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STRUCTURAL INSPECTION REPORT

Client: City of Jonesboro
515 West Washington
Jonesboro, Ar. 72401

Date: November 14, 2005

Services: A structural inspection of Justice Complex at 410 West Washington in Jonesboro, Arkansas was conducted. The inspection was limited to the roof system of the building. An as-built roof trusses analysis was performed on the roof system. The trusses were measured and analyzed for existing dead loads and a 20 pound per square foot live load.

Findings: The roof trusses were inspected and measured so an finite element model of the trusses could be formulated. The trusses consist of a double top cord that is tapered. The top edge of the top cord is curved. See Figure 1. The member is 15' - 4" long with the center 10.5" deep and the ends ranging from 7.25" to 7.5" deep. The member is 3.5" thick. The building plans provided by the city for the remodeling of the building reported the member to be 16" by 3.5 inches. The members were constructed so that the butting of two members on one side of the truss was at the center of the member on the other side of the truss. The bottom cord was a double member that measured 7.75" by 3.5". The verticals and diagonals that ran between the top and bottom cords measured 5.5" by 3.5". The finite element model generated is shown in Figure 2.

The following dead loads were placed on the truss:

1. The new standing seam roof had a calculated load of 3 pounds per square foot or 490 pounds per load point over the verticals in the truss. The roof load was supported by steel tube columns. The building plans showed the tubes over top of the truss verticals. The field measurements showed the tube being off-set by up to 14" from the verticals with an average of 4" to 8". These offsets were accounted for in the finite element model.

2. Existing old built up roof and decking were obtained from the roof was weighed. The weight of the decking and built up roofing was determined to be 6.3 pounds per square foot. The trusses were spaced 20' on center. The old built up roof and decking was supported by 2x12's on 2' centers. This load was placed on the top cord of the truss at the point loads generated from the 2x12 rafters. The applied point load was as 176 pounds on each side of the top cord..

3. A ceiling was attached to the bottom cord of the truss that consisted of 2x10's with ½" plywood placed on the under side. The top of the ceiling was cover with plywood and

used for walkways and areas to support the mechanical units. This load was added to the truss model as an uniform load on the bottom cord. The load was determined to be 80 pounds per foot.

4. The drop ceiling and lights in the building were also accounted for by adding to the bottom cord as an uniform load of 20 pounds per foot.

5. The mechanical equipment loads were calculated and added to the bottom cord as an uniform load on the bottom cord. that ranged from 27 to 75 pounds per foot.

The inspection found that the cracked truss members had been repaired. The cracked members had been pressure glued in order to fill cracks. This repair was called for when the building was renovated. The repair to the truss members had been performed as required. Several truss members had been reinforced or replaced. during the repair

The trusses were reinforced with 1.5 inch steel tension rods that ran on each side of the truss. See Figure 3. The tension rods were attached to the truss at the ends of the truss. They were not attached to the truss at interior points. The center of gravity of the rods were 7.125 inches above the center of gravity of the bottom cord. This was modeled in the finite element model.

The truss was first analyzed for the existing dead loads with tension rods loaded with 200 , 2,000, 5,000, and 10,000 pounds. The bending and axial stresses were calculated in the truss members. The stresses near the middle of the truss in the top and bottom cords are reported in Table 1. The stresses near the end of the truss were the rods are attached to the truss are also reported in the top and bottom cords. The allowable stresses for axial compression ,tension and bending were obtained from a 1974 timber construction manual. This was done to account for recent reductions in allowable stresses for newer woods. The allowable stresses are presented in Table 1. The interaction equations were calculated for the truss members and presented in Table 2. The values should be less than or equal to one. The member stresses and interaction equations were also calculated for the dead load and a live load of 20 pounds per square foot on the roof. The results are presented in Tables 1 and 2.

The truss was modeled with one end pinned and the other end permitted to slide. This was done to account for the flexibility of the walls. The analysis of the dead load condition showed that the end of the truss slid 0.59" for a 200 tension pound load on the rods and 0.31" for the 10,000 pound load. The center line deflection was 1.46" and 1.14" respectfully. When the live load was added to the truss, the end slid 1.16“ and 0.88" for the 200 and 10000 pound loads. The center line deflection was 2.89" and 2.54" respectfully. The truss was 1172" long

Interaction values over one does not mean the roof would fail but the factor of safety is being reduced. The factor of safety for wood would range from 2 to 4. The factor is this large in order to account for the knots and other defects on the wood.

The analysis revealed that the truss appears to be fully loaded when no live loads are applied to the truss. When the live load is added to the truss, the truss is over stressed and the factor of safety is being reduced. The vault action of the wood decking was not accounted for along with the diaphragm action or stiffness of the plywood attached to the bottom cord. These actions would help to reduce the chances of the collapse of the roof. The vault action would be limited by the lack of blocking between the 2x12's at load points and the methods of securing the 2x12's to the truss. If there is a large snow or ice load on the roof, care should be taken. The roof had been tested during the recent ice storms.

By placing columns from the floor to the bottom and top cord of the truss along the hall on the other side of the back wall of the court room the stresses in the roof trusses would be reduced. The interaction equations would be close to one in the truss with full live load. This should be investigated by further study and design.

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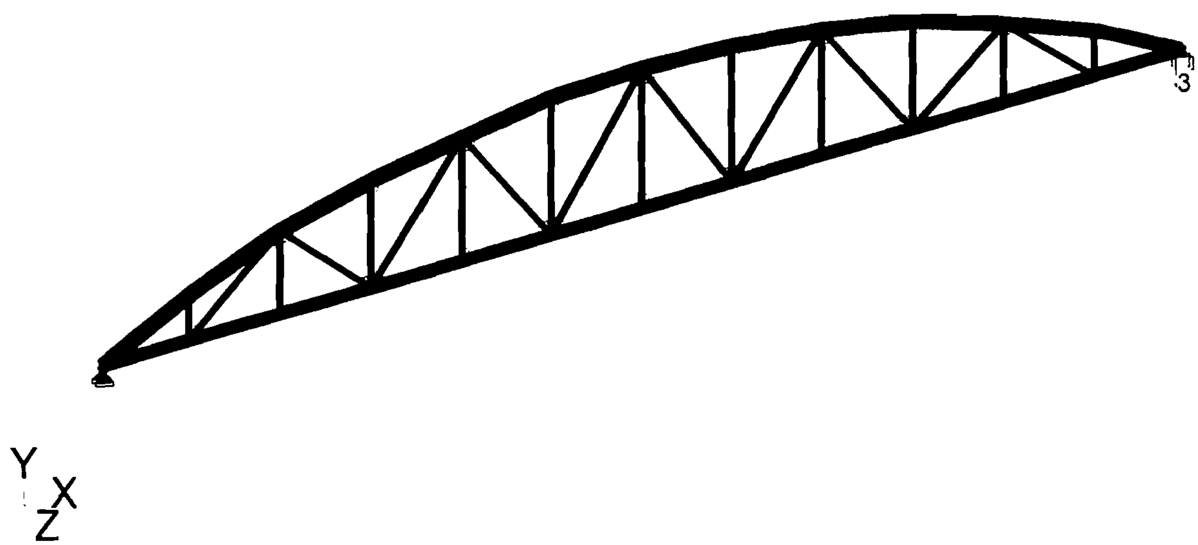

Figure 3 - Finite Element Model