such load. In general, we should expect the channels to be bent rather irregularly.

It may be worth while to point out approximate relations between these loads and the channel deflections. Let us take the channels given in Pearse's table, same distance between channels, with two rows of single lattice bars inclined 60 degrees with the column axis. Take the channels initially straight and let one of the channels be deflected 0.001 inch by the lattice bars attached to one point of one channel flange, this deflection being forcibly caused by the lattice bars. If we consider the channel as acting like a simple beam of two panels length loaded in the middle, we find the force in each lattice bar to be rather more than 100 lbs. for this small deflection. If we consider the channel as a continuous beam extending over several panels, it is evident that the lattice bar load will be considerably increased; in making an approximate solution by means of characteristic points I found the load for each lattice bar to be about 250 lbs.

One can estimate the maximum deflection that these channels can take before they reach the yield stress; using a yield stress of 30,000 lbs. per sq. in., my estimate for this is approximately 0.001 inch for each inch of depth of the channel. After these values have been checked, they can be used to estimate the maximum possible fabrication loads of the lattice bars of channel columns.

It will be noticed that these fabrication loads cannot be determined by strain gauge measurements upon columns under test loads; they may be estimated by means of such measurements made at the time of fabrication; I do not know if such tests have been tried.

If a single lattice bar is too long or too short by 0.001 inch it will tend to throw the channels out of line, and in the above set of channel columns, this bar will carry a load of about 125 lbs., the channels being regarded as continuous beams. Since this sort of an error throws the channels out of line, this bar will have to carry a portion of the column load. If the error in the bar is 1% of its length, the load in this single bar due to column load is about 5/8% of the column load.

It is to be hoped that fabrication stresses will receive much more attention in the future than they have heretofore received. It is believed that their investigation will reveal many of the reasons why we must use large factors of safety; they may show that our factors of safety as now used are not appropriate to the several structural members.

By way of summary of the views presented above, we may say that it seems improbable that any one formula can now be written for lattice bar loads that will give appropriate results for all conditions; that in assigning lattice bar loads to be used in the design of some particular set of columns it may be appropriate to express the lattice bar load by three terms: (1) the first term may depend upon the carelessness of fabrication and upon the stiffness of the main members of the column; (2) the second term may depend upon the carelessness of fabrication and upon the column loads; and (3) the third term may depend upon the general proportions of the columns; while the sum of the second and third terms should not be smaller than another term which may depend upon the general proportions of the columns and upon the rough handling to which they may be exposed in transportation, erection, and use.

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EFFECT OF ALKALI ON CONCRETE.

The engineers of the United States Reclamation Service are investigating the effect of alkali waters and soils on concrete. In the Reclamation Record for February some preliminary conclusions are presented. Sulphates, especially of magnesium and sodium, were found to be the most active in producing disintegration.

Two extreme cases may be cited in the Sunnyside and Belle Fourche projects. Of a number of test specimens exposed on the former no disintegration was observed at the end of about eleven months, with the exception of a specimen containing a soap and alum solution in the mix. The specimens were all of a 1:3:5 gravel mixture. Furthermore, none of the concrete structures on this project have been affected. On the other hand, various mixtures exposed on the Belle Fourche project were all found to be disintegrated at the end of eight months, with the exception of a 1:2 mortar specimen, which was not affected. Concrete structures in this project have also been disintegrated by alkali.

Analyses of samples from the Belle Fourche project show magnesium and sodium sulphates present in strong solution, with the former predominating, and samples from the Sunnyside project show sodium sulphate only, and in much lighter solution. As a general proposition, it must for the present be concluded that in locations where alkali containing these salts is present, special precautions must be taken to prevent its possible action, unless experience with structures previously built has shown no deleterious effect.

Lean mixtures of concrete are more susceptible to disintegration than rich mixtures, and those which are scientifically proportioned as regards cement and aggregate give the best results. This is to be expected, as with scientific proportioning the percentage of voids is reduced to a minimum, thereby preventing seepage of the alkali-laden water into the body of the concrete.

Experiments have shown that the more nearly impervious the concrete the less it is disintegrated by alkali. It is a natural deduction, therefore, that waterproof concrete will resist alkali action. Such concrete, under certain conditions, may be difficult to produce. Laboratory experiments have shown that it is possible to produce concrete that is practically impervious to water up to 50 to 75 lb. per square inch pressure, and satisfactory results have been obtained in the production of an impervious concrete in the field on structures where special care was taken toward that end.

There are numerous patented waterproofing compounds on the market; there are also being manufactured several so-called alkali-proof cements. A number of these have been tested, but the results have not been any better than those obtained with straight Portland cement. Sand cements also have so far shown no superior alkali-resisting qualities. J. Y. Jewett, cement expert, gives his tentative opinion "that with good cement, with care in the selection of suitable aggregates, with proportioning to produce a rich, dense mixture, and with proper methods of mixing and placing, it is possible to produce a dense, impervious concrete that will withstand the alkali action under ordinary conditions without the use of any special materials for waterproofing purposes." With fairly rich concrete an impervious skin of neat cement or rich mortar, such as is produced by working a flat spade between the concrete and steel or surfaced wood forms, will no doubt also have a decided effect in resisting the action of alkali.