Timber and Concrete Drift Footage by Year

	1947	1948	1949	1950 (6 months)
Timbered Slushing Drift	2,075	742	692	0
Timbered Haulage Drift	625	125	0	0
Concrete Slushing Drift	75	2,149	1,203	1,809
Concrete Haulage Drift	0	315	984	479
Total	2,775	3,331	2,879	2,288

Slushing drift footage required is about three times that of haulage drifts.

Timbered slushing drifts were drawn empty, leaving haulage drifts with concreted slushing drifts exclusively on following dates:

550 Level—May, 1949
600 Level—April, 1949
650 Level—January, 1950
700 Level—June, 1950

From this it is seen that the real benefits of having practically no repair were not attained until 1950, when footage increase was made with fewer men.

	1947	1948	1949	1950
Average Daily Timbermen	46.2	49.8	47.2	38.0

The following advantages and safety features have become apparent as this work in concreting haulage and slushing drifts progresses:

1. The most obvious safety feature of the concrete drift is its greater capacity to protect men from falling debris.
2. Elimination of hazardous repair work.
3. Elimination of heavy lifting.
4. Less experienced timbermen are required for both original placement and occasional repairs to finger openings.
5. Development of haulage and slushing drifts can be carried out far in advance of work actually required, with no deterioration of the development workings. This can be especially advantageous during shutdowns.
6. The driving of both slushing and haulage drifts with an arched section has permitted the drifts to stand unsupported until they can be lined with concrete.
7. The fire hazard from timber is eliminated. Recently the slushing-drift hoist stations have been concreted, eliminating the danger of fire through electrical hazards.
8. Cleaning of spillage in haulage drifts with air shovels is made easier in the concrete drifts due to smooth sides and a higher clearance.
9. Concrete being a poor conductor of electricity, electric blasting has been made safer.
10. The trolley wire is always on the south side of the haulage drift. The walkway along the haulage drift and the manway ladders to the slushing drifts are kept on the north side. With timber sets the walkway side clearance was only 9 in. at the posts. Although we had 19 in. of clearance between the posts, we have had a few accidents of men being squeezed. In the concreted drifts, the walkway clearance is 18 in. Safety stations every 40 ft. make an additional 2 ft. of room.
11. In the timbered slushing drift, miners would occasionally hang blasting fuse and place dynamite behind the timber, to be used later. Often this would be forgotten. In one instance, firing of a finger blast set off dynamite in the blocking with considerable damage. This has been entirely eliminated in the concrete-lined drifts, fuse and dynamite being kept in proper storage boxes.

Some necessary precautions are required:

1. Use of respirators and goggles is required by men concreting. (However, only limestone, sand, and stone aggregate are used, eliminating silicosis hazard.)
2. Some hazard results from forming-board nails, causing puncture wounds. This is practically eliminated if working places are cleaned daily.
3. Good communication is essential between blowers and forms. This is done by using independent voice-powered phones.
4. Firm handholds were installed in the roof of concrete slushing drifts between finger openings. Some hazard of rolling chunks in drifts having 35 per cent grade is evident. In a timbered drift men could step out of the way by aid of holding timber. In concrete drifts handholds are essential.

In conclusion, it is well not to compare construction work and concreting in a producing mine.

In construction work, the placer or pump is usually set close to the forms. The placer can then be emptied in about 45 sec.; 200 to 300 cu. yd. per shift is not unusual.

With our long pipe lines, 100 cu. yd. would be the maximum amount poured. Three to four sets of forms are used. This allows daily pours to one or two sections, while moving and forming the other sets.

Average weekly pours are 125 to 200 linear feet of tunnel, requiring 1⅕ cu. yd. per foot. A monthly high of 1,125 cu. yd. was used for lining drifts and miscellaneous construction work.

Mining Without Wood in the Asbestos Industry

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Wood, for centuries, has been the most widely used commodity in almost all methods of underground mining. Wood timber represents one of the major overhead charges in operating a mine. In many mines it represents the greatest single expense, which is double and treble that of any other single commodity necessary for the safe operation of a mine.

Many mines have their own timber limits and an entire woods crew whose sole occupation is supplying timber to the mine.

Wood is considered as a contaminant to asbestos fibre. It is a foreign material and is extremely difficult, if not almost impossible to separate by present general methods of milling. Wood when crushed and milled will fiberize the same as asbestos. Due to the fact that it goes through a dry milling process it will become covered by dust, and it, therefore, closely resembles opened fibre and only by manual picking on slow moving belts or picking tables could a majority of it be removed. Of course, magnetic separators are used to remove tramp iron, but copper blasting wire and wood chips and splinters still have to be hand picked. Wood is sometimes removed from certain grades of fibre by passing it over screens or through other equipment that has very critical air currents or suction hoods that separate some of the heavier splinters, but even this method leaves much to be desired.

You can readily understand the concern in eliminating wood from asbestos fibre due to the diverse nature of the two products. One is mined especially for its fireproof and heat insulating characteristics while wood is the exact opposite in every respect.

In years gone by the presence of wood in various finished asbestos products was one of the most frequent causes of rejection. The presence of wood splinters was also the frequent cause of mechanical damage, due mainly to the delicate nature of some processing equipment. Wood occasionally would continue all through the manufacturing process and only show up in the finished product, such as rigid shingles, asbestos paper, brakelining and gaskets, only to mention a few. If the final inspectors caught them before they were shipped, they would, of course, be scrapped. But human frailties being what they are, some products reached the open market that contained as little wood as you would find in one toothpick.

In the early years of the industry it was considered a necessary evil, something which could not be prevented, or which no one thought was important to give it much thought. They had wood pickers in those days, just like the coal mines had bony and slate pickers. In the old days at one mine

15 men were required to clean the loading face with an air hose to dislodge the twigs and splinters from between the rocks, which were then picked up by hand in buckets. But the boys couldn't and didn't get it all. Complaints continued to plague the industry.

In recent years the industry has come to the conclusion that the only logical way to keep wood out of the finished product was to remove it from the source.

This necessitated a complete reversal of standard methods of mining. It meant a complete retraining of the technical staffs at each mine. The underground and open pit crews had to be trained to handle steel instead of wood. Even the purchasing department and stores had to stock a new line of equipment.

Just imagine the same problem in your own mine if the order came through that starting the first of next week it is forbidden to use wood in any form.

Now don't get the idea that this problem was licked overnight. It wasn't. In fact, we have been working on it now for more than 20 years. Progress has been made. We have eliminated practically all major uses of wood, but a few of the smaller ones still persist. One of the main problems today is indoctrinating new employees. It is difficult to explain to a new man that he is forbidden to use wood in any form. When he is told that he is not even allowed to carry wood matches in his pocket he is amazed.

When the campaign was started, some mines gave away lighters and placed lighter fuel at advantageous spots around the property. Today it would be difficult to find a wood match.

One of the greatest sources of wood splinters in the open pits was the railroad ties which became broken and splintered at the face by the shovel or in moving. These were easily converted to steel ties. However, in the early days standard railroad gauge ties to carry an 85 lb. rail were not available and had to be manufactured in the mine's own shops.

Shovel and sledge hammer handles are another source of wood that so far we have not been too successful in changing. A steel shovel handle was tried some time ago, but it did not prove practical, due to the twist that would develop. A test will shortly be made of a shovel made completely of aluminum. One mine, in an effort to control the shovel splinter situation, requires that all pieces be returned to the storeroom before a new shovel is issued.

Steam shovels were equipped with wooden cabs which had to be covered with sheet iron and all new shovels were ordered with steel cabs.

Dynamite is usually transported around all mines in the original box. In the asbestos industry all dynamite and caps are opened in an opening house, the sawdust removed, and the contents placed in rubberized canvas bags to be carried to the face.

A steel blasting pole has been developed for placing bombs on a hang-up in a grizzly draw point. These blasting poles are made of sheet steel 8' x 8" and rolled into a 1" size pipe, telescoped at either end so they can be joined.

Even loading sticks for putting dynamite into the holes were a source of wood that had to be eliminated. Experiments ranged from rubber covered wood to brass and aluminum poles which were rubber tipped. Flexible plastic rod was tried. All of these couldn't stand the rough treatment and the search is still on. At the present time we are experimenting with a solid rubber hose which is flexible enough to be rolled into a 4 foot circle. This looks promising for it is now possible to load long diamond drill or sectional steel holes in a narrow drift without much difficulty.

Stairways and ladderways in the open pit and underground which were previously all wood are now made of steel. It is still permissible to use wood if the location is far enough removed from a working face, but the habit of using steel is so strong that the machine shop will automatically use steel unless a specific order is given to make the steps of wood.

At one time every machine guard in all the mills was made of wood. If a belt broke, splinters would fly and get into the final flow of the screens. About 15 years ago the making of guards was taken away from the carpenters and turned over to the tinsmiths who, of course, used sheet metal. In due course it finally became a responsibility of the machine shop and welding department, and they now make some of the finest and efficient guards I have had the pleasure of seeing anywhere.

Loading chutes underground are all made of steel plates, "I" and "H" beams. Platforms are made of sheet steel and angle iron or pipe hand rails.

One of the greatest and most important problems that has fallen upon the engineering staffs of the various mines is the conversion from wood to steel for timbering underground.

Now the asbestos industry is no different from any other mining industry when rock structure is discussed. Some of it is good ground that requires no timbering for hundreds of feet of main haulage drift. Other sections, however, require a 100 per cent timbering job, and it is quite common to use fore-poling and spiling to go through caving ground. Occasionally in severe slickensided areas two breast boards are required to keep the face itself from caving. There have been instances when a whole 8' x 10' main heading round was pulled with 6 sticks of powder with considerable overbreak, and then the driller would be reprimanded because he didn't load only the caps.

From that you can see that weak ground is encountered and that it not only exerts vertical pressure but side pressure as well. Consequently, some of the steel timber installed in the early days couldn't take the required load.

There was no previous experience to go by. Trial and error were more the rule than the exception. One mine would pioneer one idea of timbering and install it in their own mine and let the bugs develop. By that time one of the nearby mines would then be ready for underground development. The experience of the other mine would then be used to advantage, improvements would be added and experience of the second mine would be available for others. In this respect the asbestos industry has enjoyed extremely close cooperation with each other in solving their mutual problems.

While the asbestos mines have made substantial contributions to the mining industry in advancing the technique of block cave system of mining, we in turn are deeply indebted to several American mines, who, 20 years ago, gave us the benefit of their experience so we could get started. The interchange of visits by our technical staffs continues to this day.

Due to the nature of the rock structure in the asbestos field, it was found feasible to adopt the block cave system of mining. This is a system where a block of ore is ringed with boundary caving drifts, then undercut drifts are driven through the bottom of the block. Then the undercut drifts are drilled with a series of sunburst holes which are loaded with powder for the primary development blast. Below the undercut is the grizzly or slusher drift. When the undercut is blasted, then the block starts to work down and is then pulled through the grizzly raise, into a slusher drift or down through grizzly bars to the loading level 100' below.

Even though the grizzly drifts are cut into solid rock, with a 20 foot roof or back, the pressure from the caving block is sometimes terrific and the steel timber in the grizzly cabins is subjected to pressure and force that no wood could ever stand.

In making these grizzly cabins we have progressed through a series of stages from 3" I's to 4" H's and 5" and 6" I's and H's and cable reinforcing to where we now use heavy duty 8" H's at 10" centers and in some cases they are solid.

But as all things progress, we feel that it is a step forward now to endeavor to eliminate steel wherever possible by the use of concrete. It has been found that when reinforcing is used in concrete underground that it develops a line of weakness and is subject to cracking. When our steel forms are solidly concreted, vibration will sluff off the outer shell of concrete.

Experiments were made by eliminating the reinforcing from concrete and a great improvement in strength was found. If taking a little steel out on the grizzly level helped the concrete why not go further and take it all out and make a solid monolithic structure of pressure poured concrete!

This is now being done and it is too early yet to evaluate our experience. Some of our early grizzly openings were too large, we were too optimistic, and they caved in beautifully and dutifully. They are now being rebuilt and the growing pains we went through with steel we are duplicating in concrete. Maybe about two years from now we can present a paper on mining without wood or steel.