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"DESIGN AND ANALYSIS ON CRANE WIRE ROPES BY USING FEA METHOD"

Mohammad Meraj [1], Syed Qaisar Hussain [2], Dr. Avinash Ravi Raja [3]

[1] *P.G. Scholar, Department of Mechanical Engineering Greater Noida Institute of Technology Greater Noida , UP, India*

[2-3] *Asst. Prof., Department of Mechanical Engineering Greater Noida Institute of Technology Greater Noida , UP, India*

ABSTRACT

Wire rope applications and Advantages are studied, and failures in WR are also discussed. The objectives of the project were met as the analysis for failure of three WR with similar parameters has been done; comparative study between different properties has been done. By applying normal load FEA of all three Galvanized stainless steel 1*19 right lay wire rope were investigated here, with special concentration on different types of stresses and different types of deformation and strains, the contact type use here between the surfaces is bonded contact type. The results reveal that all three wire rope is deform almost equal amount of length on applying same load, this may be because the effective area of the wire ropes are almost same or all three wire ropes

Key Words: *Wire rope, WR, FEA, bonded.*

I. INTRODUCTION

1.1 EOT crane

Crane is a hoisting device use for lifting and lowering load with means of drum or lift wheel around which there will be rope or chain wraps. EOT crane is a mechanical devices used for lowering or lifting material, also used for making the material move vertically or horizontally. It will be useful when the task is beyond the human capacity to moving or lifting the loads. Crane is a special design structure equipped with mechanical elements for load by lowering or raising by manual or electrical operation. Applications of cranes are generally in the transport industries for unloading and loading of load, in construction industries for the materials movement; and in manufacturing industries for assembling of heavy equipments. This device decreases the cost of the production by increase the output, speed up the deliveries & improve quality. Due to increase in labour costs and issues related to labour management the utility of this device has further been increased. Crane is very much useful in increasing human comfort by picking up load from one point and transport the object from one place to another. In designing of cranes there are three major considerations. First, the weight of load must be lifted up by the crane. Second, no topple of the crane. Third, rupture should not be there in crane. Cranes are available in lot of categories. They are called as Jib crane, Telescopic crane, Tower crane, Gantry crane, Truck mounted, Aerial crane, EOT crane, etc. The constructions of EOT cranes are typically of two types, either single girder or in double girder.

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1.1.1 Motions of EOT cranes

Generally there are three motions of an Overhead crane shows -

Long travel Cross Travel

Hoisting (up & down)

1.1.2 Types of EOT crane

On the basis of structure, cranes are Overhead bridge , Gantry crane, Jib crane

Fig 1.1 Overhead bridge crane

Fig 1.2 Gantry crane

Fig 1.3 Jib crane

1.2 Lifting tackles

Lifting tackles is an equipment for lifting & lowering loads, including people, and/or attachments used for anchoring, supporting or fixing it. Some tackles are Chain Sling, Wire Rope Sling, Hook, Dee Shackle, Bow Shackle, Swivel, Clamp or similar appliances.

1.3 Chain

Chain hoist is a mechanical component which used for same purpose as wire ropehoist. The chain hoist is cheaper than the wire rope hoist and its maintenance is also easier than that. But the problem with chains is, that all the links are in series so if any link failed, the whole system will be fail due to which heavy loads cannot be lifted by chain hoists.

This problem is overcome by wire ropes that it construct with many wires twisted with each other, if few of the wires get fracture still the system will work. Due to this heavy

1.4 Wire ropes

A WR is a piece of flexible, multi wired, machinery made of many metal wire strands twisted into helix in different types of lay. Usually a WR consists of number of multi wired strands are “laid” around a core member. The wire rope can be differentiate in accordance to geometric construction will be according to the strand construction.

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The core is provided with the purpose to maintain and support the position of the other strands during the operation. There can be any number of metallic strands which twisted around the central core. Six strands around the core is the most common arrangement which gives the best balance, as this combination. The variation of no's of wires per strand may be any of the no's 3 to 91, but 7-wire, 19-wire, 25- wire or 37-wire strand are the majority falling into the categories of WR.

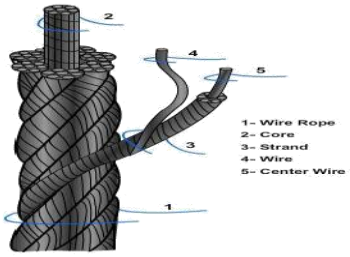

Fig. 1.4 Wire Rope

1.4.1 History of wire ropes

"Manila ropes" was the first form which was invented as the rope. It is named as manila rope, because of hemp used for making ropes was found in the Manila, a city in Philippines. The long hemp are twisted with each other to make a strand and the strands are twisted again to form a rope like structure. The hemp of manila was enough strong to lift the load.

Fig 1.5 Manila Rope

II. 3D MODELING

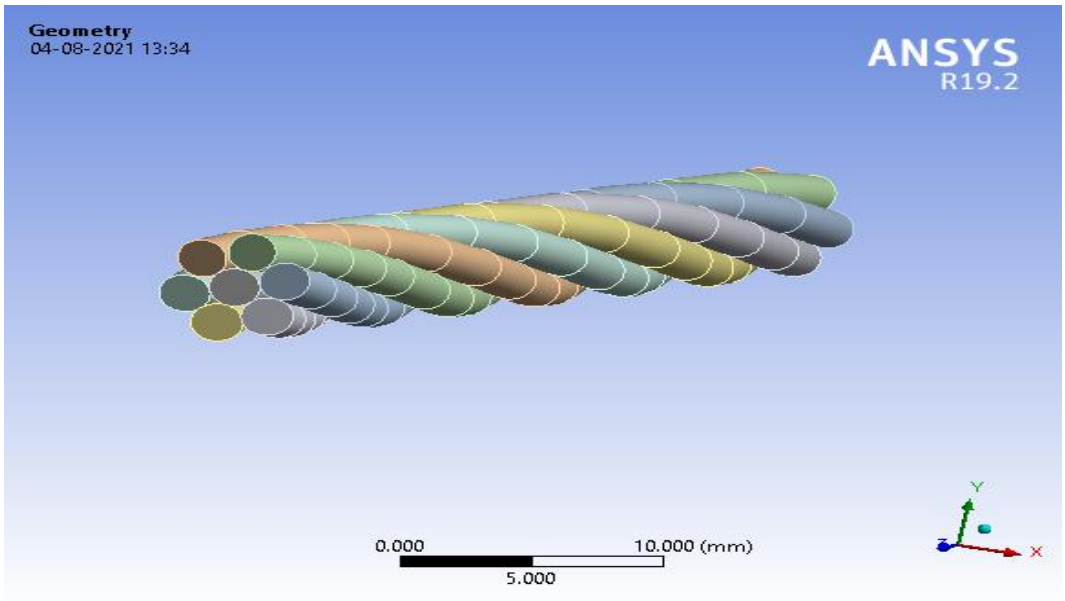

Fig 3.1 Model of Ordinary WRS

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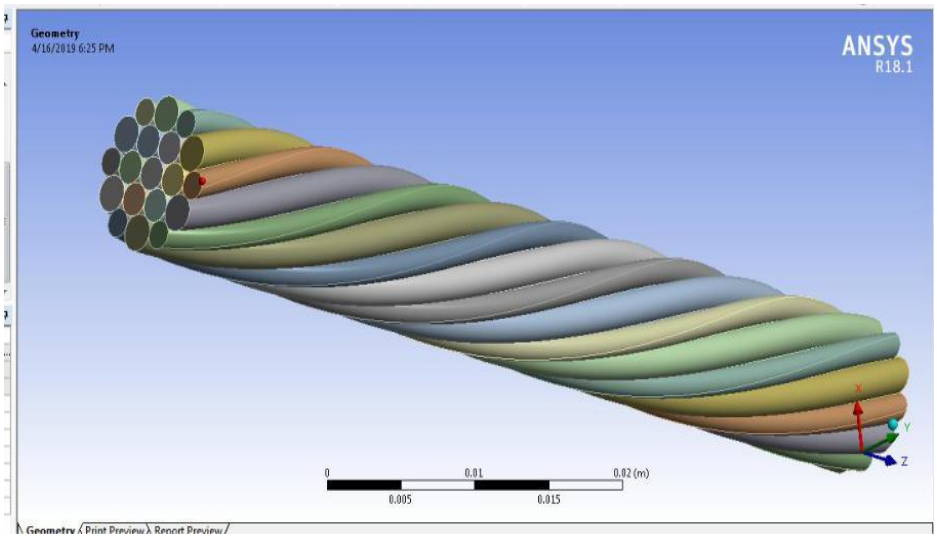

Fig 3.2 Model of Warrington WRS

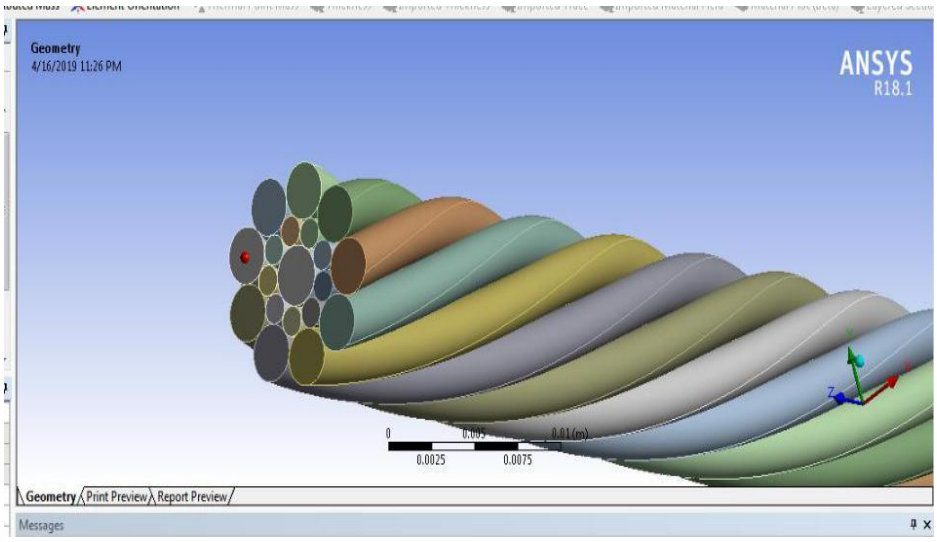

Fig 3.3 Model of Seale WRS

FEA of 1*19 wire rope core

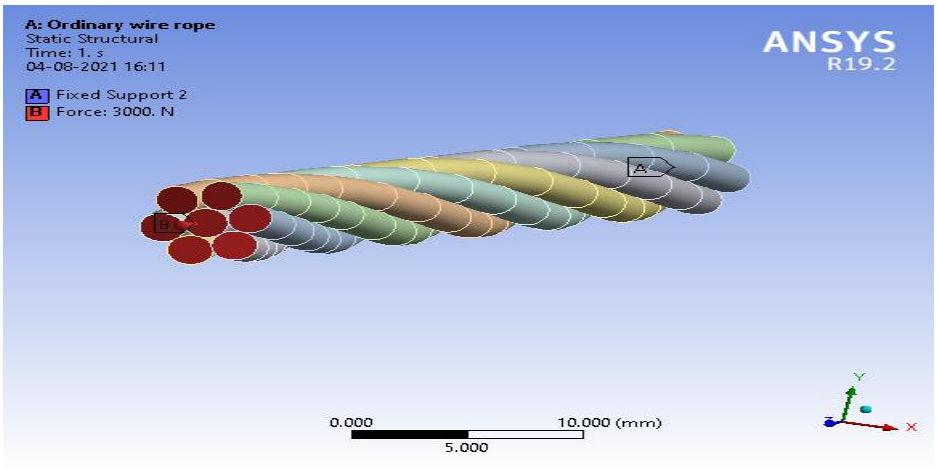

Fig 3.4 boudary conditions or wire rope

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III. RESULT

Total deformation Comparison

The analyzed load distribution of the WR is shown in fig 4.17, 4.18, 4.19. The comparison of total deformation is shown in fig. 4.20. The results reveal that all three wire rope is deform almost equal amount of length on applying same load, this may be because the effective area of the wire ropes are almost same or all three wire ropes

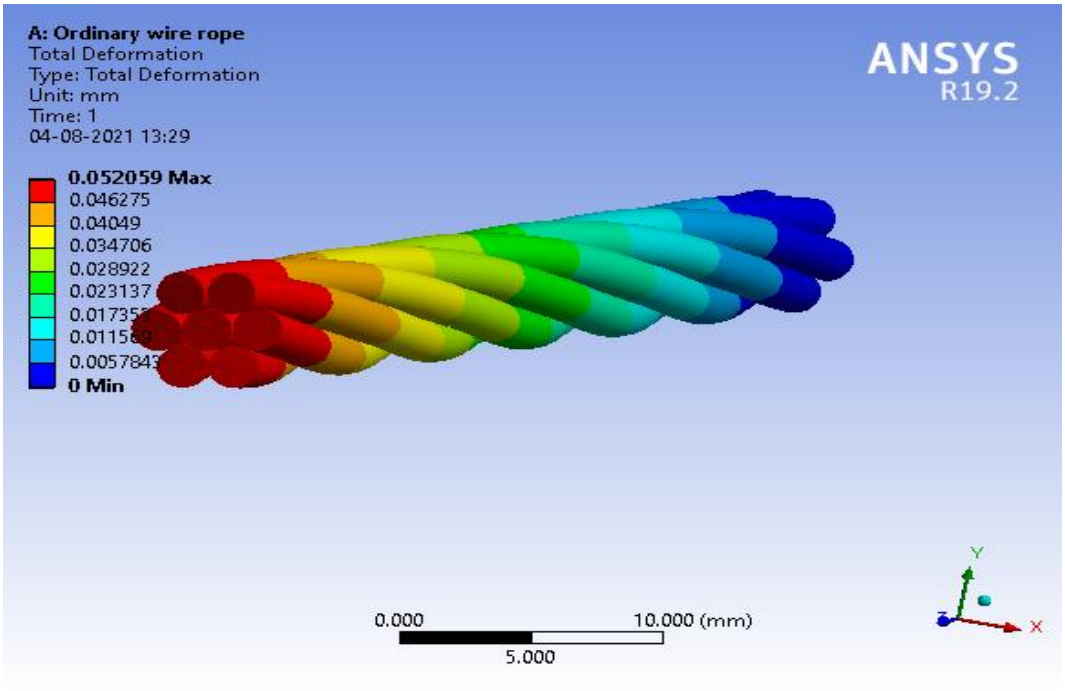

Fig 3.5 Total deformation in ordinary wire Rope

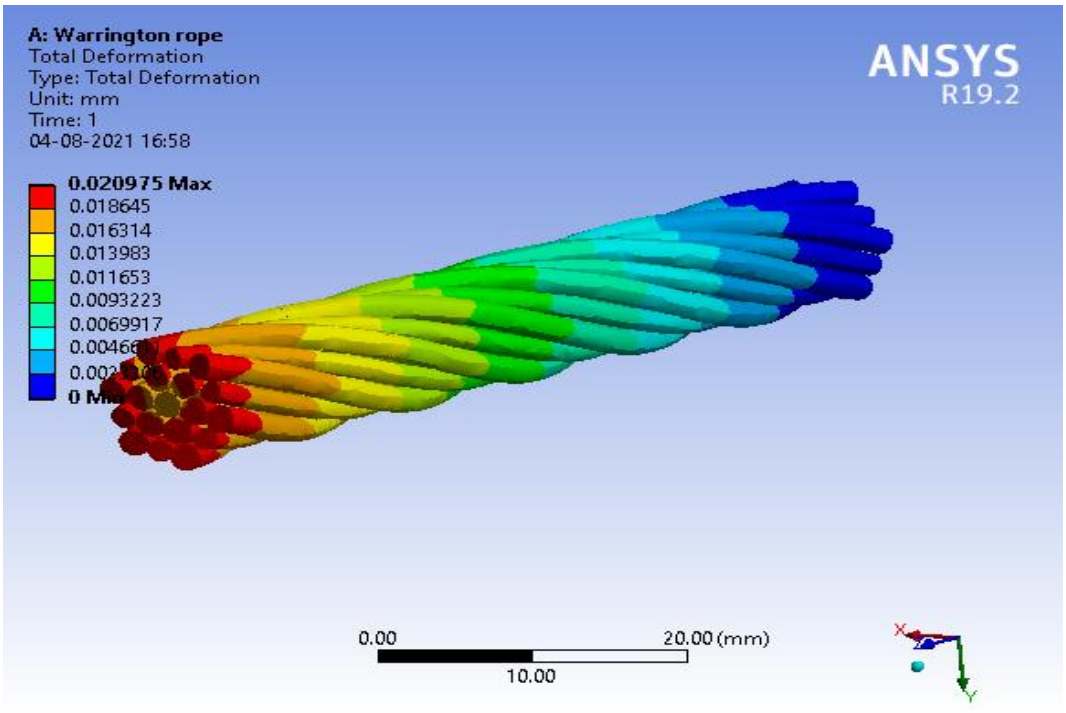

Fig 3.6 Total deformation in Warrington wire rope

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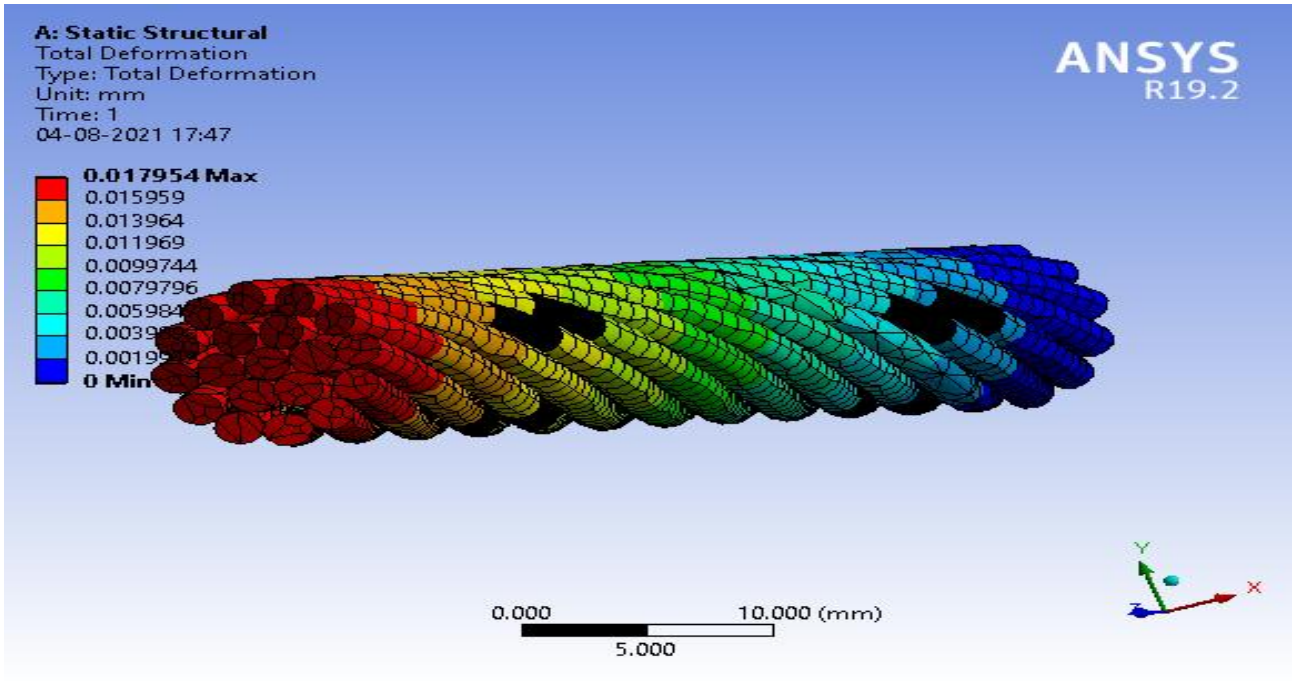

Fig 3.7 Total deformation in Seale wire rope

Directional deformation Comparison

The analyzed load distribution the WR is shown in fig. The comparison of Directional deformation in lateral direction is shown in fig. The results reveal that Seale type wire rope is bearing more shear stress on the same amount of load, the stress generated is almost 250% more than the ordinary wire rope. This may due to the shear stresses generated in the Seale type wire rope is more than the others.

V. CONCLUSION

The WR and their types are discussed. Wire rope applications and advantages are studied, and failures in WR are also discussed.
The objectives of the project were met as the analysis for failure of three WR with similar parameters has been done; comparative study between different properties has been done.
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