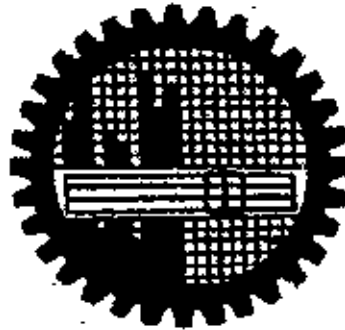


**“A CRITICAL ANALYSIS OF THE ORGANIZATIONAL
MANAGEMENT OF PUBLIC WORKS DEPARTMENT TO COPE
WITH SOCIAL AND TECHNOLOGICAL CHANGES”**

A Project Thesis

by

MD. KHALED HOSSAIN



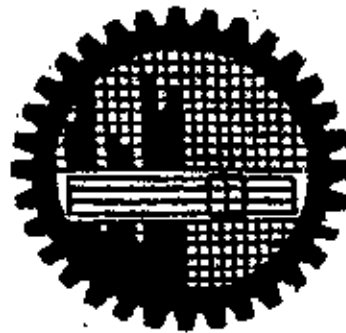
November.2003



ADVANCED ENGINEERING MANAGEMENT
DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

**“A CRITICAL ANALYSIS OF THE ORGANIZATIONAL MANAGEMENT
OF PUBLIC WORKS DEPARTMENT TO COPE WITH SOCIAL AND
TECHNOLOGICAL CHANGES”**

The project thesis submitted to the Department of Industrial and Production
Engineering ,Bangladesh University of Engineering and Technology in
partial fulfillment of the requirements for the degree of Master of
Engineering in Advanced Engineering Management.



Advanced Engineering Management
Department of Industrial & Production Engineering
Bangladesh University of Engineering and Technology

CANDIDATE'S DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma

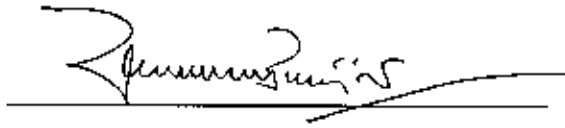
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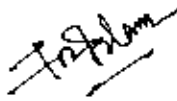
The Project Thesis Titled " *A Critical Analysis of the Organizational Management of Public Works Department to Cope with Social and Technological Changes*" Submitted by **Md. Khaled Hossain**, Roll No - 040008110P, Session April 2000 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Master of Engineering in Advanced Engineering Management , November 2003.

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It is to be mentioned that, some comments, remarks has been made in the thesis regarding PWD and it's management. These are not criticism rather limitations that need to be changed and improved to cope with the new challenges.

Abstract

Public Works Department (PWD) is pioneer in the construction sector in Bangladesh. It is a government regulatory department and takes the leading role in the construction industry. Over the last two centuries PWD successfully leading the construction sector by setting the trend and standard of building infrastructure. During post - liberation period PWD played the role of prime mover in rebuilding the country infrastructures.

During the period of British rule in 1786, a Military Board was setup to look after all public works matters. Public works department started it's journey at that time. At the mid of 19th century (1845-1856) public works were divided into three major departments, (i) "Public Works Railway department" - responsible for railway establishments, (ii) Public Works Revenue department" - responsible for districts collectorates, canal and river digging and (iii) " Public Works Judicial department"- responsible for Jail, Police Station, Court etc. Before establishment of separate Railway Board in 1905, all railway concern development works were done by PWD. In 1946 construction & maintenance works of Estate offices, Water, Power, Irrigation, Navigation, Electricity Mining, Petrol of central government were put in department of "Works, Mines, Power". In 1947 PWD was renamed as CBI department and was responsible for Building, Communication and Irrigation works. The Communication and Building directorate (C & B) which existed at that time was entrusted with all construction work for the provincial government. In 1962 C & B had divided in to 'Building Directorate' and 'Highway Directorate'. After liberation Bangladesh inherited with two separate works departments - CPWD and Building Directorate. In 1977 these two departments merged into a single department and renamed as PWD. Works Department is changing to meet the demand of the time. It is changing and developing time to time. Role of the engineers of this department is also changing. Once engineers were responsible for works of Irrigation, Mining, Railway, Highway, Building. All the branches of " Civil Engineering" were entrusted with PWD at one time. By the passage of time the need of specialization was felt and now Irrigation, Railway, Roads, Building etc all works are entrusted with independent specialized department. PWD the government biggest construction agency is a specialized building construction and maintenance department. It is now mainly responsible for economic construction and proper maintenance of government buildings. PWD under the Ministry of Housing and Public Works headquarter at the capital of the country Dhaka is presently headed by the Chief Engineer and four Zonal Chief named "Additional Chief Engineer" are working in Dhaka, Chittagong, Rajshahi and Khulna. Each Zone divided into some Circles which is headed by the Superintending Engineers. Executive Engineers work under S.E in the district level. Now there are 4 Zone 32 Circles 128 Divisions.

Before industrial revolutions that started in 18th century in Europe, building construction materials and technologies were almost indigenous. Since the time during last 150 years hardware part of technology i.e. machines, instruments, materials have evolved and developed manifold. And now at the time of information age rapid modernization going on. Size of bricks have changed, lime mortar technology has changed to cement mortar, flat slab taken the place of ribbed slab, high strength steel have come into use in lieu of steel joist. Brick, stone, steel etc widely used as building materials evolved in the industrial age are still being used by PWD.

Technological development of agricultural age and industrial age, now facing the challenges of information age. The software part of technology i.e. humnware, orgaware & infoware are also changing and developing day by day. Concept of generalized engineer changed into specialized one and more and more specialization is coming in future. Organizational design and structure of PWD have changed and developed many times over the years. PWD- as the leader in the construction field using modern building technologies and durable, cost effective building materials. In order to strengthen the efficiency and cost effective optimum design PWD is using computer and latest design software. It now uses STAAD PRO, GEAR, and GRASP for design, control and analysis purposes and Auto CAD for drafting.

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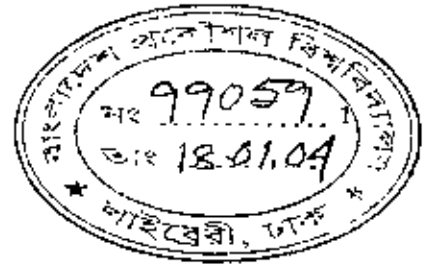
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Abbreviations Used –

1. PWD = Public Works Department.
2. C & B = Communication and Building.
3. C.E= Chief Engineer.
4. Add. C.E = Additional Chief Engineer.
5. Dy. C.E = Deputy Chief Engineer
6. C.A = Chief Architect
7. Dy. C.A = Deputy Chief Architect
8. A.E.F = Assistant Executive Engineer
9. S.E = Superintending Engineer.
10. E.E = Executive Engineer.
11. S.D.E = Sub - Divisional Engineer.
12. A.E = Assistant Engineer.
13. S.A.E = Sub - Assistant Engineer.
14. A/C = Air Conditioner.
15. Govt. = Government.
16. G.O.B = Government Of Bangladesh.
17. P.R.B = Peoples Republic of Bangladesh.
18. BWDB = Bangladesh Water Development Board.
19. R& H = Roads and Highways Department.
20. PDB = Power Development Board.
21. CMMU= Construction & Maintenance of Medical Units.
22. PWFA= Public Works Engineers Association.
23. IDEB= Institute of Diploma Engineers Bangladesh.

CHAPTER - 1



1.1 Introduction

During British Indian period Public Works Department was established in the year of 1849 at Lahore of Punjab State with the aim of constructing office and residence for the colonial British Rulers. Calcutta was the most important business center at that time. PWD constructed some offices and govt. buildings at Calcutta and established its local head office there in 1854. In 1905, the result of historic Banga-Vanga " East Bangle and Asam" Province was formed and Dhaka became the capital city. To meet the demand of constructing govt. offices and residences in the new capital & Dhaka University, Central PWD came to this land first time with one of its circle office. The residence of the superintending engineer was the present chief justice residence at Minto road. After the formation of Pakistan in 1947 there were two separate departments. PWD was under the central govt. and C&B was controlled by the provincial govt. C&B was responsible for all govt. buildings and roads (except T&T, Railways and Irrigation). Subsequently C & B was divided into two separate directorates viz.: R&H and Building Directorate in 1963. After the liberation of Bangladesh in 1971, the country inherited with two organizations for construction and maintenance of govt. buildings. These two: one Central PWD and other the Building Directorate were merged in 1977 to form the present PWD. At the same year govt. allocated "rules of business" for its different ministries and departments. Civil construction and maintenance of all govt. buildings (excluding Railway, T&I and Postal) were given on the PWD's shoulder. Government administrative reform committee "Enam Committee" in 1983 entrusted PWD with all government buildings (excluding T&I, Postal and Irrigation) construction and maintenance works. PWD is a 150 years experienced department and engaged in country's infrastructure development. PWD is enriched with numbers of highly skilled and experienced engineers. About sixteen thousands technical and non- technical employees are working with this department.

Before industrial revolutions that started in 18th century in Europe, building construction materials and technologies were almost indigenous. At the time of industrial age hardware part of technology i.e. machines, instruments, materials have evolved and developed manifold and now at the time of information age rapid modernization going on. Life cycle of different technologies are reducing day by day. Today's modern and sophisticated technology is becoming obsolete the next day. Size of bricks changed, lime mortar changed into cement mortar, flat slab taken the place of ribbed slab, high strength steel have come into use in lieu of steel joist. Auto CAD had taken the place of drafting table and STAAD PRO had reduced time and cost for modeling and designing of simple to complicated structures.

1.2 Backgrounds and Statement of the Problem

During the period of British rule in 1786, all public works matters were looked after by the military board. Independent Public Works Department was setup in the year of 1849. One chief engineer, one superintending engineer and one executive engineer were appointed for each of the three provinces of the Bengal presidency. Dhaka became the capital in 1905 and PWD came to this land at the same time with one of its Circle office. After the formation of Pakistan CBI department of central government and C&B of provincial government both were active. In 1963 C&B department was divided into R&H department and Building Directorate. In independent Bangladesh there were two departments BPWD & Building Directorate were responsible for public works. Both were merged in 1977 to form the present PWD. PWD experienced different management style and human resource strength since its creation. These changes were made to meet the demand of the time.

Up to 1900, PWD was responsible for all public works matters. After creation of independent railway board in 1905, audit & account department in 1910, industry division in 1937, water & power development board in 1959, roads & highways department in 1963 and also military engineering service in 1974, facilities department in 1986, construction & maintenance unit in 1995 - the role of PWD changed time to time. Present PWD is a specialized building construction and maintenance department.

PWD was created at the industrial age. Industrial revolution in Europe that started in the 18th centuries played the main role to adopt technologies regarding construction. Use of improved, cost effective and durable building materials started at that time. Invention of mixture machine, vibrator, crane, steel bar, cement and many others gave a good pace to the progress of construction sector in industrial age. With the invention of computer, a drastic change has taken place in construction industry. PWD as the leader in construction sector using design software for structural design and analysis, Auto CAD for drafting.

There are huge and significant changes taken place to PWD's human resource strength, management style, role & responsibilities and also to its technologies. Re-organizing PWD is the demand of the time to make it capable of facing new challenges. PWD now reached to a specific sector in where it has lot of experience. PWD used technologies of industrial age and passing through information age. More modern and sophisticated

technologies that are coming, PWD is ready to adopt . That will ensure PWD's existence as the prime building construction and maintenance agency . This research aims to justify re-organizing PWD, re-defining role and importance of immediate and continuous adoption of new technologies to cope with social and technological changes.

1.3 Objectives

- To study organizational management of PWD.
- To identify the significant changes in organizational management to cope with technological development and social changes.

1.4 Methodology:

Comprehensive study on organizational design & organizational structure will be conducted and different approaches of organizational design will be studied and compared with PWD. Hierarchy, bureaucracy and division of work of PWD will be studied. Advantages and disadvantages of Formal and Pyramid type of organizations will be discussed. Technological changes experienced by PWD during the industrial age to the information age will also be discussed.

- Study on organizational management of PWD will be conducted by using the concept of management process and management theories. Wide discussion will be made on organizational design approaches classical approach , task technology approach, environmental approach and organizational structure concept : functional organization , product / market organization, matrix organization .
- Study the development of technologies during the time of industrial age to information age with a wide discussion on hardware and software technologies with respect to PWD.

1.5 Scopes and Limitation of the Study

Public Works Department started it's journey as the only construction agency in 1849. It passed British regime, Pakistan period. In independent Bangladesh PWD is acting the role of a government regulatory department and takes the leading role in the construction sector. Since it's creation PWD experienced changes of regimes, organogram, management process, organizational design,

organizational structure. It lost its sole authority on building construction due to historic and administrative causes. There are new departments in the field of construction. Although PWD successfully leading the construction industry by setting the trend and standard for the last two centuries, now facing its challengers. So it is now thinking and taking policy to keep its position. Organizational design and structure of PWD have changed and developed several times over the years. Since the time during last 150 years hardware part of technology have evolved and developed manifold. Rapid modernization is going on now in the information age. Technological life cycle is reduced remarkable. PWD as the leader in the construction field using modern building materials and technologies. It introduced computer for design and drafting and also for keeping data. LAN, Internet, Fax, Mobile phone all become the part of daily management and sharing information and experiences.

PWD is a 150 years old government department. Like other public enterprises it has poor record keeping and documentation system. It passed British regime and independent war in 1971. Numbers of file, paper containing records had lost or damaged at that time. For this study, the author had to contract with different branches of PWD and also had to go to other departments. They all helped lot but sometimes shown reluctant to co-operate with the necessary information. As a result, in-depth and comprehensive study could not be possible sometimes.

CHAPTER – 2

Organizational Management of PWD

2.1 Creation of PWD – Historical Perspectives

Bangladesh as part of British India was under the British rule for one hundred and ninety years. Initially the British ruler kept their public works limited to the construction of their offices and residences for the officials only. A few roads, bridges cantonments e.t.c. were constructed to meet their administrative and military need without caring for the benefit of the people and development of the country. For those purposes Public Works Department was created in 1849. Before 1849 all public works matters and construction and maintenance of govt. infrastructures were being done the Military Board. Due to the failure of intense supervision and maintaining quality all public works matters transferred to the newly established public works department. The department of public works civil and military were removed from under the superintendence of the military board and placed under the management of one office, designated as Chief Engineer, in each of the three great divisions of the Bengal Presidency, viz, the Lower Provinces, the North Western Provinces and the Punjab Provinces. Under each Chief Engineer appointed Superintending and Executives Engineers.

At the time of Lord Dalhousi, infrastructure development got new momentum and all public works matters were brought under newly established Public Works Department's administrative control. To look after all these works a Secretary was appointed with the separate establishment. At that time PWD was established in each presidency and one chief engineer, one superintending engineer and one executive engineer was appointed for each presidency. PWD was liable for construction of roads, bridges, buildings and digging of canal, ponds etc. In 1864 public works department had eight major branches a) Military b) Civil c) Railway d) Establishment e) Accounts f) Revenue g) Drawing h) Registry. Department of irrigation had been separated and started it's journey as an independent department in 1867. In 1905 separate railway board was created and all railway matters transferred to the board. In 1910 audits & accounts branch were removed from PWD and entrusted with the finance division. Independent public works department was abolished and public works matters were entrusted with the industry and labor division.

In 1937 industry and labor department was divided into two separate departments e.g. Industry Department and Labor Department. Labor department was responsible for public works matters. Labor department was further divided into 1) Department of works, mines, power and 2) Department of

labor in 1946. Department of works, mines and powers were entrusted to look after construction and maintenance works of all estate buildings, roads water, power, irrigation, navigation, electricity, mines, petrol e.t.c.

After the end of the British regime Central Public Works Department of Pakistan was responsible for the works under Central Government, while Communication and Building directorate (C&B) was entrusted with the construction of the Provincial Government of the then East Pakistan. Subsequently communication and building directory of the Provincial Government was divided into two separate directorates viz. Roads & Highways Directorate and Building Directorate in 1963. After independent of Bangladesh country inherited with two organizations for construction and maintenance of the government buildings – Central Public Works Department popularly known as Pak PWD and Building Directorate. These two separate departments were merged in 1977 to form the present Public Works Department.

2.2 Credentials of the PWD in an historical perspective:

The PWD has highly qualified and experience professionals forming a multi-disciplinary team of Civil, Electrical & Mechanical Engineers and Arboriculturists. The Department of Architecture as a sister organization under the administrative control of the Ministry of Housing and Public Works are well bonded with PWD and rendering services to the nation along with PWD in the construction arena of the country. PWD is recognized as the leader and pace setter in construction industry because of its consistent and creditable performance. In its performance, functional and aesthetic quality, application of appropriate technology and local materials, cost effectiveness and user satisfaction get paramount importance. An intensive efforts of quality assurance, quality control and technical audit encompasses the entire range of activities of PWD. The department engaged in continuous human resource development programs and looking for new technologies with the aim to ensure Total Quality Management and Client Satisfaction.

Many notable and aesthetic structures having historic and architectural importances can be traced as the unique accomplishments of the PWD achieved at various stages of its existence since nineteenth centuries. To name a few most glaring of these includes, the Carzon Hall(1904), Supreme Court Building, Court Building, Chittagong (1893-94), Dhaka Medical College Building (1905-1911), Salimullah Muslim Hall Dhaka University (1929), The Parliament Complex Sher-e-Bangla Nagar and the Jatiya Sritishoudho.

2.3 Role of PWD Up to 1900

During the period of the British rule in this subcontinent in 1786 a military board was setup to look after all public works matters at that time. In 1854 the department of public works, civil and military were removed from under the superintendence of military board and placed under the management of chief engineer in each of the three great division of the Bengal Presidency viz. the Lower Provinces, the North-Western Provinces and the Punjab. Chief Engineer PWD appointed superintending engineers and executive engineers. All construction works of military board placed under direct control of the chief engineer PWD. Forest department was also placed under administrative control of PWD. The public works department up to 1900 was doing all types of civil works of the government since it's creation. PWD played the central role in the field of infrastructure development since it's creation Major branches of PWD were as followed:

- Construction of district collectorates
- Construction of national highways
- Construction of local roads,bridges.
- River and cannel digging
- Railway tracks
- Construction of dam, embankments.
- Providing irrigation facilities
- Forest
- Construction of cantonments, garisons, barraks.
- Railway station
- Police station
- Hospital
- Court buildings
- School, college, madrasa
- Navigation
- Construction of port, harbor
- Construction of food godown, silo.
- Post office

2.4 Role of PWD from 1900 to 1947

Before establishing independent railway board, all railway concern works were done by PWD. Audit and Accounts branch of PWD was put under direct control of the finance department in 1910. Independent public works department was abolished in 1923 and all PWD matters were put under the industry and labor division. In 1937 this unified industry and labor division was separated and independent labor and independent industry division were emerged. Newly born labor division took the responsibility of PWD matters. Department of labor was further segmented in 1946 in two parts (1) Department of Works, Mines & Power (2) Department of Labor. Department of works mines and power had emerged as the leader of the government works. Major avenues of the department of works mines and power were:

- Construction and maintenance of government buildings
- Construction of district collectorates and estate office
- Irrigation
- Power
- Navigation
- Communication
- Mining
- Petrol and lubricants
- Electricity
- Bridge, culvert
- Cannel and river digging
- River jetties

2.5 Role of PWD 1947 - 1972

Present public works department was known as CBI (Communication, Building and Irrigation) department up to 1959. All matters of communication, irrigation and electricity along with buildings were under this CBI department. In 1959 this CBI department was divided in two parts (1) WAPDA (Water and Power Development Authority) (2) C & B (Communication & Building). C & B was entrusted with the construction of building, road, bridge, culvert and their maintenance. In 1963 , C & B was further divided and all communication matters were put under the newly born R&T department and building matters were taken by the other department - PWD. PWD was entrusted with the construction and maintenance of all govt. buildings, structures other than Postal and T&T. In Bangladesh the then East Pakistan there were two separate agencies to do the same nature of jobs. one was CPWD (central public works department) and the

other was the Building Directorate. CPWD was headed by an Addl. Chief Engineer and was responsible for the central government structures. Building directorate of the provincial government entrusted with the construction and maintenance of all provincial government structures. Major duties of the building directorate and CPWD were :

- Construction and maintenance of all central government buildings
- Construction and maintenance of all provincial government buildings
- Educational institutions
- Food godown
- Health infrastructures
- Home affairs
- District court
- Central and district jails
- Sports infrastructures
- Cyclone centers

2.6 Role of PWD 1972 - 1984

After the liberation of independent Bangladesh in 1971 the country inherited with two separate organizations for the construction and maintenance of government buildings: the central public works department and the building directorate. These two entities were merged into one department in 1977 to form the present public works department. After liberation a new department named MES (Military Engineering Service) was formed to do all works of the army navy and airforce. All building construction works other than the T&T, Postal and Military were being done by the PWD. Major heads of works were :

- Construction of all government buildings
- Maintenance of all government buildings
- Maintenance of parks
- Health infrastructures
- Educational infrastructures
- Sports infrastructures
- Food godown
- District court
- District and central jail
- Government employees residents

2.7 Role of PWD 1984 - 1995

Work volume of public works department reduced remarkable at this time due to the creation of some independent construction cells by different ministries. Some ministries started awarding private consultants to do a handsome part of their work contents. Facilities department of the education ministry in 1986 started construction of educational infrastructures. CMMU of the health ministry took major part of the health sector in 1995. Construction cell of the sports ministry The National Sports Council started construction of sports fields, stadiums, sports villages from 1988. The food ministry, fisheries and livestock ministry started hiring the private consultants to their part of jobs. Works that related to the BDR had been taken by the MES. PWD lost its multi diversified works entities and started becoming a specialized building construction agency. Major avenues of PWD were:

- Construction of all government buildings
- Maintenance of all government buildings
- Maintenance of parks
- Part of health infrastructures
- District court
- District and central jail
- Government employees residents

2.8 Present role of PWD

Public works department now the only specialized building construction and regulatory department. It is the leader in the infrastructure development and acting as the technical advisor of the government. Divisional office of PWD is the part of the government five core offices at district level with the office of the deputy commissioner, district judge, civil surgeon and police super. Major responsibilities of PWD are :

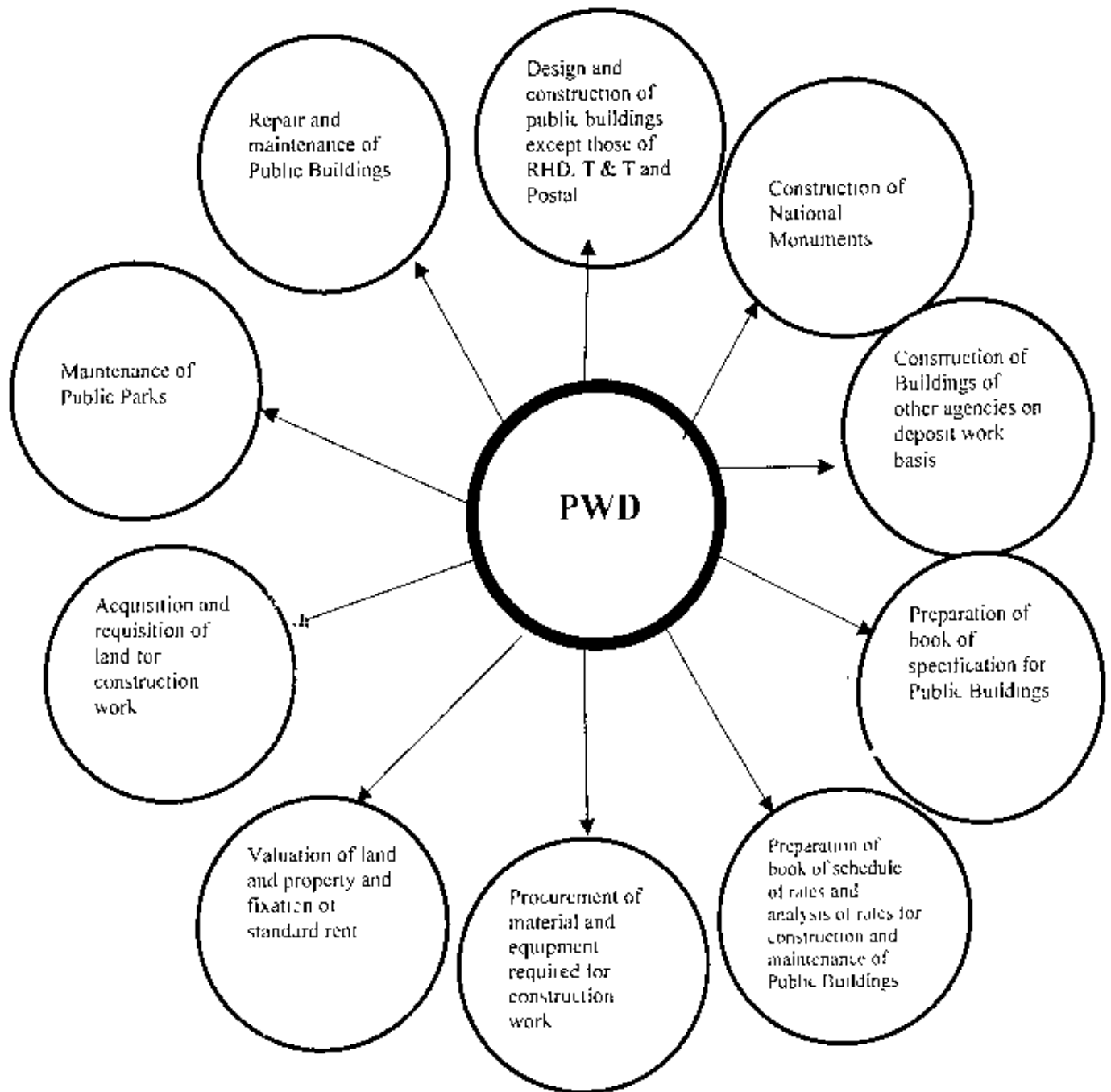
- Construction and maintenance of govt buildings
- Maintenance of monuments
- Maintenance of parks
- Preparation of rates of schedule
- Housing policy making

2.9 Allocation of business & role of PWD in national construction activities

The contribution by the PWD encompasses the entire spectrum of physical and social infrastructure for national development, national security and international relations. Its activities span throughout the length and breadth of the country including remote inaccessible areas and difficult terrenes.

Government of the People's Republic of Bangladesh has an allocation of business among the ministries and divisions oftenly termed as Rules of Business that is revised up to August'2000 contains directives of the govt. in respect to duties and functions. An inter ministerial meeting on 19.09.2001 decided to amend the aforesaid rules of business. According to the decision duties & functions of PWD changed as " construction and maintenance of public works and buildings except those otherwise specifically allocated to other agencies". PWD is trying to keep it's present status. The schedule I of the Rules of Business, 1996 illustrate the following functions to be performed by PWD under the MOHPW.

- Design and construction of public buildings except those of RHD T&T, Postal.
- Construction of National Monuments
- Construction of Buildings for other agencies on deposit work basis.
- Preparation of Book of Specification and Code of Practice for PWD.
- Preparation of Schedule of Rates and Analysis of Rates for construction and maintenance of govt. buildings and structures.
- Procurement of materials & equipment's required for construction work
- Valuation of land and property and fixation of Standard Rent
- Acquisition and Requisition of land for govt. projects.
- Maintenance of Parks
- Repair and Maintenance of govt. buildings



Eg. What PWD Does

The responsibility that has been bestowed upon PWD surely reflects one fact that the department as the prime construction agency of the government. It is however true that these trust and dependency was not gained over days. It is over centuries. Over the years, PWD has gained rich experience in wide ranging fields. It has an excellent track record for quality, cost effectiveness and speed, well documented standards, specifications, design practices, costing systems and contract documents, application of procedures which ensure proper utilization of public funds and total accountability and appropriate methods & techniques to keep pace with the state-of-the-art technology in construction. With commendable performance over the years PWD is still the biggest and experienced construction department, which is capable of facing any challenges in respect of construction activities nationally. However as per rules of business PWD has been assigned with maintenance and repair works of govt. buildings and it operates huge task throughout the country in a well-organized system.

2.10 Client Ministries of PWD

At present PWD is working as construction agencies of as many as twenty ministries of the Government of Bangladesh. These are :

- Ministry of Agriculture
- Ministry of Establishment
- Ministry of Education
- Ministry of Finance
- Ministry of Food
- Ministry of Fisheries and Live Stock
- Ministry of Foreign Affairs
- Ministry of Forest and Environment
- Ministry of Health
- Ministry of Home
- Ministry of Information
- Ministry of Jute
- Ministry of Labor and Manpower
- Ministry of Land

- Ministry of Planning
- Ministry of Religious Affairs
- Ministry of Social Welfare
- Ministry of Housing and Public Works
- Ministry of Women Affairs
- Ministry of Law, Justice and Parliamentary Affairs

2.11 Changes of PWD role 1900 -2003

The nature of jobs of PWD since its creation experienced a lot of changes. At the very beginning all most all sectors of engineering had been handled by PWD e.g. building, railway, water development, water supply, electricity, navigation, power, mining, military & others. By the passage of time PWD now reached to a specific sector in which it has had a lot of experiences i.e. construction and maintenance of building. In this time of specialization the experience of PWD in building construction is very significant and upholding its identity as a specialized building construction agency. Now specialized departments for specific jobs have been coming forward, like R & H for roads and bridges, WDB for dam & embankment, DESA for electricity, LGED for rural infrastructure development. Specialization came even in building construction like - Facilities Department is concern for educational institution, CMMU for health , MES for military & paramilitary. So we can say PWD is a specialized agency specifically in construction of government offices, residences, jails, district head quartars, police barracks, courts etc and their maintenance. PWD is also involved in the management of state and national programs. PWD becomes as a specialized building construction & maintenance department with the passage of time :

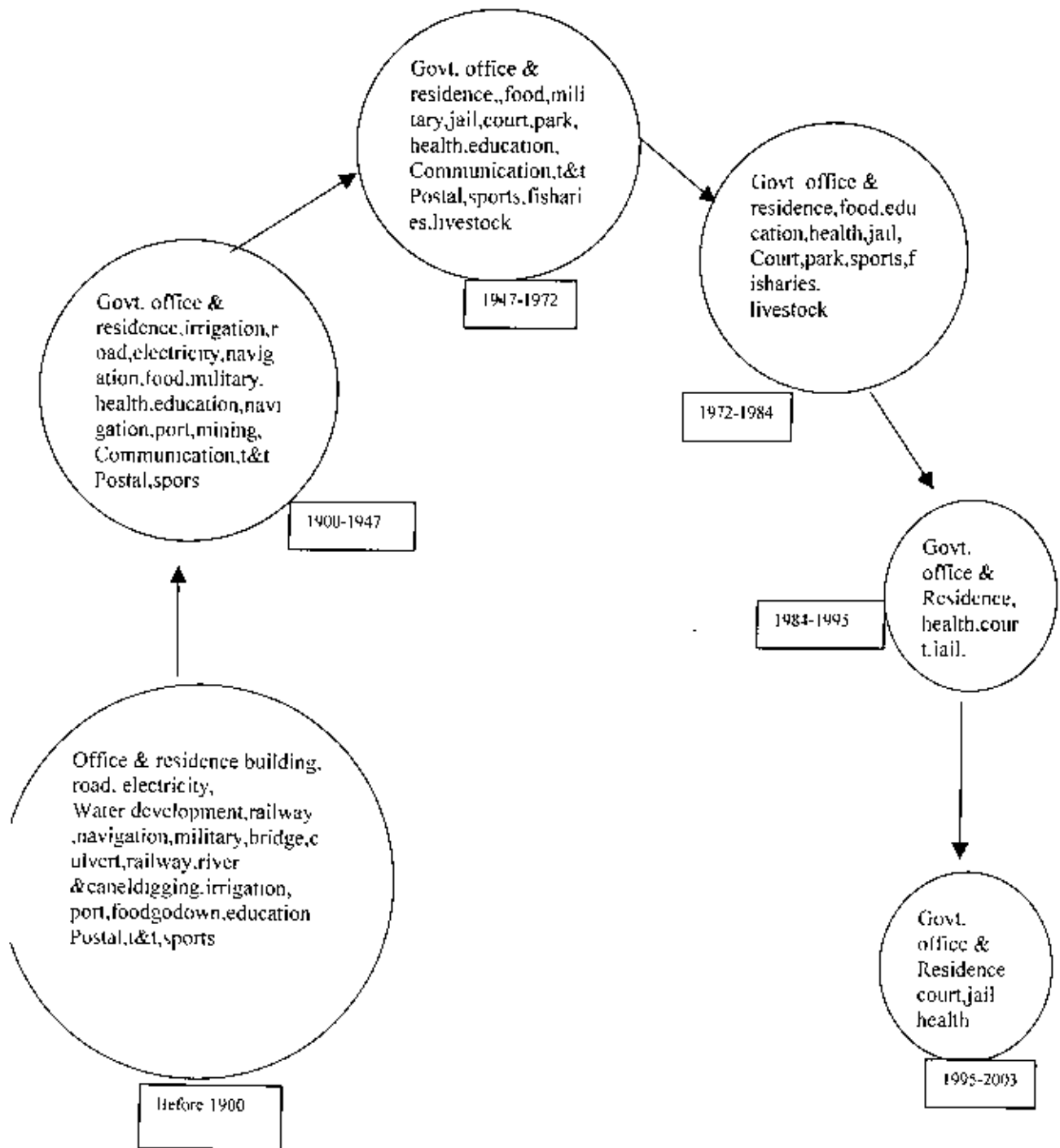


Fig - Role of PWD

2.13 Engineering Knowledge & Degree Required for PWD Engineers

Before 1900	1900-1947	1947-1972	1972-1983	1984- Today
<u>Civil Engineering</u> Major: Construction Tech. Structural Analysis Irrigation Highway Engg. Water Supply Sanitation Hydraulics Soil Engg. Electrical Engg. Mechanical Engg.	<u>Civil Engineering</u> Major: Construction Tech. Structural Analysis RCC Design Irrigation Highway Engg. Water Supply Sanitation Hydraulics Soil Engg. Electrical Engg. Mechanical Engg.	<u>Civil Engineering</u> Major: Construction Tech. Structural Analysis RCC Design Irrigation Highway Engg. Water Supply Sanitation Hydraulics Soil Engg. Electrical Engg. Mechanical Engg.	<u>Civil Engineering</u> Major: Construction Tech. Structural Analysis RCC Design Water Supply Sanitation Soil Engg. Computer Electrical Engg. Mechanical Engg.	<u>Civil Engineering</u> Major: Construction Tech. Structural Analysis Water Supply Sanitation Soil Engg. Others Auto CAD STAAD PRO Bangla (General) English(General) General Knowledge (Bangladesh Affairs) General Knowledge (International Affairs) Math & Applied Science (General) Electrical Engg. Mechanical Engg.

2.14 Chart : Employment Position of the Engineers

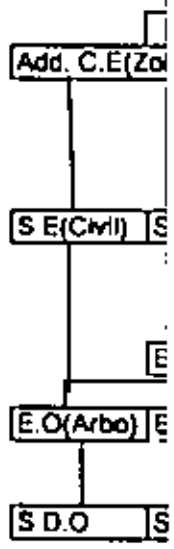
	Govt.	Industry Public sector	Teachi & R&D	Private	Overseas
40's 50's	CBI, Army	Jute Mills, Textile Mills	Engg. Colleges AEC, PCSIR	Bank, Industries	-
60's	PWD, C&B, R&H, T&T, Railway, WAPDA, BAIDP HE, Air Force, Navy, Army	EPIDC, Sector Corp Agro-based Industry	EPUET, EPAU Engg College AEC, PCSIR, Polytechnic	Bank, Industries Consultancie, Construction Self-employed	Education, Service sector Industry
70' 80's	PWD, C&B, R&H, T&T, Railway, W APDA, BAIDC, PH E, Air Force, Navy, Army, LGEB Food, PDB, WDB, PCA, CAP, BIWT A, BIWTC,	BSEC, BCIC, B SFIC, BJMC, B TMC, BFDC, B OGMC, Petrobangla Gas Field, Oil & Gass, Refinary	BUET, BAU, BIT, AEC, BC SIR, Textile Engg. College, college of Leather Tech, Polytechnic BIRI, BARI.	Bank, Industries Consultancie, Construction, Self- employed, Garment Industries, EPZ.	Education, Service Sector Industry, Software Industries, Teaching etc.
90's	PWD, C&B, R&H, T&T, Railway, WAPDA, BAIDC, PHE, Air Force, Navy, Army, LGEB, Food, PDB, WDB, PCA, CAP, BIWT A, BIWTC, BCS REB, DESA, WASA, Agriculture, Bma n, etc	BSEC, BCIC, BSFIC, BJMC, BTMC, BFDC, BOGMC, Petrobangla Gas Field, Oil & Gas Refinary.	BUET, BAU, BIT, AEC, BCSIR, Textile Engg College, college of Leather Tech., Polytechnic, BIRI BARI	Bank, Industries. Consultancie Construction Self- employed, Garment Industries, EPZ, Insurance, Real Estate	Education, Service sector Industry, Software Industries, Teach ing etc

Ref : Dev. of engg education in BD, by Dr. Golam Mohiuddin & Dr. Musharrif Jussain Khan

2.15 Organizational Set Up:

PWD is headed by the Chief Engineer who is supported at the head quarter by 3 Additional Chief Engineer (Civil), 1 Additional Chief Engineer (Elect./Mech.), 10 Superintending Engineers, 18 Executive Engineers, 44 Assistant Engineers and 40 Sub-Assistant Engineers .

There is one legal adviser to advise Chief Engineer in legal matters. PWD has field offices spread all over the country. Field offices are divided into Civil working units and Electrical/ Mechanical(E/M) working units. In the field there are four zonal Additional Chief Engineers in four Divisional Head Quarters under whom there are 22 Superintending Engineers, 107 Executive Engineers, 277 Sub-Divisional Engineers, 168 Assistant Engineers and 1307 Sub-Assistant Engineers in the field both for civil and E/M works. Present organizational set-up and a summary of manpower in PWD as shown in the next pages :



A

S

2.15.2

Present Management Of PWD	
Chief Engineer	1
Additional Chief Engineer	8
Superintending Engineer	32
Executive Engineer	125
Sub-Divisional Engineer	255
Assistant Engineer	168
Sub-Assistant Engineer	1347
Legal Adviser	1
Executive Officer (Arboriculture)	6
Sub-Divisional Officer (Arboriculture)	6
Chief Accounts Officer	1
Administrative officer	5
Welfare officer	1
Other class III/ class IV staff	15065

With this contingent of skilled manpower and experienced engineers PWD operates through out the length and breadth of the country. Unlike many other departments, PWD enjoys cheque-issuing authority (exercised by the executive engineer) as a legacy of long standing convention. Assigned with specific charter of duties the officers at different level work under a chain of command and participate in nation building. The set up at the Divisional level, District level and Upa- Zilla Level has been shown in Figure-1, Figure-2, and Figure-3 below.

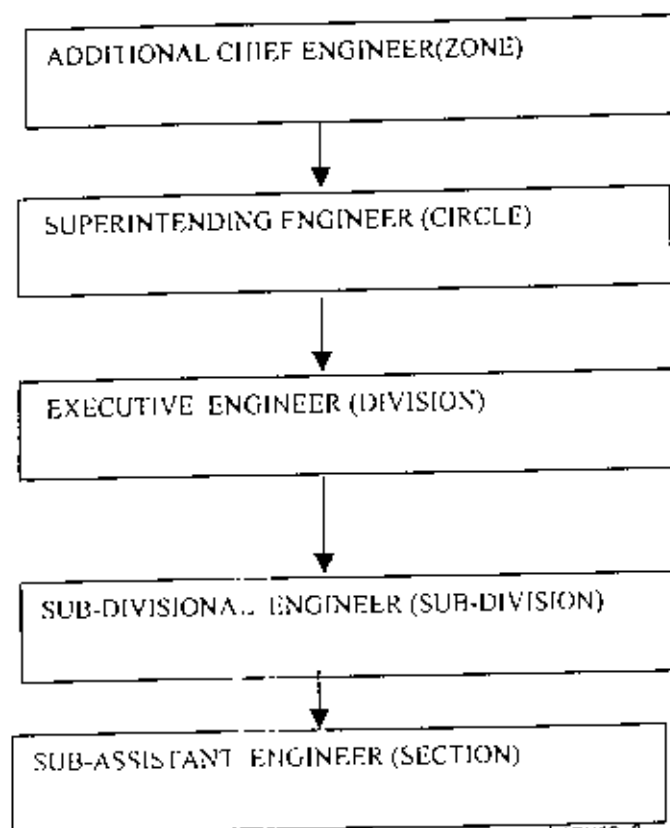
SET-UP IN DIVISIONAL LEVEL:

Figure-1

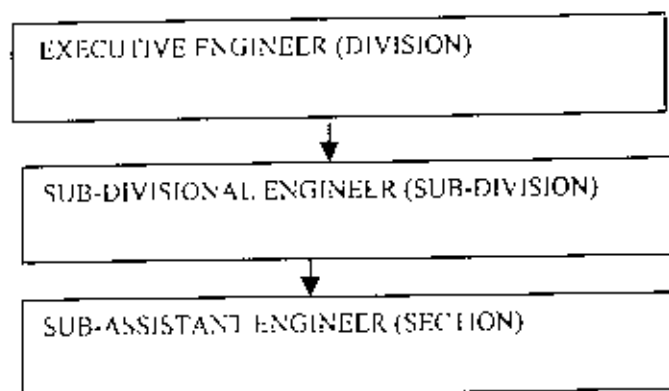
SET-UP IN DISTRICT LEVEL:

Figure-2

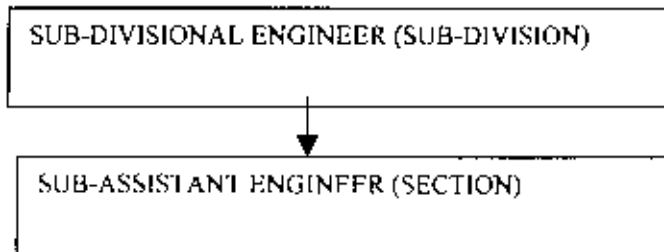
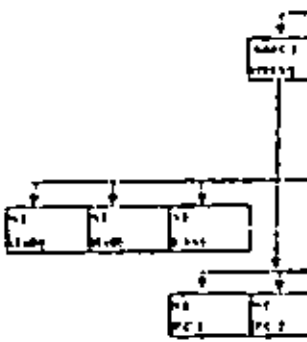
SET-UP IN SUB-DIVISIONAL LEVEL:

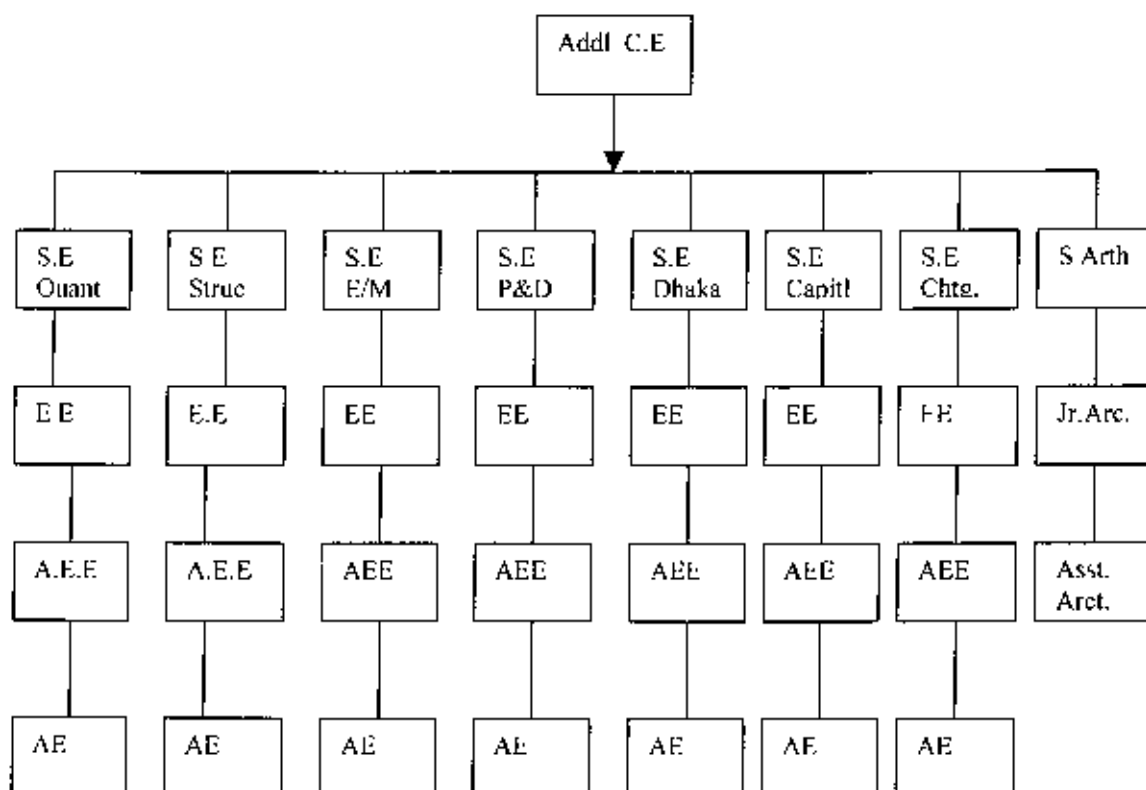
Fig-3

2.15.3 Management Strength of PWD (1977 – 1984)

Chief Engineer	1
Addl. Chief Engineer	3
Addl. Chief Architect	1
Dy. Chief Engineer	3
Dy. Chief Architect	4
Superintending Engineer	32
Executive Engineer	101
SDE/Asstt. Engineer	364
Others Class-I	15
Class-II	4
Class-III	3431
Class – IV	1473
Total	5432



2.15.5 Top Management of BPWD (1971-77)



2.15.6 Management of BPWD(1971-77)

Addl. Chief Engineer	1
Senior Architect	1
Superintending Engineer	7
Executive Engineer	22
Asstt. Executive Engineer	17
Junior Architect	5
Asstt. Engineer	20

2.15.7

Management of Building Directorate(1971-77)

C.E	1
Addl. C.E	1
Addl. C.A	1
Dy. C.E	2
Dy. C.A	3
S.E	15
A.C.E	3
A.C.A	2
E.E	52
Town planer	1
Asst. Town Planer	1
A.E	200
A.A	9

2.15.8

Changes of Top Management of PWD 1971-2003

Post	1971-1977	1977-1984	1984-today
C.E	1	1	1
Addl. C.E	2	3	8
Addl C.A	2	1	-
Dy. C.E	2	3	-
Dy. C.A	3	4	-
S.E	21	32	32
A.C.E	20	-	-
E.E	74	101	125
A.E.E	17	-	-
S.D.E	-	144	255
A.E	220	220	168
A.A/Town Planner	16	20	-

2.16 Changes of Financial Power of the Engineers of PWD for Works

SL. NO	Item of Works	Designation of the Officer	Financial Power (Lac Taka)		
			1977 to 1982	1982 to 1994	1994 to 2003
	Technical Sanction (Development works)	Chief Engineer	Full	Full	Full
		Addl. Chief Engr.	Nil	Full	Full
		Supdt. Engr.	5	25	25
		Executive Engr.	0.50	1.0	5.0
	Technical Sanction (Repair works)	Chief Engineer	Full	Full	Full
		Addl. Chief Engr.	Nil	Full	Full
		Supdt. Engr.	5.0	25.0	25.0
		Executive Engr.	0.50	1.0	5.0
	Administrative Approval	Chief Engineer	0.20	5.0	5.0
		Addl. Chief Engr.	Nil	5.0	5.0
		Supdt. Engr.	0.05	1.0	1.0
		Executive Engr.	0.01	0.10	0.10
	Acceptance of Tender (Original)	Chief Engineer	Full	Full	Full
		Addl. Chief Engr.	Nil	Full	Full
		Supdt. Engr.	Full	Full	Full
		Executive Engr.	5.0	10.0	10.0
	Acceptance of Tender (Repair)	Chief Engineer	Full	Full	Full
		Addl. Chief Engr.	Nil	Full	Full
		Supdt. Engr.	Full	Full	Full
		Executive Engr.	5.0	10.0	10.0

2.17 Changes of Financial Power of the Engineers of PWD for Disposal of Stores

Sl. NO	Item of Works	Designation of the Officer	Financial Power (Lakh Taka)		
			1977 to 1982 (Lac Taka)	1982 to 2001 (Lac Taka)	2001 to 2003 (Lac Taka)
	Write off of irrecoverable value of stores of public money other than those caused by fraud or negligence of individuals	Chief Engineer	0.10	1.0	1.0
		Addl. Chief Engr.	Nil	1.0	1.0
		Supdt. Engr.	Nil	0.25	0.25
		Executive Engr.	Nil	Nil	Nil
	Dismantling and selling of unserviceable building	Chief Engineer	Nil	1.0	Nil
		Addl. Chief Engr.	Nil	0.50	Nil
		Supdt. Engr.	Nil	0.25	Nil
		Executive Engr.	Nil	Nil	Nil
	Declaring stores unserviceable	Chief Engineer	0.50	1.0	3.0
		Addl. Chief Engr.	Nil	0.50	3.0
		Supdt. Engr.	Nil	0.25	0.50
		Executive Engr.	Nil	0.05	0.30
	Sale of unserviceable surplus materials	Chief Engineer	Full	Full	Full
		Addl. Chief Engr.	Nil	Full	Full
		Supdt. Engr.	Nil	0.50	0.50
		Executive Engr.	Nil	0.10	0.25
	Loss on due to depreciation of stock	Chief Engineer	0.20	0.20	0.20
		Addl. Chief Engr.	Nil	0.20	0.20
		Supdt. Engr.	0.10	0.10	0.10
		Executive Engr.	Nil	Nil	Nil
	Loss due to fraud or negligence	Chief Engineer	Nil	0.10	0.30
		Addl. Chief Engr.	Nil	0.05	0.30
		Supdt. Engr.	0.01	0.05	0.10
		Executive Engr.	Nil	Nil	0.05
	Purchase of contingency and office equipment	Chief Engineer	0.02	0.10	0.15
		Addl. Chief Engr.	Nil	0.02	0.15
		Supdt. Engr.	Nil	0.01	0.10
		Executive Engr.	Nil	0.005	0.05
	Petty purchase related of works	Chief Engineer	Nil	Nil	Nil
		Addl. Chief Engr.	Nil	Nil	Nil
		Supdt. Engr.	Nil	Nil	Nil
		Executive Engr.	0.005	0.05	0.50

2.18 Revenue/Development/Building Maintenance Budget of PWD

Year	Revenue Budget (Lac Taka)	Development Budget (Lac Taka)	Budget for Building Maintenance (Crore Taka)
1991-92	14808.33	1565.61	70.76
1992-93	18501.06	2225.40	77.36
1993-94	18664.97	2278.06	76.83
1994-95	19296.91	4910.12	75.23
1995-96	20037.80	5150.48	80.34
1996-97	21224.65	4269.75	88.85
1997-98	20494.84	25629.96	79.44
1998-99	21426.87	31134.78	84.87
1999-00	23710.67	42478.77	95.78
2000-01	25607.27	41934.77	97.16
2001-02	27262.05	48510.58	92.74
2002-03	29253.76	24424.26	138.0

CHAPTER-3

3.1 Development of Technology

Public works department started its journey in 1849 in this sub-continent. Industrial revolution in Europe that started in the 18th centuries had played the main role to adopted technologies regarding construction. Use of improved and durable building materials started by PWD in the industrial age. From it's creation public works department passed industrial age and now passing through information age. Hardware and software part of technology have got its pace time to time. After invention of computer and its use by PWD a new dimension in designing, more cost effective, safe and complicated structure has started. Technological advancement in construction field and their effective use by public works department can be discussed as that taken place at "Industrial Age" and "Information Age"

3.1.1 Industrial Age: PWD started its journey at the industrial age and civil engineering flourished much at this stage. Improved building materials such as brick, Stone, cement, lime, steel, RCC, etc were used. The invention of mixture machine, vibrator for proper compaction of concrete, rotary drill for soil excavation, cranes, power hammer etc. gave a good pace to the progress of the construction technology. The humnware was also developed to cope with the new technologies of improved hardware. PWD got a large group of skilled manpower that could handle the new instruments and new technologies. Started working with the foreign experts' skilled humnware developed and modern building materials and construction technologies introduced in PWD. The infoware was also developed much at this stage. Invention of scientific theories regarding concrete structure, pre-stressed concrete structures, pre-cast concrete structures, steel structures, composite structures, folded plate and shell structures and many more and their application in design and construction purposes of public works department's projects contributed remarkably to get more cost effective and durable building technology. The orgaware also evolved accordingly. Formal organization was set up for research, design and construction. The intoware got a chance to become richer with the support from the orgaware. If given a closer look at this stage, it found that humnware had a very important role to play both in the design and construction. The hardware and other two parts of the software provided good support.

3.1.2 Information Age: The Modern age belongs to the age of information technology. With the invention and development of computer, a drastic change has taken place in all the discipline of applied and pure science and civil engineering construction is also not out of that fever. At this stage much improvement have taken place in the entire sector where computer plays a very important role. PWD is now using computer controlled equipment in the construction sector like computerized concrete mixing plant where the mix proportion of the various ingredients of concrete is controlled by computer and humnware has much less to do. The machine also does the mixing and the mixed concrete is conveyed by a mechanized way. The building materials have also been changed. The traditional materials are being replaced with modern materials. There are chemical admixtures to add with the concrete. These admixtures allow the concrete to be workable with a very small water cement ratio and hence a very high strength concrete which reduces the cost of construction considerably. Similarly chemical compounds are being used instead of traditional lime terracing to make the roofs water scaled. At this age, environment is getting preference at all sector. As a result, environment friendly construction materials are being invented and used. Plastic doors and other appliances are becoming popular as it helps in saving the trees to be used in those cases. Steel shuttering materials are also being used in PWD in place of wood and bamboo.

Significant changes have taken place in the infoware part. New theories have been evolved which need computer intervention to work with. Various computer program are being used now for design and drafting. Considerable change has also been taken in the design concept keeping pace with the introduction of new model computers. The place of drafting table and parallel bar has been occupied by computer software like Auto CAD. Now the edition of drawings is very easy and one can change a drawing with the click of the mouse. The structural designers of PWD are now much relieved as computer program like STAAD-III /STAAD Pro is able to analyze three-dimensional frame with various combination of loading. Not only that the complete design with shear force and bending moment diagram is also available from the out put of such program. The information technology has changed the traditional thinking of public works department. PWD has introduced it's own website information's regarding PWD are available and open to all. Anyone can have an access to the web site and know about the activities of PWD, rules of business, charter of duty e.t.c with the click of the mouse. All-important tender documents are now given to the Internet and interested contractors could get the necessary informations without facing any hassle. Monthly publication of Public Works Engineers Association News Bulletin is also available at the web site. Local Area Network (LAN) has established with the computers of it's head quaratar. "Intranet" system is underway to establish in PWD, so that all field offices in the district level could come under with a direct communication network with the head quaratar. Personal information, field of expertise, educational qualification e.t.c

of PWD engineers are being prepared and ready to published through website so that local and foreign firms could get the consultancy services from PWD experts. More over intense computer and IT training program have taken and going on for the PWD officials with the aim of introducing computer and information technology at all levels and to acquire its benefits so that PWD could cope with the new challenges.

3.2 Construction Technology used by PWD upto 1900

Industrial revolution that started in the 18th century in Europe, led to the flourishing of construction technology by providing cost effective and durable building materials. Semi modern building technologies came in this region through the British ruler. At the tenure of Lord Dalhousi massive infrastructure development program were executed by constructing roads, bridges, culverts, offices, residences. To facilitate revenue collection and strengthen administrative control ,court building, jail, district collectorates, police stations were established. To increase food production water management and irrigation was also started. Technologies used by PWD were mainly :

- Lime concrete structure
- Load bearing foundation
- 20"/30" thick or more superstructure
- Ribbed slab
- Steel column and beam
- Brick facing wall
- Smaller size brick
- Use of earthen tali
- Wooden structure
- Brick pavement
- 20' or more room height
- One storied to two storied building
- Arched door, window, bridge
- Corrugated sheet culvert
- Earthen road

3.3 Construction Technology used by PWD, 1900 - 1950

Construction technology developed and expanded remarkably at this period. Many theories, formulae, assumptions were evolved which helped construction of more economical and safe structures. Modern construction materials started using like cement, steel bar. Use of machines and limited automation brought new dimension in

the construction industry. Time and cost both reduced significantly. Use of abacus for numerical calculations also started this time. Technologies of this time were mainly :

- Cement mortar
- Lime mortar
- Use of steel bar for reinforcing
- Rigid pavement
- Macadam roads
- Brick pavement
- Brick spar, groans
- Earthen embankment
- R.C column and beam
- Steel joist as beam and column
- Steel bridge
- Brick spars and groans
- Brick culvert
- Load bearing wall foundation
- One to five storied building

3.4 Construction Technology used by PWD, 1950 - 2000

Massive changes in the construction industry had experienced by PWD. Sophistication of humnware and hardware part of the technology was made. Development of scientific knowledge introduced more sophisticated and hi-tec technology in the construction field. Mechanization and hard automation influenced construction technology. With a result more speedy concrete mixing machine, power full vibrator, hydraulic pile driving equipment, more reliable sub-soil investigating machines and many others introduced in construction field. Invention of high strength steel, chemical admixture, water sealing agent, sub-soil confining powder, roofing compound etc turned the conventional scenario of technology and it's application. Introduction of computer made a massive change in the construction field. Public Works Department started using computer controlled mixing plant, which made it possible to control proportion of different ingredients. Auto CAD took the place of drawing table and computer based design software GEAR, GRASP, STAAD relief humnware from doing complicated and hazardous job. More reliable, safe design and authentic calculation was possible using these designs software and mainly wide uses of computer. Technology of this time were mainly:

- Introduction of hi-strength steel
- Introduction of hi-strength concrete

- Steel shattering
- Frame structure
- Raft / Mat foundation
- Pile foundation
- Hi - raised building
- Design software GEAR,GRASP,STAAD
- Drafting software Auto CAD
- Cofferdam
- Computer controlled mixing plant
- Belt conveying concrete
- Steel prop
- Fare face structure
- Earth quake resistance structure
- Aluminum fabrication
- Flat slab
- Introduction of fire fighting equipment
- Use of tiles
- Plastic door, window, water tank

3.5 Technology of this time

Significant changes have been under going due to the introduction of new model of computer and latest version of software. STAAD PRO have taken the place of former STAAD, Auto CAD 2002 are being used now. Technological life cycle is reducing remarkably. To cope with these changes all out computer and IT training program have taken. Officials of all levels of PWD are providing intense computer training. PWD introduced it's own website with an aim to open up information regarding it's activities, planning, work procedures, tender bidding, procurement, auction, supply. PWD also introduced LAN with the computers of it's headquarter. With a result any one can exchange information by the click of the mouse. Computers and specially LAN reduced paper work and helping in policymaking, auditing, monitoring, co-ordination, estimating, & human resource development. PWD is now publishing bidding information to its web site so that any one from anywhere without any hassle can get the necessary information. PWD is providing mobile telephone to its field officers at the SIDE level. So that frequent and uninterrupted communication is possible now and that helping smooth and quick implementation of the project.

3.6 Technology and Materials Changes 1900 - 2003

Up to 1900	1900-1950	1950-2000	2000- today
Lime Concrete	Cement Concrete	High Strength Concrete	High Strength Concrete
Load Bearing Wall	Lime Concrete	Concrete	Concrete
Shallow Foundation	Plain Steel Bar	Plain Cement Concrete	Plain Cement Concrete
Arch	Shallow Foundation	Concrete	Concrete
Steel Structure	Arch	Deformed bar	Deformed Bar
Steel Beam	RCC Column	High Strength Steel	High Strength Steel
Steel Column	RCC Beam	Deep Foundation	Deep Foundation
Ribbed Slab	RCC Slab	Mat/ Raft Foundation	Mat/ Raft Foundation
Small Size Brick	10"/20" Wall	Single Basement	Single Basement
20"/30" Wall	15'/20' Room Ht.	Pile Foundation	Pile Foundation
20' or more Room Ht.	Drawing Table	Frame Structure	Frame Structure
Wooden Beam	Sliding Roller	Flat Slab	Flat Slab
1 / 2 Storied Building	Manual Concrete Mixing	Admixture	Admixture
Brick Pavement	Bamboo/Wooden Shuttering	Pre-Stress Technology	Pre-Stress Technology
	Rigid Pavement	Auto Concrete Mixing	Auto Concrete Mixing
	3 / 4 Storied Building	Computer Controlled mixing plant	Computer Controlled mixing plant
	White Washing	Vibrator	Vibrator
	Earthen Embankment	Steel Shuttering	Steel Shuttering
		Belt Conveying Concrete	Belt Conveying Concrete
		Flexible Pavement	Concrete
		20 / 30 Storied Building	Flexible Pavement
		Drawing Table	20 / 30 Storied Building
		Calculator	Drawing Table
		Computer	Calculator
		Snow- Cem	Computer
		Distemper/ Plastic Paint	Snow- Cem
		Plastic Door,Window	Weather Coat
		Plastic Pipe	Distemper/ Plastic Paint
		Ceramic Tiles	Plastic
		Aluminum Fabrication	Door,Window
		Auto CAD	Plastic Pipe
		GFAR/GRASP	Ceramic Tiles
		STAAD	Aluminum Fabrication
		Telephone	Auto CAD
		Fax	GEAR/GRASP
			STAAD
			Telephone
			Fax

3.7 Application of IT

- Using design software's STAAD PRO, GEAR, and GRASP for design and analysis of normal and complicated high raised buildings.
- Using Auto CAD for drafting.
- Floating tenders with the Internet
- Commissioning LAN in the head quarter
- Commissioning own website
- Providing computers to all zones, circles & divisions.
- Computer controlled mixing plant.
- Keeping all information in the database.

3.8 Advantage of Technological Development in Construction Industry

There are tremendous influences of technological development in the field of civil engineering. PWD - the prime construction agency are being benefited by adopting these advanced technologies. Here some unique examples of the advantages of using hi-tech for a particular project: -

3.8.1 PWD is building 21-storied IDEB Bhaban at Kakrail, Dhaka. At the first phase, 4-storied academic Bhaban with 2-basement floor will be completed. Brief descriptions of the Project: -

- (I). Name :- Construction of IDEB central Bhaban (1st Phase)
- (II). Ministry :- M O H P W
- (III). Implementing Agency: - P W D

(IV).	Estimated Cost	:-	15.86 Crore
(V).	Plinth Area	:-	7402 Sq.-m
(VI)	Land	:-	0.7598 Acre

3.8.2 Structural design of the building has done by using design software STAAD-Pro. To design or analyze by STAAD Pro one need only to calculate load of different elements of a structure c: g load on column, beam, slab, foundation. There are options to select material properties (f_s , f_c , E_s , E_c , $f'c$) in STAAD Pro. Giving load input and choosing materials than by a click of the mouse one can get 2D and 3D analysis of structure, bending moment and shear force value and diagram of each component of the structure, deflection value, direction & diagram and design of column, beam, slab, and even amount of steel required for make the structure safe and economical. By changing one or more value of analysis one can get a quite new and all-out analysis and design with in a few hour. So numbers of options there to analyze a structure to select a right most design. Some unique advantage of STAAD Pro: -

- 2D modeling
- 3D modeling
- BM & SF value, diagram of each member of a structure
- Deflection diagram, direction and value.
- Window based easy operating system.
- Amount and size of steel required.
- Placement of steel.
- Simulation
- Time savings.

Study shows that to complete a structural design by STAAD pro rather than doing the same job traditionally as done manually using calculator, save time and money. It found that 16 working days were required to complete the structural design of IDEB Bhaban using STAAD pro. To do the same manually more or less 65 days would have to be need. 70% - 80% time was saved only by availing technological development of design software.

If this time savings is converted into monetary value we found a remarkable savings of cost. One SDE, One XEN, One SE, who were behind the structural design of IDFB bhaban

Table Showing Money Savings using STAAD PRO Software

Human Resource Savings:

Av. Daily salary of SE	TK 365 /-
Av. Daily salary of EE	TK 320 /-
Av. Daily salary of SDE	TK 253 / -
Total salary paid for design to SE,EE,SDE using STAAD PRO (16 days)	TK 15008 /-
If the same done manually salary will required (65 days)	TK 60970 /-
Money saved	75%
Time savings(working days)	49

3.8.3 Savings of Materials (Concrete & Cement): It is found that to design a tall structure like IDEB, Bhaban big size of column, beam etc, were need by using conventional technology and materials. To reduce size of the different components of structure, hence to reduce the cost, advantage of the development of construction technology and high strength materials have used.

Let's consider the case of basement column. Initially size of the column deigned as 50" x 50". When decision taken to reduce the size by applying developed technology i.e. admixture to increase concrete strength the size re-designed as 40" x 40". To do this i.e. to enhance concrete strength very sophisticated and hi-tech product concrete admixtures, Rebuild -1000 & Pozolith 322N used. These admixtures increase concrete workability and as a result concrete strength roses to 4500 psi which is normally 2500 psi- 3000 psi. Consequently this high strength concrete helped to reduce total volume of concrete. Concrete savings saved construction cost.

No. Of 50" x 50" size column at first basement	= 30
Av. height of the column	=15 ft
Volume of concrete of (50" x 50) size column	=7812.50 cft
Cost of 50" x 50" column	=TK1668187/00

Volume of concrete of (40" x 40") size column	= 4999.50 cft
Cost of 40" x 40" column	= TK1067714/00
Concrete saved	=2813 cft
Concrete cost saved	= TK600473/00
Ext. cost to make concrete 4500 psi	=TK59643/00
Net Cost saved	=TK540830/00
Percent saved	=32%

This savings only due to the development of technologies that used by PWD. Now. If the whole structure is considered the savings will be remarkable. So technological developments save money & time.

3.8.4 Savings on Reinforcement: In case of steel that used in this structure we find huge savings. Let's consider the steel used in foundation of the said building. High strength steel of 60 grade (415 MPa) has used in foundation, beam, column and other parts. But in normal case 40 grade steel is used. Advance technology required producing 60 grade steel, because carbon, sulphur, phosphorous content of this steels is to be maintained carefully. Only few steel industries having this hi-tech. Using 60 grade steel instead of 40 grade savings is about 30% of steel amount and hence 30% of cost. For an example of foundation (Raft foundation).

Total steel used	= 96 quintal
If 40 grade steel use, steel need	=125 quintal
Steel saved	=29 quintal
Unit cost of steel	=TK3302/ quintal
Cost of steel	=TK316992/00
Cost saved	=TK95758/00
Percent cost savings	= 30%

3.7.5 Design of reinforce concrete structures can be performed by either two alternative methods -WSD (working stress design) - that directs attention to stress conditions of the members under working load and USD (ultimate strength design) - focuses on the strength capacity of the member at conditions corresponding to failure. PWD is now following USD method. In implementation face of structure, designed by USD method,

good workmanship is very important. Materials properties, methods of concrete mixing, conveying, placing of concrete, compacting, curing, and e.t.c. all play vital role to avail the benefit of USD method. As we discuss earlier, PWD is using modern construction and material testing equipment -mixture machine, vibrator, belt conveyor, lift conveyor, earth excavator, bulldozer, grader, etc. Ultimate benefit of using USD is reduction of materials used, i.e. reduction of cost. Study made by PWD shows that huge savings reduce project cost remarkably. Here is the chart of savings: -

Table Showing Concrete and Steel savings Using USD Method

Member	Concrete Savings	Steel Savings
Slab	11%	21%
Rectangular Beam	-	26%
L - Beam	-	42%
Column	29%	20%
Footing	5%	29%
Pile Cape	-	22%
Mat Foundation	5%	20%
Pile	-	18%

Ref: Design of RCC members by WSD & USD methods
PWD 1998

It was said earlier that PWD is using modern hi-tech construction machines & equipment which help to reduce cost, time and ensuring quality. Here is another example how technological development helping reduction of cost.

3.8.6 As discussed earlier that IDEB Bhaban is a double basement hi-raised building with mat foundation. 20 feet deep excavation had been made and this bulk amount of curtailed earth were carried from site to a distance of 15 kilometer by modern Dumping Trnck. Push and Bucket Dozer were used for excavation of earth.

Here is an analysis of doing this job with modern technology and manually:

Quantity of excavated earth = 485000 cft

For excavating 100 cft of earth, labor required =18nos

For excavation 485000 cft of earth labor required =87300nos

Money need = TK6984000/00

For earth cutting 2 to 4 nos. of labor can work in an area of 100 sft

If 500 labor work a day time required =175 days

One excavator can excavate 4-5-thousand cft earth per day

Two excavators worked at the site

Time required for earth cutting by excavator = 54 days

Hire charge of excavator and others = TK 7000 - TK 9000 per day

Cost of earth cutting by excavator = TK 432000/00

Percent of cost savings due to earth cutting by excavator = 94%

Time saved = 69%

3.9 Technology of Hazard Minimization

Public Works Department is the prime construction agency in the country. It constructs low, medium and hi-raised residential, commercial, hospital and other buildings. It has been quite in almost all aspects of construction: from tall buildings in the capital to cyclone shelters in the remote offshore islands to national monuments, sports and recreational facilities as well as other complexes.

Activities of pwd are spread throughout the length and breadth of the country. Our country is geographically located in the earthquake prone area. Country is divided into three earthquake zones. Structures in the earth quake zone 3 having severe threat to earth quake damage. Fire, cyclone, flood can also cause catastrophe to the buildings. An unsafe x-ray room of a hospital may be cause of radiation spread out or an unplanned building may cause threat to the overall environment of the area. Public places like hall room, auditorium, mosque if not properly designed can cause aquatic problem. Different technologies are being used by PWD at the design stage and at the time of construction to minimize losses for any failure and also reduce the probability of failure.

3.9.1 Earth Quake

Based on the severity of the probable intensity of seismic ground motion and damages Bangladesh has been divided into three seismic zones i.e. zone 1, zone 2 & zone 3 with

zone 3 being the most severe. Here are names of the districts that have fallen under these zones:

Zone 3	Greater Sylhet, Bogra, Lalmonirhat, Brammanbaria
Zone 2	Greater Dhaka , Comilla, Chittagong, Rangpur, Dinajpur
Zone 1	Greater Khulna , Barishal, Jessore , Noakhali, Kustia

PWD is giving due emphasis on designing and constructing of an earthquake resist structure. It strictly follows Bangladesh National Building Code, ACI code to minimize the damage and hazard of probable quake. These are the measures and technologies followed by PWD at design stage and construction time:

- Strong column and weak beam
- Symmetric building plan
- 2D & 3D computer simulation
- Frame structure
- Rich concrete
- Raft foundation
- More spacious expansion joint
- No masonry building more than 40 to 50 feet height.
- Close stirrup placing at the joints
- Continuous lintel
- Close tie placing at the joints
- No un-reinforced masonry building in the seismic zone 3 & 2.

3.9.2 Environment

PWD is constructing nos. of structures – residential to commercial, hospital, police station, jail, monuments and many others. According to the Environmental Conservation Policy – 1995 and Environmental Conservation Act 1997 like other govt. and private agency PWD have to collect NOC (No objection certificate) from the ministry of forest and environment for construction of six storied or more height buildings. This NOC given with the condition that the structure will not be the potential threat to environment. Initial impact to the environmental is reported by preparing a report – IEE (Initial Environmental Examination). To prepare IEE things considered are:

Location: Location of the structure, whether it is located in forest, wet land, environmental protected area or disturbing eco system.

Construction: At the time of construction is structure creating any pollution to the air, water, soil, sound.

Operation: Liquid and solid waste producing by the users

Basis of these reports if the structure considered creating potential threat to the environment EIA (Environmental Impact Analysis) will have to done. For this impact analysis detail experiments are done - measuring effect on the water base line, location of the treatment plant, BOD, COD, TS, SS, turbidity, pH, odor, color, sulfur, Sox, Nox, CO₂, noise level. Structures are categorized according to their threat to the environment as:

Green: No threat to environment

Orange A: Imparting little threat to environment

Orange B: Imparting moderate threat to environment

Red: Imparting potential threat to environment

Public works department being a government organization violating environmental conservation act by not seeking permission from ministry of environment. No environmental assessment impact has so far made by PWD.

3.9.3 Fire

Structures like hospital, warehouse, tall building, public places are under threat of fire attack. New trend in our capital city is to build hi- raised building and PWD is not out of this fever. At the time of initiating a project extra arrangement for fire fighting is taken into account and also at the design stage minimization of fire hazard considered. Arrangements that are taken are:

- Fire hydrant.
- Fire extinguisher.
- Smoke detector
- Fire alarm
- Alternative outlet
- Wide and spacious stair
- Safe and quality electrical fittings.
- Automatic water springal.

3.9.4 Radiation

PWD construct and maintain hospitals and medical colleges. Most of the colleges have atomic medical center and hospitals have x-ray & atomic radiation treatment facilities. X-ray machines, cobalt machine and others that radiate Alpha, Beta or Gamma rays may cause health hazard if radiation come outside. Some rays are so dangerous may cause

cancer. Some special arrangements are made by PWD to protect out coming of these rays:

- 24" – 30" thick brick wall
- 12" – 24" thick RCC wall
- More slab thickness
- Rich concrete
- Steel plate protection
- Rubber floor
- Single door and no window in room

3.9.5 Flood

We are very much familiar with flood hazards. All most every year millions of floodwater rolled over this land. This catastrophic flood causes huge losses to the humane life and properties. Considering this PWD follows some rules to minimize flood hazards. Usually followed rules are:

- Keeping P.L of building above HFL.
- Retaining wall
- Keeping records of HFL.

3.9.6 Cyclone

Our coastal districts face attacks of gusty wind, water upsurge, and high tide several times every year. PWD having experienced by constructing cyclone centers first in the country considering these catastrophe at the time of design as well as construction stages. New design software is being use for 3D simulation of extra ordinary wind pressure. Technologies used usually are:

- 3D-computer simulation for wind pressure.
- Rich concrete
- Frame structure
- No partition wall at the ground floor.

3.9.7 Salinity

Technology use to save damage of the structures from saline attack is:

- More concrete covering
- Rich concrete.

3.9.8 Sound

If proper treatments are not done to minimize sound pollution's especially for the public gathering places acoustic problems will must produce. Technology uses to minimize sound hazards are:

- More room height
- Maximum surface area
- Temporary or semi permanent roof
- Use of sound absorbing materials.

CHAPTER 4

Observations & Remarks : Organizational Management of PWD

4.1 Management Process

4.1.1 Planning: PWD has a strong planing cell headed by the Addl. Chief Engineer, Planing and Special Projects (P & SP). Two Circles, each headed by a superintending engineer, four executive engineer, eight sub-divisional engineer and related non-technical persons are working to set goals and finding methods of procedures to achieve the goals Chief Engineer is monitoring and guiding to have corrective actions for according in a systematic manner

4.1.2 Organizing : PWD is a well organized govt. regulatory department. PWD runs under govt. set rules & regulations. Allocation of jobs, authority, and responsibilities everything is well defined. Financial & administrative power, rules of expenditure, allocation of business, etc. are well described in the public works Accounts Code (A-Code) & public works Departmental Code (D-code), Book of Specification and Code of Practice.

4.1.3 Leading : Top management of PWD is doing this vital Job- is leading the department. Leaders here come according to their seniority and actually leading is the part of their designated duties . Like other government organizations in PWD leaders not born but comes through following pre-defined ways .There is a little chance, to influence and motivate employees by government made leader.

4.1.4 Controlling: There is government set performance measurement method for the govt. employees. Annual Confidential Report (A C R) for the gazetted officers and service book for non gazetted employees . In most of the cases this ACR & Service Book used as a tools for repression of the subordinates by the authority A strong controlling cell exists in PWD leaded by the Add. C E (Estab & Co-ordina), S. E (Establishment) & S.E (Co-ordination) are setting process & standard testing Job and measuring performance

4.2 Fayol's Principles of Management and PWD

Fayol's 14 principles of management are not all followed by PWD. Some of them are seen working well and some are not by PWD management :

- 1) PWD- not always deployed experts on their own field. In some cases experts get preferences to work in their field of expertise.
- 2) Authority is clear and distinct by govt. rules and regulations. Formal authority is given by the govt.
- 3) Lack of discipline, found likes other public organizations. Welfare association, trade unions, etc are somehow disrupting smooth operation of the organization.
- 4) Chain of command is clear and well defined.
- 5) Directions- all the time does not come from one boss.
- 6) Employees interest get more importance then the interest of the organization.
- 7) Compensations are not good at all like other govt., organization.
- 8) Power and authority is very much concentrated to the top-level management. Corruption's, delay and indiscipline found in many cases.
- 9) Hierarchy is clearly defined and well structured.
- 10) Employees are not in their Jobs and positions where they are suited.
- 11) Subordinates don't get equal judgment from their boss. Favoritism and nepotism, prevailing in PWD.
- 12) Employees enjoy a stable situation. A little chance of loosing job suddenly and without following lengthy and time-consuming legal procedures.
- 13) Employees are not given freedom to conceive and carry out their own plans

- 14) Scope of promotions, are limited and initiatives for boosting team spirit are not found.

4.3 PWD -McGregor's "X" type organization

According to Mc Gregor,s theory X and theory Y PWD is very much close to the assumptions of theory X .

- Employees don't do their job willingly.
- Coercion needed to motivate employees.
- Employees could be motivated by money or force .
- Employees don't relish work and eagerly approach work as there is on scope for develop one's own creative capacities.
- Work seems distasteful to the employees.

4.4 PWD Management - Consisting of "Tall Hierarchy "

Although trend in the recent years is to move toward flatter organizational hierarchies, PWD inherited 'tall hierarchy' like other government organization's structure. Due to having a tall organizational structure ,PWD is facing some problems regarding it's managerial processes:

- Speed of decision making is relatively slow.
- Relationships between employees at different levels are weak and sometimes no relations between top level and lower level of management .
- Long chain of command slows down decision making process.
- Too many levels between the highest and the lowest managers .
- Loosing Competitiveness as most of the decision take months even years.

- Creativity and knowledge of lower level managers have little scope to apply.
- Close monitoring by the top management not done.

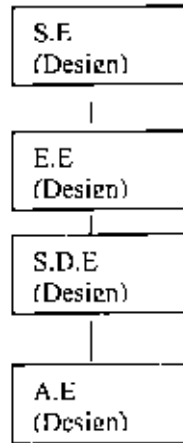
4.5 PWD - Functional Organization

We discussed earlier that every formal- organization has a structure. Organizational activities are divided, classified and entrusted according to the organization's structure. As a public enterprise organogram, charter of duties of employees, rules of business of PWD are all governed by the government. According to the types of organizational structure, pwd is very close to the type of a functional organization. Chief Engineer, PWD is the C E O or Top Authority / Manager, and Addl. C E, S.E, E E working in different Zones, Circles or Divisions are performing duties according to the functions set by the government.

Organization is divided by the functions from it's top to the bottom management. Add. C E (Establishment) Add. CE. (P&SP) SE(Co-ordination), SE (Development), and for all other positions charter of duties / functions of officers are clearly defined. .

4.6 Management style of PWD also follow " Product / market organization' characteristics:

Some parts of public works department are engaged in particular jobs. PWD design wings are doing structural designs & we can say design a product of PWD. So PWD is a product/ market type organization also Here is the management of design wing :



Product/Market Organization

There is also division by customer & division by geography. Health wing of PWD is only engaged in works of the health ministry and four zonal offices are serving for the concern local districts. Here are the management of PPC and Zones :

Addl C.E
PPC

S.E
PPC

E.E
PPC

S.D.E
PPC

A.E
PPC

Division by customer

Addl.C.E
Zone

S.E
Circle

E.E
Division

S.D.E
Sub-Div

A.E

Division by Geography

4.7 P W D ---- Formal Organization :-

PWD is a government regulatory department . Chief Engineer is the technical advisor of the government and Executive Engineers in the district level enjoy the status of Core Officer along with D.C , S P, D J, & C.S P W D is a formal organization because :-

- P W D has a hierarchical structure and guided by the govt. set rules and regulations.
- Have clear chain of command
- Rules of Business given PWD the formal authority .
- Relationships between members of P W D is formal.
- Clear descriptions of authority and responsibility have described in the "Account Code" & 'Departmental Code'.
- Executive Engineers d in the working divisions reserve the power of drawing & disbursement (D. D Power) of govt. exchequer.

4.8 Changes Of Management Time To Time To Cope With The Changing Situations.

4.8.1 Significant changes made by Combining Central Engineer Service (BPWD) and Bangladesh Engineers Service (Building directorate) together in 1977 as Public Works Department :-

1. Post of the Chief Engineer (Building) converted as Chief Engineer PWD.
2. One more post of Addl. Chief Engineer introduced and made it 3.
3. One more post of Deputy Chief Engineer introduced to make it 3.
4. 10 new circles created and consequently 10 more post of Superintending Engineer created and made it 32.

5. Post of 3 Asstt Chief Engineer abolished.
6. 32 new posts for the Executive Engineer introduced
7. Post of Asstt. Executive Engineer abolished.
8. Post for the Sub-divisional Engineer introduced newly and put them under direct control of the Executive Engineer.
9. Combined post of Sub-divisional Engineer & Asstt Engineer had made as 364, which was Asstt Engineer-200 and Asstt Executive Engineer-17. before.
10. Post of the Chief Architect, Govt. of Bangladesh abolished. Considering the directorate of architect as a special wing of PWD headed by an Addl. Chief Architect under administrative control of C E, PWD.

4.9 Significant Changes made in organizational Management by the Enam Committee Re-organization in 1984.

1. Four zones - Dhaka, Khulna, Chittagong & Rajshahi had been established. Each headed by an Addl. Chief Engineer - who is the administrative chief of that zone and enjoy the concurrent power of the chief engineer.
2. Circle's which are headed by the Superintending Engineers have come under zonal administrative control.
3. Post of 3 Dy. Chief Engineer abolished.
4. Post of Executive Engineers have increased from 101 to 125.
5. Post of Town Planner and Asstt. Town Planners had abolished
6. Directorate of Architecture, which was under administrative control of Chief Engineer PWD have isolated and emerged as an independent department.
7. Status of S D E and A E post, made changed and S D E Post given higher rank but before that both S D E & A E were the same rank. This was done, to make PWD managerial tire similar with the managerial tire of other cadre.

8. Resource divisions at Chittagong & Khulna had come under operational control of concern zone.
9. Total post of S D E plus A E have been increased from 304 to 423, where 255 given to the S D E and 168 for the A E
10. Six tier of managerial system introduced.

4.10 Some Remarkable Short Coming of Enam Committee's Reorganization

1) PWD lost its control over Directorate of Architecture. It found in many cases that delaying completion, starting of the development projects are due to not getting architectural drawings in time. As because, Department of Architecture became independent, PWD can only request for the drawings. PWD have been answering to the requiring bodies for implementation, delaying. Requiring authorities know PWD as the sole executing authority and get PWD only in the field. PWD can't take any administrative action for not getting drawings from the Department of Architect. This situation is jamming the smooth starting and completion of a project.

2) 168 posts for the Assistant Engineers, are not sufficient enough, because its immediate upper Post S D E is 425, which is much more than that. But in normal case lower level Posts are more than upper level. This abnormality creating problems -

- Recruitment of Assistant Engineers are comparatively few than other cadre.
- Assistant Engineers are holding the current charges of Sub-Divisional Engineers.
- Sub-Assistant Engineers are holding current charges of Assistant Engineers.

4.11 Organizational Behavior and Present Situation in PWD

- (1) Absenteeism of the PWD's employees is alarming. Flow of work is being disrupted and important decisions are being delayed due to the irregular and late present at the working place.
- (2) Like other government organization PWD has no effective tools to measure employees efficiency, productivity, performance. As a result overall performance of the department is decreasing day by day.
- (3) Attitude of the employees toward job satisfaction is negative. Employees believed to receive very poor remuneration.
- (4) Employees' commitment to their organization is weak. Most of the employees have little idea about organization goal.
- (5) Halo Effect is very much prominent in the department. Employee are judged on the basis of loyalty, obedience, adulation rather considering their knowledge, intelligence, skill, professionalism, discipline.
- (6) Members of PWD are less motivated to the organizational development. They seen very much keen to achieve personal benefit. Due to failure of the leadership intensity, direction and persistence of efforts of the employee toward attaining organizational goal is found poor.
- (7) No existence of Quality Circle in PWD. There is no scope of sharing areas of responsibilities. Problems are solved by the administrative actions. Most of the case decisions are not taken by making comprehensive discussion with the experts. In PWD bosses run things and employee do.
- (8) Chain Communication followed in PWD. No one can communicate directly to the chief executive by passing his immediate boss. Strong chain of command exists.
- (9) Letter is still main communication medium. Telephone, circular, bulletin are also used. Recently fax-mail I.A.N, are coming into use.

- (10) Management of PWD enjoy legitimate power as it is a formal organization and having a clear hierarchy. Leadership comes here following pre-defined seniority and hierarchy. To establish a visionary leadership no efforts are seen to be taken. Organization runs through government set rules and regulations.
- (11) Performance evaluation system is backdated and unscientific. Those receive favorable evaluation that keeps good relation with their Boss. Most of the time boss uses it as a means of repression.
- (12) Organizational politics in PWD is hampering smooth running and also polluting internal environment. Reduction of resources, unclear evaluation system, limited scope of promotion, is encouraging staffs to engage in politics.
- (13) Impression Management techniques are found to be followed for personal gain, promotion, posting, power. Employees are engaged in flattery activities to gain top management favor rather than improving performance and do the job accordingly
- (14) PWD is a highly centralized organization. Most of the time top management make all the decisions and lower level just carry out.
- (15) Numbers of Collective Bargaining Agencies (CBA) are active here. These unions are influencing recruitment, promotion, posting, fund allotment, tender bidding, supply, purchase, job design, and policy making. They are making anarchy by making procession, chanting slogans, holding meeting at office hour and office premises. Union leaders usually do not come to their office and bound others to follow them. They are found to engaged in activities for personal interest.

CHAPTER 5

Observations & Remarks: Technological Development and PWD

5.1 Some Important Building Materials and Technologies of Industrial Age

- Brick
- Stone
- Lime
- Steel
- Cement mortar
- Lime mortar
- Cement concrete
- Lime concrete
- Reinforced cement concrete
- Load bearing wall foundation
- Arch
- Wooden pile
- Wooden door, window
- Steel joist
- Mixture machine
- Vibrator
- Truss
- Plastering
- Round pan
- 10"/15"/20"/more thick wall
- 10"/15"/more room height

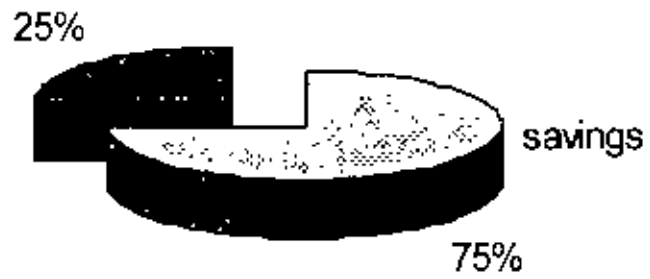
5.2 Some Important Building Materials and Technologies of Information Age

- High strength steel
- High strength concrete
- Concrete hollow block
- Mat/Raft foundation
- High raised building
- Pre cast/Cast in situ piling
- Aluminum door, window
- Plastic door, window
- Steel shattering
- Computer controlled mixing plant
- Belt conveyed concrete
- Chemical admixture
- Ceramics tiles
- Computer software's for design and analysis purpose
- Auto CAD for drafting
- Weather coat
- Snowcem

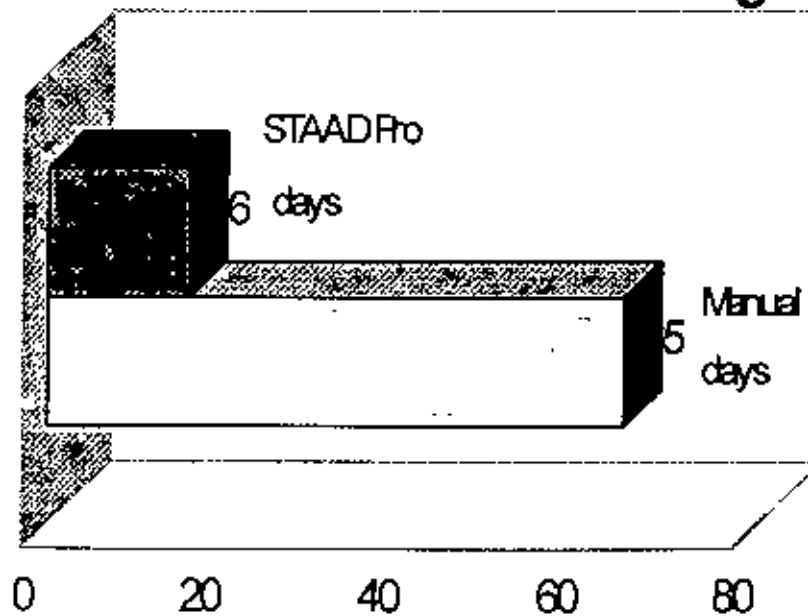
5.3 Table showing technology followed and provision taken by PWD to protect / minimize different hazards:

Earth quake	Frame structure, mat foundation, close placement of stirrup and tie, strong column & weak beam, continuous lintel, symmetric building, spacious expansion joint, rich concrete, BNBC, ACI
Environment	No assessments made
Fire	Fire extinguisher, fire hydrant, wide stair, smoke detector, fire alarm
Radiation	More thick wall, rich concrete, steel plate protection, more slab thickness, rubber floor
Sound	More room height, more surface area, sound absorbing materials, temporary roof
Saline	More concrete covering, rich concrete
Flood	Rich concrete, PL above HFL, keeping flood records
Cyclone	Rich concrete, computer simulation, no partition wall at GF,

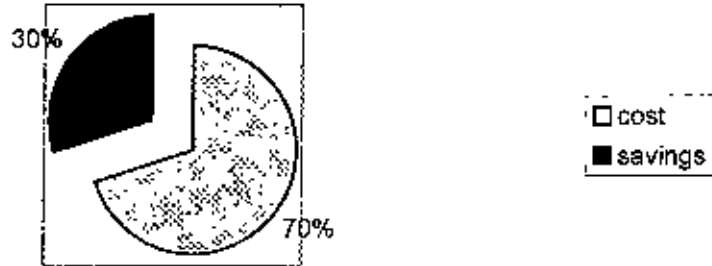
5.4: Money Savings Using STAAD Pro



5.5: Time for Structural Design

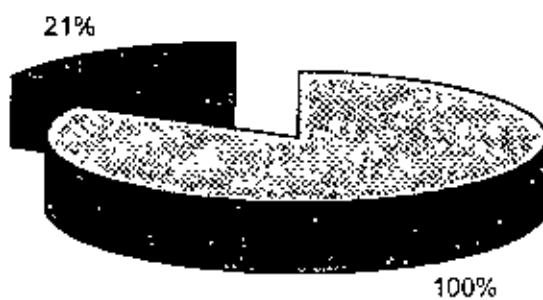


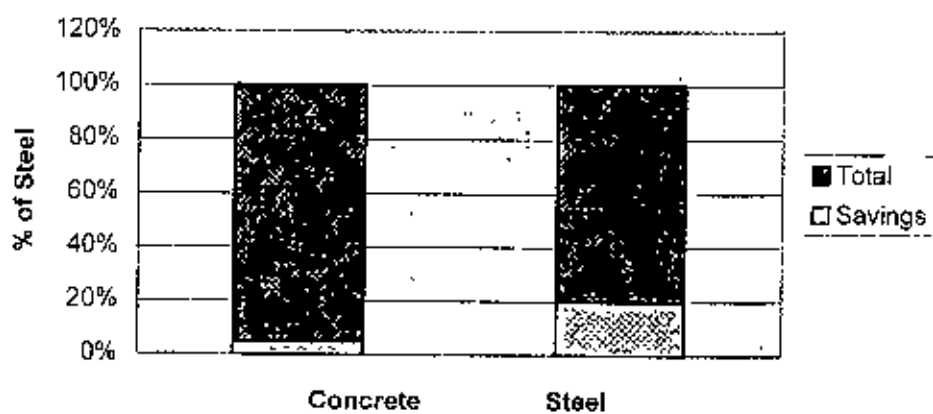
5.6 Cost Savings using 60 grade steel

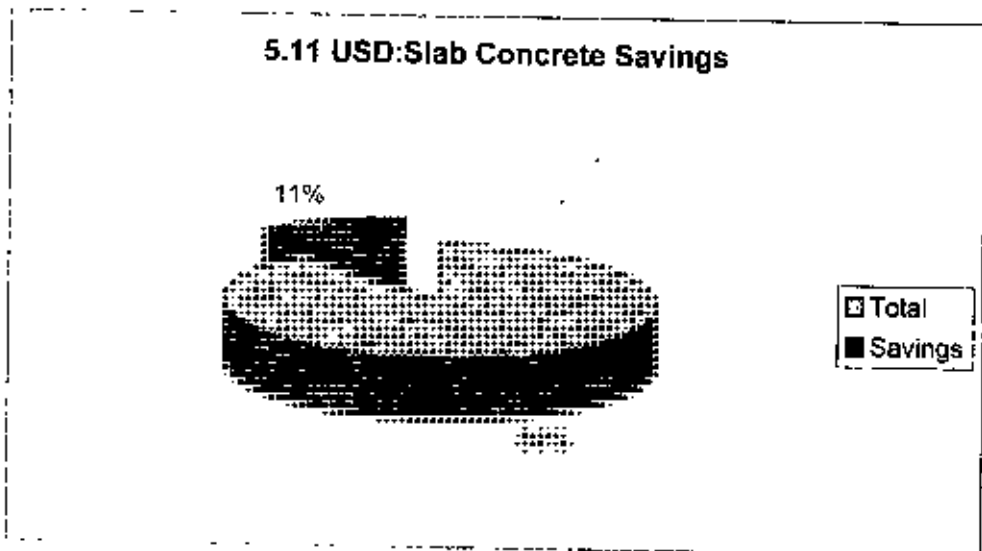
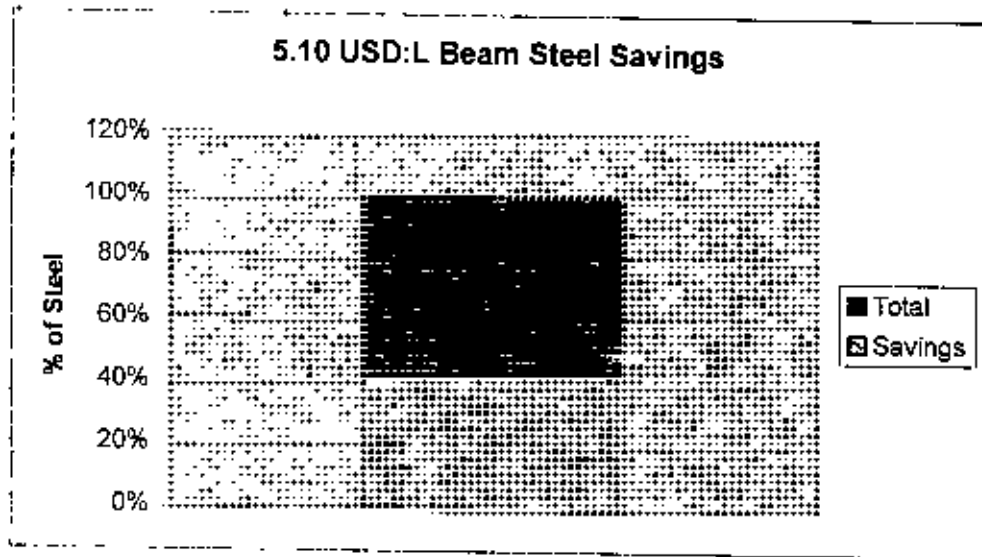


5.7 Cost Savings using Admixture

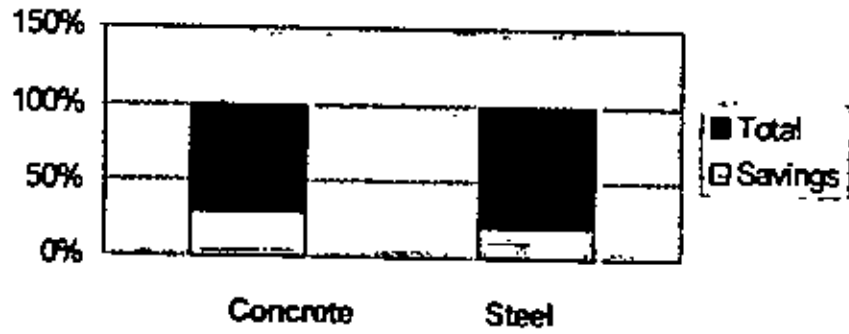


5.8 USD: Slab Steel Savings

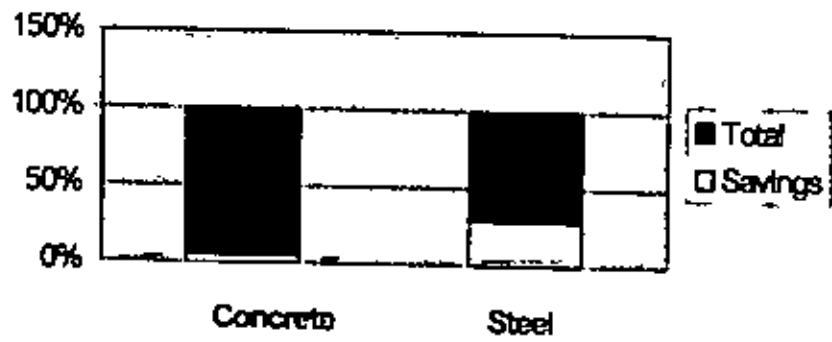
5.9 USD: Mat Foundation Concrete & Steel Savings



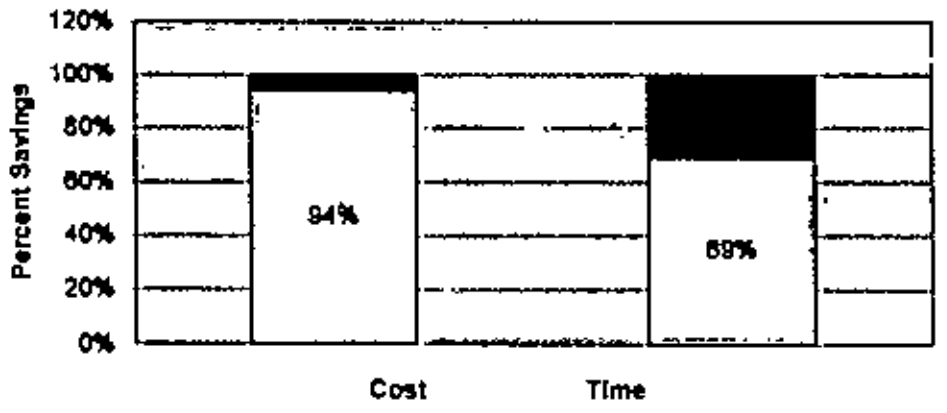
5.12 USD: Column Steel & Concrete Savings



5.13 USD: Footing Concrete & Steel Savings

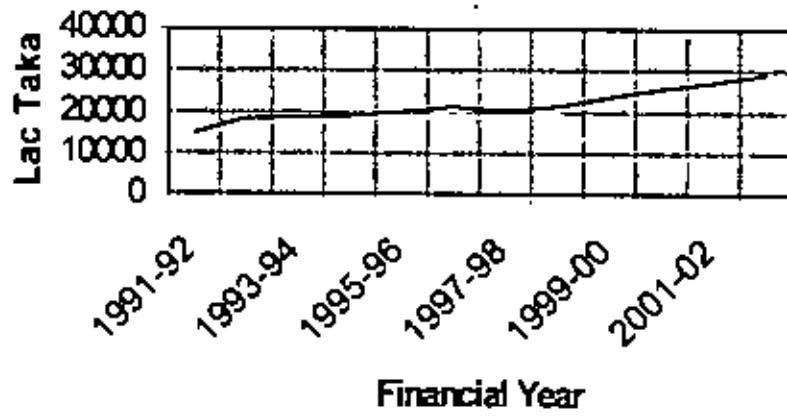


5.14 Cost & Time Savings Using Excavator

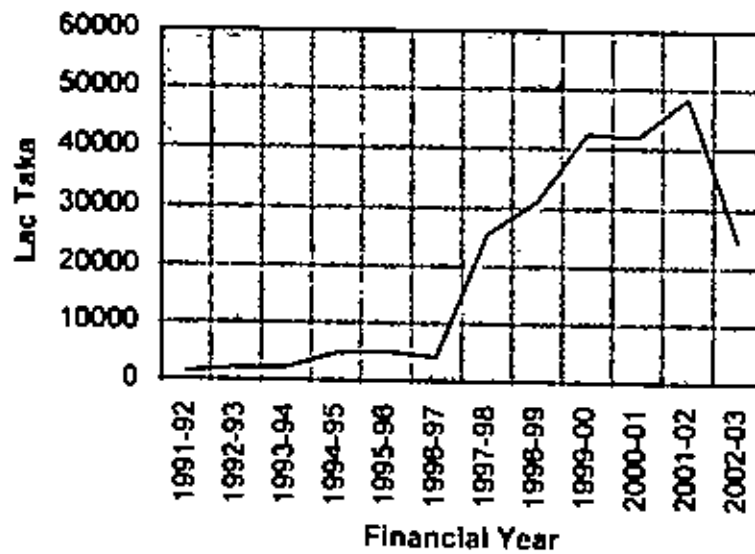


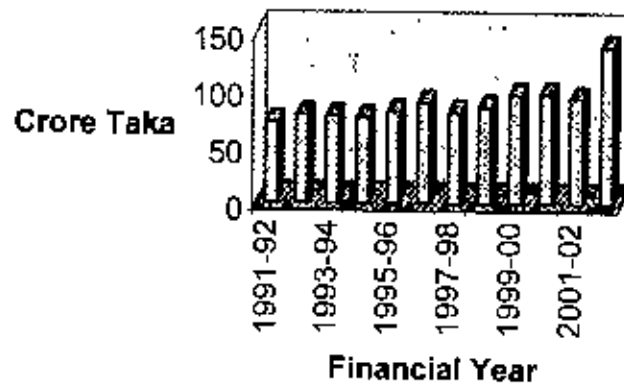
65066
99059

5.15: Renew Budget of PWD



5.16: Development Budget of PWD



5.17: Budget for Building Maintenance

CHAPTER -6

Recommendation and Conclusion

6.1 Recommendations.

1. Status of the post of C E should upgrade and make equivalent to the Secretary of the Ministry and renamed as Director General of PWD.
2. Individual wings according to the major heads of works should be introduced like C E (Health) CE (Homes) C.E (Judicial) C.E (Establishment) C.E(Social Welfare) e.t.c. Posts as mentioned above are to be created and they should given enough Power / authority to look after his matters . This will facilitate smooth implementation of the development Projects and close co-ordination with the concern ministry.
3. In order to perform the public work function at the up-zilla, office of the asst. engineer should be established at the up-zilla level and this will eliminate the present bottle neck of looking after rural area work from district.
4. Head Quarter level set up should make strong enough. PWD is responsible for construction and maintenance of more than twenty ministries of the Government of Bangladesh. So the department has to maintain close relationship with its client ministries, has to keep accounts and allocate funds in separate head to the field offices of all these ministries. It not at all an easy task to do and only two superintending engineers are there to do this job on behalf of Chief Engineer without being supported by any executive engineer or assistant engineer. Some time it happens that two or three meetings at different ministries fall at the same date and time and it become impossible to attend all meetings for one superintending engineer (Development) or one

superintending engineer(co-ordination). On the other hand, superintending engineer (establishment) has to handle the establishment related work. Without being supported by any executive engineer or any assistant engineer. Again there are six design divisions under two circle aided by the assistance of 12 assistant/sub-divisional engineers to take care of the design of buildings for more than twenty ministries which are spread all over the country.

5. Continuous training program shall have to start immediately. Technology changes very rapidly in the present days and it is almost imperative to update the knowledge of the officers after every regular interval. But unfortunately training has been neglected in PWD for long time. The department is almost 150 years old it is a matter of great regret that PWD does not have any training institute of its own.
6. Dependency on Department of Architecture should be reduced. PWD has to depend on Department of Architecture for the architectural designs and Drawings of the development projects. As Department of Architecture is a separate department, the chief engineer PWD has no control over them. It has become a common practice that PWD has to wait month after month to get the architectural drawing from Department of Architecture. Some of the main reasons are the shortage of skilled architect and lack of logistic support available to them. But the major complain against the architect is that they do private practice and pay less attention to their regular job.

7. Delay in Design Divisions tried to be avoid. There are only six design divisions in PWD to perform design of the whole country and it is a common complain from the field level officers of the department that they do not get design from the design divisions in time and have to pursue. There is also complain like the architect that the design people are also involved in private practice and hence pay less attention to their regular work.
8. Co-ordination between PWD and client ministries should be strengthen. There is lack of co-ordination between the PWD and the client ministries. Sometimes there exist genuine causes which hamper the progress of the project. But as the client ministries are not informed of the problem in time, they cannot perceive the situation and this creates confusion and put the goodwill of the department at stake.
9. Information System have to be made free and modern. This is the age of computer and information technology. But the department has not been equipped with the modern tools of keeping and sending information. Communication is mainly based on postal system which takes a lot of time. Some time Fax is being used but its use is limited. The department does not have any computer networking so that information can be accessed from anywhere with the click of a button. This old system of communication is another important factor to slow down the pace of work.
10. Negative attitude toward new technology must be changed. The lower and middle class subordinates of the department have a negative attitude toward the introduction of new technology. There is a fear that they may loose job if new technology like computer can make its road into the department. Some

15. Materials testing laboratory is to be established with all executive engineers offices of the district. Although PWD is a department of about 150 years old, it is a matter of great regret that the department does not have any testing laboratory of its own and has to rely on other external agencies which are beyond the reach of PWD. The materials testing laboratory should be allowed to run on commercial basis, which is being practiced by the LGED. This will ensure the quality of work and thus subsequently the accountability and the department will be strengthened.
16. Modern Tools, Technology, Equipment are to be introduced through out the department at it's all stages. This will strengthen the communication and decision making process and as a result the overall efficiency of the department will be increased.
17. Intensive training of Building Service Engineering should start for PWD engineers. This will facilitate proper and economic maintenance and also will give additional life to the buildings. Foreign training on building maintenance and house keeping also to be provided.
18. No amendment should be made on present rules of business. This will ensure standard and quality of works and save government money.
19. Permission for appointment of consultant to be given by MOHPW for training PWD personnel, preparing architectural & structural drawings, bidding documents. This will help to get drawings and documents timely and this will help reducing cost and completion time.
20. Close communication with the requiring agencies is to be maintained . This will be helpful to minimize gaps and enhancing relations with other ministries and also will boost-up PWD's image.

21. Detail drawings, designs, documents and also fund are to be ready before floating tender notice and starting the execution of works. This will ensure completion of a project within the stipulated time and amount of costing.

6.2 Conclusion

Having started its journey about two centuries ago Public Works Department still playing the pivotal role in the construction industry. With its work speed right across the country PWD has virtually laid the nucleus for the country's physical infrastructure. With its 200 years time PWD experienced changes of its management style. Its organogram changed several times to meet the demand of time. Present PWD from its creation was named and renamed time to time. Present PWD falling under ministry of housing and public works had experienced working under different authority and ministry. At one time military board was concern for all public works matter. Once it was under military board, labor division, mines and power division. It passed British rule, Pakistan period with different organizational style. In independent Bangladesh PWD management also changed several times. All changes were made with the to withstand new challenges and to cope with the evolved situations. Present management of PWD is still need to be change. So this changing is a continuous process and PWD must keep an eye to the global changes. PWD is thinking about reform i.e. re- arrange its management, manpower, training, recruitment and also downsizing to reduce operational cost and increasing efficiency.

Once all the branches of development works were under PWD - the railway, water development board, power, mining, port, navigation, t & t, postal, health, education, roads, bridges, cantonments, and others. By the passage of time PWD evolved as a specialized building construction agency. In this time of specialization and competition PWD is leaving no stone unturned to keep its reputation all high. Failure to keep the pace of reform and development PWD may become the part of the past history.

In this ever changing world technological life cycle is reducing dramatically. To day's latest technology is becoming obsolete tomorrow. New technology and materials are continuously coming in the construction industry. New design software is introducing and even robot has come into use for sophisticated and risky construction job in developed countries. PWD is adopting and keen to acquire new and advance technologies for the sake of its own existence and wellbeing of the country.

Bibliography

1. Public Works Department : Book of specification and code of practice, 1965
2. Public Works Department : Book of specification and code of practice, 1998
3. Stoner, Freeman, Gilbert : Management, Sixth Edition
4. Azim.M.Anwarul : Technology Management and Development of Nations. July 1999
5. Harvey Maylor : Project Management, Second Edition, 1999
6. Public Works Department : Account code, 1951
7. Public Works Department : Departmental code, 1951
8. Gary Dessler : Human Resource Management, Seventh Edition
9. Public Works Engineers Association : Annual Conference & General Meeting ,2002
10. Public Works Department : A Glimpse into the Past, Present and Future
11. Public Works Department : Open Discussion on 23 August 1999
12. Safi-Al- Abdullah : Project Implementation by PWD and Appoint of Consultants, January 2002
13. CPWD : The Symbol of a fine tradition ,New Delhi, June 1997
14. Public Works Department : Schedule of Rates for Civil Works, Ninth Edition, 1997
15. Robbins. P. Stephen : Organizational Behavior (Ninth Edition)

