Failure mode effect and criticality analysis

Business

Failure Mode Effect and Criticality Analysis of Stub axle subassembly 1. Introduction: FEMME is a methodology to identify and analyses predicted failure modes of various parts within the assembly or system. It is a technique to resolve potential problems in a system before they occur. It is most widely used reliability analysis technique performed between the conceptual and initial stage of the detailed design phase of the system in order to assure that all the potential failures have been considered and the proper provisions have been made to eliminate these failures. 1] (Ref. Yester reliability theory, 2nd edition, Marvin Arousal) this technique can assist in selecting alternative concept for the same system and also provide a basis for maintenance planning.

2. FEMME prerequisites: l. Definition of the system: The given stub axle subassembly includes mainly three parts: Stub axle 2. Steering bearing and boss subassembly steering arm 3. Bracket or All these parts are assembled by meaner of welded Joints or bolted Joints and the whole subassembly is linked with the steering rod by meaner of the swivel Joint.

The basic configuration is shown in the body diagram -1 below.

The basic function as we know of the system is to steer the vehicle, in the other words, turning the wheel any direction we want by simply rotating the steering of steering rod which results movement the wheels. II. Operational conditions: It is here assumed that the under worst condition without abusive use, the system is failed which is to be analyzed in terms of safety and reliability. 3.

System structure analysis: The boss and bearing subassembly comprises of two bearings, bearing spacer in between, upper and lower spacer, bolt passes through the subassembly which is iced to the inner race of the bearing constraining its motion.

The outer racer of the bearing is fastening into the boss. The whole subassembly is then attached with the steering arm, stub axle by meaner of welded Joints and the plate welded to the chassis by meaner of Rod end bearing(2). The steering arm is Joined with the steering rod by swivel Joint as shown in the fig .

By going through the force diagram of the system below, the number of components those are highly stressed and because of which may fail or lack in desired performance is four. I.

Stub axle: tub axle whose main function is to be a hostage of the wheel may be deformed due to high fatigue stress induced due to the repetitive compressive load on upper edge and tensile on lower edge as many times as the wheel experiences high impact load in upward direction. And the result is the difficulty while cornering.

Even though the probability of failure of stub axle is higher due to impact failure of weld Joints. Which may cause the serious safety effect. It. Hose and Bearing subassembly: As its main function is to reduce the friction, and providing bearing support, TTS conceivable failure is detected by testing during maintenance.

The probability of failure is either wearing off the rolling element, or misalignment of bearing which is a result of failure of bearing spacer. The system effect due to this is difficulty in cornering the vehicle, harsh operation.

Moreover, there may be the probability of iii. Steering arm: The steering arm may fail from two places: one is from weld Joint with the assembly and another is the swivel Join on the far end where it is connected with the steering rod. But the probability of failure of swivel Joint is higher because it putatively undergoes excessive wear as vehicle takes turning (cornering), the steering arm of the inner wheel moves in two planes as shown in diagram 3 below facing excessive wear.

The other probability of failure of that Joint is shear failure of either bolt or steering rod tip as mentioned in diagram 4 above. The failure effect of the system due to weld failure is severe, as system cease working and is a high safety impact. Lb. Rod end bearing: The main function of this component is to provide support of whole subassembly through TTS bolt. It has to bear all the impact load imparted by the stub axle through bolt. So sufficiently tough enough to withstand such load.

So the probability of failure is crushing of bush or shearing off bolt as shown in force body diagram 5 below.

The effect of such failure on the system is severe having high safety functions, expected caused of failure and its effect on the system, it would now be ease to make FEMME worksheet. 5. Conclusion: According to the results obtained from the FEMME work sheet, the values of criticality of two

components (Rod end bearing and Steering arm) are higher as compared to those of others. Since the delectability of the failure of rod end has got sigh index since it would be difficult to detect failure since it might be fail suddenly due to high impact.

And the severity would undoubtedly high since whole assembly would dismantle causing breakdown.

In case of steering arm failure, the probability of failure of swivel Joint is higher because of either repetitive wearing of bearing surface contact area or the shearing off pivotal bolt Joining them. And severity is high since it causes breakdown of system. So finally, the system safety and reliability depends mainly on criticality of these two parts and the provisions can be made to minimize these values in new concepts.