Railroad Shear Die Redesign

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Introduction

The proposed engineering project, sponsored by Holland L.P, aims to redesign a railroad shear die, a tool that removes excess material formed in the creation of continuously welded rails. Like any tool, shear dies require periodic redesign and optimization to enhance their efficiency, accuracy, and safety. Through an assessment of the existing design and research into similar solutions, the project aimed to develop an optimized shear die that offers improved performance, longevity, and cost.

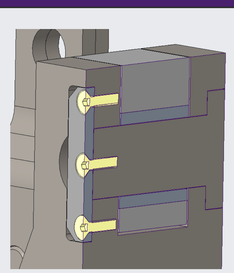
Methods

Once the project requirements and constraints were established, efforts were initiated to identify the root causes of failure in the existing design after repeated use cycles. Upon identifying these areas, potential improvements were formulated and evaluated based on research in similar applications and their potential to enhance the shear die. Subsequently, CREO Simulate, a 3D modeling software, was utilized to model the proposed designs and conduct FEA simulations for validation purposes.

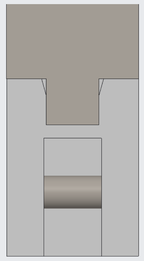
Bushing Material Comparison [1]

Material	Lubrication	Yield Strength (kpsi)	Ranking
No bushing	None	-	3
Oil-Embedded 841 Bronze	Oil	11	2
Graphite-Embedded 841 Bronze	Graphite	11	4
SAE 863	Oil	22	1

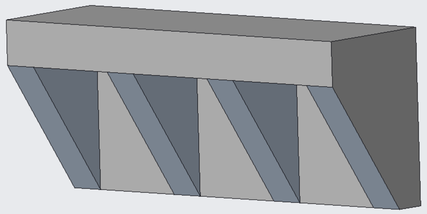
Pin System



Latch Design



Support Ledge



Results

Body Pins

- The body pins on the previous shear die had issues with operation due to high deformation of the part after repeated use cycles.
- This was addressed through implementing a bushing design. Along with this, a plate and flange were added ensuring the pin's movement happens at the bushing.
- SAE-863 was chosen as the material for the bushing due to its strength as well as lubrication [2]. The main goal of the bushing is to serve as a cheap and easily replaceable buffer for the pin.

Latching Interface

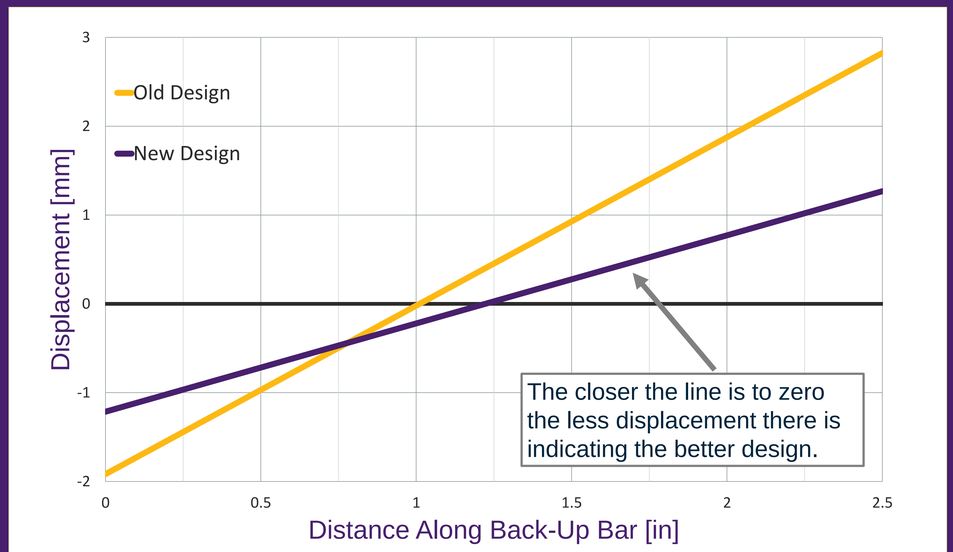
- The latching interface was improved by adding a key and groove to prevent the two sections on the die from being separated from each other.
- With the key and groove, the two halves are prevented from separating which prevents deformation permeating through the rest of the part.

Support Ledge Addition

- The design of the shear die can also lead to the die starting to tip during use, when this happens the hard edge of the die digs into the rail causing damage to the surface.

- Although the inclusion of these ledges was not deemed feasible in the final design due to weight considerations, an interface to accommodate their potential integration in future iterations was included.

Comparison of Displacement Along Back-Up Bar



Conclusions

The proposed solution serves to improve the lifespan and operability of the part by mitigating the deformation of the part which leads to increased difficulty of use and eventually failure of the die. Furthermore, the addition of the bushings will not only aid in mobility of the joints on the shear die, but it will also reduce the costs associated with repairing the shear dies by allowing the less costly bushings to act as protection for the more expensive pins.

Looking forward, future design may be able to improve the shear die by reducing weight as well as implementing further measures to uniformly distribute the force applied to the shear die during operation.

References

1. *Dependable Sintered Metal Parts,* Wakefield Bearing Corporation, 1965.

2. J. Zhang and Q. Dong, *"Lubrication performance analysis of crankshaft bush in compressor,"* Engineering Failure Analysis, vol. 90, pp. 277–289.

Acknowledgement

This project was sponsored by Holland LP. For more information about this project's sponsor, scan the QR code below.

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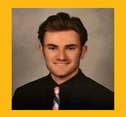

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