**Inspection Review Guidance**

During our inspection we were able to review some archive drawings of the steel frame, but these were incomplete and did not provide all the necessary details, or information on any alterations that may have been made since the original construction. In addition, none of the original design calculations were available.

Therefore we undertook a site survey to verify the steel sizes, and then carried out a full design on all the affected members to verify that they could safely support the new loading.

Please note that we have used the STAHL crane details / loadings provided, and assumed that the relative position of the two cranes is as existing i.e. limited so that only one crane can be located in a bay at any time.

The results are as follows:-

**Crane Gantry Beams at External Wall Side**

The existing 457 x 152 x 52 UB gantry beams and 229 x 76 x 26 RSC top flange were found to be satisfactory for the increased loading, with no strengthening (or similar) required.

**Gantry Girder Brackets at External Wall Side**

The fabricated gantry brackets fixed to the external columns were also found to be satisfactory for the increased loading, including all the bolting and welding.

**Existing Main External Columns**

The existing main columns are 457 x 191 x 74 UB, and were found to be satisfactory for the increased loading. No strengthening (or similar) would be required.

**Beams Over Large Doorway In External Wall**

The large external doorway has 2No 432 x 102 x 65 RSC beams over, which support a cut-off main column. These beams were found to be satisfactory for the additional loads, with no strengthening required.

**Crane Gantry Beams at Internal Concrete Wall**

Here the existing gantry beams are 406 x 178 x 54 UB and 229 x 76 x 26 RSC top flange, but with a 200 x 12 plate welded to the bottom flange, and with a considerable height of packing at the connection to the gantry brackets. The additional plate on the bottom probably indicates that the beam was strengthened at some time in the past, but it is unclear why this beam is of a different size to the one at the external wall. The calculations appeared to show that the section was satisfactory for the proposed loading, but we are concerned regarding such a large increase in loading being applied to a member that has apparently already been strengthened previously.

**Gantry Girder Brackets at Internal Concrete Wall**

Our site inspection showed that the brackets had already been altered at some time after initial installation, with crudely welded “wing” plates and additional bolts into the concrete wall. (This reinforces our impression that the gantry girder on this side of the building has been strengthened in the past.) The additional bolts appeared to be at an upward angle, probably to allow room for the drill below the gantry beam at installation. The type of bolts (both original and additional) are unknown. The “wing” plates showed considerable corrosion, and the quality of the welding is questionable. The small stiffeners to these plates also seem to have little structural capacity. Overall, therefore, it is not possible to determine the load capacity of these brackets, and we have severe reservations about their ability to safely support the proposed additional loads.

**Conclusion**

Based on the above, it can be concluded that all the existing steel members on the external side of the building can safely support the increased crane loads i.e. the gantry beams, gantry brackets, external columns, and beams over the large doorway. However, this is not the case at the internal concrete wall. For the reasons stated above, we recommend that the existing gantry beams and brackets are completely removed and replaced with new. The attached sketch number L-06653 / SK. 101 shows this. The new gantry beams are 457 x 152 x 52 UB with a 230 x 75 PFC top flange i.e. similar to the gantry girder at the external wall. The new gantry brackets are fabricated from 457 x 191 x 67 UB, and fixed to the concrete wall with M20 resin anchor bolts. Please note that the eccentricity of the gantry beams from the concrete wall face has been reduced in order to decrease the forces in the fixing bolts, but that the resulting increased span of the overhead travelling crane is still within the range of the STAHL unit.

**Foundations of Advice and Guidance**

**Existing Gantry Girders**

As previously described, the existing gantry beams have probably been strengthened in the past, so we have considerable reservations about their ability to safely support such a large increase in loading, mainly because of the unknown quality of the workmanship. In addition, there is a large amount of packing between the gantry beams and the existing gantry brackets, which is not ideal structurally and which compounds the problems of the increased loading. Hence our recommendation that the gantry beams should also be replaced.

**Proposed Gantry Girders**

New gantry beams will provide a much more robust structural solution, where we can be confident that the increased crane loads can be safely supported.

**Existing Gantry Girder Brackets**

As previously described, the existing brackets appear to have been strengthened in the past with wing plates added for additional bolts. The wing plates are of poor quality, with suspect welding, little structural capacity to the small stiffeners, and considerable corrosion. The bolts into the concrete wall (both original and additional) are of unknown type / quality, and the additional bolts have been installed at an angle. The latter is not ideal structurally. Overall, therefore, it is not possible to determine the load capacity of these brackets, but at best they must be considered as inadequate to safely support the increased loading. Hence our recommendation for their replacement.

**Proposed Gantry Girder Brackets**

Our sketch number L-06653/SK101 showed our original proposal for the new gantry brackets. The intention was for these to be in the same position as the existing brackets, the latter being taken down beforehand.

Because of the position of the joints in the existing gantry girder and crane rails at the bracket positions, if additional brackets were used they would need to be “doubled up” to each side of the existing brackets. This would obviously double the cost of the new brackets.

However, in addition, it would not be possible to install the new brackets as currently detailed because the existing gantry beam would obstruct access for the drill when installing the fixing bolts. The four bolts around the top flange of the bracket are essential to resist the new loading, and we cannot see how these can practically be repositioned. The only alternative is therefore to temporarily remove the gantry beam, which slightly defeats the object of what is trying to be achieved, or to redesign the new brackets with the bolts at a lower level. The latter option would increase the loads in the bolts (and therefore probably increase their number or diameter), and would probably require either a non-standard shape or considerable packing. Space to achieve this is also limited.

**Conclusions**

         The existing gantry beams should be replaced because of the increase in loading.

         The existing gantry brackets should be replaced because their load capacity cannot be quantified.

         Removal of the existing gantry beams will allow access for removal the existing gantry brackets and installation of the new brackets as detailed.

         If the existing gantry beams are retained (not recommended), doubled-up new brackets could be installed each side of the existing brackets, but this would considerably increase costs. The existing gantry beams would need to be taken down to achieve this, which slightly defeats the object of the exercise.

         If the existing gantry beams are retained and not removed (not recommended), the doubled-up gantry brackets would need to be redesigned so that they could be installed at a lower level. This would make them more complicated and expensive.