Site Inspection Report

<table>
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<th>Project Title: 1 Canada Square</th>
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<td>Location: 1 Canada Square, Canary Wharf, London</td>
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<td>Date of Inspection: 16/05/12</td>
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<td>System / Products: TBA (suggested flame free application)</td>
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<td>Attendees: G Herbert, Astin Burchell</td>
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On Wednesday 16th of May 2012 Moy materials visit the above site at the request of Mr Astin Burchell. The reason for this site visit was to survey all roof areas for defects, to estimate the remaining life of the existing waterproofing system and to carry out some exploratory works to ascertain the extent and location of the water ingress from the existing roof defects.

The roof survey was carried out by Mr Graeme Herbert in accordance with the institute of roofing guidelines.

The methods used for this survey were…

- Visual inspection of internal water damage
- Visual inspection of external roof details and flat areas
- Invasive inspection of the roof build-up
- Non-invasive moisture detection using specialist equipment.
Below is an overhead picture of the building. This shows the roof areas marked as they are mentioned in this report.


Roof Report, roof A:

Overview:-

Roof A is an inverted roof that runs around the lower level of the building and has an existing single layer bituminous system laid over a cementitious screed. The falls on the roof appear to be created using the screed and they work reasonably well.

There are a number of leaks apparent from inside of the building and in many areas on the roof area the protimeter was reading off the scale, proving that there was massive water ingress under the waterproofing system. The water ingress is largely concentrated around the roof details, upstands and perimeter details.

The current roofing membrane would of have had a life expectancy/guarantee at the most of 20 years and has been in situ for 22 years. The membrane is showing signs of cracking and drying, and has begun to deteriorate.

Build-up:-

Cementitious screed running from 15mm-45mm
Single layer bituminous waterproofing layer
50mm extruded polystyrene insulation
50mm pavers
Detailed report:

The outlet on the lower roof is leaking down the outside and is corroding.

The hand rail fixings running around the perimeter capping are sealed with mastic and the seals are perished. This is allowing water underneath the cappings which is inevitably getting underneath the roofing system.
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you have any questions regarding this report, please contact me on the details above.

Close up of the above photo.
There is a new brick column coming up through the lower roof which has been weathered with a temporary flashband material and is showing damp and water ingress.

Nearly all of the termination bars on the lower roof are too low and should be at least 150mm above the finished roof surface.

In many places the termination bars have been wrongly installed and have started to come away from the wall. These will need to be completely removed and new ones fitted.
Many of the cover pieces for the handrail detail are either missing or loose.

Again this will allow water ingress into the roofing system.

The fire retarding material used to protect the structural steels (circled in red) has become wet and is starting to come away from the steelwork.

Typical section of the bituminous membrane.
In this picture the bitumen membrane can be seen cracking at the detail. This is common for aged bitumen membranes.

At the of the upstand the felt can be seen splitting as it turns up the upstand.
Upper roof areas B+C:

Overview:-

The upper roof areas have an EPDM roofing system which is a 0.75mm rubber membrane. This membrane is more suited to a large detail free roof and is typically used for its speed of installation.

The problem with any single ply is that they do not lend themselves to inverted roofing situations because although they appear to be protected by pavers and insulation, over time the ballast breaks up and shards of stone and debris work their way into the roofing system which inevitably damaged the roofing membrane.

Another problem with this type of membrane is that it is notoriously difficult to work around details. EPDM is not heat welded like traditional membranes. Instead it requires careful planned cutting and is then fixed in place using a contact adhesive. These details are normally the first area to fail as the glue starts to delaminate from the membrane.

Again in many areas of this roof the moisture meter was reading off the scale, showing numerous points of water ingress and damp. The membrane in some areas has begun to degrade but the main sources of water ingress are again the details, upstands and handrail junctions.

Build-up:-

Cementitous screed 15-45mm

Isolation layer

Single layer EPDM waterproofing membrane

50mm extruded polystyrene insulation board

50mm pavers
Detailed report:

This picture shows the wall of the staircase leading up to the upper roof. A damp section can be seen from the centre of the photo spreading across to the right or internal part of the staircase.

This is the same picture as above but with the damp section marked on the photo. This damp is coming from the roof down and not the ground up.
This photo shows the staircase again but this section is covered by the rubber membrane. The moisture meter below shows that the system has failed and has allowed water underneath.

To ensure this staircase does not get water damaged it should be fully waterproofed with a trafficable waterproofing system.
Internal damage caused underneath access staircase. Water damage is very close to electrical and fire detection cables.

This photo shows where the glue adhering the rubber to the concrete plinth has delaminated and it has allowed water into the system.

Typical concrete plinth detail similar to above.
Again there are very low and failing upstand details.

We exposed a section of roof near one of the failed details and the moisture reading can be seen below.

This reading shows to be in the red. This means that there is water under the roofing system.
The water ingress on the upper roof areas is causing corrosion of the supporting steelwork.
Conclusion

All three roof areas have reached the end of their useful life and are showing signs of water ingress. In some areas the water ingress is becoming critical to the future use and safety of the building.

If these problems are not dealt with immediate effect then further damage will occur which could lead to very expensive and disruptive repairs to the building.

The membranes on the main flat areas may continue on for some time if minor repairs are carried out to these areas.

The details on the roof are all beginning to fail and so will require immediate attention.

I would suggest that any repairs should be carried out using a good quality liquid roofing system. Although repair liquids are available, they are not supposed to be used as a long term solution and will often not be compatible with materials that are used when the roof is fully refurbished.

By using a liquid roofing SYSTEM instead of a repair liquid, the roofing work can be carried out in planned stages over any period from 6 months to 3 years and once all of the work is complete the roof could be guaranteed as a whole for up to 25 years.

A repair liquid will cost a similar price but will offer no waterproofing guarantee.

I would suggest that due to the location and also the prestige of the building that no hot or flame applied system be used on this project.
Proposed scope of works:-

Option 1 (essential work)

- Expose and clean all upstands and details to all roof areas
- Fully encapsulate all details, plinths and penetrations, extending liquid system at least 400mm onto the main area.
- Extend all upstands and terminate by riveting a termination bar to the metal cladding. This should also be extended 400mm onto the main area,
- Replace missing and re-fix existing cover pieces to hand rail junctions.
- Expose and waterproof all outlets and install the correct grates and terminations
- Waterproof staircase area.

This approach will mean that the roofing work could be continued at any time.

Option 2

- Option 2 would be a number of smaller contracts to waterproof the whole roof. This could be done over a period of up to 3 years.

Option 3

- This would be a full roof recovering in one contract. This would not require the existing membrane to be removed and would completely refurbish the roof in one contract.

If you require any further information regarding this survey or if you require specification for the proposed works, please contact Graeme Herbert on 07795 310794.

I urge you to deal with the critical items in this report as soon as possible to avoid further damage.