

wind-shakes, heart cracks, and black and loose knots.

The cracks in seasoned timber, due to exposure to the direct rays of the sun, are not to be confused with heart cracks and wind shakes. These latter are splintery, the splinters in many cases easily torn off, while cracks caused by seasoning are sharp and well defined. Bridge timber should be seasoned as it wears much longer than green timber, but this is often difficult to obtain as public works seldom have their needs anticipated by the trade. Seasoning proceeds much more rapidly and the value of timber is much increased for bridge purposes, if it can be kept soaking in water for several months after being cut into plank. The water acts as a solvent in ridding the pores of sap and nitrogenous matter which are the decaying elements of wood.

The wood of newest growth, that is the part next the bark known as "sap-wood" is not durable but it is impossible to obtain any large amount of timber entirely free from it. Sap-wood is lighter in color, softer and of more open texture than heartwood and decays and wears away much faster. Timber is "merchantable" if it has not more than three sappy corners, but it is not advisable to allow more than two. The sap corners can then be end downward, the heart wood exposed to the wear, and as bridge plank always wears faster than it rots, two corners which can be thus placed are not objectionable. Bark edges, if on one corner only, which can be laid downward, should not insure the condemnation of the wood, but if on more than one corner, it indicates that the plank is composed entirely of sapwood, that it is from that portion of the log next the slab, and it therefore should not be allowed to enter the bridge.

Shingles.

A bundle of shingles, if full size, should have 25 courses on each end, and be 25 inches wide; or else have 22 courses on one end, and 23 courses on the other, and be 22 inches wide. Four such bundles contain 1,000 shingles, each supposed to be four inches wide. They are usually 16 inches long; sometimes in the nicest class of shingles they come 18 inches long. It is poor economy to use an inferior quality of shingles; it costs rather more to lay them than it does good ones, and they may make a leaky roof, almost from the first. Spruce shingles are used considerably by some, but are not suitable to make a roof, as they warp and twist, and very quickly split to pieces. Some soft pine or cedar shingles, best quality, are the cheapest in the end; but even bundles of the best quality will contain some hard, glassy shingles, which will act almost as badly as spruce; they should be thrown out.

It takes about five pounds of four-penny nails per thousand shingles; or three or

four pounds of three-penny coarse, which we think are preferable.

One thousand shingles, laid four inches to the weather, will cover 111 square feet. One thousand shingles laid four and one-half inches to the weather will cover 125 square feet. One thousand shingles, laid five inches to the weather, will cover 139 square feet. One thousand shingles (eighteen inch shingles only, except on walls), laid five and one-half inches to the weather, will cover 153 square feet.

The above does not include waste, which must be allowed.

Laying Sewer Pipe.

The method of laying sewer pipe varies somewhat with the character of the ground, the fall and other particulars. A common method and a very poor one is to set stakes at intervals of 25 feet or so in the bottom of the ditch, and take out the bottom by eye to a gradient joining the stakes. Where the gradient is near the minimum this method is bad, because it is not accurate enough to keep the flow line of the pipe straight, and low spots in the grade will tend to produce deposits which may catch and hold large objects and produce stoppage. The method is also bad because the pipes rest on the bells, and when the trench is filled the weight above is liable to break the pipe. Small holes should be dug with a trowel below the bottom of the trench to receive the bell, as the pipe is put in position, and the pipe thus made to rest in the ground throughout its entire length. An excellent method of fixing the position of the pipe which finds favor with the contractors when they have been induced to try it, is to stretch a line along the trench, usually above the surface of the ground, which shall be a fixed distance above the flow line of the pipe. A pole is provided with a piece projecting at one end at right angles. The distance of the flow line is measured from the bottom of this projection along the pole and marked. As each pipe is put in place, the projection from the pole is inserted in the pipe, and the mark on the pole is brought to the line by raising or lowering the pipe as necessary. Care should be taken to leave the bottom of the trench too high rather than take out too much so that it will never be necessary to raise the pipe any considerable amount, as the dirt put under is liable to settlement.

Before the spigot of the pipe is inserted in the bell of the pipe previously laid, mortar is put in the bottom of the bell for about one-third its circumference. When the pipe is properly placed, the remainder of the joint is filled full of mortar, and a bevel of about 45 degrees is formed on the outside of the surface. Some pipe layers can do this work quickly and well with no tool but a trowel, other require rubber mittens to press the mortar in place and properly shape the outside. Bells of pipe should be large enough and well formed to leave a quarter of an inch all round the

spigot end of a new pipe. When the ground is soft, some foundation must be put under the pipes. If this foundation is of boards, the bells of the pipe should not be rested directly on the boards, as the weight of earth on top of the pipes has been known to crush almost every pipe in a long line laid. Concrete should be built up on the boards to the form of the pipe to give it a uniform bearing. This concrete may be of gravel or sand, five parts to one part cement. Sometimes the soft material can be excavated a foot or so, and the trench refilled with proper material. When the ground is wet, and it is especially desirable that the leakage of ground water into the pipe should be a minimum, or when the sewerage must not be permitted to leak out of the joints, practically a water-tight joint can be secured by first driving into the bell of the pipe a strand of oakum which has been thoroughly soaked in a neat portland cement mortar, and then filling the remainder of the joint in the usual manner. Care must be taken in placing the pipe in position, not to force any portion of the oakum to project into the pipe, as it may be a source of trouble from stopping matters sliding along the bottom of the sewer, and finally producing serious obstructions. Earth should be carefully tramped under and around the pipe, and for a foot or two above, so as to prevent disturbance of the joints before the cement sets, and no walking on the pipes should be permitted.

The Good Roads Exhibit.

Among the new features of the Toronto Industrial Exhibition this year was a display of roadmaking machinery under the patronage of the Ontario Good Roads Association. All kinds of road machines were represented. Stone crushers, rollers (steam and horse), graders, wheel and drag scrapers, plows, etc. Some of the principal exhibitors were Copp Bros., Hamilton; Sawyer-Massey Co., Hamilton; Western Reversible Wheel Scraper Co., represented by H. A. Brownell, London; J. C. Steele, Thornhill; Waterous Co., Brantford. Trap rock was also shown by the Powell-Mitchell Co., Marquette, Mich.

Short pieces of road were each day constructed on the grounds under the direction of the Provincial Highway Commissioner and all machinery was shown in actual operation. The effect has been to create in the minds of those visiting the exhibition a feeling decidedly in favor of the use of machinery in roadwork. The stone-crushers were particularly interesting, the stone being broken, screened and separated into various sizes much more perfectly and effectively than can possibly be done by hand. Several municipalities took advantage of the exhibit to send deputations for the purpose of comparing the different makes of machines and an excellent opportunity was thus afforded them to choose a machine particularly adapted to the needs of their locality.