



CRITICAL FLAW **AVERTED**

Improved Bronze Bushing Design
Withstands Heavy-Duty Bulldozer Loads

CCTY



“

Everything flexes, which is why the right-sized bushing is critical to each application. We found that a shorter bushing with the correct tolerance would absorb the load while providing a long life for both the bushing and the shaft.”

– **Rich Perlberg**
CCTY Lead Design Engineer

EXECUTIVE SUMMARY

When a new bulldozer design called for aluminum bronze bushings ranging from 3-1/2 to 5-1/2 inches in length, CCTY's engineering team identified a potential issue: the bushings' length could lead to excessive shaft deflection, compromising long-term performance.

To validate this concern, CCTY recommended a finite element analysis (FEA) to assess deflection within the bushing length. It confirmed that the original design posed a risk of deformation at the bushing edges, which could reduce durability. Based on these findings, CCTY optimized the design by shortening the bushings to two-thirds of their original length—ensuring a more reliable and efficient solution.

THE CHALLENGE

When a bulldozer manufacturer approached CCTY about bushings for its new design, CCTY's engineers immediately questioned the unusually long bushing length. At first glance, the extended length appeared to be necessary to handle heavy application loads, with the assumption that a larger load zone would reduce PSI on the bushing surface.

However, an FEA revealed a critical flaw in the design. Instead of improving load distribution, the extra length contributed to excessive shaft deflection, which could compromise long-term performance. The challenge became clear: how to maintain the required load capacity with a bushing that was only two-thirds of the original length.



Sample requests allow us to work directly with the OEM and share our bushing expertise. In this situation, our team found an opportunity before it became an issue in the final product. This example showcases how CCTY works directly with customers to improve design applications.

– **John Sweetwood**
CCTY Strategic Sales Manager

THE SOLUTION

Leveraging its deep expertise in bushings and finishes, CCTY's engineering team proposed a more precise press fit with a tighter inner diameter relative to the shaft's outer diameter. This approach increased the load zone, effectively reducing PSI on the bushing and ensuring durability.

Every critical factor—press fits, manufacturing tolerances, tolerance stack-ups, concentricity, surface finishes, lubrication methods, chamfers and materials—was carefully evaluated. Adjustments were made to optimize load distribution, allowing the shorter bushing to perform as required.

The OEM's engineering team evaluated alternative designs, including composite Teflon bushings backed with woven fiber and epoxy. In the end, CCTY's solution outperformed the competition, providing the best balance of strength, longevity and shaft protection without the risk of galling.

THE RESULTS

Supported by FEA results and field testing, the OEM adopted CCTY's optimized bronze bushing and precise tolerance recommendations. The newly engineered bushing not only safeguarded the expensive shaft but also withstood the rigorous loads of bulldozing operations.

CCTY's solution delivered:

- **A more efficient design** that eliminated premature bushing failure;
- **Enhanced protection** for critical components; and
- **Cost savings** with a shorter, optimized bushing.

With this improvement, the OEM can now manufacture bulldozers with a bushing that is perfectly suited for the application—boosting performance, durability and cost-efficiency.





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