

Introduction

The Starrett-Bytewise Profilometer has become the worldwide standard for ultra-precision, non-contact profile measurement in the tire industry. Two hundred units are now in use at over 100 tire factories. Our Profilometer is the corporate standard for many tire companies worldwide.

The Profilometer helps the extrusion department achieve four primary goals that result in real cost savings. These goals are:

1. Reduce total tread rubber use by avoiding oversized treads
2. Reduce extrusion department scrap due to incorrect profile geometry
3. Reduce cured tire scrap due to out-of-specification treads
4. Increase tire production by reducing extruder downtime for die trials

Many manufacturers report a payback period as short as three months on their Bytewise Profilometers. It is clear that extremely precise profile measurement can deliver significant cost savings and quality improvements, even with existing process equipment.



How to reduce rubber use by avoiding oversized treads

Extrusion process control is a complex task. The extruder operator must manually make process adjustments based on a wide range of parameters. The shoulder width of a tread extrusion is often a controlling variable. If the shoulder width becomes too narrow, the operator may reduce the drawdown and run the tread heavy to meet shoulder width requirements. This can result in heavy extrusions (wasted materials) or scrapped extrusions (wasted materials and wasted production capacity). The heavy profile provides a safety factor to decrease the chance that the treads will have to be scrapped. This adds up to large amounts of excessive rubber usage. When dies are at either the high or low tolerance limits, the extruder operator does not have much control flexibility. The accuracy and precision of the Bytewise Profilometer allows die designers to build dies to tighter specifications that allow for a reduction in excess materials usage.

Cost Savings Model:

- Tires per day – 10,000
- Cost per tread - \$8
- Excess compound use – 0.5%
- Total daily cost reduction - \$400
 - Assuming 10,000 tires per day
- Total annual savings - \$140,000

How to reduce extrusion scrap and cured tire scrap

Profilometer users worldwide perform checks periodically (usually on 15 to 30 minute intervals) to ensure conformance with process tolerances and to detect process trends for profile distortion, porosity changes, and weigh-scale drift. Conventional profile tolerances are thickness measurements at specified locations, as well as specific sectional widths on the extrusion. The Bytewise Profilometer is a much faster measurement system than manual methods. The Profilometer is also far more precise and repeatable than these manual methods. There is no operator influence in Profilometer measurements. Profilometer calibration is traceable to a certified standard.

With this ultra-precise, full-profile measurement, a number of significant improvements can be made in profile inspection. For example, single numbers are calculated to represent the volume and distribution compliance for the **total** tread profile, **left** half profile, **right** half profile, and **crown** section profile. Additionally, a single **conicity value** is calculated which indicates the conicity effect present in the tread extrusion, even for non-symmetric tread extrusions.

Cost Savings Model:

- Tires per day – 10,000
- Cost per tread - \$8
- Scrap rate – 0.5%
- Reduction in scrap rate – 50%
- Total daily cost reduction - \$200
 - Assuming 10,000 tires per day
- Total annual savings - \$70,000

Out-of-specification treads sometimes get to the tire building machines, are built into tires, and cured. Cured tire defects can be identified in uniformity check, balance check, and by the inspectors. Off-line checking will reduce the likelihood of bad treads going to tire building, and reduce the cost of cured-tire scrap.

Cost Savings Model:

- Tires per day – 10,000
- Cost per tire - \$20
- Scrap rate – 2%
- Percent of scrap due to tread – 25%
- Reduction in scrap rate – 25%
- Total daily cost reduction - \$250
 - Assuming 10,000 tires per day
- Total annual savings - \$87,500



How to increase production by reducing the number of die trials

The tread extruder output can determine the total tire capacity for the plant. In this case, extruder downtime reduces tire manufacturing capacity. Many tire factories cut 10 to 20 new dies per day. Each die cut requires a verification of the extrusion geometry before being put into production. Die designers using the Bytewise Profilometer can significantly reduce die trials and increase the number of tires per day. The intuitive and powerful visual software tools provided by the Bytewise Profile Viewer software allow the die designer to more accurately measure die swell and compound behavior. The profile error display gives a quick and accurate image of a die's geometry.

Capacity Improvement Model:

- Tires per day – 10,000
- Number of die cuts per day – 6
- Time per cut and trial – 15 minutes
- Die Trial Reduction – 25%
- Time savings – 22 minutes
- Additional capacity due to added extrusion time – 152
- Profit per tire - \$1
- Additional profit per day - \$152
- Additional profit per year - \$53,200

Summary of Savings

The Bytewise Profilometer is used continuously, every day, for production-critical quality decisions at over 100 tire factories worldwide. It is the trusted standard in accuracy and repeatability. The cost savings discussed above are summarized below and are typical of these tire companies, based on user surveys. Savings are based on 10,000 tires-per-day rates and the assumptions shown above. Savings will be greater for truck tire operations.

Compound Cost Reduction	\$140,000
Extrusion Scrap Reduction	\$ 70,000
Cured Tire Scrap Reduction	\$ 87,500
<u>Added Profit from Increased Capacity</u>	<u>\$ 53,200</u>
Total Annual Benefit	\$350,700