

CHAPTER IV

CONCLUSION

By investigating and collecting the construction procedures of tunnel in Bangkok clay, the concept of designing, the unexpected field problems and remedial measures from the tunnel construction consultant (Metcalf & Eddy consulting engineers Co., Ltd.) and Japanese tunnel construction contractors (Nishimatsu construction Co., Ltd. and Ohbayashi Gumi construction Co., Ltd.). It can be concluded as follows:

According to the geological and other environmental investigation, the tunnel was selected in the most suitable alignment. Working shafts were sunk to the designed tunnel depth in the alignment of designed tunnel to divide the long tunnel into the sections for the convenience of working.

The tunnel was constructed according to the following steps:

1. Excavation of the ground by the shield tunnelling machine as the tunnel advanced from the beginning to the accessible working shaft. The machine must be selected for suitability to the excavated soil. The tunnel alignment was kept to close the designed alignment by the efficient surveying.
2. Erection of the primary lining segments under the protection of the shield tail to form a primary lining ring for the external earth pressure resistance.

3. Filling the primary lining annular back space by mortar to protect the ground surface from settlement. The compressed air system has been used before filling the back space to reduce the leakage of water.
4. Construction of secondary lining using reinforced concrete or steel pipe to resist the internal water pressure.

During the construction, the new technology was required to avoid and correct the following problems:

1. Delay of construction
2. Out of alignment.
3. Excessive distortion on primary lining.
4. Difficulty with waterproof in primary lining.
5. Long term settlement and over distortion.
6. Defective of secondary lining.

Critical path method (C.P.M.) and modern devices such as electronic computer, Laser equipment were considered to improve the working efficiency and to correct the delay of construction work.

Each of structural elements, such as primary lining segments should be checked by effective procedures so that the defective one will be forbidden to use.

Chemical grouting, the most effective grouting in water bearing granular soil should be used instead of cement grout which is ineffective for waterproofing in primary lining. To prevent the long term settlement

and over distortion of the lining, the second grout from the ground surface in alignment should be taken.

In the secondary lining, steel pipes should be used in place of reinforced concrete because of the more convenience in construction and repairing the defective one.