New Wind Design Guide and National Dynamic Wind Standard

What the Innovation is?

- Development of know-how design tools and test protocols are innovated based on 10 years of scientific research supported by industry input and field diagnostics.
- Wind is one of the essential considerations in roof design. Poor design or faulty construction, or the selection of non-compatible materials, can result in severe wind damage to the roof, the cost of which is often exceeded by losses associated with interior damage and interruption of occupancy.
- A new design technology from the National Research Council/Institute for Research in Construction provides engineers, architects and building officials with information on how to better design roofs to resist wind uplift. This publication, ***"A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs,"*** will help improve roof performance and reduce losses as a result of roof failure in high winds. I

Where and when it originated?

- In 1989, at the Oak Ridge National Laboratory (ORNL), to address the aftermath of hurricane
- Andrea and Hugo devastation on roofs, more than 150 members of the roofing community
- (Designers, Architects, Engineers, Consultant and Researchers) met and ranked, *~Development of*
- *Dynamic Testing Methodology"* as the industry number one priority.

Why it is Innovative?

- First time, an innovative procedure for testing roofs subjected to hurricane wind effects was developed in contrast to conventional wind tunnel testing and field roof assemblies were subjected to wind speeds more than 100mph.
- A simplified dynamic wind testing methodology to mimic the Mother Nature was developed for the use of North American roofing community in a laboratory environment.
- Based on the new test protocol, more than 300 roof mock-ups that are common in application were investigated and findings were documented such that the innovation has impact in the day-to-day construction design practice.

What is Changed or Replaced?

- A National consensus based standard (CSA A123.21) has been published, providing a standardized tool to evaluate hurricane wind effects on roofs.
- For roofing component manufactures, this innovation offered ways and means to identify the weakest link in the roofs and to develop innovative new products that can withstand recent climate changes.
- This know-how technology was transferred through face-to-face presentations across the country at 16 major Canadian cities and over 1100 participants have the option to use the new Guide.
- Major land lords across North America such as Public Works and Government Services, US Crop of Engineers are incorporating the new design tools and test methods in their specs.
- Guide has been used as an educational tool in community colleges to train architectural students and at the Roof Consultant Institute (RCI) and National Roofing Contractors Association (NRCA) and other educational programs.

Where it will be used in the Future?

- Insurance Industries: Wind is one of the major causes for insurance claims and roof failures under high winds contribute over 70%. Dynamic testing can become an insurance requirement.
- National and State/Provincial Code bodies will be adopting this new knowledge to regulate and improve construction design practice towards extending the service life of roofs.

International construction research agencies such as (Norwegian Building Research Institute and Division of Building Research — Japan) are embracing the Guide and process started to transfer the CSA dynamic standard in to an ISO standard such that a common platform can be established for the roofing community to compete at the Global market level.

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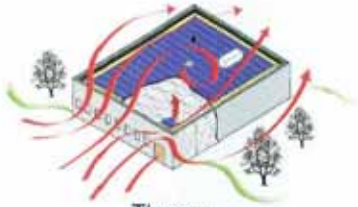
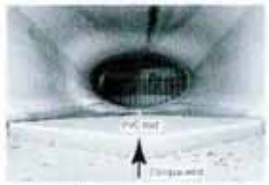
NEW WIND DESIGN GUIDE AND NATIONAL DYNAMIC WIND STANDARD

Development of Cutting - Edge Knowledge

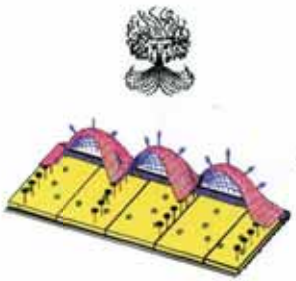
To reduce labor cost single-ply roofs were introduced into the North American roofing market as new generation roofs. Through scientific research, its dynamic response was identified compared to conventional built-up roofs. A diagnostic tool, " Which is the weakest link?" has been innovated



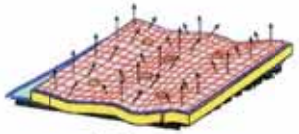
Theory



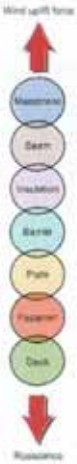
Experiment



Dynamic Response



Static Response

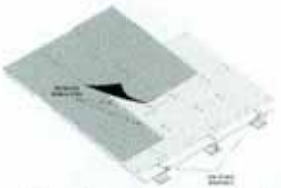


Which is the Weakest Link?

Enhancement of Construction Practice

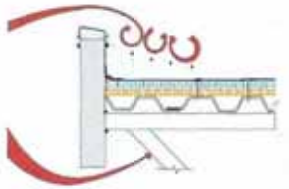
With inputs from roofing community, several good design practices were developed and implemented to improve the service life of roofs

***Poor Practice**: Membrane Fastener Rows Parallel to the Steel Deck Flanges*



***Good Practice**: Membrane Fastener Rows Perpendicular to the Steel Deck Flanges*

***Poor Practice**: Ineffective Air Barrier*



***Good Practice**: Effective Air Barrier*

Dynamic Test Mimics Hurricanes

Extensive dynamic investigations were completed and the innovation was benchmarked with Mother Nature through field roof failure investigations from recent hurricanes

Field Failures from Hurricanes Charley & Ivan

Membrane Roofs

Metal Roofs

Lab Failures from Dynamic Wind Uplift Testing

Innovative "Know-How" Design Tools to Roofing Community