The WARREN TRUSS program consists of two parts: TEXT and WARREN_1. TEXT describes how to use WARREN_1; WARREN_1 converts the stresses on a truss to stresses on the individual members of the truss. Therefore, from knowing what loads a truss must withstand, one can calculate the forces on the individual bars. The sizes of the bars can then be calculated.

This analysis is based on the joint method. The joints are identified by number; the bottom left joint is number 1, the first joint on the top is #2, the next joint on the bottom is #3 etc. All loads are considered as being placed at the joints. The distance between joints 1 and 3 and 2 and 4 is considered to be one panel length or the span of the panel. The half span or half panel length is specified in E5.

Truses are analyzed with lengths of 20, 18, 16, 14, 12, 10, 8, and 6 half panels for trusses with both distributed and discrete loads. For trusses with 4 and 2 half panel lengths only the discrete load problem is solved. (A program for solving trusses of lengths up to 40 half panels is under development. It should be ready by the time you read this. It can be obtained by registering, as described below.)

Some truss problems consider the truss as weightless and asks for the forces on the members due to discrete loads on the joints. This program handles this problem by having the user set F13, O2, and O3 equal to zero,. The required loads are set in column L. Column K adds the loads in columns L, M, and N to give the total load on each joint. The user enters truss dimensions in E4 and E5.

If the user wishes to solve the more general case of discrete loads plus distributed loads, the 0 in F13 is replaced with a 1. He then enters the pounds per foot loading inb O2 and O3 and any discrete loads in column L. The dimensions of the truss are entered in E4 and E5 and the program computes the forces on the individual bar members.

Due to subtle difficulties, the distributed loads are treated differently from discrete loads. For example, at joint 2 the distributed load is equal to the pounds per foot given in O2 multiplied by twice the half span given in E5. This load is assumed to be half of the distributed load between joints 2 and 4 and a load extending beyond joint 2 until it covers joint 1. No downward force is assumed at joint 1. At joint 3 the distributed load is assumed to consist of the load extending from joint 3 half the distance to joint 1 and half the distance to joint 5. This assumption means that the distributed load between joint 1 and halfway between joints 1 and 3 is not accounted for. This load is entered into the equations by assuming it is equal to half the distributed load at joint 3 and is located halfway between joins 1 and 2. A similar condition exists at the opposite end of the truss.

The first item in the truss calculation is the determination of the reaction (upward) force at joint 1. This is found, for the 20 half-span case, in C21, D21, and E21. The torques around joint 21 are found by multiplying the distance from joint 21 by the load at the joint being considered. The first term considered multiplies $A2 by K2. We find that $A2 is equal to 19 and K2 is the load at joint 2. The product is the torque at 2 around joint 21. These torques are found for all of the oints and are summed in B21. In cell G23 the total is divided by the distance between joints 1 and 21, given as 20 in cell G22. The result is the upward force at joint 1 for the case of discrete loads at the joints.

The correction for distributed loads is given in cell H23. Here the multiplier F13 is used. If no distributed loads are present F13 is set equal to 0 and H23 becomes zero. If F13 is set equal to 1 this cell may not be zero. The term (G22-.5) is the distance from joint 21 to half way between joints 1 and 2. This distance is multiplied by the distributed loading for joint 3. At the other end of the truss a similar correction is needed but here the distance is half the half span distance. The sum of these two torques is divided by 20, the distance between joints 1 and 21.

The values in G23 and H23 are summed in I23 to give the total upward force that must be present at joint 1. It is seen that this force is also equal to the vertical component at J26. This value is multiplied by the tangent of the angle between the vertical and the truss diagonals to find the horizontal component given in I26. H26 gives the force in the diagonal, obtained by dividing the force in J26 by the cosine of the angle the vertical makes with the diagonal.

H26 gives the diagonal force between joints 1 and 2, labelled D1,2. Since D1,2 is in compresseion it given a negative value in cell F26. The horizontal component of the diagonal force in D1,2 is given in cell I26 and is equal to the force in the member L1,3.

One can now find the forces at joint 2. The vertical force at this joint is the vertical force on D1,2 minus the force due to the weight on the joint, the force given in cell K2. This resulting vertical force is the vertical force on D2,3. The horizontal and diagonal forces can be found as before and the force on D2,3 determined. The horizontal force in U2,4 is the sum of the horizontal forces in D1,2 and D2,3.

In a similar manner one can compute all of the truss member forces.

CAVEATS: While we have calculated the forces carefully and have attempted to make the calculations error-free, we can not be certain that such is the case. A user should use another program or other means of verification for critical calculations. We would appreciate hearing immediately from anyone finding errors in the program.

To register for using the program send $15.00 to:

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