WRONG

ROOFS

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A roof system that fails in performing is very expensive in global terms. Initially there is a wastage of time and resources allocated to drying out water leakage or condensation, often requiring the making good of decorative finishes

Over a longer period of time, the life span of these roofs is reduced so that materials need to be partially or totally replaced. An ineffective thermal insulation increases the energy demand of a building. For application companies the real cost of remedial works is very high, both in terms of management time and soured client relationship

The basic underlying causes of a roof defect has to be categorised into one of the following three items : **Design**, **Workmanship**, **Materials**. It is rare for a problem to stem from just one of these causes as it is nearly always a combination of the three in different proportions. When liability is at stake, it is the balance of these proportions that is of keen interest to the various actors

Reaching a justified and reasoned statement on what these proportions should be can become extremely complex and take months or years to resolve. Formally presenting the issues in court is a time consuming and costly business with the result that commercial settlements are usually agreed before reaching a full trial. As well as the contractual arguments, there are the technical ones which run in parallel. One of the greatest common weaknesses is the inadequacy of the roof design. In many cases it is possible to find that design tasks were simply not carried out

Explanations for this defect include a lack of adequate design time, a common misunderstanding of design priciples, inaccurate technical guides, manufacturer's ambiguous literature and, probably the most common of all, confusion and misunderstanding between the parties concerning who is actually responsable for the roof design

The importance of appropriate standards of workmanship can never be under estimated. The constant need to encourage tradesmen to work with care and diligence in using their gas torchs, often working in exposed places and in difficult weather conditions, is a constant challenge to the waterproofing industry

The competitive world of subcontractors provides a strong disincentive to invest in training and to take time to do the jobs properly. Thirdly we have to consider the material division, which again is strongly motivated by the need to be competitive in a crowled market. It is interesting to observe that generic types of roof assemblies tend to fail more often than others

The term "**robust technologies**" is often used to describe those buildings methods which have proved to be stable and reliable. They are well understood by designers and constructors alike and are detailed in text books and manufacturer's literature. They are relatively insensitive to errors of design, manufacture, assembly or use. The opposite term "**infirm technologies**" can be used to describe those building methods which are sensitive to errors of design, manufacture, assembly or use

The feedback from the market is that today many constructions which were once considered as robust are becoming infirm. Well estabilished methods of forming roofs have evolved and become infirm. New and innovative techniques which have not performed satisfatorily could equally be described as " infirm ". There is a need for those involved in the waterproofing industry to learn from recent experiences using an effective feedback system and to develop more robust technologies

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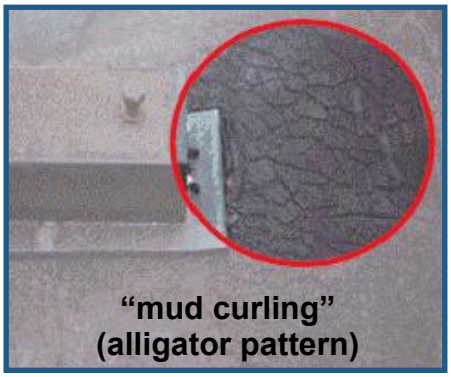
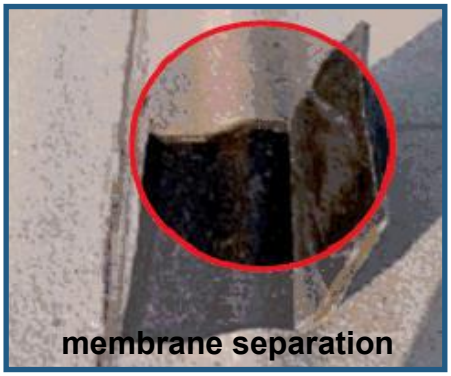
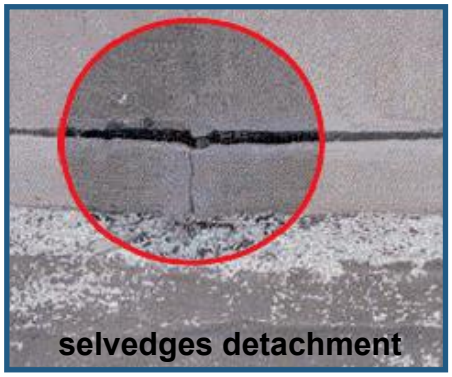
infirm technologies and solutions --- some non-exaustive examples


wind dislocations

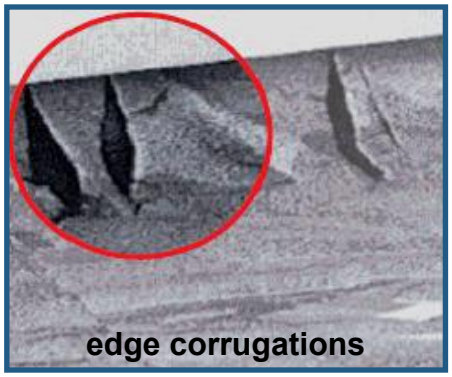

“mud curling”
(alligator pattern)

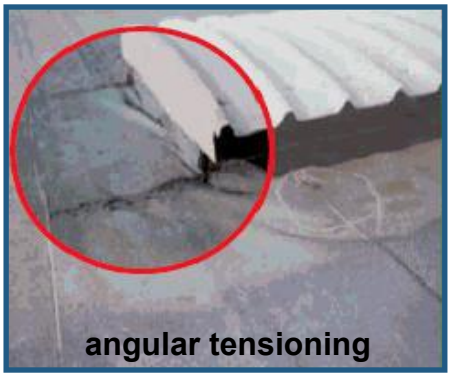

insulation detachment


membrane separation


selvedges detachment


linear crackings


edge corrugations


angular tensioning

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To understand how a roof is performing, one has to look at the whole system and consider how it behaves within its own local climate conditions. We have to consider what are the specific tasks involved in an "blameless" roof design and which profession is the best qualified to undertake them. A method to assist in understanding a problem is to develop a theoretical model. A standardized method recognises that the techniques and skills needed for the design of a roof are drawn from at least four different disciplines : **architecture** (roof construction, perimeter details, rainwater goods), **structural engineering** (adeguacy of support, wind loads and attachments, deflection calculation), **building service engineering** (thermal calculation, condensation risk analysis), **material science** (corrosion and ageing resistance, fire performance). Some would argue that fire engineering is a separate discipline on its own, while others may claim that a civil engineer is well qualified to cope with the majority of tasks. Very important is the recognition that designing a roof demands a **multi-disciplined approach** with a roof designer who needs a good working knowlwdge of all of four disciplines

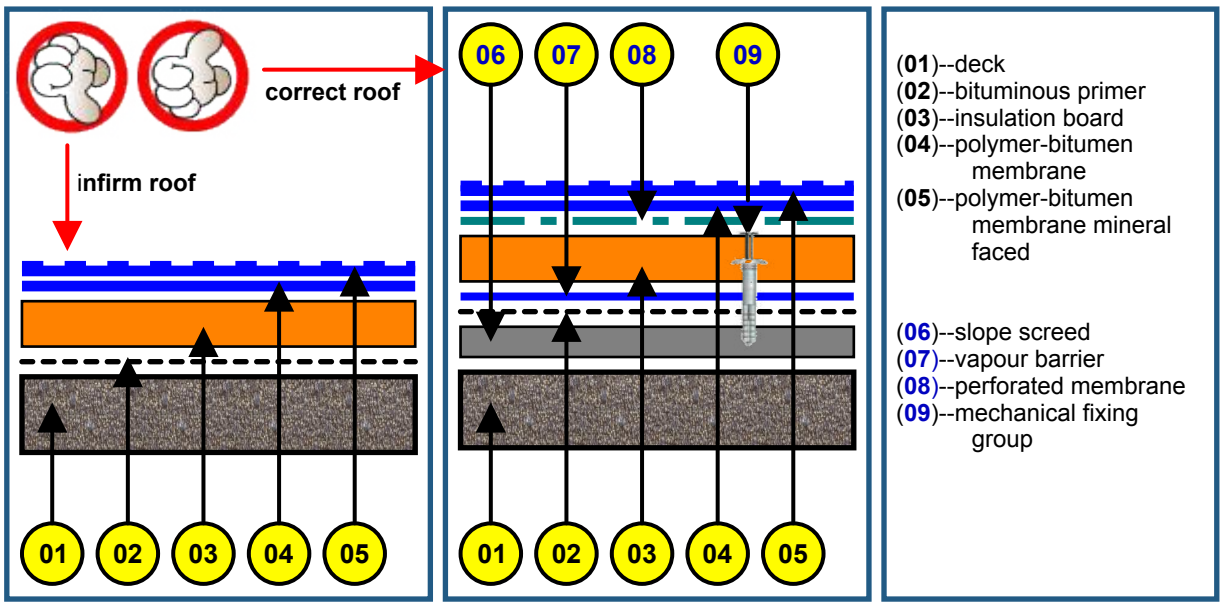
For many traditional roof constructions a rigorous design approach may not be appropriate. However, for special situations, the need for a multi-disciplined approach is essential. The model is also helpful for retrospective investigations of roof constructions which failed in performing. One other useful lesson we can draw from the model is that each of the four disciplines interrelate with one another

We can consider, for example, a flat roof above a textile factory. The roof slope is slow, requiring a membrane waterproofing. The internal air temperature and relative humidity are high, requiring thermal insulation and a vapour control layer. Around the perimeter of the roof the wind suction loading will be greater than the bond strenght of the weakest link, requiring mechanical fixings. The screws puncture the membrane which tears under cyclic wind actions, resulting in warm moist air meeting cold external surfaces and condensing. The water is trapped within the roof, resulting in the steel fasteneners rusting and ultimely breaking. Under stormy weather conditions there are high wind suction loads, resulting in the membrane becoming detached. The loose waterproofing layer tears at the roof edge, resulting in water ingress

We have to define **who actually designs the roof**. Textbooks and product literature simply refer to "the Roof Designer" as if there is an individual charged with this responsability. It is a little unusual that one person carries out the initial investigation and then designs the new roof constructions. The design of a single roof is usually sub-divided between a number of parties

An indequate design of the rainwater goods is a typical result of the fragmented nature of the industry where there is often poor coordination between. In such a case the manufacturers of the downpipes, outlets, internal gutters and roofing system couples with the inadequate overall design supervision

THE MAIN DIFFERENCES BETWEEN AN INFIRM ROOF SOLUTION AND A CORRECT ONE



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Over the past ten years we have seen the growth of the manufacturers organisations. This is a good example of where a single party can take control of the roof design and where their future success and growth is highly dependent upon getting the right roof every time. To achieve this the designers preparing the specifications need to be experienced and properly trained to follow the prescribed set of options and standard details in a considered quality procedure

When advising in liability one of the key issues becomes the published design guidance. The most important documents are the Mandatory Standards and National Regulations, with the expectation that those undertaking the elements of the design have a working knowledge of the relevant codes. With the release of a large number of detailed Standards, this is not to consider an easy task, as many practitioners find it difficult enough to pick up with them. Textbooks which give reliable guidance on roof design are few and far between

For the busy practitioner it is important that design manuals include relevant tables of current data which are readily accessible, since lengthy prose tends not to be read (may be **these pages** too). Certificates published by EOTA members are of assistance to the designer, in offering reassurance that at least some indipendent product testing has been undertaken. Manufacturer's literature, which is usually freely available and widely distributed, plays an important rule in educating designers

Thankfully most of the trade literature is based on well founded product development and testing, with some indication of appropriate applications and usual limitations. But other less responsable suppliers and manufacturers produce "look-alike" brochures which can be ambiguous, incomplete and simply misleading. Another good source of technical guidance is from specialist journals. In many cases these have highlighted and discussed "infirm" systems, giving positive feedback on ways of dealing with the issues. It is hoped that balanced articles will form part of a continuing professional development program

So **who takes the responsibility when a roof goes wrong ?**. The starting point is usually to examine the contract documents. It is disconcerning to finf that on several occasions the roofing contractor, with inadeguate design resources and of limited means, had earlier accepted an onerous design responsibility for the whole roof system, presumably at a time when he was keen to win the contract. His failure to understand his liabilities and to seek design guidance at an early stage is an important contributory factor to a great number of roof failure. One technique which could assist the roofing contractor and the design co-ordinator would be to adopt a design audit system

This could take the form of a schedule of design tasks and divided into the four disciplines to ensure that all of the tasks have been included. Greater respect should be given to the design of a roof, in particular the rainwater goods system, with appropriate resources allocated to the task. It should be recognised that some roof systems can be described as "infirm" and are sensitive to errors at all stages of the construction sequence. Feedback should be passed from the construction and maintenance teams, to designers and manufacturers to improve the real performance of roofs, encouraging manufacturers and promoters of infirm assemblies to develop more robust systems

There is the need to clarify and improve the understanding of design responsabilities, expecially on "design and build" contracts. It is sure that by allocating greater resources to the design of roof constructions, the number of roof systems that fail to perform will be reduced. Thus by "**getting the roof right first time**" there will be both financial and enviromental advantages to be gained by all

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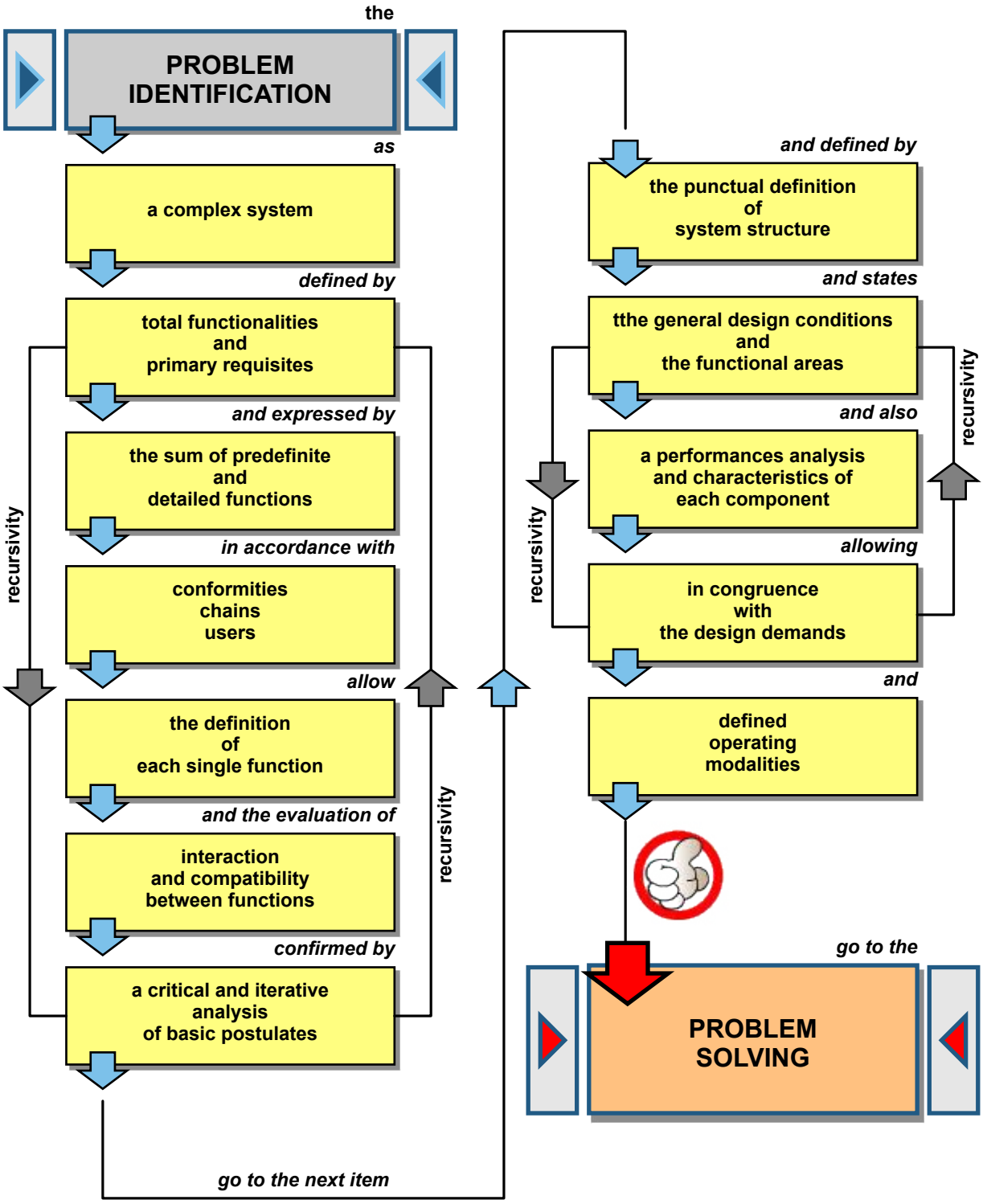
design path - a schematic analysis methodology



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periodic preventive maintenance

Ease of maintenance is one of the hallmarks of roofing systems. Recently published reference guides now make it even easier for a building owner to institute a semiannual maintenance program to maximize his roofing investment. A flexible membrane roof system is a broad category, comprising thermoset, thermoplastic and modified bitumen materials, typically pre-fabricated in a factory under strict quality controls

They are often covered by membrane warranties that actually call for periodic maintenance inspections and provisions. **In fact, warranties can be voided by the lack of regularly scheduled roof inspections and maintenance**. Periodic preventive maintenance can prevent small, easily handled problems from becoming disruptive, big-budget nightmares. Proper repairs to a roof system can prolong the roof's service life and enhance the value of the original investment made in it. Maintenance issues are attracting more attention these days from the roofing industry as a whole

A number of roofing contractors have set up roof maintenance and-or roof management programs to handle these concerns in an ongoing, professional way, freeing facility managers to concentrate on other areas. Regardless of who does it, regular inspections of the roof system should be made. Special inspections should also be made when extraordinary events occur, such as extreme storms or the installation of new rooftop equipment

The starting point of a roof inspection should actually be the interior of a building. The interior walls and ceilings should be examined for any signs of water staining which would indicate a problem above on the roof. **The roof itself should then be visually inspected. The following key areas should be checked in the order** :

---Cap Flashings
---Edge Metal
---Base Flashings
---Penetrations
---Field of the Roof
---Ballast
---Roof Adhesives and Surface Coatings, if present

Cap flashings are strips of sheet metal, often built into masonry and turned down over other flashing; used to prevent water from entering the joints and the exposed upturned edges of base flashing on a roof. Cap flashings should be inspected for :
--loose areas of attachment or loose or missing fasteners
--loose or displaced sections of metal
--deformed metal that could collect water and funnel it through an end joint
--corrosion
--missing or loose joint covers and sealants showing signs of cracking, weather and-or aging

Edge metal, installed at the edge of a roofing system to terminate the roof and provide waterproof flashing, should be checked for :
--loose areas of attachment or loose or missing fasteners
--loose or missing stripped-in flashing
--splits in the stripping at metal flashing joints
--corroded metal
--missing or displaced metal sections or joint covers
--open joints and sealants displaying signs of cracking or weathering or aging

Base flashings are flashing provided by upturned edges of a watertight membrane on a roof. Any metal or composition flashing at the joint between a roofing surface and a vertical surface, such as a wall or parapet. Base flashings be checked for :
--a secure and sealed top termination
--continuous adhesion of base flashing to substrate, with no loose membrane or extensive bridging
--a covered top seal of the membrane base flashing
--closed seams at the bottom of the base flashing at its attachment to the field membrane
--sealed seams at vertical laps

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--sealants in good condition, without signs of cracking, weathering or aging
--base flashing material without signs of deterioration or building movements

Penetrations are pipes, drains and other items that are inserted through the roof membrane. They must be flashed properly to assure a watertight roof. An inspection should examine the following :
--the drain clamping ring and drain strainer to ensure proper securement for a watertight seal at the membrane-to-drain interface
--thorough adhesion of sealant inside pitch pockets and membrane adhesion around the outside of pitch pockets
--pitch pockets containing adequate fill material to prevent water from collecting
--pipe boot flanges sealed tightly to the roof membrane
--a tight seal and termination around pipe(s) at the top of pipe boots

In the field of the roof, be sure that :
--no fasteners protrude against the membrane, causing a "tenting" effect; or that there are no visibly loose fastening points
--the membrane contains no worn spots, deteriorated areas, or holes in the membrane
--insulation panels are in their original positions - no buckling or warping
--there are no changes in insulation or substrate firmness when the roof is walked on
--adequate drainage is present
--around rooftop equipment, no areas have been degraded by equipment leaks or spills, or have been punctured by dropped tools or equipment parts from workers maintaining roofmounted equipment

In ballasted systems, it is important to note that :
--the removal of ballast or concrete pavers to inspect the membrane is not part of a routine inspection. Ballast, if present, should be continuously redistributed, although occasional small bare spots, approximately the size of a person's foot, are generally acceptable. Use a push broom as necessary to cover the membrane and prevent uneven loading

If the **roof membrane** has a **coating** on it, it should be examined. Coatings will generally require reapplication(s) during the life of the roof system; frequency depends on many factors, such as the local environment, ponding water, roof slope, and the type and quality of the original coating. Recoating work is typically the responsibility of the building owner and should be performed by a professional roofing contractor

The inspector should also pick up debris like paper, bottles, broken glass, tree limbs and vegetation and dispose of it properly. Likewise, he should also remove obstructions, such as leaves or dirt from roof drains and/or scuppers, ensuring that they flow freely. Clogged drains and/or scuppers can lead to excessive ponding on the roof, which frequently causes leaks or even roof collapse

However, caution should be exercised when **clearing debris** from drains because significant suction can be created by draining water; it can quickly suck tools into a drain. If **traffic patterns** are developing across the roof, the owner should consult the membrane manufacturer to determine how to best protect the roof membrane from traffic. A number of different walking pads or systems are available to address this issue

Roof inspection may uncover the need for repairs in a variety of categories, including spot patches, emergency repairs, general repairs and permanent repairs. If **membrane repairs** are needed, they should be performed by a professional roofing contractor specifically authorized by the membrane manufacturer. Not doing so could also void the warranty

In keeping with typical warranty requirements, the manufacturer of a warranted roof system should be notified promptly about the need for repair(s) and the procedures to be followed. Typically manufacture warranties require written notification to the warranty department within thirty (30) days of discovery of any leak

All procedures should be documented in order to create an informative history of a roof system's performance

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Right after a hail storm, the first thing that would come to your mind is to call a local roofing company to check if the disaster caused unwanted damage to your roofing system

If you are wondering how to find the right roofing company for your needs, the answer is simple. As much as possible, do not wait for a calamity to happen before you search for a company that you can trust

After a disastrous hailstorm, your mind and physical state is not in the mood for searching the best roofers in town. Prior to the unfortunate event, you must have already hired a roofing contractor who does the inspection of your roofs once a year

If the roofer has been working for you for several years already, there is a big chance that you can also entrust the job to that repair person. If roofer's performance has always been satisfactory, then that is a good sign that you don't need to look further for another people

►Vetroasfalto were established in 1939 when producing felt paper felts in Milan and can now be amongst the forerunners of high performance roofing membranes. In 1963 Prof. Giulio Natta, developed the isotactic polypropylene (IPP) from which is derived, as a natural by-product, the atactic polypropylene (APP). Vetroasfalto adopted this modifier in the production of high performance membranes with improved plasticity, temperature resistance, high mechanical qualities, stability and durability

►The new membranes were manufactured in Concorezzo, Milan, the first "polymer bitumen membrane being called "Viapol", whose name is still synonymous with bituminous waterproofing membrane throughout the world. The membranes were further developed to be reinforced with glass fabric or polyester and protected with mineral or film. In due course an alternative type of elastomeric polymers, styrene - butadiene - styrene (SBS), created a different range of products with specific features and functional implications

►During this time Vetroasfalto began manufacturing in Brazil under the Viapol brand and are now the largest membrane manufacturer in that part of South America.
In 1967 Vetroasfalto acquired the Sappi brand and provided professional contractors and merchants a range of membranes based on both APP and SBS polymer modified membranes throughout much of Europe

►Today both brands sit side by side in many countries and are recognised as quantity membranes capable of satisfying the requirements of modern construction methods and different climatic conditions. Both brands are manufactured under ISO and have CE certification. For in excess of 70 years Vetroasfalto has proved that its company philosophy is an unswerving commitment to meeting roofing professional's needs and their growing demand for quality with millions of square metres of membranes being installed worldwide

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