Hand Mining

When the term hand mining is used, we know that we are talking about some kind of tunneling. For those who have never been in a tunnel, digging a tunnel by hand conjures up images from WWII movies where the POWS are escaping.

In modern construction practices “hand mining” is a viable and cost effective method of constructing a tunnel. There are some obvious limitations that we should recognize up front. The main limitation is size. Hand mining will not be a viable method where the tunnel is too small for man entry and in large tunnels where there is a large volume of material to be excavated. The size range of hand mining is generally accepted as 42” to 60”.

Tunnels are needed for a number of uses including storm water conduits, sanitary sewer piping, raw water and treated water conveyance, material handling, and industrial piping. In order to discuss this methodology it is helpful to focus on the type of lining to be used in the tunnel.

Some tunnels are constructed using the finished pipe product as the tunnel liner and the materials that are commonly used are fiberglass pipe and concrete pipe. Other tunnels are constructed using a tunnel liner and a carrier pipe is then inserted through the lined tunnel. The following products are commonly used as a liner:

-Liner plate
-Corrugated metal
-Steel casing
-Beam and lagging
-Concrete pipe
-Wood box tunnel

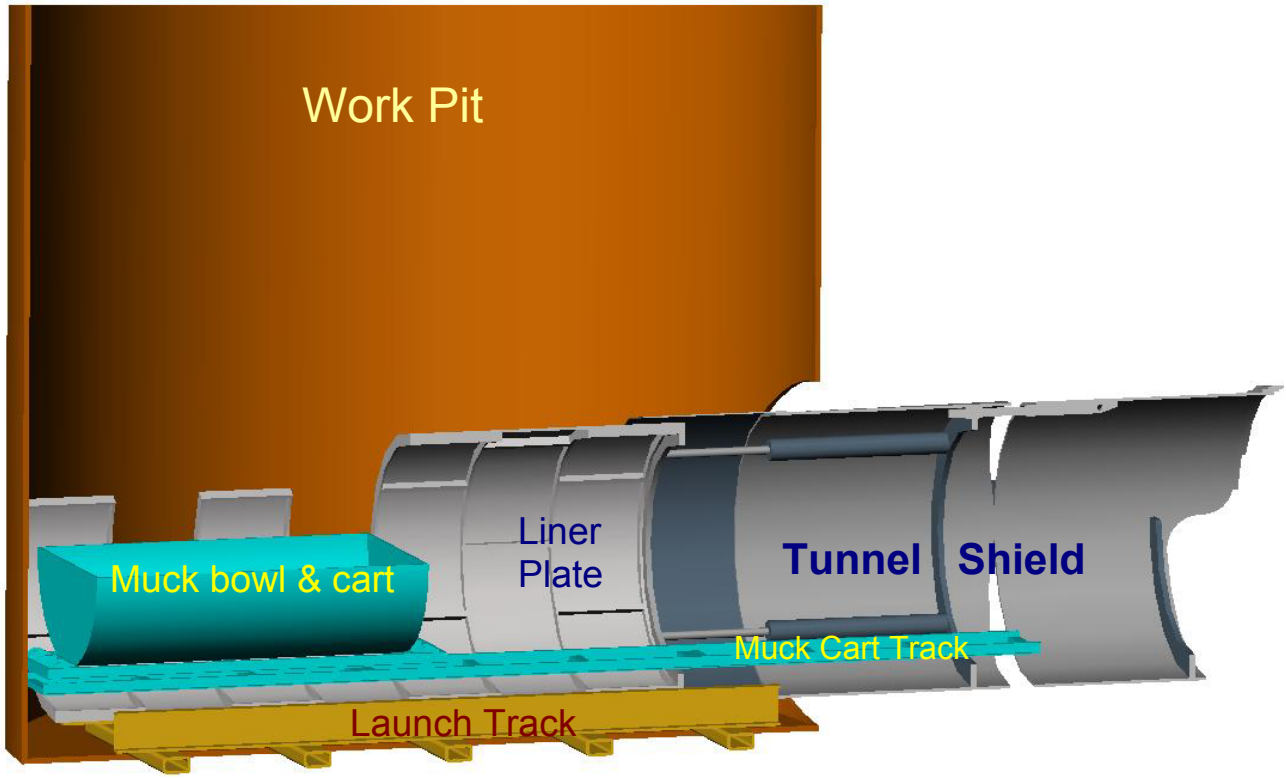
There are specific job site related parameters including the ground condition that will dictate what lining and what method is appropriate. However, hand mining is normally appropriate for all of the pipe products and liner products listed above.

Hand mining is normally limited to reasonable ground conditions in the following soil types: rock – soft or hard, clay, and stiff sand & gravels. Some groundwater can be tolerated, especially if the tunnel is being constructed heading uphill.

In all ground conditions and with all of the above pipe products, hand mining is safer and more efficient if it is done from within a shield. The shield not only protects the men but also allows for more control over the ‘heading’ of the tunnel. Many shields can be steered either mechanically or with hydraulic power.

Some shields are advanced by the advancing column of new pipe, as is the case with welded steel casing pipe or concrete pipe. While other shields have the ability to advance forward by pushing off of the tunnel liner product. In this configuration, the liner is constructed within the protection of the rear of the shield, as is the case when using liner plate or beam and lagging.

Cutaway view of a typical liner plate tunnel job



Normal sequence of construction:

1- Excavate the pit to the appropriate elevation taking into account the launch track and the liner plate dimensions.
2- Set the launch track on a firm stabilized floor.
3- Excavate a short entrance hole for the shield.
4- Set the shield on the launch track and assemble the liner plate behind it. This will allow the shield to advance by pushing off of the assembled liner plate. The liner plate must be only partially assembled at the rear of the pit for the egress of the men and to allow the muck bowl to be removed.
5- When the liner plate assembly has advanced beyond the wall of the pit, the annular space will be grouted. This grouting will be done at least as often as the end of each day. When sufficient liner plate has been grouted, the liner plate in the pit can be removed. Note – the lower sections of liner plate will remain to support the muck cart track in the launch track.
6- The new liner plate sections will be assembled at the rear of the shield and the shield will be advanced forward. When the shield is advanced enough, another section of liner plate will be assembled and the tunnel will progress to the other end.
7- Note – the work pit and the tunnel require specific safety procedures and training.