New strategies to improve the management capacity of contractors for labor-based methods in road rehabilitation in Ghana

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Dissertation

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(Abstract)

Ghana, like many African countries, is plagued with unemployment, poverty and annual trade deficits. Unemployment and poverty have led to a socio-economic breakdown. They are believed to be among the causes that led to the 1994 Rwanda genocide. Despite the abundance of an unemployed labor force, Ghana continues to depend on imported equipment, costing $174 million annually for its earthmoving and construction activities.

In 1986, the Government of Ghana, the World Bank, the International Labor Organization and the United Nations Development Program introduced labor-based road rehabilitation program in Ghana to help create more jobs and reduce the high unemployment and poverty incidence. The program has not been patronized due to the casual labor usage and labor organizational and management problems.

This research formulates the Family-Based Labor Management (FBLM) concept (also referred to as the HPWT-FBLM concept) by incorporating High Performance Work Team (HPWT), the Ghana Family System, and Roles and Responsibilities Matrix (RRM) concepts to make the program more attractive to labor and management. The FBLM concept would equip local contractors with the managerial skills to increase average monthly production from 1.33km to between 4km and 6km gaining competitive advantage over the 3.07km monthly production of the equipment-intensive contractor. Since the HPWT-FBLM concept has not been used, the related concepts HPWT and

RRM concepts are used to validate the newly formulated recruitment, training, work method, communication and reward strategies.

When adopted, the HPWT-FBLM concept would annually invest 10% of the $174 million for five years and yield employment increase of 23,000-34,000 the first year, growing to a total of 116,000-170,000 in five years. This concept will help reduce import deficit, conserve foreign exchange, and develop a pool of skilled workers and managers in Ghana. It has the potential of boosting the Ghanaian manufacturing industry for making hand-tools in lieu of purchasing imported equipment. The HPWT-FBLM concept can be adopted by the agriculture and building construction and other industries in Ghana that use large supplies of unskilled and semi-skilled labor.

Dedication

I dedicate this work which is dear to my heart to;

My dear great-grandmother: Efua Dompo,

My humble grandmother: Maame Adwoa Enua, and

My loving mother: Adwoa Kodumenyiwa

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List of Acronyms

AFD:	Agence Francaise de Développement
AfDB:	African Development Bank
ATTN:	Africa Transport Technical Notes
BADEA:	Arab Bank for Economic Development in Africa
BEA:	Bureau of Economic Analysis
BECE:	Basic Education Certificate Examination
CBER:	Center for Business and Economic Research
CCC:	Civilian Conservation Corps
CICE:	Construction Industry Cost Effectiveness
CIDB:	Construction Industry Development Board
CII:	Construction Industry Institute
CPI:	Consumer Price Index
CSHR:	Center for the Study of Human Resources
CWA:	Civil Works Administration
Danida:	Danish International Development Assistance
DFR:	Department of Feeder Roads
DPW:	Department of Public Works
DUR:	Department of Urban Roads
EPWP:	Expanded Public Works Program
EU:	European Union
FBLM:	Family-Based Labor Management
FBWT:	Family-based work team
FLH:	Federal Lands Highway
FSA:	Farm Security Administration
FERA:	Federal Emergency Relief Administration
GCE:	General Certificate Examination
GDP:	Gross Domestic Product
GFID:	Department For International Development
GFS:	Ghana Family System
GHA:	Ghana Highway Authority

GLSS: Ghana Living Standard Survey

GoG: Government of Ghana

GRF: Ghana Road Fund

GSS: Ghana Statistical Service

GTZ: Gesellschaft fur Technische Zusammenarbeit

HPWO: High Performance Work Organizations

HPWT: High Performance Work Team

IDA: International Development Association

ILO: International Labor Organization

ITA; USDOC: International Trade Administration; United States Department of Commerce

JBIC: Japan Bank for International Co-operation

JICA: Japan International Co-operation Agency

KfW: Kreditanstalt fur Wideraufbau

MFA: Ministry of Foreign Affairs

MRT: Ministry of Roads and Transport

NRSC: National Road Safety Commission

NYA: National Youth Administration

OHS: Ohio Historical Society

OPEC: Organization for Petrol Exporting Countries

PDDM: Project Development and Design Manual (of the FLH)

PWA: Public Works Administration

REA: Rural Electrification Administration

RRM: Roles and Responsibilities Matrix

RSDP: Road Sector Development Program

RSEP: Road Sub-sector Expenditure Program

SAB: South African Breweries

SAM: Social Accounting Matrix

SATS: Singapore Airport Terminal Services

SMME: Small-scaled Micro and Medium Enterprises

SMWT: Self-managed work team

SSCE:	Senior Secondary School Certificate Examination
SSS:	SATS Security Services
TUCG:	Trade Union Congress Ghana
UNDP:	United Nations Development Program
USDOT:	United States Department of Transportation
USDS:	United State Department of State
USWPA:	United States Work Projects Administration
WPA:	Work Progress Administration

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Chapter 1 Research Design

1.1 INTRODUCTION

This research is intended to help improve the labor management capacity of the local contractors involved in the labor-based feeder (gravel) road rehabilitation program. The labor-based road rehabilitation program was introduced in 1986 to help reduce the unemployment and poverty in Ghana. The term 'rehabilitation' is used to refer to both road reconstruction and routine maintenance.

Ghana is plagued with unemployment, poverty and annual trade deficits. Ghana has a population of 21 million, a work force of 10 million and an annual Gross Domestic Product (GDP) of $48.27 billion. Unemployment is about 20% (World Factbook 2005) and as much as 40% of the population is living below the poverty line (Trade Union Congress Ghana (TUCG) 2004). Though Ghana has abundant unemployed labor, it continues to depend on imported construction and earthmoving equipment that cost about $174 million (0.4% of GDP) annually (International Trade Administration, US Department of Commerce (ITA; USDOC) 2002).

The World Bank, the International Labor Organization (ILO), the United Nations Development Program (UNDP) and the Government of Ghana (GoG) introduced the use of labor-based methods for feeder road rehabilitation in Ghana in 1986 to help create more employment and reduce poverty (Osei-Bonsu 1992, Stock 1996 & Ampadu 1999). However, the program introduced in Ghana has not been attractive to many local contractors and workers due to the casual nature of the workers and organizational and management problems, though the labor-based program does have the capacity to create more employment (Stock 1996) than its alternative, the conventional equipment-intensive method (Ampadu 2001). The labor-based program is perceived as slower, has more labor organization and management problems and faces the challenge of keeping its workforce.

A family-based labor management (FBLM) concept is formulated to help make the program more attractive to the local contractors as well as equip them with efficient labor organizational and management strategies. The expression 'family-based' is used to connote the family oriented relationships (not blood kinship) that would exist among the workers who would be involved in the application of the FBLM concept.

The FBLM concept which is designed to be rooted in efficient management systems and the local culture of Ghana would have the potential of creating between 23,000 and 34,000 jobs in the first year of its implementation when an increment of 10% of the $174 million is annually invested in the labor-based road rehabilitation program. At the fifth year of its implementation, the FBLM concept would be able to create to between 116,000 and 170,000 jobs. It is anticipated that labor-based and equipment-intensive methods would then co-exist, each representing 50% of the $174 million. The employment creation potential of the FBLM concept will be developed further in Chapter 7. The FBLM concept would also help reduce Ghana's dependence on imported equipment, especially for road and other construction activities. It would help Ghana to conserve its scarce foreign exchange to boost internal investments.

1.1.1 Background

Unemployment and poverty pose a challenge to the survival of many African countries including Ghana. They promote social dissatisfaction, social isolation, criminal activities, domestic conflicts and also facilitate the deterioration of family systems. In addition, they deter investments and slow down economic growth. They are sources to political dissatisfaction and a threat to national stability (McCord 2002).

In his discussion about "How Societies Choose to Fail or Succeed" Jarod Diamond (2005) cited poverty and unemployment as some of the factors that led to the Rwandan genocides in 1994. At the 93rd session of the International Labor Conference held in Geneva in 2005, Membathisi Mdladlana the South Africa's Labor Minister, affirmed that unemployment and poverty are the biggest threats to peace in Africa. The Minister noted that unless employment creation is centralized in macro-economic decision making in Africa, the hope of the people of Africa for a better life will continue to remain a dream (Panapress 2005). There is the need to step up efforts to improve the standard of living in countries where the incidence of unemployment and poverty is high in order to prevent a total collapse.

1.2 SCOPE

The research seeks to improve the organizational and managerial capacity of labor-based road contractors in Ghana. It focuses on improving the labor organizational and management strategies of the labor-based road contractors. It formulates a family-based labor management (FBLM) concept that would facilitate the rehabilitation of more roads as compared to that of the conventional equipment-intensive method.

1.3 PROBLEM STATEMENT

As compared to the conventional equipment-intensive method, the labor-based method of road rehabilitation has not been fully utilized by the local contractors and workers. For instance, between 1986 and 1994, many trained labor-based contractors wanted to switch to use equipment-intensive methods due to problems inherent in the organizational and management of large work force (Stock 1996). Currently, there are only 93 registered labor-based contractors compared to the over 806 registered equipment-intensive contractor (Ampadu et al 2003).

The use of labor-based methods for feeder road rehabilitation has been minimal as illustrated in Table 1-1. Excluding the 20.8% data in 2001, the road rehabilitated with the labor-based method between 1998 and 2002 averages a little over 6%. The average between 1998 and 2002, including 2001 is only 9.2%.

Table 1-1: Feeder roads rehabilitated from 1998 to 2002 in Ghana (Data Sources: Ghana Budget 1999 and 2002, Ghana Permanent Mission 2005 & Ampadu et al 2003)

Year	**Total feeder road rehabilitated**	**Methods Used**		**Labor-based as % of total feeder road rehabilitated**
		Labor-based (km)	**Equipment-intensive (km)**	
1998	8,632	271	8,361	3.1
1999	3,743	283	3,460	7.6
2000	3,350	164	3,186	4.9
2001	1,342	279	1,063	20.8
2002	3,198	307	2,891	9.6
Average	**4,053**	**261**	**3,792**	**9.2**

The primary problems that limit the use of the labor-based method for road rehabilitation include:

1) The use of casual (non-permanent) labor.

The labor-based road rehabilitation program in Ghana was designed by the World Bank, ILO and UNDP to use casual (non-permanent) labor as the main production unit (Stock and Veen 1996). The use of casual labor was to eliminate the situation in which local contractors would be required to provide workers with accommodation and transportation logistics (Stock 1996 & Ampadu 1999).

The use of casual labor also causes seasonal variation in labor supply since casual laborers have no commitment or binding relationship to any particular employer (Ashong 1996). Workers tend to offer their committed services to employers who offer them permanent jobs. The decision to use casual labor did not consider the femininity tendency of the Ghanaian culture. In femininity cultures like Ghana, job security is held to be very important (Hodgetts and Luthans 2000). For employment security, workers in Ghana would prefer permanent work to seasonal and casual jobs, especially in an economy where unemployment is as high as 20%.

Some of the local labor-based contractors are now going in for permanent workers to maintain work continuity and to avoid loss of labor to other seasonal labor-based activities such as farming (Ampadu and Tuffour 1996 & Ampadu 1999). However, the use of casual labor continues to be the norm in Ghana.

2) Labor organizational and management problems.

Unlike equipment-intensive methods of feeder road rehabilitation, the current labor-based methods of road rehabilitation continue to be plagued by the problem of the organization and management of large labor force (Stock 1996). A local labor-based road contractor in Ghana uses an average of 75 workers a day to produce 1.33km of road in 20 workdays per month (Ampadu and Tuffour 1996). The organization of laborers for the execution of tasks is currently less effective. Large labor forces are to be organized everyday due to the casual nature of labor. Laborers are to be trained everyday. Moreover, the supervisor-to-laborer ratio is as high as 1:21. This makes labor management less efficient in the current approach.

The local contractors in Ghana also lack managerial capability (Addo-Abedi 1999 & Eyiah and Cook 2003) with regard to financial, material and personnel resources (Osei-Bonsu 1992). The daily scheduling of the casual labor and keeping track of work also provide a challenge to the inexperience supervisors. Poor labor organization and management usually result in poor supervision, lower worker-motivation, low production rates (Stock 1996) and poor quality of roads.

Although the conventional equipment-intensive method is faster, it generates less employment as compared to the labor-based method. Currently, whereas the equipment-intensive contractor rehabilitates an average of 3.07km of road in 20 workdays per month, the labor-based contractor rehabilitates only 1.33km in 20 workdays per month. However the equipment-intensive contractor employs only about 20 workers per a kilometer of road compared to the 75 workers employed by the labor-based contractor per kilometer of road (Ampadu 1999). The current approach to labor-based road rehabilitation depends mostly on the local resources including abundant cheap labor and hand-tools. The conventional equipment-intensive approach on the other hand depends on the importation of costly heavy equipment into a country that struggles with an annual trade deficit. Whereas a kilometer of feeder road cost $13,374 using labor-based methods, a kilometer of feeder road cost $14,218 using equipment-intensive methods.

1.4 Research Objectives

The main research objectives include:

1) Formulating the family-based labor management (FBLM) concept to help improve the organizational and management skills of local contractors involved in Ghana's labor-based road rehabilitation program. The FBLM concept is made up of the following:

- The Family-based work team (FBWT) concept.
- Improved management systems of the current labor-based method.
- Adopted management systems.

2) Proposing the recruitment of permanent laborers in place of the casual (non-permanent) laborers.

Improved organizational and management strategies coupled with the use of permanent laborers would make the program attractive to both contractors and workers in Ghana and thereby help create more jobs to reduce unemployment and poverty in Ghana.

A production rate higher than that of the equipment-intensive contractor would give the labor-based contractor a competitive advantage. The goal is to help the local labor-based contractor increase production from 1.33km to 4km (or more) in 20 workdays per month as illustrated in Figure 1-1 below.

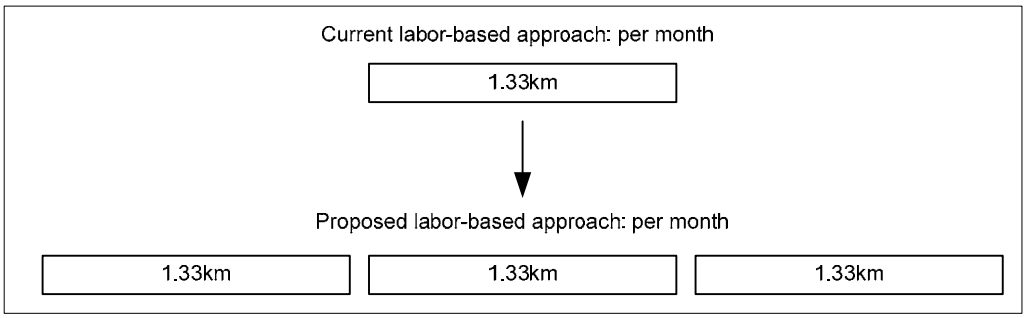

Figure 1-1: Proposed increase in the monthly production of labor-based contractors in Ghana

The initial goal is to reorganize and manage three times the resources (labor, material, hand-tools) used in the current approach to achieve the 4km goal. It is anticipated, however, that the new methods proposed will naturally improve productivity values. The potential productivity improvement due to the new methods will also be considered.

The advantages of tripling the use of labor include increasing employment opportunities and redistributing income to a wider section of the population. The challenge involved include making the labor-based road rehabilitation program attractive to workers and also equipping the local contractors with efficient strategies to organize and manage the large number of workers that would be required to rehabilitate the 4km goal.

Other objectives include:

- Proposing the co-existence of the equipment-intensive and labor-based methods in the feeder road program; each representing 50% of the $174 million capital

that is currently used for the importation of construction and earth moving equipment every year.

- Adapting the economic multiplier concept to help inform the design of economic programs in Ghana, specifically with regard to investments undertaken to boost employment creation.
- Adapting the US camber (cross slope) of the gravel road which is 3%-4% to replace the steeper slope of 5%-8% required in Ghana.

1.4.1 Limitations

The research has the following limitations:

1) The research concentrates on the formulation of the FBLM concept. Its application and data collection will be the focus of future work.
2) Though cost benefits are anticipated when the FBLM concept is adopted. Detail analysis of such cost reduction will be undertaken by future research.
3) Since the FBLM concept has not yet been used in an actual road rehabilitation project, the prediction of the potential productivity improvements that would accrue to the use of the FBLM concept will rely on data collected from related works.
4) The validation of the FBLM concept will also rely on the results of other related management research.

1.5 RESEARCH METHODS

The FBLM concept is formulated from other management concepts and the cultural norms of Ghana. Principal among these are the High Performance Work Team (HPWT) concept, the Ghana Family System (GFS) and the Roles and Responsibilities Matrix (RRM) concept. Figure 1-2 identifies the principal concepts that underlie the formulation of the FBLM concept.

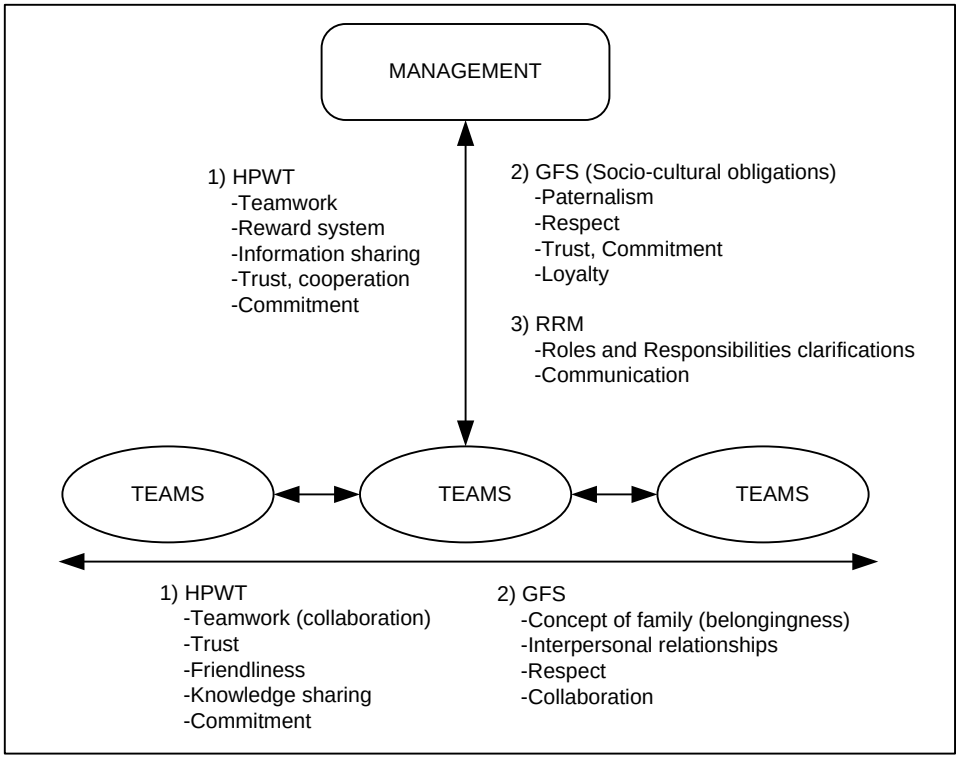

Figure 1-2: Principal concepts used in the formulation of the FBLM

The HPWT concept is a relatively new concept that makes use of practices like teamwork, participative decision making, horizontal communication systems, performance-based payment and other values including trust and commitment to improve the productivity of workers. The HPWT concept promises a range of benefits including higher levels of profitability and productivity for employers and higher earnings and challenging work for employees (ILO 2002). The concept would be used to reorganize the large workforce (that would be required for the rehabilitation of the 4km goal) into smaller manageable teams. The concept would also be used to encourage employee participation in decision-making, to help improve the communication system of the current approach and also to help motivate the workers.

The GFS is the major component of the Ghanaian culture. Every Ghanaian is connected to each other and to the society through the traditional family system; either through a male ancestor or a female ancestor (Awusabo-Asare 1990). The GFS bears much influence on the socio-economic activities of Ghanaians. Thus, it must be considered for the successful implementation of programs initiated to improve the living

standards of Ghanaians. It has been noted that many economic developments programs introduced into developing countries like Ghana fail because of their lack of organic relationship with the local socio-cultural norms (Lauer 2000). The GFS will be used to help root the HPWT efficient management concepts in the Ghanaian culture. The interpersonal processes of the HPWT concept upon which the family-based teams would operate are also complemented with some cultural values of the GFS.

The HPWT concepts and the GFS are integrated to formulate the family-based work team (FBWT) concept. The integration is motivated by the efficient HPWT management systems, the need to implant the HPWT management systems in the local culture to make it acceptable and the similarities between the HPWT concepts and the GFS.

A RRM specifically outlines all the roles, responsibilities and relationships among teams and team members. It is a tool used to identify all the roles in a project. It is also used to ensure that the responsibilities needed to complete a project are identified and assigned (Phillips 2004). The RRM concept is used to help reduce ambiguity in projects with regard to 'who does what'? It is also used to clarify task assignment and cross-functional interaction among team members (Charvat 2002).

1.6 RESEARCH CONTRIBUTION

The primary contribution is the family-based labor management (FBLM) concept. The FBLM concept is formulated to facilitate the use of more labor to rehabilitate more feeder roads as compared to that of the conventional equipment-intensive method.

The FBLM concept is made up of the following:

- Family-based work team (FBWT) concept,
- Proposed improvement in the management systems of the current approach, and
- Adopted management strategies (including the RRM) and strategies for continuous innovation.

Other research contributions include:

- The adoption of the economic multiplier concept to inform the design of economic development programs in Ghana.

- The consideration of cultural norms in the design and implementation of economic programs in Ghana.

1.6.1 The FBWT concept

The FBWT is used to reorganize the workers involved in the current approach into smaller manageable family oriented teams. The teams that would be formed for the family-based approach include the foreman-laborer teams (1:6), supervisor-foreman teams (1:3), site manager-supervisor teams (1:3) and the contractor site manager team (1:3). The teamwork concept is intended to facilitate the organization and management of large number of workers involved in the labor-based road rehabilitation program.

The basic teams would be used to reorganize the 75 workers used in the current approach (to rehabilitate the 1.33km in 20 workdays per month) into a standard unit organizational structure of the FBWT. To rehabilitate the 4km goal, the local contractor would triple the number 1.33km sites and use the standard unit organizational structure to reorganize the 75 workers at each of the three sites.

1.6.2 Proposed improvement in the management systems of the current approach

The research also uses HPWT and other concepts to improve upon the management systems of the current approach to complement the FBWT concept. The management systems that would be improved include recruitment, training, work methods, communication and reward systems.

1.6.3 Adopted management and continuous innovation strategies

The research also adopts roles and responsibilities matrix concept to help reduce the ambiguity with regard to ‘who does what?’ and also to clarify task assignment. The matrix concept would clearly set up the expectations of all the team members before projects commence. The research also adopts other strategies to ensure continuous improvements in the FBLM concept.

1.7 RESEARCH STEPS

The formulation, productivity improvement prediction and the validation of the FBLM concept will follow these steps:

Step1: The research reviews the literature on the following:

- The demographics of Ghana to understand;
    - The socio-economic situation.
    - The extent of unemployment and poverty.
- The road infrastructure in Ghana to be informed about;
    - The role roads play in the national economy.
    - The types of roads and their current conditions.
    - Funding sources.

Step 2: The research studies the following:

- The two methods used in feeder road rehabilitation in Ghana:
    - Equipment-intensive method to get acquainted with its employment generation capacity.
    - Labor-based methods;
        - To identify the problems that limits its uses.
        - Potential advantages to the national economy.
        - Challenges involved in finding solutions to the problems.
- The HPWT concept to be informed about its management systems and how they can be used to improve labor management in the Ghana rehabilitation program.
- The GFS
    - To identify the cultural values that can be used to enhance labor management.
    - To identify its commonality with HPWT concepts.
- The RRM concept to understand how it can be used to clarify roles and responsibilities of the family-based teams.
- Examples of labor-based programs, particularly the Work Progress Administration (WPA) program of the US and South Africa's labor-based programs to understand how they were successfully used to generate employment and reduce poverty.

- The economic multiplier concept to grasp which of the two programs, labor-based or equipment-intensive, would benefit more from investments especially in economies plagued with unemployment.

Step 3: The research develops the FBWT concept;

- Integrates HPWT and GFS.
- Formulates family-based team sizes.
- Formulates a FBLM standard unit organizational structure for the rehabilitation of the each of the three 1.33km road section.
- Specifies interpersonal relationships.

Step 4: Improves upon the management systems of the current labor-based approach.

- Recruitment strategies;
    - Proposes solution to the issue of the provision of accommodation and transportation logistics.
    - Proposes higher qualifications for the FBLM supervisory personnel.
- Training strategies;
    - Improves management, interpersonal, technical, financial, engineering and contracting skills of workers and management.
- Work methods;
    - Proposes the integration of the task-work and piece-work methods.
- Communication strategy;
    - Superimposes HPWT communication strategies on the GFS communication system.
- Reward strategies
    - Proposes the integration of task-work and piece-work methods and social recognition strategies to motivate workers.

Step 5: Adopts the RRM concept to develop roles and responsibilities matrices for the family-based teams and team leaders.

- Constructs roles and responsibilities matrices for the general management and major activities of labor-based road rehabilitation projects.
- Proposes mechanisms that would ensure continuous innovation.

(Steps 3, 4 and 5 combine to form the FBLM concept)

Step 6: Adapts US design for the camber of feeder (gravel) roads in Ghana.

- Proposes the reduction of the camber slope (cross slope or crown) from 5%-8% to 3%-4%.

Step 7: Apply the FMLB concept to rehabilitate 4km of feeder road.

- Constructs a typical schedule.
- Discusses tasks assignment and daily activities.

Step 8: Predicts the potential productivity improvements of FBLM concept in terms of;

- The developed FBWT concept.
- Improved management strategies.
- Work methods.

Step 9: Validates the FBLM concept including the;

- Developed family-based work team (FBWT) concept.
- Proposed management improvements.
- Adopted management strategies.

Step 10: Predicts the potential impact of the use of the FBLM concept in the Ghanaian society.

- Socio-economic impact.
- Environmental impact.
- Cultural impact.

Step 11: Recommends future work that would ensure continues to development of the FBLM concept.

Chapter 2 focuses on the review of literature. It provides information about the demography, the road infrastructure and methods used for road rehabilitation in Ghana. It also provides an understanding of the HPWT concept, the GFS and the roles and responsibilities concepts. Literature on the examples of labor-based and employment creation programs are examined and the economic multiplier concepts are also studied.

Chapter 2 Literature Review

As a background to the formulation and the validation of the family-based labor management concept, the research reviews literature on Ghana's demographics, road infrastructure, and methods of road rehabilitation. The research also reviews literature on High Performance Work Organizations (HPWO) and the Ghana Family System (GFS) concepts since they are employed in the formulation and validation of the family-based labor management (FBLM) concept. Literature on the concepts of roles and responsibilities assignments is reviewed to help improve the management skills of labor-based road contractors in Ghana.

Successful employment generation programs and labor-based programs especially the Work Progress Administration (WPA) of the United States and the current labor-based programs in South Africa are also studied to inform the Ghana labor-based road rehabilitation program introduced in 1986. Literature on the concept of the economic multiplier is reviewed to understand the full economic ripple effects of increased employment and income that would accrue to the economy due to the application of the proposed FBLM concept for gravel road rehabilitation in Ghana.

2.1 DEMOGRAPHICS OF GHANA

Ghana is a developing country located in West Africa. It shares boundaries with Cote d'Ivoire (Ivory Coast), the Republic of Togo and Burkina Faso. The Atlantic Ocean borders its southern coastline. Ghana is situated between latitudes 4° 30' N and 11° N. It occupies an area of about 238,537 sq km (92,100 sq miles) and has a population of about 21 million (The World Factbook 2005) which continues to grow at the rate of 2.1% annually (United Nations 2005). The age distribution data of the population is presented in Table 2-1. It illustrates that the current working population (those between ages 15 and 64) represents the largest percentage of 59.1% followed by that of the potential future labor force (those between ages 0 and 14) of 37.1 % (The World Factbook 2005).

Table 2-1: Age distribution structure of Ghana (Data Source: The World Factbook 2005)

Age (years)	**Population (%)**
0-14	37.1
15-64	59.1
65 and over	3.7

The ratio of men to women is 1.03:1 (The World Factbook 2005). The high population growth rate and the equal sex ratio in Ghana favor the FBLM. The proposed FBLM concept would not only require large number of workers for the rehabilitation of more roads in Ghana but would also facilitate an increase in female participation in the feeder road rehabilitation program in Ghana.

2.1.1 The Geography of Ghana

The geography of a location has considerable impact on the implementation of any labor-based road rehabilitation program. The rock formation of a location impacts the ease of excavation and the availability of local materials such as gravel and earth soil for road works. The climate affects the availability of working days and the type of vegetation also influences site preparation activities such as bush clearing and grubbing.

The topography of Ghana is mostly made up of low plains with some plateau in the south-central part of the country. The most widespread rocks include sandstone, granite, phyllite, schist and limestone (Dickson and Benneh 1988). The climate is tropical and humid. Average temperatures are usually between 20.5°C and 26°C. The annual rainfall in the coastal zone averages 830 mm (33 in.) and decreases towards the northern part of the country. The major vegetations in the country include secondary rain forest, coastal bush and grassland and the wooded savanna in the north (United State Department of State (USDS) 2005). Table 2-2 illustrates the geographical characteristics of Ghana according to the 10 administrative regions in the country. The low-lying nature of the topography, the rock types and the light vegetation cover make it easier to use labor-based methods in road rehabilitation programs in Ghana.

Table 2-2: The Geographical characteristics of Ghana (Data Sources: Dickson and Benneh 1988 & Ampadu 1999)

Administrative Region	Rainfall (mm/yr)	Number of rainy days/yr	Topography	Vegetation
Upper West	980-1170	87	Low-lying	Sudan savannah
Upper East	980-1170	87	Low-lying	Guinea savannah
Northern	980-1170	87	Low-lying	Guinea savannah
Brong Ahafo	1210-1390	118	Undulating	Semi-deciduous forest
Ashanti	1210-1390	118	Undulating	Semi-deciduous forest
Eastern	1210-1390	118	Undulating	Semi-deciduous forest
Volta	840-1140	87	Coastal plain	Semi-deciduous forest
Greater Accra	840-1140	87	Coastal plain	Scrub and grasslands
Central	840-1140	87	Coastal plain	Semi-deciduous forest
Western	1870-2030	160	Undulating	Rain forest

2.1.2 Literacy in Ghana

Literacy in Ghana is defined as the ability to read and write English language or any of the 5 main Ghanaian languages and also be able to perform some basic arithmetic calculations. Ghana's illiteracy rate is about 50% (Blunch and Verner 2000). Literacy rates have much influence on the choices of production systems available in an economy. Lower literacy rates, like those in Ghana, work better for the production system that concentrates on the training of the front-line supervisory personnel to efficiently manage large number of unskilled workforce (Brandenburg 2004). The FBLM concept would rely mostly on the training of front-line supervisors to efficiently manage large numbers of workforce. It focuses on improving the planning, organization, communication and mentoring skills of the supervisory personnel to improve the overall productivity of the large unskilled/illiterate labor force in Ghana.

2.1.3 The Economy of Ghana

Ghana's GDP is about $48.27 billion. The service sector accounts for 41.4% of the GDP, the agriculture sector accounts for 34.4% and the industry sector 24.2%. Ghana's export amounts to about $3.01 billion per annum. The major export commodities

include gold, cocoa, timber, tuna, bauxite, aluminum, manganese ore and diamonds. Its import commodities in the order of significance are petroleum, heavy equipment and foodstuffs. Imports cost Ghana about $3.699 billion per annum. Ghana has an annual trade deficit of about $0.7 billion (The World Factbook 2005). The daily minimum wage is only $1.22 (TUCG 2004).

In addition to the issue of trade deficit servicing, Ghana has to deal with its rising unemployment and poverty incidences (Gyan-Baffour and Betsey 2001 & Canagarajah and Thomas 1997). Unemployment rate is currently as high as 20% (World Factbook 2005) and as much as 40% (TUCG 2004) of the population is living under the poverty line. The labor force is about 10.24 million (World Factbook 2005) and continues to grow at 2.8% per annum (Boateng and Ofori-Sarpong 2002). The agriculture sector accounts for 60% of the labor force, the service sector 25% and the industrial sector 15% (World Factbook 2005). Trends in Ghana show that employment creation programs have not been able to keep up with the growth of the labor force. Employment is declining in while the labor force continues to grow (Boateng and Ofori-Sarpong 2002). Table 2-3 illustrates Ghana's labor supply potential with regard to those between ages 15 and 49 who would be more suitable for the implementation of the FBLM concept.

Table 2-3: Ghana's population and labor force potentials between 2000 and 2020 in thousands (Data Source: Adlakha 1996)

Ages	**2000**			**2020**		
All Ages	**Population**	**Female (%)**	**Male (%)**	**Population**	**Female (%)**	**Male (%)**
	19,272,000	50.5	49.5	26,516,000	50.7	49.3
15-49	9,422,000	50.4	49.6	14,815,000	50.5	49.5

The cost of labor is cheap in Ghana. A household survey conducted in 1999 revealed that the daily minimum wage set by the GoG remained $1.00 between 1980 and 2002. The minimum wage was increased to $1.22 in 2003 (TUCG 2004). The 1999 average household incomes in Ghana are shown in Table 2-4. The average household size in 1999 was also about 4.3 persons (TUCG 2004 & UNDP/World Bank 2003).

Table 2-4: Average incomes in Ghana, 1999 (Data Source: GLSS 2000)

Type of Income	US Dollars
Mean Annual Household Income	947.00
Mean Annual Per Capita Income	220.00
Mean Daily Household Income	2.59
Mean Daily Per Capita Income	0.60

The road infrastructure in Ghana is undergoing major rehabilitation to upgrade its condition from 35.4% good, 30.9% fair and 33.7% poor (Department of Feeder Roads (DFR) 2004, Department of Urban Roads (DUR) 2004 & Ghana Highway Authority (GHA) 2004) to 70% good, 20% fair and not more than 10% poor (Ministry of Foreign Affairs (MFA) 2000). Ghana also looks forward to expand its road infrastructure as the country continues to urbanize.

Ghana must take advantage of its local resources especially the availability of abundant cheap labor in its design of road construction and rehabilitation programs. This would help reduce the unemployment incidence and the overall dependence on the importation of heavy construction equipment. The FBLM concept is designed to make efficient use of the available local resources including local material, tools and cheap labor in feeder road rehabilitation.

2.2 ROAD INFRASTRUCTURE IN GHANA

Ghana has a total road network of 53,482.4km (DFR 2004, DUR 2004 & GHA 2004). Roads in Ghana serve as the arteries and veins of the national economy. They are essential for the movement of key exports and farm products from the industries and farms to the market. Currently, they account for 95% of all cargo and 97% of all traffic movements (Ministry of Roads and Transport (MRT) 2005a).

2.2.1 Types of roads in Ghana

There are three categories of roads in Ghana namely urban roads, highways (or trunk roads) and feeder roads (Africa Transport Technical Notes (ATTN) 1997). Urban roads include all the roads in the cities. Highways are those that connect the cities and the towns. Feeder roads connect the rural (mostly farming) areas to the highways and urban

roads. They are mostly unpaved roads (DRF 2004) used to transport agricultural and other products from the rural areas to the highways and urban roads and then to market centers and international ports (MRT 2006).

2.2.2 Agencies responsible for the road infrastructure

The government institution responsible for the construction and maintenance of roads in Ghana is the Ministry of Roads and Transport (MRT). The vision of the MRT by the year 2020 is to develop a coordinated network of roads that will serve as the foundation for investment and economic growth in Ghana. Highways are to be developed and extended to link the national capital, regional capitals, district capitals, production centers and major cities in the neighboring countries. Feeder roads are to be developed to promote easy access to small towns, rural areas and production centers including agricultural areas. Urban roads are to be developed and maintained to move people and goods into cities and towns economically, efficiently and safely (MFA 2000).

The MRT has two sectors under its domain, namely the road infrastructure sector and the transport services sector. The executing agencies for the transport services sector include the National Road Safety Commission (NRSC), the Driver Vehicle and Licensing Authority and the Government Technical Training Centre. The executing agencies for the road infrastructure sector are the Ghana Highway Authority (GHA), the Department of Feeder Roads (DFR) and the Department of Urban Roads (DUR) (MRT 2006).

The role of the GHA includes the administration, control, development and maintenance of highways and related facilities in Ghana. The DUR is charged with the responsibility of the entire road network within the urban areas including the Accra Metropolitan Area, Kumasi Metropolitan Area, Shama-Ahanta Metropolitan Area, Tema Municipal Area, Cape Coast Municipal Area, Koforidua Municipal Area, and Tamale Municipal Area and the urban areas of the Ga District in Ghana. The DFR is given the responsibility for the planning, development and the maintenance of the entire feeder road network in Ghana (MFA 2000 & World Bank 2001). All the three road infrastructure executing agencies are subject to the central governmental budgetary, procedural, financial, managerial and economic policies. It is the role of the MRT to provide the unified planning, policy formulation, implementation and monitoring

strategies for all the agencies involved in the road and transport sectors in Ghana (MFA 2000).

This work focuses on feeder road rehabilitation programs in Ghana and hence the DFR. As illustrated in Table 2-5, feeder roads (or roads under the control of the DFR) constitute about 72% of roads in Ghana. Potentially, feeder roads have more capacity to employ more labor for road rehabilitation programs. Any improvement that makes labor-based methods attractive for feeder road rehabilitation in Ghana without increasing cost would go a long way to help create more employment in a country with high unemployment rates. The FBLM concept which is formulated intends to make labor-based methods attractive in Ghana, create more jobs and facilitate the rehabilitation of more feeder roads for the same (or less) cost as compared to the conventional equipment-intensive method.

Table 2-5: Road Network Distribution in Ghana (Data Sources: GHA 2004, DFR 2004 & DUR 2004)

Department	Length (km)	Percentage of total road network	Paved road (km)	Unpaved road (km)	Percentage of unpaved road
GHA	10,859	20	5,335	5,524	51
DFR	38,560	72	1,188	37,372	99
DUR	4,062	8	2,078	1,984	49
Total	53,481	100	8,601	44,880	N/A

2.2.3 Sources of Funding for road construction and maintenance

There are three major sources of funding for the construction, maintenance and management of the road infrastructure in Ghana. They are the Government of Ghana's (GoG) Consolidated Fund, the Ghana Road Fund (GRF), and Donor Grants/Loans (MFA 2000 & MRT 2005a). The GoG consolidated fund is the main public fund in Ghana. The consolidated fund directly originates from the national budget of Ghana (The Constitution of the Republic of Ghana 1992).

The road sector used to rely entirely on the GoG's consolidated fund to finance the local portion of its expenditures. Faced with the burden of servicing the high local and foreign debt, GoG needed to raise additional funds locally to support its road

infrastructure development (World Bank 1996). Thus the GRF was established in 1985 with the aim of raising funds for road maintenance through the collection of fuel levies, road and bridge tolls and vehicle registration and transit fees. Fuel levies constitute about 94% of the GRF. The consolidated fund is still used to supplement the GRF and donor loans/grants (World Bank 2001).

The major sources of foreign grants/loans (MFA 2000) include:

- The World Bank : The International Development Association (IDA)
- European Union (EU)
- Japan
    - Japan International Co-operation Agency (JICA)
    - Japan Bank for International Co-operation (JBIC)
- Denmark : Danish International Development Assistance (Danida)
- Germany
    - Kreditanstalt fur Wideraufbau (KfW)
    - Gesellschaft fur Technische Zusammenarbeit (GTZ)
- The United Kingdom: Department For International Development (DFID)
- France: Agence Francaise de Développement (AFD)
- The Netherlands
- Spain

Other donor organizations (MFA 2000) are;

- The African Development Bank (AfDB)
- The Arab Bank for Economic Development in Africa (BADEA)
- Organization for Petrol Exporting Countries (OPEC) Fund
- Nordic Development Fund, France (Agence Francaise de Développement).

Table 2-6 is a summary of the sources of funding used for road and transport infrastructure development in Ghana between 2002 and 2005.

Table 2-6: Road and transport funding sources (Data Source: MRT 2005a)

Funding Sources	2002 $m	2003 $m	2004 $m	2005 $m	Cumulative $m	Percentage of Total
GoG	14	61	125	113	313	28.2
GRF	73	71	206	118	468	42.1
Foreign Funds	41	95	119	75	330	29.7
Total	**128**	**227**	**450**	**306**	**1,111**	**100.0**

Table 2-6 above illustrates that Ghana is responsible for about 70.3% of its road construction and maintenance expenditure. Instead of the current reliance on importation of machinery for road works, Ghana can promote investment in labor-based construction methods which are cheaper, more employment generation oriented and usually rely more on local resources including hand-tools and local materials.

2.2.4 The condition of the road infrastructure

Out of Ghana's total road network of 53,482km only 35.4% is considered to be in good condition. About 30.9% is considered to be in fair condition and as much as 33.7% is considered to be in poor condition. The details of the current condition of the three road types in Ghana are illustrated in Table 2-7 below (DFR 2004, DUR 2004 & GHA 2004).

Table 2-7: Road infrastructure in Ghana 2004 (Data Sources: DRF 2004, DUR 2004 & GHA 2004)

Type of Road	Good (%)	Fair (%)	Poor (%)
Highway/Trunk Roads	40.4	29.7	29.9
Feeder Roads	35.2	28.6	36.2
Urban Roads	30.5	34.5	35.0
Average	35.4	30.9	33.7

The GoG has launched several major rehabilitation programs to upgrade the condition of the road infrastructure. These programs include the Road Sub-sector

Expenditure Program (RSEP) which was implemented between 1996 and 2000 and the Road Sector Development Program (RSDP) which was also implemented between 2002 and 2006. The budgets for both RSEP and RSDP were $1.482 billion and $1.191 billion respectively (World Bank 1996 & World Bank 2001). In 2003, the GoG through the MRT, designed a five year unconstrained programs (2004-2008) to speed up the upgrading process of achieving the road condition mix of 70% good, 20% fair and not more than 10% poor (MRT 2003). Table 2-8 presents the budget of the 2004-2008 unconstrained programs for all the three road infrastructure executing agencies for the rehabilitation of roads in Ghana.

Table 2-8: The Budget of the 2004-2008 unconstrained road rehabilitation programs in Million US Dollars (Data Source: MRT 2003)

Executing Agencies	**2004 ($m)**	**2005 ($m)**	**2006 ($m)**	**2007 ($m)**	**2008 ($m)**	**Total ($m)**
GHA	126.83	138.76	50.12	108.34	164.01	588.06
DRF	136.35	121.50	117.60	113.41	52.78	541.64
DUR	93.90	115.70	166.40	175.10	128.70	679.80

The FBLM concept which intends to improve the management strategies of the current labor-based approach can be implemented in the unconstrained program to facilitate the upgrading of the feeder road network at a faster rate and at a cheaper cost. The implementation of the FBLM concept in this program would also help create more jobs to absorb the unemployed, reduce importation of heavy construction equipment and also help reduce the repatriation of the needed foreign exchange.

2.3 ROAD REHABILITATION METHODS PRACTICED IN GHANA

There are two major road rehabilitation methods currently used in Ghana. They are 1) the conventional equipment-intensive approach and 2) the current labor-based approach which was introduced in 1986. The current labor-based approach is discussed in chapter 3.

2.3.1 The conventional equipment-intensive approach

Though heavy construction equipment were scarce and costly to import, many sub-Saharan African countries including Ghana adopted the equipment-intensive method of road construction and rehabilitation in the 1960s as they embraced the concept of urbanization. In Ghana, the government subsidized the importation of heavy equipment and thereby made the equipment-intensive method seemed more affordable than the labor-based method which was mostly used during the colonial era (Stock 1996).

The equipment-intensive method therefore became the conventional method for both the construction and the rehabilitation of roads in Ghana. The equipment-intensive method is used by the DFR, DUR and GHA for the construction and maintenance of roads in Ghana (MRT 2005b) whereas the labor-based method is limited to only DFR roads (Ampadu et al 2003). The attractiveness of the equipment-intensive method is attributed to its more modernized character, its relatively faster production rates (Ampadu 1999) and its minimization of labor organizational and management issues (Stock 1996).

2.3.1.1 Requirements

Like labor-based road contractors, all equipment-intensive road contractors are required to register with the MRT. Equipment-intensive contractors are classified into three technical classes, A, B and S. Contractors in category A are registered for the construction and rehabilitation of roads, airports and related structures. Contractors in category B are registered for the construction of bridges and culverts, and those in category S are registered for the construction of steel bridges. Each of the three technical categories is further subdivided into four financial classes 4, 3, 2 and 1 (MRT 2005b) as shown in Table 2-9. A contractor is registered in one or more of the three classes and the subdivisions based on the contractor's technical and financial capacity. After the reintroduction of the current labor-based road rehabilitation program, a special category, C, was created for all DFR trained labor-based road contractors (Ampadu 2001).

Table 2-9: Classification of road contractors in Ghana (Data Source: MRT 2005b)

Class	Category A Roads, Airports & Related Structures	Category B Bridges, Culverts & Related Structures	Category C Labor-based Road works	Category S Steel bridges & Related Structures
4	Spot improvement and reshaping (80km), re-gravelling (20km) a. Tender figure up to cedi (local currency) equivalent of US$250,000 b. Total value of work on hand up to cedi equivalent of US$400,000	Pipe culverts up to 1.2m diameters and non-reinforcement concrete structures, drains– 0.5km a. Tender figure up to cedi equivalent of US$100,000 b. Total value of work on hand up to cedi equivalent of US$150,000	GRAVEL ROAD REHABILITATION USING LABOR-BASED METHODS AS TRAINED BY DFR	Not applicable to this Class
3	Work in Class 4 plus resealing up to 20km and resurfacing up to 10km a. Tender figure up to cedi equivalent of US$650,000 b. Total value of work on hand up to cedi equivalent of US$1,000,000	Work in Class 4 plus single box culverts and other minor reinforced concrete structure including short retaining walls a. Tender figure up to cedi equivalent of US$250,000 b. Total value of work on hand up to cedi equivalent of US$400,000		Sand blasting, cleaning, jacking, changing of members and parts, tightening of bolts and nuts, other repairs including painting a. Tender figure up to cedi equivalent of US$250,000 b. Total value of work on hand up to cedi equivalent of US$400,000
2	Work in Class 3 plus improvements, rehabilitation and minor construction works a. Tender figure up to cedi equivalent of US$1,250,000 b. Total value of work on hand up to cedi equivalent of US$2,000,000	Work in Class 3 plus major box culverts or bridges and reinforced concrete, steel or composite reinforced structures a. Tender figure up to cedi equivalent of US$500,000 b. Total value of work on hand up to cedi equivalent of US$400,000		Work in Class 3 plus minor construction a. Tender figure up to cedi equivalent of US$250,000 b. Total value of work on hand up to cedi equivalent of US$400,000
1	Work in Class 2 plus major construction of roads and airports No limit on tender	Work in Class 2 plus bridges and other major structures No limit on tender		Work in Class 2 plus major steel construction No limit on tender

The entry category/class for equipment-intensive contractors is A4 and the minimum amount of equipment holdings required for entry is shown in Table 2-10. Equipment-intensive contractors can receive equipment and plant from the MRT on a hire-purchase basis to enable them complete awarded projects successfully.

Table 2-10: Minimum equipment holdings required of equipment-intensive road contractors in Ghana (Data Sources: Ampadu 1999 & MRT 2005b)

Equipment	**Number**
Bulldozer	1
Motor grader 90KW	1
Static Roller Â-10 ton	1
Tipper truck Â-5m^3	5
Water tanker	1
Pay-loader	1

2.3.1.2 Productivity rates

One of the major arguments used in support for the extensive use of the equipment-intensive method for road construction and rehabilitation in Ghana is its faster production rate. Whereas the current labor-based method is used to rehabilitate only 1.33km of road in 20 workdays per month, the equipment-based method is used to rehabilitate 3.07km of road in 20 workdays per month. The equipment-intensive method is not affected by the topography of the site and labor management problems. It relies on heavy construction equipment and only a handful of permanent skilled workers. The use of pre-cast concrete pipes for culverts (unlike the cast-in-place method used in the labor-based method) also enhances its speed of delivery (Ampadu 1999).

2.3.1.3 Cost and Employment creation capacity

Studies conducted in Ghana between 1996 and 1998 on 10 equipment-intensive road rehabilitation projects have shown that the project cost is influenced by the technical content of the project. On average the cost of rehabilitating a kilometer of gravel road

using the conventional equipment-intensive approach is $14,218. Table 2-11 illustrates the unit cost of the 10 projects (Ampadu 2001).

Table 2-11: Unit cost of equipment-intensive road rehabilitation in Ghana (Data Source: Ampadu 2001)

Project Identification	Length (km)	Cost per (km)
1	9.90	15,528
2	22.35	18,116
3	7.50	23,173
4	21.30	12,096
5	15.35	8,091
6	9.50	13,705
7	11.00	13,769
8	25.80	10,312
9	11.20	18,662
10	11.60	8,733
Mean	**14.55**	**14,218**
Maximum	**25.80**	**23,173**
Minimum	**7.50**	**8,091**

Unlike the current labor-based contractor who employs about 75 workers to rehabilitate a kilometer of road in 20 workdays per month, a typical equipment-intensive road contractor employs less than 20 permanent workers for feeder road rehabilitation. The 20 permanent workers include supervisors, equipment operators, mechanics, office assistants and vehicle drivers (Ampadu and Tuffour 1996).

2.3.1.4 Activities, tasks and equipment

Though it is generally assumed in Ghana that the current approach to labor-based road rehabilitation is slower than the equipment-intensive method, field evidence shows that the difference is not much. The results of research conducted on the 18 labor-based and 16 equipment-intensive projects have shown that, at best, equipment-intensive methods rehabilitate only 1.74km more road in 20 workdays per month than the current

labor-based approach (Ampadu 1999). Table 2-12 below shows the breakdown of the main activities, tasks and the equipment used in a typical equipment-intensive road rehabilitation project in Ghana.

Table 2-12: The major activities, tasks breakdown and the equipment generally used in equipment-intensive road rehabilitation in Ghana (Data Source: Ampadu 1999)

Main Activities	Tasks	Equipment
Site Preparation	Clearing, tree felling and boulder removal	Bulldozer
Earthworks	Filling and cutting to formation level	Dossier, vibrating roller, water bowser
Reshaping	Blading, scarifying, non-standard earthworks and excavation of drains to formation level.	Motor grader
Culvert construction	Pre-cast pipe culverts of diameter 600-1830mm	Hydraulic excavator, crane
Gravelling	Gravel pit preparation, excavation, loading-hauling-offloading, spreading, watering and compaction	Bulldozer, pay-loader, tipper trucks, grader, water tanker and vibrating roller

Equipment-intensive construction is the conventional method used for road rehabilitation in Ghana though it continues to rely more on imports of equipment and less on labor in a country where unemployment is as high as 20% and trade deficit is as high as $0.7 billion. On the average, the total workforce on a typical equipment-intensive road rehabilitation site is less than 20 (Ampadu 1999). Table 2-13 below illustrates the major activities, quantities and a schedule of the monthly (20 workdays) average production of the 3.07km.

Table 2-13: Activities and quantities for the rehabilitation of 3.07km feeder road in 20 working days per month using equipment-intensive methods (Data Source: Ampadu 1999)

Activities	**Quantity/month (for 3.07km)**	**Equipment used**	**Machine-days required**
Site Preparation	27,630 m^2	Bulldozer	3.2
Earthworks	2,232 m^3	Dossier, vibrating roller, water bowser	3.1
Reshaping	1.80 km	Motor grader	9.2
Culverts	3.55	Hydraulic excavator, crane	2.3
Gravelling	2.0 km	Bulldozer, pay-loader, tipper trucks, grader, water tanker and vibrating roller	2.2

2.4 HIGH PERFORMANCE WORK TEAM (HPWT) CONCEPTS AND THE GHANA FAMILY SYSTEM (GFS)

The underlying reason for including the high performance work team (HPWT) principles in the formulation of the FBLM concept is their similarity with the Ghanaian family system (GFS) which bears much influence on the socio-economic activities in the country. The application of HPWT for industry organization is still relatively new but it continues to be adopted by many firms due to the benefits to both employers and employees. The concept of HPWT promises a range of benefits including higher levels of profitability and productivity for employers and higher earnings and more challenging work for employees (International labor Office (ILO) 2002). The concept has been proposed by the Tier II Work Force Strategy for the maximum utilization of skilled worker on US industrial construction projects (Chang 2002).

It has been noted that the failure of many economic developments programs introduced into developing countries like Ghana may be attributed to their lack of organic relationship with the local socio-cultural norms (Lauer 2000). Every country has certain socio-cultural values that make it unique such as the family system in Ghana (Gyekye and Salminen 2005). The GFS which bears much resemblance to the HPWT concept also

has considerable impact on socio-economic activities in the country. Integrating the two concepts into the FBLM concept would not only help improve the organizational and management skills of labor-based road contractors but also attract many workers in Ghana into the program.

2.4.1 High Performance Work Teams (HPWT)

A HPWT is defined as a supervised, self-manage and autonomous work team. In a field study conducted in 1998 (and reported in Construction Industry Institute (CII 1998) Special Publication 98-12), HPWT was defined as a group of craft persons who are collectively highly motivated, technically competent in at least one craft, success and goal-driven and willing to work in a team environment (Ray Marshall Center for the Study of Human Resources (CSHR) 1994, Kerka 1995 & Pappas 2004). The main characteristics of HPWT discussed below include the flatter and horizontal organizational structure, teamwork, self-managed work teams (SMWT), interpersonal processes and the reward systems.

2.4.1.1 Flatter and horizontal organizational structure

Management in HPWT is more horizontal as compared to the conventional hierarchical management structure of the construction industry (Kerka 1995). The hierarchical nature of construction is believed to be a hindrance to free discussion and the exchange of ideas (Chang 2002). In HPWT, authority and responsibilities are clearly assigned to each team and to individual team members. Authority is decentralized by shifting more decision-making to front-line workers. High performance systems are moving away from the strict hierarchies to more autonomous work environments (Evans and Davis 2005 & Murphy and Jackson 1999). Employees are encouraged to be involved in the determination of work processes, administration, planning and scheduling (Pappas 2004). Workers are encouraged to proactively define their own roles and responsibilities within the organization (Evans and Davis 2005).

2.4.1.2 Teamwork

A HPWT is comprised of a team leader and team members. Members of high performing teams are dependent on each other in the performance of tasks and receive feedback from each other to function as a single team (Squires 2002). The success of the team depends on the performance of the team leader and the commitment and dedication of each team member. The presence of cooperative interdependence among team members reduces interpersonal conflicts and unproductive behaviors (Chang 2002). It has been discovered that allowing team members to participate in the selection of their team members enhances team compatibility (Rentsch and Klimoski 2001). Teams function well when they are supported by management with continuous training and free flow of information needed to perform their tasks (Squires 2002). Research has proven a strong correlation between teamwork and the success of firms that employ team strategies (Rentsch and Klimoski 2001).

2.4.1.3 Self-Managed Work Teams (SMWT)

Another form of HPWT is self-managed work teams (SMWT) that are empowered by the management with the appropriate authority, responsibility and accountability to make decisions. They are the employees responsible for managing and performing the technical tasks involved in production. Decision-making is delegated to the team and the individual craft workers (Chang 2002). The team leader delegates some of the daily responsibilities to craft workers in order to have enough time for planning and facilitation. Technical tasks and management responsibilities such as monitoring quality and productivity rates are rotated among the team members (Pappas 2004).

SMWT also have the authority as a team to make decisions about their work and about the handling of internal processes to generate better products. In SMWT power is redistributed downwards to team structures and team members. To utilize the authority delegated to them efficiently, team members of SMWT must possess broad knowledge and multi-skills needed to execute projects (Evans and Davis 2005).

2.4.1.4 Interpersonal processes

Interpersonal relationship skills such as communication, cooperation, conflict resolution, trust, respect and commitment are essential for the success of HPWT. It is argued that employee social relationships add value to the organization's effectiveness (Yeatts 1998 & Collins and Clark 2003). Social relationships facilitate timely access to greater sources of information and thereby reduce the need for formal controls (Adler and Kwon 2002). Interpersonal processes also enhance the development of an organization's intellectual capital (Nahapiet and Ghoshal 1998).

A significant factor in the application of the HPWT is the development of effective team communication skills. Effective communication promotes proactive information flow, facilitates formal and informal dialogue, opens workers' access to management and encourages information sharing on projects (Chang 2002). HPWT demands open vertical and horizontal communication channels to provide access to information and the opportunity for workers to express their viewpoints. Effective communication is critical to the success of a high performance project. Conversely, the success of a project can be hindered by poor team communication skills (Thomas 1996).

Cooperation among the team members is essential for the success of HPWT. Employees and managers often clash over inherent conflicts in construction projects (Pappas 2004). Effective cooperation among workers leads to productive social relationships within the entire organization. Cooperative behavior is becoming more essential in HPWT because it is believed to improve team and organizational effectiveness. Cooperation among team members reduces unproductive behaviors and interpersonal conflicts (Evans and Davis 2004 & Treadway et al 2004).

The presence of internal conflict resolution practices among the members of HPWT saves time, minimizes disruptions and reduces calls to management for interpersonal or team-problem solving (Bailey et al 2001). The potential for the success of high performance work systems is also dependent on shared value systems. Values including trust, commitment and mutual respect are crucial to team building. Trust is increased among employees when employees have more mutual interactions and opportunities to work with each other. Management also enhances trust by showing concern for workers and by sharing control of activities with workers. Trust is essential

for team cooperation (Whitener et al. 1998). Trust also leads to commitment. It is also essential for the management to include workers in decision-making processes (Kalleberg et al 2004).

A successful implementation of HPWT requires the understanding that both employees and the management are committed to each other and to the organization. Employee commitment is shaped by the motives and sincerity of the organizations' support, rewards system, and policies (Pil and MacDuffie 1996). Other behavioral traits that are essential for the implementation of HPWT include helping behavior, sportsmanship, organizational compliance, individual initiative, civic virtue and continuous self-development (Podsakoff et al 2000).

2.4.1.5 Reward Systems

Some important motivational factors that must be considered in the implementation of HPWT are the performance-based and team-based compensation systems (Chang 2002). These reward systems include profit or gain sharing, performance contingent payment systems, team-based payment systems and above market payment policies (Evans and Davis 2005).

It is interesting to note that the concept of the HPWT discussed above bears some similarities with the underlying principles of the Ghanaian family system (GFS), especially with regard to the interpersonal processes, the reward system and the preference for teamwork.

2.4.2 Ghana Family Structure (GFS)

Every Ghanaian is born into a traditional extended family system. The extended family members are bound together by a common flesh and blood acquired through a female ancestor or a common guiding spirit derived from a male ancestor. It is believed that the sacred blood of the female ancestor sustains and maintains the physical bodies of her descendents and the sacred spirit of the male ancestor is responsible for the development of the personality of his descendents. The former is the basis of matrilineal extended families and the latter the basis of patrilineal extended families in Ghana (Ollennu 1966). In Ghana, nuclear families form part of the extended family system and

the extended family itself also forms part of the larger tribe or ethnic group. Individual Ghanaians are connected to each other through the family systems (Awusabo-Asare 1990).

The family systems have great influence on the socio-economic activities in Ghana. Actions and decisions of family members concerning their economic enterprises, education, marriage and others are expected to be taken in agreement with members of the family. For instance, marriages contracted without the consent of the other members of the extended family can be rejected (Ollenu 1966 & Lauer 2000). The major principles underlying the Ghanaian family system can be summarized as 1) high power distance, 2) collectivism, 3) low uncertainty avoidance and 4) femininity (Hofstede1994 & Gyekye and Salminen 2005). Each of the major principles is described in turn below.

2.4.2.1 High power distance

The exercise of authority in the GFS is described as high power distance because there is a recognition and acknowledgment of inequality of power sharing between family-heads (or elders) on one hand and family members on the other hand. The family structure has a highly centralized traditional political system. It is mostly managed by male leaders. Family members attribute great respect to authority and old age. In typical traditional homes, authority is exercised by the family heads (both in the nuclear and extended family systems) as the preservers of the family lineage (Hofstede1994). However, the family heads are expected to assume paternalistic responsibilities for the welfare of their family members. Family members reciprocate by according family heads trust, respect, loyalty and obedience. In this cultural set up, decisions are often made by the family heads and the subordinates are usually unwilling or afraid to disagree (Hendricks 2000 & Gyekye and Salminen 2005). This high power distance norm characteristic of the family also manifests itself in the work environment in Ghana (Gyekye and Salminen 2005).

2.4.2.2 Collectivism

Collectivism is tendency for people to belong together in groups to take care of each other (Hodgetts and Luthans 2000). The Ghanaian society is rooted and organized in

its traditional family systems including the nuclear family, the extended family and the kinship systems (Ardayfio-Schandorf 1994). For instance, individuals are encouraged to be group decision makers. The upbringing of children becomes the responsibility of the extended family when the parents refuse or are unable to provide for their children. Older parents whose retirement system is inadequate are subsidized by their progenies (Hodgetts and Luthans 2000 & Fordjor et al. 2003). Property (such as land) and business enterprises are usually collectively owned and managed by the families (Hendricks 2000 and Addo-Abedi 1999).

2.4.2.3 Low uncertainty avoidance

Social institutions that are described as low uncertainty avoidance, like Ghana, are known to accept risks associated with the unknown. They accept uncertainty as part of life. These institutions have few structured organizations set in place to provide security. Many activities and traditional organizations are less structured. There are fewer written rules and fewer legal implications with regards to social behavior. Social behavior is regulated by unwritten rules that are orally transmitted from one generation to another. It is usual to seal agreements or contracts with handshakes (Hodgetts and Luthans 2000).

Cultures described as low uncertainty avoidance are very entrepreneurial. Managers in such cultures are naturally risk-takers and assume responsibility for their actions. There is higher labor turnover and employees are also ambitious (Hodgetts and Luthans 2000). Given the opportunity, many Ghanaian workers would make use of their entrepreneurial nature to improve their living standards.

2.4.2.4 Femininity

Femininity is closely related to the concept of collectivism. The term femininity is used to describe social institutions whose dominant value is caring for others and also for quality of life. Such cultures hold cooperation, friendliness and job security as very important. Achievement in such a society is conceived more in terms of establishing cordial relationships than in monetary profits (Hodgetts and Luthans 2000). The Ghanaian family holds as important the wellbeing of their members especially children and aged members (Fordjor et al. 2003).

Though the principles underlying the Ghanaian family structure were not primarily designed for the execution of projects, they bear some similarities with some of the principles of HPWT which are designed mainly for efficient execution of projects.

2.4.3 A comparison of HPWT and GFS

There are many similarities between the characteristics of HPWT and the GFS. Table 2-14 was composed by the author to illustrate the similarities and differences between HPWT and GFS. The major differences between the two are the hierarchy systems employed in management and decision-making, the skill level of craft workers and the intensity of craft training. It has been established that flatter horizontal organizational structures (Kerka 1995), participative decision-making systems, craft-training (Pappas 2004), effective reward systems (Evans and Davis 2004), teamwork (family) (Squires 2002) and interpersonal processes including effective communication, cooperation (friendliness) (Evans and Davis 2004) do improve productivity. Interpersonal processes facilitate timely access to needed information, promote more flexible work organization, reduce the need for formal controls and facilitate collective action (Adler and Kwon 2002).

The HPWT and the family system in Ghana have much in common. However, the principles underlying the HPWT are more future-oriented and much developed for the execution of projects than those of the family system. Many of the characteristic of the family system including cooperation, social relationships, social obligations, craft training, communication strategy and the reward systems can form a good foundation for the development of a higher performance family-based work team concepts (such as the proposed FBLM) which would provide a better management tool than the casual labor work system currently being used in feeder road rehabilitation in Ghana.

Table 2-14: A comparison of the HPWT and the Ghanaian Family concept

General Institutional Traits	High Performance Work Teams	Ghana Family Structure/Characteristics
Hierarchical Structure	Flatter/Horizontal	Vertical
Organizational Structure	Flexible autonomous work environment	Less Structured, less written rules and regulations
Decision Making	Participative Management, teams, team members	Top-down male leaders
Management strategy	Self-managed	Manage by leaders
Social obligation of management/family heads for team/family members	Recommended	Required; paternalistic obligations of family heads toward members
Communication Strategy	Open vertical and horizontal channels	Closed vertical channel; Formal Open horizontal channel; Informal
Formation of team/family	Essential for work: Collaboration	Required for family life; Natural
Cooperation/Friendliness	Essential for work	Required for family life
Dispute mediator(s)	Team members	Family heads and elders
Craft Training	Multi-skilled ▪ Cross training ▪ Extensive formalized training ▪ Interpersonal skills	Life-oriented ▪ Social adaptation ▪ Apprenticeship
Craft skill level	High	Low
Reward system	Individual merits Team recognition	Group recognition Social relationships
Social Relationships (Trust, Commitment, Respect)	Essential	Required

2.5 THE CONCEPT OF ROLES AND RESPONSIBILITIES

Clear definitions and assignments of roles and responsibilities are critical to the success of a project. One of the first steps in the implementation of a collaborative project is to define clearly roles and responsibilities of the project teams (Cohen and Mankin 2002). Since teamwork concepts are utilized in the formulation of the FBLM concept, team roles and responsibilities concepts are also explored to help construct roles and responsibilities matrices that will clarify the duties, assignments and accountability of the teams involved.

Ambiguous definitions and assignments of roles and responsibilities can lead to confusion and ineffective communication (Ogunlana and Sysavath 2000 & Giandon et al 2002). Using roles and responsibilities concepts in a project from its very onset has many advantages (Cohen and Mankin 2002); project transparency, communication and commitment are usually enhanced. Roles and responsibilities concepts also help reduce conflicts among project team members (Formoso et al 1998).

2.5.1 Roles

The notion of 'role' is conceptual. Researchers have different views on what constitutes a role and how a role can be defined (Crook et al 2003). The research focuses on the concept of role as it relates to 'role theory' since the role theory bears some similarities with the concept of role distribution in the Ghanaian family system. Role theory is a sociological concept about how individuals interact with each other in a society or in an organization. A society's structure is usually defined by a set of roles. A specific role such as father, customer, friend, or advisor may demand the fulfillment of certain societal expectations (Crook et al 2003). Such expectations may be behavioral, economic, as well as cultural. Role assignment has been influential in governing human behavior in society (Dastani et al 2003). The criteria underlying role assignment in human society have evolved over time (Odell et al 2003). Below is a brief discussion on the history of role assignment.

2.5.1.1 History of role assignment

The criteria used to assign roles have evolved gradually throughout the history of human resource strategies; from the assignment of role by category through role assignment by qualification (or by function) to team role concepts as illustrated in Table 2-15 (Odell et al 2003 & Belbin 2003).

In the pre-industrial era, the autocratic rulers did not weigh their servants' preferences when assigning roles and responsibilities. Though a few favorites enjoyed their own choice of roles, a great majority of them did not have any inputs in the roles they were given. The most straightforward rule for role assignment during this era was a visual classification of people by category such as age, gender, tribe and class. Role assignment by category had such a universal appeal that it is still alive in many societies (Belbin 2003).

Table 2-15: History of role assignment strategies (Adapted: Belbin 2003)

Era	Factors for Role assignment	Method of Role Assignment
Pre-industrial	By category • Age • Sex • Tribe • Class	• Visual inspection
Industrial	By qualifications • Trade skills • Experience • Education	• Certificates • Selection panel
Post-industrial	By team concept • Team role • Personal orientation	• Computer matching • Counseling

The major disadvantage of role assignment by (category) age, gender, tribe and class was the neglect of individual skills and talents. The consideration of individual skills and talents in role assignment became common after the structures of empires and the associated tyrannies began to crumble. The advantages of role assignment by individual skills and talents were evident in small city states such as Miletus, Knossos, Rhode, Samos, Athens and Corinth. The recognition of skills and craftsmanship in role assignment in these city states led to their immense prosperity. The assignment of role by individual skills and talents (not by category) were the rule in these city states. Apprenticeship, training and general education evolved. The new way of role assignment became the preferred rule during the industrial revolution (Belbin 2003).

The industrial era emphasized individual skills (role by function) rather than roles by category. Functional role referred to the operational knowledge and technical skills individuals need to perform assigned tasks (Belbin 2003). Functional roles define positions and responsibilities on the basis of required qualifications and skills. Role assignment by qualifications or function adopted in the industrial era allowed initiatives, encouraged innovations, increased productivity and improved living standards (Ahn and Sandhu 2001).

During the pre-industrial and industrial era, jobs were well defined and roles conveyed exactly the responsibilities attached. There was less communication challenges until projects became complex and the formal boundaries of jobs began to crumble. With the crumble of job boundaries, communication among project participants became a challenge. The need to enhance communication coupled with advances in strategic thinking and technology emphasized collaboration. Skills, talents and qualifications were crucial but not enough for the success of collaborative projects. What mattered was how a prospective employee will collaborate with other employees. More emphasis began to be placed on team role (Belbin 2003).

2.5.1.2 Team role

Team roles are useful for collaborative working environments where employees are assigned to teams and team resources (Crook et al 2003). Team roles refer to the distinct ways in which a team member is expected to behave, interrelate with other co-workers and contribute to the success of a project (Belbin 2003). The focus of team role is not just on each individual's skills but most importantly on the optimization of interactions to promote communication efficiency, situational awareness and effective decision-making (Yin et al 2000).

Teamwork involves a team member role and a team leader role. A team member role requires the ability to share knowledge, experience and expertise with team members. A team leader's role requires a combination of people skills, technical skills and interpersonal skills since the role usually involves directing team members, fostering collaborative work, providing information and resolving conflicts (Scholtes et al 2003). An individual must display certain behavioral characteristics to effectively assume a team role (Henry and Stevens 1999 & Belbin 2003).

Though role assignment by category (by age, gender and tribe) is not totally absent in the role assignment strategies used in Ghana, the team role concept is utilized to enhance the effectiveness of the FBLM concept by not only discouraging role assignment by category but most importantly by going beyond the requirements of individual skills, qualifications and capabilities to emphasize the used of collaborative or team role concepts in the labor-based road rehabilitation programs in Ghana.

2.5.2 Responsibilities

Responsibility can be understood from both retroactive and proactive perspectives. In the 'retroactive' sense, responsibility may be defined as the relationship that exists between an individual and some event that happened in the past which seeks to assign blame, fault or culpability to the individual. In the 'proactive' sense, responsibility defines actions that have to be taken to fulfill a goal. In an organizational context, a role describes a collection of responsibilities and associated capabilities of a worker (Ioerger and Johnson 2001). This research concentrates on the proactive perspective since responsibility assignments in organizations are mostly proactive.

2.5.2.1 Responsibilities and Capabilities

Responsibilities require capabilities (the interrelating logics of knowledge, time and action) for the successful execution of tasks (Ioerger and Johnson 2001). Every role in the role-set demands certain capabilities for the execution of assigned tasks. Capabilities specify what each team or team members can do. To be assigned a certain role, an individual must possess the appropriate capabilities (Yin et al 2000). In teamwork individuals with the right capabilities must also have the interpersonal skills to effectively work with others who may be different from themselves (Cohen and Mankin 2002).

2.5.2.2 Responsibilities and Accountability

Responsibility implies obligation and accountability (Crook et al 2003). An individual who is assigned responsibilities and possess the capabilities is required to maintain certain degree of persistence to get expected actions done. In some cases, the individual is required to keep trying until the goal is accomplished. However, the individual is also obligated to inform team members if she or he cannot carry out the assigned responsibilities (Ioerger and Johnson 2001).

2.5.2.3 Responsibilities and Teamwork

For teamwork to be successful, team responsibilities need to be carried out both by team members and team leaders. In addition to their functional responsibilities, it is

the responsibility of team members to share their knowledge and expertise, to participate in meetings, ask questions, listen to others and stay opened to ideas of other team members. It is also the team member's responsibility to communicate effectively with each other and to assist the team leader with team management. The team leader is responsible for the clear assignment of roles and responsibilities to team members, the identification of education and training needs of the team, the planning and leading of team meetings and the coordination of teamwork. It is the responsibility of both team members and team leaders to strive for improvements based on lessons learned (Scholtes et al 2003).

2.5.3 Roles and Responsibilities Matrix

The roles and responsibilities matrix summarizes the roles and responsibilities of project team members and defines the responsibility relationships among team members (United States (US) Army 2005 & Cohen and Mankin 2002). The matrix is an excellent tool used to identify the needed roles of a project and also to determine that all the responsibilities needed to complete the project are identified and assigned. It clarifies the actions (US Army 2005) team members need to take to fulfill assigned roles. The roles and responsibilities matrix is usually an agreed upon document that helps team members understand and appreciate the roles of each other and the behavior required of them (Cohen and Mankin 2002).

The roles and responsibilities matrix reduces the ambiguity with regard to 'who does what?' and clarifies cross-functional interactions among team members. It clearly sets up the expectations of all the team members before the project commences (Charvat 2002). The matrix is able to proactively identify gaps in roles and responsibilities assignment of a particular project. The full impact of roles and responsibilities matrix is realized when it is constructed early in project planning phase before resource allocation and scheduling are completed (Pehrson and Vatn 2006).

The roles and responsibilities matrix improves the quality of communication among team members. It helps all participants to understand 'who has what information'. It facilitates the daily assessments of a project performance on a regular basis (Charvat 2002). The matrix can also be used to analyze the current role and responsibility

assignments to improve future role and responsibility assignment as technology and organizational setups change (US Army 2005). Table 2-16 below is an example of a roles and responsibilities matrix of a university class.

Table 2-16: Roles and Responsibilities Matrix example

Task	*Course Instructor*	*Other Faculty*	*Administrative Office*	*Teaching Assistant*	*Students*
Design course details	**A**				
Provide printed copies			**A**	**I**	
Distribute copies				**A**	
Lead weekly seminars	**A**			**I**	**I**
Assign weekly readings	**A**				
Complete weekly readings					**A**
Assign monthly presentations topics	**A**	**I**		**I**	**I**
Critique monthly presentations	**A**	**I**		**I**	**I**
Assist student choose term paper topics	**A**	**I**		**I**	**I**
Grade term papers	**R**			**A**	
Assign final grades to students	**A**	**I**		**I**	

Legend: A-Accountable **I**-Input **R**-Review

The use of team roles and responsibilities concepts in the formulation of the FBLM concept will help improve the management capabilities of the local contractors involved in the labor-based road rehabilitation program in Ghana. Roles such as site manager, supervisor, foreman and laborer can be clearly defined and summarized in a matrix to help avoid confusion. Individual team members will have a better understanding of their own responsibilities in relationship with those of others to facilitate efficient communication and collaboration.

2.6 EXAMPLES OF LABOR-BASED AND EMPLOYMENT GENERATION PROGRAMS

Ghana has a great opportunity to learn from many successful labor-based and employment generation programs that have been implemented in various countries to improve its socio-economic conditions. This research, which intends to contribute to the effort being made to generate employment and alleviate poverty in Ghana, will focus on

the US Works Progress Administration (WPA) program implemented during the Great Depression and the ongoing South Africa's nationwide labor-based programs designed to reduce the high incidence of unemployment and poverty in the country.

The reasons for the interest in these two employment generation and labor-based programs are not only limited to the fact that the US and South Africa are the most economically developed nations in the Americas and Africa respectively and therefore worthy of imitation, but also the socio-economic conditions such as poor export earnings, import dependence, lack of jobs, declining wages and deteriorating living standards (Ohio Historical Society (OHS) 2005a & Knight 2004) that led to the design and implementation of these programs are similar to the prevailing socio-economic conditions in Ghana (TUCG 2004).

2.6.1 The WPA

The Works Progress Administration (WPA) formed part of the Emergency Relief Appropriation Act passed on April 8, 1935 by the United States Congress under the presidency and guidance of Franklin Delano Roosevelt as the Federal government's response to alleviate the Great Depression (OHS 2005b). There were many factors that contributed to trigger the Great Depression in the 1920s. The factors included the dramatic increase in the cost of living, the declining wages of workers especially in the railroads and coal industries, the declining crop prices, poor investments and poor patronage of American export by other nations. However, it was the Stock Market Crash of October 1929 that ushered in the Great Depression (OHS 2005a).

The Great Depression was unique and unprecedented in American history. The economic collapse associated with the depression brought tremendous despair, hardship and sufferings to many Americans (Couch 2001). Millions of American workers lost their jobs. About 25.2% of the workforce became unemployed by 1933 and without any income. A nation plunged into severe economic depression turned to the federal government for assistance. On May 6, 1935, President Roosevelt signed official documents to create the Works Progress Administration (WPA) by Executive Order No. 7034 (Findlay 2004). The WPA was renamed Works Project Administration (WPA) in 1939 (OHS 2005b).

2.6.1.1 Intent of WPA

The WPA program was designed to help alleviate the suffering of Americans, to end the unprecedented economic collapse and to prevent another great depression from occurring again (Findlay 2004). The WPA created employment opportunities to employable persons to produce valuable goods and services. In theory, the WPA was to bring a halt to the human suffering and put the American economy on the way to recovery (OHS 2005b). It was also designed not only to raise the morale but also to maintain the healthy social attitude of Americans. The creation of job opportunities for the unemployed was also intended to restore the human spirit (Couch 2001).

2.6.1.2 The Organizational Structure of WPA

The WPA grew out of many earlier attempts by the Federal government to address the devastating economic crisis and social chaos associated with the Great Depression. Many existing relief programs including the Federal Emergency Relief Administration (FERA), the Public Works Administration (PWA) and the Civil Works Administration (CWA) were merged and consolidated into the WPA program. Other programs such as the Farm Security Administration (FSA), the Civilian Conservation Corps (CCC) and the Rural Electrification Administration (REA) existed as parallel programs with the WPA. The National Youth Administration (NYA) operated many programs for out-of-school youth from 1935 to 1943 as part of the WPA program (Findlay 2004).

The WPA became the best known of all the relief agencies of Roosevelt's administration. It also became synonymous with Roosevelt's entire New Deal (Findlay 2004) since the president devoted more energy and more money to it than to the other agencies (Couch 2001). The organizational structure of the WPA was subjected to constant changes during the existence of the program. In 1939, the WPA was divided into 4 sections (Findlay 2004 & U.S. Work Projects Administration (USWPA) 1940-43). They are;

A) The central Administration of WPA located in Washington, D.C.

B) The 9 regional offices:

Region 1, Boston, MA

Region 2, New York City, NY

Region 3, Baltimore, MD

Region 4, Chicago, IL

Region 5, Atlanta, GA

Region 6, New Orleans, LA

Region 7, St. Paul, MN

Region 8, Denver, CO

Region 9, San Francisco, CA

C) The State Administrations.

The State administrative jurisdictions were contiguous to state boundaries, except in the case of California and New York. California was divided into Northern and Southern administrative jurisdictions and New York into New York City and New York State. The administrative jurisdictions established for territories such as Puerto Rico, Hawaii, and the District of Columbia were also designated as State Administrations (Findlay 2004).

D) The district offices.

2.6.1.3 WPA Projects

The WPA created both blue collar and white collar jobs (Findlay and Bing 1999). Blue collar projects included the construction of highways, dams, bridges, roads, streets and public buildings such as schools and hospitals. Other physical projects included the construction of recreational facilities, airports and airway equipment, water supply and sanitation systems, flood and drainage systems. White collar workers, both men and women, were also employed in scientific research in medical, dental, clerical, cultural and recreational fields. Other white collar professionals were employed in other services including art, library, museum, music, teaching and nursing (Findlay 2004). The WPA federal projects included the Federal Art Project, the Federal Music Project, the Federal

Theater Project, the Federal Writers' Project and the Historical Records Survey (Findlay and Bing 1999).

A set of guidelines which had a Keynesian economic (economic multiplier effect) undertone were formulated in 1935 to help the approval process and the running of WPA projects (Fagette 1996). For approval and operation, a WPA project must:

1. be useful
2. ensure that a considerable proportion of the total cost goes to labor as wages.
3. be favorable in terms of the return to the federal treasury a considerable proportion of its cost.
4. be capable of immediate execution so that the money could be spent promptly.
5. facilitate the creation of more employment to reduce the high number of the unemployed on the relief rolls.

2.6.1.4 The funding of WPA

The Federal government accepted the responsibility of creating millions of blue and white-collar jobs and agreed to pay the salaries of the vast legions of the suffering workers (Findlay 2004). Though the WPA projects were mostly funded by the federal government, the states were also required to provide some of their own resources to match the funding of the federal government (Couch 2001). The expenditures of the WPA between 1936 and 1939 amounted to about $7 billion as illustrated in Table 2-17. The total expenditure increased to $11.4 billion in 1941. Over $4 billion was spent on highways, roads and street projects, about $1 billion was spent on public buildings, about $1 billion on publicly owned or operated utilities and about $1 billion was also spent on welfare projects which included the running of sewing schools and lunch projects for women (Howard 1943).

Table 2-17: WPA Expenditures from 1936 to 1939 (Data Sources: Office of Government Report 1940 in Couch 2001 & the US Department of Commerce 1987)

Year	Expenditures ($)	GDP ($billion)	Expenditure as a percentage of GDP
1936	1,295,459,010	95.8	1.36
1937	1,879,493,595	103.9	1.82
1938	1,463,694,664	96.7	1.55
1939	2,125,009,386	103.7	2.03

To compare the worth of the WPA expenditures shown in Table 2-17 above in today's currency, the official USA Consumer Price Index (CPI) (1982-1984 = 100) has been used to convert the 1936-1939 WPA expenditures into 2006 worth of the dollar as illustrated in Table 1-18 below. The conversion was made using the Federal Reserve Bank of Minneapolis calculations.

Table 2-18: The worth of the WPA Expenditures in 2006 dollar value (Data Sources: Office of Government Reports 1940 in Couch 2001& the Federal Reserve Bank of Minneapolis 2006)

Year	WPA Expenditures in US$ round to billion	Worth of WPA Expenditure in 2006 dollar value round to billion	CPI (Base year: 1982-1984 = 100)
1936	1.3	19	13.9
1937	1.9	26	14.4
1938	1.5	21	14.1
1939	2.1	31	13.9

CPI for 2006 = 201.7

2.6.1.5 Workers and Wages

The workers employed by the WPA program included both skilled and unskilled men and women. The unskilled blue collar workers in construction constituted about 90% of the WPA employees (Schindler-Carter 1999). The workers were assigned to jobs similar to their former occupations or jobs within their capabilities. Workers were treated

as employees and not as relief clients. They were actively producing for the society, and the wages they received were based on the quantity of work performed (USWPA 1938).

The salaries paid by the WPA to workers varied throughout the nation. According to the national pay figures for 1937, unskilled workers earned monthly wages between $26.00 and $55.00 a month, semi-skilled workers received between $33.00 and $65.00 a month and skilled workers received between $44.00 and $85.00 a month. Professional and technical workers were paid between $48.00 and $94.00 a month (Findlay 2004).

2.6.1.6 The Outcome of WPA

The WPA was discontinued on June 30, 1943 at the onset of World War II. More money was injected into the economy to create hundreds of thousands of jobs for World War II production. The Great Depression ended and the unemployment rate was reduced tremendously (OHS 2005c). During its short existence, from 1935 to 1943, the WPA created many projects, preserved the skills of workers, maintained their morale, and employed about 12.7 million Americans (Howard 1943). The WPA also influenced the growth of the Gross Domestic Product (GDP) of the United States (Howard 1943).

The period covered by the WPA was one of depression, not only of the economy but also of the spirit of the people as unemployment incidence continued to rise (Bloxom 1982 & Couch 2001). The WPA program restored the spirits of workers and ensured a healthier social attitude. Workers earned an honest living instead of just receiving a handout from the government. They also contributed to the economy through their work (Findlay 2004). The WPA provided a sense of self-worth to American workers who were employed by the program. It made it easier for workers to find better employment opportunities in the larger scale war production during World War II (Hopkins 1938).

The projects generated by the WPA were of both physical and human in nature (OHS 2005b). The physical projects included the construction of 600,000 miles of roads, the construction or repair of about 124,000 bridges, 125,000 public buildings, 2,500 sport stadiums, 8,000 parks and 850 airports. About 9,000 storm drains and sanitary sewer lines were also laid. The WPA undertook conservation projects by planting 24 million trees (National Appraisal Committee 1939). Other physical accomplishments of the program included the construction of airway equipment, recreational facilities, water

supply systems, electric and communication utilities and ground improvement systems. The human accomplishments were mostly realized in the field of public health, education, recreation, art, library, sewing, nursing, medical and dental care (Hopkins 1938).

Though the WPA program did not totally eliminate the high unemployment situation before the onset of World War II, the program did employ legions of both blue and white collar workers throughout the nation. The WPA was the main driving force in employment creation during its period of existence (Findlay 2004). The high unemployment incidence of 25.2% in 1933 was reduced to 13.9% in 1940 before the onset of the war (Historical Statistics of the U.S. 1976). The number of workers employed by the WPA, the CCC and the NYA combined, and the other federal projects are shown in Table 2-19.

Table 2-19: Employment created by the WPA, the CCC and the NYA and other Federal work projects in 1000s (Data Source: Howard 1943)

Workers Employed by Agencies	**1936**	**1937**	**1938**	**1939**	**1940**	**1941**
WPA in 1,000	1,995	2,227	1,932	2,911	1,971	1,638
CCC and NYA in 1,000	712	801	643	793	877	919
The other federal projects in 1,000	554	663	452	488	468	681
Total	2,361	3,691	3,027	4,192	3,316	3,238

The WPA program had a very positive impact on the GDP of the United States from its inception in 1935 until it was discontinued in 1943 (US Department of Commerce 1987. The era of the WPA program was a unique period in American history. Faced with great depression, the American government developed traditions and social models that paved the way to economic development (Findlay 2004). Through the WPA program, the government put much needed money into the hands of the millions of otherwise unemployed workers and in the process contributed to the building up of the nation's physical and human infrastructure (Couch 2001).

Ghana has a lot to learn from the WPA. Like the WPA program, Ghana can improve its national economy by investing in labor-based programs for the purpose of creating jobs for the unemployed. This study finds motivation in the WPA program. It

intends to facilitate the achievement of a similar outcome of the WPA program in Ghana including the creation of more jobs, the alleviation of poverty, the building up of healthy social attitude and ultimately the development of the economy.

2.6.2 South Africa labor-based and employment generation programs

South Africa is the most developed sub-Saharan country. It has extensive natural resources and developed agriculture and manufacturing sectors. The population of South Africa is about 44.4 million and the per capita income is about $11,900 (World Factbook 2005). During the apartheid regime, the economy of South Africa depended mostly on foreign investments and technology. Though on the average South Africa had a strong economy during the apartheid regime, there were also high rates of poverty and unemployment among the majority of its people (Knight 2004). In 1993, during the apartheid regime, the unemployment rate was as high as 45% (World Factbook 1993). Only a few of the population enjoyed higher living standards equivalent to those of developed countries. Most of the population suffered from poverty and unemployment.

After the fall of apartheid in 1994, South Africa began to emphasize job creation in all its economic programs and policies to reduce the high incidence of unemployment and poverty in the country. The development of small-scaled micro and medium enterprises (SMME) was given serious consideration. Labor-based construction was identified by the South Africa's National Public Works Program as the key to job creation programs. The 1997 Green Paper on Public Sector Procurement Reform in South Africa (Watermeyer 1997) encourages;

- the substitution capital with labor,
- the use of more "labor friendly" technologies,
- the development of small scale enterprises for the implementation of employment intensive practices.

In South Africa, labor-based methods have been employed not only for road construction but also for the construction of low level bridges, dams, water and sewage reticulations for townships, low voltage electrical reticulations and storm-water drainage systems (Kwesiga 1996 & Watermeyer 1997). Nationwide labor-based programs that have been launched to generate employment include the current extensive Expanded

Public Works Program (EPWP). The EPWP generates an average of 200,000 jobs per year since its introduction in 2003 (McCord 2003).

Traditionally, road construction and maintenance in South Africa have been equipment-intensive oriented. There was a deliberate effort to minimize the use of labor and encourage the use of heavy equipment. Labor-based road construction and maintenance methods were employed only on an ad hoc basis in the 1980s and 1990s to generate some employment (Kwesiga 1996). The launching of the current extensive labor-based construction program (the EPWP) to generate more employment in South Africa was motivated by the success of many labor-based programs; especially the two labor-based road rehabilitation programs namely the Zibambele (KwaZulu-Natal province) project and the Gundo Lashu (Limpopo province) (Sigcau 2003).

2.6.2.1 The Zibambele labor-based road rehabilitation project

The Zibambele project was initiated in 2000 to carry out routine maintenance on 11,000km (McCord 2002) of a rural road network. By 2003, about 10,000 local contractors had been awarded contracts to rehabilitate sections of the road network. The design of the projects in the KwaZulu Natal province was based on the traditional family system in South Africa. Each household involved in the Zibambele project was an independent contractor. The local households were paid a regular monthly fee for the maintenance of a given length of the road. The nature of the routine maintenance makes it possible to generate long-term employment opportunities (Phillips 2004a). In the KwaZulu Natal province the productivity of labor-based road rehabilitation ranges between 1500 and 2600 man-days per kilometer (Construction Industry Development Board (CIDB) 2005).

2.6.2.2 The Gundo Lashu labor-based road rehabilitation project

The Gundo Lashu project was launched in 2001. The project was the first long-term labor-based public works program in South Africa. The project has improved 500km of rural road infrastructure using labor-based technology without any significant increase in the cost and without sacrificing the quality of the road. About 24 local contractors (13 women and 11men) and 10 managers were trained (Phillips 2004a). The

project generated 500,000 man-days of employment and creating well over 2400 job opportunities (Mbeki 2003 & Limpopo Province 2003). On the average, women constituted about 51% of the workers, youth constituted 58% and the disabled 1%. All workers were given on-site training (Phillips 2004a).

2.6.2.3 The EPWP

The success of the Zibambele project, the Gundo Lashu project and other labor-based projects led to the initiation of the EPWP in South Africa in 2003 (Phillips 2004b & Sigcau 2003). The aim of the EPWP is to address the unemployment and poverty facing South Africa. Tables 2-20 and 2-21 illustrate the projected infrastructure network and employment opportunities that the EPWP intends to achieve within its 5 year period (Department of Public Works (DPW) South Africa 2006a). During the first year of the program's implementation, the EPWP generated 233,410 jobs which went beyond the projected 200,000 jobs planned (DPW South Africa 2006b).

Table 2-20: Breakdown of the projected infrastructure of the EPWP (Data Source: Department of Public Works (DPW) South Africa 2006a)

Infrastructure in Kilometers	**2004/5**	**2005/6**	**2006/7**	**2007/8**	**2008/9**	**Total**
Provincial Roads (Re-gravelling, light seals)	4,300	4,800	5,300	6,000	6,400	26,800
Municipal Roads (Re-gravelling, Light Seals and Roads)	1,600	1,900	2,100	2,300	2,500	10,400
Water Reticulation (Pipelines)	4,100	4,800	5,400	5,800	6,300	26,400
Sanitation (Pipelines)	850	990	1,000	1,000	1,100	5,240
Storm water	230	270	300	320	350	1,470
Pavements	20	25	30	30	35	150

Table 2-21: Breakdown of the projected employments potential of the EPWP (Data Source: the DPW, South Africa 2006a)

Infrastructure	Projected Employment Potential					
	2004/5	**2005/6**	**2006/7**	**2007/8**	**2008/9**	**Total**
Provincial Roads (Re-gravelling, light seals)	18,400	61,400	73,600	73,600	73,600	300,600
Municipal Roads (Re-gravelling, Light Seals and Roads)	10,400	34,700	41,600	41,600	41,600	169,900
Water Reticulation (Pipelines)	11,400	37,900	45,400	45,400	45,400	196,900
Sanitation (Pipelines)	2,700	8,900	10,700	10,700	10,700	43,700
Storm water	2,100	7,000	8,400	8,400	8,400	34,300
Pavements	100	320	400	400	400	1,620
Total of projected employment	45,100	150,220	180,100	180,100	180,100	735,620

Labor-based construction and rehabilitation programs including the Zibambele project, the Gundo Lashu project and the EPWP have benefited the economy of South Africa in terms of job creation, poverty alleviation and infrastructure development. Both the high incidences of unemployment and poverty in South Africa have been reduced since 1995 as shown in Table 2-22.

Table 2-22: Unemployment and Poverty in South Africa (Data Sources: The World Factbook 1995 and 2005 & Adelzadeh 2003)

Year	Unemployment rate (%)	Population below poverty line (%)
1995	32.6	51.1
2005	26.2	48.5

The success of the South African labor-based and employment generation programs serve as a source of motivation and a guide to Ghanaian labor-based programs. The FBLM concept would take into consideration the family oriented nature of the labor-based programs in South Africa including that of the Zibambele project. The concept also seeks to achieve similar economic development in Ghana.

2.7 THE ECONOMIC MULTIPLIER

The concept of the economic multiplier determines the full economic impact that investments have on an economy. The economic multiplier concept is studied to understand the full impact that investments in labor-based programs in Ghana, especially investments in labor-based road rehabilitation programs, would have on the national economy; an economy characterized with high incidence of unemployment and poverty. The research focuses on the economic multiplier data on the economies of the US, South Africa and Ghana to understand the impact investments in labor-based programs would have on the Ghanaian economy.

2.7.1 The Concept of the Economic Multiplier

The concept of the "multiplier" was popularized by John Maynard Keynes in the 1930s during the Great Depression. The multiplier is based on the concept that the expenditure of one person becomes the income of another and the expenditure of the second person also becomes the income of the third and so forth (Center for Business and Economic Research (CBER) 1997). For example, when $1.00 is spent on an item, the dollar becomes the income of the seller. The seller may choose to spend say, 40 cents (40% of the dollar) and save the rest. The 40 cents becomes the income of another who may decide to spend 16 cents (40% of the 40 cents) out of the 40 cents and so forth as illustrated in Figure 2-1. The multiplier impact of the initial dollar invested in the economy will be $1.66. The size of the multiplier is dependent on the number of rounds of re-spending. The longer the period within which the spending is multiplied, the higher is the multiplier (Coughlin and Mandelbaum 1991).

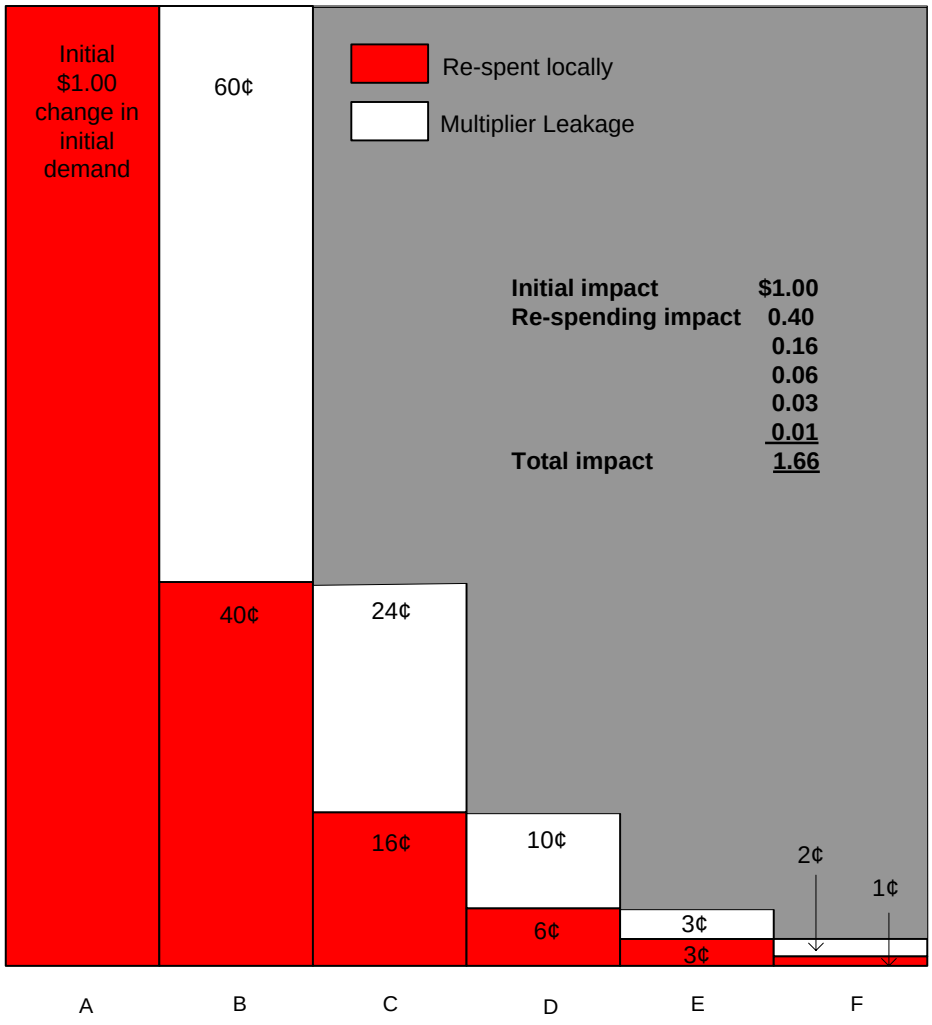

Figure 2-1: The Multiplier process (Source: Coughlin and Mandelbaum 1991)

The underlying assumption of the multiplier is that the economy invests in unused resources such as cyclically unemployed workers and industries that are sitting idle or under utilized. By increasing demand in the economy through investment, it is then possible to increase production (Bortis 2006). For example, if the government of Ghana increases its expenditure on labor-based road rehabilitation programs by $1 million, labor-based road contractors will be able to hire more unemployed laborers and distribute the money in payments, wages and profits. Households receiving income from the road industry will be able to spend more on consumer goods. Their expenditures in turn will generate more jobs, wages, and profits to others as long as the cycle continues.

2.7.1.1 Leakages in the Multiplier

Savings, imports and taxes are considered to be leakages of the multiplier. Savings limits the impact of the multiplier since it reduces the amount of spending in circulation. The greater the savings, the smaller the multiplier impact would be. Some spending would also leak out from communities or countries for import payments. Import leakages also reduce the value of the multiplier since imports do not always lead to more spending on a country's exports (CBER 1997). Taxes which are not spent reduce the amount of money spending in an economy. The important determinant of the size of the multiplier is the ability to capture all linkages in an economy without leakages to other economies. Figure 2-2 illustrates concepts of leakage in multipliers (Broomhall 1993).

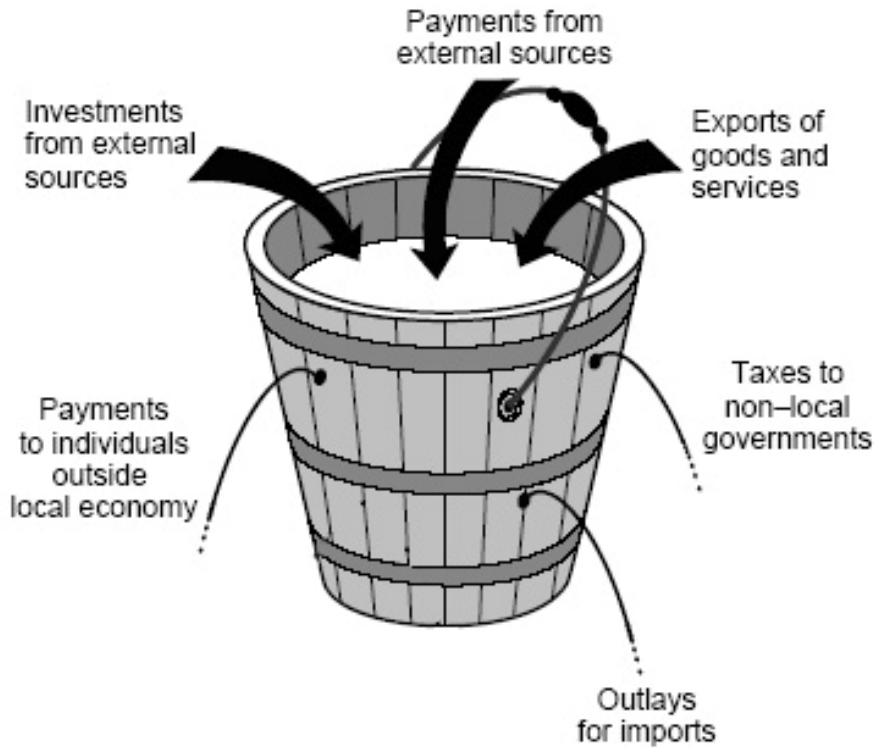

Figure 2-2: The effects of taxes and imports on the Multiplier (Source: Broomhall 1993)

2.7.1.2 Types of Multipliers

Multipliers are ratios of the total effect to the initial effect of an investment. The total effects of the multiplier include the direct effects (increase in business revenues), indirect effects (increase in employment and income) and induced effects (increase in consumer spending). The initial effect is the direct or immediate effect of an initial investment. The multiplier is a simple ratio:

$$\text{Multipliers} = \frac{\text{Total Effects}}{\text{Initial Effects}}$$

Multiplier may be referred to as Type I, Type II and Type III multipliers. These refer to the various ways in which the multiplier is calculated, especially when particular effects in the multiplier cycle such as direct and indirect effects need to be specified in the calculation. Type II and Type III multipliers are similar; however, the methods of calculating the induced effects for each type differ. Type I, Type II and Type III are calculated as follows:

$$\text{Type I Multipliers} = \frac{\text{(Direct + Indirect Effects)}}{\text{Direct effects}}$$

$$\text{Type II and Type III Multipliers} = \frac{\text{(Direct + Indirect + Induced Effect)}}{\text{Direct effects}}$$

There different kinds of economic multipliers used to assess the impact of investments on an economy. The four types of economic multipliers commonly used are *output multipliers*, *employment multipliers*, *income multipliers* and *value added multipliers* (Broomhall 1993). The *Input-Output analysis* is also used to estimate economic multiplier effects (Miller 2006).

Output multipliers estimate the change in total output of an economy that results from a direct change in the production of some goods and services due to change in investments. For example, as a plant expands to its full capacity in production, it stimulates increases in the output of the related industries that supply the plant with its inputs.

Employment multipliers measure the total change in the number of people employed in a locality as a result of an initial change in employment. For example when a plant hires 300 additional workers to increase its capacity, the spending of the 300 additional workers will increase demand of good and services which will also increase job opportunities. If the employment multiplier of the plant is 2.1, the total employment would be 630. An additional 330 employment opportunities is created as a result of the initial increase of 300 workers by the plant. The employment multiplier is useful in estimating the change in total employment as a result of some initial expansion of employment in an economy.

Income multipliers estimate the total increase in income in an economy as a result of an exogenous increase in income received by workers. The total income multiplier effect on the economy is derived from multiplying the income multiplier with the initial increase in income and the number of workers who received the new wages. For instance, if each of the 330 new workers of the plant is paid $1000 and the income multiplier of plants is 1.5, the resulting increase in income will be $495,000 (330*1000*1.5). The increase in income is $165,000 (495,000-330,000).

Value added multipliers measure the additional value added to a product as a result of activities performed to improve the product. Included in the value added activities are employee compensation, indirect business taxes and other property income.

The multiplier effects of an economy can also be estimated using an *input-output analysis*. An input-output (I-O) analysis uses a set of equations to describe the relationships that exist between the output of one industry and all the other industries in an economy. These analyses are able to estimate the multiplier effects which all other industries have on the output of each industry. Input-out analysis provides more information than the simple income, output employment and value added multipliers.

2.7.2 Economic Multipliers for the US, South Africa and Ghana

The multiplier effects data are valuable tools for assessing the merits of economic development proposals in economies. The multiplier analyses can be used to estimate economic impacts of a wide variety of changes, such as the increase in output, the creation of more employment opportunities, expansion in public projects such as

construction of roads and the investments in one-time events such as festivals and tournaments (Broomhall 1993).

2.7.2.1 Multiplier data on the US Economy

The US multiplier data used below were constructed using the Benchmark Input-Output (I-O) multiplier analysis. The US benchmark I-O tables are constructed on the basis of an economic census of the country. They provide high quality and detailed information on the structure of the US economy at 5-year intervals (Guo and Planting 2000). The data presented in Tables 2-23, 2-24 and 2-25 formed part of a larger data that was used to analyze the influence of the US manufacturing industry on the structural changes in the US economy and the role imports played in those changes between 1972 and 1996.

The US benchmark I-O data is used to analyze the impact of import (leakages) on the national economy. Though the data presented include all the major industries in the US, the analysis the focus will be on the impact of US manufacturing industry on the US economy. The computation of the data presented in Table 2-23 (US Total Output Multipliers) took into account the industry consumption of goods and services regardless of their sources, domestic or foreign. Two other data are created from the Total Output Multiplier data to measure the impact of both the domestic production (Table 2-24 US Domestic Output Multipliers) and importation (Table 2-25 US Multiplier Leakages).

The multiplier leakage is the difference between the total output required and the actual domestic output. For example, if US domestic demand for personal computers increased by $300 million (total output required) and only $100 million worth of personal computers is produced domestically (domestic output), the imported $200 million worth of personal computers would constitute the economic leakage.

Though the multiplier for the manufacturing (average) activities in the US in 1996 was 2.318 (Table 2-23), the actual multiplier that impacted the US domestic economy was 2.028 (Table 2-24) due to reliance on importation to supplement domestic output. Reliance on import resulted in a multiplier leakage of 0.291 (Table 2-25). The economic leakage of 0.291 constitutes 12.6% decline in the US manufacturing multiplier as a result

of the importation of foreign manufacturing commodities and inputs to supplement the domestic demand.

Table 2-23: US Total Output Multipliers (Data Source: the Bureau of Economic Analysis (BEA); US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	2.145	2.271	2.337	2.127	2.208	2.255
Manufacturing - Fast	2.100	2.179	2.195	1.969	2.026	2.069
Manufacturing - Slow	2.337	2.416	2.435	2.303	2.395	2.491
Agriculture	2.268	2.309	2.382	2.304	2.212	2.267
Mining	1.642	1.653	1.579	1.602	1.896	1.994
Construction	2.088	2.209	2.125	2.053	2.083	2.121
Transportation	1.698	1.800	1.996	1.849	1.867	1.919
Communication	1.350	1.393	1.470	1.734	1.738	1.840
Utilities	1.880	2.107	2.271	1.798	1.944	1.950
Trade	1.378	1.491	1.543	1.520	1.510	1.564
Finance	1.609	1.587	1.742	1.848	1.643	1.713
Insurance	1.863	1.722	2.027	1.920	2.005	2.053
Real estate	1.201	1.223	1.323	1.364	1.339	1.341
Government and others	1.110	1.136	1.198	1.176	1.138	1.149
Service fast	1.597	1.587	1.575	1.676	1.585	1.652
Service slow	1.836	1.846	1.895	1.890	1.802	1.831
Manufacturing - Average	**2.259**	**2.342**	**2.359**	**2.174**	**2.245**	**2.318**
Non-Manufacturing - Average	**1.602**	**1.657**	**1.709**	**1.686**	**1.635**	**1.678**
Total - Average	**1.840**	**1.911**	**1.921**	**1.833**	**1.801**	**1.849**

Table 2-24: US Domestic Output Multipliers (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	2.032	2.099	2.151	1.938	1.986	1.981
Manufacturing - Fast	2.004	2.035	2.037	1.811	1.845	1.853
Manufacturing - Slow	2.205	2.194	2.222	2.072	2.121	2.149
Agriculture	2.179	2.177	2.240	2.155	2.031	2.047
Mining	1.596	1.558	1.522	1.533	1.740	1.785
Construction	1.988	2.055	1.976	1.887	1.895	1.892
Transportation	1.659	1.730	1.888	1.762	1.772	1.808
Communication	1.334	1.362	1.429	1.686	1.681	1.765
Utilities	1.818	1.902	2.091	1.691	1.780	1.755
Trade	1.364	1.460	1.502	1.483	1.467	1.510
Finance	1.589	1.555	1.700	1.806	1.611	1.677
Insurance	1.843	1.701	1.986	1.880	1.966	2.002
Real estate	1.196	1.214	1.306	1.344	1.317	1.315
Government and others	1.104	1.121	1.177	1.156	1.122	1.128
Service fast	1.565	1.538	1.524	1.610	1.526	1.577
Service slow	1.771	1.755	1.797	1.184	1.701	1.712
Manufacturing - Average	**2.138**	**2.145**	**2.164**	**1.971**	**2.009**	**2.028**
Non-Manufacturing - Average	**1.562**	**1.590**	**1.637**	**1.616**	**1.562**	**1.590**
Total - Average	**1.771**	**1.795**	**1.809**	**1.723**	**1.684**	**1.707**

Table 2-25: US Leakage Multipliers (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	0.108	0.171	0.186	0.189	0.222	0.274
Manufacturing - Fast	0.095	0.145	0.158	0.158	0.181	0.216
Manufacturing - Slow	0.133	0.222	0.212	0.232	0.274	0.342
Agriculture	0.089	0.131	0.142	0.149	0.181	0.220
Mining	0.046	0.096	0.057	0.070	0.157	0.208
Construction	0.101	0.154	0.149	0.166	0.189	0.229
Transportation	0.039	0.070	0.108	0.086	0.095	0.111
Communication	0.016	0.031	0.041	0.048	0.057	0.076
Utilities	0.063	0.205	0.180	0.107	0.163	0.196
Trade	0.014	0.032	0.041	0.037	0.042	0.054
Finance	0.020	0.033	0.042	0.042	0.032	0.036
Insurance	0.020	0.021	0.041	0.040	0.039	0.051
Real estate	0.005	0.009	0.017	0.020	0.022	0.027
Government and others	0.006	0.015	0.0.021	0.019	0.017	0.021
Service - Fast	0.033	0.048	0.051	0.065	0.059	0.076
Service - Slow	0.065	0.091	0.099	0.106	0.101	0.119
Manufacturing - Average	**0.121**	**0.197**	**0.195**	**0.203**	**0.236**	**0.291**
Non-Manufacturing - Average	**0.039**	**0.067**	**0.072**	**0.071**	**0.073**	**0.088**
Total - Average	**0.069**	**0.115**	**0.112**	**0.110**	**0.117**	**0.142**

In general the impact of US domestic manufacturing on the national economy has been declining as illustrated in Table 2-26 since the US manufacturing industry has not taken advantage of the increase domestic demand for manufacturing goods and services. Rather, increase in the domestic demand for manufacturing goods and services has led to increased dependence on importation.

Table 2-26: Percentage decline of the US Manufacturing multiplier (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Year	Total Output multiplier	Domestic multiplier	Leakage multiplier	Declining Domestic Multiplier (%)	Rising Leakage Multiplier (%)
1972	2.259	2.138	0.121	94.6	5.4
1977	2.342	2.145	0.197	91.6	8.4
1982	2.359	2.164	0.195	91.7	8.3
1987	2.174	1.971	0.203	90.7	9.3
1992	2.245	2.009	0.236	89.7	10.5
1996	2.318	2.028	0.291	87.4	12.6

As shown in Table 2-26 above, whereas the US manufacturing total output multiplier increased from 2.259 to 2.318 between 1972 and 1996, the domestic manufacturing multiplier decreased from 2.138 to 2.028 within the same period. Figure 2-3 below illustrates (in percentages) the declining US domestic multiplier and the rising US manufacturing leakage multiplier.

The gap between the domestic multiplier (the multiplier that positively impact the US economy) and the leakage multiplier (the multiplier lost to US economy due to importation) is becoming much closer as illustrated in Figure 2-3 below. It can be predicted on the basis of available data that the US domestic multiplier would decline to 80.5% in 2012 and 76% in 2022 if nothing is done to reduce US dependence on the importation of manufacturing inputs and commodities. As a result of dependence on the importation, the leakage multiplier would also rise to 19.5% in 2012 and 24% in 2022 if the importation of manufacturing commodities and inputs continue on the current pace.

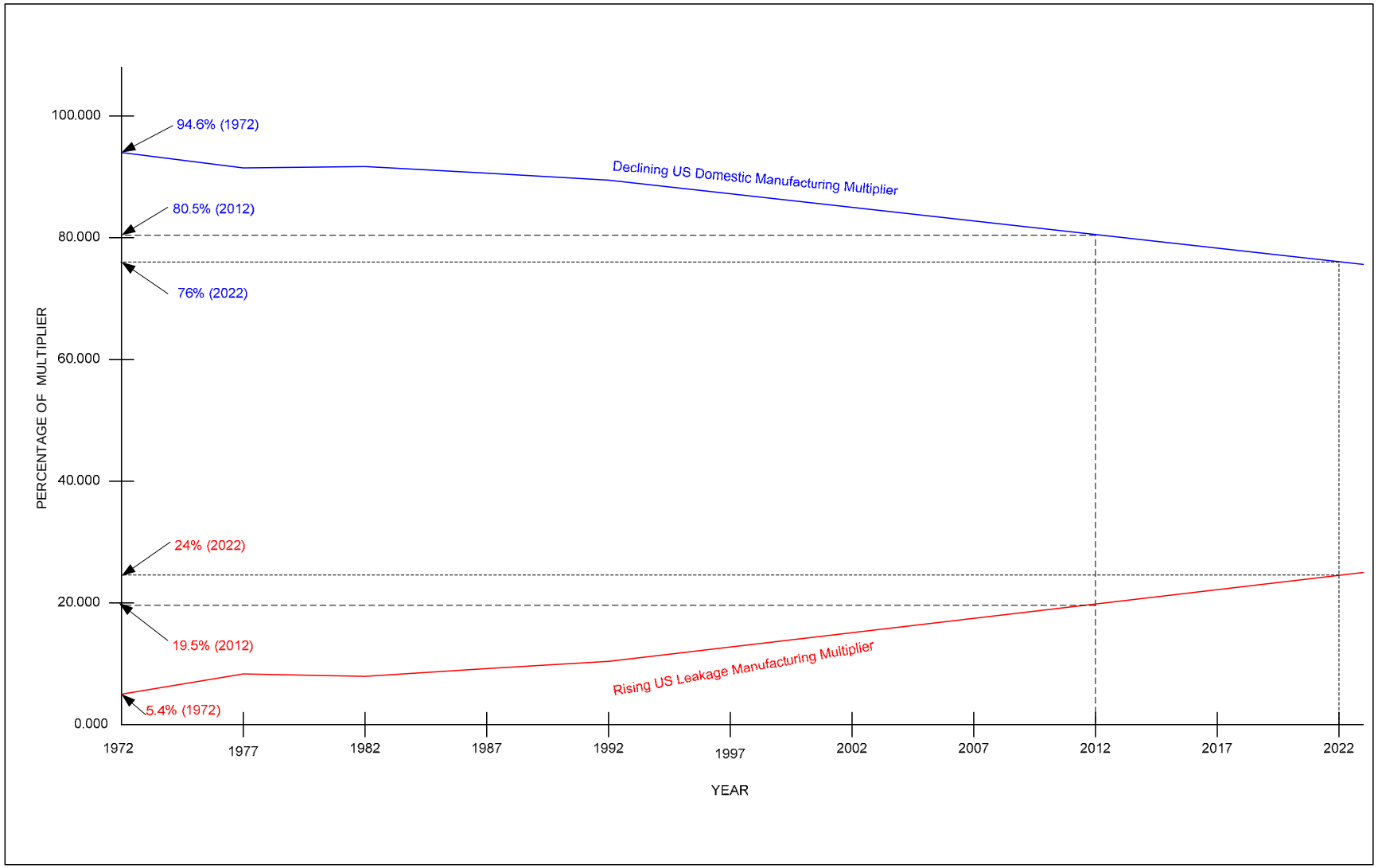

Figure 2-3: The declining US manufacturing industry multiplier

The rise in imports has also weakened the interdependencies of US industries as more US manufacturing depended more on foreign inputs than on domestic inputs. Within a quarter of a century, the influence of manufacturing on the economy has gradually decreased and more labor oriented industries such as construction, real estate and services are gaining much influence on the US domestic economy (Guo and Planting 2000).

The analysis of the multiplier data of the US economy confirms the concept that imports lead to multiplier leakages on economies. The capital that could have been invested in the US economy leaked out to other economies from which the manufacturing goods and services were imported.

By depending on the importation of heavy equipment for its construction and earth moving projects, the economy of Ghana also suffers from economic multiplier leakages. The capital ($174 million annually) that could have been used as investment to create more employment in order to improve the local economy leaks out to other economies from which the equipment is imported. See section 2.7.2.3 for the multiplier data on Ghana.

2.7.2.2 Multiplier data on the economy of South Africa

The economic multiplier data of South Africa (for 1995 and 1998) presented below was constructed using the Social Accounting Matrix (SAM) approach. The data reflects the structural changes in South Africa's economy as it moved away from the dependence on equipment-intensive methods to labor-based methods in the construction industry after the apartheid regime in 1994. South Africa began substituting equipment-intensive methods with labor-based methods in order to create more jobs to reduce its high unemployment rate (Watermeyer 1997). Small firms that depended on labor and 'labor-friendly' technologies were promoted to replace larger firms that depended on equipment-intensive methods (Kwesiga 1996).

Already in 1995 small firms which were labor-based were competing effectively with large firms which depended more on machinery for production. For instance 55% of small firms were reported to have had higher output multipliers than the large firms. The

small firms had relatively lower import multipliers than large firms in 60% of the industries/commodities (Stryker et al 2001).

A comparison of Tables 2-27, 2-28 and 2-29 show that the output multipliers for the construction industry (Building Construction and Civil Engineering) in South Africa increased from 1995 onwards as a result of the emphasis on the use of labor-based methods in the place of equipment-intensive methods. The output multiplier for the construction industry, both small and large firms, increased from 2.045 (Table 2-28, average of Building Construction and Civil Engineering) in 1995 to 3.33 in 1998 (Table 2-29). The income multiplier also increased from the average of 0.793 (Table 2-28) in 1995 to 1.37 in 1998, Table 2-29 (Stryker et al 2001 & Thurlow and Seventer 2002).

Table 2-27: The 1995 Output, Income and Import multipliers of South Africa (Data Source: Provisional Input-Output Table; in Stryker et al. 2001)

Industries/Commodities	Output		Income		Import	
	Small	Large	Small	Large	Small	Large
Agriculture, forestry and fishing	2.16	1.73	0.79	0.87	0.16	0.10
Coal mining	1.81	1.82	0.78	0.78	0.20	0.20
Gold mining	1.33	1.28	0.82	0.85	0.09	0.08
Diamond and other mining	1.82	1.87	0.84	0.82	0.15	0.15
Food	2.45	2.43	0.78	078	020	019
Beverages	2.82	2.47	0.73	0.78	0.25	0.20
Tobacco products	2.29	1.70	0.78	0.88	0.20	0.11
Textiles	2.14	2.03	0.70	0.74	0.26	0.23
Clothing	1.69	1.73	0.75	0.74	0.21	0.22
Leather products	2.04	2.20	0.80	0.77	0.19	0.21
Footwear	1.98	1.96	0.70	0.70	0.25	0.25
Wood and wood products	1.95	1.98	0.83	0.82	0.15	0.16
Furniture	1.81	1.89	0.79	0.76	0.19	0.21
Paper and paper products	2.10	2.03	0.78	0.79	0.20	0.19
Printing and publishing	1.85	1.94	0.85	0.84	0.13	0.15
Industrial chemicals	2.05	2.00	0.71	0.72	0.26	0.24
Other chemical products	2.01	1.95	0.74	0.76	0.23	0.22
Petroleum refineries	1.94	1.82	0.55	0.60	0.43	0.37
Rubber products	2.01	1.87	0.65	0.70	0.32	0.27
Plastic products	1.81	1.82	0.69	0.69	0.28	0.28
Pottery, china and earthenware	1.86	1.83	0.82	0.83	0.15	0.14
Glass and glass products	2.01	1.84	0.81	0.84	0.17	0.14
Other non-metallic minerals	1.72	1.66	0.82	0.83	0.15	0.14
Basic iron and steel	1.94	1.91	0.81	0.82	0.17	0.16
Basic non-ferrous metals	2.34	2.14	0.70	0.75	0.27	0.23
Metal products	1.86	1.94	0.78	0.76	0.20	0.22
Non-electrical machinery	1.99	2.06	0.72	0.70	0.26	0.27
Electrical machinery	1.55	1.37	0.88	0.89	0.10	0.09
Motor vehicles and parts	1.72	1.94	0.78	0.70	0.21	0.28
Other transport equipment	2.20	2.14	0.69	0.70	0.25	0.24
Other industries	1.89	1.97	0.61	0.77	0.37	0.20
Electricity, gas and steam	1.00	1.84	0.00	0.91	0.00	0.08
Water supply	1.00	2.11	0.00	0.80	0.00	0.16
Building construction	2.10	2.11	0.79	0.79	0.17	0.17
Civil Engineering and other construction	1.96	2.01	0.80	0.79	0.16	0.17
Wholesale and retail trade	1.65	1.74	0.90	0.89	0.07	0.08
Catering and accommodation services	2.34	2.02	0.84	0.88	0.13	0.10
Transport and storage	1.81	1.73	0.82	0.84	0.13	0.11
Communication	1.00	1.39	0.00	0.92	0.00	0.07
Finance and insurance	1.00	1.65	0.00	0.93	0.00	0.04
Business services	1.43	1.79	0.83	0.77	0.04	0.11
Medical. Dental and other health services	1.85	2.05	0.85	0.81	0.12	0.15
Other community and social services	2.15	1.86	0.82	0.86	0.14	0.10
Others	2.32	2.32	0.78	0.78	0.20	0.20

Table 2-28: The average of the 1995 Building Construction and Civil Engineering Output Multiplier of South Africa (Data Source: Provisional Input-Output Table; in Stryker et al 2001)

Industries	Output		Average Output Multiplier	Income		Average Income Multiplier
	Small	Large		Small	Large	
Building construction	2.10	2.11	2.105	0.79	0.79	0.79
Civil Engineering and other construction	1.96	2.01	1.985	0.80	0.79	0.795
Average	**2.03**	**2.06**	**2.045**	**0.795**	**0.79**	**0.793**

Table 2-29: The 1998 Output, Income and Import multipliers of South Africa (Data Source: 1998 Social Accounting Matrix (SAM) for South Africa; in Thurlow and Seventer 2002)

Industries/Commodities	Output Multiplier	Income Multiplier	Import Multiplier
Agriculture, forestry and fishing	2.71	1.32	0.36
Coal mining	2.88	1.40	0.35
Gold mining and uranium ore mining	3.17	1.59	0.33
Other mining	2.21	1.10	0.50
Food	2.87	1.22	0.38
Beverages and Tobacco	2.32	1.06	0.29
Textiles	2.59	1.12	0.46
Wearing apparel	2.81	1.31	0.37
Leather and leather products	2.89	1.04	0.50
Footwear	2.28	1.02	0.47
Wood and wood products	3.12	1.39	0.41
Paper and paper products	2.92	1.21	0.45
Printing, publishing and recorded media	2.67	1.19	0.046
Coke and refined petroleum products	1.77	0.81	0.30
Basic chemicals	2.32	0.98	0.53
Other chemical and man-made fibers	2.57	1.10	0.47
Rubber products	2.33	1.02	0.49
Plastic products	2.72	1.21	0.47
Glass and glass products	2.56	1.17	0.48
Non-metallic minerals	2.79	1.28	0.42
Basic iron and steel	3.06	1.32	0.42
Basic non-ferrous metals	2.75	1.21	0.44
Metal products excluding machinery	3.04	1.32	0.41
Machinery and equipment	1.58	0.70	0.64
Electrical machinery and apparatus; Television, radio and communication	2.33	1.01	0.49
Equipment	1.11	0.48	0.69
Professional and scientific equipment	1.49	0.72	0.61
Motor vehicles, parts and accessories	2.13	0.84	0.57
Other transport equipment	1.37	0.63	0.68
Furniture	2.98	1.34	0.36
Other manufacturing	2.19	1.12	0.44
Electricity, gas and steam	2.78	1.51	0.28
Water supply	3.18	1.43	0.28
Building construction and civil engineering	3.33	1.37	0.35
Wholesale and retail trade	3.09	1.55	0.31
Catering and accommodation services	2.33	1.23	0.35
Transport and storage	2.52	1.28	0.41
Communication	2.73	1.41	0.37
Finance and insurance	2.86	1.49	0.29
Business services	2.62	1.39	0.28
Medical, Dental, veterinary and other health services	2.78	1.35	0.32
Other producers	2.96	1.52	0.34
General government services	2.95	1.72	0.31

The South African experience has demonstrated that labor-based firms can compete effectively with equipment-intensive firms. By adopting the proposed FBLM concept which seeks to improve labor-based methods, Ghana would be in a good position to increase the economic multiplier for labor-based programs. Like in South Africa, the substitution of equipment-intensive methods with labor-based methods in feeder road rehabilitation in Ghana would help increase the economic multipliers and ultimately the national economy.

2.7.2.3 Multiplier data on the economy of Ghana

The data presented in Table 2-30 was constructed from the 1993 Ghana Social Accounting Matrix (SAM). The 1993 SAM provides one of the real detailed examinations of the economy of Ghana. Ghana depends heavily on the exports of a few primary products which include timber, cocoa and minerals. Other major contributors to the economy are the government sector and the household-based agricultural sector which produces most of the food for domestic consumption (Aryeetey et al. 2000).

The data presented in Table 2-30 is limited to the sectors which are subject to direct income changes as a result of an injection of exogenous investments such as money from exports and government expenditure. The data is a summary of the effects of an injection of one cedi (¢1.00) into the cocoa, mining, construction or the education and health sectors. On the basis of the injections, education and health combined as one sector has the highest multiplier effect (4.10) on the economy followed by the cocoa sector (4.06). In Ghana, the education, health and cocoa sectors are all labor-intensive. The multiplier of the construction sector (3.99) and the mining sector (2.84) had the least economic effect on the economy since they are less labor-intensive and depend more on foreign inputs such as heavy equipment and machinery (Aryeetey et al. 2000).

Table 2-30: The Total Multiplier for some selected sectors derived from the Ghana SAM (Adapted: Aryeetey et al. 2000)

Sectors	Endogenous Accounts affected by Injection	Total Multipliers
Cocoa	Employees: skilled/male	0.18
	Employees: unskilled/male	0.34
	Employees: skilled/female	0.03
	Employees: unskilled/female	0.06
	Mixed Income	1.15
	Operating Surplus	0.20
	Urban Households	1.07
	Rural Households	0.71
	Cocoa	1.08
	Total Cocoa Impact	**4.06**
Mining	Employees: skilled/male	0.15
	Employees: unskilled/male	0.25
	Employees: skilled/female	0.01
	Employees: unskilled/female	0.03
	Mixed Income	0.58
	Operating Surplus	0.40
	Urban Households	0.63
	Rural Households	0.43
	Mining	1.07
	Total Mining Impact	**2.84**
Construction	Employees: skilled/male	0.14
	Employees: unskilled/male	0.18
	Employees: skilled/female	0.02
	Employees: unskilled/female	0.03
	Mixed Income	1.44
	Operating Surplus	0.24
	Urban Households	1.14
	Rural Households	0.70
	Construction	1.08
	Total Construction Impact	**3.99**
Education and Health	Employees: skilled/male	0.44
	Employees: unskilled/male	0.30
	Employees: skilled/female	0.21
	Employees: unskilled/female	0.15
	Mixed Income	1.02
	Operating Surplus	0.28
	Urban Households	1.32
	Rural Households	0.84
	Education and Health	1.09
	Total Education and Health Impact	**4.10**

2.7.3 The Economic Multipliers of the US, South Africa, Ghana and labor-based programs

The concept of economic multipliers is used to stimulate production and create employment opportunities to boost economic development. Economic multipliers measure the potential economic gains from an initial increase in output, income or employment and their impact on an economy. The analysis of the above economic multipliers for the US, South Africa and Ghana confirm that the road construction industry in Ghana can generate high economic multipliers when Ghana invests more in labor-based technology instead of in equipment-intensive technology which is import dependent. Labor-based construction methods depend mostly on local resources and thus, would have a lower import multiplier.

The data from all three countries shows that employment-intensive industries have relatively higher economic multipliers. The data from South Africa shows how the economic multipliers of small firms that utilize labor-based methods are gradually rising to positively impact the economy. The Ghana data also confirms that sectors that are more labor-based have higher multipliers, whereas those that are more equipment-intensive have lower multipliers. When labor-based methods become the conventional methods for road rehabilitation in Ghana, the multiplier of the construction industry would rise to positively impact the national economy.

2.8 SUMMARY OF LITERATURE REVIEW

The literature review has provided an insight into how to improve the labor-based road rehabilitation program introduced in Ghana by the World Bank, ILO and UNDP in 1986 to help reduce the high incidence of unemployment and poverty in Ghana. It has provided a foundation upon which to formulate the FBLM concept that seeks to make labor-based road rehabilitation programs attractive by enhancing the management capabilities of the road contractors in Ghana.

The literature on Ghana provides an understanding of the demography, the economy, the nature of road infrastructure, and the operations of the road construction industry. The team concept including the HPWT and roles and responsibilities principles will complement and enhance the GFS in the formulation of the FBLM concept. The

review of literature on examples of labor-based and employment generation programs also provide pertinent information that can be used to the advantage of the Ghana labor-based program. Literature on the economic multiplier concept provides an understanding of the impact increased investments in labor-based programs would have on the economy of Ghana. The literature review has provided a sound background upon which to formulate the FBLM concept.

Chapter 3 studies the current approach to the labor-based road rehabilitation program in Ghana. It concentrates on its history, the requirement for labor-based road contracting, cost of gravel roads in Ghana and the employment creation capacity of the program. It also studies the typical activities involved in road rehabilitation activities, the productivity rates, the typical schedule used for the rehabilitation of 1.33km road section, and the organizational and management strategies used.

Chapter 3 The current approach to labor-based road rehabilitation in Ghana

In 1986 Ghana became the first sub-Saharan African country to launch a labor-based road rehabilitation program that uses the existing local private contracting industry. Ghana was considered by the World Bank, the International Labor Organization (ILO), the United Nations Development Program (UNDP) as an ideal country for the introduction of labor-based road rehabilitation methods due to the existence of a much developed private road contracting industry since the 1950s (Stock 1996). The discussion below concentrates on 1) the History, 2) the Requirements for contracting, 3) the Cost of feeder (gravel) roads, 4) the Employment opportunities, 5) the Typical activities 6) the Productivity rates, 7) a Typical schedule and 8) the Management strategies.

3.1 HISTORY

The labor-based road construction method used to be the norm in Ghana during the colonial era up to the late 1950s. From the late 1950s onwards, the British colonial administration discouraged the use of unskilled laborers as unproductive for road construction and promoted the use of equipment-intensive methods as practiced in Britain. By 1960 (after independence), many sub-Saharan African countries including Ghana adopted the equipment-intensive method though heavy construction equipment was still scarce and had to be imported (Stock 1996).

The Government of Ghana (GoG), like many sub-Saharan African countries, subsidized the importation of heavy equipment and thereby made the equipment-intensive method seem more affordable than the labor-based method which depended on cheap and abundant labor. The equipment-intensive method therefore became the conventional method for both the construction and the rehabilitation of roads in Ghana (Stock 1996).

The rising unemployment and poverty incidence triggered the reintroduction of labor-based methods for road rehabilitation in Ghana. The high rate of unemployment and poverty in Ghana has become great concern to the GoG and other international organizations. In 1986 the World Bank, the ILO, the UNDP and the GoG reintroduced

the labor-based road rehabilitation method in Ghana with the aim of creating more jobs to reduce the high unemployment and poverty incidence in the country (Stock 1996). The implementing agency for the labor-based road rehabilitation program in Ghana is the Department of Feeder Roads (DFR).

Currently the DFR employs both labor-based and equipment-intensive methods for the rehabilitation of feeder (gravel) roads. So far, the labor-based rehabilitation program has been used to rehabilitate only feeder roads. The feeder road network (38,560.7 km) constitutes about 72.1% of the total road network in Ghana. As much as about 97% of the feeder road network remains unpaved. Currently, 35.2% of the feeder road is considered to be in good condition, 28.6% in fair condition and 36.2% in poor condition (DFR 2004).

The labor-based program has not yet been extended to the construction of new DFR roads. It has neither been used for the construction nor the rehabilitation of urban roads (under the Department of Urban Roads: DUR) nor highways (under the Ghana Highway Authority: GHA). The labor-based program has gone through the pilot, demonstration, replication phases and now at the dissemination phase since its inception in 1986 (Ampadu et al 2003) as shown in Figure 3-1.

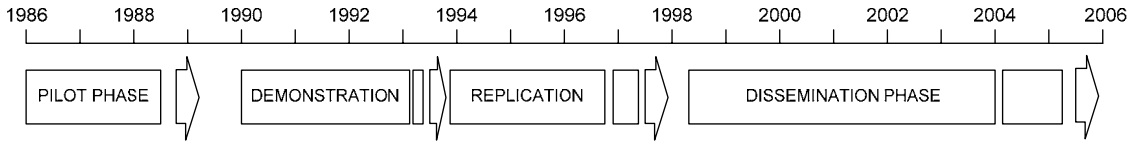

Figure 3-1: Stages of the labor-based road rehabilitation program in Ghana (Adapted: Ampadu et al 2003)

3.2 THE REQUIREMENT FOR LABOR-BASED ROAD CONTRACTING

The GoG requires all road construction firms in Ghana including both local and foreign firms to register with the Ministry of Road and Transport (MRT). Only registered contractors are eligible to undertake road contracts awarded by the MRT (MRT 2005b). Labor-based road contractors are required to 1) fulfill the training requirements of the MRT and the DFR (Danso 1996), 2) acquire the set of the standard hand-tools and light equipment required by the DFR (Ampadu et al 2003), and 3) adhere to the road

engineering standards for feeder roads in Ghana (Ampadu 2005) before they are awarded contracts.

3.2.1 Training requirements

Labor-based road contractors and supervisors are required to undergo a training program organized under the MRT and DFR and subsidized by the GoG before their firms are registered. Four supervisors from every labor-based road construction firm are required to participate in a 20 week training program (Danso 1996). The training program comprises 6 weeks of classroom work and 14 weeks of model road rehabilitation training. The participants concentrate on improving their supervisory and managerial skills. The contractors are encouraged to participate in this training program. The training focuses on mathematics related to road works, basic principles of road construction and maintenance, tools and labor management and financial management (Osei Bonsu 1992).

One week management training program is also offered to labor-based road contractors by external resource personnel who are mostly drawn from the financial institutions. The DFR also trains foremen and engineers from its own office to assist and supervise contractors (Ashong 1996). The casual nature of most of the workers involved in the current labor-based approach makes it difficult to offer them training to improve productivity.

The minimum qualification required of potential supervisory personnel to participate in the training program is a successful completion of General Certificate Examination; Ordinary Level (GCE O'Level) (Danso 1996 & Ashong 1996) which is equivalent to a successful completion of 10^{th} grade in the United State. The GCE O'Level in the former educational program in Ghana is also equivalent to the Basic Education Certificate Examination (BECE) in the current reformed educational program in Ghana.

3.2.2 Hand-tools and Light equipment requirements

Labor-based contractors are to be equipped with at least the standard set of hand-tools and light equipment required by the DFR (which costs about US$160,000). Usually, labor-based contractors are equipped by the DFR on a loan basis. The loan is repaid through deductions from the contractor's certificates on completed works (Ampadu

1999). Table 3-1 shows the content of the standard set of hand-tools and light equipment loaned to the labor-based contractor.

Table 3-1: Standard set of tools and light equipment required of labor-based contractors in Ghana (Data Source: Ampadu et al 2003)

Light equipment	**Amount provided by DFR**
Tractor heads (60-65 hp)	3
Trailers ($3m^3$)	6
Pedestrian vibratory rollers	2
Tipper truck ($5m^3$)	1
Towed water tanker (2250litre)	1
Water pump	1
Pick-up truck	1
A set of hand-tools: cutlasses, pick-axes, rakes etc.	N/A

3.2.3 Feeder road engineering requirements

The basic engineering standards used in Ghana for the rehabilitation feeder roads are summarized in Table 3-2 below.

Table 3-2: Engineering standards for feeder roads in Ghana (Data Source: Ampadu 1999)

Width of carriageway	6m
Thickness of Gravel base	100mm
Design speed	50km per hour
Level of compaction (Modified. AASHTO)	95% MDD for sub-grade
	98% MDD for sub-base
Maximum gradient	Normally 9% (12% in mountainous areas)

A typical cross-section of a feeder road in Ghana is also shown in Figure 3-2. The pavement structure consists of a layer of sub-grade material and a top layer of gravel. The thickness of the top gravel layer ranges between 100mm and 200 mm. The gravel layer also serves as the running surface. The only difference between road sections of the roads

rehabilitated using labor-based and equipment-intensive methods is the shapes of their drains. The drains of labor-based methods are trapezoidal shaped whereas those of equipment-intensive methods are V-shaped due to the tools used to construct the drains (Ampadu 2005).

This study finds the camber (crown or cross slope) of the current design which is between 5% and 8% as steeper than the camber of developed countries such as the United States. It suggests a more gentle slope of 3%-4% as used in US gravel road construction regulation. The reasons underlying the suggested camber slope is discussed in Chapter 4, section 4.4.

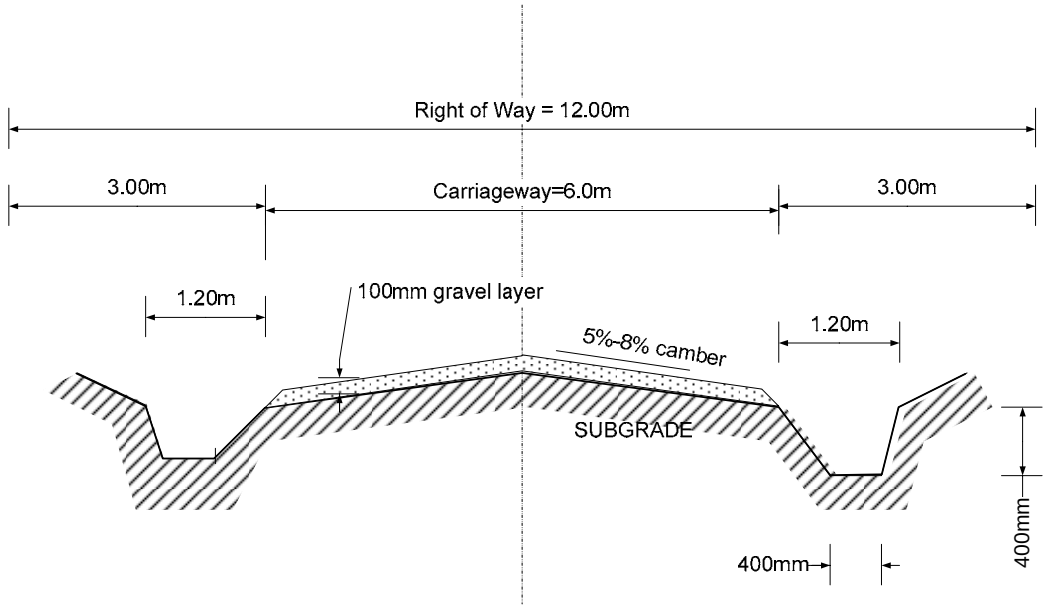

Figure 3-2: A typical section of a feeder (gravel) road in Ghana (Reproduced with permission from Ampadu 2005)

3.3 COST

The current approach to labor-based road rehabilitation is cheaper than its alternative, the conventional equipment-intensive method. Studies conducted on 12 labor-based road rehabilitation projects and 10 equipment-intensive projects between 1996 and 1998 in Ghana have shown that the average cost of rehabilitating a kilometer of

feeder road using the current labor-based method is $13,374. The average cost of a kilometer of road using the conventional equipment-intensive method, on the other hand, is $14,218 (Ampadu 2001). The lower cost of labor-based road rehabilitation may be attributed to the low wages and lower cost of hand tools used in road rehabilitation. The current daily minimum wage in Ghana is $1.22 (TUCG 2004). Table 3-3 presents the unit cost data of the 12 labor-based road rehabilitation projects studied between 1996 and 1998.

Table 3-3: Unit cost of labor-based road rehabilitation in Ghana (Data Source: Ampadu 2001)

Project Identification	Length (km)	Cost/km ($/km)
1	22.60	9,535
2	21.80	13,681
3	15.30	17,173
4	18.40	14,421
5	19.40	11,292
6	13.70	14,775
7	5.80	11,317
8	15.95	13,922
9	9.70	15,348
10	20.00	12,669
11	17.41	10,076
12	13.80	16,275
Mean	**16.16**	**13,374**
Maximum	**22.60**	**17,173**
Minimum	**5.80**	**9,535**

3.4 EMPLOYMENT CREATION CAPACITY

The current approach to labor-based road rehabilitation employs an average of 75 workers to rehabilitate 1.33 kilometers of feeder road in 20 workdays per month. The 75 workers are usually made up of 63 casual (non permanent) laborers, 8 skilled workers, 3 supervisors and 1 site manager (Ampadu and Tuffour 1996). Between 1987 and 2002 about 7,339,751 man-days of casual employment were created through the current labor-based rehabilitation program (Ampadu et al 2003). Table 3-4 illustrates the man-days of

employment that were created. The employments created were computed on the basis of 1840 man-days per a kilometer of road.

Table 3-4: Man-days of casual employment created between 1987 and 2002 (Data Source: Ampadu et al 2003)

Year	Length of road Rehabilitated (km)	Man-days of employment created
1987	32.69	60,140
1988	50.00	92,000
1989	53.20	97,888
1990	308.40	567,456
1991	440.55	810,612
1992	355.50	654,120
1993	233.42	429,493
1994	523.20	962,688
1995	355.48	654,083
1996	70.50	129,720
1997	262.30	482,632
1998	271.02	498,677
1999	283.10	520,904
2000	163.74	301,282
2001	279.05	513,452
2002	306.85	564,604
TOTAL	**3,989**	**7,339,751**

As illustrated in Figure 3-3, the man-days of employment created correspond to the different phases of the labor-based program in Ghana. The pilot phase consisted of training of personal and the testing of the acceptability of the labor-based road rehabilitation program in Ghana. The rehabilitation program at this phase was minimized and restricted to only one of the ten administrative regions in Ghana (Ampadu et al 2003).

The demonstration phase began in 1990 and continued until 1994. During this period, the program was expanded to include two more administrative regions in Ghana. The objective was to test the success of the organizational strategies developed at the pilot phase in different environments. By the end of this period about 87 labor-based contractors had been trained (Ampadu et al 2003). However, by 1994 (the beginning of the replication period) many of the trained labor-based contractors became averse to using labor-based methods for road rehabilitation. The trained contractors found the daily organizational and management of large labor force unattractive and wanted to leave the program or be allowed to use equipment-intensive methods at their sites (Stock 1996). The GoG stepped in to encourage local contactors, especially small-scale contractors to continue with the program. The replication and dissemination phases of the program consisted of nationwide expansion of the program.

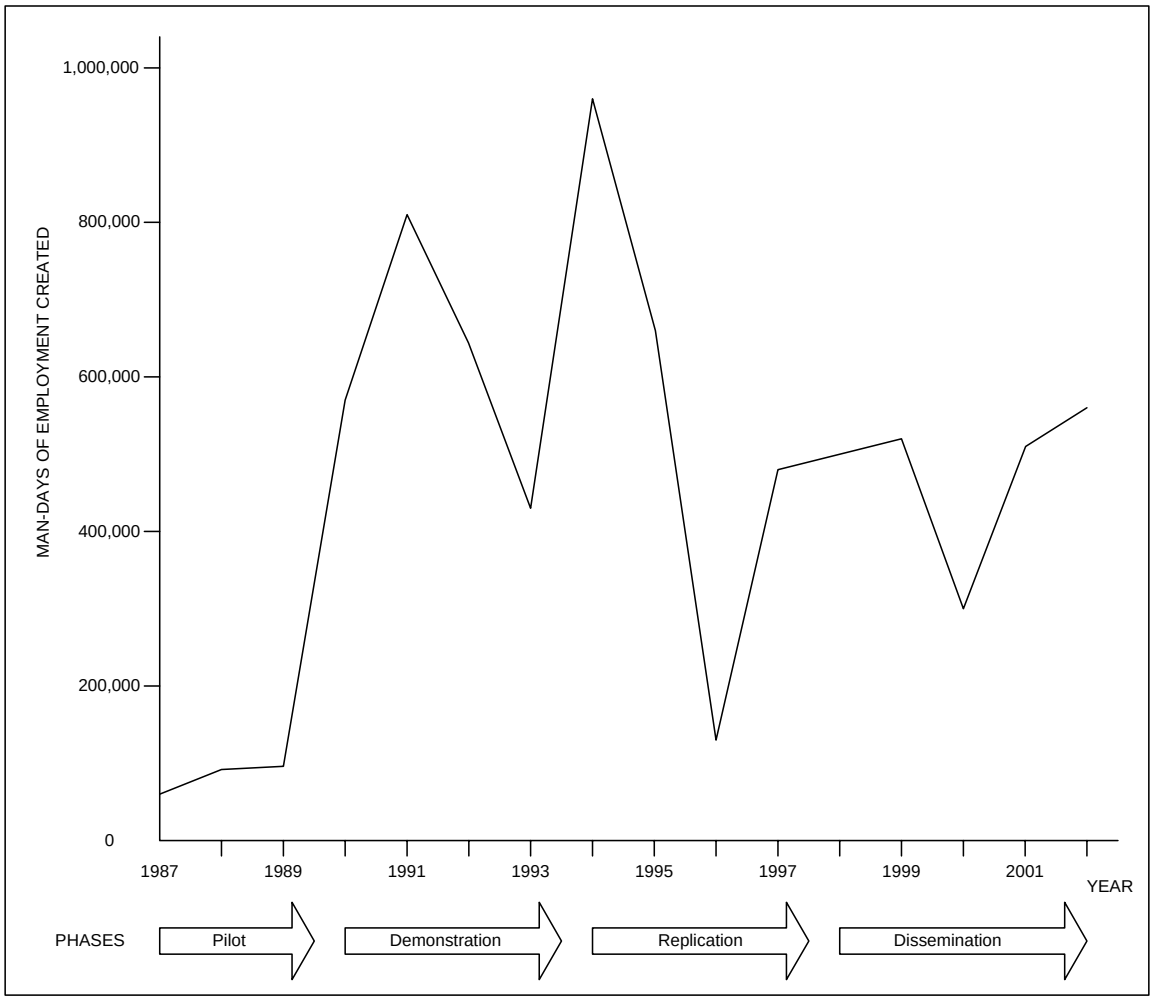

Figure 3-3: Man-days of casual employment created at the different phases of Ghana's labor-based road rehabilitation program

The current labor-based rehabilitation program employs few skilled workers and many unskilled workers. The skilled workers include supervisors, light equipment operators, office assistants and vehicle drivers. The unskilled workers are mostly casual laborers made up of both local and migrant laborers. Among the migrant labor pool are itinerant laborers who generally follow the contractor from one project to another. The itinerant laborers generally require the assistance of the contractors for transportation and accommodation logistics (Ampadu and Tuffour 1996). Female participation in current program in Ghana averages about 25% (Ampadu et al 2003).

3.5 TYPICAL ACTIVITIES

The major activities involved in the current labor-based program include 1) Site Preparation, 2) Earthworks, 3) Reshaping, 4) Culvert construction and 5) Gravelling. Table 3-5 summarizes the major activities, tasks and the hand-tools and light equipment used.

Table 3-5: Activities, tasks, hand-tools and light equipment used in labor-based road works in Ghana (Data Source: Ampadu 1999)

Main Activities and tasks	**Hand tools /light equipment**
Site Preparation • Bush clearing • Grubbing • Top soil removal • Boulder removal	Cutlasses, hoes, spades, rakes, mattocks
Earthworks • Excavation/filling for base works • Filling of potholes and gullies • Compaction of potholes and gullies	Shovels, pickaxes, water bowser, grass slasher, rake/spreader, wheel barrow and hand rammers.
Reshaping • Ditch excavation • Ditch slope excavation • Ditch back-slope excavation • Spreading of soil • Compaction of soil	Shovels, pickaxes, rake/spreader, wheel barrow, watering can and vibrating rollers
Culvert construction • Collection of sand/stone • Excavation for culvert • Fabrication of forms and reinforcement • Mixing and placing of concrete • Culvert finishing	Shovels, pickaxes, crowbars, wheelbarrows, sledgehammers, hand rammers, boning rods, heavy ropes, pickaxes, tapes, levels, cross-cut files, tenon saws, chisels, steel wedges, head-pans
Gravelling • Loading, hauling and unloading of gravel • Spreading of gravel • Compaction of gravel	Shovels, pickaxes, rakes/spreaders, tractors and trailers, tipper truck, water bowsers and vibrating rollers

Figures 3-4 to 3-8 illustrate the details involved in the 5 major activities of a typical feeder road rehabilitation project in Ghana.

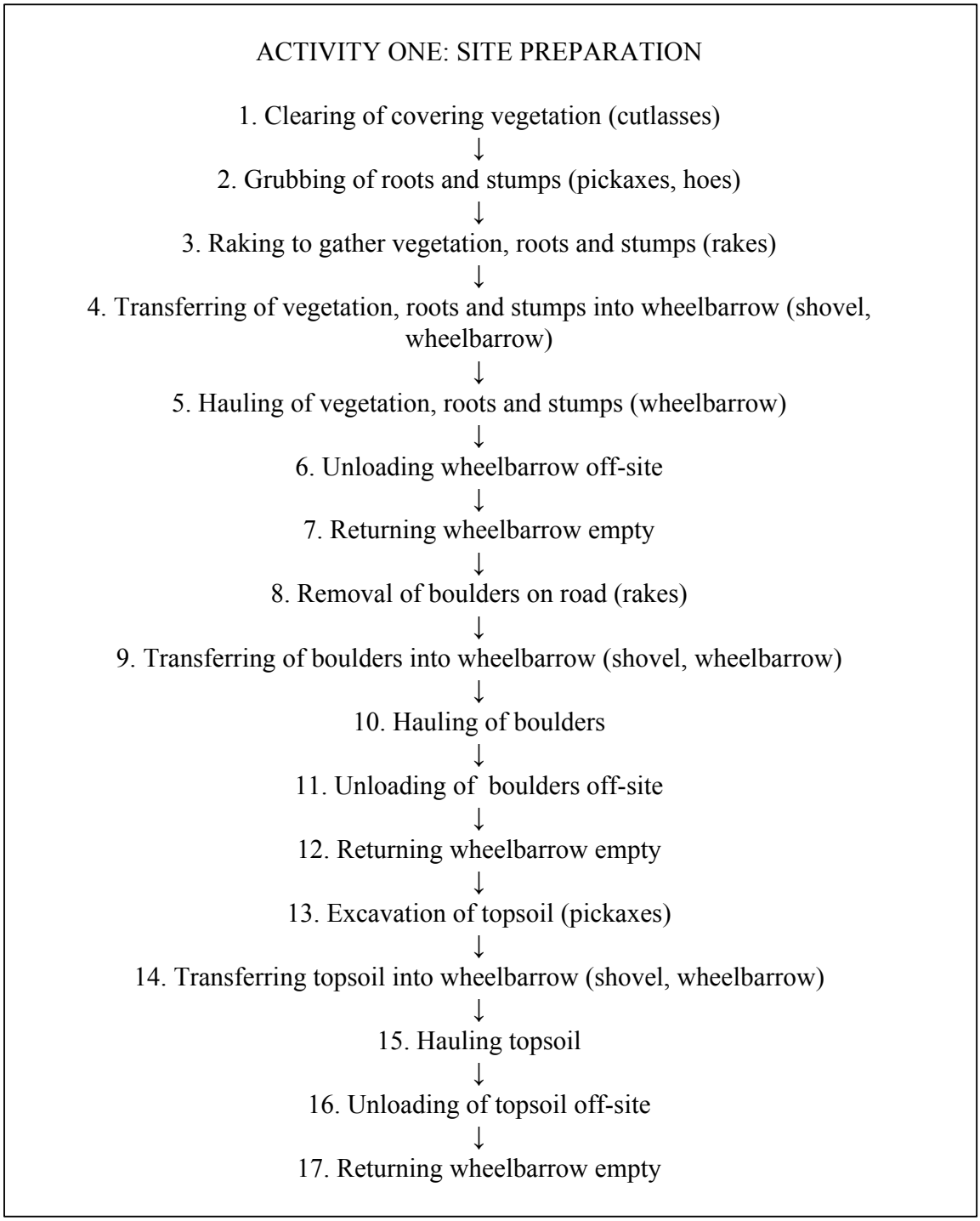

Figure 3-4: Details involved in Site Preparation activity and tools used

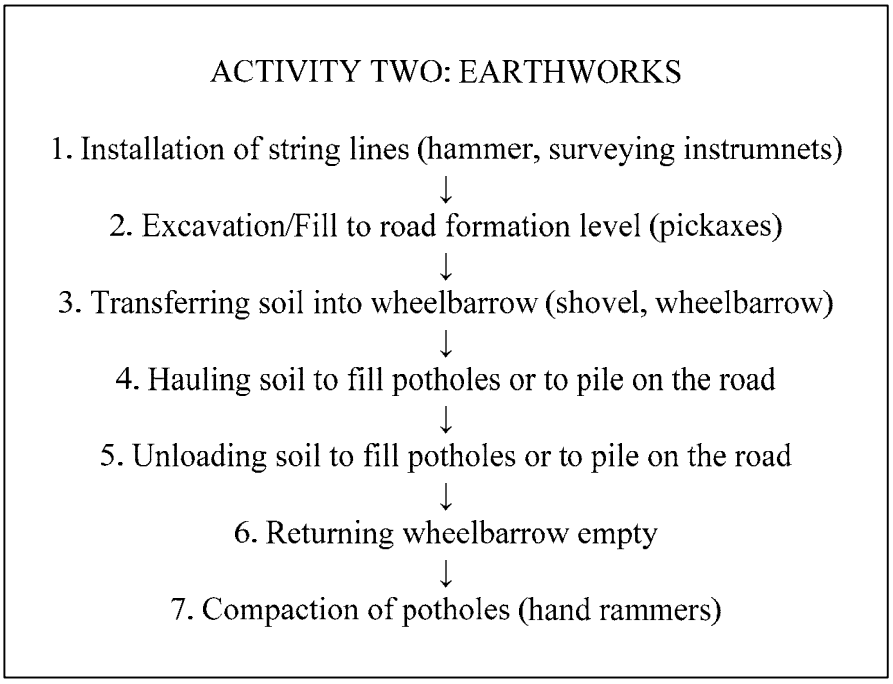

Figure 3-5: Details involved in Earthworks and tools used

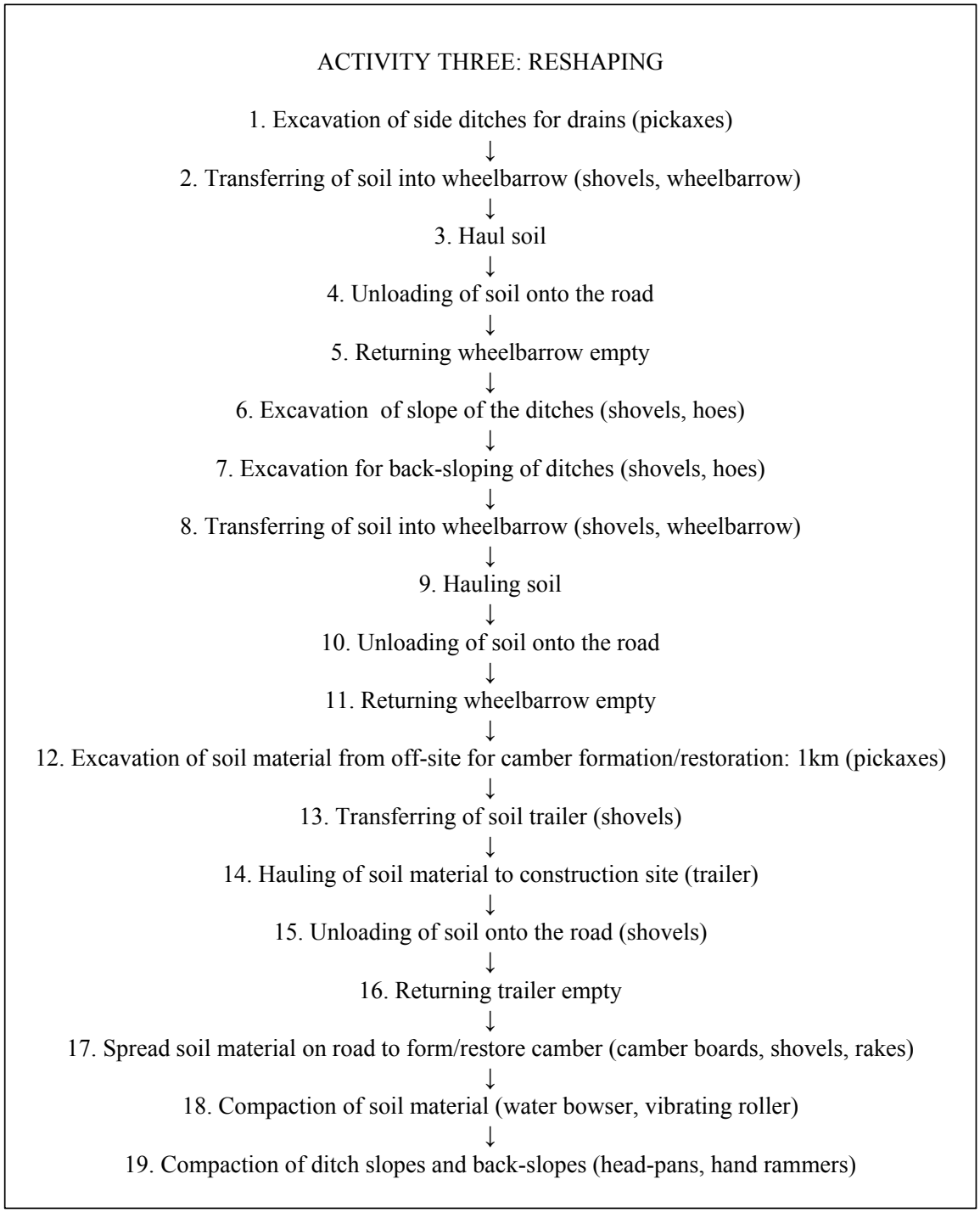

Figure 3-6: Details involved in Reshaping activity and tools used

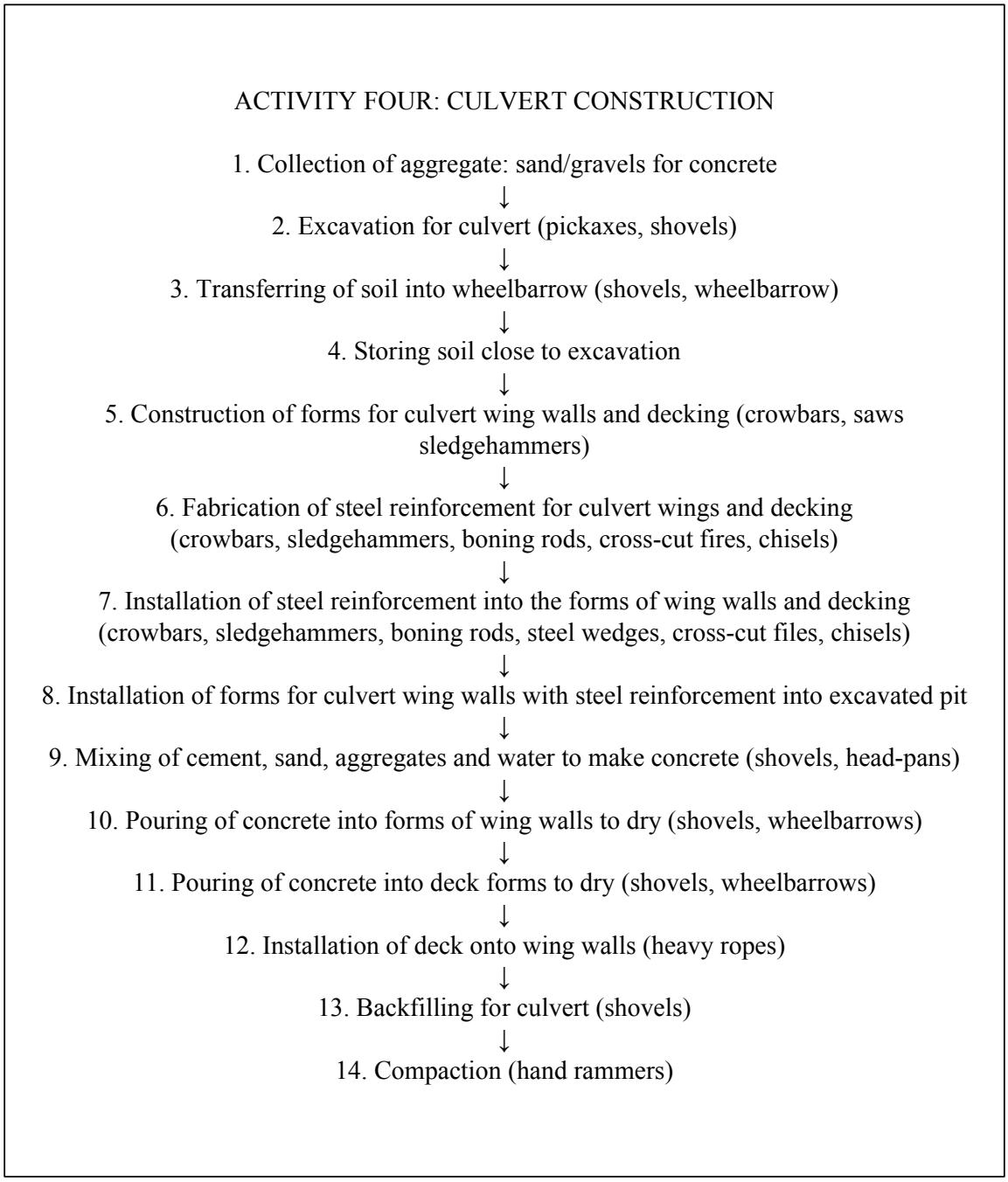

Figure 3-7: Details involved in Culvert construction and tools used

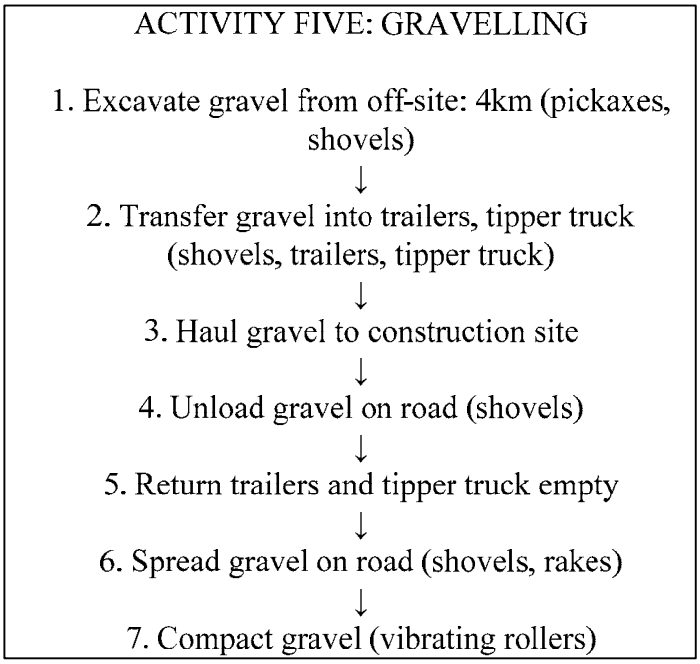

Figure 3-8: Details involved in Gravelling activity and tools used

The spacing of workers along the 1.33km road for the performance of work differs according to the different tasks and the number of casual laborers hired per a workday. Whereas clearing and excavation activities may require wider spacing to avoid overcrowding, raking tasks may not require wider spacing of laborers. The spacing of workers is also influenced by the number of laborers at the job site on daily basis. Though the average number of laborers at the site on daily basis is 63, it may rise to 94 (maximum) or fall to 29 (minimum) (Ampadu and Tuffour 1996).

3.6 PRODUCTIVITY RATES

One of the major arguments used against the labor-based road rehabilitation program in Ghana is its slow production rate. Research conducted in Ghana between 1993 and 1997 on 16 labor-based projects have shown that on the average, the current approach can deliver only 1.33km in 20 workdays per month as compared to the 3.07km of the equipment-intensive method (Ampadu 1999). The average productivity rates for the rehabilitation of feeder roads using labor-based methods in Ghana are illustrated in Table 3-6.

Table 3-6: Productivity rates, tasks and quantities for the rehabilitation of 1.33km (Data Sources: Ampadu 1999 and Veen 1985)

Activities	Tasks	Quantity per 1.33km	Productivity per hr
Site Preparation	Bush clearing	11970 m^2	37.5 m^2
	Grubbing	5320 m^2	18.9 m^2
	Top-soil removal	11970 m^2	12.5 m^2
	Boulder removal	13	1.3
Earthworks	Excavation	798 m^3	0.4 m^3
	Hauling & Filling	60 m^3	0.4 m^3
	Compaction	60 m^3	0.6 m^3
Reshaping	Ditch excavation	2660 m	1.9 m
	Slope excavation	2660 m	4.6 m
	Back slope excavation	2660 m	4.6 m
	Spreading	900 m^3	1.5 m^3
	Compaction	900 m^3	31.3 m^3
Culverts (2 per 1.33km)	Collection of stone/sand	7 m^3	0.3 m^3
	Excavation	100 m^3	0.3 m^3
	Forms and Reinforcement Fabrication	16 m	0.063 m
	Mixing and placing concrete	5 m^3	0.063 m^3
	Culvert finishing	3.6 m^3	0.063 m^3
Graveling	Loading	233 m^3	0.54 m^3
	Hauling	233 m^3	19 m^3
	Spreading	233 m^3	1.5 m^3
	Compaction	233 m^3	12.5 m^3

The assumptions (Veen 1985) underlying the above productivity rates include the following:

- The formation width (from ditch to ditch) is 6m
- The right of way is 10m
- 10 trees average 400 mm per 1km to be felled
- The topsoil to be removed covers over 90% of right of way

- Soil for the leveling of road is 600 per 1km (excavated within 1km distance)
- Ditch requirements per 1km is 2000m^3
- The average hauling distance of gravel is 4km

3.7 TYPICAL SCHEDULE

On the average, it takes a labor-based contractor 20 workdays per month to rehabilitate 1.33km of feeder road. A typical schedule of a contractor for the rehabilitation of the 1.33km road is shown in Figure 3-9 below. Figures 3-10 to 3-14 (not to scale) also illustrate the details of typical daily practice for the rehabilitation of the 1.33km road.

ID	Task Name	Duration
1	**Labor-Based Road Rehabilitation**	**159.4 hrs**
2	**Site Preparation**	**32 hrs**
3	Bush Clearing	5.1 hrs
4	Grubbing	4.5 hrs
5	Top Soil Removal	22.4 hrs
6	Boulder Removal	8 hrs
7	**Earthworks**	**40 hrs**
8	Excavation	40 hrs
9	Hauling and Filling	8 hrs
10	Compaction	8 hrs
11	**Reshaping**	**78.4 hrs**
12	Ditching	32 hrs
13	Sloping	16 hrs
14	Backsloping	24 hrs
15	Spreading	16 hrs
16	Compaction	14.4 hrs
17	**Culverts**	**72 hrs**
18	Sand and Stone Collection	8 hrs
19	Excavation for Culverts	16 hrs
20	Form and Reinforcement Fabri	16 hrs
21	Mixing and Placing Concrete	2 hrs
22	Finishing for Culvet	8 hrs
23	**Gravelling**	**27.4 hrs**
24	Loading and Hauling Gravel	16 hrs
25	Spreading	8 hrs
26	Compaction	9.4 hrs

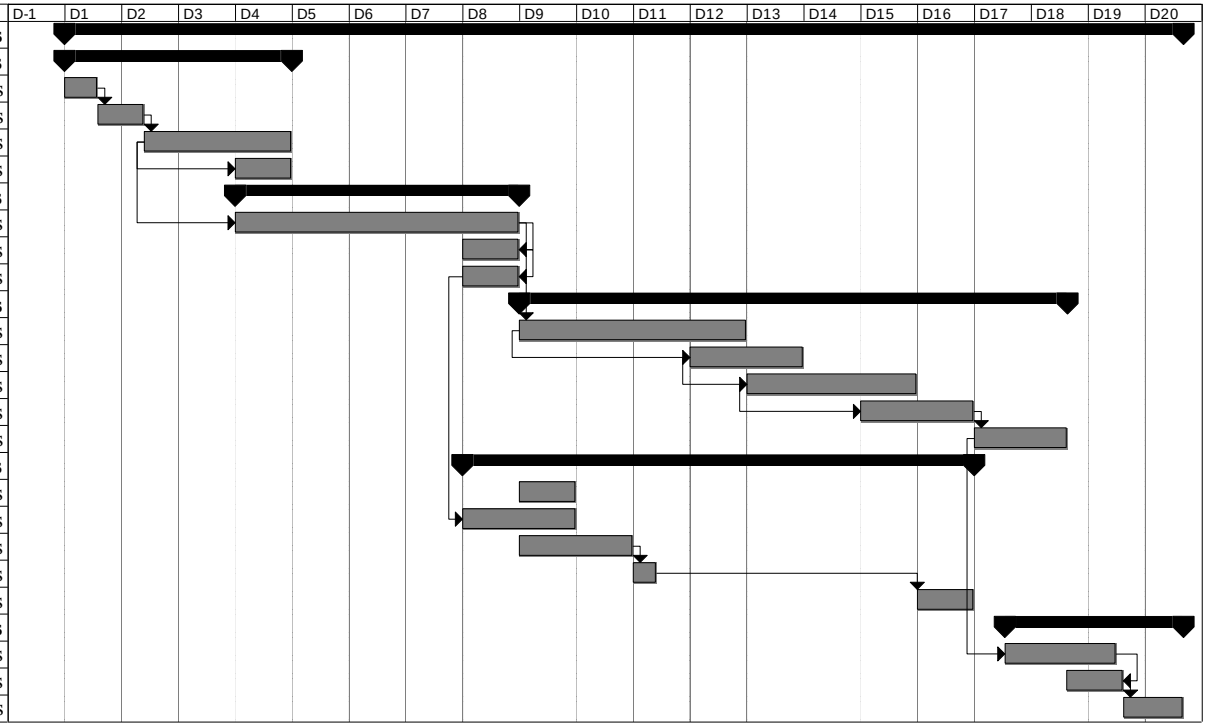

Figure 3-9: Typical Schedule of the current labor-based approach per 1.33km road section

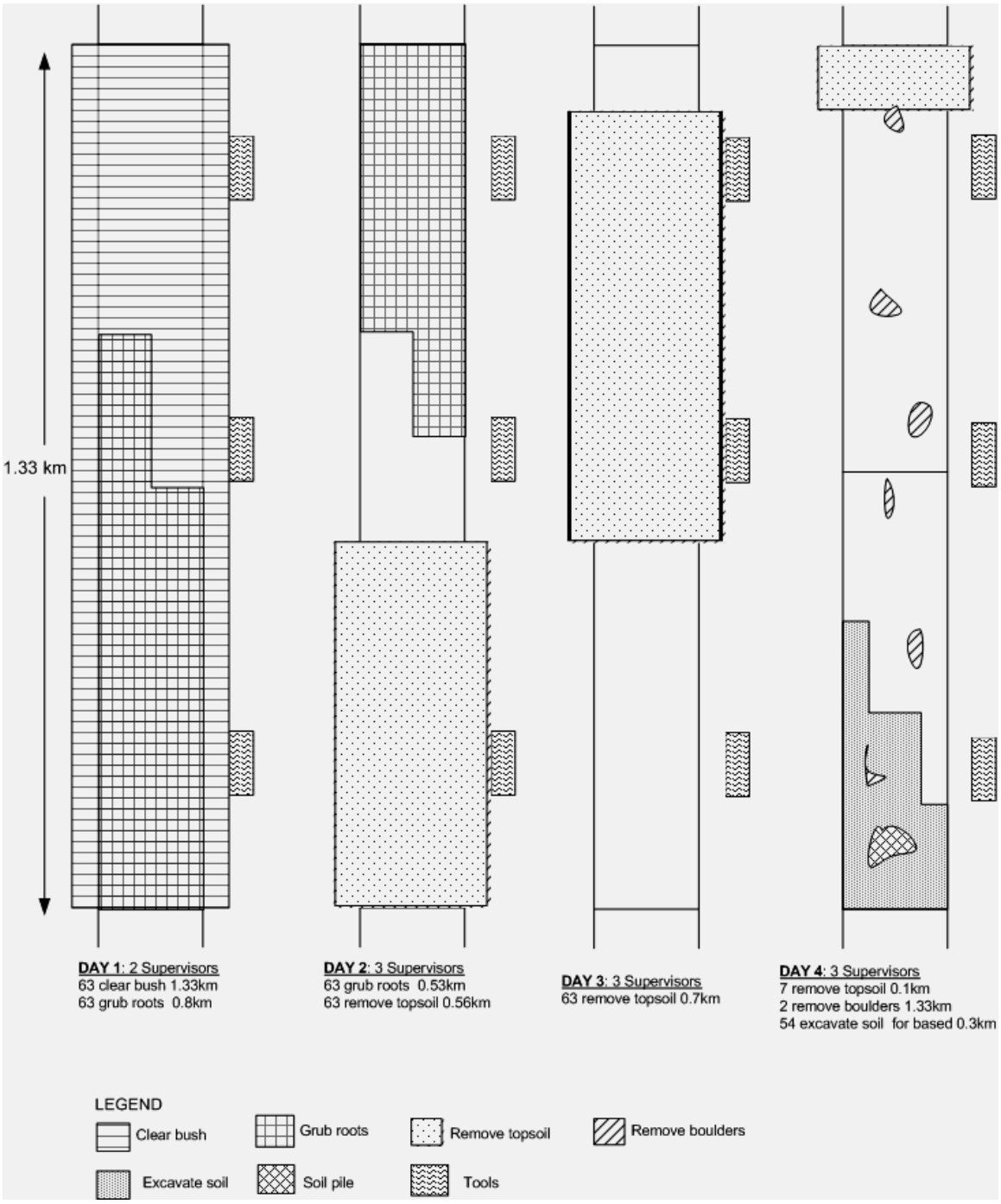

Figure 3-10: Typical practice for days 1-4

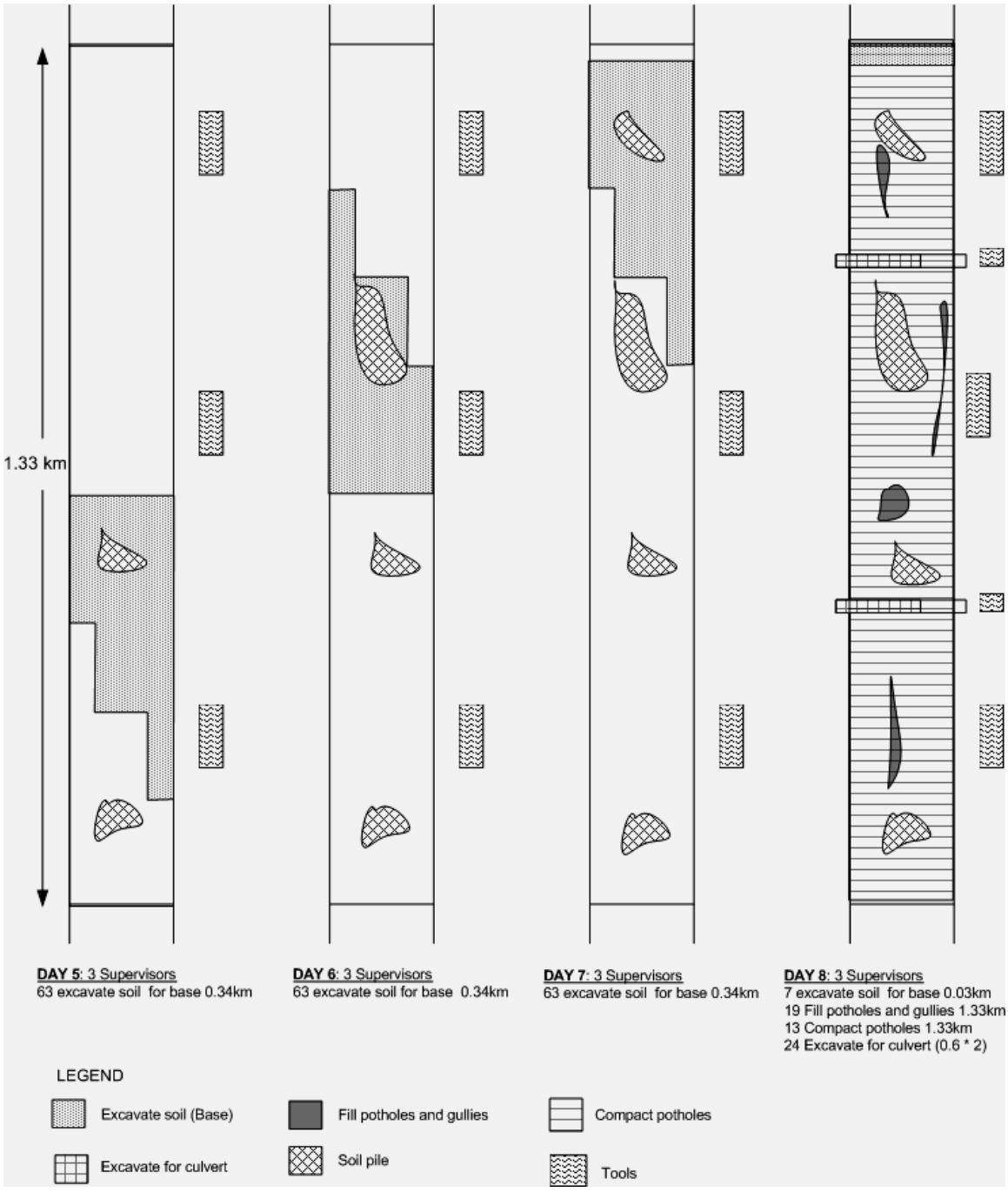

Figure 3-11: Typical practice for days 5-8

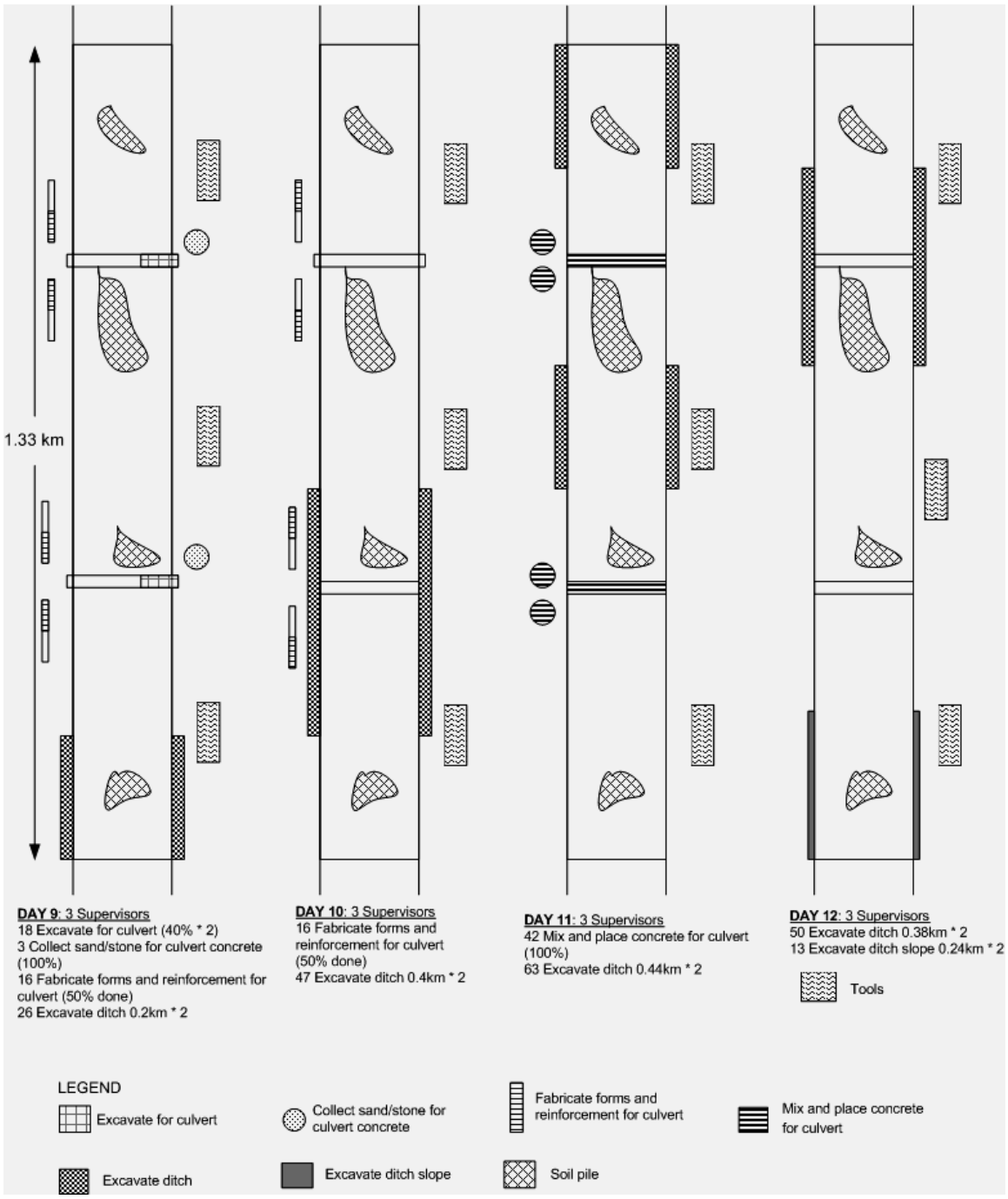

Figure 3-12: Typical practice for days 9-12

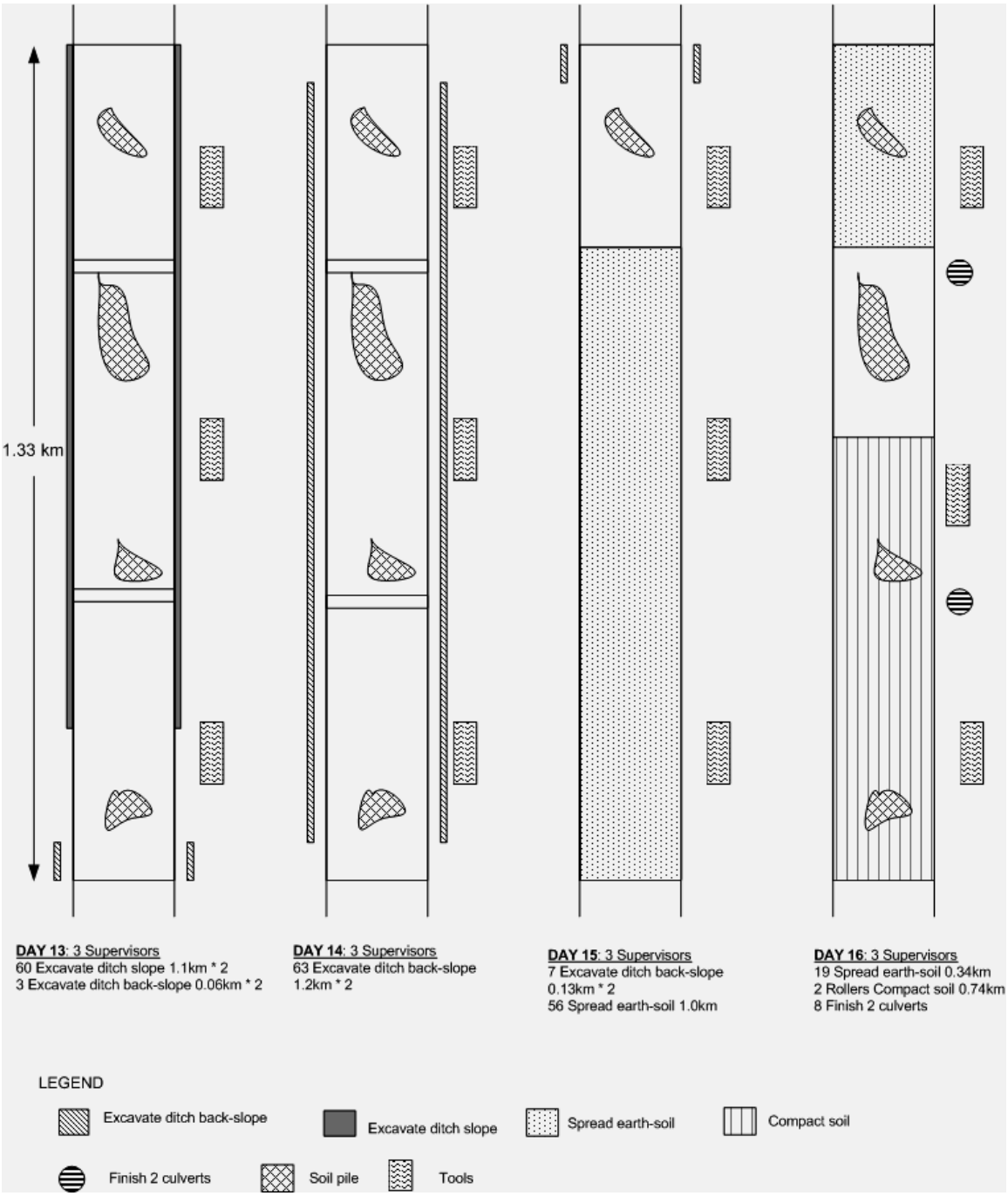

Figure 3-13: Typical practice for days 13-16

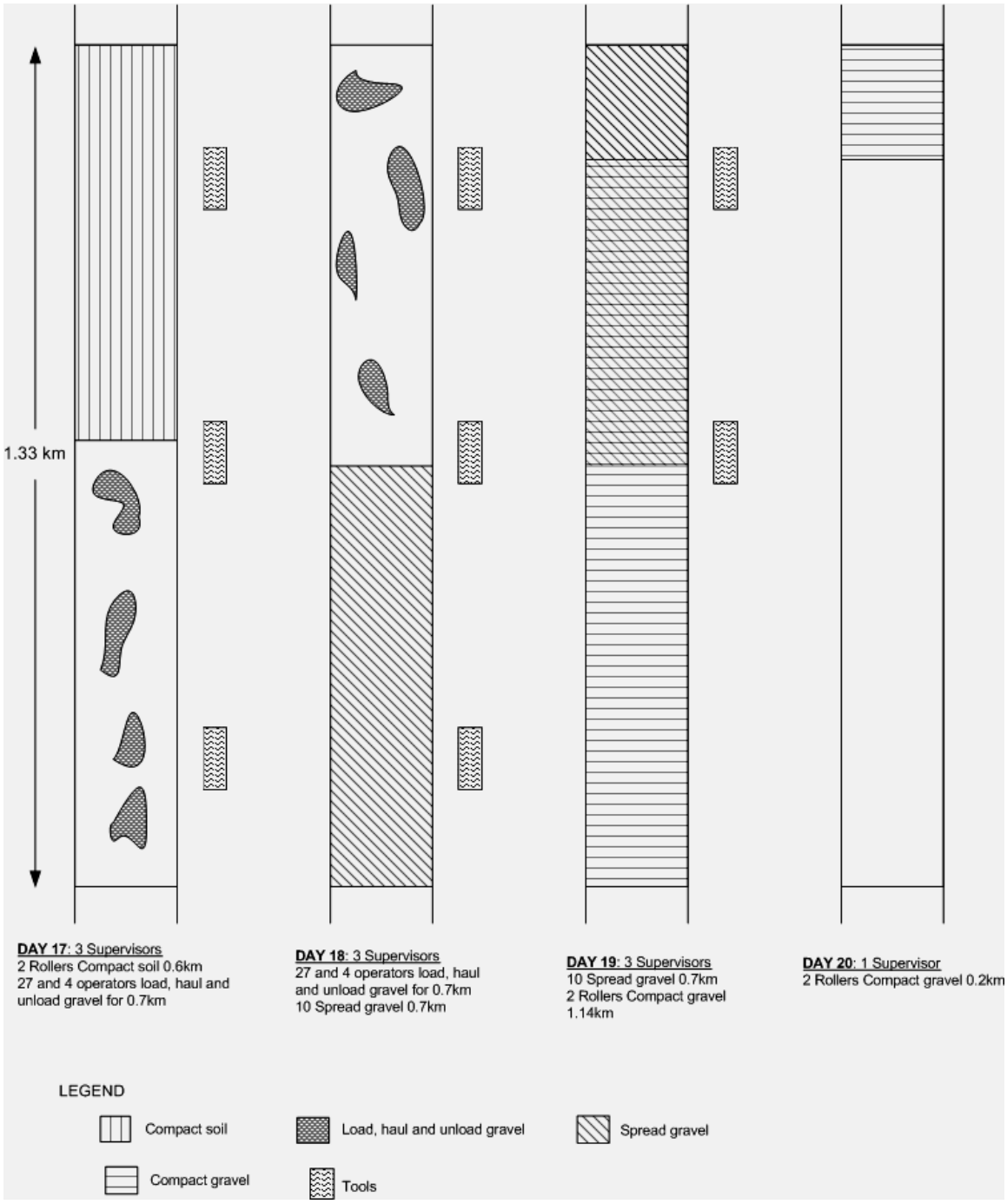

Figure 3-14: Typical practice for days 17-20

3.8 MANAGEMENT STRATEGIES

The management strategies used in the current approach include 1) training of supervisors 2) recruitment of casual laborers 3) reward strategies and 4) project implementation strategies as shown in Figure 3-15.

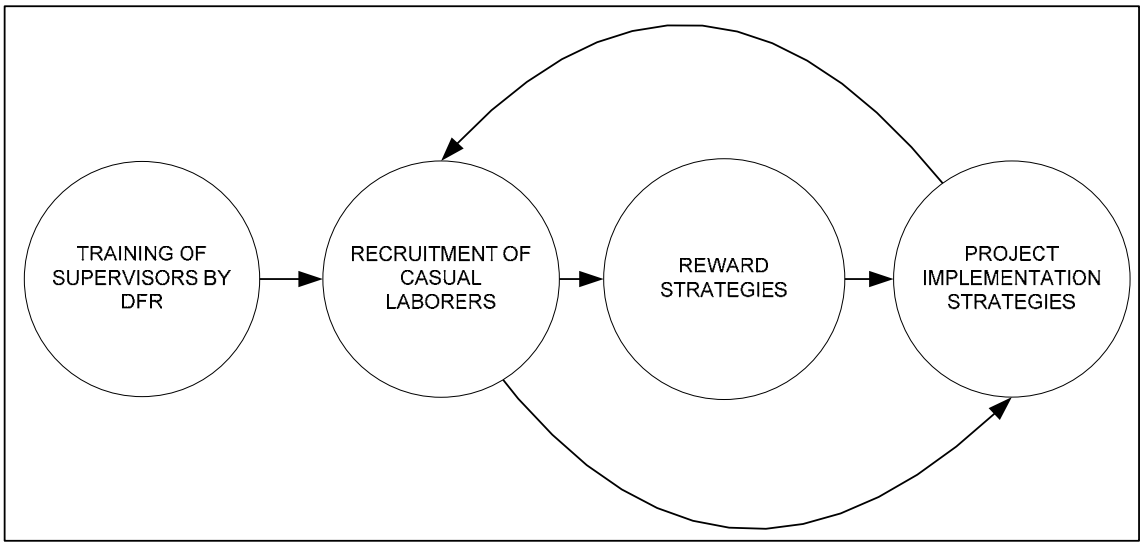

Figure 3-15: Processes involved the current approach to feeder road rehabilitation in Ghana

3.8.1 Training of supervisors

Every labor-based road contractor and four of their supervisors are required to participate in the training programs offered by the MRT and the DFR to qualify for contracts (Danso 1996). The training programs are geared towards improving their labor management skills, basic technical skills, contracting skills and financial management skills (Ashong 1996). The personnel who participate in these programs must possess a minimum qualification of GCE O'Level/BECE or equivalent technical education (Danso 1996 & Ashong 1996).

3.8.2 Recruitment strategies

The World Bank, ILO and UNDP designed the current approach to rely on casual labor (non permanent) as the main production unit (Stock 1996 & Ampadu 1999). The reason behind the use of casual labor, instead of permanent labor, is to eliminate the situation in which local contractors would be required to provide workers with

accommodation and transportation logistics (Ampadu 1999). However, in actual practice, many local contractors prefer migrant workers who will continue to work with them from one project to another (Ampadu 1995).

3.8.3 Reward Strategies

The ILO and the DFR designed the Ghana program to use the task-rate payment system as the main reward strategy (Stock 1996). In the task-rate payment system laborers are paid according to output rather than the time they spend at the site to motivate productivity increase. Research has shown that laborers are motivated to work harder when their wages are tied to output rather than time (Stiedl 1998). However, the task-rate payment system does not allow overtime. Some local labor-based road contractors have also adopted the Ghanaian traditional strategies used by farmers to motivate hired laborers. They provide food and water to the laborers and give bonuses in the form of clothing and money to supervisors (Stock 1996).

3.8.4 Project implementation strategies

The project implementation strategies used in the current approach include 1) the field organizational structure, 2) communication system and 3) the task-work method.

3.8.4.1 Field organizational structure

Figure 3-16 below illustrates a typical organizational structure of the current approach to labor-based road rehabilitation in Ghana. At the top of the hierarchy is the contractor (or the managing director). Below the contractor are the site manager and the supervisors at the second level. The site manager is responsible for the execution of the project. Working under the site manager at the second level are the supervisors. Each of the supervisors is responsible for the execution of one or more of the major activities including site preparation, earthworks, reshaping, culvert construction and gravelling. The third level consists of mostly skilled workers including light equipment operators, office assistants and artisans. The casual laborers at the bottom of the hierarchy (the fourth level) are organized into temporary gangs for task execution. On the average, there are 63 casual laborers, 8 skilled workers, 3 supervisors, 1 site manager and 1 contractor at

the project site. In the current approach, the supervisor-laborer ratio is 1:21 (Ampadu 1999).

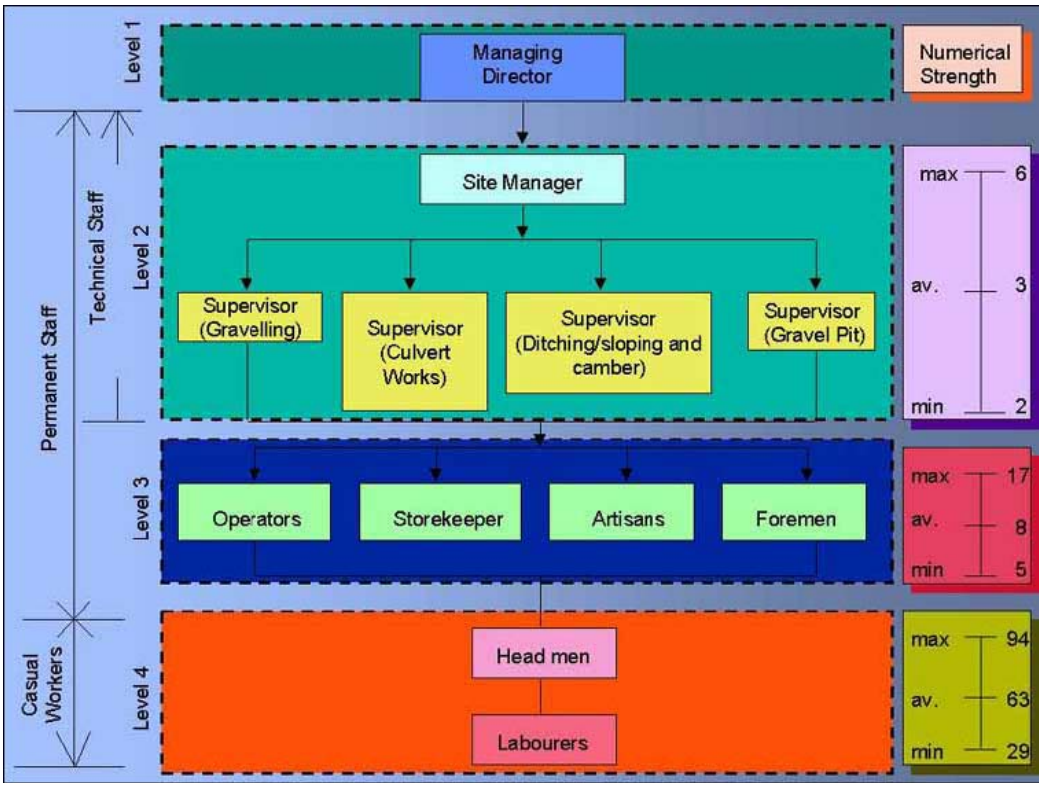

Figure 3-16: Typical field organizational structure (Reproduced with permission from ILO 1996)

3.8.4.2 Communication system

The communication system of the current approach is hierarchically oriented and reflects the field organizational structure illustrated in Figure 3-16 above. The communication system is influenced by the closed vertical communication system of the cultural system in Ghana. The cultural system is characterized with extreme top-down and almost non-existent bottom-up communication channels.

3.8.4.3 Work method

The work methods generally used in labor-based programs include the day-work, piece-work and the task-work methods. The current approach uses the task-work method (Stock 1996). In the task-work method, a realistic task or quantity of work (and the expected quality) is set to be completed by a worker during the working hours, usually 8

hours. The laborer can work harder to complete the task earlier than the 8 work hours and leave the job site to do other things. It has been noted that often workers used 50% (4 hours) of the working hours to complete their daily tasks under the task-work method. The task-work method has proved successful in practice, usually doubling productivity rates (Stiedl 1998).

3.9 SUMMARY

Though the current labor-based rehabilitation program can be competitive in terms of cost and the potential to create more employment, its use is thwarted by the use of casual labor and poor labor management. To make the labor-based program attractive and competitive, workers must be motivated to be committed to the program and local contractors must be equipped with more efficient labor management strategies.

Chapter 4 is about the new organizational and management strategies formulated to improve upon the current approach to the labor-based road rehabilitation program. The new strategies are termed family-based labor management (FBLM) concept. The FBLM concept has three components namely, the family-based work team (FBWT) concept, the proposed improved management strategies and adopted management strategies. The chapter also discusses the adoption of the US gravel road camber or cross slope to help improve the quality of gravel roads in Ghana. The application of the new strategies to labor-based road rehabilitation is also studied.

Chapter 4 Improving the current approach to compete with the conventional equipment-intensive approach

The family-based labor management FBLM concept which is the primary contribution of the research is made up of 3 main components:

1. A Family-Based Team Work (FBWT) concept (a team work concept that would have its root in the Ghanaian culture) to help attract more local contractors and workers to the program and also to facilitate an efficient management of large work force that would be required to rehabilitate the 4km (or more) roads.
2. Improved management strategies including recruitment, training, work method, communication and reward systems to complement the FBWT concept.
3. Adopted management strategies namely, the roles and responsibilities matrix strategy and other knowledge transfer strategies to complement the FBWT concept.

Figure 4-1 illustrates the FBLM concept designed to attract workers and improve the organizational and management skills of local contractors. The FBWT together with the improved and adopted strategies are referred to in this work as the Family-Based Labor Management (FBLM) concept.

To improve the quality of gravel roads in Ghana, the 3%-4% camber (cross slope) recommended by the US Department of Transportation is adopted to replace the steeper camber used in Ghana.

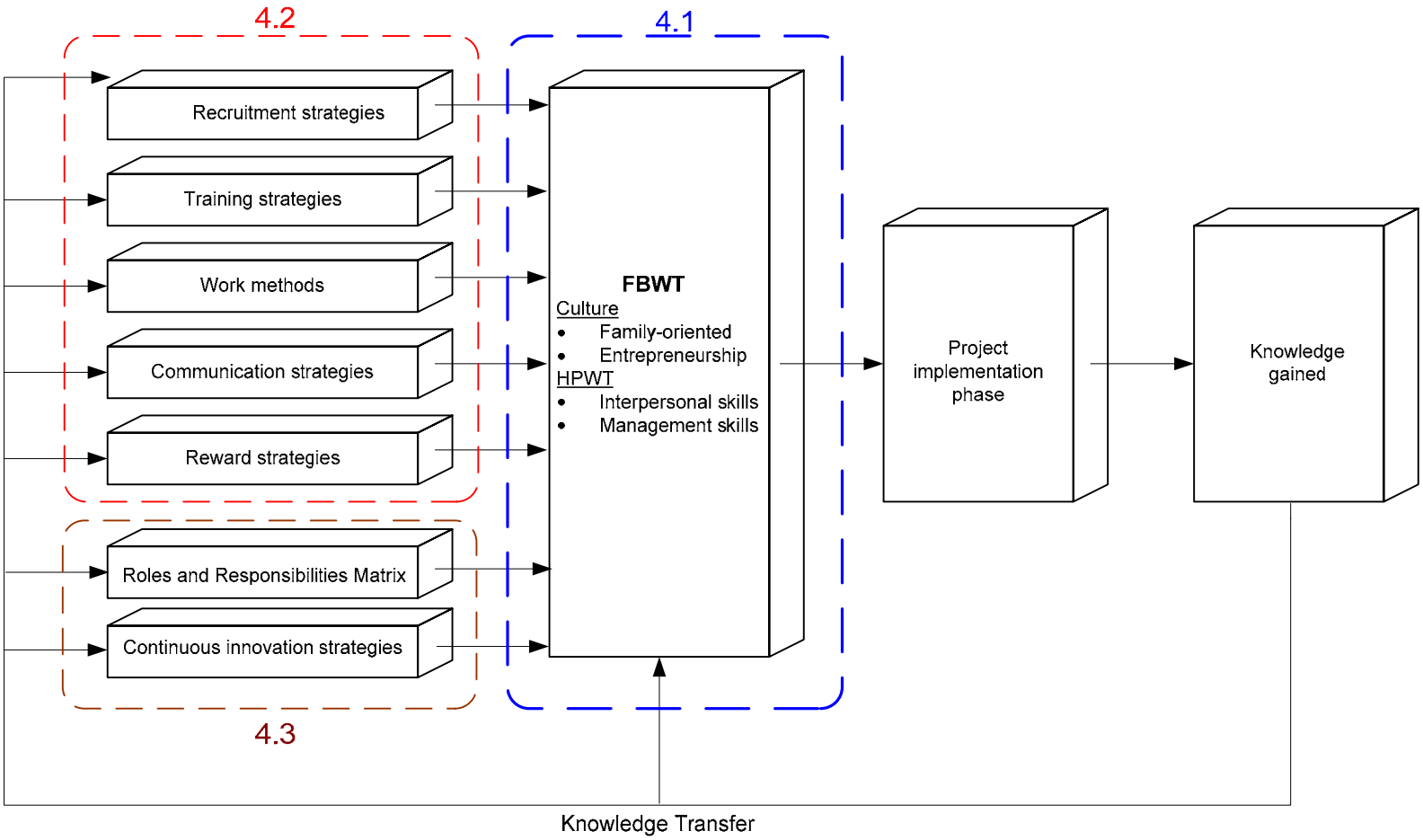

Figure 4-1 Family-Based Labor Management (FBLM) concept

The FBWT concept (4.1) is formulated to help reorganized workers into manageable 'family' oriented teams. The family-based teams would use the improved management strategies (4.2), including recruitment, training, work, communication and reward strategies of the current approach, in its implementation. The adopted management strategies (4.3) including the roles and responsibilities matrix concept and the continuous innovation strategies are also used to clarify task assignments and ensure the continuous innovation respectively.

The implementation of the FBWT, improved strategies and the roles and responsibilities concept would help attract more workers and local contractors into the labor-based road rehabilitation program. It would facilitate the creation of permanent jobs for laborers and equip local contractors with labor organizational and management capabilities. Innovations developed during road rehabilitation projects and knowledge gained would be documented for future use. Innovations achieved in labor management research would also be used to ensure continuous improvement of the FBLM concept.

4.1 FAMILY-BASED WORK TEAM (FBWT) CONCEPT

The family-based work team (FBWT) concept is developed by integrating high performance work team (HPWT) concepts and the Ghana Family System (GFS). HPWT concepts facilitate the attainment of higher profitability and productivity levels in economic ventures (ILO 2002 & Chang 2002) whereas the GFS bears great influence on the socio-economic activities in Ghana. The integration of the two concepts, as illustrated in Figure 4-2, into the family-based concept would not only facilitate the efficient management of the large work force but also make the labor-based program more attractive to many Ghanaian contractors and workers since the family-based concept would have its roots in the Ghanaian family system.

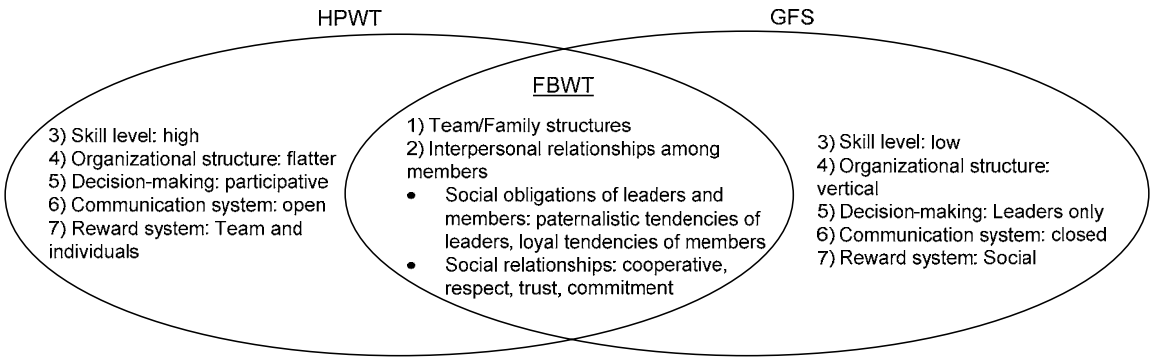

Figure 4-2: Integration of HPWT and GFS

The concepts unique to HPWT are used to improve the GFS concepts. For instance, the HPWT concept of higher skills would be used to improve the recruitment and training strategies of the current approach. The flattened organizational structure concepts and decision-making strategies would also be used to improve the communication system of the current approach. Some of the reward strategies of the HPWT would also be adopted into the FBLM concept.

The formation of the FBWT and the interpersonal principles upon which the teams operate are discussed below.

4.1.1 The formation of the FBWT concept

In forming the FBWT concept, the following are taken into consideration:

- The current labor requirements for the rehabilitation of 1.33km of feeder road in 20 workdays per month (Ampadu and Tuffour 1996).
- The supervisor-worker ratio recommended by the Tier I strategy as ideal for efficient supervision (Brandenburg 2004).
- The recommended team size for efficient team work (Scholtes et al 2003).
- The concept of family in Ghana.

As shown in Figure 4-3, to rehabilitate at least 4km (3*1.33km) feeder roads in 20 workdays per month, a contractor using the FBLM concept would need to employ 3 site managers, 9 supervisors and 189 casual laborers (three times the 1 site manager, 3 supervisors and 63 casual laborers used to rehabilitate 1.33km of feeder road in 20 workdays per month in the current approach).

The management of large unskilled and semi skilled labor has been a challenge to the local contractor. For instance between 1986 and 1996 local labor-based contractors preferred the use the equipment-intensive method due to the challenges inherent in the management of large labor force. To make the labor-based program attractive to local contractors the family-based approach develops team system approach to facilitate effective management.

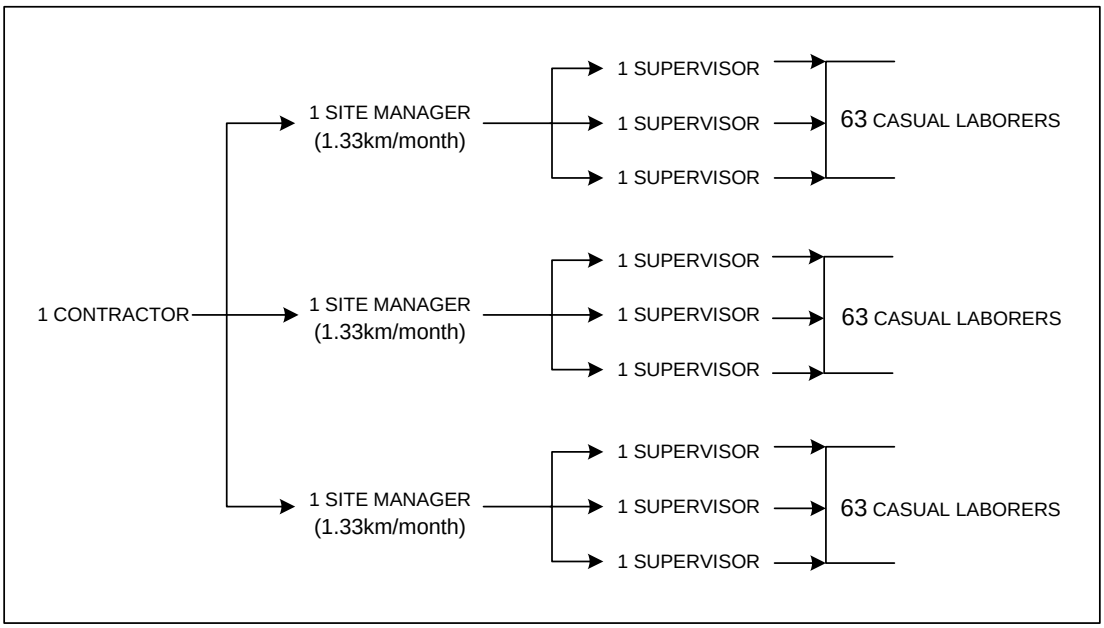

Figure 4-3: Workers required to rehabilitate 4km feeder road per month using FBLM concept

To facilitate efficient management and supervision, the family-based approach reorganizes the workers into smaller teams or "families". The 63 casual laborers working under the three supervisors (Figure 4-3) are reorganized into basic groups of 1 supervisor to 21 laborers as shown in Table 4-2. The analysis shows that the supervisor-casual laborers ratio in the current approach is 1:21.

Table 4-1: Initial breakdown of 63 workers and 3 supervisors into groups

Groups	Supervisor	Laborers
Group one	1	21
Group two	1	21
Group three	1	21
Total	3	63

The supervisor-laborers ratio of 1: 21 is far higher than the ideal ratio of between 1:8 and 1:12 recommended by the Tier I Work Force Strategy (Brandenburg 2004). It is also far higher than the recommended ideal team size of between 5 and 7 for effective team work (Scholtes et al 2003). To reduce the size of laborers to a supervisor, the family-based approach further reorganizes the number laborers (21) to a supervisor into 3 groups of 7 each and the most skilled and experienced laborer of each of the 3 groups is trained to assume the role of a foreman. Thus, there would be three groups each composed of 1 foreman and 6 laborers working under each supervisor as shown in Table 4-3.

Table 4-2: Composition of teams under a supervisor

Teams	Foremen	Laborers	Total
Team I	1	6	7
Team II	1	6	7
Team III	1	6	7
Total	3	18	21

The group of 1 foreman and 6 laborers would constitute the basic production unit in the FBWT approach. The foreman and the 6 laborers would form a team with the foreman as the team leader. All the team members would be permanent instead of casual laborers. This supervisory ratio of 1:6 conforms to the ideal ratio (of between 1:8 and 1:12) recommended by the Tier I strategy (Brandenburg 2004) and ideal team size of between 5 and 7 (Scholtes et al 2003).

The set of 3 supervisors and the site manager under whom they work would also constitute a team with the site manager as the team leader. The three site managers and

the contractor also form a team with the contractor as the team leader. Four basic teams are formed out of the reorganization of the workers used in the current approach. They are a) the foreman-laborers team (1:6), b) the supervisor-foremen team (1:3), c) the site manager-supervisors team (1:3) and d) the contractor-site managers team (1:3) as illustrated in Figure 4-4.

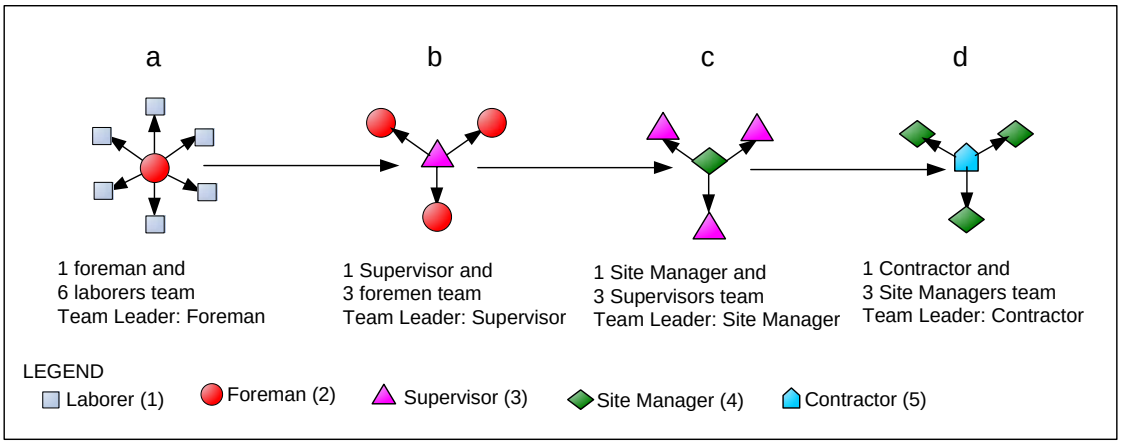

Figure 4-4: The basic teams employed in the family-based concept

Figure 4-5 illustrates the family-based organizational team structure for the rehabilitation of 1.33km in 20 workdays per month under the supervision of a site manager. The FBWT structure illustrated in Figure 4-5 constitutes the standard unit organizational structure of the proposed FBLM concept for the rehabilitation of 1.33 km of feeder roads. Multiples of the standard unit structure may be used as the labor management capacity of the local contractors develops.

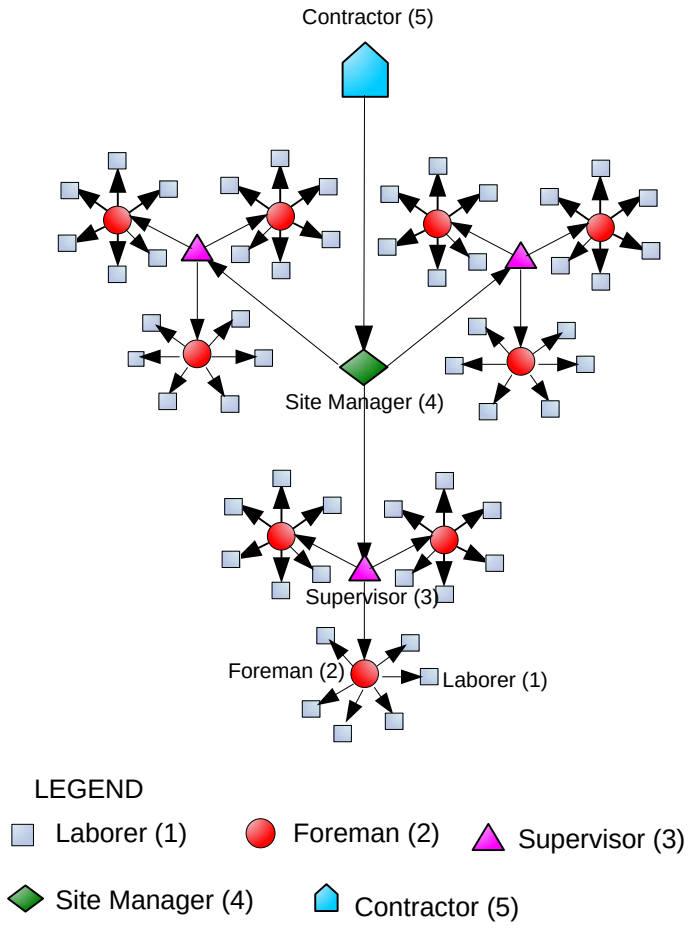

Figure 4-5: The standard unit organizational structure of the proposed FBLM for the rehabilitation of 1.33 kilometers of feeder road

A contractor can use multiples of the standard unit organizational structure to rehabilitate more roads depending on the level of their labor management capability. However, the goal is to help contractors to rehabilitate 4km per month. Figure 4-6 illustrates how the FBWT organizational structure for the rehabilitation of 4km in 20 workdays per month under a local contractor would look like.

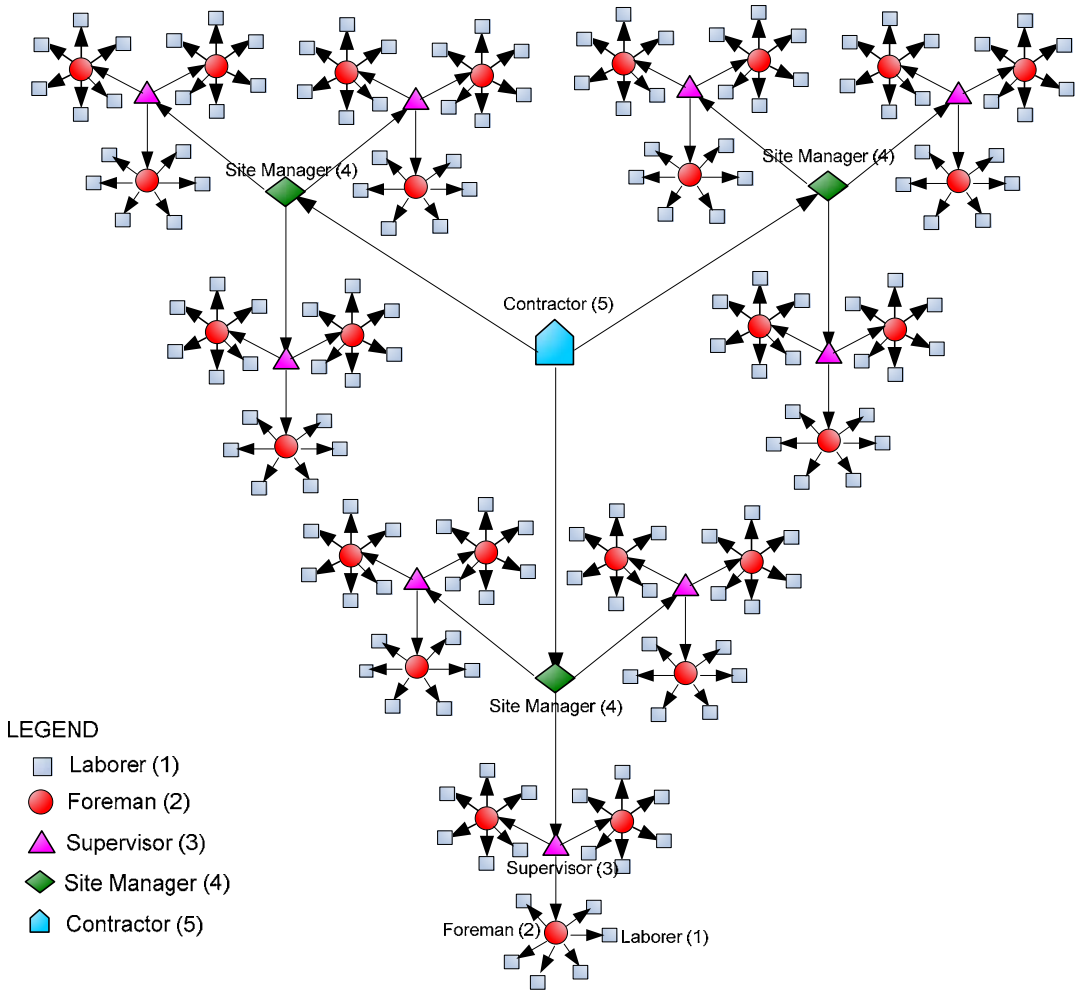

Figure 4-6: The FBLM organizational structure for the rehabilitation of 4km

4.1.2 Interpersonal relationships among family-based team members

Unlike the casual and the individualistic nature of the current workforce, the workforce of the family-based approach would be organized in teams or 'families' that operate on HPWT and GFS principles. Each family-based work team has a team leader who acts as the head of the family and the center of the team to ensure collaboration among the team members. The leader assumes the tradition paternalistic responsibilities of the family head for the welfare of the team members through caring, mentoring, showing empathy, concern and helping team members develop their skills. The collective tendency of the Ghanaian culture (Ardayfio-Schandorf 1994) must make it easier for team leaders to share information and responsibilities with team members and encourage them to participate in decision making processes. The team members are to reciprocate by showing respect, loyalty (Gyekye and Salminen 2005) and support to the team leader.

Cooperative behavior, mutual respect, trust and commitment are required from all the team members. Trust is developed among team members when they accord respect to each other. Management also enhances the trust of workers by showing concern for workers and by sharing control with them. Both employees and management are obliged to be committed to each other and the project (Whitener et al. 1998). Commitment is shaped by the motives and sincerity of management support, policies and the rewards system (Pil and MacDuffie 1996). The family-based approach also encourages workers to develop other values including helping behavior, individual initiatives, sportsmanship and other civic virtues.

4.2 IMPROVING THE MANAGEMENT STRATEGIES OF THE CURRENT APPROACH

The management strategies used in the current labor-based approach are also improved to make the program attractive and also to equip local contractors with the needed management capability. The management strategies that would be improved include 1) recruitment, 2) training 3) work methods 4) communication and 5) reward strategies as found in Figure 4-1, page 103.

4.2.1 Recruitment strategies

The recruitment strategies of the family-based approach would include employing three times the size of workers used in the current approach in order to raise the production level from 1.33km to 4km in 20 workdays per month. Unlike the current approach that employs casual labor, the family-based approach employs permanent laborers. This strategy responds to the culture of Ghana that holds job security very important in order to make the program attractive to workers. For the family-based recruitment strategy to work, the Government of Ghana (GoG) would have to allocate constant funds each year for the labor-based road rehabilitation program.

The family-based strategy would also enable contractors the possibility to profit from the workers' experiences or the learning curve. The use of permanent labor in place of casual labor is more advantageous to the project, the contractor and laborers. It facilitates productivity improvement, enable contractors to gain from experience of workers and motivate workers to be more committed to the project.

The concern of the local contractors with regard to the provision of the transportation and accommodation logistics may be resolved by splitting the burden between the workers and the contractors. It is anticipated that the use of permanent labor would benefit the program in terms of higher wages and profits. Contractors and workers must be responsible for the transportation and accommodation logistics respectively since both would gain from improved productivity. Whereas the contractor would recuperate by profiting from the reliable labor supply and the gained experience of the workers, the laborers would also gained from the constant monthly wages. Regular monthly wages must enable workers to afford their own accommodation.

The recruitment strategies of the FBLM concept require higher qualifications from supervisors, site managers and the contractor, as compared to the qualifications required of them in the current approach, to facilitate improvement in the management capabilities of the supervisory personnel.

4.2.1.1 Number of workers required

The current approach employs an average of 63 casual laborers, 3 supervisors and 1 site manager to rehabilitate 1.33km of feeder road in 20 workdays per month at the cost

of $13,374 per kilometer. It also employs about 8 skilled workers as operators of light equipment, timekeepers, accountants, storekeepers and drivers (Ampadu 2001). A labor-based contractor using the family-based concept would need to recruit a total of 189 permanent laborers, 9 supervisors, 3 site managers and 24 other skilled workers to rehabilitate 4km at the cost of $13,374 per a kilometer of feeder road in 20 workdays per month using the FBLM concept.

4.2.1.2 Qualifications of workers

Unlike the current approach, the qualification requirements in the family-based approach differ for the contractor, site manager, supervisor and the foreman. Since the family-based approach relies on the training of front-line supervisory personnel to effectively manage large number of unskilled labor, it requires higher qualifications from the supervisors, site managers and the contractor. Whereas the qualification of the foreman remains the same as in the current approach, the minimum qualification of the supervisor is raised to a successful completion of the Senior Secondary School Certificate Examination (SSCE) in Ghana, an equivalence of a successful completion of 12th grade in the US. Table 4-4 compares the qualifications required for those in the supervisory positions in the current and the FBLM approaches.

Table 4-3: Qualification comparison between the current approach and family-based approach

Supervisory personnel	**Qualification required in the current approach**	**Qualification required in the family-based approach**
Foremen	N/A	GCE O'Level/BECE
Supervisors	GCE O'Level/BECE	SSCE
Site managers	GCE O'Level/BECE	SSCE and a successful completion of 9 month training in road engineering
Contactor	GCE O'Level/BECE	Undergraduate degree in construction or related field

The minimum qualification of the site managers would be a successful completion of SSCE and a 9 month road works engineering program. The contractor is

also required to possess least an undergraduate degree in construction or civil engineering or a related field of study. The foremen, supervisors, site managers and the contractor are also required to possess basic technical skills, labor management skills, interpersonal skills or the capacity to learn these skills. Some experience of working in labor-based projects would also be required of them. The differences that would exist between the recruitment strategies of the current approach and the proposed family-based approach are summarized in Table 4-5.

Table 4-4: Differences in the recruitment strategies between the current and the family-based approaches

Areas of differences	**Current Approach**	**Family-based approach**
Women involvement	25%	Higher than 25%
Qualifications of supervisory personnel	Lower	Higher
Type of labor	Casual	Permanent

4.2.2 Training strategies

The difference between the training strategies of the current approach and the family-based approach lies in the content of programs offered. In addition to modifying the content of the training programs offered in the current approach which includes training in labor management, basic technical skills, and financial management and contracting, the family-based approach introduces training in interpersonal skills and engineering.

The interpersonal skill training program is to facilitate the efficient management of large number of laborers involved in road rehabilitation projects. The road engineering training program is designed to help improve the quality of labor-based roads (Veen 1985). Training in the family-based approach is also designed to be continuous to ensure continuous improvement in workers' skills as technology and management strategies evolve. Table 4-6 compares the training programs of the current and the family-based approaches.

Table 4-5: Comparison of the training programs of the current and the family-based approaches

Areas of differences	Current Approach	Family-based approach
Type of training	One time	Continuous
Training programs available	• Labor management • Technical Skills • Financial planning • Contracting	• Labor management • Technical Skills • Financial planning • Contracting • Interpersonal skills • Road engineering

4.2.2.1 Training in management Skills

The modifications made by the family-based approach in the current management training emphasize general planning and control. It would introduce the family-based supervisory personnel to scheduling and estimating quantities including labor, material and hand tools/light equipment. The supervisory personnel would also be trained in conflict management skills. Hand-tools and light equipment procurement management and maintenance/replacement are also emphasized in the training process. The condition of hand-tools has great influence on the productivity (Stiedl 1998) of the labor-based workers. Foremen, supervisors, site managers and the contractor of the labor-based approach would be required to participate in the modified management training program.

4.2.2.2 Training in interpersonal skills

The focus on interpersonal skills as a strategy to improve management is gaining ground in many organizations since the quality of social relationships that exist among employees influences an organization's effectiveness (Yeatts 1998 & Collins and Clark 2003). The family-based approach requires all employees to participate in the program to enhance their interpersonal skills. Workers would be exposed to the impact of interpersonal processes of the HPWT and the GFS (including good cooperative behavior, friendliness, empathy, trust, commitment, mutual respect and paternalistic obligation of leaders) on the success of organizations. These shared values facilitate timely access to greater sources of information and thereby reduce the need for formal controls and resolution of conflicts.

4.2.2.3 Training in basic technical skills

Unlike the current approach that relies on casual labor for production (Ampadu 1999 & Osei-Bonsu 1992), the family-based approach relies on permanent labor that can be trained in basic technical skills needed for labor-based road works. This is to ensure continuous improvement in labor management and wage increases. Workers and management would be well acquainted with the technical content involved in the five major activities of road rehabilitation in Ghana namely site preparation, earthworks, reshaping, culvert construction and gravelling.

4.2.2.4 Training in financial planning

Since it has been identified that the local contractors lack an efficient financial management strategy (Hernes 1987), the family-based approach seeks to upgrade the financial training program of the current approach to focus on cash flow analysis, cost control and budgeting. Knowledge in cost control would help program participants to control expenditure on resources used including materials, labor, hand-tools and light equipment. The cash flow analysis training program would help contractors with timely payments to avoid labor dissatisfaction. Only supervisors, site managers and contractors would be required to participate in this financial training program.

4.2.2.5 Feeder road engineering

One of the key arguments used against the labor-based road rehabilitation program in Ghana is its low quality of road compared to the quality of the equipment-intensive rehabilitated roads (Veen 1985). The success of using the labor-based road rehabilitation program to generate more employment opportunities in Ghana would also depend on the quality of rehabilitated roads (Ampadu 1999). Since the quality of a road is a function of its design, engineering and construction, the family-based approach introduces continuous training in engineering for the contractor and site managers. It requires the contractor to hold formal engineering degrees and the site manager must have at least 9 months of engineering training.

In the FBLM approach, both the contractor and the site manager are required to participate in continuous training in labor-based road engineering. Site managers and

contractors must be able to determine the favorability of the type of earth soil used in road rehabilitation, the water table level and sub-based materials of roads. They must be knowledgeable about the technical specifications for feeder roads including the design speed, required gradient, level of compaction and efficient drainage systems. The research also modifies the camber design of the current approach to improve the quality of feeder roads as discussed in section 4.4 of this chapter.

4.2.2.6 Contracting procedures of MRT

The contractor using the FBLM concept must participate regularly in the contracting procedure programs offered by MRT. These training programs would help the contractor develop a practical working dialogue with the DFR and the MRT, the feeder road contracting agencies in Ghana. The contractor must be well acquainted with standard contract documentation procedures of the MRT and the DFR. The program also facilitates the familiarization of the tendering procedures of labor-based road rehabilitation works.

The training needs required for the application of the FBLM concept are summarized in Table 4-7 below.

Table 4-6: The training requirements of the FBLM concept

Training type	**Laborer**	**Foreman**	**Supervisor**	**Site Manager**	**Contractor**
Interpersonal skills	Required	Required	Required	Required	Required
Basic Technical skills	Required	Required	Required	Required	Required
Labor management skills	Not Required	Required	Required	Required	Required
Conflict management	Not Required	Not Required	Required	Required	Required
Financial planning	Not Required	Not Required	Required	Required	Required
Road Engineering	Not Required	Not Required	Not Required	Required	Required
Contracting skills	Not Required	Not Required	Not Required	Not Required	Required

4.2.3 Work method

The work method used in the current approach can be modified to challenge the entrepreneurial tendency associated with cultures described as low uncertainty avoidance like the Ghanaian culture. This can be done by a combination of the task-work and the

piece-work methods. The task-work method is already in use in the current approach (Stock 1996). In the task-work method, a realistic task or quantity of work (and the expected quality) is set to be completed by a worker during the working hours, usually eight hours. It has been noted that the task-work method often motivates workers to use 50% of the working hours (4 hours) to complete their daily tasks (Stiedl 1998). However, the task-work method does not allow overtime work in Ghana (Stock 1996). Laborers usually return home after performing their assigned tasks.

4.2.3.1 The piece-work method

Piece-work method is believed to be the oldest incentive plan (Alford 1928). It has its origin in the ancient craft trade where workers were paid for each unit they produced but only when their products meet the set quality standard (Dunn and Rachel 1971). The use of the piece-work method gained more popularity in the early decades of the twentieth century, especially in Britain. It was used to boost labor productivity (Smith and Boyns 2005).

Piece-work methods attach wage value to a unit of output. In this method, a fixed quantity of output and the level of quality are set for the worker at an agreed wage. The more pieces of the fixed output the worker performs, the more the worker is paid. The method is known to promote higher productivity rates than the task-work method (Stiedl 1998).

Piecework provides better incentives to workers to work harder. In the piece-work method workers are not paid for non-productive time such as waiting time. This method is able to attract faster workers and encourage teams to aim for more effective organized work (Winch 1998). Though the piece method appears to be more individualistic oriented, it does cultivate team spirit (Greene et al 2001).

However, the use of the piece-work method is discouraged by the following:

- The exploitation of laborers (Stiedl 1998).
- The diminishing quality associated with output (Smith and Boyns 2005).

It has been noted that when it comes to the negotiation of unit prices in the piece-work method, laborers are usually at a disadvantage (Stiedl 1998). In their attempt to perform as many of the pieces of the unit output as possible, workers usually concentrate on

quantity rather than on the required quality since the more they produce the higher wages they earn (Smith and Boyns 2005).

4.2.3.2 The combination of the task-work and piece-work methods

The combination of the two methods would help eliminate both the exploitation of labor and the diminished quality of output usually encountered in the piece-work method. Workers must be allowed to perform more work under the piece-work system only after a satisfactory completion of their daily assignments (usually within 4 hours) in terms of quantity and quality under the task-work system.

To eliminate the exploitation of laborers, the extra work that the workers perform under the piece-work system must be measured as a percentage of the daily assigned task. The workers must then be paid accordingly. The diminishing quality of output usually associated with the piece-work method can also be overcome by setting the same quality as that of the daily assigned task under the task-work system.

The combination of the two work methods would also challenge the entrepreneurial cultural tendency of the Ghanaian workers to work harder to improve productivity, earn higher wages and thus help reduce poverty in Ghana.

4.2.4 Communication strategies

The family-based approach considers clear and effective communication as important for improvement in labor management systems. Clear and effective means of communication promote constant information flow and facilitate the occasion of formal and informal dialogues among teams and team members. Effective communication systems also open workers' access to management and encourage information sharing. As compared to the open communication channels of the HPWT, the current approach and the GFS have closed vertical communication channels as shown in Table 4-8 below.

Table 4-7: Comparison of the communication channels of the HPWT and the GFS

Type of Communication Channel	**HPWT**	**GFS/Current Approach**
Vertical	Open	Closed
Horizontal	Open	Open

The family-based approach seeks to reduce the extreme top-down communication strategy of the current approach by superimposing the HPWT concept on the closed vertical communication system of the GFS. The superimposition would result in a communication structure of overlapping teams that are connected successively from the top to the bottom as illustrated in Figure 4-7.

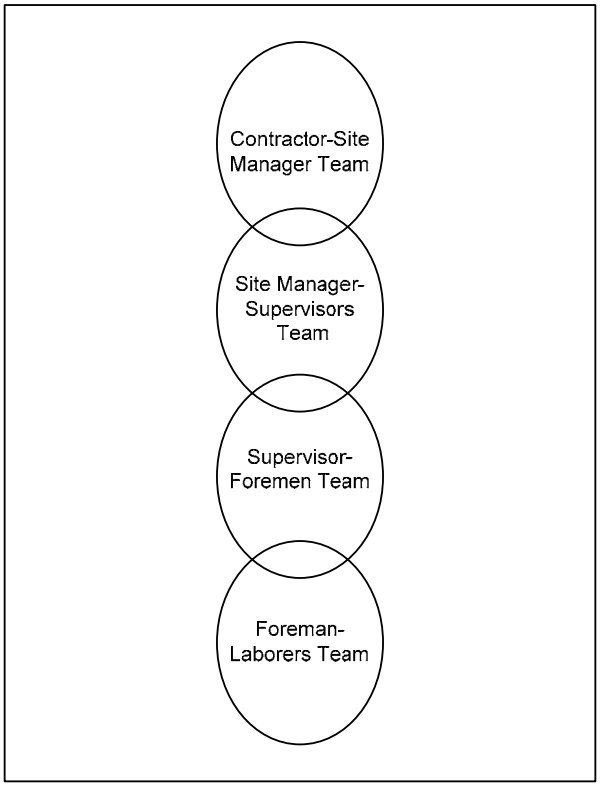

Figure 4-7: Team interconnectedness in the hierarchical organizational structure

At the top of the hierarchy of teams (Figure 4-7) is the contractor-site managers' team. The contractor is required to make decisions with the site managers. Usually, major decisions concerning administration, finances and engineering are made at this level. Since the contractor-site manager team is immediately overlapped with the second team on the hierarchy (site manager-supervisor team), decisions made are promptly shared with the supervisors through the site managers; the member of the contractor-site manager team and the leaders of the site manager-supervisors team. Team leaders become the communication links between successive teams in the hierarchical structure.

This communication strategy does not eliminate the verticality of the traditional hierarchy; it facilitates easy and prompt information flow among family-based teams as illustrated in Figure 4-8. The interconnectedness among the teams in the hierarchical organizational structure would promote discussions and two-way dialogues. It would also facilitate effective feedback from teams and team members.

The family-based approach also focuses on meetings as the forum for decision making. It promotes informal discussions among teams and team members. The documentation of meetings and improved rehabilitation methods is considered essential to innovation. Meetings, informal discussions and documentation constitute the major communication channels among the workers and management of the family-based approach.

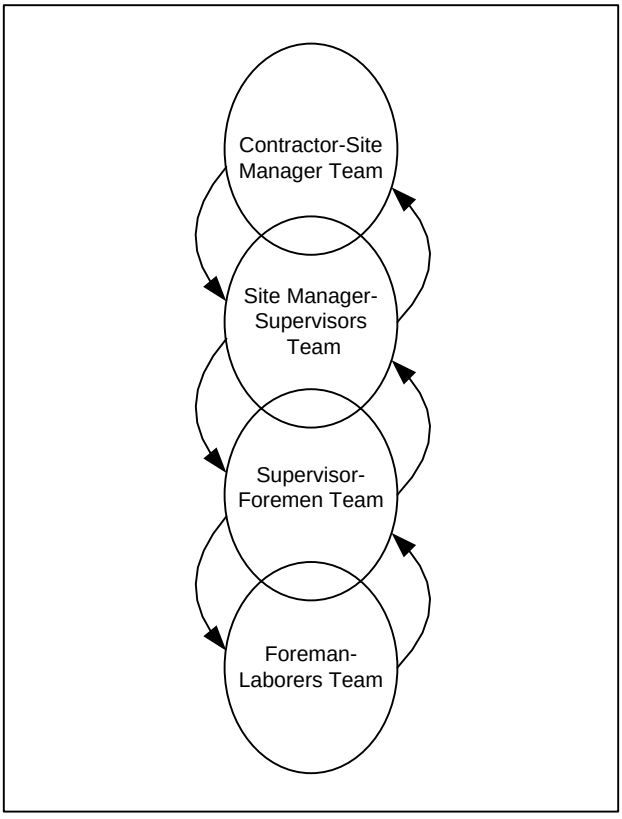

Figure 4-8: Inter-team communication and feedback systems

4.2.4.1 Meetings

Daily and weekly meetings are the forum for formal discussions about the state of projects in the family-based approach. These meetings are the venue for project assessments, tasks assignments, the expression of team and team member's viewpoints, feedback sessions and decision making processes. The family-based approach makes provisions for the team meetings in terms of the project schedule. The foreman-laborer teams meet early in the morning before rehabilitation work starts, the supervisor-foremen teams meet in the evening, the site manager-supervisor teams meet during the day and the contractor-site manager team meets on a weekly basis.

4.2.4.2 Informal discussions

The family-based approach helps develop the interpersonal skills of team members through training programs and mentoring. Interpersonal skills facilitate informal discussions between teams and team members. They equip team members with values such as empathy, cooperation, friendliness, trust, commitment and mutual respect. In a working environment where such values abound, team members find it easier to share information, their knowledge, experiences and expertise with each other. They are able to ask questions and give constructive suggestions and feedback.

4.2.4.3 Documentation and dissemination of information

Unlike the current approach which has no formal means of documentation of information, the family-based approach enforces the documentation of important information and knowledge gained in the course of rehabilitation projects. It also ensures the documentation of team meetings in order to make them available to team members for information needed. Construction processes, procedures and especially new methods discovered are also documented for future use. The documentation process cannot be avoided in the family-based concept that seeks constant innovation in labor management systems and labor-friendly technologies.

4.2.5 Reward strategies

The current approach is characterized with low motivational strategies. For instance, laborers are employed on a casual basis in a country in which job security is culturally held very important, where the unemployment rate is as high as 20% and the average daily wage is $1.22. The primary reward strategy in the current approach is the task-work payment system in which laborers were allowed to leave after performing their daily assigned tasks (Yanney 1996). Other motivational strategies include bonuses such as food, clothing and extra payment (Stock 1996).

The family-based approach on the other hand, employs the piece-work method (performance-based) and team-based reward systems as practiced in HPWT. It also employs the GFS social recognition strategy to boost the morale of workers. To motivate individual workers and teamwork, the concept employs performance contingent payment systems. The individuals and teams that perform best in terms of exceeding the current productivity rates are given extra rewards. The best performing individuals and teams are also given social recognition of their hard work through issuance of certificates from higher authorities in Ghana in a public forum.

4.3 ADOPTED MANAGEMENT AND INNOVATION STRATEGIES

In addition to improving the existing management strategies, the research also adopts the roles and responsibilities matrix and continuous improvement concepts as found in Figure 4-1, page 103. Since many local firms lack proper definition of responsibility and accountability (Addo-Abedi 1999), the concept of the roles and responsibilities matrix is adopted to help clarify the roles and responsibilities of the family-based work teams. The research adopts the continuous improvement concept to facilitate continuous improvement in the FBLM strategies.

4.3.1 Family-based team roles and responsibilities matrix

The family-based roles and responsibilities matrices summarize the roles and responsibilities of the teams involved in a road rehabilitation project. The matrices document the roles and responsibilities of the contractor-site managers' team, the site manager-supervisors team, the supervisor-foremen team and the foreman-laborers team.

The matrices also clearly define the responsibility relationships that must exist among teams and team members and the actions team members need to take in order to perform their assigned tasks successfully. The matrices are agreed upon documents (Cohen and Mankin 2002) that would help team members understand and appreciate the roles and behaviors required for performance of tasks. The family-based approach requires the distribution of the matrices on printed cards to all team leaders and also team members who can read.

The family-based matrices would help team members to understand 'who does what' and 'who has what information'? They would also be used to help analyze the current roles and responsibilities assignments in order to improve upon future assignments of roles and responsibilities as labor-based technology and organizational setups evolve. The family-based matrices would include 1) roles and responsibilities matrix for general management including recruitment, training, financial planning and road engineering, 2) general roles and responsibilities matrices for the road rehabilitation period and 3) detail roles and responsibilities matrix for each of the five general activities including site preparation, earthworks, reshaping, culvert construction and gravelling.

Table 4-9 illustrate a typical roles and responsibilities matrix for general management, Table 4-10 illustrates the general matrix during the road rehabilitation work, Table 4-11 shows the matrix for the implementation of each of the 5 major activities and Table 4-12 also shows the matrix for the post rehabilitation period.

Table 4-8: Roles and responsibilities matrix for general management

Tasks	Contractor-site managers Team	Site manager-supervisors Team	Supervisors-foremen Team	Foreman-laborers Team	Administrative officers
Recruitment of site managers and supervisors	**A**	**I**			
Recruitment of laborers	**R**		**A**		
Organization of foreman-laborers teams		**A**			
Coordination of training with MRT and DFR for supervisory personnel	**A**	**I**			
Site training for laborers		**I**	**A**		
Financial planning	**A**	**I**			**I**
Payment of workers	**S**				**A**
Hand-tools and light equipment procurement	**S**		**A**	**I**	**I**
Material procurement	**S**	**A**	**I**	**I**	**I**
Design and engineering of feeder road	**R**	**A**			
Contracting with MRT and DRF	**A**	**I**			**I**
Contract documentation	**A**	**I**			**I**
Formal decision making	**A**	**I**	**I**	**I**	**I**
Roles and responsibilities assignment and documentation	**R**	**A**	**I**	**I**	
Signing on and off tasks by laborers			**R**	**A**	
Signing on and off tasks by supervisors and foremen	**R**	**A**			

Legend: A-Accountable; **I** – Input; **R** – Review; **S** - Sign off

Table 4-9: General roles and responsibilities matrix during rehabilitation period

Tasks	Contractor-site managers Team	Site manager-supervisors Team	Supervisors-foremen Team	Foreman-laborers Team	Team Leader	Administrative officers
Organization and documentation of daily Foreman-laborers' team meetings				**I**	**A**	**I**
Organization and documentation of daily Supervisor-foremen team meetings			**I**		**A**	**I**
Organization and documentation of daily Site manager-supervisors' team meetings		**I**			**A**	**I**
Organization and documentation of weekly contractor-site managers' team meetings	**I**				**A**	**I**
Hand-tools and light equipment management			**A**	**I**		
Material management		**A**	**I**	**I**		
Tasks breakdown and tasks assignment			**A**	**I**		
Documentation of methods and processes		**I**	**A**			
Safety Concerns		**A**	**I**	**I**		
Daily site inspection and assessment	**I**	**A**				

Legend: A-Accountable; **I** – Input; **R** – Review; **S** - Sign off

Table 4-10: Roles and responsibilities matrix for the implementation of the 5 major activities

Activity	Tasks	Contractor-site managers Team	Site manager-supervisors Team	Supervisors-foremen Team	Foreman-laborers Team	Light equipment operators
Site Preparation	Bush Clearing			**I**	**A**	
	Grubbing			**I**	**A**	
	Boulder removal			**I**	**A**	
	Topsoil removal			**I**	**A**	
	Bush Clearing			**I**	**A**	
Earthworks	Installation of leveling instruments (surveying)		**A**	**I**	**I**	
	Excavation of earth soil to level			**I**	**A**	
	Filling with earth soil to level			**I**	**A**	
	Compaction of earth soil to level	**I**	**I**			**A**
Reshaping	Ditch Excavation		**I**	**I**	**A**	
	Slope and back-slope excavation		**I**	**I**	**A**	
	Camber formation		**I**	**I**	**A**	
	Compaction of earth soil to level	**I**	**I**			**A**
Culvert	Load of gravel onto truck and trailers				**A**	
	Hauling and unloading of gravel				**I**	**A**
	Spreading of gravel			**I**	**A**	
	Compaction of gravel	**I**	**I**			**A**

Legend: A-Accountable; **I** – Input; **R** – Review; **S** - Sign off

Table 4-11: Roles and responsibilities matrix for post-construction period

Tasks	Contractor-site managers Team	Site manager-supervisors Team	Supervisors-foremen Team	Foreman-laborers Team	Administrative officers
Final site inspection and assessment	**A**	**I**	**I**		
Dissemination of knowledge gained to workers	**A**	**I**	**I**		**I**
Closing of contract and acquisition of new contract from MRT and DFR	**A**	**I**			
Application of knowledge gained in future projects	**R**	**A**	**I**		

Legend: A-Accountable; **I** – Input; **R** – Review; **S** - Sign off

4.3.2 Strategy for knowledge transfer and innovations

Knowledge transfer has enormous benefits for an organization. It is an essential source of an organization's sustainable competitive advantage (Osterloh and Frey 2000 & Goh 2002). No one single innovation may continue to be the most efficient strategy for all times in the current rapidly changing world. Every new innovation would eventually reach the limits of its usefulness and be replaced (Bronowski 1955), unless it is continuously renewed with more efficient strategies.

The family-based approach seeks continuous improvement in all the processes that constitute the FBLM concept. It depends on the knowledge gained from road rehabilitation projects and the innovative discoveries in other related management programs to constantly improve the efficiency of the FBLM concept. Unlike the current approach, the family-based concept is designed with an inherent mechanism to ensure constant innovations. The family-based approach relies on knowledge gained from both internal (including discoveries of new methods of road rehabilitation) and external sources (including research findings) to ensure constant evolution of the concept in terms of labor management and labor-friendly technologies improvements as illustrated in Figure 4-9.

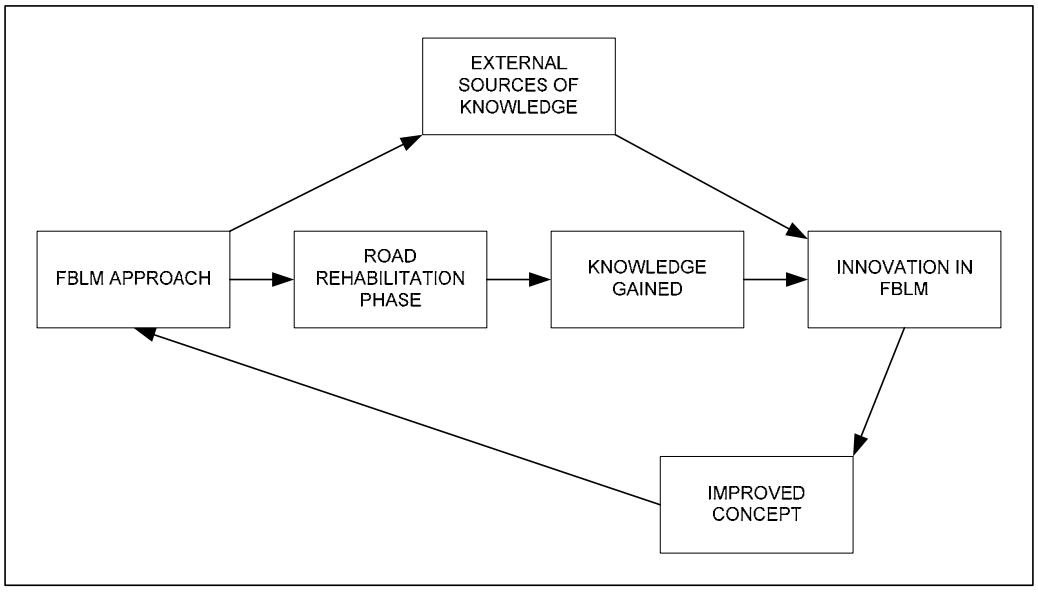

Figure 4-9: Constant evolution mechanism of the Family-based approach

4.4 IMPROVING THE CAMBER (CROWN) DESIGN OF FEEDER ROADS IN GHANA

This work also seeks to modify the road camber design used in the current approach from 5%-8% (Figure 3-2) to 3%-4% (Figure 4-10). A camber facilitates proper drainage of gravel roads. Without a camber, water collects quickly on the roads, softens the gravel and causes it to rut quickly (the United States Department of Transportation (USDOT) 2000). A camber that is too steep, on the other hand, leads to unsafe driving (USDOT 2000), erosion and displacement of gravel (Keller and Sherar 2003).

To minimize erosion, gravel displacement and unsafe driving conditions due to the steepness of a camber and to improve the drainage system of gravel roads, the USDOT recommends 4% camber slope as ideal for gravel roads (USDOT 2000). In a similar way, the 'Project Development and Design Manual' (PDDM) of the Federal Lands Highway (FLH) also recommends 3% to 4% camber slope for gravel roads (FLH 2005).

The family-based approach seeks to change the 5% to 8% camber slope used in the current approach to the 3% to 4% camber slope for the roads that would be rehabilitated using the proposed FBLM concept as illustrated in Figure 4-10 below. The 3% to 4% will minimize erosion, gravel rut and the rate of gravel displacement which in turn reduces maintenance cost. The 3% to 4% slope will also help improve the driving conditions on gravel roads in Ghana.

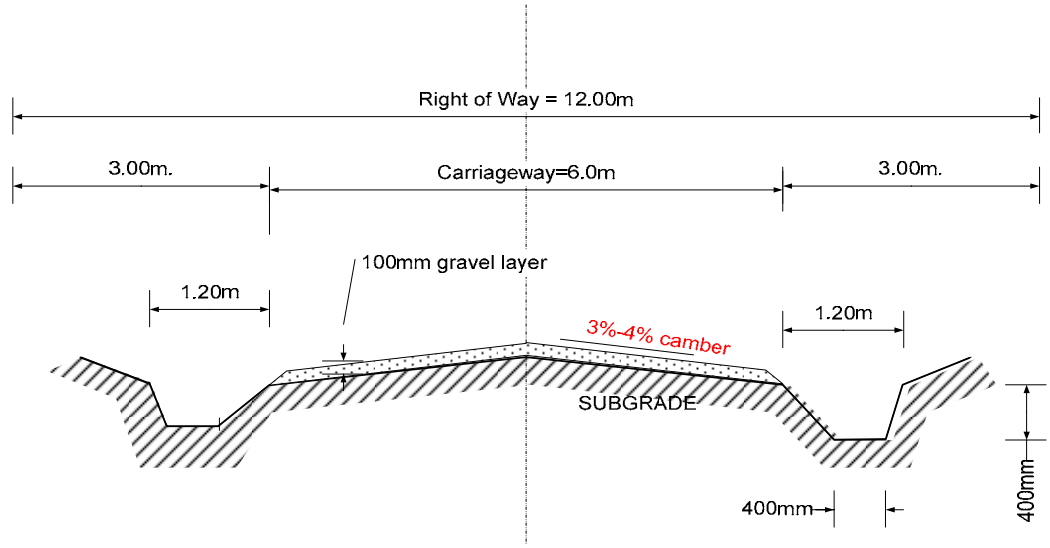

Figure 4-10: Modified camber design (Adapted: Ampadu 2005)

4.5 APPLYING FBLM CONCEPT FOR THE REHABILITATION OF 4KM

The main motivation behind the formulation of the FBLM concept is to help the labor-based road contractor in Ghana raise his/her production rate from 1.33km to 4km (or more) in 20 workdays per month. This section discusses how the application of the concept to rehabilitate the 4km goal would look like at the project site. The section focuses on the productivity rates, schedule and the detailed daily site activities.

4.5.1 Productivity Rates and Schedule

There are few differences between the productivity rates and the schedule of the current and the FBLM approaches since (in this section) the productivity of the family-based workers is assumed to remain unchanged from that of the current approach. The FBLM concept also operates on multiples of 1.33km (the average monthly production of the current approach). The difference in the two approaches is due to the team assignment of the FBLM approach instead of the individual assignment in the current approach.

Table 4-13 illustrates the productivity rates, tasks, quantities and team assignments for the rehabilitation of 1.33km under each of the 3 site managers involved in the rehabilitation of the 4km. Figure 4-11 shows a typical schedule of each of the 3 site managers responsible for the rehabilitation of 1.33km.

Table 4-12: Productivity rates, tasks, quantities and team assignment for the rehabilitation of 1.33km under each of the 3 site managers of the FBLM approach (Data Sources: Ampadu 1999 and Veen 1985)

Activities	Task No	Tasks	Quantity per 1.33km	Productivity per hr	Teams Required
Site Preparation	1	Bush clearing	11970 m^2	37.5 m^2	3 Supervisors; 9 F-L Teams (63)
	2	Grubbing	5320m^2	18.9 m^2	3 Supervisors; 9 F-L Teams (63)
	3	Top-soil removal	11970 m^2	12.5 m^2	3 Supervisors; 9 F-L Teams (63)
	4	Boulder removal	13	1.3	1 F-L Teams (7)
Earthworks	5	Excavation	798 m^3	0.4 m^3	3 Supervisors; 9 F-L Teams (63)
	6	Hauling & Filling	60 m^3	0.4 m^3	1 Supervisor; 2 F-L Teams (14)
	7	Compaction	60 m^3	0.6 m^3	1 Supervisor; 2 F-L Teams (14)
Reshaping	8	Ditch excavation	2660 m	1.9 m	3 Supervisors; 9 F-L Teams (63)
	9	Slope excavation	2660 m	4.6 m	3 Supervisors; 9 F-L Teams (63)
	10	Back slope excavation	2660 m	4.6 m	3 Supervisors; 9 F-L Teams (63)
	11	Spreading	900 m^3	1.5 m^3	3 Supervisors; 9 F-L Teams (63)
	12	Compaction	900 m^3	31.3 m^3	1 Site manager; 2 Roller operators
Culverts (2 per 1.33km)	13	Collection of stone/sand	7 m^3	0.3 m^3	1 Supervisor; 2 F-L Teams (14)
	14	Excavation	100 m^3	0.3 m^3	1 Supervisor; 9 F-L Teams (63)
	15	Forms and Reinforcement Fabrication	16 m	0.063 m	1 Supervisor; 3 F-L Teams (21)
	16	Mixing and placing concrete	5 m^3	0.063 m^3	2 Supervisors; 6 F-L Teams (42)
	17	Culvert finishing	3.6 m^3	0.063 m^3	1 F-L Teams (7)
Graveling	18	Loading	233 m^3	0.54 m^3	2 Supervisors; 4 F-L Teams (28)
	19	Hauling	233 m^3	19 m^3	1 tipper truck operator 3 trailer operators
	20	Spreading	233 m^3	1.5 m^3	3 Supervisors; 4 F-L Teams (28)
	21	Compaction	233 m^3	12.5 m^3	1 Site manager: 2 Roller operators

Legend: F-L Team: Foreman – laborers Team

ID	Task Name	Duration
1	**Labor-Based Road Rehabilitation**	**160 hrs**
2	**Site Preparation**	**32 hrs**
3	Bush Clearing	5.5 hrs
4	Grubbing	4.9 hrs
5	Top Soil Removal	20.1 hrs
6	Boulder Removal	1.5 hrs
7	**Earthworks**	**56 hrs**
8	Excavation	37.7 hrs
9	Hauling and Filling	10.3 hrs
10	Compaction	16 hrs
11	**Culverts**	**64 hrs**
12	Sand and Stone Collection	3.7 hrs
13	Excavation for Culverts	24 hrs
14	Form and Reinforcement Fabrication	8 hrs
15	Mixing and Placing Concrete	2.5 hrs
16	Finishing for Culvet	8 hrs
17	**Reshaping**	**80 hrs**
18	Ditching	32 hrs
19	Sloping	16 hrs
20	Backsloping	16 hrs
21	Spreading	16 hrs
22	Compaction of Earth Soil	16 hrs
23	**Gravelling**	**24 hrs**
24	Load, Haul and Unload Gravel	16 hrs
25	Spreading	12 hrs
26	Compaction	12 hrs

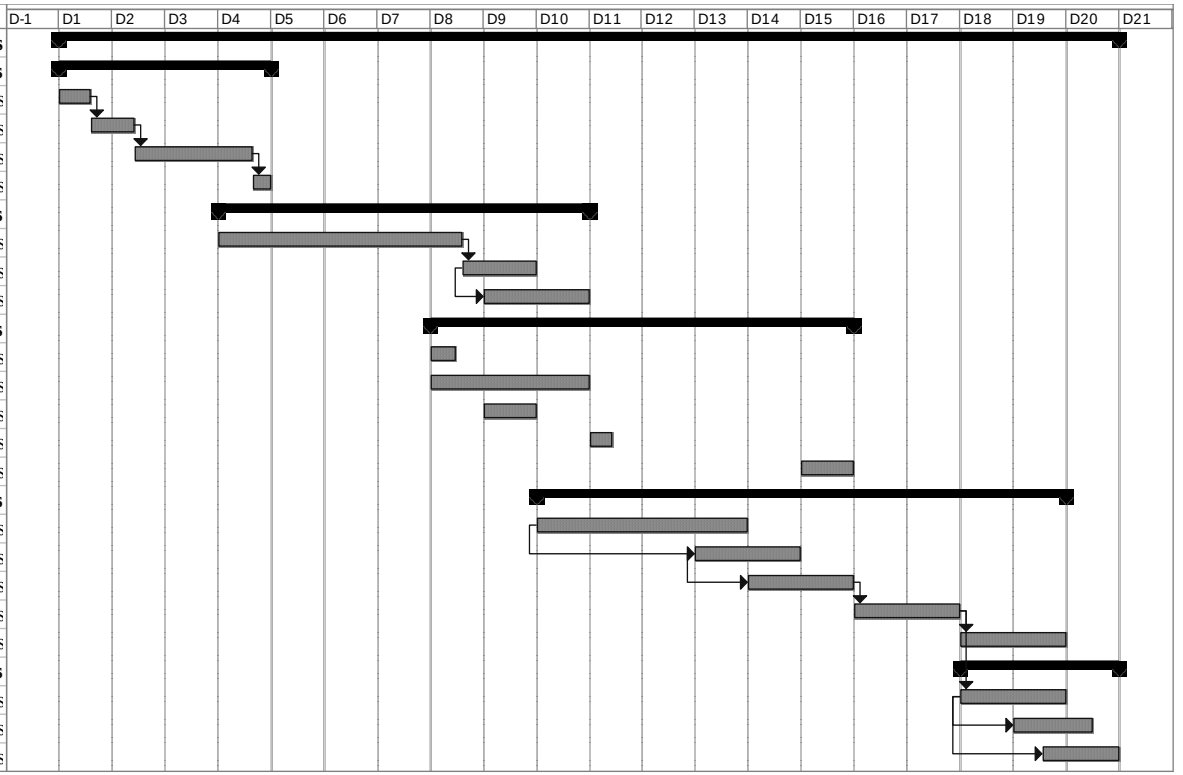

Figure 4-11: Schedule of the FBLM concept for the rehabilitation of 1.33km

4.5.2 Daily site activities

The daily activities of the FBLM approach differs slightly from that of the current approach since the FBLM approach assigns tasks to teams instead of to individuals. It also takes into consideration the period of time allotted for the daily meetings. The contractor-site manager team is responsible for the design and engineering of the roads whereas the supervisor-foremen teams are responsible for the procurement and management of hand-tools and light equipment. It is the responsibility of the contractor-site manager team to ensure that the 1.33km roads are joined to each other correctly. The 3 supervisors working under each of the three site managers bear the responsibility of providing appropriate hand-tools at the three tool stations along each of the 1.33km of road as shown in Figure 4-12.

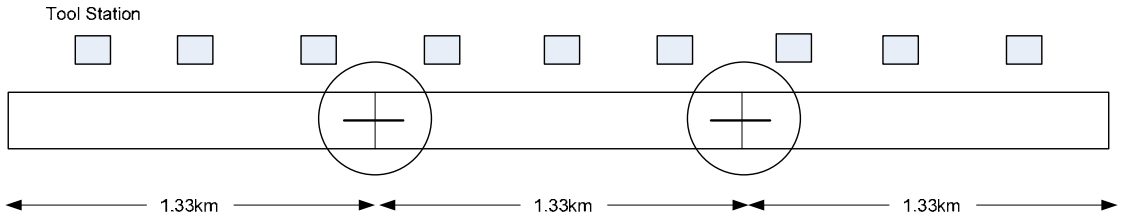

Figure 4-12: Tools stations and important road joints

The organization of the family-based teams for task execution would differ for different tasks. Figures 4-13 and 4-14 are scaled diagrams to illustrate how the teams would be organized for the ditch excavation and earth excavation/fill tasks respectively. Both Figures 4-13 and 4-14 provide only 0.05km (50m or 165ft) of the 1.33km for illustration purposes. Figure 4-13 illustrates that the average daily productivity of the 3 supervisors and the 63 workers (composed of 9 foreman-laborer teams) for the excavation of ditches (reshaping activity) is 1.0km. The diagram shows that the average spacing between workers performing the task is about 16m (52.5ft). This spacing avoids the overcrowding of workers at a particular spot and also allows vehicles carrying workers and materials to ply the site without interrupting ongoing work.

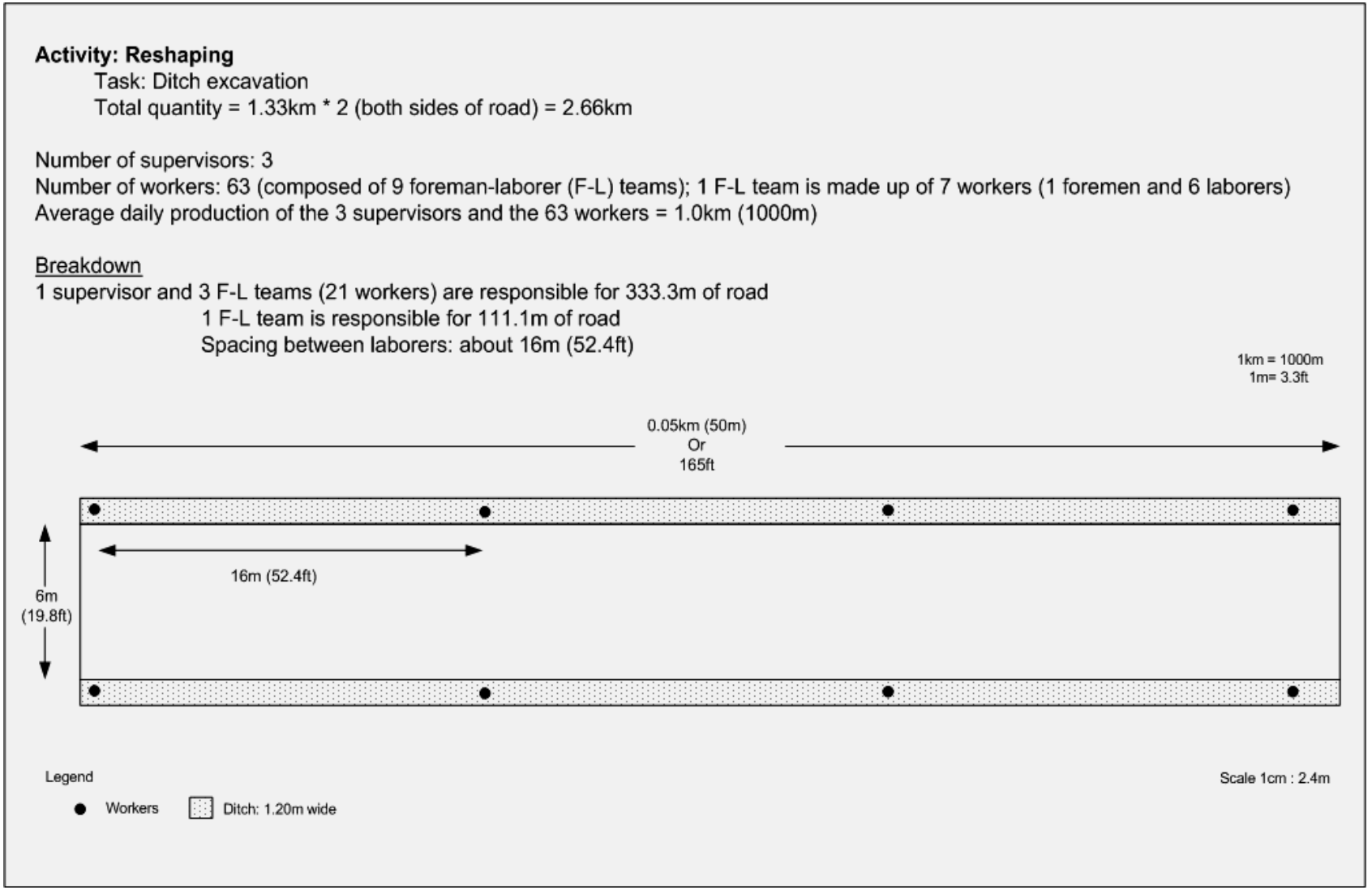

Figure 4-13: Ditch excavation

Figure 4-14 also illustrates the spacing of workers in the performance of excavation/fill to road formation task (earthworks). Each worker is assigned to work within 31.8m^2 (6m*5.3m) or 287.1sq.ft (19.8ft*14.5ft). This spacing prevents overcrowding of workers and allows available space for vehicles carrying workers, tools and materials to ply the job site without interrupting work being performed.

Figures 4-15 to 4-19 (not drawn to scale) provide the general idea of how the teams would be organized to execute the tasks involved in rehabilitation of the 4km in 20 workdays per month. The basic unit team is the foreman-laborer team (F-L team) which is composed of 1 foreman and six laborers.

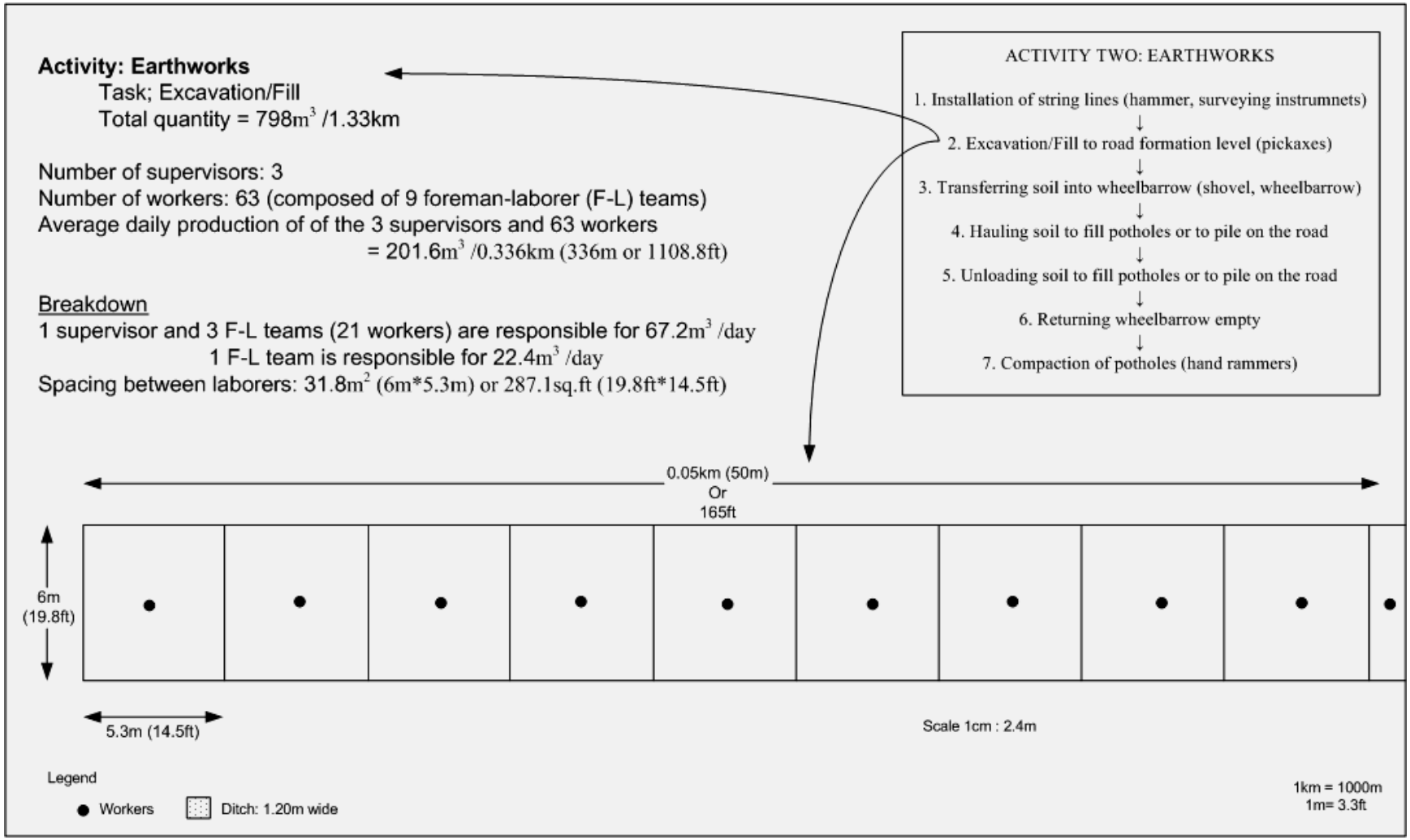

Figure 4-14: Excavation/Fill (Earthworks activity)

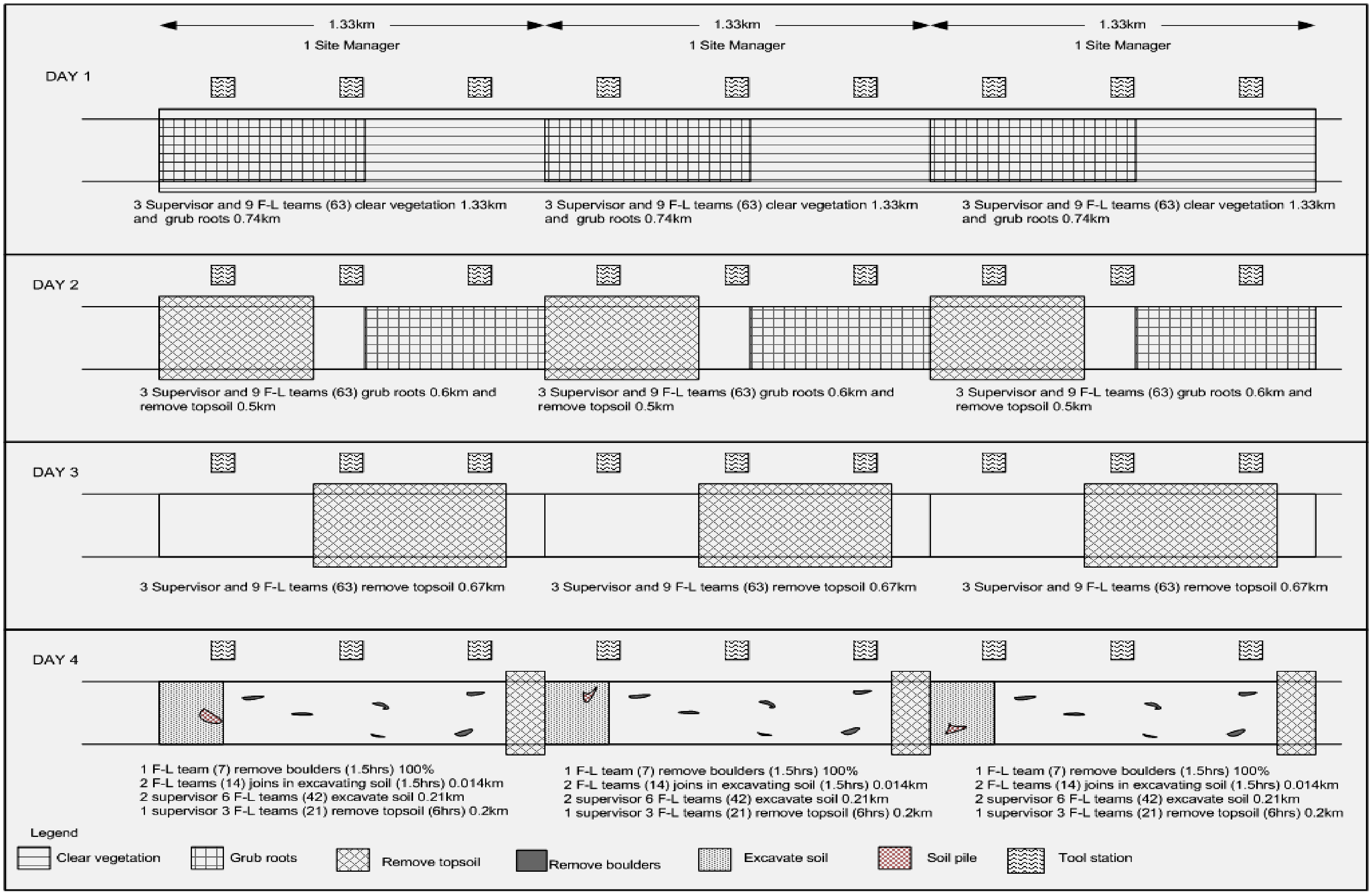

Figure 4-15: Detail activities for days 1-4

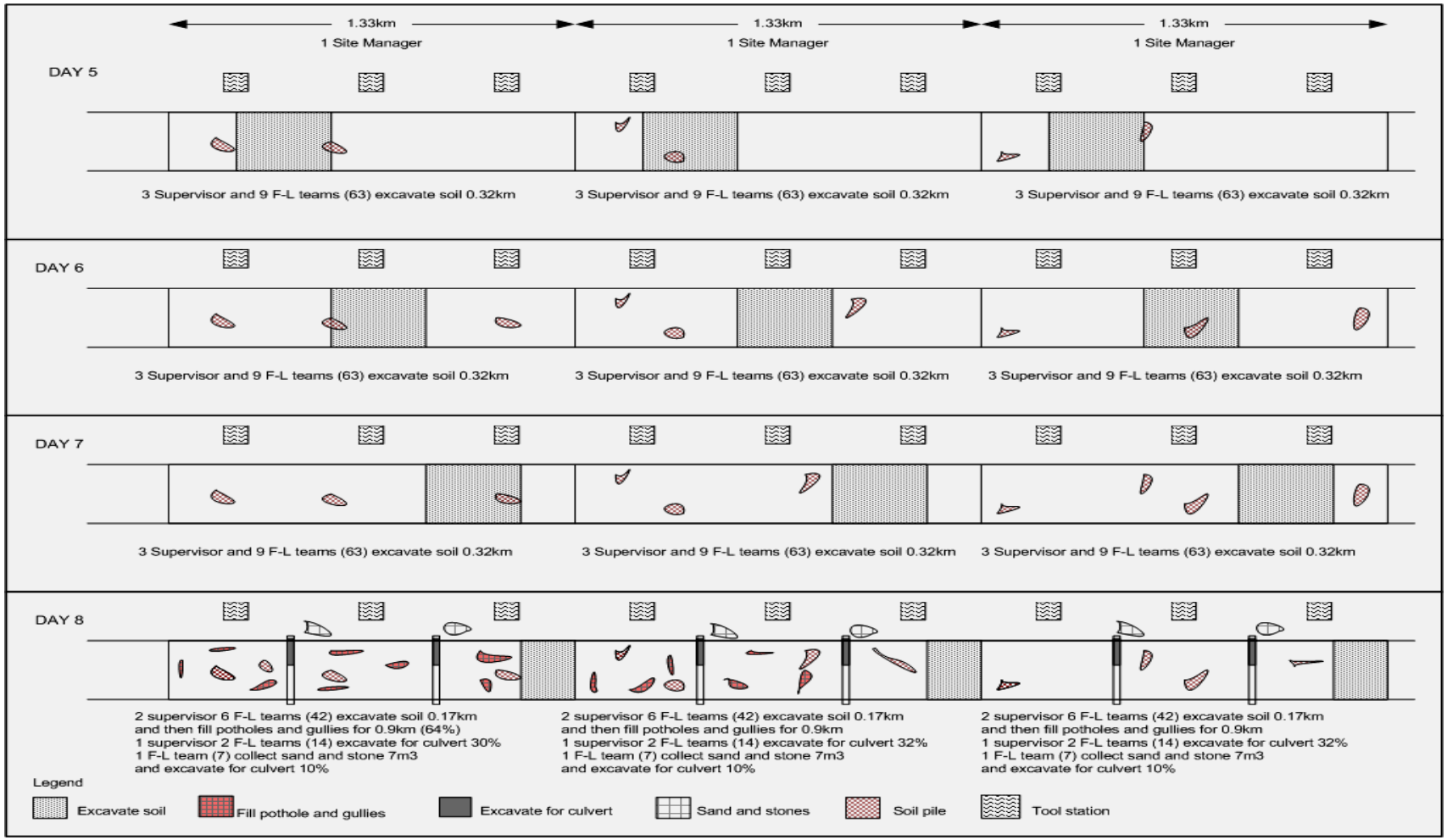

Figure 4-16: Detail activities for days 5-8

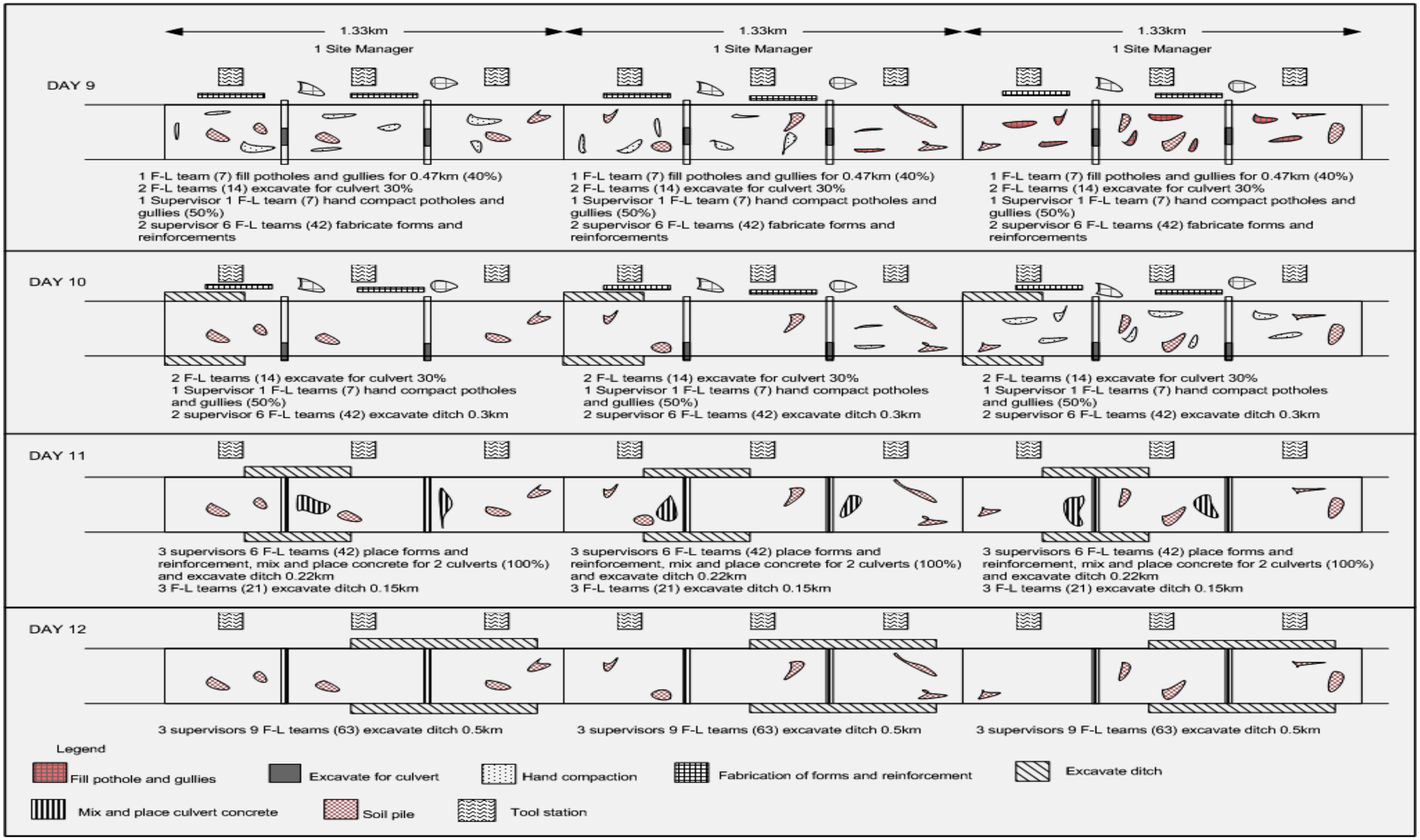

Figure 4-17: Detail activities for days 9-10

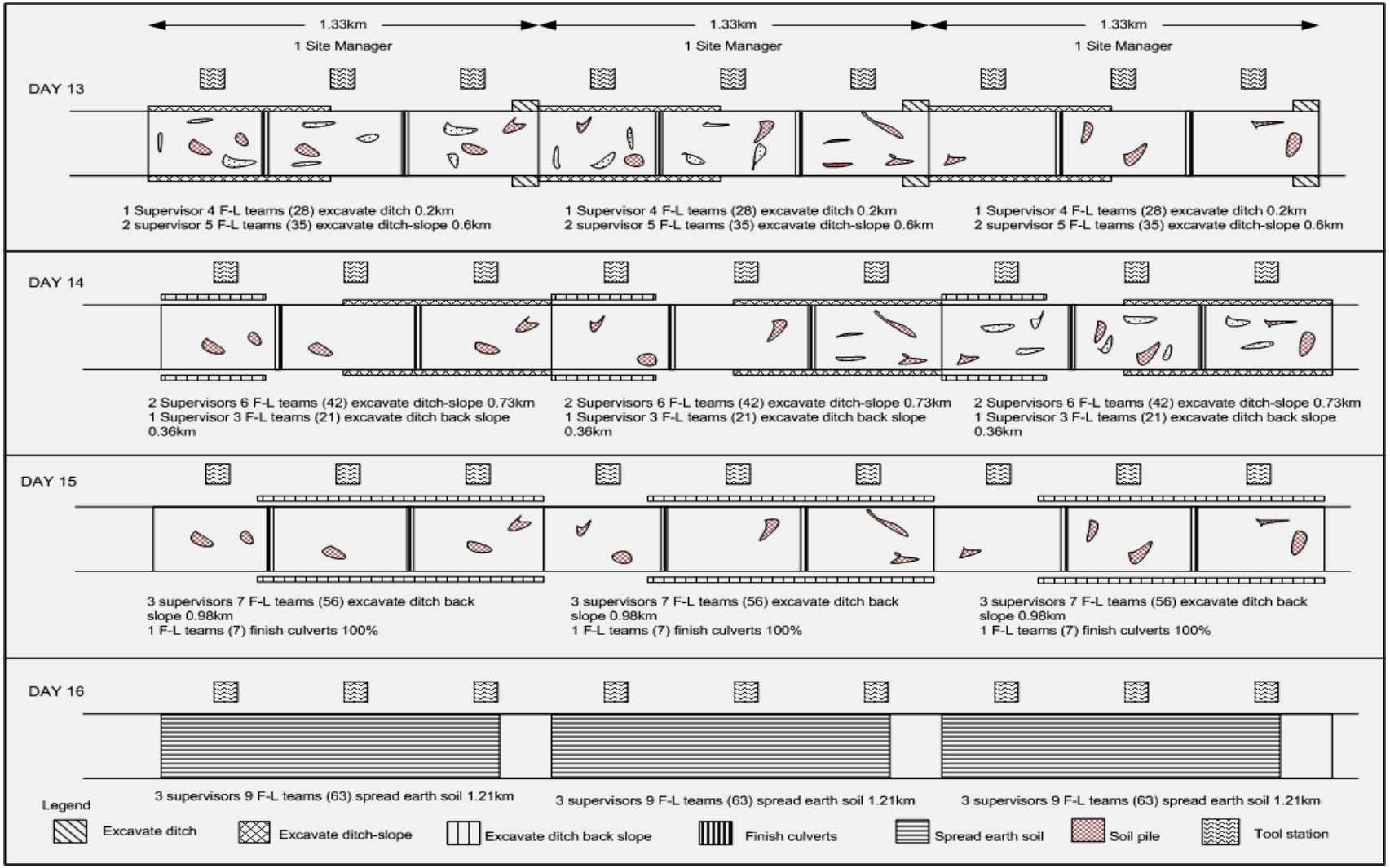

Figure 4-18: Detail activities for days 13-16

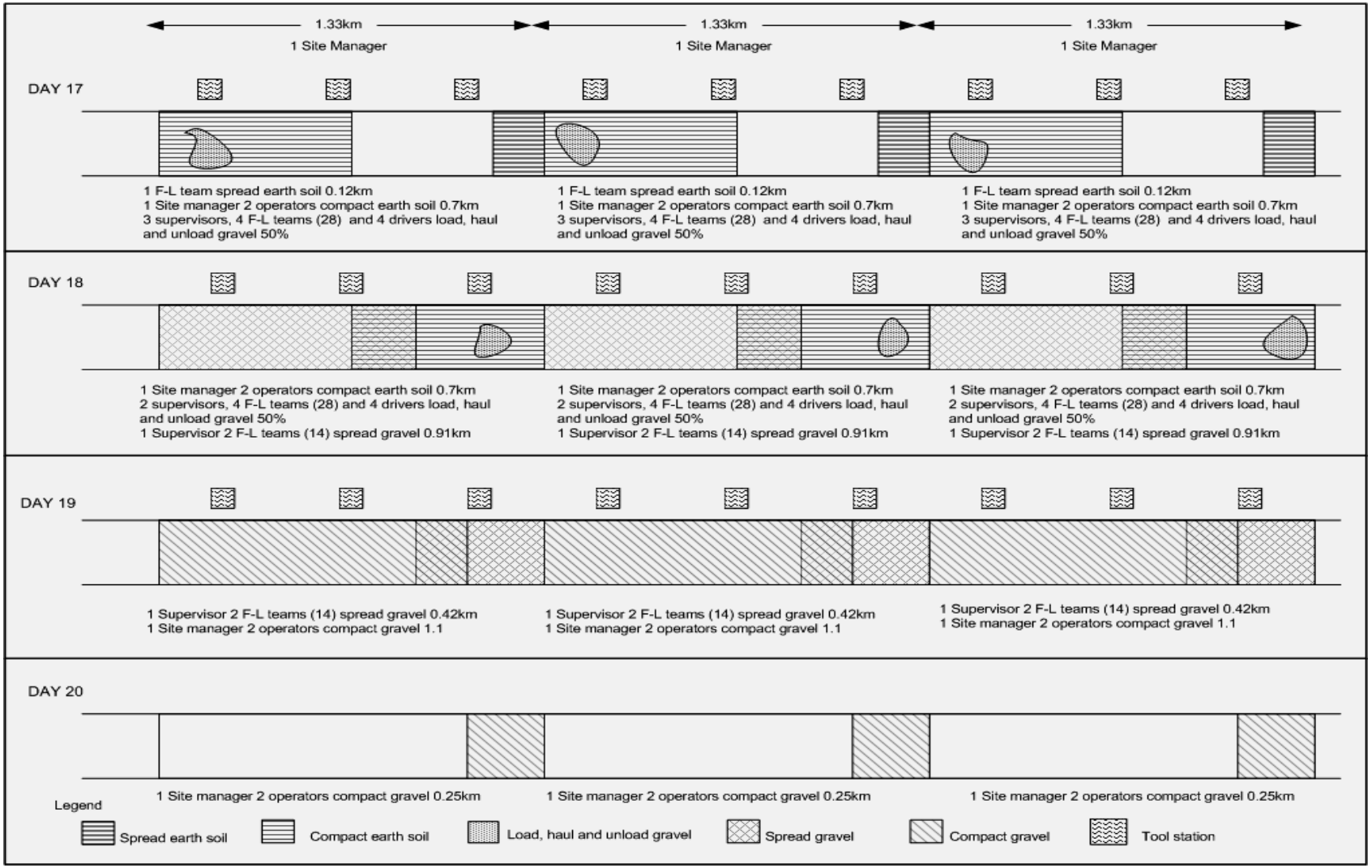

Figure 4-19: Detail activities for days 17-20

The pictorial representation of the daily activities presented above would help clarify the quantity of work expected to be perform by teams. It would also facilitate the daily assignment of workers and the supervisory personnel. The pictorial form of the daily activities would be more useful if they are printed on cards and made available to all team leaders and team members.

4.6 SUMMARY

The FBLM concept would constitute an enormous improvement on the current approach to feeder road rehabilitation in Ghana. The concept would be attractive because it is rooted in efficient management systems of the HPWT and also in the cultural tendencies of the GFS. The developed FBWT concept with the improvements made in the recruitment, training, communication and reward strategies and the adoption of the roles and responsibilities matrix and continuous innovation concepts would go a long way to improve the capacity of the local contractor to efficiently manage larger number of workers that would be involved in road rehabilitation programs.

The application of the concept would help ease the unemployment and poverty facing the country through the creation of more jobs. More workers would be absorbed into the program and more wages would be distributed than in the current labor-based and equipment-intensive approaches. Moreover, the FBLM concept would enable local contractors to rehabilitate more roads (3*1.33km) compared to the 1.33km of the current approach within the same period of time (about 160 hours or 20 working days).

Chapter 5 discusses possible productivity improvement that would be realized when the FBLM concept is adopted. Though the FBLM concept has not been used, the result of the application of other related concepts, especially the high performance work team (HPWT) concept is used as a confirmation that the FBLM concept would raise productivity values when adopted. The chapter concentrates on the proposed work method, the combination of the task-work and piece-work methods to predict the productivity improvement of the FBLM concept.

Chapter 5 Potential productivity improvements due to the application of the Family-Based Labor Management (FBLM) strategies

To raise the monthly production of the current labor-based approach from 1.33km to 4km (or more), the research has focused on increasing (that is tripling) the resources used in the current approach, rather than improving the productivity of the work force. This strategy was to help generate more employment to help reduce the high unemployment and poverty incidence in Ghana. However, the family-based labor management (FBLM) strategies are proposed to facilitate the management of large work force also possess the potential to improve crew productivity. The strategies have the potential to improve production beyond the 4km goal.

This section of the research analyzes the potential productivity improvements that would be realized through the implementation of the proposed FBLM strategies. It also considers the quantities and the productivity rates of the individual tasks due to the potential improvements in the monthly production. A schedule for the predicted monthly production is also presented. There is also a discussion on how the daily activities would be organized to achieve the predicted monthly production.

5.1 THE POTENTIAL PRODUCTIVITY IMPROVEMENTS OF THE FBLM CONCEPT

The FBLM strategies have not yet been used in actual feeder road rehabilitation. Thus, the research relies on the application of similar strategies in other programs to discuss the potential productivity improvements that could be achieved when the FBLM concept is implemented. The discussion will center on the potential productivity improvements due to the implementation of:

1) The developed family-based work team (FBWT) concept
2) The proposed improvement in the management strategies
3) The proposed work method, namely the combination of task-work and piece-work methods.

To predict the potential productivity improvements due to the implementation of the FBLM concept in the labor-based road rehabilitation program, the research will explore potential productivity improvements due to the implementation of the proposed work

method (the combination of the task-work and piece-work methods). The reasons for the focus on the proposed work method in predicting the potential productivity improvement of the FBLM concept includes the following:

- Comparatively, the potential productivity improvements of the combination of the task-work and piece-work methods can easily be measured for a more accurate prediction.
- The measurements of the potential productivity improvements of the implementation of the team concept and the proposed improved management may be more complex for accurate measurement and prediction.

5.1.1 Potential productivity/performance improvements of the FBWT strategy

The FBWT concept evolved from the integration of high performance work team (HPWT) concepts and the Ghana Family System (GFS). Since the FBWT has not yet been used in actual road rehabilitation project, the research draws on the productivity improvements achieved through the use of the HPWT concept in other programs to illustrate the potential of the proposed FBWT strategy to improve productivity.

Research has shown that the implementation of the HPWT concept is associated with productivity and performance improvements. Table 5-1 illustrates that the application of the HPWT concept in steel manufacturing (Arthur 1994), in all industries (Easton and Jarrell 1998) and in automobile manufacturing (MacDuffie 1995) resulted in productivity improvements. The proposed FBWT concept which is rooted in the HPWT concept also has the potentials to facilitate similar productivity improvements in the labor-based road rehabilitation program.

Table 5-1: Productivity improvements due to the application of HPWT (Data Source: King 1995)

Work practices	Research scope	Performance measure	Results
Teamwork	Steel	Labor hour per ton	12% higher productivity
Teamwork, organizational structure, Training	All industries	Stock price, accounting profit	Firms implementing system had 20% higher stock price after 6 years
Teamwork, Training	Automobiles	Standard production time per vehicle	Work systems associated with significant increase in productivity

5.1.2 The potential productivity improvements of the improved management strategies

To facilitate the efficient management of the large work force, the research proposes improvements in the current management systems which include training, communication and reward strategies.

5.1.2.1 Training

The research results presented in Table 5-2 illustrates the impact of training on the productivity of all the industries studied (Bartel 1994), on Michigan manufacturing firms (Holzer et al 1993) and on manufacturing industries in general. The review of literature (Bishop 1994) has also revealed similar productivity/performance improvements due to improvement in training.

Table 5-2: Impact of training on productivity/performance improvements (Data Source: King 1995)

Work practices	Research scope	Performance measure	Results
Training	All industries	Net sales per worker	Productivity up 19% over 3 years
Training	Michigan manufacturing	Scrap rate	7% decrease in scrap
Training	Manufacturing	Sale per worker	System indexes associated with higher productivity
Training	Literature review	Wage	Wages of trainees up to 12% in 8 studies

5.1.2.2 Communication System

Research has also shown that the implementation of improved communication strategies also facilitate productivity improvements. Table 5-3 below summarizes the results of research conducted on the impact of improved communication and other management systems in some organizations. It is surmised that the communication strategy of the FBLM concept would also facilitate similar productivity improvements in Ghana's labor-based feeder road program.

Table 5-3: Impact of improved communication and other systems on productivity improvements (Data Source: King 1995)

Author/dates	Work practices	Research scope	Performance measure	Results
Macy and Izumi 1993	Communication, teamwork, training	Meta-analysis	Various	Changes in work practices associated with productivity improvements; up to 40%
Levine and Tyson 1990	Participating in decision making	Literature review	Various	Majority of studies found that participation positively correlated with productivity improvements

5.1.2.3 Reward system

The family-based approach has adopted the performance based and team based reward systems of the HPWT. Research has demonstrated the effectiveness of using these two reward systems to improve productivity. Table 5-4 illustrates the productivity/performance improvements achieved through the implementation of performance based, team based and other reward strategies in manufacturing (Kaufman 1992) and in all industries studied (Huselid 1995 & Hendricks and Singhal 1996).

Table 5-4: Impact of performance based, team based and other reward strategies on productivity/performance improvements (Data Source: King 1995)

Work practices	**Research scope**	**Performance measure**	**Results**
Gain sharing (performance based)	Manufacturing	Relative labor	15% increase in productivity
Employee skills, employee motivation	All industries	Sales per worker	System indexes associated with 16% increase in productivity
Quality award recipient	All industries	Daily stock price	Quality award announcement coincides with 0.6% stock jump

5.1.3 Predicting the monthly productivity improvements of the FBLM concept on the basis of the proposed work methods

As already discussed in Chapter 4, the current approach uses the task-work method in which a realistic task or quantity of work and the expected quality is set to be performed by a worker during the daily working hours, usually 8 hours. The worker may work harder to complete the daily assigned task any time within the 8 daily working hours (Stock 1996). It has been noted (in labor-based road works) that usually it takes the worker about 50% of the daily working hours (4 hours) to perform the daily assigned task on the task-work incentive system(Stiedl 1998).

The research proposes a combination of the piece-work system with the current task-work system to facilitate productivity improvements. In the piece-work method a fixed quantity of output and the expected quality of the output are set for the worker at an agreed price. The more pieces of the fixed output the worker performs, the more the worker is paid.

For effective combination of the two work methods, the task-work method must be used for the performance of the normal daily task assignments which usually takes 4 hours of the 8 hour working day. The piece-work method must be used only for the extra work after the completion of the daily assignments. The combination of the two work methods would double or improve output by 100% as illustrated in Figure 5-1 on the basis of the following assumptions:

- Daily working hours is restricted to 8 hours to help workers recuperate from exhaustion and be prepared for the following day's tasks.
- That all the family-based work teams would take advantage of the extra daily 4 hour piece-work incentive throughout the month; assuming that workers would take advantage of their culturally oriented entrepreneurial tendency and the family oriented work environment to work harder to double their wages especially in an economy in which daily wage is as low as $1.22.

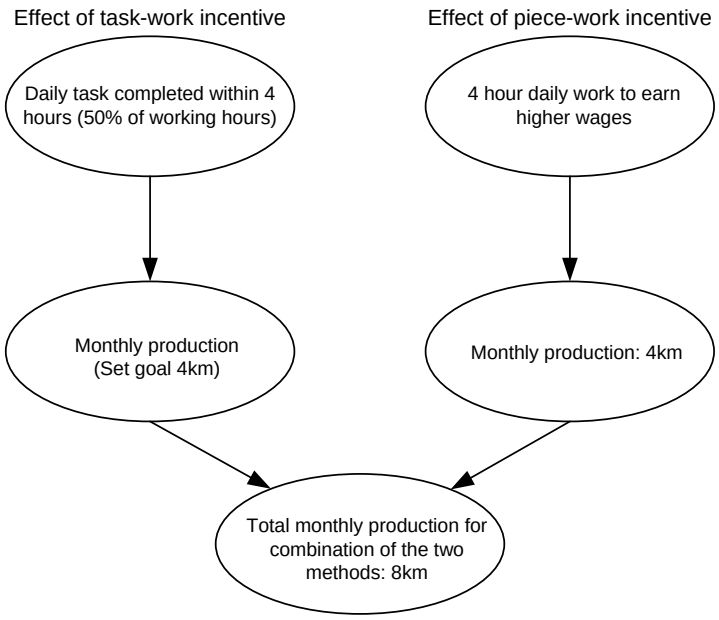

Figure 5-1: Effects of the combination of the task-work and piece-work methods on the monthly productivity

Research conducted on road construction workers in India (and confirmed by similar research in Nigeria and Tanzania) revealed that the piece-work incentive generated an average productivity improvement of 46.5% (Stock 1996). The result of the study in India also conforms to some findings of a study conducted in South Africa on the effects of work methods, quality of management and environmental conditions on the productivity of labor-based road construction activities. An excerpt of the findings is presented in Table 5-5 below.

Table 5-5: Effects of work methods, management and environmental conditions on productivity (Data Source: Coukis 1983; in Construction Industry Development Board (CIDB) 2005)

Road Authority	**Work method**	**Management quality**	**Environmental conditions**	**Productivity improvement factors**
1	Piece-work	Good	Fair	1.5
2	Task-work	Good	Good	1.5

From the analysis of the studies above (Table 5-5), it could be said that the implementation of the FBLM concept could generate productivity improvements of between 50% and 100%;

- The basis for the 50% productivity improvement are;
    - The 46.5% increase in the findings of the study conducted in India (Stock 1996).
    - The 1.5 productivity improvement factor of the study conducted in South Africa (Coukis 1983).
- 100% productivity improvements;
    - On the assumption that all the family-based work teams would take advantage of the daily piece-work incentive throughout the month.

Since it is unlikely that all the family-based work teams would take advantage of the daily task-work and piece-work incentives throughout the month, the research predicts minimum productivity improvement of 50% to conform to the findings of the research conducted in India and South Africa.

Though the research has focused on increasing (tripling) the resources used in the current approach to achieved the set goal of 4km per month, when the potential productivity improvements due to the implementation of the FBLM strategies is taken into consideration, it is realized that the monthly production level could rise from the 4km goal to 6km as illustrated in the following:

- 4km + (4 x 50%) = 4 + 2 = 6km

  or

- 4km x 1.5 = 6km

Each of the 3 site managers working under the local contractor would be responsible for the rehabilitation of 2km of the predicted 6km monthly production in 20 workdays per month. Table 5-6 compares the monthly production, cost and work force size of the conventional equipment-intensive approach, the current labor-based approach and the FBLM approach with and without the consideration of productivity improvements.

Table 5-6: A comparison of the production, cost and employment capacities of the current, the equipment-intensive and the FBLM approaches (Data Sources: Ampadu and Tuffour 1996, Ampadu 1999 & Ampadu 2001)

Approach	Production per month (km)	Cost US$ (per km)	Work force size
Conventional equipment-intensive	3.07	14,218	20
Current labor-based	1.33	13,374	75
FBLM approach (without the consideration of potential productivity improvements)	4.00	13,374	225
FBLM approach (considering potential productivity improvements)	6.00	13,374	225

5.2 PRODUCTIVITY RATES, QUANTITIES AND A SCHEDULE FOR THE REHABILITATION OF 6KM IN 20 DAYS PER MONTH

The productivity rates of the individual tasks based on the predicted monthly production and the quantities required for the rehabilitation of the 2km of feeder road under each of the three site managers are presented in Table 5-7. The productivity rates of the individual tasks would be improved by the factor 1.5.

Figure 5-2 also presents a schedule that would facilitate the rehabilitation of the 2km of feeder road under each of the three site managers.

Table 5-7: The productivity rates, tasks, quantities and team assignments for the rehabilitation of 2km under each of the three site managers of the FBLM approach (Data Sources: Ampadu 1999 and Veen 1985)

Activities	Task No	Tasks	Quantity per 2km	Productivity per hr	Teams Required
Site Preparation	1	Bush clearing	18000 m^2	56.2 m^2	3 Supervisors; 9 F-L Teams (63)
	2	Grubbing	8000 m^2	28 m^2	3 Supervisors; 9 F-L Teams (63)
	3	Top-soil removal	18000 m^2	19 m^2	3 Supervisors; 9 F-L Teams (63)
	4	Boulder removal	19.5	2	1 F-L Teams (7)
Earthworks	5	Excavation	1200 m^3	0.6 m^3	3 Supervisors; 9 F-L Teams (63)
	6	Hauling & Filling	90 m^3	0.6 m^3	1 Supervisor; 2 F-L Teams (14)
	7	Compaction	90 m^3	0.9 m^3	1 Supervisor; 2 F-L Teams (14)
Reshaping	8	Ditch excavation	4000 m	2.9 m	3 Supervisors; 9 F-L Teams (63)
	9	Slope excavation	4000 m	6.9 m	3 Supervisors; 9 F-L Teams (63)
	10	Back slope excavation	4000 m	6.9 m	3 Supervisors; 9 F-L Teams (63)
	11	Spreading	1353 m^3	2.3 m^3	3 Supervisors; 9 F-L Teams (63)
	12	Compaction	1353 m^3	50 m^3	1 Site manager: 2 Roller operators
Culverts (3 per 2km)	13	Collection of stone/sand	10.5 m^3	0.5 m^3	1 Supervisor; 2 F-L Teams (14)
	14	Excavation	150 m^3	0.5 m^3	1 Supervisor; 9 F-L Teams (63)
	15	Forms and Reinforcement Fabrication	24 m	0.1 m	1 Supervisor; 3 F-L Teams (21)
	16	Mixing and placing concrete	7.5 m^3	0.1 m^3	2 Supervisors; 6 F-L Teams (42)
	17	Culvert finishing	5.5 m^3	0.1 m^3	1 F-L Teams (7)
Graveling	18	Loading	350 m^3	0.81 m^3	2 Supervisors; 4 F-L Teams (28)
	19	Hauling	350 m^3	28.5 m^3	1 tipper truck operator 3 trailer operators
	20	Spreading	350 m^3	2.3 m^3	3 Supervisors; 4 F-L Teams (28)
	21	Compaction	350 m^3	19 m^3	1 Site manager: 2 Roller operators

Legend: F-L Team: Foreman – laborers Team

ID	Task Name	Duration
1	**Labor-Based Road Rehabilitation**	**156 hrs**
2	**Site Preparation**	**27.4 hrs**
3	Bush Clearing	5.1 hrs
4	Grubbing	4.5 hrs
5	Top Soil Removal	16.4 hrs
6	Boulder Removal	1.4 hrs
7	**Earthworks**	**52.6 hrs**
8	Excavation	36.6 hrs
9	Hauling and Filling	8 hrs
10	Compaction	8 hrs
11	**Culverts**	**72 hrs**
12	Sand and Stone Collection	2.5 hrs
13	Excavation for Culverts	21.5 hrs
14	Form and Reinforcement Fabrication	13 hrs
15	Mixing and Placing Concrete	2.2 hrs
16	Finishing for Culvet	8 hrs
17	**Reshaping**	**72 hrs**
18	Ditching	32 hrs
19	Sloping	13.4 hrs
20	Backsloping	16 hrs
21	Spreading	16 hrs
22	Compaction of Earth Soil	16 hrs
23	**Gravelling**	**28 hrs**
24	Load, Haul and Unload Gravel	16 hrs
25	Spreading	14 hrs
26	Compaction	12 hrs

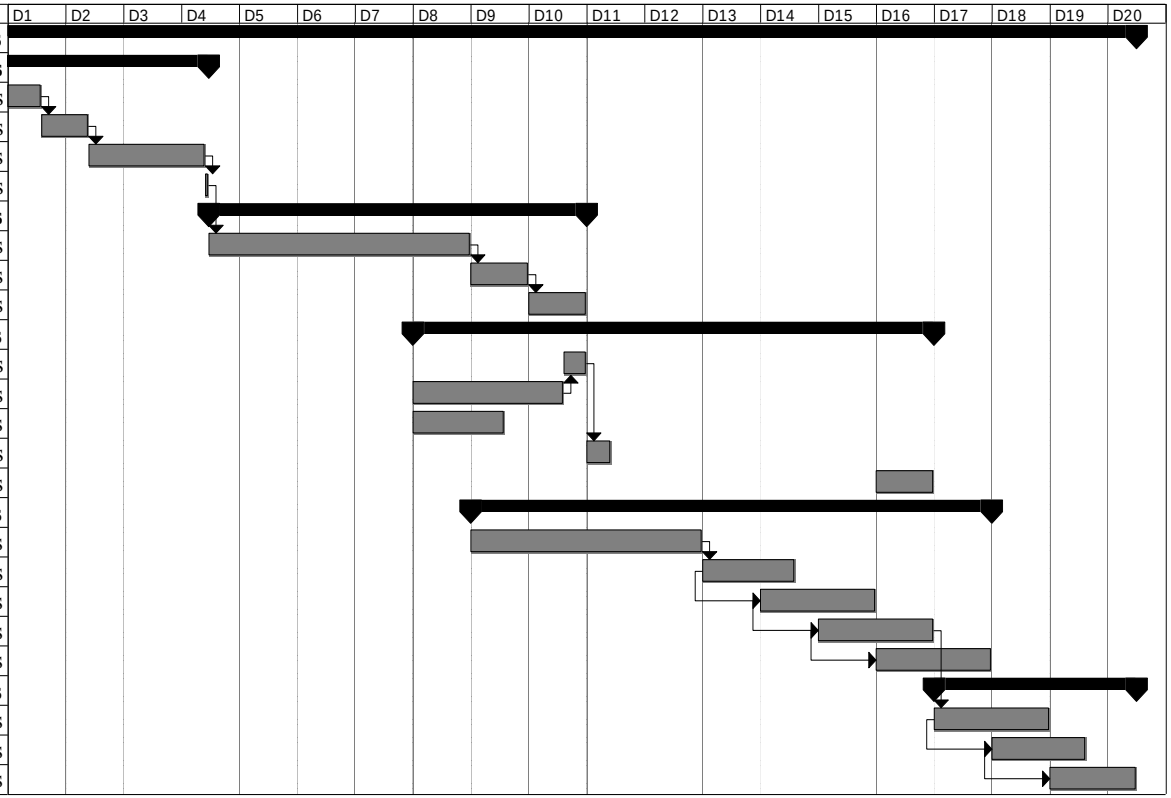

Figure 5-2: Schedule for the rehabilitation of 2km of feeder road under each of the 3 site managers

5.3 DAILY ACTIVITIES OF THE PREDICTED 6KM MONTHLY PRODUCTION

The organization of the daily activities to achieve the predicted monthly production would not differ much from the organization used to rehabilitate the 1.33km in the proposed FBLM approach. The team assignment strategy would be used in both cases and the roles and responsibilities matrix of the team members and leaders would remain the same. Figures 5-3 to 5-7 (not drawn to scale) present a pictorial illustration of how the daily activities would be organized to rehabilitate the predicted 6km (2km under each site manager) of feeder road.

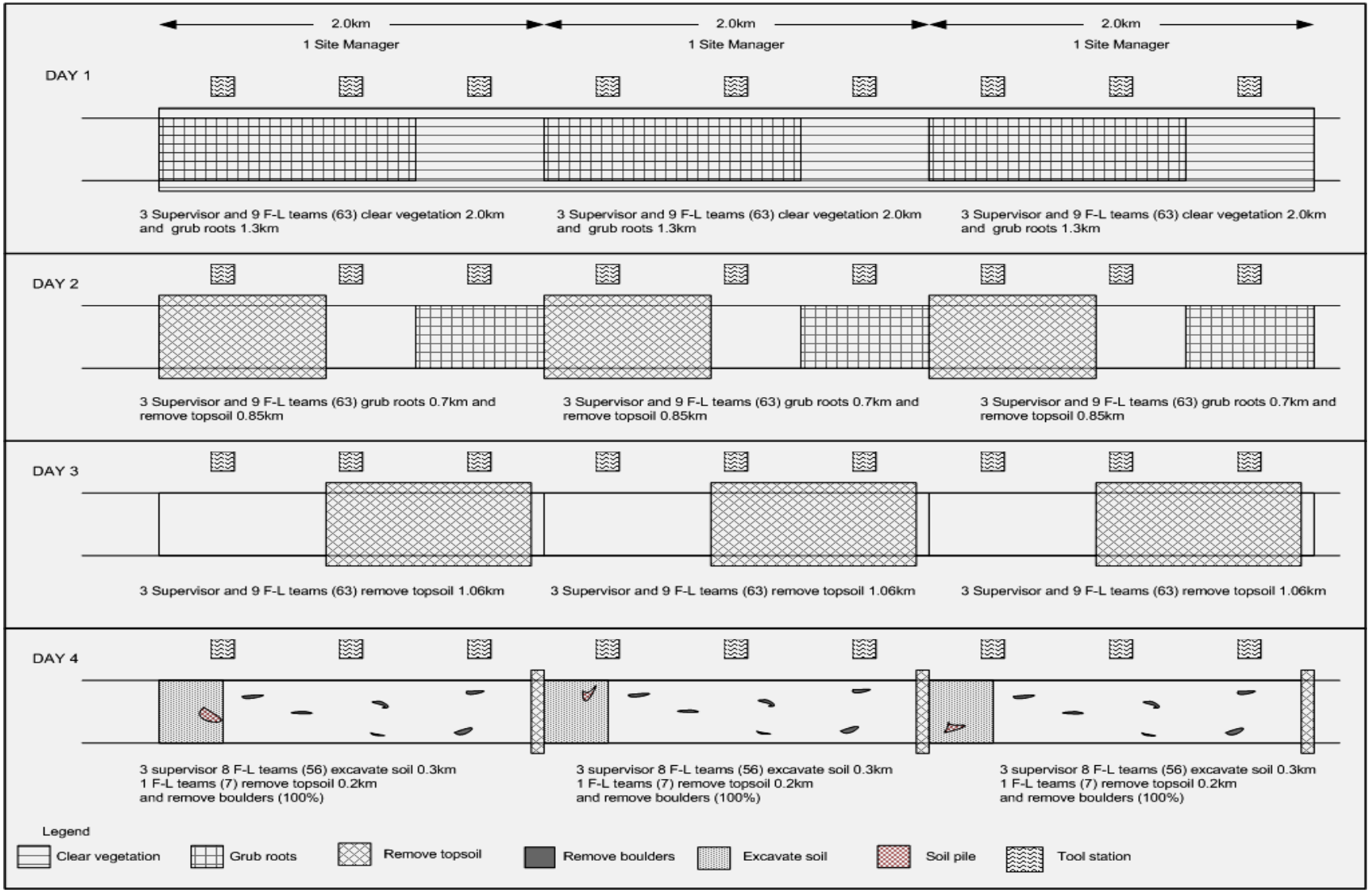

Figure 5-3: Detail activities for days 1-4 of the predicted monthly production

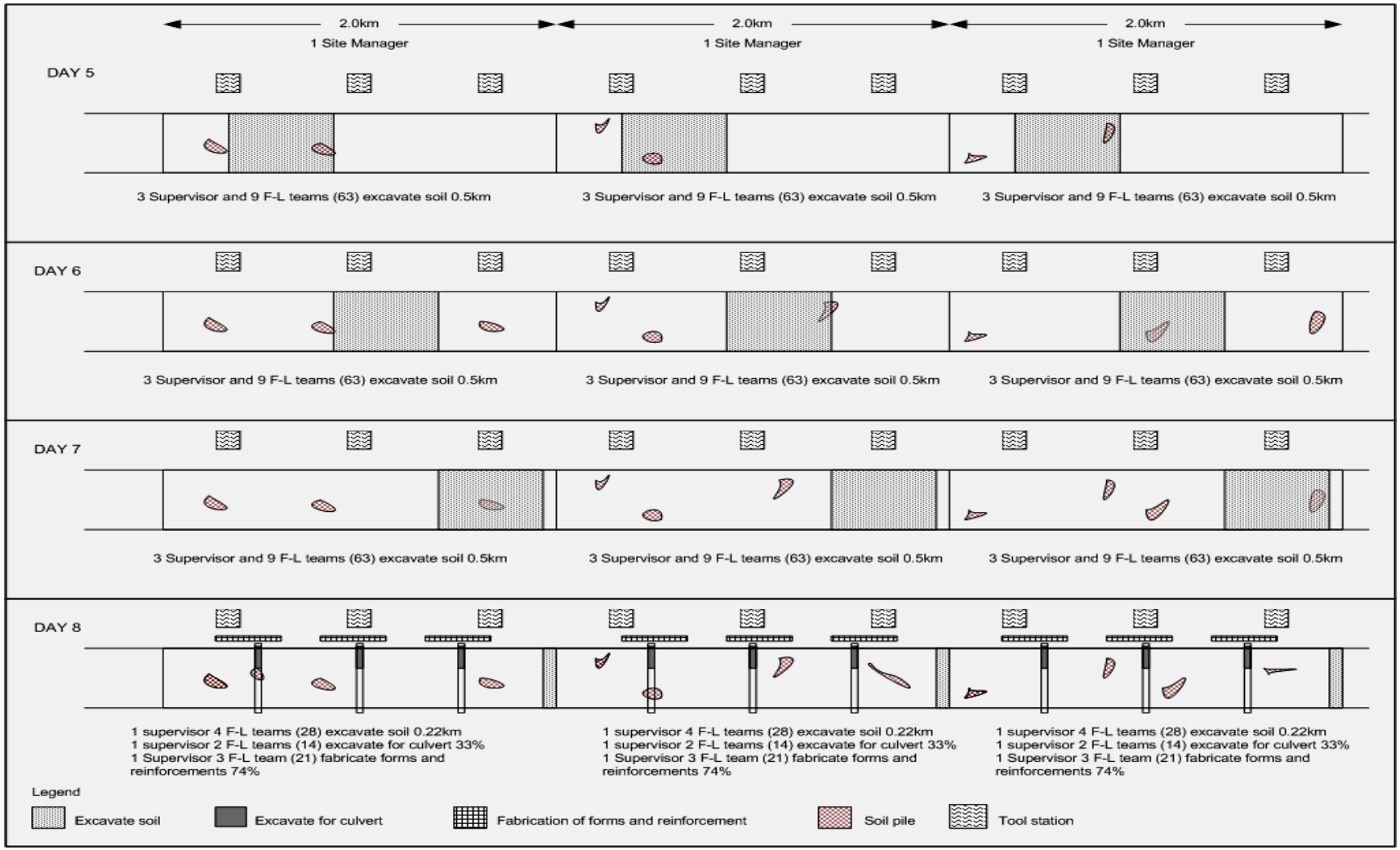

Figure 5-4: Detail activities for days 5-8 of the predicted monthly production

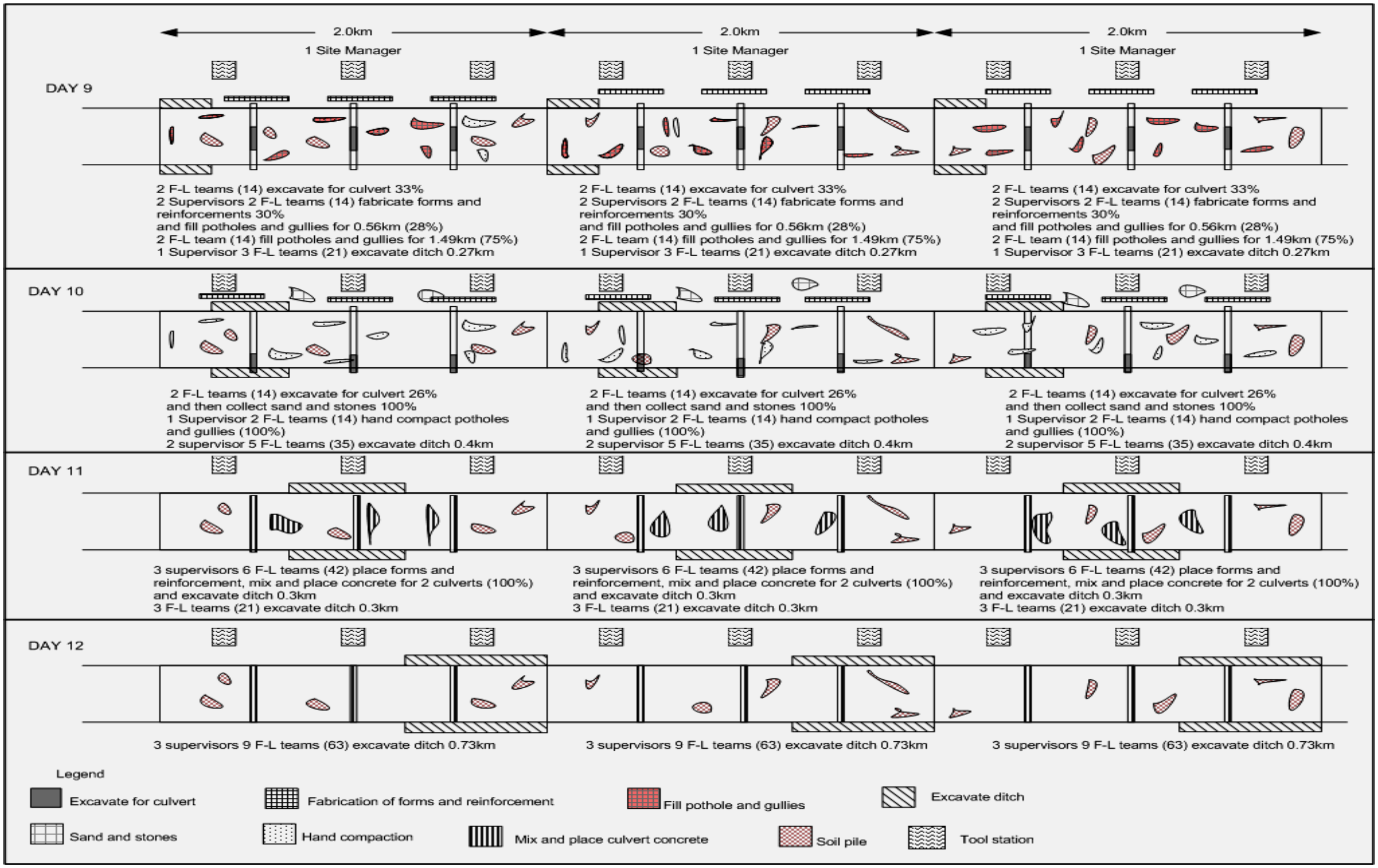

Figure 5-5: Detail activities for days 9-12 of the predicted monthly production

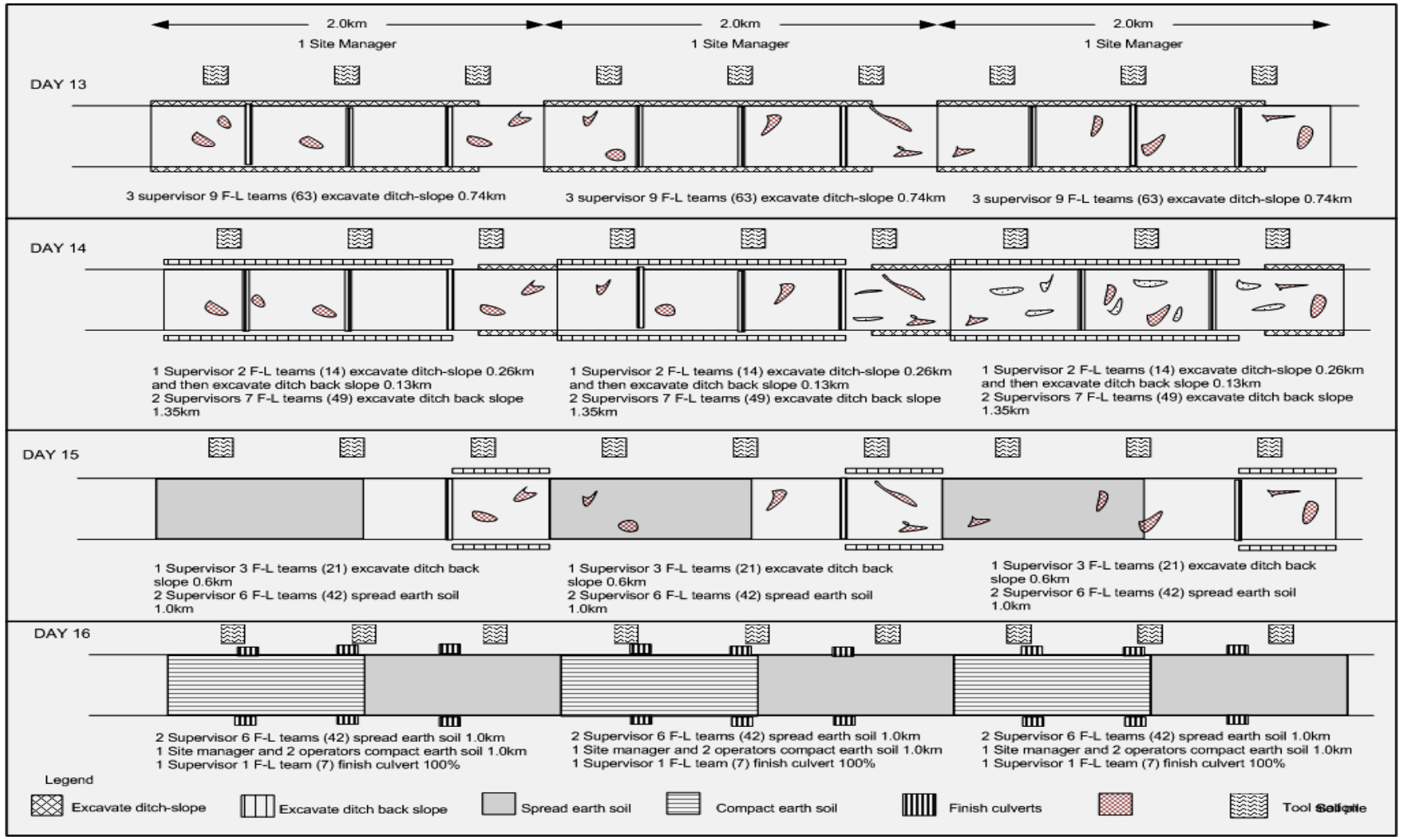

Figure 5-6: Detail activities for days 13-16 of the predicted monthly production

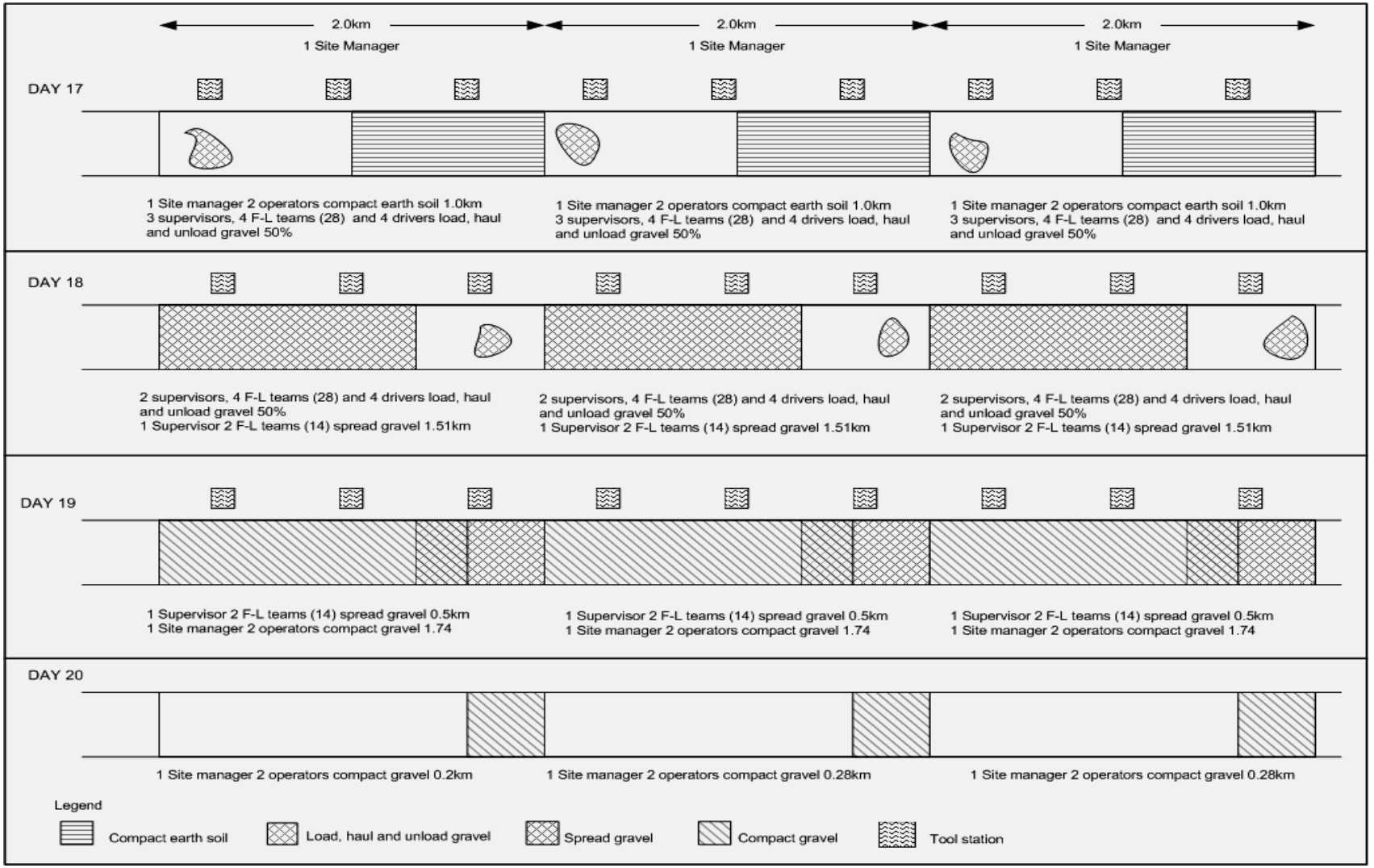

Figure 5-7: Detail activities for days 17-20 of the predicted monthly production

5.4 SUMMARY

To increase the monthly production rate of the current labor-based approach from 1.33km to 4km in order to compete with the conventional equipment-intensive productivity rate of 3.07km, the research proposed the increase (tripling) of the resources used in the current approach. This strategy would facilitate the using of the abundant and cheap resources to create more jobs to reduce the unemployment incidence in Ghana.

The consideration of the potential productivity improvements of the developed FBLM strategies has also provided the basis to predict even higher monthly production for the local contractor using the FBLM approach. The application of the FBLM strategies could increase the monthly production of the local contractor to 6km. The predicted 6km monthly production at the cost of $13,374 per kilometer would be more preferable to the 3.07km monthly production of the conventional equipment-intensive approach at the cost of $14,218 per kilometer. Moreover, with the improvement in productivity, the cost of labor-based gravel roads would drop.

Chapter 6 is focused on the validation of the proposed FBLM concept. Since the concept has not been used in actual labor-based road rehabilitation project, successful application of similar concepts including the HPWT, roles and responsibilities matrix (RRM) and continuous innovative concepts are used for its validation.

Chapter 6 The Validation of the Family-Based Labor Management (FBLM) Concept

Labor-based methods have been used successfully to execute many construction and engineering projects throughout the world. For instance, labor-based methods were used in the construction of the 1859-1869 Suez Canal (Wilson 1997), the construction of the Panama Canal (Panama Canal Authority 2005) and the Upper Ganges Canal. Labor-based road construction methods were also used for the construction of the first German Autobahns (Stock and Veen 1996). However, the Ghana labor-based road rehabilitation program intended objective.

The family-based labor management (FBLM) concept would make the labor-based road rehabilitation program in Ghana attractive to contractors and workers. Since the FBLM concept has its roots in both the Ghanaian culture and efficient management systems of high performance work team (HPWT), it possesses the potential to attract workers and also equip local contractors with the capacity to manage large work force that are required in labor-based road rehabilitation projects. However, since the FBLM strategies have not yet been used in actual road rehabilitation projects, similar management strategies that have been used successfully in other programs are used to validate the FBLM concept. Related research outcomes will be used to validate the following:

1) The developed family-based work team (FBWT) concept.

2) The proposed improvements in the management strategies.

3) The adopted management strategies including the roles and responsibilities matrix and the continuous innovation strategies.

6.1 VALIDATION OF THE FBWT CONCEPT

The FBWT concept is developed to help reorganize the workers involved in the feeder road rehabilitation program into more manageable 'family' oriented teams. It is developed from the integration of HPWT concepts and the Ghana family system (GFS). However, since the FBWT concept has not been used on any project, the research relies on the results of the application of the HPWT concept in other programs to validate the

FBWT strategy. HPWT concepts have been applied successfully to improve management systems and productivity in many organizations including the Thorn Lighting, Ltd. in the United Kingdom, the United States Social Security Administration (SSA) and South African Breweries (SAB) in the South Africa (ILO 2000).

The SAB was the fourth largest manufacturer of alcoholic beverages in the world. As the apartheid regime was falling, SAB lost its government protection and was exposed to the full weight of international competition. To remain in production, SAB had to rapidly and effectively bring its cost in line with those of its international competitors. HPWT principles were introduced to restructure its 34,000 employees (COBIT 2001) into manageable work teams to facilitate efficient communication and management.

HPWT principles were also used to build trust, promote information sharing and to secure commitment from workers (ILO 2002). Through the application of the HPWT principles, SAB is able to bring costs down and secure 98% of the beer market and 57% of the total alcohol consumed in South Africa (ILO 2000). The FBWT concept that employs HPWT, Ghana family system and roles and responsibilities concepts to reorganize the workers involved in the program into smaller manageable work teams would also facilitate similar improvements.

6.2 THE VALIDATION OF THE PROPOSED IMPROVEMENTS IN THE MANAGEMENT STRATEGIES

The management systems of the current approach for which improvements have been proposed include 1) recruitment, 2) training 3) communication and 4) reward system. The research draws on the results of related research to validate the proposed improvements in the current management strategies.

6.2.1 Recruitment

The improvements that have been proposed by the family-based approach include increasing size of the work force in order to rehabilitate more roads, using permanent laborers in place of casual laborers and requiring higher qualifications from the supervisory personnel.

6.2.1.1 Increasing the size of work force

The population of Ghana is currently about 21 million and continues to rise at the rate of 1.25% per year (The World Factbook 2005). The unemployment rate is as high as 20% and the work force stands at 10.24 million. The active age group that would be more productive in labor-based works also constitutes 50% of the population. With the average daily wage as low as $1.22 (TUCG 2004), local contractors must be able to recruit 189 permanent laborers, 9 supervisors, 3 site managers and 24 other skilled workers to rehabilitate the 4km in 20 workdays per month under the required in the FBLM concept.

6.2.1.2 Using permanent laborers in place of casual laborers

To protect the local contractors from the provision of accommodation and transportation logistics to workers, the World Bank, the International Labor Organization (ILO) and the United Nations Development Program (UNDP) designed the labor-based road rehabilitation program introduced in Ghana in 1986 to rely on rural casual labor as the main production unit (Ampadu 1999). The World Bank, the ILO and the UNDP did not take into consideration the socio-cultural importance of job security in the Ghanaian society.

As already proposed above, the transportation and accommodation logistics must be split between the contractor and laborers respectively. Whereas the contractor would recuperate by profiting from the stable labor supply and the gained experience of the workers, the laborers would also gained from the stable and continuous monthly wages. The use of permanent labor in place of casual labor is more advantageous to the project, the contractor and laborers. It facilitates productivity improvements, enables contractors to gain from experience of workers and motivates workers to be more committed to the project.

6.2.1.3 Qualification requirements of the FBLM approach

The minimum requirement in the current approach for all workers in the supervisory positions is a successful completion of General Certificate Examination; Ordinary Level/ Basic Education Certificate Examination (GCE O'Level/BECE) (Danso 1996 and Ashong 1996). The qualifications required of the supervisory personnel differ

in accordance to the different positions in the family-based approach. The minimum requirement in the family-based approach is GCE O'Level/BECE for foremen, Senior Secondary School Certificate Examination (SSCE) for supervisors, SSCE plus 9 month engineering training for the site managers and an undergraduate degree in engineering or related field of study for contractors. The family-based approach would be able to draw on the many graduates of the GCE O'Level/BECE, SSCE and universities to support the proposed management improvements. Table 6-1 presents the statistics of educational level attainment in Ghana.

It is affirmed that the higher the education level of the supervisory personnel, the more likely the supervisory personnel would be capable of increasing labor productivity, showing innovative behavior and facilitating the adoption of new methods. Research conducted in Ghana has shown that university graduates contribute about 231% more to value added than the graduate of GCE O'Level/BECE (Verner 2000). It is surmised that the contractors of the family-based approach would perform better (perhaps 231% more) than their counterpart in the current approach.

Table 6-1: Statistics of the levels of educational attainment in Ghana (Data Sources: GLSS 2000 & Verner 2000)

Highest Level Attained	Males (%)	Females (%)	All (%)
Never been to school	21.0	41.0	31.7
Below O'Level/BECE	24.6	25.5	25.1
Completion of O'Level/BECE	38.6	27.8	32.8
Completion of SSCE	14.5	4.6	9.2
Completion of University	1.3	1.1	1.2
Total	100.0	100.0	100.0

6.2.2 Training

The family-based approach promotes training of workers in labor management, technical skills, financial skills, contracting, interpersonal skills and in engineering skills to ensure continues improvements in productivity. Training has a strong correlation with productivity improvement (King 1995). Research findings show that the training of workers usually results in productivity improvement (Bartel 1994 & Bishop 1994) The

Construction Industry Cost Effectiveness (CICE) project report confirms that supervisory training programs could generate a return on investment of at least three to one (CICE 1983). The proposed improvements in training would also facilitate productivity improvements in the labor-based road rehabilitation program in Ghana

6.2.3 Communication

Case studies have shown that organizations with open vertical and open horizontal communication channels are more effective in information sharing than those with close vertical communication channels (ILO 2000) like that of the current approach to labor-based road rehabilitation in Ghana. Open communication channels promote proactive information flow (Evans and Davis 2005), informal dialogue and workers access to management (Chang 2002).

6.2.3.1 Examples of improved bottom-up and top-down communication channels

The strategies proposed to improve the extreme vertical communication strategy of the current approach would work since similar strategies have successfully been used in the SAB in South Africa and in the Singapore Airport Terminal Services' (SATS) Security Services (SSS) in Singapore. Though it is difficult to change cultural systems such as the close vertical communication system of the GFS as applied in the current approach, it is possible to improve both the top-down and the bottom-up means of information flow.

The SAB had a highly structured hierarchical system due to its size (34,000 employees). The closed vertical communication channel limited easy and prompt flow of information to its workers. The application of HPWT concepts enabled the SAB to improve its bottom-up and top-down information flow channels. Other communication tools used by the SAB to improve its communication system included the publication of newsletters, feedback sessions, newsflashes and normal team meetings (ILO 2000).

The SATS Security Services (SSS) in Singapore is another organization that used the HPWT concept to improve its bottom-up and top-down communication channels. The SSS is a subsidiary of the Singapore Airport Terminal Services (SATS). The SSS is traditionally a hierarchical organization. The major tool used by the SSS to improve its

bottom-up and top-down communication channels is the annual Strength, Weaknesses, Opportunities and Threats (SWOTS) exercise of the team members. Other tools used to improve the communication system included briefing sessions and bulletins (ILO 2000).

6.2.4 Reward strategies

The research adopts the performance based and team based reward systems of the HPWT to motivate the family-based workers. These reward strategies have been used successfully in the Thorn Lighting Limited in the United Kingdom and the SSS in Singapore (ILO 2001). Research has demonstrated the effectiveness of using performance and team based reward systems to improve productivity and quality (King 1995).

Both the Thorn Lighting Limited in the United Kingdom and the SATS Security Services (SSS) in Singapore have benefited from using the performance based and team based reward systems as sources of workers' motivation. These two organizations recognize team and individual performance with awards of badges and certificates for quality and hard work. Individual and team achievements are also publicized in magazines. These reward systems have helped the Thorn Lighting Limited enhance performance and gain larger market share. They have also facilitated continuous productivity improvements in the SSS (ILO 2000). The use of the performance based and team based reward systems would also facilitate productivity improvements in the labor-based road rehabilitation program in Ghana.

6.3 VALIDATION OF ADOPTED MANAGEMENT AND CONTINUOUS INNOVATION STRATEGIES

The research adopts the concept of roles and responsibilities matrix and continuous innovation strategies. The roles and responsibilities matrix strategy would be used to clarify the roles and responsibilities of the family-based teams and their leaders. The continuous innovation strategies would ensure continuous evolution in the FBLM concept and labor-friendly technologies.

6.3.1 Roles and responsibility matrix

The roles and responsibilities matrix concept has been used in many organizations to co-op management efforts. Since 2001, the concept of roles and responsibilities matrix has been used in the Southhampton University Hospital in the United Kingdom to improve the quality of health care. The matrix was used to eliminate confusion and to avoid unnecessary work by individual health care practitioners (Lewis at al 2002).

The matrix concept has also been used in the Los Angeles Bureau of Engineering (US) to eliminate confusion between the functional managers and the project managers. After a roles and responsibilities matrix was generated and published for the functional and project managers of the Bureau, the confusion between them was practically reduced to zero (Kuprenas 2003).

The concept of roles and responsibilities matrix is adopted in the family-based approach to facilitate access to information sources, improve communication systems and eliminate confusion and ambiguity in work assignments. The family-based approach seeks to use the matrix to achieve benefits similar to those of the Southhampton University Hospital and the Los Angeles Bureau of Engineering.

6.3.2 Continuous innovation strategies

No one single innovation may continue to be the most efficient strategy for all times in the current rapidly changing world. Every new innovation would eventually reach the limits of its usefulness and be replaced (Bronowski 1955), unless it is continuously renewed with more efficient strategies. The family-based concept adopts strategies that enhance the documentation and the application of knowledge gained, of new methods developed and discoveries made in labor management and labor-friendly technologies.

Continuous innovation through knowledge management is seen as a basis for competitive advantage. The strategies that ensure continuous innovation have been applied successfully in Hewlett-Packard and Chevron in the US. The organizational cultural characteristics identified by research as favorable for knowledge transfer and innovation which include open horizontal and vertical communication structure, co-operative behavior, collaborative behavior and trust (Goh 2002) are similar to some of the

strategies and interpersonal processes of the FBLM concept. These characteristics invigorate the workers' quest for knowledge, knowledge sharing and experimentation.

6.4 SUMMARY OF VALIDATION

Though the FBLM concept has not been used, the above discussion centered on the application of similar concepts confirms the potentials of FBLM concept to successfully improve the labor-based road rehabilitation program in Ghana. The FBLM concept which is an integration of the efficient management systems of the HPWT concept and the GFS would provide the Ghana program with efficient management strategies that are rooted in the local culture.

Chapter 7 underlines the importance of the research to the Ghanaian society. It discusses how the research would impact the lives of Ghanaians from the socio-economic, environmental and cultural standpoints when it is adopted.

Chapter 7 Importance of research to the Ghanaian Society

The importance of this research to the Ghanaian society cannot be overemphasized. The research proposes strategies that would facilitate the productive use of labor, the most valuable, abundant and cheap resource in Ghana. The abundant labor in Ghana has not yet been duly utilized to Ghana's economic advantage due to labor organization and management issues. The formulated family-based labor management (FBLM) concept would facilitate the employment of more labor to rehabilitate more feeder roads thus reduce unemployment, potentially increase wages, and reduce poverty in Ghana. The adoption of the FBLM concept would positively impact the socio-economic situation in Ghana.

The FBLM concept that depends mostly on labor rather than heavy equipment would also have a positive impact on the environment. The concept would also be a good example for the consideration of local cultural norms in economic programs designed elsewhere and introduced into the country to ensure their acceptance and success. The discussion below will focus on the impact that the FBLM would have on the socio-economic situation, the environmental conditions and cultural implications when adopted in Ghana.

7.1 THE SOCIO-ECONOMIC IMPACT

Ghana, like many African countries, suffers from unemployment (20%), poverty (40% of population) and trade deficit ($0.7 billion per annum). The employment creation programs are unable to keep up with the 2.8% annual growth of the labor force (Boateng and Ofori-Sarpong 2002). Yet Ghana spends an average of $174 million a year on the importation of construction and earth moving equipment (ITA; USDOC 2002).

The socio-economic conditions associated with poverty including hunger, domestic conflicts, family breakdown and despair that were experienced by many Americans before the initiation of the Works Progress Administration (WPA) (Couch 2001) and were also experienced in Rwanda before the 1994 genocide (Diamond 2005), are also being experienced by many Ghanaians. Research conducted in Ghana has established a strong correlation between poverty and high malnutrition, mortality and

fertility rates (Canagarajah et al 1998). The poverty incidence has limited the access to food, water and public services including education, health, electricity and housing in Ghana (Norton et al 1995).

The adoption of the FBLM concept would help improve the economy and consequently, the living standards of many Ghanaians. The FBLM concept would facilitate:

1) Employment creation and poverty reduction.
2) Reduction in imports and the conservation of foreign exchange.
3) Improvement in the road infrastructure.
4) Development of local resources.

7.1.1 Employment creation and poverty reduction

The employment creation potential is discussed from two perspectives: 1) To investing in labor-based programs in general on the basis of current wages, taking the WPA as a model and 2) To investing in Ghana's labor-based road rehabilitation program on the basis of the cost of roads.

7.1.1.1 Job creating potential due to investing in labor-based programs in general on the basis of current wages and the WPA model

The WPA program demonstrates the possibility of using labor-based programs to create productive employment opportunities to reduce poverty. Like the WPA program, Ghana can improve its national economy by investing in labor-based programs for the purpose of creating jobs for the unemployed.

Table 7-1 is compiled to study the percentage of GDP invested to generate employment during the WPA. It illustrates for example that in 1937, the US used about $1.9 billion (1.82%) of its GDP to generate about 2.2 million jobs during the WPA period.

Table 7-1: WPA expenditure as percentage of GDP and employment generated between 1936 and 1939 (Data Sources: Office of Government Reports 1940 in Couch 2001, US Department of Commerce National Income and Product Accounts 1987 and Howard 1943)

Year	Expenditure	GDP ($billion)	Expenditure as a percentage of GDP	Employment generated
1936	1,295,459,010	95.8	1.36	1,995,000
1937	1,879,493,595	103.9	1.82	2,227,000
1938	1,463,694,664	96.7	1.55	1,932,000
1939	2,125,009,386	103.7	2.03	2,911,000

Table 7-2 presents the conversion of the 1937 WPA expenditure of about $1.9 billion (Office of Government Report 1940) and the 1937 WPA national average monthly wages of $56.25 (Findlay 2004) into 2006 dollar value for better comparison of the current situation in Ghana. The conversion was made using the Federal Reserve Bank of Minneapolis calculations (2006).

Table 7-2: 2006 dollar value of 1937 WPA expenditure and wages

Dollar value per year	Expenditure US$	WPA national average monthly wage in US$	WPA national employment generation
WPA in 1937 dollar value	1,879,493,595	56.25	2,227,000
WPA in 2006 dollar value	26,325,962,369	787.50	2,227,000

On the basis of this American (WPA) example, if Ghana is to invest the entire $174 million (0.4% of GDP) used to import heavy construction and earth moving equipment annually (ITA; USDOC 2002) in labor-based programs, it would generate about 339,000 jobs annually as illustrated in the calculations below.

1) From Table 7-2, the portion of the 1936 WPA total expenditure paid in wages (2006 dollar value) for the year would be:

$787.50 * 2,227,000 * 12 = $21,045,150,000

2) Based of the 1937 WPA example, the portion of the $174 million that would go into paying wages when invested in Ghana would be about $139,000,000 as shown below:

$$\frac{174{,}000{,}000}{26{,}325{,}962{,}368.85} * \$21{,}045{,}150{,}000 = \$139{,}096{,}761$$

3) On the basis of the current monthly minimum wage of $34.16 (daily minimum wage of $1.22 * 28 days) in Ghana, the $139,096,761 would be able to generate about 339,000 jobs for the year of investment as shown below:

$$\frac{139{,}096{,}761}{34.16 * 12} = 339{,}327$$

However, it would be difficult to stop the importation of the construction and earth moving equipment completely and invest the entire $174 million to generate jobs using the FBLM concept. There can be a gradual reduction in the capital invested in the importation of the equipment to create more labor-based jobs using the FBLM concept. As an example, it is proposed that 10% yearly reduction of the $174 million be made for the labor-based works until the two methods (equipment-intensive and labor-based) co-exist at 50% each.

Thus, following the WPA example and investing an increment of 10% yearly of the $174million for five years, the FBLM concept would be able to help generate 34,000 the first of implementation. The employment potential could rise to 170,000 at the fifth year (as shown in Table 7-3 below) at which point the two methods would continue to co-exist at 50% each of the $174 million. This strategy allows the two methods (equipment-intensive and labor-based) to co-exist at 50% each of the $174million.

Table 7-3: Employment creation potential for labor-based programs in general based on the current wages with the WPA as a model

Year	Percentage of $174m used in FBLM concept	Actual capital to invest in the FBLM concept (in million US Dollars)	Employment potentials
1	10	17.4	33,933
2	20	34.8	67,865
3	30	52.2	101,798
4	40	69.6	135,731
5	50	87.0	169,664

7.1.1.2 Employment potential when investment is limited to the Ghana's labor-based road rehabilitation program

When employment creation concept is also considered on the basis of the average cost of feeder roads in Ghana, the FBLM concept could be used to facilitate the creation of 232,000 jobs per year if the GoG invests the entire $174 million in the labor-based road rehabilitation program on the following assumptions:

1) The cost of a kilometer of labor-based based increases from to $14,218 (the cost of a kilometer of the conventional equipment-intensive approach) due to cost incurred in management improvements.

2) Each contractor employs the 225 workers (that is 3 times the 75 workers including 1 site manager, 3 supervisors, 8 skilled workers and 63 laborers used in the current labor-based approach to rehabilitate 1.33km per month).

3) The multiplier of cocoa (which is more labor oriented than that of construction in Ghana) is used.

Based on the assumption that a kilometer of feeder road would cost $14,218, the $174 million could be invested to rehabilitate 12,238 kilometers of road as shown below:

$$\frac{174{,}000{,}000}{14{,}218} = 12{,}238$$

Since the FBLM concept is designed to enable a local contractor to rehabilitate 4km of feeder road per month, it would take 255 local contractors to rehabilitate 12,238 kilometers of road a year as shown below:

$$\frac{12{,}238}{4*12} = 255$$

Since each contractor would need to employ 225 workers for their monthly output of 4km, the total number of workers that would be employed by all the contractors would be 57,366 as shown below:

$$255 * 225 = 57{,}366$$

The 57,366 employment potential does not include the economic multiplier effects (ripple effects of the increase in employment). As discussed in Chapter 2, section 2.7, it has been proven that when new jobs are created, demand for goods and services increases due to overall increase in income. Industries in the economy would also have to employ more workers to meet the increase in demand for goods and services as a result of increase in the over all income. The employment economic multiplier measures the total effects of increase in employment.

In Ghana, the economic multiplier for the construction industry is 3.99 whereas that of the cocoa industry is 4.09 (Aryeetey et al. 2000). To measure the economic multiplier effects (or ripple effects) in the national economy due to the creation of the 57,366 new jobs in the labor-based road rehabilitation program, the economic multiplier of the cocoa industry (which is more labor oriented than that of the construction industry in Ghana) is used as shown below:

$$57{,}366 * 4.06 = 232{,}905$$

As already discussed in the case of the WPA example, Ghana can not stop the importation of the construction and earth moving equipment all at once in order to invest the $174million in the labor-based road rehabilitation program. A gradual reduction of 10% a year from the $174million is suggested for the generation of employment using the FBLM concept until the two methods (equipment-intensive and labor-based) co-exist at 50% each of the $174million capital. Thus, on the basis of average cost of labor-based roads and investing an increment of 10% of the capital a year for five years, Ghana would

generate about 23,000 jobs the first year, cumulating to about 116,000 jobs at the fifth year as shown in Table 7-4 below.

Table 7-4: Employment creation potential based on the average cost of feeder roads in Ghana

Year	Percentage of $174m used in FBLM concept	Actual capital to invest in the FBLM concept (in million US Dollars)	Employment potentials
1	10	17.4	23,291
2	20	34.8	46,581
3	30	52.2	69,872
4	40	69.6	93,162
5	50	87.0	116,453

In place of the 75 workers (mostly casual) employed by a local labor-based contractor in the current labor-based approach (to rehabilitate 1.33km per month) and the 20 permanent workers employed by a equipment-intensive contractor (to rehabilitate 3.07km per month), the FBLM concept would help create between 23,000 and 34,000 permanent jobs in the first year of implementation by investing 10% of the $174m. At the fifth year of investment, employment potential would rise to between 116,000 and 170,000 jobs as described above.

Such investments would be able to help redistribute income among a wider section of the population and also increase cash flow to workers to facilitate poverty reduction. Stable monthly income to the poor would go a long way to alleviate them from the livelihood crisis. The WPA program is a source of inspiration for the Ghana's labor-based program. Through the application of the FBLM concept in the labor-based road rehabilitation, Ghana would realize an outcome similar to that of the WPA program including the creation of more jobs, the alleviation of poverty and economic development.

7.1.2 Reduction in imports and the conservation of foreign exchange

The FBLM concept has the potential to attract and manage larger workforce. When adopted in Ghana, it would attract many workers and local labor-based contractors

into the feeder road rehabilitation program to discourage the use of the conventional equipment-intensive method that relies on the scarce foreign exchange (Larcher and Miles 2000) for the importation of heavy equipment. The FBLM can also be adjusted to promote the use of more labor in other production sectors of the Ghanaian economy that relies on imported equipment.

Importation leads to leakages in the economic multiplier effects (CBER 1997). For instance, though Table 7-5 shows that the total output multiplier of the US manufacturing industry in 1996 was 2.318, the actual manufacturing multiplier that impacted the domestic US economy in 1996 was 2.028 as illustrated in Table 7-6.

Table 7-5: Excerpt from US Total Output Multipliers (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	2.259	2.343	2.359	2.174	2.245	2.318
Non-Manufacturing - Average	1.602	1.657	1.709	1.686	1.635	1.678
Total - Average	1.840	1.911	1.921	1.833	1.801	1.849

Table 7-6: Excerpt from US Domestic Output Multipliers (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	2.138	2.145	2.164	1.971	2.009	2.028
Non-Manufacturing - Average	1.562	1.590	1.637	1.616	1.562	1.590
Total - Average	1.771	1.795	1.809	1.723	1.684	1.707

The decline in the economic multiplier effect of the manufacturing industry is due to its dependence on the importation of manufacturing commodities and inputs from other countries as illustrated in Table 7-7. The domestic US economy lost 0.291 of the manufacturing multiplier effect to other countries. The economic leakage of 0.291 constitutes 12.6% decline in the US manufacturing multiplier. The capital that could have been invested in the US economy leaked out to other economies from which the inputs for manufacturing were imported.

Table 7-7: Excerpt from US Output Multiplier Leakages (Data Source: BEA; US Department of Commerce; in Guo and Planting 2000)

Industry	1972	1977	1982	1987	1992	1996
Manufacturing - Average	0.121	0.197	0.195	0.203	0.236	0.291
Non-Manufacturing - Average	0.039	0.067	0.072	0.071	0.073	0.088
Total - Average	0.069	0.115	0.112	0.110	0.117	0.142

By depending on the importation of heavy equipment for its construction and earth moving projects, the economy of Ghana also suffers from economic multiplier leakage. Foreign exchange (for example the $174 million) that could have been invested to improve the local economy leaks out to other economies from which the equipment is imported. The adoption of the FBLM concept would help reduce Ghana's reliance on importation and conserve foreign exchange for the benefit of the economy.

7.1.3 Improvement in the road infrastructure

The road infrastructure in Ghana is the arteries and veins of the national economy. They account for 95% of all cargo and 97% of all traffic movements (Ampadu 2001). They are essential for moving key exports and farm products from the industries and farms to the markets and ports. Since feeder roads (gravel) forms about 72.1% (GHA 2004, DFR 2004 & DUR 2004) of the total road network in Ghana, improvements in the conditions of the feeder roads would be of great benefits to the economy.

The FBLM concept with its more improved engineering and management strategies would help labor-based contractors upgrade the feeder roads from the poor and fair conditions to good conditions at a faster rate than the conventional equipment-intensive method. The FBLM concept would facilitate the rehabilitation of more roads for the same or less cost as compared to that of the conventional equipment-intensive method.

Feeder roads in good conditions would not only facilitate safe movements of traffic but would also make it easier to rapidly transport perishable farm and other produce from the poor rural areas (where storage facilities are scarce) to the markets and

ports. Poor farmers in the rural areas of Ghana would also benefit tremendously from good feeder roads.

7.1.4 Development of local resources

The adoption of the FBLM concept would also contribute to the development of local resources including skills and local hand-tools. The application of the family-based concept would help create a pool of skilled workers and skilled managers in Ghana. As workers participate in the continuous training programs they would develop various skills including managerial, interpersonal and technical skills. These skills can be used in other labor-based sectors including the cocoa and building construction industries. The adoption of the FBLM concept would also facilitate the establishment of local industries for the production of quality hand-tools for labor-based road rehabilitation programs in Ghana.

7.2 ENVIRONMENTAL IMPACT

As compared to the equipment-intensive method of road rehabilitation, the labor-based method has less impact on environmental degradation. Heavy equipment tends to destroy more vegetation as it maneuvers to excavate soil materials for road works. The borrow pits dug by the heavy equipment also become vehicles for soil erosion. Labor-based methods tend to destroy less vegetation and avoid large cut in the terrain (Ampadu et al 2003). Comparatively, labor-based methods tend to depend less on non-renewable resources such as fuel than equipment-intensive methods (Larcher and Miles 2000). They also emit fewer pollutants into the atmosphere than do equipment-intensive methods (Stock and Veen 1996).

7.3 CULTURAL IMPACT

The principal and recurrent failure of many economic programs introduced into developing countries like Ghana may be attributed to their lack of organic relationship with the local cultural norms (Lauer 2000). By integrating HPTW principles with the local culture, the family-based approach is able to develop management strategies that are deeply rooted in the local culture. The integration would lay the foundation for the

continuous consideration of the local cultural norms to help make foreign oriented economic programs attractive and productive to the local population.

7.4 SUMMARY

The formulated FBLM concept would contribute to the development of the national economy when adopted. It would facilitate the creation of more jobs (between 232,900 and 339,327) to reduce poverty in Ghana. It would also help reduce Ghana's reliance on the importation of equipment for construction activities in order to increase the use of the local abundant and cheap labor. Application of the FBLM concept would also reduce the reliance on non-renewable resources and the emission of pollutants into the atmosphere.

Chapter 8 is about the conclusions and recommendations of the research. It summarizes the research contributions. It also makes recommendations for future work to enable continuous improvements in the FBLM concept.

Chapter 8 Conclusions and Recommendations

This research is conducted to help improve the managerial capacity of labor-based road contractors in Ghana. It formulate organizational strategies that would help the local labor-based contractor increase his/her monthly production from 1.33km to 4km (or more), which would be higher than the 3.07km monthly production of the conventional equipment-intensive contractor.

8.1 CONCLUSIONS

The main contribution of the research is the family-based labor management (FBLM) concept formulated to help make the labor-based program introduced in Ghana attractive and also equip the local contractors with the needed management capabilities. The FBLM concepts is made up of 1) the family-based work team (FBWT) concept, 2) the proposed improvements in the management systems of the current approach and 3) the adopted roles and responsibilities and continuous innovation concepts.

- The FBWT concept would be used to organize the workforce into 'family' oriented small manageable teams. Since the concepts has its roots in both the Ghana family system (GFS) and efficient management systems of the high performance work team (HPWT) concept, it would be able to attract many workers and provide contractors with the capability to manage large number of laborers.
- The research also proposed improvements for the management systems of the current approach to complement the FBWT concept.
- It also adopts the roles and responsibilities matrix concept to help improve labor management. The concept of continuous innovation is also adopted to ensure the continuous innovation of the FBLM concept.

The potential benefits of the FBLM concept include the following:

- The concept has the potential of generating either 233,000 or 339,000 jobs per year if the entire $174 million (used for the importation of construction and earthmoving equipment) is invested in either the labor-based road rehabilitation program or labor-based programs in general in Ghana. However, when the

proposal to use the 10% increment of the $174 million for five years is followed, the concept would generate between 23,000 and 34,000 jobs the first year of its implementation. At the fifth year of its implementation, the job creation potentials would increase to between 116,000 and 170,000. The strategy of investing up to 50% of the $174million would enable the two methods to co-exist in the feeder road rehabilitation program in Ghana.

- The FBLM concept would facilitate the redistribution of income to a wider section of the population to reduce poverty.
- It would help reduce Ghana's dependence on imports, conserve foreign exchange and promote the development of local resources including workers' skills and local hand-tools manufacturing.
- It would also help improve the condition of the feeder road infrastructure (72.1% of road infrastructure in Ghana) at a faster rate than using the conventional equipment-intensive method. Though the goal set is 4km/month per a contractor, which could rise to 6km due to productivity improvements, the FBWT concept can be scaled to produce even more roads depending on the organizational and management capability of the contractor.
- The FBLM would also help protect the environment.
- It would also help prove the important role that local cultural norms play in the socio-economic development of the country.

8.2 RECOMMENDATIONS

The FBLM concept has the potential to facilitate socio-economic developments in Ghana. However, since the concept has not yet been used, the research makes the following recommendations.

- The FBLM concept must be adopted in Ghana's labor-based road rehabilitation program to help make the program attractive to local contractors and workers so that the program would be beneficial to the national economy.
- The FBLM concept must also be adjusted and used in the implementation of other public projects including the construction of hospitals, schools, offices,

churches, social centers; the construction of water supply systems and gas supply systems; and the construction of sewer and storm-water systems.

- Religious bodies in Ghana must help promote the adoption of the FBLM concept in the feeder road rehabilitation projects and other public projects for the benefit of their congregation.
- Future work must concentrate of the collection of data when the FBLM concept is adopted in Ghana for cost comparison analysis and also to confirm both the productivity improvement prediction and the validation
- Continuous research must be conducted to ensure continuous improvements of the FBLM concept.
- Other African countries with similar socio-economic and cultural conditions can adjust the FBLM concept to help create employment and reduce poverty.

The FBLM concept must be adopted by Ghana and other African countries with similar socio-economic and cultural tendencies. It has great capacity to improve the living standards of people by reducing the high unemployment and poverty incidences that constitute threats to peace in Africa. When adopted, the FBLM concept will help restore the hope of Africans for a better life.

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Appendix A: Definition of Terms

Casual labor: Non-permanent labor.

Cedi (¢): Ghana's currency (Exchange rate in February 2007 is US$1.00 = ¢9,200.00).

Collectivity: 'The tendency of people to belong to groups or collectives and to look for each other in exchange for loyalty'.

Day-work method: A work method in which a worker receives a fixed pay for being at the work site for the full working hours.

Earthworks: The excavation, loading, haulage, stockpiling, filling or cutting and compaction of earth soil to road formation level.

Economic multiplier: The ratio of the total effect to the initial effect of an investment. It determines the full economic impact that investments have on an economy in terms of output, incomes, employment and imports.

Employment multipliers: The total change in the number of people employed in a locality/economy as a result of an initial change in employment.

Femininity: It refers to 'a situation in which the dominant values in society are caring for others and the quality of life'.

Gravelling: The loading, hauling, unloading, stockpiling, spreading and compaction of the gravel on roads.

High power distance: 'The extent to which less powerful members of institutions and organizations accept that power is distributed unequally'.

Income multipliers: Factors used to estimate the total increase in income in an economy as a result of an exogenous increase in income received by workers.

Input-output (I-O) analysis: Factors used to describe the relationships that exist between the output of one industry and the output of all related industries in an economy.

Literacy in Ghana: The ability to read and write English language or any of the 5 major Ghanaian languages and also be able to perform some basic arithmetic calculations.

Low uncertainty avoidance: is used to describe societies that do not feel threatened by ambiguous situations. Such societies have organizational settings with less

structuring of activities, fewer written rules, more risk-taking managers and higher labor turnover.

Multiplier leakage: A portion of a given investment that is not re-spent as in savings and taxes and the portion of any increase in the multiplier that leaks out into other economies.

Output multipliers: refers to the change in total output of an economy as a result of a direct change in the production of some goods and services in the economy.

Piece-work method: A work method in which a fixed quantity of output and the expected quality of the output are set for the worker at an agreed price. The more pieces of the fixed output the worker performs, the more the worker is paid.

Reshaping: Blading with or without scarification to restore the camber as well as re-excavation of side ditches.

Re-construction (gravel road): The restoration of impassable road into good road. The activities involved include site preparation, earthworks, reshaping, culverts and gravelling.

Rehabilitation: refers to both road re-construction and routine maintenance.

Road Camber: (Crown or cross slope) The slightly convexity or upward curve on a road designed facilitate drainage.

Routine maintenance (gravel road): Consists of the activities that are required continually to keep the road in good condition. The activities include grass cutting, grading and compaction.

Site preparation: The clearing of vegetation and removal of boulders and top soil.

Task-work method: is a work method in which a realistic task or quantity of work and the expected quality is set to be completed by a worker during the working hours.

Value added multipliers: measure the additional value added to a product as a result of activities performed to improve the product.

Vita

Victor Quagraine was born in Saltpond, Ghana. He entered the Catholic seminary to be trained as a priest. Victor earned a Bachelor degree in Sociology and Study of Religions from the University of Ghana, Legon in 1993. In 1995, he was ordained a Catholic priest and stationed at St. John the Baptist's Catholic Church at Assin Bereku, Ghana, as the assistant pastor. Between February 1997 and July 1999 Victor worked in the Nederland (Holland) in the office of Wiel Arets Architect & Associates.

In May 2003, he earned Masters Degree in Architecture and in August 2003 another Masters Degree in Construction Management, both from Washington University in St. Louis, USA. While studying at the Washington University in St. Louis, Victor worked with Ira Haspel, Architect in Bay Shore, New York. In January 2004, Victor enrolled in the Environmental Design and Planning doctoral program at Virginia Polytechnic Institute and State University (USA) in the Department of Building Construction.