samples are considered a valuable asset. Data obtained from drill and boreholes are used for subsurface bedrock orientation information, to obtain samples for chemical analysis, for estimation of the size, quality and value of the deposit, and for obtaining samples for processing or metallurgical assessment, porosity studies, etc.

Drilling is also very useful because the drill retrieves continuous core or chips of rock as it bores into the earth's crust and is a permanent record of the rock attributes of the crust at that site, and is a relatively expensive means of delineating resources.

In many cases, core and samples are preserved for the life of a mine, in other cases, as a reference to a region's geology, for many years longer. Drilling and core recovery is a major investment. Should core not be properly preserved, the loss for future sample evaluation and research opportunities is enormous. Obtaining the samples through drilling, trenching or any other means is a costly exercise. This investment needs to be preserved.

Core and or sampling could have been generated from drilling either:

- ❖ Diamond – Stored in core trays
- ❖ RC – Stored in chip trays and sample bags
- ❖ Trenching and other – Stored in sample bags

Some Important Considerations

- What core trays are currently being used?
- Was there previous drilling?
- What core trays were previously used?

How are core trays currently stored

- Racked in a racking system
- Stacked on a slab or ground
- Core trays currently in sequence of
 - Project Name or Number
 - Borehole Number
 - Core tray sequence of hole depth
 - Core tray meters of stored core
- Quality of Labelling
 - Faded information
 - Missing Labels
- Will labelling stand up to movement of core trays and or handling
 - Do core trays need to be relabelled

Scenario

Many sites have a significant amount of drilled core, from both previous and current exploration drilling activities.

Core trays may vary from

- Wood
- Metal
- Plastic

With plastic and metal core trays, one can assume that the bulk are in mechanically sound condition and would be satisfactory for ongoing use.

With wood, one would need to ascertain if they are still mechanically sound or if degradation has set in through age, rot etc.

Some could also vary in length

- 1.5 meter
- 1.2 meter
- 1.0 meter
- Other Odd Sizes

Typically, outside of South Africa 1.0 meter core trays are the norm. However, this would need to be confirmed as some odd lengths may have crept in over many years.

Note: *Should core trays not be ***mechanically sound** and or odd lengths, management would need to make a decision as to repacking into new core trays.*

****Mechanically Sound Definition:** Capable of retaining core in its orientation and sequence. Capable of being moved and or transported safely without the loss of the stored core.*

Core Tray Information

For purposes of simplicity, assumption is made that all core trays will be as follows:

- Core Trays are all approximately 1000mm long with a width of not more than 450mm
- Height varies between 85mm and 95mm dependant on core size
- Core Trays are a mixture of wood, metal and plastic.

Core Tray Labelling

Typically core trays are labelled with the following information

- Project Name / Number
- Borehole Number
- Core Tray Sequence of Hole Depth
- Core Tray Meters of Stored Core
- Core Tray Number as number of total core trays in the borehole sequence

A prerequisite - core trays are clearly labelled - Labelling can and does degenerate over time. In order to preserve core tray data integrity, management would need to decide to relabel damaged or lost labels.

A database of drill holes and core trays.

Storing of Core / Archiving - Considerations

For storing core, a number of considerations and options come into play.

- Company Policy
- Engineering signoff requirements for structures
- SHEQ Policy (Safety / Health / Environment / Mining)
- Cost, both current and future
- Available space both current and future
- Access to samples both current and future
- Frequency of access to samples
- A Combination of current sampling and long-term archiving
- Number of Core Trays
 - Current
 - Future Drilling
 - By size, i.e. NQ, HQ, PQ
 - Weight?
- Can the surface carry the weight of the stored core?
- What type of equipment will be required for moving and accessing core. i.e. forklift

Average Core Weight per Linear Metre

	Core Size	BQ	NQ	HQ	PQ	kg/M ³
Core Diameter Average		36.5	47.6	63.5	85	
Material	gm/cc					
Clay	1.86	1.945	3.308	5.887	10.549	1860
Basalt	3	3.137	5.336	9.496	17.015	3000
Dolomite	2.56	2.677	4.553	8.103	14.519	2560
Gneiss	2.69	2.813	4.784	8.515	15.257	2690
Granite	2.72	2.845	4.838	8.61	15.427	2720
Limestone	2.69	2.813	4.784	8.515	15.257	2690
Quartz	2.64	2.761	4.696	8.356	14.973	2640
Sandstone	2.42	2.531	4.304	7.66	13.725	2420
Bauxite	1.4	1.464	2.49	4.431	7.94	1400
Iron Ore (av.)	4.3	4.497	7.648	13.611	24.388	4300
Copper	2.6	2.719	4.624	8.23	14.746	2600
Lead Zinc	3.5	3.66	6.225	11.079	19.851	3500
Nickel	3.6	3.765	6.403	11.395	20.418	3600
Uranium	4.1	4.288	7.292	12.978	23.254	4100
Average Weight Per Lin Metre		2.00	3.39	6.04	10.82	

Other considerations include:

- Civil works
- Access to storage area
- Type of surface
 - Concrete
 - Compacted soil
 - Tar
 - Crushed stone
- Open to the elements
- Roof over racking system

- Roof over entire area with open walls
- Shed
- Totally enclosed building

Core Racking Options

A number of possible options exist. This could also include multiple options on one site

- Individual Drawer System
- Stacking System
- Bulk Stacking
- Pallet Stacking

Typically Concrete Slab

Ideally a concrete slab should be used to house the stored core.

- Locally designed and laid down to weight bearing specifications

Compacted Ground

A properly compacted floor can be utilised, dependant on the storage type

Core Shed

Based on requirements a prefabricated core shed, built to size, can be constructed and shipped in a container to site. A project manager can be sent to oversee erection utilising local labour.

This can be fully enclosed or open sided.

- A consideration would be lighting
- Only erected on a concrete slab

Below are pictures of the various options for storing core trays.

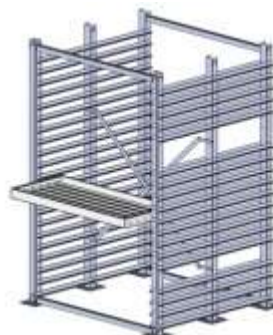
Multiple options are available

Core Tray Storage Options

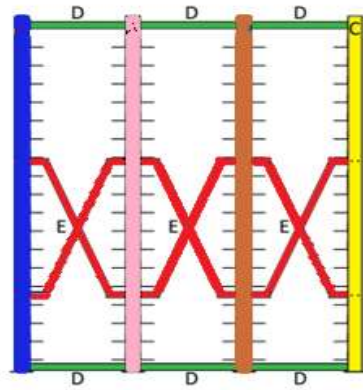
1. Individual Drawer System



End Loading



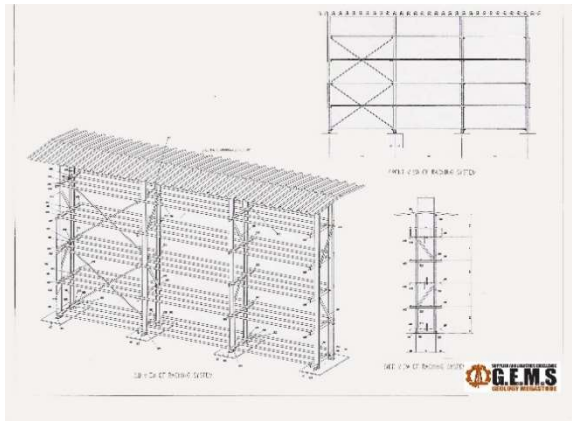
Side Loading

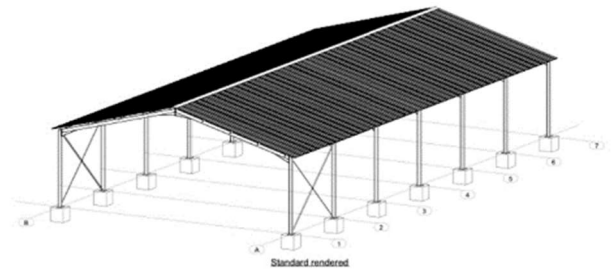
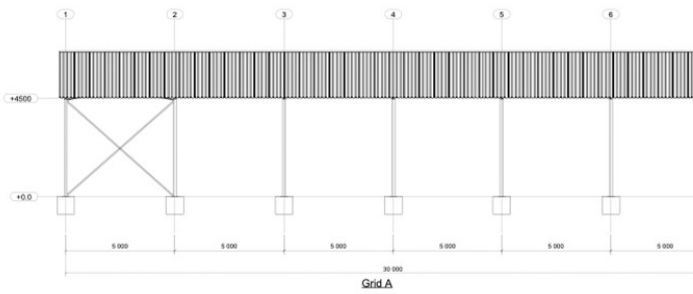


Rack Assembly Diagram

- A: Base Module
- B: Extension Module (or Supplementary)
- C: End Module
- D: Racking Spreader Bar
- E: Crossbrace

2. Stacking System





Pallet Stacking

- This would allow for three stacks of core trays per pallet, ideally 10 trays high.
- Pallets can be stacked in an industrial designed racking system allowing 4 pallets in a rack
- This would allow for some 120 core trays per bay of racking

Pallets to be used

It is recommended that plastic pallets be used for the purpose of stacking by borehole and wrapping. This to ensure longevity and eliminate future issues on degradation of the pallets
 It is recommended to use pallets that have multiple lifting points for equipment designed to lift loaded pallets and move the same.

Strapping

In order to secure the core trays on the pallet, it is recommended that these be strapped to the pallet.
 This would prevent any stack from falling over or collapsing during movement.
 It is recommended that nylon strapping be used. This is a simple process with the tools provided.
 On completion of strapping, the stack can be wrapped for long term storage

Pallet Wrap

This would be the most efficient way of preserving core.

- ✓ A wrapping machine would be required.
- ✓ Pallet stacked would be placed on the base of the unit.
- ✓ The base of the unit will rotate, allowing the wrap to continue around the stack
- ✓ A minimum of three wraps to properly secure the stack
- ✓ 17 micron wrap would be recommended allowing for between 50 and 70 micron per stack

Suggested Mode of Operation

A detailed database of all boreholes, core tray numbers and depths be maintained. Dependant on the depth of the borehole, this may require more than one pallet for storage

Borehole Number	Number of Trays	Pallet Number	Tray Number From	Tray Number To	Meters	Pallet Fumigated	Pallet Wrapped	Pallet Stored

Wood Core Trays

To stack a combination of wood and plastic core trays could be problematic due to different profiles.

It might be necessary to unpack a number of boreholes and repack into plastic or metal trays. This would give you a number of spare wood trays to be used in instances where some wood trays are beyond repair.

Wood Core trays be inspected for rot and or damage. Repacked into spare wood trays as per above.

- ✓ Wood core trays are stacked on a pallet
- ✓ The core trays are strapped on a pallet
- ✓ Pallets are moved into a fumigation container
- ✓ Fumigation takes place
- ✓ Pallets are removed from the container
- ✓ Moved to the wrapping machine for wrapping
- ✓ On completion moved to the designated position for long term storage

Using a dedicated 6 meter container, four to five stacked pallets can be fumigated at a time. This will allow for a production line as well as taking safety matters into consideration.

Plastic or Metal Core Trays

- ✓ Core trays are stacked on a pallet
- ✓ The core trays are strapped on a pallet
- ✓ Moved to the wrapping machine for wrapping
- ✓ On completion moved to the designated position for long term storage

Below is an example of data on the palletising

Please Note - Weights and Meters are Estimated										
Pallet Size	Tiers	Average Weight Core Tray	Number of Core Trays Per Tier	Core Trays Per Pallet	Weight Per Tier	Weight Per Pallet	Core Tray Size	Meters Core Per Tray	Meters Core Per Tier	Meters Core Per Pallet
1,200 x 1,000	3	45	10	30	450	1 350	NQ	6	60	180
	3	45	10				HQ	5	50	150
	3	45	10				PQ	4	40	120
1,000 x 1,000	2	45	10	20	450	900	NQ	6	60	120
	2	45	10				HQ	5	50	100
	2	45	10				PQ	4	40	80

Pallet Mobility

Fork Lift

- ✓ Minimum 2 ton, preferably 2.5 ton – Safety Load Factor
- ✓ Wheels – Off Road, Rough Terrain
- ✓ Battery Powered (Environmental or indoor use)
- ✓ Diesel
- ✓ Rough Terrain Pallet Jack
- ✓ Trolley

Equipment

- Pallet Wrapping Machine
- Pallet Strapping Machine

Accessories

- Pallets
- Pallet Strapping
- Pallet Wrap

Fogging

- Fogging Tent
- Fogging Container
- Fogger
- Fogger Chemicals
- PPE Fogging
- Contamination Outer Wear
- Respirator

Wrap Machine



Pallet Wrap with Straps

Wooden Core Trays

- What is the current condition
 - Is there evidence of rot
 - Weather related
 - Insect related
- Will they stand up to being relocated and racked
- Will they need to be repacked in plastic or metal trays
- What is the state of core
 - Weathered
 - Fragmented

In order to preserve the longevity of wooden core trays, it may be necessary to fumigate these to prevent insect rot.

The most important consideration for fumigating is the laws relating to Occupational Health and Safety.

These would include:

- The applicable Acts
- Workplace hazards and safety precautions
- Chemicals used for treatments
- Termiticide application equipment
- PPE requirements

Fumigation can take place

- ✓ In a container set up for this purpose – preferred as this is self-contained and can apply to safety standards as required
- ✓ In a tent or tarpaulin set up for this purpose

Fumigation - Setting up a dedicated container for fumigation will allow for:

- ✓ Multiple pallets and stacks to be fumigated at once
- ✓ Proper ventilation control
- ✓ Proper access control allowing for the applicable Acts and SANS codes and workplace hazards and safety precautions

General Information

Example of Information Required

Storage Type	Size	Trays	Weight Per Tray	Total Weight	Running Weight Kg's
Wood	BQ	9000	45	405 000	
	NQ	1000	50	50 000	
	TNW	250	55	13 750	
					468 750
Steel	BQ	7736	45	348 120	
	NQ	10287	50	514 350	
	TNW	627	55	34 485	
					896 955
Pulp		2000	15	30 000	
					30 000
		Total Weight Kg's		1 395 705	1 395 705
		Total Weight Ton		1 396	1 396

Orientation and Integrity

Minimum Requirements of Stored Core

- Project Name / Number
- Borehole Number
- Core Tray Sequence of Hole Depth
- Core Tray Meters of Stored Core

A number of considerations come into play

One of the considerations is the proposed requirement:

- Will further samples be required to be stored at a later time period.
- Must the system allow for expansion to meet additional storage requirements at a later time period

Included in the considerations

- **Civil Works, including the correct design of the concrete slab**
 - Weight of core racking
 - Weight of full core racking system when core trays are stored
 - Use of fork lift or other mechanised loading / transport system to move core trays
- **Engineering Requirements**
 - Structural design and sign off by either the mine or other engineering body
 - Safety requirements including working at heights and the company policies relating there to.
- **Electrical Work**
 - Sufficient and adequate lighting for working on both the movement of core trays as well as the evaluation of core

Other Lay Out Considerations

- **Will logging and or sampling be ongoing**
 - Core Splitting Area
 - Plumbing
 - Water Run Off
 - Noise
 - Light
- **Core Logging Area**
 - Logging Tables
 - Light
- **Core Lay Out Area**
 - Borehole layout / sequencing / orientation
 - Space requirement
- **Access between rows of storage**
 - Sufficient space to move core trays up and down the rows
 - Sufficient space for accessing the racks of core trays
 - Consideration whether a trolley or Side Loader can safely manoeuvre
 - The layout of a borehole sequence in full or mineralised section

Core Yard Check List

Working Sheet

Project:

Core trays	Wood	Metal	Plastic	Other	Total	Average Weight	Total Weight	Core Tray Length	Core Tray Length	Other
								1.0	1.5	
BQ				-	0					
HQ					0					
NQ					0					
PQ					0					
OTHER					0					
Totals	0	0	0	0	0					

	Average Weight	Total Weight
CHIP TRAYS		
SAMPLE BAGS		
GEOCHEM BAGS		
OTHER		

WOOD DAMAGED	
WOOD REPACKED	
ADDITIONAL TRAYS REQUIRED	
OTHER DAMAGED	
OTHER REPACKED	
OTHER TRAYS REQUIRED	

LABELS DAMAGED / MISSING	
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