



## Low Slope Steel Roofing - the Winners in Life Cycle Cost Analysis

An independent assessment of the life cycle cost for various low slope roof systems revealed that steel roofing had the longest life span, no leaks due to material failures, and the lowest overall maintenance cost.

These are the results of a recent study conducted by Ducker Research Company<sup>1</sup> for the National Roofing Contractors Association (NRCA). The purpose of the study was to compare three commonly used types of low slope roofing systems (2:12 roof slope or less) from the standpoints of service life, maintenance cost, and overall life cycle cost.

The study looked at the following three different roofing types:

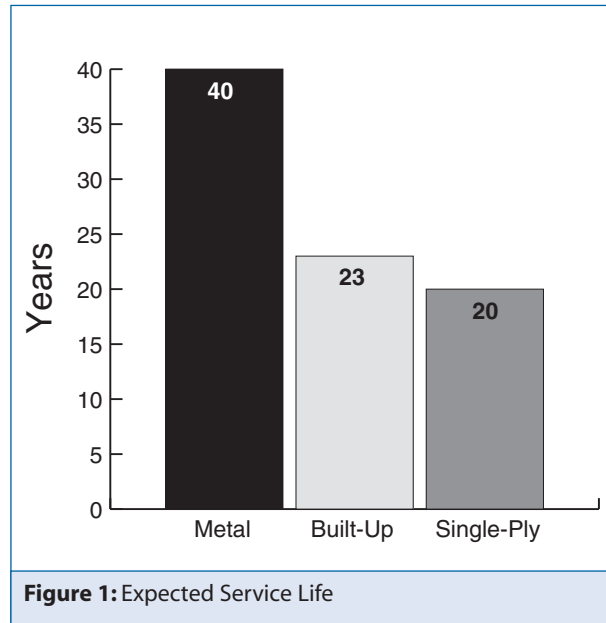
- 1) Metal (mostly unpainted coated steel roofs)
- 2) Built Up Roofs (BUR) - modified bitumen, asphalt
- 3) Single ply membrane (EPDM/PVC/TPO)

Four different building categories were surveyed:

- 1) Office/Bank
- 2) Retail (store, mercantile)
- 3) Manufacturing (industrial, warehouse)
- 4) Institutional (education, healthcare, hotel/motel)

Based on 41 plus interviews with building owners and managers, 36 case studies of roofing systems were selected from the western, northern and southern regions of the United States. In all, twelve case studies were evaluated on each of the three roofing types. Steel comprised the vast majority of the metal roofing systems.<sup>2</sup> Most of the roofs were installed between 1981 and 1994; roof areas varied from 4,000 to 750,000 square feet with the average being approximately 92,000 square feet. The expected service life of steel roofing was determined to be 40 years – 17 years longer than Built Up Roofs and 20 years longer than Single Ply systems (see Figure 1)

**Definition:** LIFE CYCLE is defined as the period of time from initial roof installation until re-covering or re-roofing is required. Factors affecting the roof life cycle costs included regular maintenance, repairs, labor assumptions based on geographic location, and energy savings/loss based on roof system.



**Life Cycle Cost:** All relevant aspects of low-slope roofing were considered: roof design, number of layers, sheet gauge, standing seam or through-fastened, insulation type and thickness, installation systems (i.e. seamed, ballasted, etc.), labour, balance of systems (i.e. venting, parapets, etc.), geographical effects, life span and additional items relating to the full life cycle, as well as the original installation cost.

Steel roofing has two characteristics that the other two roofing materials do not:

- 1) Steel is a non-porous material and under some conditions requires no underlayment to keep the building dry
- 2) Steel is easily engineered to withstand increased gravity and wind loads

Service life, durability and life cycle cost are considered the most important criteria in the selection of roofing type, according to building owners. While the majority of buildings had experienced roof leaks, none of the steel roofs had leaked as a result of material failure. By comparison,

<sup>1</sup> Ducker Research Co. Inc. Detroit, MI [www.ducker.com](http://www.ducker.com)

<sup>2</sup> Of the 12 metal roofs included in the study, ten were steel, one was copper and one was aluminum.

30% of the Built Up Roofs and 56% of the Single Ply roofs experienced leaks resulting from material failure. Furthermore, owners of buildings having steel roofs reported having little or no regular maintenance performed on their roofs. The leaks reported on steel roofing were a result of contractor installation problems. Regardless of roofing type, failure to achieve a quality installation is the primary reason for roof failure. (see Figures 2 and 3)

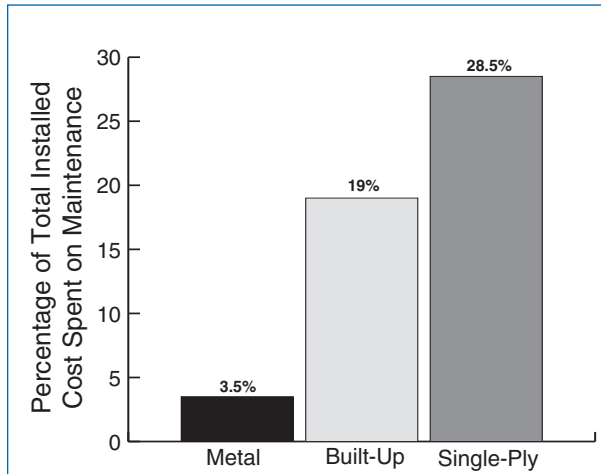


Figure 2: Maintenance

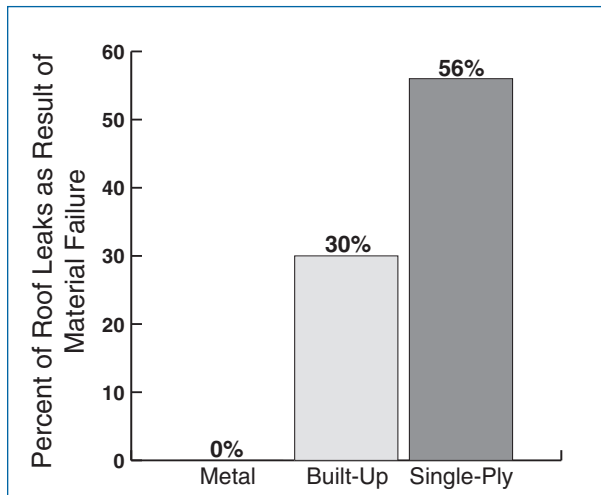


Figure 3: Roof Leaks

**Life Cycle Cost Analysis:** The LIFE CYCLE COST (LCC) of a roof is defined as the present value of all the costs associated with the roof over time.

The life cycle cost of a roof is typically calculated as follows:

$$LCC^{1,2} = IIC + AEC + AMC$$

- Where, LCC = Total Life Cycle Cost
- IIC = Present Value of Initial Installed Cost
- AEC = Present Value of Annual Energy Cost
- AMC = Present Value of Annual Maintenance Cost

The service life of a roof will vary by system type and it is critical to apply the average annual cost across the full life

of the roof system as illustrated in Figure 4. The Ducker Research study also identified that roofing material quality heavily impacts the overall life cycle cost (e.g. greater level of maintenance activities). In this regard, steel roofing and Built Up Roofing were more consistent across all four building categories.

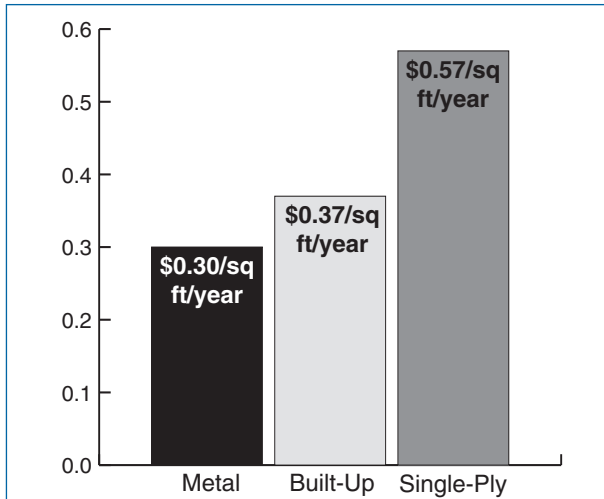


Figure 4: Expected Life Cycle Cost

**The Purchase Decision Process:** While the architect and roofing contractor are the primary decision makers for roofing material selection in new construction and re-roofing, building owners also play an active role. They are the final decision makers and should be educated about the benefits of steel roofing since they regard the service life or roof longevity, durability and life cycle cost to be the most important factors.

**Conclusion:**

The Ducker Research Company study showed that the life cycle cost of a metal roof is significantly less than BUR and Single Ply roofing. Steel roofing had the lowest maintenance costs and had, on average, a 17+ year greater lifespan than the other two roofing systems. The study also concluded that building owners believe that service life and life cycle costs are the most important factors in roofing material selection and overall, metal roofing is by far the best option based on its lowest life cycle cost. Add to this the fact that steel roofing is 100% recyclable, has industry leading recycled content and easily qualifies for LEED Canada certification.

**For More Information**

For more information on sheet steel building products, or to order any CSSBI publications, contact the CSSBI at the address shown below or visit the web site at [www.cssbi.ca](http://www.cssbi.ca) to view a copy of the Ducker Research Company report.

<sup>1</sup> Annual energy costs were not included due to large variation based on location, insulation, level, etc. However, based on past research, the use of a reflective roof system with adequate insulation can yield savings of approximately \$0.08-\$0.10 per square foot.

<sup>2</sup> The following assumptions were used in the development of the life cycle costs:  
 a) An average annual inflation rate of 3.1%.  
 b) Actual service life figures by roofing material utilized were based on Ducker/NRCA analysis conducted in 2003.