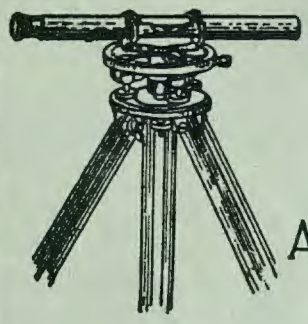

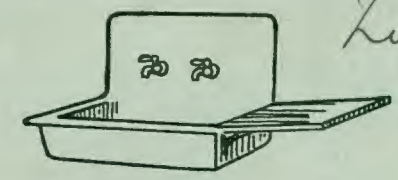


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SAWDUST-CONCRETE INVESTIGATIONS

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Ever since concrete has become popular there have been attempts to find methods of cheapening it and of making it lighter in weight and a better insulator. In spite of the many advantages of concrete for construction purposes, it has some definite disadvantages, owing to the lack of insulating characteristics and resultant cold surfaces and condensation of moisture in winter. Many lightweight aggregates, such as cinders and expanded minerals, frequently overcome some disadvantages of ordinary concrete but most of these are relatively expensive or difficult for the ordinary builder to prepare. Among these lightweight aggregates, one of the materials utilized in the attempt to lighten and cheapen concrete is ordinary wood sawdust. Through various sources a considerable popularity has been developed for sawdust-concrete, although it is as yet of questionable merit. Publications on the subject are still incomplete because of limited research and experience.

Probably the first reason for the use of sawdust as a concrete constituent is its low price in most localities where it is available. When suitable kinds of sawdust can be secured at low cost, there may be occasion to use them for certain purposes in preference to sand and gravel. The strength of sawdust-concrete does not compare with that of the standard, being in most good samples from only one-tenth to one-third as strong. Some sawdust-concretes have no strength whatever while others have reached strengths of from 300 pounds to more than 1000 pounds per square inch in compression. This is hardly sufficient for heavy load-bearing construction or reinforcing purposes but may be quite suitable for floor, wall, or roof insulation, or load-bearing use for poultry or other light stock.

Disadvantages

In addition to the lower compressive strength, certain disadvantages are apparent when sawdust is used for the aggregate. Sawdust-concrete of ordinary proportions will absorb water to a point of saturation where the weight absorbed may be as much as 70 per cent of the dry weight of the sample. For exterior construction it could not be recommended without a surface covering of a more impervious material. In a test of freezing and thawing, however, such saturated specimens were found to withstand up to 50 cycles of alternate freezing and thawing without serious consequences. Those specimens which resisted the 50 freezing cycles, surprisingly proved stronger upon subsequent testing than similar specimens tested previously with less time for curing.

Advantages

Some of the advantages of sawdust-concrete under certain conditions are its cheapness, light weight, nail-holding capacity, insulation value, and resistance to freezing, burning, and termites. Dry sawdust-concrete varies in weight from 40 pounds to 70 pounds per cubic foot. This advantage of light weight may be utilized best as a fill in ceilings or roofs where some insulation without excess weight is required in a solid material. The insulating value is similar to that of wood, varying considerably with the mixing proportions, weight, and moisture content. For average mixes its insulating value is ten or fifteen times as great as that of the usual mixes of concrete. Thus for walls or floors of poultry houses or hog houses sawdust-concrete may present a definite advantage. Its nail-holding capacity is somewhat inferior to that of wood but far better than that of plaster or masonry.

Reports from various sources have indicated results from good to very poor. Naturally the mixing proportions are an important factor. A 1:2 mix is two or three times as strong as a 1:3 mix and six or seven times as strong as a 1:5 mix. The 1:3 mix is the recommended first choice as it is cheaper and a better insulator than the 1:2 mix. In very few instances might the 1:5 mix be recommended.

Certain Woods Not Suitable

Another important feature affecting the strength is the kind of wood used. Concrete strength does not vary with the strength of the wood itself but rather with its chemical nature. For instance, most of the soft woods tested developed stronger concrete than the harder, heavier woods. Red oak, Douglas fir, and cottonwood developed zero compressive strength with ordinary mixes. Only a very low strength was developed when birch, maple, or red cedar was used. None of these woods could be recommended for any useful service. The old type dirt, sand, or clay floors would serve just as well.

Some of the woods which have proved most suitable are Norway pine, jack pine, spruce, aspen, and ponderosa pine. If sawdust-concrete is to be used for construction purposes, however, even these woods should not be mixed without experimenting with a trial batch. A one-day trial period should be sufficient as all of the usable mixes definitely set overnight.

Although large particles of sawdust have been reputed to develop stronger concrete than small particles, batches tested from the coarser and finer halves (as separated by screening) of ordinary sawdust resulted in concrete of practically equal strength.

Importance of Using Proper Amount of Water

The water-cement ratio has been found exceedingly important. If too little or too much water is used, the strength may be only half of the maximum strength. When a deficiency of water is used, the weakness in the concrete is probably due to the absorption of most of the water by the sawdust particles, leaving insufficient for the use and setting of the portland cement. The proper water-cement ratio depends on the mixing proportions and the moisture content of the sawdust. Improved results were observed when the sawdust was soaked in water overnight, allowed to drain for a few minutes, and mixed with cement without additional water. The surplus water in the sawdust was apparently sufficient for the use of the cement, and mixes of this sort were of greater strength than the others.

Sawdust soaked for one week in water and used in concrete tested yet stronger. This is probably due to the washing effects on the sawdust which will remove certain soluble sugars, gums, starches, or acids present in wood. These soluble materials are organic in nature and prevent the setting of the cement. If they are removed, the cement will set sooner and harder. The liquor removed from nine kinds of saturated sawdust was analyzed, showing a much higher organic content for the weaker species which had developed almost no strength in concrete than for spruce, Norway pine, and aspen, which were much stronger.

In conclusion, perhaps no specific recommendation can be made in favor of cement-sawdust concrete except for limited conditions where great strength is not demanded and weathering not severe. In any event it is probably unwise to proceed with mixing and pouring without first experimenting with a trial batch of the sawdust which is to be used.

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