

THE RIVER RODING PROJECT
DIFFERENCES IN GEOTECHNICAL ENGINEERING IN AUSTRALIA AND THE UK

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SUMMARY

This paper presents a review of the geotechnical site investigation for a tide retention barrage across the River Roding, a tributary of the River Thames, London. An overview of the project is given together with a description of the parties involved and their respective objectives and roles. In particular the inter-relationship between the geotechnical engineer employed by the project Engineer and geotechnical engineer employed by the site investigation Contractor is discussed. Finally the paper discusses the potential pitfalls of the system where the geotechnical engineer carrying out the field works is removed from having a comprehensive knowledge of the project and its objectives.

PROJECT OVERVIEW

The London Borough of Barking and Dagenham examined the feasibility of constructing a tidal barrage (weir) across the River Roding, which is a tributary of the River Thames in eastern London. The aim of the barrage was to retain tidal waters behind a barrier and thus create a large expanse of water. An open area of water was seen to be a way of increasing the amenity value of the area and produce a focal point for the nearby town center.

The barrage project was seen by the London Borough of Barking and Dagenham as being a primary impetus in changing the nature of the area close to the city center from mainly supporting heavy industry to one increasingly focused on the residential aspects of the area.

Robert West and Partners were commissioned to expand upon the pre-feasibility study and produce a detailed feasibility study and costing for the barrage. As part of the feasibility study a geotechnical investigation was to be carried out at the structure's preferred location and in the immediate vicinity of the barrage. An amount of UK£40,000 (A\$80,000) was allowed for the investigation. A perspective view of the barrage is shown in Figure 1 below.

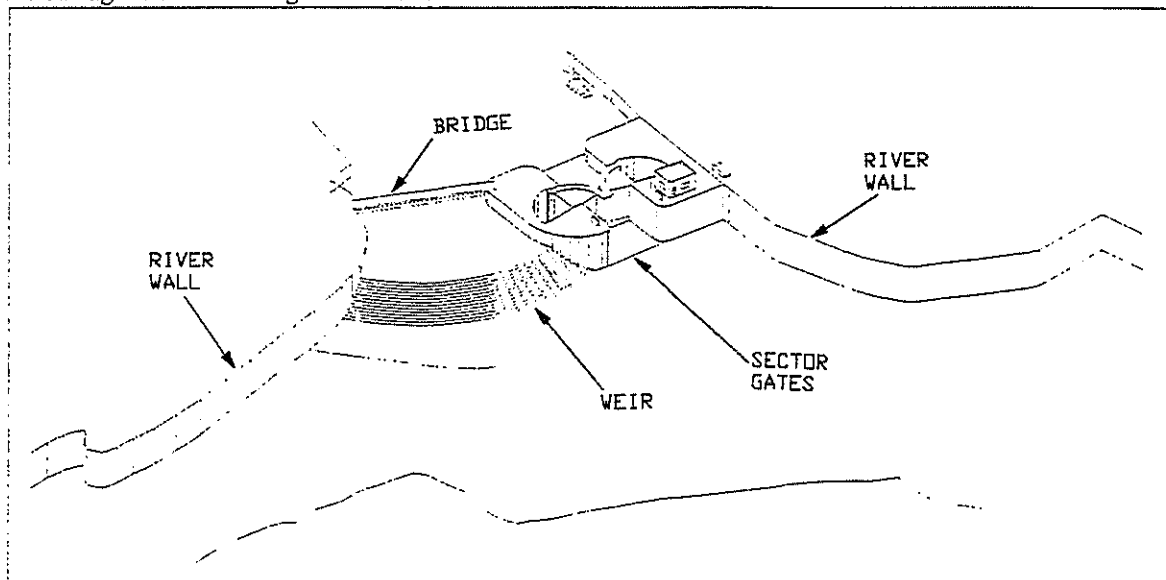


Figure 1. Perspective view of the River Roding barrage

INTER-RELATIONSHIP OF THE VARIOUS PARTIES

The relationship between each of the receptive parties plays an key part in the efficient running of any project. Long or cumbersome lines of communication have the potential to slow the information exchange process to such an extent that in a dynamic project, such as a geotechnical site investigation, important information may be lost or simply not recorded.

Figure 2 below is a diagrammatic representation of the parties involved in the project and their relationships. The downward flow of information from the Principal ultimately to the person in the field is indicated together with the upward flow of information in the form of Reports gained as a result of the investigation.

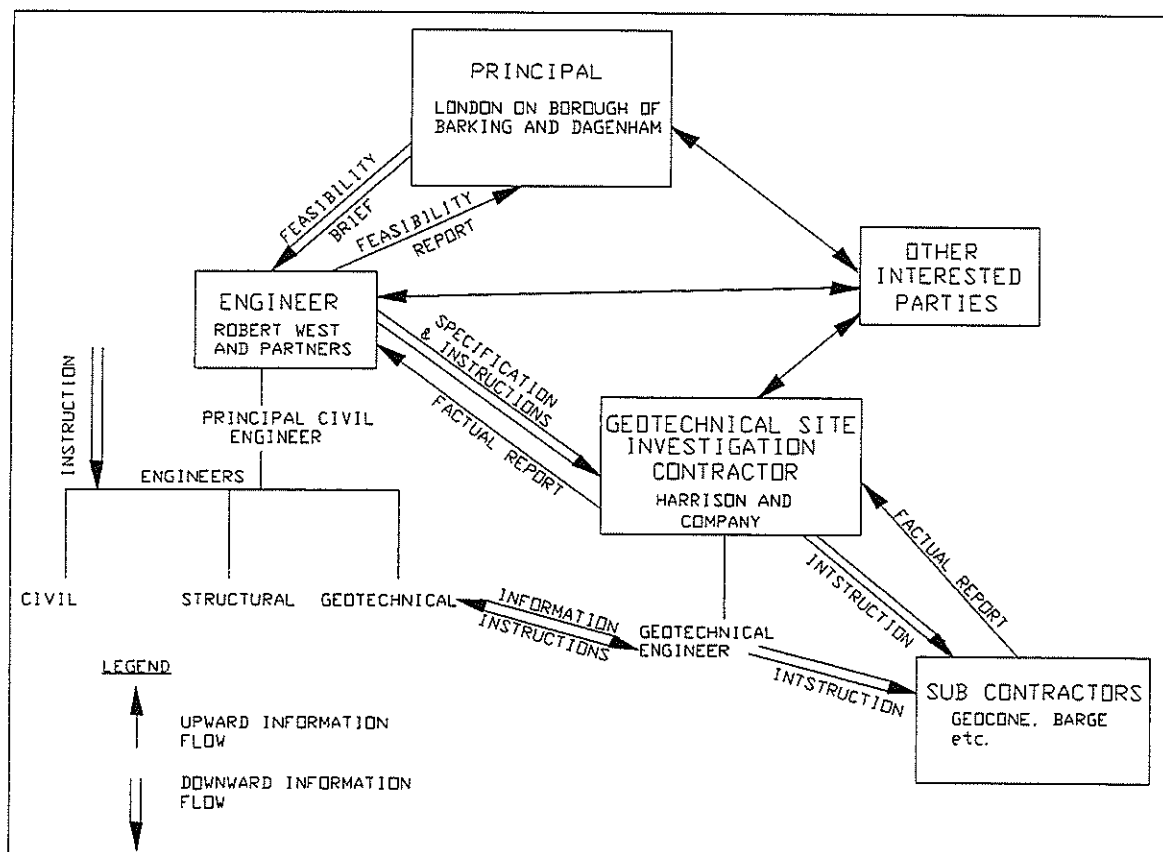


Figure 2. The parties involved in the River Roding project and their inter-relationship

The London Borough of Barking and Dagenham was the Principal for the project and they provided the funding and overall project definition. Robert West and Partners were the project Engineers and operate within the brief for the feasibility study. They were responsible for the design of the structure within the parameters set by the Borough. For the purposes of the geotechnical investigation Contract, Robert West operate as the nominated Engineer's representative with the Borough nominated as the Engineer for contractual and financial reasons. Robert West and Partners employed a geotechnical engineer (the author) to provide specialist advice. The specialist geotechnical site investigation Contractor was Harrison and Company which also employed a field geotechnical engineer. The geotechnical engineer employed by Harrison and Company effectively manages the Contract including site supervision, management of sub-contractors and initial preparation of the Factual Report. Other parties indirectly involved are land and riparian owners, river users and specialist interests groups.

It is important to note that the typical system of geotechnical site investigation in the UK makes use of a Contract and associated detailed specification prepared by the Engineer and issued to a number of specialist geotechnical site investigation Contractors. Typically the Contract documentation details the procedures to be followed and frequency of the physical on-site works, logging, sampling, testing (field and laboratory), daily reporting and the production of a "Factual Report". The site investigation company would supply the drill rig(s), field based geotechnical engineer (who acts as site supervisor) and may sub-contract out other specialist parts of the contract (such as electric friction cone testing). In a limited number of cases the

contractor may be asked to carry out interpretation of the results, though in the author's experience this is only rarely the case.

While this does not totally set the investigation "in stone", it does make any changes during the site works cumbersome. In the first instance the contract must be flexible enough to allow changes to be made as the field investigation proceeds. It then requires the Contractor's geotechnical engineer to recognise the significance of an aspect of the investigation, which is often difficult from "cold" documentation. The Contractor's geotechnical engineer then communicates this to the Engineer's geotechnical engineer, who will then liaise with the structural engineer and/or client, receive instructions and then pass these back to the Contractor's geotechnical engineer.

This somewhat contrasts with the typical Australian geotechnical site investigation where the geotechnical engineer (often a consultant engaged directly by the owner or Engineer) would organise and implement the investigation to achieve the aims set in the site investigation design. More often than not, some parts of the site investigation will be modified in light of preliminary findings with the aim of gaining more information about a particular feature. This is particularly true when there is only limited information available prior to the on site investigation commencing.

Although the system used in the UK adds only one (or two) levels to the chain of communication it was the author's experience that messages can often be lost (due to time pressures of those involved) or can become distorted; it is often difficult to describe something over the phone/on paper that may not have been sighted in the field. While the answer to this may seem to be for the Engineer's geotechnical engineer to be on site all/part time, this does introduce a degree of duplicity and it would seem that this does not often occur in reality. The other major disadvantage of this system is that the Engineer's geotechnical engineer may lose a certain amount of the "feel" for the conditions at the site.

INFORMATION TRANSFER FROM THE GEOTECHNICAL INVESTIGATION

In this type of investigation, information transfer is firstly to the Engineer's geotechnical engineer who needs to gain an understanding of the project, and particularly the structure proposed. In what is often an iterative process a number of structures may be discussed by the Principal or those in the Engineering firm, and for each part of the structure broad options and footing types may be examined. Following this it would be usual to carry out a detailed desk study to both confirm the options developed previously and assist in the detailed planning of the investigation.

In the case of the River Roding, investigation the needs of a number of types of structures and associated footing systems were examined leading to a number of more likely options targeted for further investigation. The desk study for the River Roding barrage sought information on the geology, hydrogeology, topography, hydrography, hydrology, riparian information, land ownership and access details. The author believes this was a valuable exercise (as is usually the case) and added greatly to the understanding of the area and gave a good impression of what could be expected during the on site works.

The information gathered was then distributed to the civil/ structural engineer and the Principal. The overall approach of the site investigation was then agreed upon in terms of information sought, scope and a review of the expected cost.

From this information exchange, the geotechnical engineer then designed a detailed investigation and produced the associated Contract, Specification and a Bill of Quantities that was distributed to a number of selected Tenderers.

It is not until this document is distributed that the person actually carrying out the investigation gains any information pertaining to the site. Unfortunately, the typical documentation for a geotechnical site investigation Contract will detail the physical works to be carried out and not the specific information objectives of the works to be carried out. This is where there is a discontinuity introduced into the flow of information for the project. The author did not encounter any situations where the complete desk study information was given to a Contractor, or where the contractor received more than a cursory briefing of the objectives of the investigation.

In the author's view this tends to inhibit the contractor from carrying out the project with the most efficiency. The Contractor is also likely to have objectives of his own that are not tightly bound in with the

current project such as operating to the letter of the Specification, scheduling of future work and (importantly) making a profit. An “Australian” geotechnical investigation is still likely to be placed under the same pressures but they would also be balanced to a certain extent by the information gathering objectives and needs.

After an evaluation of the Rover Roding site investigation tenders, Robert West and Partners informed the London Borough of Barking and Dagenham of their preferred tenderer, who was appointed in accordance with the recommendation.

The on-site works commenced after the award of the Contract. It was here that the differences and possible pitfalls with the UK contractual became apparent.

The field engineer is operating to a proscribed field investigation which details borehole locations and frequency of testing which have been determined as a result of the desk study. To a certain extent, the field engineer is discouraged from making variations to the specified testing routine due to unforeseen circumstances for to inter-related reasons:

- the lack of knowledge of the particular objective of that test location; and,
- the inability to judge where additional or differing testing/sampling would be better able to meet the objective at that location.

By way of example the field engineer may see the primary objective of a certain borehole as being the taking one undisturbed sample per metre to a depth of 5 metres, then conducting a SPTs at the interface with sand and one every metre thereafter to a target depth of 10 metres. Conversely the geotechnical engineer who designed the investigation may see the objective of the investigation as locating a suitable stratum in which to found an end bearing pile and verify that there are no underlying loose layers. What would occur if at a depth of 6 metres a 0.5m sand layer that was much easier to penetrate was struck?. One would hope that a further SPT would be taken, however, this is less likely to occur if the field geotechnical engineer were not aware that end bearing piles are proposed for the structure. Further if the design engineer was not aware of this occurring at this hole he may not be able to modify the next hole so that the SPT were taken in what may be a looser sand layer. What would happen in this situation? Possibly the sand layer that was easier to penetrate would be noted in the logs, but with not give a quantitative measurement on which future design review could occur.

It is also the case that the field geotechnical engineer is not aware of the significance of some seemingly minor features as the intrinsic knowledge gained as part of the desk study has not been effectively passed on. How often has a seemingly insignificant part of the geology (water bearing sand stingers and the like) revealed themselves to be critical in later design of a structure?

Much of the problems described above can be partially remedied by informal discussion between the respective geotechnical engineers. However, in many cases the author is aware of this has traditionally not been the case.

PROFESSIONAL DEVELOPMENT ISSUES

In the author’s view one on the major detrimental effects of the system is that a partitioning of field and design engineers may occur. Where the geotechnical engineers associated with a project are located primarily in the field or in the design office is that there is the possibility that:

- the design geotechnical engineer can be quite removed from the realities and intricacies of the investigation and not fully understand the inevitable problems that are often routine with most site works such as sufficient access to test sites, the need for clear logging, an understanding of how the drilling/testing is actually carried out and how to overcome the difficulties of “problem ground”; while,
- the field engineer may not have a clear understanding of the overall project objectives and the information sought at each individual test situation.

This has the potential to create an investigation where the aims and objectives are not fully reconciled with the desired design output objectives. This system also fosters the concept of “field engineers” and “design engineers” which the author believes is counter-productive to efficient and fully rounded investigations and professionals.

CONCLUDING REMARKS

The author believes that the structure of a typical geotechnical site investigations in the UK is different to that in Australia. One major result of this is that in the UK, a geotechnical engineer carrying out the field investigation is removed from the aims and objectives of that investigation. This has the potential to create loss of continuity within the design process.

In contrast , a typical Australian geotechnical investigation would not be burdened with many of the potential difficulties highlighted in this paper. The author believes that, in the Australian context, an interactive flow of information from conceptual to the final design would be established. This would benefit the design process as a whole.

While the author notes that the UK Institution of Civil Engineers requires a specialist geotechnical engineer to gain both field and design experience, a general acceptance of the broad philosophy behind this requirement will benefit both the individual and the practicing geotechnical fraternity.