

## ROOFING PRACTICES IN THE USA: TECHNIQUES OR TECHNOLOGY?

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The first Conference on Roofing Technology, sponsored jointly by the National Bureau of Standards (NBS) and the National Roofing Contractors Association (NRCA) convened here on 29 April 1969. That effort was welcomed and cheered for at least three reasons:

- 1) Problems of a technical nature require sound preventive measures as opposed to ever more costly remedial efforts.
- 2) Both NBS and NRCA had been working more or less independently for a long time in efforts to obtain facts so necessary to achieve substantial and orderly programs.
- 3) The rate of increase of problems directly affecting the roofing industry was and may yet be gaining on the rate of increase of sound solutions. Problems external to the roofing industry have produced potential for change far more profound than was contemplated as recently as five years ago.

In any event, roofing practices in the USA have been affected in largest measure by the economics of the market-place. Consider that of at least three hundred seven roofing materials for which patents had been issued by 1875, only one, the conventional built-up roof with slag surface, has remained in continuous use. The reason is clearly that it worked. In economic terms, it simply out-performed all of the other systems because it possessed an obvious total or life-cycle cost advantage to its owners.

The early part of the story of roofing practice in the USA saw the transition from pitch to asphalt as the adhesive and waterproofing element, primarily as a result of the growth of the petroleum refining industry. The middle part of the story began with the introduction of the thermal insulating layer between the structural deck and roof membrane. The consequences remain formidable to say the least. The available literature on the subject continued to grow as new deck materials provided new substrates, new insulating materials, new methods of attachment, new vapor retardant layers, new fire and wind uplift considerations: in short, the number of possible combinations which are acceptable to the various authorities is almost endless, and ever-changing. It is not surprising to discover authorities in conflict with one another at the jobsite. Each authority, depending upon his exposure to costly past problems, remains steadfast in his position, with the result that the conventional roofing system often becomes an agglomeration with an unacceptably high risk of premature failure.

Unfortunately, the roofing industry has been subject to the state-of-the-art, and to empirical rather than theoretical evolution, such as is available in other aspects of construction, for example, structural design.

Roofing practice in the USA evolved as much from varying North American climatic conditions as from the distances to sources of materials. At least six different climates are found in the USA, resulting from the various combinations of temperature range, sunlight exposure, wind, humidity, and types, rates and amounts of precipitation. Accordingly, the performance concept, addressed here in the second NBS-NRCA conference in March 1971, outlined a mechanism whereby the needed attributes of a roofing membrane might be brought more closely into register with any anticipated exposure. At present, it is almost certain that no one roofing membrane or system in the USA will have a life-cycle cost advantage over all others by reason of varying climates and distances to sources of materials.

Currently, efforts to implement the performance concept in the work-a-day world are being directed toward validating all known, efficient test procedures, to the end that overall system performance may be more accurately predicted. This will be a vast improvement for the design professional.

One interesting footnote in the current effort is the early acceptance by several major roofing asphalt producers of the concept of "Equiviscous Temperature" (EVT), the temperature at which a particular roofing asphalt may be expected to possess the optimum mopping viscosity. Also useful to the applicator are blowing temperature and flash-point, representing limits relating to the hazards of heating - the ignorance of which can result in altering the viscosity, and usually, other characteristics as well - perhaps permanently or quite suddenly, to say the least.

The new asphalt identification label would include all of the above in addition to historical classification by softening point.

A serious student of roofing practices in the USA must dig somewhat deeper, however, than exhaustively researching the available literature. The real world has another climate which, although intangible, controls roofing practice in the USA to a noticeable extent. It is the legal climate which promotes, paradoxically, some quite unfortunate technical results by operating to resist needed change. A penalty or deterrent looms large for those who set out to correct a defective material, method or technique hazardous to the life of a roofing system of which it became a part. The deterrent is the imponderable liability arising out of the tacit admission that something was wrong in the first place which cried out for change.

All too often the applicator, whose efforts may well have been deficient in one or more inconsequential particulars, finds himself defending against ills of origins unknown to him, and not truly of his own making. An effort to address just this sort of problem was undertaken on a nation-wide basis several years ago. It continues as an early-warning reporting system which is designed to inform the participants in the program of those who have experienced very similar, if not identical, problems which could not otherwise be readily explained. The ultimate effects on roofing practices in the USA are yet to be realized. At this time, the program provides a means of developing efficient remedies and sharing information which may be crucial to a proper legal defense.

What of the external forces which affect roofing practices in the USA to produce future change?

Economics being the ultimate driving force affecting roofing practice in the United States, the impact of the energy crisis will remain with us for decades. Suffice it to say that we in the United States, until fairly recently, refused to recognize the necessities of our domestic energy situation. The progress toward developing, let alone realizing, the long overdue, comprehensive, national energy program has been distressingly slow-paced. Each delay is becoming increasingly expensive. Moreover, the foundation remains for a revisit of chaotic overseas influence to abruptly dislocate the principal sources of waterproofing agents essential to the installation and performance of the bulk of flat roofing in the USA, whether they be the asphalt fraction of crude petroleum or other materials formulated from petrochemicals. Briefly consider that the roofing industry in the United States alone constructs in excess of twelve billion square feet, or about a billion and a half square meters, of roofing each year and consumes over twenty million barrels of asphalt. With requirements such as these, even seemingly minor changes in refinery techniques and practices, which scarcely address the needs of the roofing industry per se in any given locality, have resulted in extreme dislocations in the roofing industry.

Without any assistance from the energy crisis, national environmental concerns have produced air pollution control efforts epitomized in the especially pollution-prone west coast urban areas. In California, for example, an intense effort produced satisfactory means whereby emissions from heating in asphalt kettles were restricted in accordance with the limits imposed by the various air pollution control authorities. From the technical aspect, the question related much more to the effect on the asphalt properties on the roof, which effect was held to a minimum.

Beyond environmental protection and the energy crisis, the third and potentially largest external force that will affect the roofing industry during the next five years is occupational safety and health. Studies underway and planned are likely to produce dramatic changes in practices and techniques. The process of identification by industry of hazardous substances and the development of the means to deal effectively with them has been accelerated under the current Occupational Safety and Health Administration.

All employers in the industry, manufacturers and contractors alike, whose employees work with asphaltic and coal tar materials, which have been utilized in only slightly different forms for over one hundred and twenty-five years, will be affected by the outcome. It has been only the more obtrusive types of exposure to more widely recognized hazardous substances in other industries that have postponed the activity scheduled to be focused upon the roofing industry in the coming years.

In the final analysis, however, roofing practices in the USA are largely in the hands of about twenty thousand roofing contractors. Of those, ten percent, some two thousand contractors, do more than half of the total roofing volume. The top twenty-five percent, about five thousand contractors, perform more than seventy-five percent of the roofing work done in the USA. This would not be the case without mechanical equipment to apply extremely large areas of roofing efficiently and in record time. Roofing equipment and materials handling are subjects too broad to permit a fair presentation. In any event, owing to its proprietary nature, such a discussion would be inappropriate to these circumstances. The better opportunity to acquire knowledge of the tools and equipment available is to be had by visiting the exhibition hall during the next annual trade association convention. At such an occasion it will also be possible to verify that conventional built-up roofing systems have not been displaced from the largest share of the market for flat roofing. It will also be possible to verify that there are in fact a surprising number of flat roofing systems which are not conventional built-up bituminous systems.

It is obvious that such systems, to enjoy more widespread use, must provide economic advantages over the others. What is clear in the relationship between roofing practices in the USA and any new material or roofing system is simply that the more conservative the applicator becomes by reason of his experience, the longer he is likely to remain in business. The converse also seems to apply with equal force, besides the normal tendency to become more conservative the longer one's business has survived. There is ample evidence to suggest that most of

the roofing contractors intend to remain in business. Whether they realize it or not, they necessarily subscribe to and are subject to the performance concept. They realize that only those roofing practices and roofing systems will survive which tend to produce roofs which do not leak, roofs which will last for a long time, and roofs which will not blow away. Those who have survived in the business for very long seem to understand full well that roofs which are properly designed and properly constructed of time-proved materials, roofs which are not abused but properly maintained – these are the only roofing systems which will provide wholly desirable results.

In closing, you might appreciate the words of Benjamin Franklin: "In any permanent structure, the roof is only second in importance to a good foundation."