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INDUSTRY SURVEY OF BOLSTERS AND SIDE FRAMES REMOVED FROM SERVICE

SUMMARY

Transportation Technology Center, Inc. (TTCI) conducted an industry survey of defective bolsters and side frames removed from service. Scrapped components (approximately 70 bolsters and 55 side frames) from four railcar shops were analyzed, and the data collected was used to create a database quantifying the most common defects.

Bolsters and side frames can remain in service for several decades. These cast steel components have relatively high strength and generally good toughness. Parts can fail catastrophically during service, but most defective parts are removed before this occurs.

Railcar shops primarily rely on visual inspection and nondestructive testing and gauging to determine whether a component can continue to be used in service.

For bolsters, the survey found the most common problem area was the pocket. Worn pockets and cracked pockets accounted for almost 60 percent of the defects severe enough for removal from service. Figure 1 shows a cracked pocket in a bolster.

For side frames, cracked pedestal jaws and bent pedestals totaled 50 percent of side frames removed from service, and worn columns accounted for nearly 20 percent.

Figure 1. Cracked pocket in a bolster removed from service

The survey found ten issues to be responsible for the remaining bolster defects, and identified six issues for the remaining side frame defects.

Seven bolsters and six side frames were scrapped due to age. The newest of these components was cast in 1975 and the oldest in 1964.

Other components experienced cracks, excessive wear, and damage from previous repairs. The anticipated wear tolerance for certain critical features was compared with the actual dimensions measured by hard gauges or calipers.

The aforementioned issues represent a relatively low percentage of defect causes.

BACKGROUND & OBJECTIVES

Industry perception is that most bolster and side frame failures can be attributed to fatigue or brittle fracture. These conditions can result from poor welding, heat treatment, or improper casting process control.

To determine whether fatigue and brittle fractures are the main causes of bolster and side frame failure, the Association of American Railroads' Coupling System and Truck Castings Committee proposed a survey. The survey would be quantitative, and would record as much casting information as possible to create the foundation for a database. TTCI personnel would begin the survey by gathering scrapped side frame and bolster casting data from three to five car shops or repair facilities.

Additional information such as manufacturer, production date, design, and type of service could also be recorded in the database, and more data could be added in the future.

Ideally, the data would provide an accurate representation of the defects leading to the removal of these components from service. The objective was to determine the relative percentages of the various defects. Initial perceptions indicated that cracks in high stress locations would be the main defects found.

METHODS

Parts from the following four shops were examined for this survey: Havelock in Lincoln, NE, Norfolk Southern's shop in Decatur, IL, Comet Industries in Kansas City, MO, and Union Pacific's car shop in De Soto, MO.

TCCI personnel inspected the defective parts at each shop visually, at a minimum. They then recorded the defects and their locations on a defect sheet, and took photographs of all specific defect types. They noted that some of the parts exhibited multiple defects.

Approximately 70 bolsters and 55 side frames were examined for this survey. In a few cases, multiple defects were evident in one casting. Figure 2 shows the cracked pedestal jaw area of a side frame removed from service.

Figure 2. Cracked pedestal jaw of a side frame removed from service

RESULTS

For bolsters being analyzed, TCCI personnel recorded 12 types of defects during the survey. Figure 3 shows the top six occurring defect types for bolsters; they accounted for 83 percent of the defects in bolsters examined for this survey.

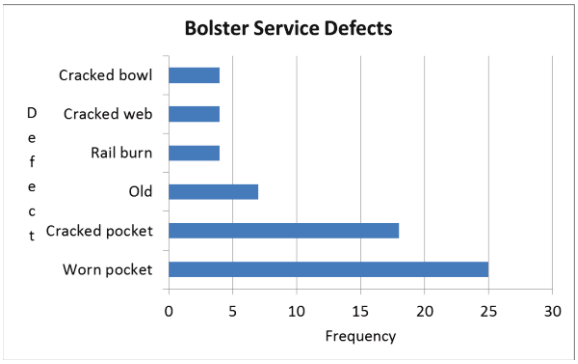

Figure 3. Top six bolster defects

The majority of the bolster defects were cracked pockets and worn pockets. Old castings, rail burns, cracked webs, and cracked bowls were the other leading defects in bolsters. Figure 4 shows a cracked bowl in a bolster.

Figure 4. Cracked bowl in bolster removed from service

The remaining types of defects in scrapped bolsters were bowls not machined correctly, oversize pinholes, gouges around bowls, worn bowls, cracked liners, and bent castings.

For the side frames, nine types of defects were recorded during the survey. Figure 5 shows the top six side frame defects, which represent 93 percent of the defective side frames examined.

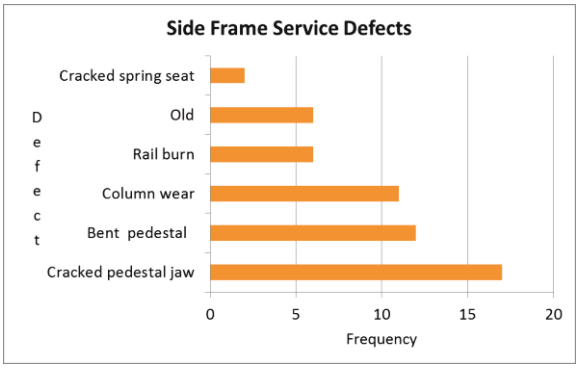

Figure 5. Top six side frame defects

The side frames had cracked pedestal jaws and bent pedestals that accounted for 50 percent of the defects. The pedestal jaws usually experience the highest loads during service.

Worn columns were also a significant problem, occurring in 19 percent of the side frames. Rail burns, old castings, and cracked spring seats completed the top six defects in side frames.

The remaining types of defects were cracks below the wear plate, bent spring seats, and cracks on lightening holes.

To note: Some components were probably scrapped in the field and not sent back to car shops or repair facilities, which may have skewed the results of this particular survey.

CONCLUSIONS

The industry survey and resulting database of specific defects showed that bolsters and side frames are removed from service for a variety of reasons. The age of a casting and the severity of its service greatly affect a bolster's lifespan.

Cracked and worn pockets in bolsters, and cracked pedestal jaws, bent pedestals, and column wear in side frames represented a large number of the scrapped parts examined in this industry survey.

Reducing the top two or three scrap causes would eliminate more than 50 percent of the scrapped components recorded in this research. Eliminating cracked pockets or reducing pocket wear would greatly reduce bolster scrap.

Eliminating side frame defects of cracked pedestal jaws and bent pedestals would greatly reduce side frame scrap.

The third largest bolster scrap category was old casting (more than 35 years old), and it was the fifth largest category for scrap side frames.

A larger sample size and continued sampling would provide more accurate data for this project.

Surveys could be repeated periodically at different shops to gather more data and build a larger database.

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KEYWORDS

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