# Modeling, Analyzing and Fabrication of Lifting SPRhook for Borewell Pipe

[1]S.Prithiviraj, [2]S.Ravikumar
[1]Post Graduate Student, [2]Assistant Professor
Department of Mechanical & Production Engineering, Sathyabama University, Chennai-600119.
[1]sprmach@gmail.com,  [2]mahailakumar@gmail.com

_____

*Abstract* -In olden days in order to remove the broken bore pipe from underground was a difficult task. Initially U-type vertical hook was used in well to bucket or any other vessels that falls in to the wells. Using the same concept ,in this present investigation SPRhook is designed in order to lift the broken bore pipes from underground.

*Keywords -* Bore pipe, SPRhook

## I.   INTRODUCTION

Now-a-days we are facing more problems in bore pipe arrangement structure. One of the most important problems is bore pipe cut from original path line in the pipe lifting process due to path line in the pipe lifting process due to the presence of tree root, small rock and wear and tear of the pipe material. So we need lifting tools for further lifting process. The lifting tool name isSPRhook. Modeling, analyzing and fabrication is shown in this present investigation. The detailed description about the pipe, bore and hook is been done in this present investigation.

### A.   Bore Well

Water may well be present on earth, but the salt water of seas and oceans accounts for 96.4% of the total water volume. Fresh water only accounts for 3.4% of the total volume of water on our planet. This fresh water is broken down as follows-2.15% is contained in the glaciers or permanent snow (about 70% of the total fresh water-0.63% is found in groundwater's (about 22% of the total fresh water)-0.019% constitutes the surface waters: lakes, rivers of all sizes (about 0.6%only of the total fresh water)-A very small amount (0.001% of the total water) is contained in atmosphere [1]. In most cases, and where there is a lack of surface water, a well or a borehole proves to be the most efficient method to obtain fresh water resources. Bore well is made in order to efficiently utilize the underground water. In bore well generally the bore vertical in profile. Bore well can be well utilized for house hold, industrial, construction, agriculture application. Based on the level of underground the bore diameter and depth is estimated. The commonly used bore diameter for domestic purposes is 4.5Inch. In places where high yield is required 6.5Inch bore diameter to drill [2].

Table 1: BORE WELL SPECIFICATION

| NEED | DIAMETER(Inch) |
|---|---|
| COMMNON DRILLING | 4.5 |
|  | 5 |
|  | 5.5 |
| HIGHER YIELD | 6.5 |
|  | 7.5 |
|  | 8.5 |
|  | 12 |

Table 2: BORE WELL DEPTH

| DEPTH(feet) |
|---|
| 500 |
| 1500 |
| 3000 |
| 3500 |

### B.   Bore Well Pipes

Bore well pipes are used to lift the water from underground level. The bore well pipe have different types, they are HDPE, PVC, UPVC, GI pipe.

#### 1.   HDPE

In HDPE pipe has advantages such has high reliability and proven service performance, resistance to low temperature. High impact, UV and chemical resistance, excellent weld ability, easy, fast and economical installation. HDPE and PVCare used for compressor. For a bore depth of 400Ft 1.25 to 1.5 inch diameter pipe is used. When the water pressure goes beyond 4-10kgf the pipe starts to break, depending on the size of pipes. HDPE is also known as High density polyethylene[3].

Table 3: DIAMETER OF HDPE PIPE IN INCH

| ½ | 5/8 | 3/8 | 1 | 1.5 | 2 | 2.5 |
|---|-----|-----|---|-----|---|-----|

**2. UPVC**

UPVC pipe has advantages such has light weight, high tensile load capacity, long life with economy and low flow rate. It is used in submersible pump and also diameter is varied but length is standard for each pipe. The PVC and UPVC length is 10feet per pipe. When the water pressure goes beyond 4-16kgf the pipe starts to break, depending on the size of pipes. UPVC pipes have female belled threads at one end and male thread on other end and / r with separate coupler. UPVC is also known as unplasticized polyvinyl chloride [4].

Table 4: DIAMETER OF UPVC PIPE IN INCH

| 0.5 | 1.5 | 2 | 2.5 |
|-----|-----|---|-----|

**3. GI**

These pipes are cheap, light in weight and easy to handle and transport and easy to join. It is used in submersible pump. GI is also known as galvanized iron. In this pipe highest weight to compare other bore pipes. The diameter is varied but length is standard for each pipe. Length is 20feet per pipe. The GI has three class there are A class, B class and C class. The bores well select B class and pipe have female belled thread at one end and male thread on other end. GI/MILD Steel casing pipes which were used earlier are not being recommended due to problem of corrosion [5].

Table 5: DIAMETER OF GI PIPE IN INCH

| 0.5 | 3/8 | 1 | 1.5 | 2 | 2.5 |
|-----|-----|---|-----|---|-----|

**C. *Hook***

There are many signification types of hook, namely fishing hook, crane hook, grappling hook, circle hook, J-hook, treble hook, S- hook, fishing hook, rose wood grill meat hook, wacky fig hook. The commonly used hook material is iron, steel, aluminum. The load carrying mechanism for each hook is different. A lifting hook is a device for grabbing and lifting lads by means of a device such as a hoist or Crain [10]. A lifting hook is usually equipped with a safety latch to prevent the disengagement of the lifting wire rope sling, chain or rope to which the load is attached. A hook may have one or more built-in pulleys to amplify the lifting force [6].

**II. EXPERIMENTAL DETAILS**

**1. Type of hook to be used**

(The hook to be modeled is called SPRhook which derives its mechanism by modifying the conventional hook mechanism). This lifting SPRhook is used to lift only HDPE pipe. This tool can be used in situation where maximum bore diameter is 6.5 and depth up to 1000Feet.SPR hook is V-shaped and is attach to a round rod. This is not been used anywhere. Three V-shaped tips are attached to the vertical round rod. The tip is placed at a particular distance from the center axis of vertical round rod and is also inclined. When the SPRhook is rotated the tip follows a circular path. The arrangement of the tips is 360º (first tip at 120º, second tip at 240º, and three-D tip at 360 °). The pipe get crushed and rolled over the SPRhook because the placement of tip at particular angle and distance. These 3 tips are carrying the load. The vertical round rod has one end which a sharp edge and other end is threaded. A round rod is use to connect to SPRhook whenever the depth of Borewell is increased.

**2. Modeling of SPRhook**
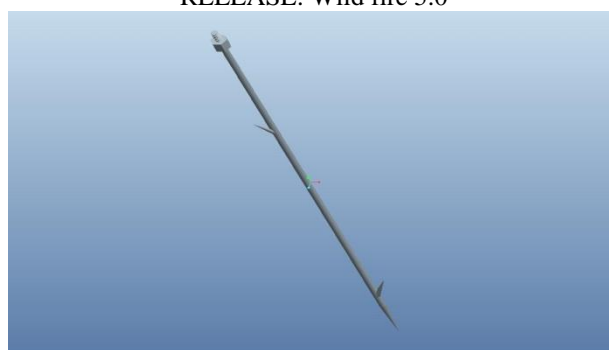
SOFTWARE USED: Pro/Engineer
RELEASE: Wild fire 5.0



Fig.1 Pro/E model of the SPR hook

**3. Material Used**

**WROUGHT IRON**

**Chemical composition of wrought iron [7]**

| Material | Iron | Carbon | Manganese | sulfur | Phosphorus | silicon |
|---|---|---|---|---|---|---|
| Wrought iron | 99–99.8 | 0.05–0.25 | 0.01–0.1 | 0.02–0.1 | 0.05–0.20 | 0.02–0.2 |

**Properties of wrought Iron**

| Property | Value |
|---|---|
| Ultimate tensile strength (MPa)[8] | 34,000-54,000 (234—372) |
| Ultimate compression strength (MPa)[8] | 34,000-54,000 (234—372) |
| Ultimate shear strength (MPa)[8] | 28,000-45,000 (193—310) |
| Yield point (MPa)[8] | 23,000-32,000 (159—221) |
| Modulus f elasticity(in tension) (MPa)[8] | 28,000,000 (193100) |
| Melting point [ºF(ºC)][9] | 2,800 (1540) |
| Density[g/cm$^3$] | 7.7 |
| Specific gravity | 7.6-7.9 |
| | 7.5-7.8 |

**Characteristics of Wrought Iron**
- Soft
- Ductile
- Magnetic
- Strong-high elasticity and tensile strength
- Malleable- can be heated and reheated and worked into various shapes.

1. **ANALYSIS OF SPR hook**

   The analysis results of SPR hook is shown in fig.2 & 3.
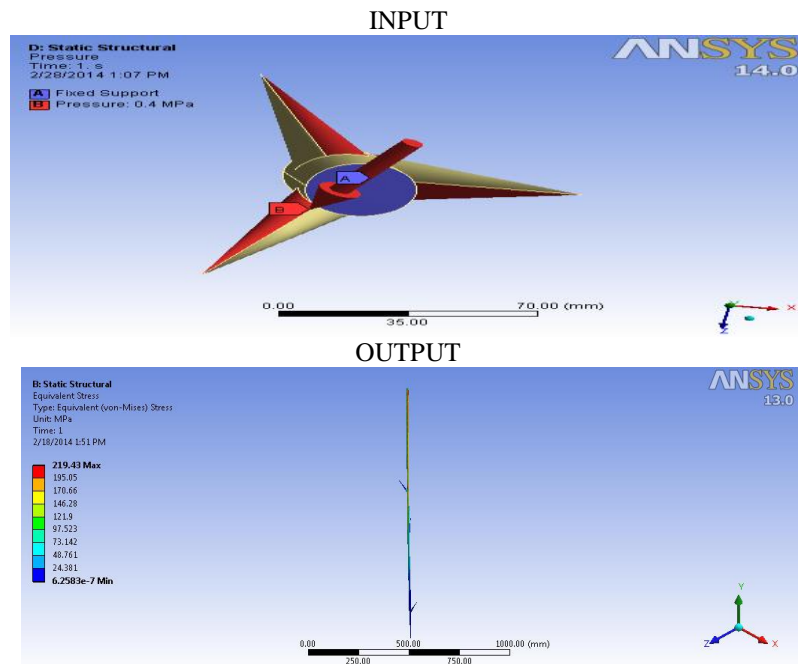   ROTATION PRESSURE FOR TIP

INPUT



OUTPUT



Fig.2 Rotational Analysis Results
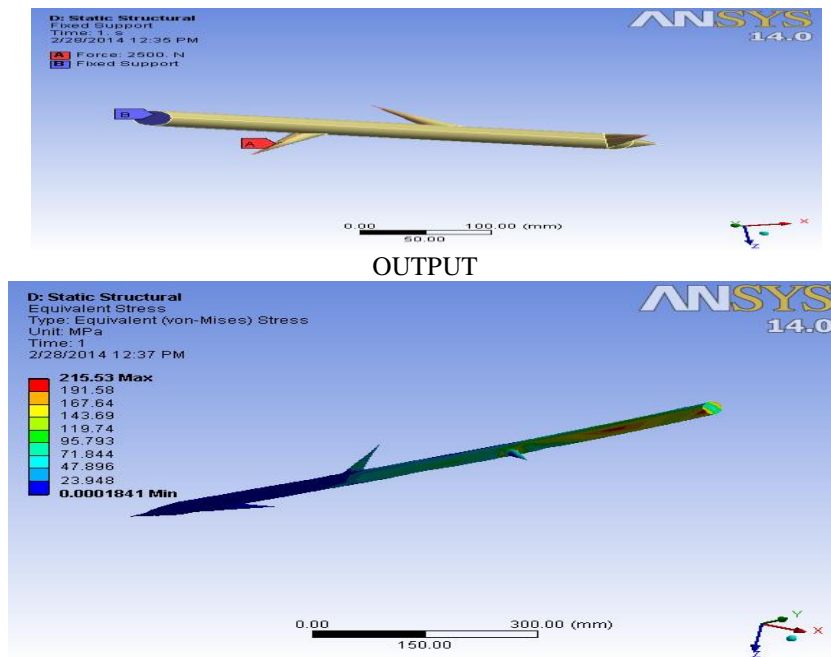
LOAD ACTING ON TIP

INPUT

OUTPUT



Fig.3 Load Analysis Results

2. **FABRICATION OF LIFTING HOOK**

The operation involved in the fabrication of SPR hook is as follows:
- ❖ Welding.
- ❖ Threading.
- ❖ Grinding.



Fig.4Fabricated SPR hook

## III. RESULTS AND DISCUSSION

Rotation and load analysis of the SPR hook was carried out and the results are shown in Fig.2 and Fig.3 respectively.Pressure is applied on half part of each tip and the top end of the rod is fixed. The pressure value of 0.4 MPa is given in the hook and the corresponding output was obtained which was found to 219.43MPa which is in close relation with the Yield strength of wrought iron (material used). The ultimate break point was reached at 370.72MPa when the load given in the tip was 0.7MPa. The load input value given 2500N in all tip and top tip fixed .the result was carried 215.3MPa and ultimate input is 4300N the output is 370.72MPa.The SPR hook can carry a load up to 400kg.

## IV. CONCLUSION

The SPRhook is modeled, analyzed, and fabricated. SPRhook is a newer one which drives is mechanism by modifying the convention mechanism of a hook. SPR hook will be very useful for lifting broken bore pipes from underground which was not the case earlier. The SPR hook can be used to lift broken bore pipe only when the bore diameter is within 6.5 inch. Also the SPR hook which is designed can be used to lift only HDPE pipes. The tip in the SPR hook carries the entire weight of the pipe.The future work can be continued by changing material and altering the dimensions.

**REFERENCES**
 [1]  www.wikiwater.fr/e28-various-types-of -wells-and.html

[2]   www.bhagrathiborewells.com

[3]   www.kndcompressors.cm/borewell.html.,ad.pensamedia.org/moti-pipe-crporation-2/hdpe-pipingsystem.html

[4]   www.riplast.cm/upvc column pipes.html

[5]   www.pipesnmetals.com/GIpipes.htm

[6]   IJISM ISSN-2319-6386, Volume-1 Issue-10,September 2013 Structural analysis of crane hook using finite element method-AjeetBergaley ,Anshumanpurohit

[7]   Camp, James McIntyre; Francis, Charles Blaine (1920), The making, shaping and Treating of Steel, Pittsburgh: Carnegie steel company, pp. 173-174, ISBN 1-147-64423-3

[8]   Oberg, Erik; ET. El. (2000), machinery's Handbook (26th ed.), New york: INDUSTRIAL PRESS, Inc.,p. 476, ISBN 0-8311-2666-3

[9]   Smith, Carroll (1984), engineer to win, motor books/MBI publishing Company,pp.ISBN 0-87938-186-8

**PATENTS REFERED**

[10] WILLIAML. HATHERLEY, OF SANBERNARDXNO, CALIFORNIA. LIFTING HOOK.PATENT FEB.19,1924 serial no.611,910.

AUTHOR:

Mr.S.PRITHIVIRAJ pursuing M.E in Computer Aided Design, Department of Mechanical & Production Engineering at SATHYABAMA UNIVERSITY, CHENNAI.

Mr.S.Ravikumar, Assistant professor, Department of Mechanical & Production Engineering at SATHYABAMA UNIVERSITY, CHENNAI.