*Emad Abed Abood Al-Zaidi* .ANALYSIS OF REINFORCED CONCRETE RIBBED DOMES RESTING ON RING BEAMS AND COLUMNS. *University of Technology*. Department of Building and Construction. M.Sc. Supervised : *Prof. Dr. Hisham M. Al-Hassani* . 2013. 142

# Abstract

This research deals with the linear F.E. analysis of large diameter reinforced concrete (R.C.) ribbed domes resting at the base on ring R.C. rectangular beam and the latter on R.C. columns that are equally spaced along the periphery of a dome base. The analysis is carried out using the computer program SAP 2000 version 14 which is basically constructed based on finite element method.

Literature indicates three basic theories for the analysis of traditional domes namely; membrane theory, bending theory, and finite element method. These three methods are first reviewed and then called upon to analyze a spherical R.C. dome under the action of self-weight only. Comparison is made between the three theoretical methods based on the results of the internal forces (membrane forces),hoop forces and meridional forces.

The membrane theory is found simple and easy to apply and fairly accurate and therefore is recommended to be used in the analysis of domes having no ribs nor ring beams and uniformly loaded. In the case of spherical domes resting on ring beam and columns ( with far ends fixed ) and having ribs running in the meridional direction, SAP 2000 computer program is found representative and of reasonable accuracy.

Many parameters are considered as variables in carrying out the dome analysis by SAP2000 including shell thickness, depth of rib, ring beam size, length of columns, rise of dome, diameter of dome, excluding ribs, adding ring beam at crown, the case of no columns and the case of additional uniform load on dome. shell of dome is presented as thin shell element while columns as beam element.

The output of such analysis includes values of the hoop and meridional forces and stresses in the dome shell, bending moment and shear force at hoop, the internal forces carried by the ribs which are axial force, shear force and bending

moment, internal forces carried by the ring beam, forces developed at column base, internal stresses at top and bottom fibers of the dome shell in the hoop and meridional directions as well as the vertical deflection at the crown of the dome.

Many conclusions are drawn from such investigation. Among them is that increasing the depth of ribs from (0.4m to 1m) causes the internal stresses in the shell to decrease by 17% for maximum tensile stress and a slightly decreases of 3% for maximum compressive stress(both occurring near the ring beam location). Also increasing the size of the ring beam from (0.5×0.5m to 1×1m) causes the internal stresses in the shell to decrease by 20% for maximum compressive stress and 72% for maximum tensile stress (both occurring at the critical nodes of the ring beam location). And The presence of ring beam at crown results in a slight increase in the internal forces and stresses of the dome shell of the order 1% for maximum compressive stress and negligible effect for maximum tensile stress. In general, any parameter that reduces horizontal displacement at base of dome can reduce hoop and meridional stresses within a wide range of the dome shell near base then they decrease gradually towards the crown.

**Keywords:** spherical shell, ribbed dome, ribbed shell, meridian force, hoop force