

Design and Analysis of a Suction Cup in Bore-Well to Rescue the Children

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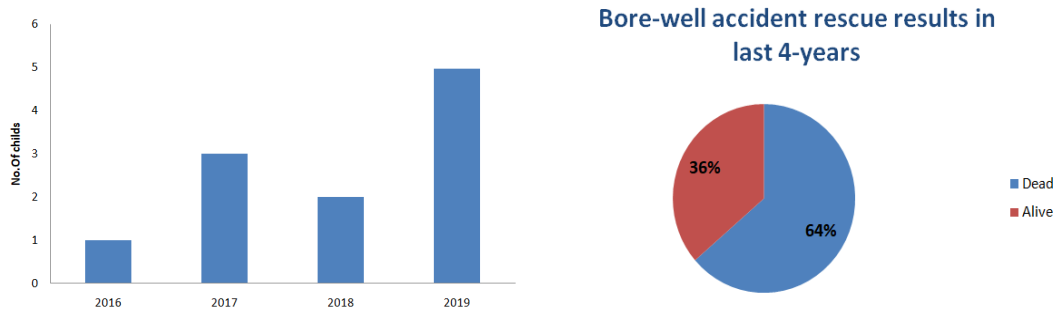
Abstract: Our Indian government or the technology we have is not enough to protect the babies of toddlers who have fallen into a bore well in India or other countries. Such knowledge or technology is to improve to protect children in these circumstances. To overcome these circumstances, proposing a new mechanism to rescue child from bore well in current research lifting mechanism is design and model in creo 2.0 software. NBR rubber materials are available in market for suction Cup. Suction cup is modeled in creo 2.0 with different thickness and diameter. Different baby weight is acts on this suction cup according to that simulation is done in ansys to identify is best suitable suction Cup is to hold baby long time. The results are explained that, Deformation, stress and strain is less for the case5 i.e., the suction cup is designed for the 43mm diameter with 3mm thickness when compared to other four cases.

Keywords: Suction cup, NBR Rubber, Creo 2.0 and Ansys.

1. Introduction

Mokshita at the age of 3 years, fallen into the bore-well at June 24, 2019 in Nellore, A.P, India. The government has taken action on this issue and the rescue team struggled a lot to save this child but unfortunately the child was dead within 3 hours after felt. Two years (Tejpratap) old baby from Bhopal Madhya Pradesh. In January 28, 2019 the boy fallen into the bore-well. The Rescue Team has been taken a struggle to save the child after 70 hours by the god grace the child was alive. In Punjab India, a boy name was Fatehveer (2 years) has fallen in bore well in January 11 2019. The Punjab government taken 110 hours to save the child but child was dead. Seema's age was 6 years old living at Farrukhab located in Uttar Pradesh, India. In April 11, 2019 she fallen into bore-well, the Rescue Team is struggle a lot to save the child, but the child was dead. R.Shiva age of 2 years from Nagputtinum city located in Tamilnadu India. In September 23, 2018. The Rescue Team has been taken a struggle to save the child after 12 hours by the god grace the child was alive. Similarly another child Roshan, four years old from Dewas Uttar Pradesh India. in March 2018 even in bore well after 12 hours struggle the baby was taken out from the bore well and the child was alive. Chinnari 2 years old from Hyderabad located in Telangana. The child was fallen in bore-well. After 60 hours of the rescue team struggle, the baby was taken out from the bore well but the child was dead. Similarly in the same area a boy was fallen into the bore-well name was Rakesh three years old, after 27 hours of the Rescue Team struggled to save but unfortunately the child was dead.

The one year old baby Name was Chandrasekhar Bhai from Bhopal Madhya Pradesh, in February 18 2017 he fallen in bore well immediately the government has taken action on this issue and after 17 hours the child was taken from bore-well and he is alive. From the state of Karnataka. A 6 years old baby, she fallen into bore-well at 27 April 2017. after 24 hours of rescued the child was dead. kamal 6 years old from Rajasthan fallen in bore well after a long time struggle that is 168 hours the child was dead. Tamanna having six years old living in bagalkat located in Karnataka at August 10 2014, the child was fallen in bore-well after 150 hours of the rescue the child was dead.



Column chart: 1 Number of bore-well accidents year by year in last 4-years and **Pie chart: 1** Bore-well accident rescue results in last 6-years

2. Problem Statement

Borewell is a narrow pipe bored vertically or horizontally in the ground. The purpose of the bore well dug is extraction water or oil (such as petroleum, kerosene...natural gases).most of the bore well accidents happen in rural areas. Lesser diameter Bore wells are used for domestic purposes in the cities. So it seems bigger diameter holes are a problem. In the villages, the bore-wells are dug for two reasons. Those are domestic and agriculture purposes. When underground sources are drained, the pipes are pulled out, and they forgot filling mud in the holes because of lack of knowledge. Someday a child goes there and falls in uncovered bore well. Sometimes a small mistake can charge death. The child may go completely bottom are stuck somewhere else. Bore-well depths are commonly from 100 feet to 500 feet. Saving child in high depth and deathly holes is not easy. Most of rescue operations are failed to save the child because they know where the child stuck. In the previous incidents, people use to move into the hole by using thread to save the child. These rescue operations may cost rescue person life also and not useful because the child hands may be stuck in the hole. It is time that we look for an alternate solution in which we can save the child without human resources.

3. Literature Survey

Table I. Literature Survey

S.NO	Author Name	Title	Year of Patent application	Important findings
1	K.Arunkumar	Bore well rescue robot	4974/CHE/2015	The rescue robot is sent by a rope to inside the well and a CCD camera is identifying the child position.
2	Ganesh Ram Jangir	Instrument for the rescue of open bore-well vietims	211/DEL/2011	It is outfitted with a flash light, and a camcorder to watch the exact circumstance intently and nonstop cooperation with the sufferer. It is a light weight machine that can go down easily into the bore well and hold the child.
3	Girish Badragond	Portable bore well scanning device	992/CHE/2015	LED, GPS, temperature sensor, pressure sensor, moisture sensor and HD camera were arranger to this robot to find the baby location and also condition of the bore well at every point through the sensors.
4	Dr.R.Marappa	Device for	3490/CHE/20	A robot for recovering Childs trapped in

	n	rescuing trapped victims from bore -wells and method thereof	14	profound openings or bore-wells is revealed. The gadget utilizes more than one different ways to recover the person. The gadget can be worked either by pneumatic methods or hydraulic methods.
5	Sridhar K.P	Bore Well Rescue System	6183/CHE/2013	The camera catches a place of the human who caught inside the bore well. The control unit gets data identified with the situation of the human from the camera, and procedures the data to shows in the display. The widespread grasper incorporates a hexagonal pole, a rigging arrangement, and at least one fingers. The hexagonal bar is stretched out utilizing a Helen screw to a profundity at which the human is caught inside the drag well. The apparatus arrangement is associated with the hexagonal rod.
6	Dr. Rakshit Ameta	"A device to rescue children from a bore well"	153/DEL/2009	In this procedure JCB machine, enormous men power and so on is required and it likewise requires some investment. During that period, the kid may lose his life, because of dread and absence of oxygen. Till today, there is no ideal answer for this issue is known and in this way, an exertion is made by building a gadget having human-like structure. Utilizing this gadget, we may spare the lives of those kids, who lamentably tumble down in bore well. This gadget will help us in finding the situation of the kid in bore well,
7	Omar Mohammed Alhousseini	Well rescue device	US20150306434	The well recue gadget incorporates a clasp get together designed to offer help to a middle of the person. While moving the person in question. Furthermore, the well salvage gadget incorporates a seat get together designed to give seating backing to the person.
8	Geo Pulickal	Bore-well Rescue And Inspection Robot	124/CHE/2015	The robot ought to be intended to lift the kid from the pit. The robot needs to follow up on the bore well conditions, for example, land sliding, event of tree roots inside the bore well gaps. A range sensor additionally ought to be joined with the robot so as to

				comprehend careful separation among robot and kid. The robot is to be constrained by the actuators through the switches given in the control board.
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A. Boundary condition

Baby weight was assumed as 12 kg, 15 kg and 18kg. five models are designed in creo and simulated in ANSYS

Case 1: suction cup – 1mm thickness - diameter 39mm

Case 2: suction cup – 2mm thickness - diameter 39mm

Case 3: suction cup – 3mm thickness - diameter 39mm

Case 4: suction cup – 3mm thickness - diameter 41mm

Case 5: suction cup – 3mm thickness - diameter 43mm

B. Suction cup design in 3D modeling software

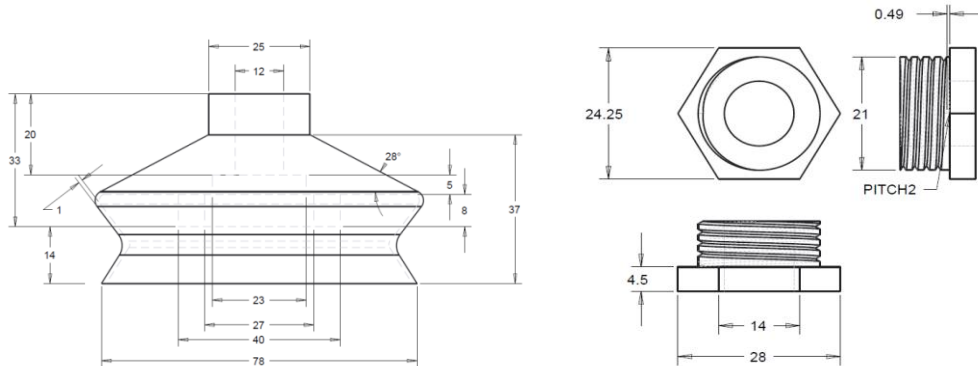


Fig 1: Suction cup- drafting

Fig2: Nut- drafting

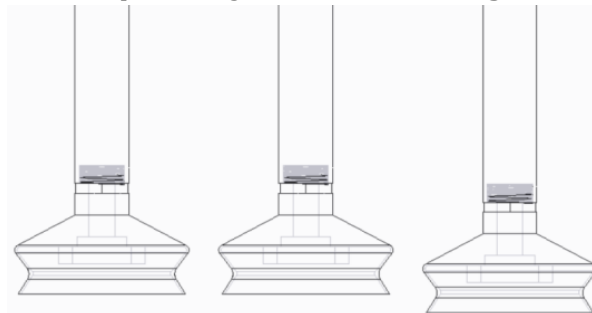


Fig 3: All three parts are assembled together

C. Results and discussions

The baby weight was assumed as 12 kg, 15 kg and 18kg. The suction Cup is made by NBR material. The suction Cup holds the baby at different locations. So the load is distributed to 3 suction cups (Fig 3). The use of suction Cup is to lift the baby from the bore well. We observed that the maximum defamation (Fig 4&7) is obtained at the tip of the NBR material.

The stresses are uniformly distributed (Fig 5 &9) throughout the NBR material suction cup. The safety factor (Fig 6) is below 1. From the above graph, the different weight of the baby weight is compared with respect to the different conditions we assumed in the simulation.

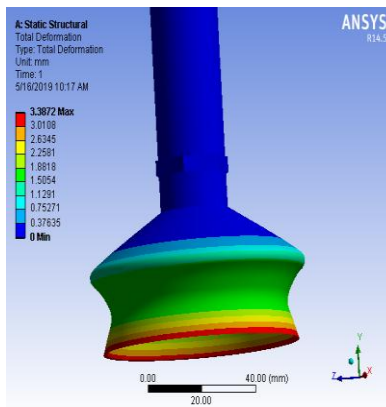


Fig 4: Total deformation

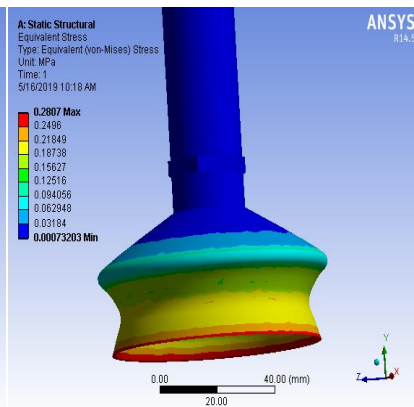


Fig 5: Stress

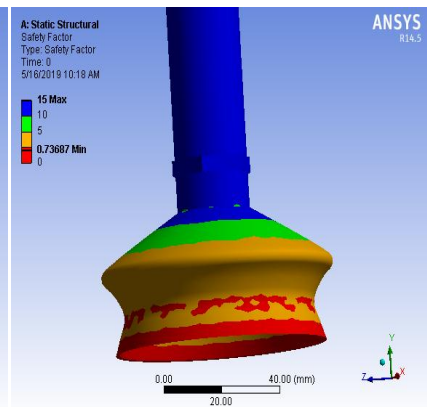


Fig 6: Safety factor

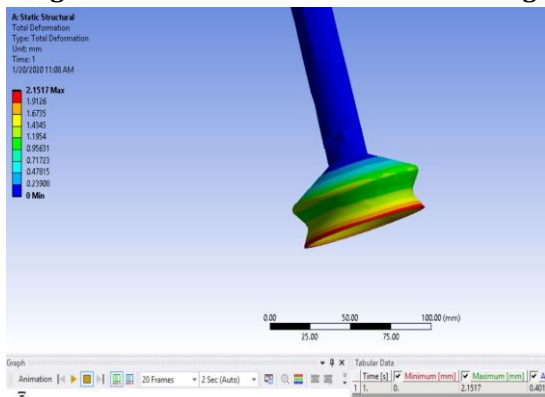


Fig 7: Total deformation for the case 5

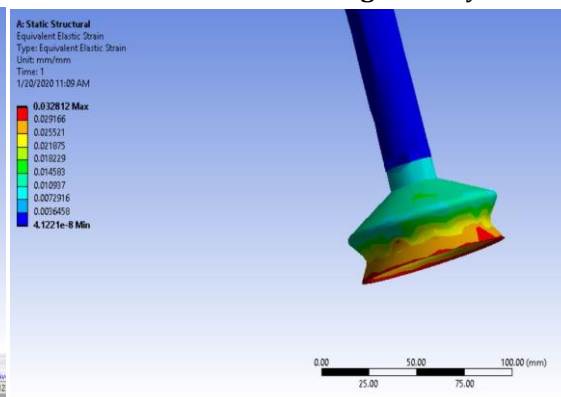


Fig 8: Strain

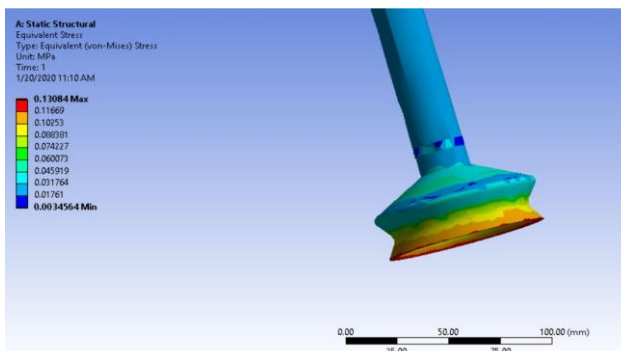


Fig 9: Equivalent Stress

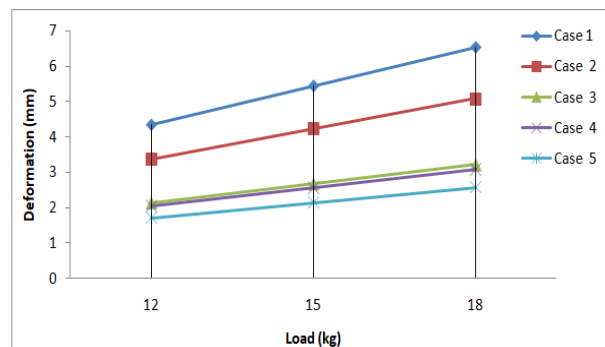


Fig 10: Comparison of the Load (Kg) Vs Deformation

From the Figure 10, The deformation (4.3485mm for 12kg and 6.5302mm for 18kg) is high for the case 1 i.e., When the suction Cup is 1 mm thickness and standard 39 mm diameter. When compare with all cases, the deformation (1.7192mm for 12kg and 2.581mm for 18kg) is very low for 43 mm diameter and 3 mm thickness of the suction cup. The results are explained that if the thickness of the suction cup is increases then the defamtion will be decreases.

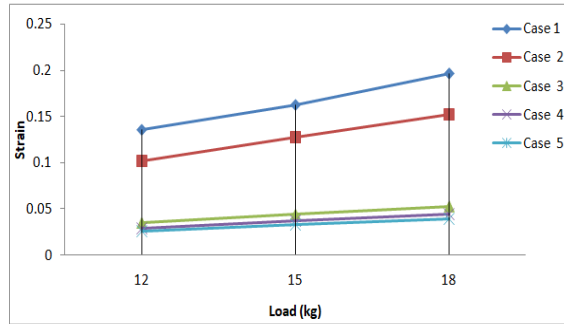
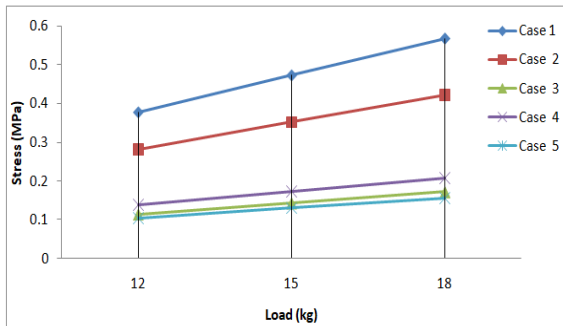


Fig 11: Comparison of the Load (Kg) Vs Stress

Fig 12: Comparison of the Load (Kg) Vs Strain

Similarly, the stresses (Fig 11) are compared with respect to different loads acting on the suction cup and with different cases as we assumed in the simulation. From this result we can say that the maximum stresses are obtained for 1 mm thickness with 39 mm diameter that is case 1 and very low stresses obtained for the case five that is 43 mm diameter with 3 mm thickness of the suction cup.

4. Conclusion

The simulation results are explained that if the thickness of the suction cup is increases then the defamation will be decreases. The deformation (1.7192mm for 12kg and 2.581mm for 18kg) is very low for 43 mm diameter and 3 mm thickness of the suction cup. Minimum stresses (0.157 MPa for 18kg and 0.104 MPa for 12kg) obtained for the case five that is 43 mm diameter with 3 mm thickness of the suction cup. So, the material is safe under 18kg load.

Deformation, stress and strain is less for the case 5 i.e., the suction cup is designed for the 43mm diameter with 3mm thickness when compared to other four cases.

Acknowledgment

My research area is Bore-Well rescue mechanism fabrication, I have a patent application published in my research area and title of the patent is "An Efficient Methodology and a System to Rescue a Child Fell into Abandoned Bore Well" [Patent Application No. 201941050067].

References

- [1]. K.Arunkumar, (2015), BORE WELL RESCUE ROBOT, Indian patent number. 4974/CHE/2015.
- [2]. GANESH RAM JANGIR, (2011), Instrument for the rescue of open bore-well vietims, Indian patent number. 211/DEL/2011.
- [3]. Girish Badragond, (2015), Portable bore well scanning device, Indian patent number. 992/CHE/2015.
- [4]. Dr.R.Marappan (2014), Device for rescuing trapped victims from bore -wells and method thereof, Indian patent number. 3490/CHE/2014.
- [5]. SRIDHAR K.P (2013), BORE WELL RESCUE SYSTEM, Indian patent number 6183/CHE/2013.
- [6]. DR. RAKSHIT AMETA (2009), A device to rescue children from a bore well, Indian patent number 153/DEL/2009.
- [7]. Omar Mohammed Alhuseini, (2015), well rescue device. <https://patents.google.com/patent/US20150306434?q=patent:US20150306434>
- [8]. Geo Pulickal (2015), Borewell Rescue and Inspection Robot. Indian patent number 124/CHE/2015.