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Lauderdale House, Highgate, London Cupola Report
Site Survey & Scheme of Works Conducted on Tuesday 6th June 2017

Lauderdale House was originally built in 1582. We understand the cupola situated above the upper Gallery is Georgian. It would of been installed between 1714 and 1830 either to an original part of the building or as part of a new extension at that time. The top section steel frame of the cupola may not be the original and could have been replaced, due to corrosion, with new additions added such as the laminated safety glass. It's probable that the outside was also decorated similar to the inside of the vertical side sections but lead roofing now covers this area, again a modern addition for water ingress protection.

Preliminaries

Before works start on the Cupola we recommend repositioning the newly installed fire alarm sensor which has been placed at the very top point on the inside of the cupola. And for all truncking and cables to the fire alarm sensor should be removed, repositioned and made electrically safe by a qualified person.

The Existing Cupola

Steel Frame – This is made up of steel "**+**" and "**T**" profile steel sections which are in poor condition with heavy corrosion and pitting in areas due to many years of weathering. With it being a ferrous metal, any attempt to

restore this will again in future cause problems with corrosion, leaking and continued maintenance. On measuring sections of the steel openings, it was also clear that it's not symmetrical and all glazed sections are different sizes, which is also noticeable to the eye looking from below.

Glazing – The top sections of glass are laminated with a very poor rough edged finish. These do not overhang enough due to the sloping steel sections being too short that hold the glass in place, causing any water run off to not clear properly. See Fig1
The glass to the side sections are likely to be standard annealed glass as they don't appear to be very thick. This could potentially be a hazard if broken as these can break into large sections. The other give away is that the whole cupola has been painted in a clear plastic paint know as a shatterproof paint. We believe this was also put on in an attempt to seal up any leaks as it's been applied over the above laminated glass where it's not necessary. This paint also causes a lose of clarity to the glass.

Glass Fixing – The glazing would have been fitted with a traditional linseed oil putty. The bottom glazing is putted with many layers of paint applied on top but the above glazing has been bedded in with a clear silicone which is very unsightly and incorrect. Also, the steel section that holds the top glazing in place is of an insufficient sized profile to take the thick laminated glass as there is limited room to apply a good sized bead of putty. See Fig2
The top glazed sections are also held back by safety clips incase the putty fails which prevents the glass slipping away. These are made of lead and are very weak and insufficient. See Fig3

Ventilation – There is a slight gap between the top of the bottom glazing frame and the underside of the top glazing all the way around, but this has been sealed up with silicone all the way around probably in an attempt to stop any leaks. This should act like a trickle vent that you get in modern day windows. A Trickle Vent does exactly that and allows air to trickle into an area at a reasonable rate so that you will not feel a cold draught, keeping condensation at bay and giving you a balanced environment all year round. The gap also provides an escape route outside for any moisture that could potentially built up on the underside of the top glazing. See Fig4
There is a leaded cap on the very top point of the cupola which is for weather proofing and also ventilation. The removal and further inspection of this when work starts will provide evidence to see if it is sufficient enough for ventilation. See Fig5

Base – The steel cupola frame appears to be screwed down on to its base. These are most likely to corroded if ferrous steel screws have been used. The

weatherproofing and sealing around the outside seems to be inadequate as the lead sheeting appears to just butt up to the steel frame. This was difficult to see due to paint treatments to the lead and steel. See Fig6

Recommended Improvements

Cupola

A) **Frame –** Remake the frame copying the design of the existing but if possible making it symmetrical if the footprint of the base it fits on to allows. Extend the sloping steel profiles in which the top glazing sits into allowing the water run off to completely clear the cupola below. Use a larger steel profile on the sloping glazing and side glazing to allow a correct sized bead of fixing sealant to the glass and steel on the outside. We also recommend fitting a fully welded cill or skirt all the way around the bottom of the frame to clear the lead cill it now sits on. This will eliminate sealing problems and all water run off would go straight to the roof floor.

B) **Material –** The frame should be re manufactured in stainless steel using just a "**T**" profile section and not the existing "**+**" used around the glazing. This would of been used for strength purposes and as we suggest using stainless steel which stronger than mild steel there would be no need. This will simplify the structure and be more pleasing to the eye from the inside. The cost will be greater using stainless steel to a mild steel but the frame is not of a considerable size in all so it would be more cost affective. Using stainless steel means it will be maintenance free and corrosion free thus keeping future maintenance costs down. There are two commonly used grades of stainless steel, 304 and 316. 304 grade is stronger than the 316 grade due to its higher carbon content. The 316 grade is mainly used in the marina industry or for applications used close to the coast. We suggest the 304 grade to be sufficient and is also a cheaper option to the other.

C) **Finish –** We recommend a powder coating finish once the frame has been manufactured. This process is environmentally friendly and cost effective. It applies thicker than a standard paint with a high quality finish and it's also very tough and resistant to impact, chemicals, UV light, moisture and extreme weather conditions. It will last a very very long time along with stainless steel and will reduce the maintenance

costs dramatically. This can be applied in almost any colour but as the existing frame is white and the internal decoration is white we would suggest keeping it white for visual purposes.

D) **Glazing –** We recommend fully glazing the cupola in a laminated safety glass. This glass consists of two pieces of glass laminated together with a very tough and durable plastic.
When broken it will still remain integral due to the plastic between the glass, remaining safe even when broken. Although it will break or crack easier than toughened glass, it has a better security aspect as a much greater force is needed to break the plastic.
The other option would be toughened glass, the is around 8 times stronger than your standard glass but it will still shatter and fall if hit hard enough by an object or a person. Furthermore, each piece has to be made to order in a mold as it cannot be cut by hand. Laminated safety glass can be cut by hand to order and the edges can be polished smooth.
There are three types of laminated safety glass, the first being the standard clear. The next is an acoustic type which will considerably reduce noise from the outside and the latter is a toughened type. With the Toughening process and the Laminating process together this will provide a barrier which is very hard to penetrate. If one of the toughened glass panes does happen to break not only will there be no falling glass particles but the additional toughened glass pane and the interlayer will provide an extra barrier to prevent injury. This is a huge advantage when glass is being used for balustrades, flooring, canopies etc. where safety is paramount. The interlayer used when laminating the glass gives an extremely high transparency, durability and long-term reliability. It can be used indoors or outdoors as it is fully water proof therefore making it the perfect product for canopies and balcony balustrades that are exposed to the weather.

E) **Glass fixing –** We recommend using a new type of sealant called “Dry Seal.” This is ideal as a permanently elastic and paintable alternative to linseed oil putty and is for new glazing applications, renovation and restoration. It’s a permanent replacement for putty in steel frames and it’s made for external and internal applications. Fully cured after 2 hours and compatible with double-glazed sealed units, laminated & acoustic glass. It is moisture and UV-resistant with excellent adhesion to glass and steel. It is also available in white so no painting would be required if the frame was to be finished in white.
We recommend the top glazing hold back clips to be made out of stainless steel also by who ever manufactures the frame and also powered coated white. Otherwise, these could be made from copper or

brass but they will dis-colour over time and can cause staining on anything below.

F) **Ventilation –** The frame should be manufactured in the same way as the existing leaving a small gap, a so called trickle vent as written above in the existing ventilation section. This should not be sealed up. This gap also provides access to the anchor point for the hold back clips to the glazing above. With regards to the cupola weather cap and further inspection, it maybe possible to either use the existing cap or remake another out of lead as the existing does not look very well made. There is also the possibility of having something completely bespoke manufactured in a different material, but still making sure weatherproofing and ventilation is key.

G) **Base –** Assuming the base in which the frame sits on is to be renewed, we would just recommend again screwing it down but using substantial stainless steel screws at more points, maybe three to four fixings on each side. The frame can also be bedded down onto a bead of the "Dry Seal" as written above, which has great permanent water proofing and fixing properties to timber as its also made for wooden window frames.

Any roofing materials used can now be finished underneath the stainless steel cill or skirt all around the bottom of the cupola frame, eliminating any worrying joints and making it completely watertight.

Schedule of Works for the Removal of the Existing Cupola Frame

- Visit site and make safe below the cupola for any possible falling objects.
- Ensure all works have been carried out for the removal of the fire alarm sensor.
- Remove the weather cap and all glazing from the steel cupola.
- Remove all fixings to the cupola frame.
- Remove from its position and safely move and lower to ground level outside to the agreed route and means by the site manager.
- Measure and template the base (for possible symmetrical frame remake)
- Clean and clear the work area.
- Inform the site manager of works progress so they are able to make the opening weather tight and safe.
- Clear all scrap glass and waste material from site along with the cupola frame for a template and guide.

Schedule of Works for the New Cupola Frame & Glazing

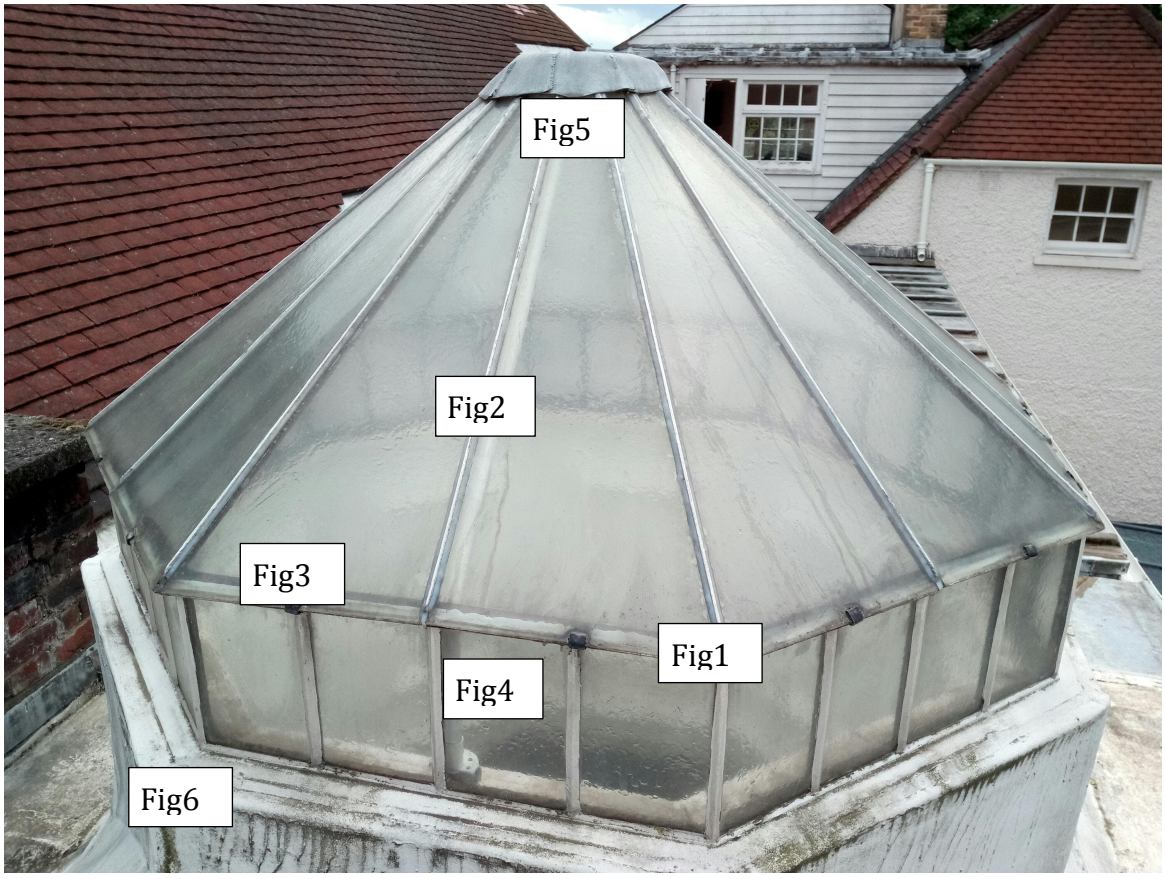
- The contractor either fabricates the frame them selves if they have the facilities or subcontracts the frame out to be manufactured to the above specification if agreed.

- Once the cupola frame and clips are complete they will need to be powder coated to the agreed colour.
- Protect from damage for transportation once coating is complete.
- Template all glazing openings for glass supplies to cut and finish to the agreed type of glazing to be used ensuring each opening is numbered to match the correct piece of glazing.
- Check all glazing fits into its correct opening.
- If required, manufacture or sub contact a new weather cap to agreed specification.
- We would not recommend glazing any of the cupola until it is in it's final fixed position. Even glazing the lower smaller sections first could make the fixing down of the cupola awkward. Also the weight will increase and make moving it around site more difficult.
- Protect the cupola and glazing from damage for transportation to site and the moving into position.

Schedule of Works for the Fitting & Glazing to the New Cupola Frame

- Make the site manager aware of your return so they can prepare for the removal of the weather protection to the cupola position and that all works have been completed and prepared for the fitting of the cupola.
- Visit site and make safe below the cupola for any possible falling objects.
- Inspect the base to ensure it is satisfactory and all parties are happy.
- Move the cupola frame and glazing safely to the roof to the agreed route and means by the site manager.
- Carefully remove the protective packaging.
- Lift the cupola onto its base to ensure its correct position. Once achieved mark a line all around the inside of the cupola base and pilot drill all fixing holes.
- Lift off the cupola maintaining the correct orientation.
- Put down a heavy bead of the "Dry Seal" following the drawn line.
- Lift into position again ensuring the same orientation and screw down with the agreed stainless steel fixings with an impact screw driver.
- Clean off any dry seal excess to the inside of the frame base.
- Start glazing from the top first bedding in the glass with the dry seal and cleaning off any excess to the inside of the glazing. Fit the hold back clips and then completing each section with a good bead of dry seal traditionally angled against the steel frame and glass. Clean off any excess, finger marks and smears as the sealant will cure in approximately two hours and could make any excess removal difficult after that time.
- Fit and secure the agreed weather and ventilation cap.
- Fit the lower glazing sections following the same steps as above.
- If the cupola frame is not to be finished in a white coating the dry seal will need to painted to match the cupola frame colour. This can easily achieved roughly two hours after application of the dry seal.
- Clean the cupola frame and glazing inside and out.
- Clean and clear site of all waste materials.

Recent photo of Cupola during visit. See for Figure codes.



Please see pictures below for interest: