

# Evaluating tensile, tear strengths of modified bitumens

Roofing researcher Heshmat Laaly, Ph.D., makes a case for roof membranes with higher tensile and tear strengths

**By Dr. Heshmat Laaly**

How much performance is enough? That is a question heard often in my 45 years in the roofing industry.

It is certainly true that considerations of cost and application severity must be part of any purchasing decision. **But the implication that there exists a natural ceiling beyond which manufacturers should not go, in terms of specific performance characteristics, such as tensile strength, is just untrue.**

**Experience convinces me that the value of longevity justifies the higher initial costs of a superior roofing system.**

Safety margins are built into the design of a number of key building components, such as elevators, as well as into roofing. The question is what is that safety margin? The roof designed with a safety margin of zero will, I predict, probably fail sooner than one with a safety margin of 20%, 50% or 80%.

This is not "over-engineering." Safety factors are built into product design because most products---including roofing---begin to deteriorate once they are put into use. Safety margins are built into high-performance roofing materials to ensure long term protection against Mother Nature.

## **Evaluating roofing technologies**

In the 1970s, the National Research Council of Canada division of Building Research Laboratories (now known as the Institute for Research in Construction-IRC), undertook an extensive research program involving the evaluation of hundreds of roofing membranes.

Individual technical committees were assigned to assess the properties and performance characteristics for specific types of roofing materials, including APP (Atactic Polypropylene) and SBS (Styrene Butadiene Styrene) modified bitumens.

Each category of membrane was further divided into those with and without reinforcement so as to assess the differences in their physical and performance properties

The opinions expressed in this article, are based on initial findings of that research, which is ongoing, and also on my own personal experiences in laboratories in West Germany and Canada.

## **Assessment tests**

There exist today more Than 50 distinct tests that are applicable to roofing membranes. Since the compositions and applications methods of various materials differ, depending on geographical regions and specific climates not, all of these tests apply to every material. Nevertheless, each class of roofing materials has specific testing protocols

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APP modified bitumen materials differ with each modifier, as well as with various production factors that contribute to product performance

for predicting service life and performance behavior.

While the correlation between laboratory test results and actual field performance has been the subject of many research papers, suffice it to say there is indeed a correlation when testing protocols have been intelligently designed and properly implemented.

### Evaluating modified bitumens

The physical and chemical properties of SBS or APP modified bitumen materials differ with each modifier, as well as with various production factors, and contribute to product performance.

The primary factors evaluated for modified bitumen roofing are:

- Type of asphalt;
- Type of modifier;
- Type of extenders; and
- Type of reinforcement.

For comparison, I recently tested five different modified bitumen membranes from different suppliers. I used American Society for Testing and Materials (ASTM) test methods and uniform lab conditions to assess tensile strength, tear strength and low- temperature flexibility.

**We found that the performance within any single category of product can vary significantly.**

### Implications

The climactic conditions in which modified bitumen products must perform can vary from subzero temperatures to 190 F. For this reason, tensile and tear strength are among the most important physical properties when evaluating the ultimate performance of these membranes, as is the amount of wear and tear and exposure to which they are subjected. All these factors must be evaluated when selecting a roofing system.

**In my opinion, tensile and tear strength are the most important physical properties when evaluating ultimate performance.**

Among the samples I tested, **tensile strengths ranged widely**, from 30 to 525 lb.-ft. per inch. In those same samples, tear strengths ranged from 40 to 925 lb.-ft., while low-temperature flexibility ranged from -4 to -40 F.

In attempting to establish safe thresholds for roofing material performance, it is necessary and inevitable that standards committees set baseline limits. However, this should not be misconstrued as an endorsement of minimum standard products.

### Conclusions

A healthy roofing industry requires, in my opinion, two conditions:

- Adherence to recognized standards such as those of ASTM; and
- Incentives for Innovation.

**From evidence I've seen, I believe that superior performance in critical areas such as tensile strength does contribute to longer service life, which is of monetary advantage to the building owner.**

In order for performance innovations such as these to continue, I think that it's imperative that the **life-cycle cost benefits** resulting from manufacturer investments in research and development be appropriately acknowledged.  
**RSI**