Action plan for critical areas 1-23 2023-12-20

1) N1 critical area, north arm

Condition summary: Widespread salts efflorescences and crusts, some sitting on the paint surface with no or minimal apparent disturbance of the paint layer, but in some areas causing exfoliation and loss of the paint layer. There is an area of detachment which is distorted, and with peripheral cracking. There is a previous fill here which is failing.

Suggested approach:

- Nothing can be done to mitigate the problems of paint layer exfoliation at this stage (any intervention at this stage would be likely to cause more harm). However this could be an area for salt sampling from both the crusts and the whiskery efflorescences. In the areas where the paint layer is stable this could also offer a useful monitoring location following gentle brushing away/collection of salts.
- The fill is dense and heavy-looking and is likely to be putting stress on the surrounding weakened plaster. Suggest the application of cyclododecane along the peripheral cracks to provide temporary support during fill removal. Next, careful separation of the fill from the original plaster edges and removal to relieve stress. After this, a longer-lasting temporary support to the edges and along the peripheral cracks. This could be either paraloid (make an initial stock solution for facings of 20% but this particular area may be ok with a dilution down to 10% - we can discuss) and lens tissue or keeping the cyclododecane support in place then applying paraloid on top to slow sublimation process.
- Salts may be removed more generally where this will not endanger the paint layer or plaster, to reduce the quantities of the salts in the system and to minimise the effects of salts cycling.

N1 Critical Area North Arm

2) N2 critical area, north arm

Condition summary: lifting, powdering and loss of paint layer which appears to be the result of salts activity although surface manifestation is not so much in evidence as in area N1. The plaster is in places delaminating and distorted, and at least in places appears to lack cohesion, especially the area on the extreme right of the last image. In its weakened condition, this area could suffer further loss if it was physically impacted, or if its cohesion continues to be undermined by further salts crystallisation.

Suggested approach:

- The paint layer on the surface of the most vulnerable area is lifting and the exposed plaster is too weak to allow safe or effective temporary facing. The area of concern is fairly small and self-contained and has no peripheral cracks, which makes large-scale loss unlikely. In the longer term, and when we have more information, this area can be treated (fixing, consolidation, grouting etc.) as appropriate, but only following proper evaluation and the selection of methods and materials based on rigorous testing and evaluation.
- As elsewhere, salts can be removed where it is safe to do so.

N2 Critical Area_North Arm

3) N3 critical area, north arm

Condition summary: the number of small repairs from different periods which already exist in this location testify to chronic problems of localised plaster delamination, decohesion and loss. Although salts are not much in evidence here the condition of the plaster may point to earlier (and possibly ongoing) salts and moisture problems. The original, weakened plaster has receded around the perimeter of several dense white toned repairs testifying to their unsuitability, and to serious plaster decohesion problems in this area. One area of plaster loss within this zone appears to be recent and has rather fragile edges. It is possible that the loss occurred during erection of the scaffold.

Suggested approach:

- in theory the loss with the fragile edges could be repaired using a lime-based repair of appropriate strength and openness of structure. However as most of this area of delamination has already been lost it should not be regarded as a top priority for emergency intervention.
- Loose salts may be removed, as elsewhere, if it is safe to do so.

In due course the condition of this whole zone will need to be re-evaluated. Treatment options in the longer term would be plaster consolidation, minimal grouting and the removal and replacement of hard, dense fills that endanger the weaker original plaster, using carefully considered methods and materials, and based on appropriate testing and evaluation.

N3 Critical Area_North Arm

4) N4 critical area, east arm

Condition summary: This area has been heavily restored. The (gypsum-based?) restoration repairs are 'blowing' and the restoration paint layer is flaking, both presumably in response to salts and moisture. The destabilisation of the restoration interventions does not seem to be adversely affecting the original paint layer and plaster in any significant way.

Suggested approach:

- Emergency measures are not needed here, and as this area is also in an active salts zone and intervention could cause more problems. There are no appropriate temporary measures for the situation here. Fixing or consolidation interventions cannot be undertaken until appropriate methods and materials have been sourced and tested.
- Salts efflorescences can be removed where it is safe to do so.

N4 Critical Area_East Arm

5) N5 critical area, south arm

Condition summary: not very clear from the images what the particular concern is here. There are previous fills, some losses with edge repairs (as far as I can see) and an area which has a temporary facing on it on the extreme right of the first image. There's clearly been a lot of damage and paint loss as well as plaster loss in this area but I can't see if there is ongoing salts damage and I can't see if any of the losses have unsupported edges. Could you please send an image/images/description of the area/s of concern?

Suggested approach:
Awaiting further information
Will be updated in February 2023

N5 Critical Area_Southwest_Pendentives

6) N6 critical area, west arm

Condition summary: copious salts efflorescences associated with plaster decohesion, paint pustules, flaking, powdering and loss. The area is in general in poor condition but it is not possible to discern any areas where plaster is in imminent danger of loss.

Suggested approach:

- This is an area where there are copious salts on top of and within the upper stratigraphies so treatment at this stage could cause more problems, and in any case there are no appropriate temporary measures. Fixing or consolidation interventions cannot be undertaken until appropriate methods and materials have been sourced and tested.
- This area may be a good one for salts sampling (in areas where this will not endanger the paint layer), and the selection of a location for clearance of efflorescences/salts monitoring.
- More generally, removal of efflorescences can be undertaken where it is safe to do so.

N6 Critical areas_West Arm

7) N7 critical area, north arm

Condition summary: widespread paint flaking, powdering and loss with fewer areas of efflorescences and no evidence for imminent plaster failure.

Suggested approach:

- As this is an area where there is likely to be ongoing salts activity fixing any intervention could be actively harmful. There are no appropriate temporary measures. Fixing or consolidation interventions cannot be undertaken until appropriate methods and materials have been sourced and tested.
- Removal of efflorescences can be undertaken where it is safe to do so.

N7 Critical Area_North arm

8) N8 critical area, west arm

Condition summary: serious paint flaking particularly affecting the more complex stratigraphies of the flesh painting. It is not clear from the images that the problem is associated with salts activity. There is no evidence for imminent plaster failure.

Suggested approach:

- It is difficult to discern whether or not this an area of ongoing salts activity. Flaking is serious but it is necessary to understand the mechanisms of deterioration or the rate of loss before intervening. There are no appropriate emergency interventions. Fixing or consolidation interventions cannot be undertaken until appropriate methods and materials have been sourced and tested. fixing or consolidation interventions cannot be recommended at this stage.

N8 Critical Area_West Arm

9) N9 critical area, south arm

Condition summary: Extremely poor condition, with infiltration runs down the paint surface the surface associated with powdery salts (?) and crazing associated with powdery salts (?). Extensive areas of paint flaking, powdering and loss together with pockets of plaster deterioration. There is a fairly substantial area of detachment and loss which has been supported by a previous edge repair which is now failing and is associated with peripheral cracking.

Suggested approach:

- Nothing can be done to mitigate the problems of paint loss and pockets of plaster decohesion at this stage (any intervention at this stage would be likely to cause more harm).
- The failing edge repair is likely to be putting stress on the delaminating plaster it is supposed to be supporting. Even though this is an area where there is a lot of salts contamination the plaster in this area seems to be in fairly good condition and could benefit from temporary support. Suggest the application of cyclododecane along the peripheral cracks to provide temporary support during fill removal. Next, careful separation of the edge repair and removal to relieve stress. After this, a longer-lasting temporary support to the edges and along the peripheral cracks. A stronger support than N1 is probably required, and suggest paraloid (prob 20%) and lens tissue strapping.
- Salts may be removed more generally where this will not endanger the paint layer or plaster, to reduce the quantities of the salts in the system and to minimise the effects of salts cycling.

N9 Critical area_South Arm

10) N11 critical area, west arm

Condition summary: Extremely poor condition, with buckling and distorted delamination of plaster at the top of the wall. Here the plaster appears to be extremely weak, fragile, and lacking in cohesion. Salts are likely to be present throughout the stratigraphy at the top of the wall, and to be concentrated more on the surface in the area below, where the plaster appears to be attached and in a less weakened state. The most vulnerable areas have been faced with tissue and an adhesive, while along the top, in the area of most severe delamination the tissue appears to have been strapped across the top in an attempt to hold it in place. It is difficult to determine from the images whether the strappings and facings remain fully functional.

Suggested approach:

- Because of the extremely weakened condition of the plaster and the copious salts present, treatment cannot be recommended at this stage (would be likely to cause more harm). Given the weakened condition of this area the facings and straps should remain in place, as removal could result in further weakening and loss.
- If any of the facings/straps are failing or insufficiently secured it is recommended that adhesion is spot reinforced using paraloid (10 - 20%) only where necessary, not overall as this might impede safe removal of the facings afterwards.
- Salts may be removed more generally where this will not endanger the paint layer or plaster, to reduce the quantities of the salts in the system and to minimise the effects of salts cycling. This might also be a good area of salts sampling for analysis.

N11 Critical Area_West Arm

11) N12 critical area, west arm arch

Condition summary: Extremely poor condition characterised by salts efflorescences, extensive loss of paint layer, plaster decohesion and loss. There is buckling and distorted delamination of plaster at the top of the arch. The most vulnerable areas have been faced with tissue and reinforced with an application of gauze. It is difficult to determine from the images whether the strappings and facings remain fully functional, but there may have been further loss in this area following their application as the lower edges of the faced areas look sharp and raw. It is also likely that distortion, cracking, delamination and plaster weakening continued after the facing, creating new areas of vulnerability in peripheral areas.

Suggested approach:

- Because of the extremely weakened condition of the plaster and the copious salts present, treatment cannot be recommended at this stage (would be likely to cause more harm). Given the weakened condition of this area the facings and straps should remain in place, as removal could result in further weakening and loss.
- If any of the facings/straps are failing or insufficiently secured it is recommended that adhesion is spot reinforced using paraloid (10 - 20%) only where necessary, not overall as this might impede safe removal of the facings afterwards.
- The area of weakened and distorted painted plaster at the edge of a recent loss (several images of this area) can be carefully faced with tissue and secured with a strap to the exposed support. There are a couple of small vulnerable areas visible in images 7 and 8. The first is directly beneath the lower faced area, and the other is directly beneath on the inner arch, in an area of fresh distortion and cracking. These can be supported in the same way.
- Salts may be removed more generally where this will not endanger the paint layer or plaster, to reduce the quantities of the salts in the system and to minimise the effects of salts cycling.

N12 Critical areas West Arm Arch

12) N13 critical area, north arm

Condition summary: Extremely fragile area characterised by salts efflorescences, extensive loss of paint layer, plaster decohesion and loss. Most of the paint layer and the upper surface of the plaster in this area are in an advanced stage of powdering. High levels of salts are likely to be present throughout the stratigraphy.

Suggested approach:

- Salts deterioration is at such an advanced state here that temporary measures cannot be implemented and future treatment is unlikely to be effective. Further powdering and loss is probably unavoidable.
- In the most badly affected area salts contamination is so thorough that efflorescences cannot be effectively reduced. In the less badly affected peripheral areas some surface salts reduction may be possible.

N13 Critical Area_North arm

13) N14 critical area, northwest pendentive

Condition summary: area of salts-related plaster decohesion, deformation and detachment, accompanied by extensive loss of paint layer. The most deformed areas of plaster are blistering and crumbling and there is a high risk of further loss. Most of the paint layer and the upper surface of the plaster in this area are in an advanced stage of powdering. High levels of salts are likely to be present throughout the stratigraphy.

Suggested approach:

- Temporary measures would be likely to cause more harm. Further loss of paint and plaster may occur but this is not inevitable, and the area is more likely to be salvageable if nothing is done at present.
- In the most badly affected area salts contamination is so thorough that efflorescences cannot be effectively reduced. In the less badly affected peripheral areas some surface salts reduction may be possible.

N14 Critical Area_Northwest_Pendentives

14) N15 critical area, north arm

Condition summary: salts affected area characterised by paint flaking, blistering, powdering and loss. Plaster distortion and decohesion is less in evidence. Flesh painting, especially faces, are among the most severely affected areas, probably owing to the multi-layered nature of these paint passages. Thick and complex layer structures encourage salts sub/inter/intralamellar fluorescence. In some places only underdrawing remains.

Suggested approach:

- However regrettable loss of these particularly important paint passages are, paint layer treatment at this stage is likely to be more harmful than helpful and should not be attempted.
- In the less badly affected peripheral areas some surface salts reduction may be possible.

N15 Critical Areas_North arm

15) N16 critical area, northeast pendentive

Condition summary: area of salts activity characterised by superficial efflorescence and veiling associated with large-scale paint powdering, flaking and loss. In some places plaster loss has occurred through the same mechanisms. There are also localised areas of plaster deformation, detachment, decohesion with a small amount of loss in the worst-affected areas.

Suggested approach:

- Regrettable as such extensive loss important areas of paint is, the area is so fragile and so badly affected by salts that temporary measures would be likely to cause more harm. Further loss of paint and plaster may occur but this is not inevitable, and the area is more likely to be salvageable if nothing is done at present.
- In the most badly affected area salts contamination is so thorough that efflorescences cannot be effectively reduced. In the less badly affected peripheral areas some surface salts reduction may be possible.

N16 Critical Area_Northeast_Pendentives_Arch

16) N17 critical area, east arm

Condition summary: flaking, powdering and loss of the paint layer in areas belonging to the extensive restoration which has been done here. There is some plaster blowing, apparently restricted to restoration repairs, but it is also possible that some deterioration may be linked to salts migration from the restoration repairs into the original. It is unclear from the image how much or how little of the original paint layer remained prior to the restoration, or how much was concealed by overpainting, however in many places paint loss is almost total.

Suggested approach:

- Most damage is restricted to the paint layer, while the plaster looks to be in relatively good condition. No effective temporary measures can be recommended to contain the paint deterioration, and would be likely to do more harm than good.
- In the less badly affected areas some surface salts reduction may be possible.

N17 Critical Area_East Arm_Noth Wall

17) N18 critical area, west arm

Condition summary: two separate areas are imaged here: the first shows patchy salts-related paint flaking and loss within an area where the plaster is sound and the paint layer is otherwise in good condition. The second appears to be an island of surviving plaster in an area of extensive plaster loss. The paint layer here is affected by relatively low levels of salts disruption and veiling where there is also some paint powdering and loss

Suggested approach:

- In the first area, no temporary measures can be recommended to secure the paint layer and it is not necessarily the case that further loss is inevitable.
- In the second area, although the painted plaster appears to be an island of survival in a zone of plaster loss it seems to remain in a planar state and fairly well adhered to the substrate so temporary stabilisation measures do not seem necessary. No temporary means of mitigating salts effects on the condition of the paint layer can be recommended.

N18 Critical Area _ West Arm

18) N19 critical area, northeast chapel

Condition summary: the images show areas of loss in dado-level plaster. Although this zone may be to some extent affected by ground water and low-level salts activity, it retains its paint layer and the plaster appears to be in otherwise sound. The physical location of this area renders it vulnerable to impact damage, and this is the likely cause of the losses. The larger loss may have been recently extended as some of the edges are sharp and white. These losses remain vulnerable to further damage and further loss.

Suggested approach:

- The losses may be repaired but, since plaster characterisation has not yet been done and tests have not been carried out to identify suitable plaster mixes, repairs in these areas should probably be regarded as temporary. They should be weaker and less dense than the original plaster to minimise stress, and so that they may easily be excavated at a later stage. The temporary plaster should be lime-based, and we suggest using well-graded sharp sand in a ratio of around 1:4. Alternatively the damaged areas of plaster could be cordoned off to prevent further impact damage until properly researched and tested repairs can be done.

  N19 Critial Area_Northeast Chapel

19) N20 critical area, northwest chapel

Condition summary: the images show areas of loss in dado-level plaster beneath a window recess. Some of the losses in and around the recess are likely to result from impact damage but there may also be some localised environmental deterioration at this

point too. The number of scattered previous repairs within a zone of plaster deterioration and unrepaired losses suggests an ongoing problem to which condensation or water infiltration may be a contributory factor. The physical location of this area, and its potentially weakened condition renders it vulnerable to impact damage and further loss.

Suggested approach:

- Given the extent of loss, the presence of earlier repairs, the likelihood of environment-related localised plaster weakening, and the possibility that causes of deterioration may be ongoing, the condition in this area requires investigation and evaluation in order to develop a coherent stabilisation strategy. Temporary edge repairs may be applied (see N19 above) and/or facings/straps (see N1 and N9 above) as appropriate. Alternatively the area could be cordoned off as a protective measure until properly researched and tested repairs can be done.

N20 Critical Area _ Northwest Chapel

20) N21 critical area, southwest (marine) chapel

Condition summary: the images show problems which are likely to have different origins. Patterns of paint and plaster deterioration of the lower part of the crucifixion scene and localised patches higher up suggest salts and moisture problems, but moisture sources are unclear, nor is is it evident whether the problem is ongoing. This area has also been cleaned. Another highlighted problem is failure of previously applied edge repairs.

Suggested approach:

- The mechanisms and rate of deterioration plaster deterioration and paint loss are unclear, and if they relate to moisture and salts, moisture sources remain unknown. There is a possibility that causes remain unaddressed and deterioration is ongoing so this area requires investigation and evaluation in order to develop a coherent stabilisation strategy. Temporary edge repairs (see N19 above) and/or facings/straps (see N1 and N9 above) may be applied in areas of concern if there is a serious risk of further failure and loss. Otherwise it can be left until necessary investigations and testing have been undertaken.

N21 Critical Area _ Southwest (Marine) Chapel

21) N22 critical area, St George

Condition summary: the image of St George is disrupted by losses and apparent plaster decohesion. A large number of repairs have been applied at different periods which

testifies to chronic problems in this area. There may be a fibre content to this plaster which is preferentially blowing, causing disruption to the plaster and paint layer. This suggests possible salts and moisture problems the nature of which is unclear. There may be salts veiling, patchy paint loss, or damage from cleaning – it is not really possible to diagnose from the images.

Suggested approach:

- The mechanisms and rate of deterioration are unclear, and if they relate to moisture and salts, moisture sources remain unknown. There is a possibility that causes remain unaddressed and deterioration is ongoing so this area requires investigation and evaluation in order to develop a coherent stabilisation strategy. There do not seem to be any areas in need of emergency treatment at present.

N22 Critical Area St. George

22) N23 critical area, north arm

Condition summary: Salts efflorecences can be seen in the images, together with some paint and upper plaster disruption.

Suggested approach:

- There is a possibility that deterioration is ongoing in this area. This requires investigation and evaluation in order to develop a coherent stabilisation strategy. There do not seem to be any areas in need of emergency treatment at present.

North Arm

Follow the link to see graphical documentation of critical areas:
Graphic Documentation