Evaluation of NatureBlend™ Biodegradable Flange Lubrication from MPL Technology, Inc.

Testing Conducted at Transportation Technology Center, Inc.

Report generated by MPL Technology with data provided by TTCI

October, 2012

EXECUTIVE SUMMARY

MPL Technology, Inc. has developed a new patent pending formulation of solid lubrication using environmentally friendly materials called NatureBlend™. This material is made up of a combination of biodegradable and renewable plastics, a vegetable oil and a combination of proven extreme pressure additives designed to provide railroads with a green alternative for flange lubrication.

Testing of the lubrication benefits of material was conducted on October 19, 2012 at the Transportation Testing Center in Pueblo, CO to determine effectiveness and longevity. Testing was conducted using a combination of mechanical and electrical measurements on two locomotives while testing on the Wheel Rail Mechanism Loop. Testing was conducted by TTCI personnel and the data was recorded using the TTCI data acquisition system attached directly to the locomotives.

The results of these testing indicate that within a short time period of application, energy savings provided by the NatureBlend lubricant were 7% in mechanical energy measurements and 5% on the electrical energy measurements.

In addition to field testing conducted at TTCI, MPL Technology has conducted extensive third party lab evaluations of these materials using an Amsler twin disc roller machine. Further detail on the testing lab, equipment used and testing results can be found in Appendix B.

INTRODUCTION

MPL Technology has been the industry leader in providing SolidStick flange lubrication for over a decade. In an effort to keep up with today's increasing environmental awareness MPL begin researching the possibility of developing a solid lubrication formulation that was both biodegradable and renewable. The result of this research is the patent pending NatureBlend formulation which uses a combination of biodegradable and renewable plastics in combination with a vegetable oil and traditional extreme pressure additives to provide the rail industry with an environmentally conscious flange lubrication alternative that does not comprise performance or benefits received from the use of flange lubrication.

In order to document the performance of the NatureBlend formulation, MPL contracted TTCI to preform testing of the material under actual field conditions. This report documents the testing protocol, equipment used and results of the analysis.

TEST OBJECTIVE

The objective of the testing is to quantify the energy between dry and lubricated conditions and determine the residual effects of a locomotive flange lubrication system for subsequent trains. In order to accomplish these objectives, the amount of energy required to transport a heavy haul train under dry conditions must first be documented, then compared with energy requirements subsequent to the lubrication system being activated.

PROCEDURES

Testing was conducted on the 3.5 mile Wheel Rail Mechanism (WRM) loop using the two SD 70 FAST locomotives and 30 (125 ton) cars of the FAST train as trailing tonnage. The target speed for laps during operation was 30 mph.

TTCI selected two SD 70 FAST locomotives and installed main generator shunts on both locomotives in addition to an instrumented coupler in the first car of a loaded thirty car consist to measure mechanical forces. Electrical data from the locomotives and force data from the instrumented coupler was collected using a single data collection system located in the first locomotive.

The test procedure called for undetermined number of baseline laps to be run until such time a relatively similar number for both electrical and mechanical energy was able to be identified. The average of these baseline laps would be used as the "dry" baseline measurement for comparison purposes.

Once a dry baseline was established the flange lubrication sticks would be installed in the applicators already installed on the locomotives. The applicators would apply the NatureBlend formulation to the #3 and #4 axels on both of the locomotives. Once installed, the train would resume laps and monitor electrical and mechanical energy on a per lap basis to determine any reduction in energy consumption. Laps were to continue to be run until such time readings become consistent indicating lubricant saturation of the rail.

Once rail saturation has been determined, the lubrication sticks were to be removed from the applicators, measured to determine consumption rate and the train will resume operation to measure residual effect and dry down time.

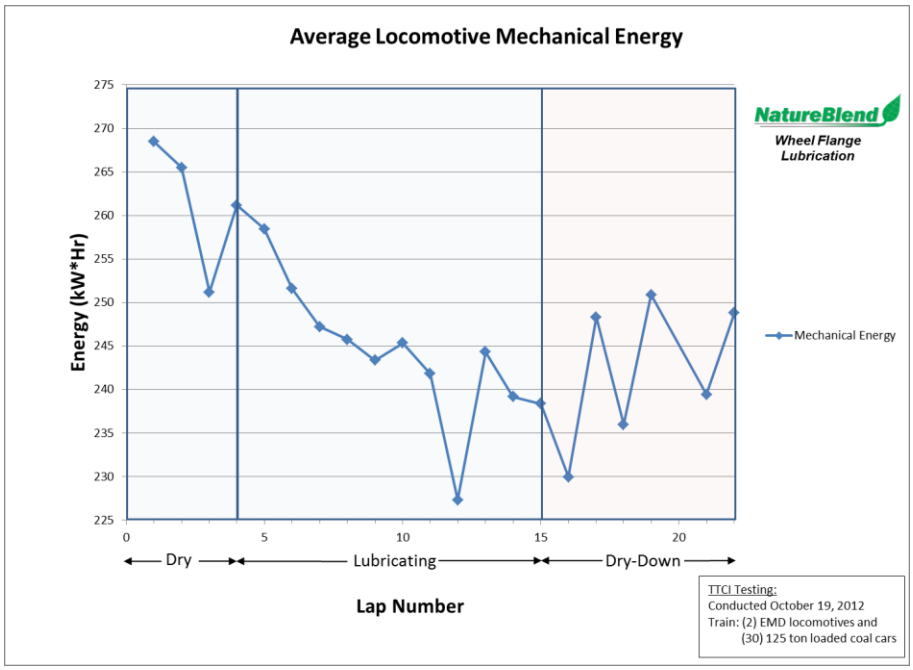
Coefficient of friction readings of the gauge corner were to be taken after each lap of baseline, lubricating, and dry-down laps; however, the TTCI staff indicated that due to the highly worn condition of the rail gauge these readings may not prove to be accurate. The subsequent measurements of the gauge corner did not reflect any measureable trends that would be expected during lubricated and non-lubricated conditions.

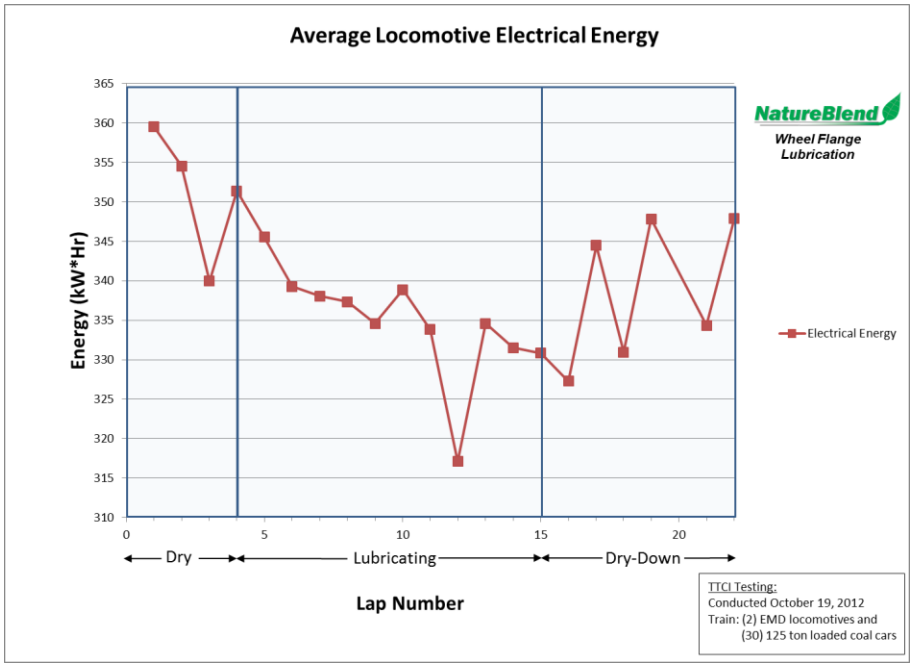
TEST RESULTS

The NatureBlend testing was conducted Friday morning, October 19, 2012 at the TTCI testing facility located in Pueblo, CO. The weather conditions on that day were sunny with light winds and a morning low temperature of 25F and a high of 78F. Average relative humidity for the day was 29%.

The train began running the first dry lap to measure baseline conditions at 10:50 am and the recorded four laps of data when it was determined that average number could be calculated based on three of the four laps completed.

The train was then stopped so that the NatureBlend lubrication sticks could be installed in the applicators. The sticks were measured and installed in the locomotives on the number 3 and 4 axels. Subsequent laps were then conducted and the following chart represents the documented energy measurements from both watt meters and coupler forces:





Once it was determined that the train had established a steady state friction reduction based on the energy measurements the train was stopped and the flange lubrication sticks were removed. The sticks were then measured to determine wear rates over the 35 miles traveled during testing.

Once the NatureBlend sticks were removed from the applicators, the locomotive resumed travel with no lubrication to determine residual benefit of the flange lubricant sticks. The goal was to determine the duration that the lubricant remained in place and provide noticeable benefit for subsequent trains.

The dry average was determined by averaging 3 of the 4 dry baseline laps as the one single outlier was determined to not be representative of actual conditions. Once lubrication was initiated the results indicate immediate reduction in energy requirements after a single lap. Subsequent laps continue to reduce energy requirements through lap 3 where the energy savings stabilize around 7% reduction in mechanical energy and 5% on electrical energy. Actual energy measurements can be found in Appendix A.

NatureBlend Analysis Results (% Reduction in Energy Requirements)		
	Mechanical Energy (KWH)	*Electrical Energy(KWH)*
Dry Average	265.050	355.154
Lap 1	-2.6%	-2.8%
Lap 2	-5.4%	-4.7%
Lap 3	-7.2%	-5.1%
Lap 4	-7.9%	-5.3%
Lap 5	-8.9%	-6.1%
Lap 6	-8.0%	-4.8%
Lap 7	-9.6%	-6.4%

Once it was determined that the track had reached a saturation point, the train was stopped and the NatureBlend lubrication sticks were removed from the applicators. It is worth noting that although the train was stopped due to time constraints, the energy measurement readings were continuing to decrease with each subsequent lap. Once removed, the train resumed movement and dry down laps were conducted. The NatureBlend formulation proved to provide residual benefit after the sticks were removed; however a noticeable trend of increasing energy requirements can be identified during the dry down laps.

BENEFITS

In an effort to quantify the value provided by the use of the NatureBlend lubricate, a brief analysis is conducted below to determine fuel savings based off of the test data. The average baseline electrical energy used by both locomotives for a single lap was 355.154 KWH. This energy is derived from diesel fuel which contains 40.6 KWH of energy/gallon. Based on this analysis both locomotives would have consumed 8.75 gallons of diesel fuel during a single dry baseline lap.

Once lubricant began being applied, the energy dropped to 338.055 KWH which translates to 8.32 gallons of diesel fuel consumed per 3.5 mile lap. The following calculation demonstrates the savings for the same consist over 10,000 miles:

Dry Condition: 10,000 miles = 25,000 gallons of diesel X $3.00/gal = $75,000
Lubricated Condition: 10,000 miles = 23,770 gallons of diesel X $3.00/gal = $71,310
Savings/10,000 miles: $3,690

CONCLUSION

The biodegradable and renewable materials used in the NatureBlend formulation have proven to provide a quantifiable benefit to railroad operations. The formulation ensures that this product is one of the most environmentally friendly lubricants on the market today and still is able to provide superior lubrication and energy savings.

APPENDIX A – Test Data

Dry Baseline Conditions			
	Average Speed (MPH)	*Mechanical Energy (KWH)*	*Electrical Energy(KWH)*
Lap 1	29.536	268.486	359.513
Lap 2	29.005	265.491	354.545
Lap 3	29.062	251.169	339.951
Lap 4	29.450	261.174	351.404

NatureBlend Test Laps			
	Average Speed (MPH)	*Mechanical Energy (KWH)*	*Electrical Energy(KWH)*
Lap 0	-	-	-
Lap 1	29.190	258.456	345.540
Lap 2	28.879	251.568	339.271
Lap 3	29.031	247.187	338.055
Lap 4	29.060	245.726	337.346
Lap 5	28.870	243.331	334.604
Lap 6	28.980	245.319	338.883
Lap 7	29.146	241.820	333.800
Lap 8	29.206	227.282	317.085
Lap 9	28.865	244.309	334.595

NatureBlend Dry Down Laps			
	Average Speed (MPH)	*Mechanical Energy (KWH)*	*Electrical Energy(KWH)*
Lap 0	-	-	-
Lap 1	29.165	239.155	331.507
Lap 2	29.407	238.362	330.828
Lap 3	29.109	229.947	327.255
Lap 4	29.367	248.299	344.506
Lap 5	28.978	235.973	330.949
Lap 6	28.638	250.862	347.861
Lap 7	28.849	239.421	334.363
Lap 8	28.489	248.802	347.920