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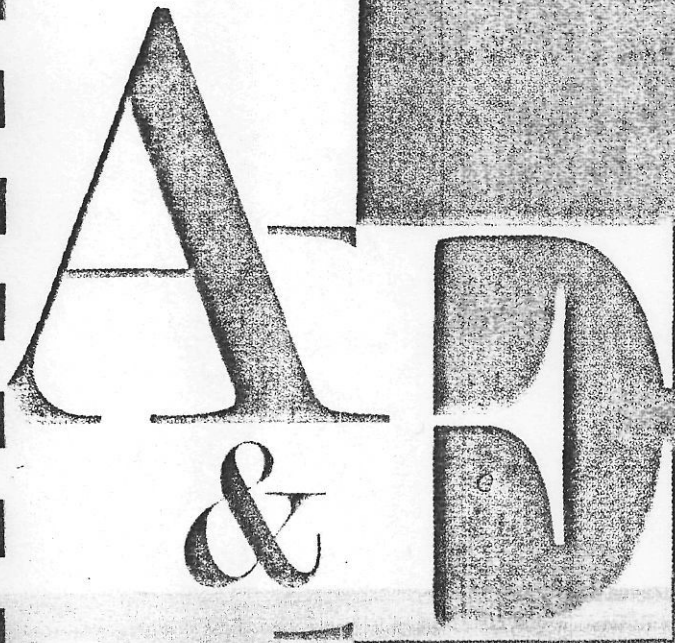
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ARCHITECTURE AND ENGINEERING

Structural Inspection

Britannia Mines

November 1990



Canada

Introduction

This brief report is based on a cursory inspection of the structure of the main building of Britannia Mines conducted by Ghassan Attar, Chief, Period Engineering Section, and Dr. M. Assaly, a concrete consultant from Vancouver (who indicated some interest in visiting the building because of its historical importance) on November 26, 1990.

The inspection had to be limited due to time constraint because of difficulties in reaching the site except at specific times due to closure of the highway; and to safety consideration.

A more detailed description of the building, its history and historical significance can be found in the agenda paper prepared by E. Mills for the Historic Sites and Monuments Board of Canada and in the report prepared by C. J. Taylor also prepared for the Board. The purpose of this report is to give a brief description of the structural problems encountered in this building.

Description of the Structure

The main structure consists of mainly reinforced concrete columns and beams on the south or mountain side; steel columns, beams, joists and floor systems on the other sides and in the middle. A few wood columns exist also in different areas.

The structure is unique and very impressive in terms of construction, volume and function, therefore its historical importance can not be ignored.

The structure seemed at first glance in good shape due to its volume and lack of obvious deformation. This gives the false impression of stability. A closer look however, showed some serious problems. Therefore, the recent decision by the Museum to close it is an appropriate one from safety point of view.

Structural Problems

The structural problems in this building are due to two causes; water and neglect. The main problem is the corrosion which has affected mainly the steel structure and to a lesser degree the concrete one. Some minor erosion of the foundation soil has also occurred near the east annex of the building.

The structural problems can be summarized as follows:

The roof

The roof seems to be in relatively good shape but requires some maintenance work since some areas need patching and repair to prevent water entry.

The exterior

The exterior does not show any sign of major problems giving a false impression of a stable structure. The obvious problems are the missing corrugated metal sheathings, the superficial rusting of the columns, the erosion of the foundation soil near the east annex and the deterioration of the bottom part of the west side structural elements. Fig.1 - Fig.4.

The interior

The east side and the upper part of the building seem to be in stable condition. The steel structure however has been affected by superficial rust and minor corrosion. Fig.5 - Fig.8.

The west side, where the chemically polluted water is running freely, is in poorer condition. Some of the structural elements are completely corroded and basically have lost their structural strength. The concrete elements have also corroded and lost not only their concrete cover but also their reinforcing bars. This area is generally hazardous. Fig.9 - Fig.16.

The remaining interior structure has been affected to different degrees by the rust and corrosion. One main bridge in the middle of the ground floor has lost most of its shear strength due the corrosion of the joist webs (fig.17); one of the stairs has lost part of its bottom support to corrosion; several walkaways have lost some parts completely; several columns have superficial rust and corrosion. Fig.18 -Fig.21.

Conclusions

The main building at Britannia Mines is a very impressive structure. Due to the massiveness of its structure and lack of obvious deformations, it gives a false impression of stability. The structure has suffered from polluted water which resulted in the rusting and corrosion of some concrete elements and most of the steel elements of its north west part. This has resulted in some hazardous areas.

Some of the structural elements are in a state of imminent collapse and the recent decision to close the building to visitors was a necessary one for safety considerations.

Recommendations

Due to its size and conditions it is very difficult to make any specific recommendations about the stabilization of this building. It is, no doubt, of great historical importance due to its function and to its structure itself.

The structural stabilization of this building, which is a major part of its restoration due to the nature of the structural system and its problems, has a major financial implication (over \$ 5,000,000.00). The structural detailed investigation alone can run into hundreds of thousands of dollars. This however is imperative as a first step in the stabilization of this asset.

. Due to the nature of its structural problems, there is no fast fix solution to freeze the structure in time. The chemical treatment of the steel members to slow down the corrosion process should however be considered as part of the regular maintenance.

. The building should be recorded as soon as possible due to its condition and the possibility of it being inaccessible due to safety considerations. The possibility of cooperation with the University of B.C. should be explored since it will result in good student exercise and major saving. The recording team should be accompanied by a structural engineer to identify unsafe areas to be braced before the work can start.

. Signs should be posted around and inside the building to warn people of the danger of collapse.

. The maintenance staff can enter the building only if they are familiar with unsafe areas.

. I feel that the interpretation of this important structure and its role should be done but in an economically feasible manner. Therefore the possibility of using models, slides and movies rather than the actual building should be explored.

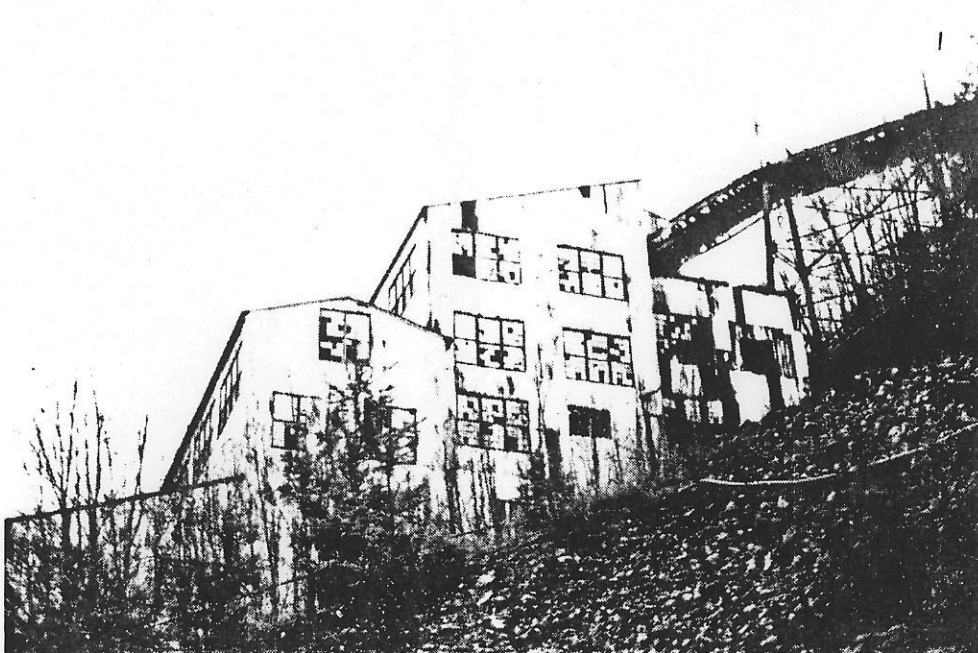


Figure 1. West Facade (no of apparent problems)

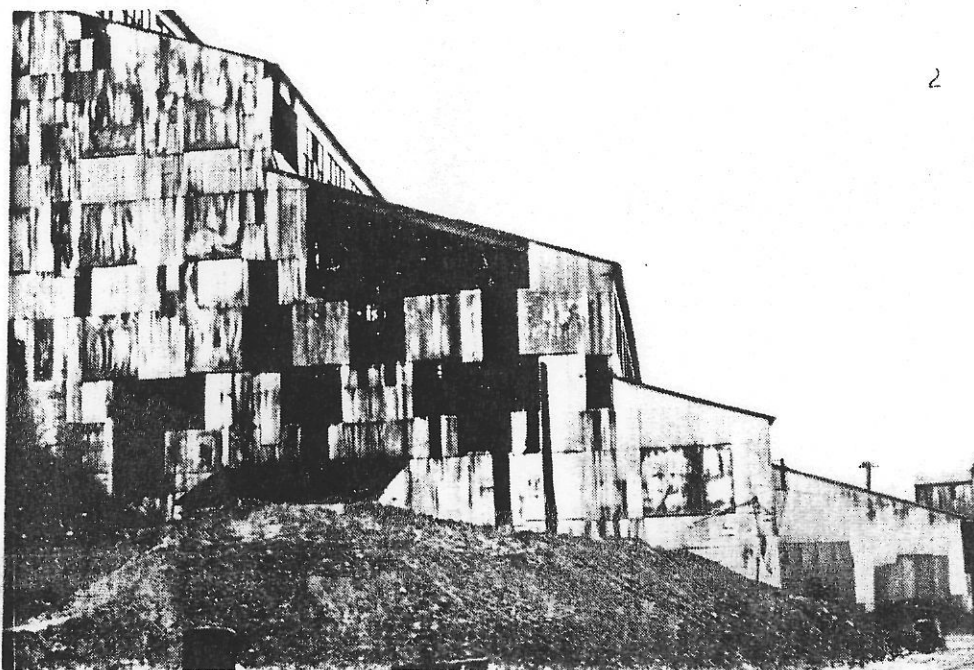


Figure 2. East Facade (No indication of any major problem)

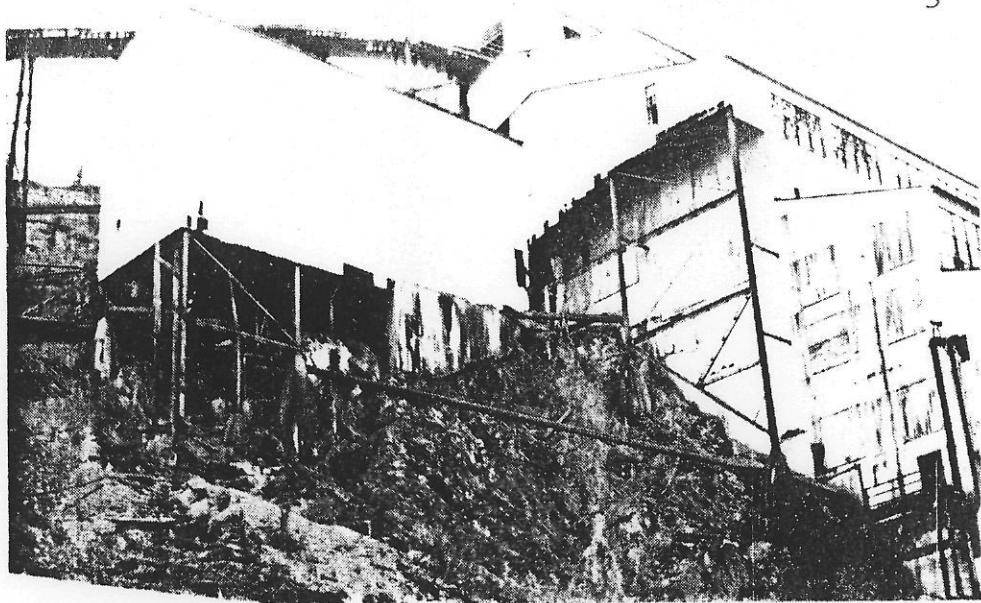


Figure 3. Erosion of Foundation Soil.

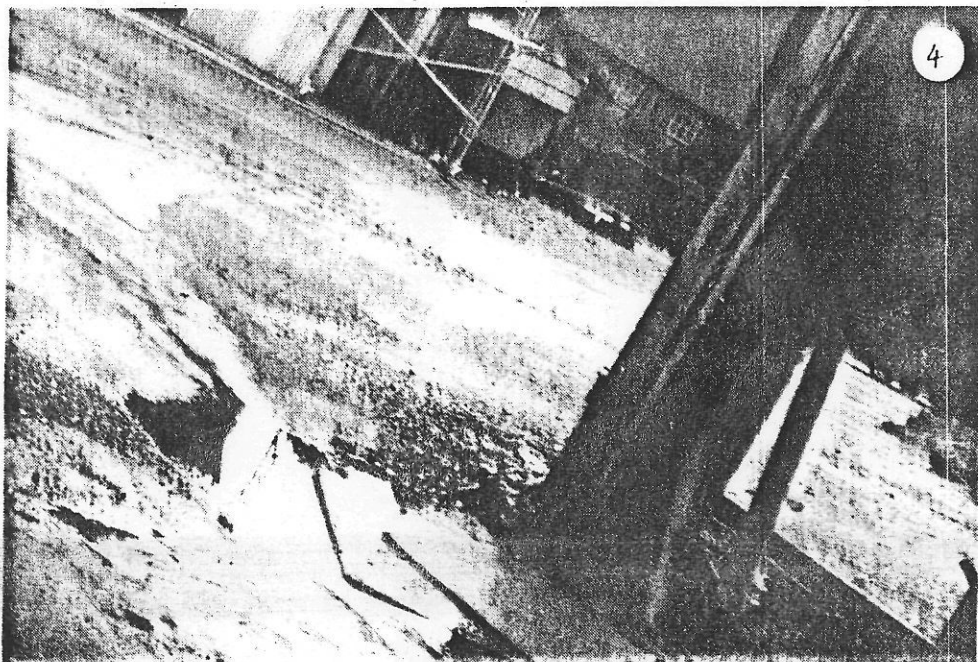


Figure 4. Minor Deterioration of Column Base.

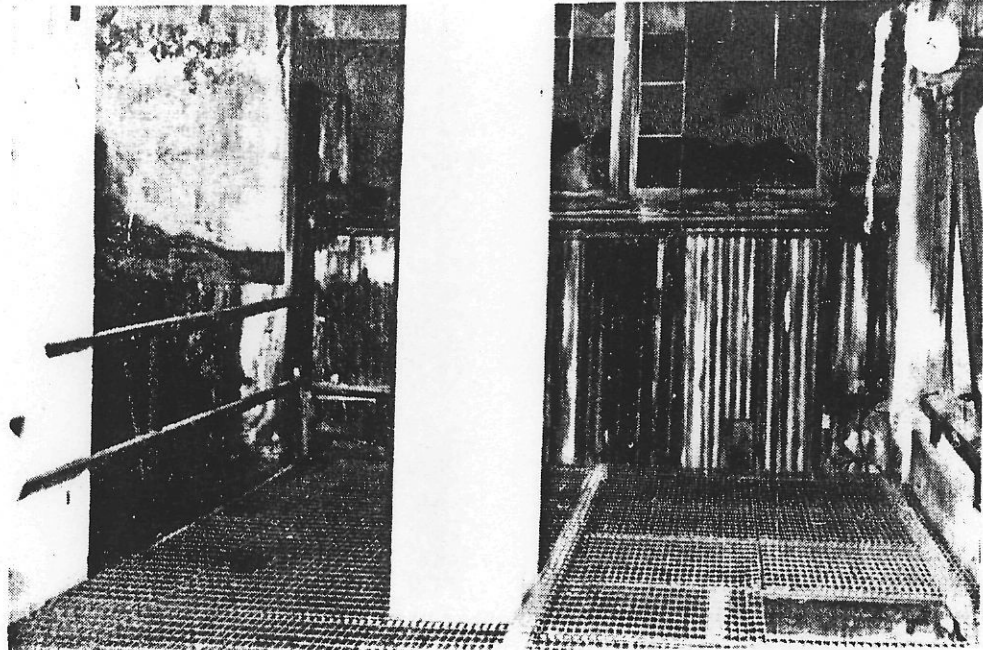


Figure 5. Concrete Column and Steel Flooring in Good Condition.

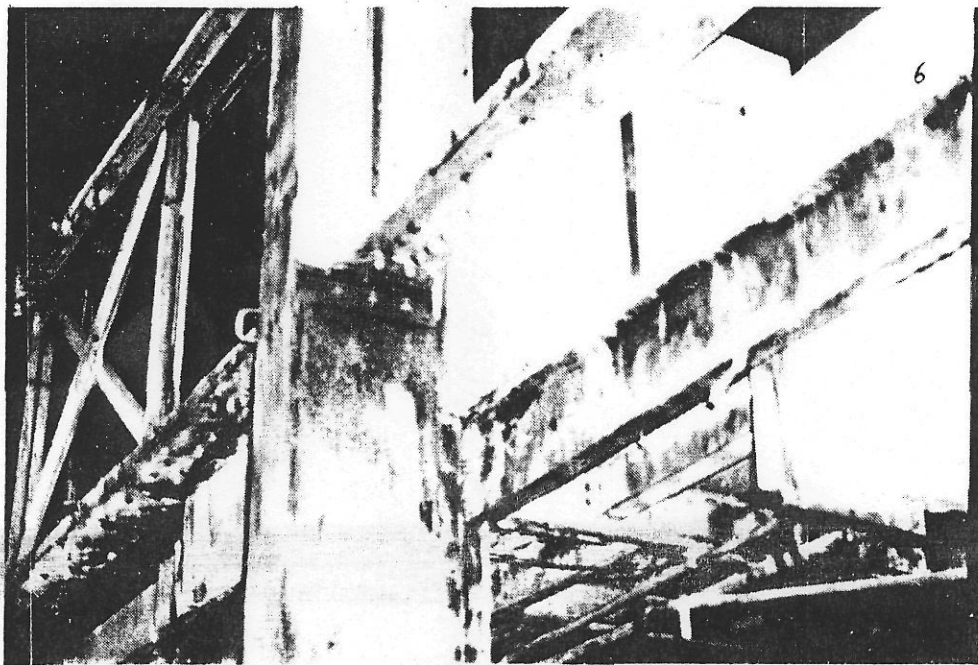


Figure 6. Steel Members Affected By Rust & Minor Corrsion.

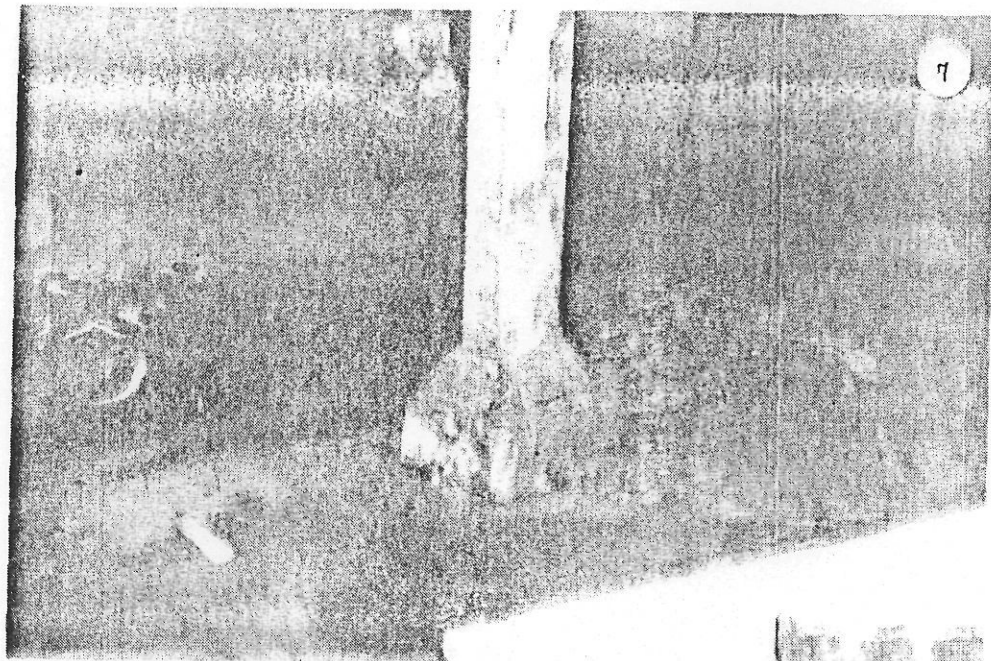


Figure 7. Steel Column and Concrete Base With Rust & Minor Corrosion.

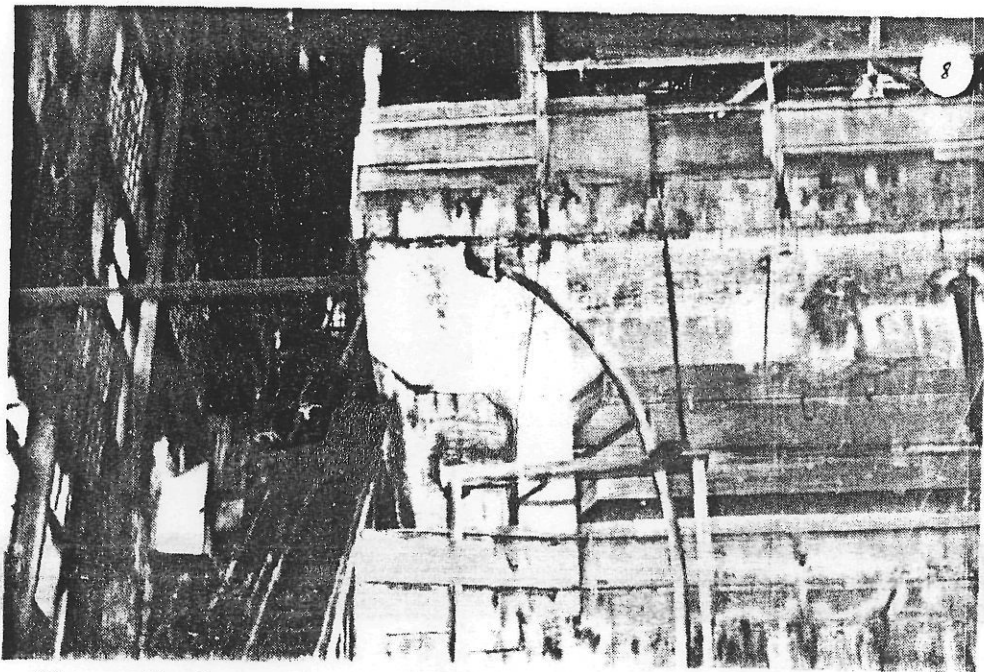


Figure 8. Concrete Elements in Relatively Good Condition.



Figure 9. Badly Corrode Concrete Beam.

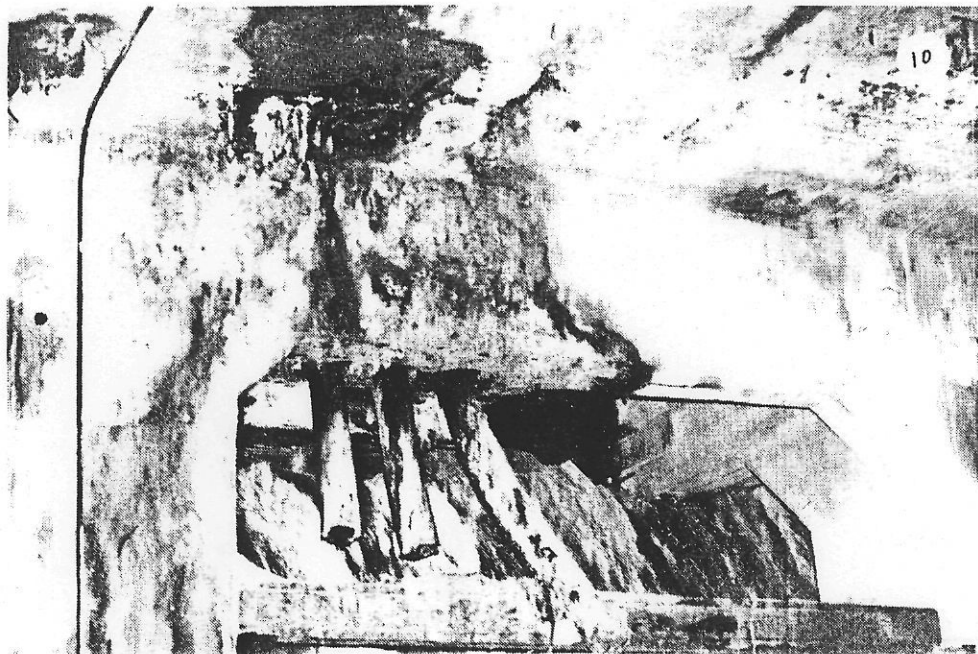


Figure 10. Corroded Concrete Beam.

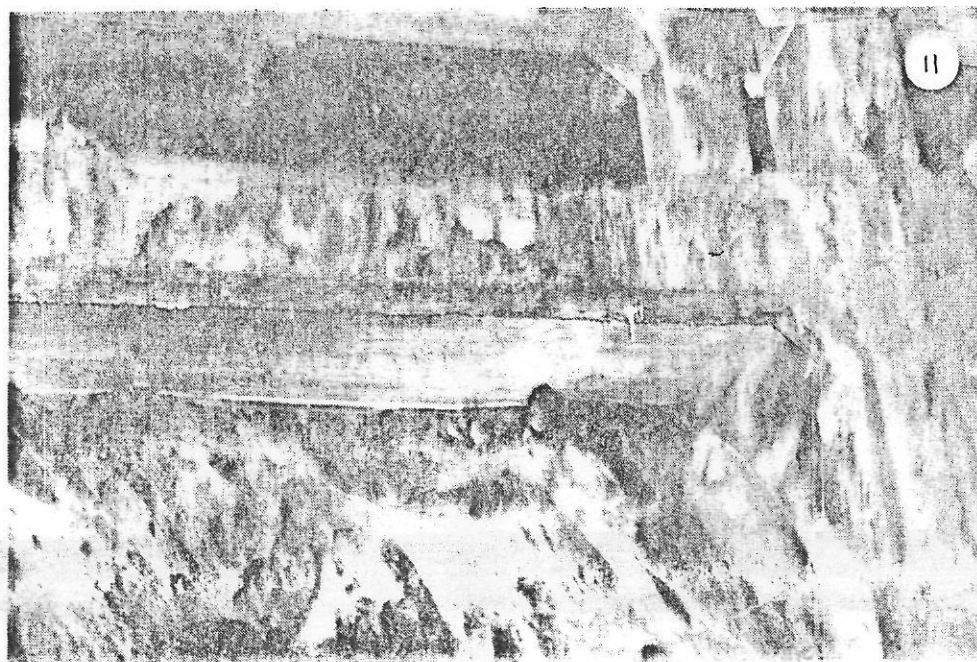


Figure 11. Corroded Concrete Beam.

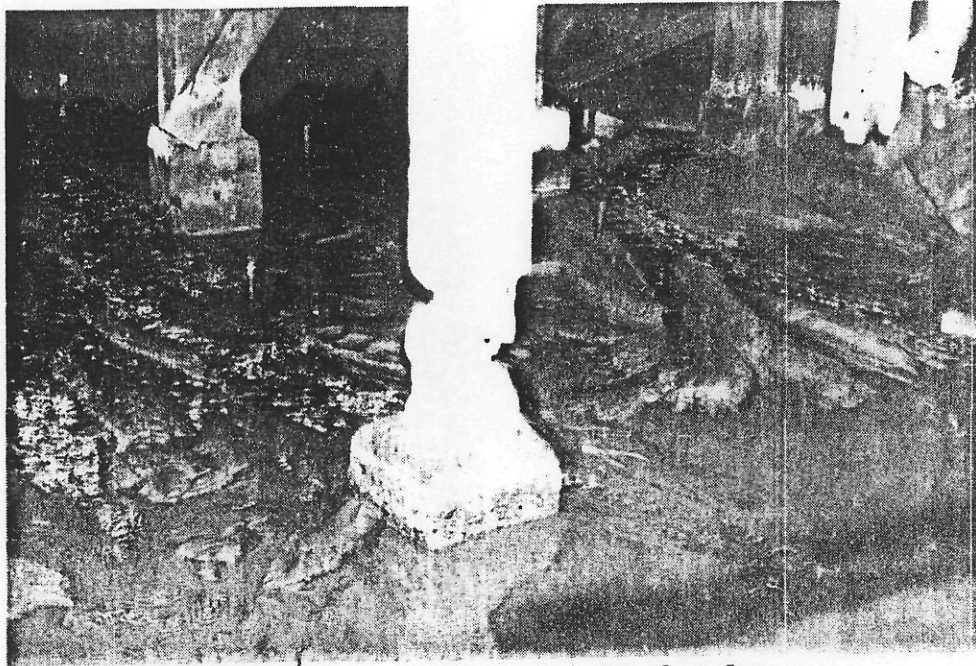


Figure 12. Badly Corroded Steel Columns.

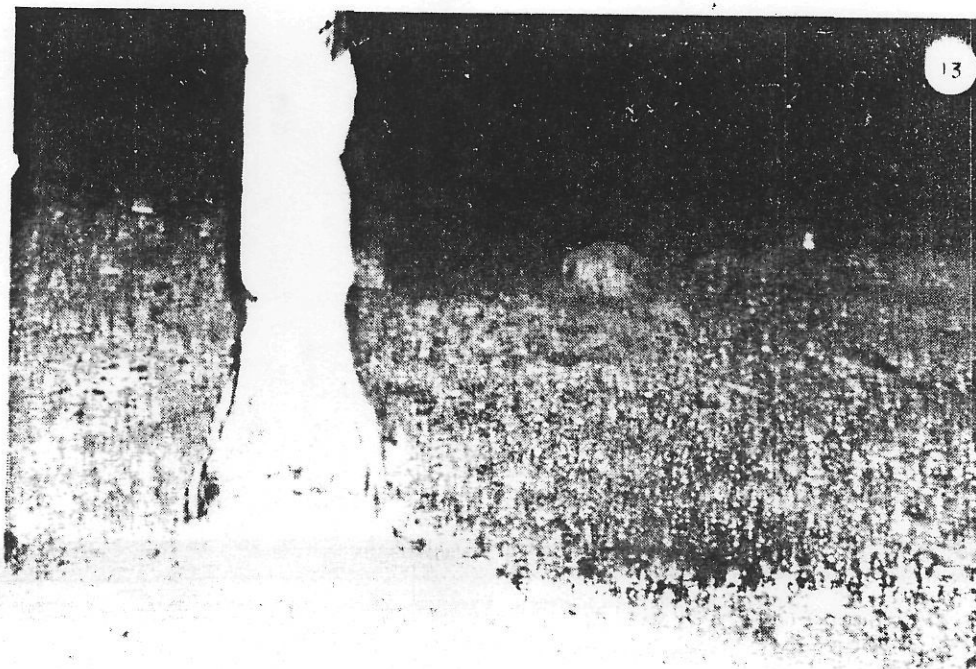


Figure 13. Badly Deteriorated Column.



Figure 14. Corroded Steel Support.

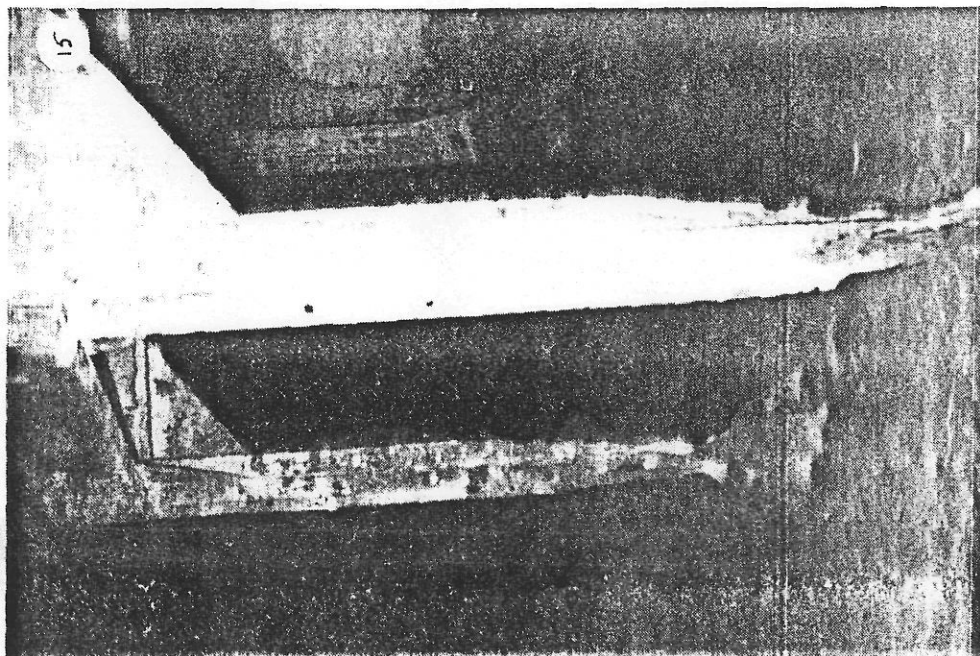


Figure 15. Badly Corroded Columns.



Figure 16. Timber Elements in Relatively Good Condition.

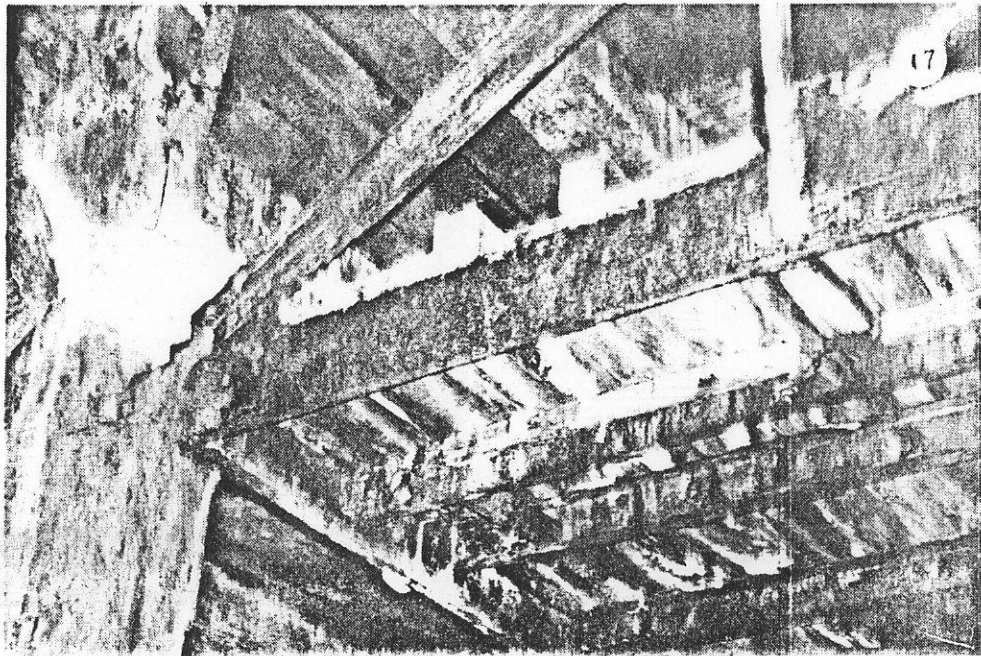


Figure 17. Webs Of Bridge Joists Completely Corroded.

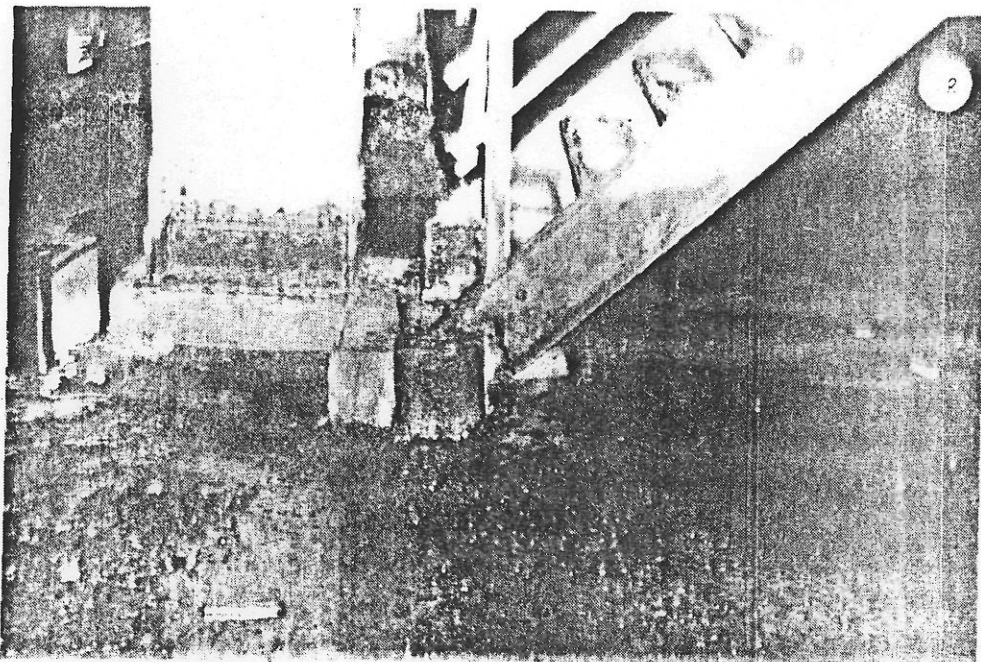


Figure 18. Corroded Stairs Support.

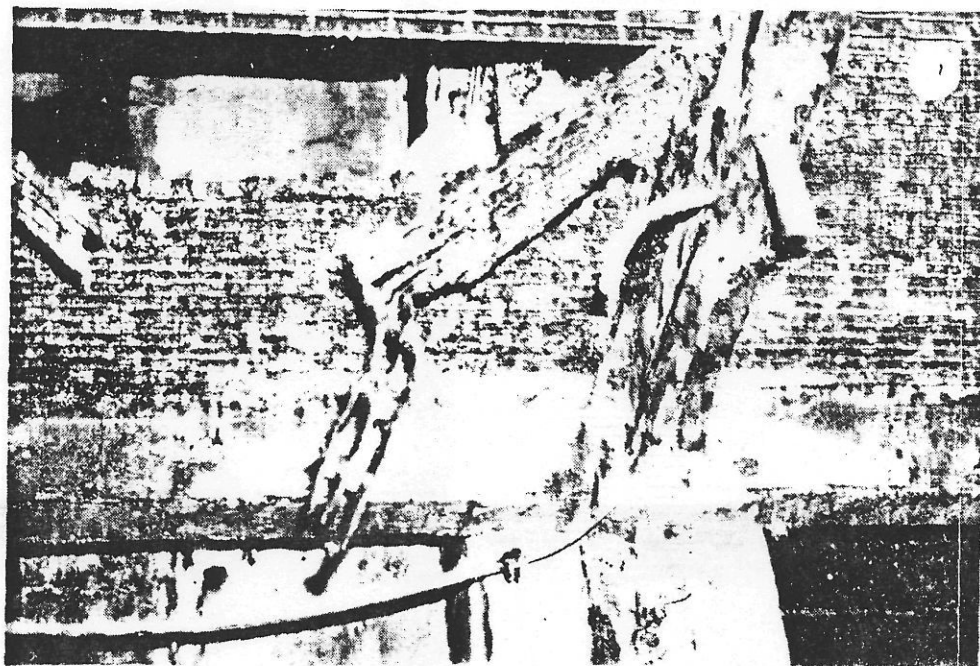


Figure 19. Walkways Completely Corroded.

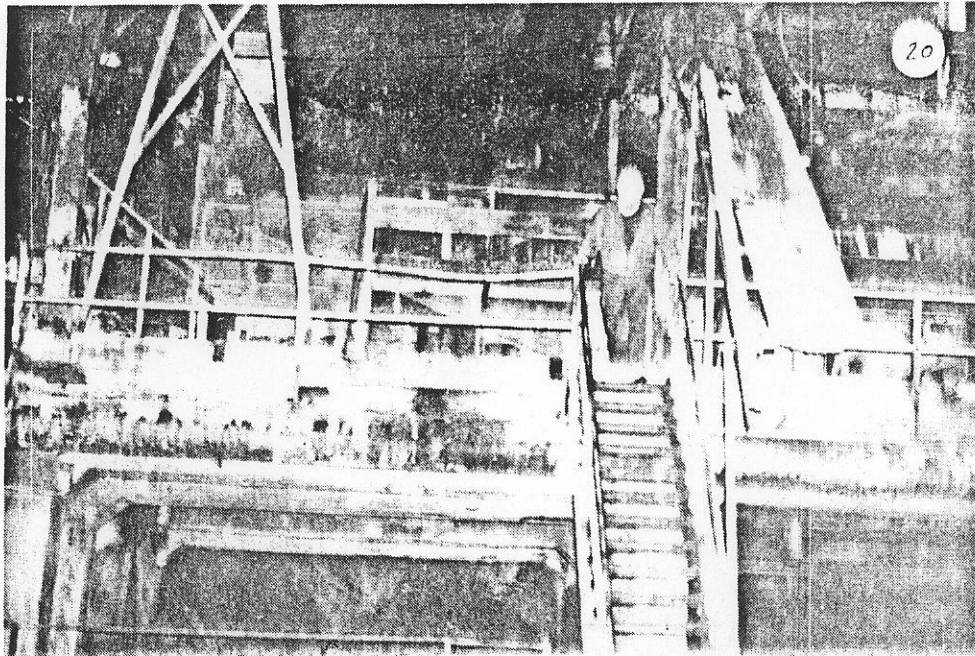


Figure 20. Upper Structure Superficially Rusted.

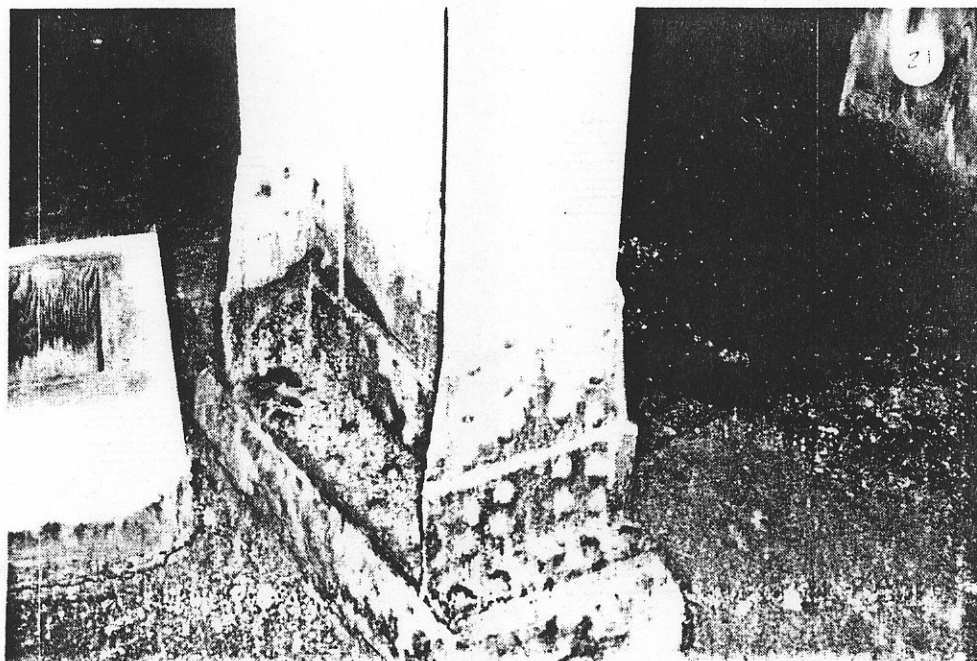


Figure 21. Column Base Superficially Corroded.