



TEXAS TECH UNIVERSITY CENTER FOR MULTIDISCIPLINARY RESEARCH IN TRANSPORTATION

Project Summary Report 4144-S
Research Project 0-4144

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March 2002

Study of Re-Refined Oil Use in Diesel Engines: Summary Report

TxDOT has experienced problems with burned exhaust valves and bearing failures in the Detroit Diesel 8V-92 engines used in ferryboat applications. Ferryboat operations suspected that the engine failures were related to the use of re-refined oil.

Prior to 1998 the ferryboat engines were operated on virgin oil (Costal Fleet HD-40 MIL-L 2104F which also meets API CF-2 specs). In the spring of 1998 the use of an SAE 40 CF-2/SH re-refined oil was begun. However, the ferryboat operations switched to low zinc formulation oil developed for railroad engines, which had a higher TBN to help reduce oil consumption.

What We Did...

Both 8V-92 engines in the ferryboat Oliver, which had recently been rebuilt, were used to compare the wear effects of re-refined and virgin oils. One engine was to use virgin oil and one re-refined oil. Two oil samples were to be taken at the midpoint oil change (75 hours of operation) and at the end of every engine oil change (150 hours of operation). The oil samples were analyzed and the results compared to determine engine wear rates. SAE 40 CF-2/SH re-refined and the virgin oils were to be used for the tests. Detroit Diesel engineers indicated that the use of low zinc oil could increase the rate of valve train wear.

Ferryboat operations began collecting oil samples in December 1999. In May 2000 the engines were removed from the Oliver, torn down and inspected for wear by an authorized Detroit Diesel dealer. Pictures of the disassembled engines were taken and bearings, pistons, cylinder liners, etc. were measured and documented for comparison with a second inspection scheduled for the end of the study.

The 38 oil samples taken between December 1999 and December 2000 provided inconsistent results and the sampling was less frequent after the engine teardown in July 2000. During a visit to ferryboat headquarters in March 2001 it



was discovered that for some time virgin oil had been used in both engines.

What We Found...

Because of the mix up in the oils used, the study was terminated; thus, results of the study are limited.

Oil Sample Results

The study investigators were not informed which engine was run on virgin oil and which was run on re-refined oil; the engines were specified as Engine A and Engine B. A plot of iron concentration versus time is shown in Figure 1. This plot is typical of the other wear metals as found in the oil samples. Examination of the figure indicates that the frequency of sampling decreased significantly at about the time the engines were torn down and inspected in July 2000. One of the problems initially identified with Ferry Boat Operations procedures was not changing engine oil frequently enough. The oil change frequency is not known specifically, but can be estimated from the sample dates. Trends shown in the oil sample data tend to track fairly well for the samples taken early in the program. However, for the later samples trends are more erratic. Because there was no re-refined oil used in the engines for a significant part of the test, and possibly for the entire test period, it is not possible to interpret what effect re-refined oil had on engine wear versus virgin oil.

Engine Teardown Results

During July 2000 the engines were removed and torn down for inspection by

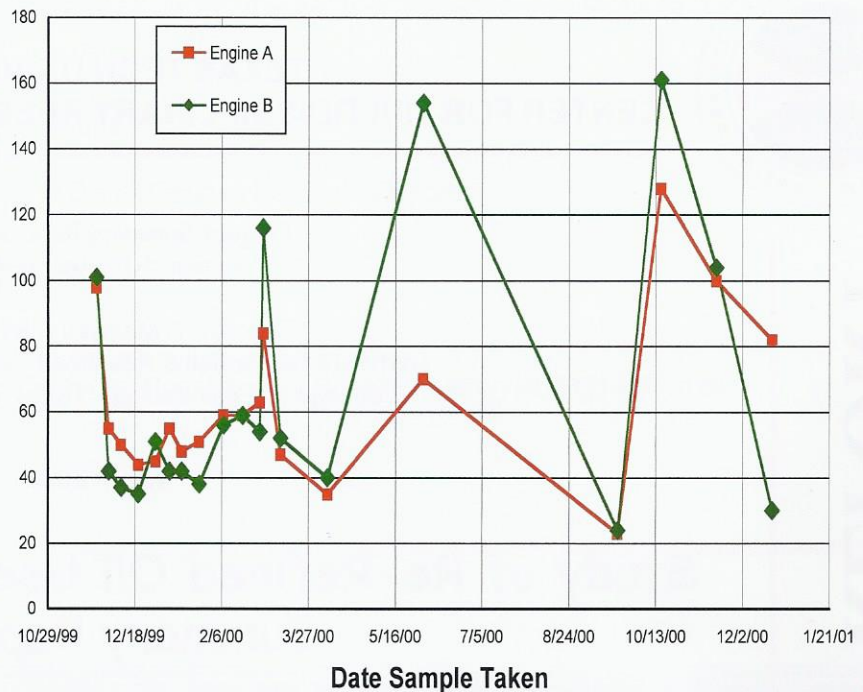


Figure 1: Iron Concentration in Oil Samples

a Detroit Diesel authorized representative. Major wear components were measured, data was recorded, and pictures were taken of the major engine components. The measurement of engine wear surfaces indicated only insignificant differences in the condition of the two engines. Figure 2 shows a view of one of the cylinder liners. Figure 3 shows a view of the top of the cylinder head.

The engine teardown and inspection indicated essentially equal wear for both engines and in no way indicated any oil related problems.

The Researchers Recommend...

Because the test was terminated as a result of the confusion of what oils had

been used in the Oliver's engines, it is not possible to draw specific conclusions as to the effect of re-refined oil versus virgin oil on wear and other problems related to the operation of the 8V-92 Detroit Diesel engines used in the ferry boats. However, a couple of inferences can be made.

- ☐ The engines should be run on SAE 40 CF-2/SH oil, virgin or re-refined oil.
- ☐ Engine oil change intervals should be much shorter than is typical for the ferryboat engines.





Figure 2: Cylinder Liner from One of the Engines

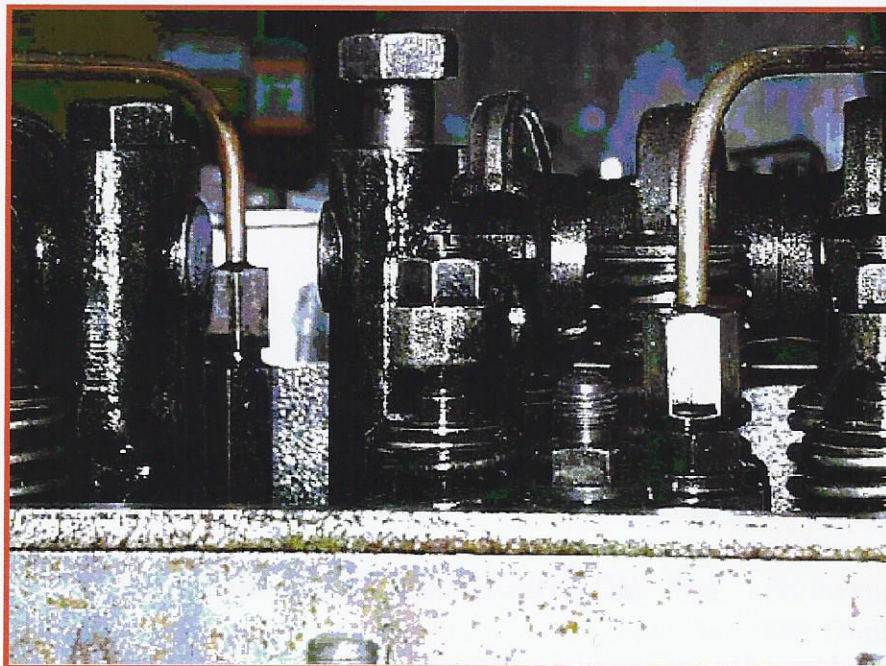


Figure 3: Top of Cylinder Head



For More Details...

The research is documented in the following reports:

Report 4144-S, Study of Re-Refined Oil Use in Diesel Engines: Summary Report.

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To obtain copies of the reports, contact the Center for Transportation Research Library at (512) 332-3126.

TXDOT IMPLEMENTATION STATUS

January 2002...

Several positive findings and actions did stem from this project:

1. Ferry system engines are now being serviced with a heavier weight of oil, SAE 40 CF-2SH. Either virgin or re-refined oil is allowed.
2. Oil Change intervals have been shortened to 150 hours.
3. The Maintenance Division is forming a team to prepare a preventive maintenance manual for the ferry system.

For more information, please contact; Glenn Hagler, General Services Division at (512) 416-2082 or ghagler@dot.state.tx.us.

Your Involvement Is Welcome...

This research was performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not for product endorsement.